



Automatic Power Interruption For Saving Energy And Life.

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هداء يعبر ولو مجزاء من الوفاء

إلى معلم البشرية ومنبع العلم ... نبينا محمد (صلى الله عليه وسلم)

إلى ينبوع العطاء الذي زرع في نفسي الطموح
... والدي العزيز

إلى نبع الحنان الذي لا ينضب ... أمي الغالية

إلى الذين رووا بدمائهم ثرى فلسطين إلى من هم
أفضل منا جميعا إلى الذين ارتقوا إلى السموات...

إلى الذين عشقوا الحرية التي تفوح منها رائحة
الليمون والبرتقال والندرجس...

إلى الذين هم رمز للاستبسال والشجاعة ...
غزة هاشم وأطفالها وأطفال أهل اليرموك

إلى أعمدة العلم والمعرفة الذين خطوا لي وللآخرين
... المعلم والمربيالفاضل . .
سميرخضر

إلى القلوب الطاهرة الرقيقة والنفوس البريئة إلى
رياحين حياتي ...

Abstract :

As a result of accidents and the growing risks in the electricity there are many applications have been developed to provide. The survival of devices connected to the electric power source without the need for them disastrous problem is the drain part of the electrical energy and the occurrence of fires .Two models were used the first model to measure the minimum value of the electric current cell phone was used electronic pieces programmed within the form.Designed especially circuit to convert the current to read the voltage to facilitate dealing with a piece of electronic programmedwill be compared in the electronic segment between the measured voltage value with the reference value represents the minimum amount of voltage during the removal of the cellular phone device from the charger with the survival of the charger socket and thus disconnect the charger as well as automatic optical sensor was used.The send a signal in the case of recharging the cell phone. The second model is to unplug electrical heater in the absence of movement in place and use thermal sensor inside the kinetic model of the motion sensor in place and send a signal to the electronic segment is programmed to disconnect the current of the heater automatically.

:

تتبع الحوادث والمخاطر المتزايدة من الكهرباء هناك العديد من التطبيقات التي طورت للتوفير .
فيبقى الأجهزة متصلة بمصدر الطاقة الكهربائية دون الحاجة إليها هي مشكلة كارثية تتمثل في استنزاف جزء من
الطاقة الكهربائية وحدوث حرائق. تم استخدام نموذجين النموذج الأول لقياس أدنى قيمة
للتيار الكهربائي للهاتف الخليوي حيث تم استخدام قطعة إلكترونية مبرمجة داخل النموذج.
دائرة كهربائية خاصة لتحويل قراءة التيار إلى جهد لتسهيل التعامل مع القطعة الإلكترونية المبرمجة
يتم مقارنة داخل القطعة الإلكترونية بين قيمة الجهد المقاسة مع قيمة مرجعية تمثل أدنى مقدار للجهد أثناء إزالة
جهاز الهاتف الخليوي من الشاحن مع بقاء الشاحن بالمقبس وبالتالي فصل الشاحن أوتوماتيكي كذلك تم استخدام
مجس ضوئي يقوم بإرسال إشارة في حالة إعادة شحن الهاتف الخليوي.
النموذج الثاني يتمثل في فصل التيار الكهربائي عن الصوبة الكهربائية في حال عدم وجود حركة في مكان
تواجدها.
الإلكترونية المبرمجة ليتم فصل التيار عن الصوبا بشكل أوتوماتيكي.

Contents

Chapter One: Introduction .

1.1 Overview.....	7
1.2 Project Motivation	7
1.3 Project Objectives.....	7
1.4 Literature Review.....	7
1.5 Time Plan.....	8
1.6 Project Cost.....	8

Chapter Two: Basics Of Electricity. .

2.1 Introduction.....	92.2
Dangers Of Electricity.....	92.3
Basic Electrical Safety.....	11

Chapter Three :System Design And Analysis .

3.1Design Principles.....	12
3.1.1The Cellphone Circuit	12
3.1.2 The Heater Circuit.....	14
3.2Reduction Voltage Circuit	15
3.3 Hard ware Devices.....	16
3.3.1Relay 5vdc RY5WFZ-K.....	16
3.3.2 LDR Sensor.....	17

3.3.3 Ultrasonic Sensors.....	18
3.3.4 Amplifier Transistors P2N2222.....	20
3.3.5D6T-44L / D6T-8L Thermal Sensor.....	21

Chapter Four :Software Design.

4.1 Arduino Uno.....	24
4.2Liquid Crystal Display	27
4.3Flow Chart.....	29
4.3.1Cell Phone.....	29
4.3.2 Heater.....	31

Chapter Five :Results & Analysis.

5.1 Scenario.....	32
5.2 Test Circuit	33

Chapter Six :Future Work & Recommendations.

6.1Future Work.....	36
6.2 Challenges.....	37

List of Figures

Figure 3.1 Electrical Cellphone Circuit	13
Figure 3.2 General Block Diagram- Cellphone.....	13
Figure 3.3 General Block Diagram- Heater.....	14
Figure 3.4 Reduction Voltage Circuit... ..	15
Figure 3.5 Internal Installation Of Relay.....	16
Figure 3.6 LDR Sensor.....	17
Figure 3.7 Ultrasonic Sensor.....	19
Figure 3.8 Transistor.....	20
Figure 3.9 Difference Between Pyro Electric And non-contact Temperature Tensors.....	22
Figure 3.10 Sensitivity Characteristics: FOV Image.....	22
Figure 3.11 Changing factor of measurement by distance.....	23
Figure 4.1 Arduino UNO.....	25
Figure 4.2 Liquid Crystal Display	27
Figure 4.3 Flow Chart-Cellphone	30
Figure 4.3 Flow Chart-Heater.....	31
Figure 5.1 Human Detection.....	33
Figure 5.2 Magnitude and Wave form-Full Receiver	33
Figure 5.3 Magnitude and Wave form- op amp.....	34
Figure 5.4 Power Supply Level Detection Circuit of 0.0 volt.....	35
Figure 5.5 Power Supply Level Detection Circuit of 230 volt.....	35

List of Tables

Table 1.1 Activities Planning	8
Table 1.2 Project Cost.....	8
Table 4.1 LCD Pins Configuration.....	28

List of Abbreviation :

HSE : Health And Safety Executive.

LDR :Light Dependent Resistor.

DC : Direct Current .

AC : Alternate Current.

USB : Universal Serial Bus.

LED : Light Emitting Diode.

Chapter One : Introduction

1.1 Project Overview :

The project supports in the field of automatic interruption will be used for electronic items and sensors, particularly suitable for measuring the current and turn it into a voltage and comparing the reference value within the programmed electronic piece. As well as the result of the sensor comparing within software code .

1.2 Project Motivation :

1. Protect humanity from the risks related to electricity.
2. Protection devices and thus increase the lifespan of electrical devices.
3. Alleviate the burden of the citizens.

1.3 Project Objectives :

1. Providing a new way to protect your home.
2. Devices, which do not have a load such as cell phone charger will be interrupted automatically.
3. Electrical heater in the absence of traffic will be interrupted electronically using special sensors.

1.4 Literature Review :

Many previous applications were used alarm in the event of an electrical fault, but this method does not protect against the risk of the occurrence.

In addition, there are some electric heaters by the occurrence of interruption at risk but they have high cost device.

Automatic interruption features from the previous techniques that the interruption of

electrical energy for devices before the occurrence of the risk and therefore guarantee the security of home.

1.5 Time Plan :

The Table 1.1 shows the activities that done in the project, and the time of each one.

Weeks Activities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Obtaining required components	■	■	■	■												
System Design					■	■	■	■								
Recording Results									■	■	■	■	■			
Results analysis and conclusion														■	■	■
Documentation				■	■	■	■	■	■	■	■	■	■	■		

Table 1.1 :Activities Planning .

1.6 : Project Cost :

Component	Cost JD
Operational amplifiers , Batteries , Switches , Resistors , Potentiometers ,Transformer , connectors .	50.2 JD
Thermal and Ultrasonic sensor with extension cable , LCD display , Arduino .	144.4 JD
Total	195 JD

Table 1.2 : Project cost .

Chapter Two: Basics Of Electricity

2.1 Introduction :

In order to understand even the simplest concepts of electronics, the first understand what electricity is. After all, the whole purpose of electronics is to get electricity to do useful and interesting things. The concept of electricity is both familiar and mysterious. That electricity comes from power plants that burn coal, catch the wind, or harness nuclear reactions. It travels from the power plants to our houses in big cables hung high in the air or buried in the ground. Once it gets to our houses, it travels through wires through the walls until it gets to electrical outlets.

From there, we plug in power cords to get the electricity into the electrical devices we depend on every day.

2.2 Dangers Of Electricity.

What are the risks from electricity?

Harm can be caused to any person when they are exposed to 'live parts' that are either touched directly or indirectly by means of some conducting object or material.

Voltages over 50 volts AC or 120 volts DC are considered hazardous.

Electricity can kill. Each year about 1000 accidents at work involving electric shocks or burns are reported to the (HSE). Around 30 of these are fatal, most of them arising from contact with overhead or underground power cables.

Shocks from faulty equipment can cause severe and permanent injury and can also lead to indirect injuries, due to falls from ladders, scaffolds, or other work platforms.

Faulty electrical appliances can also lead to fires. As well as causing injuries and loss of life, fires cause damage to plant, equipment and property.

Assessing the risks from electricity:

Consider the following hazards in your risk assessment:

Live parts Normal mains voltage, 230 volts AC, can kill. Also, contact with live parts can cause shocks and burns.

Fire Electrical faults can cause fires. This is particularly true where the equipment contains a heat source (e.g. heaters, including water heaters, washing machines, ovens, heat-seal packaging equipment).

Flammable or explosive atmospheres Electricity can be a source of ignition in a potentially flammable or explosive atmosphere, e.g. in spray paint booths or around refueling areas[1].

Where and how electricity is used ?

The risks from electricity are greatest in harsh conditions. In wet conditions, unsuitable equipment can easily become live and can make its surroundings live. While outdoors, equipment may not only become wet but may be at greater risk of damage. In cramped or confined spaces with a lot of earthed metalwork, such as inside tanks, ducts and silos, if an electrical fault develops it can be very difficult to avoid a shock. Types of equipment in use some items of equipment can also involve greater risk than others[2]. Extension leads are particularly liable to damage to their plugs and sockets, cables, and electrical connections. Other flexible leads, particularly those connected to equipment that is moved a great deal, can suffer from similar problems.

2.3 Basic Electrical Safety.

Below are some minimum steps you should take to ensure electrical safety.

- 1) Maintain all electrical installations in good working order.
- 2) Avoid overloading socket-outlets – using adaptors can cause fires.
- 3) Provide an accessible and clearly identified switch ('Emergency Off' or 'EMO' button) near fixed machinery to cut off power in an emergency.
- 4) For portable equipment, connect to nearby socket-outlets so that it can be easily disconnected in an emergency.
- 5) Choose electrical equipment that is suitable for its working environment.
- 6) Ensure that equipment is safe when supplied and maintain it in a safe condition.
- 7) Ensure cable ends always have their outer sheaths firmly clamped to stop wires working loose from plugs or inside equipment.
- 8) Automatic cutter for electrical appliances when not needed to use them.

Purpose of Protection System:

Minimize damage, leave unaffected equipment in-service, maintain equipment operating limits and maintain electrical system stability .

Chapter Three :System Design And Analysis

3.1 Design Principles :

This project aims to design a complete circuit which can identify the circles to separate automatic for electrical appliances.

3.1.1 The Cell Phone Circuit.

1- At No Load.

Apply a small current in the circuit and then the value is converted to the voltage. After getting the voltage signal, the signal will enter the Arduino environment and be compared with a reference voltage. If the input voltage is less than the reference voltage, a programmable code will trigger stimulating pulses for electric switches. See **Appendix A**.

2- At Load.

When it is re-connected to the mobile charger, the LDR sensor works and gives a change in resistance, then it is transferred to the voltage. After getting the voltage signal, the signal will enter the transistor, then to the relay, and therefore electricity is connected to the transformer again.

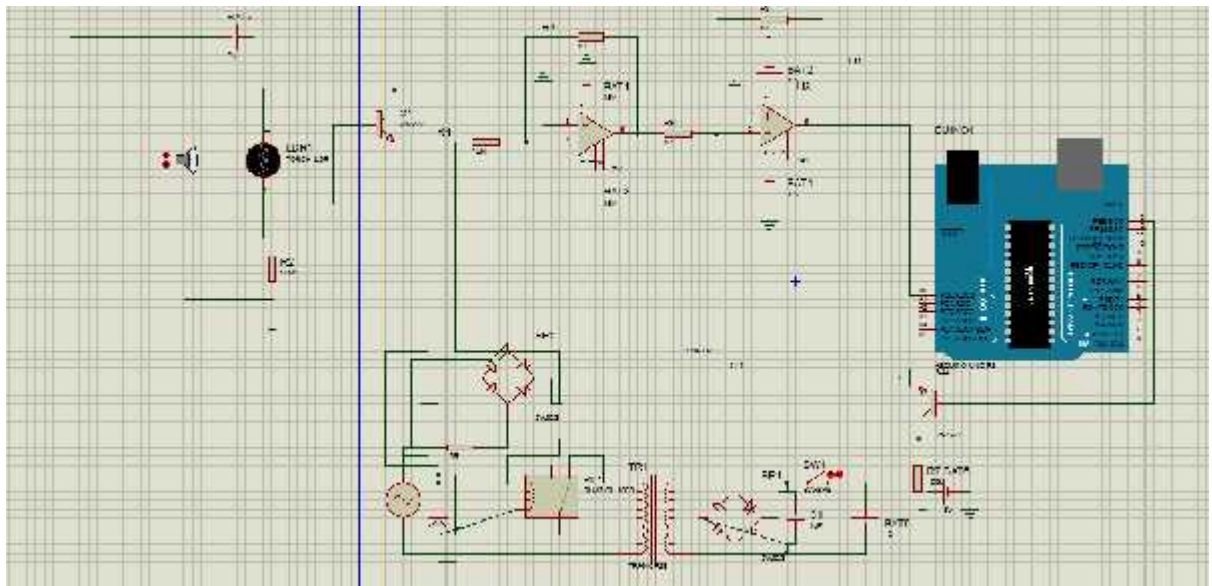


Figure3.1: Electrical –Cellphone Circuit

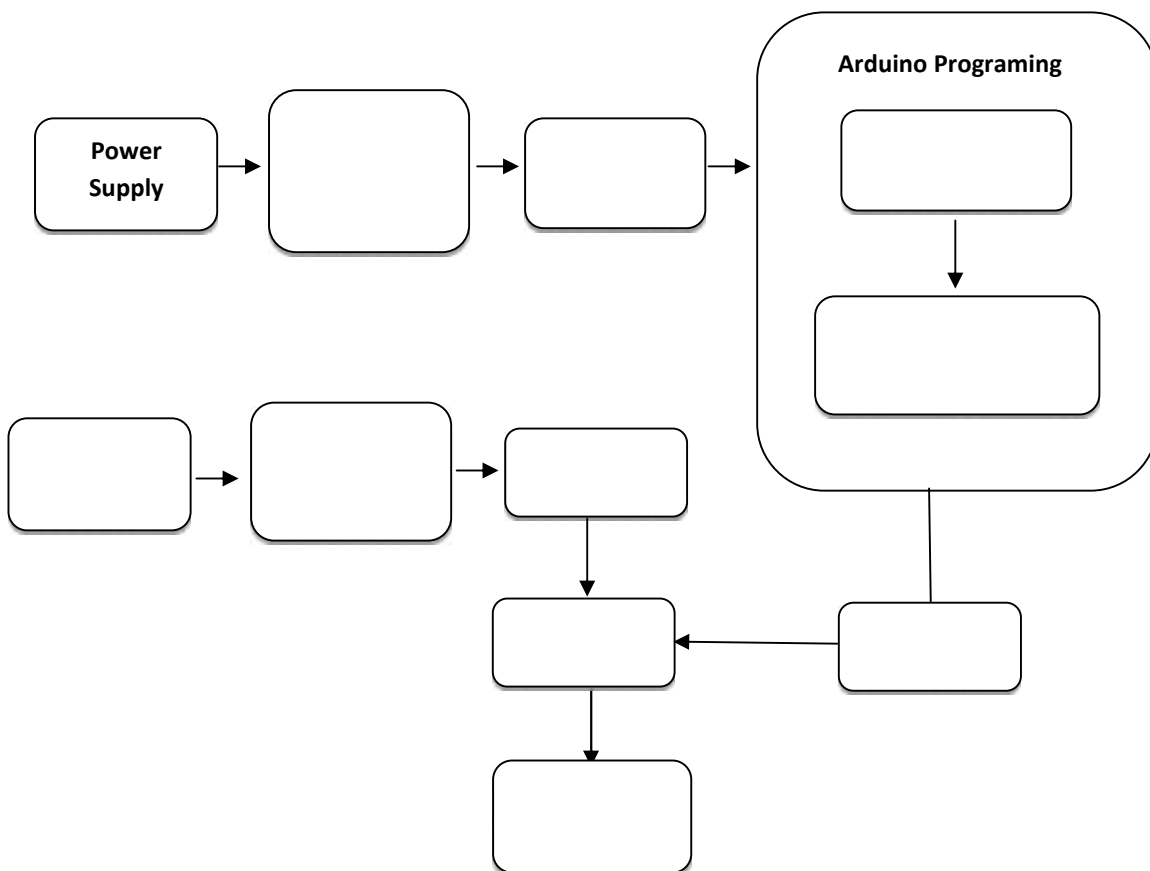


Figure3.2: General Block Diagram-Cellphone.

3.1.2 The Heater Circuit.

When someone enters the room, the ultrasonic sensor gives a signal and the thermal sensor analysis of human activities inside the room. If a person is sleeping or leaves the room, the sensors send a signal to the Arduino, programmable code will trigger stimulating pulses for electric switches then be automatic interrupted. Otherwise heater remain running. See **Appendix B**.

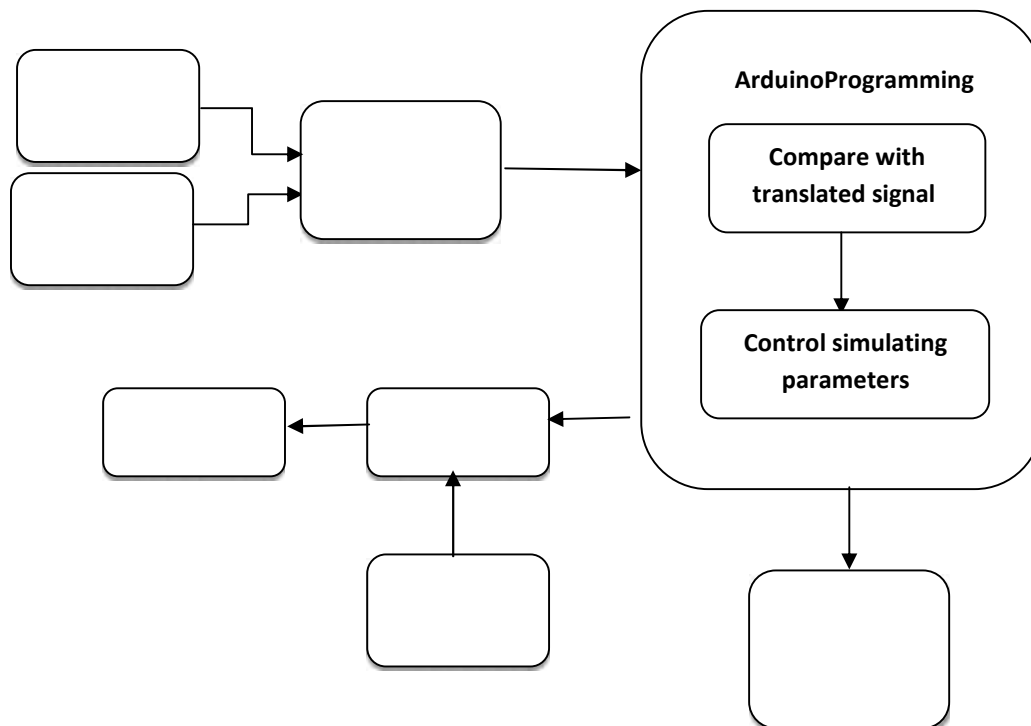


Figure3.3 : General Block Diagram-Heater .

3.2 Reduction Voltage Circuit :

As the main power supply voltage and the recommended stimulating intensity is 5volt , a rail to rail op-amp should be used . LM741 op-amp was used since it is rail to rail with a wide range of single supply voltage with several acceptable specifications as power supply rejection ratio , common mode rejection ratio , input offset current and other characteristics as illustrated in **Appendix C**.

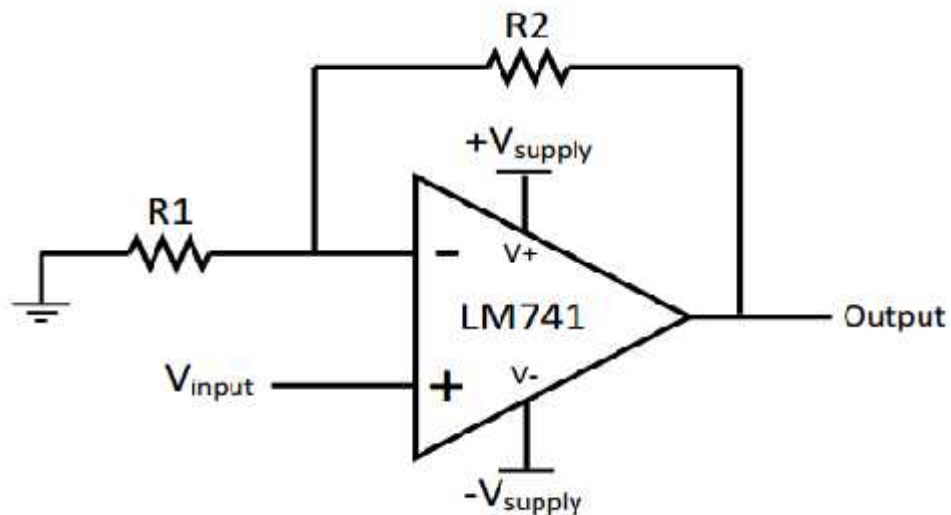


Figure 3.4:Reduction Voltage Circuit .

3.3 Hardware Devices

3.3.1 Relay 5vdc RY5WFZ-K .

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it). Many sensors are incredibly sensitive pieces of electronic equipment and produce only small electric currents. But often we need them to drive bigger pieces of apparatus that use bigger currents. Relays bridge the gap, making it possible for small currents to activate larger ones [3]. That means relays can work either as switches (turning things on and off) or as amplifiers converting small currents into larger ones as illustrated in **Appendix D**. See figure 3.5.

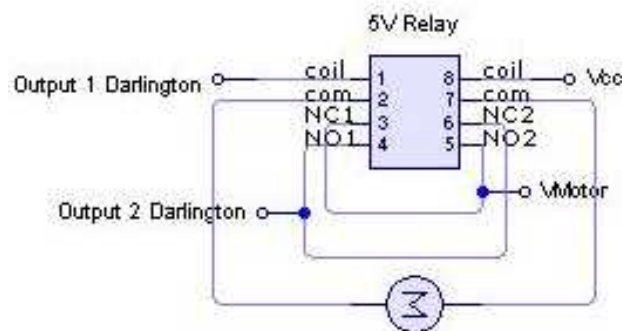


Figure 3.5 :Internal installation of relay .

3.3.2 LDR Sensor .

A photo resistor or photocell is a light-controlled variable resistor.

The resistance of a photo resistor decreases with increasing incident light intensity, in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

A photo resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as several (M Ω), while in the light, a photo resistor can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photo resistor can substantially differ among dissimilar devices. Moreover, unique photo resistors may react substantially differently to photons within certain wavelength bands.

See Figure 3.6.

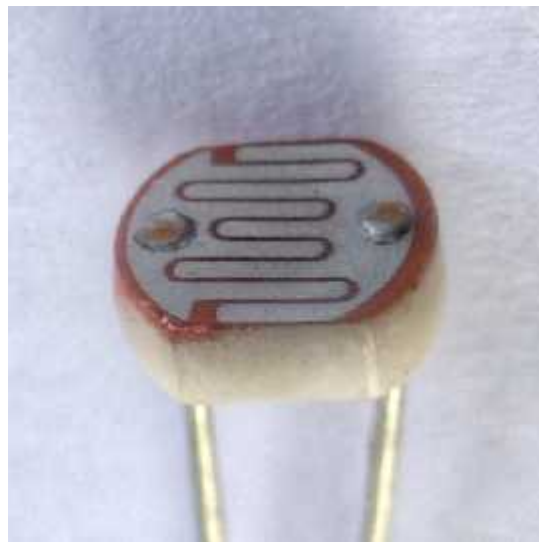


Figure 3.6:LDR Sensor

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own chargecarriers and is not an efficient semiconductor, for example, silicon. In intrinsic devices the only available electrons are in the valenceband, and hence thephoton must have enough energy to excite the electron across the entire gap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. Photo resistors are less light-sensitive devices than photodiodes or phototransistors: the two latter components are trues, while a photo resistor is a passive component and does not have a PN-junction. The photo resistivity of any photo resistor may vary widelydepending on ambient temperature, making them unsuitable for applications requiring precise measurement of or sensitivity to light. Photo resistors also exhibit a certaindegree of latency between exposure to light and the subsequent decrease in resistance, usually around 10 milliseconds. The lag time when going from lit to dark environments iseven greater, often as long as one second. This property makes them unsuitable for sensing rapidly flashing lights, but is sometimes used to smooth the response of audio signal compression [4].

3.3.3 Ultrasonic Sensors.

Ultrasonic sensors provide excellent repeatability and linearity in detecting the precise position of objects. The sensors provide high precision performance on any material of any color, irrespective of external light levels.

They produce accurate results even when used with highly transparent objects such as film or glass surfaces and are completely unaffected by normal levels of soiling on the sensor surface. The sensors are also characterized by high sound intensity that makes it possible to detect even the smallest of objects with extremely high reliability. This ability to maintain outstanding performance and reliability, even with the presence of suspended particles or water vapors, means that BERNSTEIN ultrasonic sensors are in daily use all over the World in a diverse range of demanding industrial applications. Advantages of ultrasonic sensors like as : Large detection range of up to 6000 mm (depending on design) , high linearity , high repeatability , narrow sound beam of 8°, adaptive 0–10 V voltage or 4–20 Ma current output (analogue sensors) , two switching outputs, can be used independently or together (switching sensors) and IP 67 type of protection. as illustrated in **Appendix E**.

Measuring principle of this sensor :

The sensor emits a sound pulse that is reflected from the object to be detected. The sensor reads in the reflected pulse and the distance to the object is determined by means of a runtime measurement routine. See figure 3.7.

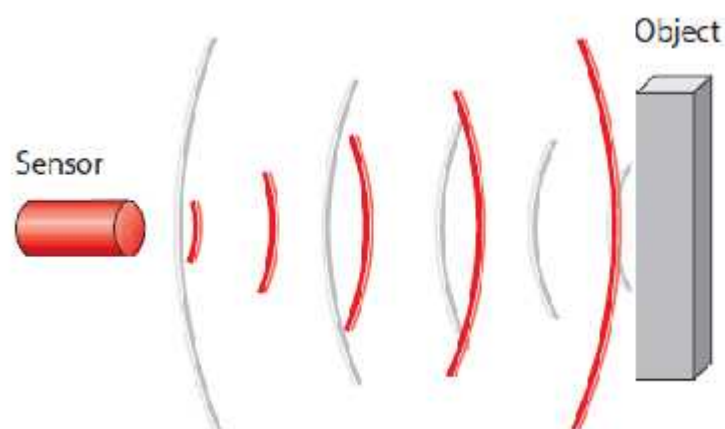


Figure 3.7:Ultrasonic sensors

3.3.4 Amplifier Transistors P2N2222A.

An electrical signal can be amplified by using a device which allows a small current or voltage to control the flow of a much larger current from a dc power source. Transistors are the basic device providing control of this kind. There are two general types of transistors, bipolar and field-effect .Very roughly, the difference between these two types is that for bipolar devices an input current controls the large current flow through the device, while for field-effect transistors an input voltage provides the control. In this experiment we will build a two-stage amplifier using two bipolar transistors. See figure 3.8[5]

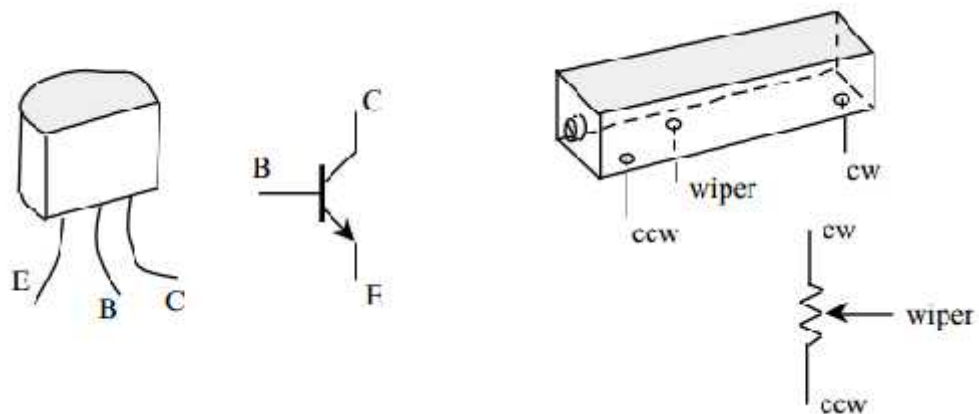


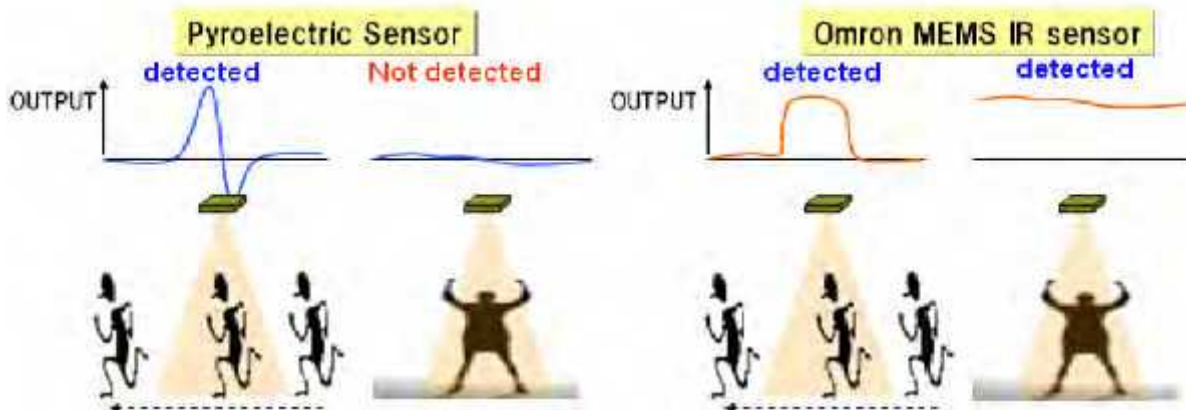
Figure 3.8: Transistor .

3.3.5 D6T-44L / D6T-8L Thermal Sensor.

The D6T series sensors are made up of a cap with silicon lens, MEMS thermopile sensor chips, and dedicated analog circuit and a logic circuit for converting to a digital temperature value on a single board through one connector. The basic measuring operation is as follows: The silicon lens collects radiated heat (far-infrared ray) emitted from an object onto the thermopile sensor in the module, the radiated heat (far-infrared ray) produces an electromotive force on the thermopile sensor, the analog circuit calculates the temperature of an object by using the electromotive force value and a measured temperature value inside the module, the measured value is outputted through an I2C bus.

This sensor has many advantages as the non-contact temperature sensor measures the surface temperature of an object. D6T-44L-06 and D6T-8L-06 have sensor chip arrays of 16 channels (4x4) and 8 channels (1x8) respectively. By mounting the signal processing circuit closely to the sensor chip, a low noise temperature measurement is realized.

The module can also be used for detecting the presence of human beings. Omron's non-contact temperature sensor can solve the shortcomings of a conventional pyroelectric sensor, which cannot catch the signal of a stationary person because the sensor detects the change of signal [in principle]. Moreover, Omron's non-contact temperature sensor *keeps* detecting the far-infrared ray of an object, while the pyroelectric models do not. See figure 3.9

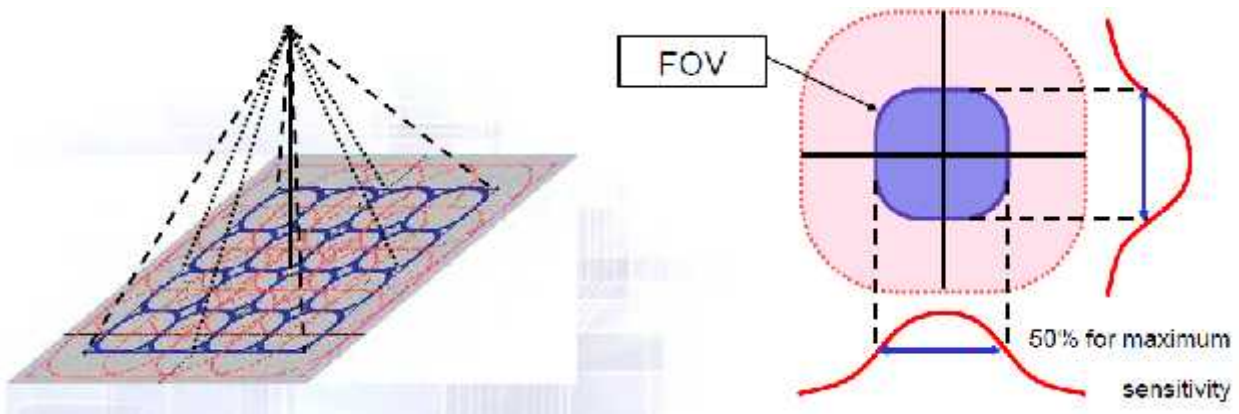


a)Pyro electric sensor output

b)Non-contact temperature sensor output

Figure 3.9:Difference between pyro electric and non-contact temperature sensors

The non-contact temperature sensor achieves its sensitivity characteristic for an object view angle by using a silicon lens. FOV (Field Of View) – an indication of view angle – is generally specified as an area angle of 50% for maximum sensitivity. See figure 3.10



(a) D6T-44L-06 FOV (16ch) image

(b) FOV and XY axis for a element

Figure 3.10:Sensitivity characteristics: FOV Image

The sensitivity area is wider than the FOV specified area. When an object to be measured is smaller than the sensitivity area, the background temperature effects the measurements. Though Omron's D6T sensor corrects a temperature measurement value by using a reference heat source (blackbody furnace), the measurement's value is influenced by the emissivity of the specific material of the object to be measured, and the surface shape of the occupant relative to the sensitivity area. See figure 3.11[6]

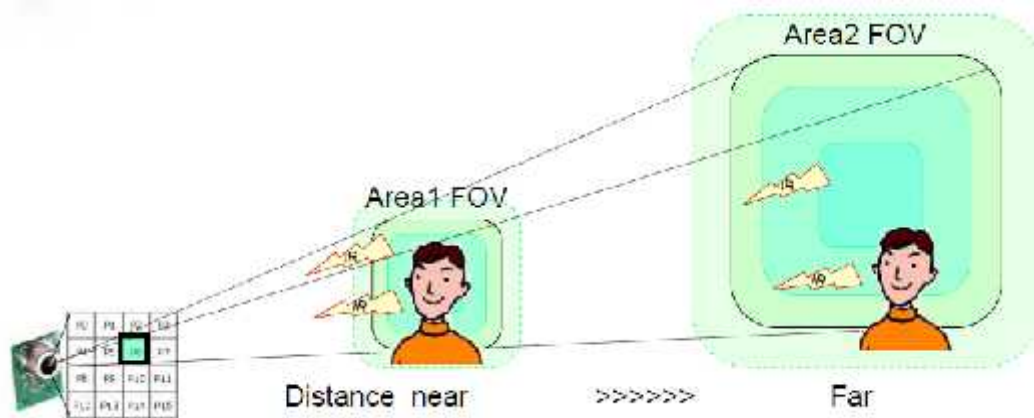


Figure 3.11: Changing factor of measurement by distance

Chapter 4 : Software Design

Programming process for the project was build through the use of Arduino software to control the element and time in order to be applied later to the devises to achieve the necessary protection. The result of the hardware design are displayed at a 16x2 liquid crystal display, which supports the project requirements.

4.1Arduino Uno:

Arduino is an open-source physical computing platform based on a simple I/O board and a development environment that implements Processing language .

The open-source Arduino environment makes it easy to write code and upload it to the I/O board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java , C , and other open source software .The Arduino Uno is a microcontroller board based on the ATmega328. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started .It can operate on (7- 12) voltage supply ,with a 16Mhz Clock Speed .

See figure 4.1[7]



Figure 4.1 :Arduino Uno.

The main parts :

1-The AT mega processor : Main IC " ATmega328 .

2- Power (USB / Barrel Jack) :Every Arduino board needs a way to be connected to a power . source. The Arduino Mega can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack.

3 - Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF) : The Arduino has several different kinds of pins .

- **GND** : There are several GND pins on the Arduino, any of which can be used to ground

the circuit .

- **5V & 3.3V**: Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.

- **Analog** : The area of pins (A0 through A5) are " Analog In" pins . These pins can read the signal from an analog sensor and convert it into a digital value that we can read .
- **Digital**: 14 digital pins (0 through 13) . These pins can be used for both digital input and digital output .
- **PWM**: These pins act as normal digital pins, but can also be used for something called Pulse - Width Modulation (PWM)
- **AREF**: Stands for Analog Reference. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

4 - Reset Button : Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino .

5 - Voltage Regulator: It controls the amount of voltage that is let into the Arduino board .

6 - TX RX LEDs : TX is short for transmit, RX is short for receive. These LEDs will give us visual indications whenever the Arduino is receiving or transmitting data .

7 - Power LED Indicator .

4.2 Liquid Crystal Display .

LCD (Liquid Crystal Display) screen is an electronic display module and have a wide Range of applications. 16x2 LCD display is very basic module and is very commonly used in various devices and circuits as illustrated in **Appendix F**.



Figure 4.2:16x2LCD display.

Dimensions :

- Width : 3.45 inches or 87mm .
- Height : 2.35 inches or 60mm .
- Display : view size 62mm x 26mm

Table 4.1 :LCD Pins Configuration .

Pin Number	Symbol	Level	Description
1	VSS	0V	Ground
2	VDD	5V	Supply Voltage for logic
3	VO	(Variable)	Operating voltage for LCD
4	RS	H/L	H: DATA, L: Instruction code
5	R/W	H/L	H: Read ,L: Write
6	E	H,H->L	Chip enable signal
7	DB0	H/L	Data bus line
8	DB1	H/L	Data bus line
9	DB2	H/L	Data bus line
10	DB3	H/L	Data bus line
11	DB4	H/L	Data bus line
12	DB5	H/L	Data bus line
13	DB6	H/L	Data bus line
14	DB7	H/L	Data bus line
15	A	5V	LED +
16	K	0V	LED-

4.3 Flow Chart.

4.3.1 Cell Phone

This diagrammatic representation is helpful for programming the Arduino Uno. First of all , initialize the values of current by declare each of them by a variable .According to special software code and peripherals selectionwe will get voltagevalue . If the voltage value is less than the referencevoltage value , this meansthat the device is inactive state, then a suitable interruption mode and time will be selectedto achieve complete safety.

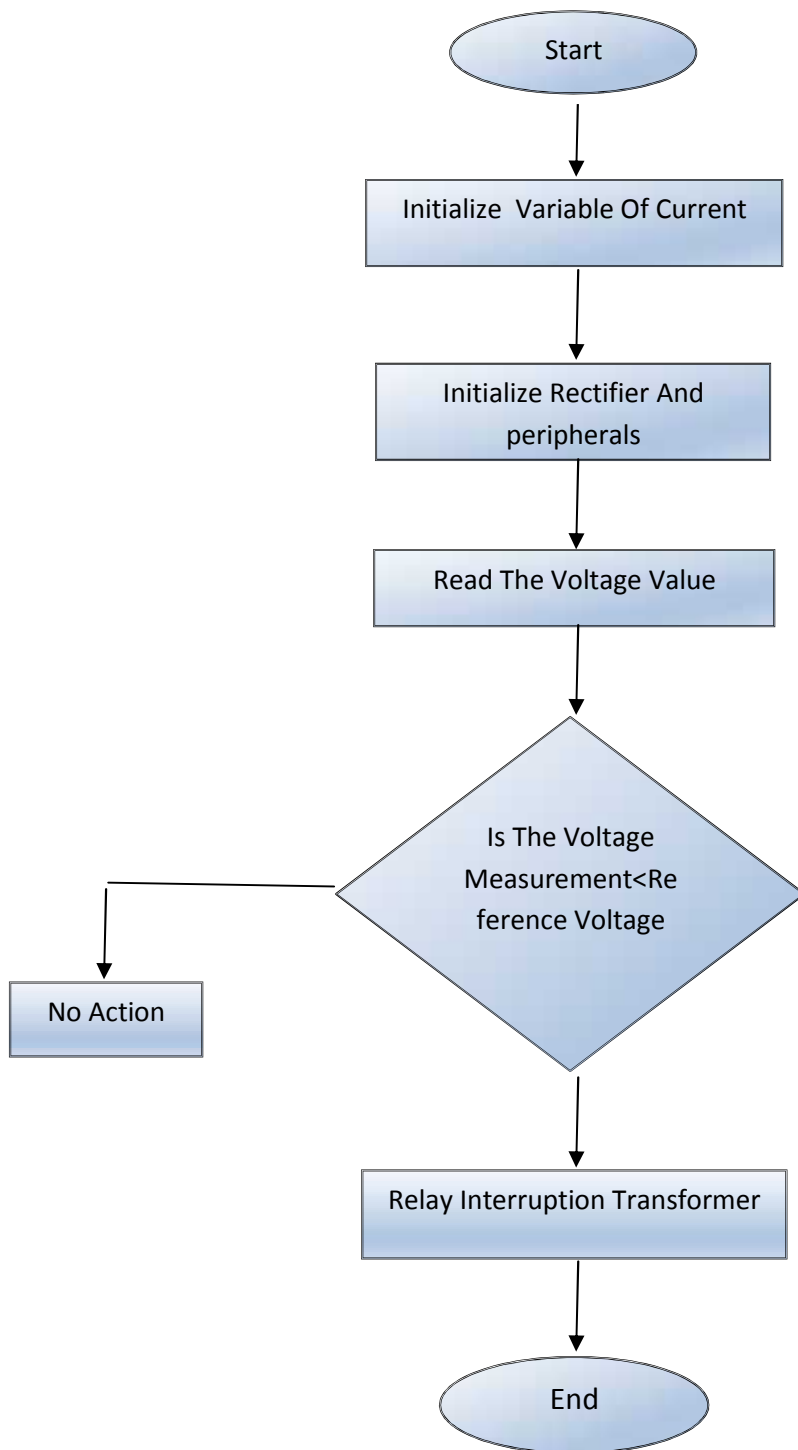


Figure 4.3: Flow Chart – Cellphone

4.3.2 Heater.

The second representation is also helpful for the heater process. First of all, initialize the values of sensor by declare each of them by a variable. According to special software code and elements selection we will get movement and heat value. If it does not have any movement, this means a suitable interruption mode and time will be selected to achieve safety.

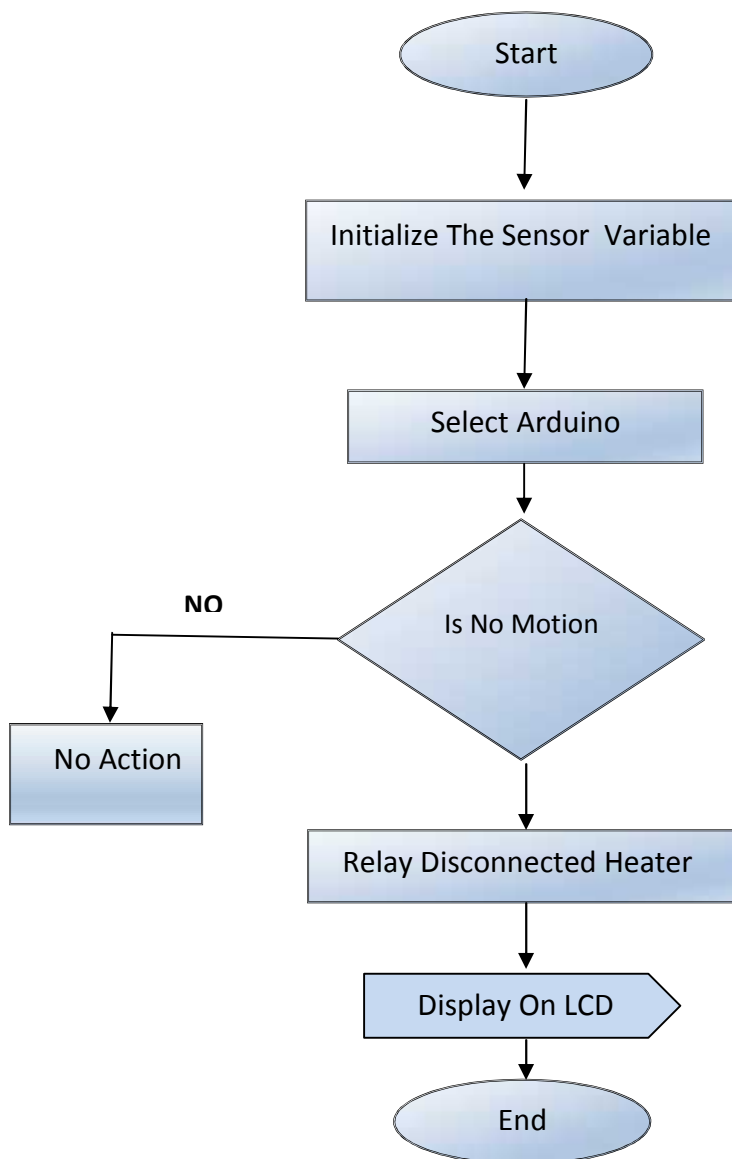


Figure 4.4 : Flow Chart – Heater

```
int in = A0;
float out = 13;

int volt = 0;

void setup() {
  pinMode(in, INPUT);
  pinMode(out, OUTPUT);
  {
  void loop(){
    volt = analogRead(in); // 0-1023
    volt = ((volt *5.0) / 1023.0);
  }
  if ( volt < 0.5){
    delay(1000*20);
    if ( volt < 0.5){
      digitalWrite(out, HIGH);
    }else{
      digitalWrite(out, LOW);
    }
  }

  delay(10);
}
```

Chapter Six : Future Work & Recommendations

6.1 Future Work.

- The energy interruption depending on relay which are responsible for the interruption circuit . More accuracy can be achieved if the use of other techniques.

- Arduino uses to control the interruption .More accuracy can be achieved if the use of other microcontroller for less energy consumption.

- Using rechargeable battery can increase the possibility of using the device for a longer period of time without battery repeated replacement.

- The system can be developed by the use other techniques with greater accuracy than LDR sensor .

- According to room condition , a study about the ability to find a relation between motion, heat and oxygen will be a brilliant solution for home safety.

- Additional electrical circuits can be included to increase the safety level of this device . as those which can open the system when there is an unexpected leakage from electrical components .

- The systems applied to the two load , will be a brilliant solution for home safety when it applied for all the loads in the home.

6.2 Challenges :

- Choose an appropriate element with design and suitable size for module structure .
- To determine the reference value for each device that will trigger interruption automatic.
- To provide the maximum level of safety as much as possible when applying electrotherapy by restricting with its principles .
- To persuade consumers with a new , unique method for interruption automatic with less cost .

```
Liquid Crystal LCD (12, 11, 5, 4, 3, 2);
```

```
Int trig Pin=13;
```

```
Int echo Pin=10;
```

```
Int maximum Range = 200;
```

```
Int minimum Range = 0;
```

```
Long duration, distance;
```

```
Void setup ()
```

```
{
```

```
Serial .begin (9600)
```

```
Pin Mode (trig Pin, OUTPUT) ;(
```

```
Pin Mode (echo Pin, INPUT) ;(
```

```
LCD. begin (16, 2);
```

```
LCD. Set Cursor (0, 0);
```

```
LCD. print ("heater :");
```

```
Wire. Begin ();
```

```
Serial. Begin (9600);
```

```
}
```

```
Int reading = 0;
```

```
Int count=0;
```

```
Char buff [3];
```

```
Void loop ()
```

```
{
```

```
Digital Write (trig Pin, LOW);
```



```

Delay Microseconds (2);
Digital Write (trig Pin, HIGH);
Delay Microseconds (10);
Digital Write (trig Pin, LOW);
    Duration = pulse in (echo Pin, HIGH);
Distance = duration/58.2;
If (distance >= maximum Range || distance <= minimum Range){
    Serial. Print in ("-1");
    LCD. Set Cursor (0, 1);
    LCD. print ("    off    ");

}
Else {

    Serial. Print in (distance);
    LCD .set Cursor (0, 1);
    LCD. print ("    on    ");
}

delay(50);

Wire.beginTransaction (0x0a);

    Wire. Write (byte (0x4c));

Wire.endTransmission (false);

Wire.requestFrom (0x0a, 32);

```

```
Count=0;
```

```
While (count<32)
```

```
{
```

```
if (2 <= Wire. Available ())
```

```
{
```

```
Reading = Wire. Read ();
```

```
Reading+= Wire. Read ()<<8;
```

```
Serial. Print (reading);
```

```
Serial. Print (" ");
```

```
Count+=2;
```

```
}
```

```
}
```

Reference:

[1] Managing Electrical Risks In The Workplace. New York Singapore ,2000.

https://www.safework.sa.gov.au/uploaded_files/CoPManagingElectricalRisksWorkplace.pdf

[2] Key World Energy Statistics .Compared with Electret Microphones. December 2000.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297281/LIT_8990_7a4691.pdf

[3] Surface Mounting Relay with the World's Smallest Mounting Area. Michael D. Seal, P.E., GE Senior Specification Engineer and Daniel J. Hap, GE Engineer (Retired).

<https://www.omron.com/ecb/products/pdf/en-g6k.pdf>

[4] Light Dependent Resistance as a Sensor in Spectroscopy Setups Using Pulsed Light and Compared with Electret Microphones. February 2006; in revised form: 27 April 2006 / Accepted: 9 May 2006.

http://www.openobject.org/physicalprogramming/images/c/cd/Sensor_Report.pdf

[5] Walter G. Jung, Op Amp Applications, Analog Devices, 2002, ISBN 0-916550-26-5.

<http://www.colorado.edu/physics/phys3330/PDF/Experiment7.pdf>

[6] D6T-44L/D6T-8L Thermal sensor. Copyright © 2013 OMRON Corporation. All Rights Reserved.

http://www.mouser.com/pdfdocs/D6T01_ThermalIRSensorWhitepaper.pdf

[7] Cover Photo Credit: Arduino Cake Copyright © 2011 Alan G. Smithe All Rights Reserved.

<http://www.introtoarduino.com/downloads/IntroArduinoBook.pdf>

APPENDIX A

Software design code- Cell Phone .

APPENDIX B

Software design code- Heater .

APPENDIX C

Datasheet for LM741 operational amplifier

APPENDIX D

Datasheet for Relay5vdcRY5WFZ-K .

APPENDIX E

Datasheet for UltrasonicSensors.

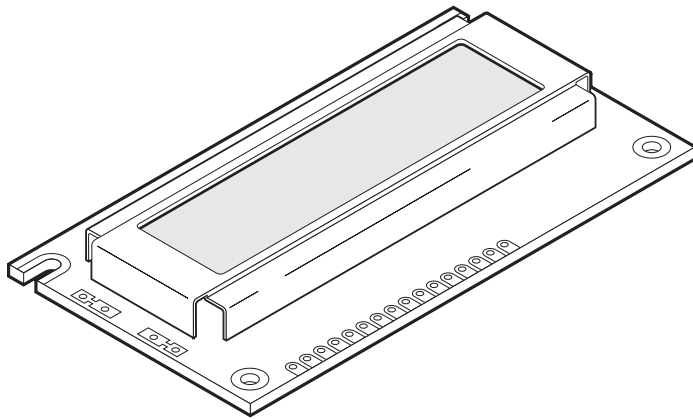
APPENDIX F

Datasheet For Liquid Crystal Display .

ALPHANUMERIC LCD DISPLAY (16 x 2)

Order Code

LED008 16 x 2 Alphanumeric Display
FRM010 Serial LCD Firmware (optional)



Contents

1 x 16x2 Alphanumeric Display
1 x data booklet

Introduction

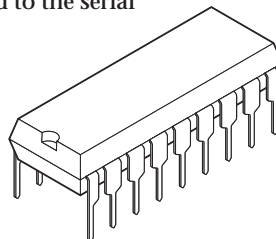
Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).

Further Information

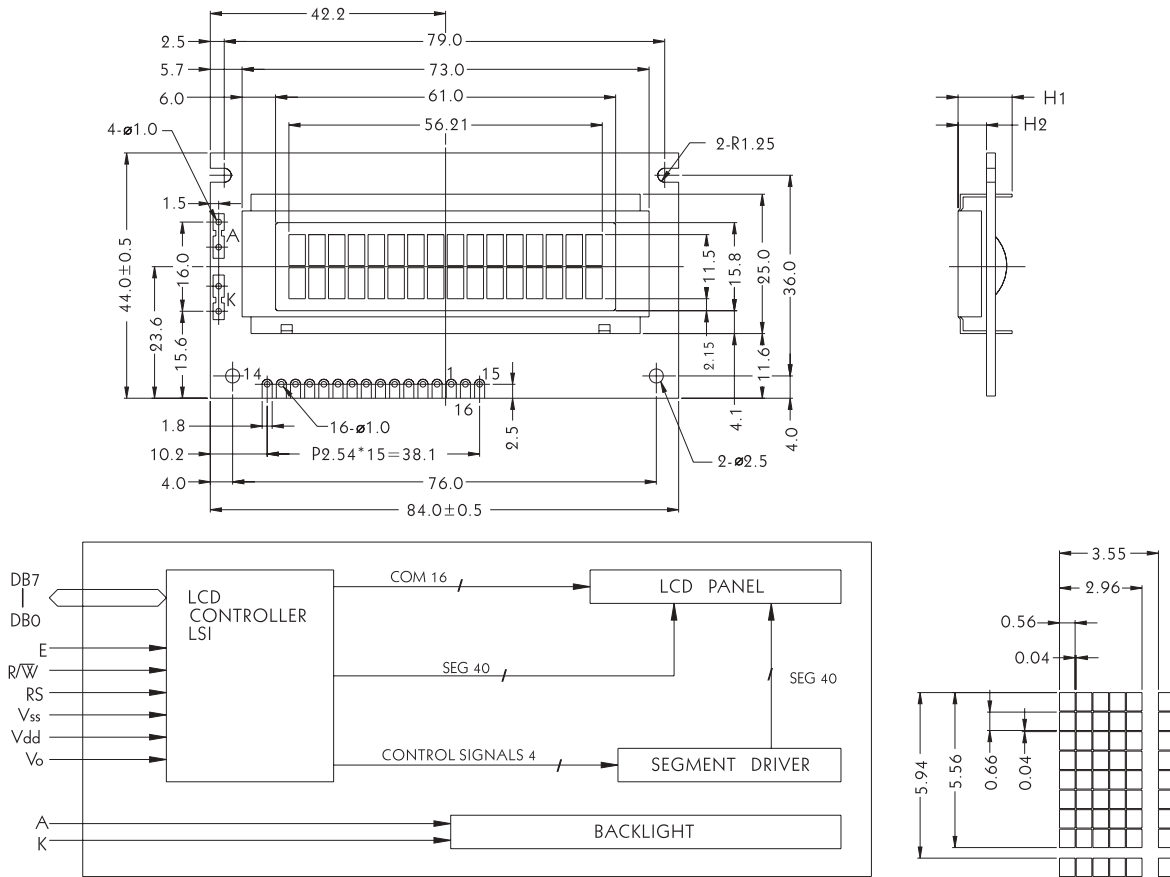
Available as an optional extra is the Serial LCD Firmware, which allows serial control of the display. This option provides much easier connection and use of the LCD module. The firmware enables microcontrollers (and microcontroller based systems such as the PICAXE) to visually output user instructions or readings onto an LCD module. All LCD commands are transmitted serially via a single microcontroller pin. The firmware can also be connected to the serial port of a computer.

An example PICAXE instruction to print the text 'Hello' using the `serout` command is as follows:

```
serout 7,T2400,("Hello")
```



Outline Dimension and Block Diagram



The tolerance unless classified ±0.3mm

MECHANICAL SPECIFICATION

Overall Size	84.0 * 44.0	Module	H2 / H1
View Area	61.0 * 15.8	W/O B/L	5.1 / 9.7
Dot Size	0.56 * 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.60 * 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT

Pin no.	Symbol	Function
1	V _{ss}	Power supply (GND)
2	V _{dd}	Power supply (+5V)
3	V ₀	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read/write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING

Item	Symbol	Conditions	Min.	Max.	Unit
Power Supply Voltage	V _{dd} -V _{ss}	—	0	7	V
LCD Driving Supply Voltage	V _{dd} -V _{ee}	—	0	13	V
Input Voltage	V _{in}	—	-0.3	V _{dd} +0.3	V
Operating Temperature	T _{opr}	Nor.	0	50	°C
Storage Temperature	T _{stg}	Nor.	-20	+70	°C

ELECTRICAL CHARACTERISTICS (V_{dd} = +5V, T_a = 25°C)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V _{dd}	—	4.5	5	5.5	V
"H" Input Voltage	V _{IH}	—	2.2	—	—	V
"L" Input Voltage	V _{IL}	—	—	—	0.6	V
"H" Output Voltage	V _{OH}	—	2.4	—	—	V
"L" Output Voltage	V _{OL}	—	—	—	0.4	V
Supply Current	I _{dd}	—	2	—	—	mA
LCD Driving Voltage	V _{LCD}	V _{dd} -V ₀	4.3	—	4.8	V

Electrical Characteristics

Vdd = 5V±5%
Vss = 0V

Item	Symbol	Condition	Standard value			Unit	Applicable terminal
			Min.	Typ.	Max.		
Power voltage	Vdd		4.5	5.00	5.5	V	Vdd
Input H - level voltage	VIH		2.2	—	Vdd	V	RS, R/ \overline{W} , E DB0~DB7
Input L - level voltage	VIL		-0.3	—	0.6	V	
Output H - level voltage	VOH	- IOH = 0.205mA	2.4	—	—	V	DB0~DB7
Output L - level voltage	VOL	IOL = 1.2mA	—	—	0.4	V	
I/O leakage current	IIL	Vin = 0~Vdd	-1	—	1.0	μ A	RS, R/ \overline{W} , E DB0~DB7
Supply current	Idd	Vdd = 5V	2	—	—	mA	Vdd
LCD operating voltage	VLCD	Vdd-V0	3.0	—	11.0	V	V0

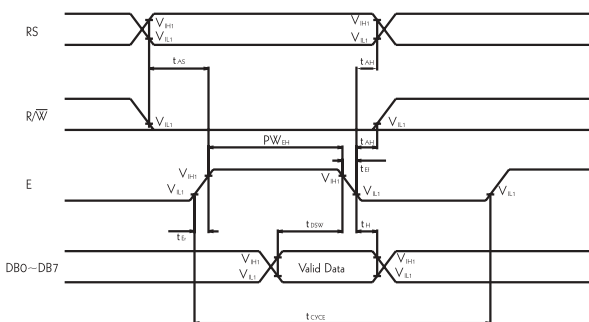
Timing Characteristics

Vdd = 5V±5%
Vss = 0V

Item	Symbol	Min.	Max.	Unit
Enable cycle time	TCYCE	500	—	ns
Enable pulse width	PWEH	220	—	ns
Enable rise / fall time	TER, TEF	—	25	ns
Set-up time	TAS	40	—	ns
Address hold time	TAH	10	—	ns
Data set-up time	TDSH	60	—	ns
Data delay time	TDDR	60	120	ns
Data hold time (writing)	TH	10	—	ns
Data hold time (reading)	TDHR	20	—	ns
Clock oscillating frequency	TOSC	270 (Typ.)		KHz

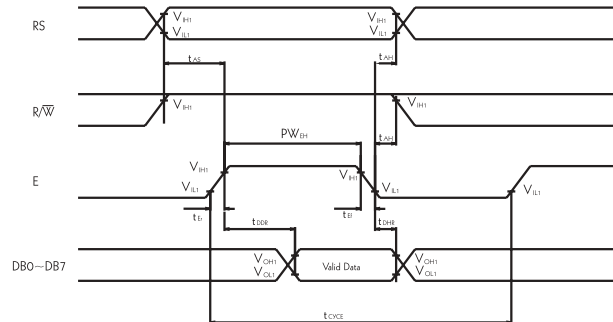
Timing Chart

◆ FIG.1 WRITE OPERATION



(Write Data from MPU to MODULE)

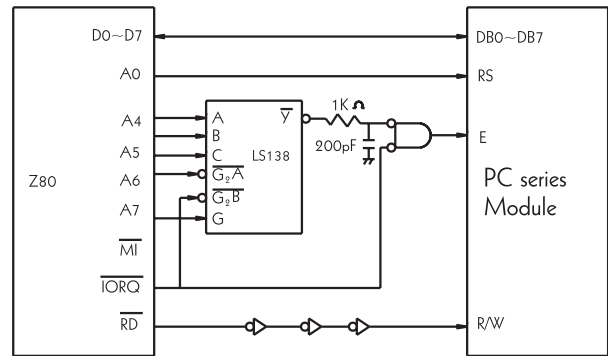
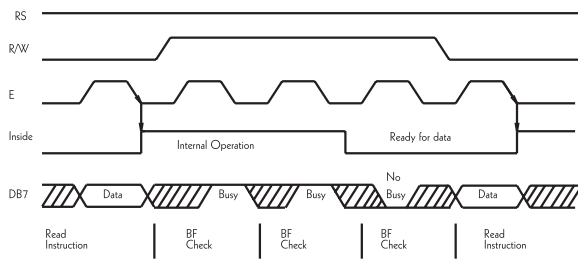
◆ FIG.2 READ OPERATION



(Read Data from MODULE to MPU)

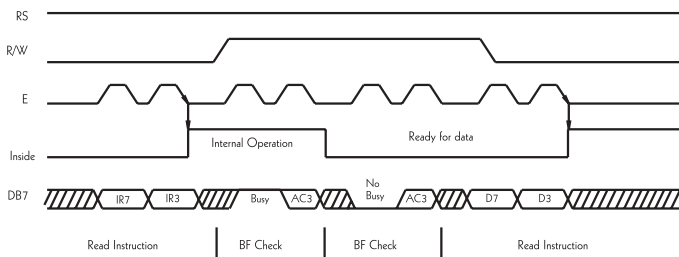
Interface with MPU

◆ Example of Interface with 8-bit MPU (Z80)

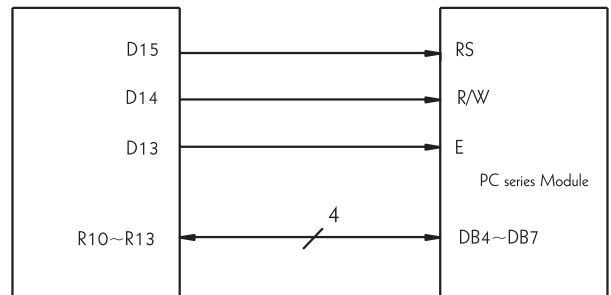


◆ Example of interface with 4-bit MPU

Interface with 4-bit MPU can be made through I/O port of 4-bit MPU. If there are enough I/O ports, data can be transferred by 8-bit, however, if there are not data transfer can be done by 4-bit in twice (select interface is 4-bit long), and timing sequence will be complicated in this case. Please take into account that 2 cycles of BF check is necessary, while 2 cycles of data transfer are also necessary.



Note: IR7, IR3: 7th bit, 3rd bit of instruction
AC3: 3th bit of Address Counter



Features

- (1) Interface with 8-bit or 4-bit MPU is available.
- (2) 192 kind of alphabets, numerals, symbols and special characters can be displayed by built-in character generator (ROM).
- (3) Other preferred characters can be displayed by character generator (RAM).
- (4) Various functions of instruction are available by programming.
 - Clear display • Cursor at home • On / off cursor
 - Blink character • Shift display • Shift cursor
 - Read / write display data.....etc.
- (5) Compact and light weight design which can be easily assembled in devices.
- (6) Single power supply +5V drive (except for extended temp. type).
- (7) Low power consumption.

*Interface between data bus line and 4-bit or 8-bit MPU is available.
Data transfer are made in twice in case of 4-bit MPU, and once in case of 8-bit MPU.

◆ If interface data is 4-bit long

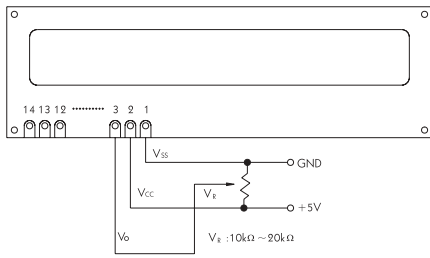
Data transfer are made through 4 bus lines from DB4 to DB7. (while the rest of 4 bus lines from DB0 to DB3 are not used.) Data transfer with MPU are completed when 4-bit data are transferred in twice. (first upper 4-bit data. then lower 4-bit data.)

◆ If interface data is 8-bit long

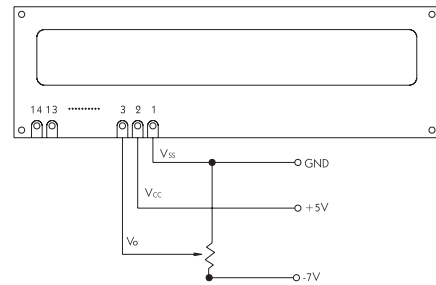
Data transfer are made through all of 8 bus lines from DB0 to DB7.

Example of Power Supply

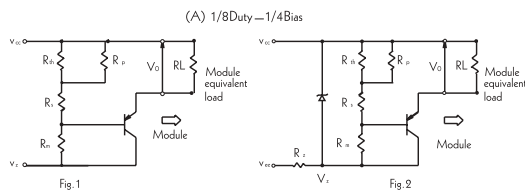
◆ Normal Temperature Type



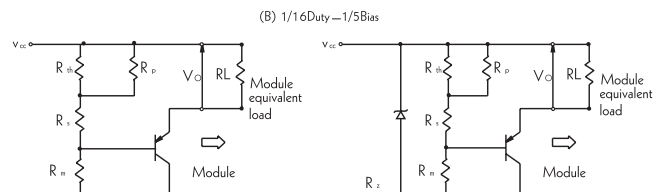
◆ Extended Temperature Type



◆ Examples of Temperature Compensation Circuits for Extended Temp Type. (Only for reference)



Thermistor: $R_{th}(25^{\circ}\text{C})=15[\text{k}\text{-ohm}]$, $B=4200[\text{K}]$
 Resistors: $R_p=30[\text{k}\text{-ohm}]$, $R_s=6.8[\text{k}\text{-ohm}]$, $R_m=3.3[\text{k}\text{-ohm}]$
 Transistor: PNP Type
 $V_{cc}=+5\text{V}$, $V_{ss}=0\text{V}$ (Logic Supply)
 $V_z=-8[\text{V}]$ (-7.8 to -8.2[V])
 $V_{ee}<V_z[\text{V}]$, $R_z=(V_z-V_{ee}) / 5[\text{k}\text{-ohm}]$



Thermistor: $R_{th}(25^{\circ}\text{C})=15[\text{k}\text{-ohm}]$, $B=4200[\text{K}]$
 Resistors: $R_p=510[\text{k}\text{-ohm}]$, $R_s=8.2[\text{k}\text{-ohm}]$, $R_m=3.9[\text{k}\text{-ohm}]$
 Transistor: PNP Type
 $V_{cc}=+5\text{V}$, $V_{ss}=0\text{V}$ (Logic Supply)
 $V_z=-11[\text{V}]$ (-10.725 to -11.275[V])
 $V_{ee}<V_z[\text{V}]$, $R_z=(V_z-V_{ee}) / 5[\text{k}\text{-ohm}]$

Instructions

Instruction	Code										Description	Executed Time(max.)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to the home position (Address 0)	1.64mS
Cursor At Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (Address 0). Also returns the display being shifted to the original position. DD RAM contents remain unchanged.	1.64mS
Entry Mode Set	0	0	0	0	0	0	0	1	D	S	Sets the cursor move direction and specifies or not to shift the display. These operations are performed during data write and read.	40μS
Display On / Off Control	0	0	0	0	0	0	1	D	C	B	Sets ON / OFF of all display (D), cursor NO / OFF (C), and blink of cursor position character (B).	40μS
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DD RAM contents.	40μS
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL) number of display lines (L) and character font (F)	40μS
CG RAM Address Set	0	0	0	1	ACG					Sets the CG RAM address. CG RAM data is sent and received after this setting.	40μS	
DD RAM Address Set	0	0	1	ADD					Sets the DD RAM address. DD RAM data is sent and received after this setting.	40μS		
Busy Flag / Address Read	0	1	BF	AC					Reads Busy flag (FB) indicating internal operation is being performed and reads address counter counts.	0μS		
CG RAM / DD RAM Data Write	1	0	WRITE DATA					Writes data into DD RAM or CG RAM.	40μS			
CG RAM / DD RAM Data Read	1	1	READ DATA					Reads data from DD RAM or CG RAM.	40μS			

Code	Description	Executed Time (max)
I / D = 1 : Increment I / D = 0 : Decrement S = 1 : With display shift S / C = 0 : cursor movement R / L = 1 : Shift to the right R / L = 0 : Shift to the left DL = 1 : 8-bit	DL = 0 : 4-bit N = 1 : 2lines N = 0 : 1line F = 1 : 5×10dots F = 0 : 5×7dots BF = 1 : Internal operation is being performed BF = 0 : Instruction acceptable	DD RAM: Display Data RAM CG RAM: Character Generator RAM ACG: CG RAM Address ADD: DD RAM Address Corresponds to cursor address. AC: Address Counter, used for both DD RAM and CG RAM *: Invalid
		fcp or fosc = 250KHz However, when frequency changes, execution time also changes Example if fcp or fosc is 270KHz, $70\mu\text{S} \times 250 / 270 = 37\mu\text{S}$

Power Supply Reset

The internal reset circuit will be operated properly when the following power supply conditions are satisfied. If it is not operated properly, please perform initial setting along with the instruction.

Item	Symbol	Measuring Condition	Standard Value			Unit
			Min.	Typ.	Max.	
Power Supply RISE Time	tree	—	0.1	—	10	mS
Power Supply CFF Time	toff	—	1	—	—	mS

Reset function

◆ Initialization Made by Internal Reset Circuit

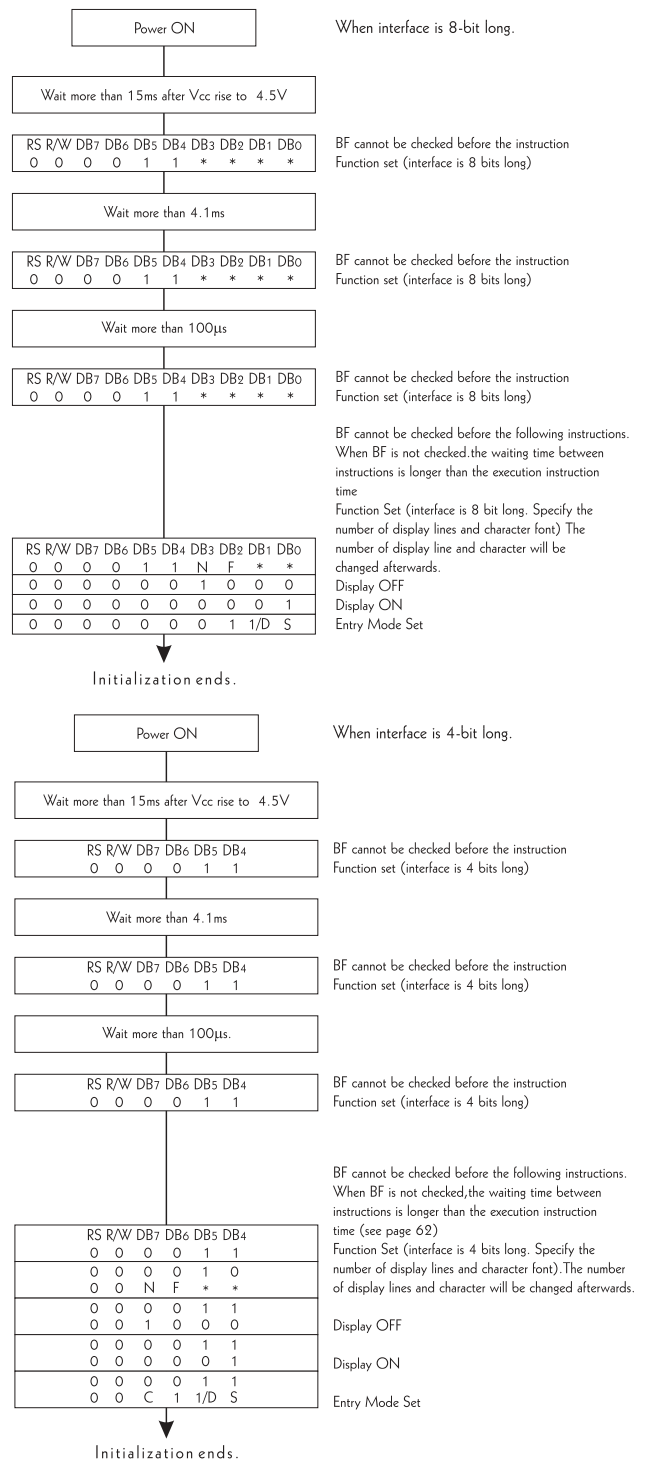
HD44780 automatically initializes (resets) when power is supplied (builtin internal reset circuit). The following instructions are executed in initialization. The busy flag (BF) is kept in busy state until initialization ends. (BF=1) The busy state is 10 ms after Vdd reaches to 4.5V.

- (1) Display clear
- (2) Function set
 - DL= 1:8 bit long interface data
 - DL= 0:4 bit F= 0:5 x 7dots character font
 - N= 1:2 lines
 - N= 0:1 line
- (3) Display ON / OFF control
 - D= 0:Display OFF C= 0:Cursor OFF
 - B= 0:Blink OFF
- (4) Entry mode set
 - 1 / D= 1:+1(increment) S= 0:No shift

Note:When conditions stated in power supply conditions using internal reset circuit are not satisfied.The internal reset circuit will not operate properly and initialization will not be performed. Please make initialization using MPU along with instruction.

◆ Initialization along with instruction

If power supply conditions are not satisfied, which for proper operation of internal rest circuit, it is required to make initialization along with instruction. Please make following procedures.



Standard Character Pattern (Powertip Module)

		Higher 4-bit (D4 to Character Code (Hexadecimal))																		
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)	±		0	0	P	'	P	5	5	5	'	'	R	B	7			
	1	CG RAM (2)	≡	!	1	A	0	a	4	0	2	i	"	J	+	y	U			
	2	CG RAM (3)	7	"	2	B	R	b	n	é	f	6	'	o	5	5	X			
	3	CG RAM (4)	□	#	3	C	S	c	s	á	á	á	'	P	9	e	v			
	4	CG RAM (5)	⋮	\$	4	D	T	t	t	á	á	á	'	4	n	Z	o			
	5	CG RAM (6)	⋮	%	5	E	U	e	u	á	á	á	'	2	t	2	n	7		
	6	CG RAM (7)	⋮	&	6	F	V	v	v	á	á	á	'	u	w	0	0	8		
	7	CG RAM (8)	⋮	'	7	G	W	w	w	á	á	á	'	U	R	X	+	A	L	4
	8	CG RAM (1)	⋮	(	8	H	X	x	x	á	á	á	'	÷	÷	÷	K	0	0	0
	9	CG RAM (2)	⋮	)	9	I	V	i	v	v	á	á	'	¿	Γ	T	A	4		
	A	CG RAM (3)	⋮	*	*	*	J	Z	j	z	é	é	'	0	A	Z	7	S	M	7
	B	CG RAM (4)	⋮	+	;	K	K	k	c	i	n	g	'	g	L	v	v	*		
	C	CG RAM (5)	⋮	=	,	<	L	\	l	l	á	á	'	á	á	á	á	á	á	á
	D	CG RAM (6)	⋮	~	~	~	M	N	n	D	i	á	á	'	*	*	w	w	~	~
	E	CG RAM (7)	⋮	#	.	>	N	^	n	^	á	á	'	á	á	á	á	á	á	á
	F	CG RAM (8)	⋮	@	/	?	0	_	o	á	á	á	'	~	0	o	o	o	o	o

Standard Character Pattern (Elec & Eltek Module)

Upper(4bit) Lower(4bit)		LLLL	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)															
LLLH	(2)															
LLHL	(3)															
LLHH	(4)															
LHLL	(5)															
LHLH	(6)															
LHHL	(7)															
LHHH	(8)															
HLLL	(1)															
HLLH	(2)															
HLHL	(3)															
HLHH	(4)															
HHLL	(5)															
HHLH	(6)															
HHHL	(7)															
HHHH	(8)															

LM741 Operational Amplifier

1 Features

- Overload Protection on the Input and Output
- No Latch-Up When the Common-Mode Range is Exceeded

2 Applications

- Comparators
- Multivibrators
- DC Amplifiers
- Summing Amplifiers
- Integrator or Differentiators
- Active Filters

3 Description

The LM741 series are general-purpose operational amplifiers which feature improved performance over industry standards like the LM709. They are direct, plug-in replacements for the 709C, LM201, MC1439, and 748 in most applications.

The amplifiers offer many features which make their application nearly foolproof: overload protection on the input and output, no latch-up when the common-mode range is exceeded, as well as freedom from oscillations.

The LM741C is identical to the LM741 and LM741A except that the LM741C has their performance ensured over a 0°C to +70°C temperature range, instead of -55°C to +125°C.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
LM741	TO-99 (8)	9.08 mm × 9.08 mm
	CDIP (8)	10.16 mm × 6.502 mm
	PDIP (8)	9.81 mm × 6.35 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Typical Application

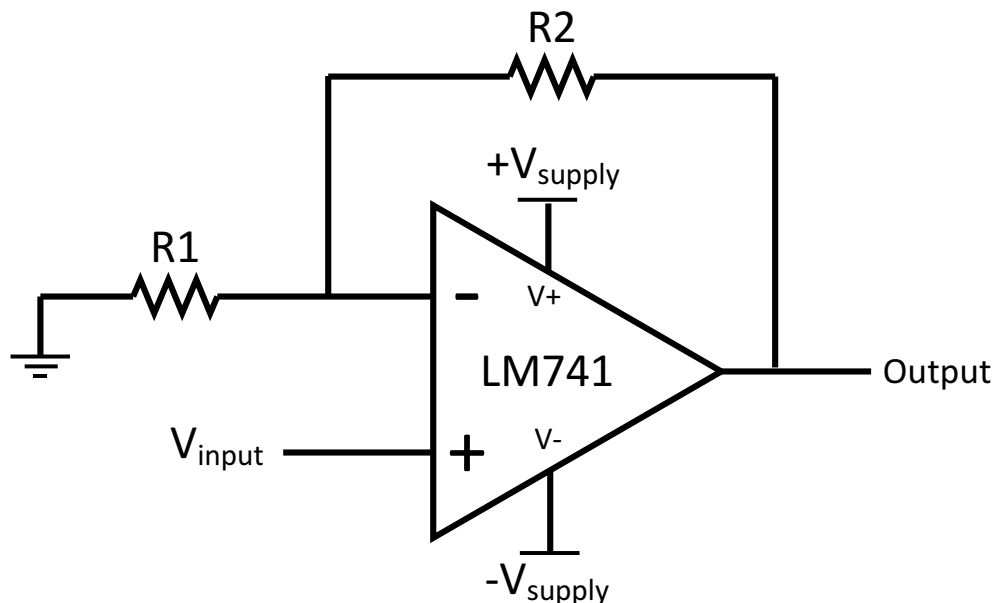


Table of Contents

1 Features 1 2 Applications 1 3 Description 1 4 Revision History 2 5 Pin Configuration and Functions 3 6 Specifications 4 6.1 Absolute Maximum Ratings 4 6.2 ESD Ratings 4 6.3 Recommended Operating Conditions 4 6.4 Thermal Information 4 6.5 Electrical Characteristics, LM741 5 6.6 Electrical Characteristics, LM741A 5 6.7 Electrical Characteristics, LM741C 6 7 Detailed Description 7 7.1 Overview 7 7.2 Functional Block Diagram 7	7.3 Feature Description 7 7.4 Device Functional Modes 8 8 Application and Implementation 9 8.1 Application Information 9 8.2 Typical Application 9 9 Power Supply Recommendations 10 10 Layout 11 10.1 Layout Guidelines 11 10.2 Layout Example 11 11 Device and Documentation Support 12 11.1 Community Resources 12 11.2 Trademarks 12 11.3 Electrostatic Discharge Caution 12 11.4 Glossary 12 12 Mechanical, Packaging, and Orderable Information 12
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4 Revision History

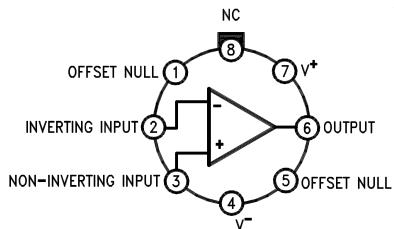
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision C (October 2004) to Revision D	Page
• Added <i>Applications</i> section, <i>Pin Configuration and Functions</i> section, <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section	1
• Removed NAD 10-Pin CLGA pinout	3
• Removed obsolete M (S0-8) package from the data sheet	4
• Added recommended operating supply voltage spec	4
• Added recommended operating temperature spec	4

Changes from Revision C (March 2013) to Revision D	Page
• Added <i>Applications</i> section, <i>Pin Configuration and Functions</i> section, <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section	1
• Removed NAD 10-Pin CLGA pinout	3
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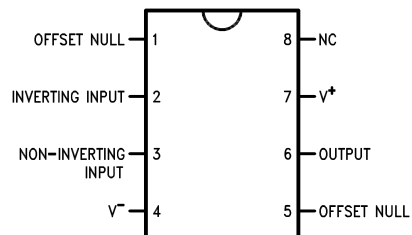
5 Pin Configuration and Functions

LMC Package
8-Pin TO-99
Top View



LM741H is available per JM38510/10101

NAB Package
8-Pin CDIP or PDIP
Top View



Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
INVERTING INPUT	2	I	Inverting signal input
NC	8	N/A	No Connect, should be left floating
NONINVERTING INPUT	3	I	Noninverting signal input
OFFSET NULL	1, 5	I	Offset null pin used to eliminate the offset voltage and balance the input voltages.
OFFSET NULL			
OUTPUT	6	O	Amplified signal output
V+	7	I	Positive supply voltage
V-	4	I	Negative supply voltage

6 Specifications

6.1 Absolute Maximum Ratings

 over operating free-air temperature range (unless otherwise noted)⁽¹⁾⁽²⁾⁽³⁾

		MIN	MAX	UNIT
Supply voltage	LM741, LM741A	±22		V
	LM741C	±18		
Power dissipation ⁽⁴⁾		500		mW
Differential input voltage		±30		V
Input voltage ⁽⁵⁾		±15		V
Output short circuit duration		Continuous		
Operating temperature	LM741, LM741A	-50	125	°C
	LM741C	0	70	
Junction temperature	LM741, LM741A	150		°C
	LM741C	100		
Soldering information	PDIP package (10 seconds)	260		°C
	CDIP or TO-99 package (10 seconds)	300		°C
Storage temperature, T _{stg}		-65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) For military specifications see RETS741X for LM741 and RETS741AX for LM741A.
- (3) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (4) For operation at elevated temperatures, these devices must be derated based on thermal resistance, and T_j max. (listed under "Absolute Maximum Ratings"). $T_j = T_A + (\theta_{JA} P_D)$.
- (5) For supply voltages less than ±15 V, the absolute maximum input voltage is equal to the supply voltage.

6.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±400	V

- (1) Level listed above is the passing level per ANSI, ESDA, and JEDEC JS-001. JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
Supply voltage (VDD-GND)	LM741, LM741A	±10	±15	±22	V
	LM741C	±10	±15	±18	
Temperature	LM741, LM741A	-55		125	°C
	LM741C	0		70	

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		LM741			UNIT
		LMC (TO-99)	NAB (CDIP)	P (PDIP)	
		8 PINS	8 PINS	8 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	170	100	100	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	25	—	—	°C/W

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

6.5 Electrical Characteristics, LM741⁽¹⁾

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input offset voltage	$R_S \leq 10 \text{ k}\Omega$	$T_A = 25^\circ\text{C}$		1	5	mV
		$T_{AMIN} \leq T_A \leq T_{AMAX}$			6	mV
Input offset voltage adjustment range	$T_A = 25^\circ\text{C}, V_S = \pm 20 \text{ V}$			± 15		mV
Input offset current	$T_A = 25^\circ\text{C}$ $T_{AMIN} \leq T_A \leq T_{AMAX}$			20	200	nA
				85	500	
Input bias current	$T_A = 25^\circ\text{C}$ $T_{AMIN} \leq T_A \leq T_{AMAX}$			80	500	nA
					1.5	μA
Input resistance	$T_A = 25^\circ\text{C}, V_S = \pm 20 \text{ V}$		0.3	2		M Ω
Input voltage range	$T_{AMIN} \leq T_A \leq T_{AMAX}$		± 12	± 13		V
Large signal voltage gain	$V_S = \pm 15 \text{ V}, V_O = \pm 10 \text{ V}, R_L \geq 2 \text{ k}\Omega$	$T_A = 25^\circ\text{C}$	50	200		V/mV
		$T_{AMIN} \leq T_A \leq T_{AMAX}$	25			
Output voltage swing	$V_S = \pm 15 \text{ V}$	$R_L \geq 10 \text{ k}\Omega$	± 12	± 14		V
		$R_L \geq 2 \text{ k}\Omega$	± 10	± 13		
Output short circuit current	$T_A = 25^\circ\text{C}$			25		mA
Common-mode rejection ratio	$R_S \leq 10 \Omega, V_{CM} = \pm 12 \text{ V}, T_{AMIN} \leq T_A \leq T_{AMAX}$		80	95		dB
Supply voltage rejection ratio	$V_S = \pm 20 \text{ V}$ to $V_S = \pm 5 \text{ V}, R_S \leq 10 \Omega, T_{AMIN} \leq T_A \leq T_{AMAX}$		86	96		dB
Transient response	Rise time	$T_A = 25^\circ\text{C}, \text{unity gain}$		0.3		μs
	Overshoot			5%		
Slew rate	$T_A = 25^\circ\text{C}, \text{unity gain}$			0.5		V/ μs
Supply current	$T_A = 25^\circ\text{C}$			1.7	2.8	mA
Power consumption	$V_S = \pm 15 \text{ V}$	$T_A = 25^\circ\text{C}$		50	85	mW
		$T_A = T_{AMIN}$		60	100	
		$T_A = T_{AMAX}$		45	75	

(1) Unless otherwise specified, these specifications apply for $V_S = \pm 15 \text{ V}, -55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ (LM741/LM741A). For the LM741C/LM741E, these specifications are limited to $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$.

6.6 Electrical Characteristics, LM741A⁽¹⁾

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input offset voltage	$R_S \leq 50 \Omega$	$T_A = 25^\circ\text{C}$		0.8	3	mV
		$T_{AMIN} \leq T_A \leq T_{AMAX}$			4	mV
Average input offset voltage drift					15	$\mu\text{V}/^\circ\text{C}$
Input offset voltage adjustment range	$T_A = 25^\circ\text{C}, V_S = \pm 20 \text{ V}$		± 10			mV
Input offset current	$T_A = 25^\circ\text{C}$ $T_{AMIN} \leq T_A \leq T_{AMAX}$			3	30	nA
					70	
Average input offset current drift					0.5	nA/ $^\circ\text{C}$
Input bias current	$T_A = 25^\circ\text{C}$ $T_{AMIN} \leq T_A \leq T_{AMAX}$			30	80	nA
					0.21	μA
Input resistance	$T_A = 25^\circ\text{C}, V_S = \pm 20 \text{ V}$ $T_{AMIN} \leq T_A \leq T_{AMAX}, V_S = \pm 20 \text{ V}$		1	6		M Ω
			0.5			
Large signal voltage gain	$V_S = \pm 20 \text{ V}, V_O = \pm 15 \text{ V}, R_L \geq 2 \text{ k}\Omega$	$T_A = 25^\circ\text{C}$	50			V/mV
		$T_{AMIN} \leq T_A \leq T_{AMAX}$	32			
		$V_S = \pm 5 \text{ V}, V_O = \pm 2 \text{ V}, R_L \geq 2 \text{ k}\Omega, T_{AMIN} \leq T_A \leq T_{AMAX}$	10			

(1) Unless otherwise specified, these specifications apply for $V_S = \pm 15 \text{ V}, -55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ (LM741/LM741A). For the LM741C/LM741E, these specifications are limited to $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$.

Electrical Characteristics, LM741A⁽¹⁾ (continued)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage swing	$V_S = \pm 20\text{ V}$	$R_L \geq 10\text{ k}\Omega$	± 16			V
		$R_L \geq 2\text{ k}\Omega$	± 15			
Output short circuit current	$T_A = 25^\circ\text{C}$		10	25	35	mA
	$T_{AMIN} \leq T_A \leq T_{AMAX}$		10		40	
Common-mode rejection ratio	$R_S \leq 50\ \Omega$, $V_{CM} = \pm 12\text{ V}$, $T_{AMIN} \leq T_A \leq T_{AMAX}$		80	95		dB
Supply voltage rejection ratio	$V_S = \pm 20\text{ V}$ to $V_S = \pm 5\text{ V}$, $R_S \leq 50\ \Omega$, $T_{AMIN} \leq T_A \leq T_{AMAX}$		86	96		dB
Transient response	Rise time	$T_A = 25^\circ\text{C}$, unity gain		0.25	0.8	μs
	Overshoot			6%	20%	
Bandwidth ⁽²⁾	$T_A = 25^\circ\text{C}$		0.437	1.5		MHz
Slew rate	$T_A = 25^\circ\text{C}$, unity gain		0.3	0.7		V/ μs
Power consumption	$V_S = \pm 20\text{ V}$	$T_A = 25^\circ\text{C}$		80	150	mW
		$T_A = T_{AMIN}$			165	
		$T_A = T_{AMAX}$			135	

(2) Calculated value from: BW (MHz) = 0.35/Rise Time (μs).

6.7 Electrical Characteristics, LM741C⁽¹⁾

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input offset voltage	$R_S \leq 10\text{ k}\Omega$	$T_A = 25^\circ\text{C}$		2	6	mV
		$T_{AMIN} \leq T_A \leq T_{AMAX}$			7.5	mV
Input offset voltage adjustment range	$T_A = 25^\circ\text{C}$, $V_S = \pm 20\text{ V}$			± 15		mV
Input offset current	$T_A = 25^\circ\text{C}$			20	200	nA
	$T_{AMIN} \leq T_A \leq T_{AMAX}$				300	
Input bias current	$T_A = 25^\circ\text{C}$			80	500	nA
	$T_{AMIN} \leq T_A \leq T_{AMAX}$				0.8		$\mu\text{A}$
Input resistance	$T_A = 25^\circ\text{C}$, $V_S = \pm 20\text{ V}$		0.3	2		M Ω
Input voltage range	$T_A = 25^\circ\text{C}$		± 12	± 13		V
Large signal voltage gain	$V_S = \pm 15\text{ V}$, $V_O = \pm 10\text{ V}$, $R_L \geq 2\text{ k}\Omega$	$T_A = 25^\circ\text{C}$	20	200		V/mV
		$T_{AMIN} \leq T_A \leq T_{AMAX}$	15			
Output voltage swing	$V_S = \pm 15\text{ V}$	$R_L \geq 10\text{ k}\Omega$	± 12	± 14		V
		$R_L \geq 2\text{ k}\Omega$	± 10	± 13		
Output short circuit current	$T_A = 25^\circ\text{C}$			25		mA
Common-mode rejection ratio	$R_S \leq 10\text{ k}\Omega$, $V_{CM} = \pm 12\text{ V}$, $T_{AMIN} \leq T_A \leq T_{AMAX}$		70	90		dB
Supply voltage rejection ratio	$V_S = \pm 20\text{ V}$ to $V_S = \pm 5\text{ V}$, $R_S \leq 10\ \Omega$, $T_{AMIN} \leq T_A \leq T_{AMAX}$		77	96		dB
Transient response	Rise time	$T_A = 25^\circ\text{C}$, Unity Gain		0.3		μs
	Overshoot			5%		
Slew rate	$T_A = 25^\circ\text{C}$, Unity Gain			0.5		V/ μs
Supply current	$T_A = 25^\circ\text{C}$			1.7	2.8	mA
Power consumption	$V_S = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$			50	85	mW

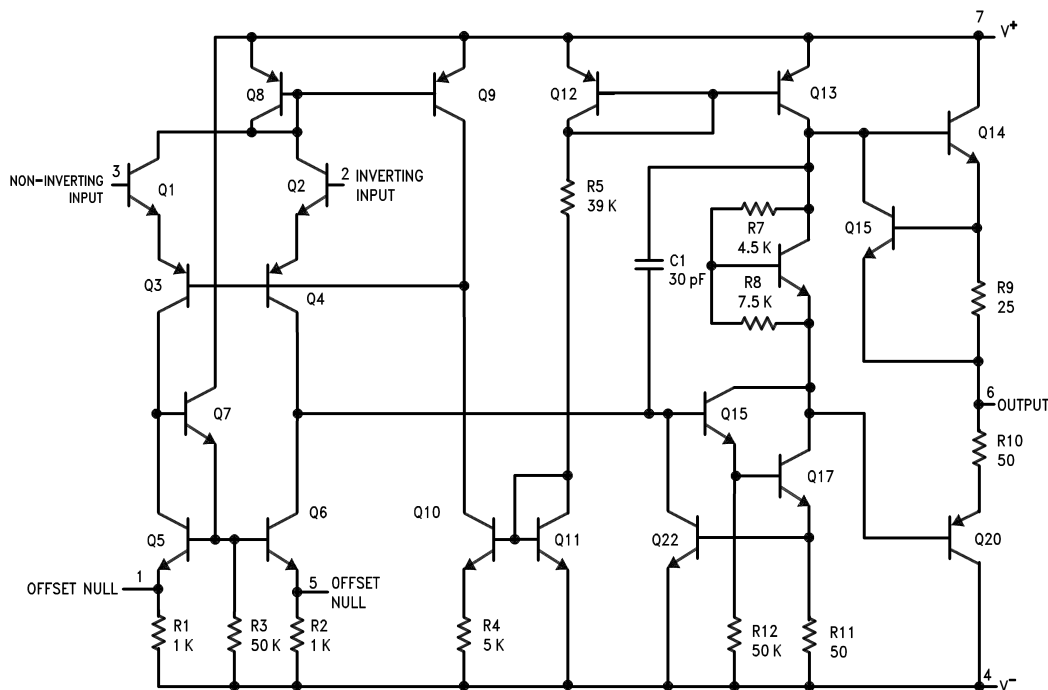
(1) Unless otherwise specified, these specifications apply for $V_S = \pm 15\text{ V}$, $-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ (LM741/LM741A). For the LM741C/LM741E, these specifications are limited to $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$.

