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TOMORROW'S TECHNOLOGY

TTLLSW
Liquid Level Switches
User Manual

PATENT PENDING

www.typhon-technologies.com

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Functionality

The Typhon Technologies TTLLSW is an Electronic Liquid Level Switch, cost efficient and reliable switch used for liquid level measurement in all types of cooling and heating systems including Heat pumps application and oil return sensor.

The Liquid level switch is used to detect the presence of liquid at a certain level. The switch has an SSR output function which is activated by the liquid level. The SSR output can e.g. be used for alarm indication or control signal.

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

With the TTLLSW and the High-end technology within the capacitive measuring principle, combined with integrated AI technology and conductance measurements it takes the Liquid Level Switch 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, which also adds the features of only having one mechanical part. Use the same mechanical part for everything, just configure the switch for the selectable use via TT SmartConfig App.

All sensors have built-in 1000VAC Galvanic Isolation – Increase reliability and sensitivity.

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 be used within all types of refrigerant media.

TTLLSW 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 TTLLSW detects all types of refrigerant media e.g. NH3, CO2, HFC, HFO, CFC, OIL, Alcohol and Water (Pure). The TTLLSW can also be configured as oil return sensor (See section ”Oil - Return sensor”) – Simply connect to the TT SmartConfig App and configure the sensor for the given application.

*Measurement in Butane, Propane, Isobutane is possible, however the TTLLSW is not EX certified.

Features

- Plug and play liquid level switch
- One-point installation
- One switch – 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 and oil return sensor)
- 1000VAC Galvanic Isolation – Increase reliability and sensitivity
- Simplify your order/locally stock – One Switch fits all refrigerant media
- Integrated heater – ambient temperature range -40°C to +60°C
- High pressure up to 150 bars
- Refrigerant media temperature -60°C to 150°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
- *Augmented reality – multiple sensor information through TT SmartConfig App (coming features)*

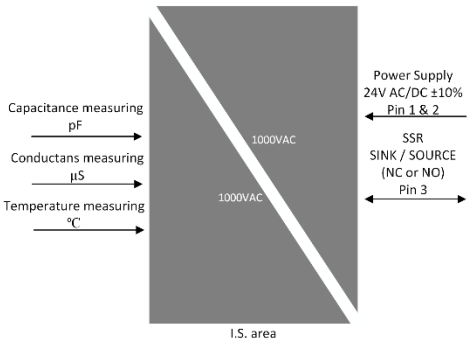
Product Specification

General	
Dimension Insert (L x D) / Outside (L)	90 x Ø15 mm / 145mm
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%, ISO4400/DIN43650 Plug
Power Consumption	Max 600mW with heater ON
Power Output Current	Maximum 100mA
Galvanic Isolation	1000 VAC
Thread Connection	½" BSPP, ¾" BSPP, ½" NPT, ¾" NPT
Environment	
Protection Degree	IP66
Ambient Temperature	-40 to +60°C
Compatible Refrigerant media	NH3/Water (Pure)/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 +150°C CO2: -55 to +30°C
Max Pressure	150 bar
Input	
None	None
Output	
SSR Output Signal	Source/Sink
Contact function	NO/NC
LED Indication	1 x Blue, 4 x Red, 4 x Green
Wireless	
BLE	Protocol: 5.1 Sensitivity: -88 dBM Transmit power: +8 dBm
AR – Augmented Reality (coming)	*Protocol: TT-Custom*
APP Interface	TT SmartConfig App

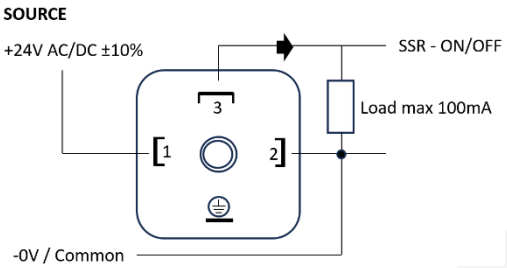
*Measurement in Butane, Propane, Isobutane is possible, however the TTLLSW is not EX certified.

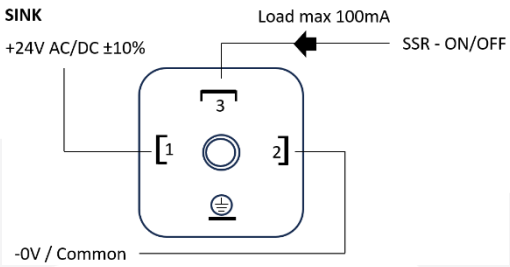
Electrical connection

The TTLLSW liquid level switch can be powered with an external power supply 24V AC/DC ±10% through the standard ISO4400 valve plug connector. The TTLLSW is 1000VAC galvanic isolation for increasing reliability and sensitivity.

