

HLX360

High-End Moisture in Oil Transmitter

HLX360 is dedicated for reliable monitoring of lubrication, hydraulic and insulation oils as well as diesel fuel. In addition to highly accurate measurement of water activity (a_w) and temperature (T) HLX360 calculates the absolute water content (x) in ppm.

The probe can be employed up to 180 °C (356 °F), 20 bar (290 psi) and is available with either ISO or NPT slide fitting, which allows for variable immersion depth. Using the optional ball valve, the probe can be mounted or removed even without process interruption.

The design of the enclosure facilitates easy mounting and maintenance. HLX360 is available with IP65 polycarbonate or stainless steel enclosure.

The measured data is available on two analogue outputs and on the optional digital interface RS485 with Modbus RTU or Ethernet with Modbus TCP. An optional relays module can be used for alarms and process control.

The state of the art TFT colour display can show all measurands simultaneously and offers extensive error diagnostics. The integrated data logging function saves all measured data in the internal memory. The logged data can be displayed in a graph directly on the device or easily downloaded via USB interface.



Typical applications

Monitoring of transformer, lubrication, hydraulic or quench oil as well as diesel fuel.

Features

3,5" TFT Colour Display

- » shows all measurands simultaneously
- » layout freely selectable
- » integrated data logger for 20.000 values per measurand
- » logged values shown in graph
- » error diagnostics
- » intuitive device setup with push buttons

Probe

- » oil temperature -40...180 °C (356 °F)
- » pressure tight up to 20 bar (290 psi)
- » ISO or NPT process connection
- » pluggable probe option

Ball valve

- » probe mounting and removal without process interruption

Enclosure

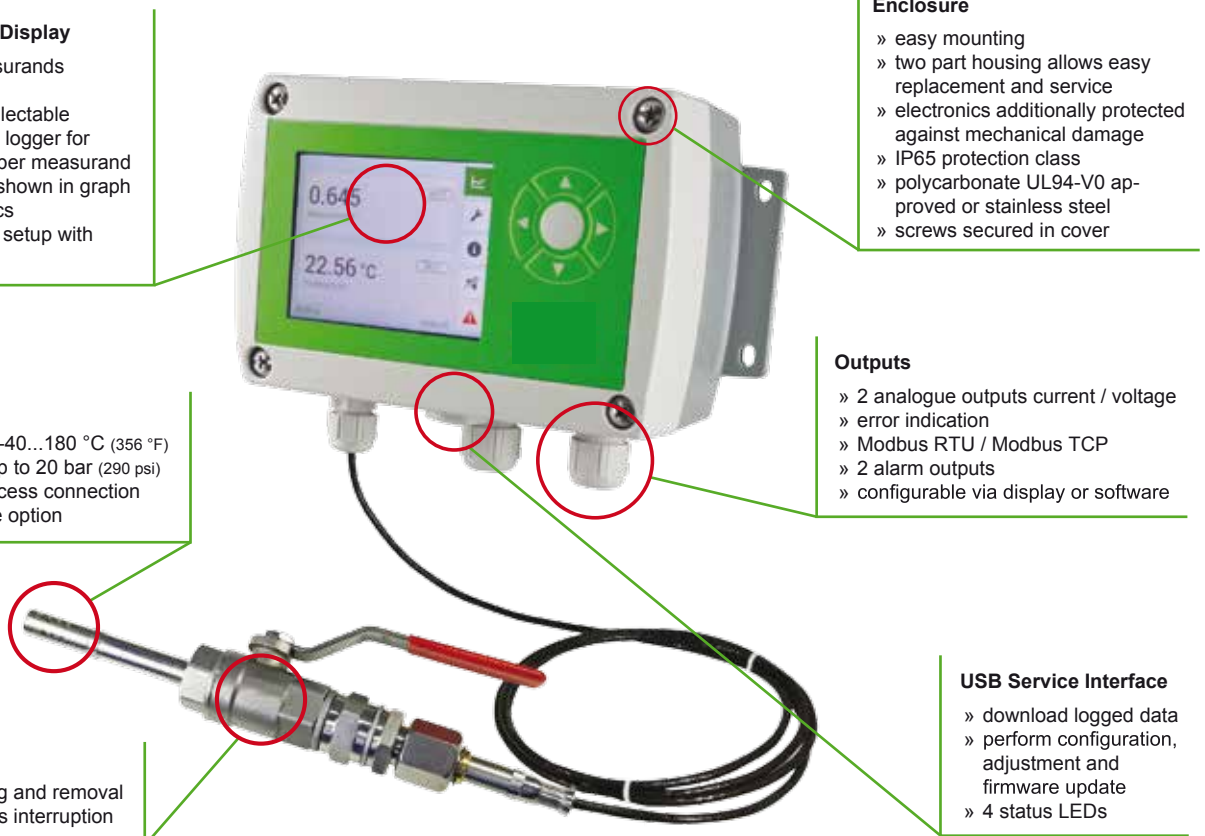
- » easy mounting
- » two part housing allows easy replacement and service
- » electronics additionally protected against mechanical damage
- » IP65 protection class
- » polycarbonate UL94-V0 approved or stainless steel
- » screws secured in cover