7 Detailed Description

7.1 Overview

The LM74 devices are general-purpose operational amplifiers which feature improved performance over industry standards like the LM709. It is intended for a wide range of analog applications. The high gain and wide range of operating voltage provide superior performance in integrator, summing amplifier, and general feedback applications. The LM741 can operate with a single or dual power supply voltage. The LM741 devices are direct, plug-in replacements for the 709C, LM201, MC1439, and 748 in most applications.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Overload Protection

The LM741 features overload protection circuitry on the input and output. This prevents possible circuit damage to the device.

7.3.2 Latch-up Prevention

The LM741 is designed so that there is no latch-up occurrence when the common-mode range is exceeded. This allows the device to function properly without having to power cycle the device.

7.3.3 Pin-to-Pin Capability

The LM741 is pin-to-pin direct replacements for the LM709C, LM201, MC1439, and LM748 in most applications. Direct replacement capabilities allows flexibility in design for replacing obsolete parts.

7.4 Device Functional Modes

7.4.1 Open-Loop Amplifier

The LM741 can be operated in an open-loop configuration. The magnitude of the open-loop gain is typically large thus for a small difference between the noninverting and inverting input terminals, the amplifier output will be driven near the supply voltage. Without negative feedback, the LM741 can act as a comparator. If the inverting input is held at 0 V, and the input voltage applied to the noninverting input is positive, the output will be positive. If the input voltage applied to the noninverting input is negative, the output will be negative.

7.4.2 Closed-Loop Amplifier

In a closed-loop configuration, negative feedback is used by applying a portion of the output voltage to the inverting input. Unlike the open-loop configuration, closed loop feedback reduces the gain of the circuit. The overall gain and response of the circuit is determined by the feedback network rather than the operational amplifier characteristics. The response of the operational amplifier circuit is characterized by the transfer function.

8 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

The LM741 is a general-purpose amplifier that can be used in a variety of applications and configurations. One common configuration is in a noninverting amplifier configuration. In this configuration, the output signal is in phase with the input (not inverted as in the inverting amplifier configuration), the input impedance of the amplifier is high, and the output impedance is low. The characteristics of the input and output impedance is beneficial for applications that require isolation between the input and output. No significant loading will occur from the previous stage before the amplifier. The gain of the system is set accordingly so the output signal is a factor larger than the input signal.

8.2 Typical Application

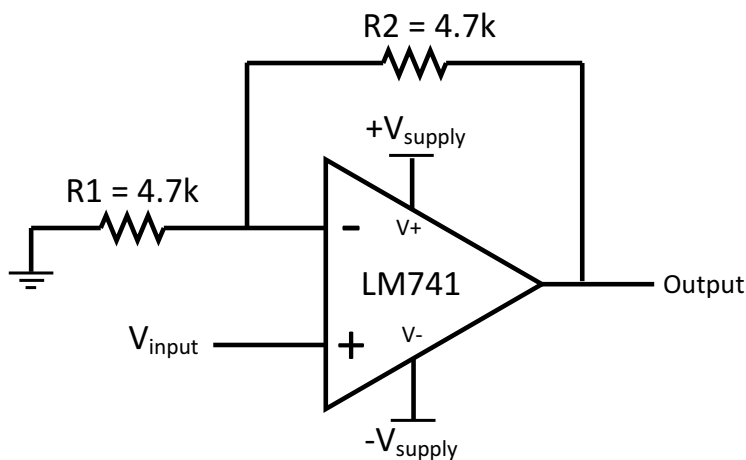


Figure 1. LM741 Noninverting Amplifier Circuit

8.2.1 Design Requirements

As shown in [Figure 1](#), the signal is applied to the noninverting input of the LM741. The gain of the system is determined by the feedback resistor and input resistor connected to the inverting input. The gain can be calculated by [Equation 1](#):

$$\text{Gain} = 1 + (R2/R1) \quad (1)$$

The gain is set to 2 for this application. R1 and R2 are 4.7-k resistors with 5% tolerance.

8.2.2 Detailed Design Procedure

The LM741 can be operated in either single supply or dual supply. This application is configured for dual supply with the supply rails at ± 15 V. The input signal is connected to a function generator. A 1-V_{pp}, 10-kHz sine wave was used as the signal input. 5% tolerance resistors were used, but if the application requires an accurate gain response, use 1% tolerance resistors.

Typical Application (continued)

8.2.3 Application Curve

The waveforms in [Figure 2](#) show the input and output signals of the LM741 non-inverting amplifier circuit. The blue waveform (top) shows the input signal, while the red waveform (bottom) shows the output signal. The input signal is 1.06 V_{pp} and the output signal is 1.94 V_{pp}. With the 4.7-kΩ resistors, the theoretical gain of the system is 2. Due to the 5% tolerance, the gain of the system including the tolerance is 1.992. The gain of the system when measured from the mean amplitude values on the oscilloscope was 1.83.

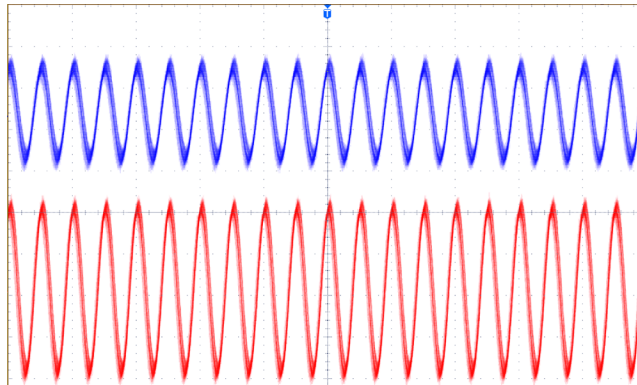


Figure 2. Waveforms for LM741 Noninverting Amplifier Circuit

9 Power Supply Recommendations

For proper operation, the power supplies must be properly decoupled. For decoupling the supply lines, a 0.1-μF capacitor is recommended and should be placed as close as possible to the LM741 power supply pins.

10 Layout

10.1 Layout Guidelines

As with most amplifiers, take care with lead dress, component placement, and supply decoupling in order to ensure stability. For example, resistors from the output to an input should be placed with the body close to the input to minimize pick-up and maximize the frequency of the feedback pole by minimizing the capacitance from the input to ground. As shown in Figure 3, the feedback resistors and the decoupling capacitors are located close to the device to ensure maximum stability and noise performance of the system.

10.2 Layout Example

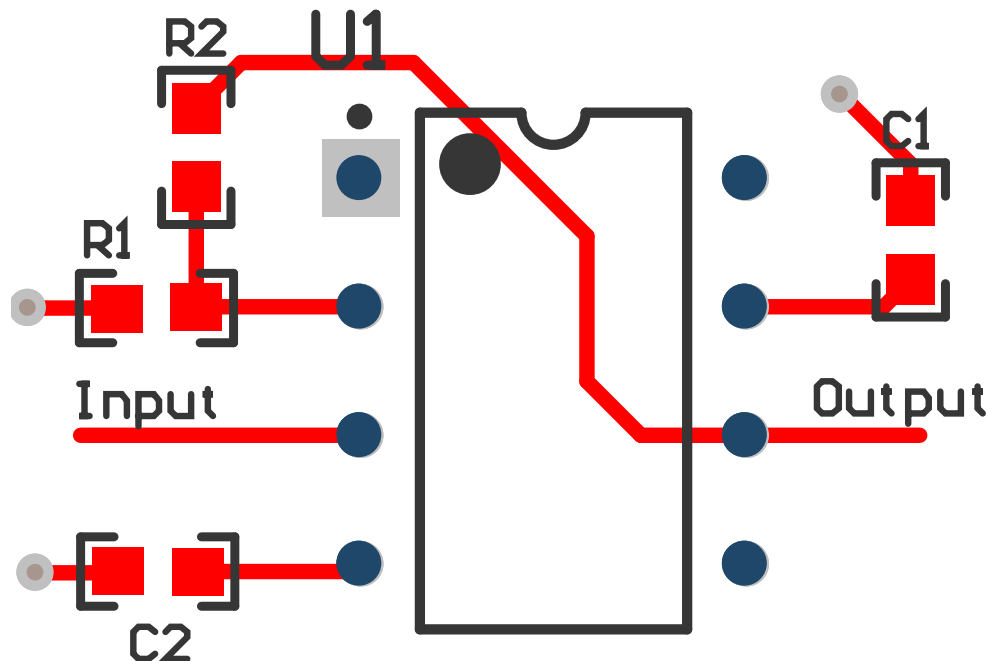


Figure 3. LM741 Layout

11 Device and Documentation Support

11.1 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

11.2 Trademarks

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

11.3 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

11.4 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM741CH	ACTIVE	TO-99	LMC	8	500	TBD	Call TI	Call TI	0 to 70	(LM741CH ~ LM741CH)	Samples
LM741CH/NOPB	ACTIVE	TO-99	LMC	8	500	Green (RoHS & no Sb/Br)	Call TI	Level-1-NA-UNLIM	0 to 70	(LM741CH ~ LM741CH)	Samples
LM741CN/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	CU SN	Level-1-NA-UNLIM	0 to 70	LM 741CN	Samples
LM741H	ACTIVE	TO-99	LMC	8	500	TBD	Call TI	Call TI	-55 to 125	(LM741H ~ LM741H)	Samples
LM741H/NOPB	ACTIVE	TO-99	LMC	8	500	Green (RoHS & no Sb/Br)	Call TI	Level-1-NA-UNLIM	-55 to 125	(LM741H ~ LM741H)	Samples
LM741J	ACTIVE	CDIP	NAB	8	40	TBD	Call TI	Call TI	-55 to 125	LM741J	Samples
U5B7741312	ACTIVE	TO-99	LMC	8	500	TBD	Call TI	Call TI	-55 to 125	(LM741H ~ LM741H)	Samples
U5B7741393	ACTIVE	TO-99	LMC	8	500	TBD	Call TI	Call TI	0 to 70	(LM741CH ~ LM741CH)	Samples
U9T7741393	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI	0 to 70	LM 741CN	

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

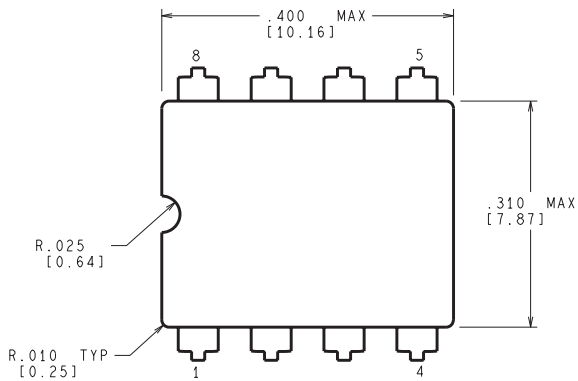
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

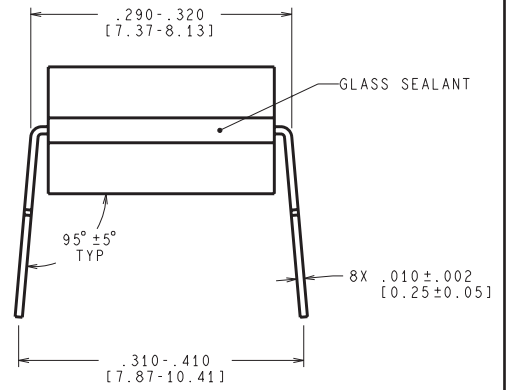
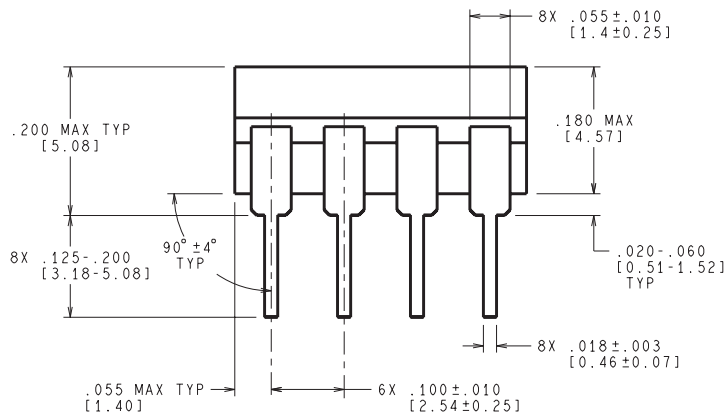
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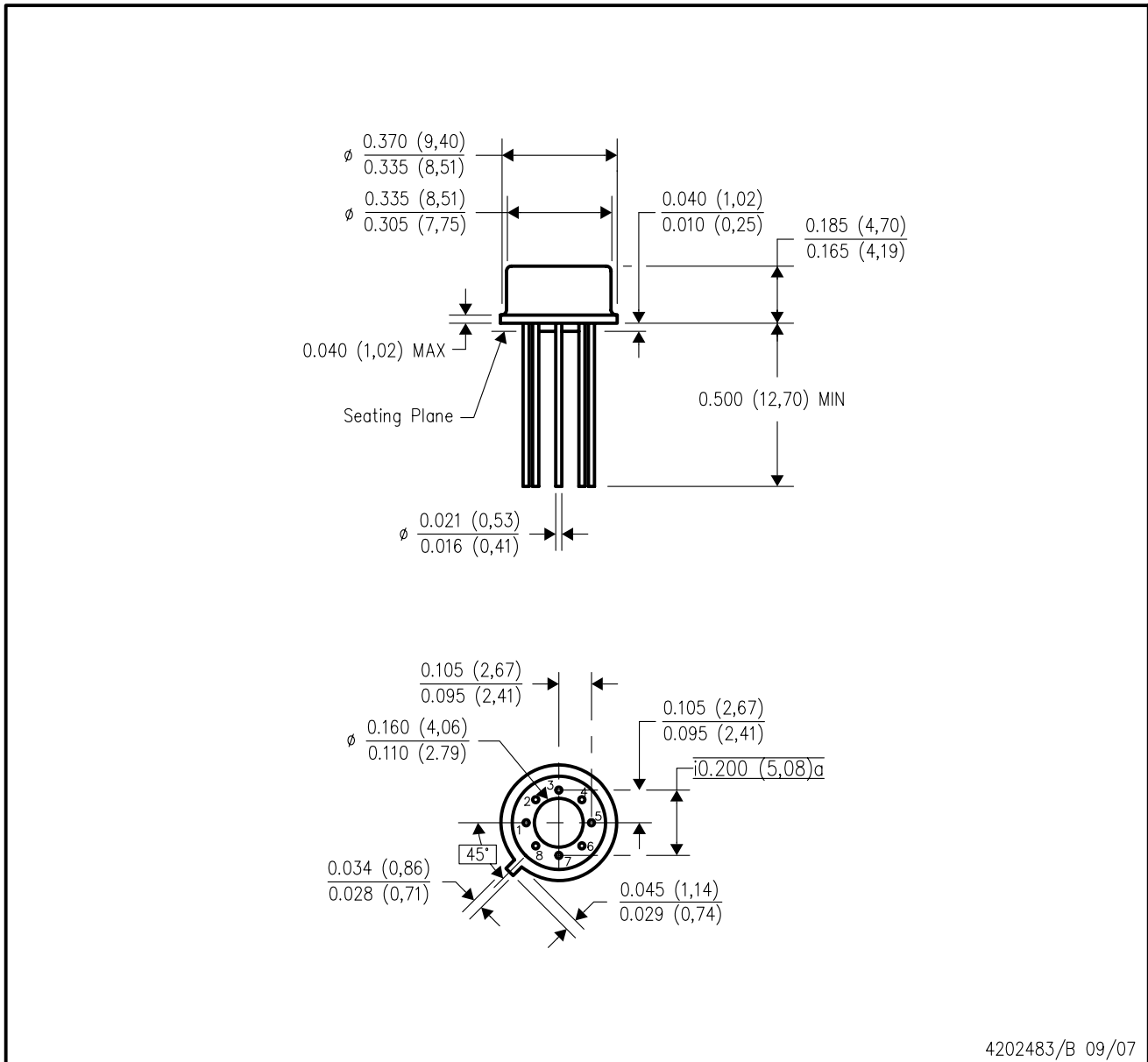
CONTROLLING DIMENSION IS INCH
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J08A (Rev M)

LMC (O-MBCY-W8)

METAL CYLINDRICAL PACKAGE



- NOTES:
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 - B. This drawing is subject to change without notice.
 - C. Leads in true position within 0.010 (0,25) R @ MMC at seating plane.
 - D. Pin numbers shown for reference only. Numbers may not be marked on package.
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P (R-PDIP-T8)

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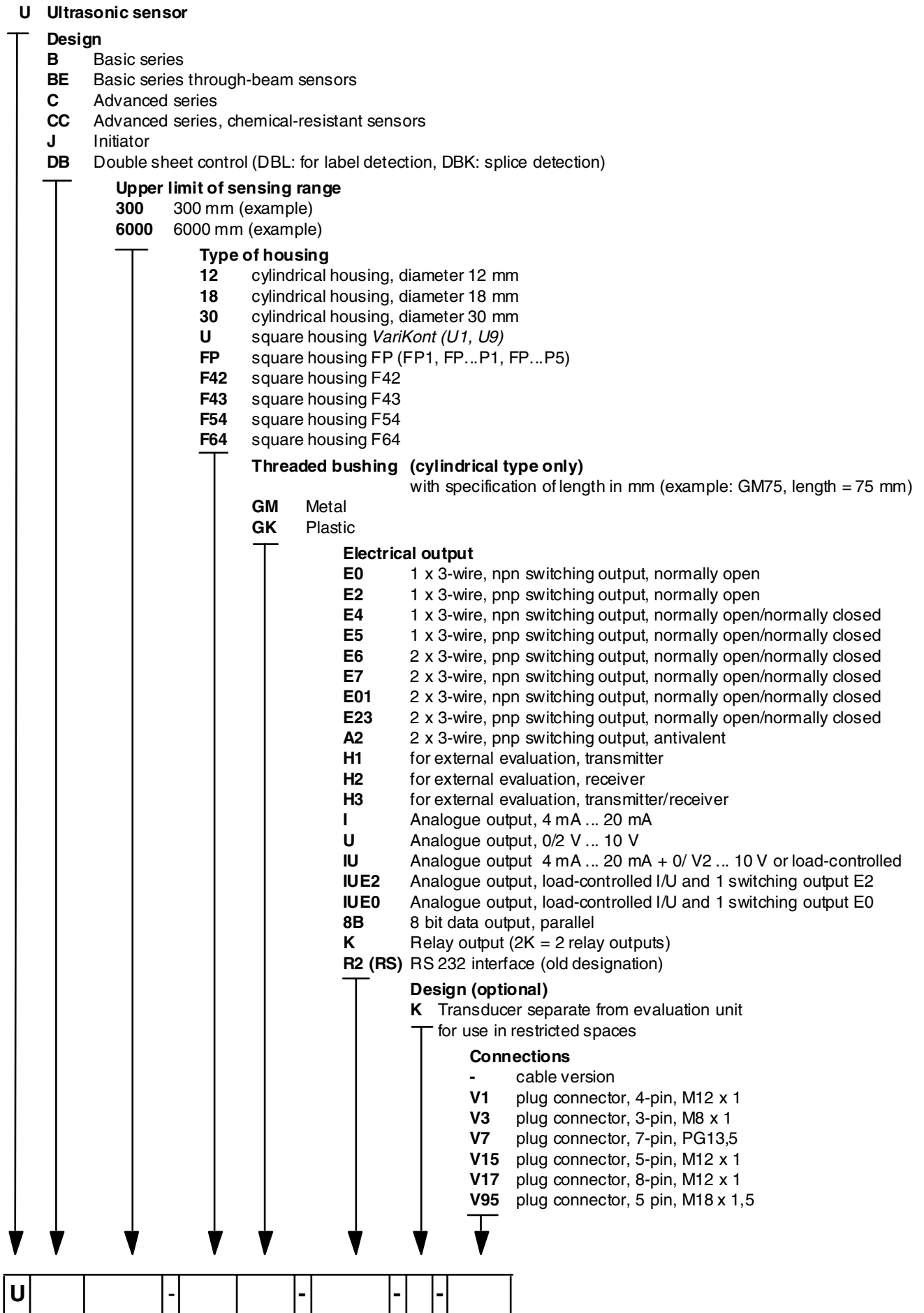
ULTRASONIC SENSORS



Ultrasonic sensors

<u>Contents</u>	<u>Page</u>
Type code	7
Selection table	8
Operating principles and technology of ultrasonic sensors	10
Selecting the correct sensor	12
Sensor principle	12
Output functions	14
Types/housing shapes	16
Electrical connections	19
Parameterisation	21
General information	23
Notes for installation and operation	24
Cylindrical form	27
Series -12GM	27
Series -18GK and -18GM	33
Series -30GM	65
Block type	99
Series <i>VariKont</i> ®	99
Series -FP	115
Series -F12	129
Series -F42	133
Series -F43	155
Series -F54	161
Series -F64	171
Series -D1	175
Series -LUC	181
Sensors for double-sheet monitoring	185
Evaluation units and power supplies	201
UH3	202
DA5...	208
WE77..	212
KFA6...	214
Accessories	217
Mating connectors	218
Mounting aids	223
Programming units UB-PROG 2/UB PROG 3	233
Service software ULTRA 2001	234
Additional information	236
Standards	236
Resistance of our housing materials to chemical substances	237
Protective enclosures	239
Glossary	240
Alphabetical type index	244
Pepperl+Fuchs GmbH worldwide	246
Notes	254

Type code (without series LUC...)*

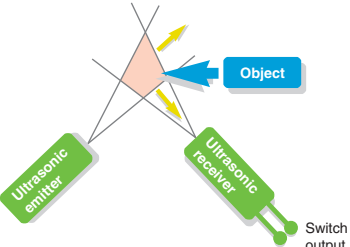
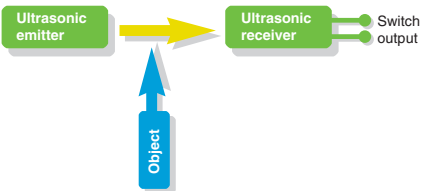
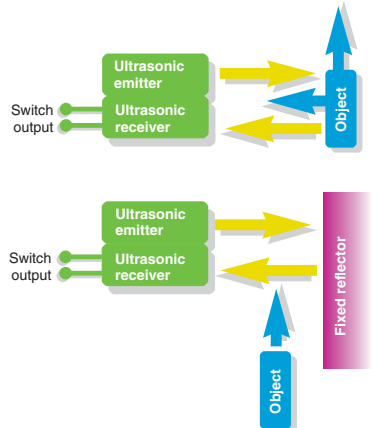
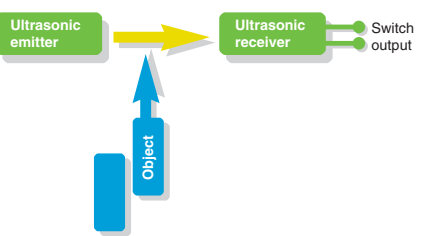


Date of issue 13.09.2005

* The type codes for the LUC series can be found on page 181.

Overview

Selection table

	Detection range (max.)	Output	Connection
		PNP NPN Push-pull Relais Analog	Kabel Stecker Klemmen
 <p>Sensors for separate evaluation units</p> <p>Series -30GM 6000 mm Series <i>VariKont</i>® 3000 mm Series -FP 6000 mm Series -F54 2000 mm</p>			
 <p>Through beam sensors</p> <p>Series -18GK 500 mm Series -18GM40 1000 mm Series -30GM 4000 mm Series <i>VariKont</i> 6000 mm Series -F64 1500 mm</p>			
 <p>Detection and reflection sensors</p> <p>Series -12GM 400 mm Series -18GM40 300 mm Series -18GM75 1000 mm Series -30GM 6000 mm Series <i>VariKont</i>® 3000 mm Series -FP 6000 mm Series -F12 800 mm Series -F42 4000 mm Series -F43 2000 mm Series -F54 2000 mm Series -D1 550 mm Series -LUC 4000 mm</p>			
 <p>Double sheet monitoring</p> <p>Series UDC-18GM 60 mm Series UDB-18GM 80 mm</p>			
<p>Control / evaluation units</p> <p>UH3-KHD2-4E5 UH3-KHD2-4I UH3-T1-KT DA5-IU...</p>			

- 1) on request
- 2) 10 ... 30 V DC without function of the current output
- 3) 10 ... 252 V DC / 20 ... 252 V AC
- 4) DC-Types: 10 ... 30 V DC,
 DC/AC-Types: 20 ... 253 V DC
 15 ... 253 V AC
- 5) only DC-Types

Supply voltage range	angled head	Error indicator	Timer-function/ Pulse prolongation	N.C./N.O./ Window selectable mode	Synchronisation input	TEACH-IN/ Parameterisation	adjustable sound lobe width	Serial interface	Parallel interface (8 Bit)	Page
10 ... 30 V DC					●					65
10 ... 30 V DC					●					99
10 ... 60 V DC					●					115
10 ... 30 V DC					●					161
18 ... 30 V DC										33
10 ... 30 V DC	● ¹⁾	●					●			33
18 ... 30 V DC		●	●							65
20 ... 30 V DC		●								99
7,5 ... 30 V DC										171
10 ... 30 V DC		●		●		●				27
10 ... 30 V DC	●	●		●		●				33
18 ... 30 V DC	● ¹⁾	●		●	●	●	●			33
10 ... 30 V DC		●		●	●	●		●		65
15 ... 30 V DC		●		●	●	●		●	●	99
15 ... 30 V DC		●		●	●	●		●	●	115
10 ... 30 V DC		●		●	●	●	●			129
DC/AC ⁴⁾		●		●	● ⁵⁾	●	●			133
15 ... 30 V DC ²⁾		●	●	●	●	●		●		155
10 ... 30 V DC		●		●	●	●				161
DC/AC ³⁾		●		●	●	●				175
10 ... 30 V DC		●		●	●	●				181
20 ... 30 V DC	●		●			●				185
24 V DC		●				●				185
20 ... 30 V DC				●		●				201
20 ... 30 V DC				●		●				201
20 ... 30 V DC			●							201
10 ... 30 V DC										201
90 ... 260 V AC										

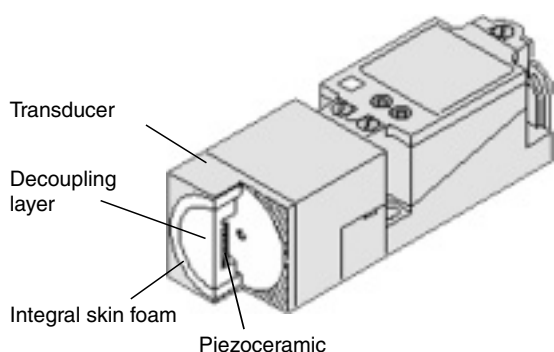
1) on request
 2) 10 ... 30 V DC without function of the current output
 3) 10 ... 252 V DC / 20 ... 252 V AC
 4) DC-Types: 10 ... 30 V DC,
 DC/AC-Types: 20 ... 253 V DC
 15 ... 253 V AC
 5) only DC-Types

Operating principles and technology of ultrasonic sensors

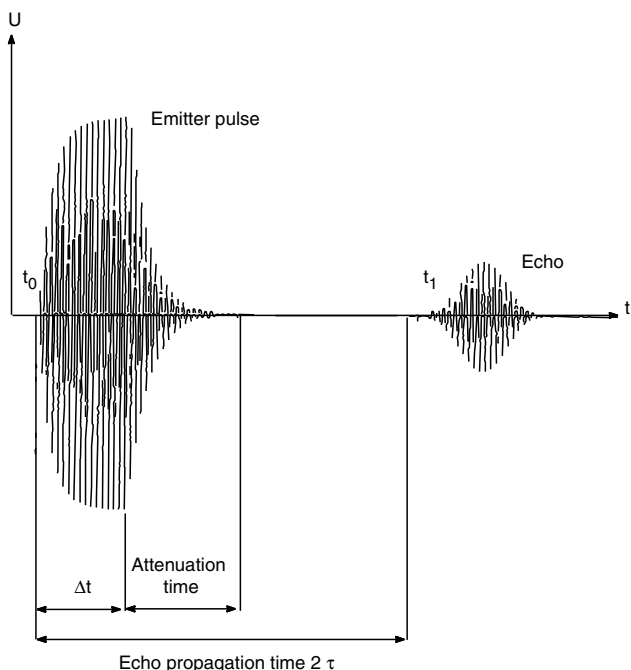
Operating principles and technology of ultrasonic sensors

Pepperl+Fuchs ultrasonic sensors operate with a piezoelectric transducer as the sound emitter and receiver. A patented decoupling layer in special material is used to decouple the ultrasonics to the air - an acoustically thin medium.

This ultrasonic transducer is embedded, watertight, into the sensor housing, in polyurethane foam.



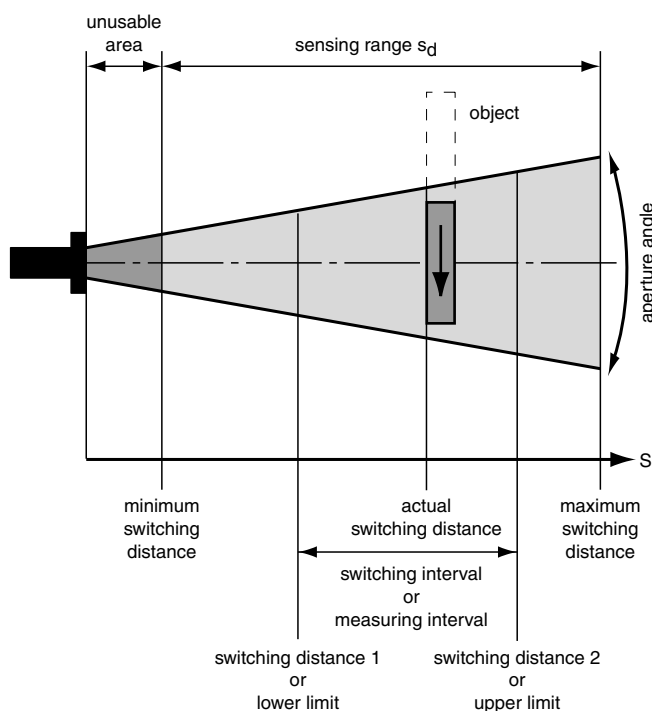
The transducer transmits a packet of sonic pulses and converts the echo pulse into a voltage. The integrated controller computes the distance from the echo time and the velocity of sound. The transmitted pulse duration Δt and the decay time of the sonic transducer result in an unusable area in which the ultrasonic sensor cannot detect an object. The ultrasonic frequency lies between 65 kHz and 400 kHz, depending on the sensor type; the pulse repetition frequency is between 14 Hz and 140 Hz.



The active range of the ultrasonic sensor is referred to as the sensing range s_d . This range is bounded by the lowest and highest sensing distances, whose values depend on the characteristics of the transducer. The highest sensing distance is given in the type code.

The ultrasonic sensor detects objects within its sensing range, regardless of whether these objects approach the sensor axially or move through the sound cone laterally.

Ultrasonic sensors are available with switching outputs and/or analogue outputs, various output functions are available according to type.



The ultrasonic beam has an opening angle of around $\pm 5^\circ$. The sound pressure level outside of this cone is less than half (-6 dB) that of the value on the sensor axis.

The opening angle defines the spatially dimension of the sound cone. The diameter of the sound cone D for a certain distance from the sensor S can be calculated by

$$D = 2 \cdot \tan \alpha \cdot S$$

in a good approach.

In the formula above, only the angle between the curve and the centre-line (0°) has to be inserted (half opening angle).

For a simple evaluation of the sound cone diameter D , you can use the list below, which shows the \tan -values for angles between $\alpha = 2^\circ$ and $\alpha = 20^\circ$ in 2° intervals.

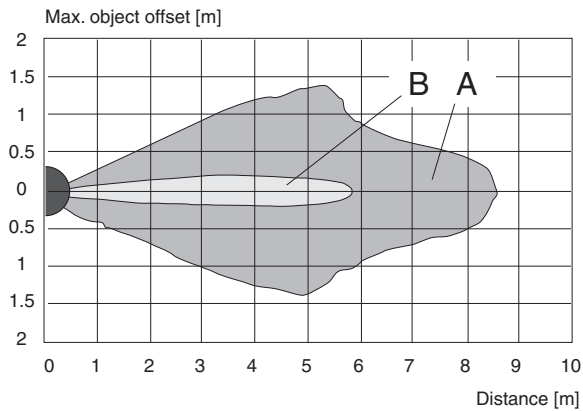
angle α	$\tan \alpha$	angle α	$\tan \alpha$
2°	0.035	12°	0.213
4°	0.07	14°	0.249
6°	0.105	16°	0.287
8°	0.141	18°	0.325
10°	0.176	20°	0.364

Date of edition 08/18/2005

Operating principles and technology of ultrasonic sensors

The figure shows the response ranges of typical objects, rather than the intensity distribution of the ultrasonic beam. Within these ranges, the sensor detects the specified object A or B.

Example: UC6000-FP...



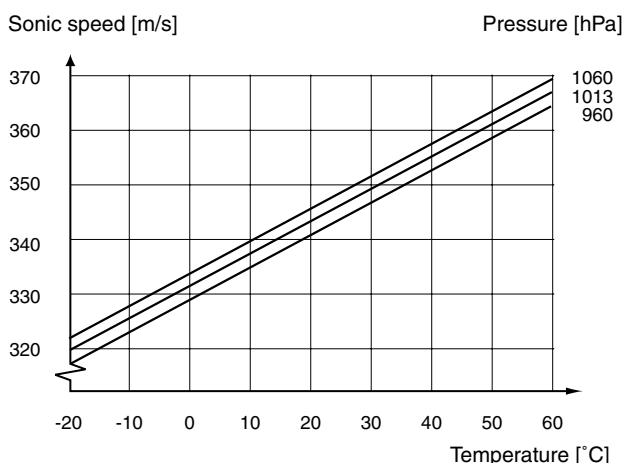
Where A = flat plate, 100mm x 100 mm
B = round rod, diameter 25 mm

The details given in the type code relate to a flat standard plate, 100 mm x 100 mm. This plate must be placed at right angles to the axis of the beam. The packet of sound pulses is reflected away if the object is inclined to this axis and consequently the echo does not reach the sensor.

Due to the physical properties of sound propagation, the decay (range) and velocity of the ultrasonic beam is dependent on the:

- Air temperature
- Relative humidity
- Barometric pressure

The following chart shows the theoretical relationship between the air temperature and pressure and the velocity of sound.



As the signal echo time is evaluated in our ultrasonic sensors, most sensors are temperature-compensated. This eliminates most temperature effects on the sensor output.

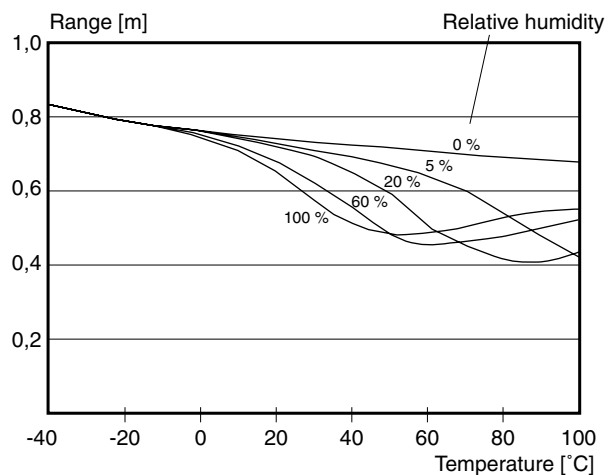
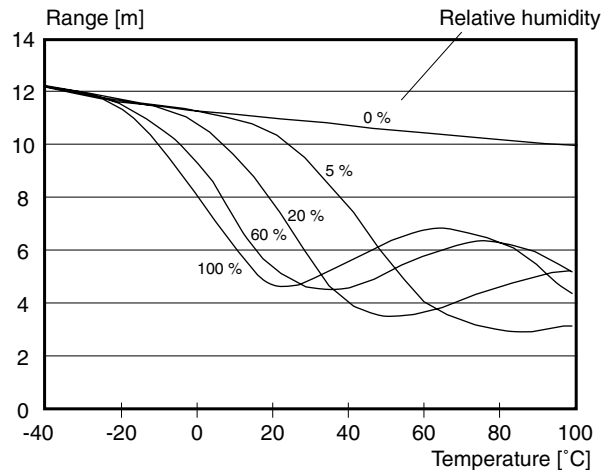
This temperature compensation is performed by an electrical temperature sensor that is integrated into the sensor.

The sensor gives off a certain intrinsic heat that depends on the operating mode and the design. The result of this intrinsic

heat is that the sensor has an additional temperature error of 2 % in the heating phase from 0.5 h ... 1 h.

As a result of the lag of the internal temperature sensor in reflecting the true current temperature, greater short-term fluctuations may occur than are specified on the data sheet due to a sudden change in the ambient temperature.

The relationships between the range of ultrasonic sensors and the air temperature, as well as that between the range and the relative humidity are shown in the following charts. The relationships shown here apply to sensors of the UC4000-30GM... and UC500-30GM... series, but with regard to the specific sensing range, apply in principle to all ultrasonic sensors.



The substantially increased sensor range at low temperatures is apparent, virtually independent of the relative humidity. The reduction in range at high temperatures, however, is subject to a strong influence by the relative humidity.

The sensing ranges stated in the data sheets for our ultrasonic sensors are based on an ambient temperature of +20 °C and a relative humidity of 50 %.

Date of edition 08/18/2005

Sensor principle

Selecting the correct sensor

The range of ultrasonic sensor products is a large one due to their wide range of deployment. Important selection criteria are described in detail on the next five pages to assist you in selecting the correct sensor type for your specific applications:

1. Sensor principle
2. Output functions
3. Series
4. Electrical connections
5. Parameterisation

1. Sensor principle

The principle by which ultrasonic sensors yield measurements is that of evaluating the time taken for the sound to travel between transmission and reception (direct detection), or a process of checking whether the transmitted signal has been received (detection by beam interruption). The following distinctions are made between types of sensor function:

Detection by beam interruption

Through-beam sensor

The emitter and receiver are mounted facing each other. If the ultrasonic beam is broken by an object, then the switch output becomes active.

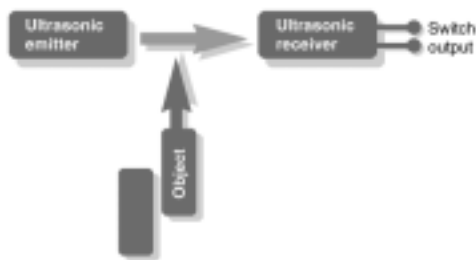


Properties:

- High range, as the ultrasonic beam only travels the signal distance once.
- Less susceptible to interference, thus suitable for difficult operating conditions.
- Greater installation complexity, as two separate units must be wired.

Double-sheet monitoring

Double-sheet monitoring is a special application involving through-beam sensors designed especially for this purpose. This application originated in the printing industry and uses an ultrasonic beam to monitor the thickness of paper or foils.



Ultrasonic sensors for double-sheet monitoring are suitable for distinguishing between:

- no sheet, a single sheet, a double sheet
- Base material
- Base material with labels

Ultrasonic double-sheet monitoring is deployed in all situations in which the automatic, high-speed distinction between base material, labels, single and double sheets is required in order to protect machines or avoid waste production.

A complete system consists of an ultrasonic emitter, an ultrasonic receiver and an evaluation unit. These units have been optimally tuned to one another at the factory and may not be used separately.

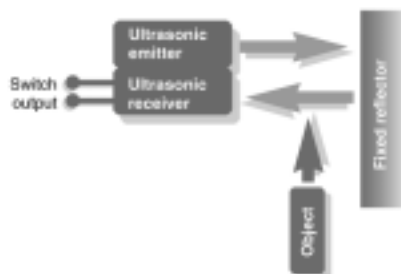
Properties:

- The sensing range covers 10 g/m² paper to 2000 g/m² carton.
- Thin plastic or metal foils can also be detected.
- TEACH-IN of various materials
- Suitable for use with glossy or transparent materials
- Automatic adaptation of the operation point to slow changes in ambient conditions
- Very high processing speed
- Insensitive to dust and dirt

Reflex sensor mode

The emitter and receiver are mounted in the same housing. The ultrasonic beam is reflected back to the receiver by a fixed reflector plate. Objects entering the sensing range are detected by:

- changes to the measured distances
- lack of signal from the reflector due to absorption or diffuse reflection



Properties:

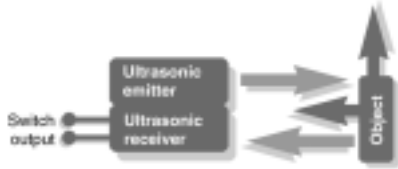
- Only one measuring head
- High detection reliability of problematic objects (sound-absorbent objects or objects with angled surfaces)
- Less susceptible to interference, thus suitable for difficult operating conditions.

Direct detection

Reflection sensor

The emitter and receiver are mounted in the same housing (reflection sensor).

The object acts as a sound reflector.

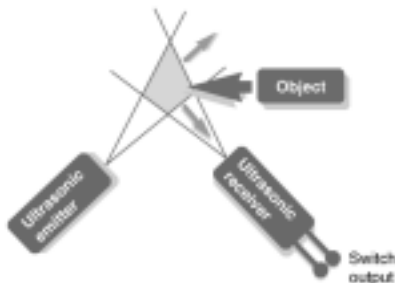


Properties:

- The sensing range depends on the reflectance of the object, i.e. the surface properties and the angle of incidence. Within limits, these influences can be compensated by adjusting the sensitivity.
- Simple installation, as the sensor consists of a single unit.
- Sensitive with regard to changes in the reflection properties of objects

Reflection sensor with twin-head

Emitter and receiver are separate, the axes of the emitter and receiver transducers intersect each other (reflex/direct detection). The use of separate units for the emitter and receiver reduces the unusable area considerably, as this arrangement is not subject to delays while waiting for oscillations of the emitter to die out.



Properties:

- It is possible to detect very small objects.
- Three-dimensional sensing range
- Insensitive with regard to unwanted reflections from objects outside the sensing range (background suppression)

Analogue distance measurement

The time of travel of the sound pulse is the means of measuring the distance of the object. The sensors operate in direct detection mode and have various analogue outputs, depending on the type:

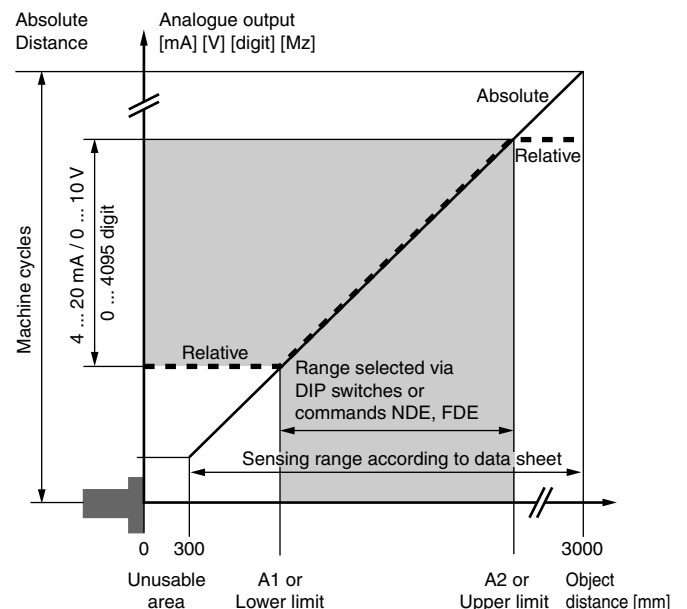
- Analogue voltage output: 0 V ... 10 V
- Analogue current output: 4 mA ... 20 mA
- 8-bit parallel output
- Serial output, RS 232

Absolute: distance as a series of digits in [mm]

Relative: type ...RS: three-digit sequence (0 ... 254)

type ...R2: four-digit sequence (0 ... 4095)

An arbitrary measuring window can be set within the near and far evaluation limits (lower/upper limit) of the sensor. The relative data determines the position of the object in the measuring window.



Output functions

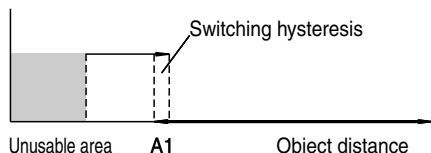
2. Output functions

Switching output

Switching distance mode

On sensors with two independent switch points, each output becomes active when the object passes the related switch point A1, A2. These switch points can be arbitrarily taught-in to the sensing range.

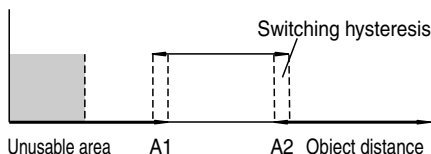
Normally open, n.o. and Normally closed, n.c.



Window mode

In window mode the ultrasonic sensor changes its output state when the first detected echo, and thus the object, is within the switching window. The window limits A1 and A2 can be taught-in as required. If multiple echoes arrive at different times and one of these is before A1, the output will not switch, even if a later echo is within the switching window. The sensor only evaluates the first echo detected. Multiple echoes thus cannot be evaluated.

Normally open, n.o.



With our ultrasonic sensors, which support the window mode, the reflex sensor mode can be realised in an easy way (see reflex sensor mode).

Reflex sensor mode

The output of the ultrasonic sensor switches in the following cases:

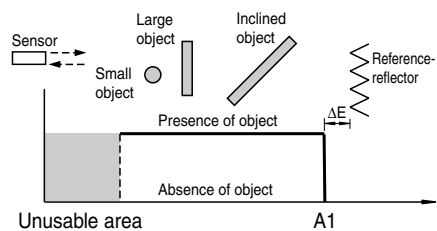
- The sensor receives an echo from a small object in the sound cone and from the reference reflector.
- The sensor detects a large object and no longer receives the echo from the reference reflector.
- The sensor does not receive an echo, for example in the event that an object is positioned at an angle that reflects the sound away.

The position of the reference reflector may not be changed. The set or taught-in switching distance A1 must be shorter than the distance to the reflector by the distance ΔE .

Example:

UC3000... $\Delta E > 2\%$ of 3000 mm = 60 mm
 UC6000... $\Delta E > 2\%$ of 6000 mm = 120 mm

Normally open, n.o.



Note

Reflex sensor mode is possible with each of our ultrasonic sensors, which support the window mode. Therefore by means of the switch points A1 and A2 a small window area is defined. Inside this area, the fixed reference reflector must be placed. An object outside of this defined window will cause reliably an output status change, independent of its reflection properties. The wished output function (normally open/normally closed) can be set, when adjusting a window operation in the opposite output function.

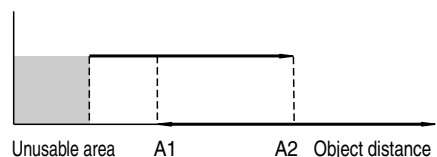
Example: to detect an object with normally open output function, a window mode with normally closed output function has to be set.

Double switching point mode (hysteresis mode)

The ultrasonic sensor maintains its previous switching state in the selected area of the evaluation window. The output switches when the object approaches the near switching point A1. It then does not switch back until the object passes the far switching point A2. The two switching points form a large range hysteresis.

Double switching point mode can be used in many applications (such as monitoring filling levels to perform tasks with a single output that would otherwise require two outputs in normal switching-distance mode).

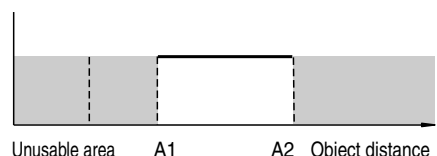
Normally open, n.o.



Area monitoring

The ultrasonic sensor monitors the evaluation window. The output switches only if an object is detected in the window. Echoes other than those from the evaluation window are ignored by the sensor software. Thanks to this active masking of the foreground in the area monitoring mode, echoes from areas outside of the switching window (foreground) do not cause interference.

Normally open, n.o.

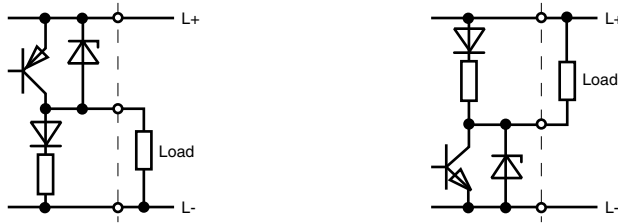


The area monitoring mode is supported by our UC... sensors.

Date of edition 08/18/2005

nnp/pnp output

The outputs of the ultrasonic sensors can be realised in npn or in pnp technology. The sensors in this catalogue are mainly pnp types. In this case the load is connected to -L, at the switching output of the sensor +L is connected to the load.



pnp

nnp

Relay output

A number of ultrasonic sensors feature relay outputs. Please refer to the individual data sheets for the maximum switching loads and electrical design of the sensors. Information related to the mechanical service life refers to the number of switching actions of the relay contacts in a no-load condition. This value can also be reached with low electrical contact loads. At the rated load for the electrical contacts, the service life is reduced to the value indicated for the electrical service life. The life time data stated are MTBF values.

Analogue output: 4 mA ... 20 mA/0 V ... 10 V

This issues a current/voltage signal proportional to the distance. The limits of the analogue measuring window can be parameterised as required within the sensing range. Depending on the type, this can be realised by:

- TEACH-IN with programming wire or programming plug
- DIP switch
- RS 232 interface
- Two potentiometers

External evaluation

On these sensors an external synchronising pulse triggers the measuring cycle. The sensor transmits the ultrasonic pulse and, on receipt of the time-delayed echo, outputs a voltage pulse. The echo time evaluation is performed by the evaluation unit.

The following evaluation units are available:

- UH3-KHD2-4I (4 analogue outputs)
- UH3-KHD2-4E5 (4 switching outputs)
- UH3-T1-KT (1 relay output)

With the types UH3-KHD2..., 4 sensors can be used in synchronous or multiplex mode, thus permitting special applications such as the spatial detection of objects, increased sound-cone coverage, and multiple measuring ranges.

The type UH3-T1-KT features a clock-pulse output and 3 signal inputs. It has a relay output with adjustable pick-up and release delay.

Power is also supplied to the connected sensors by the evaluation unit.

Digital, parallel

The distance is issued in the form of an 8-bit data word in parallel on three lines.

Digital, serial

These ultrasonic sensors can be parameterised via a bi-directional RS 232 interface, or issue the measured distance in serial form.

Outputs:

- Absolute/relative distance in 8- or 12-bit resolution
- Switching states
- Object in measuring window (A1, A2 or NDE*, FDE*)
- Object in sensing range
- etc.

* NDE = Near Distance of Evaluation
 FDE = Far Distance of Evaluation

Parameterisation

- Switching distances A1, A2
- Measuring window (NDE, FDE)
- Rising/falling ramp of analogue output
- Normally open/normally closed function
- Filter (for adaptation to application)
- etc.

The parameterisation can be performed with the Ultra 2001 service program or a terminal program and individual commands. A list of valid commands is contained in the individual sensor data sheets.

Digital, serial/parallel

These ultrasonic sensor function in the same way as those with the serial interface, but also feature an 8-bit parallel output for the measured distance. The parallel interface is parameterisable via RS 232 using the Ultra 2001 application.

3. Types/housing shapes

Cylindrical form

Design: 12GM...
18GK...
18GM40... / 18GM40A...
18GM75...
30GM...



Properties:

- Material: Plastic, nickel-plated brass or stainless steel.
- Thread: M12 x 1, M18 x 1 or M30 x 1.5
- Active area on the axial face (18GM40 and 18GM75 also available with angled head)
- Installation: In an existing threaded hole or using Pepperl+Fuchs mounting aids (see Accessories section)

Design: UC...-30GM... -T-...



Properties:

- Material: Plastic, stainless steel.
- Thread: M30 x 1,5
- Active area on the axial face
- Best suitable for low-temperature applications
- Installation: In an existing threaded hole or using Pepperl+Fuchs mounting aids (see Accessories section)

Design: 30GM... -K-...



Properties:

- Sensor head and evaluation unit are separate. The unit can therefore be installed in tight spaces.
- Material: Stainless steel.
- Thread: M30 x 1.5 (amplifier electronics)
M18 x 1 or M30 x 1,5 (transducer head).
- Active area on the axial face
- Installation: In an existing threaded hole or using Pepperl+Fuchs mounting aids (see Accessories section)

Design: LUC...



Properties:

- Material: PBT.
- Thread: G1½A and 1½" NPT in stainless steel or polypropylene
- Active area on the axial face
- Installation: In existing threaded flange
- Teflon-coated ultrasonic sensor for deployment in chemically aggressive environments

Design: D1

The D1 type was designed specifically for single-hole mounting in container lids to monitor fill levels. The display and operating elements are located under the transparent, permanently attached screw cap.



Properties:

- Material (housing): Plastic
- Material (flange): Stainless steel
- Single-hole mounting
- Simple parameterisation via DIP switch
- Large operating voltage range

Cuboid shaped types

VariKont® (Designation: U1 and U9)

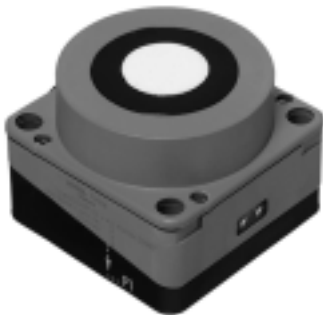
The **VariKont**® housing was developed by Pepperl+Fuchs and has been proven in millions of applications. It is extremely flexible due to the adjustability of the head (i.e. the active section) in five directions without changes to the mounting of the sensor. The electronics section can be replaced independently of the base of the sensor. Changing the wiring or adjustment is therefore not required.



Properties:

- Material: PBT
- Active section is adjustable in 5 directions without affecting the mounting of the sensor.
- The electronic section can be replaced without changes to the base of the sensor. The wiring and adjustment remain unaffected.
- Connection through terminal compartment
- Standardised mounting hole pattern as in mechanical roller-lever limit switches (compliant with EN 60947)

Design: FP



Properties:

- Material: PBT
- Active area at right angle to mounting surface
- The electronic section can be replaced without changes to the base of the sensor. The wiring and adjustment remain unaffected.
- Connection through terminal compartment

Design:

F12

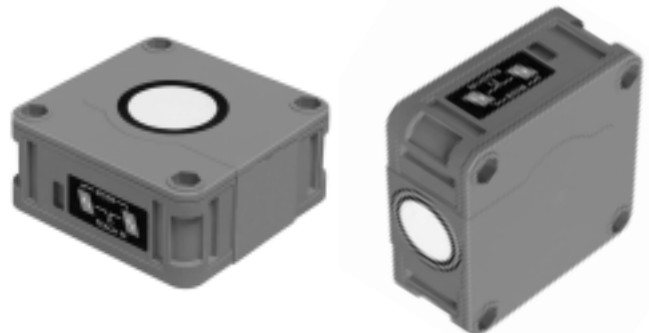


Properties:

- Robust housing, waterproof and nonbreakable
Material: dy cast zinc, nickel plated, PC, PBT
- Active area on the front face
- Multiple installation possibilities by means of slotted hole and dove tail mount
- Best visible indicator LEDs at the front and at the rear side

Connection via 90° turnable connector, M12 x 1

Design: F42



Properties:

- Material: PBT
- Direct surface-installation without additional mounting bracket
- Easy programming via built in keypad. No external programming tool required
- LEDs for status indication and for user support through numerous programming routines
- Top-looker und side-looker designs available for ideal matching to the local conditions
- DC-versions with semiconductor switching outputs or analogue outputs
- AC/DC-versions with wide voltage supply range and relay output

Electrical connections

Design: F43



Properties:

- Material: PBT
- Direct surface mounting without additional mounting angles
- LEDs on the plug side
- No unusable area in the twin-head version

Design: F54



Properties:

- Cubical housing, material: PBT
- Direct surface mounting without additional mounting angles

Design: F64



Properties:

- Through-beam ultrasonic barrier
- Cubical housing, material: PA
- Direct surface mounting without additional mounting angles

Double-sheet monitoring

The ultrasonic double-sheet monitor is a measuring system consisting of a cylindrical ultrasonic emitter unit and a receiver unit with built in evaluation electronics in M18 threaded bushes or cylindrical ultrasonic emitter and receiver units (M18) with a separate cubical evaluation unit.



Properties:

- Material (evaluation unit, only UDB... devices): Makrolon (UDC... devices do't have a separate evaluation unit)
- Material (sensor heads): Nickel-plated brass
- Non-contact distinction between single and double sheets
- Short response times to 1 ms
- Insensitive to dust and dirt
- Paper weights between 10 g and ca. 2000 g detectable
- Installation: In existing threaded holes or using the special fork-mounting aid MH-UDB01 (see Accessories section)

Applications:

The ultrasonic double-sheet monitor is deployed in all situations in which the automatic distinction between single and double sheets is required in order to protect machines or avoid waste production.

Typical applications include:

- deployment in printing machines
- monitoring of bonding sheets in labeling machines
- deployment in letter-opening machines
- deployment in document counters
- deployment in packaging machines
- the detection of air, single and double sheets in paper processing machines.

4. Electrical connections

Direct voltage sensors, 3-wire (Type E)

3-wire sensors have separate connections for the power supply and load. The load can be switched to positive (pnp) or negative (npn).

They are protected against overload, short circuit and reversal of polarity. The residual current is negligible.

Sensors with analogue output

are direct-voltage sensors that provide an output signal proportional to the measured value. They also have separate connections for the power supply and load.

The output signal is in the 0/4 mA ... 20 mA (current output) or 0/2 V ... 10V (voltage output) range.

Additionally, they can feature switching or control outputs and are protected against overload, short circuit and reversal of polarity.

Sensors with external evaluation

are direct voltage sensors with a clock pulse input that issue a pulse for the echo time at a separate output connection. The time at which the echo pulse is output is proportional to the echo time. A separate back-end unit is required for these sensors (see data section).

Sensors with serial interface

are direct voltage sensors that feature connections for an RS 232 interface in addition to the supply connections. This interface can be used for parameterisation, as well as to read out the sensor. Additional analogue or switching outputs may also be present.

Sensors with parallel interface

are direct voltage sensors that feature connections for the parallel output of the measured distance in addition to the supply connections. They can also feature control inputs, outputs, or a serial interface. Due to the large number of connections, these sensors are available with cable connections only.

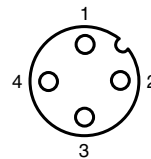
Three different connection types are used on Pepperl+Fuchs ultrasonic sensors:

Cable connection - The lengths, wire diameters and cable materials are stated in the individual data sheets. Sensors with cable connections do not have a supplementary designation in the type code.

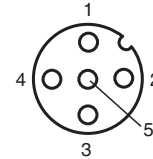
Terminal compartment - The *VariKont*® (U1 or U9) and *FP* types are equipped with a terminal compartment. The maximum diameter of the cable or cross section of the wires is stated in the data sheet.

Plug - The type of plug is stated under V... in the type code (see illustration).

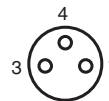
Plug connector -V1
(Circular connection M12)



Plug connector -V15
(Circular connection M12)



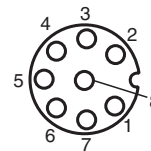
Plug connector -V3
(Circular connection M8)



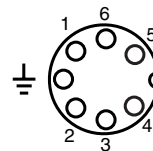
Colour assignments of ready-to-use mating connectors, V1, V15, V3:

Pin	Colour	Abbrev.
1	Brown	BN
2	White	WH
3	Blue	BU
4	Black	BK
5	Grey	GY

Plug connector -V17
(circular connector M12x1)



Plug connector -V7
(circular connector PG 13,5)



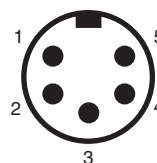
Colour assignments of ready-to-use mating connectors, V17:

Pin	Colour	Abbrev.
1	White	WH
2	Brown	BN
3	Green	GN
4	Yellow	YW
5	Grey	GY
6	Pink	PK
7	Blue	BU
8	None (shielding)	

Recommended colour assignments mating connectors V7:

Pin	Colour	Abbrev.
1	White	WH
2	Brown	BN
3	Green	GN
4	Yellow	YW
5	Grey	GY
6	Pink	PK
7	Blue	BU

Connector V95
(7/8"-16 UN 2A)

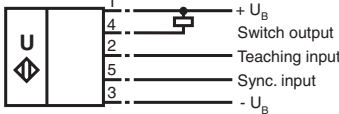
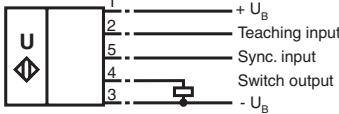
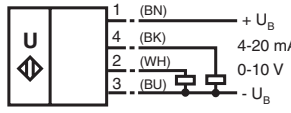
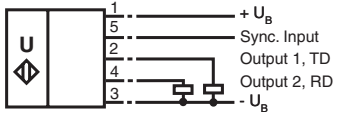
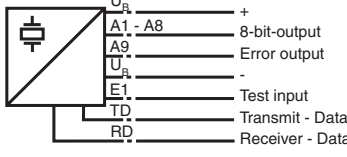
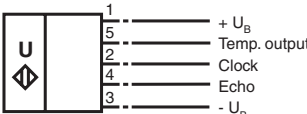


Recommended colour assignments mating connectors V95:

Pin	Colour	Abbrev.
1	Black	BK
2	Blue	BU
3	Green/ Yellow	GN/YE
4	Brown	BN
5	White	WH

Parameterisation

Overview of electrical connections

Typical electrical data	Type	Switching output/Remarks	Standard symbol (selection)	
3-wire Rated operating voltage 10 V ... 30 V DC Output 100 mA/200 mA	E0 E1 E01 E4 E7 E2 E3 E23 E5 E6	NPN NPN NPN NPN NPN PNP PNP PNP PNP PNP	Normally open NO Normally closed NC* E0 + E1* Normally closed NC/ Normally open NO (switchable)* 2 x E4* Normally open NO Normally closed NC* E2 + E3 Normally open NO Normally closed NC/ (switchable)* 2 x E5*	Standard symbol/Connections: (version E0, npn)  Standard symbol/Connections: (version E2, pnp) 
Analogue Rated operating voltage 10 V ... 30 V DC Output 4 mA ... 20 mA Output 0 V ... 10 V	IU	Sensor for distance measurement with analogue output	Standard symbol/Connection: (version IU)  Core colours in accordance with EN 60947-5-2.	
Serial Rated operating voltage 10 V ... 30 V DC	R2 (RS)	Communication-enabled, parameterisable sensor with RS 232 interface Old designation	Standard symbol/Connection: (Version E6, pnp) 	
Parallel Rated operating voltage 20 V ... 30 V DC	8B	Communication-enabled, parameterisable sensor with 8-bit parallel output	Standard symbol/Connection: Transceiver (parallel interface) 	
External evaluation Rated operating voltage 10 V ... 30 V DC	H1 H2 H3	Emitter* Receiver* Emitter/receiver	Standard symbol/Connection: 	

Note: The standard symbols shown here are examples. The types marked with * are not shown.

5. Parameterisation

Switching distances A1 and A2 or the lower and upper limits of the measuring window of ultrasonic sensors in direct-detection mode can be parameterised in a variety of ways depending on their type.

Coding switch in terminal compartment

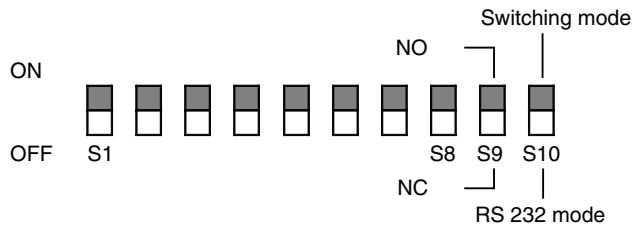
The near and far switching distances (A1 or A2) are set in steps using 4 DIP switches each. The step size of the adjustable switching distances is determined by the sensor software. For the sensor in the following example, the switch combinations 0000 ... 1000 correspond to 150 mm and for 1001 ... 1111 to 200 mm.

Different steps may apply to other sensors with coding switches (see the technical data for the relevant sensor type).

The following types are equipped with coding switches in terminal compartment:

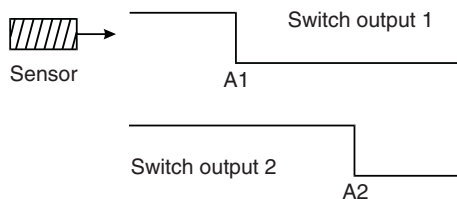
- UC500+U9+E6/E7+R2, UC500+U9+IUE2/UE0+R2
- UC3000+U9+E6/E7+R2, UC3000+U9+IUE2/UE0+R2
- UB1000+FP1+E6
- UC6000-FP-E6/E7-R2-P5, UC6000-FP-IUE2/UE0-R2-P5

Example 1: UC3000+U9+E6+R2
(sensor with 2 switching outputs or RS 232 interface)



Near				Far					
S1	S2	S3	S4	S5	S6	S7	S8	A1/mm	A2/mm
0	0	0	0	0	0	0	0	300	400
0	0	0	1	0	0	0	1	450	550
0	0	1	0	0	0	1	0	600	700
...	...								
0	1	0	1	1	1	0	0	1050	2400
...	...								
1	1	1	1	1	1	1	1	2900	3000

(1 = ON, 0 = OFF)



(S9 = ON, normally open)

Example 2: UB1000+FP1+E6
(sensor with 2 switching outputs or 1 switching output and switching window)

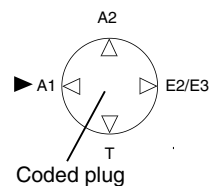
S10	Operating behaviour	
0		Output 1 Output 2
1		Output 1 (window) Output 2

- Switch S1 ... S8: adjustment of the switching range (200 mm ... 1000 mm)
- Switch S9: (0) normally closed/(1) normally open
- Switch S10: (0) two independent switching points (1) measuring window

Programming plug

The following ultrasonic sensors are equipped with a programming plug with an integrated temperature probe. The plug can be connected in four different positions:

UC300 UC500 UC1000 UCC1000 UC2000 UC4000 UC6000	30GM	E6 E6R2 E7R2 IU IUR2	(K)	V1 V15
LUC4T	G5P G5S N5P N5S	IU		V15



The switching distances A1 and A2 of the evaluation (E2/E3), or the lower and upper limits of the measuring window are set using TEACH-IN.

Position	Function
A1	Distance A1 is taught (switching distance or measuring window limit)
A2	Distance A2 is taught (switching distance or measuring window limit)
E2/E3	E2: individual switching distances/falling analogue ramp E3: window/rising analogue ramp
T	Temperature compensation is activated

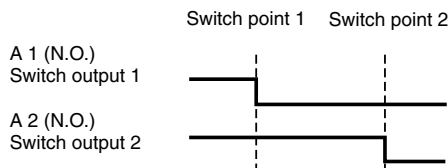
The state is stored when the plug is removed. The taught-in switching distances and functions are retained when power is switched off.

General information

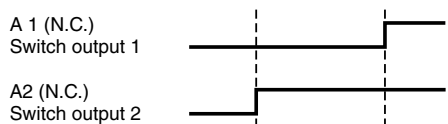
Switching outputs: types ...-E6R2/E7R2

1. Switch point mode

When $A1 < A2$, both switch outputs are activated as N.O. contacts.

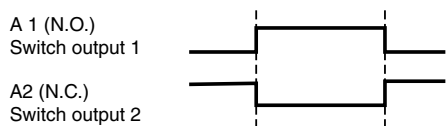


When $A1 > A2$, both switch outputs are activated as N.C. contacts.



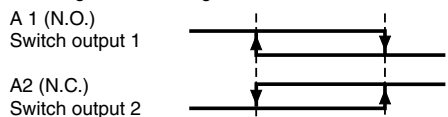
2. Window mode

To exchange the switching distances is of no effect.

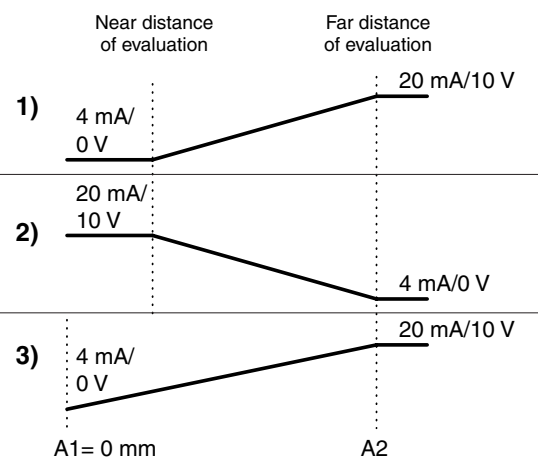


3. Hysteresis mode

To exchange the switching distances is of no effect.



Analogue output: types ...-IU and ...-IUR2



Programming units UB-PROG 2/UB-PROG 3

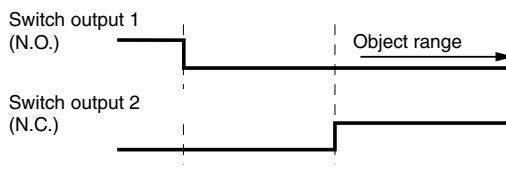
Ultrasonic sensor of the types:

UB500	18GM75 30GM F54	E01	V15
UB2000		E23	
UB4000		E4	
UB6000		E5	
		E6	
	E7		
	I		
	U		

permit the UB-PROG 2/UB-PROG 3 programming units to be inserted into the supply circuit. This permits the switching distances A1 and A2 or the evaluation limits to be programmed in an elegant manner (TEACH-IN). Each switching point/each evaluation limit has its own button.

A window function or a normally closed/normally open function can be set for sensors with switching outputs depending on the order in which buttons A1 and A2 are pressed. The evaluation range and the mode of operation of the analogue output can be set for sensors with analogue output.

Switching output: types ...E01/E02



- Switch point 1 $\rightarrow \infty$: Switch output 1, (N.O.)
Detection of object presence
- Switch point 2 $\rightarrow \infty$: Switch output 2, (N.C.)
Detection of object presence

Switching output: types ...E4/E5

- Window mode, normally open function
 $A1 < A2$:
- Window mode, normally closed function
 $A2 < A1$:
- One switch point, normally open function
 $A1 \rightarrow \infty$:
- One switch point, normally closed function
 $A2 \rightarrow \infty$:
- $A1 \rightarrow \infty, A2 \rightarrow \infty$: Detection of object presence
Object detected: Switch output closed
No object detected: Switch output open

Switching output: types ...E6/E7

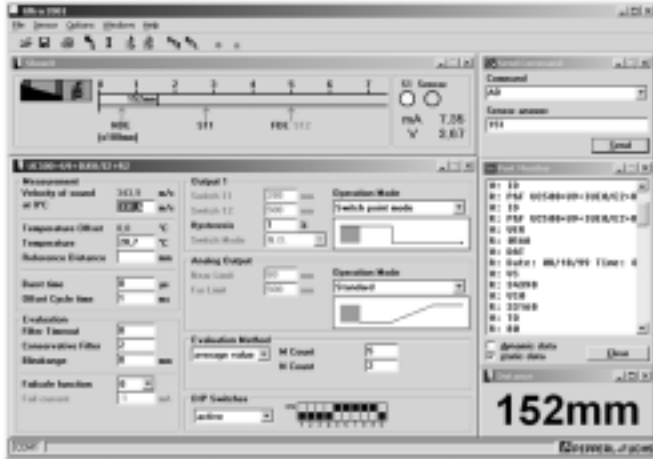
-
-
- Switch point 1 $\rightarrow \infty$: Switch output 1, (N.C.)
Detection of object presence
 - Switch point 2 $\rightarrow \infty$: Switch output 2, (N.O.)
Detection of object presence
 - Switch point 1 a. 2 $\rightarrow \infty$: Both switch outputs, (N.O.)
Detection of object presence

Ultra 2001 PC service program (RS 232, bi-directional interface)

The Ultra 2001 application can be used to parameterise, and read out the parameters and measured values, of ultrasonic sensors with the designation ...R2 (RS) in their type code.

The sensors must be connected to a PC/notebook using the supplied interface cable.

Ultra 2001 is running with WINDOWS™ 32-Bit systems (WINDOWS 95™ and higher) and features a modern user interface. The operation of the program is mouse-based.



UC-F43-R2 programming adapter

The UC-F43-R2 programming adapter is designed to be inserted between sensors of the -F43- series and the supply lead. A 9-pin cable socket with 1 m of cable permit the sensor to be connected to the RS 232 interface of a PC with ease. The usual wiring requirements become superfluous with the use of the programming adapter.

The PC service program Ultra 2001 can be used for the actual programming of ultrasonic sensors of the -F43- series.

UC-30GM-R2 programming adapter

The interface cable UC-30GM-R2 permits the parameterisation of ultrasonic sensors series UC...-30GM...R2-V15 using the PC service program ULTRA 2001. This cable connects the PC-internal RS 232-interface to the program/temperature socket of the sensor. During the parameterisation procedure, the program/temperature plug is unplugged.

UC-FP/U9-R2 programming adapter

The interface cable UC-FP/U9-R2 permits the parameterisation of ultrasonic sensors series VariKont (U9) and FP, which are equipped with a serial interface, (marked with R2 or RS in model number). This cable connects the PC-internal RS 232-interface to the according terminal screws in the sensor base.

6. General information

Resolution

Pepperl+Fuchs ultrasonic sensors of the UC... series are equipped with an integrated 12-bit DA converter. A resolution of 12 bits corresponds to 4096 steps. The echo time of an ultrasonic packet is determined with a resolution of 1 µs (sensors without an RS 232 interface) or 1.085 µs (sensors with an RS 232 interface) due to the clocking of the microcontroller. This corresponds to a physical resolution of 0.172 mm or 0.186 mm. This maximum sensor resolution is available if the measuring window (the range between A1 and A2 or between the lower and upper limits) is less than or equal to

$$4096 \times 0.172 \text{ mm} = 705 \text{ mm}$$

or

$$4096 \times 0.186 \text{ mm} = 762 \text{ mm}$$

Up to this window size, the resolution is solely dependent on the clock rate of the microcontroller. The DA converter controls the sensor resolution if a larger measuring window is selected. It can then be calculated using the following formula:

$$(A2 - A1) / 4096$$

or

$$(\text{upper limit} - \text{lower limit}) / 4096$$

Example:

A UC4000-30GM-IUR2-V1 sensor has been set up with the following parameters:

Upper limit: 3500 mm
Lower limit: 800 mm

In this application, the physical resolution of the sensor amounts to

$$(3500 \text{ mm} - 800 \text{ mm}) / 4096 = 0.66 \text{ mm.}$$

Ultrasonic sensors with 8-bit parallel output resolve the measuring window in 256 steps. Their resolution can be calculated as follows:

$$(\text{upper limit} - \text{lower limit}) / 256$$

if the measuring window has been set to a size greater than 44 mm. For smaller measuring windows, the resolution is 0.172 mm. The resolution given in the data sheet is based on the largest possible measuring window.

Accuracy (conformity error)

To determine the absolute accuracy of the measured value of an ultrasonic sensor, factors such as

- temperature
- atmospheric pressure
- relative humidity
- turbulence
- hot spots in the air surrounding the sensor
- Sensor in hot operating mode status

must be taken into consideration.

Notes for installation and operation

In addition, tolerances of the electronic components and differences in the response characteristic of the ultrasonic sensor due to varying signal strengths of the sound reflected by the object also have an effect.

Under consideration of all of these influences, an accuracy of better than 2 % generally can be achieved, along with a reproducibility and linearity of better than 0.2 %.

Resistance to shock and vibration

Pepperl+Fuchs ultrasonic sensors fulfill the DIN EN 60947-5-2 standards for low-voltage switching equipment, Part 5, Section 2: Proximity Switches. A reference is made to the applicable environmental testing procedures within the framework of this standard.

Resistance to shock

Our ultrasonic sensors were tested for their resistance to mechanical shocks in accordance with IEC 60068-2-27 under the following conditions:

6 impacts in each direction along 3 axes at right angles to one another (6 individual tests).

Pulse form:	half sine
Peak acceleration:	30 g (300 m/s ²)
Pulse duration:	11 ms

Resistance to vibration

Our ultrasonic sensors were tested for their resistance to vibration in accordance with IEC 60068-2-6 under the following conditions:

Vibration along 3 axes at right angles to one another.

Frequency range:	10 Hz ... 55 Hz
Amplitude:	1 mm
Duration:	30 min each (55 Hz)

Electromagnetic compatibility

The DIN EN 60947-5-2 "proximity switch standard" also refers to the applicable standards for the documentation of electromagnetic compatibility. Pepperl+Fuchs ultrasonic sensors fulfill the requirements of

- Interference immunity in accordance with DIN EN 61000-4-2 (immunity to electrostatic discharge)
- Interference immunity in accordance with DIN EN 61000-4-3 (immunity to high-frequency interference)
- Interference immunity in accordance with DIN EN 61000-4-4 (immunity to fast transients)
- Emitted interference in accordance with EN 55011 and DIN EN 50081-2.

7. Notes for installation and operation

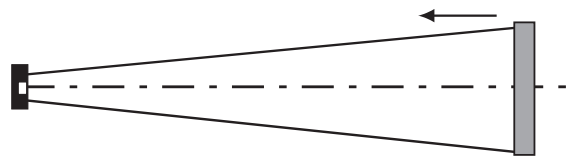
Ultrasonic sensors can be installed and operated in any position. Avoid installation positions that may lead to impaired functioning due to deposits of dust or dirt.

When cleaning ultrasonic sensors, take care not to damage the sensor surface (decoupling layer) or the integral foam in which the transducer is embedded.

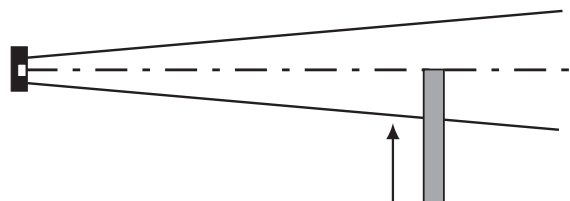
Water drops or the formation of crusts on the decoupling layer will lead to an impairment of the ultrasonic sensor's function. Light dust deposits are uncritical.

Actuation direction

The objects to be detected can enter the sound beam from any arbitrary direction. The sensor ranges and response curves in the data sheets represent the maximum object sensing ranges.

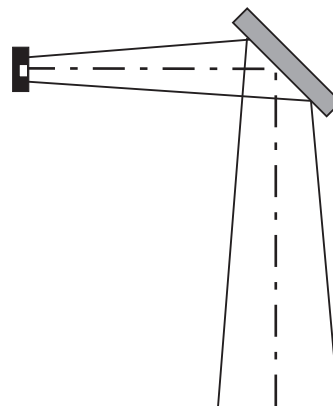


For objects moving radially, i.e. at right angles or any other angle lateral to the sound cone axis, refer to the response curve of the data sheet to determine the switching distance.



Deflection of the sound cone

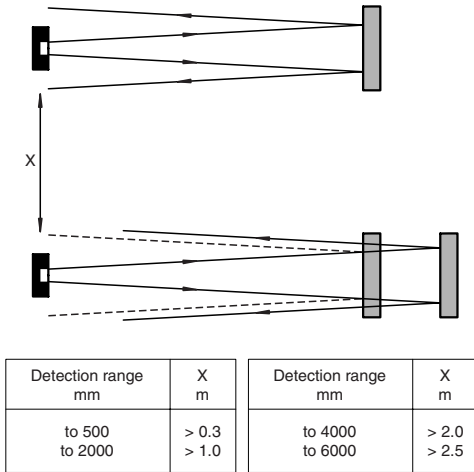
The sound cone can be deflected with smooth, even reflectors. Do not deflect the signal more than twice, however, as the signal damping that occurs with each deflection will result in reduced range.



An exact alignment of the reflector surfaces is required. Pepperl+Fuchs offers 45° reflectors for some sensor types to achieve a deflection of 90°.

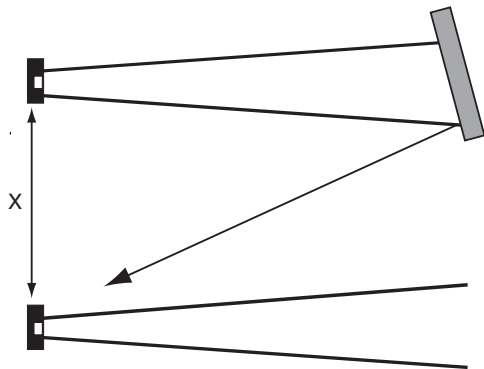
Mutual interference

To prevent mutual interference, observe the minimum distances between sensors of the same type shown in the following drawings.



The indicated values should be regarded as guidelines. They apply if the sound cones are aligned parallel to one another and the surfaces of the objects are at right angles to the axes of the sound cones. The actually required spacing "X" is dependent on alignment, the nature of the target objects to be detected, and local conditions related to other objects located in the sound cone.

In the event that objects with an unfavourable alignment are to be detected, a greater spacing "X" must be used.



The indicated spacing can be reduced significantly by synchronising the ultrasonic sensors. Pepperl+Fuchs offers a series of sensors equipped with synchronisation inputs for this purpose. These can be used in synchronised or multiplex mode. The synchronisation can be realised with an external synchronisation signal or with self-synchronisation in some sensor types.

The opposed installation on non-synchronised sensors of the same type should be avoided.

Synchronisation

Mutual interference of sensors with synchronisation inputs can be prevented effectively by synchronising the sensors. A distinction is made between synchronised and multiplex mode.

Multiplex mode

In this operating mode, the sensors are activated for a brief period, consecutively and in a cyclic manner. Please note that in this operating mode the cycle time T is extended by a factor of N, in which N stands for the number of sensors in the multiplex mode.

$$T_{\text{multiplex}} = N \times T_{\text{sensor}} \quad \text{and} \quad f_{\text{Sync}} = 1 / T_{\text{multiplex}}$$

If sensors of different types are used, the total cycle time is equal to the sum of the cycle times of the individual sensors.

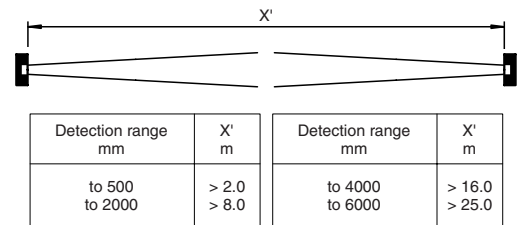
$$T_{\text{multiplex}} = T_{\text{sensor 1}} + T_{\text{sensor 2}} + \dots + T_{\text{sensor N}}$$

If the self-synchronisation option is used, the sensors work in multiplex mode.

Synchronised mode

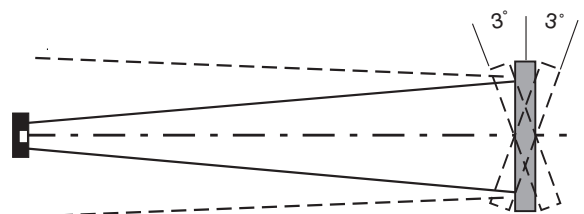
In this mode, the synchronisation inputs of all sensors are connected to one another and controlled together. Unlike multiplex mode, the cycle time does not increase. In addition to the monitoring of large areas, the synchronised mode is above all suitable for the reduction of the required minimum lateral spacing of sensors of the same type, and for the operation of opposed sensors of the same type.

In the case of opposed sensor installation, observe the distances specified below.



Measuring plate/objects

Objects to be detected by ultrasonic sensors can be solid, liquid or in powder form. The properties of the object's surface are important for the echo to be evaluated by the sensor. All level and smooth surfaces arranged at a right angle to the sound cone, provide an ideal reflection. An angular deviation of the measuring plate by a maximum of 3° is permissible for reliable detection.



Material properties such as transparency, colour, or surface finish (polished or matte) have no effect on detection reliability. The roughness of the object's surface, together with the sensor-specific transducer frequency, determines whether the echo is reflected or diffused. The following table contains a listing of the transducer frequencies used in Pepperl+Fuchs ultrasonic sensors and the associated degrees of surface roughness for the reflection or diffusion of the sensor signal. The following rule applies:

If the sound wavelength is longer than the peak-to-valley height of the surface roughness, the directional share of the reflection will predominate. If it is shorter than the peak-to-valley height, the diffuse share will predominate.

Transducer frequency	Degree of object surface roughness for a predominately directional reflection	Degree of object surface roughness for a predominately diffuse reflection
65 kHz	< 1 mm	> 25 mm
85 (90) kHz	< 0.8 mm	> 20 mm
120 (130) kHz	< 0.5 mm	> 13 mm
175 kHz	< 0.4 mm	> 10 mm
375 (400) kHz	< 0.2 mm	> 5 mm

The transition from directional to diffuse reflection is continuous. Depths of roughness between the indicated values will result in reflections with diffuse and directional shares. Objects with great surface roughness will result in a reduction of the ultrasonic sensor's sensing range.

Greater degrees of surface roughness permit greater deviations of the angle of incidence from the ideal position. The reason for this is the predominately diffuse reflection of the ultrasonic signal. As a result, filling levels or pouring cones of coarse-grained materials can be detected at an angular deviation of up to 45° (at a reduced sensing range).

The following objects are well-suited for detection:

- All smooth and solid objects that are aligned at a right angle to the sound cone.
- All solid objects with degrees of surface roughness that cause a diffuse reflection and which are to a large extent independent of their alignment.
- The surfaces of liquids, insofar as these are not angled more than 3° from the axis of the sound cone.

The following materials are poorly suited:

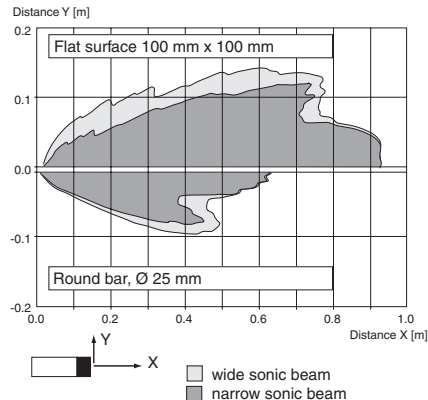
- Materials that absorb ultrasonic signals such as felt, cotton wool, coarse textiles, or plastic foam.
- Materials at temperatures greater than 100 °C.

It may be necessary to resort to through-beam operation for such materials.

Sensors with adjustable sound cone width

Some series offer a sound cone width adjustment in the close range. This enables the operation of such sensors even at narrow places, where objects can extend sideways into the sound cone. Such circumstances would cause erratic switching or erratic measurement under the use of sensors without this feature. An adjustment of the sound cone can solve this problem.

The adjustment of the shape of the sound cone has no influence to the maximum sensing range.



In the figure above, the characteristic response curve of the sensor UB500-F42... is shown for 2 different objects (round bar with d= 25 mm (upper part) and flat surface 100 mm x 100 mm (lower part)).

If you have any questions pertaining to difficult applications, simply give us a call. Take advantage of our help and experience. Our service team will be pleased to be of assistance.

Our contact addresses, you can find at the rear catalogue cover or in the chapter "Pepperl+Fuchs GmbH worldwide" beginning at page 246

Series -12GM



Model number	Detection range	Page
UB400-12GM-E5-V1 UB400-12GM-I-V1 UB400-12GM-U-V1	400 mm	28

Date of edition 09/13/2005

Subject to reasonable modifications due to technical advances.

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Series
-12GM

Series
-18GK/-18GM

Series
-30GM

Series
VarKont

Series
-FP

Series
-F12

Series
-F42

Series
-F43

Series
-F54

Series
-F64

Series
-D1

Series
LUC

Double sheet
monitoring

Control units/
Power supplies

Accessories



- TEACH-IN input
- Temperature compensation
- Analogue output 0 V ... 10 V
- Analogue output 4 mA ... 20 mA
- Switch output
- 5 different output functions can be set
- Measuring window adjustable

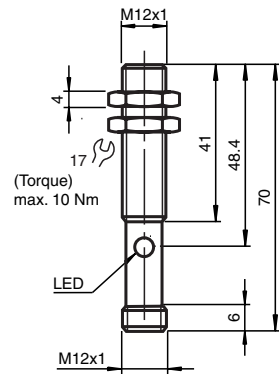


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

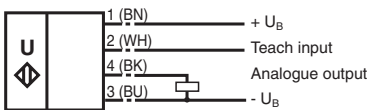
	Model number	UB400-12GM-E5-V1	UB400-12GM-I-V1	UB400-12GM-U-V1
Sensing range	30 ... 400 mm	●	●	●
Adjustment range	50 ... 400 mm	●	●	●
Unusable area	0 ... 30 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 310 kHz	●	●	●
Response delay	approx. 50 ms	●	●	●
LED yellow	permanently yellow: object in the evaluation range yellow, flashing: TEACH-IN function, object detected indication of the switching state flashing: TEACH-IN function object detected	●	●	●
LED red	permanently red: Error red, flashing: TEACH-IN function, object not detected	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS} 15 ... 30 V DC, ripple 10 % _{SS}	●	●	●
No-load supply current	≤ 30 mA	●	●	●
Output type	1 analogue output 0 ... 10 V 1 analogue output 4 ... 20 mA, short-circuit/overload protected 1 switch output E5, prp NO/NC, parameterisable	●	●	●
Resolution	0,17 mm	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●
Repeat accuracy	≤ 1 %	●	●	●
Rated operational current	± 0,5 % of full-scale value 100 mA, short-circuit/overload protected	●	●	●
Voltage drop	≤ 3 V	●	●	●
Switching frequency	≤ 8 Hz	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●
Load impedance	> 1 kOhm 0 ... 300 Ohm	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●
Input type	1 TEACH-IN input operating distance 1: -U _B ... +1 V, operating distance 2: +6 V ... +U _B input impedance: > 4,7 kΩ TEACH-IN pulse: ≥ 1 s 1 TEACH-IN input lower evaluation limit A1: -U _B ... +1 V, upper evaluation limit A2: +4 V ... +U _B input impedance: > 4,7 kΩ, pulse duration: ≥ 1 s	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●
Protection degree	IP65	●	●	●
Connection	V1 connector (M12 x 1), 4-pin	●	●	●
Housing	brass, nickel-plated	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●
Mass	25 g	●	●	●

Date of edition: 08/18/2005



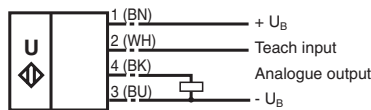
Electrical connection

Standard symbol/Connections:
(version I)



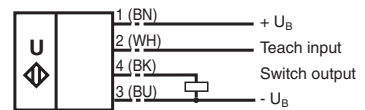
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

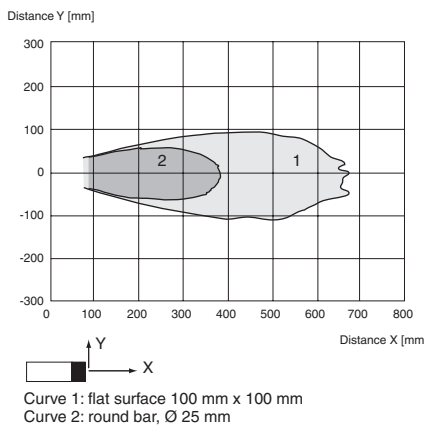
Standard symbol/Connections:
(version E5, pnp)



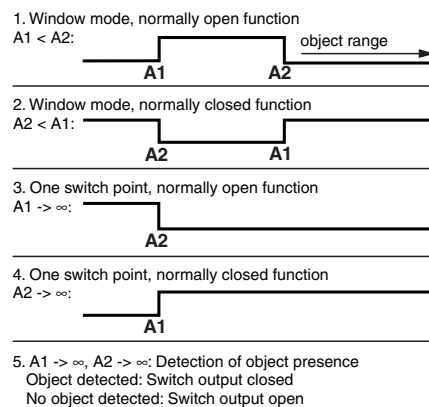
Core colours in accordance with EN 60947-5-2.

Diagrams

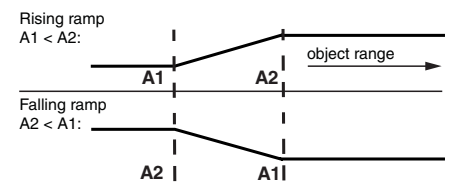
Characteristic response curve



Programmed switching output function



Programmed analogue output function



Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Output version E5:

Adjusting the switching points

The ultrasonic sensor features a switch output with two teachable switching points. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Switching point A1 is taught with $-U_B$, A2 with $+U_B$.

Five different output functions can be set

1. Window mode, normally-open function
2. Window mode, normally-closed function
3. one switching point, normally-open function
4. one switching point, normally-closed function
5. Detection of object presence

TEACH-IN window mode, normally-open function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Set target to far switching point
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN window mode, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Set target to far switching point
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN switching point, normally-open function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN switching point, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN detection of objects presence

- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$
- TEACH-IN switching point A2 with $+U_B$

Default setting of switching points

A1 = blind range, A2 = nominal distance

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED
TEACH-IN switching point:		
Object detected	off	flashes
No object detected	flashes	off
Object uncertain (TEACH-IN invalid)	On	off
Normal operation	off	Switching state
Fault	on	Previous state

Output versions -I and -U:

Adjusting the evaluation limits

The ultrasonic sensor features an analogue output with two teachable evaluation limits. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. The lower evaluation limit A1 is taught with $-U_B$, A2 with $+U_B$.

Two different output functions can be set:

1. Analogue value increases with rising distance to object (rising ramp)
2. Analogue value falls with rising distance to object (falling ramp)

TEACH-IN rising ramp (A2 > A1)

- Position object at lower evaluation limit
- TEACH-IN lower limit A1 with $-U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A2 with $+U_B$

TEACH-IN falling ramp (A1 > A2):

- Position object at lower evaluation limit
- TEACH-IN lower limit A2 with $+U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A1 with $-U_B$

Default setting

A1: unusable area
 A2: nominal sensing range
 Mode of operation: rising ramp

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED
TEACH-IN evaluation limit		
Object detected	off	flashes
No object detected	flashes	off
Object uncertain (TEACH-IN invalid)	on	off
Normal mode (evaluation range)	off	on
Fault	on	previous state

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -18GK/-18GM



UBE500-18GK...



