TTLLS-Cable
Liquid Level Sensors
User Manual

www.typhon-technologies.com

Functionality

The Typhon Technologies TTLLS-Cable is an Electronic Liquid Level Sensor, cost efficient and reliable level sensor used for liquid level measurement in all types of cooling systems.

The Liquid level sensor is used for monitoring the liquid level in standpipes and other applications, where level monitoring is needed. The liquid level sensor has an analog output, which can be selected as either mA or Voltage for indication for 0-100% level.

The installation is simple with only one-point installation, it comes with different thread types. TTLLS-Cable have smart commissioning via Bluetooth connected to the TT SmartConfig App, which easy allow the user to select the desired refrigerant media and controlling the output.

With the TTLLS-Cable and the High-end technology within the capacitive measuring principle, combined with integrated AI technology it takes the Liquid Level Sensor to a new level, offering cost-efficiency, reliability, and user-friendliness. This high-end technology also makes it possible to not use any isolating material on the electrode.

The capacitive measuring principle makes sure that the mechanical part is never worn down, because there are no moving parts inside the mechanical part. Because of the High-end patent pending technology within the capacitive measuring principle the same mechanical part can used within all types of refrigerant media.

TTLLS-Cable is constructed with the user in mind, it easy to install with only one connection point, and replacement of the electronic part can be done without affecting the pressurized or empty the subsystem.

The TTLLS-Cable detect level in all types of refrigerant media e.g. NH3, Alcohol, HFC, HFO, CFC, OIL, CO2, Butane, Propane, Isobutane and Water – Simply connect to the TT SmartConfig App and configure the sensor for the given application.

For measuring in OIL, CO2, Butane, Propane, Isobutane the TTLLS-Cable can be used up to 4" standpipe. For measuring OIL, CO2, Butane, Propane, Isobutane in tanks, or standpipes bigger than 4" use the TTLLS Liquid Level Sensor.

Features

- Plug and play liquid level sensor
- One-point installation
- One level sensor – Easy configuration of liquid type and output by TT SmartConfig App
- Advanced measuring technology – not impacted by metal parts or any conductive parts
- AI integrated technology – Machine learning liquids properties, optimize long-term stable and correct liquid measuring.
- Notification of change in the media.
  - E.g. notification if your oil gets more conductive due to metal parts.
- Applicable for all types of cooling and heating systems (including heat pumps application)
- 1000VAC Galvanic Isolation – Increase reliability and sensitivity
- Simplify your order/locally stock – One level sensor fits all refrigerant media
- Integrated heater – ambient temperature range -40°C to +60°C
- High pressure up to 150 bar
- Refrigerant media temperature -60°C to 60°C
- IP66 protection degree
- Simple configuration, diagnostic and Live data on site via Bluetooth and TT SmartConfig App
- Maintenance free
- Advanced capacitance measuring principle – No worn down mechanical part
- No moving mechanical parts
- Replacement of electronic part without removing mechanical part
- RF Link - connects level sensors and accessories wireless together
- NFC interface – Save your Settings locally
- Augmented reality – multiple sensor information through TT SmartConfig App
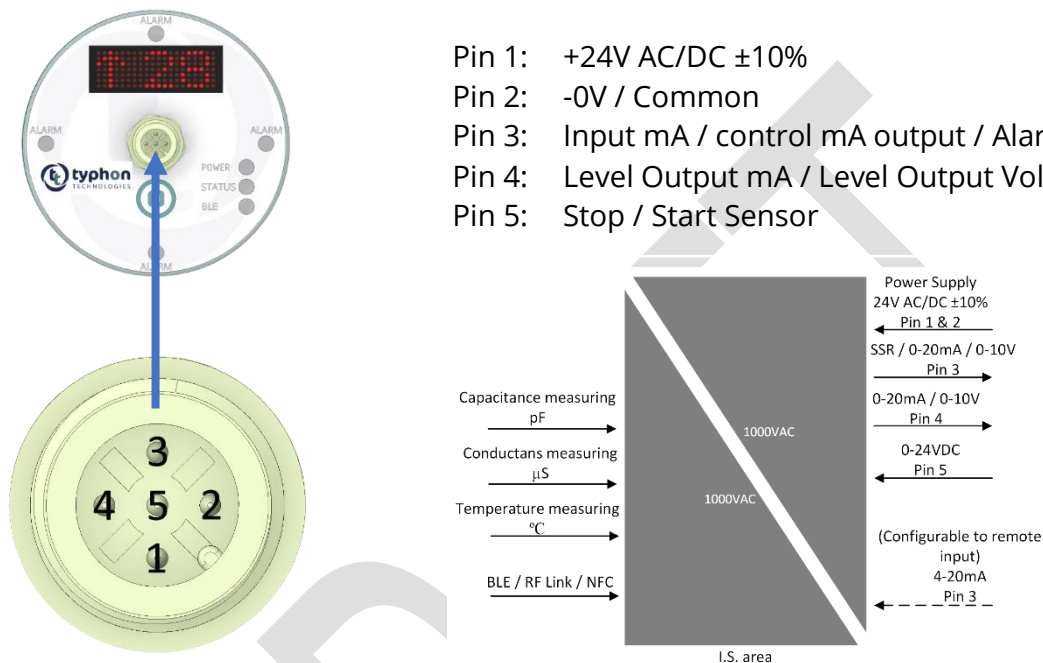
Product Specification