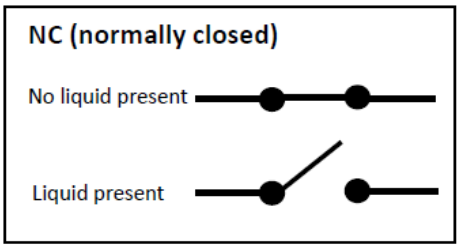


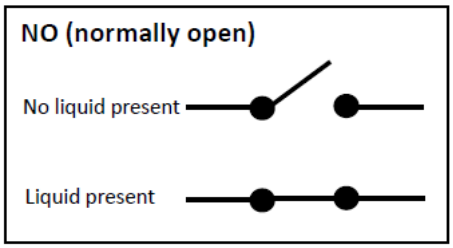
Via Bluetooth connection to the TT SmartConfig app, the SSR output contact can be configured to either source the current output or to sink the current input. See the wiring diagram below for electrical wiring of the switch.



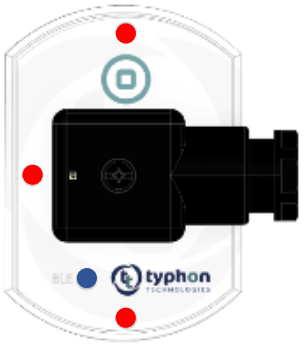


When liquid is present the switch toggles the SSR contact, the SSR contact can be configured as NO (Normally open) or NC (Normally closed). The initial state is when there are no liquid surrounding the switch.





LED Indication



1 x Blue BLE LED on means Bluetooth connection active

1 x Blue BLE LED flashing indicates Bluetooth active

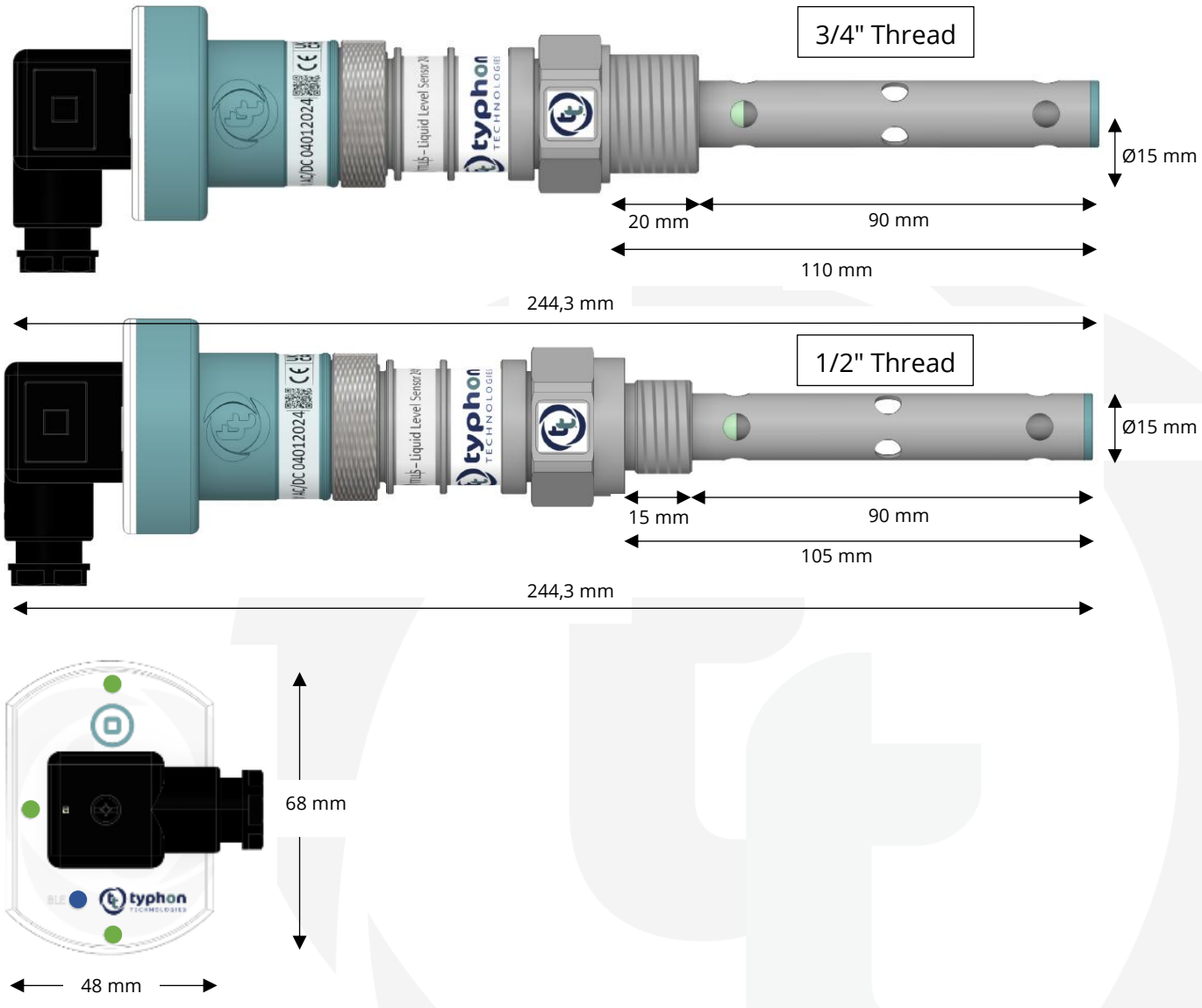
4 x Red LED's Indicate refrigerant media present