UB...-18GM40A...



UB...-18GM40...



UB...-18GM75...

Model number	Detection range	Page
UBE500-18GK-SE0-V1 UBE500-18GK-SE2-V1	500 mm	34
UBE1000-18GM40-SE2-V1	1000 mm	36
UB300-18GM40-E5-V1 UB300-18GM40-I-V1 UB300-18GM40-U-V1 UB800-18GM40-E5-V1 UB800-18GM40-I-V1 UB800-18GM40-U-V1	300 mm 800 mm	38
UB300-18GM40A-E5-V1 UB300-18GM40A-I-V1 UB300-18GM40A-U-V1 UB800-18GM40A-E5-V1 UB800-18GM40A-I-V1 UB800-18GM40A-U-V1	300 mm 800 mm	40
UB500-18GM75-E4-V15 UB500-18GM75-E5-V15 UB500-18GM75-I-V15 UB500-18GM75-U-V15	500 mm	42
UB500-18GM75-E01-V15 UB500-18GM75-E23-V15 UB500-18GM75-E6-V15 UB500-18GM75-E7-V15	500 mm	44
UB500-18GM75-F-V15 UB500-18GM75-BIT-V15 UB500-18GM75-PWM-V15	500 mm	46
UB1000-18GM75-E4-V15 UB1000-18GM75-E5-V15 UB1000-18GM75-I-V15 UB1000-18GM75-U-V15	1000 mm	48
UB1000-18GM75-E01-V15 UB1000-18GM75-E23-V15 UB1000-18GM75-E6-V15 UB1000-18GM75-E7-V15	1000 mm	50
UB1000-18GM75-F-V15 UB1000-18GM75-BIT-V15 UB1000-18GM75-PWM-V15	1000 mm	52

Date of edition: 08/18/20.05

For detailed function description, see page 54

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Series -12GM
 Series -18GK/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories



- High switching frequency
- Small, compact design
- Plastic housing
- Suited for applications for detection and counting of transparent objects (e.g. bottles and plastic-wrapping)
- Emitter and receiver included in the delivery package



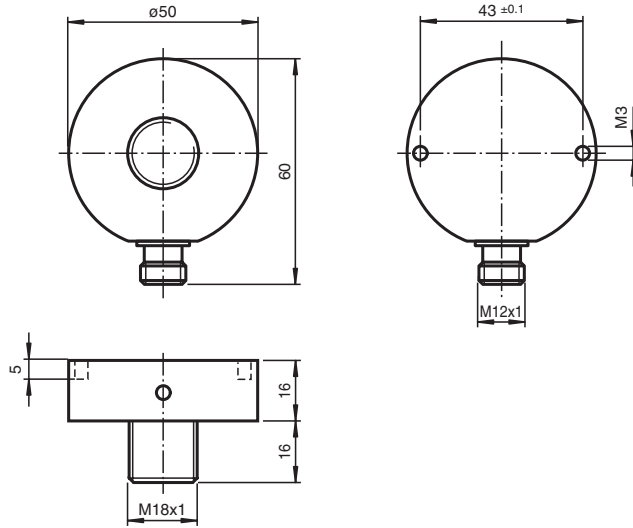
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UBE500-18GK-SEB-V1	UBE500-18GK-SE2-V1
Sensing range	0 ... 500 mm, distance emitter-receiver 15 mm ... 500 mm	●	●
Transducer frequency	400 kHz	●	●
LED yellow	indication of the switching state (receiver)	●	●
Operating voltage	18 ... 30 V DC, ripple 10 % _{SS}	●	●
No-load supply current	20 mA receiver 25 mA emitter	●	●
Output type	1 switch output E0, npn NO 1 switch output E2, pnp NO	●	●
Rated operational current	200 mA	●	●
Voltage drop	≤ 1,5 V	●	●
Switching frequency	100 Hz	●	●
Standards	EN 60947-5-2	●	●
Ambient temperature	0 ... 60 °C (273 ... 333 K)	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●
Protection degree	IP65	●	●
Connection	V1 connector (M12 x 1), 4-pin	●	●
Housing	Polyamide (PA)	●	●
Mass	50 g	●	●

Series -12GM
Series -18GK/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

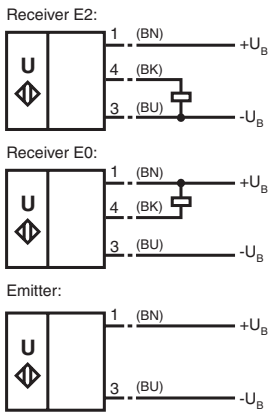
Date of edition: 08/18/2005



Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Electrical connection

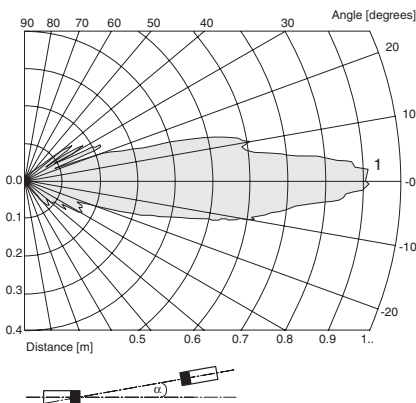
Standard symbol / Connection:



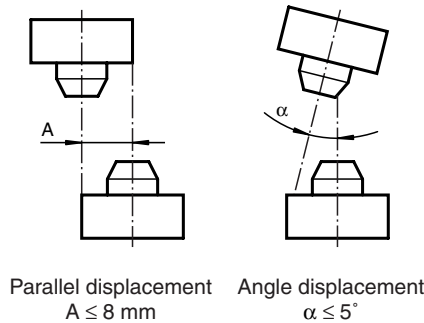
Core colours in accordance with EN 60947-5-2.

Diagrams

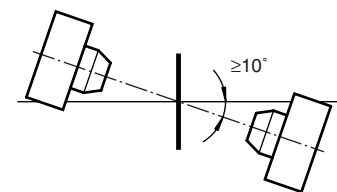
Characteristic response curves



Mounting/Adjustment



Thin foil detection



Date of edition: 08/18/2005

Ultrasonic sensor

UBE1000-18GM40-SE2-V1



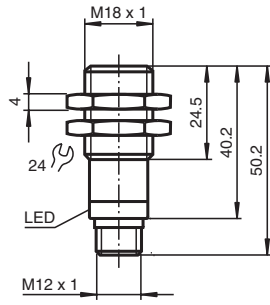
- Short design, 40 mm
- Function indicators visible from all directions
- Switch output
- TEACH-IN input
- Integrated alignment aid



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

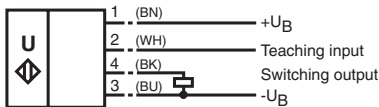
	Model number	
		UBE1000-18GM40-SE2-V1
Sensing range	50 ... 1000 mm	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 205 kHz	●
LED yellow	switching state	●
LED red	error, object uncertain	●
LED green	Power on	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 20 mA	●
Output type	NO prp	●
Rated operational current	200 mA, short-circuit/overload protected	●
Voltage drop	≤ 3 V	●
Switching frequency	≤ 100 Hz	●
Switch-on delay	< 5 ms	●
Input type	1 TEACH_IN input operating distance 1: -U _B ... +1 V, operating distance 2: +6 V ... +U _B input impedance: > 4,7 kΩ TEACH-IN pulse: ≥ 1 s	●
Standards	EN 60947-5-2	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
Protection degree	IP65	●
Connection	V1 connector (M12 x 1), 4-pin	●
Housing	brass, nickel-plated	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●
Mass	25 g	●



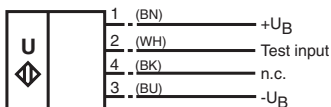
Electrical connection

Standard symbol/Connection:
(version E2, pnp)

Receiver:



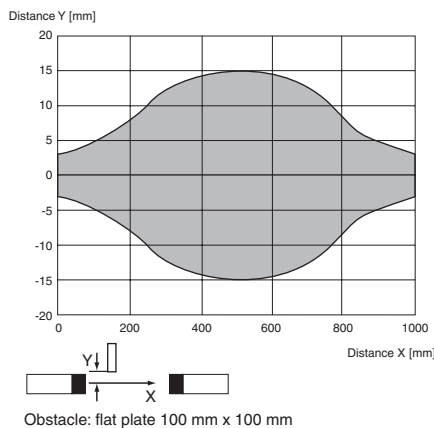
Emitter:



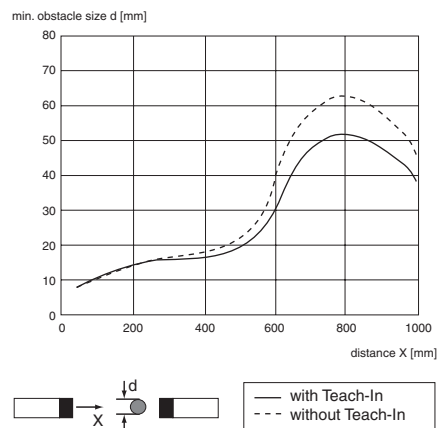
Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curve



Obstacle size



Date of edition: 08/18/2005

Series -12GM

Series -18GM

Series -30GM

Series VarKont

Series -FP

Series -F12

Series -F42

Series -F43

Series -F54

Series -F64

Series -D1

Series LUC

Double sheet monitoring

Control units/ Power supplies

Accessories



- Short design, 40 mm
- Function indicators visible from all directions
- TEACH-IN input
- Temperature compensation
- Measuring window adjustable
UB...-18GM40-I-V1
UB...-18GM40-U-V1
- Analogue output 0 V ... 10 V
UB...-18GM40-U-V1
- Analogue output 4 mA ... 20 mA
UB...-18GM40-I-V1
- Switch output
UB...-18GM40-E5-V1
- 5 different output functions can be set
UB...-18GM40-E5-V1

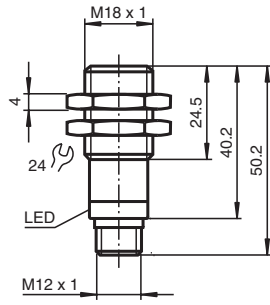


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

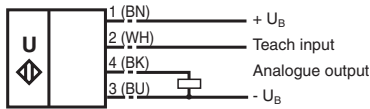
	Model number	UB300-18GM40-E5-V1	UB300-18GM40-I-V1	UB300-18GM40-U-V1	UB800-18GM40-E5-V1	UB800-18GM40-I-V1	UB800-18GM40-U-V1
Sensing range	30 ... 300 mm	●	●	●			
	50 ... 800 mm				●	●	●
Adjustment range	50 ... 300 mm	●	●	●			
	70 ... 800 mm				●	●	●
Unusable area	0 ... 30 mm	●	●	●			
	0 ... 50 mm				●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●	●	●
Transducer frequency	approx. 205 kHz				●	●	●
	approx. 390 kHz	●	●	●			
Response delay	approx. 100 ms				●	●	●
	approx. 30 ms	●	●	●			
LED yellow	permanently yellow: object in the evaluation range, yellow, flashing: TEACH-IN function, object detected	●	●	●			
	indication of the switching state, flashing: TEACH-IN function object detected	●	●	●	●	●	●
LED red	permanently red: Error, red, flashing: TEACH-IN function, object not detected	●	●	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●	●	●
	15 ... 30 V DC, ripple 10 % _{SS}				●	●	●
No-load supply current	≤ 20 mA	●	●	●	●	●	●
Output type	1 analogue output 0 ... 10 V	●	●	●	●	●	●
	1 analogue output 4 ... 20 mA, short-circuit/overload protected				●	●	●
Default setting	1 switch output E5, prep NO/NC, parameterisable	●	●	●			
	evaluation limit 1: 50 mm evaluation limit 2: 300 mm				●	●	
	evaluation limit 1: 70 mm evaluation limit 2: 800 mm						●
	Switch point A1: 50 mm Switch point A2: 300 mm	●					
	Switch point A1: 70 mm Switch point A2: 800 mm						●
Resolution	0,4 mm at max. sensing range		●	●	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value		●	●	●	●	●
Repeat accuracy	≤ 1 %	●	●	●	●	●	●
	± 0,5 % of full-scale value				●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●	●	●
Voltage drop	≤ 3 V	●	●	●	●	●	●
Switching frequency	≤ 13 Hz	●	●	●			
	≤ 4 Hz				●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●	●	●
Load impedance	> 1 kOhm				●	●	●
	0 ... 300 Ohm		●	●	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●	●	●	●
Input type	1 TEACH-IN input	●			●		
	operating distance 1: -U _B ... +1 V, operating distance 2: +6 V ... +U _B						
	input impedance: > 4,7 kΩ TEACH-IN pulse: ≥ 1 s				●	●	●
	1 TEACH-IN input				●	●	●
	lower evaluation limit A1: -U _B ... +1 V, upper evaluation limit A2: +4 V ... +U _B						
	input impedance: > 4,7 kΩ pulse duration: ≥ 1 s				●	●	●
Standards	EN 60947-5-2	●	●	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●	●	●
Protection degree	IP65	●	●	●	●	●	●
Connection	V1 connector (M12 x 1), 4-pin	●	●	●	●	●	●
Housing	brass, nickel-plated	●	●	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●	●	●
Mass	25 g	●	●	●	●	●	●

Date of edition: 08/18/2005



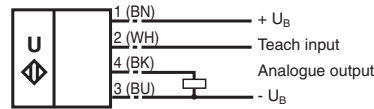
Electrical connection

Standard symbol/Connections:
(version I)



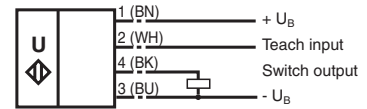
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

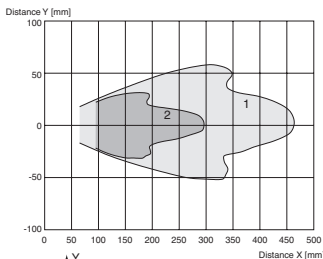
Standard symbol/Connections:
(version E5, pnp)



Core colours in accordance with EN 60947-5-2.

Diagrams

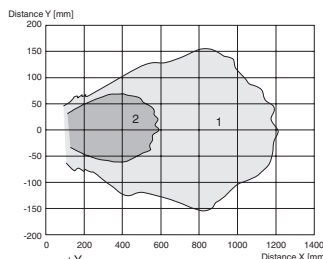
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB300-18GM40-V1

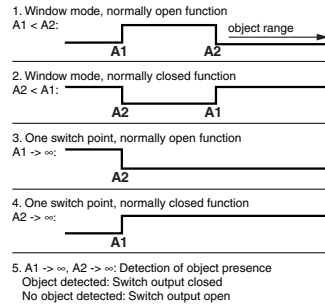
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

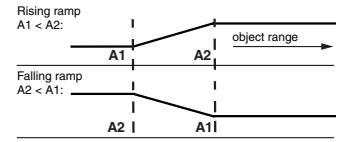
UB800-18GM40...-V1

Programmed switching output function



output version -E5

Programmed analogue output function



output versions -I and -U

Date of edition: 08/18/2005

Series -12GM
Series -18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



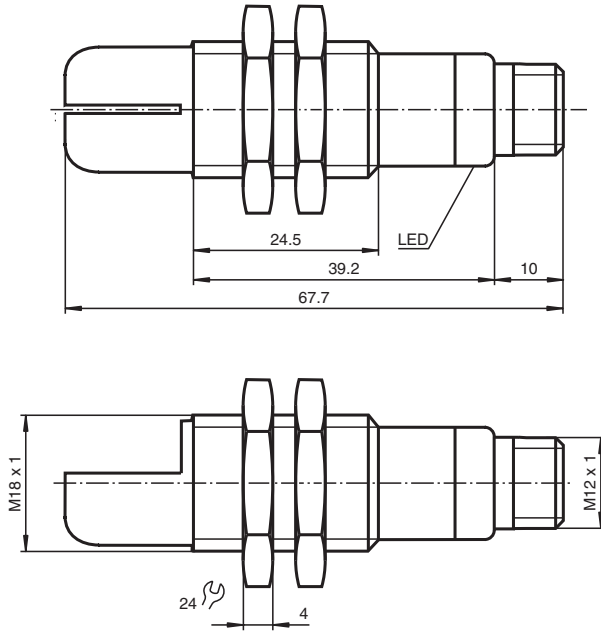
- Short design, 40 mm
- Function indicators visible from all directions
- TEACH-IN input
- Temperature compensation
- Measuring window adjustable
UB...-18GM40A-I-V1
UB...-18GM40A-U-V1
- Analogue output 0 V ... 10 V
UB...-18GM40A-U-V1
- Analogue output 4 mA ... 20 mA
UB...-18GM40A-I-V1
- Switch output
UB...-18GM40A-E5-V1
- 5 different output functions can be set
UB...-18GM40A-E5-V1

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

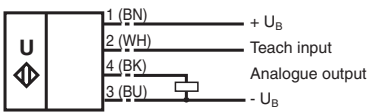
	Model number	UB300-18G M40A-E5-V1	UB300-18G M40A-I-V1	UB300-18G M40A-U-V1	UB800-18G M40A-E5-V1	UB800-18G M40A-I-V1	UB800-18G M40A-U-V1
Sensing range	30 ... 300 mm 50 ... 800 mm	●	●	●	●	●	●
Adjustment range	50 ... 300 mm 70 ... 800 mm	●	●	●	●	●	●
Unusable area	0 ... 30 mm 0 ... 50 mm	●	●	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●	●	●
Transducer frequency	approx. 205 kHz approx. 390 kHz	●	●	●	●	●	●
Response delay	approx. 100 ms approx. 30 ms	●	●	●	●	●	●
LED yellow	permanently yellow: object in the evaluation range, yellow, flashing: TEACH-IN function, object detected indication of the switching state, flashing: TEACH-IN function object detected	●	●	●	●	●	●
LED red	permanently red: Error, red, flashing: TEACH-IN function, object not detected	●	●	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS} 15 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●	●	●
No-load supply current	≤ 20 mA	●	●	●	●	●	●
Output type	1 analogue output 0 ... 10 V 1 analogue output 4 ... 20 mA, short-circuit/overload protected 1 switch output E5, prp NO/NC, parameterisable	●	●	●	●	●	●
Default setting	evaluation limit 1: 50 mm evaluation limit 2: 300 mm evaluation limit 1: 70 mm evaluation limit 2: 800 mm Switch point A1: 50 mm Switch point A2: 300 mm Switch point A1: 70 mm Switch point A2: 800 mm	●	●	●	●	●	●
Resolution	0,4 mm at max. sensing range	●	●	●	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●	●	●	●
Repeat accuracy	≤ 1 % ± 0,5 % of full-scale value	●	●	●	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●	●	●
Voltage drop	≤ 3 V	●	●	●	●	●	●
Switching frequency	≤ 13 Hz ≤ 4 Hz	●	●	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●	●	●
Load impedance	> 1 kOhm 0 ... 300 Ohm	●	●	●	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●	●	●	●
Input type	1 TEACH-IN input operating distance 1: -U _B ... +1 V, operating distance 2: +6 V ... +U _B input impedance: > 4,7 kΩ TEACH-IN pulse: ≥ 1 s 1 TEACH-IN input lower evaluation limit A1: -U _B ... +1 V, upper evaluation limit A2: +4 V ... +U _B input impedance: > 4,7 kΩ, pulse duration: ≥ 1 s	●	●	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●	●	●
Protection degree	IP65	●	●	●	●	●	●
Connection	V1 connector (M12 x 1), 4-pin	●	●	●	●	●	●
Housing	brass, nickel-plated	●	●	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●	●	●
Mass	25 g	●	●	●	●	●	●

Date of edition: 08/18/2005



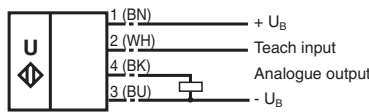
Electrical connection

Standard symbol/Connections:
(version I)



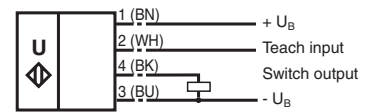
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

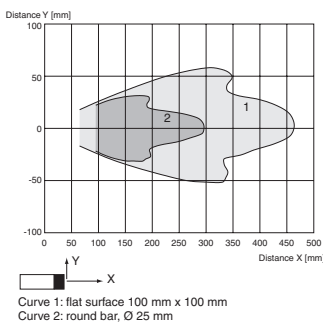
Standard symbol/Connections:
(version E5, pnp)



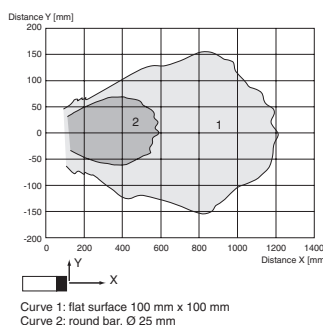
Core colours in accordance with EN 60947-5-2.

Diagrams

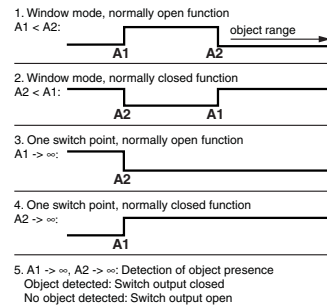
Characteristic response curve



Characteristic response curve

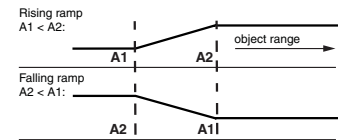


Programmed switching output function



output version -E5

Programmed analogue output function



output versions -I and -U

Date of edition: 08/18/2005



- Selectable sound lobe width
- TEACH-IN input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Very small unusable area
- Switch output
5 different output functions can be set
- Analogue output 0 V ... 10 V
Analogue output 4 mA ... 20 mA
Measuring window adjustable

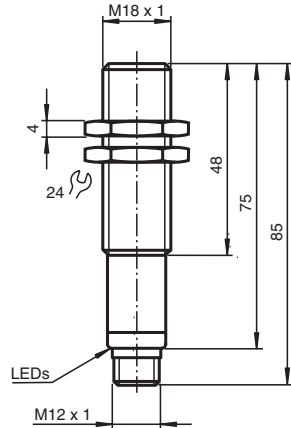


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

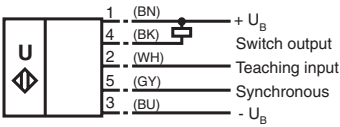
	Model number	UB500-18GM75-E4-V15	UB500-18GM75-E5-V15	UB500-18GM75-I-V15	UB500-18GM75-J-V15
Sensing range	30 ... 500 mm	●	●	●	●
Adjustment range	50 ... 500 mm	●	●	●	●
Unusable area	0 ... 30 mm	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 380 kHz	●	●	●	●
Response delay	approx. 50 ms	●	●	●	●
LED yellow	permanently yellow: object in the evaluation range, yellow, flashing: TEACH-IN function, object detected indication of the switching state, flashing: TEACH-IN function object detected	●	●	●	●
LED red	permanently red: Error, red, flashing: TEACH-IN function, object not detected "Error", object uncertain, in TEACH-IN function: No object detected	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS} 15 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤ 45 mA ≤ 50 mA	●	●	●	●
Output type	1 analogue output 0 ... 10 V 1 analogue output 4 ... 20 mA 1 switch output E4, npn NO/NC, parameterisable 1 switch output E5, prp NO/NC, parameterisable	●	●	●	●
Resolution	0,11 mm at max. sensing range 0,13 mm for max. detection range	●	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●	●
Repeat accuracy	≤ 1 % ± 0,1 % of full-scale value	●	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 3 V	●	●	●	●
Switching frequency	max. 8 Hz	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●
Load impedance	> 1 kOhm 0 ... 300 Ohm	●	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●	●
Input type	1 TEACH-IN input, operating range 1: -U _B ... +1 V, operating range 2: +4 V ... +U _B input impedance: > 4,7 kΩ; TEACH-IN pulse: ≥ 1 s	●	●	●	●
	1 TEACH-IN input lower evaluation limit A1: -U _B ... +1 V, upper evaluation limit A2: +4 V ... +U _B input impedance: > 4,7 kΩ, pulse duration: ≥ 1 s	●	●	●	●
Synchronisation	1 synchronous connection, bi-directional 0-level: -U _B ... +1 V, 1-level: +4 V ... +U _B , input impedance: > 12 kΩ synchronisation pulse: ≥ 100 μs, synchronisation interpulse period: ≥ 2 ms	●	●	●	●
Common mode operation	≤ 95 Hz	●	●	●	●
Multiplex operation	≤ 95/n Hz, n = number of sensors	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Housing	brass, nickel-plated	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●
Mass	60 g	●	●	●	●

Date of edition: 08/18/2005



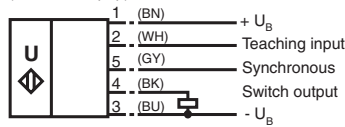
Electrical connection

Standard symbol/Connections:
(version E4, npn)



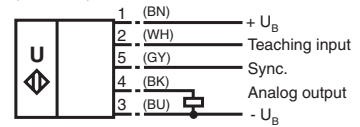
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E5, pnp)



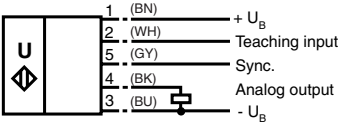
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

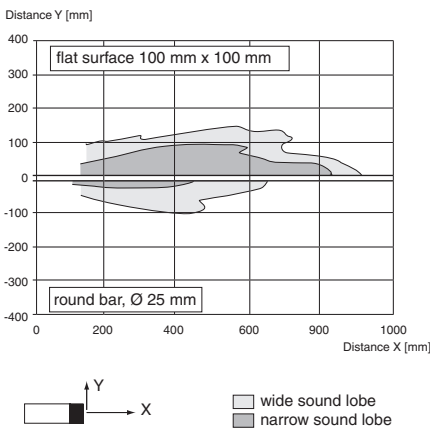
Standard symbol/Connections:
(version I)



Core colours in accordance with EN 60947-5-2.

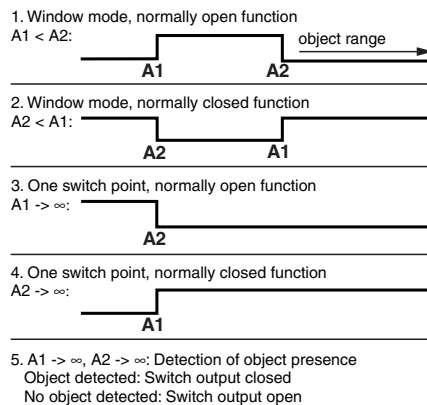
Diagrams

Characteristic response curve



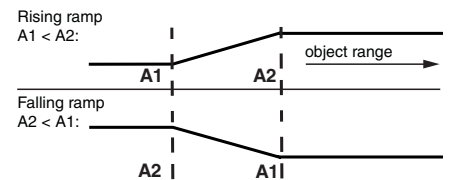
Date of edition: 08/18/2005

Programmed switching output function



output versions -E4 and -E5

Programmed analogue output function



output versions -I and -U

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/Power supplies
 Accessories



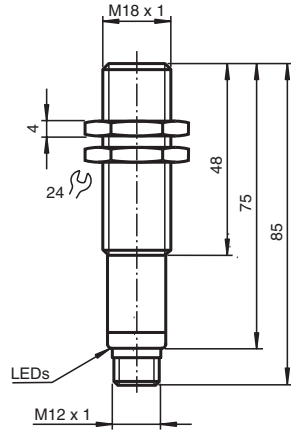
- 2 switch outputs
- Selectable sound lobe width
- TEACH-IN input
- Temperature compensation
- Very small unusable area
- 3 different output functions can be set
UB500-18GM75-E7-V15
UB500-18GM75-E6-V15



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

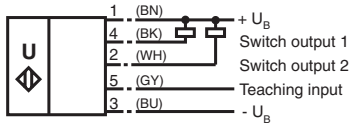
Technical Data

	Model number	UB500-18GM75-E01-V15	UB500-18GM75-E23-V15	UB500-18GM75-E7-V15	UB500-18GM75-E6-V15
Sensing range	30 ... 500 mm	●	●	●	●
Adjustment range	50 ... 500 mm	●	●	●	●
Unusable area	0 ... 30 mm	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 380 kHz	●	●	●	●
Response delay	approx. 50 ms	●	●	●	●
LED yellow	indication of the switching state flashing: TEACH-IN function object detected	●	●	●	●
LED red	"Error", object uncertain in TEACH-IN function: No object detected	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤ 50 mA	●	●	●	●
Output type	2 switch outputs npn, NO/NC, parameterisable 2 switch outputs prp, NO/NC, parameterisable	●	●	●	●
Repeat accuracy	≤ 1 %	●	●	●	●
Rated operational current	2 x 100 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 3 V	●	●	●	●
Switching frequency	max. 8 Hz	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●	●
Input type	1 TEACH-IN input, operating range 1: -U _B ... +1 V, operating range 2: +4 V ... +U _B input impedance: > 4.7 kΩ; TEACH-IN pulse: ≥ 1 s	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Housing	brass, nickel plated	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●
Mass	60 g	●	●	●	●



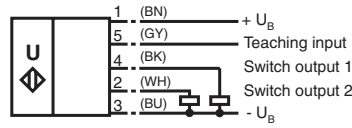
Electrical connection

Standard symbol/Connections:
(version E7, npn)



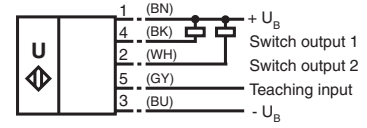
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E6, pnp)



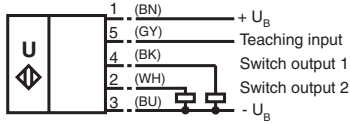
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E01, npn)



Core colours in accordance with EN 60947-5-2.

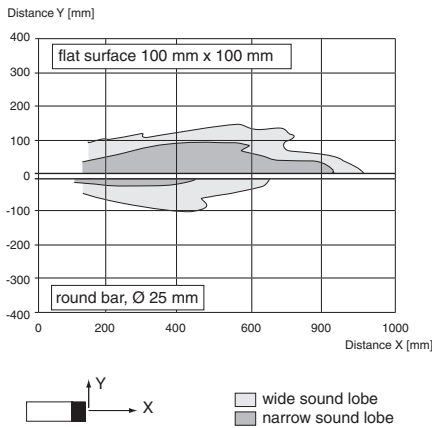
Standard symbol/Connections:
(version E23, pnp)



Core colours in accordance with EN 60947-5-2.

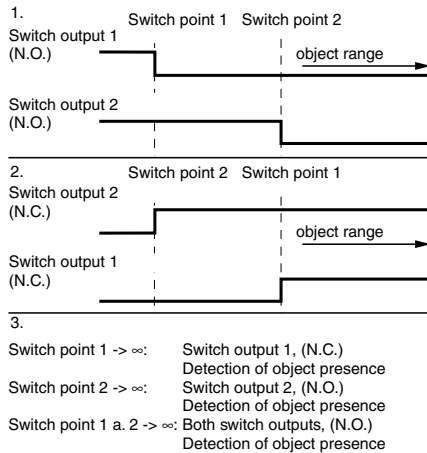
Diagrams

Characteristic response curve



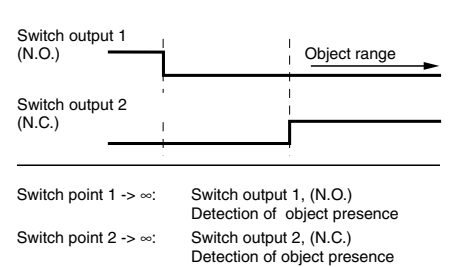
Date of edition: 08/18/2005

Programmed switching output function



output versions -E6 and -E7

Programmed switching output function



output versions -E01 and -E23

Series -12GM
Series -18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



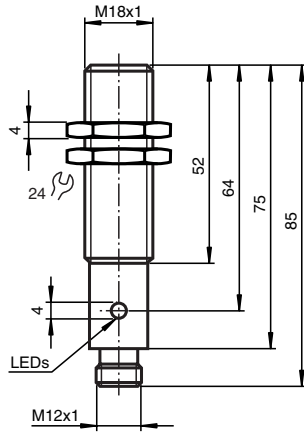
- 3 different options of outputs parameterisable
- Paramaterisation input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Very small unusable area
- Frequency output
UB500-18GM75-F-V15
- PWM output
UB500-18GM75-PWM-V15
- Serial digital output
UB500-18GM75-BIT-V15



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

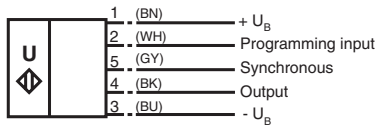
Technical Data

	Model number	UB500-18GM75-F-V15	UB500-18GM75-BIT-V15	UB500-18GM75-P-WM-V15
Sensing range	30 ... 500 mm	●	●	●
Unusable area	0 ... 30 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 380 kHz	●	●	●
Response delay	approx. 50 ms	●	●	●
LED red	flashing: error(bi>permanent: no object detected	●	●	●
LED green	Power on	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
No-load supply current	≤ 50 mA	●	●	●
Output type	1 frequency output, push/pull, parameterisable	●		
	1 PWM output, push/pull, parameterisable			●
	1 serial output, push/pull, parameterisable			●
Resolution	1 mm	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●
Repeat accuracy	± 0,5 % of full-scale value	●	●	●
Load impedance	> 1000 Ohm < 100 nF	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●
Input type	1 Parameterisation input Input impedance: > 4.7 kΩ	●	●	●
Synchronisation	1 synchronous connection, bi-directional 0-level: -U _B ... +1 V 1-level: +4 V ... +U _B input impedance: > 12 kΩ synchronisation pulse: ≥ 100 μs, synchronisation interpulse period: ≥ 2 ms	●	●	●
Common mode operation	≤ 95 Hz	●	●	●
Multiplex operation	≤ 95/n Hz, n = number of sensors	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●
Protection degree	IP65	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material				
Housing	brass, nickel-plated	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●
Mass	60 g	●	●	●



Electrical connection

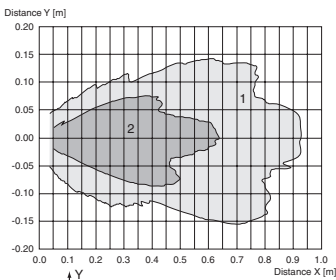
Standard symbol/Connections:



Core colours in accordance with EN 60947-5-2.

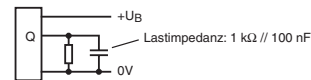
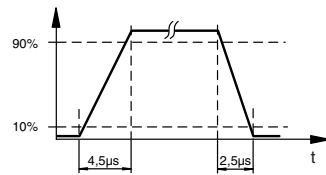
Diagrams

Characteristic response curve

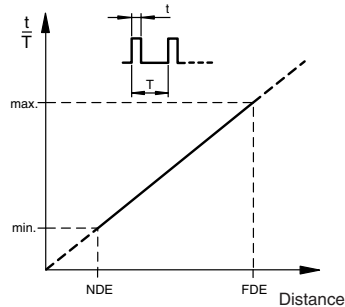


Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Anstiegs-/Abfallzeit des Ausgangssignals

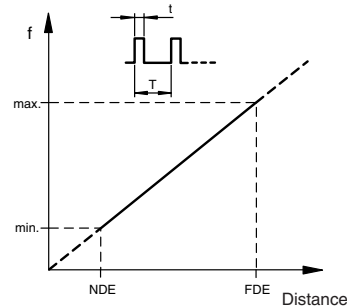


Output characteristic



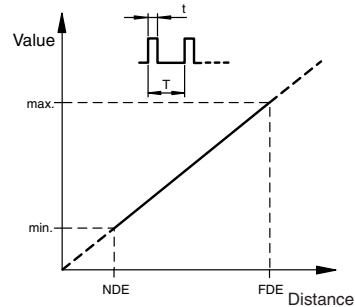
output version -PWM

Output characteristic



output version -F

Output characteristic



output version -BIT

Date of edition: 08/18/2005

Series -12GM
 Series -18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories



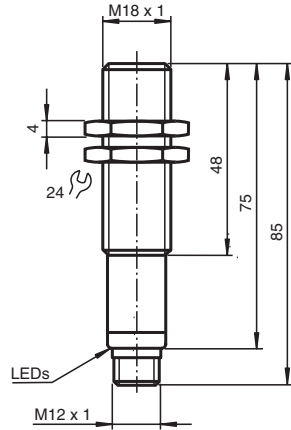
- Selectable sound lobe width
- TEACH-IN input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Very small unusable area
- Switch output
5 different output functions can be set
- Analogue output 0 V ... 10 V
Analogue output 4 mA ... 20 mA
Measuring window adjustable

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

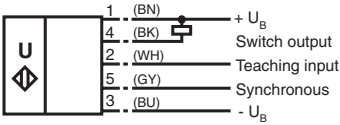
	Model number	UB100 0-18GM75-E4-V15	UB100 0-18GM75-E5-V15	UB100 0-18GM75-I-V15	UB100 0-18GM75-U-V15
Sensing range	70 ... 1000 mm	●	●	●	●
Adjustment range	90 ... 1000 mm	●	●	●	●
Unusable area	0 ... 70 mm	●	●	●	●
	0 ... 90 mm			●	
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 205 kHz	●	●	●	●
Response delay	approx. 125 ms	●	●	●	●
LED yellow	permanently yellow: object in the evaluation range, yellow, flashing: TEACH-IN function, object detected	●	●	●	●
	indication of the switching state, flashing: TEACH-IN function object detected	●	●	●	●
LED red	permanently red: Error, red, flashing: TEACH-IN function, object not detected	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
	15 ... 30 V DC, ripple 10 % _{SS}				●
No-load supply current	≤ 45 mA				●
	≤ 50 mA	●	●	●	●
Output type	1 analogue output 0 ... 10 V	●	●	●	●
	1 analogue output 4 ... 20 mA			●	
	1 switch output E4, npn NO/NC, parameterisable	●			
	1 switch output E5, pnp NO/NC, parameterisable		●		
Resolution	0,35 mm			●	●
Deviation of the characteristic curve	± 1 % of full-scale value			●	●
Repeat accuracy	≤ 1 %	●	●	●	●
	± 0,1 % of full-scale value			●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 3 V	●	●		
Switching frequency	max. 3 Hz	●	●		
Range hysteresis	1 % of the set operating distance	●	●		
Load impedance	> 1 kOhm				●
	0 ... 300 Ohm			●	
Temperature influence	± 1,5 % of full-scale value	●	●	●	●
Input type	1 TEACH-IN input, operating range 1: -U _B ... +1 V, operating range 2: +4 V ... +U _B	●	●		
	input impedance: > 4.7 kΩ; TEACH-IN pulse: ≥ 1 s				
	1 TEACH-IN input lower evaluation limit A1: -U _B ... +1 V, upper evaluation limit A2: +4 V ... +U _B			●	●
	input impedance: > 4.7 kΩ; pulse duration: ≥ 1 s				
Synchronisation	bi-directional	●	●	●	●
	0 level -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 kOhm				
	synchronisation pulse: ≥ 100 μs, synchronisation interpulse period: ≥ 2 ms				
Common mode operation	≤ 40 Hz	●	●	●	●
Multiplex operation	≤ 40/n	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Material					
Housing	brass, nickel-plated	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●
Mass	60 g	●	●	●	●

Date of edition: 09/13/2005



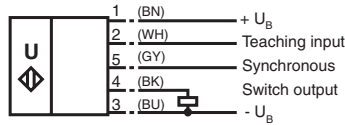
Electrical connection

Standard symbol/Connections:
(version E4, npn)



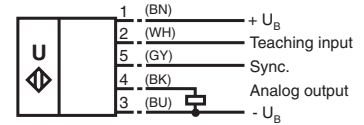
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E5, pnp)



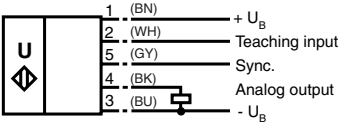
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

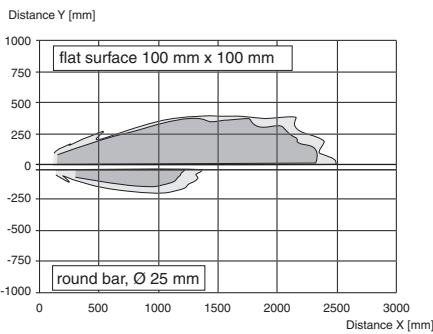
Standard symbol/Connections:
(version I)



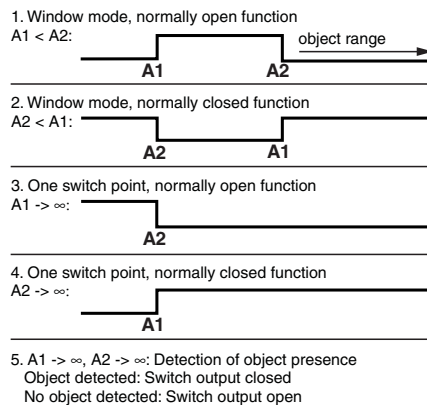
Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curve

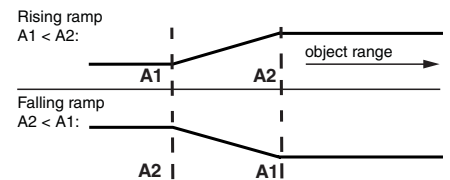


Programmed switching output function



output versions -E4 and -E5

Programmed analogue output function



output versions -I and -U

Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



- 2 switch outputs
- Selectable sound lobe width
- TEACH-IN input
- Temperature compensation
- Very small unusable area
- 3 different output functions can be set
UB1000-18GM75-E6-V15
UB1000-18GM75-E7-V15



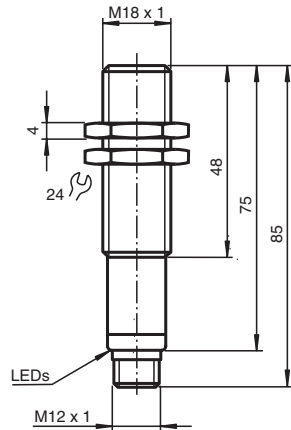
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UB100 0-18GM75-E01-V15	UB100 0-18GM75-E23-V15	UB100 0-18GM75-E6-V15	UB100 0-18GM75-E7-V15
Sensing range	70 ... 1000 mm	●	●	●	●
Adjustment range	90 ... 1000 mm	●	●	●	●
Unusable area	0 ... 70 mm	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 205 kHz	●	●	●	●
Response delay	approx. 125 ms	●	●	●	●
LED yellow	indication of the switching state flashing: TEACH-IN function object detected	●	●	●	●
LED red	"Error", object uncertain in TEACH-IN function: No object detected	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤ 50 mA	●	●	●	●
Output type	2 switch outputs npn, normally open/closed	●			
	2 switch outputs npn, normally open/close selectable				●
	2 switch outputs prp, NONC		●		
	2 switch outputs prp, normally open/close selectable			●	
Repeat accuracy	≤ 1 %	●	●	●	●
Rated operational current	2 x 100 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 3 V	●	●	●	●
Switching frequency	max. 3 Hz	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●	●
Input type	1 TEACH-IN input, operating range 1: -U _B ... +1 V, operating range 2: +4 V ... +U _B input impedance: > 4.7 kΩ; TEACH-IN pulse: ≥ 1 s	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Material					
Housing	brass, nickel-plated	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●
Mass	60 g	●	●	●	●

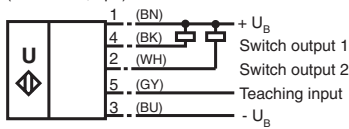
Series -12GM
Series -18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -DI
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Date of edition: 08/18/2005



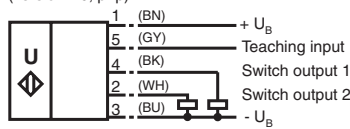
Electrical connection

Standard symbol/Connections:
(version E7, npn)



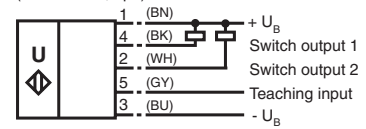
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E6, pnp)



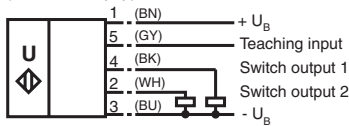
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E01, npn)



Core colours in accordance with EN 60947-5-2.

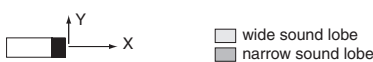
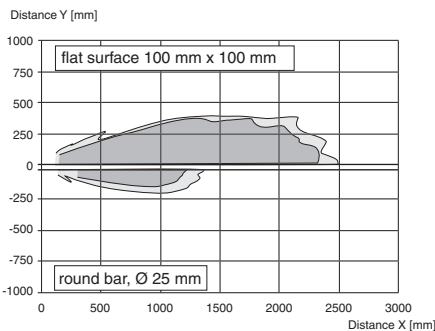
Standard symbol/Connections:
(version E23, pnp)



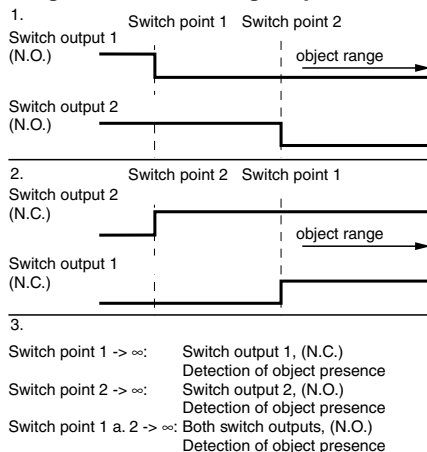
Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curve

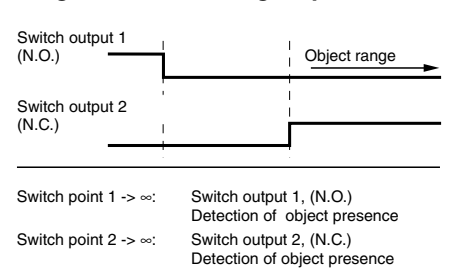


Programmed switching output function



output versions -E6 and -E7

Programmed switching output function



output versions -E01 and -E23

Date of edition: 08/18/2005

Series -12GM
 Series -18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/Power supplies
 Accessories

Ultrasonic sensor

UB1000-18GM75-...-V15



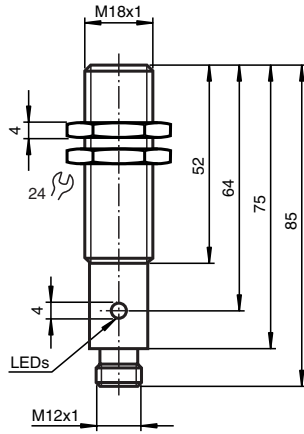
- 3 different options of outputs parameterisable
- Parameterisation input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Frequency output
UB1000-18GM75-F-V15
- PWM output
UB1000-18GM75-PWM-V15
- Serial digital output
UB1000-18GM75-BIT-V15



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

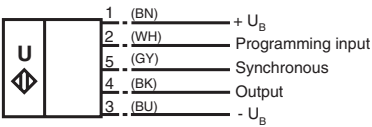
Technical Data

	Model number	UB1000-18GM75-F-V15	UB1000-18GM75-BIT-V15	UB1000-18GM75-P-WM-V15
Sensing range	80 ... 1000 mm	●	●	●
Unusable area	0 ... 80 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 205 kHz	●	●	●
Response delay	approx. 150 ms	●	●	●
LED red	flashing: error (br>permanent: no object detected	●	●	●
LED green	Power on	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
No-load supply current	≤ 50 mA	●	●	●
Output type	1 frequency output, push/pull, parameterisable	●		
	1 PWM output, push/pull, parameterisable			●
	1 serial output, push/pull, parameterisable		●	
Resolution	1 mm	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●
Repeat accuracy	± 0,5 % of full-scale value	●	●	●
Load impedance	> 1000 Ohm < 100 nF	●	●	●
Temperature influence	± 1,5 % of full-scale value	●	●	●
Input type	1 Parameterisation input Input impedance: > 4.7 kΩ	●	●	●
Synchronisation	bi-directional 0 level: -U _B ...+1 V 1 level: +4 V...+U _B input impedance: > 12 kΩ synchronisation pulse: ≥ 100 μs, synchronisation interpulse period: ≥ 2 ms	●	●	●
Common mode operation	≤ 30 Hz	●	●	●
Multiplex operation	≤ 30/n Hz, n = number of sensors	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●
Protection degree	IP65	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material				
Housing	brass, nickel-plated	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●
Mass	60 g	●	●	●



Electrical connection

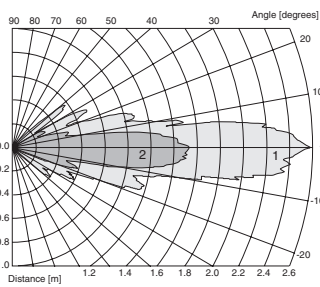
Standard symbol/Connections:



Core colours in accordance with EN 60947-5-2.

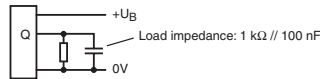
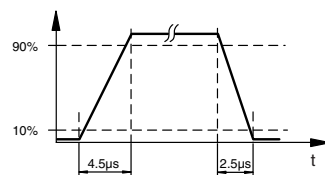
Diagrams

Characteristic response curves

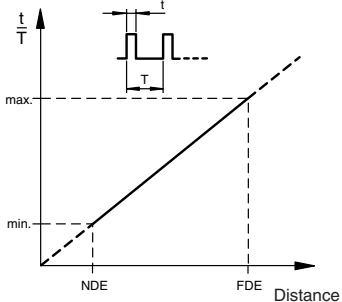


Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Rise-/fall time of output signal

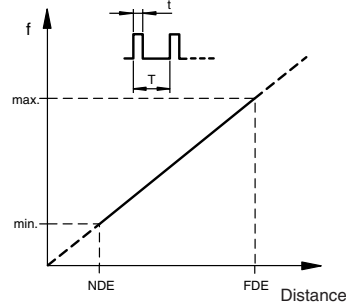


Output characteristic



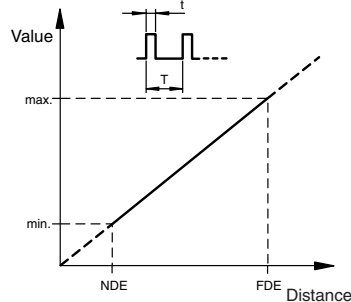
output version -PWM

Output characteristic



output version -F

Output characteristic



output version BIT

Date of edition: 08/18/2005

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/Power supplies
 Accessories

UBE500-18GK-SE0-V1 and UBE500-18GK-SE0-V1**Function**

A through-beam ultrasonic barrier always consists of a single emitter and a single receiver. The function of a through-beam ultrasonic barrier is based in the interruption of the sound transmission to the receiver by the object to be detected.

The emitter sends an ultrasonic signal that is evaluated by the receiver. If the signal is interrupted or muted by the object to be detected, the receiver switches.

No electrical connections are required between the emitter and receiver.

The function of through-beam ultrasonic barriers is not dependent on the position of their installation. We recommend, however, to install the emitter below in the case of vertical installations to prevent the accumulation of dust particles.

Installation tolerances

The installation tolerances of the central axes of the emitter and receiver may not exceed the values specified in the illustration.

Detection of thin foils

For the detection of thin foils (< 0.1 mm), install the through-beam ultrasonic barrier at an angle of $\geq 10^\circ$ from perpendicular to the foil.

Caution

Mount or replace emitter and receiver only in pairs. Both devices are optimally matched to each other by the manufacturer.

UBE1000-18GM40-SE2-V1**Function**

A through-beam ultrasonic barrier always consists of a single emitter and a single receiver. The function of a through-beam ultrasonic barrier is based in the interruption of the sound transmission to the receiver by the object to be detected.

The emitter sends an ultrasonic signal that is evaluated by the receiver. If the signal is interrupted or muted by the object to be detected, the receiver switches.

No electrical connections are required between the emitter and receiver.

The function of through-beam ultrasonic barriers is not dependent on the position of their installation. We recommend, however, to install the emitter below in the case of vertical installations to prevent the accumulation of dust particles.

Startup and parameterising

For easy alignment of emitter and receiver towards each other, the receiver is equipped with an alignment aid. To activate the alignment aid, the TEACH-Input of the receiver (pin 2) has to be connected to ground ($-U_B$). The flashing frequency of the yellow LED indicates the strength of the received ultrasonic signal. The better the alignment, the stronger the signal.

LED yellow, flashing frequency	Description
slowly (appr. 1.5 Hz)	no signal
medium (appr. 3 Hz)	weak signal
fast (appr. 9 Hz)	strong signal

Simultaneously the ultrasonic barrier evaluates the signal strength of the unobstructed signal path and generates the optimal switching threshold. When disconnecting the TEACH-input from $-U_B$, this threshold is stored non-volatile in the receivers memory. In case of clear ultrasonic path (no object), all LEDs are off.

TEACH-In of very small objects/obstacles

Like shown in the curve "obstacle size", the ultrasonic barrier offers the possibility to detect very small objects at a distance of more than 300 mm.

- place the object to be detected in the desired distance inside the ultrasonic path
- connect TEACH-input of the receiver to $+U_B$ (yellow LED flashes slowly)
- disconnect TEACH-input

In case of successful TEACH-IN (object is detected reliable), the yellow LED is on and the taught detection threshold is stored non-volatile to the receivers memory.

In case of unsuccessful TEACH-IN (object too small or too porous for ultrasonic sound), the red LED flashes 5 times and the ultrasonic barrier continues normal operation with unmodified detection threshold value.

Test function

For test purpose, the ultrasonic emitter is equipped with a test input. In normal operation mode (test input not connected or connected to $-U_B$), the green LED of the emitter is on. If the test input is connected to $+U_B$, the ultrasonic emitter gets deactivated and its LED changes into red. Simultaneously the receiver switches and its yellow LED goes on.

UB...-18GM40(A)-... , output type -E5 (1 switch output)**Adjusting the switching points**

The ultrasonic sensor features a switch output with two teachable switching points. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Switching point A1 is taught with $-U_B$, A2 with $+U_B$.

Five different output functions can be set

1. Window mode, normally-open function
2. Window mode, normally-closed function
3. one switching point, normally-open function
4. one switching point, normally-closed function
5. Detection of object presence

TEACH-IN window mode, normally-open function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Set target to far switching point
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN window mode, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Set target to far switching point
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN switching point, normally-open function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN switching point, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN detection of objects presence

- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$
- TEACH-IN switching point A2 with $+U_B$

Default setting of switching points

A1 = blind range, A2 = nominal distance

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED
TEACH-IN switching point:		
Object detected	off	flashes
No object detected	flashes	off
Object uncertain (TEACH-IN invalid)	On	off
Normal operation	off	Switching state
Fault	on	Previous state

UB...-18GM40(A)-... , output types -I and -U (analogue output)**Adjusting the evaluation limits**

The ultrasonic sensor features an analogue output with two teachable evaluation limits. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. The lower evaluation limit A1 is taught with $-U_B$, A2 with $+U_B$.

Two different output functions can be set:

1. Analogue value increases with rising distance to object (rising ramp)
2. Analogue value falls with rising distance to object (falling ramp)

TEACH-IN rising ramp (A2 > A1)

- Position object at lower evaluation limit

- TEACH-IN lower limit A1 with $-U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A2 with $+U_B$

TEACH-IN falling ramp (A1 > A2):

- Position object at lower evaluation limit
- TEACH-IN lower limit A2 with $+U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A1 with $-U_B$

Default setting

A1:	unusable area
A2:	nominal sensing range
Mode of operation:	rising ramp

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED
TEACH-IN evaluation limit		
Object detected	off	flashes
No object detected	flashes	off
Object uncertain (TEACH-IN invalid)	on	off
Normal mode (evaluation range)	off	on
Fault	on	previous state

All UB...-18GM75-... types**Installation conditions**

If the sensor is installed at places, where the environment temperature can fall below 0 °C, for the sensors fixation, one of the mounting flanges BF18, BF18-F or BF 5-30 must be used.

In case of direct mounting of the sensor in a through hole using the steel nuts, it has to be fixed at the middle of the housing thread. If a fixation at the front end of the threaded housing is required, plastic nuts with centering ring (accessories) must be used.

UB...-18GM75-..., output types -E4 and -E5 (1 switch output)**Synchronisation**

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be realised as follows:

External synchronisation

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 µs. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level at the synchronisation input disables the sensor.

Two operating modes are available

1. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
2. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

Internal synchronisation

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors will operate in multiplex mode. The response delay increases according to the number of sensors to be synchronised. Synchronisation cannot be performed during TEACH-IN and vice versa. The sensors must be operated in an unsynchronised manner to teach the switching point.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

Adjusting the switching points

The ultrasonic sensor features a switch output with two teachable switching points. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Switching point A1 is taught with $-U_B$, A2 with $+U_B$.

Five different output functions can be set

1. Window mode, normally-open function
2. Window mode, normally-closed function
3. One switch point, normally-open function
4. One switch point, normally-closed function
5. Detection of object presence

TEACH-IN window mode, normally-open function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Set target to far switching point
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN window mode, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Set target to far switching point
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN switching point, normally-open function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN switching point, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN detection of object presence

- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$
- TEACH-IN switching point A2 with $+U_B$

Default setting of switching points

A1 = unusable area
 A2 = nominal sensing range

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED
TEACH-IN switching point:		
Object detected	off	flashes
No object detected	flashes	off
Object uncertain (TEACH-IN invalid)	on	off
Normal operation	off	switching state
Fault	on	previous state

Adjusting the sound cone characteristics:

The ultrasonic sensor enables two different shapes of the sound cone, a wide angle sound cone and a small angle sound cone.

1. Small angle sound cone

- switch off the power supply
- connect the Teach-input wire to $-U_B$
- switch on the power supply
- the red LED flashes once with a pause before the next.
- yellow LED: permanently on: indicates the presence of an object or disturbing object within the sensing range
- disconnect the Teach-input wire from $-U_B$ and the changing is saved



2. Wide angle sound cone

- switch off the power supply
- connect the Teach-input wire with $+U_B$
- switch on the power supply
- the red LED double-flashes with a long pause before the next.
- yellow LED: permanently on: indicates an object or disturbing object within the sensing range
- disconnect the Teach-input wire from $+U_B$ and the changing is saved



UB...-18GM75-..., output types -E01 and -E23 (2 switch outputs)

Date of edition: 08/17/20.05

- Series -12GM
- Series -18GK/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/ Power supplies
- Accessories

Adjusting the switching points

The ultrasonic sensor features two switch outputs with one teachable switching point. The switching points are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Switching point A1 is taught with $-U_B$, A2 with $+U_B$.

TEACH-IN switching point for switch output 1

- Set target of desired switching point for switch output 1
- TEACH-IN switching point for switch output 1 with $-U_B$

TEACH-IN switching point for switch output 2

- Set target of desired switching point for switch output 2
- TEACH-IN switching point for switch output 2 with $+U_B$

TEACH-IN detection of object presence

- Cover the sensor with your hand, or remove all objects from the sensing range
- TEACH-IN switching point for switch output 1 with $-U_B$
- TEACH-IN switching point for switch output 2 with $+U_B$

Comments

Only one switch output can be configured for detection of presence of objects. If the sensor detects an objects within the maximum detection range, the switch output switches.

Default setting of switching points

- Switch output 1: unusable area
- Switch output 2: nominal sensing range

LED Displays

Displays in dependence on operating mode	Red LED	LED 1 yellow	LED 2 yellow
TEACH-IN switching point 1 Object detected No object detected Object uncertain (TEACH-IN invalid)	off flashes on	flashes off off	off off off
TEACH-IN switching point 2: Object detected No object detected Object uncertain (TEACH-IN invalid)	off flashes on	off off off	flashes off off
Normal operation	off	switch state 1	switch state 2
Fault	on	previous state	previous state

Adjusting the sound cone characteristics:

The ultrasonic sensor enables two different shapes of the sound cone, a wide angle sound cone and a small angle sound cone.

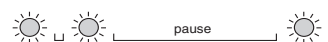
1. Small angle sound cone

- switch off the power supply
- connect the Teach-input wire to $-U_B$
- switch on the power supply
- the red LED flashes once with a pause before the next.
- yellow LED: permanently on: indicates the presence of an object or disturbing object within the sensing range
- disconnect the Teach-input wire from $-U_B$ and the changing is saved



2. Wide angle sound cone

- switch off the power supply
- connect the Teach-input wire with $+U_B$
- switch on the power supply
- the red LED double-flashes with a long pause before the next.
- yellow LED: permanently on: indicates an object or disturbing object within the sensing range
- disconnect the Teach-input wire from $+U_B$ and the changing is saved



Date of edition 08/17/20 05

UB...-18GM75-..., output types -E6 and -E7 (2 switch outputs)

Adjusting the switching points

The ultrasonic sensor features two switch outputs with one teachable switching point. The switching points are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input.

The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Switching point A1 is taught with $-U_B$, A2 with $+U_B$.

Three different output functions can be set:

1. normally-open function
2. normally-closed function
3. Detection of object presence

TEACH-IN normally-open function

Switching point for switch output 1 < switching point for switch output 2

- Set target of desired switching point for switch output 1
- TEACH-IN switching point for switch output 1 with $-U_B$
- Set target of desired switching point for switch output 2
- TEACH-IN switching point for switch output 2 with $+U_B$

Comments: The order doesn't make any difference. If you want, you can set only one switching point.

TEACH-IN normally-closed function

Switching point for switch output 2 < switching point for switch output 1

- Set target of desired switching point for switch output 1
- TEACH-IN switching point for switch output 1 with $-U_B$
- Set target of desired switching point for switch output 2
- TEACH-IN switching point for switch output 2 with $+U_B$

Comments: The order doesn't make any difference. If you want, you can set only one switching point. If both switching points are equal, the sensor works in close function.

TEACH-IN detection of object presence

- Cover the sensor with the palm, or remove all objects from the detection range of the sensor
- TEACH-IN switching point for switch output 1 with $-U_B$
- TEACH-IN switching point for switch output 2 with $+U_B$

Comments

Only one switch output can be configured for detection of presence of objects. If the sensor detects an object within the maximum detection range, the switch output switches.

Default setting of switching points

Switch output 1: unusable area

Switch output 2: nominal sensing range

LED Displays

Displays in dependence on operating mode	Red LED	LED 1 yellow	LED 2 yellow
TEACH-IN switching point 1			
Object detected	off	flashes	off
No object detected	flashes	off	off
Object uncertain (TEACH-IN invalid)	flashes on	off	off
TEACH-IN switching point 2:			
Object detected	off	off	flashes
no object detected	flashes	off	off
Object uncertain (TEACH-IN invalid)	flashes on	off	off
Normal operation	off	switch state 1	switch state 2
Fault	on	previous state	previous state

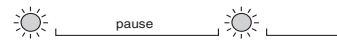
Adjusting the sound cone characteristics:

The ultrasonic sensor enables two different shapes of the sound cone, a wide angle sound cone and a small angle sound cone.

1. Small angle sound cone

- switch off the power supply
- connect the Teach-input wire to $-U_B$
- switch on the power supply

- the red LED flashes once with a pause before the next.
- yellow LED: permanently on: indicates the presence of an object or disturbing object within the sensing range
- disconnect the Teach-input wire from $-U_B$ and the changing is saved



2. Wide angle sound cone

- switch off the power supply
- connect the Teach-input wire with $+U_B$
- switch on the power supply
- the red LED double-flashes with a long pause before the next.
- yellow LED: permanently on: indicates an object or disturbing object within the sensing range
- disconnect the Teach-input wire from $+U_B$ and the changing is saved



UB...-18GM75-..., output types -I and -U (analogue output)

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be realised as follows:

External synchronisation

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 μ s. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level at the synchronisation input disables the sensor. Two operating modes are available:

1. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
2. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

Internal synchronisation

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors will operate in multiplex mode.

The response delay increases according to the number of sensors to be synchronised. Synchronisation cannot be performed during TEACH-IN and vice versa. The sensors must be operated in an unsynchronised manner to teach the evaluation limits.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

Adjusting the evaluation limits

The ultrasonic sensor features an analogue output with two teachable evaluation limits. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. The lower evaluation limit A1 is taught with $-U_B$, A2 with $+U_B$.

Two different output functions can be set:

1. Analogue value increases with rising distance to object (rising ramp)
2. Analogue value falls with rising distance to object (falling ramp)

TEACH-IN rising ramp (A2 > A1)

- Position object at lower evaluation limit
- TEACH-IN lower limit A1 with $-U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A2 with $+U_B$

TEACH-IN falling ramp (A1 > A2):

- Position object at lower evaluation limit
- TEACH-IN lower limit A2 with $+U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A1 with $-U_B$

Default setting

A1: unusable area
 A2: nominal sensing range
 Mode of operation: rising ramp

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED
TEACH-IN evaluation limit		
Object detected	off	flashes
No object detected	flashes	off
Object uncertain (TEACH-IN invalid)	on	off
Normal mode (evaluation range)	off	on
Fault	on	previous state

Adjusting the sound cone characteristics:

The ultrasonic sensor enables two different shapes of the sound cone, a wide angle sound cone and a small angle sound cone.

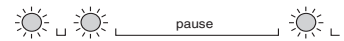
1. Small angle sound cone

- switch off the power supply
- connect the Teach-input wire to -U_B
- switch on the power supply
- the red LED flashes once with a pause before the next.
- yellow LED: permanently on: indicates the presence of an object or disturbing object within the sensing range
- disconnect the Teach-input wire from -U_B and the changing is saved



2. Wide angle sound cone

- switch off the power supply
- connect the Teach-input wire with +U_B
- switch on the power supply
- the red LED double-flashes with a long pause before the next.
- yellow LED: permanently on: indicates an object or disturbing object within the sensing range
- disconnect the Teach-input wire from +U_B and the changing is saved



UB...-18GM75-..., output type -F (frequency output)

Parameter assignment of the signal output

The ultrasonic sensor is equipped with a signal output that represents the distance determined to the object in the form of a frequency proportional to the distance of the object. The current path characteristic of this output signal follows a zero-point straight line, i.e. The extrapolated output frequency for the object distance 0 (which is not usable in practical terms) also corresponds to 0. As the object distance increases, the output frequency also increases. The object distance can be calculated according to:

$$\text{Object distance [mm]} = \text{output frequency [Hz]} / \text{gain [Hz/mm]}$$

If no object is detected, the level 1 is permanently present on the output. The frequency of the output channel is adjusted by the gain of the output characteristic line.

Wiring arrangement of the parameterisation input	Gain of the output characteristic line
-U _B	2 Hz/mm
Not used	1 Hz/mm
+U _B	4 Hz/mm

The sensor checks the parameterisation input when the operating voltage is switched on. A change in the wiring of the parameterisation input during ongoing operation has no effect on the signal output.

LED display

The sensor is equipped with 2 LEDs. Their meaning is as follows:

- LED green: Operating voltage applied
- LED red: No object detected

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be implemented as follows:

External synchronisation

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 µs. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input results in normal operation of the sensor. A high level at the synchronisation input disables the sensor.

Two operating modes are available

Date of edition: 08/17/20 05

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

- 1) Multiple sensors can be controlled by the same synchronisation signal. The sensors work on the same clock rate.
- 2) The synchronisation pulses are sent cyclically to only one sensor at a time. The sensors operate in multiplex mode.

Internal synchronisation

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors operate in multiplex mode. The response delay increases according to the number of sensors to be synchronised.

Note

If the option for synchronisation is not used, the synchronisation input should be connected with ground (0 V) or the sensor should be operated with a V1 cable connector (4-pin).

UB...-18GM75-..., output type -PWM (pulse width modulation)**Parameter assignment of the signal output**

The ultrasonic sensor is equipped with a signal output that represents the distance determined to the object in the form of a pulse-duty factor proportional to the distance of the object. The current path characteristic of this output signal follows a zero-point straight line, i.e. the extrapolated pulse-duty factor for the object distance 0 (not usable in practice) also corresponds to 0. As the distance to the object increases, the pulse-duty factor also increases. It is 50 % when the nominal sensing range is reached.

The object distance can be calculated according to:

$$\text{Object distance [mm]} = 2 * \text{sensing range [mm]} * \text{pulse length [s]} * \text{frequency [Hz]}$$

If the object distance reaches or exceeds twice the nominal detection range, or if no object is detected, a level 1 is permanently present on the output.

The frequency of the output channel is adjusted by the wiring arrangement of the parameterisation input.

Wiring arrangement of the parameterisation input	Output frequency
-U _B	30 Hz
Not used	245 Hz
+U _B	1900 Hz

The sensor checks the parameterisation input when the operating voltage is switched on. A change in the wiring of the parameterisation input during ongoing operation has no effect on the signal output.

LED display

The sensor is equipped with 2 LEDs. Their meaning is as follows:

LED green: Operating voltage applied

LED red: No object detected

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be implemented as follows:

External synchronisation

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 µs. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input results in normal operation of the sensor. A high level at the synchronisation input disables the sensor.

Two operating modes are available

- 1) Multiple sensors can be controlled by the same synchronisation signal. The sensors work on the same clock rate.
- 2) The synchronisation pulses are sent cyclically to only one sensor at a time. The sensors operate in multiplex mode.

Internal synchronisation

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors operate in multiplex mode. The response delay increases according to the number of sensors to be synchronised.

Note

If the option for synchronisation is not used, the synchronisation input should be connected with ground (0 V) or the sensor should be operated with a V1 cable connector (4-pin).

UB...-18GM75-..., output type -BIT (digital value)

Parameter assignment of the signal output

The ultrasonic sensor is equipped with a signal output that represents the distance determined to the object in the form of a digital value proportional to the distance of the object. The current path characteristic of this output signal follows a zero-point straight line, i.e. The extrapolated digital value for the object distance 0 (which is not usable in practical terms) also corresponds to 0. As the object distance increases, the digital value also increases. The digital value is generated serially. A word consists of 1 start bit (level 1), 12 data bits (value), and 1 stop bit (level 0). The object distance can be calculated according to:

$$\text{Object distance [mm]} = \text{Value} / 2$$

If no object is detected, a level 1 is permanently present on the output.
The bit width is adjusted by the wiring arrangement of the parameterisation input.

Wiring arrangement of the parameterisation input	Bit width
-U _B	50 µs
Not used	100 µs
+U _B	200 µs

The sensor checks the parameterisation input when the operating voltage is switched on. A change in the wiring of the parameterisation input during ongoing operation has no effect on the signal output.

LED display

The sensor is equipped with 2 LEDs. Their meaning is as follows:

LED green: Operating voltage applied

LED red: No object detected

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be implemented as follows:

External synchronisation

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 µs. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input results in normal operation of the sensor. A high level at the synchronisation input disables the sensor.

Two operating modes are available

- 1) Multiple sensors can be controlled by the same synchronisation signal. The sensors work on the same clock rate.
- 2) The synchronisation pulses are sent cyclically to only one sensor at a time. The sensors operate in multiplex mode.

Internal synchronisation

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors operate in multiplex mode. The response delay increases according to the number of sensors to be synchronised.

Note

If the option for synchronisation is not used, the synchronisation input should be connected with ground (0 V) or the sensor should be operated with a V1 cable connector (4-pin).

Accessories
Control units/ Power supplies
Double sheet monitoring
Series LUC
Series -D1
Series -F64
Series -F54
Series -F43
Series -F42
Series -F12
Series -FP
Series Var/Kont
Series -30GM
Series -18GM/-18GM
Series -12GM

Series -30GM



Model number	Description	Detection range	Page
Comfort design (with RS 232 serial interface)			
UC300-30GM-IUR2-V15		300 mm	66
UC300-30GM-E6R2-K-V15 UC300-30GM-E7R2-K-V15 UC300-30GM-IUR2-K-V15	for installation in confined spaces	300 mm	68
UC500-30GM-E6R2-V15 UC500-30GM-E7R2-V15 UC500-30GM-IUR2-V15		500 mm	70
UC1000-30GM-E6R2-K-V15 UC1000-30GM-IUR2-K-V15	for installation in confined spaces	1000 mm	72
UCC1000-30GM-E6R2-V15 UCC1000-30GM-IUR2-V15	with chemical resistant transducer coating	1000 mm	74
UC2000-30GM-E6R2-V15 UC2000-30GM-E7R2-V15 UC2000-30GM-IUR2-V15		2000 mm	76
UC2000-30GM-E6R2-T-V15 UC2000-30GM-E7R2-T-V15 UC2000-30GM-IUR2-T-V15	extended temperature range	2000 mm	78
UC4000-30GM-E6R2-V15 UC4000-30GM-E7R2-V15 UC4000-30GM-IUR2-V15		4000 mm	80
UC6000-30GM-E6R2-V15 UC6000-30GM-E7R2-V15 UC6000-30GM-IUR2-V15		6000 mm	82
Basic design			
UBE4000-30GM-SA2-V15	Ultrasonic through beam barrier	4000 mm	84
UB500-30GM-E4-V15 UB500-30GM-E5-V15 UB2000-30GM-E4-V15 UB2000-30GM-E5-V15		500 mm 500 mm 2000 mm 2000 mm	86
UB4000-30GM-E4-V15 UB4000-30GM-E5-V15 UB6000-30GM-E4-V15 UB6000-30GM-E5-V15		4000 mm 4000 mm 6000 mm 6000 mm	88
Ultrasonic sensors for external control units			
UB500-30GM-H3-V1 UB2000-30GM-H3-V1 UB4000-30GM-H3-V1 UB6000-30GM-H3-V1	Emitter/receiver	500 mm 2000 mm 4000 mm 6000 mm	90

For detailed function description, see page 92

Date of edition: 08/18/20.05

Subject to reasonable modifications due to technical advances.

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Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



- Very small unusable area
- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Current and voltage output
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

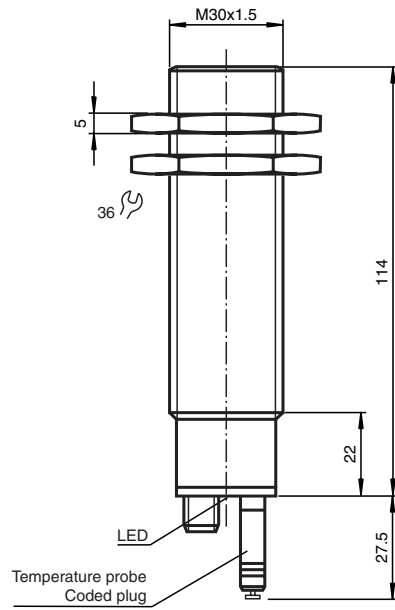
Technical Data

Model number

UC300-30GM-UR2-V15

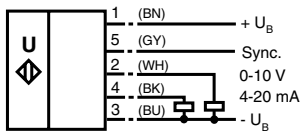
Sensing range	15 ... 300 mm	●
Adjustment range	15 ... 300 mm	●
Unusable area	0 ... 15 mm	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 380 kHz	●
Response delay	21 ms minimum 63 ms factory setting	●
LED green	permanent: Power-on flashing: Standby mode or TEACH-IN function object detected	●
LED yellow 1	permanent: object in evaluation range flashing: TEACH-IN function	●
LED yellow 2	permanent: object in detection range flashing: TEACH-IN function	●
LED red	permanent: temperature/TEACH-IN plug not connected flashing: fault or TEACH-IN function object not detected	●
Temperature/TEACH-IN connector	temperature compensation, TEACH-IN for evaluation range, output function setting	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●
Power consumption	≤ 900 mW	●
Output type	1 current output 4 ... 20 mA 1 voltage output 0 ... 10 V	●
Repeat accuracy	≤ 0,1 % of full-scale value	●
Deviation of the characteristic curve	≤ 0,2 % of full-scale value	●
Resolution	evaluation range [mm]/4000, but ≥ 0,05 mm	●
Load impedance	current output: ≤ 500 Ohm Voltage output: ≥ 1000 Ohm	●
Temperature influence	≤ 2 % from full-scale value (with temperature compensation) ≤ 0,2 %/K (without temperature compensation)	●
Synchronisation	bi-directional 0 level: -U _B ...+1 V 1 level: +4 V...+U _B input impedance: > 12 kOhm synchronisation pulse: ≥ 100 µs, synchronisation interpulse period: ≥ 2 ms	●
Common mode operation	≤ 95 Hz	●
Multiplex operation	≤ 95/n Hz, n = number of sensors	●
Interface type	RS 232, 9600 Bit/s, no parity, 8 data bits, 1 stop bit	●
Standards	EN 60947-5-2	●
Ambient temperature	0 ... 70 °C (273 ... 343 K)	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
Protection degree	IP65	●
Connection	connector V15 (M12 x 1), 5 pin	●
Material		●
Housing	stainless steel 1.4303 plastic parts PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	170 g	●

Date of edition: 08/18/2005



Electrical connection

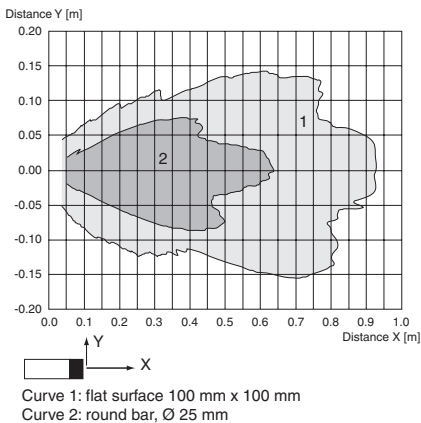
Standard symbol/Connection:
(version IU)



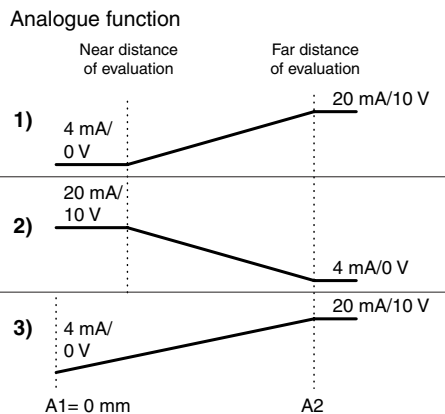
Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curve



Programmed analogue output function



Date of edition: 08/18/2005

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories



- **Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001**
- **Synchronisation options**
- **Adjustable acoustic power and sensitivity**
- **Temperature compensation**
- **2 switch outputs freely adjustable**
UC300-30GM-E6R2-K-V15, UC300-30GM-E7R2-K-V15
- **Hysteresis mode selectable**
UC300-30GM-E6R2-K-V15, UC300-30GM-E7R2-K-V15
- **Window function can be selected**
UC300-30GM-E6R2-K-V15, UC300-30GM-E7R2-K-V15
- **Current and voltage output**
UC300-30GM-IUR2-K-V15

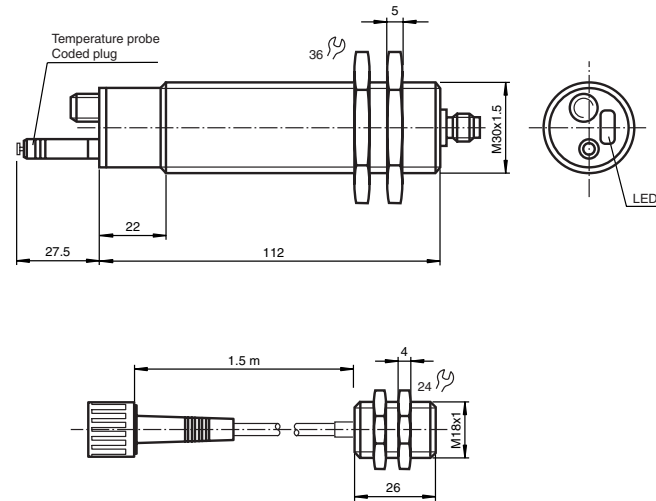


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

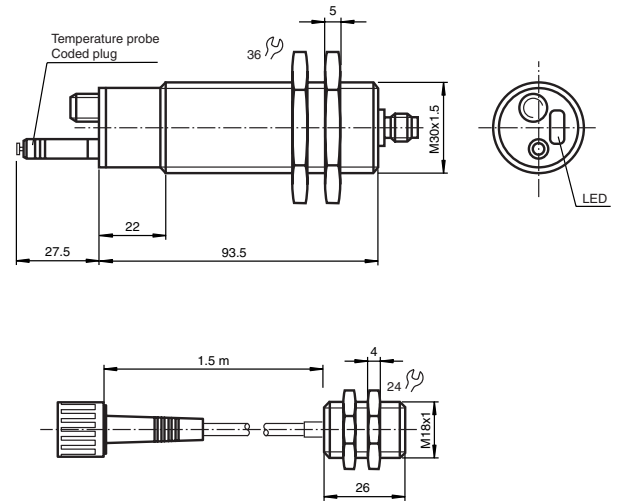
Technical Data

	Model number	UC300-30GM-E6R2-K-V15	UC300-30GM-E7R2-K-V15	UC300-30GM-IUR2-K-V15
Sensing range	30 ... 300 mm	●	●	●
Adjustment range	50 ... 300 mm	●	●	●
Unusable area	0 ... 30 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 380 kHz	●	●	●
Response delay	21 ms minimum, 63 ms factory setting	●	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●	●
LED yellow1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●
LED yellow2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●	●
Temperature/TEACH-IN connector	temperature compensation, TEACH-IN of the switch points, output function setting	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
No-load supply current	≤ 50 mA	●	●	●
Power consumption	≤ 900 mW	●	●	●
Output type	1 current output 4 ... 20 mA, 1 voltage output 0 ... 10 V	●	●	●
	2 switch outputs npn, NO/NC, parameterisable	●	●	●
	2 switch outputs prp, NONC, parameterisable	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●
Voltage drop	≤ 2,5 V	●	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●	●
Range hysteresis	1 % of the adjusted operating range (default settings), programmable	●	●	●
Switching frequency	≤ 7 Hz	●	●	●
Deviation of the characteristic curve	≤ 0,2 % of full-scale value	●	●	●
Resolution	evaluation range [mm]/4000, but ≥ 0,05 mm	●	●	●
Load impedance	current output: ≤ 500 Ohm, voltage output: ≥ 1000 Ohm	●	●	●
Temperature influence	≤ 2 % from full-scale value (with temperature compensation)	●	●	●
	≤ 0,2 %/K (without temperature compensation)	●	●	●
Synchronisation	bi-directional	●	●	●
	0 level: -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 KOhm	●	●	●
	synchronisation pulse: ≥ 100 µs, synchronisation interpulse period: ≥ 2 ms	●	●	●
Common mode operation	≤ 95 Hz	●	●	●
Multiplex operation	≤ 95/n Hz, n = number of sensors	●	●	●
Interface type	RS 232, 9600 B/s, no parity, 8 data bits, 1 stop bit	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●
Protection degree	sensor head: IP67	●	●	●
	connector sensor head/controller unit: IP52	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material		●	●	●
Housing	stainless steel 1.4303, plastic parts PBT	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●
Mass	210 g	●	●	●
	260 g	●	●	●

Date of edition: 08/18/2005



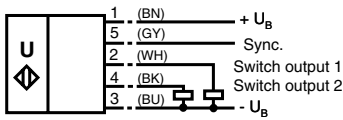
output version -IUE2



output version -E6R2 and -E7R2

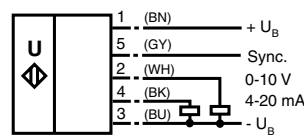
Electrical connection

Standard symbol/Connection:
(version E6, nnp)



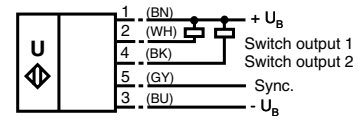
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

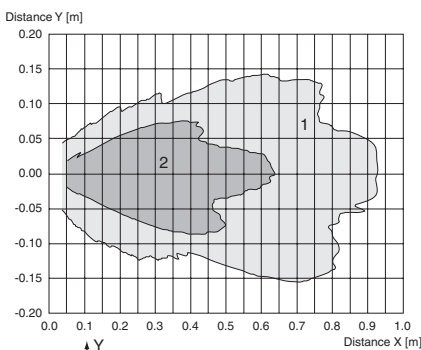
Standard symbol/Connection:
(version E7, npr)



Core colours in accordance with EN 60947-5-2.

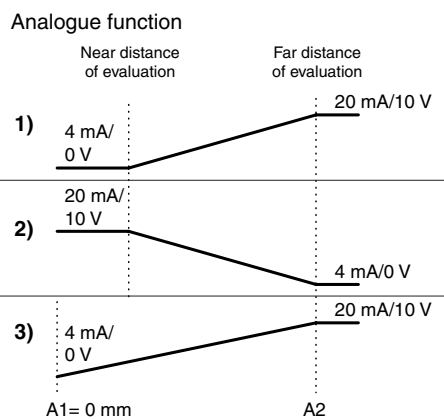
Diagrams

Characteristic response curve



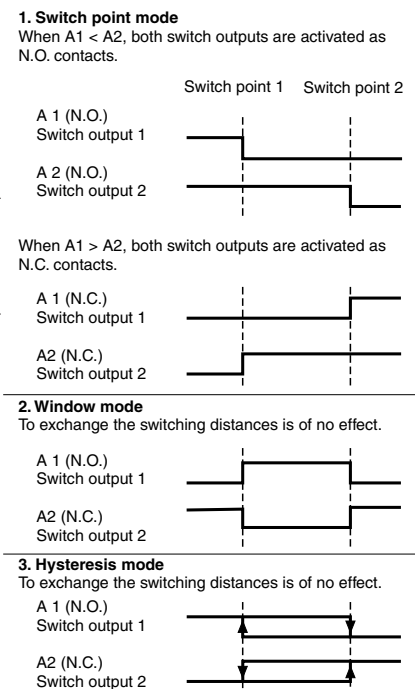
Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function



output version -IUE2

Possible operating modes



output version -E6R2 and -E7R2

Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Ultrasonic sensor

UC500-30GM...-V15



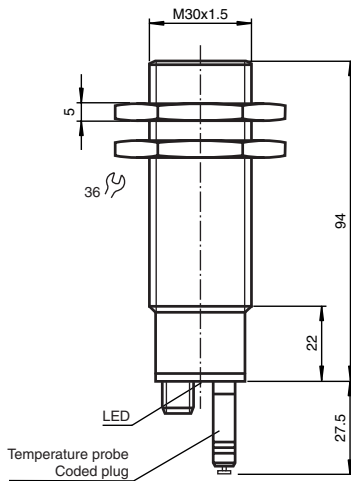
- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- 2 switch outputs freely adjustable
UC500-30GM-E6R2-V15, UC500-30GM-E7R2-V15
- Hysteresis mode selectable
UC500-30GM-E6R2-V15, UC500-30GM-E7R2-V15
- Window function can be selected
UC500-30GM-E6R2-V15, UC500-30GM-E7R2-V15
- Current and voltage output
UC500-30GM-IUR2-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

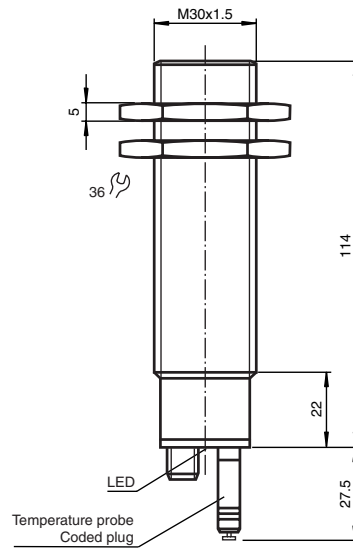
Technical Data

	Model number	UC500-30GM-E6R2-V15	UC500-30GM-E7R2-V15	UC500-30GM-IUR2-V15
Sensing range	30 ... 500 mm	●	●	●
Adjustment range	50 ... 500 mm	●	●	●
Unusable area	0 ... 30 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 380 kHz	●	●	●
Response delay	21 ms minimum, 63 ms factory setting	●	●	●
Focke Ident-Nr.	8 763 161	●	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●
LED yellow 2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●	●
Temperature/TEACH-IN connector	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●	●
Operating voltage	permanent: temperature/TEACH-IN plug not connected, flashing: fault or TEACH-IN function object not detected	●	●	●
No-load supply current	temperature compensation, TEACH-IN of the switch points, output function setting	●	●	●
Power consumption	temperature compensation, TEACH-IN for evaluation range, output function setting	●	●	●
Output type	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
Rated operational current	≤ 50 mA	●	●	●
Voltage drop	≤ 900 mW	●	●	●
Repeat accuracy	2 switch outputs npn, NO/NC, parameterisable	●	●	●
Range hysteresis	2 switch outputs prp, NONC, parameterisable	●	●	●
Switching frequency	200 mA, short-circuit/overload protected	●	●	●
Deviation of the characteristic curve	≤ 2,5 V	●	●	●
Resolution	≤ 0,1 % of full-scale value	●	●	●
Load impedance	1 % of the adjusted operating range (default settings), programmable	●	●	●
Temperature influence	≤ 7 Hz	●	●	●
Synchronisation	≤ 0,2 % of full-scale value	●	●	●
Common mode operation	evaluation range [mm] 4000, but ≥ 0,05 mm	●	●	●
Multiplex operation	current output: ≤ 500 Ohm, voltage output: ≥ 1000 Ohm	●	●	●
Interface type	≤ 2 % from full-scale value (with temperature compensation)	●	●	●
Standards	≤ 0,2 %/K (without temperature compensation)	●	●	●
Ambient temperature	bi-directional	●	●	●
Storage temperature	0 level -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 KOhm	●	●	●
Protection degree	synchronisation pulse ≥ 100 μs, synchronisation interpulse period ≥ 2 ms	●	●	●
Connection	≤ 95 Hz	●	●	●
Material	≤ 95/n Hz, n = number of sensors	●	●	●
Housing	FS 232, 9600 Bit/s, no parity, 8 data bits, 1 stop bit	●	●	●
Transducer	EN 60947-5-2	●	●	●
Mass	140 g	●	●	●
	170 g	●	●	●

Date of edition: 08/18/2005



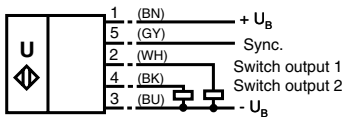
output versions -E6R2 and -E7R2



output version -IUR2

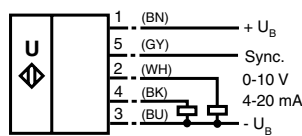
Electrical connection

Standard symbol/Connection:
(version E6, nnp)



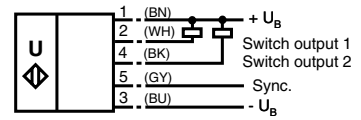
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

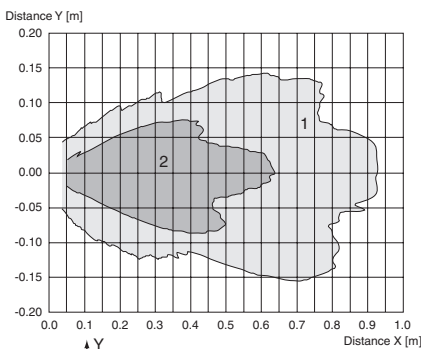
Standard symbol/Connection:
(version E7, npr)



Core colours in accordance with EN 60947-5-2.

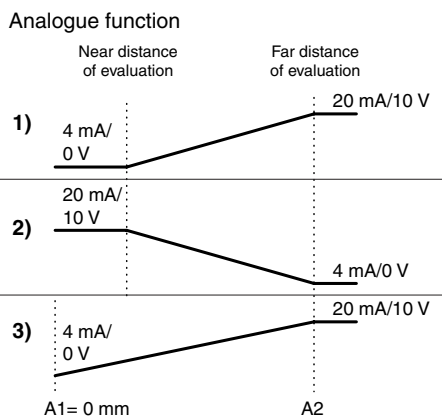
Diagrams

Characteristic response curve



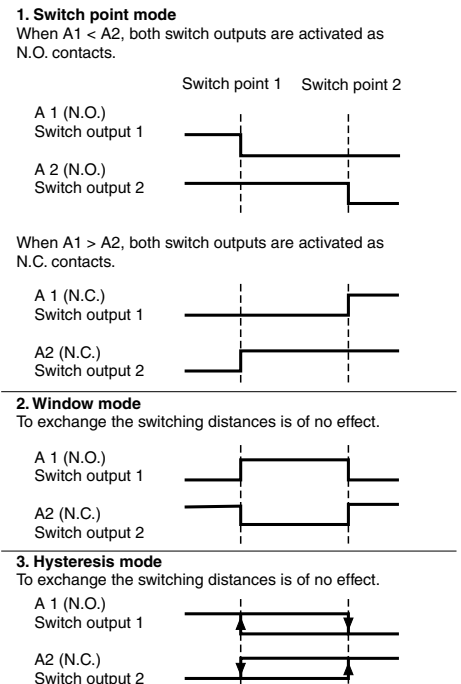
Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function



output version -IUR2

Possible operating modes



output versions -E6R2 and -E7R2

Date of edition: 08/18/2005

Ultrasonic sensor

UC1000-30GM-..F2-K-V15



- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- Current and voltage output
UC1000-30GM-IUR2-K-V15
- 2 switch outputs freely adjustable
UC1000-30GM-E6R2-K-V15
- Hysteresis mode selectable
UC1000-30GM-E6R2-K-V15
- Window function can be selected
UC1000-30GM-E6R2-K-V15

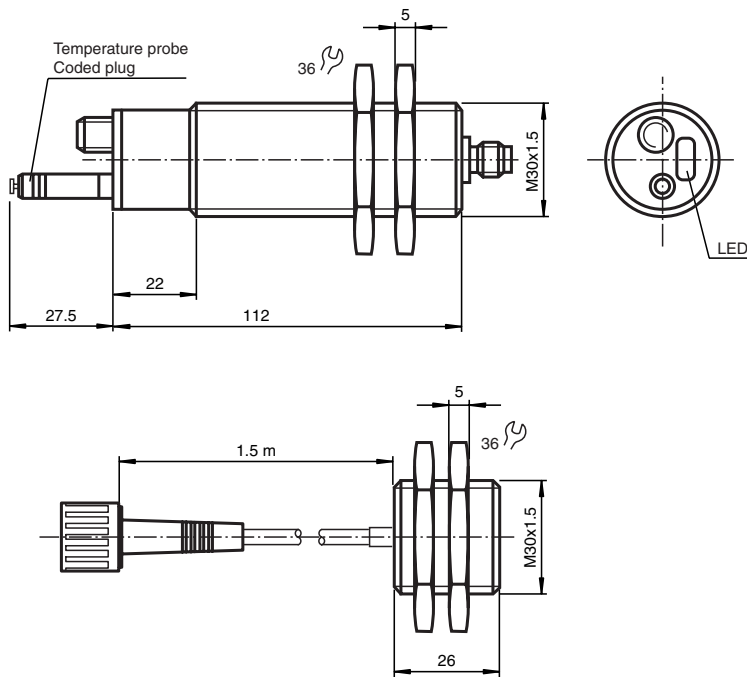


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

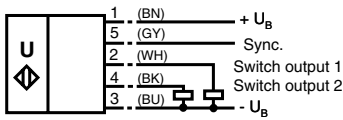
	Model number	UC1000-30GM-E6R2-K-V15	UC1000-30GM-IUR2-K-V15
Sensing range	80 ... 1000 mm	●	●
Adjustment range	120 ... 1000 mm	●	●
Unusable area	0 ... 80 mm	●	●
Standard target plate	100 mm x 100 mm	●	●
Transducer frequency	approx. 180 kHz	●	●
Response delay	65 ms minimum, 195 ms factory setting	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●
LED yellow 2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●
Temperature/TEACH-IN connector	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●
Operating voltage	permanent: temperature/TEACH-IN plug not connected, flashing: fault or TEACH-IN function object not detected	●	●
No-load supply current	temperature compensation, TEACH-IN of the switch points, output function setting	●	●
Power consumption	temperature compensation, TEACH-IN for evaluation range, output function setting	●	●
Output type	10 ... 30 V DC, ripple 10 % _{SS}	●	●
Rated operational current	≤ 50 mA	●	●
Voltage drop	≤ 900 mW	●	●
Repeat accuracy	1 current output 4 ... 20 mA, 1 voltage output 0 ... 10 V	●	●
Range hysteresis	2 switch outputs prp, NONC, parameterisable	●	●
Switching frequency	200 mA, short-circuit/overload protected	●	●
Deviation of the characteristic curve	≤ 2,5 V	●	●
Resolution	≤ 0,1 % of full-scale value	●	●
Load impedance	1 % of the adjusted operating range (default settings), programmable	●	●
Temperature influence	≤ 2,5 Hz	●	●
Synchronisation	≤ 0,2 % of full-scale value	●	●
Common mode operation	evaluation range [mm]/4000, but ≥ 0,35 mm	●	●
Multiplex operation	current output: ≤ 500 Ohm, voltage output ≥ 1000 Ohm	●	●
Interface type	current output: ≤ 2 % from full-scale value (with temperature compensation)	●	●
Standards	≤ 0,2 %/K (without temperature compensation)	●	●
Ambient temperature	EN 60947-5-2	●	●
Storage temperature	-25 ... 70 °C (248 ... 343 K)	●	●
Protection degree	-40 ... 85 °C (233 ... 358 K)	●	●
Connection	sensor head: IP67	●	●
Material	connector sensor head/controller unit: IP52	●	●
Housing	connector V15 (M12 x 1), 5 pin	●	●
Transducer	stainless steel 1.4303, plastic parts PBT	●	●
Mass	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●
	210 g	●	●
	260 g	●	●

Date of edition: 08/18/2005



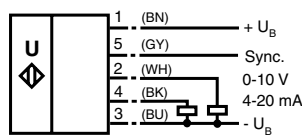
Electrical connection

Standard symbol/Connection:
(version E6, pnp)



Core colours in accordance with EN 60947-5-2.