Outputs

- » 2 analogue outputs current / voltage
- » error indication
- » Modbus RTU / Modbus TCP
- » 2 alarm outputs
- » configurable via display or software

USB Service Interface

- » download logged data
- » perform configuration, adjustment and firmware update
- » 4 status LEDs



TFT colour display with integrated data logger (option D2)



Settings

- » analogue, digital and alarm output setup
- » one and two point adjustment for RH and T
- » probe replacement (for pluggable probe)
- » password protection for all relevant settings

Error Diagnostics

- » error self-diagnosis
- » error description
- » audible and visual error warnings

Data logger

- » 20.000 values saved per measurand
- » selectable sampling rates
- » view recorded data as graph
- » download data via USB port and EE-PCS software

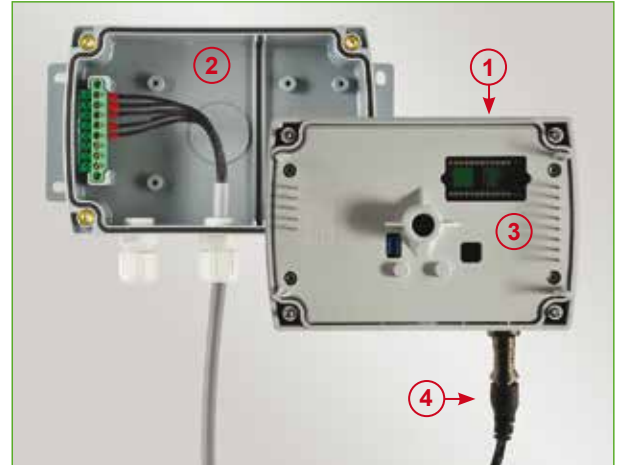


Modular Housing / Pluggable Probe

The upper part of the transmitter (1), which accommodates the electronics and the probe, can be plugged off for service or adjustment and can be replaced within seconds. This allows for the bottom part (2) to remain mounted with intact cabling.

A polycarbonate cover (3) on the inside of the housing protects the electronics during installation or service.

The remote probe models are also available with a pluggable probe (4) which can be easily exchanged by a push-pull plug. It is ideal for installation of long probe cables and in applications that might require periodical probe replacements.



Measurement of water activity a_w / water content x

The moisture in oil can be expressed in absolute or relative terms.

- **Water activity a_w** is the relative measure for moisture in oil. It represents the ratio between the actual amount of dissolved water and the maximum possible amount of dissolved water in the oil at a certain temperature T . Independently of the oil type, the water activity shows how close to saturation is the oil at a certain temperature.

