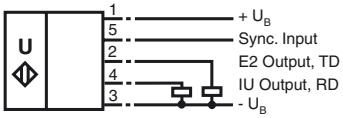
Ultrasonic sensor
UC500+U9+IUE2+R2

Features

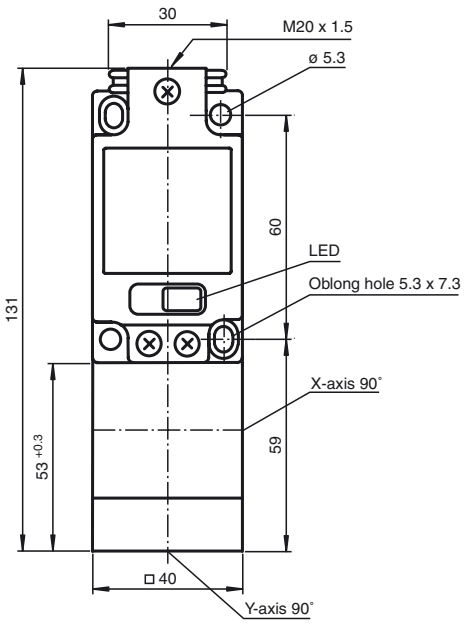
- Analogue output, load-dependent voltage or current
- Switch output
- Serial interface
- Synchronisation options
- Temperature compensation
- Absolute polarity reversal protection
- Parameterisable with ULTRA 2001

Electrical connection

Standard symbol/Connection:
(Version IUE2, pnp)



Dimensions



Technical data

CE

General specifications	
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)
Indicators/operating means	
LED yellow	switching state switch output
LED red/green	permanently green : "Power on", flashes during standby operation red flashing : "Error", (e. g. background noise level too high)
Electrical specifications	
Operating voltage	20 ... 30 V DC , ripple 10 $\%_{SS}$
No-load supply current I_0	≤ 60 mA
Interface	
Interface type	RS 232, 9600 bit/s, no parity, 8 data bits, 1 stop bit (S10 = OFF)
Input/Output	
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
Output	
Output type	1 switch output E5: pnp 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
Resolution	≥ 0.172 mm
Deviation of the characteristic curve	≤ 0.2 % of full-scale value
Repeat accuracy	≤ 0.1 % of full-scale value
Rated operational current I_e	200 mA , short-circuit/overload protected
Voltage drop U_d	≤ 3 V DC
Range hysteresis H	≤ 1 % of the set operating distance
Temperature influence	≤ 2 %
Standard conformity	
Standards	EN 60947-5-2
Ambient conditions	
Ambient temperature	-25 ... 70 °C (248 ... 343 K)
Storage temperature	-40 ... 85 °C (233 ... 358 K)
Mechanical specifications	
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

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Notes

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.

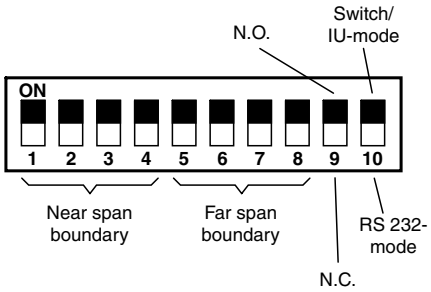
The response time increases when sensors are synchronised as the measuring cycle time is increased by the synchronisation.

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 ^ ON, 0 ^ OFF

DIP Switches in Terminal Compartment: Adjustment of the Target Window



near span boundary < distant limit ⇒ IU-rising slope
near span boundary > distant limit ⇒ IU-declining slope
near span boundary = distant limit ⇒ IU-switch point

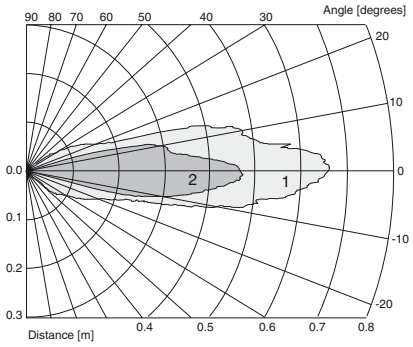
Switch point switch output:
(NDE + FDE)/2 (Preconfiguration)

Model number

UC500+U9+IUE2+R2

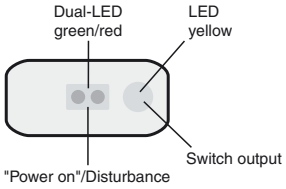
Characteristic curves/additional information

