



# UK1F M18 CILINDRYCAL ULTRASONIC SENSOR

Installation manual - CAT8BUK1148902 - ENG - Rev n° 2 : 02/08/2012

## SUPPLIED MATERIAL

- Installation manual
- 2 plastic nuts
- 2 flexible washer

## SUPPLIED MATERIAL FOR ATEX

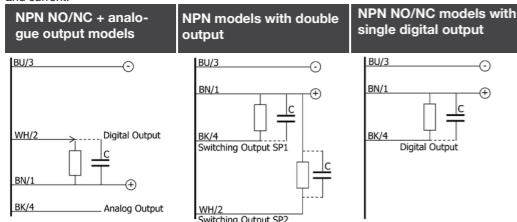
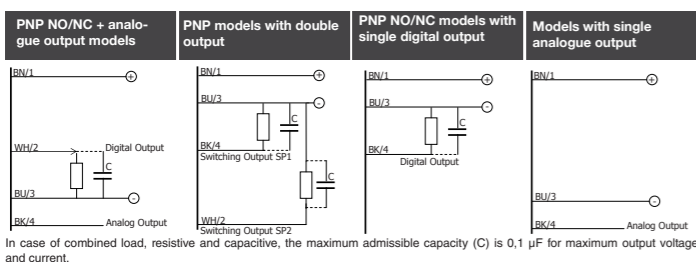
## CERTIFIED PRODUCTS

- Installation manual
- Safety instructions for dangerous areas
- Declaration of CE conformity
- Label ATEX marked
- 2 plastic nuts
- 2 flexible washers

## GENERAL DESCRIPTION

- M18 ultrasonic sensors with output plug (M12) or cable (2m)
- Models with single output:
  - Current analogue output (4 – 20 mA)
  - Voltage analogue output (0 -10 V)
  - Digital output (NPN/PNP, NO/NC selectable)
- Models with double outputs:
  - Current analogue output (4 – 20 mA) and digital output (NPN/PNP, NO/NC selectable)
  - Voltage analogue output (0 -10 V) and digital output (NPN/PNP, NO/NC selectable)
  - Digital output (PNP/NPN NO/NC selectable)
- Operating distance adjustment (Windows Teach-in option and On object Teach-in option)
- Complete protection against electrical damages
- Multifunction LED indicator: output state, Teach-in function and NO/NC configuration
- Plastic housing

## ELECTRICAL DIAGRAMS OF THE CONNECTIONS

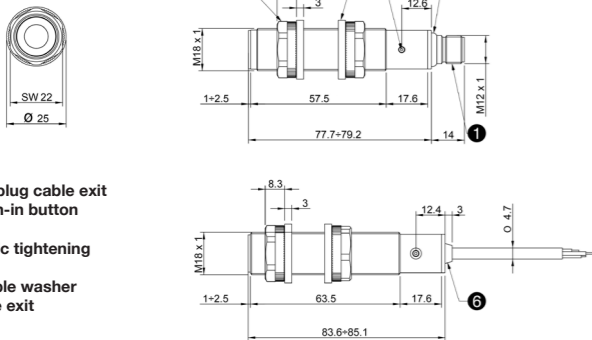


KEY: BN = brown; BK = black; BU = blue; WH = white

## ERROR CONDITIONS

Error condition	Sensor state	Corrective action
Teach P1 = P2	Exit OFF until a new and correct teach operation	Repeat correctly the Teach operation
Teach P2 (closest point) after the P1 (farthest point)		
Teach P1 (farthest point) within the range and P2 at infinity		