$a_w=0$ indicates completely dry oil, while $a_w=1$ fully saturated oil.
HLX360 measures directly the water activity.

- The **water content x** is an absolute measure equal to the share of water (dissolved, emulsified or separate) in the oil. The water content is measured in ppm (parts per million) and is independent from the oil temperature. For assessing how far is the oil from saturation, x must be regarded together with T . HLX360 calculates x out of the measured a_w and T values. The calculation is oil dependent and requires a set of oil specific parameters.

Modbus RTU (Option J3) and Modbus TCP (Option J4)

Additional to the analogue outputs, HLX360 offers optionally a digital interface, either RS485 with Modbus RTU or Ethernet with Modbus TCP. The RS485 and Ethernet modules are available also for upgrading existing HLX360.

The Ethernet interface features power over Ethernet (PoE) and RJ45 connector with IP65 protection class.



RS485 - Modbus RTU



Ethernet - Modbus TCP

Modbus Map

Register [DEC]	Protocol address [HEX]	Measured value	Unit	Type
Read registers: function code 0x03 / 0x04				
31021	3FC	Relative humidity ¹⁾	%	
31003	3EA	Temperature	°C	32-bit float
31005	3EC	Temperature	°F	32-bit float
31009	3F0	Temperature	K	32-bit float
31135	46E	Water activity	aw	32-bit float
31141	474	Water content	x	32-bit float
Write registers: function code 0x06 for 16-bit and 0x10 (decimal: 16) for 32-bit				
0001	0	Slave-ID	/	16-bit integer
5001	1388	Air pressure	mbar	32-bit float

1) Use for adjustment and calibration.

Alarm outputs (option AM2)

This optional module features two freely configurable relay outputs for control purposes. Various operation modes are available including hysteresis, window and error indication. When error indication is selected, a fault in the humidity or temperature measurement will trigger the alarm output. The measurands at the outputs as well as the thresholds and hysteresis can be set using the PCS software or directly on the device via display and push buttons.



Integrated Power Supply Module (option AM3)

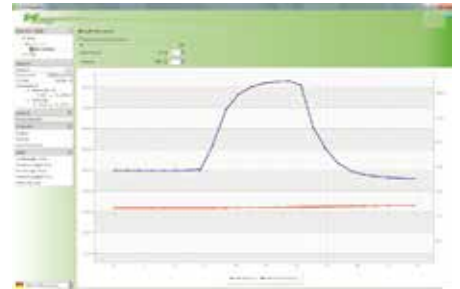
The module allows the device to be powered with 100...240 V AC (50/60 Hz).



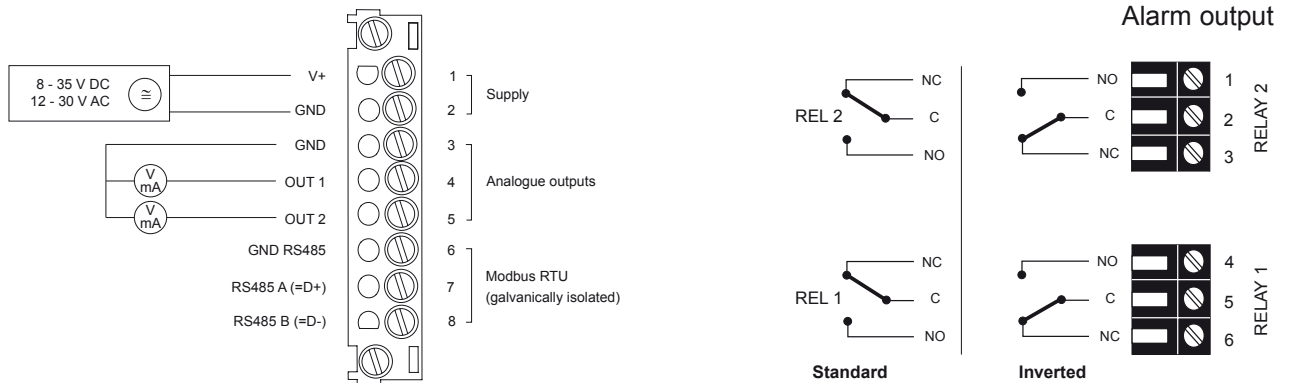
Product Configuration Software

EE-PCS is an intuitive software that allows the user to perform:

