

FLD-03 and FLD-04
Installation and Configuration Manual

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P.30009.UMA.000006

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1 INTRODUCTION

1.1 Scope

The scope of the present document is to provide necessary information for the correct installation, configuration and security handling of the Fuel Level Display model FLD-03 and FLD-04.

2 GLOSSARY

2.1 Glossary

AP	Access Point
FLD	Fuel Level Display
EMI	Electro-Magnetic Interference
FW	FirmWare (on board SW)
HW	HardWare
LSI	Leonardo Sistemi Integrati
N/A	Not Applicable
PC	Personal Computer
PCB	Printed Circuit Board
p/n	part number
SI	Système International
s/n	serial number
SW	SoftWare
TBC	To Be Confirmed
TBD	To Be Defined

3 DECLARATION OF CONFORMITY



EU Declaration of Conformity

Document number:

P.30009.DEC.000007

We:

Leonardo Sistemi Integrati S.r.l.
Via Greto di Cornigliano, 6r - 16152 Genova
(ITALY)

Declare that the product models:

FLD-03

P/N:

P.30009.ASY.000035 (FLD-03)


Description:

Fuel Level Display

Is in conformity with the relevant directives:

Directive 2014/34/EU (ATEX)
Equipment for explosive atmospheres
Directive 2014/53/EU (RED)
Radio Equipment
Directive 2011/65/EU (RoHS)
Restriction of the use of certain hazardous substances

By means of the harmonized standards:

Directive 2014/34/EU (ATEX)
EN IEC60079-0: 2018
EN 60079-1:2014
EN 60079-11:2012
IEC 60079-11:2023
 **II 2(1)G Ex db [ia IIC Ga] IIB T4 Gb**
-20°C ≤ Ta ≤ +55°C

Notified body number:
2261

Type examination certificate:
TÜV CY 24 ATEX 0207027X

Directive 2014/30/EU (EMC)
EN 61000-6-2
EN 61000-6-3

Signed:

Date:

12/12/2024

The Declaration certifies the conformity with the directives mentioned. The safety instructions contained in the installation manual accompanying the product have to be observed. If the apparatus is modified without having obtained the manufactures prior consent and/or if instructions aren't followed, this Declaration is void



EU Declaration of Conformity

Document number:

P.30009.DEC.000006

We:

Leonardo Sistemi Integrati S.r.l.
Via Greto di Cornigliano, 6r - 16152 Genova
(ITALY)

Declare that the product models:

FLD-04

P/N:

P.30009.ASY.000036 (FLD-04)


Description:

Fuel Level Display

Is in conformity with the relevant directives:

Directive 2014/34/EU (ATEX)
Equipment for explosive atmospheres
Directive 2014/53/EU (RED)
Radio Equipment
Directive 2011/65/EU (RoHS)
Restriction of the use of certain hazardous substances

By means of the harmonized standards:

Directive 2014/34/EU (ATEX)
EN IEC60079-0: 2018
EN 60079-1:2014
EN 60079-11:2012
IEC 60079-11:2023
 **II 2(1)G Ex db [ia IIC Ga] IIB T4 Gb**
-20°C ≤ Ta ≤ +55°C

Notified body number:
2261

Type examination certificate:
TÜV CY 24 ATEX 0207027X

Directive 2014/53/EU (RED)
EN 62368-1
EN 300 328 v.2.2.2
EN 301 489-1 v.2.2.3

Signed:

Date:

12/12/2024

The Declaration certifies the conformity with the directives mentioned. The safety instructions contained in the installation manual accompanying the product have to be observed. If the apparatus is modified without having obtained the manufactures prior consent and/or if instructions aren't followed, this Declaration is void

4 SYSTEM DESCRIPTION

FLD-03 system is a configurable device that implements the following functions:

- Level probes reading (up to 5 probes) through RS-485 bus and relative power supply - suited for: **Fafnir Universal Device Protocol level probes**
- Input / Output lines management:
 - ◆ RS-232 (on USB link) for local configuration
 - ◆ 2 Open-drain output (General Purpose Output)
 - ◆ RS-485 serial line for general purpose wired communication
- 2 inches graphical TFT display.

FLD-03 is identified by the p/n P.30009.ASY.000035 and is made up of these main parts:

- Electronic assembly p/n P.30009.ASY.000037, including:
 - ◆ Display board p/n P.30009.PCB.000016 (and related firmware)
 - ◆ External I/F board p/n P.30009.PCB.000017
 - ◆ Internal cable p/n P.30009.EWS.000008
 - ◆ Cable lock p/n P.30009.MEC.000032
 - ◆ Display p/n P.30009.PCH.000084
 - ◆ Display support P.30009.MEC.000037
- Heat sink p/n P.30009.ASY.000039 (Aluminum sheet with thermal pad)
- Flameproof enclosure p/n P.30009.PCH.000076 (3 x ½" NPT female hole) or p/n P.30009.PCH.000081 (3 x M20 female hole)
- Cable gland (x2) p/n P.30009.PCH.000078 (½" NPT) or p/n P.30009.PCH.000082 (M20)
- Hole plug (x1) P.30009.PCH.000077 (½" NPT) or P.30009.PCH.000083 (M20)

Additional cable gland for Modbus connection and/or Output controls (hole plug in place as default provision) can be ordered with the above specified p/n.

FLD-04 has the same features of the FLD-03 adding:

- a WiFi connection to locally broadcast the information

In the following, FLD-03 and FLD-04 are referred as FLD if not otherwise specified.

4.1 Technical features

FLD is a full range supply devices:

- Voltage: 10V to 30V direct current
- Rated Current: < 500mA
- Operating temperature: -20°C to +55°C
- Ingress protection: IP66 (IEC 60529)

4.2 FLD external view

The following figure shows an external view of the FLD.

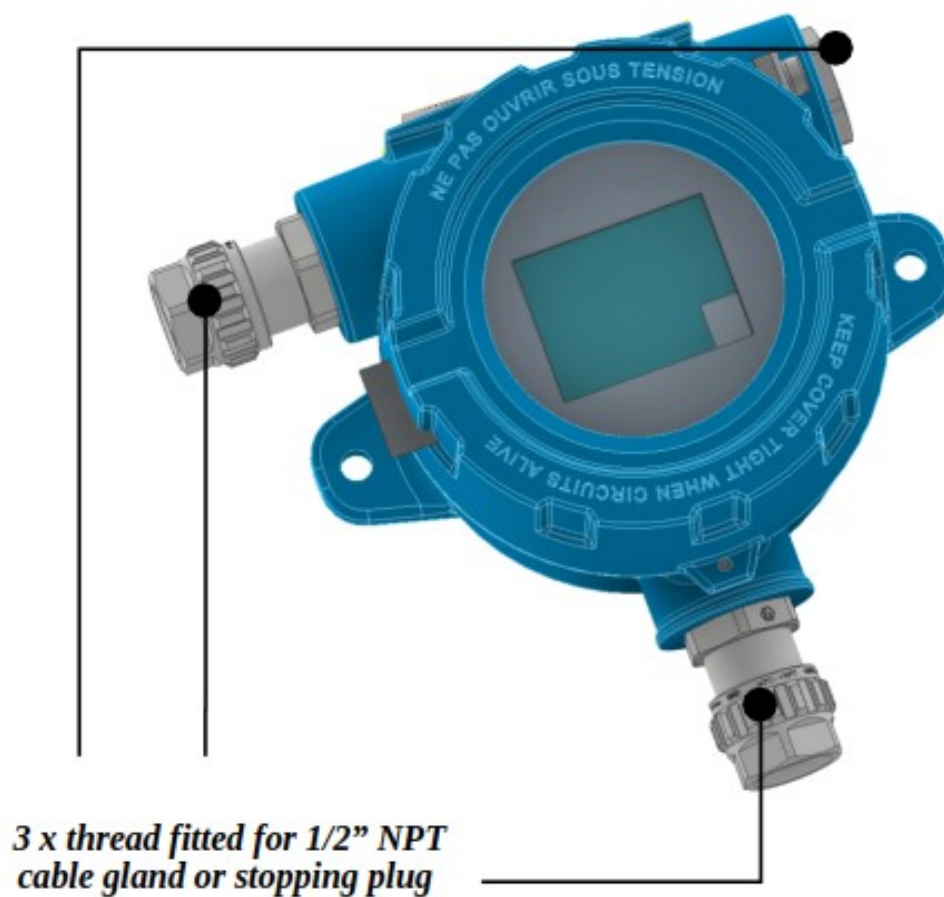


Figure 1 - FLD external view

5 SYSTEM INSTALLATION

5.1 Foreword

Every damage attributable to the negligence or inexperience of the installation staff is not covered.

The following picture schematically shows the FLD assembly.

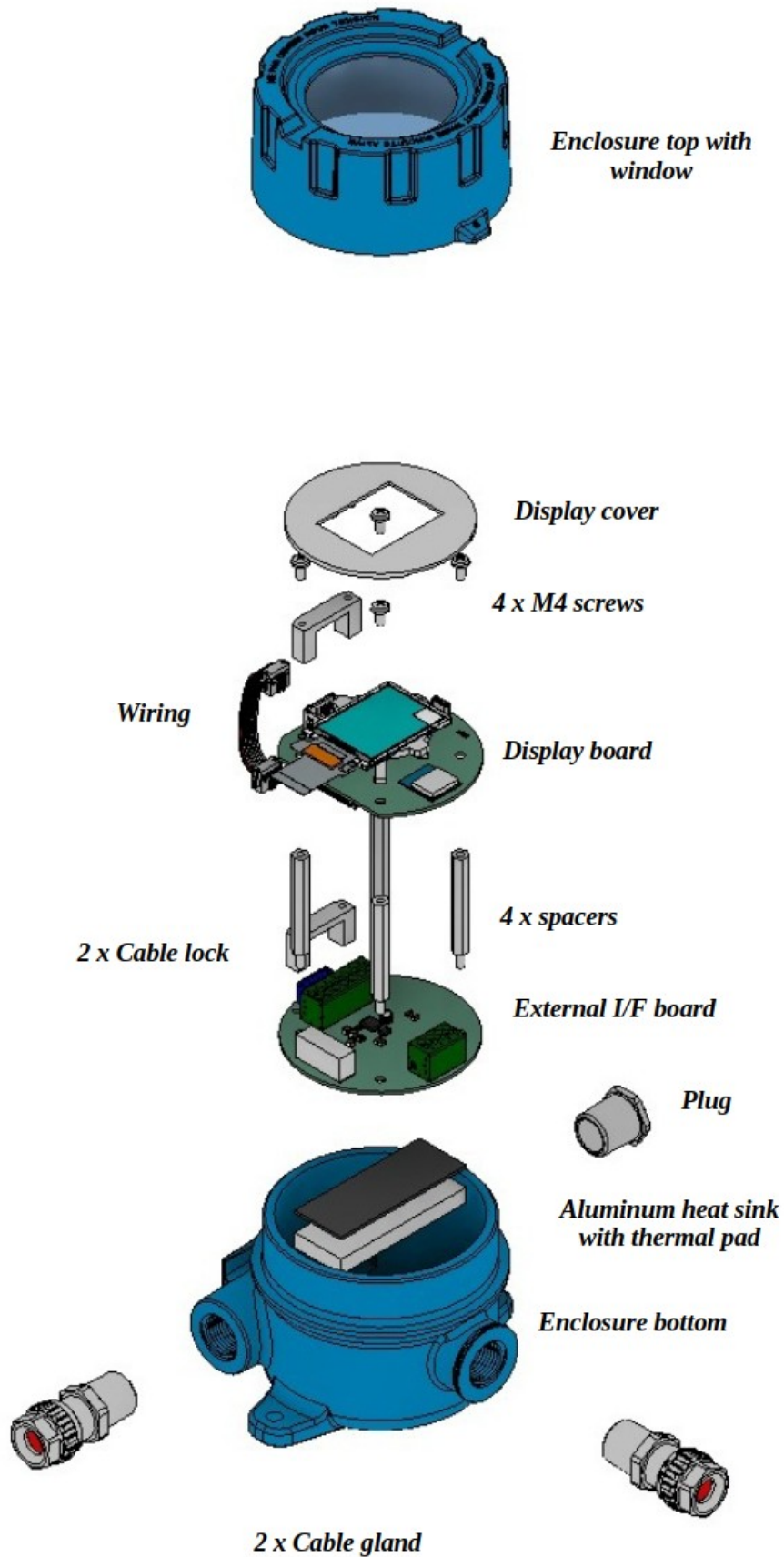
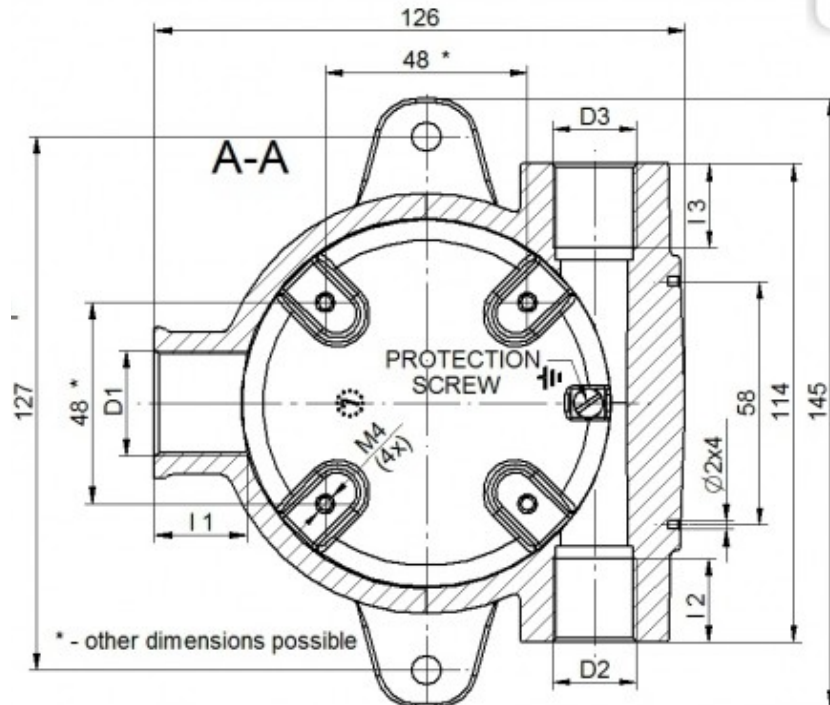


Figure 2 - FLD assembly

5.2 Mechanical installation

Install the FLD in appropriate area using the suitable drillings on the flange of FLD.