## DIMENSIONS



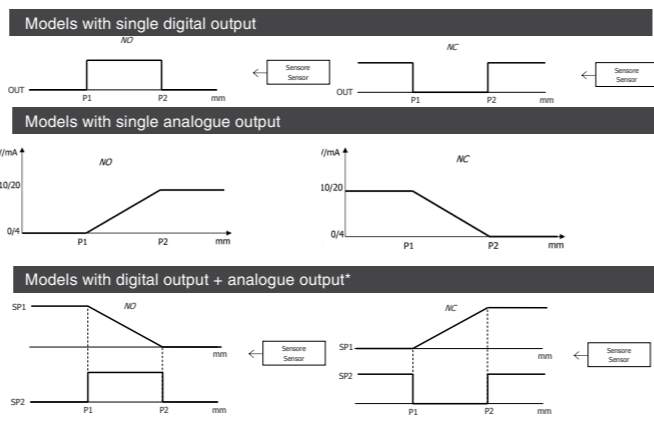
## CODE STRUCTURE

<b>UK</b>	M18 ultrasonic sensor
<b>1</b>	Standard body length
<b>F</b>	200 - 2,200 mm direct diffuse
<b>/</b>	
<b>E</b>	Sensitivity adjustment and NO/NC selection by Teach-in button
<b>1</b>	0 ... 10 V single voltage analogue output
<b>2</b>	4 ... 20 mA single current analogue output
<b>3</b>	NPN - NO/NC two digital outputs (*) coded window output
<b>4</b>	NPN - NO/NC digital output + 4 ... 20 mA current analogue output
<b>5</b>	PNP - NO/NC two digital outputs (*) coded window output
<b>6</b>	PNP - NO/NC digital output + 4 ... 20 mA current analogue output
<b>7</b>	PNP - NO/NC digital output + 0 ... 10 V voltage analogue output
<b>9</b>	NPN - NO/NC digital output + 0 ... 10 V voltage analogue output
<b>N</b>	NPN - NO/NC single digital output
<b>P</b>	PNP - NO/NC single digital output
<b>W</b>	PNP - NO/NC two digital outputs with standard window and adjustable hysteresis functions (**)
<b>M</b>	NPN - NO/NC two digital outputs with standard window and adjustable hysteresis functions (**)
<b>0</b>	Plastic housing
<b>E</b>	M12 plug cable exit
<b>A</b>	Axial cable exit
<b>AN</b>	ATEX certified, Cat. 3 Zone 2,22 (*)
<b>UL</b>	With cULus certification
<b>LV</b>	Coded window output and adjustable hysteresis (**)

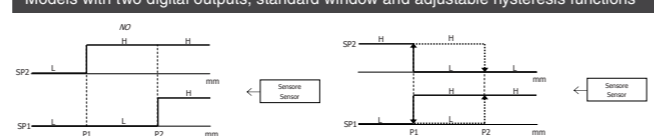
(\*) Model with coded output. Please see the "Output curve" section.  
 (\*\*) The transition between the two functions takes place by pressing the "teach-in" button for more than 8 seconds, until the status LED will flash quickly. Release the button and the LED will flash slowly. When the LED stops flashing, the function is changed. In the output window function (Coded & Standard) the state selection was done by wires reversing on the plc controller (NO / NC). See the "Output curve" section.  
 (\*\*) Only for the PNP plug version.  
 (\*\*\*) This double digital output differs from the standard model because removing the target the exit status is maintained. Available only for "W" models.

## OUTPUT CURVES

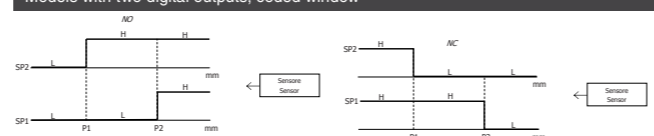
The following graphics are referred to the PNP state output, while the NPN state output have the of the inverted functions.



## Models with two digital outputs, standard window and adjustable hysteresis functions\*\*



## Models with two digital outputs, coded window\*\*\*

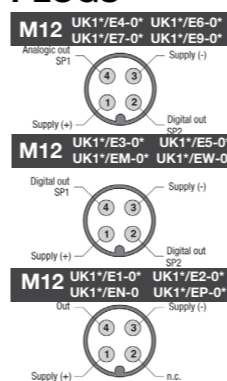


\* It can be used as a single model output.  
 \*\* In the double digital output model with the standard window and adjustable hysteresis functions if the target is removed from the field of view of the sensor, the output state switches. In these models is not provided the NO/NC function, which can be obtained through a logic reverse by the control system (e.g. PLC)  
 \*\*\* The double digital output model with the coded window is designed for the target detection that moves along the longitudinal axis sensor: the sensor remains in the last stored output state removing the target or it doesn't receive echoes.