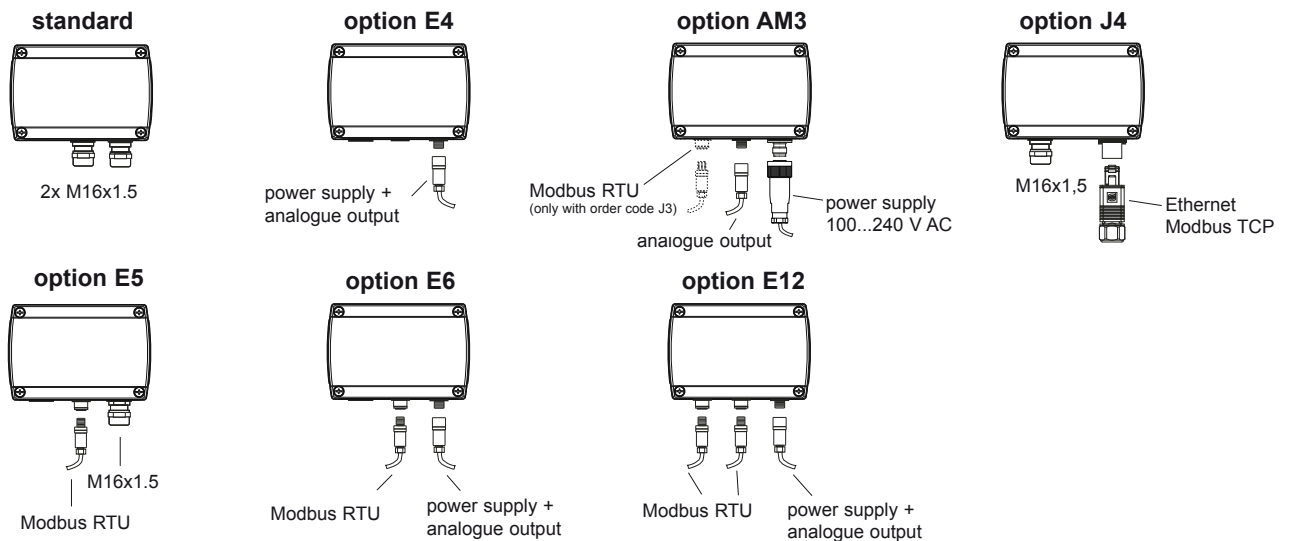
- flexible, easy and fast setup of the analogue and alarm outputs
- 1 or 2 point adjustment of humidity and temperature
- replacement of the pluggable sensing probe
- Modbus RTU communication setup
- setup of the display layout
- download logged data
- view error diagnosis information



Connection diagram



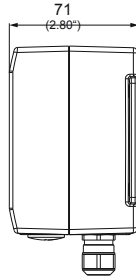
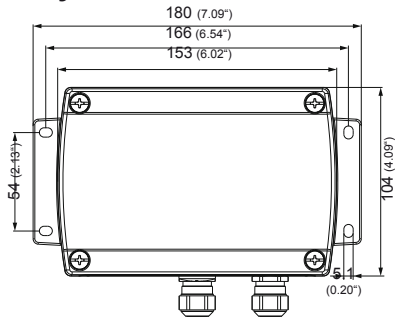
Electrical connection