Suggested screw diameter for fixing: M6

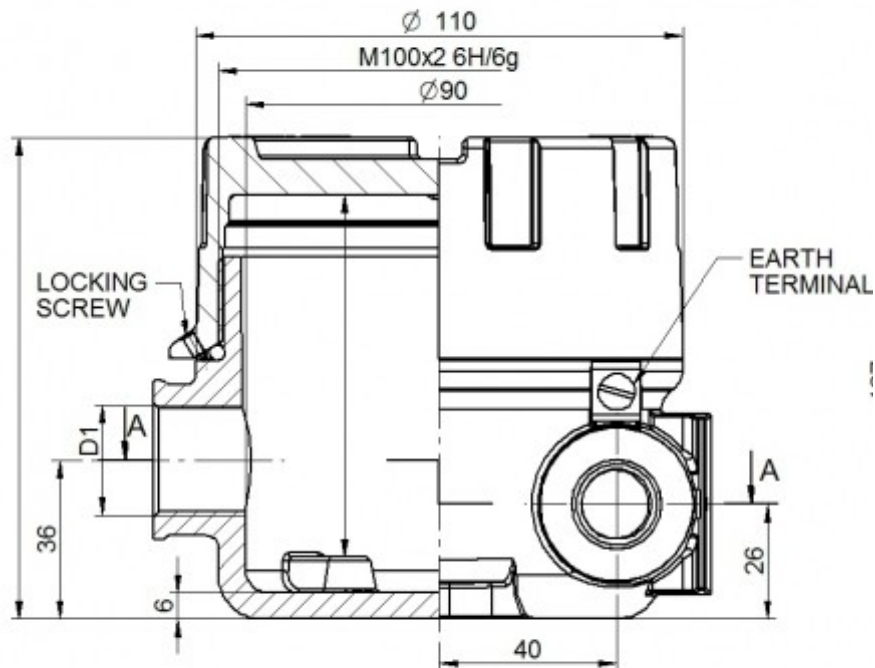


Figure 3 - FLD enclosure dimensions

5.3 Grounding

Safety grounding of the FLD shall be made by means of a dedicated wire connected to the Earth Terminal shown in Figure 3.

The minimum required wire section is: AWG 17 (1mm²).

5.4 Electrical connections

In order to access the external interface connectors on the External I/F board, the FLD shall be opened (see paragraph 5.5 for how to open and close the flameproof enclosure) and the Display board shall be removed (4 x M4 screws shall be removed).

NOTE:

It is not required to disconnect the flat cable between the Display board and the External I/F board because the Display board can be flipped upside-down – **be careful in order to avoid any damage to the TFT Display (not covered by warranty).**

5.4.1 Power supply

Connect power cable (2 wires) according to the following indications:

- Insert power cable through the specific cable gland;
- Connect the power cable wires to the relative spring terminals block, according to the information on the PCB silk-screen (see Figure 4).

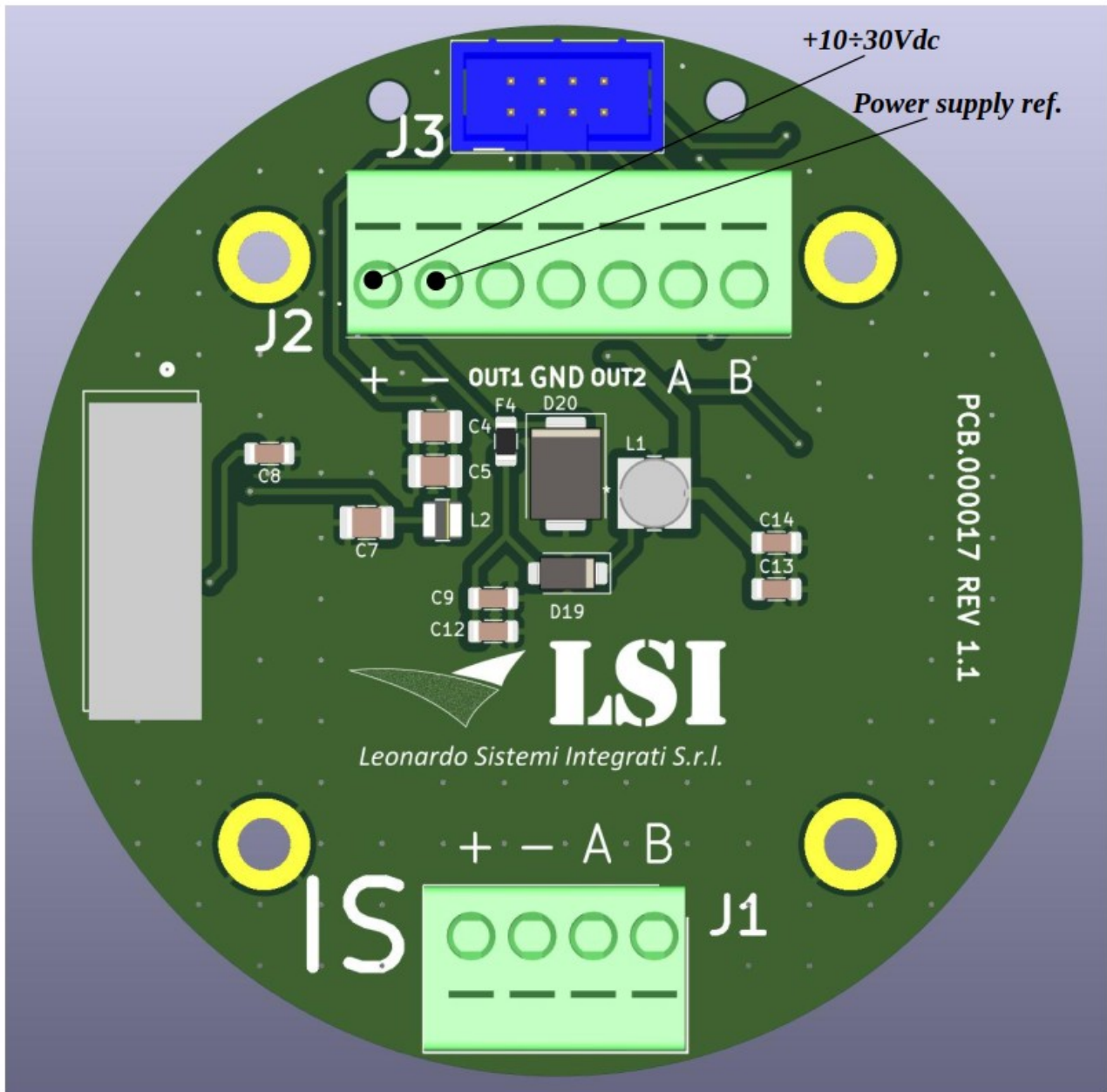


Figure 4 - Power supply connection (J2)

NOTE:

The FLD is protected against polarity inversion: in case of reverse polarity the unit will not power on without any damage.

WARNING:

Do not supply power in EX area, until system is fully installed and the flameproof enclosures is completely closed and locked (see para. 5.5).

Cable gland manufacturer provide tolerance on the dimension of the cable outer diameter: from 6mm to 12mm.

5.4.2 Level probe

Connect probe cable (4 wires) according to the following indications:

- Insert probe cable through the specific cable gland;
- Connect the wiring of probe to the relative spring terminals block, respecting the information on the PCB silk-screen (see Figure 5).

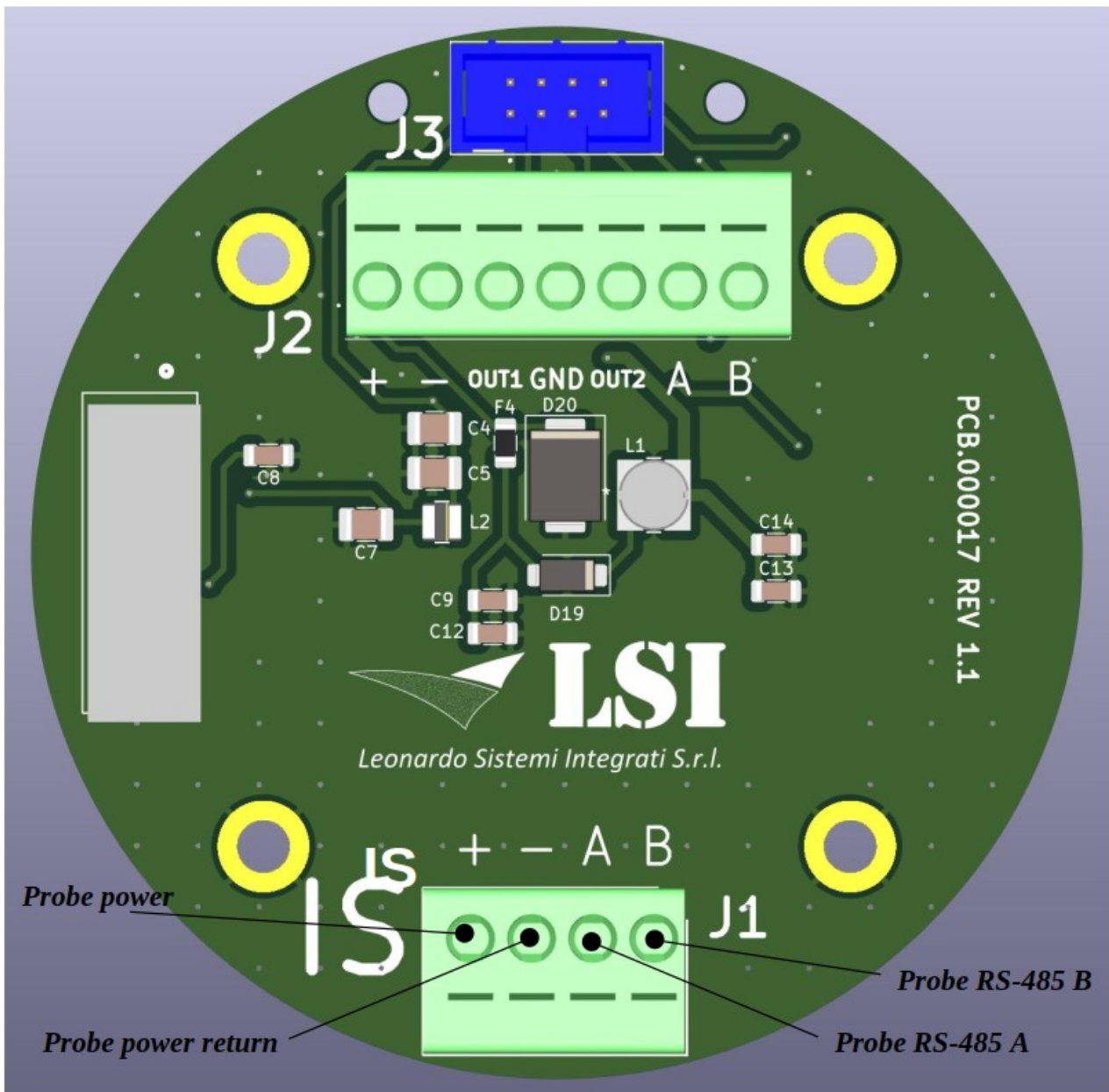


Figure 5 - Level probe connection (J1 – IS connector)

The following table report the signals distribution on to the relative external probe connector.

External probe connector pin	Signal	Function	Wire color
3	PROBE GROUND	Power Return	Blue
1	PROBE POWER	Probe Power Supply	Brown
2	PROBE A	RS-485 communication interface	White
4	PROBE B		Black

Table 1 - Level probe cable wiring

The following picture schematically shows different pins of the level probe connector that the system FLD use.

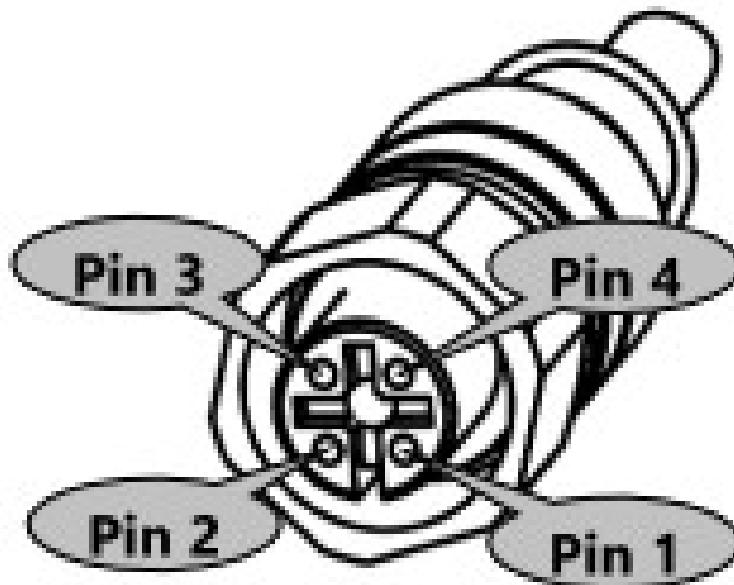


Figure 6 - Level probe connector

WARNING:

Cable gland manufacturer provide tolerance on the dimension of the cable outer diameter: from 6mm to 12mm.

5.4.3 Modbus

Connect the Modbus cable (2 wires RS485) according to the following indications:

- insert probe cable through the specific cable gland;
- connect the two-wire cable to the relative spring terminals block, respecting the A and B information of the PCB silk-screen printed in the figure below.

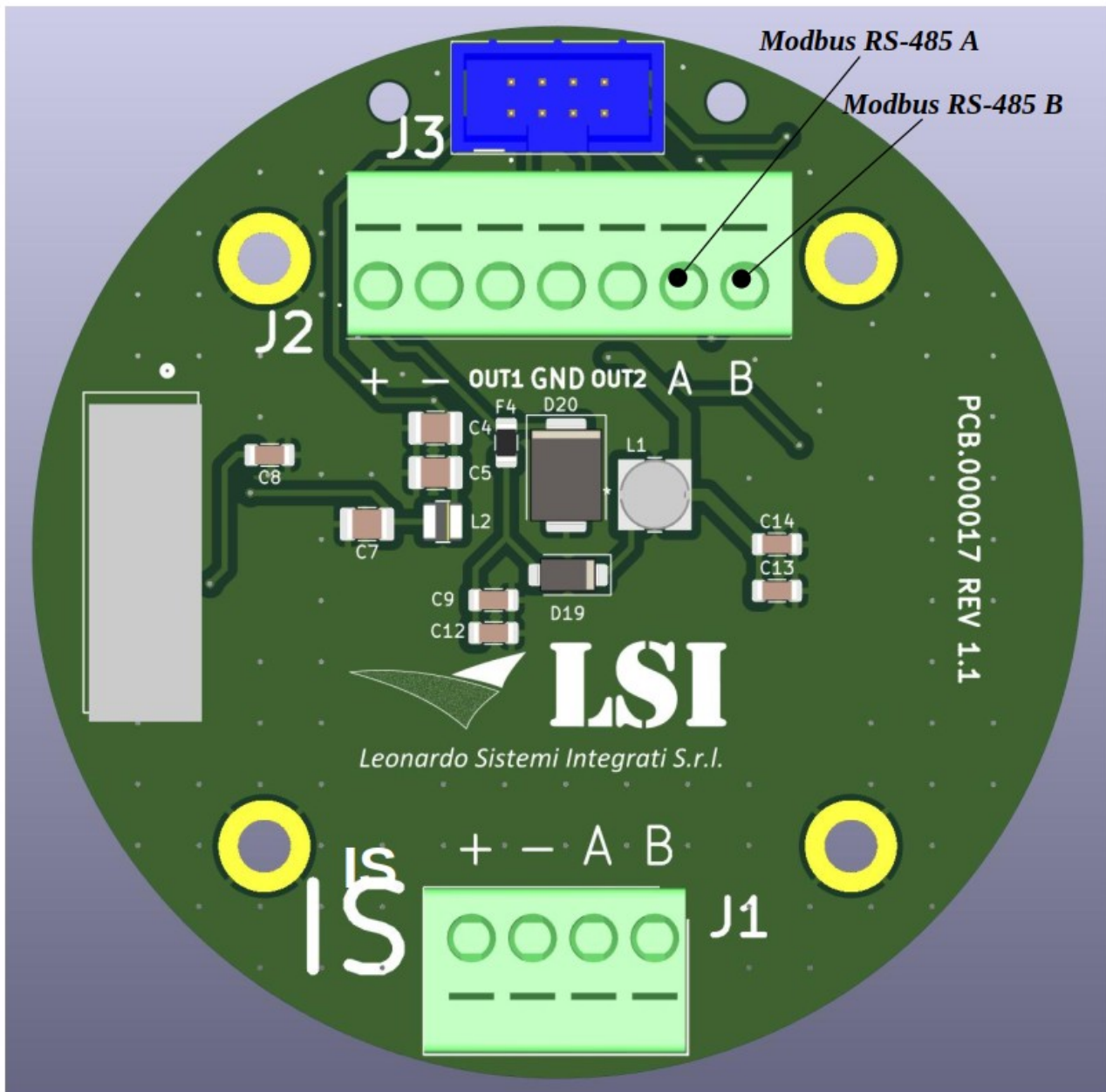


Figure 7 - MODBUS over RS485 wire connection

WARNING:

Cable gland manufacturer provide tolerance on the dimension of the cable outer diameter: from 6mm to 12mm.