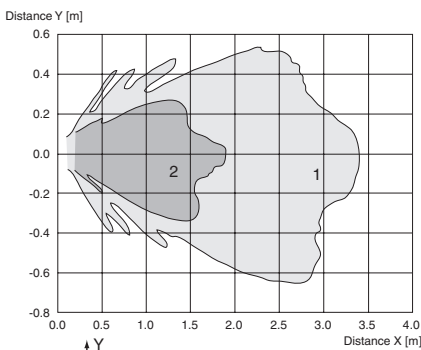
Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

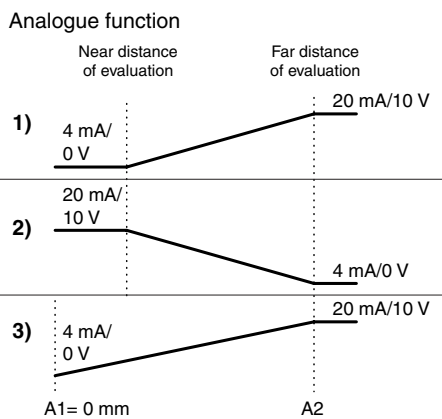
Diagrams

Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function



Possible operating modes

1. Switch point mode
When $A1 < A2$, both switch outputs are activated as N.O. contacts.

A 1 (N.O.)
Switch output 1

A 2 (N.O.)
Switch output 2

When $A1 > A2$, both switch outputs are activated as N.C. contacts.

A 1 (N.C.)
Switch output 1

A 2 (N.C.)
Switch output 2

2. Window mode
To exchange the switching distances is of no effect.

A 1 (N.O.)
Switch output 1

A 2 (N.C.)
Switch output 2

3. Hysteresis mode
To exchange the switching distances is of no effect.

A 1 (N.O.)
Switch output 1

A 2 (N.C.)
Switch output 2

output version -IUR2

output version -E6R2

Date of edition: 08/18/2005



- High chemical resistance through teflon-coated transducer surface
- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- Current and voltage output
UCC1000-30GM-IUR2-V15
- 2 switch outputs freely adjustable
UCC1000-30GM-E6R2-V15
- Hysteresis mode selectable
UCC1000-30GM-E6R2-V15
- Window function can be selected
UCC1000-30GM-E6R2-V15

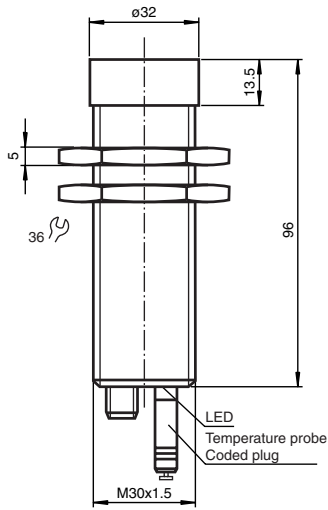


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

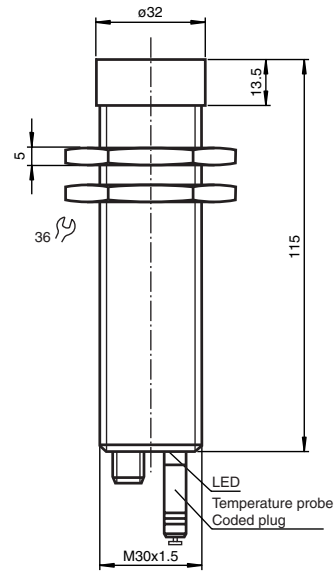
Technical Data

	Model number	UCC1000-30GM-E6R2-V15	UCC1000-30GM-IUR2-V15
Sensing range	80 ... 1000 mm	●	●
Adjustment range	100 ... 1000 mm	●	●
	120 ... 1000 mm	●	●
Unusable area	0 ... 80 mm	●	●
Standard target plate	100 mm x 100 mm	●	●
Transducer frequency	approx. 175 kHz	●	●
Response delay	65 ms minimum, 195 ms factory setting	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●
	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●
LED yellow 2	permanent: object in detection range, flashing: TEACH-IN function	●	●
	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●
LED red	permanent: temperature/TEACH-IN plug not connected, flashing: fault or TEACH-IN function object not detected	●	●
Temperature/TEACH-IN connector	temperature compensation, TEACH-IN of the switch points, output function setting	●	●
	temperature compensation, TEACH-IN for evaluation range, output function setting	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●
No-load supply current	≤ 50 mA	●	●
Power consumption	≤ 900 mW	●	●
Output type	1 current output 4 ... 20 mA, 1 voltage output 0 ... 10 V	●	●
	2 switch outputs prp, NONC, parameterisable	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●
Voltage drop	≤ 2,5 V	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●
Range hysteresis	1 % of the adjusted operating range (default settings), programmable	●	●
Switching frequency	≤ 2,5 Hz	●	●
Deviation of the characteristic curve	≤ 0,2 % of full-scale value	●	●
Resolution	evaluation range [mm]/4000, but ≥ 0,35 mm	●	●
Load impedance	current output: ≤ 500 Ohm, voltage output ≥ 1000 Ohm	●	●
Temperature influence	≤ 2 % from full-scale value (with temperature compensation)	●	●
	≤ 0,2 %/K (without temperature compensation)	●	●
Synchronisation	bi-directional	●	●
	0 level -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 KOhm	●	●
	synchronisation pulse ≥ 100 µs, synchronisation interpulse period ≥ 2 ms	●	●
Common mode operation	≤ 30 Hz	●	●
Multiplex operation	≤ 30/n Hz, n = number of sensors	●	●
Interface type	FS 232, 9600 Bit/s, no parity, 8 data bits, 1 stop bit	●	●
Standards	EN 60947-5-2	●	●
Ambient temperature	0 ... 70 °C (273 ... 343 K)	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●
Protection degree	IP65	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●
Housing	stainless steel 1.4303, plastic parts PBT	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●
Mass	140 g	●	●
	170 g	●	●

Date of edition: 08/18/2005



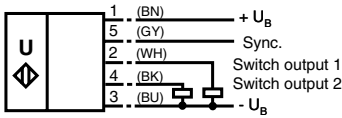
output version -E6R2



output version -IUR2

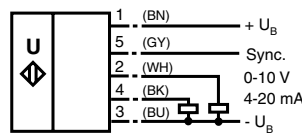
Electrical connection

Standard symbol/Connection:
(version E6, pnp)



Core colours in accordance with EN 60947-5-2.

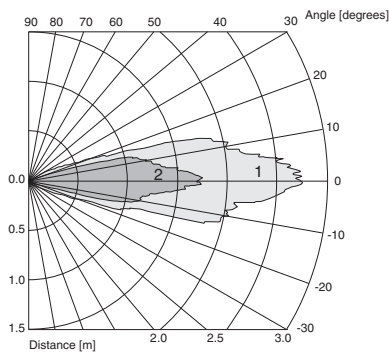
Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curves

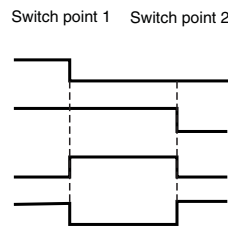
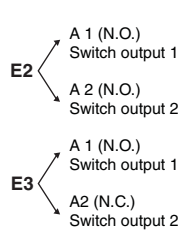


Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Date of edition: 08/18/2005

Programmed switching output function

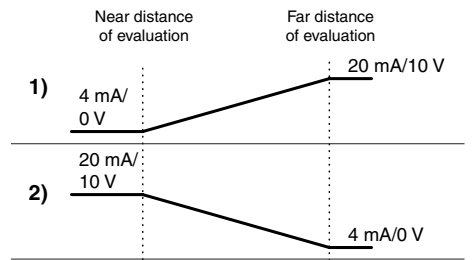
Position of insert
Switch output functions



output version -E6R2

Programmed analogue output function

Analogue function



output version -IUR2



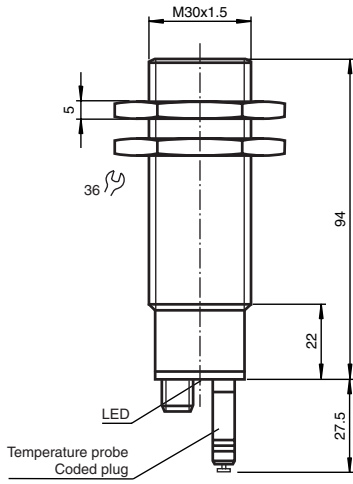
- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- 2 switch outputs freely adjustable
UC2000-30GM-E6R2-V15, UC2000-30GM-E7R2-V15
- Hysteresis mode selectable
UC2000-30GM-E6R2-V15, UC2000-30GM-E7R2-V15
- Window function can be selected
UC2000-30GM-E6R2-V15, UC2000-30GM-E7R2-V15
- Current and voltage output
UC2000-30GM-IUR2-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

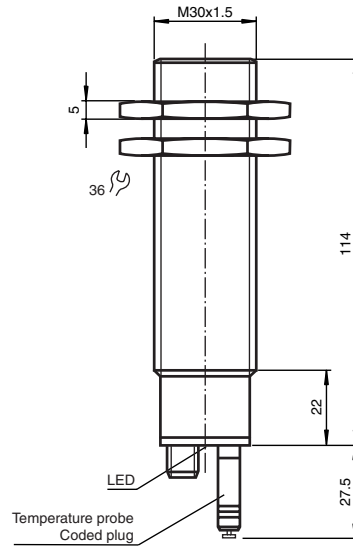
Technical Data

	Model number	UC2000-30GM-E6R2-V15	UC2000-30GM-E7R2-V15	UC2000-30GM-IUR2-V15
Sensing range	80 ... 2000 mm	●	●	●
Adjustment range	120 ... 2000 mm	●	●	●
Unusable area	0 ... 80 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 180 kHz	●	●	●
Response delay	65 ms minimum, 195 ms factory setting	●	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●
LED yellow 2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●	●
Temperature/TEACH-IN connector	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●	●
Operating voltage	permanent: temperature/TEACH-IN plug not connected, flashing: fault or TEACH-IN function object not detected	●	●	●
No-load supply current	temperature compensation, TEACH-IN of the switch points, output function setting	●	●	●
Power consumption	temperature compensation, TEACH-IN for evaluation range, output function setting	●	●	●
Output type	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
Rated operational current	≤ 50 mA	●	●	●
Voltage drop	≤ 900 mW	●	●	●
Repeat accuracy	≤ 20 mA, 1 voltage output 0 ... 10 V	●	●	●
Range hysteresis	2 switch outputs npn, NO/NC, parameterisable	●	●	●
Switching frequency	2 switch outputs prp, NONC, parameterisable	●	●	●
Deviation of the characteristic curve	200 mA, short-circuit/overload protected	●	●	●
Resolution	≤ 2,5 V	●	●	●
Load impedance	≤ 0,1 % of full-scale value	●	●	●
Temperature influence	1 % of the adjusted operating range (default settings), programmable	●	●	●
Synchronisation	≤ 2,5 Hz	●	●	●
Common mode operation	≤ 0,2 % of full-scale value	●	●	●
Multiplex operation	evaluation range [mm] 4000, but ≥ 0,35 mm	●	●	●
Interface type	current output: ≤ 500 Ohm, voltage output: ≥ 1000 Ohm	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	≤ 2 % from full-scale value (with temperature compensation)	●	●	●
Storage temperature	≤ 0,2 %/K (without temperature compensation)	●	●	●
Protection degree	IP65	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material	bi-directional	●	●	●
Housing	0 level -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 KOhm	●	●	●
Transducer	synchronisation pulse ≥ 100 μs, synchronisation interpulse period ≥ 2 ms	●	●	●
Mass	≤ 30 Hz	●	●	●
	≤ 30 n Hz, n = number of sensors	●	●	●
	FS 232, 9600 B/Ws, no parity, 8 data bits, 1 stop bit	●	●	●
	EN 60947-5-2	●	●	●
	-25 ... 70 °C (248 ... 343 K)	●	●	●
	-40 ... 85 °C (233 ... 353 K)	●	●	●
	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●
	140 g	●	●	●
	170 g	●	●	●

Date of edition: 08/18/2005



output versions -E6R2 and -E7R2

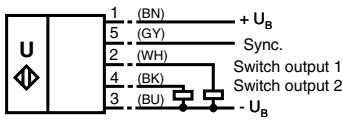


output version -IUR2

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

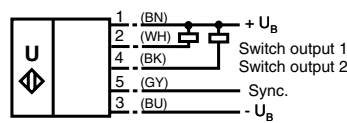
Electrical connection

Standard symbol/Connection:
(version E6, pnp)



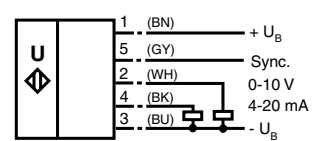
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:
(version E7, npn)



Core colours in accordance with EN 60947-5-2.

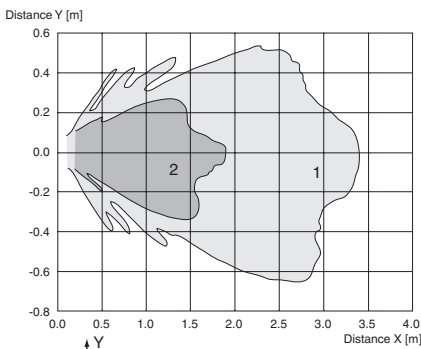
Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

Diagrams

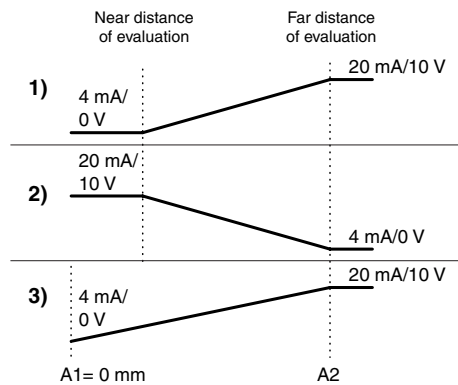
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function

Analogue function

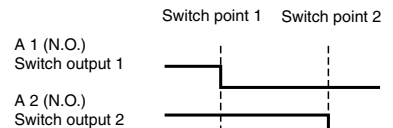


output version -IUR2

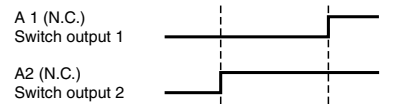
Possible operating modes

1. Switch point mode

When A1 < A2, both switch outputs are activated as N.O. contacts.

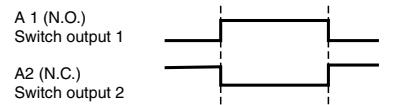


When A1 > A2, both switch outputs are activated as N.C. contacts.



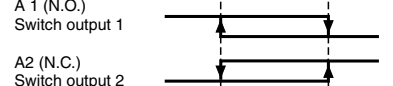
2. Window mode

To exchange the switching distances is of no effect.



3. Hysteresis mode

To exchange the switching distances is of no effect.



output versions -E6R2 and -E7R2

Date of edition: 08/18/2005



- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- 2 switch outputs freely adjustable
UC2000-30GM-E6R2-T-V15, UC2000-30GM-E7R2-T-V15
- Hysteresis mode selectable
UC2000-30GM-E6R2-T-V15, UC2000-30GM-E7R2-T-V15
- Window function can be selected
UC2000-30GM-E6R2-T-V15, UC2000-30GM-E7R2-T-V15
- Current and voltage output
UC2000-30GM-IUR2-T-V15

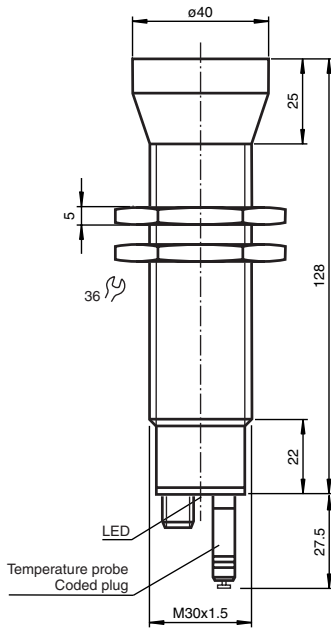


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

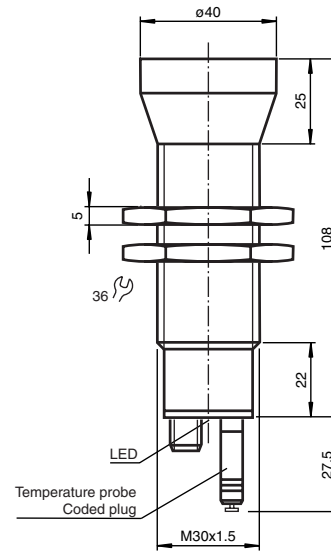
Technical Data

	Model number	UC2000-30GM-E6R2-FV15	UC2000-30GM-E7R2-FV15	UC2000-30GM-IUR2-T-V15
Sensing range	80 ... 2000 mm	●	●	●
Adjustment range	120 ... 2000 mm	●	●	●
Unusable area	0 ... 80 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 175 kHz	●	●	●
Response delay	65 ms minimum, 195 ms factory setting	●	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●
LED yellow 2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●	●
Temperature/TEACH-IN connector	temperature compensation, TEACH-IN of the switch points, output function setting	●	●	●
Operating voltage	temperature compensation, TEACH-IN for evaluation range, output function setting	●	●	●
No-load supply current	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
Power consumption	≤ 50 mA	●	●	●
Output type	≤ 900 mW	●	●	●
	1 current output 4 ... 20 mA, 1 voltage output 0 ... 10 V	●	●	●
	2 switch outputs npn, NO/NC, parameterisable	●	●	●
	2 switch outputs prp, NONC, parameterisable	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●
Voltage drop	≤ 2,5 V	●	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●	●
Range hysteresis	1 % of the adjusted operating range (default settings), programmable	●	●	●
Switching frequency	≤ 2,5 Hz	●	●	●
Deviation of the characteristic curve	≤ 0,2 % of full-scale value	●	●	●
Resolution	evaluation range [mm]/4000, but ≥ 0,35 mm	●	●	●
Load impedance	current output: ≤ 500 Ohm, voltage output ≥ 1000 Ohm	●	●	●
Temperature influence	≤ 2 % from full-scale value (with temperature compensation)	●	●	●
	≤ 0,2 %/K (without temperature compensation)	●	●	●
Synchronisation	bi-directional	●	●	●
	0 level -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 KOhm	●	●	●
	synchronisation pulse ≥ 100 µs, synchronisation interpulse period ≥ 2 ms	●	●	●
Common mode operation	≤ 30 Hz	●	●	●
Multiplex operation	≤ 30/n Hz, n = number of sensors	●	●	●
Interface type	FS 232, 9600 Bit/s, no parity, 8 data bits, 1 stop bit	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●
Protection degree	IP65	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material		●	●	●
Housing	stainless steel 1.4303, plastic parts PBT	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●
Mass	180 g	●	●	●
	210 g	●	●	●

Date of edition: 08/18/2005



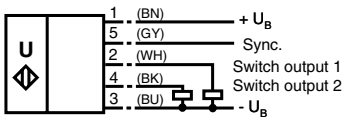
output version -IUR2



output versions -E6R2 and -E7R2

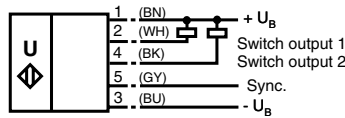
Electrical connection

Standard symbol/Connection:
(version E6, pnp)



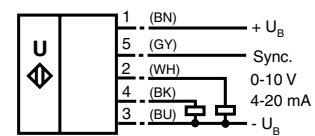
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:
(version E7, npn)



Core colours in accordance with EN 60947-5-2.

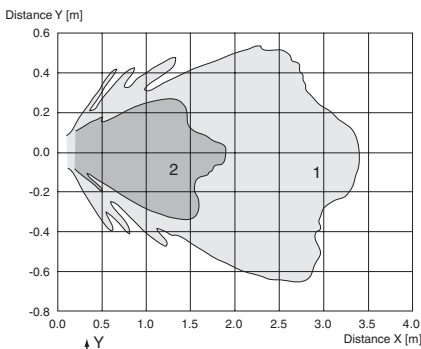
Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

Diagrams

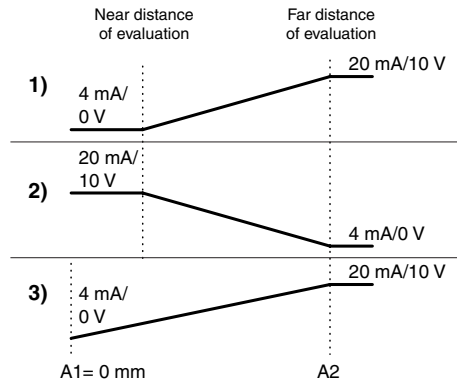
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function

Analogue function

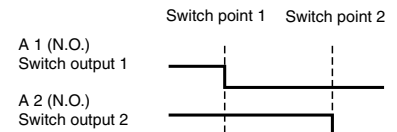


output version -IUR2

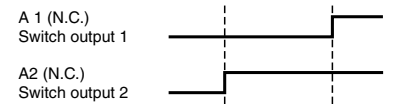
Possible operating modes

1. Switch point mode

When A1 < A2, both switch outputs are activated as N.O. contacts.

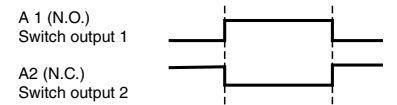


When A1 > A2, both switch outputs are activated as N.C. contacts.



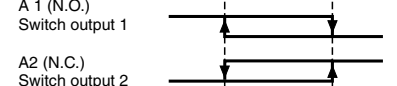
2. Window mode

To exchange the switching distances is of no effect.



3. Hysteresis mode

To exchange the switching distances is of no effect.



output versions -E6R2 and -E7R2

Date of edition: 08/18/2005

Ultrasonic sensor

UC4000-30GM-...-V15



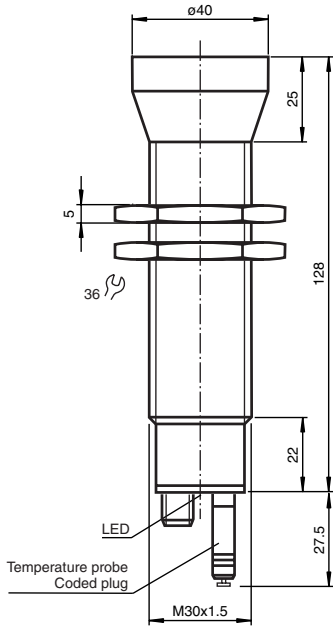
- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- 2 switch outputs freely adjustable
UC4000-30GM-E6R2-V15, UC4000-30GM-E7R2-V15
- Hysteresis mode selectable
UC4000-30GM-E6R2-V15, UC4000-30GM-E7R2-V15
- Window function can be selected
UC4000-30GM-E6R2-V15, UC4000-30GM-E7R2-V15
- Current and voltage output
UC4000-30GM-IUR2-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

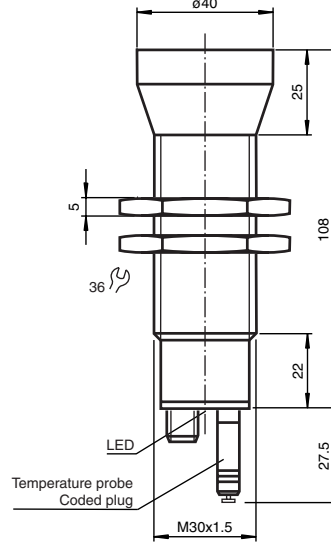
Technical Data

	Model number	UC4000-30GM-E6R2-V15	UC4000-30GM-E7R2-V15	UC4000-30GM-IUR2-V15
Sensing range	200 ... 4000 mm	●	●	●
Adjustment range	240 ... 4000 mm	●	●	●
Unusable area	0 ... 200 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 85 kHz	●	●	●
Response delay	145 ms minimum, 440 ms factory setting	●	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●
LED yellow 2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●	●
Temperature/TEACH-IN connector	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●	●
Operating voltage	permanent: temperature/TEACH-IN plug not connected, flashing: fault or TEACH-IN function object not detected	●	●	●
No-load supply current	temperature compensation, TEACH-IN of the switch points, output function setting	●	●	●
Power consumption	temperature compensation, TEACH-IN for evaluation range, output function setting	●	●	●
Output type	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
Rated operational current	≤ 50 mA	●	●	●
Voltage drop	≤ 900 mW	●	●	●
Repeat accuracy	1 current output 4 ... 20 mA, 1 voltage output 0 ... 10 V	●	●	●
Range hysteresis	2 switch outputs npn, NO/NC, parameterisable	●	●	●
Switching frequency	2 switch outputs prp, NONC, parameterisable	●	●	●
Deviation of the characteristic curve	200 mA, short-circuit/overload protected	●	●	●
Resolution	≤ 2,5 V	●	●	●
Load impedance	≤ 0,1 % of full-scale value	●	●	●
Temperature influence	1 % of the adjusted operating range (default settings), programmable	●	●	●
Synchronisation	≤ 1 Hz	●	●	●
Common mode operation	≤ 0,2 % of full-scale value	●	●	●
Multiplex operation	evaluation range [mm] 4000, but ≥ 0,35 mm	●	●	●
Interface type	current output: ≤ 500 Ohm, voltage output ≥ 1000 Ohm	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	≤ 2 % from full-scale value (with temperature compensation)	●	●	●
Storage temperature	≤ 0,2 %/K (without temperature compensation)	●	●	●
Protection degree	IP65	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material	bi-directional	●	●	●
Housing	0 level -U _B ...+1 V, 1 level: +4 V...+U _B , input impedance: > 12 KOhm	●	●	●
Transducer	synchronisation pulse ≥ 100 μs, synchronisation interpulse period ≥ 2 ms	●	●	●
Mass	≤ 13 Hz	●	●	●
	≤ 13/n Hz, n = number of sensors	●	●	●
	RS 232, 9600 Baud/s, no parity, 8 data bits, 1 stop bit	●	●	●
	EN 60947-5-2	●	●	●
	-25 ... 70 °C (248 ... 313 K)	●	●	●
	-40 ... 85 °C (233 ... 353 K)	●	●	●
	IP65	●	●	●
	connector V15 (M12 x 1), 5 pin	●	●	●
	stainless steel 1.4303, plastic parts PBT	●	●	●
	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●
	180 g	●	●	●
	210 g	●	●	●

Date of edition: 08/18/2005



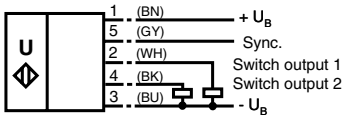
output version -IUR2



output versions -E6R2 and E7R2

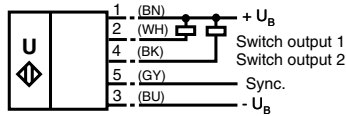
Electrical connection

Standard symbol/Connection:
(version E6, pnp)



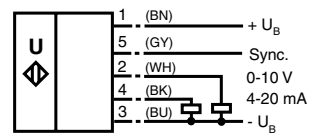
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:
(version E7, npn)



Core colours in accordance with EN 60947-5-2.

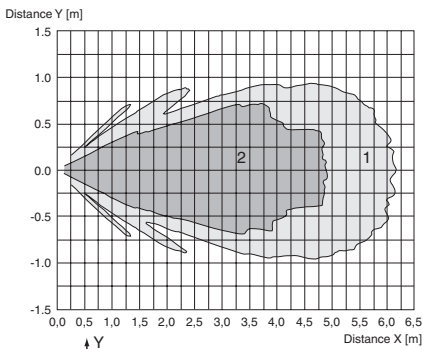
Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

Diagrams

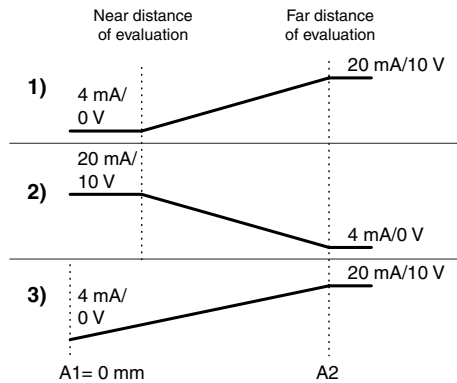
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function

Analogue function

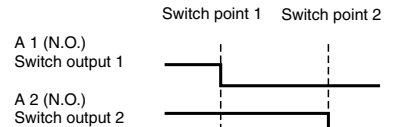


output version -IUR2

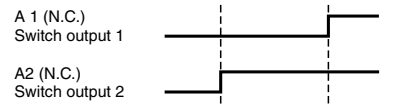
Possible operating modes

1. Switch point mode

When A1 < A2, both switch outputs are activated as N.O. contacts.

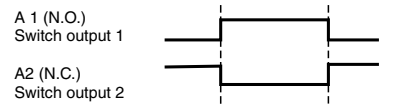


When A1 > A2, both switch outputs are activated as N.C. contacts.



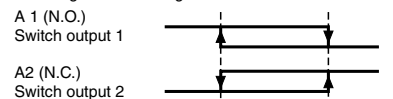
2. Window mode

To exchange the switching distances is of no effect.



3. Hysteresis mode

To exchange the switching distances is of no effect.



output versions -E6R2 and -E7R2

Date of edition: 08/18/2005

Ultrasonic sensor

UC6000-30GM-...-V15



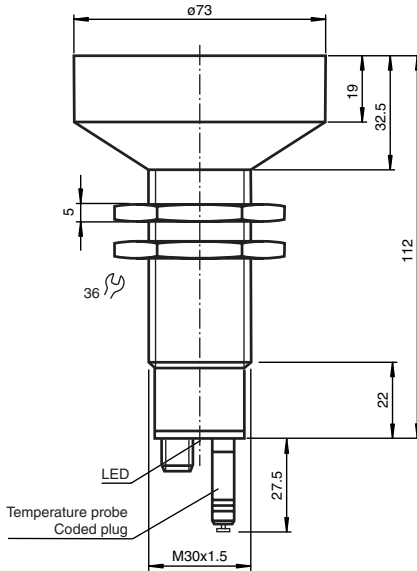
- Parameterisation interface for the application-specific adjustment of the sensor setting via the service program ULTRA 2001
- Synchronisation options
- Adjustable acoustic power and sensitivity
- Temperature compensation
- 2 switch outputs freely adjustable
UC6000-30GM-E6R2-V15, UC6000-30GM-E7R2-V15
- Hysteresis mode selectable
UC6000-30GM-E6R2-V15, UC6000-30GM-E7R2-V15
- Window function can be selected
UC6000-30GM-E6R2-V15, UC6000-30GM-E7R2-V15
- Current and voltage output
UC6000-30GM-IUR2-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

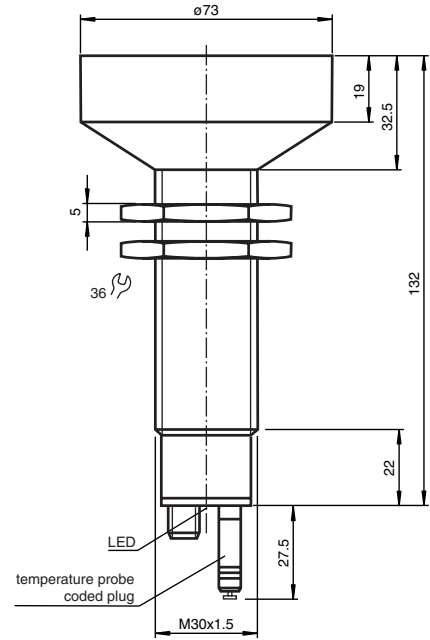
Technical Data

	Model number	UC6000-30GM-E6R2-V15	UC6000-30GM-E7R2-V15	UC6000-30GM-IUR2-V15
Sensing range	350 ... 6000 mm	●	●	●
Adjustment range	400 ... 6000 mm	●	●	●
Unusable area	0 ... 350 mm	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●
Transducer frequency	approx. 65 kHz	●	●	●
Response delay	285 ms minimum, 850 ms factory setting	●	●	●
LED green	permanent: Power-on, flashing: Standby mode or TEACH-IN function object detected	●	●	●
LED yellow 1	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●
LED yellow 2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●
LED red	permanent: object in detection range, flashing: TEACH-IN function	●	●	●
Temperature/TEACH-IN connector	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●
No-load supply current	≤ 50 mA	●	●	●
Power consumption	≤ 900 mW	●	●	●
Output type	1 current output 4 ... 20 mA, 1 voltage output 0 ... 10 V	●	●	●
	2 switch outputs npn, NO/NC, parameterisable	●	●	●
	2 switch outputs pnp, NONC, parameterisable	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●
Voltage drop	≤ 2,5 V	●	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●	●
Range hysteresis	1 % of the adjusted operating range (default settings), programmable	●	●	●
Switching frequency	≤ 0,5 Hz	●	●	●
Deviation of the characteristic curve	≤ 0,2 % of full-scale value	●	●	●
Resolution	evaluation range [mm] 4000, but ≥ 0,35 mm	●	●	●
Load impedance	current output: ≤ 500 Ohm, voltage output ≥ 1000 Ohm	●	●	●
Temperature influence	≤ 2 % from full-scale value (with temperature compensation) ≤ 0,2 %/K (without temperature compensation)	●	●	●
Synchronisation	bi-directional 0 level: -U _B ... +1 V, 1 level: +4 V ... +U _B , input impedance: > 12 KOhm synchronisation pulse ≥ 100 μs, synchronisation interpulse period ≥ 2 ms	●	●	●
Common mode operation	≤ 7 Hz	●	●	●
Multiplex operation	≤ 7/n Hz, n = number of sensors	●	●	●
Interface type	RS 232, 9600 Bit/s, no parity, 8 data bits, 1 stop bit	●	●	●
Standards	EN 60947-5-2	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●
Protection degree	IP65	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●
Material		●	●	●
Housing	stainless steel 1.4303, plastic parts PBT	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●
Mass	270 g	●	●	●
	280 g	●	●	●

Date of edition: 08/18/2005



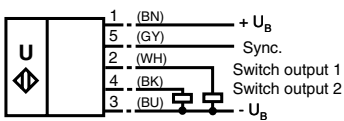
output versions -E6R2 and -E7R2



output version -IUR2

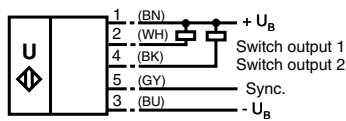
Electrical connection

Standard symbol/Connection:
(version E6, pnp)



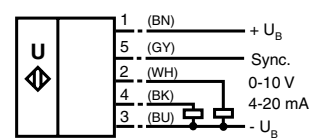
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:
(version E7, npn)



Core colours in accordance with EN 60947-5-2.

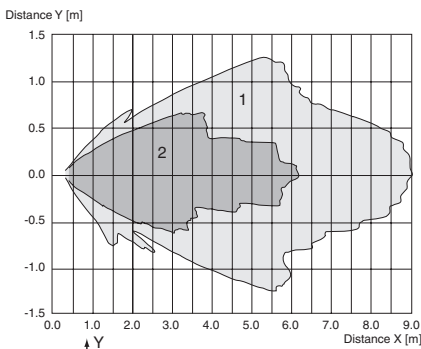
Standard symbol/Connection:
(version IU)



Core colours in accordance with EN 60947-5-2.

Diagrams

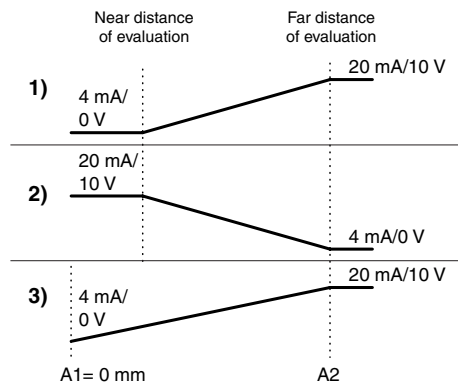
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Programmed analogue output function

Analogue function

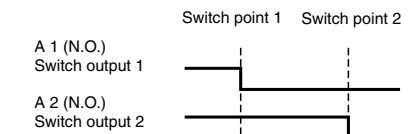


output version -IUR2

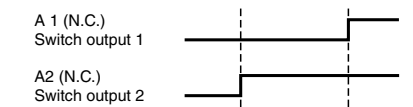
Possible operating modes

1. Switch point mode

When A1 < A2, both switch outputs are activated as N.O. contacts.

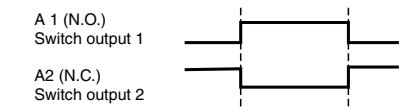


When A1 > A2, both switch outputs are activated as N.C. contacts.



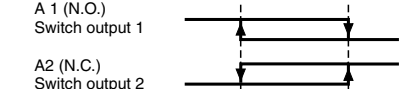
2. Window mode

To exchange the switching distances is of no effect.



3. Hysteresis mode

To exchange the switching distances is of no effect.



output versions -E6R2 and -E7R2

Date of edition: 08/18/2005



- Reliable detection of transparent materials
- High switching frequency
- Small angle of divergence
- Protective functions
- Emitter and receiver included in the delivery package
- Adjustable acoustic power
- Adjustable switch-on delay



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

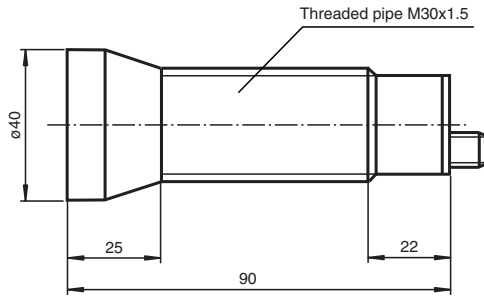
Technical Data

	Model number	
		UBE4000-30GM-SA2-V15
Sensing range	0 ... 4000 mm , distance emitter-receiver 500 mm ... 4000 mm	●
Through-beam mode	Single path ultrasonic switch	●
Transducer frequency	85 kHz	●
Reference target	receiver	●
LED green	alignment aid OFF: no ultrasonic signal flashing: uncertain area ON: positive reception	●
LED yellow	switching state	●
Operating voltage	18 ... 30 V DC , ripple 10 % _{SS}	●
No-load supply current	35 mA emitter 25 mA receiver	●
Output type	2 switch outputs prp, normally open/closed (complementary)	●
Rated operational current	200 mA	●
Voltage drop	≤ 2,5 V	●
Switching frequency	≤ 15 Hz	●
Switch-on delay	100 ... 3000 ms	●
Standards	EN 60947-5-2 C-UL listed: 57M3, IND CONT. EQ., "Powered by Class 2 Power Source"	●
Ambient temperature	0 ... 60 °C (273 ... 333 K)	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●
Protection degree	IP65	●
Connection	connector V15 (M12 x 1), 5 pin	●
Material		
Housing	brass, nickel-plated, plastic components PBT	●
Mass	160 g each sensor	●

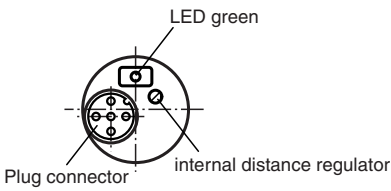
Series -12GM
Series -16GM/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Date of edition: 08/18/2005

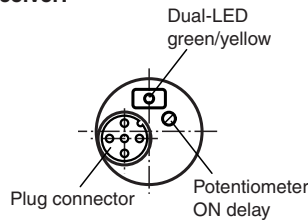
Dimensions:



Emitter:



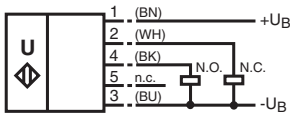
Receiver:



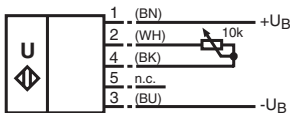
Electrical connection

Standard symbol/Connection:
(version A2, pnp)

Receiver:



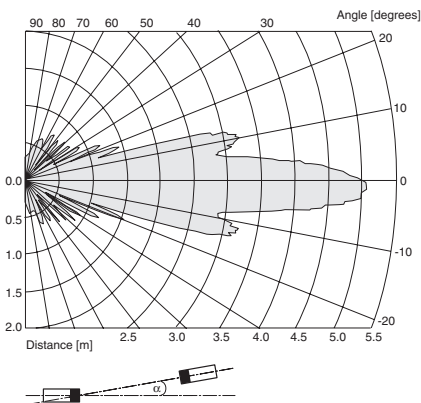
Emitter:



Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curves



Date of edition: 08/18/2005

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories

Ultrasonic sensor

UB...30GM...V15



- Switch output
- 5 different output functions can be set
- TEACH-IN input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Insensitive to compressed air

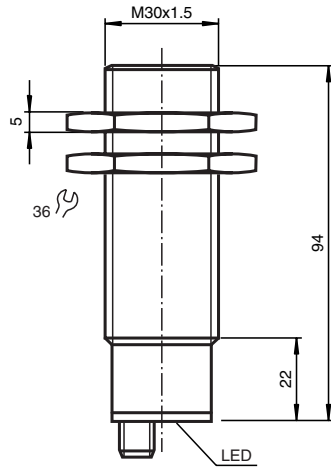


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

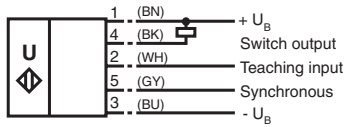
	Model number	UB500-30GM-E4-V15	UB500-30GM-E5-V15	UB2000-30GM-E4-V15	UB2000-30GM-E5-V15
Sensing range	30 ... 500 mm	●	●		
	80 ... 2000 mm			●	●
Adjustment range	120 ... 2000 mm			●	●
	50 ... 500 mm	●	●		
Unusable area	0 ... 30 mm	●	●		
	0 ... 80 mm			●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 180 kHz	●	●	●	●
	approx. 380 kHz	●	●		
Response delay	approx. 150 ms	●	●	●	●
	approx. 50 ms	●	●		
LED green	permanent: Power-on	●	●	●	●
	flashing: TEACH-IN function object detected	●	●	●	●
LED yellow	permanent: switching state switch output	●	●	●	●
	flashing: TEACH-IN function	●	●	●	●
LED red	normal operation: "fault"	●	●	●	●
	TEACH-IN function: no object detected	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤ 50 mA	●	●	●	●
Output type	1 switch output E4, npn NO/NC, parameterisable	●	●		
	1 switch output E5, pnp NO/NC, parameterisable		●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 2,5 V	●	●	●	●
Repeat accuracy	≤ 0,5 % of switching point	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●
Switching frequency	≤ 10 Hz	●	●		
	≤ 3,3 Hz			●	●
Temperature influence	< 2 % of full-scale value	●	●	●	●
	Input type	1 TEACH-IN input, operating range 1: -U _B ... +1 V, operating range 2: +4 V ... +U _B	●	●	●
Synchronisation	input impedance: > 4.7 kΩ; TEACH-IN pulse: ≥ 1 s	●	●	●	●
	bi-directional 0 level: -U _B ... +1 V 1 level: +4 V ... +U _B input impedance: > 12 kΩ synchronisation pulse: ≥ 100 μs, synchronisation interpulse period: ≥ 2 ms	●	●	●	●
Common mode operation	≤ 30 Hz			●	●
	≤ 95 Hz	●	●		
Multiplex operation	≤ 30/n Hz, n = number of sensors	●	●	●	●
	≤ 95/n Hz, n = number of sensors	●	●		
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Material					
Housing	brass, nickel-plated, plastic components PBT	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●	●
Mass	135 g	●	●		
	140 g			●	●

Date of edition: 08/18/2005



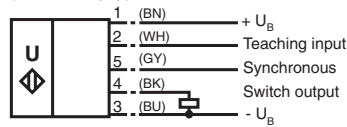
Electrical connection

Standard symbol/Connections:
(version E4, npn)



Core colours in accordance with EN 60947-5-2.

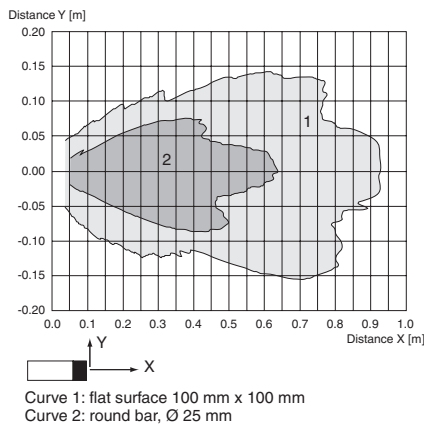
Standard symbol/Connections:
(version E5, pnp)



Core colours in accordance with EN 60947-5-2.

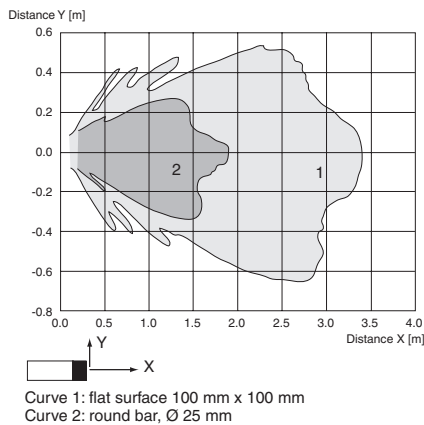
Diagrams

Characteristic response curve



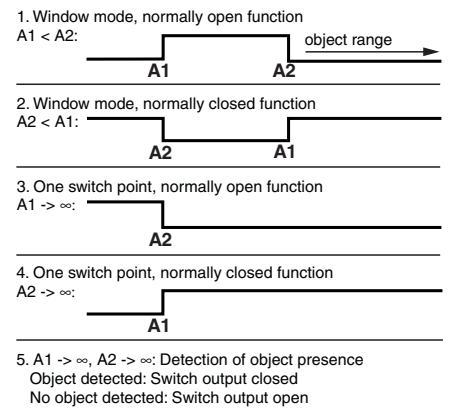
UB500-30GM-...

Characteristic response curve



UB2000-30GM-...

Programmed switching output function



Date of edition: 08/18/2005

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories

Ultrasonic sensor

UB...-30GM...-V15



- Switch output
- 5 different output functions can be set
- TEACH-IN input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Insensitive to compressed air

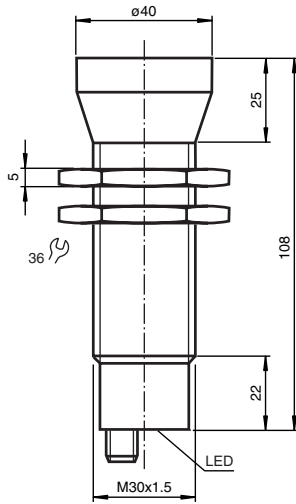


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

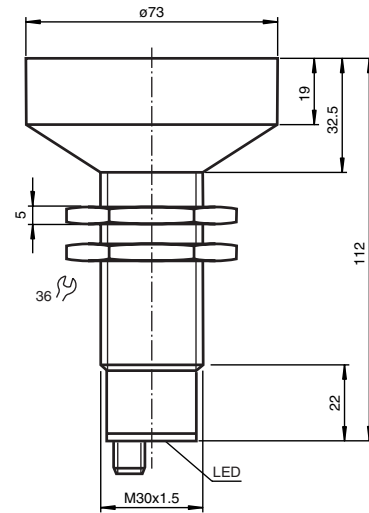
Technical Data

	Model number	UB4000-30GM-E4-V15	UB4000-30GM-E5-V15	UB6000-30GM-E4-V15	UB6000-30GM-E5-V15
Sensing range	200 ... 4000 mm	●	●		
	350 ... 6000 mm			●	●
Adjustment range	240 ... 4000 mm	●	●		
	400 ... 6000 mm			●	●
Unusable area	0 ... 200 mm	●	●		
	0 ... 350 mm			●	●
Standard target plate	100 mm x 100 mm	●	●		
Transducer frequency	approx. 65 kHz	●	●		
	approx. 85 kHz			●	●
Response delay	approx. 325 ms	●	●		
	approx. 650 ms			●	●
LED green	permanent: Power-on flashing: TEACH-IN function object detected	●	●	●	●
LED yellow	permanent: switching state switch output flashing: TEACH-IN function	●	●	●	●
LED red	normal operation: "fault" TEACH-IN function: no object detected	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤ 50 mA	●	●	●	●
Output type	1 switch output E4, npn NO/NC, parameterisable	●	●		
	1 switch output E5, pnp NO/NC, parameterisable			●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 2,5 V	●	●	●	●
Repeat accuracy	≤ 0,5 % of switching point	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●
Switching frequency	≤ 0,8 Hz	●	●		
	≤ 1,5 Hz			●	●
Temperature influence	< 2 % of full-scale value	●	●	●	●
Input type	1 TEACH-IN input, operating range 1: -U _B ... +1 V, operating range 2: +4 V ... +U _B input impedance: > 4.7 kΩ; TEACH-IN pulse: ≥ 1 s	●	●	●	●
Synchronisation	bi-directional 0 level: -U _B ... +1 V 1 level: +4 V ... +U _B input impedance: > 12 kΩ synchronisation pulse: ≥ 100 μs, synchronisation interpulse period: ≥ 2 ms	●	●	●	●
Common mode operation	≤ 13 Hz	●	●		
	≤ 7 Hz			●	●
Multiplex operation	≤ 13/n Hz, n = number of sensors	●	●		
	≤ 7/n Hz, n = number of sensors			●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Material					
Housing	brass, nickel-plated, plastic components PBT	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●	●
Mass	180 g	●	●		
	250 g			●	●

Date of edition: 08/18/2005



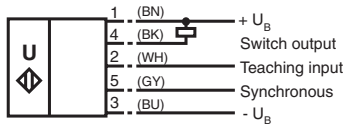
UB4000-30GM...



UB6000-30GM...

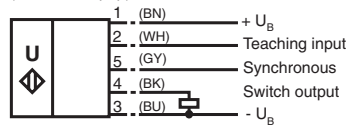
Electrical connection

Standard symbol/Connections:
(version E4, npn)



Core colours in accordance with EN 60947-5-2.

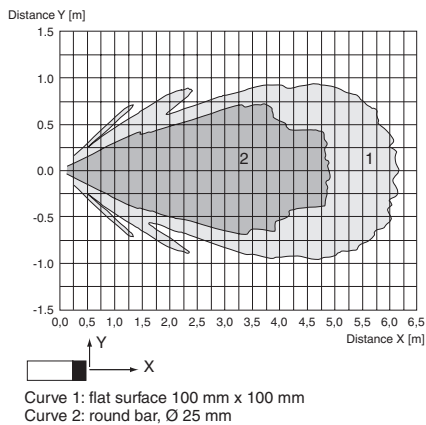
Standard symbol/Connections:
(version E5, pnp)



Core colours in accordance with EN 60947-5-2.

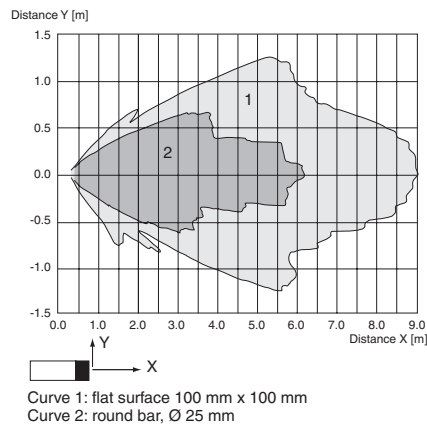
Diagrams

Characteristic response curve



UB4000-30GM...

Characteristic response curve



UB6000-30GM...

Programmed switching output function

- Window mode, normally open function
A1 < A2:
- Window mode, normally closed function
A2 < A1:
- One switch point, normally open function
A1 -> ∞:
- One switch point, normally closed function
A2 -> ∞:
- A1 -> ∞, A2 -> ∞: Detection of object presence
Object detected: Switch output closed
No object detected: Switch output open

Date of edition: 08/18/2005



- Separate evaluation
- Direct detection mode



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

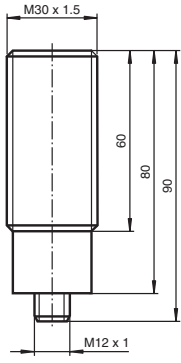
Technical Data

	Model number	UB500-30GM-H3-V1	UB2000-30GM-H3-V1	UB4000-30GM-H3-V1	UB6000-30GM-H3-V1
Sensing range	200 ... 4000 mm				●
	30 ... 500 mm	●			
Adjustment range	350 ... 6000 mm				●
	80 ... 2000 mm		●		
	120 ... 2000 mm		●		
	240 ... 4000 mm			●	
Unusable area	400 ... 6000 mm				●
	50 ... 500 mm	●			
	0 ... 200 mm ¹⁾			●	
	0 ... 30 mm ¹⁾	●			
Standard target plate	0 ... 350 mm ¹⁾				●
	0 ... 80 mm ¹⁾		●		
	100 mm x 100 mm	●	●	●	●
	Transducer frequency approx. [kHz]	380	180	85	65
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤ 30 mA	●	●	●	●
Output type	1 pulse output for echo run time, short-circuit proof open collector pnp with pull down resistor = 22 kOhm level 0 (no echo): -U _B , level 1 (echo detected): ≥ (+U _B -2 V)	●	●	●	●
Rated operational current	15 mA, short-circuit/overload protected	●	●	●	●
Temperature influence	the echo propagation time: 0,17 %/ K	●	●	●	●
Input type	1 pulse input for transmitter pulse (clock) 0-level (active): < 5 V (U _B > 15 V), 1-level (inactive): > 10 V ... +U _B (U _B > 15 V) 0-level (active): < 1/3 U _B (10 V < U _B < 15 V), 1-level (inactive): > 2/3 U _B ... +U _B (10 V < U _B < 15 V)	●	●	●	●
Pulse length	20 ... 300 μs (typ. 200 μs) ²⁾		●		
	40 ... 600 μs (typ. 500 μs) ²⁾				●
	5 ... 100 μs (typ. 50 μs) ²⁾	●			
	50 ... 700 μs (typ. 500 μs) ²⁾				●
Pause length	≥ 50 x pulse length	●	●	●	●
Impedance	10 kOhm internal connected to +U _B	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 85 °C (248 ... 368 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●
Protection degree	IP67	●	●	●	●
Connection	V1 connector (M12 x 1), 4-pin	●	●	●	●
Housing	brass, nickel-plated, plastic components PBT	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●	●
Mass	140 g	●	●		
	180 g			●	
	250 g				●

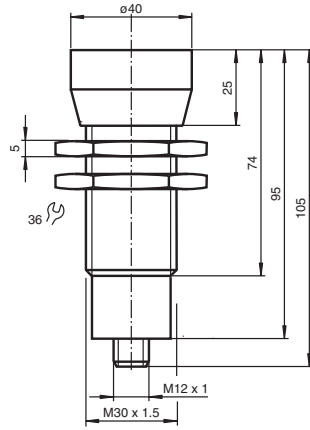
Function

The sensing range is determined in the downstream evaluation electronics (e. g. the units UH3-KHD2-4E5, UH3-KHD2-4I or UH3-T1-KT). PLC modules or other existing evaluation units can also be substituted for these units offered by Pepper+Fuchs. The object distance in pulse-echo mode is obtained from the echo time.

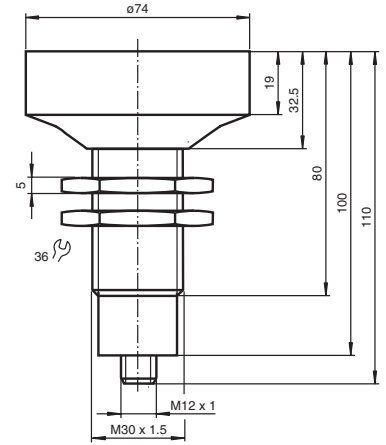
- 1) The unusable area (blind range) BR depends on the pulse duration T_p. The unusable area reaches a minimum with the shortest pulse duration.
- 2) The sensors detection range depends on the pulse duration T_p. With pulse duration < typical pulse duration, the sensors detection range may be reduced.



UB500-... and UB2000-...



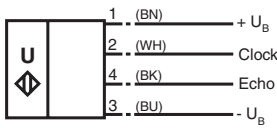
UB4000-...



UB6000-...

Electrical connection

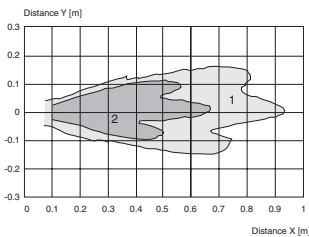
Standard symbol/Connection:



2 = Emitter pulse input
4 = Echo propagation time output
Core colours in accordance with EN 60947-5-2.

Diagrams

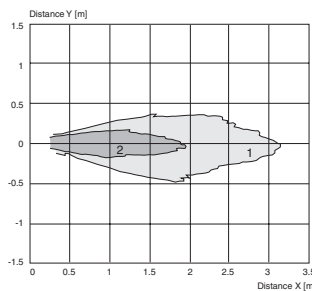
Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB500-30GM-H3-V1

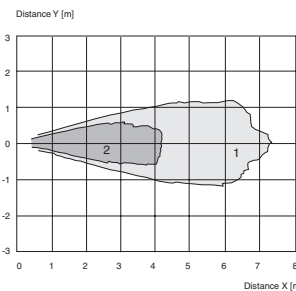
Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB2000-30GM-H3-V1

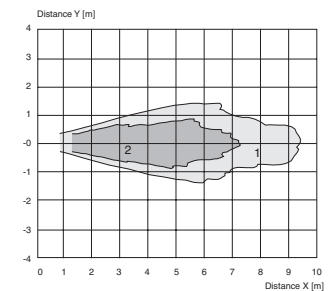
Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB4000-30GM-H3-V1

Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB6000-30GM-H3-V1

Date of edition: 08/18/2005

Series -12GM
 Series -18GK/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories

UC...-30GM-IUR2...-V15 (with 2 analogue outputs)

Description of the sensor functions

This ultrasonic sensor features a four-pole temperature/TEACH-IN plug, that can be connected in four different positions. These have the following significance.

Plug position	Meaning
A1	TEACH-IN evaluation limit A1
A2	TEACH-IN evaluation limit A2
E2/E3	Rising/falling ramp/output characteristic of the voltage output by zero point
T	Temperature compensation

Description of the TEACH-IN procedure

TEACH-IN the evaluation limits 1 or 2

- Cut supply voltage
- Remove TEACH-IN plug
- Restore supply voltage (Reset)
- Set object to desired switching point
- Plug and remove the TEACH-IN plug in pos. A1 or A2. This teaches the evaluation limits A1 or A2.
Caution: Removing the temperature/TEACH-IN plug, the values of the object position will be adopted.
- The TEACH-IN procedure is controlled with the LED. The green LED flashes, when object is detected, the red LED flashes when no object is detected.
- Connect TEACH-IN plug in pos. T. This completes the TEACH-IN procedure and saves the distance.
- The sensor works in normal mode

TEACH-IN the analogue function

- Cut supply voltage
- Remove TEACH-IN plug
- Restore supply voltage (Reset)
- Connect TEACH-IN plug in pos. E2/E3. By multiple plugging, three different modes of operation can be set in cyclical sequence:
 - 1) rising ramp, LED A2 flashes,
 - 2) falling ramp, LED A1 flashes,
 - 3) zero line, LED A1 and A2 flash
- Connect TEACH-IN plug in pos. T. This completes the TEACH-IN procedure and saves the mode of operation.
- The sensor works in normal mode

Note: If the temperature/TEACH-IN plug has not been plugged in within 5 minutes in position T, the sensor will return to normal mode (with the latest permanent stored values) without temperature compensation.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level ≥ 1 s or an open synchronisation input will result in the normal operation of the sensor.

A high level > 1 s will result in the standby mode of the sensor (indicator green LED). The outputs pause in the latest status.

Synchronisation cannot be performed during TEACH-IN and vice versa.

Multiple operating modes are possible:

1. Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
2. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
3. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.
4. A high level at the synchronisation input disables the sensor.

The response time increases when the sensor is synchronised, because the synchronisation increases the measurement cycle time.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

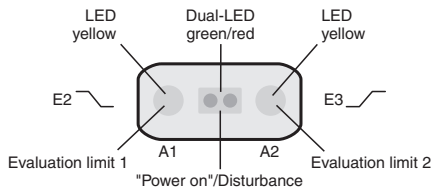
Default setting

A1: unusable area
 A2: nominal sensing range
 Mode of operation: rising ramp

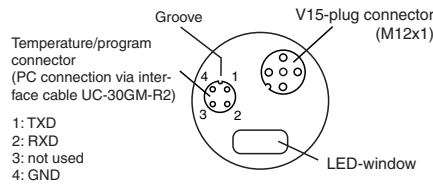
LED Displays/Analogue output

Displays in dependence on operating mode	Dual LED green	Dual-LED red	LED yellow A1	LED yellow A2	analogue output
TEACH-IN evaluation limit A1 object detected object not detected	flashing off	off flashing	flashing flashing	off off	unchanged
TEACH-IN evaluation limit A2 object detected object not detected	flashing off	off flashing	off off	flashing flashing	unchanged
TEACH-IN mode of operation (E2/E3) rising ramp falling ramp zero line	on on on	off off off	off flashing flashing (synchronised)	flashing off flashing (synchronised)	unchanged
Normal mode temperature compensated plug pulled/shorted	on off	off on	on, if target in evaluation range	on, if target in detection range	analogue value
Standby	flashing	off	previous state	previous state	unchanged
Interference (e.g. compressed air)	off	flashing	previous state	previous state	unchanged or error value

LED-Window



RS 232-connection



Note on communication with the UC-30GM-R2 interface cable

The UC-30GM-R2 interface cable allows for communication with the ultrasonic sensor using the ULTRA 2001 service program. The cable creates a connection between the PC-internal RS 232 interface and the plug-in connection for the temperature/program plug on the sensor. When setting up the connection on the sensor, make certain the plug is lined up correctly; otherwise no communication will be possible. The protrusion of the round plug must be inserted into the groove of the plug connection on the sensor side and **not** into the arrow symbol on the sensor.

Adjustable parameter with service program ULTRA 2001

- Evaluation limits A1 and A2
- Rising/falling ramp/zero line
- Mode of operation
- Sonic speed
- Temperature offset (The inherent temperature-rise of the sensor can be considered in the temperature compensation)
- Expansion of the unusable area (for suppression of unusable area echoes)
- Reduction of the detection range (for suppression of remote range echoes)
- Time of measuring cycle
- Acoustic power (interference of the burst duration)
- Sensitivity
- Behaviour of the sensor in case of echo loss
- Behaviour of the sensor in case of a fault
- Average formation via an allowed number of measuring cycles
- Selection of the parameter set, RS 232 or manually.

UC...-30GM-... , output versions -E6R2 and -E7R2 (with 2 switch outputs)

Description of the sensor functions

This ultrasonic sensor features a four-pole temperature/TEACH-IN plug, that can be connected in four different positions. These have the following significance.

Plug position	Meaning
A1	TEACH-IN switching point A1
A2	TEACH-IN switching point A2
E2/E3	Switching: 2 independent switching points/window mode/hysteresis mode
T	Temperature compensation

Description of the TEACH-IN procedure

TEACH-IN of switching points 1 or 2

- Cut supply voltage
- Remove TEACH-IN plug
- Restore supply voltage (Reset)
- Set object to desired switching point
- Plug and remove the TEACH-IN plug in pos. A1 or A2. Switching point A1 or A2 is taught.
Caution: Removing the temperature/TEACH-IN plug, the values of the object position will be adopted.
- The TEACH-IN procedure is controlled with the LED. The green LED flashes, when object is detected, the red LED flashes when no object is detected.
- Connect TEACH-IN plug in pos. T. The TEACH-IN procedure is completed, the sensor is working in normal mode.

TEACH-IN of switching function

- Cut supply voltage
- Remove TEACH-IN plug
- Restore supply voltage (Reset)
- Connect TEACH-IN plug in pos. E2/E3. By multiple plugging, three different modes of operation can be set in cyclical sequence:
 - switching point mode, LED A1 is flashing,
 - window mode, LED A2 is flashing
 - hysteresis mode, LED A1 and A2 are flashing
- Connect TEACH-IN plug in pos. T. The TEACH-IN procedure is completed, the sensor is working in normal mode.

Note: If the temperature/TEACH-IN plug has not been plugged in within 5 minutes in position T, the sensor will return to normal mode (with the latest permanent stored values) without temperature compensation.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level ≥ 1 s or an open synchronisation input will result in the normal operation of the sensor.

A high level > 1 s will result in the standby mode of the sensor (indicator green LED). The outputs pause in the latest status.

Synchronisation cannot be performed during TEACH-IN and vice versa.

Multiple operating modes are possible

1. Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
2. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
3. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.
4. A high level at the synchronisation input disables the sensor.

The response time increases when the sensor is synchronised, because the synchronisation increases the measurement cycle time.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

Default setting

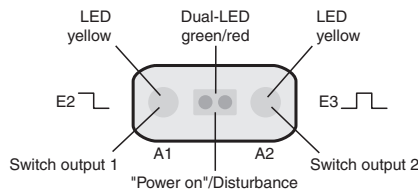
- A1: unusable area
A2: nominal sensing range

LED Displays

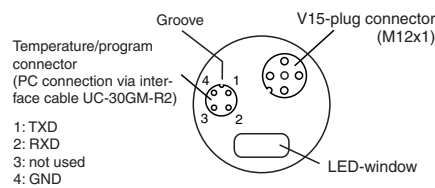
Displays in dependence on operating mode	Dual LED green	LED red	LED yellow A1	LED yellow A2
TEACH-IN of switching point A1 object detected no object detected	flashing off	off flashing	flashing flashing	off off
TEACH-IN switching point A2 object detected no object detected	flashing off	off flashing	off off	flashing flashing
TEACH-IN mode of operation (E2/E3) two independent switching points window mode Hysteresis mode	on on on	off off off	flashing off flashing	off flashing flashing
Normal mode temperature compensated plug pulled or shorted	on off	off on	switching state A1 switching state A1	switching state A2 switching state A2
Interference (e.g. compressed air)	off	flashing	last or defined condition	last or defined condition
Standby	flashes	off	previous state	previous state

LED ON indicates closed switch output.

LED-Window



RS 232-connection



Note on communication with the UC-30GM-R2 interface cable

The UC-30GM-R2 interface cable allows for communication with the ultrasonic sensor using the ULTRA 2001 service program. The cable creates a connection between the PC-internal RS 232 interface and the plug-in connection for the temperature/program plug on the sensor. When setting up the connection on the sensor, make certain the plug is lined up correctly; otherwise no communication will be possible. The protrusion of the round plug must be inserted into the groove of the plug connection on the sensor side and **not** into the arrow symbol on the sensor.

Adjustable parameter with service program ULTRA 2001

- Switching point 1 and 2
- NO/NC function
- Mode of operation
- Sonic speed
- Temperature offset (The inherent temperature-rise of the sensor can be considered in the temperature compensation)
- Expansion of the unusable area (for suppression of unusable area echoes)
- Reduction of the detection range (for suppression of remote range echoes)
- Time of measuring cycle
- Acoustic power (interference of the burst duration)
- Sensitivity
- Behaviour of the sensor in case of echo loss
- Behaviour of the sensor in case of a fault
- Average formation via an allowed number of measuring cycles
- On/off-delay
- Switching hysteresis
- Selection of the parameter set, RS 232 or manually.

Date of edition: 09/13/20.05

UBE4000-30GM-SA2-V15 (through beam type)

Description of the sensor functions

Remote potentiometer

The distance range of the through-beam ultrasonic barrier can be adjusted with the potentiometer integrated in the emitter, or via a remote potentiometer connected to the emitter.

The remote potentiometer simplifies the adjustment of the distance range if the sensors are installed in an inaccessible location. A 10 k Ω /0.3 W potentiometer serves as the remote potentiometer. The connection is realised using the plug connector pins 2 and 4 of the emitter (see: Electrical Connection).

The following distance ranges can be set using the remote potentiometer:

Adjustment of the internal distance regulator	Distance range adjustable via remote potentiometer
Minimum switching point	0 m ... 2 m
Maximum switching point	2 m ... 4 m

When operating without a remote potentiometer, the plug connector pins 2 and 4 must be bridged.

Alignment

When adjusting the emitter and receiver, take care to align them as precisely as possible.

Angular tolerance: $\alpha < \pm 2^\circ$
 maximum offset: $s < \pm 5 \text{ mm}$

A through-beam ultrasonic barrier consists of a single emitter and a single receiver.

Caution

Mount or replace emitter and receiver only in pairs. Both devices are optimally matched to each other by the manufacturer.

UB...-30GM-... , output types -E4 and -E5 (with 1 switch output)

Description of the sensor functions

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be realised as follows:

External synchronisation:

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 μs . The measuring cycle starts with the falling edge of a synchronisation pulse. Two operating modes are available:

1. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
2. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

Internal synchronisation:

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors will operate in multiplex mode.

The state of the switch output will not change until the switching threshold has been exceeded five times as an average of the five measurements is determined internally. A low level $> 1 \text{ s}$ or an open synchronisation input will result in the normal operation of the sensor.

Synchronisation cannot be performed during TEACH-IN and vice versa. The sensors must be operated in an unsynchronised manner to teach the switching point.

A high level at the synchronisation input disables the sensor.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

Adjusting the switching points

The ultrasonic sensor features an analogue output with two teachable evaluation limits. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Evaluation limit A1 is taught with $-U_B$, A2 with $+U_B$. For simple setting the switching point and the output functions the programming unit UB-PROG2 can be used.

Five different output functions can be set:

1. Window mode, normally-open function
2. Window mode, normally-closed function
3. One switching point, normally-open function
4. One switching point, normally-closed function
5. Detection of object presence

TEACH-IN window mode, normally-open function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Set target to far switching point
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN window mode, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Set target to far switching point
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN one switching point, normally-open function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN one switching point, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN detection of object presence

- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$
- TEACH-IN switching point A2 with $+U_B$

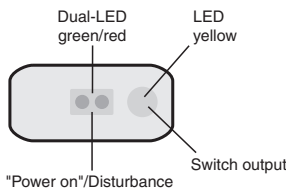
Default setting

A1: unusable area
 A2: nominal sensing range

LED Displays

Displays in dependence on operating mode	Green LED	Red LED	Yellow LED
TEACH-IN switching point			
Object detected	flashes	off	flashes
No object detected	off	flashes	flashes
Object uncertain (TEACH-IN invalid)	off	flashes	off
Normal operation	on	off	switching state
Interference	off	flashes	previous state

LED-Window



Date of edition: 09/13/2005

Series -12GM

Series -18GM/-18GM

Series -30GM

Series VarKont

Series -FP

Series -F12

Series -F42

Series -F43

Series -F54

Series -F64

Series -D1

Series LUC

Double sheet monitoring

Control units/ Power supplies

Accessories

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories



Model number	Description	Detection range	Page
UC500+U9+E6+R2	Switching output + RS 232-interface	500 mm	100
UC500+U9+IUE2+R2	Analogue output + RS 232-interface		
UC3000+U9+E6+R2	Switching output + RS 232-interface	3000 mm	102
UC3000+U9+E7+R2			
UC3000+U9+IUE0+R2	Analogue output + 1 Switching output + RS 232-interface		
UC3000+U9+IUE2+R2			
UJ3000+U1+8B+RS	8 Bit parallel-interface	3000 mm	104
UBE6000+U1+SA2	Through beam ultrasonic barrier	6000 mm	106
UB500+U9+H3	for external control/evaluation units	500 mm	108
UB3000+U9+H3		3000 mm	

For detailed function description, see page 110

Ultrasonic sensor

UC500+U9+...+R2



- Serial interface
- Synchronisation options
- Temperature compensation
- Absolute polarity reversal protection
- Parameterisable with ULTRA 2001
- 1 Analogue output, load-dependent voltage or current + 1 switch output
UC500+U9+IUE2+R2
- 2 independent switch outputs
UC500+U9+E6+R2

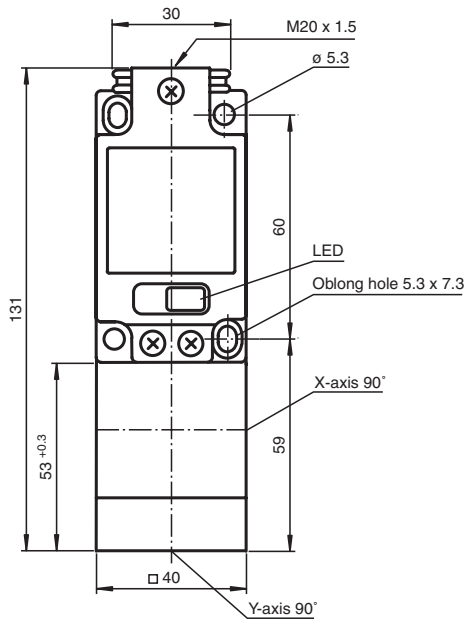


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

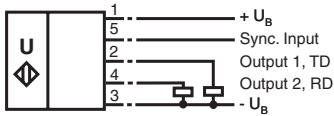
	Model number	UC500+U9+E6+R2	UC500+U9+IUE2+R2
Sensing range	60 ... 500 mm	●	●
Unusable area	0 ... 60 mm	●	●
Standard target plate	100 mm x 100 mm	●	●
Transducer frequency	approx. 380 kHz	●	●
Response delay	for factory setting minimal (EM, NONE): ≤20 ms (2 measuring cycles) default (EM, MXN, 5, 2): ≤40 ms (4 measuring cycles) dynamic (EM, DYN): ≤30 ms (3 measuring cycles)	●	●
LED yellow	switching state switch output switching state switch output 1 switching state switch output 2	●	●
LED red/green	permanently green: "Power on", flashes during standby operation red flashing: "Error", (e.g. background noise level too high)	●	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●	●
No-load supply current	≤ 60 mA	●	●
Output type	1 switch output E5: prp NO/NC switchable 1 analogue output, load-dependent R _L ≤ 500 Ohm: current output 4 ... 20 mA R _L ≥ 1 kOhm: voltage output 2 ... 10 V 2 switch outputs prp, NONC	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●
Voltage drop	≤ 3 V DC	●	●
Deviation of the characteristic curve	≤ 0,2 % of full-scale value	●	●
Resolution	< 1 mm ≥ 0,172 mm	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●
Range hysteresis	≤ 1 % of the set operating distance	●	●
Temperature influence	≤ 2 %	●	●
Synchronisation	1 synchronous connection, bidirectional 0-level: -U _B ... (-U _B + 1 V), 1-level: (-U _B + 5 V) ... +U _B	●	●
Pulse length	≥ 100 μs	●	●
Pause length	≥ 2 ms	●	●
Synchronisation frequency	≤ 80 Hz, with external synchronisation	●	●
Interface type	FS 232, 9600 bits, no parity, 8 data bits, 1 stop bit FS 232, 9600 bit/s, no parity, 8 data bits, 1 stop bit (S10 = OFF)	●	●
Standards	EN 60947-5-2	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●
Protection degree	IP65	●	●
Connection	terminal compartment, ≤ 2,5 mm ² conductor csa	●	●
Material		●	●
Housing	PBT	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●
Mass	180 g	●	●

Date of edition: 08/18/2005

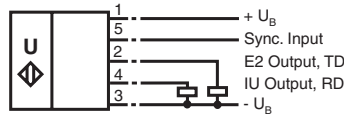


Electrical connection

Standard symbol/Connection:
(Version E6, pnp)

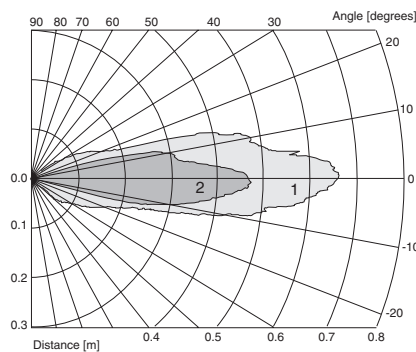


Standard symbol/Connection:
(Version IUE2, pnp)



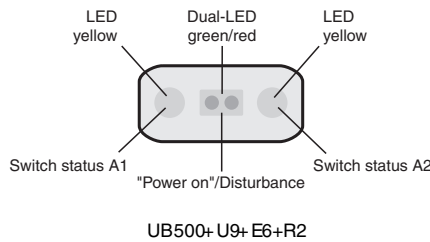
Diagrams

Characteristic response curves

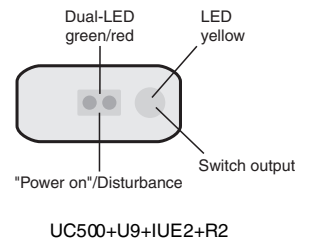


Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

LED-Window



LED-Window



Date of edition: 08/18/2005

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories



- Serial interface
- Synchronisation options
- Temperature compensation
- Absolute polarity reversal protection
- Parameterisable with ULTRA 2001
- 1 Analogue output, load-dependent voltage or current + switch output
UC3000+U9+IUE0+R2
UC3000+U9+IUE2+R2
- 2 independent switch outputs
UC3000+U9+E6+R2
UC3000+U9+E7+R2

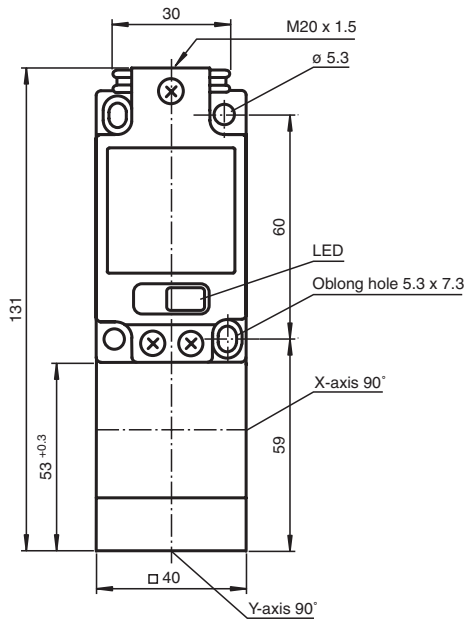


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

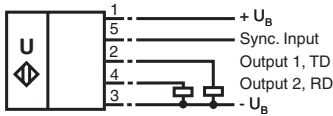
	Model number	UC3000+U9+ E6+ R2	UC3000+U9+ E7+ R2	UC3000+U9+ IUE0+R2	UC3000+U9+ IUE2+R2
Sensing range	300 ... 3000 mm	●	●	●	●
Unusable area	0 ... 300 mm	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 130 kHz	●	●	●	●
Response delay	for factory setting minimum (EM; NCNE): ≤80 ms (2 measuring cycles) default (EM, MXN, 5, 2): ≤160 ms (4 measuring cycles) dynamic (EM, DYN): ≤120 ms (3 measuring cycles)	●	●	●	●
LED yellow	switching state switch output switching state switch output 1 switching state switch output 2	●	●	●	●
LED red/green	permanently green: "Power on", flashes during standby operation red flashing: "Error", (e.g. background noise level too high)	●	●	●	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
No-load supply current	≤60 mA	●	●	●	●
Output type	1 switch output E0, npn, normally open/closed switchable 1 analogue output, load dependent: R _L ≤ 500 Ohm: current output 4 ... 20 mA R _L ≥ 1 kOhm: voltage output 2 ... 10 V	●	●	●	●
	1 switch output E5: prp NO/NC switchable 1 analogue output, load-dependent R _L ≤ 500 Ohm: current output 4 ... 20 mA R _L ≥ 1 kOhm: voltage output 2 ... 10 V				●
	2 switch outputs npn, normally open/closed		●		
	2 switch outputs prp, NONC	●			
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤3 V DC	●	●	●	●
Deviation of the characteristic curve	≤0,2 % of full-scale value			●	●
Resolution	<1 mm	●	●		
	≥0,172 mm			●	●
Repeat accuracy	≤0,1 % of full-scale value	●	●	●	●
Range hysteresis	≤1 % of the set operating distance	●	●	●	●
Temperature influence	≤2 %	●	●	●	●
Synchronisation	1 synchronous connection, bidirectional 0-level: -U _B ... (-U _B + 1 V), 1-level: (-U _B + 5 V) ... +U _B	●	●	●	●
Pulse length	≥100 μs	●	●	●	●
Pause length	≥2 ms	●	●	●	●
Synchronisation frequency	≤20 Hz, with external synchronisation ≤80 Hz, with external synchronisation	●	●		
Interface type	RS 232, 9600 bit/s, no parity, 8 data bits, 1 stop bit RS 232, 9600 bit/s, no parity, 8 data bits, 1 stop bit (S10 = OFF)	●	●		
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	terminal compartment, ≤2,5 mm ² conductor csa	●	●	●	●
Material					
Housing	PBT	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●	●
Mass	180 g	●	●	●	●

Date of edition: 08/18/2005

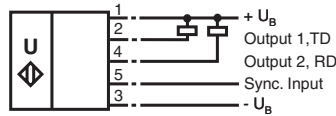


Electrical connection

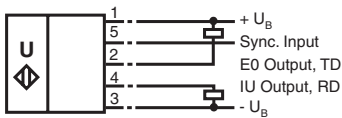
Standard symbol/Connection:
(Version E6, npn)



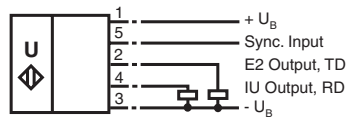
Standard symbol/Connection:
(Version E7, npn)



Standard symbol/Connection:
(Version IUE0, npn)

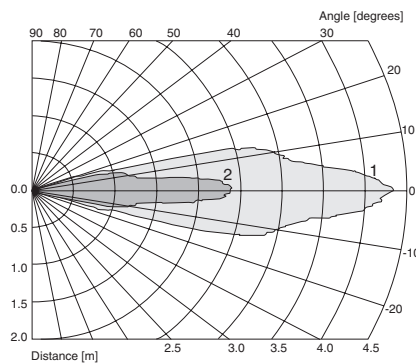


Standard symbol/Connection:
(Version IUE2, npn)



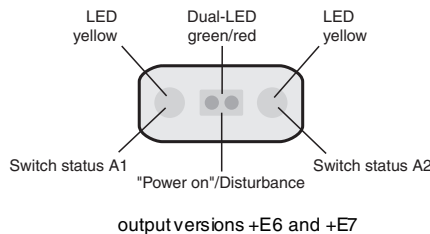
Diagrams

Characteristic response curves

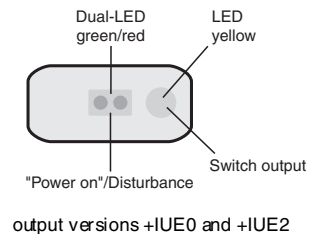


Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

LED-Window



LED-Window



Date of edition: 08/18/2005

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Ultrasonic sensor

UJ3000+U1+8B+RS



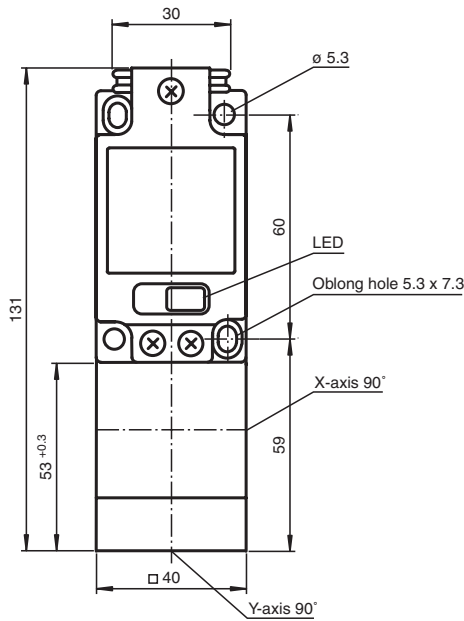
- 8 bit output
- Absolute polarity reversal protection
- Test input
- Fault output
- Serial interface
- Parameterisable with ULTRA 2001



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

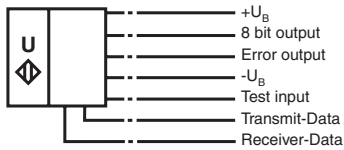
Technical Data

	Model number	UJ3000+U1+8B+RS
Sensing range	300 ... 3000 mm	●
Unusable area	0 ... 300 mm	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 130 kHz	●
Response delay	static 4: ≤ 280 ms (factory setting) static 1: ≤ 70 ms dynamic: ≤ 100 ms	●
LED red/green	green LED: Power on red LED, flashing at 2 Hz: error (high level of external noise)	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 90 mA	●
Output type	8 bit output for outputting object distance, prp 1 fault output, prp NC	●
Rated operational current	20 mA, short-circuit/overload protected	●
Voltage drop	U _e - 4 V	●
Resolution	11 mm, (corresponding to 1 LSB)	●
Repeat accuracy	11 mm, (corresponding to 1 LSB)	●
Range hysteresis	11 mm, (corresponding to 1 LSB)	●
Temperature influence	0,17 %/K	●
Input type	1 test input, (-U _B + 5 V) up to +U _B , ≤ 100 kOhm	●
Interface type	RS 232, 9600 bits, no parity, 8 data bits, 1 stop bit	●
Standards	EN 60947-5-2	●
Ambient temperature	-10 ... 50 °C (263 ... 323 K)	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●
Protection degree	IP65	●
Connection	2 m, cable, 14 x 0.14 mm ² , cast terminal compartment	●
Material		
Housing	PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	290 g	●



Electrical connection

Standard symbol/Connection:



Legend:

- +U_B = Brown Test input = Grey/Pink
- U_B = Blue Error output = Red/Blue

Interface:

Receiver-Data RD = White/Green

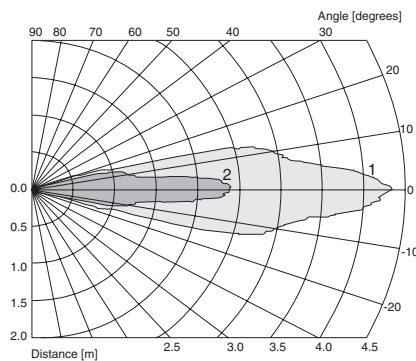
Transmit-Data TD = Brown/Green

8 bit output:

- A1 = White A2 = Yellow
- A3 = Pink A4 = Red
- A5 = Green A6 = Grey
- A7 = Black A8 = Violet

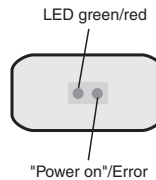
Diagrams

Characteristic response curves



Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

LED-Window



Date of edition: 08/18/2005

- Series -12GM
- Series -18GK/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories



- High switching frequency
- Complementary outputs
- Absolute polarity reversal protection
- Adjustable sensitivity



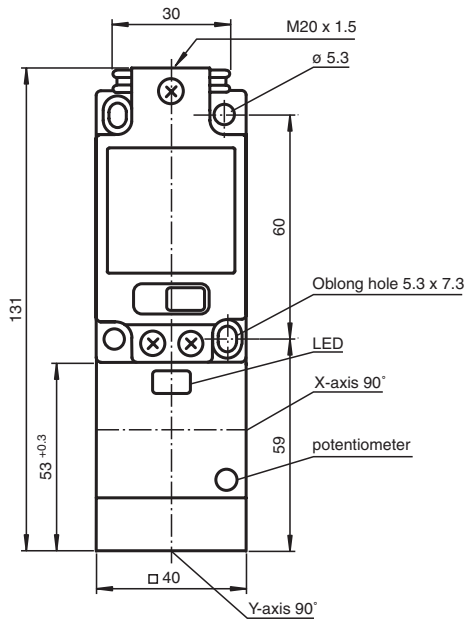
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

Model number

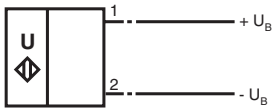
UBE6000-U1+SA2

Sensing range	0 ... 6000 mm	●
Transducer frequency	approx. 130 kHz	●
Operating range	0 ... 6000 mm	●
Reference target	receiver	●
LED yellow	switching state (receiver only)	●
LED green	Emitter: "Power on" mains ON Receiver: "Power on" mains ON	●
LED red	LED on continuously: strong signal LED 2 Hz flashing: multiple reflections	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
Power consumption	Emitter: ≤ 1,5 W Receiver: ≤ 1 W	●
Output type	Receiver: Complementary output stage 200 mA, Short-circuit/overload protected	●
Voltage drop	Receiver: U _B - 3 V	●
Switching frequency	≤ 30 Hz	●
Standards	EN 60947-5-2	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●
Protection degree	IP65	●
Connection	terminal compartment, ≤ 2,5 mm ² conductor csa	●
Housing	PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	180 g each sensor	●

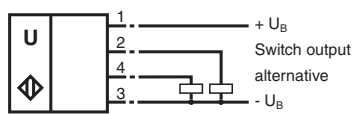


Electrical connection

Standard symbol / Connection:
Emitter

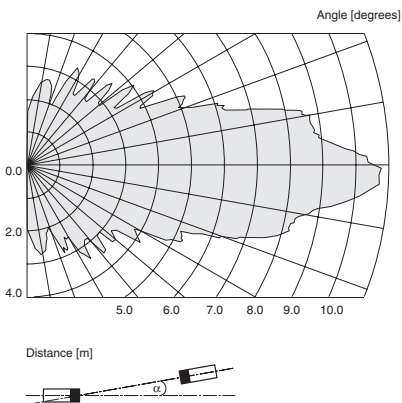


Standard symbol / Connection:
Transceiver

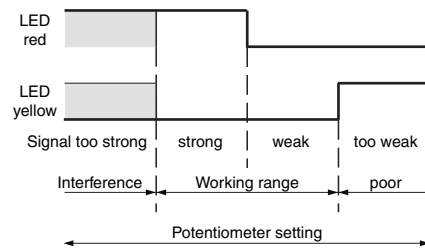


Diagrams

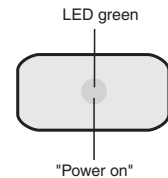
Characteristic response curves



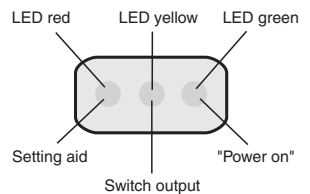
Indicating/operating means



LED-Window



LED-Window-Receiver



Date of edition: 08/18/2005

Series -12GM
 Series -18GK/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories



- Separate evaluation
- With temperature sensor
- Direct detection mode



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

		Model number	UB500-U9+H3	UB3000-U9+H3
Sensing range	300 ... 3000 mm			
	60 ... 500 mm		●	●
Unusable area	0 ... 300 mm ¹⁾			●
	0 ... 60 mm ¹⁾		●	
Standard target plate	100 mm x 100 mm		●	●
Transducer frequency	approx. 130 kHz		●	●
	approx. 380 kHz		●	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}		●	●
No-load supply current	≤ 30 mA		●	●
Output type	1 pulse output for temperature 1-level: > 4 V (100 μA), 0-level: < 0.5 V (100 μA) 1 pulse output for echo propagation time 1-level: ≥ U _B - 3 V (< 10 mA), 0-level: ≤ 1 V (100 μA)		●	●
Temperature influence	the echo propagation time: ≤ 0,17 % / K the echo propagation time: 0,17 % / K		●	●
Pulse length	10 μs/K + timer pulse, synchronisation with the timer pulse		●	●
Input type	1 pulse input for transmitter pulse, activation through open collector npn < 1 V: emitter active, > 4 V: emitter inactive		●	●
Pulse length	10 ... 100 μs (typ. 50 μs) ²⁾		●	
	20 ... 500 μs (typ. 300 μs) ²⁾			●
Pause length	≥ 50 x pulse length		●	●
Standards	EN 60947-5-2		●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)		●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)		●	●
Protection degree	IP65		●	●
Connection	terminal compartment, ≤ 2,5 mm ² conductor csa		●	●
Material				
Housing	PBT		●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam		●	●
Mass	180 g		●	●

Description of the sensor functions

The sensing range is determined in the downstream evaluation electronics (e. g. the units UH3-KHD2-4E5, or UH3-KHD2-4I).
The sensing range is determined on the basis of the echo time of a transmitted pulse in pulse-echo mode.