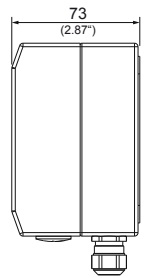
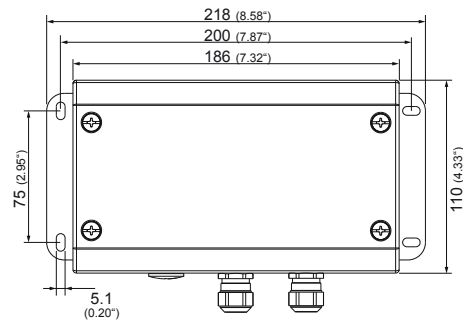
Mating plugs included in the scope of supply

Dimensions (mm/inch)

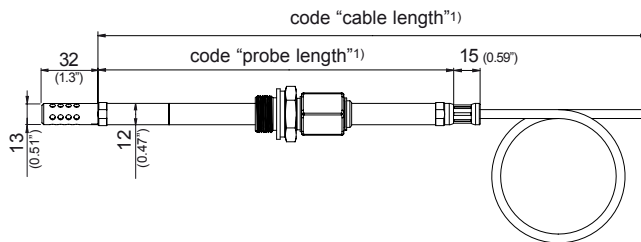
Polycarbonate enclosure



Stainless steel enclosure



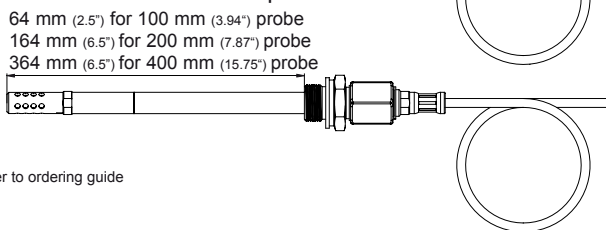
Probe:



minimum installation depth



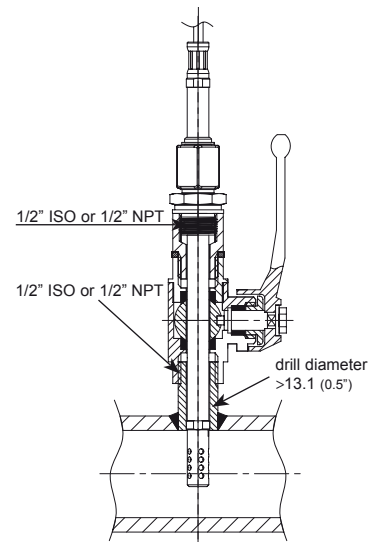
maximum installation depth



1) Refer to ordering guide

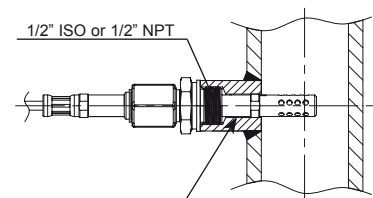
Ball valve installation

pressure-tight up to 20 bar (290 psi)
only for 200 mm (7.87") probe



Direct installation

pressure-tight up to 20 bar (290 psi)



