

Technical Information

Radar module UTR30

Free space radar



Sensor unit for distance measurement and level monitoring of liquids and bulk solids

Application

- Continuous distance measurement and level monitoring of liquids and bulk solids
- Maximum measuring range: 35 m (115 ft)
- Ambient temperature: -40 to +85 °C (-40 to +176 °F)

Your benefits

- Reliable 80 GHz radar module
- Precise distance measurement due to strong focus, even in rough environments
- Easy commissioning
- Low power consumption - suitable for battery applications
- Radio approval (FCC/ISED) available

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About this document

Document function





This document contains all the technical data for the device and provides an overview of the device versions that can be ordered, which may differ, for example, in their mechanical design or output signal.

Symbols used

Safety symbols

Symbol	Meaning
	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

Symbols for certain types of information

Symbol	Meaning
	Tip Indicates additional information.
	Permitted or recommended
	Forbidden or not recommended
1. , 2. , 3. ...	Series of steps
	Reference to page

Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
A, B, C, ...	Views

Function and input parameters

Measuring principle

The core component of the UTR30 radar module is a radar sensor, operating based on the time-of-flight method (ToF). It measures the distance from the reference point to the product surface. The radar signals based on the "Frequency Modulated Continuous Wave" (FMCW) principle are emitted by an antenna, reflected off the product surface and received again by the radar system.

Process

- The measurement can be carried out directly through tanks
 - This is only possible for electrically non-conductive tank walls
 - No contact is made with the process medium.

Measured variable

Measured process variables:

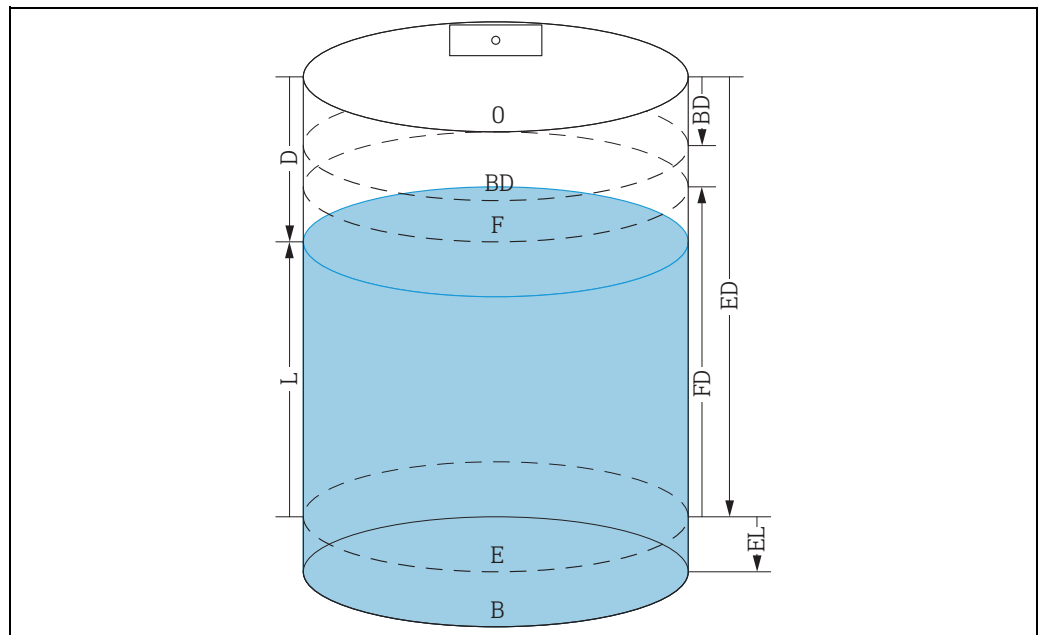
- **Level / Distance:** 0 to 35 m (0 to 115 ft)

Measuring range

Maximum measuring range: 0 to 30 m (0 to 98 ft) for solids and liquids with permittivity > 1.9