5.4.4 Output

The FLD can handle two output useful for load control in case of configured alarms (e.g.: siren, light, ...) or via Modbus protocol.

The outputs are configured as open-drain and can manage 12V to 24V direct current load only.

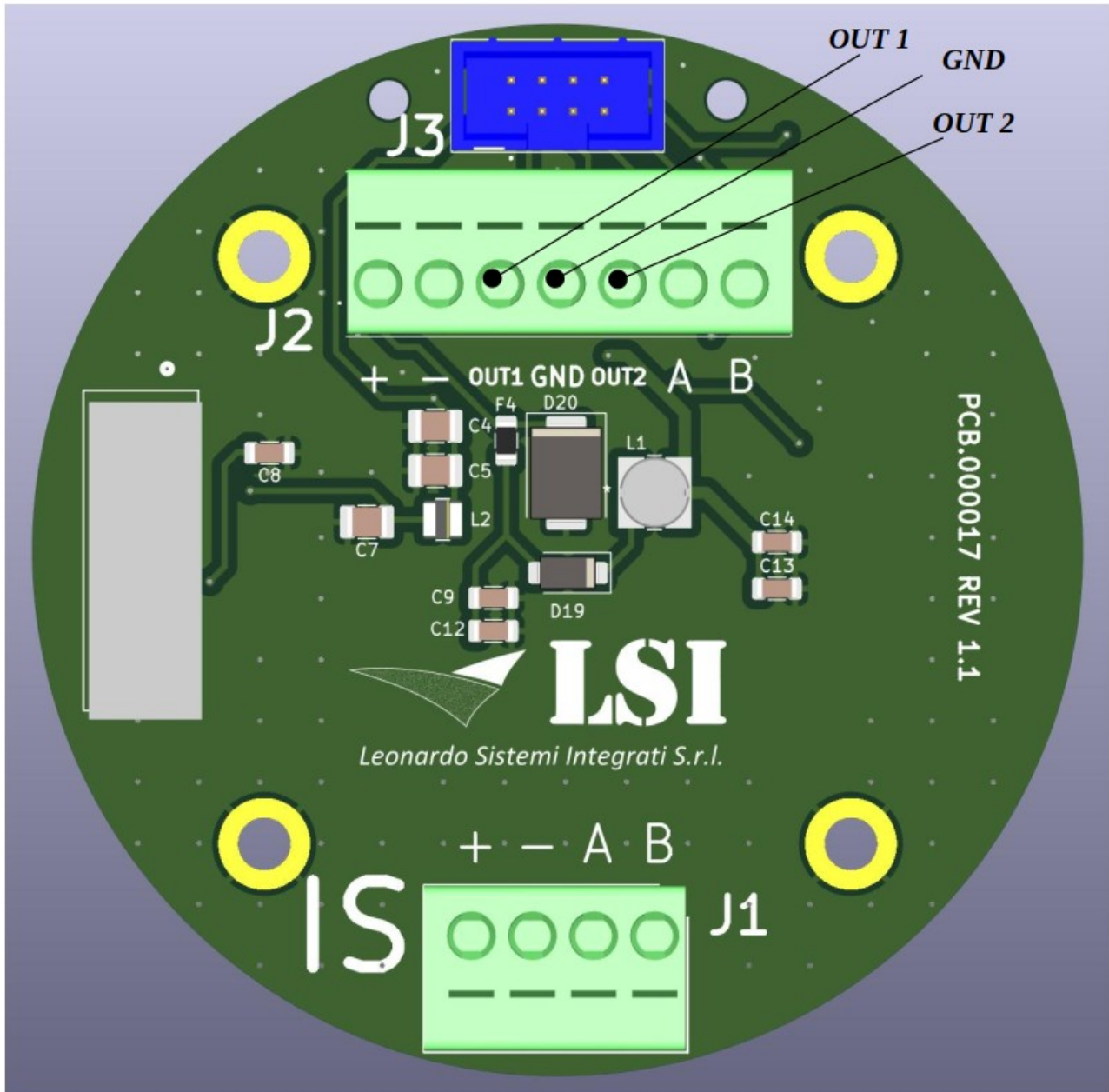


Figure 8 - Output connections

The following diagram shows the schematic for the connection of external load.

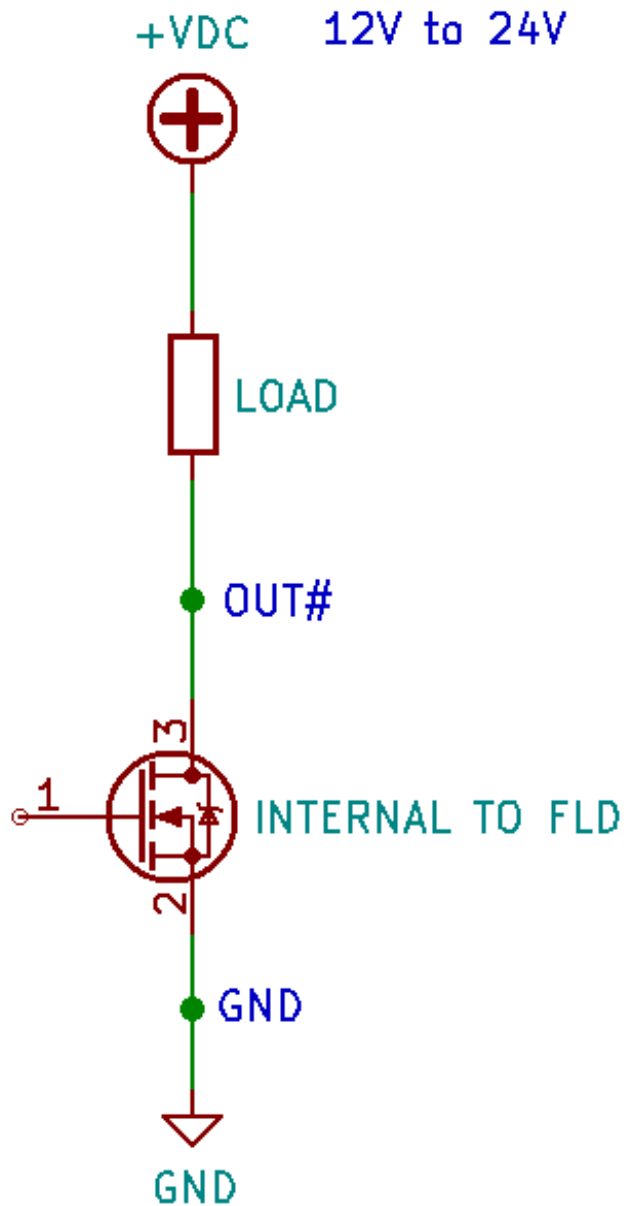


Figure 9 - Output load schematic diagram

WARNING:

The maximum admitted voltage is +30Vdc; no warranty cover if overvoltage is applied.

The maximum admitted load current is 500mA.

5.5 Flameproof enclosure opening and closing

For any detail see Figure 10.

5.5.1 Opening

- Unscrew the nut (Allen key #1.5mm) on the enclosures cover;
- Unscrew the enclosure cover.

5.5.2 Closing

- Tighten up the enclosure cover with normal hand force until the end.
- Tighten up the enclosure locking nut (Allen key #1.5mm) with normal hand force until the end.

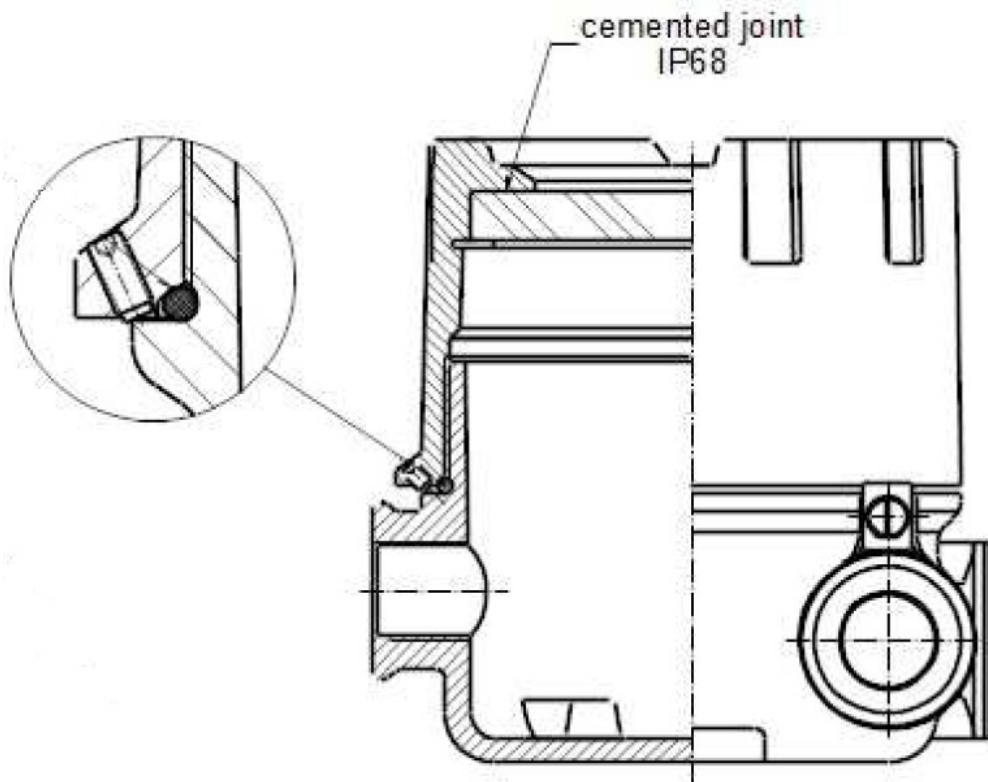


Figure 10 - Enclosure locking nut

6 SYSTEM CONFIGURATION

6.1 RS-232 connection on USB

In order to configure the FLD for the first time, an USB A – USB C cable shall be connected between the programming connector on the FLD (J6 on Display board) and an USB port on a Personal Computer running the SW *FLD Console* (for MS Windows operating system only).

In order to connect the FLD to the *FLD Console*, the following steps shall be carried out:

- Open the flameproof enclosure in a not EX area;
- Remove Covering Display
- Connect the PC to the FLD with the USB A – USB Type C cable (shall be a cable enabled for data link) to the USB port (J6) (Figure 11);
- Switch off (if not already switched off) the FLD;
- Switch on the FLD board;
- Wait for the COM port driver installation on the PC and record the number of COM port;¹
- Run the *FLD Console* on the PC according to next paragraph 6.2.

¹ If driver doesn't install automatically, you can manually download the FTDI driver from website <https://ftdichip.com/drivers/>. Select and find the device driver that you want, and click the driver that is matched with your computer system.

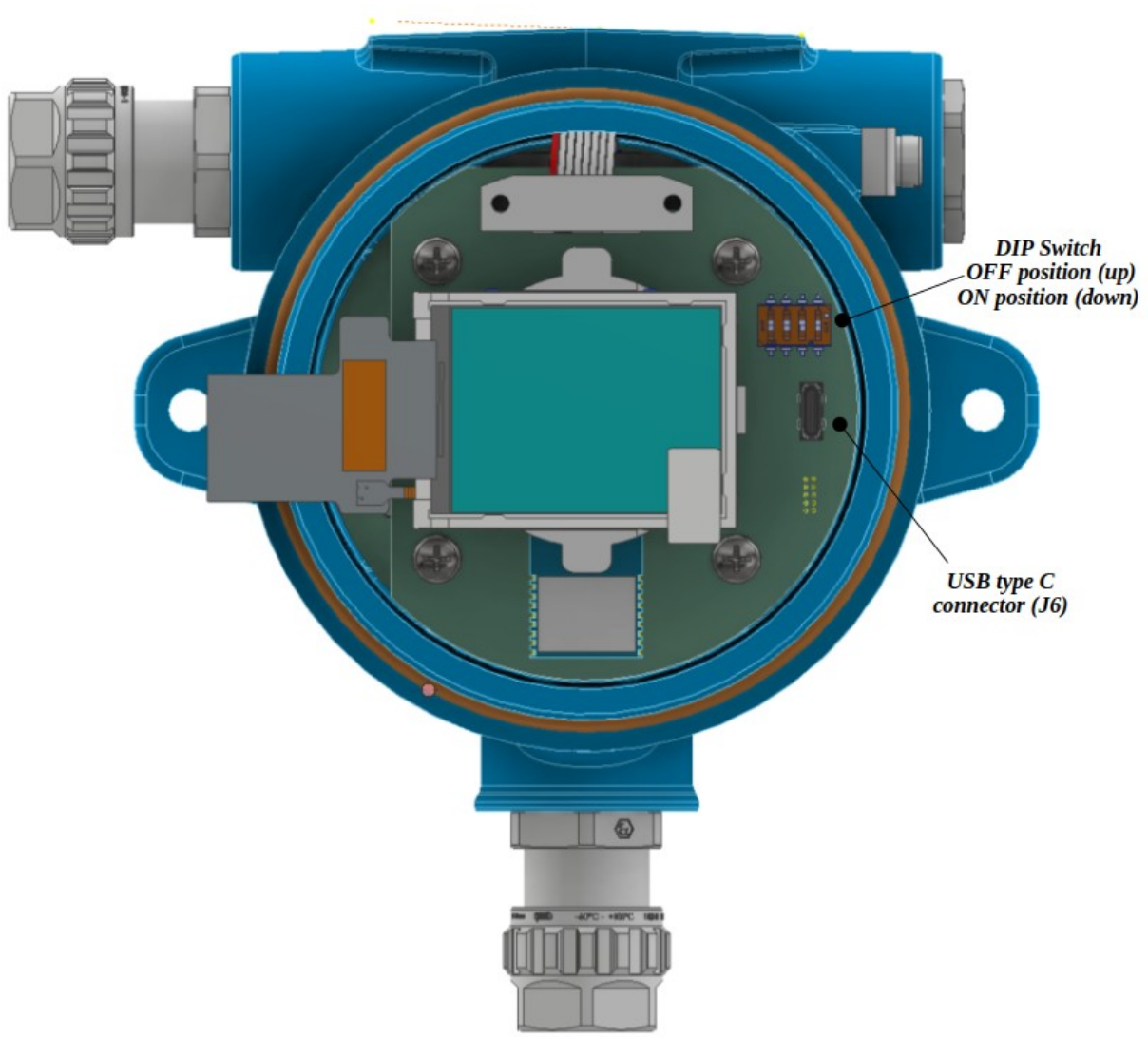


Figure 11 - Programming connector

The following table shows the configuration mode of the Dip Switch.