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

4 x Green LED's indicate alive signal and no refrigerant media present

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

Dimension



Sensor Configuration

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

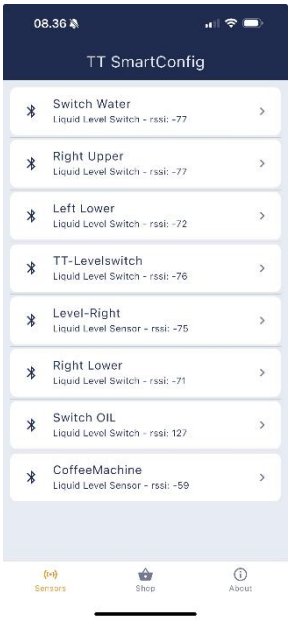
Always download or update to the latest app version.

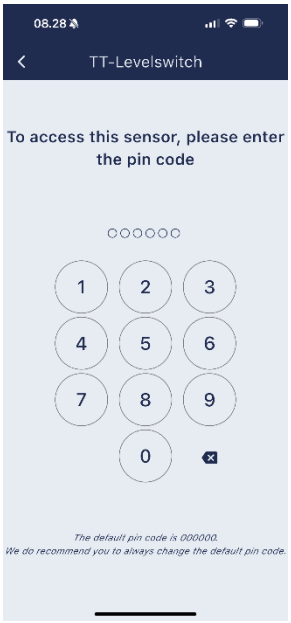
The configuration of the parameter setting of a Typhon Technologies (TT) sensor is done by opening the app and performing a scan for devices. The app will get a list of all TT sensors that are present at the actual location. The list will include a name, ID and RSSI value for each of the present TT sensors.

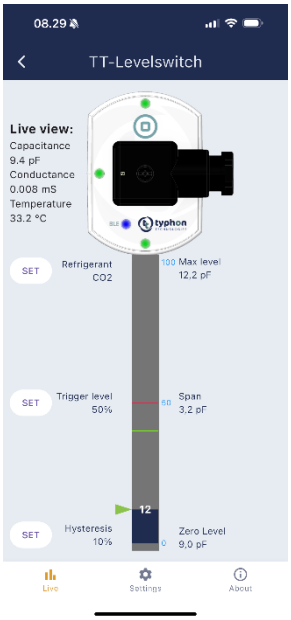
The name and configurable parameters of any sensor can be changed at any time.

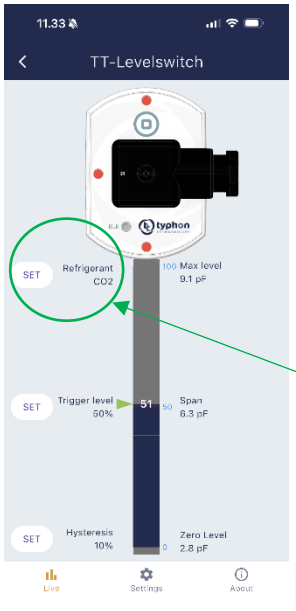
1. Press the button for activating Bluetooth (It's enabled for 5 minutes, if no connection is made.) The blue LED is flashing.
2. Connect the first item on the list and observe which sensor's Blue LED is constantly on.
3. Log-in with the provided PIN code. (Default code is 000000. For safety reasons the PIN code should be changed afterwards)
4. PIN code can be cleared by pressing the button on the sensor for 10 seconds. Blue LED turns on after 10 seconds to indicate PIN code reset.
5. Rename the device to an up to 24 symbol name (14 symbols displayed)
6. Check the parameter settings and if needed change one or several parameters. E.g. refrigerant media type, SSR State (NO/NC).
7. *Save and share the settings in text file. (coming)*
8. Disable the communication and observe that the blue LED starts flashing (Bluetooth is enabled 5 minutes after communication is disabled – blue LED is off)
9. This sensor is now ready for operation
10. If more sensors are present, connect to the next item on the list, and repeat steps 1 to 8