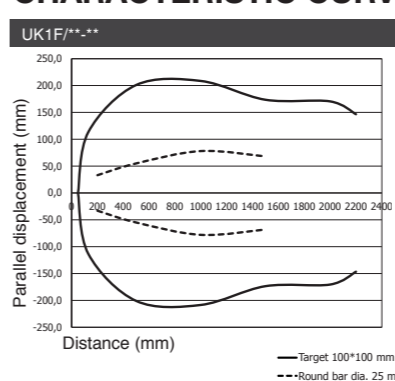
Models	UK1F/E*-0***	UK1F/E*-0*UL**	UK1F/E*-0*AN**
Maximum sensing distance	2,200 mm <sup>(1)</sup>		
Minimum sensing distance (blind zone)	200 mm		
Sensing range (Sd)	200-2,200 mm		
Beam angle	± 8°		
Switching frequency (digital output)	1 Hz		
Response time (digital output)	500 ms		
Hysteresis	<1%		
Repeat accuracy	0,5%		
Linearity error	< 1%		
Temperature range	-20°..+70 °C	-20°..+60 °C	-20°..+70 °C
Temperature compensation	Yes		
Operating voltage	15 ... 30 Vdc		
Thermal drift	5%		
Ripple	5%		
Leakage current	10 µA @ 30 Vdc		
Output voltage drop	2.2 V max. @ (I=100 mA)		
No-Load current	≤ 45 mA		
Output current	500 mA UK1F/E#-0*** with # = 3,5,N,P,W,M 300 mA UK1F/E#-0*** with # = 4,6,7,9	100 mA UK1F/E*-0EAN UK1F/E*-0*UL	
Analog voltage output minimum load resistance	3 k Ω		
Adjustment set point	Teach-in button		
Time delay before availability (digital output)	500 ms; < 900 ms for UK1D/E#-0*** with # = 3,5,W,M		
Resolution	1 mm		
Supply electrical protections	Polarity reversal, overvoltage pulses		
Digital output electrical protections <sup>(2)</sup>	Short circuit, overvoltage pulses		
EMC	Conforming to the EC Directive 2004/108/EC requirements according to EN 60947-5-2		
Protection degree	IP67 (EN60529) <sup>2</sup>		
Housing material	PBT		
Front end material	Epoxy-Glass resin		
Weight	35 g		
Tightening torque	1 Nm		
Storage temperature	-35 °C...+70 °C without freezing		

- (1) Metallic target 200x200 mm
- (2) Protection guarantee only with plug cable well mounted
- (3) Analogue outputs are not protected to short circuit

## PLUGS



## CHARACTERISTIC CURVES



## ADJUSTMENT

**P1 AND P2**  
 P1 coincides with the maximum working distance requested; during regulation phase P1 must be the first point to be set up. P2 coincides with the minimum working distance requested; during regulation phase P2 must be the second point to be set up.

**ANALOGUE OUTPUT**  
 P1 determines the position corresponding to 10 V (voltage output) or 20 mA (current output); P2 determines the position corresponding to 0 V (voltage output) or 4 mA (current output). Positive slope: P2 < P1. Negative slope: P2 > P1.

**NORMAL FUNCTION**  
 The LED is ON when the echo is received and the target is between P1 and P2 (Windows Teach-in option) or the target is detected into sensing area (On object Teach-in option), in NO state (Normally Open).

**BUTTON TEACH-IN ADJUSTMENT OPTIONS**  
 Two Teach-in adjustment options are available :1) Windows Teach-in option 2) On object Teach-in option

1) WINDOWS TEACH-IN OPTION (adjustment of two points: P1 and P2)

**TEACH-IN OF P1 POSITION**  
 Place the target at the right distance P1, then press the teach-in button for 1 second. The LED turns ON after maximum 2 seconds, from OFF state, and the sensor will acquire the position P1. Only at this point it is possible to remove the target. The LED will stay in ON state waiting for the regulation of P2 point.

**TEACH-IN OF P2 POSITION**  
 Place the target at the right distance P2, then press the Teach-in button. The LED turns OFF, from ON state, then blinks 5 times, and in this phase the sensor acquires the position of P2 point. The LED returns in ON state and only at this point it is possible to remove the target. At this time P1 and P2 are programmed and the sensor works in Normal Function state with the values stored in the memory: the LED is in ON state when target is between P1 and P2, if the sensor is NO State (Normally Opened).

2) ON OBJECT TEACH-IN OPTION (adjustment of only one point: P1)

**TEACH-IN OF P1 POSITION**  
 Place the target at the right distance P1, then press the teach-in button for 1 second. The LED turns ON after maximum 2 seconds, from OFF state, and the sensor will acquire the position P1. Only at this point it is possible to remove the target.

**TEACH-IN OF P2 POSITION**  
 Place the target (or another object able to cover the active face) in front of the sensor at a distance less than 50 mm; press the teach-in button for 1 second to acquired P2 distance. P2 will coincide with the minimum sensing distance (200 mm). The LED will turn OFF, from ON state, then will blink 5 times and during this phase the sensor acquires the position of P2 point. The LED return in ON state and only at this point it is possible to remove the target. At this time P1 and P2 are programmed and the sensor works in Normal Function state with the values stored in the memory: the LED is in ON state when target is between P1 and the minimum sensing distance, if the sensor is NO State (Normally Opened).