Increased measuring range: 30 to 35 m (98 to 115 ft) for solids and liquids with the following application conditions:

- Only for media with a high permittivity value, such as water.
- No turbulent surfaces
- No increased inhomogeneous atmosphere (increased amount of dust particles, gas phases, high humidity or similar)



Radartransducer_Abgleichparameter

Calibration parameter

- | | |
|----|----------------------------|
| B | Bottom |
| D | Measured distance |
| E | Empty calibration (= zero) |
| F | Full calibration (= span) |
| L | Level in % |
| BD | Blocking distance |
| FD | Full distance |
| ED | Empty distance |
| EL | Extended length |

Medium

Media: solids and liquids

Usable measuring range for solid applications

The usable measuring range depends on the reflection properties of the medium, the installation position and possible interference reflections.



Measurement of the following media with absorbing gas phase

For example the following media

- Ammonia (pure - 100 %)
- Acetone
- Methylene chloride
- Methyl ethyl ketone
- Propylene oxide
- VCM (vinyl chloride monomer)

To measure absorbing gases, either use a guided radar, measuring devices with another measuring frequency or another measuring principle.

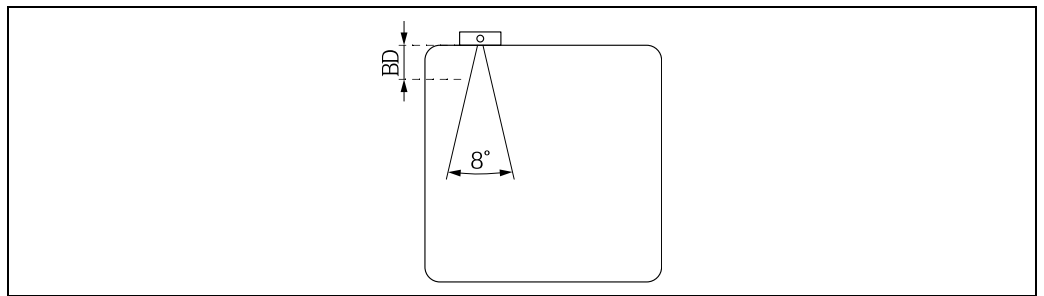
If measurements must be performed in one of these media, please contact Endress+Hauser.

Operating frequency

80 GHz

The operating frequency is for measurement purposes only.

Blocking distance



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- No signals are analyzed within the blocking distance (BD)
For this reason, the blocking distance can be used to suppress interference signals (e.g. from condensate) near the antenna.
- The blocking distance (BD) can be set. The factory setting is 0 mm (0 in).
A change is made via a blocking distance parameter.

Sensitivity

The sensitivity of the sensor can be configured using a "sensitivity parameter" (high, medium, low).

Output

Output signal

UART (option D)

Digital: UART (8N1 inverted)
 Baud rate: 230.4 kBd
 data bits: 8
 Parity: none
 Stop bits: 1
 Polarity: inverted (idle low)

RS422 (option E)

Baud rate: 230.4 kBd
 data bits: 8
 Parity: none
 Stop bits: 1

Protocol-specific data

The UTR30 has the following read and write parameters:

Parameter	Unit	Read	Write
Measured distance	mm	X	
Measured level	%	X	
Configurable blocking distance	mm	X	X
Definition for state "Empty"	mm	X	X
Definition for level "Full"	mm	X	X
Medium type liquid / solid		X	X
Trigger measurement on / off		X	X
Reception strength of radar signal	strong, medium, weak, no signal	X	
Sensitivity of sensor	low, medium, high	X	X
Hardware version		X	
Software version		X	
Serial number		X	
Error status		X	
Z-Offset (correction value from the calibration)	mm	X	X

Performance characteristics

Reference operating conditions

- Temperature = +24 °C (+75 °F) ±5 °C (±9 °F)
- Pressure = 960 mbar abs. (14 psi) ±100 mbar (±1.45 psi)
- Humidity = 60 % ± 5 %
- Reflector: metal plate with a diameter ≥ 1 m (40 in)
- No major interference reflections inside the signal beam

Maximum measured error

- Accuracy for liquids applications: ±2 mm (±0.08 in) within the entire measuring range
- Accuracy for bulk solids applications: ±10 mm (±0.39 in) within the entire measuring range (higher measuring accuracy optionally possible)



The reference condition for the accuracy refers to the setting **Medium type = Liquid**.
With the setting **Medium type = Solid**, the devices are optimized for solid applications in the delivery state.