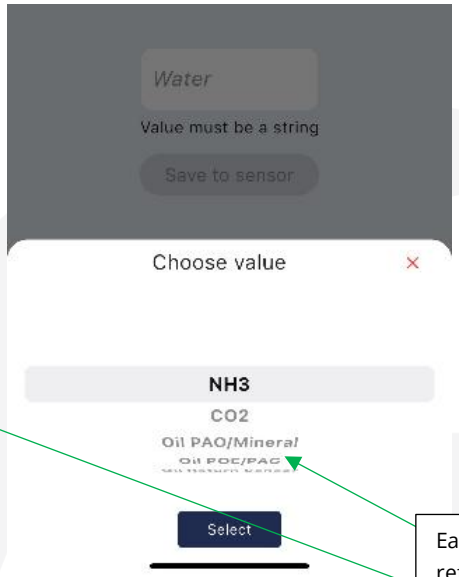
Simple Sensor Configuration











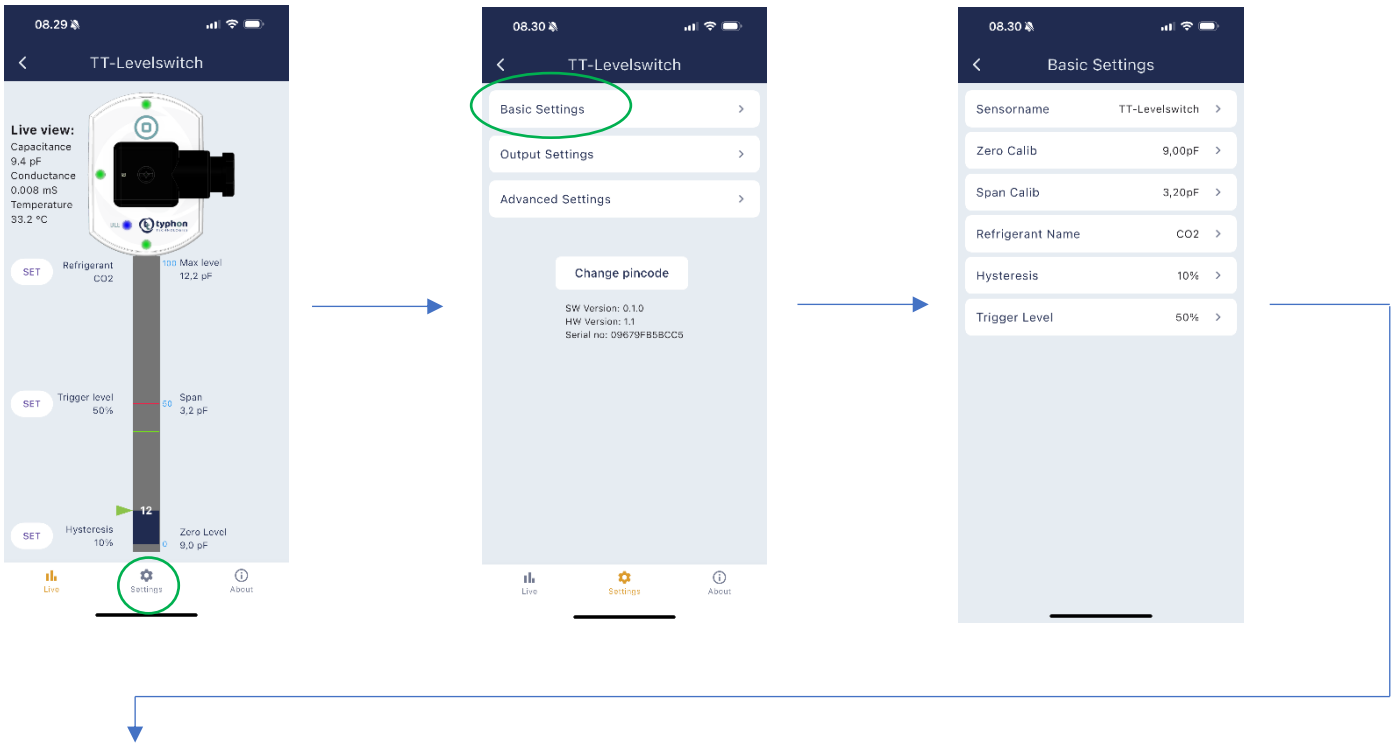
Easy configuration of Refrigerant – Select refrigerant from drop down list – Sensor is automatically calibrated for the selected refrigerant.