General

Dimension Insert (L x D) / Outside (L)	(L) x Ø22 mm / 145mm L = 200-6000mm
Color	RGB:80/115/119
Material - Electronic	Nylon 6 PA / Stainless steel 304 / PTFE
Material - Mechanical	Stainless steel 304 / PTFE / PEEK
Power Supply	External 24V AC/DC ±10%, 5 Plug IEC 61076-2
Power Consumption	Max 600mW with heater ON
Power Output Current	Maximum 1A
Thread Connection	¾" BSPP, ¾" NPT

Environment

Protection Degree	IP66
Ambient Temperature	-40 to +60°C
Compatible Refrigerant media	NH3/Water/Alcohol HFC/HFO/CFC * OIL * CO2/Butane/Propane/Isobutane
Refrigerant media Temperature	NH3: -60 to +110°C HFC/HFO/CFC: -60 to +110°C OIL: 0 to +145°C CO2: -55 to +30°C
Max Pressure	150 bar

Input

Pin 3: mA input	Input mA: Remote set point 4-20mA / Resolution 0.002mA

Output

Pin 4: mA output / Voltage output	Level Output: 4-20mA – Selectable range: 0-20mA / Resolution 0.001mA Selectable range: 0-10V
Pin 3: mA output /	control mA output / Alarm SSR Control signal 4-20mA / Resolution 0.001mA

SSR Output Signal	SSR Alarm (Source/Sink) (NO/NC)
Pin 5: Stop / Start Sensor	Voltage: 0V-24VDC
LED Matrix	Level 0-100% General service Information
LED Indication	1 x Blue, 4 x Red, 1 x Green, 1 x Yellow
Wireless	
RF Link	Frequency: 868 MHz Protocol: TT-custom Sensitivity Typ.: -110 dBm Output power Typ.: +15 dBm
BLE	Protocol: 5.1 Sensitivity: -88 dBM Transmit power: +8 dBm
NFC	Frequency: 13,56 MHz Protocol: ISO14 443-2 A, ISO14 443-3 A Compatibility: NFC-enabled smartphones: 100%
AR – Augmented Reality	Protocol: TT-Custom
APP Interface	TT SmartConfig App

* For those refrigerant maximum standpipe size is 4"

Electrical connection

The TTLLS-Cable liquid level sensor can be powered with an external power supply 24V AC/DC ±10% through the standard M12 5 pins IEC 61076-2 plug connector. The TTLLS-Cable is 1000VAC galvanic isolation for increasing the reliability and sensitivity.

Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common
Pin 3:   Input mA / control mA output / Alarm SSR
Pin 4:   Level Output mA / Level Output Voltage
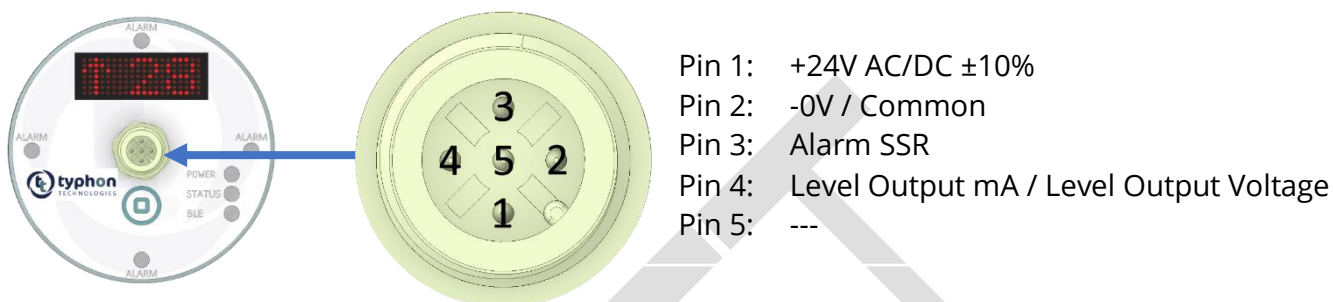Pin 5:   Stop / Start Sensor

Via Bluetooth connection to the TT SmartConfig app, the Pin 3 can be selected either as SSR alarm output. If the sensor is setup for control mode, the Pin 3 can indicate the controlling status through mA or Voltage output. In control mode the Pin can also be setup as mA input, which can used to remotely change the set point in the PID regulator.

The TTLLS-Cable liquid level sensor can be set up in either Level mode or control mode.

In control mode, the liquid level sensor can be ordered, with a controlling cable directly to a valve, such as either a 1) PWM Valve e.g. Danfoss AKVA, 2) Stepper motor valve e.g. Carel E2V or 3) mA-controlled modulation valve e.g. Siemens MVS661.
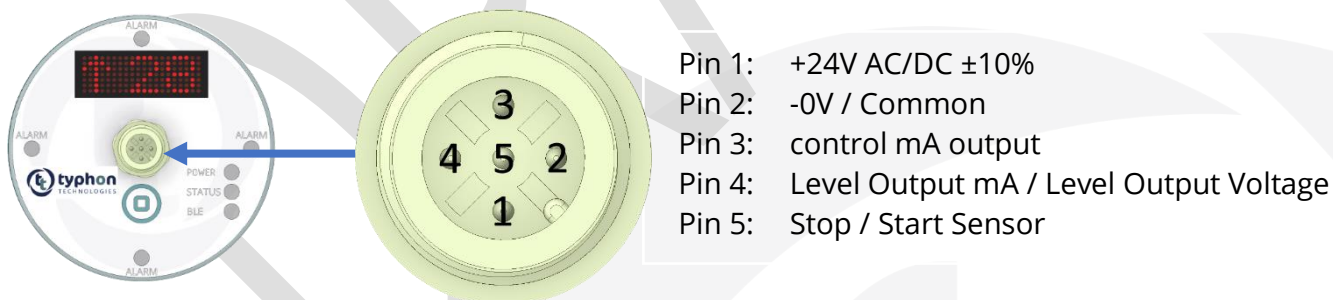
TTLLS-Cable liquid level sensor – Level Mode

In level mode the TTLLS-Cable liquid level sensor measuring the level and transmit a selected analog output linear level, either as mA or voltage corresponding to the measured liquid level on Pin 4.

Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common
Pin 3:   Alarm SSR
Pin 4:   Level Output mA / Level Output Voltage
Pin 5:   ---