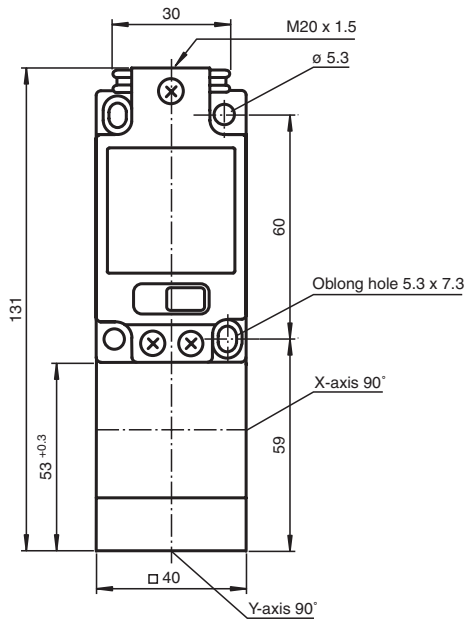
Temperature compensation

A temperature pulse is available at the temperature output for external temperature compensation. It is synchronous to the externally applied clock pulse and has the length T_{Temp}, calculated as follows:

$$T_{Temp} [\mu s] = T_{Takt} [\mu s] + T [K] \times 10 \mu s / K$$

Put into the formula the temperature in Kelvin and the clock time in the unit μs.

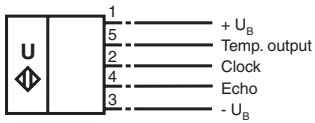
- 1) The unusable area (blind range) BR depends on the pulse duration.
The unusable area reaches a minimum with the shortest pulse duration.
- 2) The sensors detection range depends on the pulse duration.
With pulse duration < typical pulse duration, the sensors detection range may be reduced.



Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

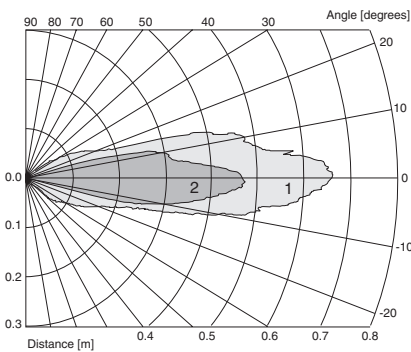
Electrical connection

Standard symbol/Connection:



Diagrams

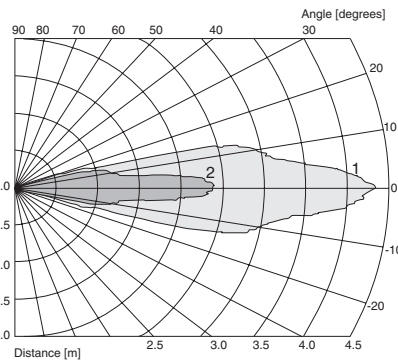
Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

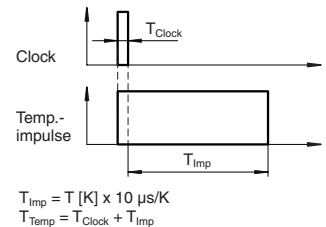
UB500+...

Characteristic response curves



Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB3000+...



$$T_{Imp} = T [K] \times 10 \mu s/K$$

$$T_{Temp} = T_{Clock} + T_{Imp}$$

Date of edition: 08/18/2005

UC500+U9+E6+R2

Description of the sensor functions

The outputs of the sensor can be used in two different operating modes: Switching mode with 2 adjustable switching points, or RS 232 mode (RS 232, 9600, n, 8, 1). Select the operating mode with DIP switch 10. The switching points are set with the DIP switches 1-4 and 5-8 (see table). Switch 9 is used to set the close or open function of the switch outputs. For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 Interface".

Caution: Ensure that DIP switch S10 is correctly set before connecting the RS 232 interface.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level > 1 s will result in the standby operation of the sensor (green LED). Several functions are available:

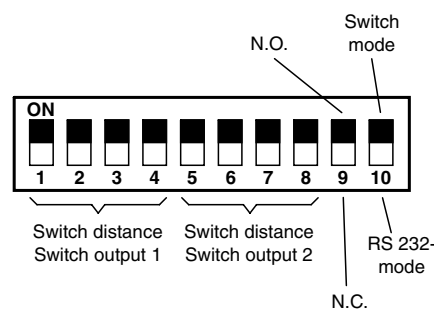
- Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
 - Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
 - The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.
- The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

Adjustment of the evaluation window via coding switch in terminal compartment

Switch 1 2 3 4	NDE [mm]	Switch 5 6 7 8	FDE [mm]
0 0 0 0	60	0 0 0 0	70
0 0 0 1	80	0 0 0 1	90
0 0 1 0	100	0 0 1 0	110
0 0 1 1	125	0 0 1 1	135
0 1 0 0	150	0 1 0 0	160
0 1 0 1	175	0 1 0 1	185
0 1 1 0	200	0 1 1 0	210
0 1 1 1	230	0 1 1 1	240
1 0 0 0	260	1 0 0 0	270
1 0 0 1	290	1 0 0 1	300
1 0 1 0	320	1 0 1 0	330
1 0 1 1	350	1 0 1 1	360
1 1 0 0	385	1 1 0 0	395
1 1 0 1	420	1 1 0 1	430
1 1 1 0	455	1 1 1 0	465
1 1 1 1	490	1 1 1 1	500

1 \triangle ON, 0 \triangle OFF

DIP Switches in Terminal Compartment



UC500+U9+IUE2+R2

Description of the sensor functions

The outputs of the sensor can be used in two different operating modes: Switching/analogue mode, or RS 232 mode (RS 232, 9600, n, 8, 1). Select the operating mode with DIP switch 10. The limits of the IU ramp are set with the DIP switches 1-4 and 5-8 (see table). Switch 9 is used to set the close or open function of the switch output. For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 Interface".

Caution: Ensure that DIP switch S10 is correctly set before connecting the RS 232 interface.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level > 1 s will result in the standby operation of the sensor (green LED). Several functions are available:

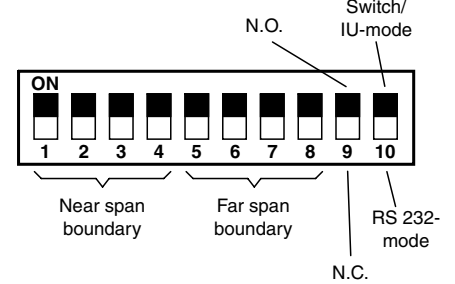
- Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
 - Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
 - The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.
- The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

Adjustment of the evaluation window via coding switch in terminal compartment

Switch 1 2 3 4	NDE [mm]	Switch 5 6 7 8	FDE [mm]
0 0 0 0	60	0 0 0 0	60
0 0 0 1	80	0 0 0 1	80
0 0 1 0	100	0 0 1 0	100
0 0 1 1	125	0 0 1 1	125
0 1 0 0	150	0 1 0 0	150
0 1 0 1	175	0 1 0 1	175
0 1 1 0	200	0 1 1 0	200
0 1 1 1	230	0 1 1 1	230
1 0 0 0	260	1 0 0 0	260
1 0 0 1	290	1 0 0 1	290
1 0 1 0	325	1 0 1 0	325
1 0 1 1	360	1 0 1 1	360
1 1 0 0	395	1 1 0 0	395
1 1 0 1	430	1 1 0 1	430
1 1 1 0	465	1 1 1 0	465
1 1 1 1	500	1 1 1 1	500

1 $\hat{=}$ ON, 0 $\hat{=}$ OFF

DIP Switches in Terminal Compartment:
Adjustment of the Target Window



near span boundary < distant limit \Rightarrow IU-rising slope
 near span boundary > distant limit \Rightarrow IU-declining slope
 near span boundary = distant limit \Rightarrow IU-switch point

Switch point switch output:
 (NDE + FDE)/2 (Preconfiguration)

UC3000+U9+... output versions +E6+R2 and +E7+R2

Description of the sensor functions

The outputs of the sensor can be used in two different operating modes: Switching mode with 2 adjustable switching points, or RS 232 mode (RS 232, 9600, n, 8, 1). Select the operating mode with DIP switch 10. The switching points are set with the DIP switches 1-4 and 5-8 (see table). Switch 9 is used to set the close or open function of the switch outputs.

For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 Interface".

Caution: Ensure that DIP switch S10 is correctly set before connecting the RS 232 interface.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level > 1 s will result in the standby operation of the sensor (green LED).

Several functions are available:

- Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
- Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
- The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

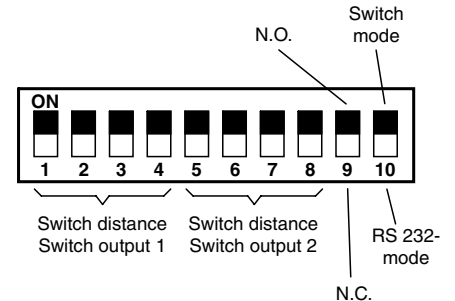
The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

Adjustment of the evaluation window via coding switch in terminal compartment

Switch 1 2 3 4	NDE [mm]	Switch 5 6 7 8	FDE [mm]
0 0 0 0	300	0 0 0 0	400
0 0 0 1	450	0 0 0 1	550
0 0 1 0	600	0 0 1 0	700
0 0 1 1	750	0 0 1 1	850
0 1 0 0	900	0 1 0 0	100
0 1 0 1	1050	0 1 0 1	1150
0 1 1 0	1200	0 1 1 0	1300
0 1 1 1	1350	0 1 1 1	1450
1 0 0 0	1500	1 0 0 0	1600
1 0 0 1	1700	1 0 0 1	1800
1 0 1 0	1900	1 0 1 0	2000
1 0 1 1	2100	1 0 1 1	2200
1 1 0 0	2300	1 1 0 0	2400
1 1 0 1	2500	1 1 0 1	2600
1 1 1 0	2700	1 1 1 0	2800
1 1 1 1	2900	1 1 1 1	3000

1 $\hat{=}$ ON, 0 $\hat{=}$ OFF

DIP Switches in Terminal Compartment



Date of edition: 08/17/20 05

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VariKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

UC3000+U9+... , output versions +IUE0+R2 and +IUE2+R2

Description of the sensor functions

The outputs of the sensor can be used in two different operating modes: Switching/analogue mode, or RS 232 mode (RS 232, 9600, n, 8, 1). Select the operating mode with DIP switch 10. The limits of the IU ramp are set with the DIP switches 1-4 and 5-8 (see table). Switch 9 is used to set the close or open function of the switch output. For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 Interface".

Caution: Ensure that DIP switch S10 is correctly set before connecting the RS 232 interface.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level > 1 s will result in the standby operation of the sensor (green LED). Several functions are available:

- Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
- Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
- The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

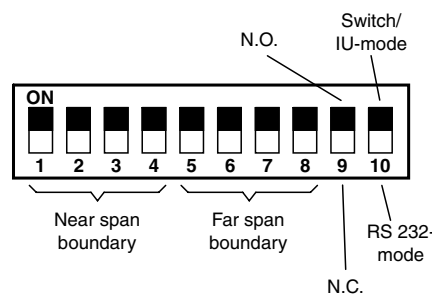
The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

Adjustment of the evaluation window via coding switch in terminal compartment

Switch 1 2 3 4	NDE [mm]	Switch 5 6 7 8	FDE [mm]
0 0 0 0	300	0 0 0 0	300
0 0 0 1	450	0 0 0 1	450
0 0 1 0	600	0 0 1 0	600
0 0 1 1	750	0 0 1 1	750
0 1 0 0	900	0 1 0 0	900
0 1 0 1	1050	0 1 0 1	1050
0 1 1 0	1200	0 1 1 0	1200
0 1 1 1	1400	0 1 1 1	1400
1 0 0 0	1600	1 0 0 0	1600
1 0 0 1	1800	1 0 0 1	1800
1 0 1 0	2000	1 0 1 0	2000
1 0 1 1	2200	1 0 1 1	2200
1 1 0 0	2400	1 1 0 0	2400
1 1 0 1	2600	1 1 0 1	2600
1 1 1 0	2800	1 1 1 0	2800
1 1 1 1	3000	1 1 1 1	3000

1 \triangle ON, 0 \triangle OFF

**DIP Switches in Terminal Compartment:
Adjustment of the Target Window**



near span boundary < distant limit \Rightarrow IU-rising slope
 near span boundary > distant limit \Rightarrow IU-declining slope
 near span boundary = distant limit \Rightarrow IU-switch point

Switch point switch output:
 (NDE + FDE)/2 (Preconfiguration)

UJ3000+U1+8B+RS

Description of the sensor functions

The measurement of the distance is realised using the echo time of the ultrasonic pulse. The μ processor calculates the distance on the basis of the echo time and the speed of sound. The distance is directly issued in parallel in the form of an 8-bit data word.

A serial interface (RS 232, 9 600, n, 8, 1) is also available.

The output functions can be set up flexibly. For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 interface".

In the event of interference that the sensor cannot handle, the sensor goes into failure mode in that the failure output opens and the 8-bit output retains the most recent measuring value. The dual LED goes into the red flashing state.

A 1 level at the test input causes the 8-bit output to switch from 00000000 to 11111111 and back every 200 ms.

UBE6000+U1+SA2

Description of the sensor function

This system consists of one emitter and one receiver, which are operating independent of each other.

For the handling of the wide dynamic range the sensitivity of the receiver can be adjusted by means of a built in potentiometer.

The red LED can be used as adjustment aid.

System adjustment

Mount emitter and receiver in the desired distance. The detection area has to be unobstructed. Switch on supply voltage and turn potentiometer counter-clockwise until the red LED lights up permanently (strong signal). In case of short distance application, it may happen, that the red LED flashes at a frequency of approx. 2 Hz caused by multi sound reflections between the sensors transducers. In that case, turn the potentiometer clockwise, until the red LED goes off.

Make sure, that the receivers output is not activated (yellow LED off) when the detection area is unobstructed.

In the strong working range, the system is highly resistant against any interference. Only large objects can be detected.

In the weak working range the systems resistance against interference is decreased, but the system is highly sensitive even to detect small objects.

UB...+U9+H3

Description of the sensor functions

The sensing range is determined in the downstream evaluation electronics (e. g. the units UH3-KHD2-4E5, or UH3-KHD2-4I). The sensing range is determined on the basis of the echo time of a transmitted pulse in pulse-echo mode.

Temperature compensation

A temperature pulse is available at the temperature output for external temperature compensation. It is synchronous to the externally applied clock pulse and has the length T_{Temp} calculated as follows:

$$T_{Temp}[\mu s] = T_{akt}[\mu s] + T[K] \times 10 \mu s / K$$

Put into the formula the temperature in Kelvin and the clock time in the unit μs .

- 1) The unusable area (blind range) BR depends on the pulse duration. The unusable area reaches a minimum with the shortest pulse duration.
- 2) The sensors detection range depends on the pulse duration. With pulse duration < typical pulse duration, the sensors detection range may be reduced.

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VariKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -FP

Notes

Series -12GM
Series -16GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Subject to reasonable modifications due to technical advances.

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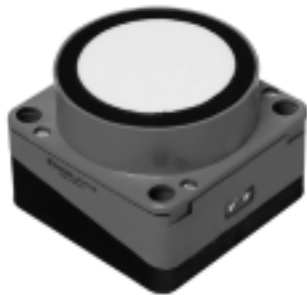
Courtesy of Steven Engineering, Inc. • 230 Ryan Way, South San Francisco, CA 94080-6370 • General Inquiries: (800) 670-4183 • www.stevenengineering.com

Series -FP



Model number	Description	Detection range	Page
UC6000-FP-E6-R2-P5 UC6000-FP-E7-R2-P5	2 switching outputs + RS 232 interface	6000 mm	116
UC6000-FP-IUE0-R2-P5 UC6000-FP-IUE2-R2-P5	1 analogue output + 1 switching output + RS 232 interface	6000 mm	116
UJ4000-FP-E2-P1	1 switching output	4000 mm	118
UJ6000-FP-8B-RS	8 bit parallel interface + RS 232 interface	4000 mm	120
UB1000+FP1+E6	Reflex sensor with switching output	1000 mm	122
UB6000-FP-H3	For external control/evaluation unit	6000 mm	124

For detailed function description, see page 126



- Serial interface
- Synchronisation options
- Temperature compensation
- Absolute polarity reversal protection
- Parameterisable with ULTRA 2001
- 1 analogue output, load-dependent voltage or current + 1 switch output
UC6000-FP-IUE0-R2-P5
UC6000-FP-IUE2-R2-P5
- 2 independent switch outputs
UC6000-FP-E6-R2-P5
UC6000-FP-E7-R2-P5
- UC6000-FP-E7-R2-P5

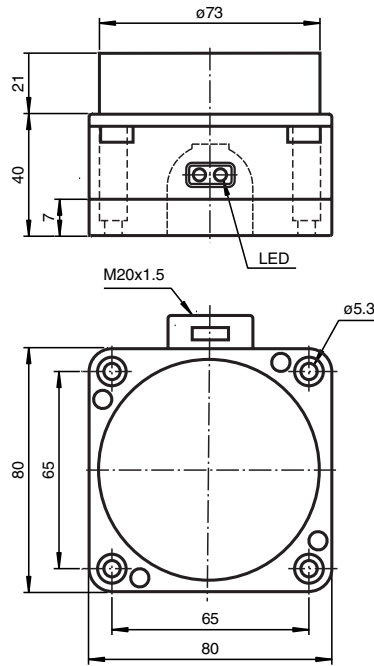


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

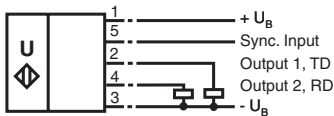
	Model number	UC6000-FP-E6-R2-P5	UC6000-FP-E7-R2-P5	UC6000-FP-IUE0-R2-P5	UC6000-FP-IUE2-R2-P5
Sensing range	800 ... 6000 mm	●	●	●	●
Unusable area	0 ... 800 mm	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 65 kHz	●	●	●	●
Response delay	for factory setting minimal (EM, NONE): ≤180 ms (2 measuring cycles) default (EM, MXN, 5, 2): ≤360 ms (4 measuring cycles) dynamic (EM, DYN): ≤270 ms (3 measuring cycles)	●	●	●	●
LED yellow	switching state switch output			●	●
	switching state switch output 1	●	●		
	switching state switch output 2				
LED red/green	permanently green: "Power on", flashes during standby operation red flashing: "Error", (e.g. background noise level too high)	●	●	●	●
Operating voltage	15 ... 30 V DC, ripple 10 % _{SS} 20 ... 30 V DC, ripple 10 % _{SS}	●	●		
No-load supply current	≤ 60 mA	●	●	●	●
Output type	1 switch output E0, npn, normally open/closed switchable 1 analogue output, load dependent: R _L ≤ 500 Ohm; current output 4 ... 20 mA, R _L ≥ 1 kOhm; voltage output 2 ... 10 V			●	
	1 switch output E5: prp NO/NC switchable 1 analogue output, load-dependent R _L ≤ 500 Ohm; current output 4 ... 20 mA, R _L ≥ 1 kOhm; voltage output 2 ... 10 V				●
	2 switch outputs npn, normally open/closed		●		
	2 switch outputs prp, NONC	●			
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●
Voltage drop	≤ 3 V DC	●	●	●	●
Range hysteresis	≤ 1 % of the set operating distance	●	●	●	●
Deviation of the characteristic curve	≤ 0,2 %	●	●	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●	●	●
Resolution	< 1 mm	●	●		
	depending on the set evaluation range: 0,172 mm, if evaluation range < 705 mm, evaluation range [mm]/ 3296, when evaluation range > 705 mm			●	●
Temperature influence	≤ 2 %	●	●	●	●
Synchronisation	1 synchronous connection, bidirectional 0-level: -U _B ... (-U _B + 1 V), 1-level: (-U _B + 5 V) ... +U _B	●	●	●	●
Pulse length	≥ 100 μs	●	●	●	●
Pause length	≥ 2 ms	●	●	●	●
Synchronisation frequency	≤ 10 Hz, with external synchronisation	●	●	●	●
Interface type	RS 232, 9600 bits, no parity, 8 data bits, 1 stop bit RS 232, 9600 bits, no parity, 8 data bits, 1 stop bit (S10 = OFF)	●	●		
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	terminal compartment, ≤ 2,5 mm ² conductor csa	●	●	●	●
Material					
Housing	PBT	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●	●
Mass	320 g	●	●	●	●

Date of edition: 08/18/2005

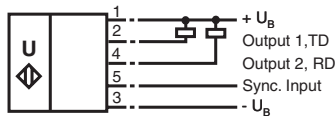


Electrical connection

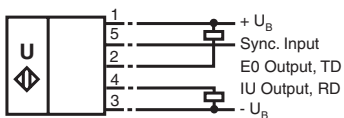
Standard symbol/Connection:
(Version E6, npn)



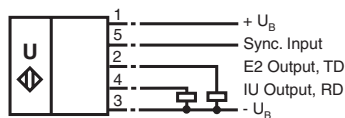
Standard symbol/Connection:
(Version E7, npn)



Standard symbol/Connection:
(Version IUE0, npn)

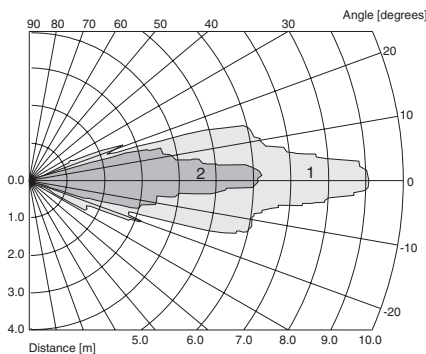


Standard symbol/Connection:
(Version IUE2, npn)



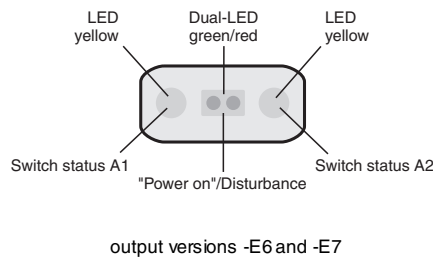
Diagrams

Characteristic response curves

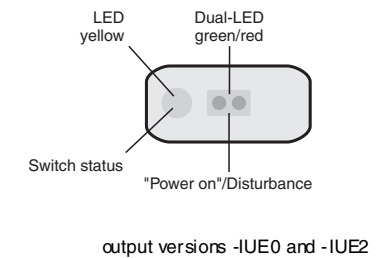


Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

LED-Window

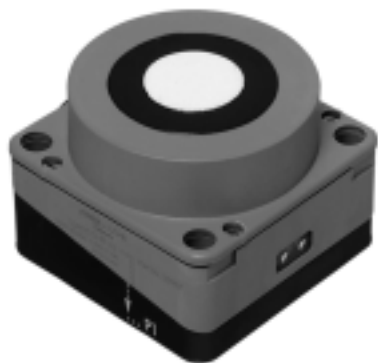


LED-Window



Date of edition: 08/18/2005

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories



- Absolute polarity reversal protection
- 1 switch output
- TEACH-IN input
- Reflex sensor function



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

Model number

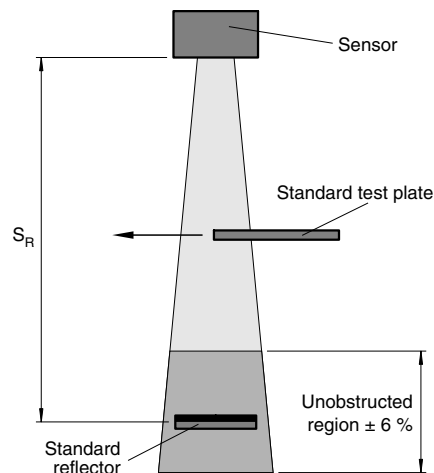
UJ4000-FP-E2-P1

Series -F12			
Series -F42	Sensing range	1000 ... 4000 mm	●
	Operating range	0 ... reflector distance s_R - 6 %	●
	Standard target plate	100 mm x 100 mm	●
	Transducer frequency	approx. 85 kHz	●
	Response delay	≤ 900 ms, for TEACH-IN with $+U_e$ ≤ 150 ms for TEACH-IN with $-U_e$	●
Series -F43	LED yellow	switching state switch output	●
	LED red/green	green LED: Power on red LED, flashing at 2 Hz: error (reflector incorrectly positioned)	●
Series -F54	Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
	No-load supply current	≤ 90 mA	●
	Output type	1 switch output, NOprp	●
	Rated operational current	200 mA, short-circuit/overload protected	●
	Voltage drop	≤ 3 V	●
	Input type	1 TEACH-IN input, operating distance 1: $-U_B$... $(-U_B + 2V)$, operating distance 2: $(+U_B - 2V)$... $+U_B$	●
Series -F64	Standards	EN 60947-5-2	●
	Ambient temperature	-10 ... 50 °C (263 ... 323 K)	●
	Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
	Protection degree	IP65	●
	Connection	terminal compartment, ≤ 2.5 mm ² conductor csa	●
Series -D1	Material		
	Housing	PBT	●
	Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
	Mass	320 g	●

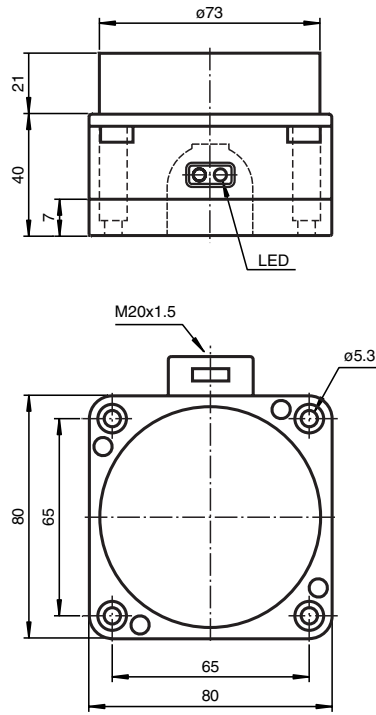
Description of the sensor functions

The measurement of the distance is realised using the echo time of ultrasonic pulses. After installation, the transmitter is taught with the distance to a stationary reflector and stores this value by shorting the TEACH-IN input with $-U_B$ or $+U_B$ (see Electrical Connection). The distance determined in this manner is retained for as long as required when the power supply is shut off. If an interruption of the barrier by an object is determined during operation, switch output is closed.

If objects smaller than the standard measuring plate are to be detected, the reflector must also be reduced in size accordingly. This may result in a reduction of range.

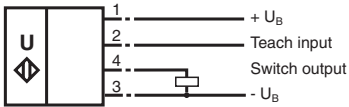


Date of edition: 08/18/2005



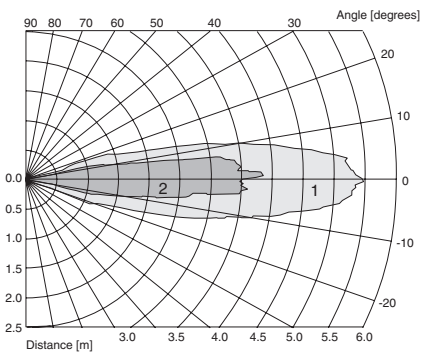
Electrical connection

Standard symbol/Connection:



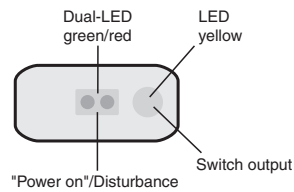
Diagrams

Characteristic response curves



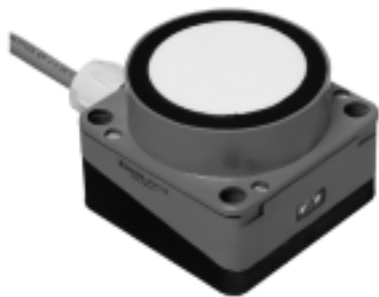
Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

LED-Window



Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



- 8 bit output
- Absolute polarity reversal protection
- Test input
- Fault output
- Serial interface
- Parameterisable with ULTRA 2001



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UJ6000-FP-8B+RS
Sensing range	800 ... 6000 mm	●
Unusable area	0 ... 800 mm	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 65 kHz	●
Response delay	static 4: ≤ 720 ms (factory setting) static 1: ≤ 180 ms dynamic: ≤ 270 ms	●
LED red/green	green LED: Power on red LED, flashing at 2 Hz: error (high level of external noise)	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 90 mA	●
Output type	8 bit output for outputting object distance, prp 1 fault output, prp NC	●
Rated operational current	20 mA, short-circuit/overload protected	●
Voltage drop	≤ 4 V	●
Range hysteresis	21 mm, (corresponding to 1 LSB)	●
Repeat accuracy	21 mm, (corresponding to 1 LSB)	●
Resolution	21 mm, (corresponding to 1 LSB)	●
Temperature influence	0,17 %/K	●
Input type	1 test input, (-U _B + 5 V) up to +U _B , ≤ 100 kOhm	●
Interface type	RS 232, 9600 bits, no parity, 8 data bits, 1 stop bit	●
Standards	EN 60947-5-2	●
Ambient temperature	-10 ... 50 °C (263 ... 323 K)	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
Protection degree	IP65	●
Connection	2 m, cable, 14 x 0.14 mm ² , cast terminal compartment	●
Material		
Housing	PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	430 g	●

Description of the sensor functions

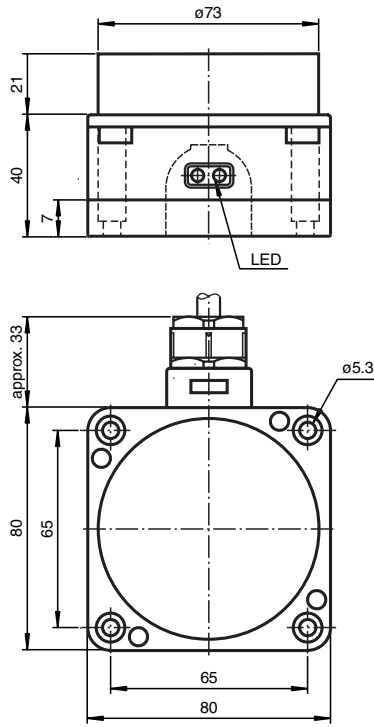
The measurement of the distance is realised using the echo time of the ultrasonic pulse. The μ processor calculates the distance on the basis of the echo time and the speed of sound. The distance is directly issued in parallel in the form of an 8-bit data word.

A serial interface (RS 232, 9 600, n, 8, 1) is also available.

The output functions can be set up flexibly. For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 interface".

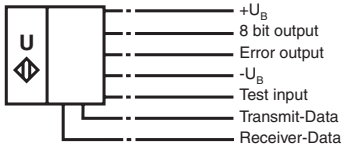
In the event of interference that the sensor cannot handle, the sensor goes into failure mode in that the failure output opens and the 8-bit output retains the most recent measuring value. The dual LED goes into the red flashing state.

A 1 level at the test input causes the 8-bit output to switch from 00000000 to 11111111 and back every 200 ms.



Electrical connection

Standard symbol/Connection:



Legend:

- +U_B = Brown Test input = Grey/Pink
- U_B = Blue Error output = Red/Blue

Interface:

Receiver-Data RD = White/Green

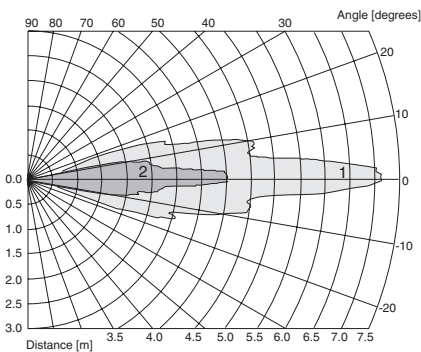
Transmit-Data TD = Brown/Green

8 bit output:

- A1 = White A2 = Yellow
- A3 = Pink A4 = Red
- A5 = Green A6 = Grey
- A7 = Black A8 = Violet

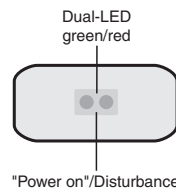
Diagrams

Characteristic response curves



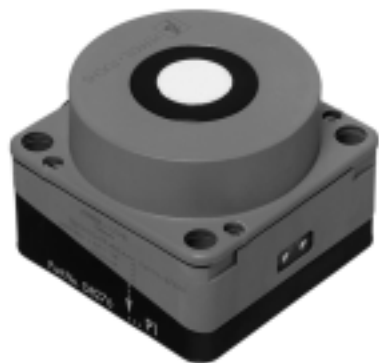
Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

LED-Window



Date of edition: 08/18/2005

- Series -12GM
- Series -18GK/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories



- Through-beam and direct detection modes
- 2 independent switch outputs
- 4 operating modes can be set



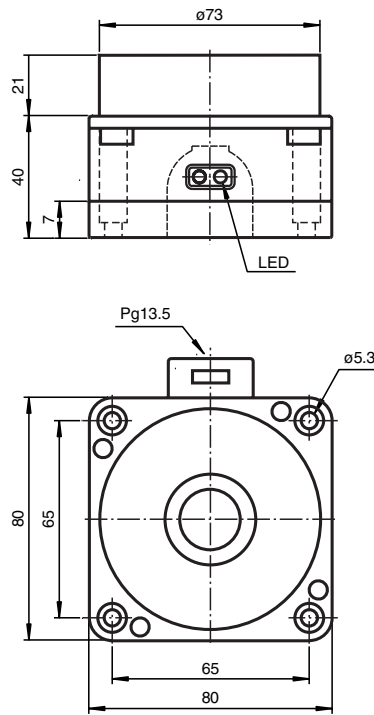
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UB1000+FP1+E6
Sensing range	200 ... 1000 mm	●
Unusable area	0 ... 200 mm	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 175 kHz	●
Response delay	≤ 100 ms	●
LED green	Power on	●
LED yellow	switch output 1 switch output 2	●
LED red	fault (due to external noise or incorrect adjustment)	●
DIP-switch	S9= ON/NO S9= OFF/ NC S10= ON/Window operation (barrier mode) S10= OF/independent switch points	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 90 mA	●
Output type	2 switch outputs prp, NONC	●
Rated operational current	200 mA, short-circuit/overload protected	●
Voltage drop	≤ 3 V DC	●
Range hysteresis	≤ 5 % of the set operating distance	●
Switching frequency	≤ 5 Hz	●
Repeat accuracy	≤ 1 %	●
Temperature influence	≤ 0,17 %/ K	●
Standards	EN 60947-5-2	●
Ambient temperature	-10 ... 50 °C (263 ... 323 K)	●
Storage temperature	-40 ... 85 °C (233 ... 353 K)	●
Protection degree	IP65	●
Connection	terminal compartment, ≤ 2,5 mm ² conductor csa	●
Material		
Housing	PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	338 g	●

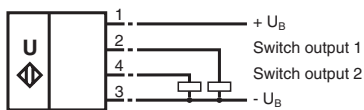
Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -DI
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Date of edition: 08/18/2005



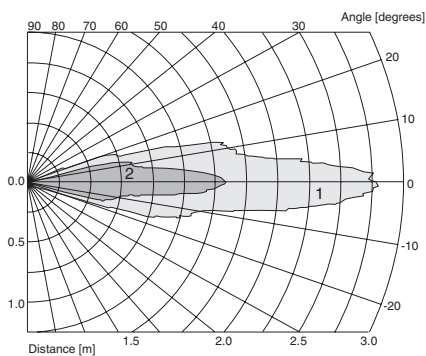
Electrical connection

Standard symbol/Connection:



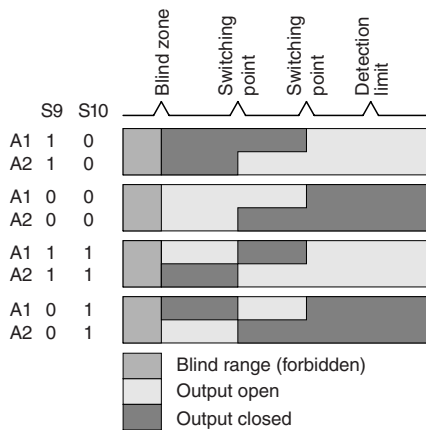
Diagrams

Characteristic response curves

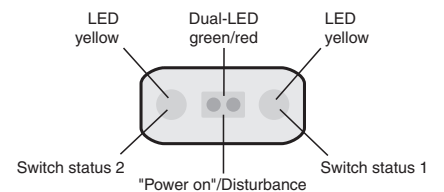


Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Output functions

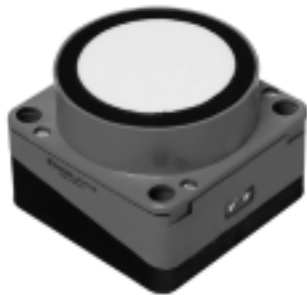


LED-Window



Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



- Separate evaluation
- With temperature sensor
- Direct detection mode



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UB6000-FP-H3
Sensing range	800 ... 6000 mm	●
Unusable area	0 ... 800 mm ¹⁾	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 65 kHz	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 30 mA	●
Output type	1 pulse output for temperature 1-level: > 4 V (100 μA), 0-level: < 0.5 V (100 μA) 1 pulse output for echo propagation time 1-level: ≥ U _B - 3 V (< 10 mA), 0-level: ≤ 1 V (100 μA)	●
Temperature influence	the echo propagation time: ≤ 0,17 % / K	●
Pulse length	10 μs/K + timer pulse, synchronisation with the timer pulse	●
Input type	1 pulse input for transmitter pulse, activation through open collector npn < 1 V: emitter active, > 4 V: emitter inactive	●
Pulse length	50 ... 700 μs (typ. 500 μs) ²⁾	●
Pause length	≥ 50 x pulse length	●
Standards	EN 60947-5-2	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●
Protection degree	IP65	●
Connection	terminal compartment, ≤ 2,5 mm ² conductor csa	●
Material		
Housing	PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	320 g	●

Description of the sensor functions

The sensing range is determined in the downstream evaluation electronics (e. g. the units UH3-KHD2-4E5, or UH3-KHD2-41). The sensing range is determined on the basis of the echo time of a transmitted pulse in pulse-echo mode.

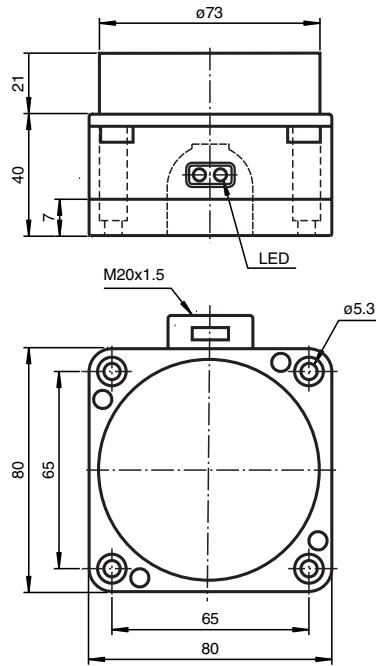
Temperature compensation

A temperature pulse is available at the temperature output for external temperature compensation. It is synchronous to the externally applied clock pulse and has the length T_{Temp}, calculated as follows:

$$T_{Temp} [\mu s] = T_{Akt} [\mu s] + T [K] \times 10 \mu s / K$$

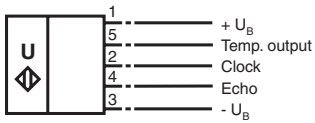
Put into the formula the temperature in Kelvin and the clock time in the unit μs.

- 1) The unusable area (blind range) BR depends on the pulse duration. The unusable area reaches a minimum with the shortest pulse duration.
- 2) The sensors detection range depends on the pulse duration. With pulse duration < typical pulse duration, the sensors detection range may be reduced.



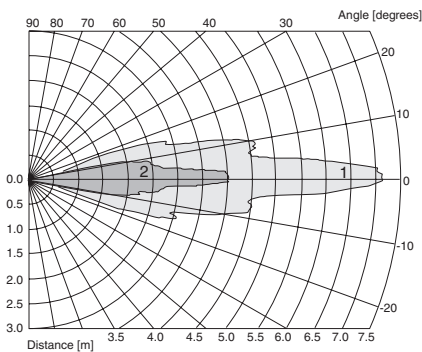
Electrical connection

Standard symbol/Connection:

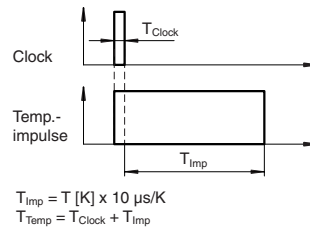


Diagrams

Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm



$T_{imp} = T [K] \times 10 \mu s/K$
 $T_{Temp} = T_{Clock} + T_{imp}$

Date of edition: 08/18/2005

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

UC6000-FP-...-R2-P5 , output versions -E6 and -E7

Description of the sensor functions

The outputs of the sensor can be used in two different operating modes: Switching mode with 2 adjustable switching points, or RS 232 mode (RS 232, 9600, n, 8, 1). Select the operating mode with DIP switch 10. The switching points are set with the DIP switches 1-4 and 5-8 (see table). Switch 9 is used to set the close or open function of the switch outputs.

For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 Interface".

Caution: Ensure that DIP switch S10 is correctly set before connecting the RS 232 interface.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level > 1 s will result in the standby operation of the sensor (green LED).

Several functions are available:

- Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
- Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
- The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

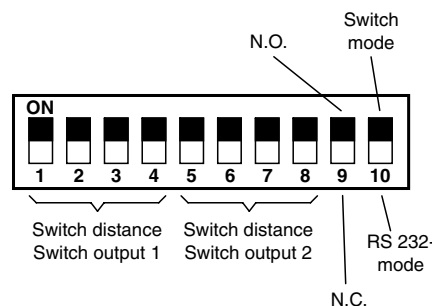
The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

Adjustment of the evaluation window via coding switch in terminal compartment

Switch 1 2 3 4	NDE [mm]	Switch 5 6 7 8	FDE [mm]
0 0 0 0	800	0 0 0 0	950
0 0 0 1	1100	0 0 0 1	1250
0 0 1 0	1400	0 0 1 0	1550
0 0 1 1	1700	0 0 1 1	1850
0 1 0 0	2000	0 1 0 0	2150
0 1 0 1	2300	0 1 0 1	2450
0 1 1 0	2600	0 1 1 0	2750
0 1 1 1	2900	0 1 1 1	3050
1 0 0 0	3200	1 0 0 0	3350
1 0 0 1	3500	1 0 0 1	3650
1 0 1 0	3800	1 0 1 0	4000
1 0 1 1	4200	1 0 1 1	4400
1 1 0 0	4600	1 1 0 0	4800
1 1 0 1	5000	1 1 0 1	5200
1 1 1 0	5400	1 1 1 0	5600
1 1 1 1	5800	1 1 1 1	6000

1 \uparrow ON, 0 \uparrow OFF

DIP Switches in Terminal Compartment



UC6000-FP-...-R2-P5 , output versions -IUE0 and -IUE2

Description of the sensor functions

The outputs of the sensor can be used in two different operating modes: Switching/analogue mode, or RS 232 mode (RS 232, 9600, n, 8, 1). Select the operating mode with DIP switch 10. The limits of the IU ramp are set with the DIP switches 1-4 and 5-8 (see table). Switch 9 is used to set the close or open function of the switch output.

For further information on the sensor's command set, please see the publication "Command Set for Ultrasonic Sensors with RS 232 Interface".

Caution: Ensure that DIP switch S10 is correctly set before connecting the RS 232 interface.

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. It can be synchronised by applying a square wave voltage. A falling edge leads to the transmission of a single ultrasonic pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level > 1 s will result in the standby operation of the sensor (green LED).

Several functions are available:

- Two to five sensors can be synchronised by interconnecting their synchronisation inputs. In this case, the sensors alternately transmit ultrasonic pulses.
- Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
- The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

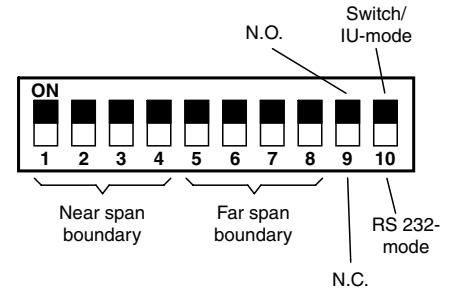
The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

Adjustment of the evaluation window via coding switch in terminal compartment

Switch 1 2 3 4	NDE [mm]	Switch 5 6 7 8	FDE [mm]
0 0 0 0	800	0 0 0 0	800
0 0 0 1	1100	0 0 0 1	1100
0 0 1 0	1400	0 0 1 0	1400
0 0 1 1	1700	0 0 1 1	1700
0 1 0 0	2000	0 1 0 0	2000
0 1 0 1	2300	0 1 0 1	2300
0 1 1 0	2650	0 1 1 0	2650
0 1 1 1	3000	0 1 1 1	3000
1 0 0 0	3350	1 0 0 0	3350
1 0 0 1	3700	1 0 0 1	3700
1 0 1 0	4050	1 0 1 0	4050
1 0 1 1	4400	1 0 1 1	4400
1 1 0 0	4800	1 1 0 0	4800
1 1 0 1	5200	1 1 0 1	5200
1 1 1 0	5600	1 1 1 0	5600
1 1 1 1	6000	1 1 1 1	6000

1 \triangle ON, 0 \triangle OFF

DIP Switches in Terminal Compartment:
Adjustment of the Target Window



near span boundary < distant limit \Rightarrow IU-rising slope
 near span boundary > distant limit \Rightarrow IU-declining slope
 near span boundary = distant limit \Rightarrow IU-switch point

Switch point switch output:
 (NDE + FDE)/2 (Preconfiguration)

UB1000+FP1+E6

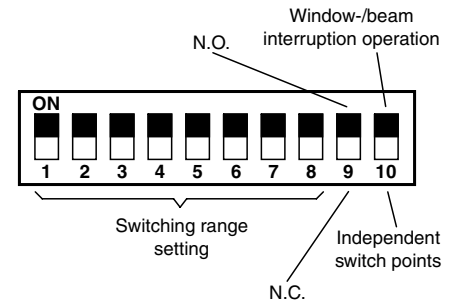
Description of the sensor functions

The sensor is suitable for direct-detection mode as well as beam-interruption mode. The functions of the outputs can be set with switches S9 and S10 in accordance with the following table.

Switch	Switching range
S1	200 ... 300 mm
S2	300 ... 400 mm
S3	400 ... 500 mm
S4	500 ... 600 mm
S5	600 ... 700 mm
S6	700 ... 800 mm
S7	800 ... 900 mm
S8	900 ... 1000 mm

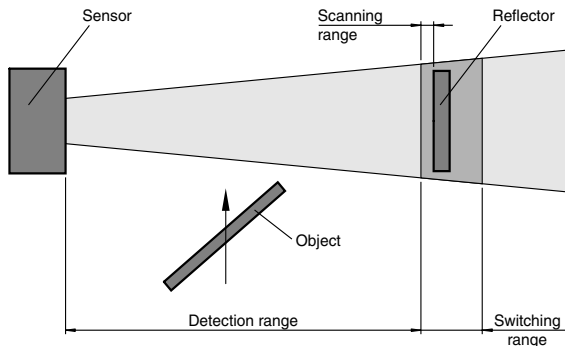
A continuous switching range must be selected. When operating with independent switching points, A1 switches the upper limit and A2 the lower limit of the switching range.

DIP Switches in Terminal Compartment



Barrier mode

In barrier mode, primarily the range up to objects used as reflector will be evaluated (e. g. machine part). Objects entering the range between the sensor and reflector are detected. This includes objects of a strongly sound-absorbent nature and objects positioned at an angle to the sensor's active axis. In this case, no echo reaches the receiver. If the sound is reflected by an object, the reflection will have a different echo time from the regular reflector echo. The sensor detects the object on the basis of the shorter echo time or lack of an echo while in barrier mode.



For use as a barrier, set the close function (S9 = 1) and window mode (barrier mode) (S10 = 1). The distance between the sensor and the reflector determines the switching range which must be set using a switch between S1 and S8. Only one switch may be set to "ON", resulting in a switching range of 100 mm.

The sensor and/or reflector should be adjusted in such a manner that output A1 is closed. The reflector should be positioned as closely as possible to the sensor's near switching range limit. The sensor works in direct-detection mode in the area between the reflector and the sensor's near limit. A reliable evaluation is therefore not possible.

If an interruption of the barrier by an object is determined during operation, switch output A1 is opened. Output A2 is not taken into consideration as a rule, as it also works in direct-detection mode rather than beam-interruption mode.

Date of edition: 08/17/20.05

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Series -F12

Notes

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Subject to reasonable modifications due to technical advances.

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Series -F12



Model number	Detection range	Page
UB800-F12P-EP-V15	800 mm	130

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Series
-12GM

Series
-18GM/-18GM

Series
-30GM

Series
VarKont

Series
-FP

Series
-F12

Series
-F42

Series
-F43

Series
-F54

Series
-F64

Series
-D1

Series
LUC

Double sheet
monitoring

Control units/
Power supplies

Accessories



- Push-pull output
- Selectable sound lobe width
- Synchronisation options
- Temperature compensation
- Very small unusable area




Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

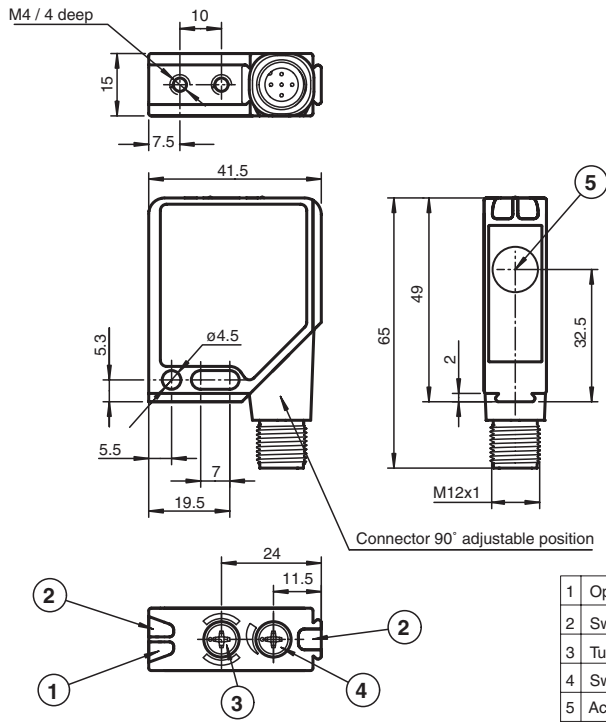
Technical Data

Model number

UB800-F12P-EP-V15

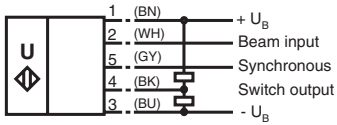
Series -F12			
Series -F42	Sensing range	30 ... 800 mm	●
	Adjustment range	50 ... 800 mm	●
	Unusable area	0 ... 30 mm	●
	Standard target plate	100 mm x 100 mm	●
Series -F43	Transducer frequency	approx. 310 kHz	●
	Response delay	approx. 100 ms	●
	LED green	Operating display	●
	LED yellow	switch output	●
	LED red	permanent: stop plate switch point adjuster flashing: error	●
Series -F54	Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●
	No-load supply current	≤ 25 mA	●
	Output type	Push-pull output, short-circuit proof, protected against reverse polarity	●
	Repeat accuracy	≤ 1 %	●
	Rated operational current	200 mA, short-circuit/overload protected	●
	Voltage drop	≤ 3 V	●
Series -F64	Switching frequency	max. 4 Hz	●
	Range hysteresis	1 % of the set operating distance	●
	Temperature influence	± 1,5 % of full-scale value	●
	Input type	1 input for sound lobe adjustment small sound beam: -U _B ... +1 V wide sound beam: +4 V ... +U _B or open input input impedance: > 4.7 kΩ switching delay: 1 s	●
Series -D1	Synchronisation	1 synchronous connection, bi-directional 0-level: -U _B ... +1 V 1-level: +4 V ... +U _B input impedance: > 12 kΩ synchronisation pulse: ≥ 100 μs, synchronisation interpulse period ≥ 2 ms	●
Series LUC	Common mode operation	≤ 45 Hz	●
	Multiplex operation	≤ 45/n Hz, n = number of sensors	●
Double sheet monitoring	UL	Power from Class 2 Power Source IND.CONTR.EQ.57M3 	●
	Standards	EN 60947-5-2	●
	Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●
	Storage temperature	-40 ... 85 °C (233 ... 368 K)	●
	Connection	connector V15 (M12 x 1), 5 pin	●
	Housing	Frame: die-cast zinc, nickel-plated Laterals: plastic PC, glass-fiber reinforced	●
Control units/ Power supplies	Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●
	Mass	60 g	●

Date of edition: 08/18/2005



Electrical connection

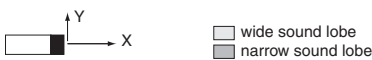
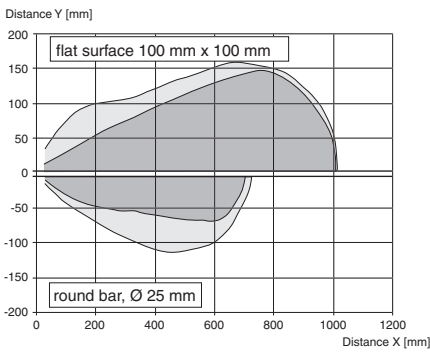
Standard symbol/Connections:
(version EP, pnp/npn)



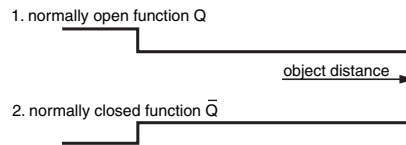
Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curve



Switching output function



Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

UB800-F12P-EP-V15

Synchronisation

To suppress mutual influence, the sensor is equipped with a synchronisation connection. If this is not activated, the sensor works with an internally generated clock. Synchronisation of multiple sensors can be achieved in the following ways.

External synchronisation

The sensor can be synchronized by external application of a square wave voltage. A synchronisation impulse on the synchronisation input leads to the execution of one measurement cycle. The impulse width must be larger than 100 μ s. The measurement cycle starts with the falling flank. A low level > 1 sec or an open synchronisation input puts the sensor in normal mode. A high level on the synchronisation input deactivates the sensor.

Two operational modes are possible

1. Multiple sensors are controlled using the same synchronisation signal. The sensors work in synch.
2. The synchronisation impulses are cyclically fed to only one sensor at a time. The sensors work in multiplex mode.

Autosynchronisation

The synchronisation connections of up to 10 sensors are connected together with the option of autosynchronisation. These sensors work in multiplex mode after power is switched on. The activation delay is increased corresponding to the number of synchronised sensors.

Note:

If the synchronisation option is not used, the synchronisation input should be connected to ground (0V), or the sensor connected using a V1 connector cable (4-pin).

Selection of beam characteristics

By switching the beam input, the activation characteristics of the ultrasound sensor can be selected. If the beam input is open or connected to $+U_B$, the sensor works with a wide ultrasonic cone. A beam input connected to $-U_B$ causes the sensor to work with a narrower ultrasonic cone. This setting is preferred when an object in the vicinity of the sensor is close to the ultrasonic beam, and should be suppressed. The characteristic of the ultrasonic cone can be changed during sensor operation. Switching the sound cone characteristics becomes active one second after the change to the signal level at the beam input.

Setting the switch point

The ultrasonic sensor possesses a switch output, of which the switching point can be set simply and precisely using the built-in 12-position potentiometer. Using the switch Q / \bar{Q} which is also easy to find on the upper side of the sensor, the effective direction of the switching output can be selected.

There are two different output functions which can be selected

1. one switching point, normally open
2. one switching point, normally closed

LED display

	Opening function (Q)	Closing function (Q)
LED green:	Power On	
LED yellow:	Switch state Object outside switching area, or no object	Switch state Object detected in switching area
LED red	Potentiometer for setting of switch point at "lim it"	
LED red flashing	Ultrasonic error	

Series -F42



UB...-F42-...V15
(top looker)



UB...-F42S-...V15
(side looker)

Model number	AC-version/ relay output	side looker	top looker	Detection range	Page
UB400-F42-UK-V95	●		●	400 mm	134
UB400-F42S-UK-V95	●	●			
UB500-F42-E4-V15			●	500 mm	136
UB500-F42S-E4-V15		●			
UB500-F42-E5-V15			●		
UB500-F42S-E5-V15		●			
UB500-F42-I-V15			●		
UB500-F42S-I-V15		●			
UB500-F42-U-V15			●		
UB500-F42S-U-V15		●			
UB500-F42-E6-V15			●		
UB500-F42S-E6-V15		●			
UB500-F42-E7-V15			●		
UB500-F42S-E7-V15		●			
UB1500-F42-UK-V95	●		●	1500 mm	138
UB1500-F42S-UK-V95	●	●			
UB2000-F42-E4-V15			●	2000 mm	140
UB2000-F42S-E4-V15		●			
UB2000-F42-E5-V15			●		
UB2000-F42S-E5-V15		●			
UB2000-F42-I-V15			●		
UB2000-F42S-I-V15		●			
UB2000-F42-U-V15			●		
UB2000-F42S-U-V15		●			
UB2000-F42-E6-V15			●		
UB2000-F42S-E6-V15		●			
UB2000-F42-E7-V15			●		
UB2000-F42S-E7-V15		●			
UB3000-F42-UK-V95	●		●	3000 mm	142
UB4000-F42-E4-V15			●	4000 mm	144
UB4000-F42-E5-V15			●		
UB4000-F42-I-V15			●		
UB4000-F42-U-V15			●		
UB4000-F42-E6-V15			●		
UB4000-F42-E7-V15			●		

For detailed function description, see page 146

Date of edition 08/18/20.05

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Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories



- Relay output for high power
- Extremely small unusable area
- TEACH-IN
- Interference suppression (adjustable width of sound cone in close range)
- Temperature compensation
- NO/NC selectable



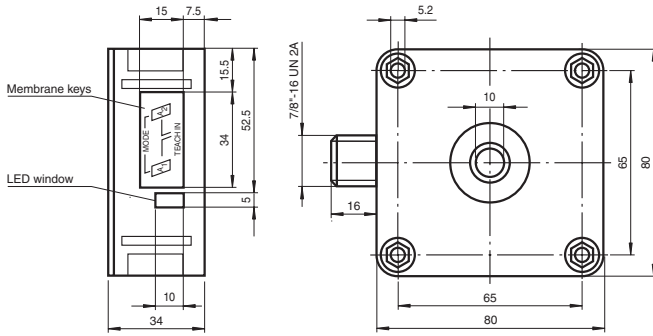
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

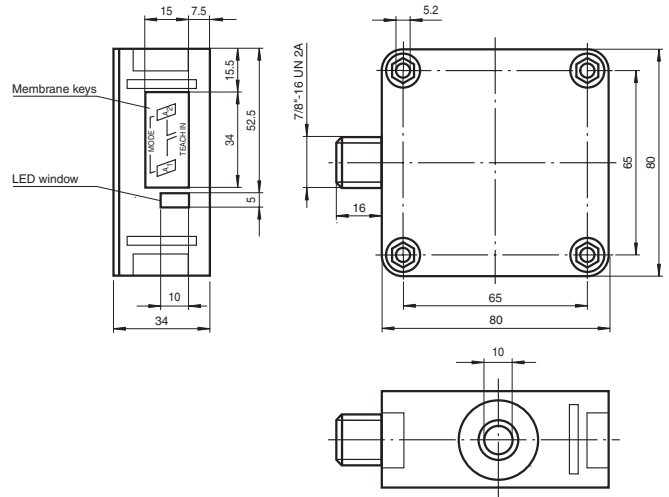
	Model number	UB400-F42-UK-V95	UB400-F42S-UK-V95
Sensing range	40 ... 400 mm	●	●
Adjustment range	50 ... 400 mm	●	●
Unusable area	0 ... 40 mm	●	●
Standard target plate	100 mm x 100 mm	●	●
Transducer frequency	approx. 390 kHz	●	●
Response delay	approx. 50 ms	●	●
LED green	permanently green: Power on	●	●
LED yellow	permanent: switching state switch output flashing: TEACH-IN function	●	●
LED red	normal operation: "fault" TEACH-IN function: no object detected	●	●
Operating voltage	20 ... V DC ... 253 V AC	●	●
No-load supply current	≤ 60 mA	●	●
Output type	1 relay output	●	●
Rated operational current	3 A	●	●
Switching frequency	≤ 8 Hz	●	●
Range hysteresis	1 % of the set operating distance	●	●
Repeat accuracy	≤ 0,5 % of switching point	●	●
Temperature influence	± 1 % of full-scale value	●	●
Standards	EN 60947-5-2	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●
Protection degree	IP65	●	●
Connection	Connector V95 (7/8"-16 UN2A), 5-pin	●	●
Housing	PBT	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●
Mass	260 g	●	●

Dimensions

UB400-F42(S)-UK-V95



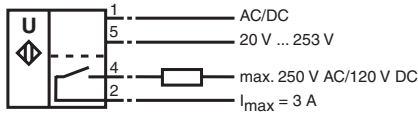
Housing version -F42



Housing version -F42S

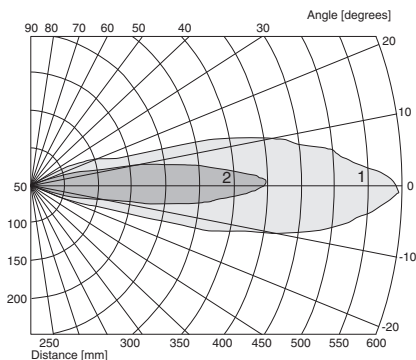
Electrical connection

Standard symbol/Connections:



Diagrams

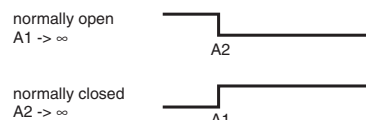
Characteristic response curves



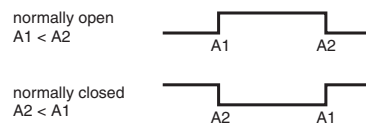
Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Possible operating modes

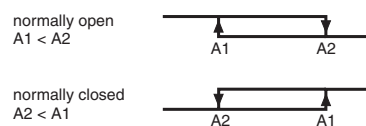
1. Switch point operation



2. Window operation



3. Hysteresis operation



4. Object presence detection mode

A1 -> ∞, A2 -> ∞: Sensor detects object presence within sensing range
Note A1 -> ∞, A2 -> ∞ means: cover sensor with hand or remove all objects from sensing range

Date of edition: 08/18/2005

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/ Power supplies
- Accessories



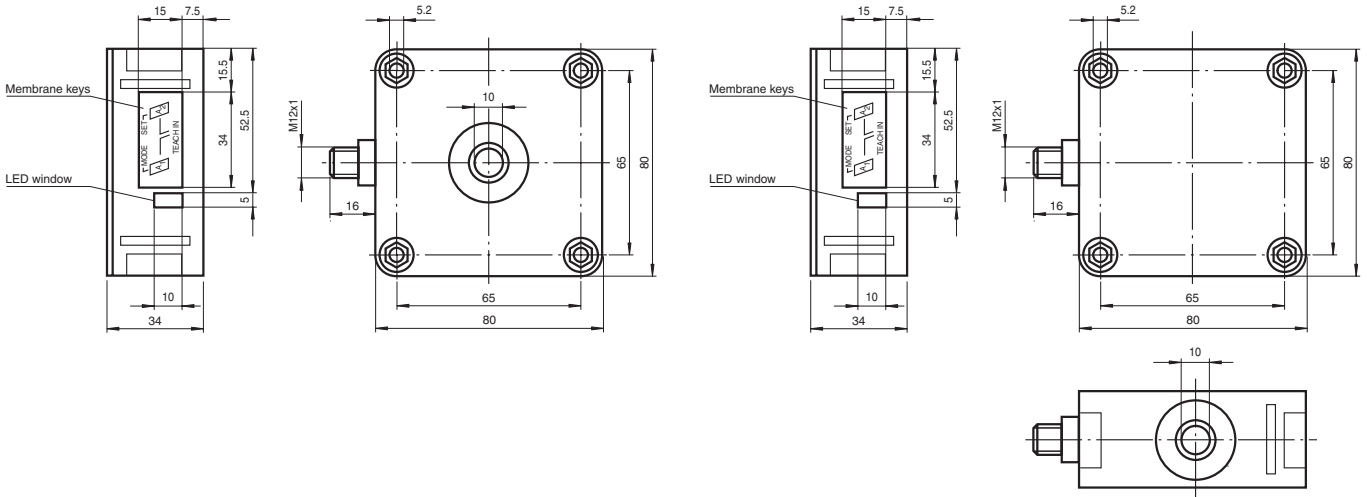
- **Extremely small unusable area**
- **TEACH-IN**
- **Interference suppression (adjustable width of sound cone in close range)**
- **Temperature compensation**
- **Synchronisation options**
- **1 Switch output**
UB500-F42(S)-E4-V15
UB500-F42(S)-E5-V15
- **2 independent switch outputs**
UB500-F42(S)-E6-V15
UB500-F42(S)-E7-V15
- **Analogue output 0 V ... 10 V**
UB500-F42(S)-U-V15
- **Analogue output 4 mA ... 20 mA**
UB500-F42(S)-I-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UB500-F42-E4-V15	UB500-F42S-E4-V15	UB500-F42-E5-V15	UB500-F42S-E5-V15	UB500-F42-I-V15	UB500-F42S-I-V15	UB500-F42-U-V15	UB500-F42S-U-V15	UB500-F42-E6-V15	UB500-F42S-E6-V15	UB500-F42-E7-V15	UB500-F42S-E7-V15
Sensing range	30 ... 500 mm	●	●	●	●	●	●	●	●	●	●	●	●
Adjustment range	50 ... 500 mm	●	●	●	●	●	●	●	●	●	●	●	●
Unusable area	0 ... 30 mm	●	●	●	●	●	●	●	●	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●	●	●	●	●	●	●	●	●
Transducer frequency	approx. 390 kHz	●	●	●	●	●	●	●	●	●	●	●	●
Response delay	approx. 50 ms	●	●	●	●	●	●	●	●	●	●	●	●
LED green	permanently green: Power on	●	●	●	●	●	●	●	●	●	●	●	●
LED yellow	permanent: object in evaluation range, flashing: TEACH-IN function permanent: switching state switch output, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●	●
LED yellow 1	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●	●
LED yellow 2	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●	●
LED red	normal operation: "fault", TEACH-IN function: no object detected	●	●	●	●	●	●	●	●	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10% _{ess} 17 ... 30 V DC, ripple 10% _{ess}	●	●	●	●	●	●	●	●	●	●	●	●
No-load supply current	≤ 50 mA	●	●	●	●	●	●	●	●	●	●	●	●
Output type	1 analogue output 0 ... 10 V 1 analogue output 4 ... 20 mA 1 switch output E4, rpn NONC, parameterisable 1 switch output E5, npn NONC, parameterisable 2 switch outputs npn, normally open/close selectable 2 switch outputs prp, normally open/close selectable	●	●	●	●	●	●	●	●	●	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●	●	●	●	●	●	●	●	●
Voltage drop	≤ 2.5 V	●	●	●	●	●	●	●	●	●	●	●	●
Switching frequency	≤ 8 Hz	●	●	●	●	●	●	●	●	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●	●	●	●	●	●	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●	●	●	●	●	●	●	●	●	●
Repeat accuracy	≤ 0.5 % of switching point ± 0.1 % of full-scale value	●	●	●	●	●	●	●	●	●	●	●	●
Resolution	0.2 mm at max. sensing range 0.2 mm for max. detection range	●	●	●	●	●	●	●	●	●	●	●	●
Load impedance	> 1 kOhm 0 ... 300 Ohm	●	●	●	●	●	●	●	●	●	●	●	●
Temperature influence	± 1 % of full-scale value	●	●	●	●	●	●	●	●	●	●	●	●
Synchronisation	bi-directional 0 level: -U _B ... +1 V 1 level: +4 V ... +U _B input impedance: > 12 kOhm synchronisation pulse: ≥ 100 µs, synchronisation interpulse period: ≥ 2 ms	●	●	●	●	●	●	●	●	●	●	●	●
Common mode operation	≤ 95 Hz	●	●	●	●	●	●	●	●	●	●	●	●
Multiplex operation	≤ 95/n Hz, n = number of sensors	●	●	●	●	●	●	●	●	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●	●	●	●	●	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●	●	●	●	●	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●	●	●	●	●	●	●	●	●
Protection degree	IP54	●	●	●	●	●	●	●	●	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●	●	●	●	●	●	●	●	●
Housing	ABS	●	●	●	●	●	●	●	●	●	●	●	●
Transducer	epoxy resin/hd low glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●	●	●	●	●	●	●	●	●
Mass	140 g	●	●	●	●	●	●	●	●	●	●	●	●

Date of edition: 08/18/2005

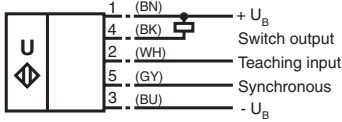


Housing version -F42

Housing version -F42S

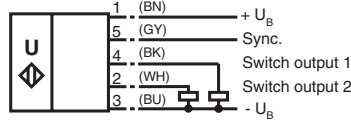
Electrical connection

Standard symbol/Connections:
(version E4, npn)



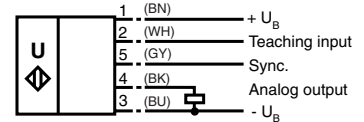
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E6, pnp)



Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version I)



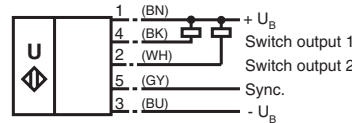
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E5, pnp)



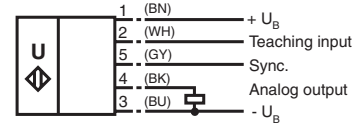
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E7, npn)



Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

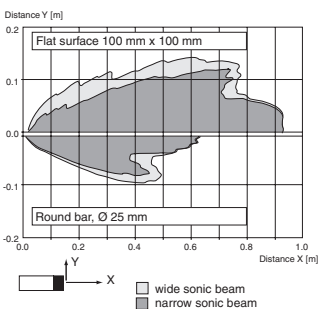
Diagrams

output versions -I and -U

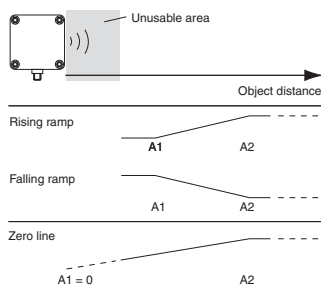
output versions -E6 and E7

output versions -E4 and -E5

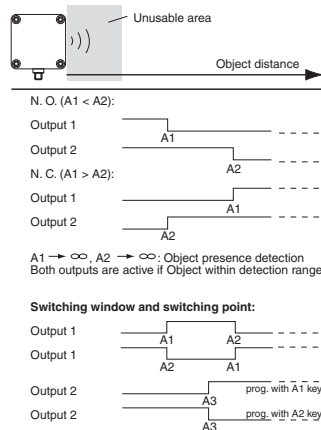
Characteristic response curve



Analogue output programming

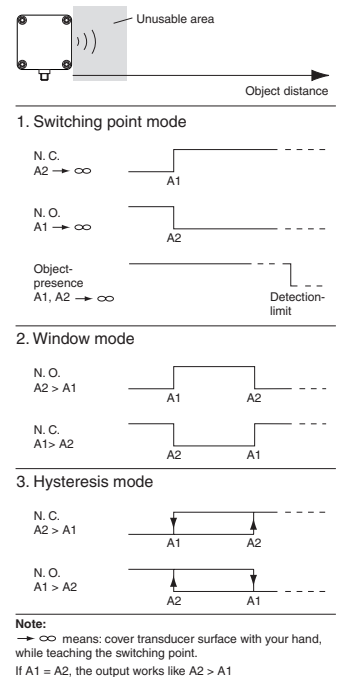


Switching output programming



Note:
→ ∞ means: cover transducer surface with your hand, while programming the output.
If A1 = A2, the output work like A1 < A2

Programmable operation modes



Note:
→ ∞ means: cover transducer surface with your hand, while teaching the switching point.
If A1 = A2, the output works like A2 > A1

Date of edition: 08/18/2005

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/Power supplies
 Accessories



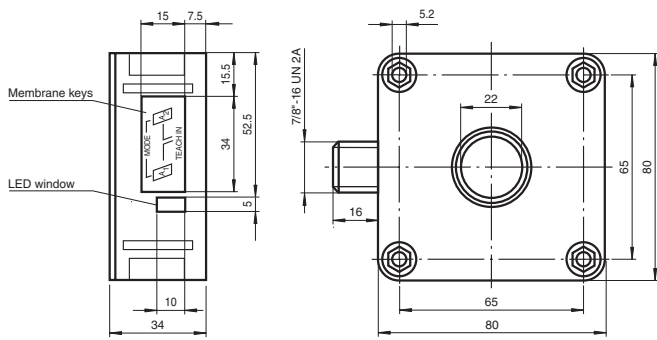
- Relay output for high power
- Extremely small unusable area
- TEACH-IN
- Interference suppression (adjustable width of sound cone in close range)
- Temperature compensation
- NO/NC selectable



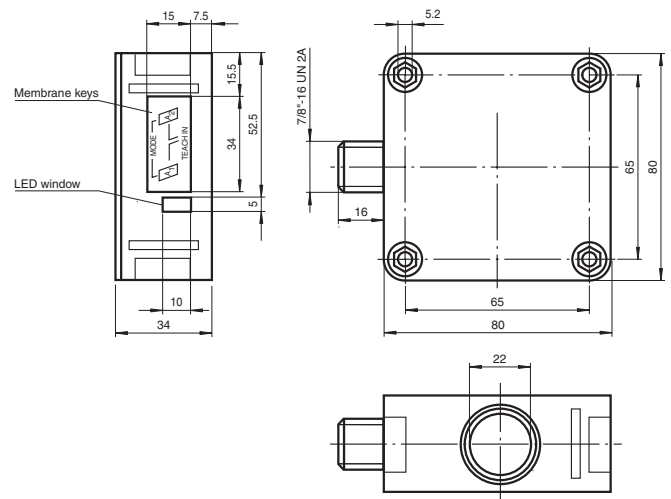
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UB1500-F42-UK-V95	UB1500-F42-S-UK-V95
Sensing range	70 ... 1500 mm	●	●
Adjustment range	90 ... 1500 mm	●	●
Unusable area	0 ... 70 mm	●	●
Standard target plate	100 mm x 100 mm	●	●
Transducer frequency	approx. 175 kHz	●	●
Response delay	approx. 150 ms	●	●
LED green	permanently green: Power on	●	●
LED yellow	permanent: switching state switch output flashing: TEACH-IN function	●	●
LED red	normal operation: "fault" TEACH-IN function: no object detected	●	●
Operating voltage	20 ... V DC ... 253 V AC	●	●
No-load supply current	≤ 60 mA	●	●
Output type	1 relay output	●	●
Rated operational current	3 A	●	●
Switching frequency	≤ 3 Hz	●	●
Range hysteresis	1 % of the set operating distance	●	●
Repeat accuracy	≤ 0,5 % of switching point	●	●
Temperature influence	± 1 % of full-scale value	●	●
Standards	EN 60947-5-2	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●
Protection degree	IP65	●	●
Connection	Connector V95 (7/8" -16 UN2A), 5-pin	●	●
Housing	PBT	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●
Mass	260 g	●	●



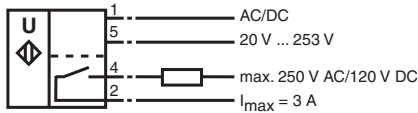
Housing version -F42



Housing version -F42S

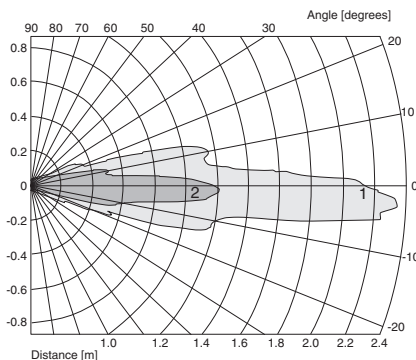
Electrical connection

Standard symbol/Connections:



Diagrams

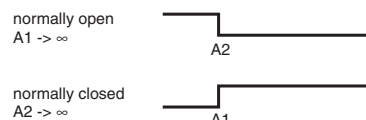
Characteristic response curves



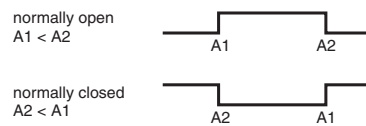
Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Possible operating modes

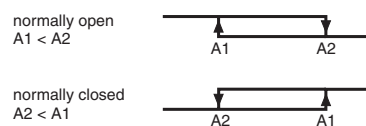
1. Switch point operation



2. Window operation



3. Hysteresis operation



4. Object presence detection mode

A1 -> ∞, A2 -> ∞: Sensor detects object presence within sensing range
Note A1 -> ∞, A2 -> ∞ means: cover sensor with hand or remove all objects from sensing range

Date of edition: 08/18/2005

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/ Power supplies
- Accessories



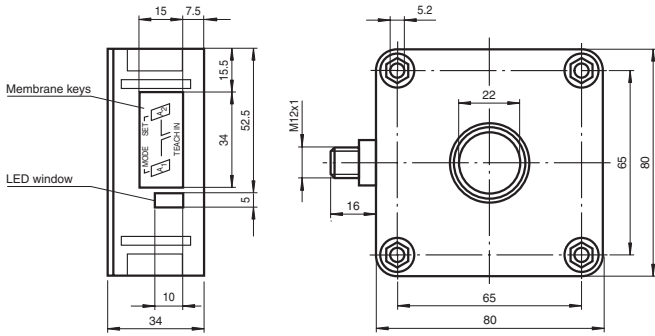
- **Extremely small unusable area**
- **TEACH-IN**
- **Interference suppression (adjustable width of sound cone in close range)**
- **Temperature compensation**
- **Synchronisation options**
- **1 Switch output**
UB2000-F42(S)-E4-V15
UB2000-F42(S)-E5-V15
- **2 independent switch outputs**
UB2000-F42(S)-E6-V15
UB2000-F42(S)-E7-V15
- **Analogue output 0 V ... 10 V**
UB2000-F42(S)-U-V15
- **Analogue output 4 mA ... 20 mA**
UB2000-F42(S)-I-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

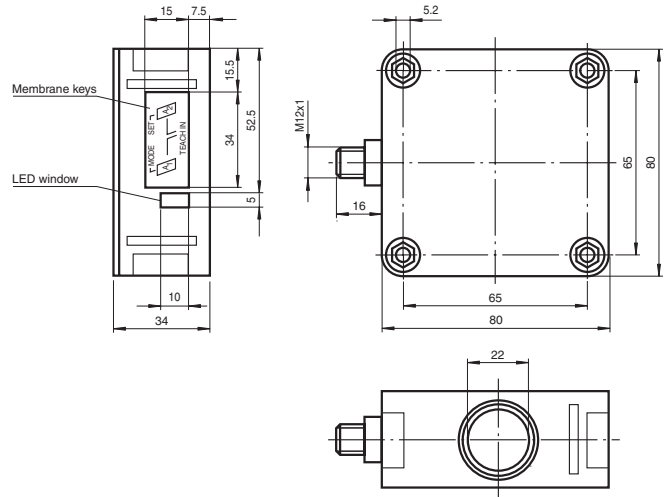
Technical Data

	Model number	UB2000-F42-E4-V15	UB2000-F42-S-E4-V15	UB2000-F42-E5-V15	UB2000-F42-S-E5-V15	UB2000-F42-I-V15	UB2000-F42-S-I-V15	UB2000-F42-U-V15	UB2000-F42-E6-V15	UB2000-F42-S-E6-V15	UB2000-F42-E7-V15	UB2000-F42-S-E7-V15
Sensing range	60 ... 2000 mm	●	●	●	●	●	●	●	●	●	●	●
Adjustment range	90 ... 2000 mm	●	●	●	●	●	●	●	●	●	●	●
Unusable area	0 ... 60 mm	●	●	●	●	●	●	●	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●	●	●	●	●	●	●	●
Transducer frequency	approx. 175 kHz	●	●	●	●	●	●	●	●	●	●	●
Response delay	approx. 150 ms	●	●	●	●	●	●	●	●	●	●	●
LED green	permanent: green: Power on	●	●	●	●	●	●	●	●	●	●	●
LED yellow	permanent: object in evaluation range, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●
LED yellow1	permanent: switching state switch output, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●
LED yellow2	permanent: switching state switch output 1, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●
LED red	permanent: switching state switch output 2, flashing: TEACH-IN function	●	●	●	●	●	●	●	●	●	●	●
Operating voltage	normal operation: "fault", TEACH-IN function: no object detected	●	●	●	●	●	●	●	●	●	●	●
	10 ... 30 V DC, ripple 10% _{SS}	●	●	●	●	●	●	●	●	●	●	●
	17 ... 30 V DC, ripple 10% _{SS}	●	●	●	●	●	●	●	●	●	●	●
No-load supply current	≤ 50 mA	●	●	●	●	●	●	●	●	●	●	●
Output type	1 analogue output 0 ... 10 V	●	●	●	●	●	●	●	●	●	●	●
	1 analogue output 4 ... 20 mA	●	●	●	●	●	●	●	●	●	●	●
	1 switch output E4, rpn NONC, parameterisable	●	●	●	●	●	●	●	●	●	●	●
	1 switch output E5, prp NONC, parameterisable	●	●	●	●	●	●	●	●	●	●	●
	2 switch outputs npn, normally open/close selectable	●	●	●	●	●	●	●	●	●	●	●
	2 switch outputs prp, normally open/close selectable	●	●	●	●	●	●	●	●	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●	●	●	●	●	●	●	●
Voltage drop	≤ 2,5 V	●	●	●	●	●	●	●	●	●	●	●
Switching frequency	≤ 2,7 Hz	●	●	●	●	●	●	●	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●	●	●	●	●	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●	●	●	●	●	●	●	●	●
Repeat accuracy	≤ 0,5 % of switching point	●	●	●	●	●	●	●	●	●	●	●
	± 0,1 % of full-scale value	●	●	●	●	●	●	●	●	●	●	●
Resolution	0,7 mm	●	●	●	●	●	●	●	●	●	●	●
Load impedance	> 1 kOhm	●	●	●	●	●	●	●	●	●	●	●
	0 ... 300 Ohm	●	●	●	●	●	●	●	●	●	●	●
Temperature influence	± 1 % of full-scale value	●	●	●	●	●	●	●	●	●	●	●
Synchronisation	bi-directional	●	●	●	●	●	●	●	●	●	●	●
	0 level: -U _B ... +1 V	●	●	●	●	●	●	●	●	●	●	●
	1 level: +4 V ... +U _B	●	●	●	●	●	●	●	●	●	●	●
	input impedance: > 12 kOhm	●	●	●	●	●	●	●	●	●	●	●
	synchronisation pulse: ≥ 100 μs, synchronisation inter-pulse period: ≥ 2 ms	●	●	●	●	●	●	●	●	●	●	●
Common mode operation	≤ 30 Hz	●	●	●	●	●	●	●	●	●	●	●
Multiplex operation	≤ 30 n Hz, n = number of sensors	●	●	●	●	●	●	●	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●	●	●	●	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●	●	●	●	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●	●	●	●	●	●	●	●
Protection degree	IP54	●	●	●	●	●	●	●	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●	●	●	●	●	●	●	●
Housing	ABS	●	●	●	●	●	●	●	●	●	●	●
Transducer	epoxy resin/hd low glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●	●	●	●	●	●	●	●
Mass	140 g	●	●	●	●	●	●	●	●	●	●	●

Date of edition: 08/18/2005



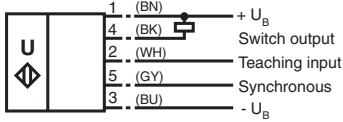
Housing version -F42



Housing version -F42S

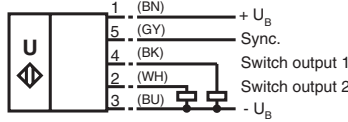
Electrical connection

Standard symbol/Connections:
(version E4, npn)



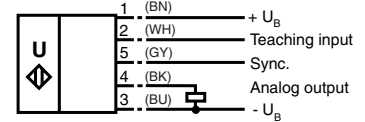
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E6, pnp)



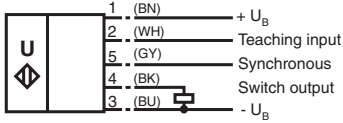
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version I)



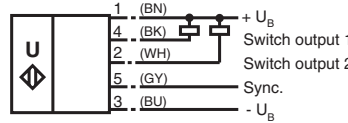
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E5, pnp)



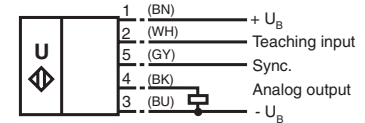
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version E7, npn)



Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections:
(version U)



Core colours in accordance with EN 60947-5-2.

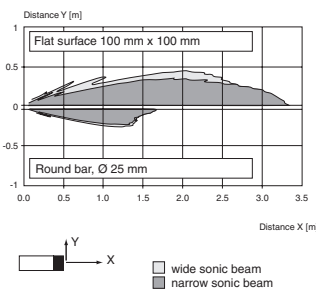
Diagrams

output versions -I and -U

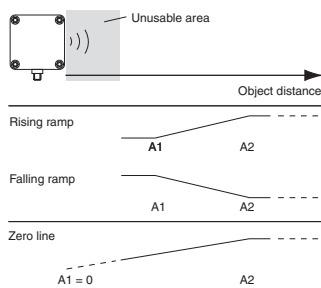
output versions -E6 and E7

output versions -E4 and -E5

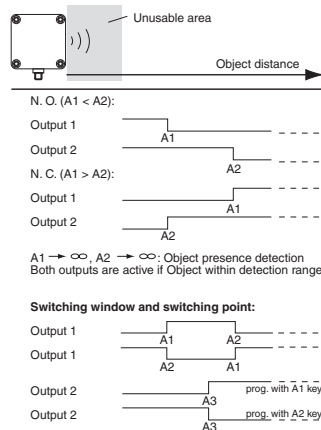
Characteristic response curve



Analogue output programming

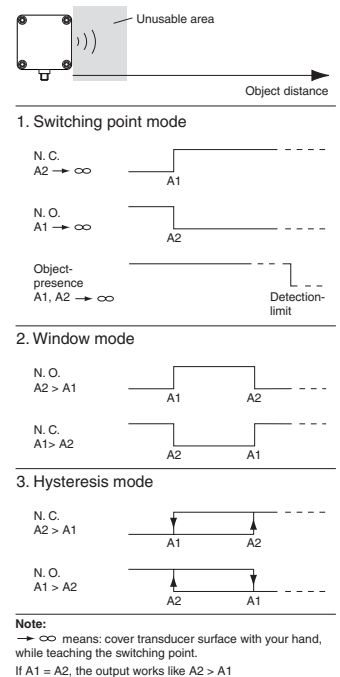


Switching output programming



Note:
→ ∞ means: cover transducer surface with your hand, while programming the output.
If A1 = A2, the output work like A1 < A2

Programmable operation modes



Note:
→ ∞ means: cover transducer surface with your hand, while teaching the switching point.
If A1 = A2, the output works like A2 > A1

Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories



- Relay output for high power
- Extremely small unusable area
- TEACH-IN
- Interference suppression (adjustable width of sound cone in close range)
- Temperature compensation
- NO/NC selectable



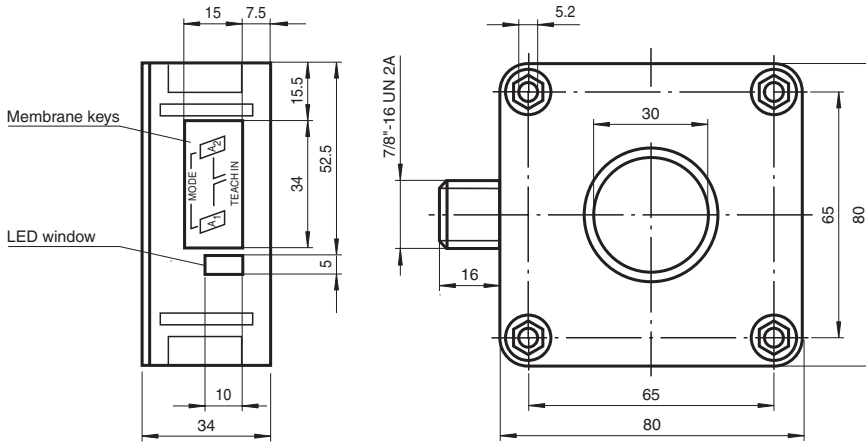
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

Model number

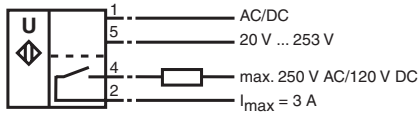
UB3000-F42-UK-V95

Series -F12			
Series -F42			
Series -F43			
Series -F54			
Series -F64			
Series -D1			
Series LUC			
Double sheet monitoring			
Control units/Power supplies			
Accessories			
	Sensing range	200 ... 3000 mm	●
	Adjustment range	240 ... 3000 mm	●
	Unusable area	0 ... 200 mm	●
	Standard target plate	100 mm x 100 mm	●
	Transducer frequency	approx. 85 kHz	●
	Response delay	approx. 325 ms	●
	LED green	permanently green: Power on	●
	LED yellow	permanent: switching state switch output flashing: TEACH-IN function	●
	LED red	normal operation: "fault" TEACH-IN function: no object detected	●
	Operating voltage	20 ... V DC ... 253 V AC	●
	No-load supply current	≤ 60 mA	●
	Output type	1 relay output	●
	Rated operational current	3 A	●
	Switching frequency	≤ 1,5 Hz	●
	Range hysteresis	1 % of the set operating distance	●
	Repeat accuracy	≤ 0,5 % of switching point	●
	Temperature influence	± 1 % of full-scale value	●
	Standards	EN 60947-5-2	●
	Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●
	Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
	Protection degree	IP65	●
	Connection	Connector V95 (7/8" -16 UN2A), 5-pin	●
	Housing	PBT	●
	Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●
	Mass	260 g	●



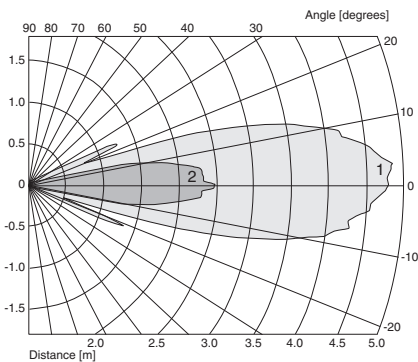
Electrical connection

Standard symbol/Connections:



Diagrams

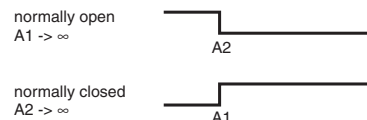
Characteristic response curves



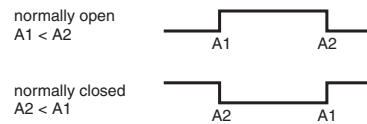
Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Possible operating modes

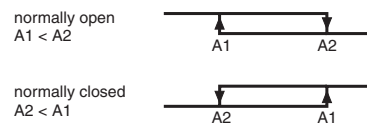
1. Switch point operation



2. Window operation



3. Hysteresis operation



4. Object presence detection mode

A1 -> ∞, A2 -> ∞: Sensor detects object presence within sensing range
Note A1 -> ∞, A2 -> ∞ means: cover sensor with hand or remove all objects from sensing range

Date of edition: 08/18/2005

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories



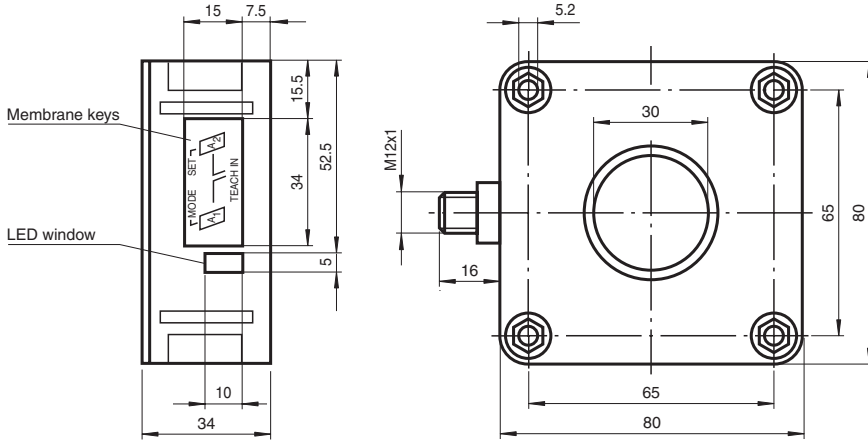
- Extremely small unusable area
- TEACH-IN
- Interference suppression (adjustable width of sound cone in close range)
- Temperature compensation
- Synchronisation options
- 1 Switch output
UB4000-F42-E4-V15
UB4000-F42-E5-V15
- 2 independent switch outputs
UB4000-F42-E6-V15
UB4000-F42-E7-V15
- Analogue output 0 V ... 10 V
UB4000-F42-U-V15
- Analogue output 4 mA ... 20 mA
UB4000-F42-I-V15

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UB4000-F42-E4-V15	UB4000-F42-E5-V15	UB4000-F42-E6-V15	UB4000-F42-E7-V15	UB4000-F42-I-V15	UB4000-F42-U-V15
Sensing range	200 ... 4000 mm	●	●	●	●	●	●
Adjustment range	240 ... 4000 mm	●	●	●	●	●	●
Unusable area	0 ... 200 mm	●	●	●	●	●	●
Standard target plate	100 mm x 100 mm	●	●	●	●	●	●
Transducer frequency	approx. 85 kHz	●	●	●	●	●	●
Response delay	approx. 325 ms	●	●	●	●	●	●
LED green	permanently green: Power on	●	●	●	●	●	●
LED yellow	permanent: object in evaluation range flashing: TEACH-IN function	●	●	●	●	●	●
LED yellow1	permanent: switching state switch output 1 flashing: TEACH-IN function	●	●	●	●	●	●
LED yellow2	permanent: switching state switch output 2 flashing: TEACH-IN function	●	●	●	●	●	●
LED red	normal operation: "fault" TEACH-IN function: no object detected	●	●	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS} 17 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●	●	●
No-load supply current	≤ 60 mA	●	●	●	●	●	●
Output type	1 analogue output 0 ... 10 V 1 analogue output 4 ... 20 mA 1 switch output E4, npn NO/NC, parameterisable 1 switch output E5, prp NO/NC, parameterisable 2 switch outputs npn, normally open/dose selectable 2 switch outputs prp, normally open/dose selectable	●	●	●	●	●	●
Rated operational current	200 mA, short-circuit/overload protected	●	●	●	●	●	●
Voltage drop	≤ 2,5 V	●	●	●	●	●	●
Switching frequency	≤ 1,2 Hz	●	●	●	●	●	●
Range hysteresis	1 % of the set operating distance	●	●	●	●	●	●
Deviation of the characteristic curve	± 1 % of full-scale value	●	●	●	●	●	●
Repeat accuracy	≤ 0,5 % of switching point ± 0,1 % of full-scale value	●	●	●	●	●	●
Resolution	0,7 mm	●	●	●	●	●	●
Load impedance	> 1 kOhm 0 ... 300 Ohm	●	●	●	●	●	●
Temperature influence	± 1 % of full-scale value	●	●	●	●	●	●
Synchronisation	bi-directional 0 level -U _B ...+1 V 1 level: +4 V...+U _B input impedance: > 12 kOhm synchronisation pulse ≥ 100 µs, synchronisation interpulse period ≥ 2 ms	●	●	●	●	●	●
Common mode operation	≤ 13 Hz	●	●	●	●	●	●
Multiplex operation	≤ 13/n Hz, n = number of sensors	●	●	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●	●	●	●	●	●
Protection degree	IP54	●	●	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●	●	●
Housing	ABS	●	●	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT	●	●	●	●	●	●
Mass	150 g	●	●	●	●	●	●

Date of edition: 08/18/2005



Series -12GM

Series -18GM/-18GM

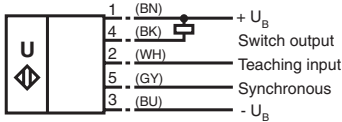
Series -30GM

Series VarKont

Series -FP

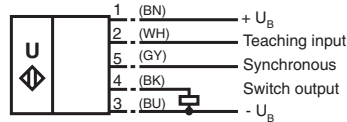
Electrical connection

Standard symbol/Connections: (version E4, npn)



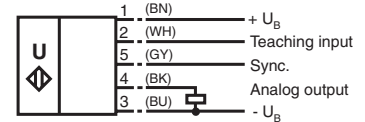
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections: (version E5, npn)



Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections: (version U)

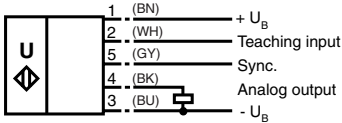


Core colours in accordance with EN 60947-5-2.