Technical data

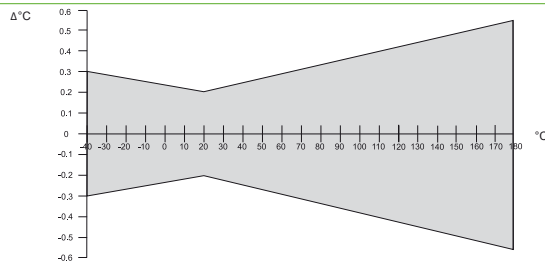
Measuring values

Water activity (a_w) / Water content (x)¹⁾

Humidity sensor	HC1000-400		
Measuring range	0...1 a_w / 0...100,000 ppm		
Accuracy ²⁾			
-15...40 °C (5...104 °F)	$\leq 0.9 a_w$	$\pm (0.013 + 0.3\% \cdot mv) a_w$	mv = measured value
-15...40 °C (5...104 °F)	$> 0.9 a_w$	$\pm 0.023 a_w$	
-25...70 °C (-13...158 °F)		$\pm (0.014 + 1\% \cdot mv) a_w$	
-40...180 °C (-40...356 °F)		$\pm (0.015 + 1.5\% \cdot mv) a_w$	
Temperature dependence of electronics	typ. $\pm 0.0001 [1/^\circ\text{C}]$	(typ. $\pm 5.6 \cdot 10^{-5} [1/^\circ\text{F}]$)	
Temperature dependence of sensing probe	typ. $\pm (0.00002 + 0.0002 \times a_w) \times \Delta T [^\circ\text{C}]$		$\Delta T = T - 20 \text{ }^\circ\text{C}$
Response time at 20 °C (68 °F) / t_{90}	typ. 10 min in still oil		

Temperature (T)

Temperature sensor	Pt1000 (tolerance class A, DIN EN 60751)
Working range sensing probe	-40...180 °C (-40...356 °F)
Accuracy	





Temperature dependence of electronics	typ. $\pm 0.005 \text{ }^\circ\text{C}/^\circ\text{C}$
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Outputs

Two analogue outputs (freely selectable and scalable)	0 - 1 / 5 / 10 V	-1 mA $< I_L < 1$ mA
	4 - 20 mA 3-wire	$R_L < 500$ Ohm
	0 - 20 mA 3-wire	$R_L < 500$ Ohm
Digital interface	RS485 with Modbus RTU, up to 32 devices in one bus Ethernet with Modbus TCP	

General

Power supply class III  (EU) / class 2 (NA)	8...35 V DC 12...30 V AC 100...240 V AC, 50/60Hz with option AM3 ³⁾
Current consumption - 2x voltage output - 2x current output	for 24 V DC/AC: typ. 40 mA typ. 80 mA
Pressure range sensing probe	0.01...20 bar (0.15...300 psi)
Probe material	Stainless steel 1.4404 / AISI 316L
Enclosure material for plastic enclosure for metal enclosure	Polycarbonate UL94-V0 approved Stainless steel 1.4404 / AISI 316L
Protection class	IP65
Cable glands for plastic enclosure for metal enclosure	M16 x 1.5, for cable \varnothing 3 - 7 mm (0.12 - 0.28") M16 x 1.5, for cable \varnothing 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	Screw terminals up to max. 1.5 mm ² (AWG 16)
Working and storage temperature electronics	-40...60 °C (-40...140 °F) without display -20...50 °C (-4...122 °F) with display
Electromagnetic compatibility	EN61326-1 EN61326-2-3 ICES-003 ClassA  Industrial Environment FCC Part15 ClassA
Alarm outputs (2 relays) ³⁾	250 V AC / 6 A 28 V DC / 6 A
System requirements for PCS software	Windows XP or higher; USB port

1) ppm output is valid in the range 0...100 °C (32...212 °F)

2) Including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...

The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation).

The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

3) Appropriate for outdoor use, wet location, degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft).