TTLLS-Cable liquid level sensor – Control Mode

In control mode the TTLLS-Cable liquid level sensor measuring the level and transmit a selected analog output linear level, either as mA or voltage correspon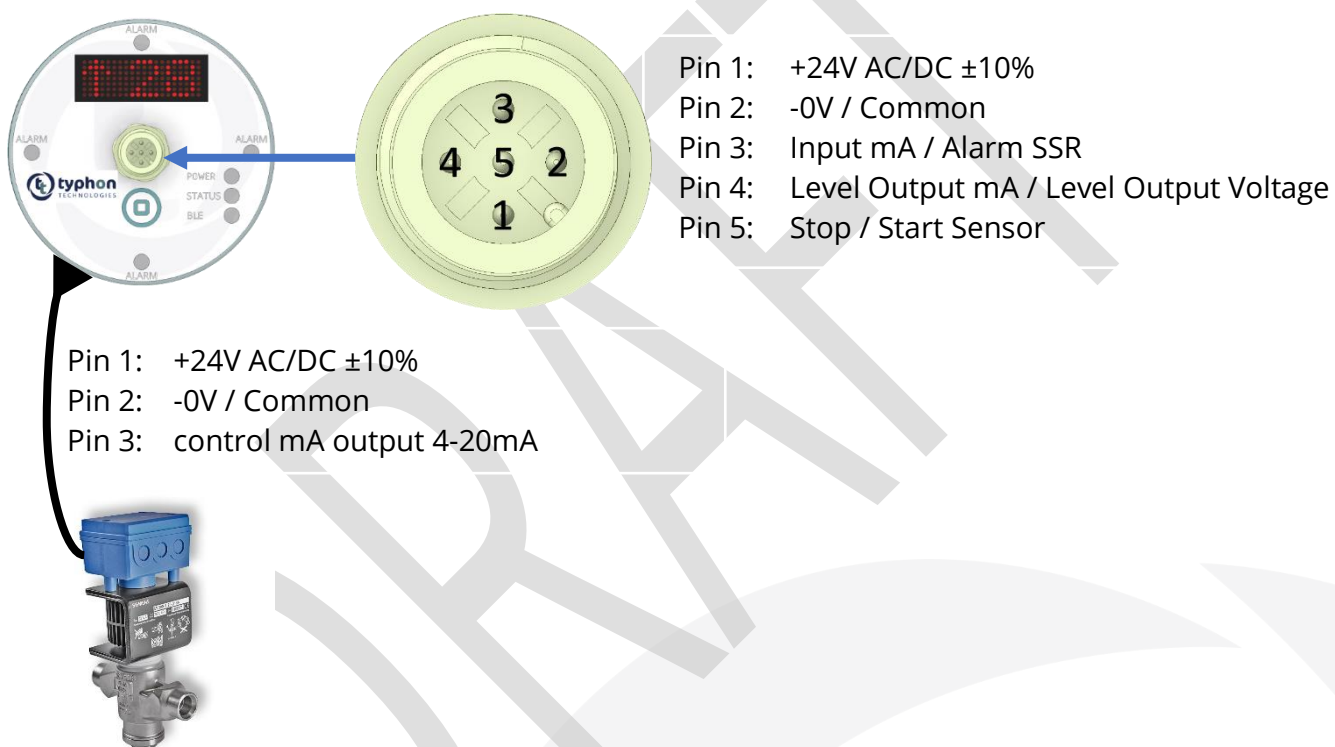ding to the measured liquid level on Pin 4. When control mode is selected, it enables the built-in controller which can be used for regulating signal for e.g. a PLC on Pin 3. Pin 5 have a digital signal input in control mode, for stop and starting the sensors controller.
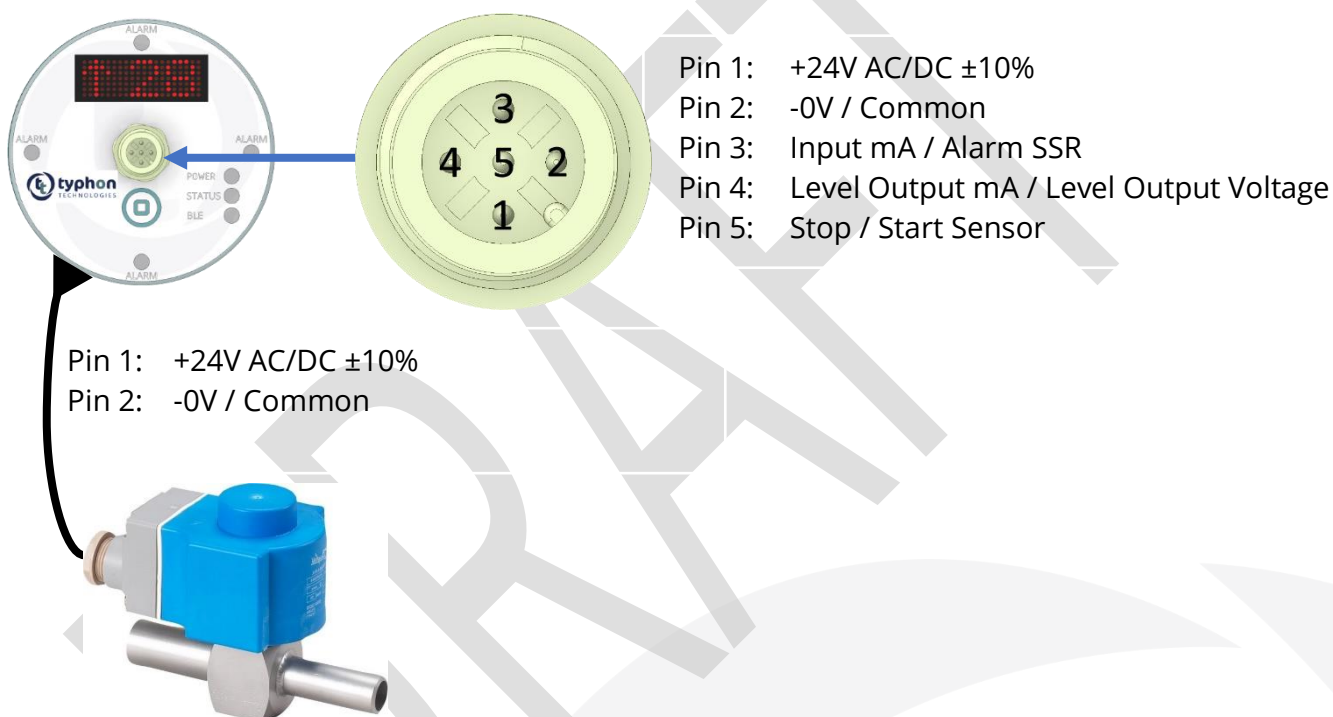
Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common
Pin 3:   control mA output
Pin 4:   Level Output mA / Level Output Voltage
Pin 5:   Stop / Start Sensor