**NOTE 1:** If the sensor is taught for a time more longer than 1 second and then left, without target in front of the sensor or with the target out from the maximum sensing distance (2,200 mm), it will acquire as distance P1 a distance more longer than the maximum sensing distance indicated in the table of Technical Specifications, and this distance is not uniquely definite and repeatable and as distance P2 the minimum sensing distance (200 mm). Don't use this regulation with analogue output. To optimize the resolution it is necessary to adjust the working range using Teach-in on object option or Windows Teach-in option.

**NOTE 2:** When the analogical output is used, it must be used the Windows Teach-in option mode in order to reach the maximum resolution.

## CONFIGURATION OF NO AND NC STATES

Sensors are delivered from factory in NO state. It is possible to change the logical digital output state of the sensor (except the models UK1\*/EW-0\* or UK1\*/EM-0\*) by pushing the Teach in button for more than 8 seconds until the LED starts to blink fast. Release the Teach in button and the LED will blink slowly. When the LED will stop to blink the digital output state is changed. If the output is in NO state the slope of analogical output is positive moving from P2 towards P1, otherwise if the sensor is in NC state the slope of the analogical output is positive moving from P1 towards P2. This option is possible any time and it is separated from the Teach-in option.

## MODELS WITH ADJUSTABLE HYSTERESIS

In the UK1\*/EW-0\* and UK1\*/EM-0\* models the output function for adjustable hysteresis, which can be selected by pressing the "Teach-in" button for more than 8 seconds (until the Status LED will flash quickly). Release the button and the LED will flash slowly. When the LED stops flashing, the function is changed in to the hysteresis state. The output function is shown in the "Output curves". In these models with the standard window and adjustable hysteresis functions if the target is removed from the field of view of the sensor, the output state switches. In these models isn't provided the NO/NC function, which can be obtained through a logic reverse by the control system (e.g. PLC). A typical application is the liquid level control, the output sensor switches to the achievement of the P1 point (farthest from the sensor) when the container is empty and the nearest to P2 point in the liquid filling.

## INSTALLATION CONDITION

The fixation of the sensor has to be done using plastic nut and flexible washer supplied with ultrasonic sensor (see Supplied Material). If the sensor is fixed directly into metal block through hole or threaded, it is necessary to use always flexible washer and plastic nut to fix the sensor. Anyway both nuts and metal block have to be minimum 5 mm from the edge of the active face and it is necessary that the first 5 mm of the threaded housing are not screwed. Both metal blocks and nuts have to be connected to ground.

## STATES PRESERVATION

The sensor preserves the last adjustment made, therefore removing the voltage supply and restoring it, the sensor works in according to last value of P1 and P2 point.

## ATTENTION

Make sure that the supply voltage is correctly set with a ripple corresponding to the values indicated on the catalogue. In case the noise produced by the power lines exceeds the values foreseen by the CE norm (interference immunity), separate the sensor cables from both the power and high tension lines and insert it in a grounding metal raceway. Moreover it is advisable to connect the sensor directly to the supply source and not to other devices. To extend the supply and output cables, it is necessary to use a cable having conductors with a minimum size of 1 mm<sup>2</sup>. The maximum length of extension is 100 m (this value is referred to a minimum tension and power supply at the load of 100 mA). In industrial environments, we recommend to use shielded cables in order to prevent possible disturbances on the devices caused by electromagnetic fields induced. Do not expose sensor head to hot water > 50 °C, water steam, acids or solvents. Clean the active face of the sensor with a wet cloth and then dry it.



II 3G Ex nA IIC T5  
 II 3D Ex tD A22 IP67 T 90°C  
 Number of certificate:1109020X



WARNING These products are NOT safety sensors and are NOT suitable for use in personnel safety application

### Declaration of conformity

M.D. Micro Detectors S.p.A. con Unico Socio declare under our sole responsibility that these products are in conformity with the following EEC directive: 2004/108/EC and subsequent amendments



**M.D. Micro Detectors S.p.A.** con Unico Socio  
 Strada S. Caterina, 235 - 41122 Modena Italy  
 Tel. +39 059 420411 Fax +39 059 253973  
 www.microdetectors.com  
 info@microdetectors.com