DIP switch #	ON (Figure 11 - down side)	OFF (Figure 11 - up side)
1	SPARE	SPARE
2	SPARE	SPARE
3	To be enabled when the FLD is used as bus terminator (120ohm) for Probe bus	Normal operating status of FLD
4	To be enabled when the FLD is used as bus terminator (120ohm) for Modbus	Normal operating status of FLD

Table 2 - DIP switch configuration mode

6.2 FLD Console - main window

This paragraph describes in detail the steps to configure the FLD with the appropriate configuration parameters.

The FLD may operate in different modes:

- PROBES (up to 5): to display levels from probes connected to J1 on External I/F board – see Figure 5 and see paragraph 6.3.1 for parameters setting;
- VISY-COMM DISPLAY: to display level messages coming from VISY-COMMAND (FAFNIR) connected to J2 on External I/F board – see Figure 7 and see paragraph 6.3.2 for parameters settings;
- MODBUS DISPLAY: to display information coming from external device (using Modbus Function Codes 6 or 16 – up to five 32bit registers IEEE754 coded) connected by means of RS-485 bus. Additionally, there are two 16-bit registers for controlling the outputs (OUT 1 and OUT 2), making the FLD a control point as well as a display device – see Figure 7 and paragraph 6.3.3 for parameters setting;
- HECTRONIC DISPLAY: to display information coming from up to 5 Hectronic probes. In this mode, the FLD acts as a master unit on RS-485 bus, allowing the user to configure the communication parameters (Baud Rate), a specific command delay, and assign a unique ID and name to each probe. See paragraph 6.3.4 for parameters setting;
- TRANSPARENT MODE: to display levels from probes connected locally (as in PROBES mode) while simultaneously acting as a transparent gateway on the RS-485 bus. In this configuration, the FLD makes the data from its connected probes available to an external master device (e.g., a PLC or SCADA system) upon interrogation, effectively bridging the local probe interface with an external monitoring system. See paragraph 6.3.5 for parameters setting.

The FLD Console shall be used to select the desired operating mode and configure the related parameters, according to the following instructions:

- Select the COM port of the FLD board (for example, in Figure 12 the COM associated with the FLD board is COM53);
- Select the desired operating mode;

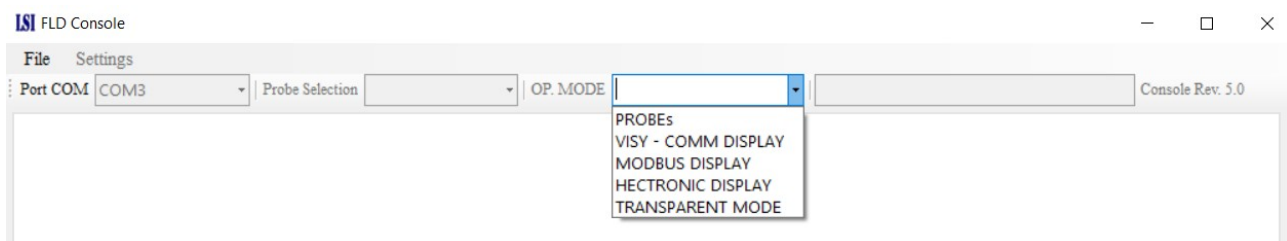


Figure 12 - COM port and operating mode selection

- Configure the parameters for the desired operating mode (see paragraph 6.3 for operating modes parameters) or, otherwise, use the File menu Import configuration to load, if already saved, the configuration parameters from an external file;

- If required use the File menu Export configuration to save the configuration parameters to an external file;
- When the desired parameters have been changed and you are ready to make them operational on the FLD board, in File menu select the Send to Display option to configure the board and wait for the loading process end (see Figure 13 and Figure 14);
- Close the FLD Console program on the PC;
- Switch off the FLD;
- Disconnect the USB A – USB C cable;

The FLD board is now ready for normal operation at the next switch on.

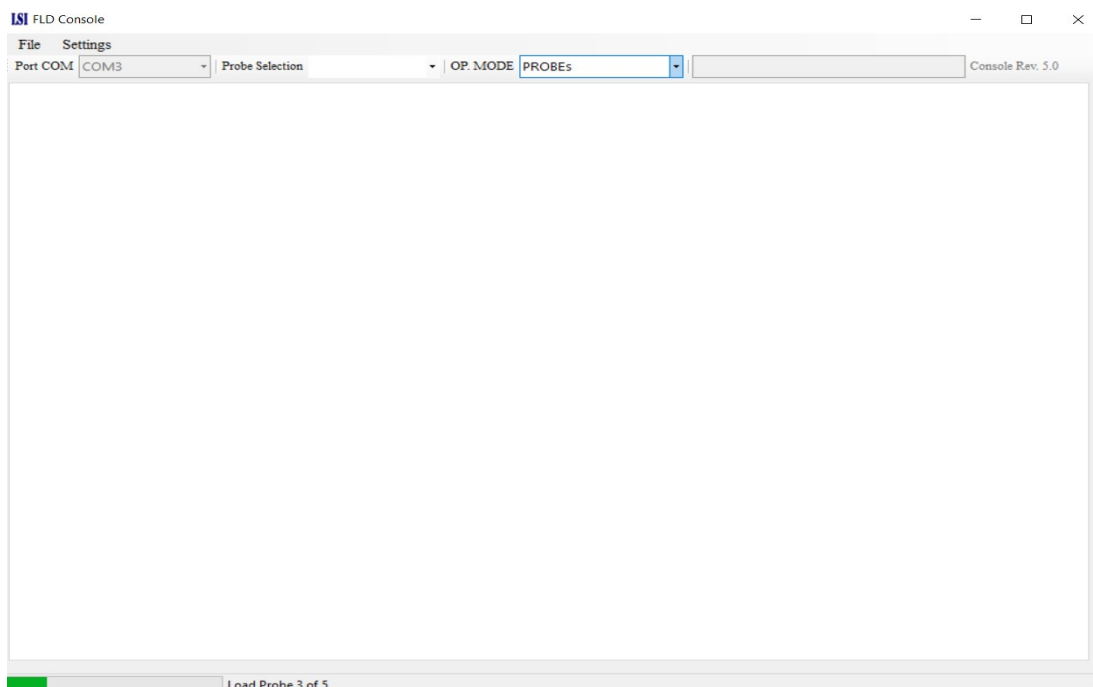


Figure 13 - Data loading process on FLD

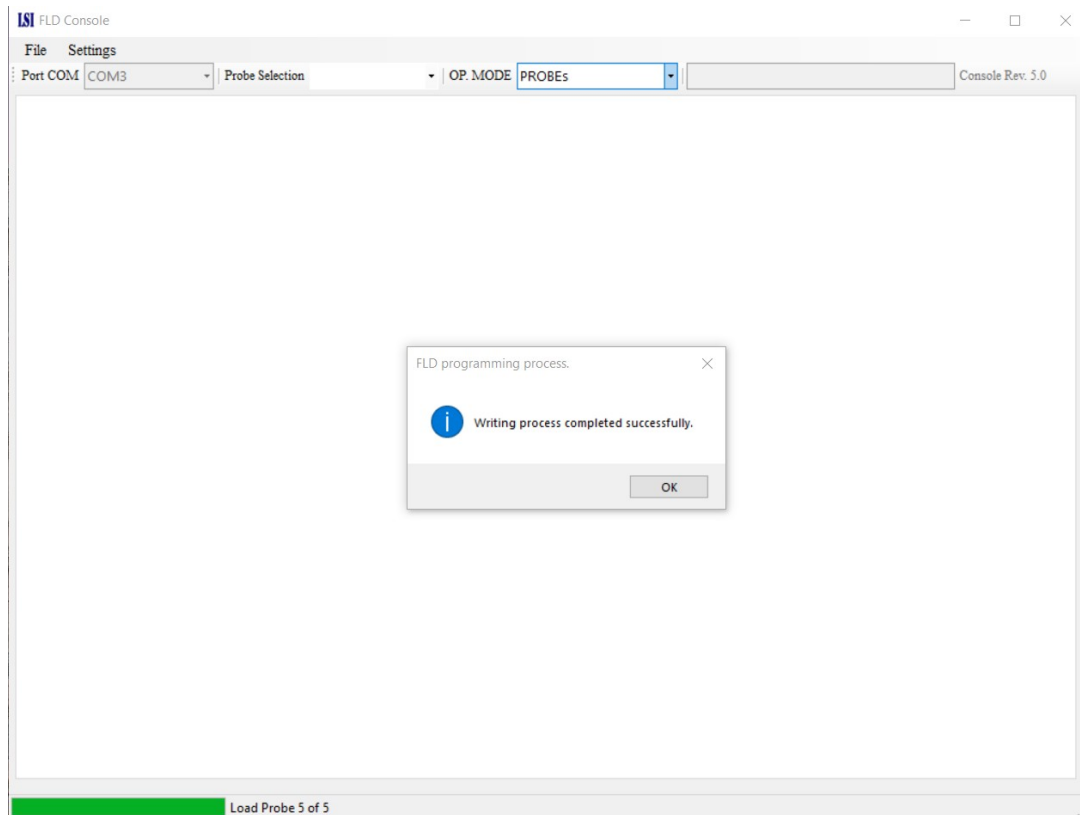


Figure 14 - Data loading process end

6.2.1 File Menu

The File menu shall be used for the following operations:

- Export configuration – to export the full configuration parameters on a .bin file;
- Import configuration – to import the full configuration parameters from a .bin file;
- Send to Display – to load the configuration parameters on the FLD;
- Read Display – to load the configuration parameters of the connected display, on the FLD Console;
- Close – to exit the FLD Console.

WARNING:

The Import command do not automatically load the parameters on the FLD; in order to load the imported parameters, the Send to Display command shall always be used.

The Send to Display command shall be used when the whole parameters have been configured.

NOTE:

The Read Display and Import Configuration commands, will set the operating mode read from the source (form FLD and from file respectively) and the associated tabs will be

opened; from this point the user will be able to change everything according to the required configuration.

6.2.2 Settings menu

This menu shall be used to manage the following global settings:

- DISPLAY;
- WiFi;
- MODBUS.

NOTE:

These settings are applicable for PROBES operating mode only.

6.2.2.1 DISPLAY settings

The DISPLAY settings window, (see Figure 15), is used to configure the following display common parameters for PROBES operating mode only:

- Type of units (Metric (for UE) or Imperial (for US));
- Type of information for a tank level (product level or ullage);
- Compensation for:
 - ◆ Temperature
 - ◆ Road slope

NOTE: these flags can be selected together

- Display time for each kind of window in ms (0 ms means no display):
 - ◆ Summary (one window for each probe enabled);
 - ◆ Complete (one window for each probe enabled with graphic bar);
 - ◆ All tanks (one graphic bar for each enabled probe, in one window);
 - ◆ Alarms (logical OR of the defined alarms for each enabled probe, in one window).

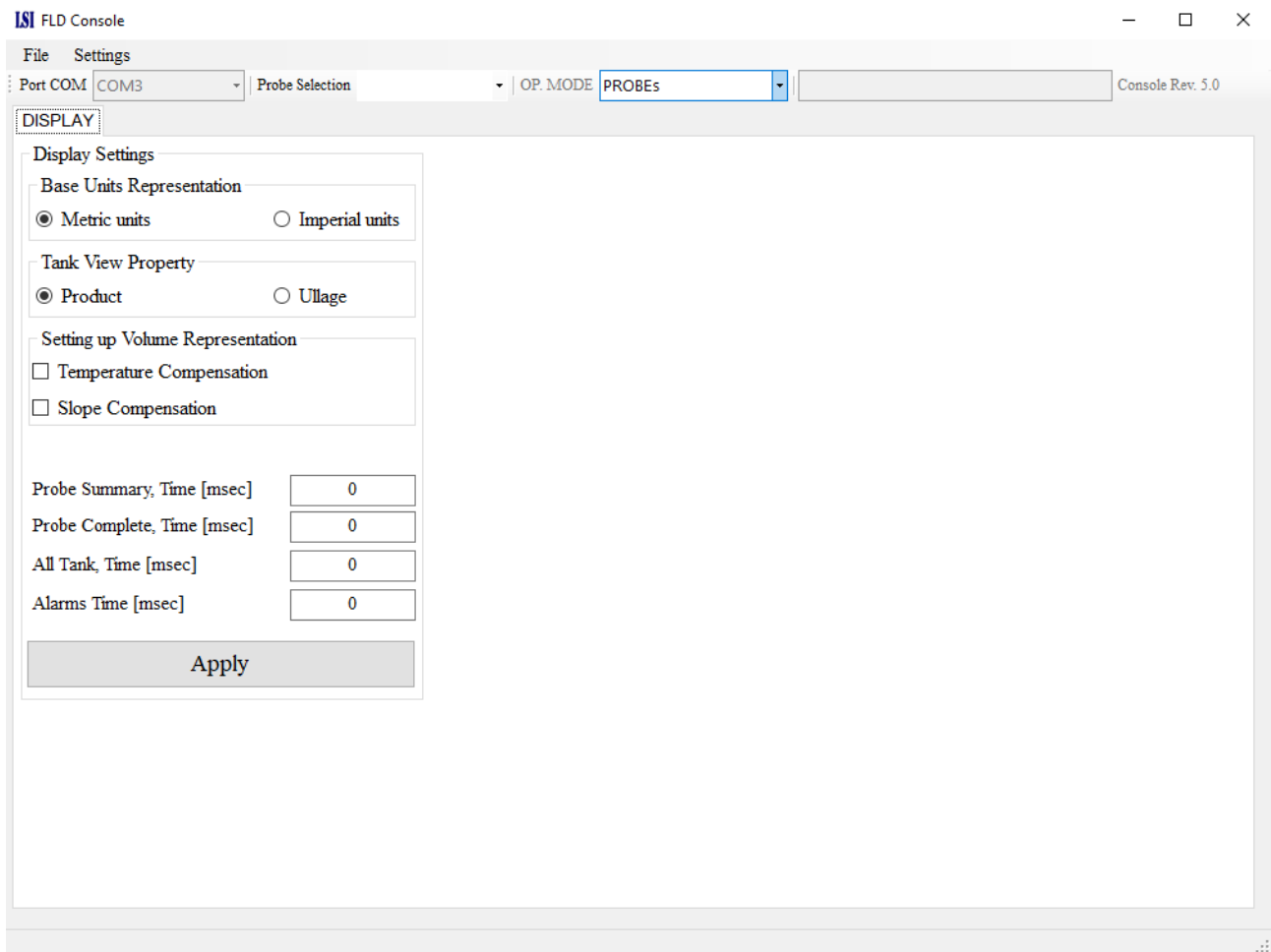


Figure 15 - DISPLAY settings

The FLD board is equipped with a tilt angle sensor; if the display is configured to correct the displayed level taking into account the road slope (see DISPLAY parameters under the Setting menu), it is required to align the FLD zero slope with the tanks zero slope and therefore, if the Slope Compensation is selected, a pop-up window will appear showing the current FLD angle and the button “Zero and Continue”, allowing the user to set the current angle value as offset for the measures when operating (see Figure 16).