TTLLS-Cable liquid level sensor – Control Mode – Modulating Valve

TTLLS-Cable can be ordered with a cable output directly controlling a modulating valve. In control mode the TTLLS-Cable liquid level sensor measuring the level and transmit a selected analog output linear level, either as mA or voltage corresponding to the measured liquid level on Pin 4. When control mode is selected and with a cable output, it enables the built-in controller which can be used for regulating signal directly to the modulating valve. Pin 3 can be configured to either be used as remote input for changing the Set Point in the built-in controller or as Alarm output signal. Pin 5 is a digital signal input in control mode, for stop and starting the sensors controller.
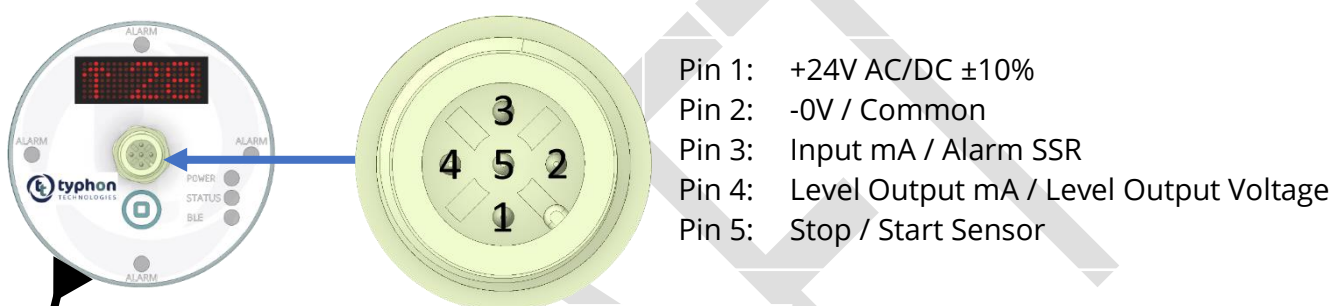

Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common
Pin 3:   Input mA / Alarm SSR
Pin 4:   Level Output mA / Level Output Voltage
Pin 5:   Stop / Start Sensor

Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common
Pin 3:   control mA output 4-20mA