Series -F12

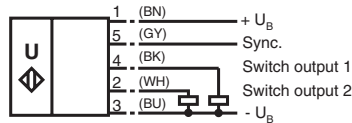
Series -F42

Standard symbol/Connections: (version I)



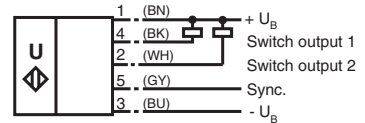
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections: (version E6, npn)



Core colours in accordance with EN 60947-5-2.

Standard symbol/Connections: (version E7, npn)



Core colours in accordance with EN 60947-5-2.

Series -F43

Series -F54

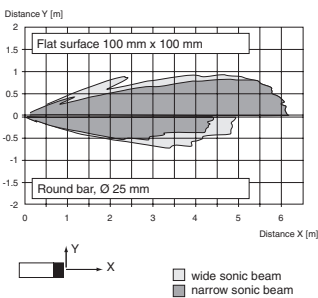
Diagrams

output versions -I and -U

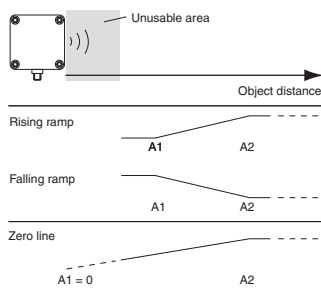
output versions -E6 and E7

output versions -E4 and -E5

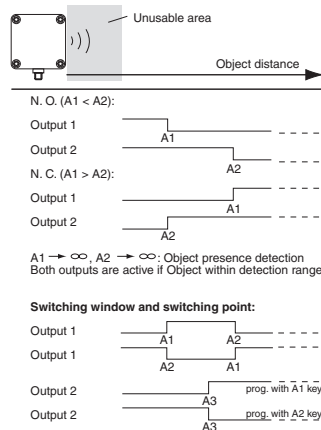
Characteristic response curve



Analogue output programming

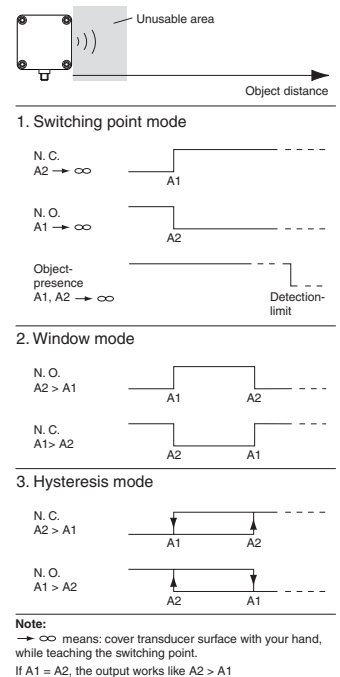


Switching output programming



Note: → ∞ means: cover transducer surface with your hand, while programming the output. If A1 = A2, the output work like A1 < A2

Programmable operation modes



Note: → ∞ means: cover transducer surface with your hand, while teaching the switching point. If A1 = A2, the output works like A2 > A1

Series -F64

Series -D1

Series LUC

Double sheet monitoring

Control units/ Power supplies

Accessories

Date of edition: 08/18/2005

UB...-F42(S)-... , output versions -UK

Safety notes:

The supply circuit is separated from the relay circuit by basic insulation.
Safety class II is only guaranteed when using the accessorial connector cable. The connector cable may only be separated from the unit when the power is off.

**CAUTION:**

The UB...-F42(S)-UK-V95 ultrasonic sensor is not suitable for use in environments subject to explosion hazards.

Conformity:	EN 60947-5-2
Housing insulation:	Safety class II
Degree of contamination:	3
Overvoltage category:	III

Parameterisation:

You can use 2 keys to parameterise the sensor. In order to start the switch point 1 learning mode, press the A1 key; in order to start the switch point 2 learning mode, press the A1 key.

If you keep both keys pressed as you switch on the power supply, the sensor will switch over to the sensitivity adjustment mode of operation.

In case the parameterisation procedure is not completed within 5 minutes, the sensor will discontinue the process and retain all previous settings.

Teaching in switch points:

Teaching in A1 switch point by pressing A1 key.

Keep A1 key pressed for > 2 s The sensor enters the switch point 1 learning mode

Position target object in the desired distance The sensor indicates via LED lights whether the target object has been detected. In case the object has been detected, the yellow LED will flash; if the object has not been detected, the red LED flashes.

Briefly press the A1 key The sensor completes the switch point 1 TEACH-IN process and saves this value in non-volatile memory. In the event of an uncertain object (flashing red LED), the value learned is invalid. The system exits the TEACH-IN mode.

Analogously, the A2 switch point is learned in the same fashion as described above using the A2 key.

Switching hysteresis operation mode <--> switch point/window operation mode:

Keep both A1 and A2 keys pressed The sensor indicates the current operation mode through the green LED.
permanent green: Switch point/window operation mode
flashing green: Hysteresis operation mode

after 2 seconds: The sensor changes the operation mode which can be identified through the green LED.
permanent green: Switch point/window operation mode
flashing green: Hysteresis operation mode

Release keys The green LED of the sensor keeps indicating the operation mode selected for additional 5 seconds

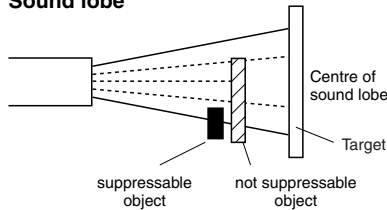
Suppression of disturbing targets

Some types of installation or particular conditions during operation of an ultrasonic sensor may admit that undesired objects (such as shelf brow posts, edges of machines) are closer than the actual target as they enter the recording range. In this case, the sensor would normally detect these objects rather than the desired target. So in order to ensure an error-free operation, it may be necessary to suppress those objects.

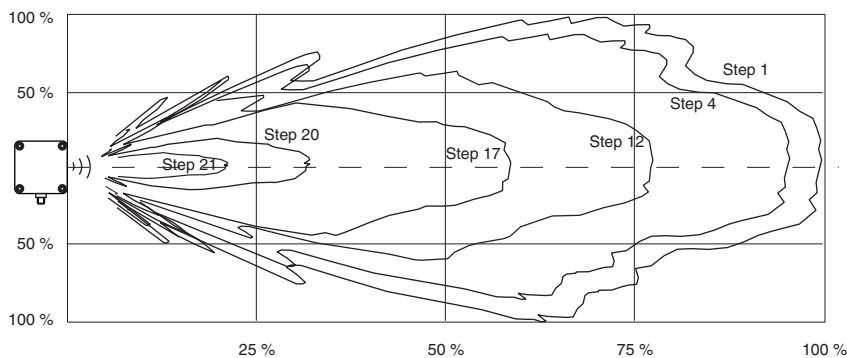
Objects can be suppressed if they meet the following conditions:

- The disturbing target must not hide the actual target completely.
- The amplitude of the disturbing signal must be smaller than the amplitude of the desired signal.
- The disturbing target must remain in the edge region of the sound lobe and must not enter its center.

Sound lobe



The suppression of the disturbing target is effected through reduction of the response sensitivity. This figure shows its effect on the response characteristics of the sensor. The sensor is preset on step 1 by the manufacturer.



Sensitivity adjustment for suppression of disturbing targets

Remove the actual target object from the detection range.

- | | |
|--|---|
| <p>Keep A1 and A2 keys pressed as you switch on power supply</p> | <p>The sensor enters the sensitivity adjustment mode of operation.
The sensor sensitivity can be adjusted in 24 steps.
Step 1 = high response
Step 24 = low response</p> |
| <p>Briefly press the A1 key</p> | <p>Response is increased. The LED lights indicate the actual state of the sensor.</p> <ul style="list-style-type: none"> - flashing red: no disturbing target detected - flashing yellow: disturbing target detected - permanent red: upper setting limit is reached. |
| <p>Briefly press the A2 key</p> | <p>Response is decreased. The LED lights indicate the actual state of the sensor.</p> <ul style="list-style-type: none"> - flashing red: no disturbing target detected - flashing yellow: disturbing target detected - permanent red: lower setting limit is reached. |
| <p>Press both A1 and A2 keys at once</p> | <p>Exiting sensitivity adjustment. The sensor response is saved in non-volatile memory.
In the event the sensitivity adjustment is not exited through this procedure, the sensor will exit this operation mode automatically after 5 minutes, and the previous sensitivity value remains valid.</p> |

Date of edition: 08/17/20.05

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories

UB...-F42(S)-... , output versions -E4 and -E5

Functional Description

The sensor may be completely parameterised via two keys on the side panel of the housing. As a special feature provided by this sensor, the ultrasound beam width may be adapted to the environmental conditions at the place of operation of the sensor.

Default settings

A1: Minimum sensing range
A2: Nominal distance
window function
wide ultrasound beam

Specifying the switching points:

When specifying the switching points, the user determines at which points the switching output changes its state. The order of the switching points $A1 > A2$, or $A1 < A2$ also determines the direction of action (i.e. normally-closed/normally-open contact function).

Specifying the A1 switching point by pressing the A1 key	
Holding down the A1 key > 2 seconds	The sensor switches to learn mode and the user may specify the A1 switching point
Positioning the target object at the desired distance	The yellow LED of the sensor flashes fast to indicate that the target object has been recognised. The red LED flashes if the object has not been recognised.
Briefly pressing the A1 key	The sensor terminates the specification of the A1 switching point and saves it as a non-volatile value. The specified value is invalid if the object is uncertain (i.e. the red LED lights up at irregular intervals). The learn mode is exited.

The A2 switching point is specified via the A2 key, analogous to the description above.

Alternatively, the switching points may also be specified electrically via the learn input. To specify the A1 switching point, the learn input must be connected to

$-U_B$; to specify the A2 switching point, it must be connected to $+U_B$. Specified values are saved upon the disconnection from the learn input.

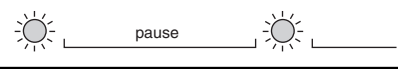


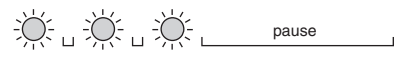
Switching points may only be specified directly after Power on. A time lock secures the adjusted switching points against unintended modification 5 minutes after the last keypress. To modify the switching points later, the user may specify the desired values only after a new Power On.

Proceed as follows to parameterise the output function and the ultrasound beam width:

Press the A1 key during Power on and hold down the key for another second to ensure that the sensor starts the two-step parameterisation of the operating modes.

Step 1, parameterisation of the output function

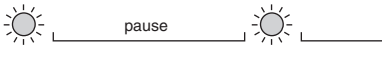

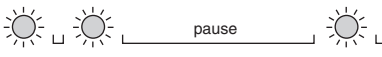

The output function parameterised last is displayed. All output functions available may be selected via consecutive, brief strokes of the A2 key. These strokes are visualised via short flashes of the green LED.

Operating mode	Flash sequence of the green LED	A2 key
1 switching point/ object detection		
Window function (default)		
Hysteresis mode		

Hold down the A1 key for 2 seconds to save the selected output mode, complete the parameterisation and ensure that the sensor returns to normal mode. Step 2 may be initiated by briefly pressing the A1 key (parameterisation of the ultrasound beam width).

Step 2, parameterisation of the ultrasound beam width

In the near range, via Step 2, the ultrasound beam width may be adapted to the requirements of the corresponding application. The beam width parameterised last is displayed first. Available beam width settings may be selected via consecutive, brief strokes of the A2 key. These strokes are visualised via the flash sequence of the red LED.

Beam width	Flash sequence of the red LED	A2 key
Small beam		
Medium beam		
Large beam		

Hold down the A1 key for 2 seconds to save the selected beam shape, complete the parameterisation and ensure that the sensor returns to normal mode. Briefly press the A1 key to return to Step 1 (parameterisation of the output function).

If the parameterisation mode is not terminated within 5 minutes after last keypress (by holding down the A1 key for 2 seconds), the sensor aborts this mode without modifying the settings.

Synchronisation

The sensor has a synchronisation port to suppress mutual influencing. If this port has not been connected, the sensor works at an internally generated cycle rate. Several sensors may be synchronised via the following options.

External synchronisation:

The sensor may be synchronised via the external application of a square wave voltage. A synchronisation pulse on the synchronisation input initiates a measuring cycle. The pulse width must be greater than 100 μ s. The measuring cycle is started with the falling edge. A low level > 1 s or an open synchronisation input initiate the transition to normal sensor mode. A high level on the synchronisation input deactivates the sensor.

Two modes are possible:

- Several sensors are controlled via the same synchronisation signal. The sensors work in common mode.
- The synchronisation pulses are forwarded at cyclic intervals to respectively one single sensor. The sensors work in multiplex mode.

Self-synchronisation:

The synchronisation ports of up to 5 sensors suitable for self-synchronisation are connected to each other. These sensors work in multiplex mode after Power on. The On delay increases depending on the number of sensors to be synchronised. While the learn mode is active, no synchronisation is possible (and vice-versa). To specify the switching points, the sensors must be operated in non-synchronised mode.

Note:

If the synchronisation option is not used, the synchronisation input must be connected to ground (0V) or the sensor must be operated with a (4-pole) V1 connecting cable.

UB...-F42(S)-... , output versions -E6 and -E7

Functional description

The sensor can be completely parameterised using 2 keys on the side of the housing. One special feature of this sensor is the option of adapting the ultrasonic beam width to the ambient conditions at the place where the sensor is used.

Default settings

A1: blind range
 A2: nominal distance
 2 x normally open function
 Wide ultrasonic beam width

Teach-in of switching points:

Teach-in of switching points is used to determine the points at which the switching outputs will change their state. In addition, the order of switching points $A1 < A2$, or $A1 > A2$ also determines the effective direction (normally closed/open function) of the window in the output function (operating mode) "Window + Switching point" (see below).

Teach-in of switching point A1 with key A1	
Press key A1 > 2 seconds	The sensor goes into learning mode for switching point A1
Position the target object at the desired distance	The sensor indicates by rapid flashing of the yellow LED that the target object has been detected. If no object is detected, the red LED flashes.
Press key A1 briefly	The sensor completes the Teach-in process for switching point A1 and stores the value in permanent memory. If the object is uncertain (red LED lit irregularly) the Teach-in value is not valid. Teach-in mode closes.

The process for Teach-in of switching point A2 is similar to what was described above, using key A2.

Special feature for output function "Window + switching point"

In the case of the output function (operating mode) "Window + switching point" (see below), switching points A1 and A2 define the window limits of switch output 1.

A third switching point A3 can also be defined here at which switch output 2 switches.

Teach-in of switching point A3 with keys A1 and A2 (only for operating mode window + switching point, see below)	
Press key A1 + A2 > 2 seconds	The sensor goes into learning mode for switching point A3
Position the target object at the desired distance	The sensor indicates by rapid flashing of the yellow LEDs that the target object has been detected. If no object is detected, the red LED flashes.
Press key A1 briefly (output 2: normally closed) or Press key A2 briefly (output 2: normally open)	The sensor completes the Teach-in process for switching point A3 and stores the value in permanent memory. If the object is uncertain (red LED lit irregularly) the Teach-in value is not valid. Teach-in mode closes.

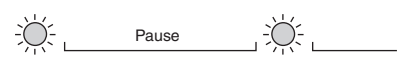
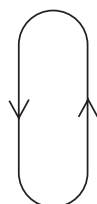

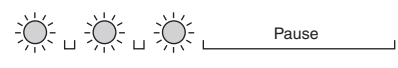
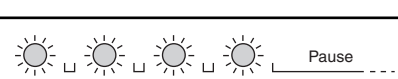
Teach-in for switching points can only be performed within the first 5 minutes after turning on the power supply. If the switching points need to be changed at a later time, this cannot be done until there is a new Power On.

Parameter assignment of the output function and ultrasound beam width

If you press the A1 key while the power supply is being turned on and then hold it down for 1 second, the sensor goes into the two-level parameterisation of operating modes.

Level 1, parametrisation of the output function

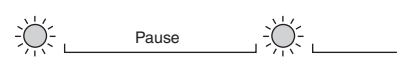
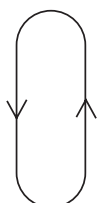


Pressing the A2 key briefly will cause the possible output functions to be selected one after the other (depending on the last output function to be parameterised). The functions are indicated by a flashing sequence of the green LED.

Operating mode	Flashing sequence of green LED	A2 key
2 x normally open function (default)		
2 x normally closed function		
2 switching points n.o. (output 1) + n.c. (output 2)		
Window (output 1) + switching point (output 2)		

Pressing the A1 key for 2 seconds saves the selected output operating mode. The parameter assignment process is then complete and the sensor returns to normal mode. If you press the A1 key briefly instead, you go to Level 2 (parameter assignment of ultrasonic beam range).

Level 2, parameter assignment of ultrasonic beam width

The ultrasonic beam width can be adjusted to match the requirements of the application in Level 2. Pressing the A2 key briefly will cause the possible beam widths to be selected one after the other (depending on the last beam width to be parameterised). The functions are indicated by a flashing sequence of the red LED.

Beam width	Flashing sequence of red LED	A2 key
Narrow beam width		
Average beam width		
Wide beam (default)		

Pressing the A1 key for 2 seconds saves the selected type of beam width. The parameter assignment process is then complete and the sensor returns to normal mode. If you press the A1 briefly instead, you go back to Level 1 (parameter assignment of output function).

If parameterisation is not complete within 5 minutes (pressing the A1 key for 2 seconds), the sensor interrupts parameterisation mode without changing the settings.

Synchronisation

The sensor is equipped with a synchronisation connection to suppress mutual interaction. If it is not turned on, the sensor works at an internally generated cycle rate. Synchronisation of more than one sensor is possible in a number of different ways.

External synchronisation:

The sensor can be synchronised by the application of a square wave voltage externally. A synchronisation pulse on the synchronisation input results in the execution of a measurement cycle. The pulse width must be greater than 100 µs. The measurement cycle must be started with the falling signal edge. A Low level > 1 s or an open synchronisation input results in normal operation of the sensor. A High level on the synchronisation input deactivates the sensor.

Two different operating modes are possible

- Multiple sensors can be controlled by the same synchronisation signal. The sensors work on synonymous cycle.
- Synchronisation pulses are sent cyclically to only one sensor each time. The sensors work in Multiplex mode.

Self synchronisation:

The synchronisation connections of up to 5 sensors with option for self-synchronisation are connected with each other. These sensors work after turning on the operating voltage in Multiplex mode. The On delay increases depending on the number of sensors to be synchronised. Synchronisation is possible during Teach-in and vice-versa. Sensors must be operated unsynchronised to perform Teach-in of switching points.

Note:

If the option for synchronisation is not used, the synchronisation input can be connected with ground (0 V) or the sensor can be operated with a V1 connection cable (4-pin).

Date of edition: 08/17/20.05

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

UB...-F42(S)-... , output versions -I and -U

Functional description

The sensor can be completely parameterised using 2 keys on the side of the housing. One special feature of this sensor is the option of adapting the ultrasonic beam width to the ambient conditions at the place where the sensor is used.

Default settings

A1: blind range
 A2: nominal distance
 2 x normally open function
 Wide ultrasonic beam width

Teach-in of switching points:

Teach-in of switching points is used to determine the points at which the switching outputs will change their state. In addition, the order of switching points $A1 < A2$, or $A1 > A2$ also determines the effective direction (normally closed/open function) of the window in the output function (operating mode) "Window + Switching point" (see below).

Teach-in of switching point A1 with key A1	
Press key A1 > 2 seconds	The sensor goes into learning mode for switching point A1
Position the target object at the desired distance	The sensor indicates by rapid flashing of the yellow LED that the target object has been detected. If no object is detected, the red LED flashes.
Press key A1 briefly	The sensor completes the Teach-in process for switching point A1 and stores the value in permanent memory. If the object is uncertain (red LED lit irregularly) the Teach-in value is not valid. Teach-in mode closes.

The process for Teach-in of switching point A2 is similar to what was described above, using key A2.

Special feature for output function "Window + switching point"

In the case of the output function (operating mode) "Window + switching point" (see below), switching points A1 and A2 define the window limits of switch output 1.

A third switching point A3 can also be defined here at which switch output 2 switches.

Teach-in of switching point A3 with keys A1 and A2 (only for operating mode window + switching point, see below)	
Press key A1 + A2 > 2 seconds	The sensor goes into learning mode for switching point A3
Position the target object at the desired distance	The sensor indicates by rapid flashing of the yellow LEDs that the target object has been detected. If no object is detected, the red LED flashes.
Press key A1 briefly (output 2: normally closed) or Press key A2 briefly (output 2: normally open)	The sensor completes the Teach-in process for switching point A3 and stores the value in permanent memory. If the object is uncertain (red LED lit irregularly) the Teach-in value is not valid. Teach-in mode closes.

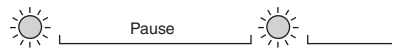
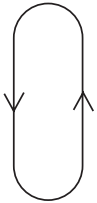



Teach-in for switching points can only be performed within the first 5 minutes after turning on the power supply. If the switching points need to be changed at a later time, this cannot be done until there is a new Power On.

Parameter assignment of the output function and ultrasound beam width

If you press the A1 key while the power supply is being turned on and then hold it down for 1 second, the sensor goes into the two-level parameterisation of operating modes.

Level 1, parametrisation of the output function

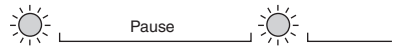
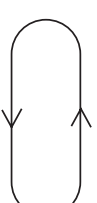


Pressing the A2 key briefly will cause the possible output functions to be selected one after the other (depending on the last output function to be parameterised). The functions are indicated by a flashing sequence of the green LED.

Operating mode	Flashing sequence of green LED	A2 key
2 x normally open function (default)		
2 x normally closed function		
2 switching points n.o. (output 1) + n.c. (output 2)		
Window (output 1) + switching point (output 2)		

Pressing the A1 key for 2 seconds saves the selected output operating mode. The parameter assignment process is then complete and the sensor returns to normal mode. If you press the A1 key briefly instead, you go to Level 2 (parameter assignment of ultrasonic beam range).

Level 2, parameter assignment of ultrasonic beam width

The ultrasonic beam width can be adjusted to match the requirements of the application in Level 2. Pressing the A2 key briefly will cause the possible beam widths to be selected one after the other (depending on the last beam width to be parameterised). The functions are indicated by a flashing sequence of the red LED.

Beam width	Flashing sequence of red LED	A2 key
Narrow beam width		
Average beam width		
Wide beam (default)		

Pressing the A1 key for 2 seconds saves the selected type of beam width. The parameter assignment process is then complete and the sensor returns to normal mode. If you press the A1 briefly instead, you go back to Level 1 (parameter assignment of output function).

If parameterisation is not complete within 5 minutes (pressing the A1 key for 2 seconds), the sensor interrupts parameterisation mode without changing the settings.

Synchronisation

The sensor is equipped with a synchronisation connection to suppress mutual interaction. If it is not turned on, the sensor works at an internally generated cycle rate. Synchronisation of more than one sensor is possible in a number of different ways.

External synchronisation:

The sensor can be synchronised by the application of a square wave voltage externally. A synchronisation pulse on the synchronisation input results in the execution of a measurement cycle. The pulse width must be greater than 100 µs. The measurement cycle must be started with the falling signal edge. A Low level > 1 s or an open synchronisation input results in normal operation of the sensor. A High level on the synchronisation input deactivates the sensor.

Two different operating modes are possible

- Multiple sensors can be controlled by the same synchronisation signal. The sensors work on synonymous cycle.
- Synchronisation pulses are sent cyclically to only one sensor each time. The sensors work in Multiplex mode.

Self synchronisation:

The synchronisation connections of up to 5 sensors with option for self-synchronisation are connected with each other. These sensors work after turning on the operating voltage in Multiplex mode. The On delay increases depending on the number of sensors to be synchronised. Synchronisation is possible during Teach-in and vice-versa. Sensors must be operated unsynchronised to perform Teach-in of switching points.

Note:

If the option for synchronisation is not used, the synchronisation input can be connected with ground (0 V) or the sensor can be operated with a V1 connection cable (4-pin).

Date of edition: 08/17/20.05

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -12GM
Series -16GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -F43



UC2000-F43-2KIR2-V17

UC300-F43-2KIR2-V17

Model number	Detection range	Page
UC300-F43-2KIR2-V17	300 mm	156
UC2000-F43-2KIR2-V17	2000 mm	

Date of edition 09/13/2005

Subject to reasonable modifications due to technical advances.

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Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Ultrasonic sensor

UC...-F43-2KIR2-V17



- Current output 4 mA ... 20 mA
- 2 relay outputs
- Serial interface
- Temperature compensation
- Reverse polarity protection
- Parameterisable with ULTRA 2001

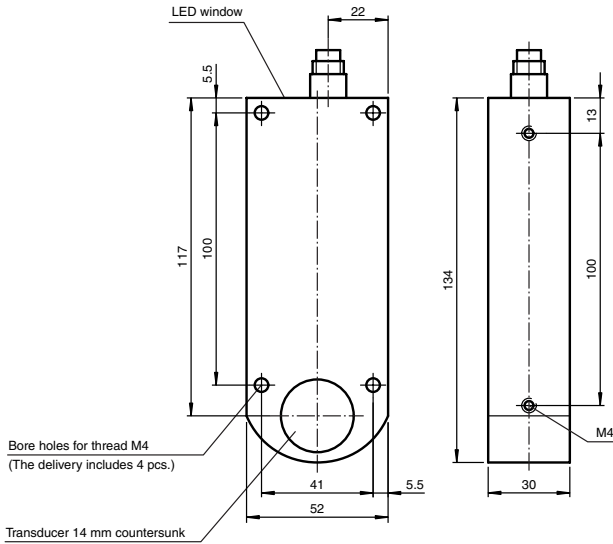


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

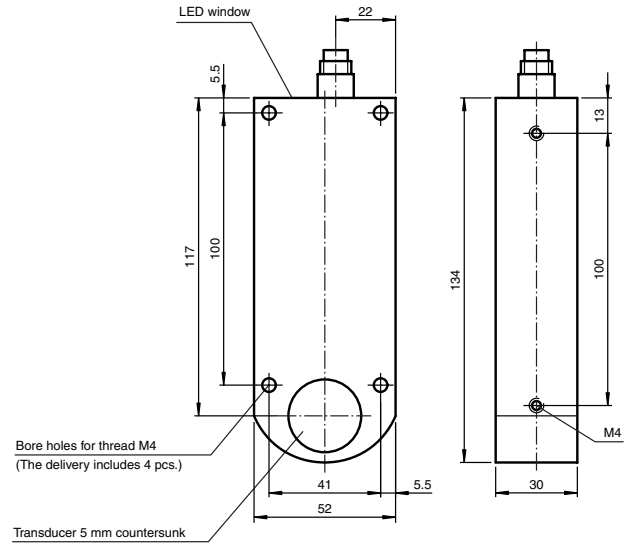
Technical Data

	Model number	UC300-F43-2KIR2-V17	UC2000-F43-2KIR2-V17
Sensing range	0 ... 300 mm 80 ... 2000 mm	●	●
Adjustment range	100 ... 2000 mm		●
Unusable area	0 ... 80 mm		●
Standard target plate	0 mm 100 mm x 100 mm	●	●
Transducer frequency	approx. 175 kHz approx. 390 kHz	●	●
Response delay	minimum (EM; NCNE): ≤20 ms (2 measuring cycles) factory setting (EM; MXN, 5, 2): ≤60 ms (6 measuring cycles) dynamic (EM; DYN): ≤30 ms (3 measuring cycles) minimum (EM; NCNE): ≤50 ms (2 measuring cycles) factory setting (EM; MXN, 5, 2): ≤150 ms (6 measuring cycles) dynamic (EM; DYN): ≤75 ms (3 measuring cycles)	●	●
LED green	continuous: object in the measuring window flashing: object outside the measuring window	●	●
LED red	error (e. g. interference level too high)	●	●
Operating voltage	10 ... 30 V DC ripple ± 10 % _{SS}	●	●
Power consumption	≤ 2 W (all relays pulled-in, current output 20 mA) no-load power consumption ≤ 0.7 W	●	●
Output type	2 relay outputs, 1 analogue output 4 ... 20 mA	●	●
Deviation of the characteristic curve	< 0,2 % of full-scale value	●	●
Repeat accuracy	≤ 0,1 % of full-scale value	●	●
Resolution	0,2 mm 0,6 mm	●	●
Load impedance	current output: ≤ 500 Ω at U _b ≥ 17V ≤ 200 Ω at U _b < 17V	●	●
Range hysteresis	0 ... 15% parameterisable with ULTRA2001	●	●
Contact loading	60 V DC / 1 A (max. 24 W DC), ohmic 60 V DC / 1 A (max. 24 W DC), ohmic	●	●
Lifetime	electrical: 3 x 10 ⁵ switching cycles at resistive load (1 A / 24 V DC) mechanical: 10 ⁷ switching cycles	●	●
Temperature influence	≤ 2 % of full-scale value	●	●
Interface type	RS 232, 9600 bit/s, no parity, 8 data bits, 1 stop bit	●	●
Standards	EN 60947-5-2	●	●
Ambient temperature	0 ... 70 °C (273 ... 343 K) -25 ... 70 °C (248 ... 343 K) -40 ... 85 °C (233 ... 358 K)	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●
Protection degree	IP65	●	●
Connection	8-pin round connector, Lumberg type RSF 8	●	●
Material		●	●
Housing	PBT	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●
Mass	290 g	●	●

Date of edition: 08/18/2005



UC300-F43-2KIR2-V17

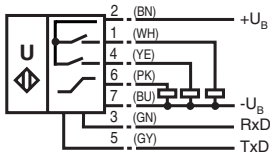


UC2000-F43-2KIR2-V17

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Electrical connection

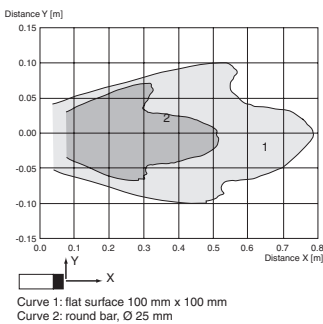
Standard symbol/Connection:



Core colours in accordance with EN 60947-5-2.

Diagrams

Characteristic response curve

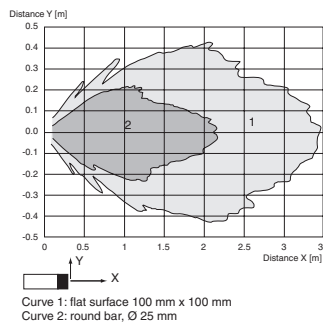


UC300-F43-2KIR2-V17

Basic setting

- OM:** Relay 1: NO, Relay 2: NO
- SD1/SD2:** Switch point relay 1 = 25 mm, Switch point relay 2 = 50 mm
- NDE/FDE:** Analogue output: 4 mA ⇒ 25 mm, 20 mA ⇒ 300 mm
- FSF:** Error ⇒ Relay 1 and 2: latest state, Analogue output: I_{OUT} = 3,9 mA
- NEF:** No echo ⇒ error message
- MA,S:** Switching mode

Characteristic response curve



UC2000-F43-2KIR2-V17

Basic setting

- OM:** Relay 1: NO, Relay 2: NO
- SD1/SD2:** Switch point relay 1 = 100 mm, Switch point relay 2 = 2000 mm
- NDE/FDE:** Analogue output: 4 mA ⇒ 100 mm, 20 mA ⇒ 2000 mm
- FSF:** Error ⇒ Relay 1 and 2: latest state, Analogue output: I_{OUT} = 3,9 mA
- NEF:** No echo ⇒ error message
- MA,S:** Switching mode

Date of edition: 08/18/2005

UC300-F43-2KIR2-V17

Thanks to its extensive command set, the sensor can be configured to suit the application via the RS 232 interface.

RS 232 command set (overview)

Command	Meaning	Parameter	Access
VS0	Velocity of Sound at 0 °C	Velocity of sound at 0 °centigrade VS0 in [cm/s] {10000 ... 60000}	read and set
VS	Velocity of Sound	Velocity of sound VS in [cm/s]	read
TO	Temperature Offset	TO in [0.1 K] {-200 ... 200}	read and set
TEM	TEMperature	TEM in [0.1 K]	read and adapt to TO
REF	REFerence measurement	REF distance in [mm]	adaptation of VS0
SD1	Switching Distance 1	Switching point, relay 1 SD1 in [mm] {1 ... 800}	read and set
SD2	Switching Distance 2	Switching point, relay 2 SD2 in [mm] {1 ... 800}	read and set
SH1	Switching Hysteresis 1	Hysteresis, relay 1 in [%] {0 ... 15}	read and set
SH2	Switching Hysteresis 2	Hysteresis, relay 2 in [%] {0 ... 15}	read and set
NDE	Near Distance of Evaluation	Near measuring window limit in [mm] {1 ... 800}	read and set
FDE	Far Distance of Evaluation	Far measuring window limit in [mm] {1 ... 800}	read and set
BR	Unusable area (Blind Range)	Unusable area in [mm] {0 ... 800}	read and set
RR	Range Reduction	reduces sensing range [mm] {0 ... 800}	read and set
CBT	Constant BurstTime	Burst length {0, 1, 2, 3}	read and set
CCT	Constant Cycle Time	Time in [ms] {0 ... 1000}	read and set
FTO	Filter TimeOut	Number of measurements without echo to be filtered {0 ... 255}	read and set
EM	Evaluation Method	Evaluation method {0 = NONE; PT1[.f,p,c]; MXN[.m,n]; DYN[p]}	read and set
CON	CONservative filter	Counter threshold as number {0 ... 255}	read and set
OM	Output Mode	OM coded [normally-open = 0, normally-closed = 1, inactive =]	read and set
FSF	Fail SafeFunction	Failure function type e.g. FSF,1,1,35 {0, 1, 2}, [fault current in 0.1 mA], -1 = current output indifferently	read and set
MD	Master Device	Function as master {0 = NONE}, AD, RD, RT, SS, ADB, RDB, RTB }	read and set
MA	Main Application	Determines whether the green LED orients on analogue output or switching outputs {A,S}	read and set
NEF	No Echo Failure	Sensor behaviour when no echo is present {0,1}	read and set
AD	Absolute Distance	Distance in [mm]	read
RD	Relative Distance	Relative distance as number {0 ... 4095}	read
RT	RunTime	Echo run time in machine cycles [1 machine cycle = 1.085 µs]	read
SS1	Switching State 1	SS1 binary [0: inactive, 1 active] (independent of OM)	read
SS2	Switching State 2	SS2 binary [0: inactive, 1 active] (independent of OM)	read
ADB	Absolute Distance Binary	Distance in [mm] not as ASCII	read
RDB	Relative Distance Binary	Relative distance as number {0 ... 4095} not as ASCII	read
RTB	RunTime Binary	Echo run time in machine cycles [1 machine cycle = 1.085 µs] not as ASCII	read
ER	Echo Received	Echo detected: no, yes [0/1]	read
VER	VERsion	Version string: xxxx	read
ID	IDentification	ID string: P&F UC300-F43-2KIR2-V17...	read
DAT	DATe	Date string: e.g. Date: 04/12/02 Time: 11:14:35	read
ST	STatus	Status as hexadecimal string	read
RST	ReSeT	Performs a reset	Command
DEF	DEFault settings	Restores defaults	Command
SUC	Store User Configuration	Stores all settings	Command
RUC	Recall User Configuration	Restores stored settings	Command

UC2000-F43-2KIR2-V17

Thanks to its extensive command set, the sensor can be configured to suit the application via the RS 232 interface.

RS 232 command set (overview)

Command	Meaning	Parameter	Access
VS0	Velocity of Sound at 0 °C	Velocity of sound at 0 °centigrade VS0 in [cm/s]{12000 ... 60000}	read and set
VS	Velocity of Sound	Velocity of sound VS in [cm/s]	read
TO	Temperature Offset	TO in [0..1K]	read and set
TEM	TEMPerature	TEM in [0..1K]	read and adapt to TO
REF	REFerence measurement	REF distance in [mm]{100 ... 4000}	adaptation of VS0
SD1	Switching Distance 1	Switching point, relay 1 SD1 in [mm] {100 ... 4000}	read and set
SD2	Switching Distance 2	Switching point, relay 2 SD1 in [mm] {100 ... 4000}	read and set
SH1	Switching Hysteresis 1	Hysteresis, relay 1 in [%] {0 ... 15}	read and set
SH2	Switching Hysteresis 2	Hysteresis, relay 2 in [%] {0 ... 15}	read and set
NDE	Near Distance of Evaluation	Near measuring window limit in [mm] {100 ... 4000}	read and set
FDE	Far Distance of Evaluation	Far measuring window limit in [mm] {100 ... 4000}	read and set
BR	Unusable area (Blind Range)	Unusable area in [mm] {0 ... 4000}	read and set
RR	Range Reduction	reduces sensing range [in mm] {100 ... 4000}	read and set
CBT	Constant Burst Time	Burst length {0,1, 2, 3}	read and set
CCT	Constant Cycle Time	Time in [ms] {0 ... 1000}	read and set
FTO	Filter TimeOut	Number of measurements without echo to be filtered {0 ... 255}	read and set
EM	Evaluation Method	Evaluation method { 0 = NONE; PT1[f,p,c]; MXN[,m,n]; DYN[,p]}	read and set
CON	CONservative filter	Counter threshold as number {0 ... 255}	read and set
OM	Output Mode	OM coded [normally-open = 0, normally-closed = 1, inactive = I]	read and set
FSF	Fail Safe Function	Failure function type e.g. FSF,11,35 {0,1,2}, [fault current in 0.1 mA], -1 = current output indifferently	read and set
MD	Master Device	Function as master {0 = NONE},AD,RD,RT,SS,ADB,RDB,RTB}	read and set
MA	Main Application	Determines whether the green LED orients on analogue output or switching outputs {A,S}	read and set
NEF	No Echo Failure	Sensor behaviour when no echo is present {0,1}	read and set
AD	Absolute Distance	Distance in [mm]	read
RD	Relative Distance	Relative distance as number {0 ... 4095}	read
RT	RunTime	Echo run time in machine cycles [1 machine cycle = 1.085µs]	read
SS1	Switching State1	SS1 binary [0: inactive, 1 active] (independent of OM)	read
SS2	Switching State2	SS2 binary [0: inactive, 1 active] (independent of OM)	read
ADB	Absolute Distance Binary	Distance in [mm] not as ASCII	read
RDB	Relative Distance Binary	Relative distance as number {0 ... 4095} not as ASCII	read
RTB	RunTime Binary	Echo run time in machine cycles [1 machine cycle = 1.085µs] not as ASCII	read
ER	Echo Received	Echo detected: no, yes [0/1]	read
VER	VERsion	Version string: xxxx	read
ID	IDentification	ID string: P&F UC2000-F43-2KIR2-V17...	read
DAT	DATE	Date string: e.g. Date: 04/12/02 Time: 11:14:35	read
ST	STatus	Status as hexadecimal string	read
RST	ReSeT	Performs a reset	Command
DEF	DEFault settings	Restores defaults	Command
SUC	Strore User Configuration	Stores all settings	Command
RUC	Recall User Configuration	Restores stored settings	Command

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -F54



Model number	Description	Detection range	Page
UB500-F54-E4-V15	Switching output	500 mm	162
UB500-F54-E5-V15		500 mm	
UB2000-F54-E4-V15		2000 mm	
UB2000-F54-E5-V15		2000 mm	
UB500-F54-I-V15	Analogue output	500 mm	164
UB500-F54-U-V15		500 mm	
UB2000-F54-I-V15		2000 mm	
UB2000-F54-U-V15		2000 mm	
UB500-F54-H3-V1	For external control/evaluation unit	500 mm	166
UB2000-F54-H3-V1		2000 mm	

For detailed function description, see page 168



- Switch output
- 5 different output functions can be set
- TEACH-IN input
- Synchronisation options
- Deactivation option
- Temperature compensation

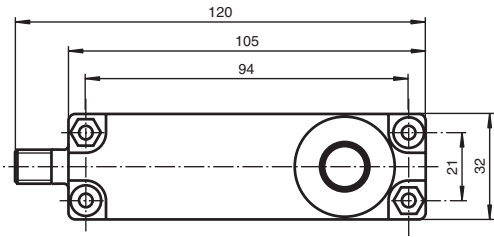


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

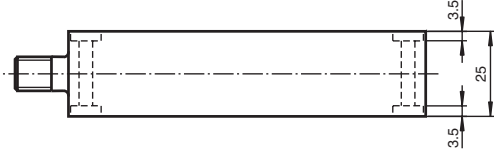
Technical Data

	Model number	UB500-F54-E4-V15	UB500-F54-E5-V15	UB2000-F54-E4-V15	UB2000-F54-E5-V15
Sensing range	30 ... 500 mm	●	●		
Adjustment range	80 ... 2000 mm			●	●
Unusable area	50 ... 500 mm	●	●		
Standard target plate	0 ... 30 mm	●	●		
Transducer frequency	0 ... 80 mm	●	●		
Response delay	100 mm x 100 mm	●	●		
LED green	approx. 175 kHz	●	●		
LED yellow	approx. 380 kHz	●	●		
LED red	≤ 150 ms	●	●		
Operating voltage	≤ 50 ms	●	●		
No-load supply current	permanently green: monitoring system	●	●		
Output type	green flashing: TEACH-IN function	●	●		
Rated operational current	indication of the switching state	●	●		
Voltage drop	flashing: TEACH-IN function object detected	●	●		
Switching frequency	flashing: TEACH-IN mode, error, TEACH-IN function: no object detected	●	●		
Range hysteresis	permanently: TEACH-IN mode, object uncertain	●	●		
Repeat accuracy	10 ... 30 V DC, ripple 10 % _{SS}	●	●		
Temperature influence	≤ 55 mA	●	●		
Input type	1 switch output E4, npn NO/NC	●	●		
Synchronisation	1 switch output E5, prp NO/NC	●	●		
Common mode operation	200 mA, short-circuit/overload protected	●	●		
Multiplex operation	max. 10 Hz	●	●		
Standards	max. 3 Hz	●	●		
Ambient temperature	≤ 1 % of the set operating distance	●	●		
Storage temperature	≤ 1 % of full-scale value	●	●		
Protection degree	± 1,5 % of full-scale value	●	●		
Connection	1 TEACH-IN input,	●	●		
Material	switching point A1: -U _B ... +1 V, switching point A2: +4 V ... +U _B	●	●		
Housing	input impedance: > 4.7 kΩ, TEACH-IN pulse: ≥ 1 s	●	●		
Transducer	1 synchronisation input	●	●		
Mass	0 level: -U _B ... +1 V, 1 level: +4 V ... +U _B	●	●		
	input impedance: > 12 kΩ, synchronisation pulse: 0,1 ... 28 ms	●	●		
	1 synchronisation input	●	●		
	0 level: -U _B ... +1 V, 1 level: +4 V ... +U _B	●	●		
	input impedance: > 12 kΩ, synchronisation pulse: 0,1 ... 8 ms	●	●		
	≤ 100 Hz	●	●		
	≤ 33 Hz	●	●		
	≤ 100 / n Hz, n = number of sensors	●	●		
	≤ 33 / n Hz, n = number of sensors	●	●		
	EN 60947-5-2	●	●		
	-25 ... 70 °C (248 ... 343 K)	●	●		
	-40 ... 85 °C (233 ... 358 K)	●	●		
	IP65	●	●		
	connector V15 (M12 x 1), 5 pin	●	●		
	ABS	●	●		
	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●		
	100 g	●	●		

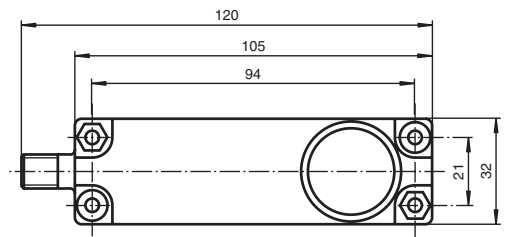
Date of edition: 08/18/2005



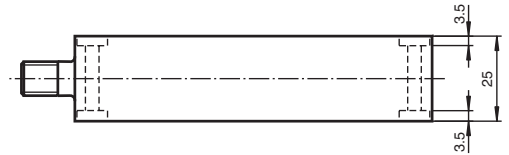
Bore hole and countersinking for screws/hexagon M4



UB500-F54...



Bore hole and countersinking for screws/hexagon M4



UB2000-F54...

Series -12GM

Series -18GM/-18GM

Series -30GM

Series VarKont

Series -FP

Series -F12

Series -F42

Series -F43

Series -F54

Series -F64

Series -D1

Series LUC

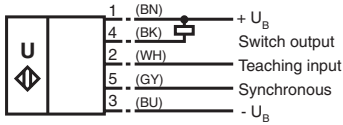
Double sheet monitoring

Control units/ Power supplies

Accessories

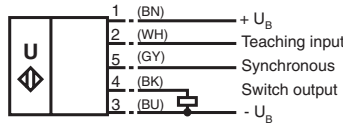
Electrical connection

Standard symbol/Connections:
(version E4, npn)



Core colours in accordance with EN 60947-5-2.

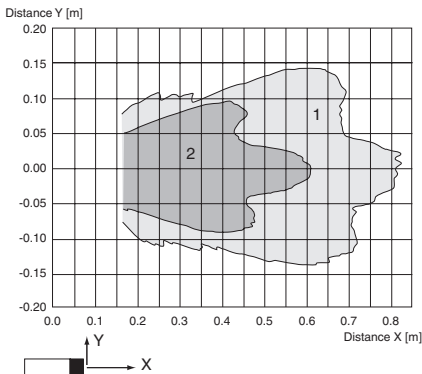
Standard symbol/Connections:
(version E5, pnp)



Core colours in accordance with EN 60947-5-2.

Diagrams

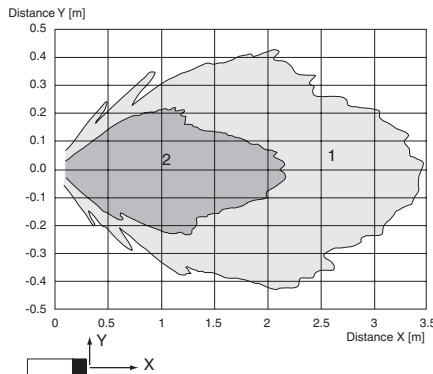
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB500-F54...

Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB2000-F54...

Programmed switching output function

- Window mode, normally open function
A1 < A2:
- Window mode, normally closed function
A2 < A1:
- One switch point, normally open function
A1 -> ∞:
- One switch point, normally closed function
A2 -> ∞:
- A1 -> ∞, A2 -> ∞: Detection of object presence
Object detected: Switch output closed
No object detected: Switch output open

Date of edition: 08/18/2005



- Measuring window adjustable
- TEACH-IN input
- Synchronisation options
- Deactivation option
- Temperature compensation
- Analogue output 0 V ... 10 V
UB500-F54-U-V15
UB2000-F54-U-V15
- Analogue output 4 mA ... 20 mA
UB500-F54-I-V15
UB2000-F54-I-V15

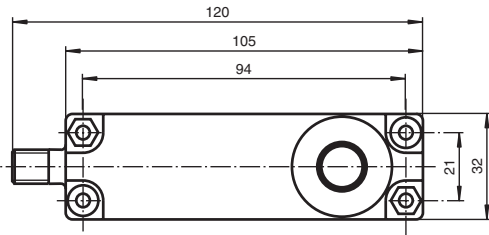


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

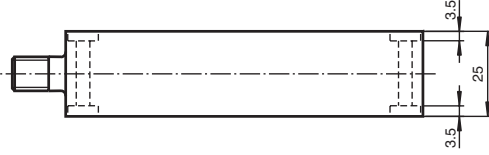
Technical Data

	Model number	UB500-F54-I-V15	UB500-F54-U-V15	UB2000-F54-I-V15	UB2000-F54-U-V15
Sensing range	30 ... 500 mm	●	●		
	80 ... 2000 mm			●	●
Adjustment range	100 ... 2000 mm			●	●
	50 ... 500 mm	●	●		
Unusable area	0 ... 30 mm	●	●		
	0 ... 80 mm			●	●
Standard target plate	100 mm x 100 mm	●	●	●	●
Transducer frequency	approx. 175 kHz	●	●	●	●
	approx. 380 kHz	●	●		
Response delay	≤ 150 ms			●	●
	≤ 50 ms	●	●		
LED green	permanently green: monitoring system	●	●	●	●
	green flashing: TEACH-IN function	●	●	●	●
LED yellow	permanently yellow: object in the evaluation range	●	●	●	●
	yellow flashing: TEACH-IN function, object detected	●	●	●	●
LED red	flashing: normal mode: error, TEACH-IN function: no object detected	●	●	●	●
	permanently: TEACH-IN mode, object uncertain	●	●	●	●
Operating voltage	10 ... 30 V DC, ripple 10 % _{SS}	●		●	
	15 ... 30 V DC, ripple 10 % _{SS}		●		●
No-load supply current	≤ 55 mA	●	●	●	●
Output type	1 analogue output 0 ... 10 V	●	●	●	●
	1 analogue output 4 ... 20 mA	●		●	
Deviation of the characteristic curve	± 1 % of full-scale value				●
Resolution		0,13 mm	0,11 mm	0,5 mm	0,47 mm
Repeat accuracy	± 0,1 % of full-scale value	●	●	●	●
Load impedance	≥ 1 kOhm	●	●	●	●
	0 ... 300 Ohm	●		●	
Temperature influence	± 1,5 % of full-scale value	●	●	●	●
Default setting	evaluation limit 1: 100 mm evaluation limit 2: 2000 mm	●	●	●	●
	evaluation limit 1: 50 mm evaluation limit 2: 500 mm	●	●		
Input type	1 TEACH-IN input	●	●	●	●
	lower evaluation limit A1: -U _B ... +1 V, upper evaluation limit A2: +4 V ... +U _B				
Synchronisation	input impedance: > 4,7 kΩ, pulse duration: ≥ 1 s				
	1 synchronous input, 0 level: -U _B ... +1 V, 1 level: +4 V ... +U _B	●	●	●	●
Common mode operation	input impedance: > 12 kOhm, synchronisation pulse: 0,1 ... 28 ms	●	●		
	input impedance: > 12 kOhm, synchronisation pulse: 0,1 ... 8 ms			●	●
Multiplex operation	≤ 100 Hz	●	●		
	≤ 33 Hz			●	●
Standards	≤ 100 / n Hz, n = number of sensors	●	●		
	≤ 33 / n Hz, n = number of sensors			●	●
Standards	EN 60947-5-2	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Material					
Housing	ABS	●	●	●	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●	●	●	●
Mass	100 g	●	●	●	●

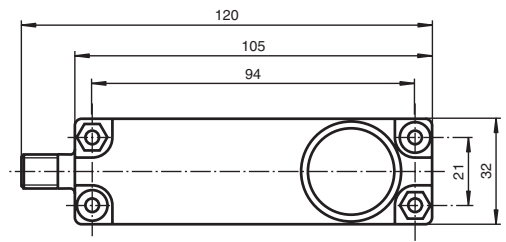
Date of edition: 08/18/2005



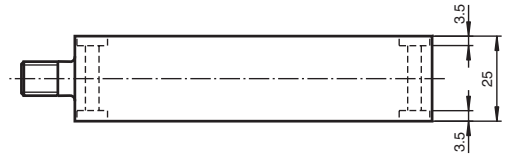
Bore hole and countersinking for screws/hexagon M4



UB500-F54...



Bore hole and countersinking for screws/hexagon M4



UB2000-F54...

Series -12GM

Series -18GM/-18GM

Series -30GM

Series VarKont

Series -FP

Series -F12

Series -F42

Series -F43

Series -F54

Series -F64

Series -D1

Series LUC

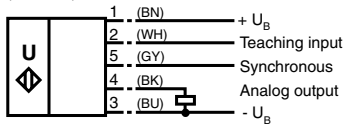
Double sheet monitoring

Control units/Power supplies

Accessories

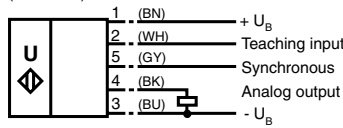
Electrical connection

Standard symbol/Connections: (version I)



Core colours in accordance with EN 60947-5-2.

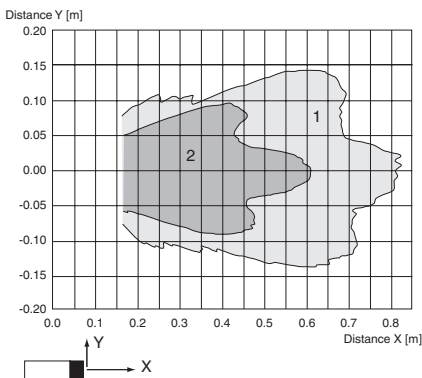
Standard symbol/Connections: (version U)



Core colours in accordance with EN 60947-5-2.

Diagrams

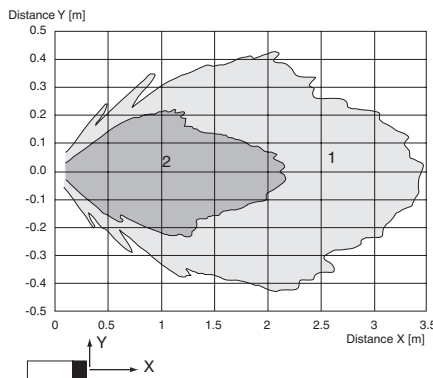
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB500-F54...

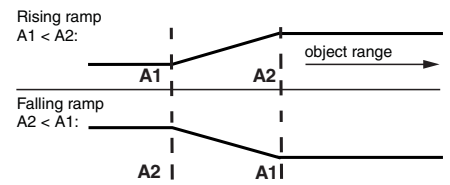
Characteristic response curve



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB2000-F54...

Programmed analogue output function



Date of edition: 08/18/2005



- Separate evaluation
- Direct detection mode



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

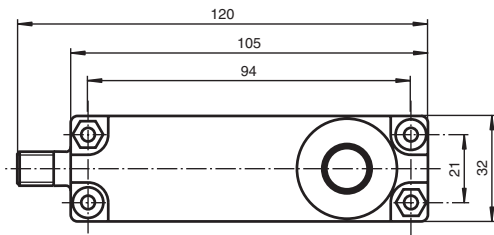
Technical Data

		Model number	UB500-F54-H3-V1	UB2000-F54-H3-V1
Series -F12	Sensing range	30 ... 500 mm	●	●
	Adjustment range	80 ... 2000 mm		●
Series -F42	Unusable area	50 ... 500 mm	●	●
	Standard target plate	0 ... 30 mm ¹⁾	●	●
Series -F43	Transducer frequency	0 ... 80 mm ¹⁾	●	●
	Operating voltage	100 mm x 100 mm	●	●
Series -F54	No-load supply current	approx. 175 kHz	●	●
	Output type	approx. 380 kHz	●	●
Series -F64	Rated operational current	10 ... 30 V DC, ripple 10 % _{SS}	●	●
	Temperature influence	≤ 30 mA	●	●
Series -D1	Pulse length	1 pulse output for echo run time, short-circuit proof	●	●
	Pause length	open collector pnp with pull down resistor = 22 kOhm	●	●
Series LUC	Impedance	level 0 (no echo): -U _B	●	●
	Standards	level 1 (echo detected): ≥ (+U _B -2 V)	●	●
Double sheet monitoring	Ambient temperature	15 mA, short-circuit/overload protected	●	●
	Storage temperature	the echo propagation time: 0,17 %/ K	●	●
Control units/ Power supplies	Protection degree	1 pulse input for transmitter pulse (clock)	●	●
	Connection	0-level (active): < 5 V (U _B > 15 V)	●	●
Accessories	Material	1-level (inactive): > 10 V ... +U _B (U _B > 15 V)	●	●
	Mass	0-level (active): < 1/3 U _B (10 V < U _B < 15 V)	●	●
		1-level (inactive): > 2/3 U _B ... +U _B (10 V < U _B < 15 V)	●	●

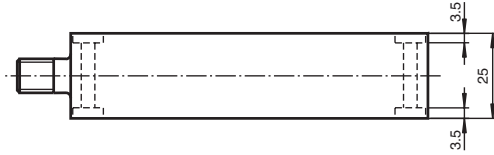
Function

The sensing range is determined in the downstream evaluation electronics (e. g. the units UH3-KHD2-4E5, UH3-KHD2-4I or UH3-T1-KT). PLC modules or other existing evaluation units can also be substituted for these units offered by Pepperl+Fuchs. The object distance in pulse-echo mode is obtained from the echo time.

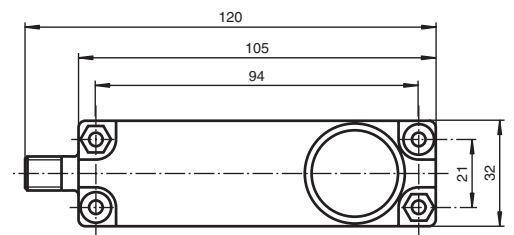
- 1) The unusable area (blind range) BR depends on the pulse duration T_i. The unusable area reaches a minimum with the shortest pulse duration.
- 2) The sensors detection range depends on the pulse duration T_i. With pulse duration < typical pulse duration, the sensors detection range may be reduced.



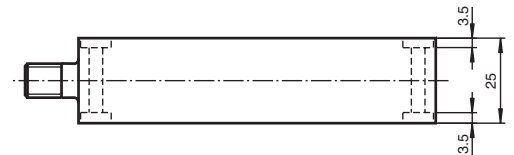
Bore hole and countersinking for screws/hexagon M4



UB500-F54...



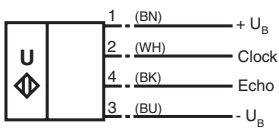
Bore hole and countersinking for screws/hexagon M4



UB2000-F54...

Electrical connection

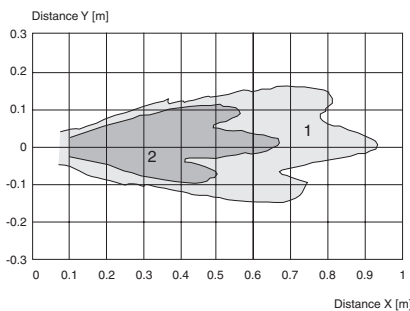
Standard symbol/Connection:



2 = Emitter pulse input
4 = Echo propagation time output
Core colours in accordance with EN 60947-5-2.

Diagrams

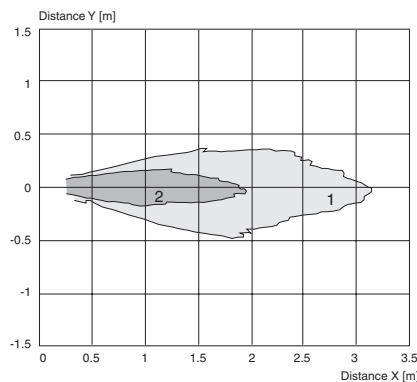
Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB500-F54...

Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

UB2000-F54...

Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

UB...-F54... , output versions -E4 and -E5

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be realised as follows:

External synchronisation

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 µs. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level at the synchronisation input disables the sensor.

Two operating modes are available

1. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
2. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

Internal synchronisation

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors will operate in multiplex mode. The response delay increases according to the number of sensors to be synchronised. Synchronisation cannot be performed during TEACH-IN and vice versa. The sensors must be operated in an unsynchronised manner to teach the switching point.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

Adjusting of switching points

The ultrasonic sensor features a switch output with two teachable switching points. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. Switching point A1 is taught with $-U_B$, A2 with $+U_B$.

Five different output functions can be set

1. Window mode, normally-open function
2. Window mode, normally-closed function
3. One switching point, normally-open function
4. One switching point, normally-closed function
5. Detection of object presence

TEACH-IN window mode, normally-open function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Set target to far switching point
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN window mode, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Set target to far switching point
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN one switching point, normally-open function

- Set target to near switching point
- TEACH-IN switching point A2 with $+U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$

TEACH-IN one switching point, normally-closed function

- Set target to near switching point
- TEACH-IN switching point A1 with $-U_B$
- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A2 with $+U_B$

TEACH-IN detection of object presence

- Cover sensor with hand or remove all objects from sensing range
- TEACH-IN switching point A1 with $-U_B$
- TEACH-IN switching point A2 with $+U_B$

Default setting of switching points

A1 = unusable area

A2 = nominal sensing range

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED	Green LED
TEACH-IN switching point:			
Object detected	off	flashes	flashes
No object detected	flashes	off	flashes
Object uncertain (TEACH-IN invalid)	on	off	flashes
Normal operation	off	switching state	on
Fault	flashes	previous state	off

UB...-F54-... , output versions -I and -U

Synchronisation

The sensor features a synchronisation input for the suppression of mutual interference. If this input is not used, the sensor will operate using an internally generated clock rate. The synchronisation of multiple sensors can be realised as follows:

External synchronisation:

The sensor can be synchronised by the external application of a square wave voltage. A synchronisation pulse at the synchronisation input starts a measuring cycle. The pulse must have a duration greater than 100 μ s. The measuring cycle starts with the falling edge of a synchronisation pulse. A low level > 1 s or an open synchronisation input will result in the normal operation of the sensor. A high level at the synchronisation input disables the sensor.

Two operating modes are available:

1. Multiple sensors can be controlled by the same synchronisation signal. The sensors are synchronised.
2. The synchronisation pulses are sent cyclically to individual sensors. The sensors operate in multiplex mode.

Internal synchronisation:

The synchronisation connections of up to 5 sensors capable of internal synchronisation are connected to one another. When power is applied, these sensors will operate in multiplex mode.

The response delay increases according to the number of sensors to be synchronised.

Synchronisation cannot be performed during TEACH-IN and vice versa. The sensors must be operated in an unsynchronised manner to teach the evaluation limits.

Note:

If the option for synchronisation is not used, the synchronisation input has to be connected to ground (0V) or the sensor has to be operated via a V1 cable connector (4-pin).

Adjusting the evaluation range (analogue output)

The ultrasonic sensor has an analogue output with programmable evaluation limits. These are set by applying the supply voltage $-U_B$ or $+U_B$ to the TEACH-IN input. The supply voltage must be applied to the TEACH-IN input for at least 1 s. LEDs indicate whether the sensor has recognised the target during the TEACH-IN procedure. The lower evaluation limit A1 is taught with $-U_B$, A2 with $+U_B$.

Two different output functions can be set:

1. Analogue value increases with rising distance to object (rising ramp)
2. Analogue value falls with rising distance to object (falling ramp)

TEACH-IN rising ramp (A1 > A2)

- Position object at lower evaluation limit
- TEACH-IN lower limit A1 with $-U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A2 with $+U_B$

TEACH-IN falling ramp (A1 > A2):

- Position object at lower evaluation limit
- TEACH-IN lower limit A2 with $+U_B$
- Position object at upper evaluation limit
- TEACH-IN upper limit A1 with $-U_B$

LED Displays

Displays in dependence on operating mode	Red LED	Yellow LED	Green LED
TEACH-IN evaluation limit			
Object detected	off	flashes	flashes
No object detected	flashes	off	flashes
Object uncertain (TEACH-IN invalid)	on	off	flashes
Normal mode (evaluation range)	off	on	on
Fault	flashes	previous state	off

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -F64



Model number	Connection type	Detection range	Page
UBE500-F64-SE0	cable	500 mm	172
UBE500-F64-SE0-V3	M8 connector, 3-pin	500 mm	
UBE500-F64-SE2	cable	500 mm	
UBE500-F64-SE2-V3	M8 connector, 3-pin	500 mm	172
UBE1500-F64-SE0	cable	1500 mm	
UBE1500-F64-SE0-V3	M8 connector, 3-pin	1500 mm	
UBE1500-F64-SE2	cable	1500 mm	172
UBE1500-F64-SE2-V3	M8 connector, 3-pin	1500 mm	

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Subject to reasonable modifications due to technical advances.

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- Reliable detection of transparent materials
- High switching frequency
- Small angle of divergence
- Small, compact design
- Plastic housing
- Emitter and receiver included in the delivery package



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

	Model number	UBE500-F64-SE0	UBE500-F64-SE0-V3	UBE500-F64-SE2	UBE500-F64-SE2-V3	UBE1500-F64-SE0	UBE1500-F64-SE0-V3	UBE1500-F64-SE2	UBE1500-F64-SE2-V3
Sensing range	0 ... 1500 mm, distance emitter-receiver 20 mm ... 1500 mm 0 ... 500 mm, distance emitter-receiver 15 mm ... 500 mm	•	•	•	•	•	•	•	•
Reference target	receiver	•	•	•	•	•	•	•	•
Transducer frequency	200 kHz	•	•	•	•	•	•	•	•
LED yellow	indication of the switching state (receiver)	•	•	•	•	•	•	•	•
Operating voltage	18 ... 30 V DC, ripple 10 % _{SS}	•	•	•	•	•	•	•	•
No-load supply current	20 mA receiver 12 mA emitter	•	•	•	•	•	•	•	•
Output type	1 switch output E0, npn NO 1 switch output E2, pnp NO	•	•	•	•	•	•	•	•
Rated operational current	200 mA 50 mA	•	•	•	•	•	•	•	•
Voltage drop	≤ 0,5 V ≤ 2 V	•	•	•	•	•	•	•	•
Switching frequency	100 Hz 120 Hz	•	•	•	•	•	•	•	•
Switch-on delay	< 5 ms	•	•	•	•	•	•	•	•
Standards	EN 60947-5-2	•	•	•	•	•	•	•	•
Ambient temperature	0 ... 60 °C (273 ... 333 K)	•	•	•	•	•	•	•	•
Storage temperature	-40 ... 85 °C (233 ... 368 K)	•	•	•	•	•	•	•	•
Protection degree	IP54	•	•	•	•	•	•	•	•
Connection	V3 connector (M8 x 1), 3 pin 2 m PVC cable emitter: 2 x 0.34 mm ² receiver: 3 x 0.34 mm ²	•	•	•	•	•	•	•	•
Material		•	•	•	•	•	•	•	•
Housing	PA 6.6	•	•	•	•	•	•	•	•
Mass	80 g per device	•	•	•	•	•	•	•	•

Function

A through-beam ultrasonic barrier always consists of a single emitter and a single receiver. The function of a through-beam ultrasonic barrier is based in the interruption of the sound transmission to the receiver by the object to be detected.

The emitter sends an ultrasonic signal that is evaluated by the receiver. If the signal is interrupted or muted by the object to be detected, the receiver switches.

No electrical connections are required between the emitter and receiver.

The function of through-beam ultrasonic barriers is not dependent on the position of their installation. We recommend, however, to install the emitter below in the case of vertical installations to prevent the accumulation of dust particles.

Installation tolerances

The installation tolerances of the central axes of the emitter and receiver may not exceed the values specified in the illustration.

Detection of thin foils

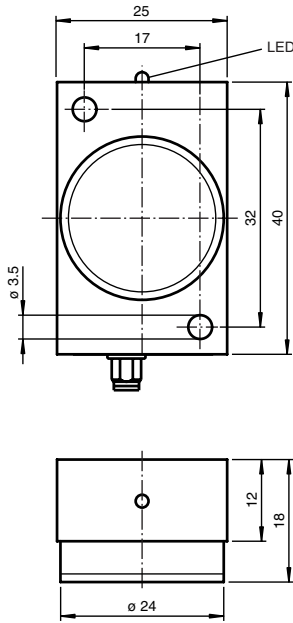
For the detection of thin foils (< 0.1 mm), install the through-beam ultrasonic barrier at an angle of ≥ 10° from perpendicular to the foil.

Caution

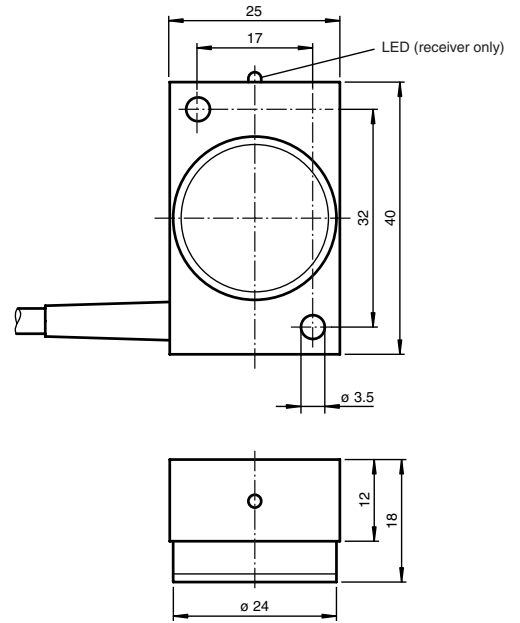
Mount or replace emitter and receiver only in pairs. Both devices are optimally matched to each other by the manufacturer.

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Date of edition: 08/18/2005



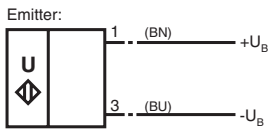
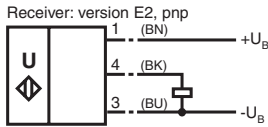
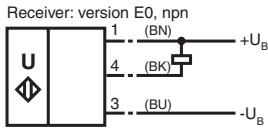
UBE...-F64-SE.-V3 (connector version)



UBE...-F64-SE. (cable version)

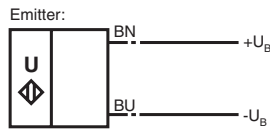
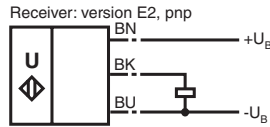
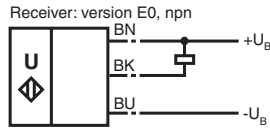
Electrical connection

Standard symbol/Connection:



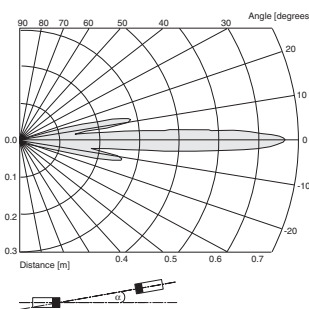
Core colours in accordance with EN 60947-5-2.

Standard symbol/Connection:



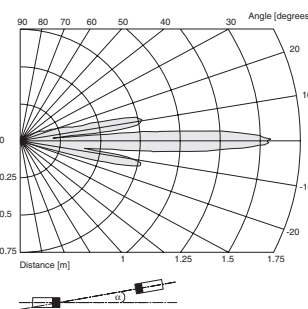
Diagrams

Characteristic response curves



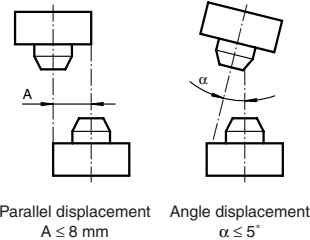
UBE500-F64...

Characteristic response curves

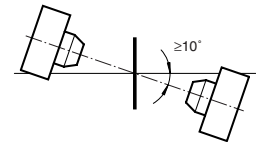


UBE1500-F64...

Mounting/Adjustment



Thin foil detection



Date of edition: 08/18/2005

- Series -12GM
- Series -18GK/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series -D1



Model number	Detection range	Page
UC500-D1-3K-V7	500 mm	176

Date of edition 08/18/20.05

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- Series -12GM
- Series -18GK/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/ Power supplies
- Accessories

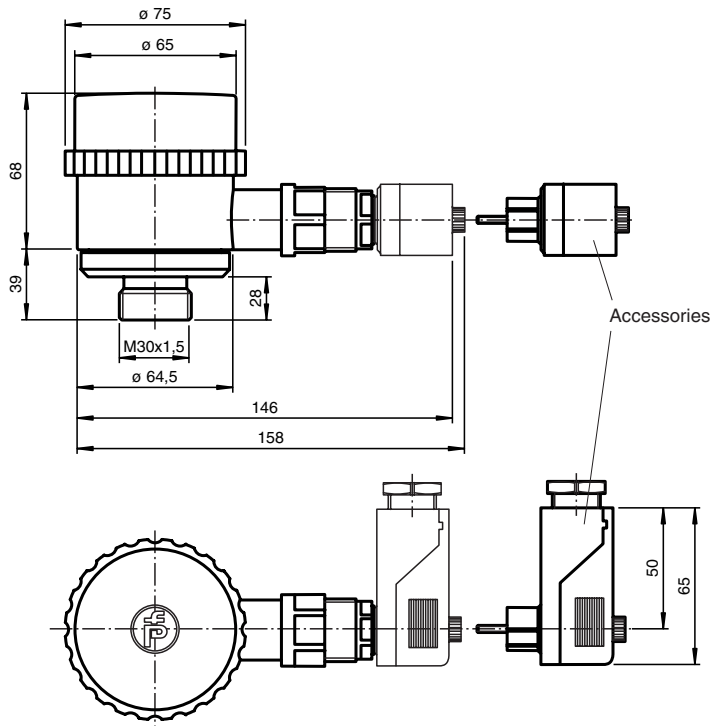


- Specially for level monitoring in vessels
- Large operating voltage range
10 V DC ... 252 V DC
20 V AC ... 252 V AC
- 3 relay outputs
- Parameter assignment via DIP-switches
- Temperature compensation

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

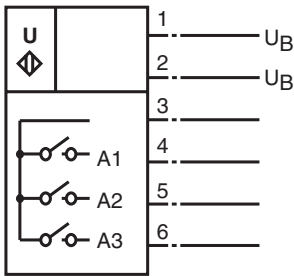
Technical Data

	Model number	UC500-D1-3K-V7
Output type	3 relay outputs, normally open/closed, selectable	●
Contact loading	252 V AC/150V DC, 3 A (ohm. load)	●
Lifetime	Electrical: 10 ⁵ switching cycles at resistive load (3 A / 252 V AC or 3 A / 30 V DC) min. contact load: 100 µA / 100 mV DC mechanical: 20 x 10 ⁶ switching cycles	●
Range hysteresis	20 mm	●
Temperature influence	< 4 %	●
Sensing range	60 ... 550 mm	●
Unusable area	0 ... 60 mm	●
Standard target plate	100 mm x 100 mm	●
Transducer frequency	approx. 380 kHz	●
Response delay	> 10 s, relay < 1 s, LEDs	●
Standards	EN 60947-5-2	●
LED green/yellow	LED 2: overfill warning and normal operation LED 3: normal operation and underfill warning	●
LED red	LED 1: overfill indication LED 4: underfill indication	●
DIP-switch	setting of the switch points/operating modes	●
Operating voltage	10 ... 252 V DC 20 ... 252 V AC, 47 ... 63 Hz	●
No-load supply current	< 30 mA with U _B = 30 V DC < 110 mA at U _B = 10 V DC < 25 mA at U _B = 220 V AC	●
Ambient temperature	-20 ... 60 °C (253 ... 333 K)	●
Storage temperature	-40 ... 85 °C (233 ... 368 K)	●
Protection degree	IP65	●
Connection	Cable connector 90° V7, (7-pin)	●
Material		
Housing	cover: PC housing: PBT threaded flange: stainless steel installation connector/cable socket: PETP	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	700 g	●



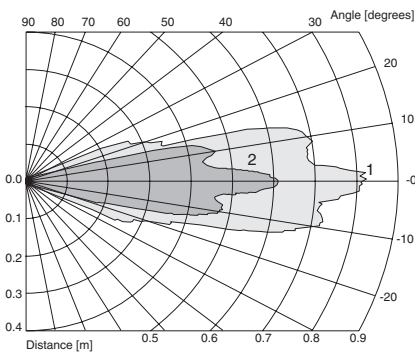
Electrical connection

Standard symbol/Connection:



Diagrams

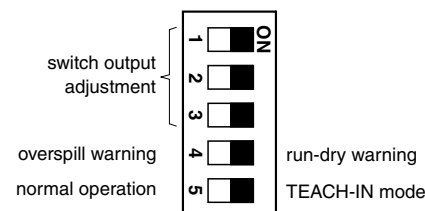
Characteristic response curves



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, $\phi 25$ mm

Indicators/operating means

LED	S4 = OFF	S4 = ON
1 \otimes (red)	full	full
2 \otimes (green/yellow)	high	normal
3 \otimes (green/yellow)	normal	low
4 \otimes (red)	empty	empty



Date of edition: 08/18/2005

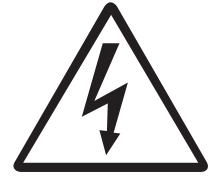
Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Safety notes:

The supply circuit is separated from the relay circuit by basic insulation.

The cover may only be opened by specially trained personnel. Degree of contamination 2 is permissible when the cover is open. Ensure that the sealing ring of the cover is in good condition.

Safety class II is only guaranteed when using the accessoril cable box and the associated mounting screw with plastic head. When operating this device with operating voltage exceeding 42 V, you must replace the metal mounting screw by the supplied plastic head mountig screw to avoid electric treatment. The cable box may only be separated from the unit when the power is off.

**CAUTION:**

The UC500-D1-K3-V7 ultrasonic sensor is not suitable for use in environments subject to explosion hazards.

Conformity: EN 60947-5-2
 Housing insulation: Safety class II
 Degree of contamination: 4
 Overvoltage category: III

TEACH-IN of switching points:

One switching point can be taught for each of the 3 switch outputs. Set DIP switch 5 to ON to put the sensor in TEACH-IN mode. The sensor indicates TEACH-IN mode with two lit red LEDs. The green-yellow LEDs are off.

Next, position a suitable target object at the desired switching point in front of the sensor and switch the DIP switch associated with the relevant switch output (switches 1-3). The sensor will now be flashing yellow or green in addition to the lit red LEDs. Flashing green indicates that the target object was detected; flashing yellow signals that it was not detected. The measured switching point will be transferred to RAM when the associated DIP switch is switched back while the LED is flashing green. Only the red LEDs should now be lit. This signals the user that the DIP switches 1-3 have been restored to their original positions. The other switching points are set in the same manner. The TEACH-IN procedure is completed by setting DIP switch 5 back to the OFF position. The measured switching points will then be transferred to the nonvolatile EEPROM.

Under normal circumstances, switching point A1 should be less than A2, and A2 less than A3. If this is not observed, the sensor will automatically exchange the switching points after the TEACH-IN procedure is complete so that $A1 < A2 < A3$. This ensures that the LEDs respond correctly and that the shortest switching point is assigned to relay 1, the middle distance to relay 2 and the longest distance to relay 3.

If DIP switch 4 is switched during TEACH-IN, the default value for the switching point will be set rather than a target object. The default values for the switching points are 60 mm for A1, 220 mm for A2 and 270 mm for A3.

Display during TEACH-IN:

DIP1-3	one or more DIP switches changed TEACH-IN active			in normal state TEACH-IN complete	
DIP4	normal state TEACH-IN of object distance		change d default para meter	normal state	changed
State	object detected	object n ot detected	default active		
LED 1, red	lit	lit	lit	lit	lit
LED 2, green/yellow	flashes green	off	lit green	off	lit green
LED 3, green/yellow	off	flashes yellow	lit yellow	off	lit yellow
LED 4, red	lit	lit	lit	lit	lit

The relays switch to the "safe state" (all relays open, regardless of close/open function) during TEACH-IN.

Setting the switching behaviour:

In normal mode (DIP switch 5 OFF), the DIP switches 1 to 3 can be used to set the switching behaviour of the switch outputs 1 to 3. If the associated DIP switch is ON, the associated switch output has a close function; if the switch is set to OFF the output has an open function. Close function means that the relay trips when the object distance is less than the associated switching point; in the case of open function, the relay trips when the object distance is greater than the switching point.

The relays switch to the "safe state" (all relays open, regardless of close/open function) in the event of a failure

Setting the display modes:

Two display modes can be selected with DIP switch 4:

Display mode 1: DIP switch 4 ON, underfill warning:

Object distance x	$x < A1$	$A1 < x < A2$	$A2 < x < A3$	$x > A3$
LED 1, red (full)	flashes	off	off	off
LED 2, green/yellow (normal)	off	lit green	off	off
LED 3, green/yellow (low)	off	off	flashes yellow	off
LED 4, red (empty)	off	off	off	flashes

In this mode LED 1 (red) serves as the overflowing indicator, LED 2 (green) indicates the normal state, LED 3 (yellow) serves as the preliminary warning that the container is nearly empty and LED 4 (red) signals the "container empty" state.

Display mode 2: DIP switch 4 OFF, overflow warning

Object distance x	$x < A1$	$A1 < x < A2$	$A2 < x < A3$	$x > A3$
LED 1, red (full)	flashes	off	off	off
LED 2, green/yellow (high)	off	flashes yellow	off	off
LED 3, green/yellow (normal)	off	off	lit green	off
LED 4, red (empty)	off	off	off	flashes

In this mode LED 1 (red) serves as the overflowing indicator, LED 2 (yellow) serves as the preliminary warning that the container is nearly full, LED 3 (green) indicates the normal state, and LED 4 (red) signals the "container empty" state.

The relays switch to the "safe state" (all relays open, regardless of close/open function) in the event of a failure.

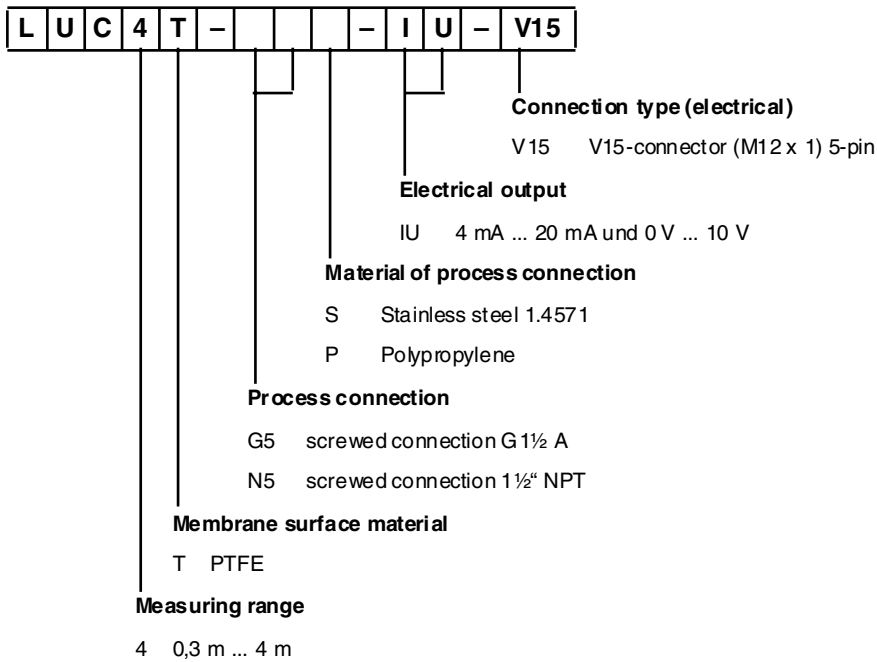
Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series LUC



Model number	Detection range	Page
LUC4T-G5P-IU-V15 LUC4T-G5S-IU-V15 LUC4T-N5P-IU-V15 LUC4T-N5S-IU-V15	4000 mm	182

Type code/ordering information



Date of edition 08/18/20.05

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Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/Power supplies
 Accessories



- Fixed target suppression
- Simple calibration
- Function monitoring
- Fail-safe behaviour in the event of no echo
- Output signal 4 mA ... 20 mA/0 V ... 10 V
- Temperature compensation

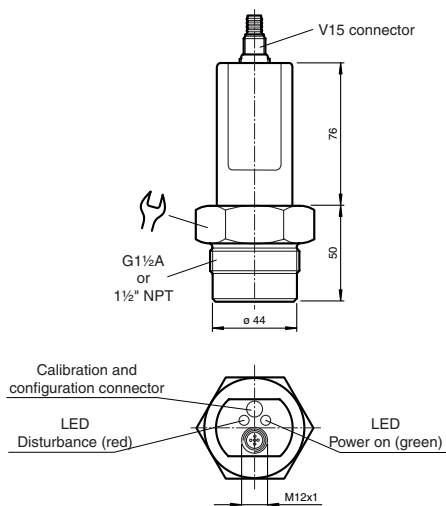


Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

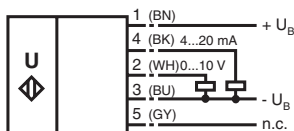
Technical Data

	Model number	LUC4TG 5P-IU-V15	LUC4TG 5S-IU-V15	LUC4TNGP-IU-V15	LUC4TNS-IU-V15
Output type	1 analogue output 4 ... 20 mA, $R_L \leq 500 \text{ Ohm}$, error $\geq 21 \text{ mA}$ 1 voltage output 0 ... 10 V, $R_L \geq 1000 \text{ Ohm}$, error $\geq 10.5 \text{ V}$	●	●	●	●
Resolution	2 mm	●	●	●	●
Deviation of the characteristic curve	0,5 % of upper limit of measuring range	●	●	●	●
Sensing range	0,3 ... 4 m, with fluids	●	●	●	●
Transducer frequency	approx. 85 kHz	●	●	●	●
Standards	EN 60947-5-2	●	●	●	●
LED green	power on	●	●	●	●
LED red	2 Hz flashing error	●	●	●	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●	●	●	●
Power consumption	$\leq 1200 \text{ mW}$	●	●	●	●
Ambient temperature	-25 ... 70 °C (248 ... 343 K)	●	●	●	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●	●	●	●
Protection degree	IP65	●	●	●	●
Connection	connector V15 (M12 x 1), 5 pin	●	●	●	●
Mounting	screwed connection G1½A screwed connection 1½" NPT	●	●	●	●
Material					
Housing	PBT, stainless steel 1.4571		●		●
	PBT, polypropylene	●		●	
Transducer	PTFE (diaphragm surface)	●	●	●	●
Mass	220 g	●	●	●	●

Dimensions

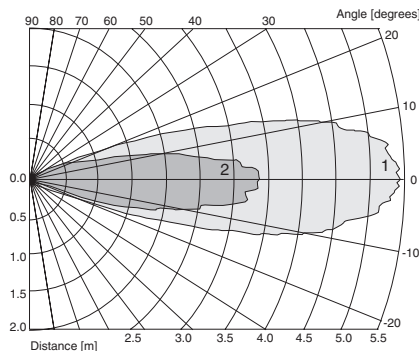


Standard symbol/Connection:



Core colours in accordance with EN 60947-5-2.

Characteristic response curves



Curve 1: flat plate 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Additional information

Product description:

The LUC4T-... ultrasonic sensor is especially designed to measure the fill level of liquids. With its Teflon-coated surface, the sensor is outstandingly suited for use with corrosive liquids. The masking of fixed objects permits the sensor to be deployed in locations in which struts or other internal structures extend into the measuring field.

Sensors of the LUC4T-... series feature a 4 mA ... 20 mA current and 0 V ... 10 V voltage output as standard. The outputs have fail-safe behaviour in the event of a fault.

Function

The ultrasonic converter sends out an acoustic pulse. This pulse is reflected by the contents of the container and registered by the converter after traveling the measurement distance.

A microprocessor evaluates the echo signals and determines the fill level.

Sources of interference such as weld seams, fixed installations, etc. are suppressed reliably via the masking of fixed objects.

Temperature-related changes of the velocity of sound are compensated.

Measuring system:

A measuring system consists of a LUC4T-...-IU-V15 ultrasonic level sensor and a DA5... display unit or power supply. The LUC4T-...-IU-V15 ultrasonic level sensor can also be connected directly to a PLC.

Compensation:

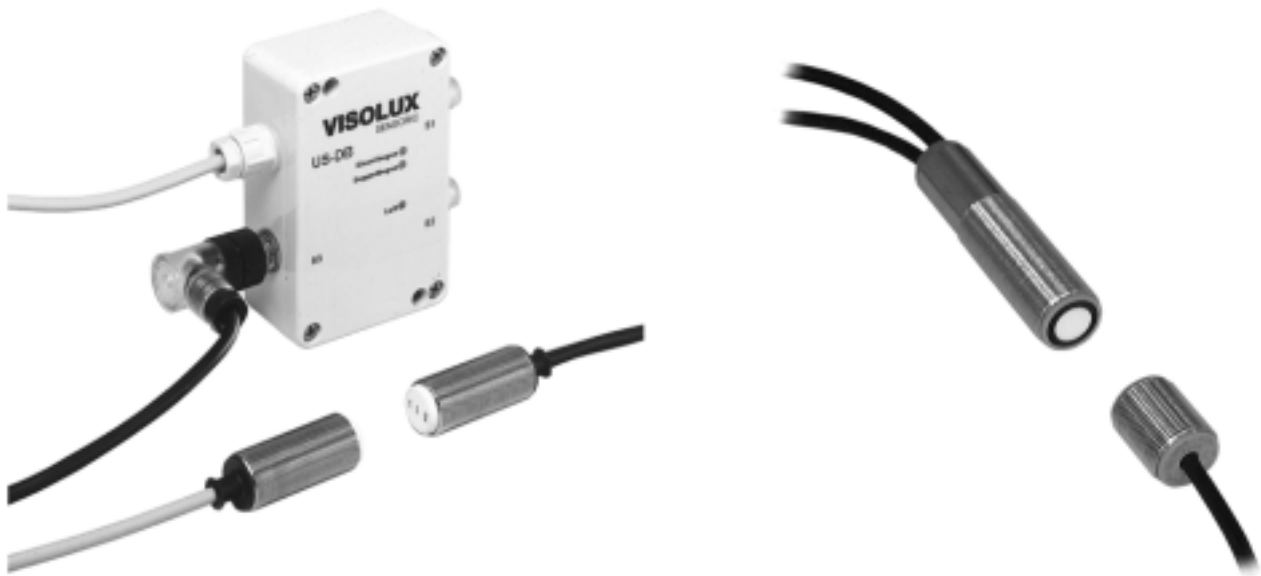
Compensation (not installed)	Compensation (installed)	Plug position
1. Empty TEACH-IN simulation of 0 % level (wait 15 s)	1. Empty TEACH-IN approach 0 % level in container (wait 15 s)	T
Accept empty value Empty value accepted (red LED flashing) Empty TEACH-IN complete	Accept empty value Empty value accepted (red LED flashing) Empty TEACH-IN complete	A1 A1 T
2. Full TEACH-IN simulation of 100 % level (wait 15 s)	2. Full TEACH-IN approach 100 % level in container (wait 15 s)	T
Accept full value Full value accepted (red LED flashing) Full TEACH-IN complete	Accept full value Full value accepted (red LED flashing) Full TEACH-IN complete	A2 A2 T
TEACH-IN complete	TEACH-IN complete	T

Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Series UDC / UDB



Model number	Description	Page
UDC-18GM-400-3E3	Optimised for double sheet detection with integrated evaluation unit	186
UDC-18GMA-400-3E3	Optimised for double sheet detection with integrated evaluation unit Angled sensor head version	190
UDB-18GM35-3E2	Optimised for double sheet detection	194
UDBL-18GM35-3E2	Optimised for label detection	196
UDBK-18GM35-3E2	Optimised for jointing/splice detection	198

Applications:

The ultrasonic double-sheet monitor is deployed in all situations in which the automatic distinction between single and double sheets is required in order to protect machines or avoid waste production.

For example:

- Deployment in printing machines, in which the ultrasonic double-sheet monitor prevents damage to the complex mechanics by the inadvertent feed of two sheets or ensures that the second sheet does not remain in the machine.
- The monitoring of bonding sheets in labeling machines, in which the application of the sheets to a base material is detected and counted.

- Deployment in letter-opening machines to verify the complete emptying of the opened envelopes.
- Deployment in document counters, in which the ultrasonic double-sheet monitor ensures that bank deposit slips, for example, are properly counted.
- Deployment in packaging machines for the detection of splices in aluminium packaging foil and proper regulation of the machine speed.
- Detection of air, single and double sheet in paper processing machinery.