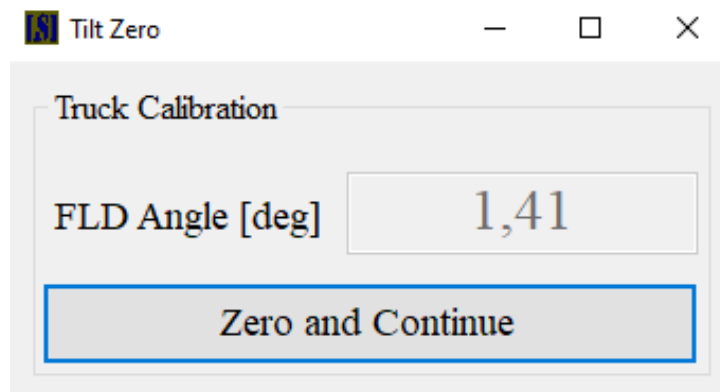


Figure 16 - Zero Slope Calibration

NOTE:

this operation shall be performed with the truck on zero slope road.

6.2.2.2 WiFi settings (for FLD-04 only)

The WiFi Access Point can be enabled by the customer (the FLD-04 is shipped with WiFi Access Point disabled) for PROBES operating mode only.

The following Figure 17 shows the window where the customer can:

- enable the WiFi AP;
- define the WiFi SSID and the associated password.

WARNING:

The WiFi address cannot be modified and is factory set at the following value: **192.168.4.1**

When the Enable WiFi Module is selected, the FLD Console enable the WiFi Access Point parameter setting box, showing the factory default; customer can change these parameters.

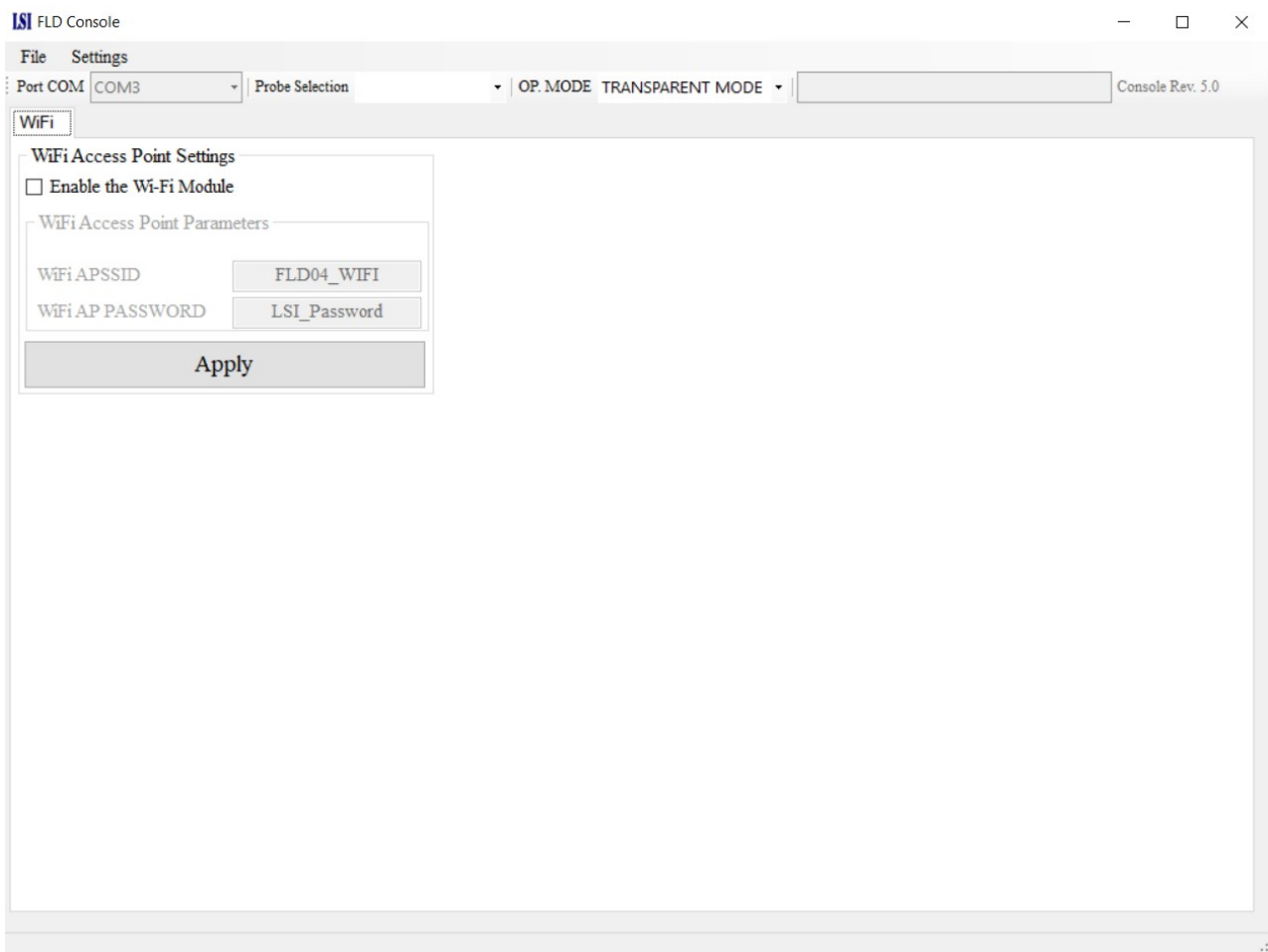


Figure 17 - WiFi settings

6.2.2.3 MODBUS Settings

The MODBUS settings window (see Figure 18) is used to configure:

- MODBUS ID – consists of a single byte containing the address of the selected FLD board; values allowed by the protocol are in the range 0÷247;
- MODBUS Baud rate – the baud rate range is from 4800 to 115200 bps.

These settings are related to the PROBES mode only.

WARNING:

MODBUS port is configured to work with the following parameters (not editable):

- 8 bit, 1 stop bit 1, no parity, no flow control
- RTU mode

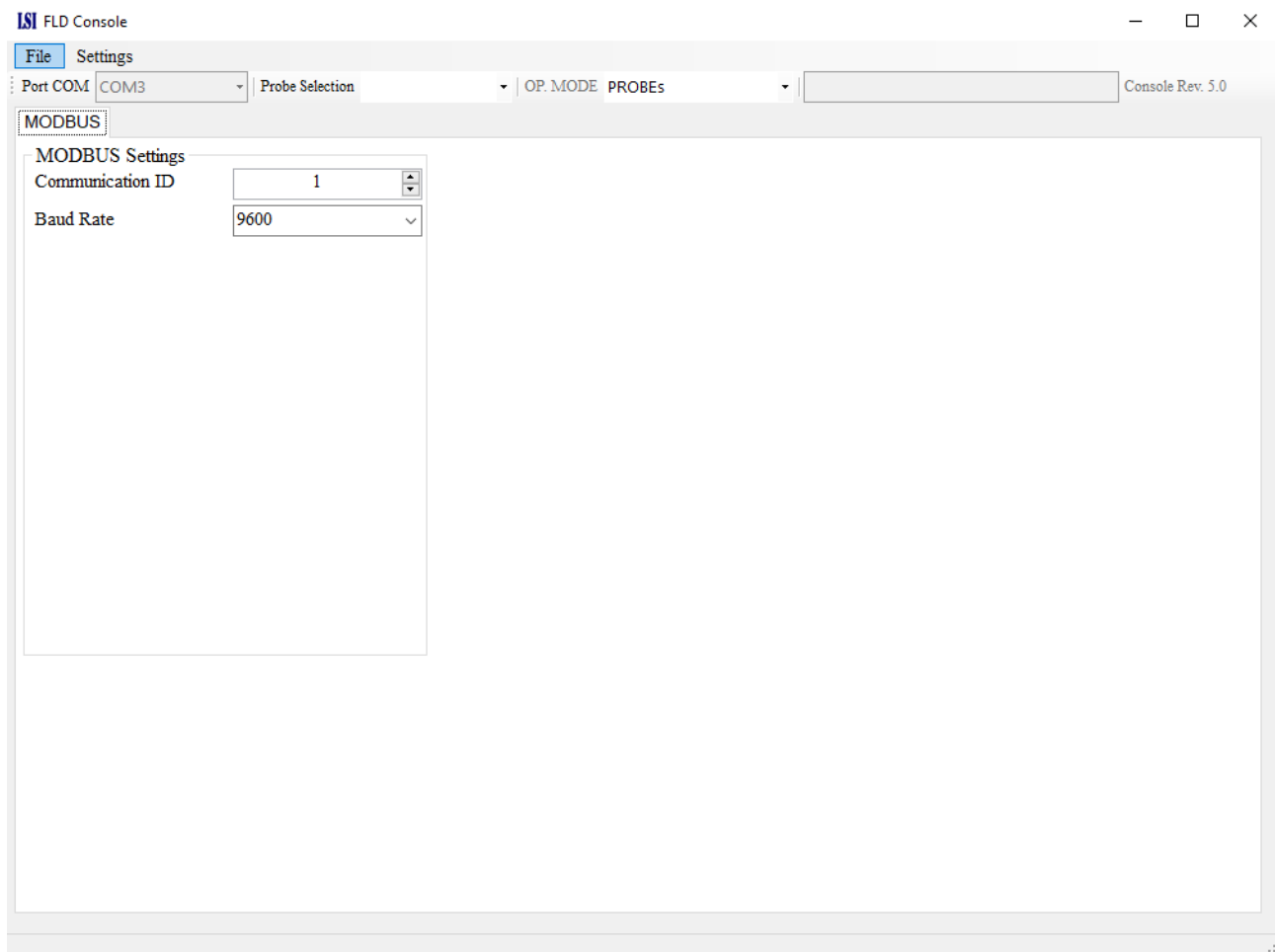


Figure 18 - MODBUS settings

6.3 FLD Console - Operating modes

6.3.1 PROBES mode

For each probe the following configuration Tabs are shown in order to specify the configuration parameter for the display behavior:

- CFG;
- ALARM;
- LOOKUP TABLE.

A drop-down menu is available to select the probe to be configured and the tabs will take the selected probe number (from 1 to 5).

Following Figure 19 shows the configuration window (starting from the CFG tab).

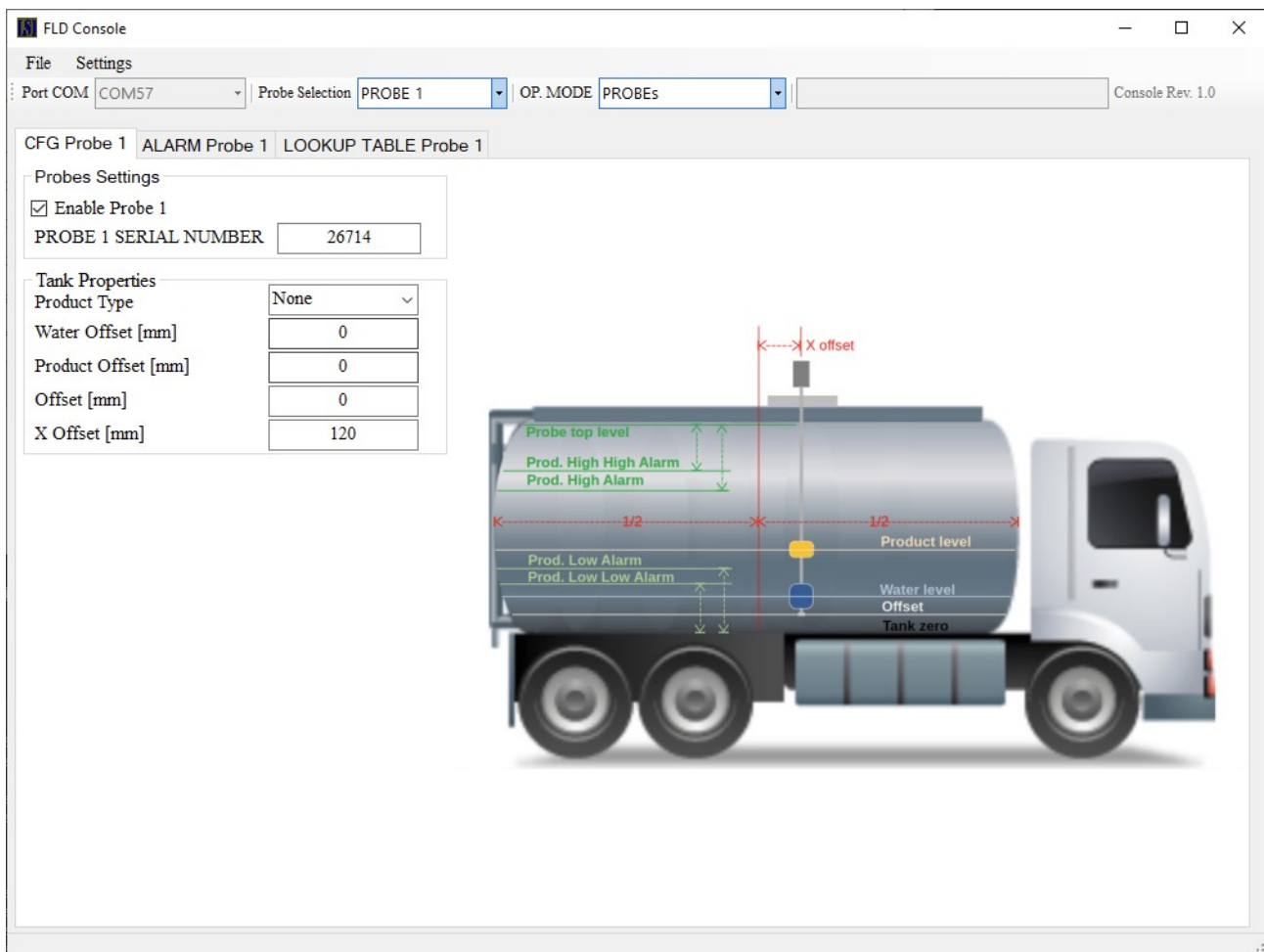


Figure 19 - CFG tab

6.3.1.1 CFG Tab

The CFG tab is used to configure the following parameters:

- Probe settings:

- ◆ The probe serial number (s/n) shall be specified (avoid meaningless zeros).
- Tank properties, according to the picture shown in the window and in detail:
 - ◆ Product Type – to specify the type of product to be measured (between Diesel and Gasoline);
 - ◆ Water and product offsets – to specify the lowest value that the probe can represent in according to the figure shown from the program, can be taken as the gap between product level and the bottom of the probe;
 - ◆ Offset – to specify the probe installation offset according to the figure shown from the program, can be taken as the gap between the bottom of the probe and the bottom of the tank;
 - ◆ X Offset – to specify the probe shift in respect to the half of the tank, along the truck longitudinal axis (forward shift shall be inserted as positive value, backward shift shall be inserted as negative value).

6.3.1.2 ALARM Tab

The ALARM tab, see Figure 20, is used to configure the parameters shown in the following Figure 20.

Alarm	Description	Unit	Note
None	Not configured	-	-
Failure	Probe failure	-	-
Water Hi	Water high threshold	mm	From the bottom of the tank
Product Lo Lo	Product very low level	mm	From the bottom of the tank
Product Lo	Product low level	mm	From the bottom of the tank
Product Hi	Product high level	mm	From the Probe Top
Product Hi Hi	Product very high level	mm	From the Probe Top
Temperature Lo	Temperature low level	°C	
Temperature Hi	Temperature high level	°C	

Table 3 - Alarm parameters

Each output can be configured to be activated from one of the above alarms. The output can also be configured to be activated by a FAILURE condition; a failure is detected both in case of probe hardware error and probe communication error.

WARNING:

The alarm configuration is related to the selected probe; output lines are managed with OR logic condition in respect to the alarms of the probes.