The sensor is ready to use after selectable of refrigerant!

Oil return sensor – see section Oil - Return sensor

Change relevant functions, if necessary, under “Basic Settings”, “Output Settings” and “Advanced Settings”.

Basic Settings



Sensorname: can be changed to e.g. “Vessel low”. Maximum 16 letters

Zero Calib: Change the zero calibration manually - This value is automatic calculated when Refrigerant is changed.

Span Calib: Change the zero calibration manually - This value is automatic calculated when Refrigerant is changed.

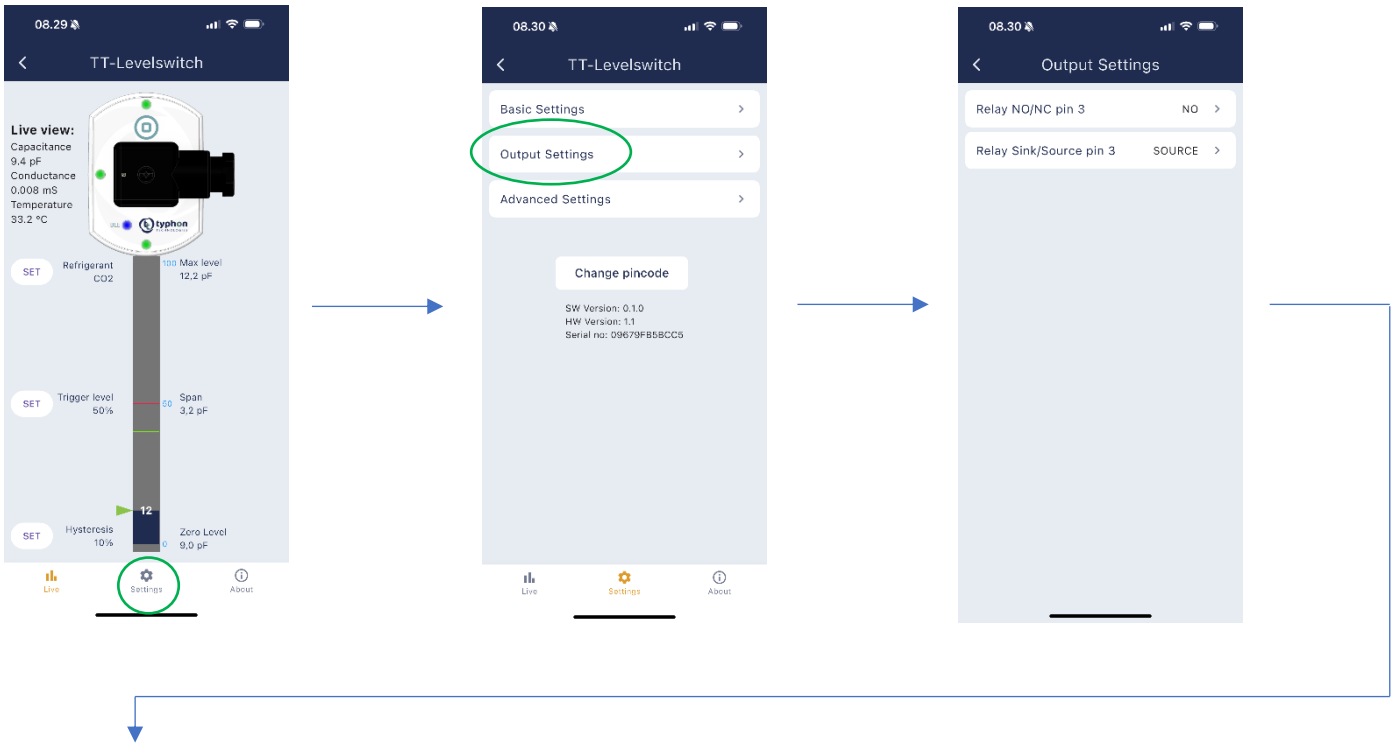
Refrigerant Name: Set the refrigerant type, oil or Oil return which the sensor should be used for.

Hysteresis: Default is set to 10%, which is the level below Trigger Level when the switch does not indicate liquid.