- Ultrasonic system for reliable detection of no, one, or two overlapping sheet materials, preferably papers
- No TEACH-IN required
- Function indicators visible from all directions
- Insensitive to printing, colours and shining surfaces
- Material weight from 10 g/m² up to over 2000 g/m²
- Very wide material spectrum, finest papers up to thin sheet metals as well as plastic- and metal foils
- Perpendicular or inclined sensor mounting relative to the sheet plane possible



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

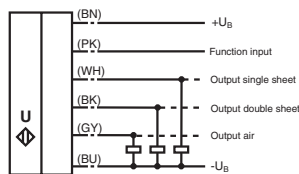
Technical Data

Series	Model number	UDC-18GM-400-3E3
-F12		
-F42	Sensing range	20 ... 60 mm, optimal distance: 45 mm
	Transducer frequency	395 kHz
	Focke Ident-Nr.	9362245
	LED green	indication: single sheet detected
	LED yellow	Display: No sheet detected (Air)
	LED red	indication: double sheet detected
-F43	Operating voltage	18 ... 30 V DC, ripple 10 % _{SS}
	No-load supply current	<80 mA
	Time delay before availability	<500 ms
	Output type	3 Switch outputs pnp, normally-closed
-F54	Rated operational current	3 x 100 mA, short-circuit/overload protected
	Voltage drop	≤ 2 V
	Switch-on delay	approx. 25 ms
	Switch-off delay	approx. 25 ms
	Pulse extension	min. 120 ms parameterisable
-F64	Input type	Function input
	0 level: -U _B ... -U _B + 1V	
	1 level: +U _B - 1 V ... +U _B	
	Pulse length	≥ 100 ms
	Impedance	≥ 230 kΩ
	Standards	EN 60947-5-2 C-UL listed: 57M3, IND CONT. EQ., "Powered by Class 2 Power Source"
-D1	Ambient temperature	0 ... 60 °C (273 ... 333 K)
	Storage temperature	-40 ... 70 °C (233 ... 343 K)
	Protection degree	IP67
	Connection	2 m, PVC cable 0.14 mm ²
LUC	Housing	brass, nickel-plated, plastic components PBT
	Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam
	Mass	150 g

Electrical connection, diagrams, additional information

Standard symbol/Connection:

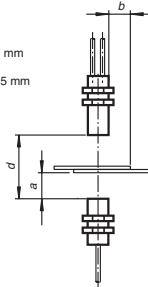
Double sheet control



Mounting/Adjustment

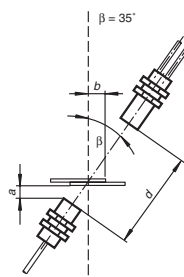
Recommended distances

- a = 5 ... 15 mm
- b ≥ 10 mm
- d = 40 ... 45 mm



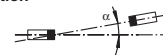
Mounting/Adjustment

(for very thick papers)



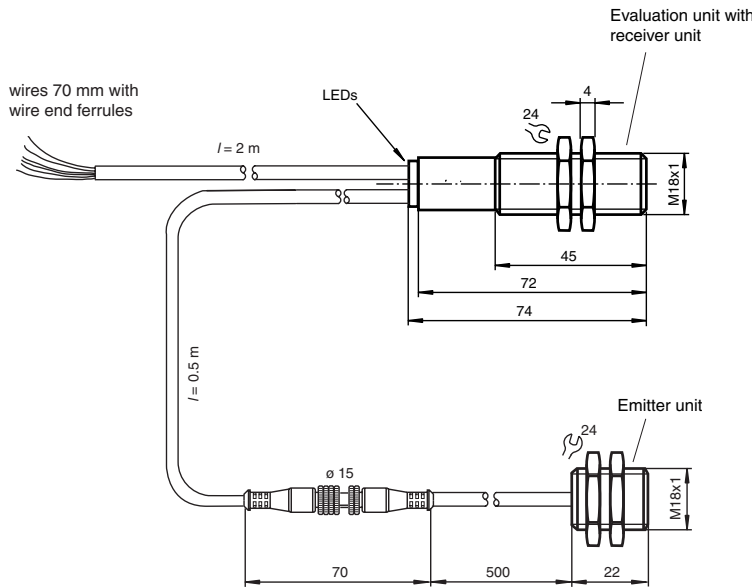
Thin foil detection

α < +/- 1°



s < +/- 1 mm





Additional information

Description of sensor functions

The ultrasonic double sheet monitor is used for double sheet detection in all situations in which the automatic distinction between double and single sheets is required in order to protect machines or avoid waste production. The double-sheet monitor is based on the ultrasonic through-beam principle. The following can be detected:

- No sheet, i.e. air,
- Individual sheet
- Double sheet

A microprocessor system evaluates the signals. The appropriate switch outputs are set as a result of the evaluation. Changes in ambient conditions such as temperature and humidity are compensated for automatically. The interface electronics is integrated into a compact M18 metal housing together with a sensor head.

Switching on

The sensor is equipped with 6 connections. The functionality of the connections is described in the following table. The function input (PK) is used to assign parameters to the sensor. (See Output pulse extension, Alignment aid and Program selection). During normal operation, the function input must always be securely connected with +U_B or -U_B, to avoid possible interference or improper functionality.

Colour	Switching on	Comments
BN	+U _B	
WH	Switch output for single sheets	Pulse width corresponds to the event
BK	Switch output for double sheets	Pulse width corresponds to the event
GY	Switch output for air	Pulse width corresponds to the event
PK	-U _B / +U _B	Function input for parameter assignment/pulse prolongation
BU	-U _B	

Normal mode

The sensor is working in normal mode if the function input (PK) is applied to -U_B or +U_B when the power source (Power-On) is supplied, as shown in the output pulse extension table (see below).

Displays:

- LED yellow: Detection of air
- LED green: Detection of single sheets
- LED red: Detection of double sheets

Switch outputs:

The switch outputs are only active in normal operation!

- White: WH Single sheet output
- Black: BK Double sheet output
- Gray: GY Air output

Date of edition: 08/18/2005

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/Power supplies
- Accessories

Output pulse extension

Switching the function input (PK) on to $-U_B$ or $+U_B$ makes it possible to select a minimum pulse width of 120 ms for all output pulses of the three switch outputs.

Switching on (PK)	Operating behaviour (after Power-On)
$-U_B$	No output pulse extension for switch outputs
$+U_B$	Output pulse extension of all switch outputs to at least 120 ms

Please note:

This can result in a condition in which more than one switch output is switched through!

Display Mode

The selected parameter assignment of the sensor can be displayed by switching the function input (PK) to voltage-free during normal operation. The green LED displays the program number (the number of flashing pulses (1 ... 4) = the program number). The outputs are inactive during this time.

If the function input (PK) is switched to voltage-free when power is supplied (Power-On), the sensor will also work in display mode.

If the unit is switched to voltage-free while the function input (PK) is in operation due to an error (broken cable, coming loose because of vibration), display mode acts as a fault display.

Parameter assignment

The sensor is equipped with 4 programs for different ranges of application. This makes it possible to work with a wide range of material. The user can select the program best suited for a specific application.

The default setting, Program 1, is designed so that no change in the setting is required for most applications.

Programs

Program number	Notes:	Range of materials
1	Default setting, standard paper	20 - 1200 g/m ²
2	Thick paper, cardboard, fine corrugated boards (DIN 55 468-1) and thin sheet metal**	> 100 g/m ²
3	Thin paper	20 - 250 g/m ²
4	Extremely fine paper	< 40 g/m ²

*) The measurements were made under the following conditions: $d = 45$ mm, $a = 10$ mm, $\beta = 0^\circ$

*) The measurements were made under the following conditions: $d = 45$ mm, $a = 10$ mm, $\beta = 35^\circ$

Procedure for assigning parameters

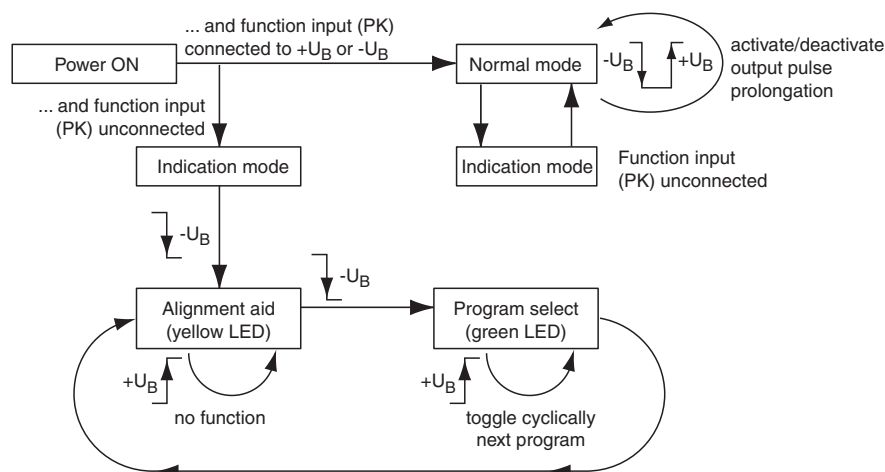
It is possible to switch to additional parameter assignment modes from the display mode:

- Alignment mode -->
- Program selection mode -->
- Alignment aid mode --> (for checking)

When the function input (PK) is applied to $-U_B$ (for > 500 ms), the mode changes. When the "Program selection" mode is active, switching on function input (PK) on to $+U_B$ (for > 500 ms) selects the next program level.

Disconnecting the power supply causes the system to exit the current mode with the selected program change.

The switch outputs are not active while parameters are being assigned to the sensor!



Modes

Alignment aid

During installation, the DSM can provide an adjustment aid for optimal alignment of the emitter to the receiver.

If the sensor detects an area of air (yellow LED is lit) the DSM will begin to display the intensity of the measured amplitude signal:

- If the signal is weak, the yellow LED will flash at a slow rate
- As the intensity of the signal increases, the rate at which the LED flashes becomes faster
- At optimal alignment (maximum signal intensity), the yellow LED is continuously lit.

The single sheet function (green LED) and double sheet function (red LED) continues to be active. This makes it possible to check for correct functionality of the double sheet control.

Program selection

In the program selection mode, the current program is displayed by the green LED (number of flashing pulses = program number). Applying the adjustment input (PK) to +U_B (for > 500 ms) causes the next program to be selected in cyclic sequence (program 1 follows through to program 4).

Notes:

A complete device consists of an ultrasonic emitter and an evaluation unit with an ultrasonic emitter. The sensor heads are optimally adjusted to each other when they leave the factory. Therefore, they must not be used separately or exchanged with other devices of the same type. The plug connector on the emitter/receiver connection cable is only intended to be used for easier mounting, not to replace units.

Very light papers (for example handkerchiefs) or perforated papers are not always suitable for double sheet detection because of their physical characteristics.

If two or more double sheet controls are used in the immediate vicinity of each other, there may be mutual interference between them, which can result in improper functionality of the devices. Mutual interference can be prevented by introducing suitable countermeasures when planning systems.



- Ultrasonic system for reliable detection of no, one, or two overlapping sheet materials, preferably papers
- No TEACH-IN required
- Function indicators visible from all directions
- Insensitive to printing, colours and shining surfaces
- Material weight from 10 g/m² up to over 2000 g/m²
- Very wide material spectrum, finest papers up to thin sheet metals as well as plastic- and metal foils
- Perpendicular or inclined sensor mounting relative to the sheet plane possible
- Automatic compensation of the single-sheet value in the case of slowly changing ambient conditions



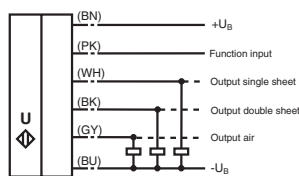
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

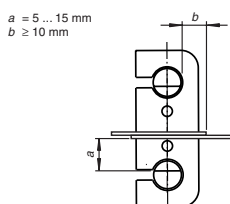
Series	Model number	UDC-18G MA-400-3E3
-F12		
-F42		
-F43		
-F54		
-F64		
-D1		
LUC		
Sensing range	20 ... 60 mm, optimal distance: 45 mm	●
Transducer frequency	395 kHz	●
LED green	indicator: single sheet detected	●
LED yellow	Display: No sheet detected (Air)	●
LED red	indicator: double sheet detected	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	<80 mA	●
Time delay before availability	<500 ms	●
Output type	3 Switch outputs pnp, normally-closed	●
Rated operational current	3 x 100 mA, short-circuit/overload protected	●
Voltage drop	≤ 2 V	●
Switch-on delay	approx. 25 ms	●
Switch-off delay	approx. 25 ms	●
Pulse extension	min. 120 ms parameterisable	●
Input type	Function input 0 level: -U _B ... -U _B + 1V 1 level: +U _B - 1V ... +U _B	●
Pulse length	≥ 100 ms	●
Impedance	≥ 230 kΩ	●
Standards	EN 60947-5-2 C-UL listed: 57M3, IND CONT. EQ., "Powered by Class 2 Power Source"	●
Ambient temperature	0 ... 60 °C (273 ... 333 K)	●
Storage temperature	-40 ... 70 °C (233 ... 343 K)	●
Protection degree	IP67	●
Connection	2 m, PVC cable 0.14 mm ²	●
Housing	brass, nickel-plated, plastic components PBT	●
Transducer	epoxy resin/hollow glass sphere mixture; polyurethane foam	●
Mass	150 g	●

Electrical connection, diagrams, additional information

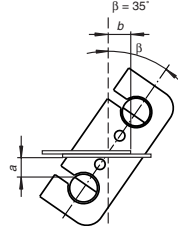
Standard symbol/Connection: Double sheet control

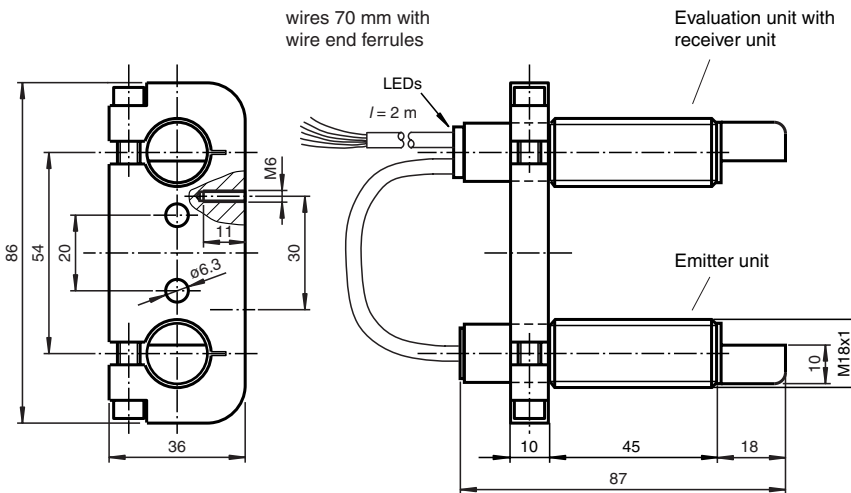


Mounting/Adjustment Recommended distances



Mounting/Adjustment (for very thick Papers)





Additional information

Description of sensor functions

The ultrasonic double sheet monitor is used for double sheet detection in all situations in which the automatic distinction between double and single sheets is required in order to protect machines or avoid waste production. The double-sheet monitor is based on the ultrasonic through-beam principle. The following can be detected:

- No sheet, i.e. air,
- Individual sheet
- Double sheet

A microprocessor system evaluates the signals. The appropriate switch outputs are set as a result of the evaluation. Changes in ambient conditions such as temperature and humidity are compensated for automatically. The interface electronics is integrated into a compact M18 metal housing together with a sensor head. To ensure a reliable operation of the double sheet monitor, the detection threshold is adapted dynamically to the detected paper thickness.

Switching on

The sensor is equipped with 6 connections. The functionality of the connections is described in the following table. The function input (PK) is used to assign parameters to the sensor. (See Output pulse extension, Alignment aid and Program selection). During normal operation, the function input must always be securely connected with +U_B or -U_B, to avoid possible interference or improper functionality.

Colour	Switching on	Comments
BN	+U _B	
WH	Switch output for single sheets	Pulse width corresponds to the event
BK	Switch output for double sheets	Pulse width corresponds to the event
GY	Switch output for air	Pulse width corresponds to the event
PK	-U _B / +U _B	Function input for parameter assignment/pulse prolongation
BU	-UB	

Normal mode

The sensor is working in normal mode if the function input (PK) is applied to -U_B or +U_B when the power source (Power-On) is supplied, as shown in the output pulse extension table (see below).

Displays:

- LED yellow: Detection of air
- LED green: Detection of single sheets
- LED red: Detection of double sheets

Switch outputs:

The switch outputs are only active in normal operation!

- White: WH Single sheet output
- Black: BK Double sheet output
- Gray: GY Air output

Date of edition: 08/18/2005

Output pulse extension

Switching the function input (PK) on to $-U_B$ or $+U_B$ makes it possible to select a minimum pulse width of 120 ms for all output pulses of the three switch outputs.

Switching on (PK)	Operating behaviour (after Power-On)
$-U_B$	No output pulse extension for switch outputs
$+U_B$	Output pulse extension of all switch outputs to at least 120 ms

Please note:

This can result in a condition in which more than one switch output is switched through!

Display Mode

The selected parameter assignment of the sensor can be displayed by switching the function input (PK) to voltage-free during normal operation. The green and the red LED display alternately the program number and the operation mode.

LED green: Number of blinking pulses = program number

LED red: single flashing = continuous operation mode

double flashing = pulsed operation mode

The outputs are inactive during this time.

If the function input (PK) is switched to voltage-free when power is supplied (Power-On), the sensor will also work in display mode.

If the unit is switched to voltage-free while the function input (PK) is in operation due to an error (broken cable, coming loose because of vibration), display mode acts as a fault display.

Parameter assignment

The sensor is equipped with 4 programs for different ranges of application. This makes it possible to work with a wide range of material. The user can select the program best suited for a specific application.

The default setting, Program 1, is designed so that no change in the setting is required for most applications.

Programs

Program number	Notes:	Range of materials
1	Default setting, standard paper	20 - 1200 g/m ²
2	Thick paper, cardboard, fine corrugated boards and thin sheet metal	> 100 g/m ²
3	Thin paper	20 - 250 g/m ²
4	Extremely fine paper	< 40 g/m ²

Operation modes

The double sheet monitor offers the possibility to select between continuous operation mode and pulsed operation mode. Due to the pulsed operation mode is pre-selected as the standard mode, most applications need no modification.

Procedure for assigning parameters

It is possible to switch to additional parameter assignment modes from the display mode:

Alignment mode -->

Program selection mode -->

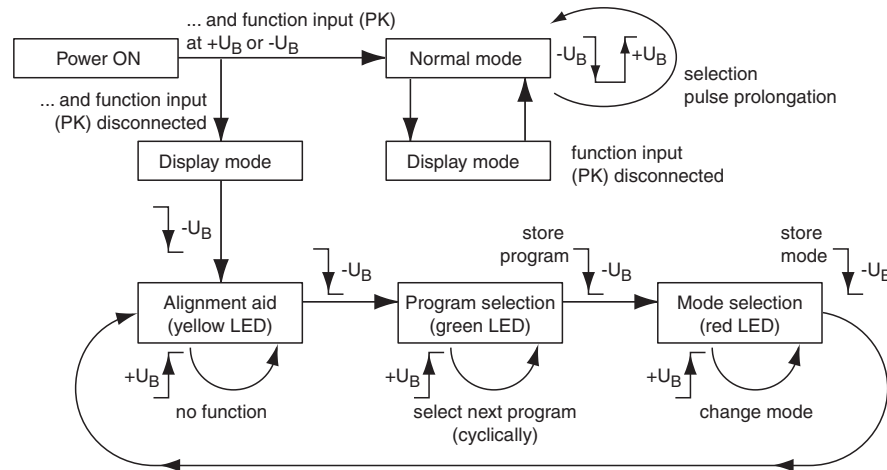
Operation mode selection mode -->

Alignment aid mode --> (for checking)

When the function input (PK) is applied to $-U_B$ (for > 500 ms), the mode changes and the storage of the current parameter. Within the Modes "program selection" and "operation mode selection" you can scroll through the programs or modes by applying $+U_B$ (for > 500 ms) to the function input (PK).

Disconnecting the power supply causes the system to exit the current mode with the selected program change.

The switch outputs are not active while parameters are being assigned to the sensor!



Modes

Alignment aid

During installation, the DSM can provide an adjustment aid for optimal alignment of the emitter to the receiver.

If the sensor detects an area of air (yellow LED is lit) after 3 seconds, the DSM will begin to display the intensity of the measured amplitude signal:

- If the signal is weak, the yellow LED will flash at a slow rate
- As the intensity of the signal increases, the rate at which the LED flashes becomes faster
- At optimal alignment (maximum signal intensity), the yellow LED is continuously lit.

The single sheet function (green LED) and double sheet function (red LED) continues to be active. This makes it possible to check for correct functionality of the double sheet control.

Program selection

In the program selection mode, the current program is displayed by the green LED (number of flashing pulses = program number). Applying the adjustment input (PK) to $+U_B$ (for > 500 ms) causes the next program to be selected in cyclic sequence (program 1 follows through to program 4).

Operation mode selection

In the operation mode selection mode, the current program is displayed by the red LED.

single flashing: continuous operation mode

double flashing: pulsed operation mode

Applying the adjustment input (PK) to $+U_B$ (for > 500 ms) causes an alteration of the operation mode.

Notes:

A complete device consists of an ultrasonic emitter and an evaluation unit with an ultrasonic emitter. The sensor heads are optimally adjusted to each other when they leave the factory. Therefore, they must not be used separately or exchanged with other devices of the same type. The plug connector on the emitter/receiver connection cable is only intended to be used for easier mounting, not to replace units.

Very light papers (for example handkerchiefs) or perforated papers are not always suitable for double sheet detection because of their physical characteristics.

If two or more double sheet controls are used in the immediate vicinity of each other, there may be mutual interference between them, which can result in improper functionality of the devices. Mutual interference can be prevented by introducing suitable countermeasures when planning systems.



- Ultrasonic system for detection of single sheet, no sheet and double sheet. Also detection of pasted double sheets.
- Weights of paper from 30 g up to cartons weighing over 1200 g can be detected.
- It is also possible to detect thin metal and plastic films.
- Various materials and thicknesses are programmed in via a TEACH-IN signal.
- Automatic compensation of the operating point in the case of slowly changing ambient conditions.
- Signal output via short-circuit proof PNP switch outputs.
- Very high processing speeds are possible.

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

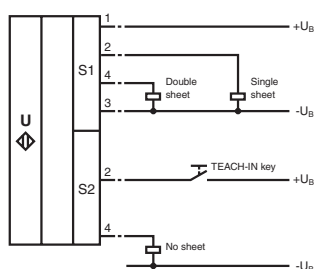
Model number

UDB-18GM35-3E2

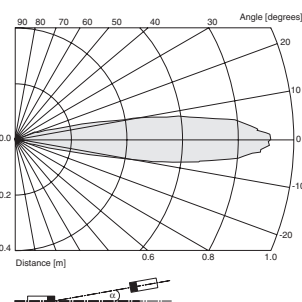
Series -F12			
Series -F42	Transducer frequency	180 kHz	●
	LED green	indication: single sheet detected	●
	LED yellow	indication: no sheet detected	●
	LED red	indication: double sheet or pasted double sheets detected	●
	Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
Series -F43	No-load supply current	<80 mA	●
	Output type	3 switch outputs prp, NO	●
	Rated operational current	3 x 200 mA	●
	Voltage drop	≤ 2 V	●
	Switch-on delay	≤ 5 ms	●
	Switch-off delay	≤ 5 ms	●
Series -F54	Input type	1 pulse input for TEACH-IN	●
	Pulse length	≥ 100 ms	●
	Impedance	≥ 10 kOhm	●
	Voltage	12 ... 30 V	●
Series -F64	Standards	EN 60947-5-2	●
	Ambient temperature	0 ... 60 °C (273 ... 333 K)	●
	Storage temperature	-40 ... 70 °C (233 ... 343 K)	●
	Protection degree	IP65	●
	Connection	emitter: V1-W connector with 2.5 m cable receiver: 2.5 m fixed cable (not disconnectable) S1, S2: 2 connectors V1-W, M12x1 (included with delivery)	●
Series -D1	Housing	Makrolon/nickel-plated brass	●
	Mass	370 g	●

Electrical connection, diagrams, additional information

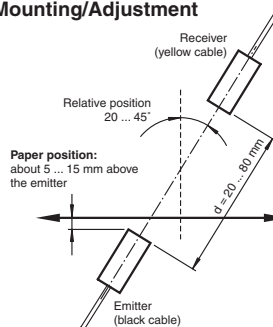
Standard symbol/Connection: Double-sheet-control

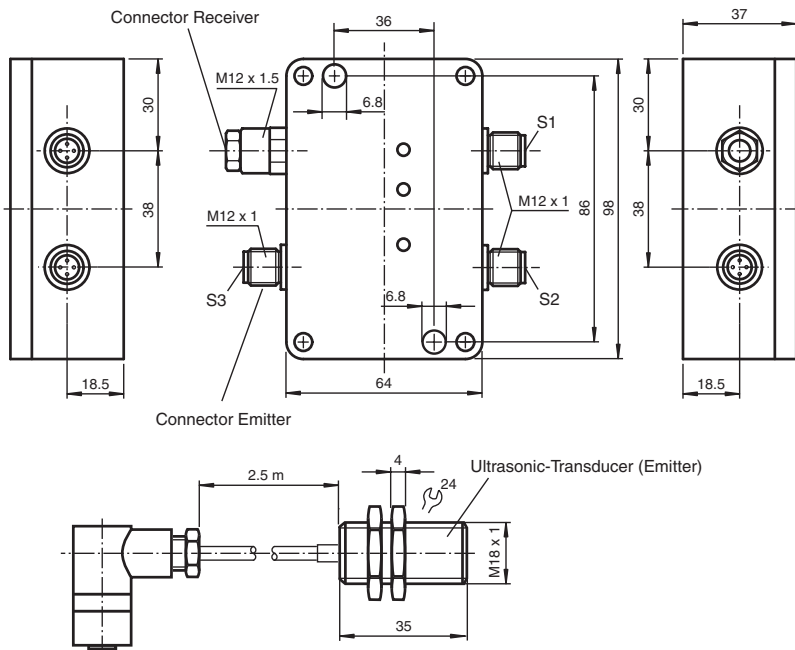


Characteristic response curves



Mounting/Adjustment





Additional information

Description of the sensor functions

In addition to the printing industry, the ultrasonic double-sheet monitor is deployed in all situations in which the automatic distinction between single and double sheets is required in order to protect machines or avoid waste production. The double-sheet monitor is based on the ultrasonic through-beam principle. The following can be detected:

- No sheet
- Individual sheet
- Double sheet or pasted double sheet

A microprocessor system evaluates the signals. The appropriate switch outputs are set as a result of the evaluation. Changes in ambient conditions such as temperature and humidity are automatically compensated. The evaluation electronics are installed in a cuboid plastic housing separate from the sensor heads.

Measuring system

A complete system consists of an ultrasonic emitter, an ultrasonic receiver and an evaluation unit. These units have been optimally tuned to one another at the factory and may not be used separately.

Alignment

When adjusting the emitter and receiver, take care to align them as precisely as possible.

- Distance of the sensor heads: $d = 20 \text{ mm} \dots 80 \text{ mm}$
- Angular tolerance: $\alpha < +/- 2^\circ$
- Maximum offset: $s < +/- 2 \text{ mm}$

To ensure their correct function, the sensor heads must be aligned at an angle of $20^\circ \dots 45^\circ$ from vertical on to the paper surface. The paper is guided over the emitter at a distance of $5 \text{ mm} \dots 15 \text{ mm}$. The emitter is installed below in order to prevent dust deposits. Install the sensor heads using the included plastic nuts. The sound cone must be completely covered by the paper. This means that the sensor heads must be installed above the sheet of paper and at least 10 mm away from the side edge of the paper.

Maximum feed speed of the sheet (approximate value)

$$v_{\text{max}} [\text{m/s}] = \text{overlapping of sheets} [\text{mm}] / 5 \text{ ms} \quad (\text{overlapping} > 20 \text{ mm})$$

TEACH-IN

1. After the operating voltage has been applied, a single sheet can be fed in as the first sheet. It will automatically be programmed as a reference value by the system.
2. If a single sheet of paper is located between the ultrasonic emitter and receiver when the operating voltage is turned on, it will automatically be programmed as a reference value by the system.

Automatic learning for thinner types of sheets

If you are inserting a thinner type of sheet, you can dispense with the use of the TEACH-IN signal to program the system. In order to do this, a single sheet of paper must be between the emitter and receiver for at least 10 s.

Automatic learning for thicker types of sheets

If you are inserting a thicker type of sheet but still not one that will result in double-sheet output, you can dispense with learning by means of the TEACH-IN signal. In order to do this, a single sheet of paper must be between the emitter and receiver for at least 10 s.

TEACH-IN for new type of sheet

If you are inserting a new type of sheet that will result in double-sheet output, the system must be reprogrammed. To do this, a single sheet must be placed between the emitter and receiver. After the TEACH-IN signal has been applied, the corresponding reference value will be accepted.

Caution!

The paper sheets may not touch the sensor heads during operation. Depending on physical conditions, reflections on the edge of a single sheet may result in double-sheet output. This is not an error, and can be masked out in the higher-level control system.

Sensor systems for ultrasonic double-sheet monitoring can also be delivered with a customised time response for optimal adaptation to specific applications.

Subject to reasonable modifications due to technical advances.

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Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories



- Ultrasonic system for detection of labels, carrier materials and double sheets.
- Weights of paper from 30 g up to cartons weighing over 1200 g can be detected.
- It is also possible to detect thin metal and plastic films.
- Various materials and thicknesses are programmed in via a TEACH-IN signal.
- No automatic switching threshold tracking in the case of slowly changing ambient conditions.
- Signal output via short-circuit proof PNP switch outputs.
- Very high processing speeds are possible.

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

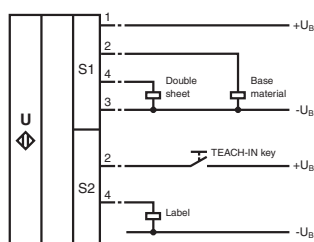
Model number

UDBL-18GM35-3E2

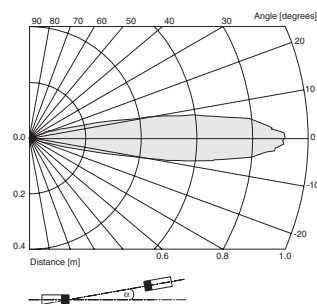
Series -F12			
Series -F42	Transducer frequency	180 kHz	●
	LED green	indication: carrier material detected	●
	LED yellow	indication: label detected	●
	LED red	indication: double sheet detected	●
Series -F43	Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
	No-load supply current	<80 mA	●
	Time delay before availability	≥5 minutes	●
	Output type	3 switch outputs prp, NO	●
	Rated operational current	3 x 200 mA	●
	Voltage drop	≤2 V	●
Series -F54	Switch-on delay	≤1 ms	●
	Switch-off delay	≤1 ms	●
	Input type	1 pulse input for TEACH-IN	●
	Pulse length	≥100 ms	●
	Impedance	≥10 kOhm	●
Series -F64	Voltage	12 ... 30 V	●
	Standards	EN 60947-5-2	●
	Ambient temperature	0 ... 60 °C (273 ... 333 K)	●
	Storage temperature	-40 ... 70 °C (233 ... 343 K)	●
	Protection degree	IP65	●
Series -D1	Connection	emitter: V1-W connector with 2.5 m cable receiver: 2.5 m fixed cable (not disconnectable) S1, S2: 2 connectors V1-W, M12x1 (included with delivery)	●
	Housing	Makrolon/nickel-plated brass	●
	Mass	370 g	●

Electrical connection, diagrams, additional information

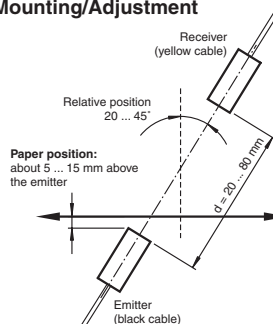
Standard symbol/Connection:
Double sheet control



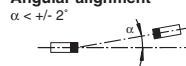
Characteristic response curves



Mounting/Adjustment

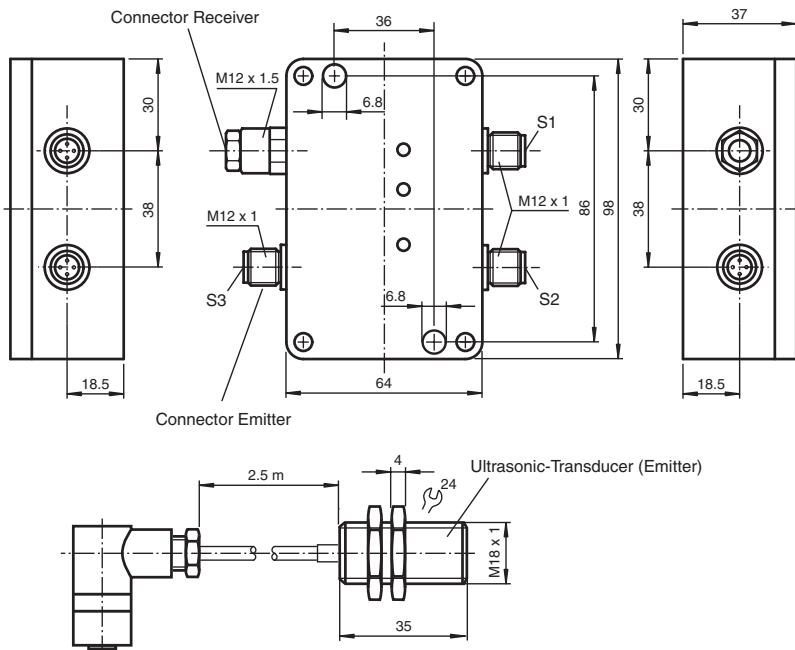


Angular alignment



Sensor offset





Additional information

Description of the sensor functions

Ultrasonic double-sheet monitoring to detect labels is used in all situations in which an automatic distinction must be made between labels and carrier material as well as double sheets in order to protect machines or avoid waste production. The double-sheet monitor is based on the ultrasonic through-beam principle. The following can be detected:

- Base material
- Label
- Double sheet

A microprocessor system evaluates the signals. The appropriate switch outputs are set as a result of the evaluation. The evaluation electronics are installed in a cuboid plastic housing separate from the sensor heads.

Measuring system

A complete system consists of an ultrasonic emitter, an ultrasonic receiver and an evaluation unit. These units have been optimally tuned to one another at the factory and may not be used separately.

Alignment

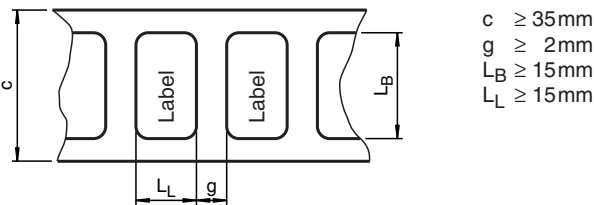
When adjusting the emitter and receiver, take care to align them as precisely as possible.

- Distance of the sensor heads: $d = 20 \text{ mm} \dots 80 \text{ mm}$
- Angular tolerance: $\alpha < +/- 2^\circ$
- Maximum offset: $s < +/- 2 \text{ mm}$

To ensure their correct function, the sensor heads must be aligned at an angle of $20^\circ \dots 45^\circ$ from vertical on to the paper surface. The paper is guided over the emitter at a distance of $5 \text{ mm} \dots 15 \text{ mm}$. The emitter is installed below in order to prevent dust deposits. Install the sensor heads using the included plastic nuts. The sound cone must be completely covered by the paper. This means that the sensor heads must be installed above the sheet of paper and at least 10 mm away from the side edge of the paper.

Maximum feed speed of the sheet (approximate value)

Depends on the label and gap width as well as the materials in question. Approximate value 10 m/s while maintaining the required minimum sizes.



TEACH-IN

Before starting a valid TEACH-IN a warm up period of approx. 5 min must be maintained. After the warm up period and a short-time reset of the operating voltage a valid value is automatically taught in, provided that a carrier material and label is between emitter and receiver.

TEACH-IN for new type of sheet

If a new type of labels is used, the TEACH-IN procedure must be carried out. To do this, a label with carrier material is put between emitter and receiver and the teach-in is performed with reference to the label. After having applied the TEACH-IN-signal the value is adopted automatically.

Caution!

The paper sheets may not touch the sensor heads during operation. Depending on physical conditions, reflections on the edge of a single sheet may result in double-sheet output. This is not an error, and can be masked out in the higher-level control system.

Sensor systems for ultrasonic double-sheet monitoring can also be delivered with a customised time response for optimal adaptation to specific applications.

Date of edition: 08/18/2005

- Series -12GM
- Series -18GM/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/ Power supplies
- Accessories



- Ultrasonic system for detection of single and pasted double sheet.
- Weights of paper from 30 g up to cartons weighing over 1200 g can be detected.
- It is also possible to detect thin metal and plastic films.
- Various materials and thicknesses are programmed in via a TEACH-IN signal.
- Automatic compensation of the operating point in the case of slowly changing ambient conditions.
- Signal output via short-circuit proof PNP switch outputs.
- Very high processing speeds are possible.

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

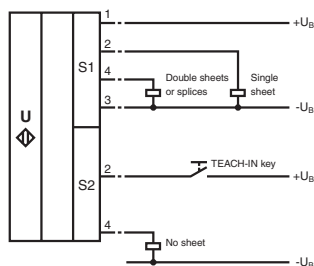
Model number

UDBK-18GM35-3E2

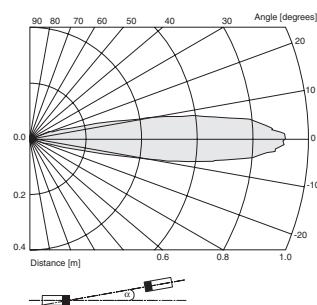
Series -F12	Transducer frequency	180 kHz	●
Series -F42	Focke Ident-Nr.	7 020 464	●
Series -F43	LED green	indication: single sheet detected	●
Series -F43	LED yellow	indication: no sheet detected	●
Series -F43	LED red	indication: double sheet or contact spot detected	●
Series -F54	Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
Series -F54	No-load supply current	< 80 mA	●
Series -F54	Output type	3 switch outputs prp, NO	●
Series -F54	Rated operational current	3 x 200 mA	●
Series -F54	Voltage drop	≤ 2 V	●
Series -F54	Switch-on delay	≤ 1 ms	●
Series -F54	Switch-off delay	≤ 100 ms	●
Series -F54	Input type	1 pulse input for TEACH-IN	●
Series -F54	Pulse length	≥ 100 ms	●
Series -F54	Impedance	≥ 10 kOhm	●
Series -F54	Voltage	12 ... 30 V	●
Series -F64	Standards	EN 60947-5-2	●
Series -D1	Ambient temperature	0 ... 60 °C (273 ... 333 K)	●
Series -D1	Storage temperature	-40 ... 70 °C (233 ... 343 K)	●
Series -D1	Protection degree	IP65	●
Series -D1	Connection	emitter: V1-W connector with 2.5 m cable receiver: 2.5 m fixed cable (not disconnectable) S1, S2: 2 connectors V1-W, M12x1 (included with delivery)	●
Series -D1	Housing	Makrolon/nickel-plated brass	●
Series -D1	Mass	370 g	●

Electrical connection, diagrams, additional information

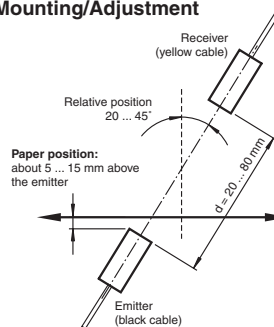
Standard symbol/Connection: Double-sheet-control



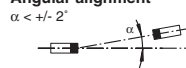
Characteristic response curves



Mounting/Adjustment

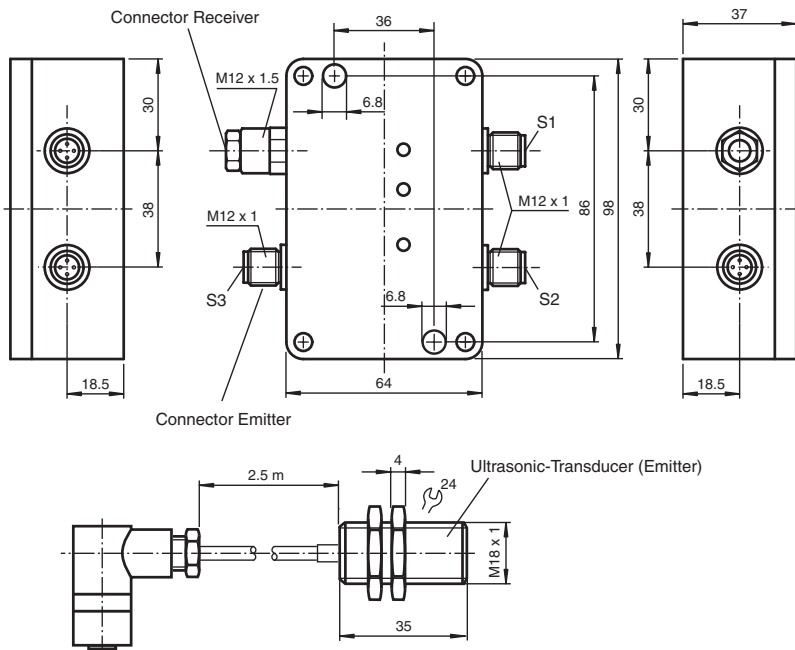


Angular alignment



Sensor offset





Additional information

Description of the sensor functions

Ultrasonic double-sheet monitoring to detect splice points is used in all situations in which an automatic distinction must be made between splice points and double sheets in order to protect machines or avoid waste production. Double-sheet monitoring for splice point detection is based on the ultrasonic through-beam principle. The following can be detected:

- No sheet
- Individual sheet
- Splice point or double sheet

A microprocessor system evaluates the signals. The appropriate switch outputs are set as a result of the evaluation. Changes in ambient conditions such as temperature and humidity are automatically compensated. The evaluation electronics are installed in a cuboid plastic housing separate from the sensor heads.

Measuring system

A complete system consists of an ultrasonic emitter, an ultrasonic receiver and an evaluation unit. These units have been optimally tuned to one another at the factory and may not be used separately.

Alignment

When adjusting the emitter and receiver, take care to align them as precisely as possible.

Distance of the sensor heads: $d = 20 \text{ mm} \dots 80 \text{ mm}$

Angular tolerance: $\alpha < +/- 2^\circ$

Maximum offset: $s < +/- 2 \text{ mm}$

To ensure their correct function, the sensor heads must be aligned at an angle of $20^\circ \dots 45^\circ$ from vertical on to the paper surface. The paper is guided over the emitter at a distance of 5 mm ... 15 mm. The emitter is installed below in order to prevent dust deposits. Install the sensor heads using the included plastic nuts. The sound cone must be completely covered by the paper. This means that the sensor heads must be installed above the sheet of paper and at least 10 mm away from the side edge of the paper.

Feed speed of the sheet (approximate value)

$v_{min} = 0.035 \text{ m/s}$

$v_{max} [\text{m/s}] = \text{overlapping of sheets [mm]} / 1 \text{ ms}$ (approx. value, overlapping > 20 mm)

TEACH-IN

1. After the operating voltage has been applied, a single sheet can be fed in as the first sheet. It will automatically be programmed as a reference value by the system.
2. If a single sheet of paper is located between the ultrasonic emitter and receiver when the operating voltage is turned on, it will automatically be programmed as a reference value by the system.

Automatic learning for thinner types of sheets

If you are inserting a thinner type of sheet, you can dispense with the use of the TEACH-IN signal to program the system. In order to do this, a single sheet of paper must be between the emitter and receiver for at least 2 s.

Automatic learning for thicker types of sheets

If you are inserting a thicker type of sheet but still not one that will result in double-sheet output, you can dispense with learning by means of the TEACH-IN signal. In order to do this, a single sheet of paper must be between the emitter and receiver for at least 2 s.

TEACH-IN for new type of sheet

If you are inserting a new type of sheet that will result in double-sheet output, the system must be reprogrammed. To do this, a single sheet must be placed between the emitter and receiver. After the TEACH-IN signal has been applied, the corresponding reference value will be accepted.

Caution!

The paper sheets may not touch the sensor heads during operation. Depending on physical conditions, reflections on the edge of a single sheet may result in double-sheet output. This is not an error, and can be masked out in the higher-level control system.

Sensor systems for ultrasonic double-sheet monitoring can also be delivered with a customised time response for optimal adaptation to specific applications.

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Series -12GM
Series -16GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Control units/Power supplies



Model number	Description	Page
UH3-KHD2-4E5	Control/evaluation unit with 4 switching outputs	202
UH3-KHD2-4I	Control/evaluation unit with 4 analogue current outputs (4 mA ... 20 mA)	204
UH3-T1-KT	Control/evaluation unit with relay output for high power loads	206
DA5-IU-C	Process indication device	208
DA5-IU-2K-C DA5-IU-2K-V	Process indication device	210
WE77-RE2	Isolated switch amplifier with power supply und 2 relay outputs	212
KFA6-STR-1.24.500	Power supply	214

Date of edition 08/18/2005

Subject to reasonable modifications due to technical advances.

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Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/Power supplies
 Accessories



- External evaluation for ultrasonic sensors UB...-H1, -H2 and -H3
- Modular concept: Installation of sensor on-site and evaluation in the control cabinet
- Simultaneous operation of 1 to 4 ultrasonic sensors with ranges from 60 mm to 6 m
- Freely selectable evaluation range
- Multiplex operation - no mutual interaction, operation is possible in a very confined space
- Synchronous operation
- Temperature compensation
- Reference measurement for highest accuracy
- 4 switch outputs

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

Model number

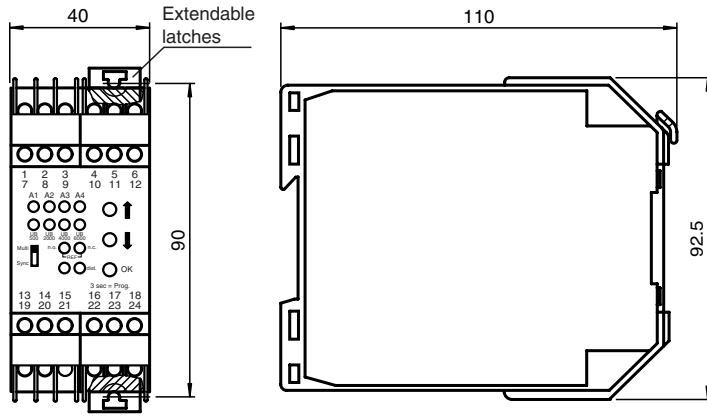
UH3-KHD2-4E5

Operating modes	with switch-over: multiplex operation - consecutive activation of the channels synchronous operation - activation of the channels simultaneously	●
Measuring frequency	dependent on the operating mode, number and longest range of the active sensors (see page multiplex/synchronous operation)	●
Standards	EN 60947-5-2	●
LED green	sensor type / channel active (4 items) NO/NC/PEF (2 items) switch point (1 item)	●
LED yellow	channel number A1 ... A4 / object in operating range (4 items)	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 50 mA (without sensors)	●
Output type	4 switch outputs A1 ... A4 I _{max} = 500 mA, pnp, reverse polarity protected, NO/NC operation	●
Repeat accuracy	multiplex operation: ± 1 mm synchronous operation: ± 3 mm	●
Input type	for 4 sensors for each of 4 connections +U _E /-U _E /clock (T)/echo (E) short-circuit proof with reverse-polarity protection attachable sensors: UB500/2000/4000/6000...-H3 or -H1/-H2	●
Ambient temperature	-20 ... 70 °C (253 ... 343 K)	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
Protection degree	IP20	●
Connection	terminal housing, suitable for 35 mm standard rail plug-in screw terminal 1.5 mm ²	●
Mass	230 g	●

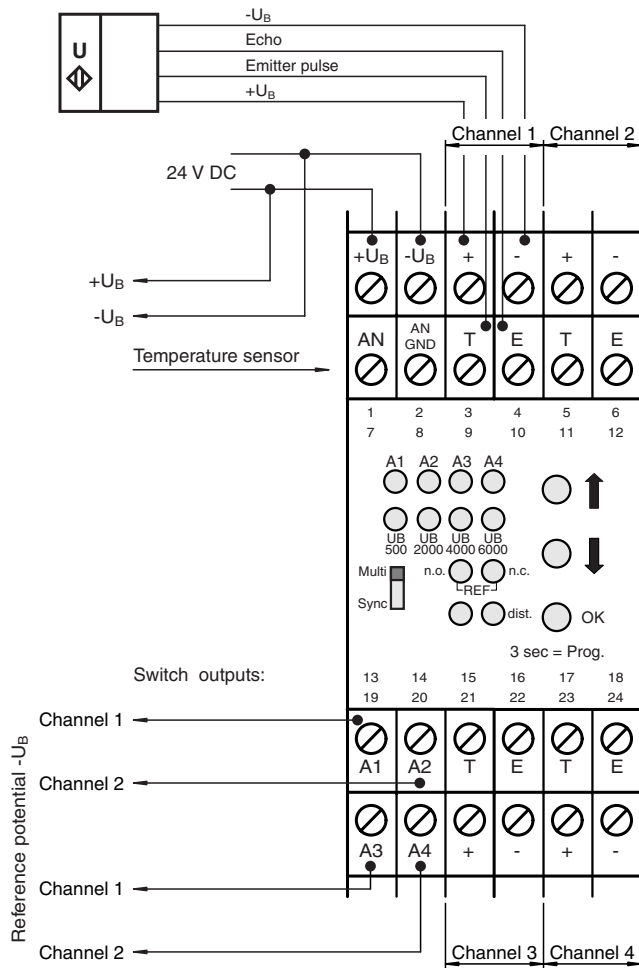
The UH3-KHD2-4E5 is an evaluation device for ultrasonic sensors with external interface electronics. Up to four sensors of type UB...-H3 or sensor pairs UB...-H1/-H2 can be connected to the device.

The evaluation unit issues the transmission pulses (cycle) for each sensor channel, then records the echo signal and forms the sensing range according to the echo time. A switch output is associated with each channel. If the detected distance is less than the set switching point, the output of the associated channel is actuated according to the selected open/close action. This is indicated by the yellow LED assigned to the channel. Sensors with a variety of detection ranges can be deployed on the four evaluation channels. One of the channels can be programmed as a reference measurement for a temperature compensation.

Note:
The maximum cable-length between evaluation unit and sensor must not exceed 20 m!



Electrical connection



Date of edition: 08/18/2005

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories



- External evaluation for ultrasonic sensors UB...-H1, -H2 and -H3
- Modular concept: Installation of sensor on-site and evaluation in the control cabinet
- Simultaneous operation of 1 to 4 ultrasonic sensors with ranges from 60 mm to 6 m (up to 15 m when operated as a through beam barrier)
- Freely selectable measuring window
- Multiplex operation - no mutual interaction, operation is possible in a very confined space
- Synchronous operation
- Temperature compensation
- Reference measurement for highest accuracy
- 4 analogue outputs 4 mA ... 20 mA (rising/falling slope can be set)

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

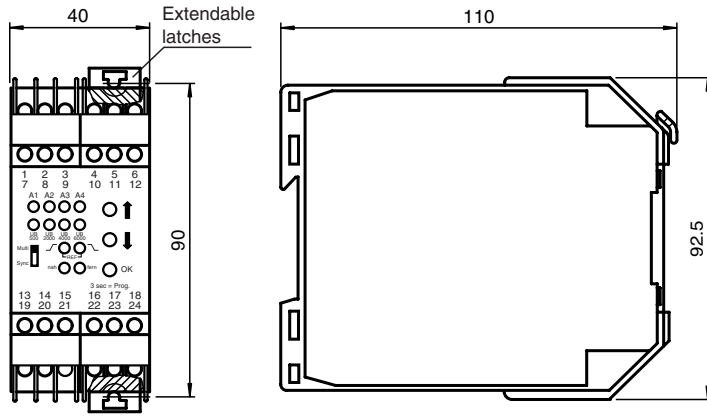
	Model number	UH3-KHD2-4I
Operating modes	with switch-over: multiplex operation - consecutive activation of the channels synchronous operation - activation of the channels simultaneously	●
Measuring frequency	dependent on the operating mode, number and longest range of the active sensors (see page multiplex/synchronous operation)	●
Standards	EN 60947-5-2	●
LED green	sensortype / channel active (4 items) current slope: increasing / decreasing / FEF (2 items) measuring window limits near / far (2 items)	●
LED yellow	channel number A1 ... A4 / object in operating range (4 items)	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 50 mA (without sensors)	●
Output type	4 analogue outputs A1 ... A4, 4 ... 20 mA rising/falling ramp	●
Repeat accuracy	multiplex operation: ± 1 mm synchronous operation: ± 3 mm	●
Input type	for 4 sensors for each of 4 connections +U _E / -U _E / clock (T) / echo (E) short-circuit proof with reverse-polarity protection attachable sensors: UB500/2000/4000/6000...-H3 or -H1/-H2	●
Ambient temperature	-20 ... 70 °C (253 ... 343 K)	●
Storage temperature	-40 ... 85 °C (233 ... 358 K)	●
Protection degree	IP20	●
Connection	terminal housing, suitable for 35 mm standard rail plug-in screw terminal 1.5 mm ²	●
Mass	230 g	●

The UH3-KHD2-4I is an evaluation device for ultrasonic sensors with external interface electronics. Up to four sensors of type UB...-H3 or sensor pairs UB...-H1/-H2 can be connected to the device.

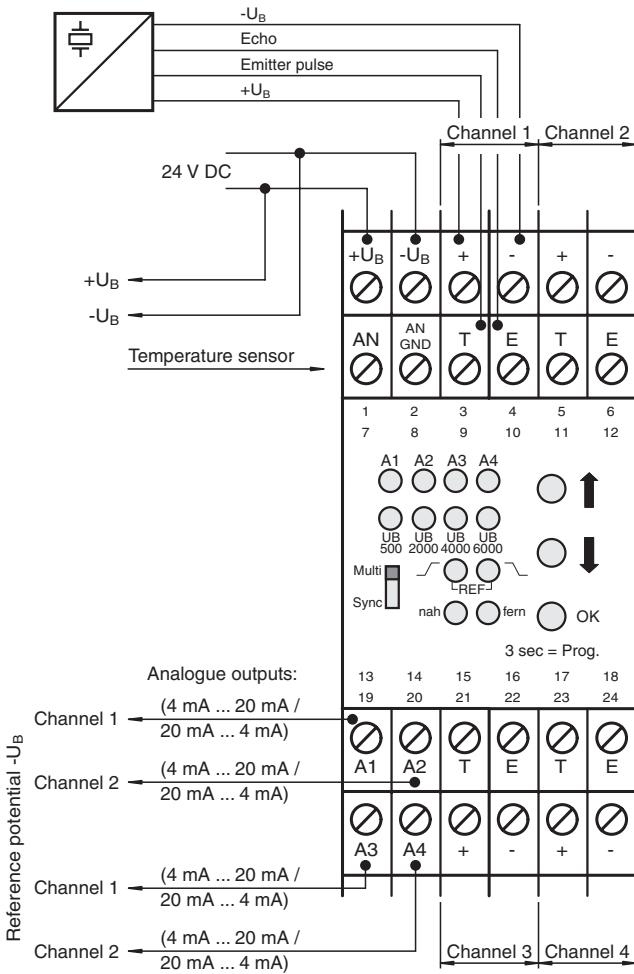
The evaluation unit issues the transmission pulses (cycle) for each sensor channel, then records the echo signal and forms a current value proportional to the echo time (4 mA ... 20 mA). An analogue output is associated with each channel. An evaluation window and a rising or falling current ramp can be selected in the detection section for each output. If the distance determined is within the programmed measuring window, the output of the associated channel will deliver a value between 4 mA and 20 mA. The yellow LED associated with the channel will be lit. Sensors with a variety of detection ranges can be deployed on the four evaluation channels. One of the channels can be programmed as a reference measurement for a temperature compensation.

Note:

The maximum cable-length between evaluation unit and sensor must not exceed 20 m!



Electrical connection



Date of edition: 08/18/2005

- Series -12GM
- Series -18GK/-18GM
- Series -30GM
- Series VarKont
- Series -FP
- Series -F12
- Series -F42
- Series -F43
- Series -F54
- Series -F64
- Series -D1
- Series LUC
- Double sheet monitoring
- Control units/ Power supplies
- Accessories



- External evaluation for ultrasonic sensors UB...-H1, -H2 and -H3
- Relay output for high power
- Pull-in/Drop-out delay can be set
- Normally open/closed
- Switch point can be selected in steps in the sensing range

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

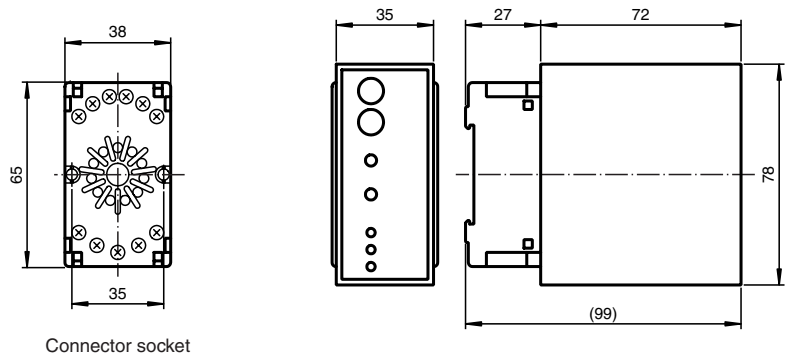
Technical Data

	Model number	UH3-T1-KT
Measuring frequency	approx. 16 Hz	●
Standards	EN 60947-5-2	●
Rotary switch	sensor select: setting the switch-point behaviour distance select: setting the operating distance	●
Operating voltage	20 ... 30 V DC, ripple 10 % _{SS}	●
No-load supply current	≤ 120 mA (without sensors)	●
Output type	changeover contact terminals 6 to 1 (NO) and 11 (NC)	●
Contact loading	AC: 8 A/250 V	●
Energised/De-energised delay	270°-potentiometer: ON delay, between 0.2 s ... 8 s (± 10%) 270°-potentiometer: OFF delay, between 0.2 s ... 8 s (± 10%)	●
Input type	for max. 3 ultrasonic sensors in direct detection mode: UB 500/2000/4000/6000, UJ 3000/6000 or for a through beam barrier: UB 2000 (e.g.)	●
Ambient temperature	-20 ... 60 °C (253 ... 333 K)	●
Storage temperature		
Connection	plug socket 11-pin, attached using 2 x M3 screws or snapped-on to 35 mm standard rail according to EN 50022 Base is included with delivery	●
Housing	modular housing	●
Mass	110 g	●

The UH3-T1-KT is a back-end unit for ultrasonic sensors with external evaluation logic. It features direct-detection and through-beam operating modes. All sensors of the types H3, H1 and H2 can be connected to the unit.

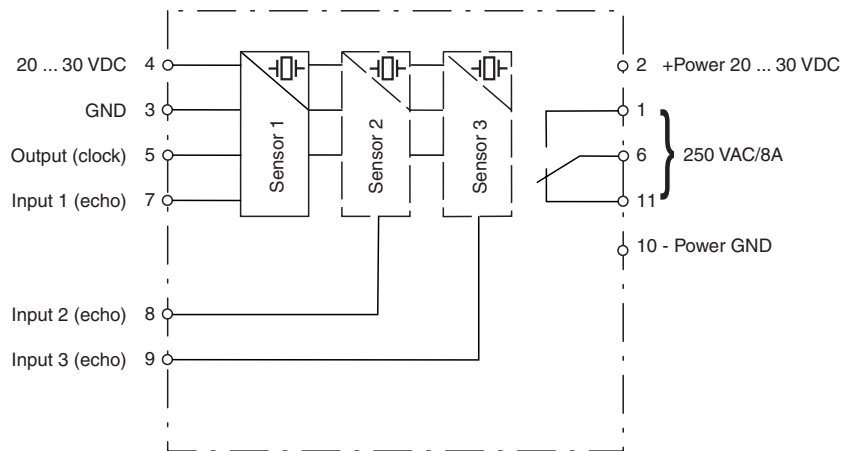
When an object is detected, a relay trips a change-over contact. The action and release delays can be adjusted independently of one another. In direct-detection mode the unit generates a clock signal for the sensors and determines the object distance on the basis of the echo time. A switching point can be set in steps in the detection range.

In barrier mode the clock signal starts the ultrasonic pulse from the device in the transmitter/sender. The receiver generates an echo signal when it picks up the ultrasonic signal. If this echo signal is not received, the evaluation unit trips the output relay.



Connector socket

Electrical connection



Date of edition: 08/18/2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Digital display unit

DA5-IU-C



- Bright, high contrast 5-digit LED indicator
- Leading zero suppression
- Adjustable decimal point
- Maximum- and minimum-value display



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

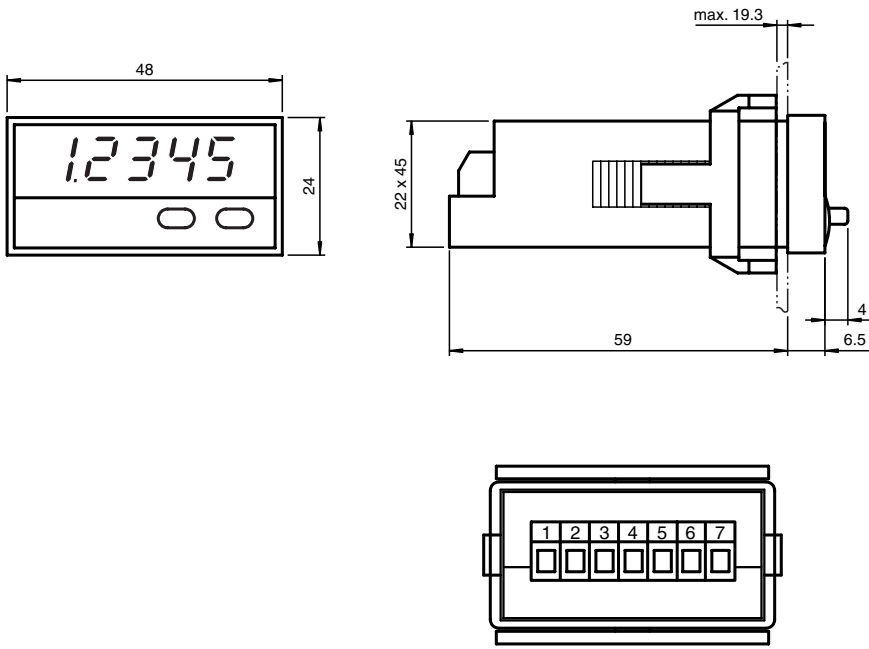
Technical Data

	Model number	DA5-IU-C
Pre-selection	none	●
Data storage	10 ⁶ storage cycles or 10 years, EEPROM	●
Programming	keypad-driven menu	●
Type	7-segment LED display, red	●
Number of decades	5	●
Display value	digit height 8 mm	●
Display interval	-19999 ... 99999	●
Decimal point	freely adjustable	●
Resolution	14 Bit	●
Scale factor	via linear characteristic curve	●
Reset	maximum value, manually	●
Key interlock	-	●
Operating voltage	10 ... 30 V DC	●
Power consumption	1,5 VA	●
Impedance	1 MΩ	●
Voltage	max. 30 DC	●
Analogue voltage input	0 ... 10 V / 2 ... 10 V DC	●
Analogue current input	0 ... 20 mA / 4 ... 20 mA	●
Ambient temperature	-10 ... 50 °C (263 ... 323 K)	●
Storage temperature	-25 ... 70 °C (248 ... 343 K)	●
Relative humidity	≤ 80 % (non-condensing)	●
Mounting	latch fastener/mounting frame	●
Connection	7-pin screw terminal max. core cross-section 0,34 ... 1,5 mm ²	●
Dimensions	48 mm x 24 mm x 65 mm	●
Mass	approx. 50 g	●

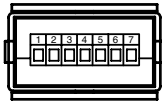
The DA5-IU-C permits a simple visual inspection by operating and maintenance personnel. It converts the analogue sensor output signal into a readable form for this purpose. Depending on the task or setting, 4 ... 20 mA or 0 ... 100 % values can be displayed.

Scope of delivery:

- Process control unit DA5-IU-C
- Screw terminal, 7-pin
- Clamp clip
- Seal
- 1 sheet of adhesive symbols



Electrical connection



Terminal No.	
1	10 ... 30 V DC
2	0 V (GND)
3	0 V LATCH
4	LATCH
5	Current input
6	0 V input signal
7	Voltage input

Date of edition: 08/18/2005

Process control and indication equipment

DA5-IU-2K-



- 2 adjustable limit values
- 2 relay outputs
- Operation via keypad
- Programmable characteristics
- Resetting the outputs, automatic, manual or with external signal
- Connection via plug-in screw terminals
- Auxiliary power output for sensors (Only DA5-IU-2K-V)
- Protection degree IP65 in accordance with DIN EN 60529 (front only)
- Shock resistance in accordance with DIN EN 60068-2-27
- Vibration resistance in accordance with DIN EN 60068-2-6
- System hum suppression



Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

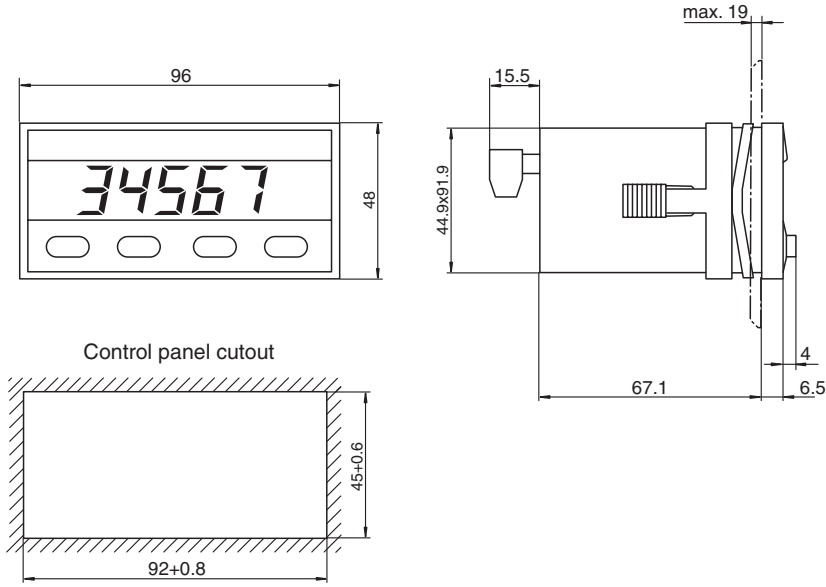
	Model number	DA5-IU-2K-C	DA5-IU-2K-V
Pre-selection	2-fdd	●	●
Data storage	10 ⁶ storage cycles or 10 years, EEPROM	●	●
Programming	keypad-driven menu	●	●
Type	7-segment LED display, red	●	●
Number of decades	5	●	●
Display value	digit height 14,2 mm	●	●
Display interval	-19999 ... 99999	●	●
Decimal point	freely adjustable	●	●
Resolution	14 Bit	●	●
Scale factor	via characteristic curve with up to 24 value pairs	●	●
Reset	manually or external	●	●
Key interlock	with "high"-level at terminal "KEY"	●	●
Operating voltage	10 ... 30 V DC	●	●
	90 ... 260 V AC	●	●
Power consumption	2 W	●	●
	7 VA	●	●
Sensor supply	24 V DC, 100 mA	●	●
Relay	2 x 250 V AC / 300 V DC, 3 A, changeover contact	●	●
Impedance	> 1 MΩ for voltage measurement < 50 Ω for current measurement	●	●
Analogue voltage input	0 ... 10 V / 2 ... 10 V DC, -10 ... 10 V DC	●	●
Analogue current input	0 ... 20 mA / 4 ... 20 mA	●	●
Ambient temperature	-10 ... 50 °C (263 ... 323 K)	●	●
Storage temperature	-25 ... 70 °C (248 ... 343 K)	●	●
Relative humidity	≤ 80 % (non-condensing)	●	●
Mounting	mounting frame with latch fastener	●	●
Connection	8-pin and 11 pin connectors with plug-in screw terminals	●	●
Dimensions	96 mm x 48 mm x 90 mm	●	●
Mass	220 g	●	●

The DA5-IU-2K-... permits a simple visual inspection by operating and maintenance personnel. It converts the analogue sensor output signal into a readable form for this purpose. Depending on the task or setting, 4 mA ... 20 mA or 0 % ... 100 % values can be displayed.

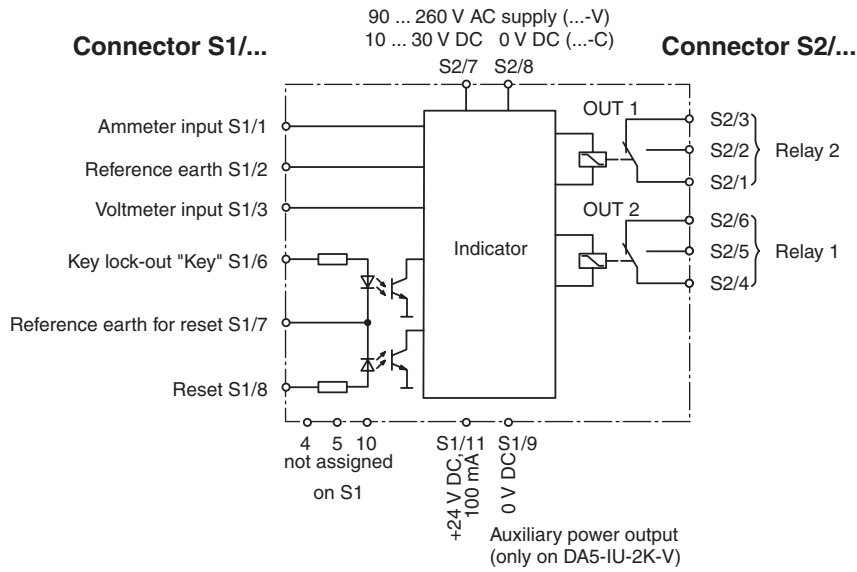
Scope of delivery:

- Process control unit DA5-IU-2K-...
- Screw terminals
 - 1 RM 5.08 8-pole terminal for power supply and outputs
 - 1 RM 3.81 11-pole terminal for measuring and control inputs
- Clamp clip
- Seal
- 1 sheet of adhesive symbols

Date of edition: 08/18/2005



Electrical connection

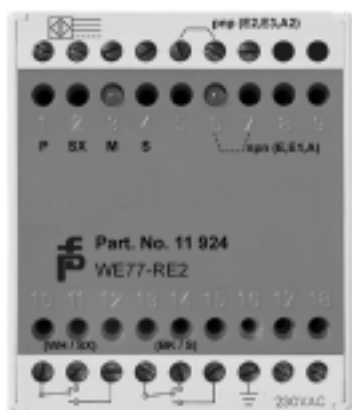


Date of edition: 08/18/2005

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories

Isolated switch amplifier

WE77-RE2



- 2-channel isolated switch amplifier
- Control circuit designed for the direct current versions of ultrasonic sensors and proximity switches
- 230 V AC/115 V AC mains nominal voltage
- Switching frequency 10 kHz
- Each with 1 relay output with 1 changeover contact
- One LED status display for each output relay
- Modular housing
- For PNP-sensors the terminals 5 and 6, for NPN-sensors the terminals 6 and 7 are to short out
- Mode of operation: input closed - energising the relay/input open - relay de-energised



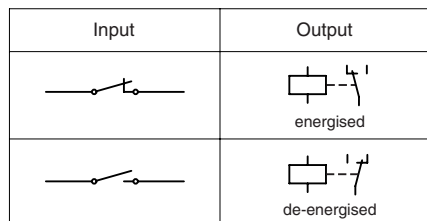
Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

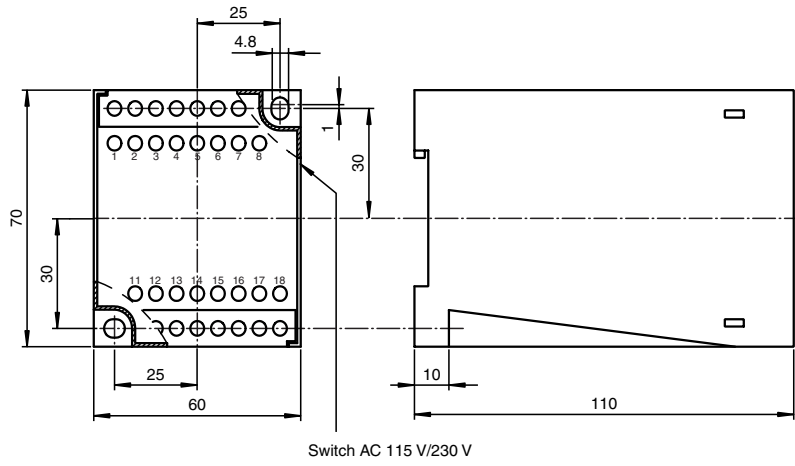
	Model number	WE77-RE2
Connection	terminals 17, 18	●
Rated voltage	98 ... 126 V AC / 198 ... 253 V AC, 45 ... 63 Hz, switchable	●
Power consumption	approx. 7 VA	●
Voltage	24 V DC ± 20 %	●
Current	160 mA at 60 °C, short-circuit proof	●
Contact loading	AC: 250 V / 4 A / 500 VA / cos φ ≥ 0.7 DC: 220 V / 0.1 A; 60 V / 0.6 A; 24 V / 4 A	●
Energised/De-energised delay	approx. 20 ms / approx. 10 ms	●
Connection	terminals 10, 11, 12, 13, 14, 15 terminals 1+, 3-	●
Mechanical life	10 ⁷ switching cycles	●
Connection	terminals 2; 4	●
Input signal	high: 24 V DC ± 20 % 37 mA low: < 1 V DC, ≤ 0.5 mA	●
Switching frequency	≤ 10 Hz	●
Ambient temperature	-25 ... 60 °C (248 ... 333 K)	●
Storage temperature	-25 ... 85 °C (248 ... 368 K)	●
Construction type	modular housing	●
Protection degree	IP20	●
Mounting	snap-on to 35 mm standard rail or screw fixing	●
Connection	self-opening apparatus connection terminals, max. conductor cross section 1 x 2.5 mm ²	●
Dimensions	60 mm x 70 mm x 110 mm	●
Mass	approx. 650 g	●

When using proximity switches (sensors) in pnp-technique (switched high), the connections 5 and 6 have to be bridged
 When using proximity switches (sensors) in npn-technique (switched low), the connections 6 and 7 have to be bridged.

Mode of operation

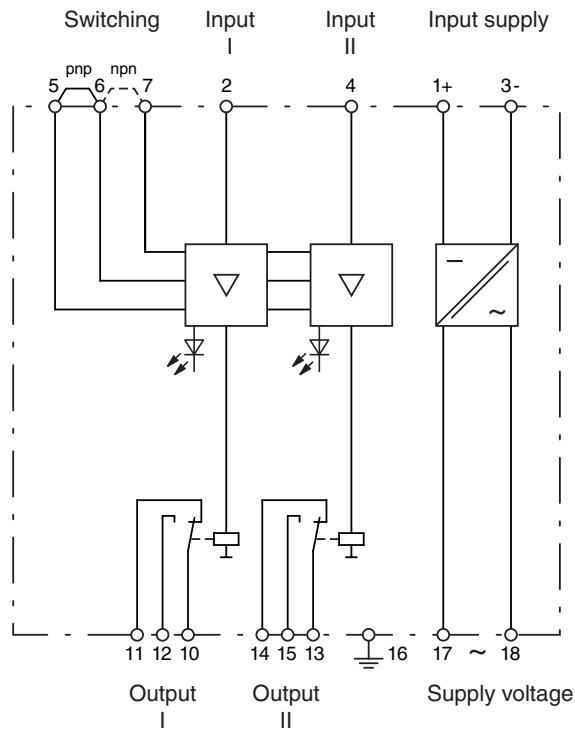


Date of edition: 09/13/2005



Switch AC 115 V/230 V

Electrical connection



Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Power supply

KFA6-STR-1.24.500



CE

- Switched power supply
- 230/115 V AC supply voltage
- 24 V DC output voltage
- Max. output current 500 mA
- No ground connection required
- Removable terminals and Power Rail

Suitable connector cables, mounting aids and more, you can find in chapter "Accessories"

Technical Data

Series	Model number	
-F12		
-F42		
-F43		
-F54		
-F64		
		KFA6-STR-1.24.500
	SIL/IEC 61508	no
	Fault message output	no
	Explosion protection	No Ex-protection
	Connection	terminals 14, 15
	Rated voltage	90 ... 253 V AC, 48 ... 63 Hz
	Power loss	2,5 W
	Number of channels	1
	Connection	Power Rail or terminals 7+, 8-
	Current	500 mA at 60 °C, permanent short-circuit protection (electronically)
	Voltage	24 V ± 0,5 V
	Power supply/Output	safe isolation acc. to DIN VDE 0106, rated insulation voltage 253 V _{eff}
	Ambient temperature	-20 ... 60 °C (253 ... 333 K)
	Protection degree	IP20
	Mass	approx. 140 g

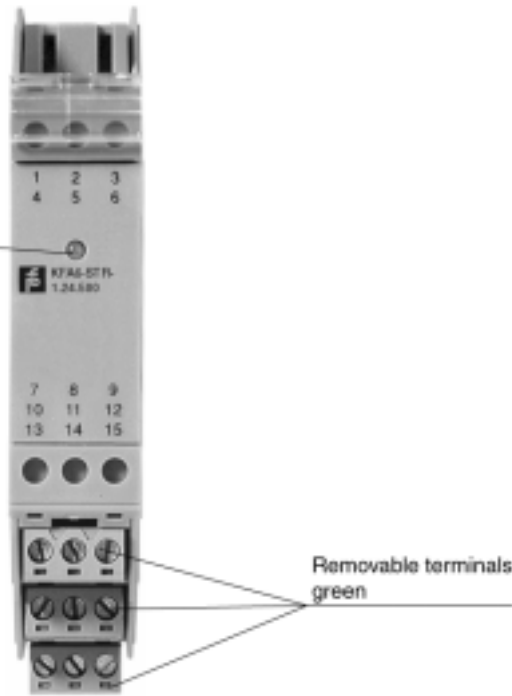
Function

The output voltage of the power supply is regulated and remains stable regardless of the size of the power supply and the load current.

Front View

Housing type C
(see system description)

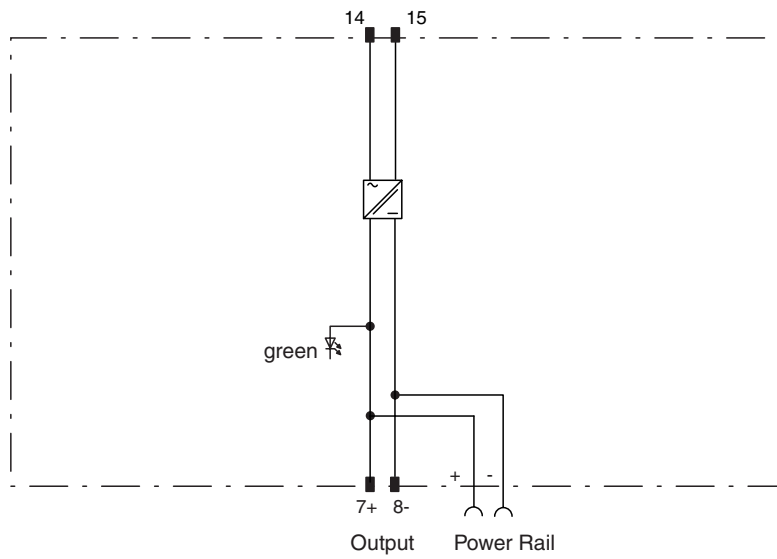
LED green:
Power supply



Removable terminals
green

Electrical connection

Power supply



Output Power Rail

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Date of edition: 08/18/2005

Series -12GM
Series -16GK/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Accessories



Type	Description	Page
Kabeldosen	Ready-to-use and customisable	218
MH 04-3505	Mounting aid for series -FP sensors	223
MH 04-2681F	Mounting aid for series <i>VariKont (+U1+ und +U9*)</i> sensors	223
OMH 04	Mounting bracket for series -18GM sensors	224
MHW 11	Mounting bracket for series -FP und -F42 sensors	224
MH-UDB01	Rotatable mounting bracket for ultrasonic double sheet monitors	224
BF12, BF18, BF30	Mounting flanges for series -12GM, -18GM and -30GM sensors	225
M105	Mounting flanges for series -30GM sensors	226
BF18-F/BF30-F	Mounting flanges for series -18GM and -30GM sensors	226
PA02	Mounting flanges for series -FP sensors	227
BF 5-30	Universal mount for $\varnothing 5$ mm ... $\varnothing 30$ mm sensors	228
UVW90-K18 UVW90-K30	Redirection mirror for series -18GM and -30GM sensors	229
UVW90-M30	Focussing redirection mirror for series -30GM sensors	229
UC-30GM-TEMP	External temperature probe	230
LUC4-Z30-G2V LUC4-Z30-N2V	External temperature probe	230
FP100	Remote potentiometer for through beam barrier UBE4000-30GM-SA2-V1	230
USB-0,8M-PVC ABG SUBD9	Interface adapter USB/RS 232	231
UC-F43-R2	RS 232 interface for series -F43 sensors	231
UC-30GM-R2	Interface cable for series -30GM sensors	232
UC-FP/U9-R2	Interface cable for series <i>VariKont</i> und -FP sensors	232
UC-30GM-PROG	Extension cable for the programming of UC...-30GM-... and LUC4T-... series sensors	232
UB-PROG2/UB-PROG3	Programming units for all UB...-sensors with -V15 connector, where the TEACH-input is at connector-pin 2 (UB-PROG2) or at connector-pin 5 (UB-PROG3).	233
ULTRA 2001	Service program for easy programming of ultrasonic sensors with RS 232 interfaces	234

Date of edition 08/18/2005

Accessories - cables, plugs, mating connectors

Non pre-wired connectors in M8, M12, M18 and Rd24 x 1/8:

Design	Order designation	Design	Connecting technique	Number of pins	Wire cross-section (mm ²)	Fig.
M8	V3-GM	Socket, straight	Insulation piercing	3-pin	0.25 ... 0.34	1
	V3-WM	Socket, angled	Insulation piercing	3-pin	0.25 ... 0.34	2
	V3S-GM	Connector, straight	Insulation piercing	3-pin	0.25 ... 0.34	1
M12	V1-G ¹⁾	Socket, straight	Screw terminal, PG7 cable gland	4-pin	max. 2.5	3
	V1-W ¹⁾	Socket, angled		4-pin	max. 2.5	4
	V1S-G	Connector, straight		4-pin	max. 2.5	-
	V1S-W	Connector, angled		4-pin	max. 2.5	-
	V1-E-LED	LED board (npn)	suitable for mounting in V1-G and V1-W	-	-	-
	V1-E2-LED	LED board (pnp)		-	-	-
	V1-G-Q2	Socket, straight	Insulation piercing	4-pin	0.34 ... 0.75	5
	V1S-G-Q2	Connector, straight	Insulation piercing	4-pin	0.34 ... 0.75	-
	V1-WV2A-PG9-Y42685 ²⁾	Socket, angled	Screw terminal	4-pin	max. 2.5	7
	V15-G-PG9 ¹⁾	Socket, straight	Screw terminal	5-pin	max. 0.75	-
	V15-W-PG9 ¹⁾	Socket, straight	Screw terminal	5-pin	max. 0.75	-
	V15-WV2A-PG9-Y117132 ²⁾	Socket, angled	Screw terminal	5-pin	max. 2.5	7
with central screw	V-W	Socket with central screw, angled	Screw terminal	5-pin	max. 2.5	-
	V-W-E2	Socket with central screw, angled	Screw terminal, with integrated LED	5-pin	max. 2.5	-
	V-W-N	Socket with central screw, angled	Screw terminal	5-pin	max. 2.5	-
	V7-W	Socket with central screw, angled	Screw terminal	7-pin	max. 2.5	6



Fig. 1



Fig. 2



Fig. 3¹⁾



Fig. 4¹⁾



Fig. 5



Fig. 6



Fig. 7²⁾

¹⁾ not suitable for UC...-30GM...

²⁾ suitable for UC...-30GM...

Technical data for connector with integrated cable

Connector and sockets

Number of pins	2-, 3-, 4- or 5-pin
Locking	Screw locking
Self-locking	via O-ring in cap nut
Colour of handle	green
Material of handle	PUR
Material of contacts	CuSn/Au
Material of contact surface	Au
Material of cap nut	CuSn/Ni
Material of sealing ring	NBR
protection class in accordance with DIN 40050	IP68 in screwed state
Max. operating voltage	60 V DC or 250 V AC (for V13-...-types)
Max. operational current	4 A
Volume resistance	< 5 mΩ
Insulation resistance	in acc. with VDE 0295
Test voltage	1500 V _{eff.} AC, 50 Hz

Cable

Cable structure	finely stranded, flexible
Wire cross-section	Cables for M12 connection: 0.34 mm ² but NAMUR mating connectors: 0.50 mm ² Cables for M8 connections: 0.25 mm ²
Colour of sheath	grey
Temperature range for PVC conductors	moving: -5 °C bis +70 °C non-moving: -30 °C bis +80 °C
Temperature range for PUR conductors ¹⁾	moving: -5 °C bis +70 °C non-moving: -30 °C bis +105 °C
Minimum permissible bending radius	> 10 x conductor diameter, appropriate for conveyor chains
Sheath diameter	∅4.6 mm for M8 and ∅4.8 mm for M12, but ∅5.2 mm in 5-pin variant
Material of core insulation	PVC or in the case of halogen free cable synthetic material on polyester base
Core colours in acc. with VDE 293	2-pin: BN, BU 3-pin: BN, BU, BK 4-pin: BN, BU, BK, WH 5-pin: BN, BU, BK, WH, GY (GN/YE bei PE)

¹⁾ Please note reduced mechanical values for PUR cables at temperatures over +80 °C.

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories

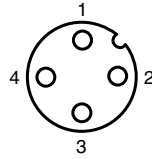
Accessories - cables, plugs, mating connectors

Core colours and connection assignment (EN 60947-5-2)

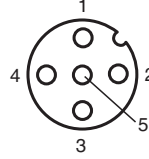
Colour assignment of ready-to-use cable sockets V1, V15, V3:

Pin	Colour	Abbrev.
1	Brown	BN
2	White	WH
3	Blue	BU
4	Black	BK
5	Grey	GR

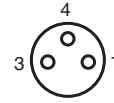
Plug connector -V1
(Circular connection M12)



Plug connector -V15
(Circular connection M12)



Plug connector -V3
(Circular connection M8)

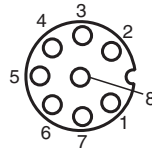


Top view of plug side

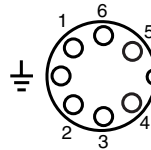
Colour assignment ready-to-use Mating connectors V17, V7 and :

Pin	Colour	Abbrev.
1	White	WH
2	Brown	BN
3	Green	GN
4	Yellow	YW
5	Grey	GR
6	Pink	PK
7	Blue	BU
8	None (screening)	

Plug connector -V17
(circular connector M12x1)



Plug connector -V7
(circular connector PG 13,5)



Top view of plug side

Mating connectors M8 type with metal cap nut ¹⁾

Suitable for sensors with 2, 3 or 4 wires						
Cable-sheath	Length	No. of wires	Ø (mm ²)	Design straight	Design angled	Design angled with 2 LEDs
PUR, grey	2 m	3	0,25			V3-WM-E2-2M-PUR
	5 m	3	0,25	V3-GM-5M-PUR	V3-WM-5M-PUR	V3-WM-E2-5M-PUR
	10 m	3	0,25			V3-WM-E2-10M-PUR
PVC, grey	2 m	3	0,25	V3-GM-2M-PVC	V3-WM-2M-PVC	
	5 m	3	0,25	V3-GM-5M-PVC	V3-WM-5M-PVC	
	10 m	3	0,25	V3-GM-10M-PVC	V3-WM-10M-PVC	
PUR, grey	2 m	4	0,25	V3-... mating connectors		
	5 m	4	0,25	V31-GM-5M-PUR	V31-WM-5M-PUR	
	10 m	4	0,25	V31-... mating connectors		
PVC, grey	2 m	4	0,25	V31-GM-2M-PVC	V31-WM-2M-PVC	
	5 m	4	0,25	V31-GM-5M-PVC	V31-WM-5M-PVC	
	10 m	4	0,25	V31-GM-10M-PVC	V31-WM-10M-PVC	

¹⁾ M8 mating connectors with twist connect on demand.

Cable connectors in M12 design for DC sensors

Suitable for DC sensors with 2, 3 or 4 wires						
Cable-sheath	Length	No. of wires	Ø (mm ²)	Design straight	Design angled	Design angled with 2 LEDs
PVC, grey	2 m	4	0,34	V1-G-2M-PVC	V1-W-2M-PVC	
	5 m	4	0,34	V1-G-5M-PVC	V1-W-5M-PVC	
	10 m	4	0,34	V1-G-10M-PVC	V1-W-10M-PVC	
PUR, grey	2 m	4	0,34	V1-G-2M-PUR	V1-W-2M-PUR	V1-W-A2-2M-PUR
	5 m	4	0,34	V1-G-5M-PUR	V1-W-5M-PUR	V1-W-A2-5M-PUR V1-A0-5M-PUR V1-W-E2/E3-5M-PUR
	10 m	4	0,34	V1-G-10M-PUR	V1-W-10M-PUR	V1-W-A2-10M-PUR
PUR, grey	2 m	3	0,34	V15-... mating connectors		V1-W-E2-2M-PUR
	5 m	3	0,34			V1-W-E2-5M-PUR V1-W-E-5M-PUR
	10 m	3	0,34			V1-W-E2-10M-PUR
PVC, grey	2 m	5	0,34	V15-G-2M-PVC	V15-W-2M-PVC	
	5 m	5	0,34	V15-G-5M-PVC	V15-W-5M-PVC	
	10 m	5	0,34	V15-G-10M-PVC	V15-W-10M-PVC	
PUR, grey	2 m	5	0,25		V15-W-2M-PUR	
	5 m	5	0,25		V15-W-5M-PUR	
PUR, grey screened	2 m	7	0,25	V17-G-2M-PUR		
	5 m	7	0,25	V17-G-5M-PUR		
	10 m	7	0,25	V17-G-10M-PUR		

Mating connectors in M12 design with cross-braided lead

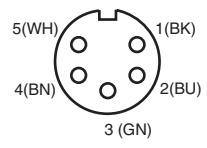


Suitable for DC sensors with 2, 3 or 4 wires technique, cross-braided halogen free lead or with PE						
Cable-sheath	Length	No. of wires	Ø (mm ²)	Design straight	Design angled	Design angled with 2 LEDs
PUR, halogen free, cross-braided, orange	2 m	4	0,34	V1-G-2M-PUR H/S	V1-W-2M-PUR H/S	V1-W-A2-2M-PUR H/S
	5 m	4	0,34	V1-G-5M-PUR H/S	V1-W-5M-PUR H/S	V1-W-A2-2M-PUR H/S
PUR, cross-braided with PE, orange	2 m	4+1	0,34	V15-G-2M-PUR S/PE	V15-W-2M-PUR S/PE	V15-W-A2-2M-PUR S/PE
	5 m	4+1	0,34	V15-G-5M-PUR S/PE	V15-W-5M-PUR S/PE	V15-W-A2-5M-PUR S/PE

Date of issue 17.8.05

Series -12GM
 Series -18GM/-18GM
 Series -30GM
 Series VarKont
 Series -FP
 Series -F12
 Series -F42
 Series -F43
 Series -F54
 Series -F64
 Series -D1
 Series LUC
 Double sheet monitoring
 Control units/ Power supplies
 Accessories

Series -12GM
Series -18GN/-18GM
Series -30GM
Series Var/Kort
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Mating connectors 7/8" -16 UN 2A for AC sensors in series F42 (UB...-F42(S)-UK-V95)

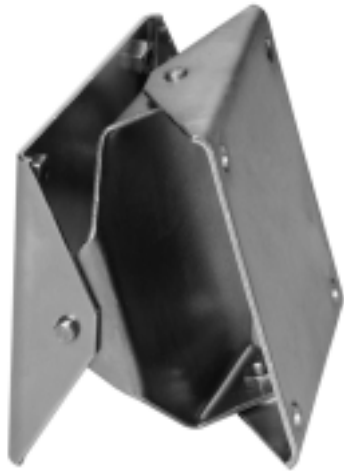
Pin out/wire colours 					
Cable sheath	Length	Number of wires	Ø (mm²)	Design straight	Design angled
PVC	2 m	5	0,75	upon request	V95-W-2M-PVC

Type code mating connectors

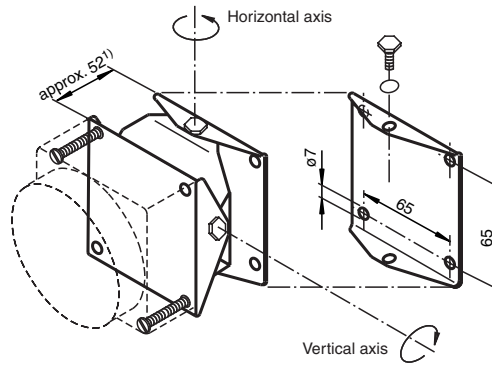
V1 - W - E2 - 2M - PVC

Cable material	- PVC - PUR - PUR H/S, halogen free cross-braided - PUR S/PE cross-braided, with PE
Cable length	2 2 m - 5 m - additional length on demand
with/without LED	- E2 (for 3-wire pnp), 2 LEDs - E0 (for 3-wire npn), 2 LEDs - E2/E3 (contact 2 + 4 link), 2 LEDs - A0 (for 4-wire npn), 2 LEDs - A2 (for 4-wire pnp), 2 LEDs - no designation = without LED
Design	- W angled - G straight - WM angled with cap nut - WR angled with twist connect - GR straight with twist connect
Connection method	- V1 M12 x 1, 4-pin, DC - V1S M12 x 1, 4-pin, DC, connector - V13 M12 x 1, 3-pin, AC - V15 M12 x 1, 5-pin, DC - V15S M12 x 1, 5-pin, DC, connector - V16 Rd24 x 1/8, 7-pin, AC/DC - V16S Rd24 x 1/8, 7-pin, AC/DC, connector - V17 M12 x 1 7-pin, DC - V18 M18 x 1, 4-pin, AC/DC - V3 M8 x 1, 3-pin, DC - V3S M8 x 1, 3-pin, DC, connector - V31 M8 x 1, 4-pin, DC - V31S M8 x 1, 4-pin, DC, connector - V7 Amphenol-Tuchel C164 639F 7S22 - V95 7/8" -16 UN 2A, 4-pin, AC - V with central screwed connection, 4-pin

MH 04-3505



Mounting accessory for the simple adjustment of -FP and -F42 series sensors



The type 04-3505 mounting accessory simplifies the adjustment of ultrasonic sensors of the -FP and -F42 series.

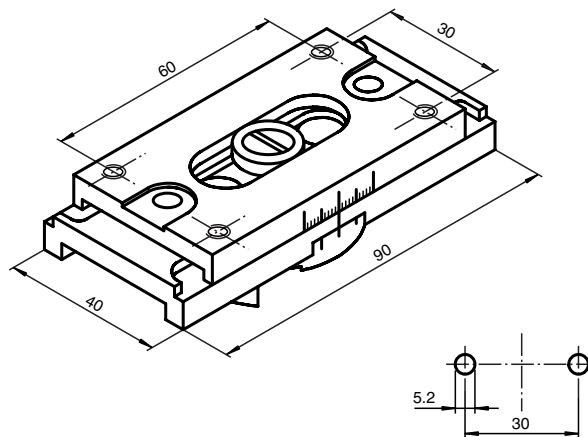
It permits the completely installed and wired sensor to be swiveled by up to $\pm 30^\circ$ in 2 orthogonal axes.

The sensor is locked in the desired position by tightening the mounting screws.

MH 04-2681F



Mounting accessory for the simple adjustment of VariKont® series sensors



Height in two-point installation approx. 28 mm

For ultrasound sensors (VariKont®, +U9+ series) compliant with DIN 43694, EN 50025 oder EN 50037.