OUT 1 and OUT 2 correspond to the output lines available on External I/F board J2 connector.

NOTE:

The display time of the alarm page is defined in the DISPLAY tab, see paragraph 6.2.2.1.

NOTE:

For the displayed alarms (only one condition is shown), temperature alarms are handled with higher priority in respect to level alarms and therefore, if it is required a priority on level alarms, a wide temperature range shall be specified. Outputs behavior is selective according to the drop down list.

NOTE:

Alarm configuration is valid only for PROBES mode.

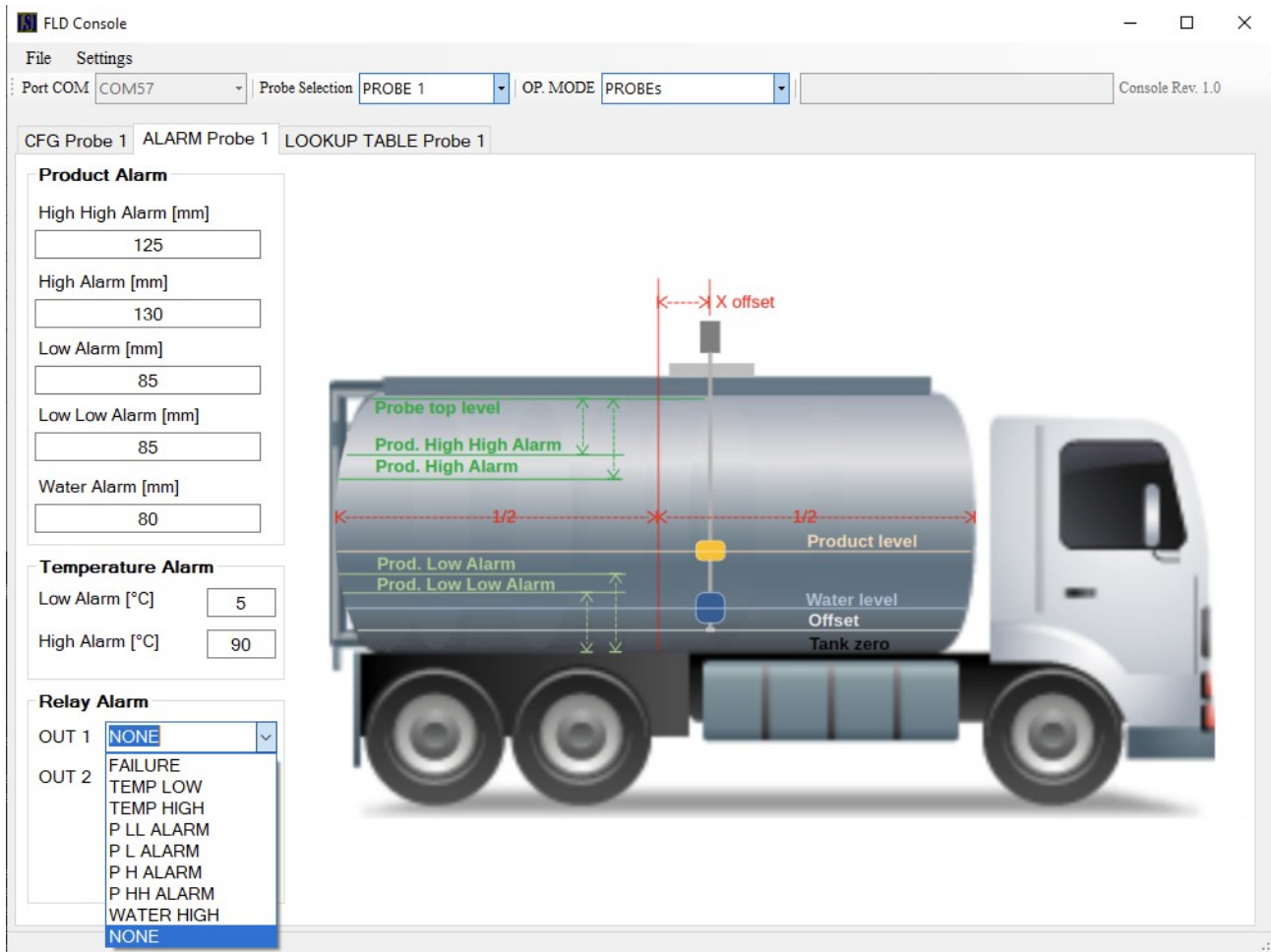


Figure 20 - ALARM tab

These settings are related to the PROBES mode only.

6.3.1.3 LOOKUP TABLE Tab

The LOOKUP TABLE Tab, (see Figure 21), is used to specify the level-to-volume relationship of the tank; it is possible to specify a maximum of 200 couples of values.

The look table can be imported from a CSV file where each row specify a couple level-volume separated by a semicolon (;):

level;volume

where:

- **level** is in mm
- **volume** in liters.

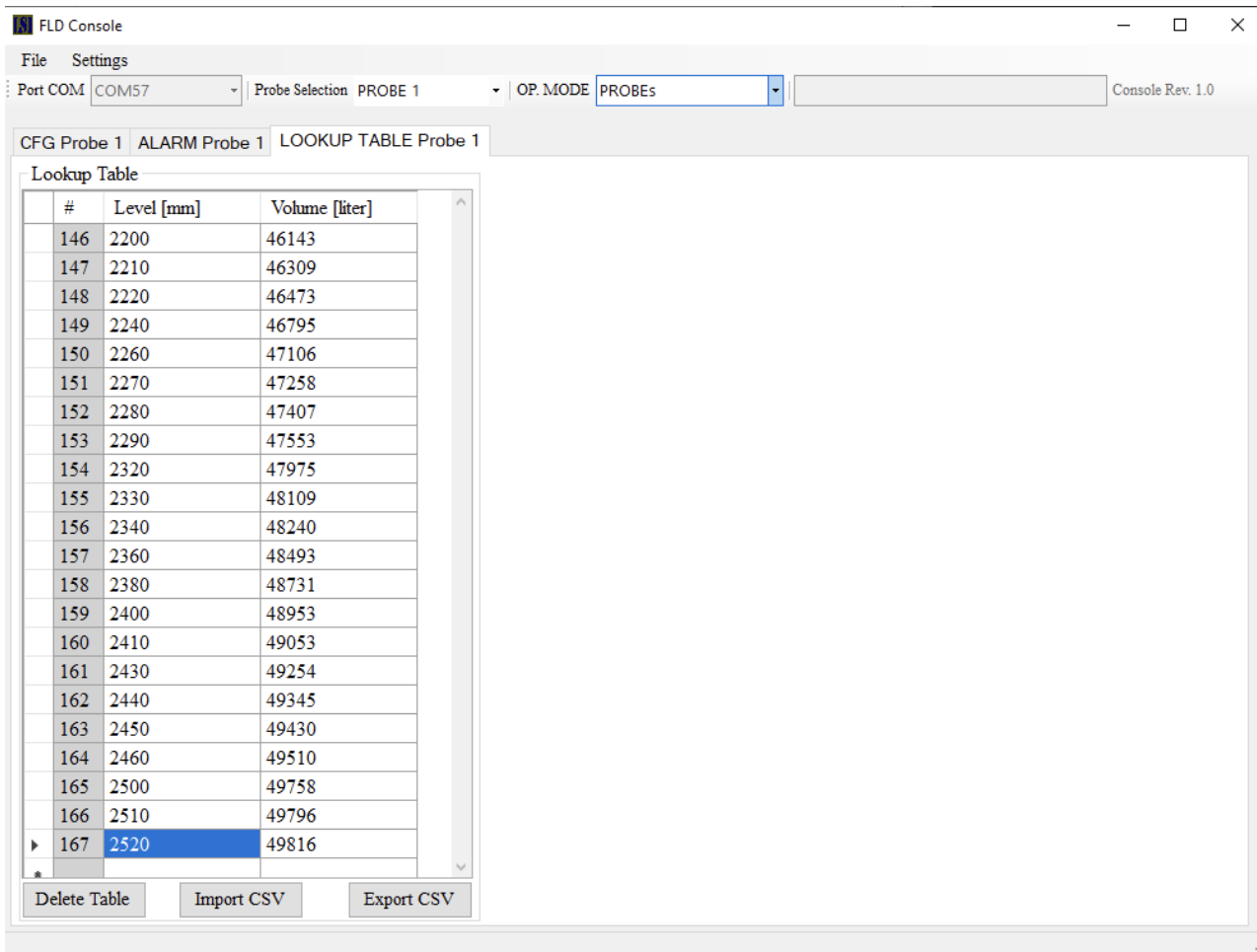


Figure 21 - LOOKUP TABLE tab

6.3.2 VISY-COMM DISPLAY mode

The VISY-COMM DISPLAY settings window (see Figure 22) is used to configure:

- VISY Probe ID – consists of a single byte containing the address of the selected tank VISY probe; values allowed by the protocol are in the range 1÷16;
- VISY Baud rate: the baud rate range is from 4800 to 115200 bps.
- Type of units (Metric (for UE) or Imperial (for US));
- Display Cycle Delay (in ms) - for the page refresh timing

WARNING:

VISY-COMM DISPLAY mode, uses the MODBUS RS-485 port that is configured to work with the following parameters:

- 8 bit, 1 stop bit 1, no parity, no flow control.

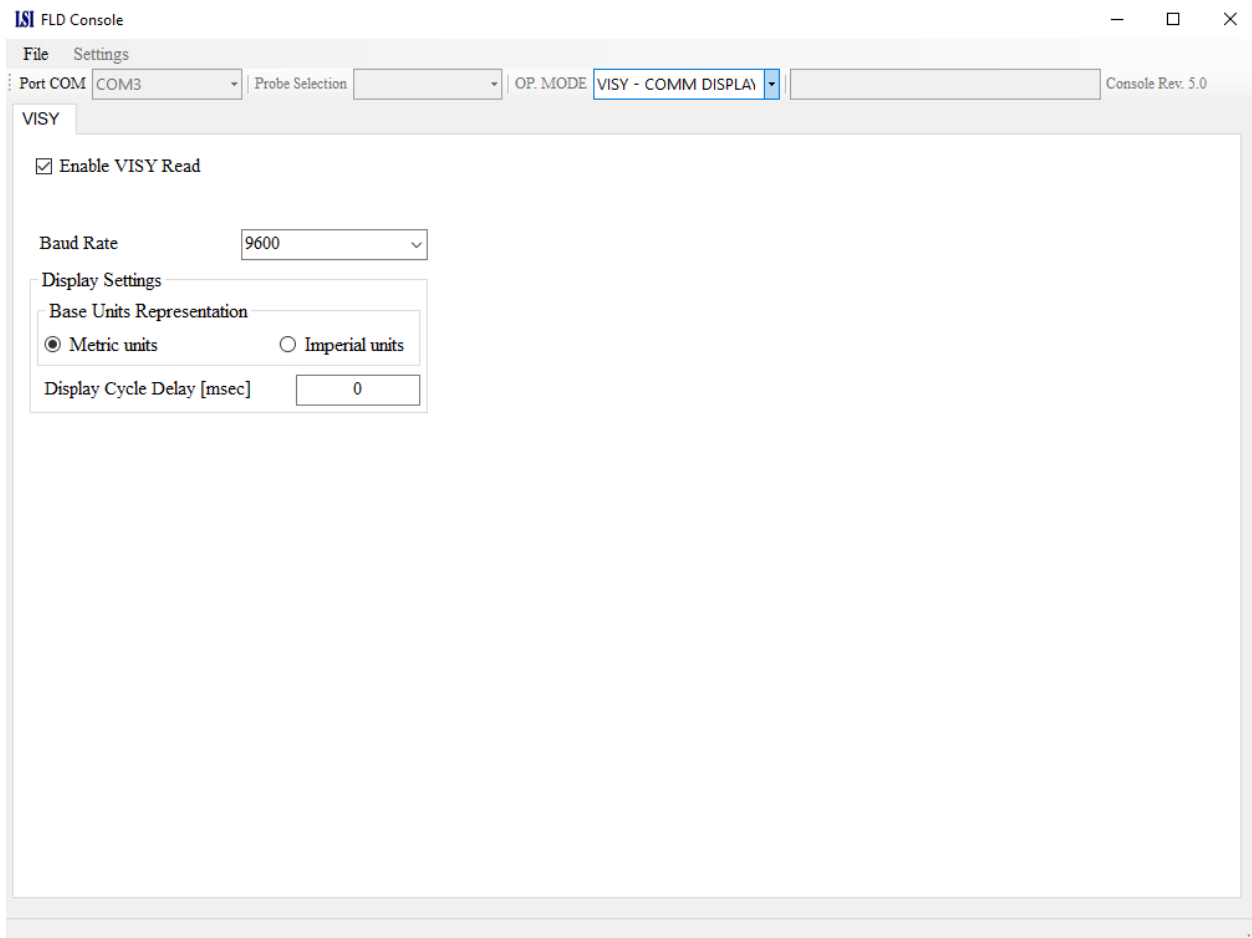


Figure 22 - VISY tab

6.3.3 MODBUS DISPLAY mode

MODBUS DISPLAY mode, uses the MODBUS RS-485 port that is configured to work with the following parameters:

- 8 bit, 1 stop bit 1, no parity, no flow control
- RTU mode (FLD is a slave)

The MODBUS DISPLAY settings window (see Figure 23) is used to configure:

- MODBUS ID – consists of a single byte containing the address of the selected FLD board; values allowed by the protocol are in the range 0÷247;
- MODBUS Baud rate – the baud rate range is from 4800 to 115200 bps;
- Type of units (Metric (for UE) or Imperial (for US));
- Five rows on the display (top-down order) with:
 - ◆ the associated MODBUS register address for each display line:
 - line 1 (top): address 400
 - line 2: address 402

- line 3: address 404
- line 4: address 406
- line 5 (bottom): address 408
- ◆ the associated type of information (drop down list on the right)

NOTE: each register is 32bit wide and each value is a float IEEE754 coded, and where:

 - **Empty %** is from 0 to 100
 - **Fill %** is from 0 to 100
 - **Product** is from 0 to 99,999,999
 - **Time** is the date and time in seconds from 01/01/1970 00:00:00 UTC (UNIX time)
 - **Temperature** is from -50.0 to 130.0
 - **Ullage** is from 0 to 99,999,999
 - **Battery** state is coded according to the following list: 3 = EXCELLENT (green color), 2 = GOOD (yellow color), 1 = POOR (red color)
 - **Error** is a number from 01 to 99 (red color) (no number shown with no error)
- Display Cycle Delay (in ms) - for the page refresh timing

In MODBUS DISPLAY mode, the device can drive two outputs via Modbus protocol; for this feature, two 16-bit Modbus registers have been used:

- **OUTPUT 1:** address 410
 - ◆ output disabled: 0x0000
 - ◆ output enabled: 0xFFFF
- **OUTPUT 2:** address 411
 - ◆ output disabled: 0x0000
 - ◆ output enabled: 0xFFFF

Remote Modbus master, can therefore control the OUTPUT 1 and 2 status, simply writing the above bit sequences on registers at address 410 and 411 respectively.