TTLLS-Cable can be ordered with a cable output directly controlling a PWM valve. In control mode the TTLLS-Cable liquid level sensor measuring the level and transmit a selected analog output linear level, either as mA or voltage corresponding to the measured liquid level on Pin 4. When control mode is selected and with a cable output, it enables the built-in controller which can be used for regulating signal directly to the PWM valve. Pin 3 can be configured to either be used as remote input for changing the Set Point in the built-in controller or as Alarm output signal. Pin 5 have a digital signal input in control mode, for stop and starting the sensors controller.
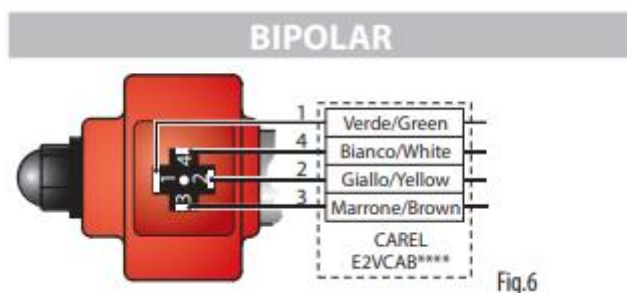
Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common
Pin 3:   Input mA / Alarm SSR
Pin 4:   Level Output mA / Level Output Voltage
Pin 5:   Stop / Start Sensor

Pin 1:   +24V AC/DC ±10%
Pin 2:   -0V / Common

TTLLS-Cable can be ordered with a cable output directly controlling a stepper motor valve. In control mode the TTLLS-Cable liquid level sensor measuring the level and transmit a selected analog output linear level, either as mA or voltage corresponding to the measured liquid level on Pin 4. When control mode is selected and with a cable output, it enables the built-in controller which can be used for regulating signal directly to the stepper motor valve. Pin 3 can be configured to either be used as remote input for changing the Set Point in the built-in controller or as Alarm output signal. Pin 5 have a digital signal input in control mode, for stop and starting the sensors controller.

Pin 1:	+24V AC/DC ±10%
Pin 2:	-0V / Common
Pin 3:	Input mA / Alarm SSR
Pin 4:	Level Output mA / Level Output Voltage
Pin 5:	Stop / Start Sensor

A-:	White pin 4
A+:	Yellow pin 2
B+:	Brown pin 3
B-:	Green pin 1

BIPOLAR

1	Verde/Green
4	Bianco/White
2	Giallo/Yellow
3	Marrone/Brown

CAREL
E2VCAB****

Fig.6

LED Indication

1 x Blue LED Flashing means Bluetooth connection active

4 x Red LED's Indicate alarm

4 x Red flashing indicate error/warning – Connect to TT SmartConfig App for further details

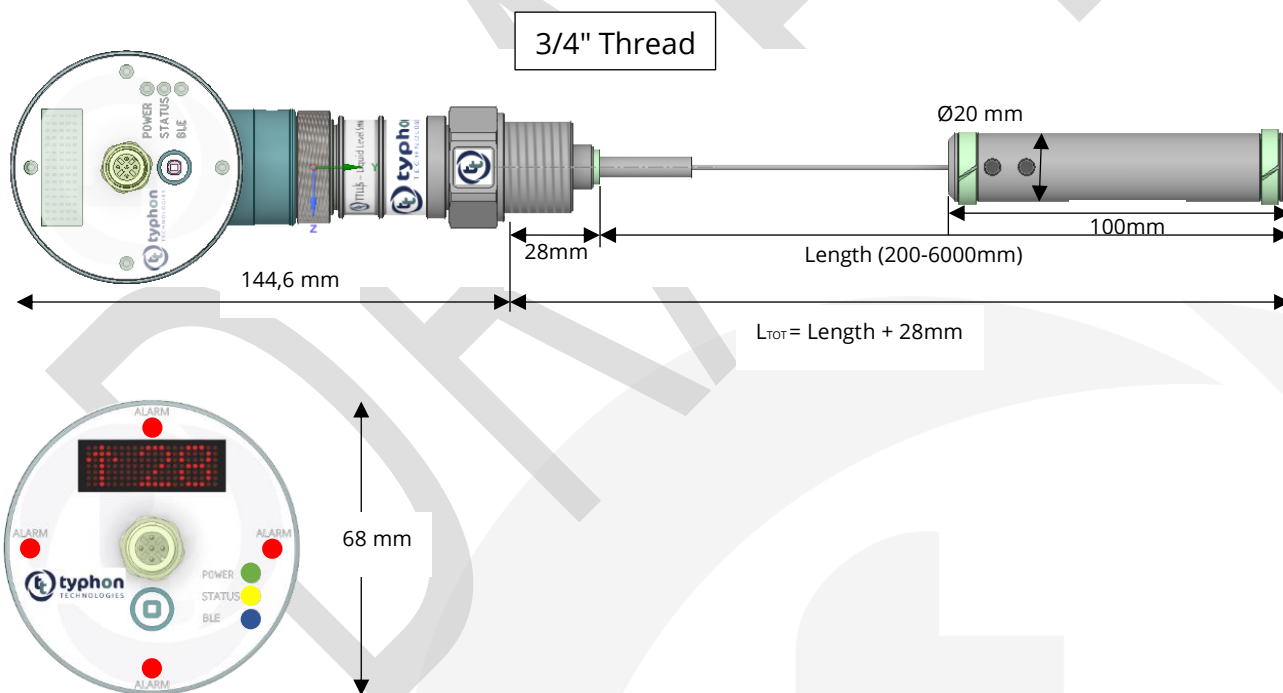1 x Green flashing indicate sensor active