The simple mounting is performed with traditional C-profile rails¹) as in EN 50024 (15 x 30 x 1.5). For existing systems, the mounting accessories will also fit on C-rails¹) that comply with the obsolete DIN 43662 standard (15 x 30 x 2). Generous scope for adjustment in the x and y directions and 360° rotation simplify and speed up installation and adjustment work. The adjustment of the sensor in the selected position is performed using the switch mounting screws (included). Provision has also been made for two-point mounting as an alternative to the C-rail. The required holes can be accessed through the central guide slot. M5 x 16 mm screws may be used for mounting.

Technical data:

Material	Injection molded zinc, chromated
Permissible shock and Vibration loads	b < 30 g, T < 11 ms f < 55 Hz, a < 1 mm
Mass	as per IEC 68-2-6 and IEC 68-2-27 approx. 270 g

Date of issue 18.08.2005

Subject to reasonable modifications due to technical advances.

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Series -12GM
Series -18GK/-18GM
Series -30GM
Series VariKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
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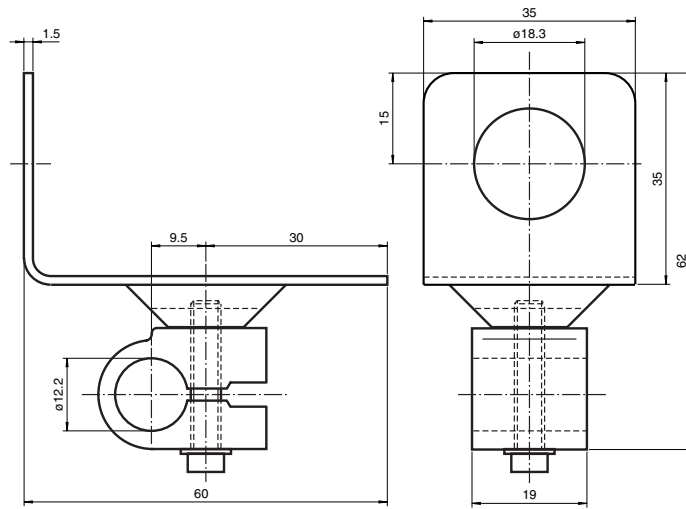
Accessories - mounting aids

OMH 04



Universal mounting for all cylindrical $\varnothing 18$ mm sensors

Material: sheet steel, galvanised
 Angle: sheet steel, galvanised
 Locking disc: sheet steel, galvanised
 Locking profile: aluminium, diecast



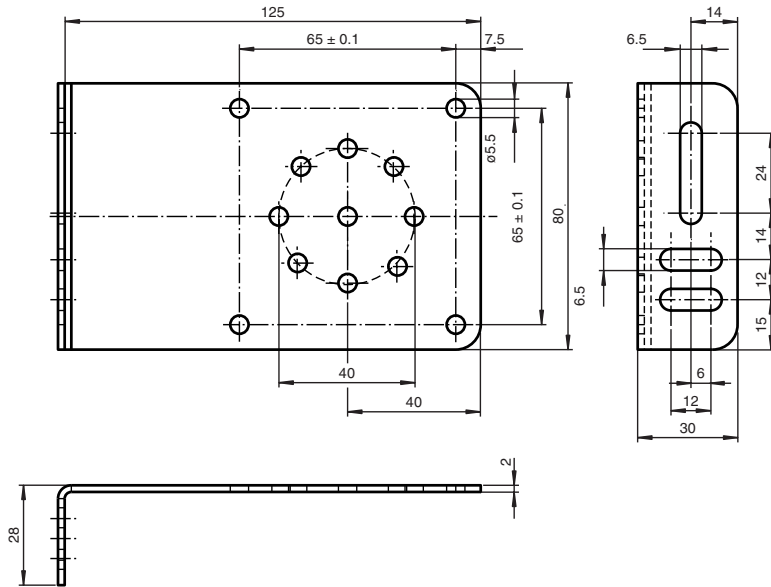
For installation on $\varnothing 12$ mm round rod or sheet material (thickness 1.5 mm ... 3 mm). Suitable for -18GM series sensors.

MHW 11



Mounting angle for -FP and -F42 series sensors

Material: Stainless steel

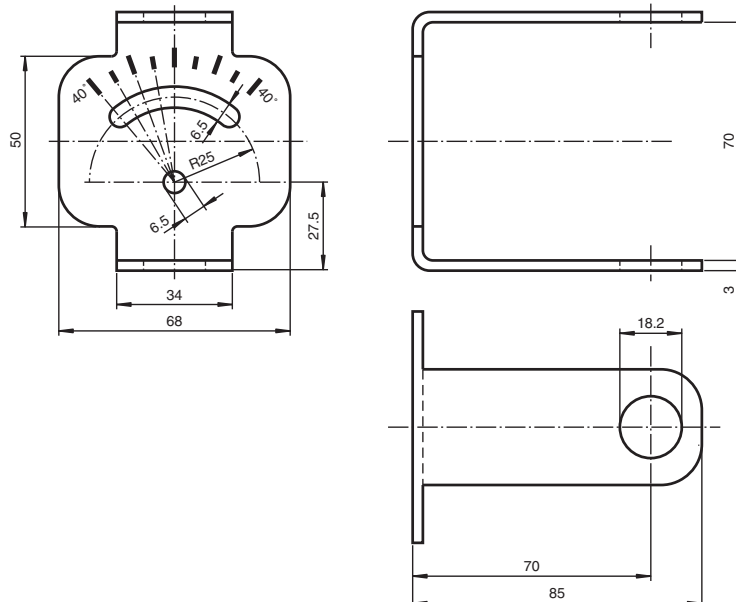


MH-USB01



Rotatable mounting angle with angle scale for ultrasonic double-sheet monitors.

Material: Stainless steel



Date of issue 18.08.2005

CPZ18B03



Mounting flange with tumble mechanism.
For sensors with an M18 threaded housing

Rotation range: 360°
Swing range: 10°

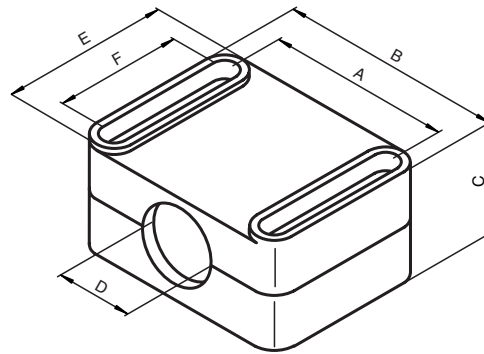
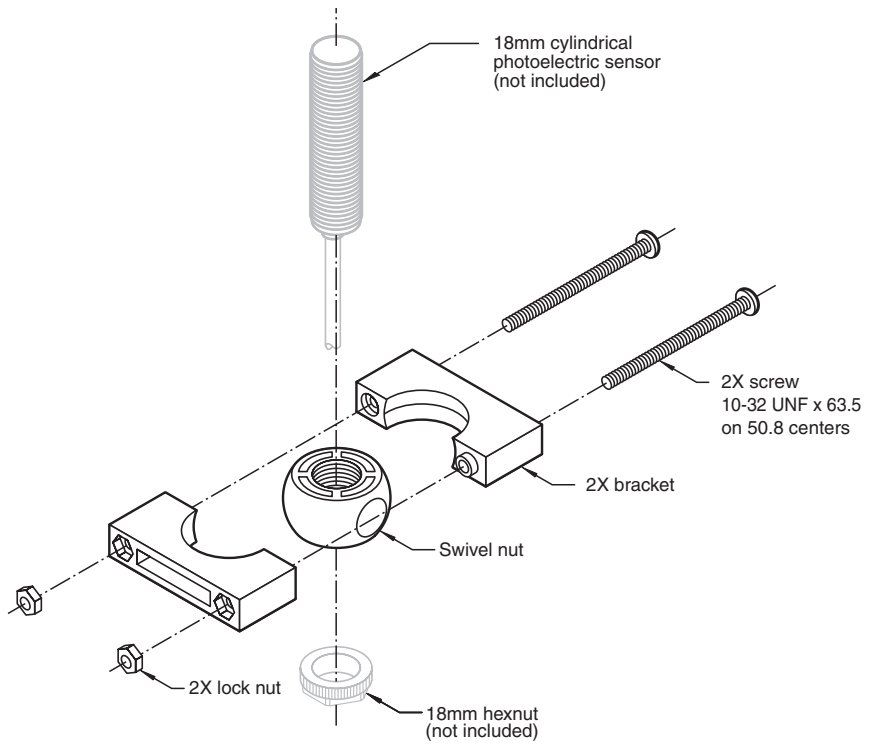
(Delivery of mounting flange does not include sensor)

BF 12 BF 18 BF 30



Universal mounting brackets with transparent upper part for all cylindrical sensors with $\varnothing 12$ mm, $\varnothing 18$ mm, or $\varnothing 30$ mm.

Material: PBT



	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	suitable cylinder head screws
BF12	24	36	19	12	30	16	M4 x 20
BF18	30	44	23	18	40	26	M5 x 25
BF30	40	56	34	30	40	24	M5 x 40

Accessories - mounting aids

M105

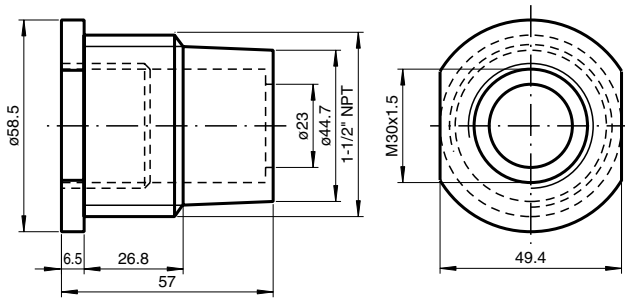


Universal mounting for cylindrical sensors with $\varnothing 30$ mm for sensors with front-end thread (UB/UC300, -500 and -2000).

- **Secure mounting**
- **Easy installation**
- **Robust design**
- **Chemical-resistant**

Material: PTFE

(Delivery of mounting accessories does not include sensor)



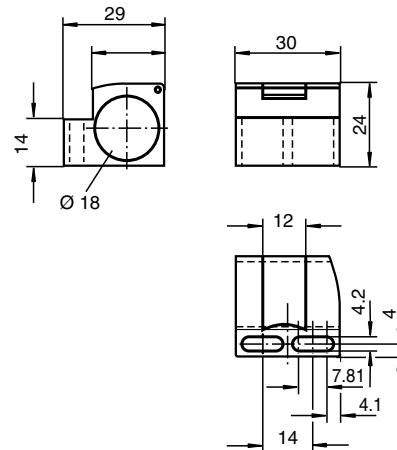
BF18-F BF30-F



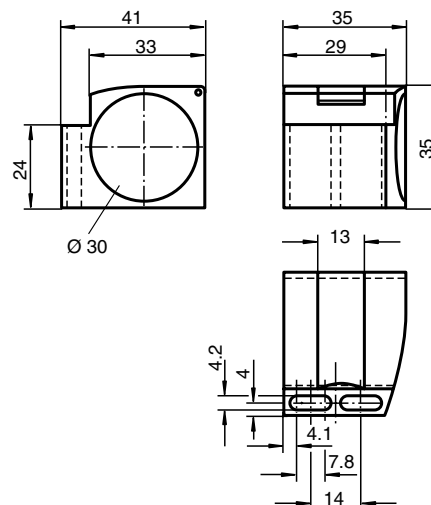
Universal mounting for all cylindrical sensors with $\varnothing 18/\varnothing 30$ mm

- **The flange is mounted using the oblong holes, the adjustment range is 8 mm at maximum.**
- **Suitable screws for installation of the mounting flange: M4**

BF18-F



BF30-F



PA02

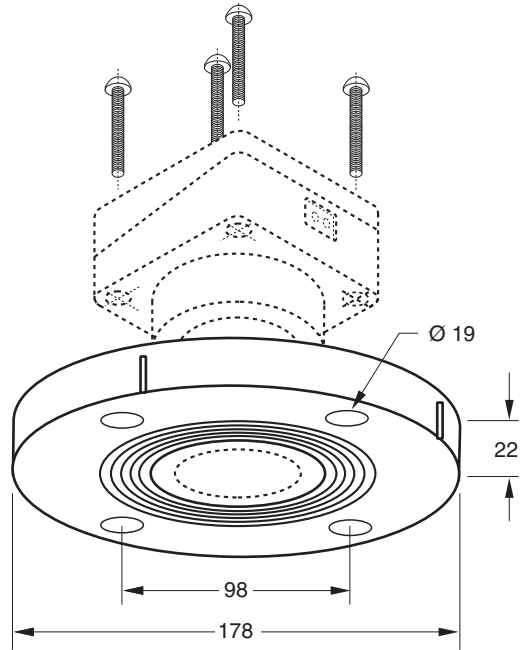


Mounting flange for all block type -FP series sensors

- **Secure mounting**
- **Easy installation**
- **Robust design**

(Delivery of mounting flange does not include sensor)

Material: PVC



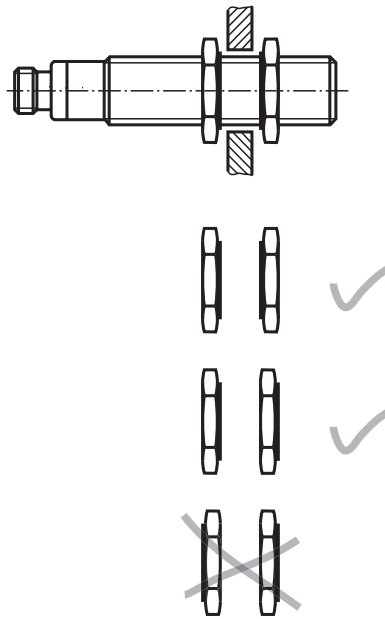
Nut M12K-VE
Nut M18K-VE
Nut M30K-VE



Plastic nuts with centering ring for vibration decoupled installation of cylindrical sensors with diameters of 12 mm, 18 mm and 30 mm.

These nuts should be used in applications, where the sensor is fixed at the front third of the housing, when ambient temperatures of $< 0^{\circ}\text{C}$ can occur.

Material: PA
Packaging unit: 1 pair



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Subject to reasonable modifications due to technical advances.

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Courtesy of Steven Engineering, Inc. • 230 Ryan Way, South San Francisco, CA 94080-6370 • General Inquiries: (800) 670-4183 • www.stevenengineering.com

Series -12GM
Series -18GK/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

Accessories - mounting aids

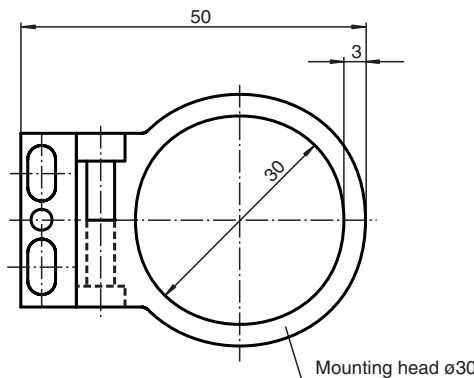
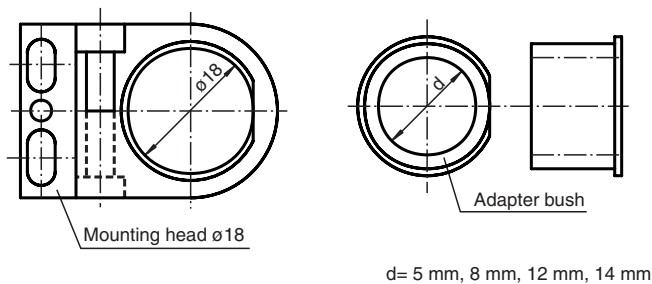
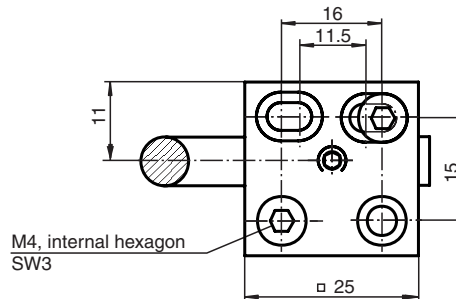
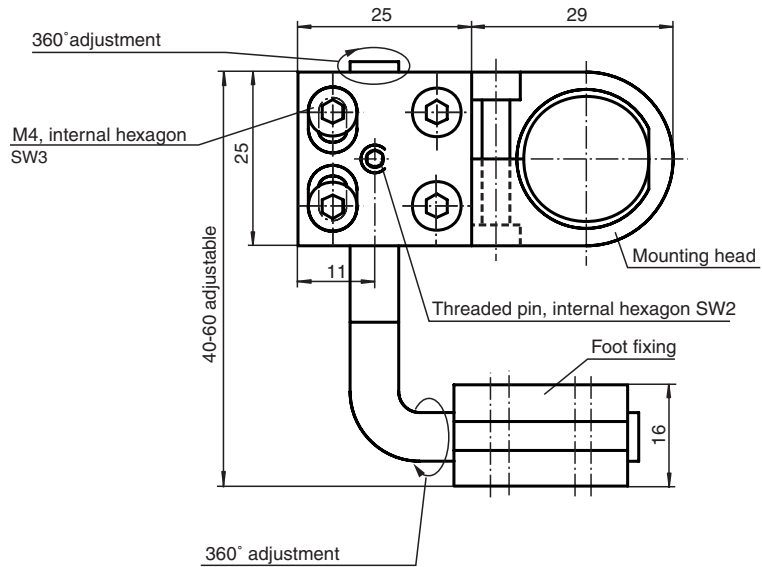
BF 5-30



Universal mounting for all cylindrical sensors with $\varnothing 5 \text{ mm} \dots \varnothing 30 \text{ mm}$

- **Secure mounting**
- **Easy installation**
- **Flexible 360° adjustment of measuring head and base**
- **Robust design**

The BF 5-30 mounting flange is supplied with two mounting heads ($\varnothing 18 \text{ mm}$, $\varnothing 30 \text{ mm}$) and 4 sleeves ($\varnothing 5 \text{ mm}$, $\varnothing 8 \text{ mm}$, $\varnothing 12 \text{ mm}$, $\varnothing 14 \text{ mm}$).



UVW90-K18 UVW90-K30



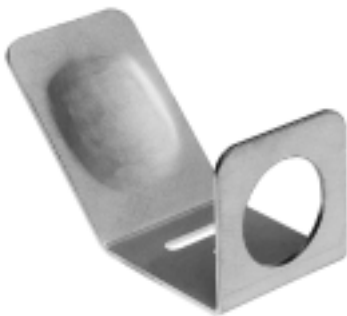
Sound deflector for cylindrical -18GM and -30GM series ultrasonic sensors.

- **Clamp mounting**
- **90° sound deflection for difficult installation circumstances**
- **Universal installation position**

On the underside of the slope the sound deflector has a hole over the complete width. Falling particle of dust can not congregate in the focusing attachment. The function is also guaranteed in dusty environment.

Material: PMMA

UVW90-M30

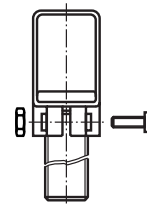
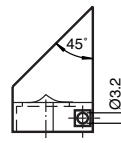
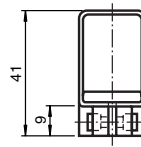
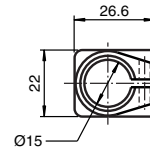


Focusing attachment for cylindrical -30GM series ultrasonic sensors.

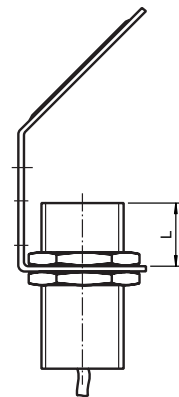
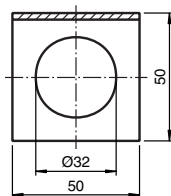
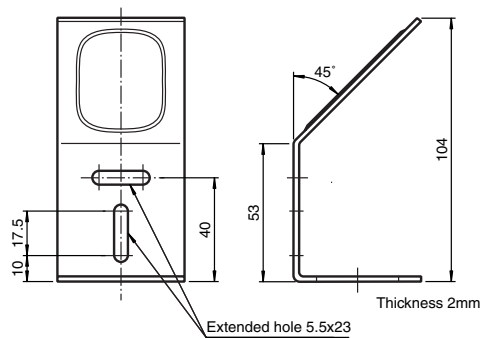
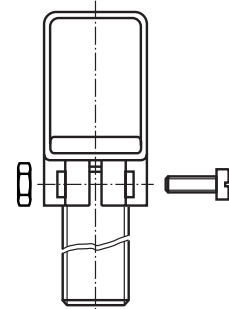
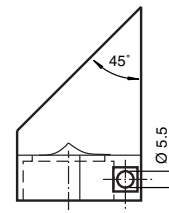
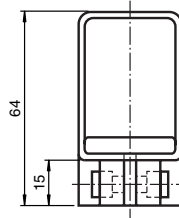
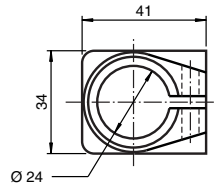
- **Universal installation options**
- **90° sound deflection for difficult installation circumstances**
- **Universal installation position**
- **Focusing effect**
- **Detection range increase (through focussing)**
 - approx. 40% with UB/UC500 (with dimension L = 10 mm)
 - approx. 20% with UB/UC2000 (with dimension L = 35 mm +/- 5 mm)

Material: Stainless steel

UVW90-K18



UVW90-K30



Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/ Power supplies
Accessories

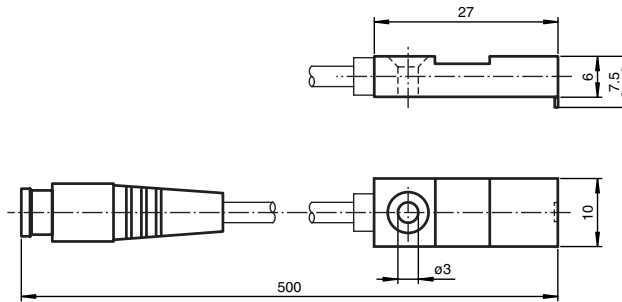
Accessories - external temperature probes, remote potentiometers

UC-30GM-TEMP



External temperature probe

- For ultrasonic sensors of the UC...-30GM-... and LUC4T-... series
- 8 mm plug connector
- Single-hole mounting with position locking



The external UC-30GM-TEMP temperature probe may be connected to ultrasonic sensors of the UC...-30GM-... and LUC4T-... series as an alternative to the supplied temperature plug.

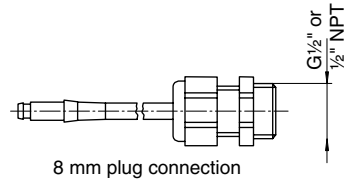
The use of the UC-30GM-TEMP permits the ambient temperature of the measuring area to be monitored independently of the installation conditions of the sensor in order to minimise temperature influences as effectively as possible.

LUC4-Z30-G2V LUC4-Z30-N2V



External temperature probe

- For ultrasonic level sensors of the LUC4T-... and UC...-30GM-... series
- 8 mm plug connector
- Single-hole mounting in thread: G $\frac{1}{2}$ A (LUC4-Z30-G2V) ½NPT (LUC4-Z30-N2V).



cable length: 300 mm

The external LUC4-Z30-G2V (with G $\frac{1}{2}$ A thread) or LUC4-Z30-N2V (with ½NPT thread) temperature probes may be connected to ultrasonic sensors of the LUC4T-... and UC...-30GM-... series as an alternative to the supplied temperature plug.

The use of the LUC4-Z30-... permits the ambient temperature of the measuring area to be monitored independently of the installation conditions of the sensor in order to minimise temperature influences as effectively as possible.

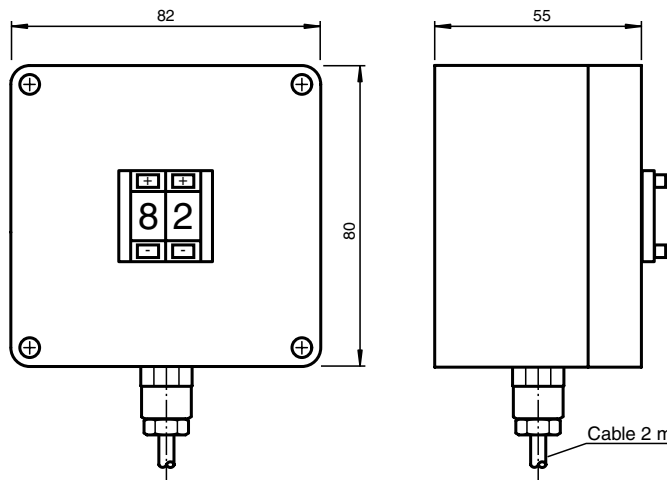
FP100



Remote potentiometer

Potentiometer for the adjustment of the sensing range of ultrasonic through-beam sensor UBE4000-30GM-SA2-V15.

The potentiometer connection occurs on the transmitter



USB-0,8M-PVC ABG-SUBD9



Interface adapter USB/RS_232

Modern notebooks and PCs are often not equipped with a standard RS 232 serial interface.

Anyhow, to allow the use of the multiple functions of the service program ULTRA 2001, the interface adapter USB-0,8M-PVC ABG-SUBD9 offers a simple solution.

The interface adapter USB-0,8M-PVC ABG-SUBD9 provides a RS 232 serial interface at a free USB port.

It can be connected to the USB port either directly or via the 800 mm USB cord, which is included in scope of delivery.

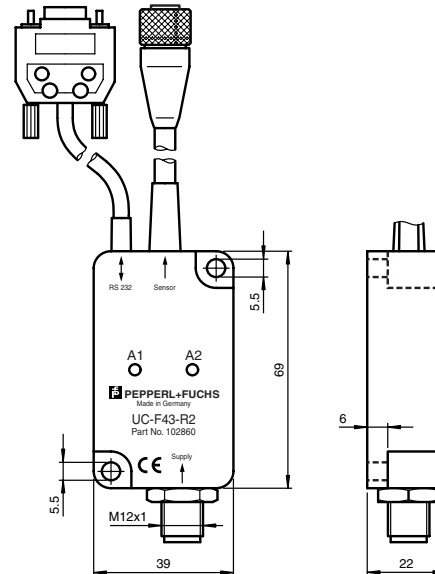
Our interface cables can be connected to the 9 pin SUB-D connector in the accustomed way.

UC-F43-R2



RS 232 interface

- For the sensors UC300-F43-2KIR2-V17 and UC2000-F43-2KIR2-V17.
- Simple insertion in the sensor connection lead.



The unit can be switched from the V17 cable connection socket and the V17 plug connection on the sensor for the TEACH-IN procedure.

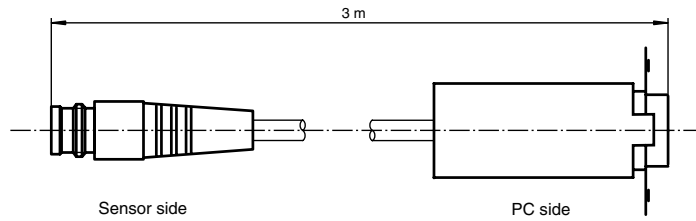
The parameterised functions are retained when the programming unit is removed and/or the power is switched off.

Accessories - programming aids

UC-30GM-R2



Interface cable

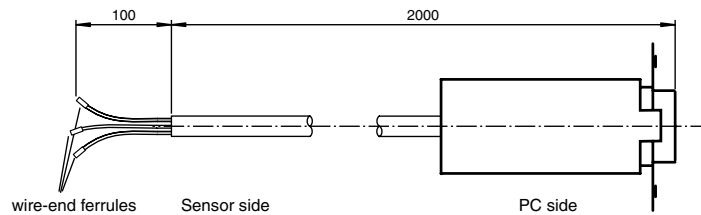


The UC-30GM-R2 interface cable enables the parameterisation of ultrasonic sensors of types UC...-30GM-..R2-V15 using the ULTRA 2001 service software. The cable creates a connection between the PC-internal RS 232 interface and the connector of the temperature/programming plug on the sensor.

UC-FP/U9-R2



Interface cable

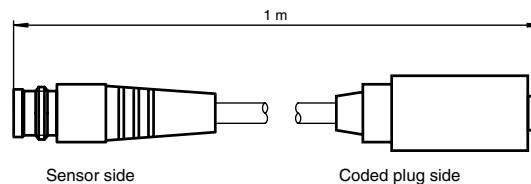


The UC-FP/U9-R2 interface cable enables the parameterisation of *VariKont*[®] and FP series ultrasound sensors using the ULTRA 2001 service software. The cable creates a connection between the PC-internal RS 232 interface and the interface connections in the terminal space of the sensor.

UC-30GM-PROG



Extension cable



The UC-30GM-PROG extension cable permits sensors of the UC...-30GM-... and LUC... series to be taught-in at inaccessible installation locations. The sensor-side end of the extension cable is connected to the sensor's temperature plug socket. The sensor can be programmed with the temperature plug at the other end of the cable.

UB-PROG2



Programming device

- For ultrasonic sensors series

UB300				
UB400	-12GM			
UB500	-18GM40	-E4		
UB800	-18GM75	-E5		
UB1000	-30GM	-I		-V15
UB2000	F42(S)	-U		
UB4000	-F54			
UB6000				

... whose teach-in input is on pin 2.

- Simple TEACH-IN of the switching distances A1/A2 or the measuring window.
- Simple selection of the output function:
Window mode, normally open/normally closed function.
One switching distance, normally open/normally closed function.
Monitoring of the detection range.

UB-PROG3



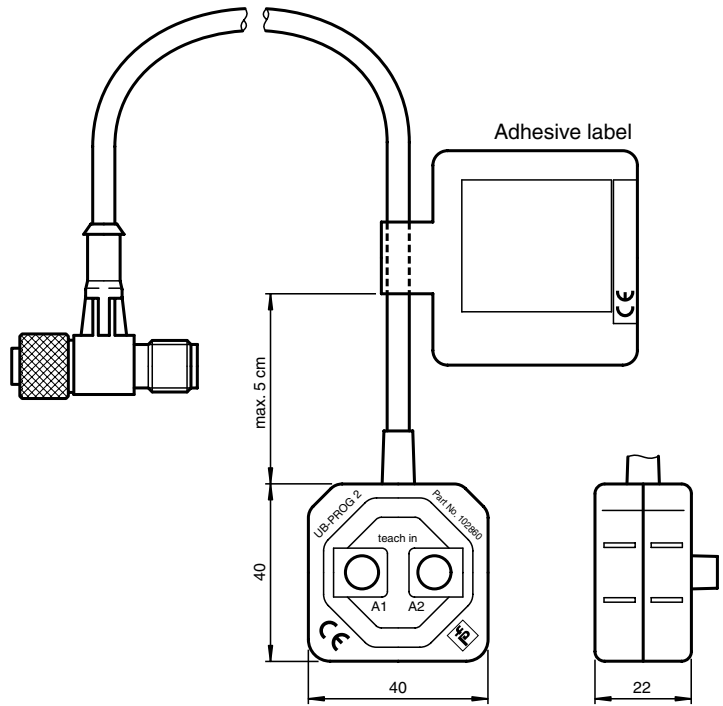
Programming device

- For ultrasonic sensors series

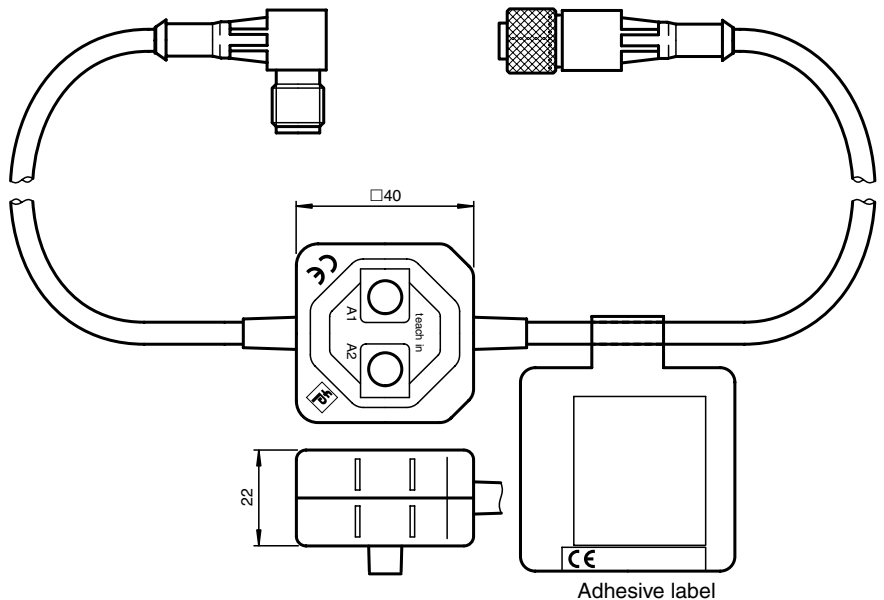
UB500	-18GM75	-E01		
UB1000		-E23		
		-E6		-V15
		-E7		

... whose teach-in input is on pin 5.

- Simple TEACH-IN of the switching distances A1/A2 or the measuring window.
- Simple selection of the output function:
Window mode, normally open/normally closed function.
One switching distance, normally open/normally closed function.
Monitoring of the detection range.



The unit can be switched from the V15 cable connection socket and the V15 plug connection on the sensor for the TEACH-IN procedure.
The switching distances/measuring window and output function can be taught in using the A1 and A2 buttons.
The taught-in switching distances and functions are retained when the programming unit is removed and/or the power is switched off.



The unit can be switched from the V15 cable connection socket and the V15 plug connection on the sensor for the TEACH-IN procedure.
The switching distances/measuring window and output function can be taught in using the A1 and A2 buttons.
The taught-in switching distances and functions are retained when the programming unit is removed and/or the power is switched off.

Date of issue 18.08.2005

Series -12GM
Series -18GM/-18GM
Series -30GM
Series VarKont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -D1
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

Series -12GM
Series -16GM/-18GM
Series -30GM
Series Var/Kont
Series -FP
Series -F12
Series -F42
Series -F43
Series -F54
Series -F64
Series -DI
Series LUC
Double sheet monitoring
Control units/Power supplies
Accessories

ULTRA 2001

Service software

- WINDOWS™ user interface with up to 5 independent windows.
- For all ultrasonic sensors with RS 232 interfaces.
- Convenient parameterisation of all relevant sensor functions such as:
 - Evaluation process
 - Switching behaviour
 - Switching distances
 - Analogue output
 - Measuring window
 - Filter functions
 - Fault management
 - etc.
- Logging functions for sensor parameter settings and recorded series of measurements.

Software and manual as free download:

<http://www.pepperl-fuchs.com>

Procedure:

- Select your product, which can be parameterised by ULTRA 2001 at our „Products“ page.
- Click on "1830288.zip" in the „Further documents“ section.
- Save and unpack the file on your local drive.

Use the appropriate interface or interface cable for communication between PC and sensor (see page 231)

Why use PC software for parameterisation?

Commands and parameters can be transferred to sensors via an RS 232 interface, if present. These commands can be used to output measured values, configure the evaluation process, switching outputs and/or analogue output, set and query parameters and control the general unit functions. This provides the user with an aid in adapting the sensor optimally to its specific application and visualising parameters or measured results.

Parameterisable sensors

Series:	sensor types:
-30GM	UC...-30GM-..R2-V15
Varikont®	UC...+U9+E6/E7+R2 and UC...+U9+IUE0/E2+R2
	UJ3000+U1+...+RS
-FP	UC6000-FP-...-R2-P5 and UJ6000-FP-...+RS
-F43	UC...-F43-2KIR2-V17

Brief description

The program features a multilingual, menu-based user interface with comprehensive help. It supports up to 5 independent windows. The windows can be displayed or hidden, and their size and position on the screen can be adjusted as required. The size and position of the windows is retained by the program.

Show It: Graphical display of the measured distance. The set switching distances are marked. Simulated LEDs display the switching states of the outputs.

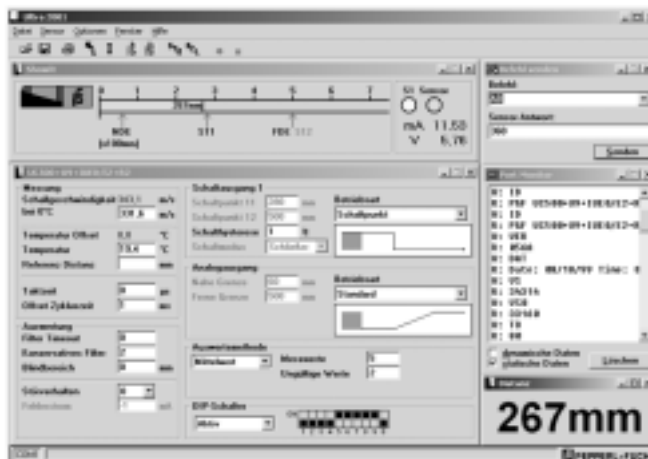
Parameters: All parameters are editable here. Display and input fields permit commands or parameters to be changed at the click of the mouse without detailed knowledge of the relevant commands or their syntax.

Send command: Sensor parameters are set and queried here in the same manner as with a terminal program (alternative to the parameterisation window).

Port Monitor: Display of commands sent to the sensor and received by it.

Distance: Display of the currently measured distance in mm.

The program and sensor parameters read out by the program can be saved to the hard drive or a diskette. Measurement series can be started, the measurement data queried periodically and output to a printer or saved to the hard drive/diskette.



System requirements

The Ultra 2001 application will run on any PC or laptop. Windows 95/98/ME/NT4/2000 or XP, an EGA or VGA graphic boards and a free RS 232 interface are required.

Date of issue 18.08.2005

Subject to reasonable modifications due to technical advances.

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Accessories	Control units/ Power supplies	Double sheet monitoring	Series LUC	Series -D1	Series -F64	Series -F54	Series -F43	Series -F42	Series -F12	Series -FP	Series VarKont	Series -30GM	Series -18GK/-18GM	Series -12GM
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Standards

The proximity switches of Pepperl+Fuchs GmbH are developed and manufactured consistently according to applicable standards. Moreover, draft standards are taken into account during new development, redesign, and changes to existing products

German standards

DIN VDE 0660	Part 208 Low-voltage switching devices, auxiliary power switches, supplement on inductive proximity switches
DIN VDE 0660	Part 209 Switching devices, low-voltage switching devices, supplement on contact-free position switches for safety applications
DIN VDE 0660	Part 212 (replaces DIN 19234) Measurement, regulation, control - Electrical path sensors - DC interface for path sensors and switching amplifiers

European standards

EN 60947-5-2	Low-voltage switching devices Part 5: Control devices and switching elements, main section 2: Proximity switches
EN 60947-5-6	Control devices and switching elements, proximity sensors - DC interface for proximity sensors and switching amplifiers (NAMUR)

International standards

IEC 60947-5-2	Low-voltage switching devices and control devices, Part 5 Control circuit devices and switching elements - Section 2, proximity switches
Draft IEC 61934	Control circuit devices and switching elements DC interface for proximity sensors and switching amplifiers (NAMUR)

Standards for electromagnetic compatibility

EN 50081	Basic technical standard for radiation interference Part 1, Residential areas Part 2, Industrial areas
EN 50082	Basic technical standard for interference resistance Part 1, Residential areas Part 2, Industrial areas
EN 61000-4	EMC, testing and measurement procedures Parts 2, 3, 4, 5, and 6

Standards for explosion protection

DIN EN 50014	Electrical equipment for hazardous areas General requirements
DIN EN 50020	Electrical equipment for explosion hazardous areas Intrinsic safety "i"
EN 60079-10	Electrical equipment for gas explosion hazardous areas Classification of hazardous areas
EN 60079-14	Electrical equipment for gas explosion hazardous areas Electrical systems in explosion hazardous areas (excluding excavations)

Quality assurance standards

DIN ISO 9000-9004	EN 29000-29 004) Quality assurance (QA) for products and services
DIN ISO 9001	QA from development to production, installation, and customer service

Pepperl+Fuchs GmbH is DIN ISO 9001-certified.

Additional information

The CE logo

The CE logo is a declaration by the manufacturer that the so designated product conforms to the European standards and directives that are applicable to the product. The following directives are applicable to Pepperl+Fuchs products:

89/336/EEC	EMC directive (EN 60 947-5-2)
73/23/EEC	Low-voltage directive (cf. VDE 0160, product standard EN 60947-5-2)
Directive 94/9/EC	Equipment and protective systems intended for use in potentially explosive atmospheres

Pepperl+Fuchs GmbH certifies the conformance of their products with applicable directives in a manufacturer declaration.

ALPHA

Pepperl+Fuchs GmbH is a member of ALPHA, an association for the testing and certification of low-voltage devices, e. V. This association promotes individual responsibility on the part of manufacturers of such devices through unified testing guidelines compliant with applicable standards, and thus supports high product quality. Through ALPHA's membership in LOVAG (Low Voltage Agreement Group), government-recognised product certifications issued by ALPHA under certain conditions are also recognised in other European countries.

Resistance of our housing materials to chemical substances

The following tabular listing of the chemical resistances of our housing materials gives some indications for the application of our sensors in aggressive environmental conditions (next page).

Chemical resistance

Chemically resistant to	V2A	ABS	Epoxy	PBT	PC	POM	PP	PPS	PS	PVC
Acetone	+	-	-	+	-	+	+	+	-	-
Formic acid	20 °C	40%	+	10%	-	-	85%	O	40%	50%
Ammonia	+	25%	O	10%	-	+	+	+	+	O
Petrol	+	25%	+	+	O	+	-	+	-	+
Benzene	+	-	+	+	-	+	-	+	-	-
Brake fluid	-	O	-	-	-	+	+	-	-	-
Butane	-	+	+	-	+	+	+	+	-	+
Butanol	-	-	-	-	-	+	+	-	-	40 °C
Calcium chloride	-	+	-	10%	+	+	+	+	+	60 °C
Chlorobenzene	20 °C	-	+	-	-	+	-	-	-	-
Diesel oil	-	+	+	+	O	+	60 °C	+	-	-
Acetic acid	20 °C	25%	O	+	10%	10%	70%	+	50%	40 °C
Formaldehyde	+	30%	50%	30%	-	+	40%	37%	40%	+
Frigen 113	-	-	-	-	+	-	-	+	-	+
Fruit juice	+	-	+	-	+	+	+	-	-	+
Glycerine	+	+	+	+	O	+	+	+	+	60 °C
Heating oil	-	O	+	+	O	+	60 °C	+	-	-
Hydraulic oil	-	-	-	-	+	+	60 °C	-	-	+
Caustic potash	-	50%	O	3%	-	+	50%	-	50%	60 °C
Potassium chloride	+	-	-	-	+	+	+	-	+	60 °C
Potassium hydroxide	+	-	-	-	-	-	+	-	-	-
Linseed oil	+	+	-	-	+	+	+	-	+	+
Methanol	+	-	+	+	-	+	+	+	-	+
Methylene chloride	+	-	-	-	-	O	O	+	-	-
Lactic acid	20 °C	80%	+	-	+	+	+	-	80%	O
Mineral oils	+	-	+	+	-	+	+	+	-	+
Motor oils	+	+	-	+	-	+	+	+	O	-
Sodium carbonate	+	+	-	-	+	+	+	-	+	-
Sodium chloride	+	+	-	-	+	+	+	-	+	+
Sodium hydroxide	20 °C	+	-	-	-	-	+	-	-	-
Caustic soda	20 °C	50%	-	3%	-	+	+	-	50%	+
Nitric acid	66%	-	-	-	10%	-	25%	-	10%	+
Hydrochloric acid	-	O	-	10%	20%	-	+	-	10%	O
Lubricating oil	+	-	+	-	+	O/+	+	-	-	-
Carbon disulphide	+	-	-	-	-	+	+	-	-	O
Sulphuric acid	-	50%	-	28%	50%	-	80%	50%	50%	70%
Sea water (cold)	+	-	+	+	-	+	+	+	-	+
Seifenlauge	+	-	+	-	O	+	+	-	-	+
Detergent	+	-	-	-	-	-	+	-	-	-
Turpentine	+	-	+	-	O	-	+	-	-	+
Carbon tetrachloride	+	-	-	-	O	-	-	-	-	O
Toluene	+	-	+	+	-	+	-	+	-	-
Trichlorethylene	+	-	-	+	-	-	-	O	-	-
Water	+	+	68 °C	68 °C	+	+	+	+	+	60 °C
Tartaric acid	20 °C	+	+	-	+	10%	+	-	+	60 °C
Xylene	+	-	-	+	-	+	-	+	-	-
Zinc sulphate	-	+	-	-	+	-	+	-	-	-
Citric acid	20 °C	+	+	-	10%	+	+	-	+	-

Legend:

+: resistant / O: resistant under some conditions / -: not resistant / □: unknown
 ..°C: resistant up to ... °C / ..%: resistant up to a ...% solution

Additional information

Protective enclosures

(DIN VDE 0470 Part 1, EN 60529)

IP 6 7

Degree of protection against contact and foreign bodies	Degree of protection against water
0 - Not protected	0 - Not protected
1 - Protected against contact with hazardous components with the backs of the hand - Protected against solid foreign bodies with a size and diameter of 50 mm and above	1 - Protected against dripping water
2 - Protected against contact with hazardous components with fingers - Protected against solid foreign bodies with a size and diameter of 12.5 and above	2 - Protected against dripping water when housing is tilted up to 15°
3 - Protected against contact with hazardous components with a tool - Protected against solid foreign bodies with a size and diameter of 2.5 mm and above	3 - Protected against sprayed water
4 - Protected against contact with hazardous components with a wire - Protected against solid foreign bodies with a size and diameter of 1.0 mm and above	4 - Protected against splash water
5 - Protected against contact with hazardous components with a wire - Dustproof	5 - Protected against water jets
6 - Protected against contact with hazardous components with a wire - Protected against dust	6 - Protected against strong water jets
	7 - Protected against temporary submersion in water
	8 - Protected against continuous submersion in water
	9 - Protected against water in high-pressure/steam-jet cleaning operations

Notes:

Wherever a code number is not required, the letter "X" must be used in its place.

Devices identified with a second digit 7 or 8 do not have to fulfil the requirements of the second digits 5 or 6 unless they have a double identification (e.g. IPX6/IPX7).

Glossary

ABS

Acrylonitrile butadiene styrol

Accuracy of measurement

Maximum value of the deviation from the ideal characteristic. This is given for sensors used for distance measurement and is based on the maximum measuring range.

Actuation direction

The objects can enter the sound beam from any arbitrary direction. All catalogue data on switching points relates to objects approaching the sensor along its axis.

Adjustment accessories

⇒ Mounting accessories

Adjustment range

The range within which the switching point of a sensor can be set.

Air pressure

During normal atmospheric variation, ($\pm 5\%$) the speed of sound varies by about $\pm 0,6\%$ in a fixed location. The resulting changes in switching distances can normally be ignored.

Air temperature

The velocity of sound is strongly dependent on the air temperature. This may lead to a strong dependence of the base values of an ultrasonic sensor if the sensor is not temperature-compensated.

⇒ Temperature compensation

Alarm

⇒ Fault indicator

Ambient conditions

Pepperl+Fuchs ultrasonic sensor operate unaffected by dust, mist, rain, snow and audible sound. Deposits on the faces of the sensors are normally prevented by the self-cleaning effect of the oscillating decoupling layer.

Ambient temperature

According to the applicable standards, ultrasonic sensors must be operational at temperatures from $-25\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$.

This corresponds to the standard temperature range of Pepperl+Fuchs sensors. The values appropriate to specific equipment are given on the relevant data sheet.

Blind range

⇒ "Unusable area" section

Cable length

Cables of up to 300 m length can be used for sensors with internal evaluation. A maximum length of 100 m can be used if the cable is used for communication via the RS 232 interface.

The cable should be shielded in the event of high interference levels.

In the case of sensors without evaluation (H1/2/3 sensors), the cable length should not exceed 50 m.

CE symbol

The CE symbol is a declaration by the manufacturer, that the so designated product conforms to the European and international standards and directives that are applicable to the product. The following standards and directives are applicable to Pepperl+Fuchs products:

89/336/EEC EMC-directive
(see also IEC 801)
73/23/EEC Low
voltage directive
(see VDE 0160,
EN 60 947-5-2)

94/9/EC Devices and protec-
tion systems
for hazardous areas

Concentration

The sound cone has an opening angle of approx. 5° at a sound pressure level of -6 dB . Further concentration of the ultrasonics, e.g. by placing a tube in front of the transducer, is not possible.

Detectable object

⇒ Standard measuring plate

Detection width hysteresis

This denotes the separation of the switching points between lateral approach and removal of the measuring plate, i.e. between approach and removal at right angles to the reference axis.

Deviation of characteristic curve

⇒ Accuracy of measurement

Diffuse reflection

⇒ Reflection

EMC classification

Electromagnetic compatibility is the ability of an electrical device to function satisfactorily in an electromagnetic environment, without interfering with other devices and without receiving interference itself. The EMC classification is obtained from tests for emission and resistance to interference in various test gradings. Grade 3, for example, corresponds to a normal industrial environment.

(see EN 60947-5-2 Annex X).

Fault indicator (alarm)

Many ultrasonic sensors from Pepperl+Fuchs are equipped with a red LED to indicate faults. Faults are generally due to the incorrect adjustment of the sensor or excessive levels of interference.

These are then indicated by the flashing red LED.

In case of a fault, the last valid output state is "frozen". Output states remain in effect until the fault is corrected and the sensor is returned to normal operation.

Humidity

The velocity of sound increases by 2% from dry to saturated air. As a result, switching distances decrease by a maximum of 2%. This can be disregarded under normal circumstances.

Hysteresis

⇒ Range hysteresis
⇒ Detection width hysteresis

Impulse relay function

Time function for switching outputs in which an output pulse of a specified length is generated which is not affected by the length of the switching event.

⇒ Timer function

Interference, mutual

Ultrasonic sensors operating simultaneously with overlapping detection areas may interfere with one another. For this reason, minimum distances between the sensors must be maintained.

- If the sensors are transmitting in the same direction, the lateral safety distance corresponds to around half the sensing range.
- In the case of opposed sensors, the distance should amount to slightly more than the sum of the sensors' sensing ranges.

The use of synchronisable sensors is recommended if these safety distances cannot be maintained.

Light emitting diodes

Pepperl+Fuchs ultrasonic sensors are equipped with LEDs to signal a variety of states.

Please refer to the appropriate data sheets for the significance of the individual LEDs.

Linearity

- ⇒ Accuracy of measurement

Measuring output

Absolute: The measuring output indicates the distance of the object from the face of the sensor in millimeters. The output is either analogue (4 mA ... 20 mA, or 0V ... 10 V) or digital (parallel 8-bit or serial RS232).
Relative: The measuring output gives the position of the object within the window area (A1/A2 or lower limit/upper limit).

Measuring range

Evaluation range of measuring sensors. The starting value of the measuring range is determined by the "lower limit" the end value by the "far limit" of the sensor.

Mounting accessories

The catalogue lists mounting brackets and angles for use with sensors, which can be adjusted relative to each other. These items simplify adjustment and alignment of the sensors.

No load current

This represents the self current requirement of the sensor and is measured under conditions of zero load.

No load power consumption

This is the power consumption of the sensor itself under no-load conditions.

Normally closed

If the sensor does not detect an object, then the output is energised. When an object is detected it is de-energised (normally closed, n.c.).

Normally open

If the sensor does not detect an object, then the output is de-energised. When an object is detected it is energised (normally open, n.o.).

Objects

The specification of a sensing range is normally based on a flat standard measuring plate measuring 100 x 100 mm which is positioned at right angles to the sensor axis. The sensing ranges for sensors for very small distances are sometimes based on smaller plates (see data sheets). Solid materials, powders and liquids can be detected.

When working with poorly reflecting materials (felt, cotton wool, foam rubber, coarse textiles), we recommend deploying ultrasonic sensors as reflex sensors. Hot materials (>100 °C) are poor reflectors.

- ⇒ Section "Notes for installation and operation"

PBT

Polybutyleneterephthalate

PC

Polycarbonate

PMMA

Polymethylmethacrylate

Probe

- ⇒ Reflection sensor

Protection class

EN 40050 classifies the protection of electrical apparatus against touch, penetration of objects or water through the housing, uncovering, and so on. The IP code consists of the letters "IP" (International Protection) and two digits:

1st digit:
Degree of protection against contact and foreign objects

2nd digit:
Degree of protection against entry of water

- ⇒ Table "Protective enclosures"

Pulse extension

Time function by means of which the switching time can be extended, provided it is shorter than the value of the pulse extension.

- ⇒ Timer function

Quality assurance

The standards DIN ISO 9000-9004 (EN 29000-29004) regulate the quality assurance (QA) of products and services.

Pepperl+Fuchs is certified in accordance with

DIN ISO 9001.

Range hysteresis

This is the separation of the switch points between the condition when the measuring plate approaches the sensor and the condition when it is moving away from the sensor. The hysteresis is given as a percentage of the operating distance (range).

Range

Usable distance between the ultrasonic transmitter and receiver (through-beam), sensor and reflector (interrupted beam), or sensor and object (reflection sensor).

- ⇒ Sensing range

Rated operating current

This value represents the maximum operating current for continuous operation.

Rated operating voltage

The rated operating voltage is given in terms of a maximum and minimum value of the supply voltage. Satisfactory operation of the sensor is assured in this range.

Rated operating voltage

The rated operational voltage is given in terms of a maximum and minimum value of the supply voltage, e.g. $V_e = 10 \text{ V DC} \dots 30 \text{ V DC}$. Correct operation of the sensors is assured within this range.

Readiness delay

The readiness delay is the time that passes from switch-on of the operating voltage to the point when a proximity switch is ready to operate.

Reference axis

Ideal line upon which the transmitter and receiver (through-beam) or sensor and object/reflector (reflection sensor or reflection barrier) are positioned. In the case of single-head systems the reference axis refers to the line of symmetry of the ultrasonic beam; in twin-head systems it is the central line between the ultrasonic beam axes of the transmitter and receiver.

Reflection barrier (Type R)

Ultrasonic sensor in interrupted beam mode.

An object with good reflective properties within the sensing range serves as a reference. Poorly reflecting objects that enter the sensing range can be detected reliably in this operating mode.

⇒ Section "Sensor principle"

Reflection sensors (Type D)

consist of an active unit with integrated ultrasonic transmitter and receiver. The sound waves are reflected diffusely by the material to be detected.

⇒ Section "Sensor principle"

Reflection

The term generally refers to the reversal of the direction of waves at the border between two media.

A distinction is made between three types of reflection:

- Specular reflection: A reflection in which virtually the entire incoming radiation is reflected with the angle of incidence equaling the angle of reflection, as in a mirror.
- Predominately specular reflection: A mirror reflection with a diffuse share, e.g. from roughened surfaces.
- Diffuse reflection: A reflection in which the incoming radiation is reflected evenly in all directions.

The manner in which an ultrasonic beam is reflected depends on the ratio of the wavelength to the roughness of the surface.

⇒ Section "Notes for installation and operation"

Reflective capability

The property of objects, depending on surface nature and structure, to reflect ultrasonic waves to a greater or lesser extent, directionally or diffusely. The non-reflected is absorbed or transmitted. In the case of reflection sensors, the attainable sensor range can be estimated using reflection tables for common materials.

Reflector range

Range within which the reflector of an ultrasonic sensor in beam-interruption mode must be positioned in order to be detected reliably. The reflector range extends from the end of the blind range to the end of the sensing range.

Reflector

A reflector is a flat plate with good reflective properties which is positioned within the sensing range at right angles to the ultrasonic beam. The reflector acts as the reference object for ultrasonic reflection sensors used in interrupted-beam mode.

⇒ Sensor principle

Repeat accuracy

(also: repeatability)

Repeatability is determined in an 8 hour test at $23 \pm 5 \text{ }^\circ\text{C}$ and at the rated operating voltage. The difference between two operating distances must not exceed 10% of the nominal operating distance.

Repeatability

⇒ Repeat accuracy

Residual current

Current in the load circuit of the sensor when in blocked state.

Resolution

The smallest change in the measurement variable that can be detected and represented by a measuring sensor.

Response time

The shortest possible time between two switching processes. The response time corresponds to half the switching frequency.

Reverse polarity protection

All Pepperl+Fuchs ultrasonic sensors are protected against incorrect connection of the operating voltage.

Ripple

The alternating voltage which is superimposed on the direct operating voltage (peak to peak) is expressed as a percentage of the arithmetic mean values. Pepperl+Fuchs sensors conform to the standard EN 50008 in having a maximum ripple of 10%.

Sensing range

Maximum usable distance between reflection sensor and object. The sensor range depends on the intensity of the transmitted ultrasonic packets, the conditions along the measuring distance, and above all the reflectance of the object.

⇒ Sensing range

Sensing range

Range, within its object or reflector is detected with certainty. In EN 60947-5-2, the terms range and sensor range have been replaced by the term sensing range.

This range is determined while applying rated operational voltage V_e at an ambient temperature of $20 \text{ }^\circ\text{C}$ and a relative humidity of 50 %. In through-beam sensors, the receiver is moved axially against the sensor; in reflection sensors, the measurement plate is moved. The control element must switch reliably in the sensing range s_d .

Sensor principle

Physical principle upon which the function of a sensor is based.

Setting

The sensitivity of a number of ultrasonic sensor types can be adjusted using a potentiometer to ensure that they are optimally suited to their deployment.

Short circuit protection

Many ultrasonic sensors in the Pepperl+Fuchs range are provided with pulsing short circuit protection. If the limiting current value is exceeded, the output is periodically blocked and then switched free again, until the short circuit has been eliminated.

Standard measuring plate

Standard measuring plates permit comparative measurements of the switching distances and sensing ranges of a variety of proximity switches. The following has been established for ultrasonic sensors:

Through-beam and double-sheet monitor:

- Receiver specified by manufacturer (corresponds to the receiver of the two-part sensor set)

Reflection sensor:

- Flat plate, 100 mm x 100 mm.

Switching difference

Differences in sensor range due to variations in the reflectance of the objects to be detected. This specification relates especially to ultrasonic sensors in direct detection mode.

Switching frequency f

The switching frequency is the maximum number of relevant events in a given interval that can be detected by the sensor. It applies for a sensing ratio of 50% and is indicated in Hertz (Hz).

Switching hysteresis

The hysteresis is the difference in the path between the switch-on and switch-off point, when an object moves toward or away from the sensor in the axial direction about a switching distance. This prevents a continual changeover at the boundary of the region.

Switch-off delay

(previously: switch-off time)

Period of time required by the sensor from the point at which the object is removed from the detection area, to the point at which switching occurs. (Switch-on delay is analogous to this)

Switch-on delay

(previously: response time)

Period of time required by the sensor from the point at which the object enters the detection area, to the point at which switching occurs. (Switch-off delay is analogous to this).

Switch-on pulse suppression

This device, with which all sensors are equipped, suppresses an output error signal when operating voltage is applied, during the readiness delay interval.

Synchronisation

In order to avoid mutual interaction between neighbouring sensors, many types use a synchronisation input. If this is unused or on zero potential, then the sensor operates asynchronously or with its internal clock-pulse generator.

A positive synchronisation pulse initiates a measuring cycle. It is started with the falling pulse edge.

Pepperl+Fuchs can supply sensors with synchronisation inputs or outputs which can be linked together for the purpose of self-synchronisation with each other.

Temperature compensation

Many ultrasonic sensors from Pepperl+Fuchs are provided with automatic temperature compensation to reduce the effect of air temperature fluctuations.

⇒ Air temperature

Temperature effect

The effect of temperature on the output parameters and switching points of a sensor.

The data is given in mm/K.

Through-beam sensor (Type T)

Through-beam sensors consist of two separate, active devices, the ultrasonic transmitter and the receiver.

⇒ see section "Sensor principle"

Tightening torque

On fixed cylindrical sensors with threaded housings, the recommended tightening torque of 15 Nm should not be exceeded.

Timer function

Parameterisable time function for the switch output of a sensor.

⇒ Pulse extension

⇒ Impulse relay function

Type D

According to EN 60947-5-2, the designation for a Diffuse mode sensor.

Type R

According to EN 60947-5-2, the designation for a Reflective mode sensor.

Type T

According to EN 60947-5-2, the designation for a Through-beam sensor.

Unusable area

Range in which a reflection sensor, for example, cannot detect an object.

⇒ "Sensing range" section

Unusable area

Zone immediately in front of an ultrasonic sensor in which an object or reflector will not be detected.

⇒ Section "Sensing range"

⇒ Adjustment range

Voltage drop

The voltage drop is measured across the active output of the sensor.

Watchdog function

In event of interruptions to the operating voltage or EMC effects, the watchdog function resets the internal microcontroller of the sensor to a defined initialisation status, i.e. a reset of the sensor's internal program is performed.

Window range

The switching output becomes active when an object is located in the area defined by the switching distances A1 and A2.

Alphabetical Type Index

Model number	Page	Model number	Page
BF 5-30	228	UB2000-F42S-E6-V15	140
BF12	225	UB2000-F42S-E7-V15	140
BF18	225	UB2000-F42S-I-V15	140
BF18-F	226	UB2000-F42S-U-V15	140
BF30	225	UB2000-F42-U-V15	140
BF30-F	226	UB2000-F54-E4-V15	162
CPZ18B03	225	UB2000-F54-E5-V15	162
DA5-IU-2K-C	210	UB2000-F54-H3-V1	166
DA5-IU-2K-V	210	UB2000-F54-I-V15	164
DA5-IU-C	208	UB2000-F54-U-V15	164
FP100	230	UB3000+U9+H3	108
KFA6-STR-1.24.500	214	UB3000-F42-UK-V95	142
LUC4T-G5P-IU-V15	182	UB300-18GM40A-E5-V1	40
LUC4T-G5S-IU-V15	182	UB300-18GM40A-I-V1	40
LUC4T-N5P-IU-V15	182	UB300-18GM40A-U-V1	40
LUC4T-N5S-IU-V15	182	UB300-18GM40-E5-V1	38
LUC4-Z30-G2V	230	UB300-18GM40-I-V1	38
LUC4-Z30-N2V	230	UB300-18GM40-U-V1	38
M105	226	UB4000-30GM-E4-V15	88
MH 04-2681 F	223	UB4000-30GM-E5-V15	88
MH 04-3505	223	UB4000-30GM-H3-V1	90
MH-UDB01	224	UB4000-F42-E4-V15	144
MHW 11	224	UB4000-F42-E5-V15	144
Nut M12K-VE	227	UB4000-F42-E6-V15	144
Nut M18K-VE	227	UB4000-F42-E7-V15	144
Nut M30K-VE	227	UB4000-F42-I-V15	144
OMH 04	224	UB4000-F42-U-V15	144
PA02	227	UB400-12GM-E5-V1	28
UB1000+FP1+E6	122	UB400-12GM-I-V1	28
UB1000-18GM75-BIT-V15	52	UB400-12GM-U-V1	28
UB1000-18GM75-E01-V15	50	UB400-F42S-UK-V95	134
UB1000-18GM75-E23-V15	50	UB400-F42-UK-V95	134
UB1000-18GM75-E4-V15	48	UB500+U9+H3	108
UB1000-18GM75-E5-V15	48	UB500-18GM75-BIT-V15	46
UB1000-18GM75-E6-V15	50	UB500-18GM75-E01-V15	44
UB1000-18GM75-E7-V15	50	UB500-18GM75-E23-V15	44
UB1000-18GM75-F-V15	52	UB500-18GM75-E4-V15	42
UB1000-18GM75-I-V15	48	UB500-18GM75-E5-V15	42
UB1000-18GM75-PWM-V15	52	UB500-18GM75-E6-V15	44
UB1000-18GM75-U-V15	48	UB500-18GM75-E7-V15	44
UB1500-F42S-UK-V95	138	UB500-18GM75-F-V15	46
UB1500-F42-UK-V95	138	UB500-18GM75-I-V15	42
UB2000-30GM-E4-V15	86	UB500-18GM75-PWM-V15	46
UB2000-30GM-E5-V15	86	UB500-18GM75-U-V15	42
UB2000-30GM-H3-V1	90	UB500-30GM-E4-V15	86
UB2000-F42-E4-V15	140	UB500-30GM-E5-V15	86
UB2000-F42-E5-V15	140	UB500-30GM-H3-V1	90
UB2000-F42-E6-V15	140	UB500-F42-E4-V15	136
UB2000-F42-E7-V15	140	UB500-F42-E5-V15	136
UB2000-F42-I-V15	140	UB500-F42-E6-V15	136
UB2000-F42S-E4-V15	140	UB500-F42-E7-V15	136
UB2000-F42S-E5-V15	140	UB500-F42-I-V15	136

Date of edition: 2005-08-18

Model number	Page	Model number	Page
UB500-F42S-E4-V15	136	UC300-30GM-E7R2-K-V15	68
UB500-F42S-E5-V15	136	UC300-30GM-IUR2-K-V15	68
UB500-F42S-E6-V15	136	UC300-30GM-IUR2-V15	66
UB500-F42S-E7-V15	136	UC300-F43-2KIR2-V17	156
UB500-F42S-I-V15	136	UC-30GM-PROG	232
UB500-F42S-U-V15	136	UC-30GM-R2	232
UB500-F42-U-V15	136	UC-30GM-TEMP	230
UB500-F54-E4-V15	162	UC4000-30GM-E6R2-V15	80
UB500-F54-E5-V15	162	UC4000-30GM-E7R2-V15	80
UB500-F54-H3-V1	166	UC4000-30GM-IUR2-V15	80
UB500-F54-I-V15	164	UC500+U9+E6+R2	100
UB500-F54-U-V15	164	UC500+U9+IUE2+R2	100
UB6000-30GM-E4-V15	88	UC500-30GM-E6R2-V15	70
UB6000-30GM-E5-V15	88	UC500-30GM-E7R2-V15	70
UB6000-30GM-H3-V1	90	UC500-30GM-IUR2-V15	70
UB6000-FP-H3	124	UC500-D1-3K-V7	176
UB800-18GM40A-E5-V1	40	UC6000-30GM-E6R2-V15	82
UB800-18GM40A-I-V1	40	UC6000-30GM-E7R2-V15	82
UB800-18GM40A-U-V1	40	UC6000-30GM-IUR2-V15	82
UB800-18GM40-E5-V1	38	UC6000-FP-E6-R2-P5	116
UB800-18GM40-I-V1	38	UC6000-FP-E7-R2-P5	116
UB800-18GM40-U-V1	38	UC6000-FP-IUE0-R2-P5	116
UB800-F12P-EP-V15	130	UC6000-FP-IUE2-R2-P5	116
UBE1000-18GM40-SE2-V1	36	UCC1000-30GM-E6R2-V15	74
UBE1500-F64-SE0	172	UCC1000-30GM-IUR2-V15	74
UBE1500-F64-SE0-V3	172	UC-F43-R2	231
UBE1500-F64-SE2	172	UC-FP/U9-R2	232
UBE1500-F64-SE2-V3	172	UDB-18GM35-3E2	194
UBE4000-30GM-SA2-V15	84	UDBK-18GM35-3E2	198
UBE500-18GK-SE0-V1	34	UDBL-18GM35-3E2	196
UBE500-18GK-SE2-V1	34	UDC-18GM-400-3E3	186
UBE500-F64-SE0	172	UDC-18GMA-400-3E3	190
UBE500-F64-SE0-V3	172	UH3-KHD2-4E5	202
UBE500-F64-SE2	172	UH3-KHD2-4I	204
UBE500-F64-SE2-V3	172	UH3-T1-KT	206
UBE6000+U1+SA2	106	UJ3000+U1+8B+RS	104
UB-PROG2	233	UJ4000-FP-E2-P1	118
UB-PROG3	233	UJ6000-FP-8B+RS	120
UC1000-30GM-E6R2-K-V15	72	ULTRA 2001	234
UC1000-30GM-IUR2-K-V15	72	USB-0,8M-PVC ABG-SUBD9	231
UC2000-30GM-E6R2-T-V15	78	UVW90-K18	229
UC2000-30GM-E6R2-V15	76	UVW90-K30	229
UC2000-30GM-E7R2-T-V15	78	UVW90-M30	229
UC2000-30GM-E7R2-V15	76	VAZ-2FK-B1	220
UC2000-30GM-IUR2-T-V15	78	VAZ-FK-CL1	220
UC2000-30GM-IUR2-V15	76	VAZ-G6F-V1	220
UC2000-F43-2KIR2-V17	156	VAZ-G6F-W2M	220
UC3000+U9+E6+R2	102	VAZ-T1-FK-PG13.5	220
UC3000+U9+E7+R2	102	VAZ-T1-FK-PG9	220
UC3000+U9+IUE0+R2	102	VAZ-T1-FK-V1	220
UC3000+U9+IUE2+R2	102	WE77-RE2	212
UC300-30GM-E6R2-K-V15	68		

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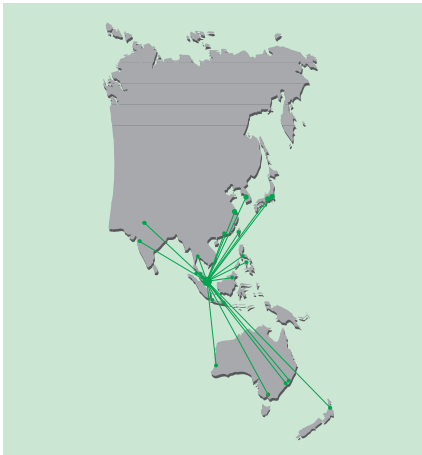
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MINIATURE RELAY

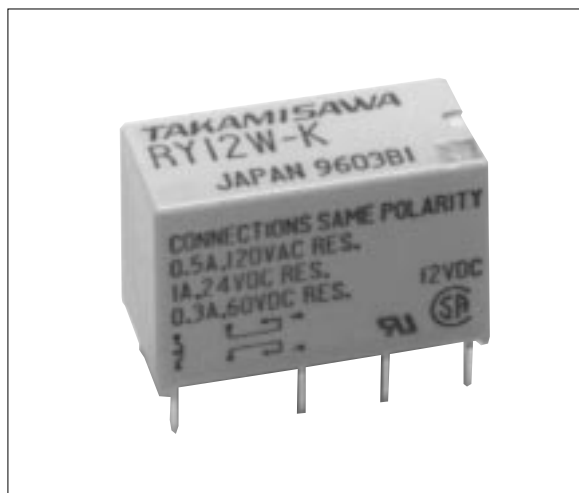
2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

RY SERIES

RoHS Compliant

■ FEATURES

- Ultra high sensitivity
- UL, CSA recognized
- Conforms to FCC rules and regulations Part 68
—Surge strength 1,500 V
- High dielectric strength type available (RY-WF type)
- Contact arrangement MBB type available (RY-D type)
- High reliability-bifurcated contacts
- Wide operating range
- DIL pitch terminals
- Plastic sealed type
- RoHS compliant since date code: 0438B9
Please see page 8 for more information



■ ORDERING INFORMATION

[Example] $\frac{RY}{(a)}$ - $\frac{12}{(*)}$ $\frac{WF}{(b)}$ - $\frac{K}{(d)}$

(a)	Series Name	RY : RY Series
(b)	Nominal Voltage	Refer to the COIL DATA CHART
(c)	Coil and Contact Function	W : High sensitive type WZ : Nominal 0.5 W type WF : High dielectric strength type WFZ : 2 A type D : 2 FORM D (2 MBB type)
(d)	Enclosure	K : Plastic sealed type

Note: Actual marking omits the hyphen (-) of (*)
For movable and stationary contact with gold overlay type, add suffix “-OH”.

■ SAFETY STANDARD AND FILE NUMBERS

UL478, 508 (File No. E45026)

C22.2 No. 14 (File No. LR35579)

Please request when the approval markings are required on the cover.

Please note that UL/CSA ratings may differ from the standard ratings.

Type	Nominal voltage	Contact rating* ¹	
RY-W RY-WZ	3 to 48 VDC	0.5 A 120 VAC 1 A 24 VDC 0.3 A 60 VDC	resistive
RY-WF	5 to 48 VDC	0.25 A 120 VAC 1 A 48 VDC 0.3 A 60 VDC	resistive
RY-WFZ	3 to 48 VDC	0.5 A 120 VAC 2 A 30 VDC 0.6 A 110 VDC	resistive
RY-D	4.5 to 48 VDC	0.3 A 120 VAC 0.2 A 60 VDC	resistive

Note: *¹ Contact ratings mentioned above are subject to same polarity.

■ SPECIFICATIONS

Item		High Sensitive Type	500 mW Type	High Dielectric Strength	2 A Type	Continuous (MBB) Type	
		RY-() W-K	RY-() WZ-K	RY-() WF-K	RY-() WFZ-K	RY-() D-K	
Contact	Arrangement	2 form C (DPDT)				2 Form D (2 MBB)	
	Material	Gold overlay silver-palladium			Gold overlay silver-nickel	Gold overlay silver-palladium	
	Style	Bifurcated				Single	
	Resistance (initial)	Maximum 100 mΩ (at 1 A 6 VDC)					
	Maximum Carrying Current	1.25 A			2 A	0.6 A	
	Rating	1 A 24 VD 0.5 A 120 VAC		1 A 24 VDC 0.25 A 120 VAC	2 A 30 VDC 0.5 A 125 VAC	0.15 A 48 VDC 0.3 A 120 VAC	
	Maximum Switching Power	60 VA/24 W		30 VA/24 W	62.5 VA/60 W	36 VA/7.2 W	
	Maximum Switching Voltage	120 VAC, 60 VDC			125 VAC, 150 VDC	120 VAC, 60 VDC	
	Maximum Switching Current	1 A			2 A	0.6 A	
	Minimum Switching Load*1	0.01 mA 10 mVDC				0.1 mA 10 mVDC	
	Capacitance	Approx. 0.9 pF (between open contacts) 1.4 pF (adjacent contacts) Approx. 1.9 pF (between coil and contacts)					
Coil	Nominal Power (at 20°C)	0.15 to 0.30 W	0.5 to 0.58 W	0.45 to 0.46 W	0.5 to 0.58W	0.45 to 0.48 W	
	Operate Power (at 20°C)	0.075 to 0.14 W	0.125 to 0.145 W	0.2 to 0.21 W	0.2 to 0.324 W	0.2 to 0.21 W	
	Operating Temperature (No frost)	-30°C to +90°C	-30°C to +60°C (refer to the CHARACTERISTIC DATA)			-30°C to +70°C	
Time Value	Operate (at nominal voltage)	Maximum 6 ms					
	Release (at nominal voltage)	Maximum 3 ms					
Insulation	Resistance (at 500 VDC)	Minimum 1,000 MΩ					
	Dielectric Strength	between open contacts	AC 500 V 1 minute	1,000 VAC 1 minute	500 VAC 1 minute		
		between adjacent contacts	1,000 VAC 1 minute				
		between coil and contacts	1,000 VAC 1 minute				
Surge Strength	1,500 V						
Life	Mechanical	2 × 10 ⁷ ops. min.	1 × 10 ⁷ operations minimum			1 × 10 ⁶ ops. min.	
	Electrical (at contact rating)	2 × 10 ⁵ ops. min. (0.5 A 120 VAC) 5 × 10 ⁵ ops. min. (1 A 24 VD C)	5 × 10 ⁵ ops. min. (0.25 A 120 VAC 1 A 24 VDC	1 × 10 ⁵ ops. min. (2 A 30 VDC)		2 × 10 ⁵ ops. min. (0.3 A 120 VAC) 5 × 10 ⁵ ops. min. (0.15 A 48 VDC)	
Other	Vibration	Misoperation	10 to 55 Hz (double amplitude of 1.5 mm)				
		Endurance	10 to 55 Hz (double amplitude of 4.5 mm)				
	Shock	Misoperation	100 m/s ² (11±1 ms)				
		Endurance	1,000 m/s ² (6±1 ms)				
	Weight	Approximately 5 g					

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

RY SERIES

■ COIL DATA CHART

	MODEL	Nominal voltage	Coil resistance (±10%)	Must operate voltage	Must release voltage	Nominal power
High Sensitive Type	RY-4.5 W-K	4.5 VDC	135Ω	3.2 VDC	0.23 VDC	150 mW
	RY- 5 W-K	5 VDC	165Ω	3.6 VDC	0.25 VDC	150 mW
	RY- 6 W-K	6 VDC	240Ω	4.3 VDC	0.3 VDC	150 mW
	RY- 9 W-K	9 VDC	540Ω	6.4 VDC	0.45 VDC	150 mW
	RY- 12 W-K	12 VDC	960Ω	8.5 VDC	0.6 VDC	150 mW
	RY- 18 W-K	18 VDC	1,620Ω	12.6 VDC	0.9 VDC	200 mW
	RY- 24 W-K	24 VDC	2,880Ω	16.8 VDC	1.2 VDC	200 mW
	RY- 48 W-K	48 VDC	7,680Ω	32.6 VDC	2.4 VDC	300 mW
500 mW Type	RY- 3 WZ-K	3 VDC	18Ω	1.5 VDC	0.15 VDC	500 mW
	RY-4.5 WZ-K	4.5 VDC	36Ω	2.25 VDC	0.23 VDC	560 mW
	RY- 5 WZ-K	5 VDC	45Ω	2.5 VDC	0.25 VDC	560 mW
	RY- 6 WZ-K	6 VDC	66Ω	3.0 VDC	0.3 VDC	550 mW
	RY- 9 WZ-K	9 VDC	140Ω	4.5 VDC	0.45 VDC	580 mW
	RY- 12 WZ-K	12 VDC	280Ω	6.0 VDC	0.6 VDC	510 mW
	RY- 18 WZ-K	18 VDC	560Ω	9.0 VDC	0.9 VDC	580 mW
	RY- 24 WZ-K	24 VDC	1,070Ω	12.0 VDC	1.2 VDC	540 mW
RY- 48 WZ-K	48 VDC	4,000Ω	24.0 VDC	2.4 VDC	580 mW	
High Dielectric Strength	RY- 5 WF-K	5 VDC	56Ω	3.3 VDC	0.25 VDC	450 mW
	RY- 6 WF-K	6 VDC	80Ω	4.0 VDC	0.3 VDC	450 mW
	RY- 9 WF-K	9 VDC	180Ω	6.0 VDC	0.45 VDC	450 mW
	RY- 12 WF-K	12 VDC	320Ω	8.0 VDC	0.6 VDC	450 mW
	RY- 18 WF-K	18 VDC	720Ω	12.0 VDC	0.9 VDC	450 mW
	RY- 24 WF-K	24 VDC	1,260Ω	15.9 VDC	1.2 VDC	450 mW
	RY- 48 WF-K	48 VDC	5,000Ω	33.0 VDC	2.4 VDC	460 mW
2 A Type	RY- 3 WFZ-K	3 VDC	18Ω	1.9 VDC	0.15 VDC	500 mW
	RY-4.5 WFZ-K	4.5 VDC	36Ω	2.9 VDC	0.23 VDC	560 mW
	RY- 5 WFZ-K	5 VDC	45Ω	3.2 VDC	0.25 VDC	560 mW
	RY- 6 WFZ-K	6 VDC	66Ω	3.8 VDC	0.3 VDC	550 mW
	RY- 9 WFZ-K	9 VDC	140Ω	5.7 VDC	0.45 VDC	580 mW
	RY- 12 WFZ-K	12 VDC	280Ω	7.6 VDC	0.6 VDC	510 mW
	RY- 18 WFZ-K	18 VDC	560Ω	11.4 VDC	0.9 VDC	580 mW
	RY- 24 WFZ-K	24 VDC	1,070Ω	15.2 VDC	1.2 VDC	540 mW
	RY -48 WFZ-K	48 VDC	4,000Ω	36.0 VDC	2.4 VDC	580 mW

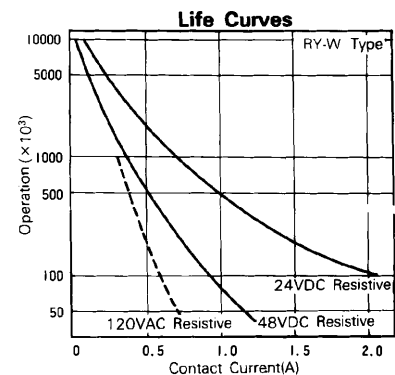
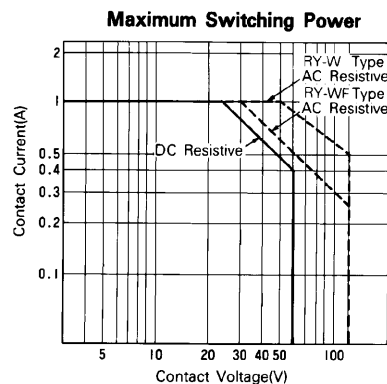
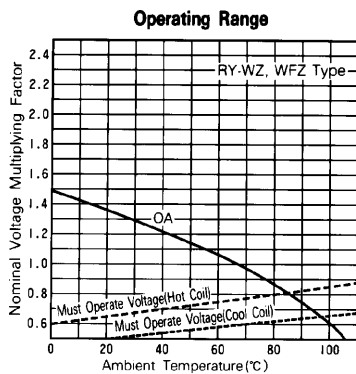
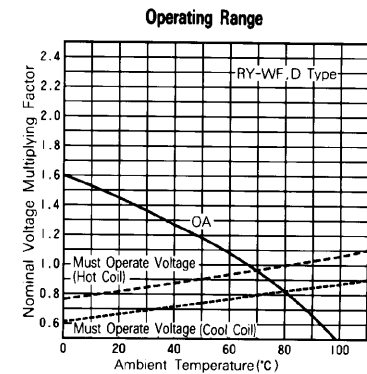
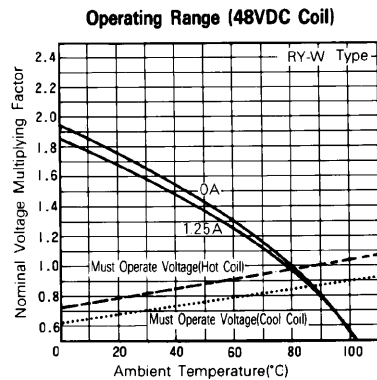
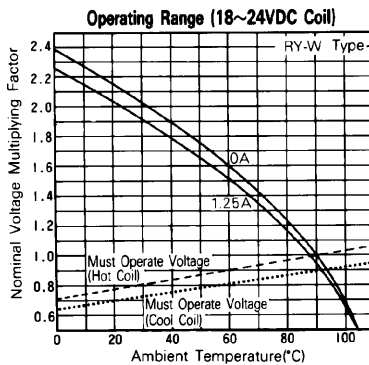
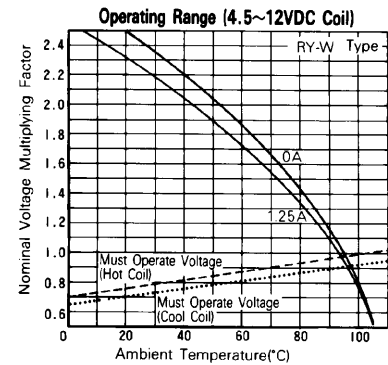
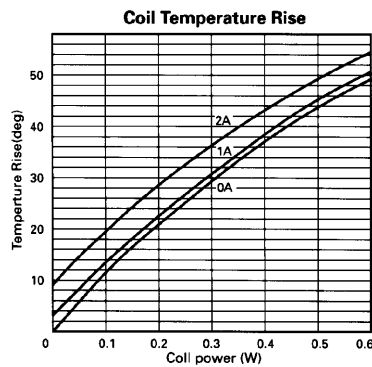
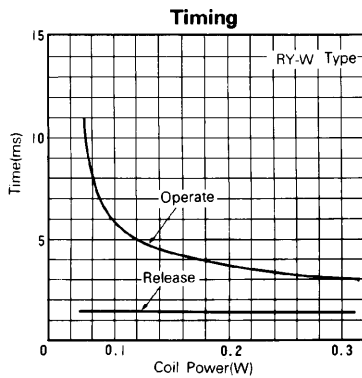
Note : All values in the table are measured at 20°C.

RY SERIES

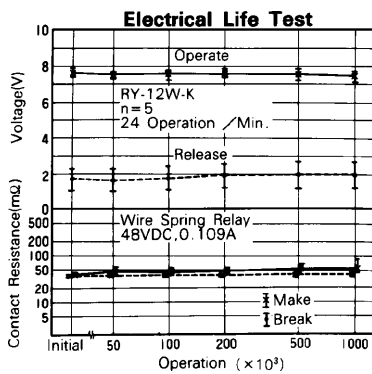
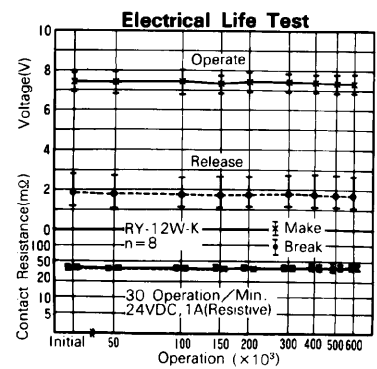
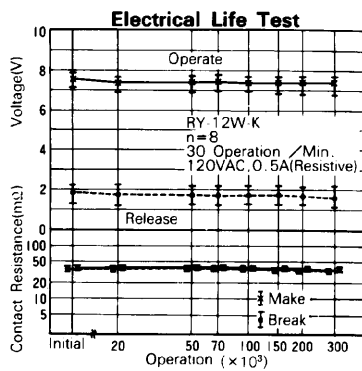
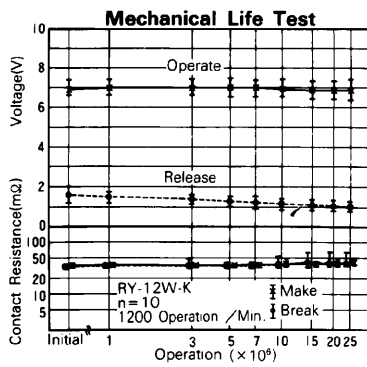
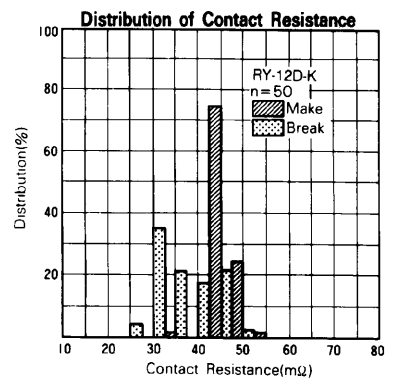
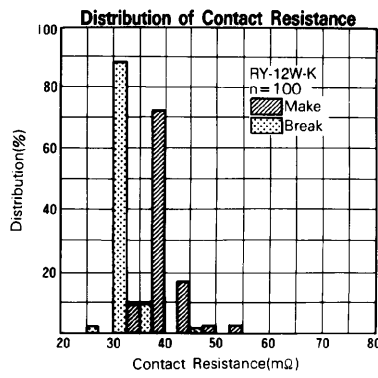
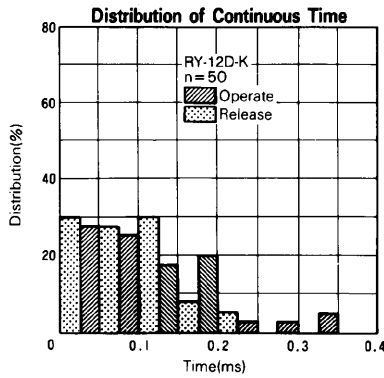
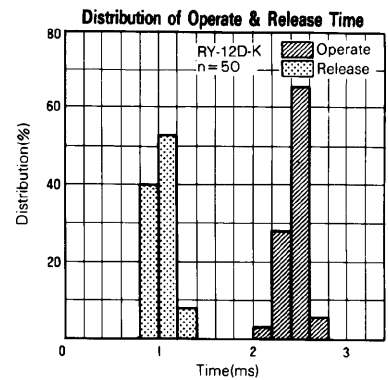
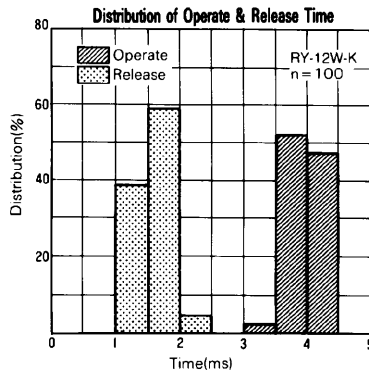
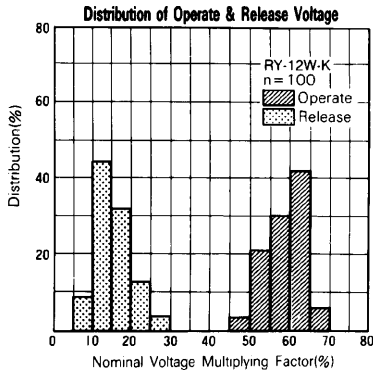
	MODEL	Nominal voltage	Coil resistance ($\pm 10\%$)	Must operate voltage	Must release voltage	Nominal power
Continuous (MBB) Type	RY-4.5 D-K	4.5 VDC	45 Ω	3.0 VDC	0.23 VDC	450 mW
	RY- 5 D-K	5 VDC	55 Ω	3.3 VDC	0.25 VDC	450 mW
	RY- 6 D-K	6 VDC	80 Ω	3.95 VDC	0.3 VDC	450 mW
	RY- 9 D-K	9 VDC	180 Ω	5.9 VDC	0.45 VDC	450 mW
	RY- 12 D-K	12 VDC	320 Ω	7.9 VDC	0.6 VDC	450 mW
	RY- 18 D-K	18 VDC	720 Ω	11.8 VDC	0.9 VDC	450 mW
	RY- 24 D-K	24 VDC	1,280 Ω	15.8 VDC	1.2 VDC	450 mW
	RY- 48 D-K	48 VDC	4,800 Ω	31.8 VDC	2.4 VDC	480 mW

Note : All values in the table are measured at 20°C.

CHARACTERISTIC DATA

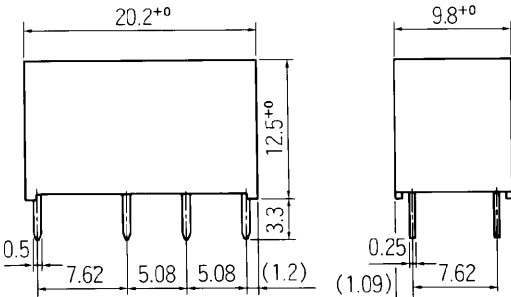


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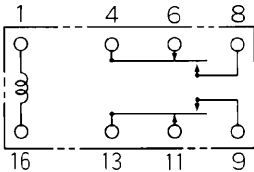


■ DIMENSIONS

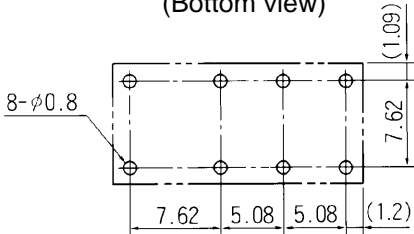
● Dimensions



● Schematics (Bottom view)



● PC board mounting hole layout (Bottom view)



Unit: mm

RoHS Compliance and Lead Free Relay Information

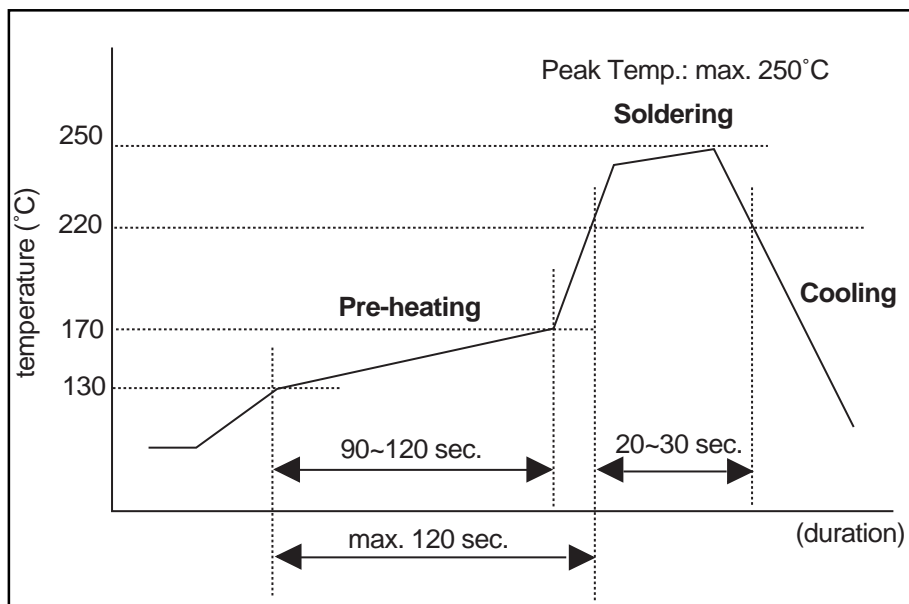
1. General Information

- Relays produced after the specific date code that is indicated on each data sheet are lead-free now. Most of our signal and power relays are lead-free. Please refer to Lead-Free Status Info. (<http://www.fcai.fujitsu.com/pdf/LeadFreeLetter.pdf>)
- Lead free solder paste currently used in relays is Sn-3.0Ag-0.5Cu. From February 2005 forward Sn-3.0Cu-Ni will be used for FTRB3 and FTR-B4 series relays.
- Most signal and some power relays also comply with RoHS. Please refer to individual data sheets. Relays that are RoHS compliant do not contain the 6 hazardous materials that are restricted by RoHS directive (lead, mercury, cadmium, chromium IV, PBB, PBDE).
- It has been verified that using lead-free relays in lead assembly process will not cause any problems (compatible).
- "LF" is marked on each outer and inner carton. (No marking on individual relays).
- To avoid leaded relays (for lead-free sample, etc.) please consult with area sales office. We will ship leaded relays as long as the leaded relay inventory exists.

2. Recommended Lead Free Solder Profile

- Recommended solder paste Sn-3.0Ag-0.5Cu and Sn-3.0 Cu-Ni (only FTR-B3 and FTR-B4 from February 2005)

Reflow Solder condition



Flow Solder condition:

Pre-heating: maximum 120°C
Soldering: dip within 5 sec. at 260°C solder bath

Solder by Soldering Iron:

Soldering Iron
Temperature: maximum 360°C
Duration: maximum 3 sec.

We highly recommend that you confirm your actual solder conditions

3. Moisture Sensitivity

- Moisture Sensitivity Level standard is not applicable to electromechanical relays.

4. Tin Whisker

- SnAgCu solder is known as low risk of tin whisker. No considerable length whisker was found by our in-house test.

5. Solid State Relays

- Each lead terminal will be changed from solder plating to Sn plating and Nickel plating. A layer of Nickel plating is between the terminal and the Sn plating to avoid whisker.

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