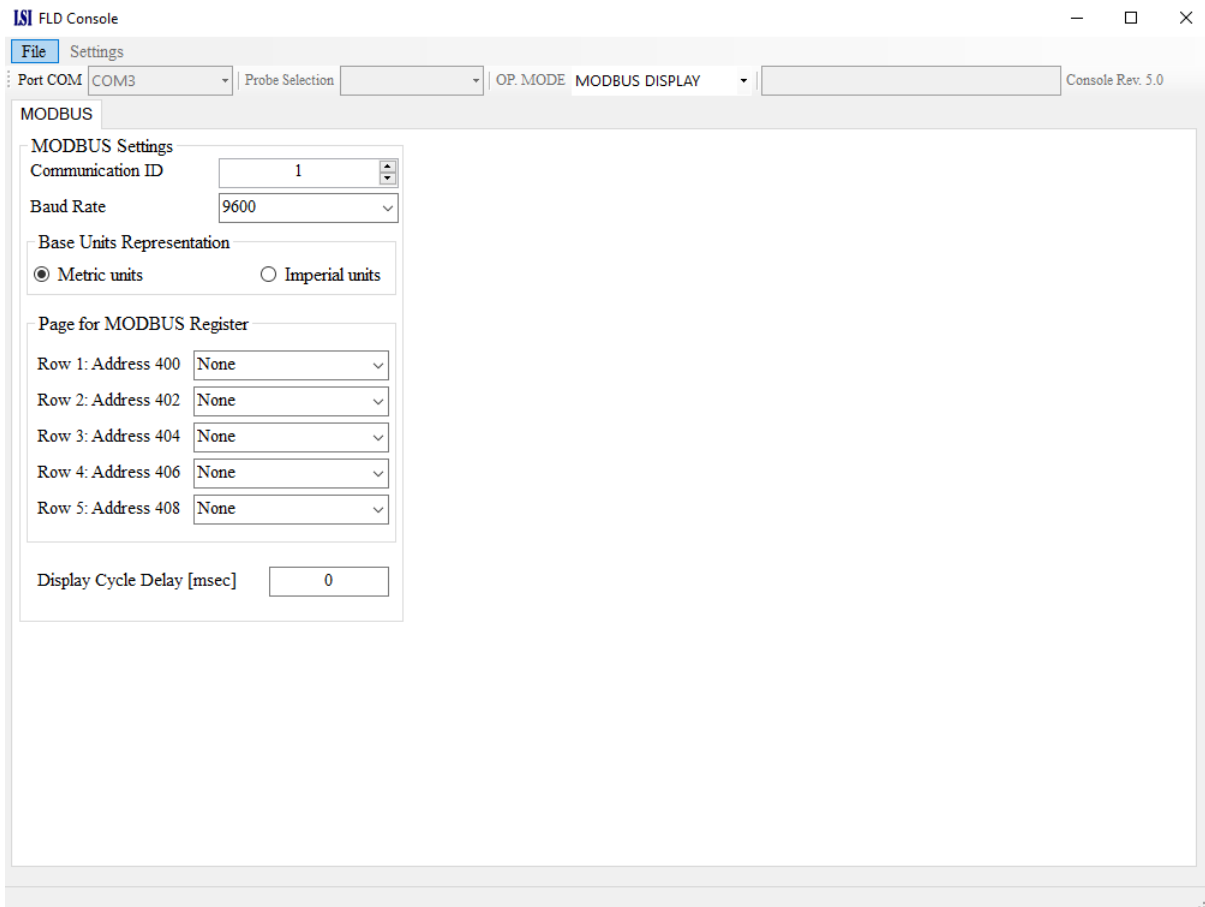


Figure 23 - MODBUS tab

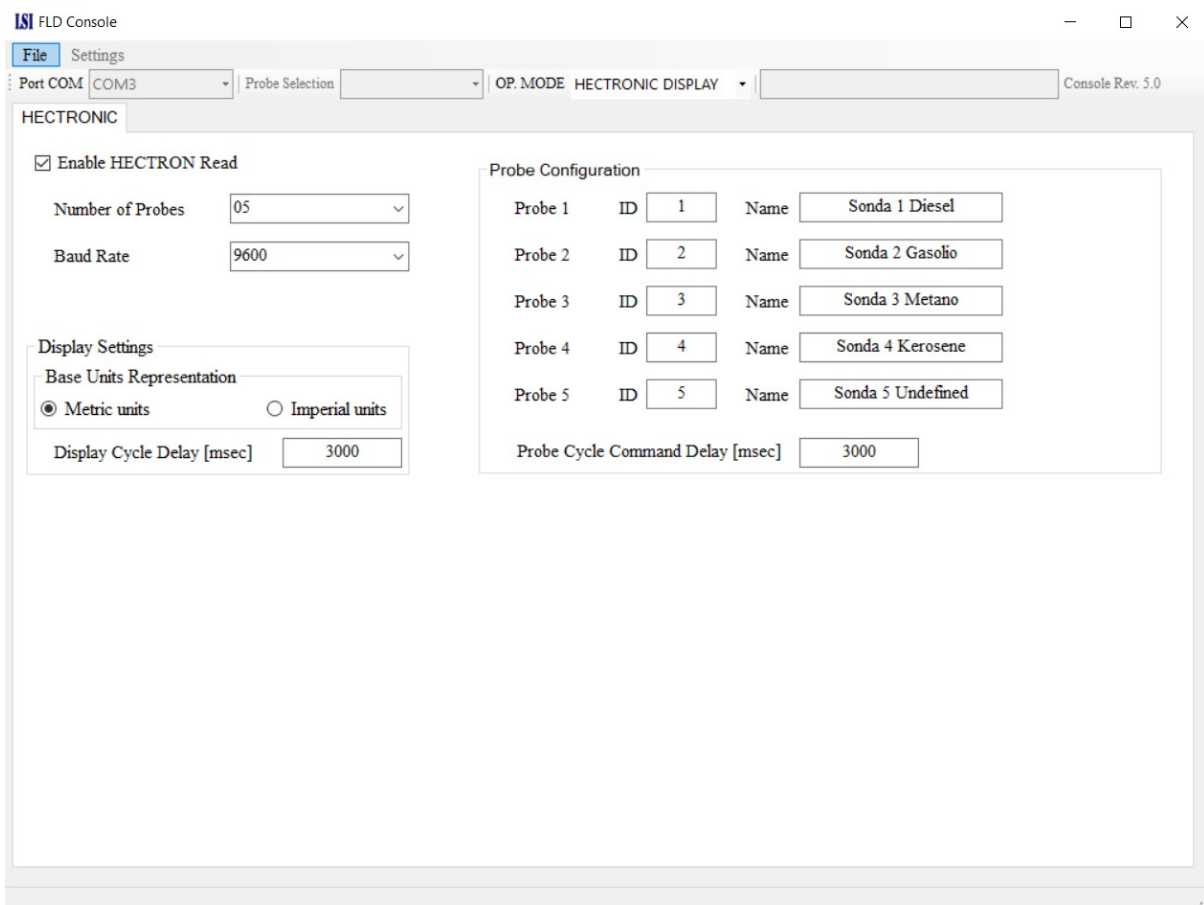
6.3.4 HECTRONIC DISPLAY mode

HECTRONIC DISPLAY mode, uses the MODBUS RS-485 port that is configured to work with the following parameters:

- 8 bit, 1 stop bit 1, no parity, no flow control

The HECTRONIC DISPLAY settings window (see Figure 24) is used to configure:

- Number of Probes – to define how many Hectronic probes (from 1 to 5) are connected to the bus;
- Baud rate – the baud rate range is from 4800 to 115200 bps;
- Display Settings – to set the measurement unit (e.g., metric) and the time each probe's information is shown on the display (minimum value 1500ms);
- Probe Specific Parameters – for each enabled probes, it is possible to configure:
 - ◆ A unique Probe ID (*numeric*);
 - ◆ A descriptive Probe Name (*alphanumeric*) - the name that will be shown on top of the display probe page;
- Probe Cycle Command Delay – set the delay in milliseconds between the command sequences sent to each probe (minimum value 1500ms).



ISI FLD Console

File Settings

Port COM COM3 | Probe Selection | OP. MODE HECTRONIC DISPLAY | Console Rev. 5.0

HECTRONIC

Enable HECTRON Read

Number of Probes 05

Baud Rate 9600

Display Settings

Base Units Representation

Metric units Imperial units

Display Cycle Delay [msec] 3000

Probe Configuration

Probe	ID	Name
Probe 1	1	Sonda 1 Diesel
Probe 2	2	Sonda 2 Gasolio
Probe 3	3	Sonda 3 Metano
Probe 4	4	Sonda 4 Kerosene
Probe 5	5	Sonda 5 Undefined

Probe Cycle Command Delay [msec] 3000

Figure 24 - HECTRONIC tab

6.3.5 TRANSPARENT mode

The TRANSPARENT mode is visually the same as PROBES mode (see Figure 26).

This mode combines the functionalities of the "PROBES" mode with RS-485 gateway capabilities. The configuration is therefore analogous to the PROBES mode, allowing for detailed setup of the locally connected probes.

Additionally, communication parameters for the RS-485 bus can be configured to ensure proper integration with an external master system (see following figure).

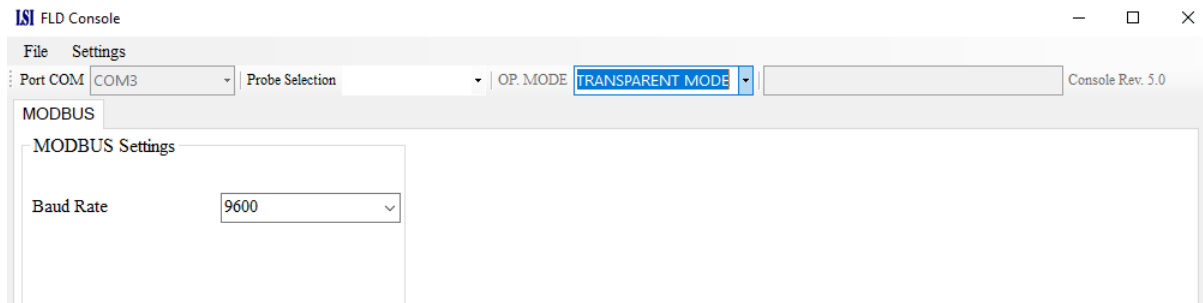


Figure 25 - Modbus setting for TRANSPARENT mode

In this mode, the device operates as follows:

- When the remote host sends a request as FUD protocol (**Fafnir Universal Device Protocol**), the firmware immediately responds using the most recent data already stored in memory.
- There is no additional message forwarding to the physical probes. This prevents conflicts on the communication bus and makes the system faster and more robust.
- The response sent to the host is formatted exactly like a real probe response (FUD protocol), ensuring full compatibility with existing host software.
- This implementation allows the device to handle remote requests asynchronously, without interrupting the probes polling cycle operations.

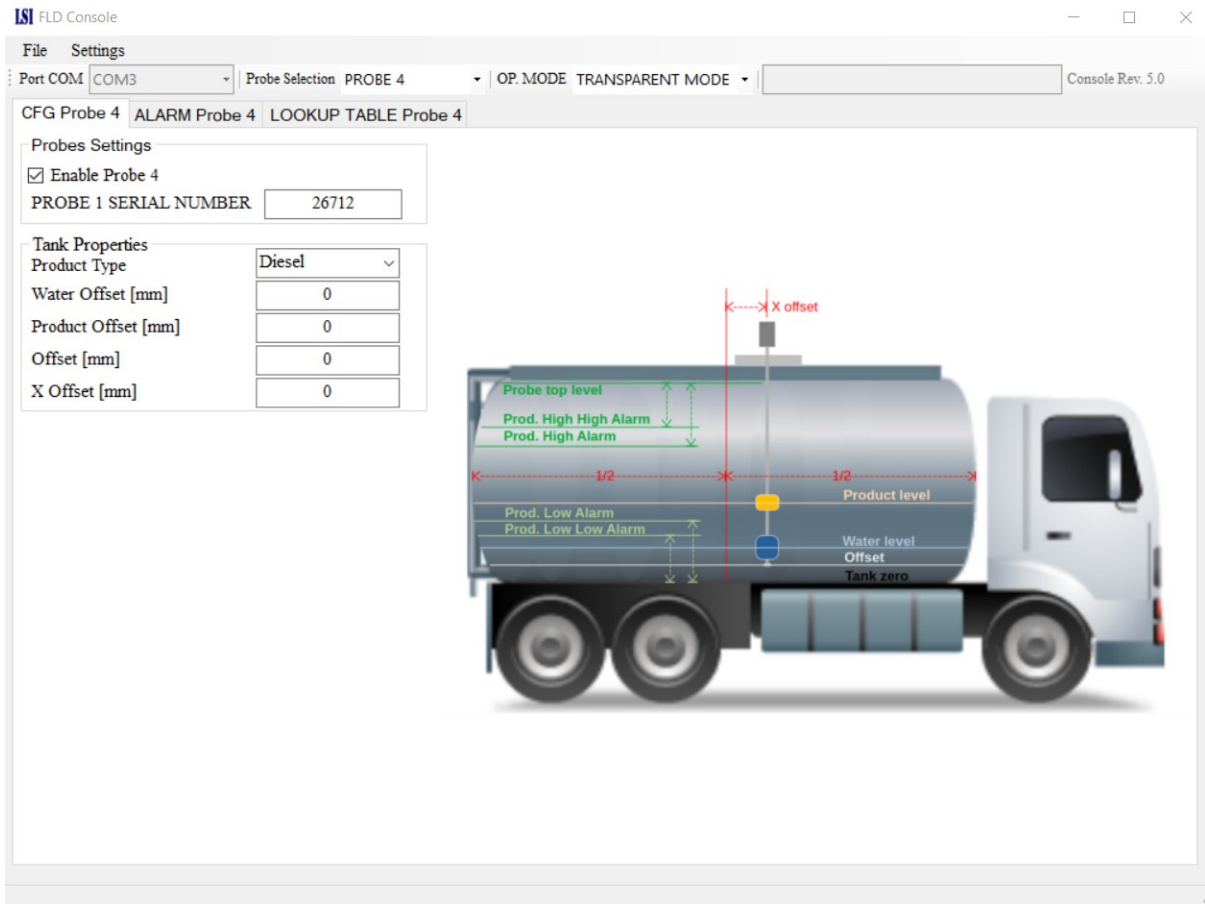


Figure 26 - TRANSPARENT tab

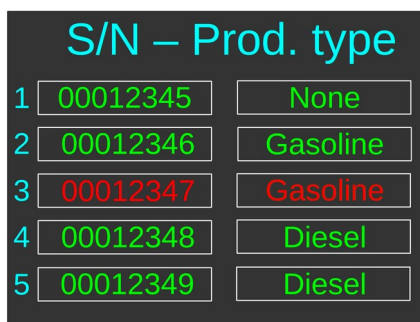
7 FLD OPERATION

7.1 Switch on

Switch ON the FLD, after the LSI splashscreen, it will show the following firmware release page (rev. may be different from the figure):



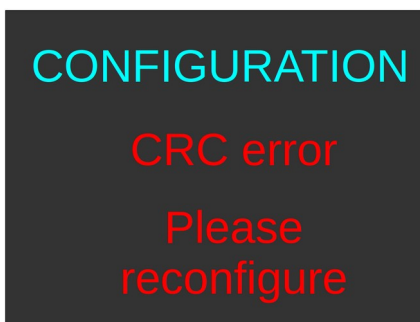
After this page, if everything is properly working, the FLD will show the following summary page for the s/n of the enabled probes, the communication status with the probes s/n and the type of product (if defined):



WARNING: red text means that the probe is not answering.

After the above summary page the FLD will enter the Normal operation – see paragraph 7.2.