Ordering Guide

		HLX360	
Hardware Configuration	Enclosure	polycarbonate stainless steel	no code HS2
	Cable length (incl. probe length)	2 m (6.6 ft)	no code
		5 m (16.4 ft)	K5
		10 m (32.8 ft)	K10
	Probe length	100 mm (3.94")	L100
		200 mm (7.87")	no code
		400 mm (15.75")	L400
Process connection	1/2" ISO thread 1/2" NPT thread	no code PA25	
Electrical connection ¹⁾	cable glands 1 plug for power supply and outputs 1 cable gland / 1 plug for Modbus RTU 2 plugs for power supply / outputs and for Modbus RTU 3 plugs for power supply / outputs and Modbus RTU network	no code E4 E5 E6 E12	
Optional features	TFT colour display with integrated data logger ²⁾	D2	
	RS485 - Modbus RTU ³⁾	J3	
	Ethernet - Modbus TCP ^{5) 8)} pluggable probe ⁸⁾ alarm outputs ^{4) 5)} integrated power supply 100...240 V AC, 50/60 Hz ^{5) 6)}	J4 PC4 AM2 AM3	
Setup - Analogue outputs	Output 1	water activity a_w []	no code
		other measurand (xx see Measurand Code below)	MAxx
	Output Signal 1 ⁷⁾	0-1 V	GA1
		0-5 V	GA2
		0-10 V	GA3
		0-20 mA	GA5
		4-20 mA	GA6
	Scaling 1 low	0 value	no code SALvalue
	Scaling 1 high	1 value	no code SAHvalue
	Output 2	temperature T [°C]	no code
		other measurand (xx see Measurand Code below)	MBxx
	Output Signal 2 ⁷⁾	0-1 V	GB1
		0-5 V	GB2
		0-10 V	GB3
0-20 mA		GB5	
4-20 mA		GB6	
Scaling 2 low	value	SBLvalue	
Scaling 2 high	value	SBHvalue	

Measurand Code

		Mx
Temperature	°C	1
	°F	2
Water activity	aw	67

		Mx
Water content x in mineral transformer oil	ppm	70
Water content x in customer specific oil	ppm	70PPMxxx

- 1) Plug options E5 / E6 / E12 only in combination with Modbus RTU output, (option J3).
 2) Factory setup: the display shows the measurands selected for output 1 and output 2.
 Default language English, other languages selectable in display menu.
 3) Factory settings: baudrate 9600, parity even, stop bit 1 / slave-ID 231 (16 bit integer).
 4) Alarm outputs only available with cable glands

- 5) Combination of alarm output, Ethernet module - Modbus TCP and integrated power supply is not possible.
 6) Integrated power supply includes 2 plugs for power supply and outputs, other connection options are not possible
 7) Both analogue outputs are either voltage or current.
 8) Only with polycarbonate enclosure

Order Example

HLX360-D2J3GA3GA3GB3SBL-40SBH180

Enclosure:	no code	polycarbonate	Output 1:	no code	water activity
Cable length:	no code	2 m (6.6 ft)	Output Signal 1 & 2:	GA3	0-10 V
Probe length:	no code	200 mm (7.87")	Scaling 1 low:	no code	0
Process connection:	no code	1/2" ISO thread	Scaling 1 high:	no code	1
Electrical connection:	no code	cable glands	Output 2:	no code	temperature °C
Optional features:	D2	TFT colour display with integrated data logger	Scaling 2 low:	SBL-40	-40
	J3	Modbus RTU	Scaling 2 high:	SBH180	180

Scope of supply

	Included in versions
HLX360 according to ordering guide	all versions
Operation manual english*	all versions
Inspection certificate according to DIN EN 10204 – 3.1	all versions
Mating plug for integrated power supply	AM3
Mating plug RKC 5/7	AM3 / E4 / E6 / E12
Mating plug RSC 5/7 (2 pcs. for option E12)	E5 / E6 / E12
Mating plug HPP V4 RJ45 Cat 5	J4

*) Other languages can be downloaded at www.epluse.com/EE360

Accessories / Replacement Parts (for further information, see data sheet "Accessories")

- Replacement filter cap	HA010110
- Replacement probe ¹⁾	refer to operation manual
- Replacement humidity sensor	FE09
- Bracket for installation onto mounting rails ²⁾	HA010203
- Investigation of oil specific parameters	ppm-cal
- Humidity calibration kit	refer to data sheet „Humidity calibration kit“
- Ball valve set 1/2“ ISO	HA050101
- Ball valve set 1/2“ NPT	HA050104
- RS485 add-on chip ³⁾	HA010605
- Ethernet Module for retrofitting plastic enclosure	HA010606 for remote probe type T5, T10 HA010607 for duct mounting type T2

1) Only for devices with PC4 option.

2) 2 pieces necessary per device.

3) For upgrade to Modbus RTU interface.