Trigger Level: Default is set to 50%, which is the level when the switch indicate liquid

E.g. Actual Percent = 60 -> Switch is indicating liquid present (Switch ON)
E.g. Actual Percent = 42 -> Switch is indicating liquid present (Switch ON)
E.g. Actual Percent = 39 -> Switch does not indicate liquid present (Switch OFF)

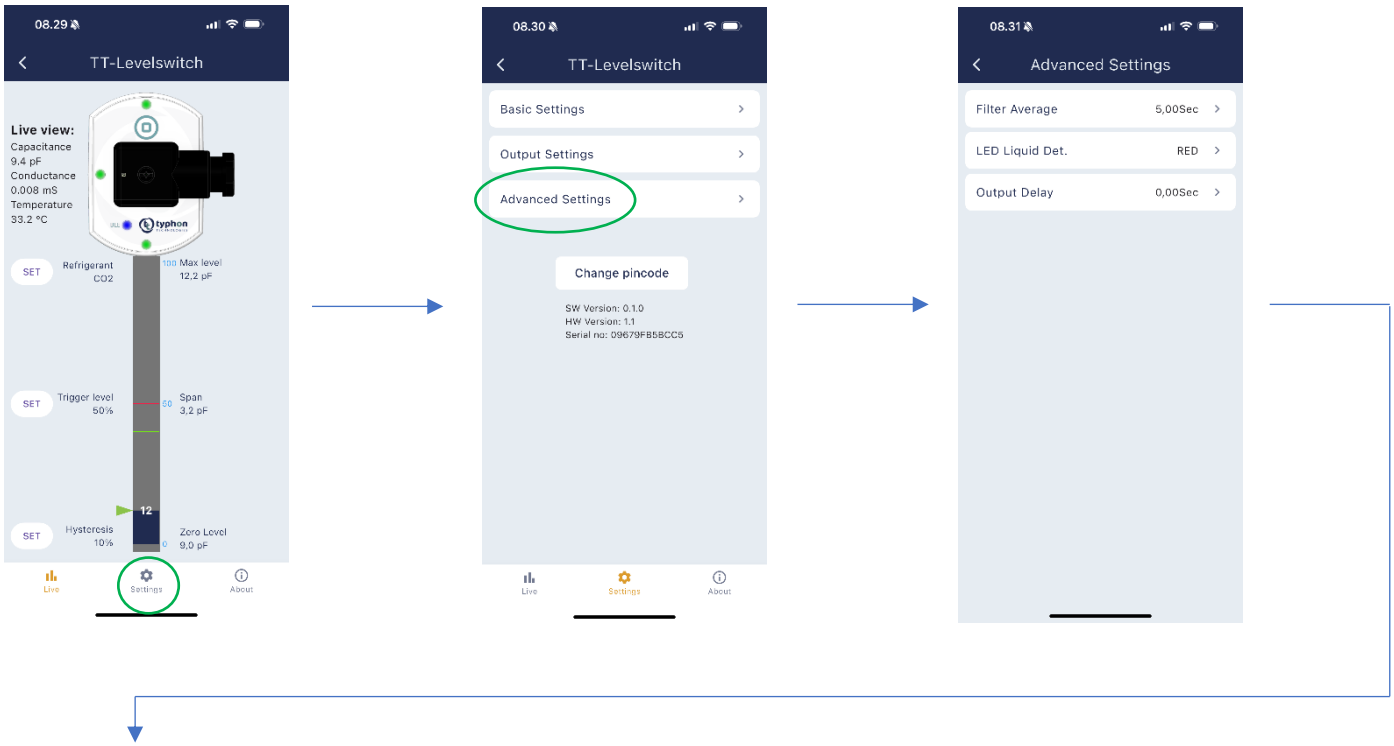
Output Settings



Relay NO/NC pin 3: The state of the relay function can be changed to either NO or NC. See section Electric Connection for further description of NO/NC.

Relay Sink/Source pin3: The relay function can be changed to be either SINK or SOURCE. See section Electric Connection for further description of SINK/SOURCE.