Influence of ambient temperature

Temperature coefficient: ≤ 4 mm (0.16 in) per 10 K

Environment

Ambient temperature

−40 to +85 °C (−40 to 185 °F)

Storage temperature

−40 to +85 °C (−40 to +185 °F)

Relative humidity

0 to 95 %

Operating altitude according to DIN EN 61010-1 Ed. 3

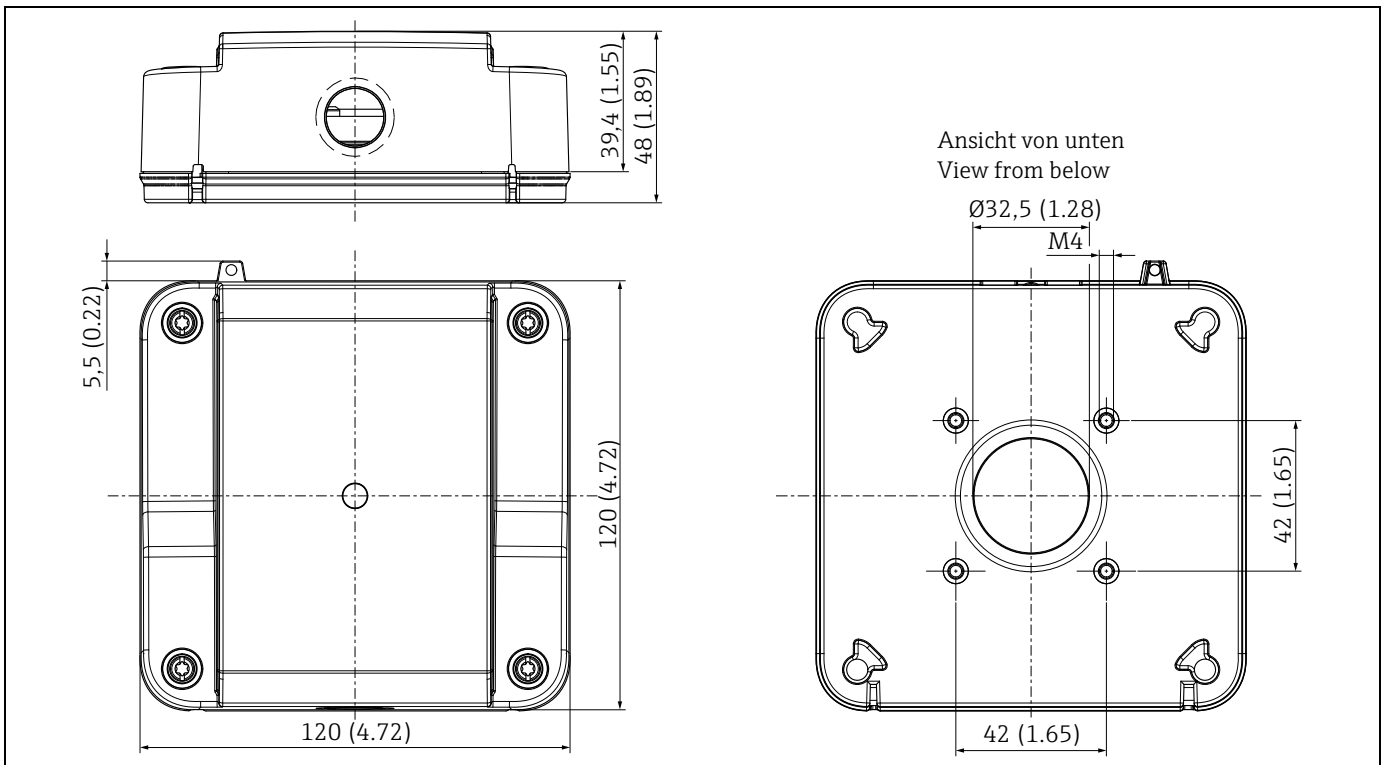
Up to 2000 m (6600 ft) above sea level

Degree of protection	IP66/68 (Radar module in plastic enclosure) IP00 (Radar module mounted on base plate)
Pollution degree	Pollution degree 3 according to IEC/EN 61010-1

Mechanical construction

Dimensions The radar module is available in a plastic enclosure and mounted on a base plate (without cover).

Radar module in plastic enclosure



* Unit of measurement mm (in)

Radar module mounted on base plate

The dimensions of the base plate can be seen in the previous drawings of the plastic enclosure. Further information on the geometry of the inside of the enclosure is available on request.

NOTICE

The fixing screws of the circuit board must not be removed!