Characteristic response curves



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

LED-Window



Accessories

Mounting aid

MH 04-2681F

Interface-cable

UC-FP/U9-R2

Service program

ULTRA 2001

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	**V**elocity of **S**ound at **0** °C	VS0 in [cm/s]	read and set
VS	**V**elocity of **S**ound	VS in [cm/s]	read
TO	**T**emperature **O**ffset	TO in [0.1K]	read and set
TEM	**TEM**perature	TEM in [0.1K]	read and adapt to TO
REF	**REF**erence measurement	REF distance in [mm]	adaptation of VS0
UDS	**U**se **D**IP **S**witches	UDS binary [0/1]	read and set
SD1[1]	**S**witching **D**istance **1 1**	SD11 distance in [mm]	read and set
SD12	**S**witching **D**istance **1 2**	SD12 distance in [mm]	read and set
SH1	**S**witching **H**ysteresis **1**	Hysteresis in [%]	read and set
NDE	**N**ear **D**istance of **E**valuation	Near measuring window limit in [mm]	read and set
FDE	**F**ar **D**istance of **E**valuation	Far measuring window limit in [mm]	read and set
BR	Unusable area (**B**lind **R**ange)	Unusable area in [mm]	read and set
RR	**R**ange **R**eduction	Unusable area from [mm]	read and set
NEF	**N**o **E**cho is **F**ailure	1: "no echo" is failure; 0: "no echo" is not failure	read and set
FSF	**F**ail **S**afe **F**unction	Shutdown function in event of failure	read and set
CBT	**C**onstant **B**urst **T**ime	Burst time in [µs]	read and set
CCT	**C**onstant **C**ycle **T**ime	Time in [ms]	read and set
SSY	**S**tartup **SY**nchronised	SSY binary [0/1]	read and set
FTO	**F**ilter **T**ime**O**ut	Number of measurements without echo to be filtered	read and set
EM	**E**valuation **M**ethod	Evaluation method { 0 = NONE; PT1[,f,p,c]; MXN[,m,n]; DYN[,p] }	read and set
CON	**CON**servative filter	Counter threshold as number	read and set
OPM	**O**peration **M**ethod	Switch output operating mode { S,R,W,L,H } analogue output { S,L }	read and set
OM	**O**utput **M**ode	OM coded [normally-open NO = 0, normally-closed NC = 1]	read and set
FSF	**F**ail **S**afe **F**unction	Failure function type {0,1,2},[fault current in 0.1 mA]	read and set
MD	**M**aster **D**evice	Function as master {0 = NONE},AD,RD,RT,SS,ATB,RDB,RTB }	read and set
DIP	**DIP** switch settings	DIP switch setting as hexadecimal string	read
AD	**A**bsolute **D**istance	Distance in [mm]	read
RD	**R**elative **D**istance	Relative distance as number {0 ... 4095}	read
RT	**R**un**T**ime	Echo run time in machine cycles [1 machine cycle = 1.085µs]	read
SS1	**S**witching **S**tate **1**	SS1 binary [0: inactive, 1 active] (independent of OM)	read
ADB	**A**bsolute **D**istance **B**inary	Distance in [mm], binary	read
RDB	**R**elative **D**istance **B**inary	Relative distance as number {0 ... 4095} binary	read
RTB	**R**un**T**ime **B**inary	Echo run time in machine cycles [1 machine cycle = 1.085µs], binary	read
ER	**E**cho **R**eceived	Echo detected: no, yes [0/1]	read
VER	**VER**sion	Version string: xxxx	read
ID	**ID**entification	ID string: P&F UC...-..-IUE0/E2-R2 Eprom: xxxx Version yyyy	read
DAT	**DAT**e	Date string: e.g. Date: 06/11/96 Time: 16:14:26	read
ST	**ST**atus	Status as hexadecimal string	read
RST	**R**e**S**e**T**	Performs a reset	Command
DEF	**DEF**ault settings	Restores defaults	Command
SUC	**S**tore **U**ser **C**onfiguration	Stores all settings	Command
RUC	**R**ecall **U**ser **C**onfiguration	Restores stored settings	Command

Programming instructions

Caution: When programming the sensor via the integrated RS 232 interface, ensure that DIP switch 10 is in the OFF (RS 232 mode) position before connecting the interface cable.

Electrical connection of interface cable UC-FP/U9-R2 (see accessories).

Interface cable Conductor colour	Sensor terminal compartment Terminal no.
brown (TD)	4 (RD)
black (RD)	2 (TD)
blue (GND)	3 ($-U_B$)

Structure of the filter functions