Advanced Settings



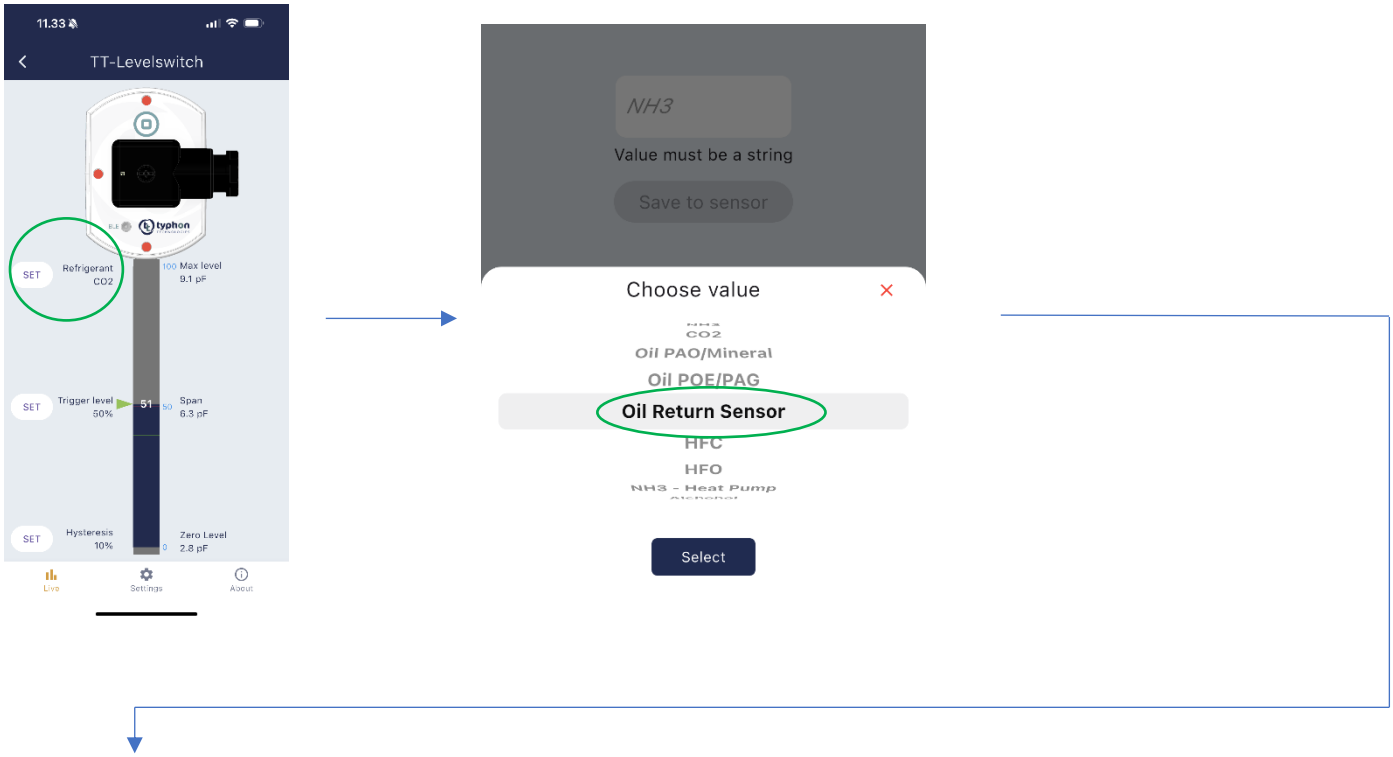
Filter Average: Default set to 5 seconds. If filter average is set to 0, the sensor uses the instantaneous measurement directly, this could cause the sensor to react to fast and be affected by fluctuation in the liquid. Higher filter average value makes the sensor less sensitive for fluctuation in the liquid and a steadier measuring.

LED Liquid Det.: Default set to RED, which means that when refrigerant/oil is present the 4 x LED's is turned on with red light. When there are no refrigerant/oil present, the 4 x LED's is changed to green, which indicates the sensor is working but no refrigerant/oil is present.

If this setting is changed to GREEN, means that when refrigerant/oil is present the 4 x LED's is turned on with green light. When there are no refrigerant/oil present, the 4 x LED's is changed to red, which indicates the sensor is working but no refrigerant/oil is present.

Output Delay: Default set to 0 seconds. The output change of the relay function can be delayed from the sensor is detecting liquid to the change of the output relay is activated. The 4 x LED's is not affected by this delay, the 4 x LED's is turned on as soon the sensor is detecting liquid.

Oil - Return sensor



Oil – Return sensor:

Setting the Liquid Level Switch to "**Oil – Return sensor**" the switch can be used for automatically oil return in e.g. oil pot. When the "**Oil return sensor**" settings are selected, the switch distinguish between oil and ammonia.

When the switch is detecting oil, the output signal will be activated. Connecting the output signal from the Switch to e.g. an PLC, the output signal can be used for starting the oil return draining.

The output signal is deactivated when the Switch is detecting ammonia. When the output signal is deactivated, the PLC stops the oil return draining.

LED Liquid Det.: Default set to RED, which means that when oil is present the 4 x LED's is turned on with red light. When there are refrigerant present, the 4 x LED's is changed to green, which indicates the sensor is working but no oil is present.

If this setting is changed to GREEN, means that when oil is present the 4 x LED's is turned on with green light. When there are refrigerant present, the 4 x LED's is changed to red, which indicates the sensor is working but no oil is present.