Weight	Radar module in plastic enclosure: 68 g Radar module mounted on base plate: 180 g + separate cover: 124 g
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Materials	<ul style="list-style-type: none"> ■ Radar antenna: Plastic PBT ■ Coupling adapter: PPS GF40 (metallized) ■ Enclosure: Plastic PBT/PC ■ Seal: TPE
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Power supply

Supply voltage

The radar module offers various options with regard to the output signal. The supply voltage must be considered depending on this.

UART (option D)

The radar system requires 2 supply voltages:

Sensor: 3.5 to 5.5 VDC

Digital interface: 1.7 to 3.6 VDC (It is possible to cover both supply voltages with one voltage source).

RS422 (option E)

5 ... 15 VDC

Power consumption

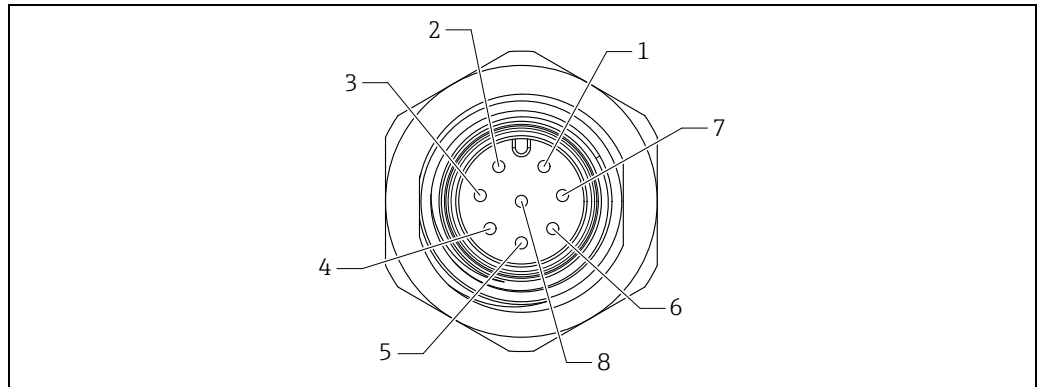
~32 mW static

~1000 mW peak for < 10 ms during measurement

Electrical connection and pin assignment

The radar module offers the following connection options:

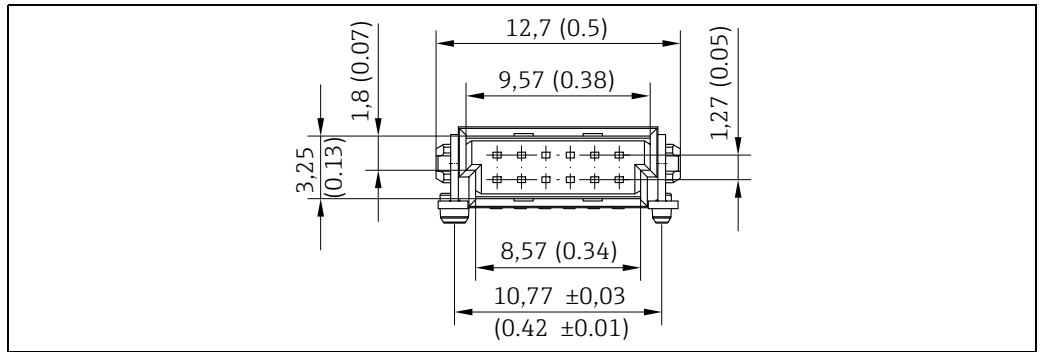
Plug M12x1



211070709A

PIN	Type	Sensor output	Master connection	Description
1	Input	V _{DD}	V _{DD}	Positive power supply
2	Input	GND	GND	Negative power supply
3	Output	Z/Tx-	Rx+	Inverting output
4	Output	Y/Tx+	Rx-	Not inverting output
5	Input	B/Rx-	Tx+	Inverting input
6	Input	A/Rx+	Tx-	Not inverting input
7	Input	GND	GND	Negative power supply
8	Output	RDY	RDY	Ready signal/ Open drain (optionally usable)

Mount header 2x6 pins

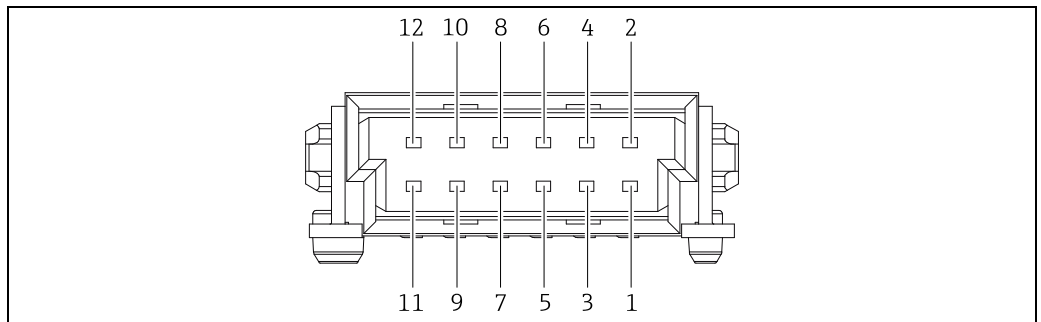


Maße_Anschlussstecker

Dimensions of the electrical connector plug, unit of measurement mm (in)

Connector plug	
Manufacturer	ERNI
Type	SMC Connector
Part no.	154763

Possible connection cables	Example 1	Example 2
Manufacturer	ERNI	HARTING
Type	SMC Cable	har-flex
Part no.	173799	33152430500102



Pin-Belegung_Anschlussstecker

PIN assignment of electrical connector plug

PIN	Type	Name	Description
1	Input	GND	Ground
2	Input	V _{DD_RADAR}	Power supply for HF part
3	Input	GND	Ground
4	Input	V _{DD_RADAR}	Power supply for HF part
5	Input	GND	Ground
6	Input	V _{DD_IF}	Digital power supply
7	Input	RX	UART RX (data to UTR30)
8	Output	TX	UART TX (data from UTR30)
9	Input	RESET	Reset signal. If "HIGH", the UTR30 is in reset.

PIN	Type	Name	Description
10	Output	SIG1	Display of the standby status. If "HIGH" the UTR30 is ready to start a new measurement.
11	Input	GND	Ground
12	Input	GND	Ground

Installation instructions

Safety notes for installation

For work on and with the device:



NOTICE

Danger of damaging the device

Static sensitive devices.