1 x Green constantly on – sensor is in control mode and waiting for start signal.

1 x Yellow.

The LED's is activated as above, regardless of NO or NC state is selected of the SSR contact output.

Dimension

3/4" Thread

Ø20 mm

144,6 mm

28mm

Length (200-6000mm)

100mm

L_{TOT} = Length + 28mm

68 mm

Bluetooth communication

TT SmartConfig app can be downloaded from IOS app store or Android google play.

All communication with all Typhon Technologies sensor is done by use of this app. Communication can only happen with one sensor at a time.

Each sensor includes its own serial number, which will appear in the app when connected. At the same time the blue LED in the actual connected sensor will be constantly ON.

Bluetooth configuration

Always download or update to latest app version.

The configuration of the parameter setting of a Typhon Technologies (TT) sensor is done by opening the app and performing a scan for devices. The app will get a list of all TT sensor that are present at the actual location. The list will include a name, ID and the matching serial number for each of the present TT sensor.

The name and configurable parameters of any sensor can be changed at any time.

1. Choose the first item on the list and observe which sensor's Blue LED is flashing.
2. Log-in with the provided PIN code. (Default code is 0000. For safety reason the PIN code should be changed afterwards)
3. Touch the Menu Icon
4. Touch the Log-in
5. Enter the Password provided.
   a. Default code is 12345678. For safety reason the Password should be changed afterwards
6. Rename the device to an up to 24 symbol name (8 symbols displayed)
7. Check the parameter settings and if needed change one or several parameters. E.g. refrigerant media type, SSR State (NO/NC).
8. Save and share the settings in text file and save the setting in the NFC tag.
9. Disable the communication and observe that the Blue LED stops flashing
10. This sensor is now ready for operation
11. If more sensors are present, choose the next item on the list, and repeat steps 1 to 10

Show the configuration pictures from the APP......

The installation of the Level Sensor is depending on the type of thread, for those with NPT thread, Teflon tape or liquid conductive sealant can be used. For NPT thread it's important that the thread have electrical connection to the standpipe. Using liquid conductive sealant electrical connection is insured. Using Teflon Tape do only apply on part of the thread.

Parallel (straight) thread as BSPP is installed with aluminum gasket, which is delivered together with the sensor. While using aluminum gasket, this will always ensure electrical connection between standpipe and sensor.

Always ensure that the thread have electric connection to the standpipe. This can easily be measured by an ohm meter between the standpipe and the sensor. It should measure 0 ohms.

The following applies to the design of the system:

- TTLLS-Cable Liquid Level Sensor must be installed in a vertical position
- The outlet pipe from standpipe shall be mounted in an angle of 5-10 degree from horizontal. This to drain the standpipe from oil.
- Minimum 50mm free space in bottom.
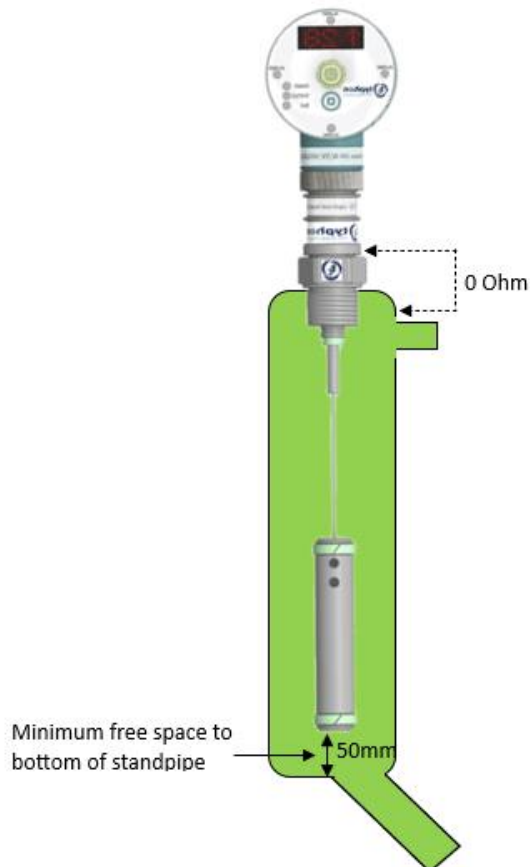
Capacitive measuring principle

The capacitive measuring principle is based on the working principle of a capacitor. A capacitor creates an electric field between two conductive plates when the voltage is applied.

Capacitance (C) names the ability of a capacitor to accumulate electric charging (depending on the voltage). It is the effect of the combination of the area of overlap (A) on the two plates (in square meters), "d" the separation between the plates (in meters) and "ε" the relative permittivity (dielectric constant) of the material (media).

$$C = \epsilon_0 \, \epsilon_r * \frac{A}{D}$$
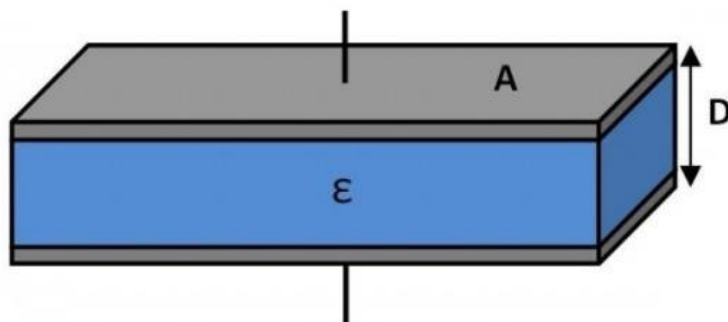
Capacitance is proportional to the area of overlap but inversely proportional to the separation between the conducting sheets. The bigger the area of overlap is and the closer the sheets are to each other, the greater is the capacitance.

The distance of the conducting sheets (d) and the size of the plates themselves are always kept constant to a capacitive sensor.

Vacuum: $\varepsilon r = 1$; Measuring medium: $\varepsilon r > 1$

So the changing of the capacitance is either caused by changing the amount of liquid between the 2 conductive plates or a media with higher relative permittivity replaces the media with a lower relative permittivity.

Safety / Precautions

⚠️ Every use that is not described in this document is considered incorrect and is not authorized by the manufacturer.

The TTLLS sensor should only be used with approved refrigerant media listed under Product Specifications. Use with other refrigerant media must be validated by Typhon Technologies before installation.

Verify that the installation and operating conditions of the switch respect those specified in this document, especially concerning the supply voltage and environmental conditions.

All service and maintenance operations must be performed by qualified personnel. Installation must comply with local standards and legislation.

Before carrying out any maintenance operations on the switch, disconnect the switch from the main power supply. Before unscrewing the switch from the pipe or tank ensure that pipe or tank is empty and not under pressure.

Liability for injury or damage caused by incorrect use of the device lies solely with the user. Depending on the application, the metallic part of the switch may be hot or cold.

Certificates

For all industries, electromagnetic compatibility and the Low Voltage Directive apply that electrical and electronic product solutions must be approved as safe products, which cannot cause any harm and danger to people or destroy other equipment with electrical noise. In all products developed by Typhon Technologies we do have approval with relevant test laboratories about which industry-specific directives the safety of the products must comply with before the products are launched in the market.

After safety approval of the products, they receive a CE | UKCA mark as a proof that the products comply with the defined requirements for safety, health, and environment within the industry's product area.

Certifications	
Radio	Bluetooth
EMC	EN61000-3
General	CE	UKCA