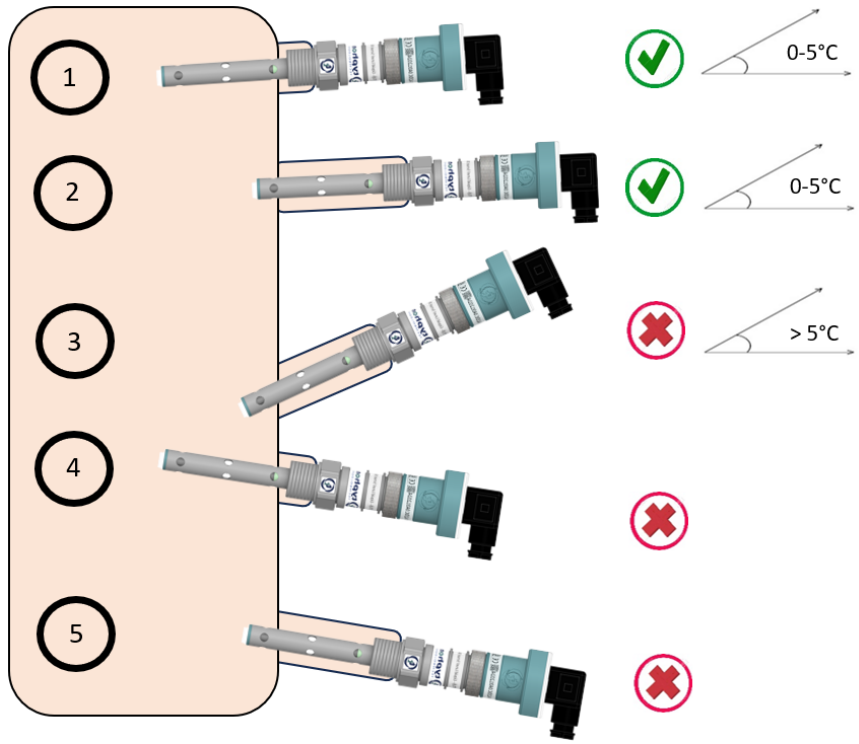
Mechanical installation

The installation of the switch depends on the type of thread, for those with NPT thread, Teflon tape or liquid sealant can be used. Parallel (straight) thread as BSPP is installed with aluminum gasket, which is delivered together with the sensor.

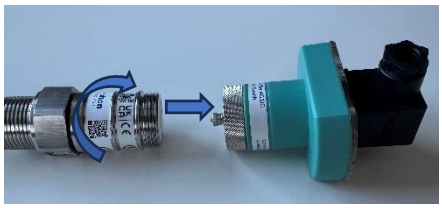
The switch shall as minimum be installed horizontal, and best with a little downwards degree of 0-5 degree. Especially liquid with high viscosity, is recommend having a small downward degree to ensure that liquid can drain from the switch. See installation picture below.

1. Optimal installation with no risk
2. Good installation, ensure maximum angle of 5 degrees, otherwise gas pockets may be trapped. Use this solution when insulation is used.
3. Wrong installation – Gas pockets may be trapped and lead to incorrect measuring.
4. Wrong installation – A little liquid may be trapped and lead to incorrect measuring.
5. Wrong installation – Liquid will be trapped and lead to incorrect measuring.

CAUTION! In the case of welding work on the unit, we recommend removing the electronic head or at least making sure that proper earthing is carried out to avoid damaging the electronics.



1) Unmount the electronic head before installing the mechanical part



2) Mount the mechanical part in the standpipe, ensure correct sealing depending on the type of thread, please refer to the description above for which sealing is recommended.

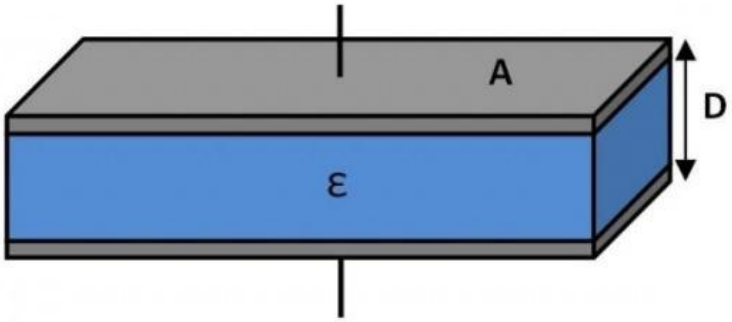
3) After mounting the mechanical part, attached the electronic part, connect the power cable and power on the sensor. Configure the sensor by following the step in section “Simply Sensor Configuration”.

Measuring principle

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: εr = 1; Measuring medium: εr > 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 TTLLSW switch 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 the 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 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