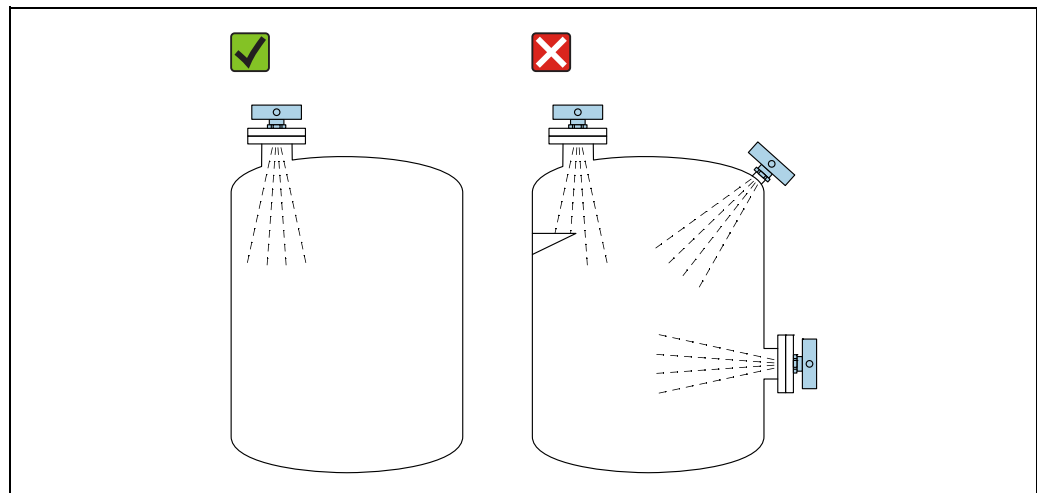
- ▶ Handle only at static safe work stations!

Beam angle

8°

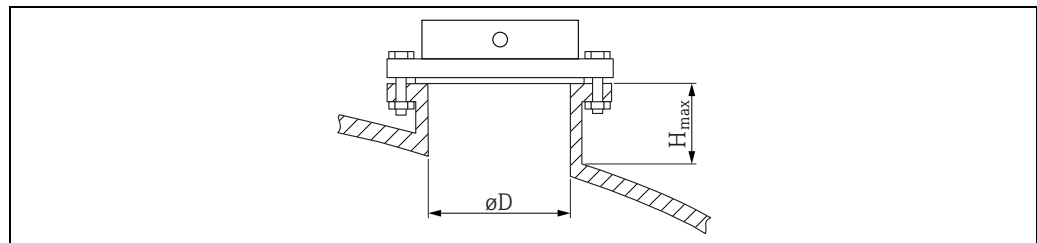
Positioning

- Mount the end measuring device in a horizontal position so that it is parallel to the tank ceiling. Otherwise, undesired reflections from the surroundings can cause interference signals.
- The radar antenna should never be covered by metal objects.
- Do not mount any objects which may cause interference, such as tank internal fittings, grids or agitators, below or in the direct vicinity of the radar (see the graphic below).



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Maximum nozzle height and distance to wall



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Diameter D [mm (in)]	H _{max} [mm (in)]	Measuring distance [mm (in)]	Radiation width ¹⁾ [mm (in)]
40 (1.57)	230 (9.06)	500 (19.69)	70 (2.76)
50 (1.97)	300 (11.81)	1000 (39.37)	140 (5.51)
80 (3.15)	520 (20.47)	2000 (78.74)	280 (11.02)
100 (3.94)	660 (25.98)	5000 (196.85)	699 (27.52)
150 (5.91)	1020 (40.16)	10000 (393.70)	1399 (55.08)

1) The beam angle is 8°

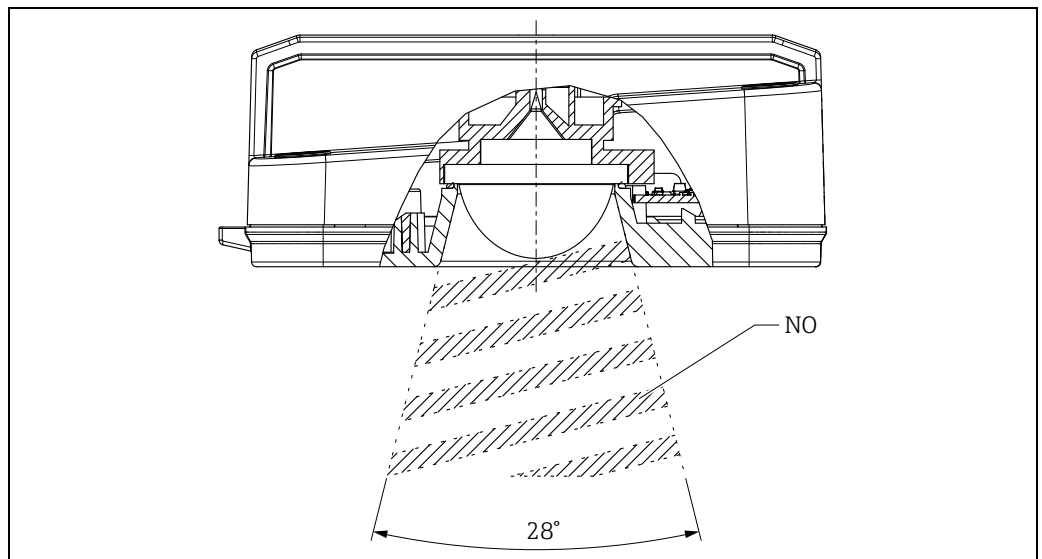
Integration into an overall system

Characteristics

- Simple mechanical/electrical integration into an end device
- Configuration and control via widely used digital interface (UART & RS422) with defined command set (see Customer Manual)
- Startup time: <250 ms until first measurement can be performed
- Measurement cycle time: <100 ms

Integration

- The sensor must be installed inside a closed housing.
- A minimum distance of >2 mm (0.08 in) to any mechanical part has to be left around and above the PCB as to not interfere with any signals of the sensor.
- The signal cone must not be obstructed by any elements of the housing or add ons.
- The electrical connection must be done via the selected connection type (see chapter "Power supply" for pin assignment) and it is necessary to use a fitting counterpart connector with a locking mechanism.
- After mounting, a functional check and zero offset calibration has to be performed. The zero plane can be defined by the customer.



NO no objects zone

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Check list

- Is the radar module undamaged (visual inspection)?
- Is the sensor properly mounted and fixed in position?
- Is the antenna and enclosure properly sealed?
- Is the sensor signal cone unobstructed?
- Is the electrical connector properly fitted and locked?
- Is the sensor responsive and returns a correct measurement value without any communication errors or active error bits?

Certificates and approvals

RoHS

The Directive on the Restriction of the Use of Certain Hazardous Substances 2011/65/EU (RoHS 2) and the Delegated Directive (EU) 2015/863 (RoHS 3).

Compliance Radio Directive ETSI EN 302 729

The module complies with the requirements of ETSI EN 302 729 V2.1.1 (2016) for a level probing radar. If the module is integrated into an end product in accordance with the integration documentation, this standard can be used to assess the conformity of the end device in accordance with the Radio Equipment Directive 2014/53/EU.

That is exclusively valid for the listed products in delivery status.

Please note the following for operation of the devices outside of closed vessels:

1. The device must be mounted in accordance with the instructions in the "Installation instructions" section.
2. Installation must be carried out by properly trained, expert staff.
3. The device antenna must be installed in a fixed location pointing vertically downwards.
4. The installation site must be located at a distance of 4 km from the astronomy stations listed below or otherwise approval must be provided by the relevant authority. If the device is installed at a distance of 4 to 40 km from one of the listed stations, it must not be installed at a height of more than 15 m (49 ft) above the ground.

Astronomy stations

Country	Name of the station	Latitude	Longitude
Germany	Effelsberg	50°31'32" North	06°53'00" East
Finland	Metsähovi	60°13'04" North	24°23'37" East
	Tuorla	60°24'56" North	24°26'31" East
France	Plateau de Bure	44°38'01" North	05°54'26" East
	Floirac	44°50'10" North	00°31'37" West
Great Britain	Cambridge	52°09'59" North	00°02'20" East
	Damhall	53°09'22" North	02°32'03" West
	Jodrell Bank	53°14'10" North	02°18'26" West
	Knockin	52°47'24" North	02°59'45" West
	Pickmere	53°17'18" North	02°26'38" West
Italy	Medicina	44°31'14" North	11°38'49" East
	Noto	36°52'34" North	14°59'21" East
	Sardinia	39°29'50" North	09°14'40" East
Poland	Krakow Fort Skala	50°03'18" North	19°49'36" East
Russia	Dmitrov	56°26'00" North	37°27'00" East
	Kalyazin	57°13'22" North	37°54'01" East
	Pushchino	54°49'00" North	37°40'00" East
	Zelenchukskaya	43°49'53" North	41°35'32" East
Sweden	Onsala	57°23'45" North	11°55'35" East
Switzerland	Bleien	47°20'26" North	08°06'44" East
Spain	Yeves	40°31'27" North	03°05'22" West
	Robledo	40°25'38" North	04°14'57" West
Hungary	Penc	47°47'22" North	19°16'53" East



As a general rule, the requirements outlined in ETSI EN 302 729 V2.1.1 must be observed.

FCC

Compliance with Part 15 of the FCC rules. Operation is subject to the following two conditions:
 (1) This device may not cause harmful interference, and
 (2) this device must accept any interference received, including interference that may cause undesired operation

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices are compliant with the FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.209

The limited module approval is only valid with the provided Antenna.

In addition, the module is compliant with Section 15.256.

When the module is integrated into a device the text "Contains FCC ID: LCGUXR3XYEL" must be added to the type plate of the device. Further it has to be verified that the device meets all spurious emission FCC requirements and the fundamental-frequency has to be tested for compliance with the FCC. The device must comply to all applicable requirements of Part 15 Subpart B. Any integration of the module has to be approved by Endress+Hauser and a FCC Change in ID has to be requested.

If the module is used in combination with other active radio components the coexistence of the modules must be tested.

For these LPR (Level Probe Radar) applications the device must be professionally installed in a downward operating position. In addition, the devices are not allowed to be mounted in a zone of 4 km around RAS stations and within a radius of 40 km around RAS stations the maximum operation height of devices is 15 m (49 ft) above ground.

Industry Canada**Canada CNR-Gen Section 7.1.3**

Compliance with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- The installation of the LPR/TLPR module shall be done by trained installers, in strict compliance with the manufacturer's instructions
- The use of this device is on a "no-interference, no-protection" basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device. However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense
- For any integration of the module into a device an ISED multiple listing has to be requested
- The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are latitude 49°19'15" N and longitude 119°37'12" W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.) or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards Industry Canada, may be contacted.)



The customers measurement systems with UTR30, which is based on USR30, can fulfill the requirements for use as LPR (Level Probe Radar).

Approvals of closed measuring systems

NOTICE

The UTR30 radar module is a sensor unit that is installed as a component in a system by the customer. It is therefore the customer's responsibility to obtain the relevant approvals for his measuring system.

Endress+Hauser's measuring systems that include the sensor unit of the UTR30 comply with the following guidelines:

EN 61010-1

Endress+Hauser **closed measuring systems with this sensor unit** meet the requirements of EN 61010-1 (Safety requirements for electrical equipment for measurement, control and laboratory use).

CE mark

The **closed measuring systems** from Endress+Hauser **with this sensor unit** meet the legal requirements of the applicable EU directives. These are listed in the corresponding EU Declaration of Conformity together with the standards applied.

Explanations and supplementary documentation

Supplementary documentation



For an overview of the scope of the associated Technical Documentation, refer to the following:

- Customer manual USR30

Disposal



As required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to Endress+Hauser for disposal under the conditions stipulated in the General Terms and Conditions or as individually agreed.

Contact addresses

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