If something has gone wrong during the configuration phase, the FLD will not show the summary page and will stop, showing the following error page:



asking for a new configuration from the user by means of the *FLD console*.

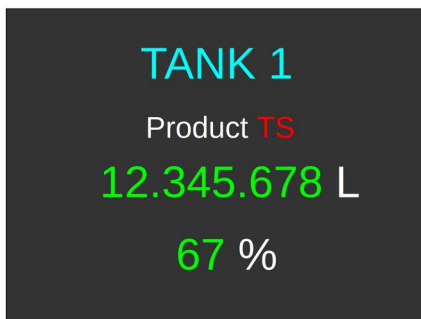
7.2 Normal operation

The following paragraphs show some snapshots and explanation (where applicable) of the pages shown from the FLD in normal operation.

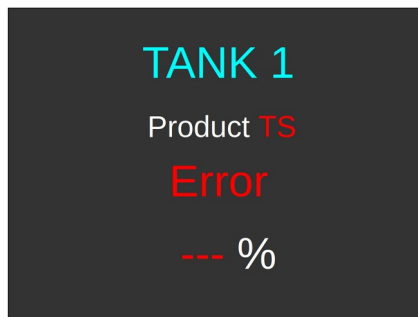
Each operating mode is addressed.

7.2.1 PROBES mode

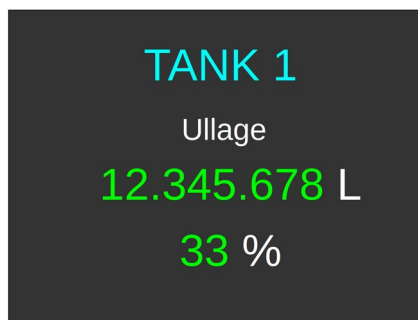
- Summary Display, example with:
 - ◆ Tank 1
 - ◆ Product volume compensated for Temperature (T) and Slope (S)
 - ◆ Metric units (on the left), Imperial units (on the right)



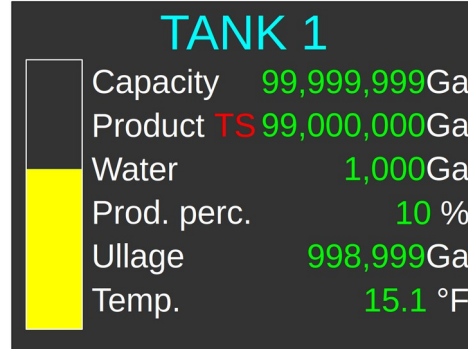
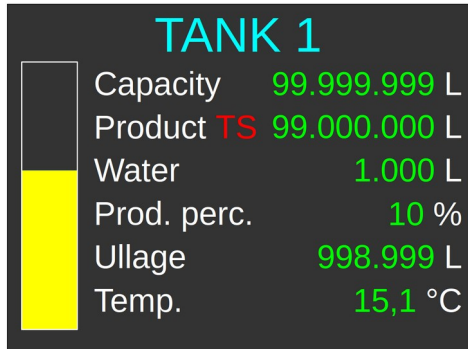
- Summary Display, example as above but with communication error:



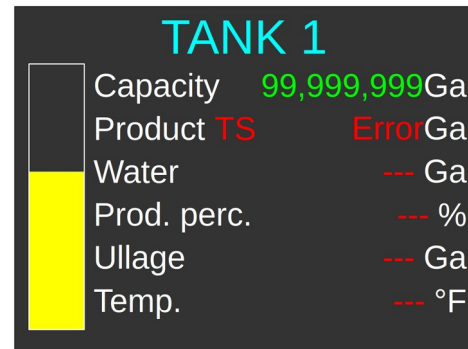
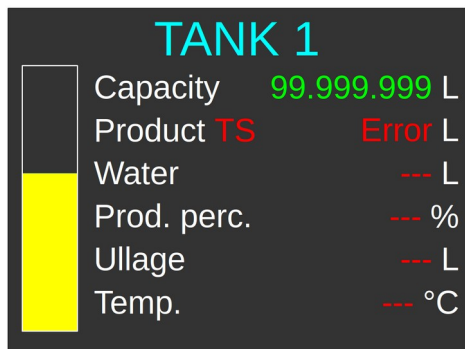
- Summary Display, example with:
 - ◆ Tank 1
 - ◆ Ullage volume without any compensation
 - ◆ Metric units



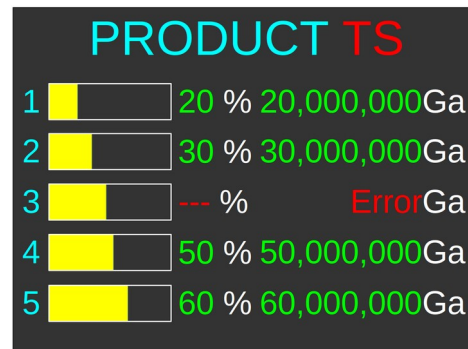
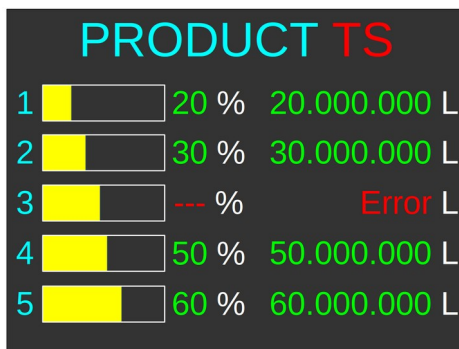
- Complete Display, example with:
 - ◆ Tank 1
 - ◆ Product volume compensated for Temperature (T) and Slope (S)
 - ◆ Metric units (on the left), Imperial units (on the right)



- Complete Display, example as above but with communication error:



- All Tanks Display, example with:
 - ◆ Five tanks enabled
 - ◆ Product volume compensated for Temperature (T) and Slope (S)
 - ◆ Metric units (on the left), Imperial units (on the right)
 - ◆ One probe (n. 3) with communication error



- Alarms Display, example with:

- ◆ Alarms (logical or of the defined alarms for each enabled probe, in one window).

7.2.1.1 Modbus registers in PROBES mode

The following Table 4 shows the Modbus register available (less significant bit first).

Type	Start	Length (32 bits words)	R/W	Format	Description
Configuration	100	2	R/W	Decimal	MODBUS ID (default = 1)
	102	2	R	Decimal	Software Version
Main Measures Probe 1	104	2	R	Float	Product level (mm) with height offset (default = -1.0)
	106	2	R	Float	Product volume temperature compensated (liter) (default = -1.0)
	108	2	R	Float	Water level (mm) with height offset (default = -1.0)
	110	2	R	Float	Water volume (liter) (default = -1.0)
	112	2	R	Float	Probe temperature (°C) (default = -1.0)
Main Measures Probe 2	114	2	R	Float	Product level (mm) with height offset (default = -1.0)
	116	2	R	Float	Product volume (liter) (default = -1.0)
	118	2	R	Float	Water level (mm) with height offset (default = -1.0)
	120	2	R	Float	Water volume (liter) (default = -1.0)
	122	2	R	Float	Probe temperature (°C) (default = -1.0)
Main Measures Probe 3	124	2	R	Float	Product level (mm) with height offset (default = -1.0)
	126	2	R	Float	Product volume (liter) (default = -1.0)
	128	2	R	Float	Water level (mm) with height offset (default = -1.0)
	130	2	R	Float	Water volume (liter) (default = -1.0)
	132	2	R	Float	Probe temperature (°C) (default = -1.0)
Main Measures Probe 4	134	2	R	Float	Product level (mm) with height offset (default = -1.0)
	136	2	R	Float	Product volume (liter) (default = -1.0)
	138	2	R	Float	Water level (mm) with height offset (default = -1.0)
	140	2	R	Float	Water volume (liter) (default = -1.0)
	142	2	R	Float	Probe temperature (°C) (default = -1.0)
Main Measures Probe 5	144	2	R	Float	Product level (mm) with height offset (default = -1.0)
	146	2	R	Float	Product volume (liter) (default = -1.0)
	148	2	R	Float	Water level (mm) with height offset (default = -1.0)
	150	2	R	Float	Water volume (liter) (default = -1.0)
	152	2	R	Float	Probe temperature (°C) (default = -1.0)

Table 4 – Registers available in Modbus protocol

Every register is available using the function 0x03 (Modbus Function Code 03: “Read Holding Registers”) with a float (IEEE754) or int32 format depending on your setting.

The Modbus ID parameter of the device could be set between 1 and 247 by accessing the register located at address 100 (without any specific request, the default value is set to 1).

In case the level probe stops communicating with the device, the value of the measure registers (register from address 104 to 152) will be the default value.

7.2.2 VISY-COMM DISPLAY mode

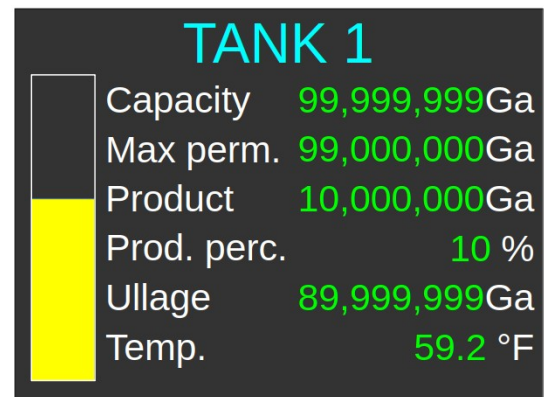
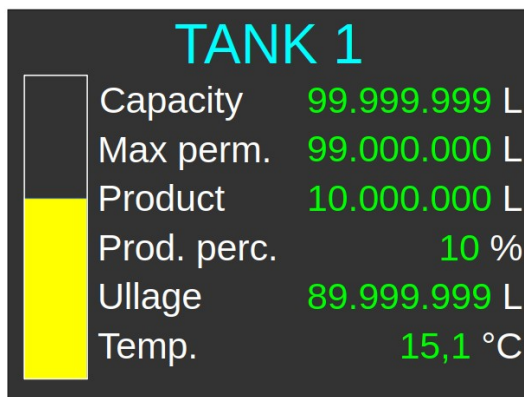
VISY-COMM DISPLAY mode is a special operating mode devoted to show the values coming from a VISY COMMAND board (FAFNIR).

NOTE:

the display will show, with the defined refresh time, each probe enabled on the VISY COMMAND board.

After the switch on messages (only the firmware release page), the display will show the following message:

- VISY-COMM DISPLAY, example with:
 - ◆ Probe 1
 - ◆ Metric units (on the left), Imperial units (on the right)



The message is updated with the refresh time indicated in VISY configuration (see Figure 22).

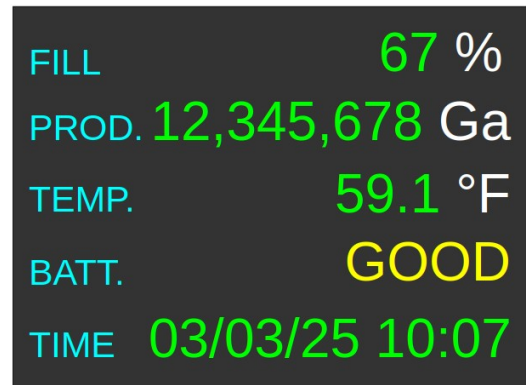
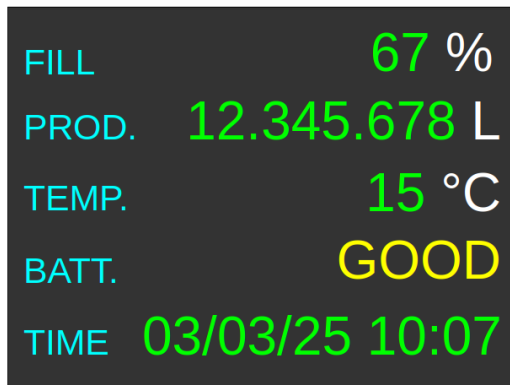
7.2.3 MODBUS DISPLAY mode

MODBUS DISPLAY mode is a special operating mode devoted to show the values coming from an external MODBUS master unit, writing on the defined registers (see paragraph 6.3.3) by means of Function Codes 06 (one register at a time) or 16 (multiple register at a time).

After the switch on messages (only the firmware release page), the display will show the following message:

- MODBUS DISPLAY, example with:
 - ◆ Row 1 (register 400) = Fill %
 - ◆ Row 2 (register 402) = Product

- ◆ Row 3 (register 404) = Temperature
- ◆ Row 4 (register 406) = Battery
- ◆ Row 5 (register 408) = Time
- ◆ Metric units (on the left), Imperial units (on the right)



The message is updated with the refresh time indicated in configuration (see Figure 23).

7.2.4 HECTRONIC DISPLAY mode

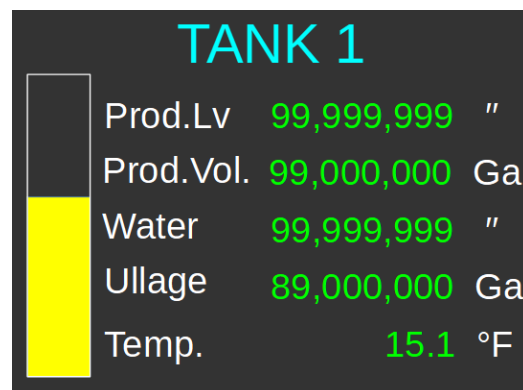
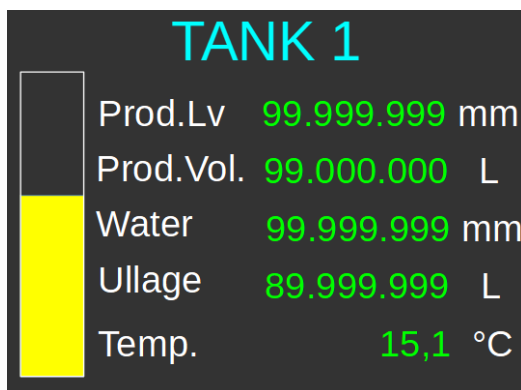
The HECTRONIC DISPLAY mode is a special operating mode devoted to show the values coming from an external Hectronic system.

NOTE:

The display will show, with the defined refresh time, each Hectronic-monitored probe (or tank) enabled on the system.

After the switch on messages (only the firmware release page), the display will show the following message:

- HECTRONIC DISPLAY, example with:
 - ◆ Probe 1
 - ◆ Metric units (on the left), Imperial units (on the right)



The message is updated with the refresh time indicated in HECTRONIC configuration (see Figure 24).


7.2.5 TRANSPARENT mode

The TRANSPARENT mode is visually identical to the PROBES mode during normal operation, displaying, with the defined refresh time, the levels and statuses of the locally connected probes (see paragraph 7.2.1).

8 SECURITY INSTRUCTION SUMMARY

8.1 Marking

ATEX:

CE (notified body number)  II 2(1) G Ex db [ia IIC Ga] IIB T4 Gb Tamb -20°C / +55°C

IECEX:

Ex db [ia IIC Ga] IIB T4 Gb Tamb -20°C / +55°C

$U_m=30Vdc$

$I_m=0.5A$

Internally supplied Associated Apparatus parameters

Fuel probes supply lines:

- $U_o= 13.6Vdc$
- $I_o= 114mA$
- $P_o = 400mW$
- C_o (IIC) = 1.15uF
- L_o (IIC) = 2.7mH
- L_o/R_o (IIC) = 91.3uH/ohm

Fuel probes data bus (RS485) lines:

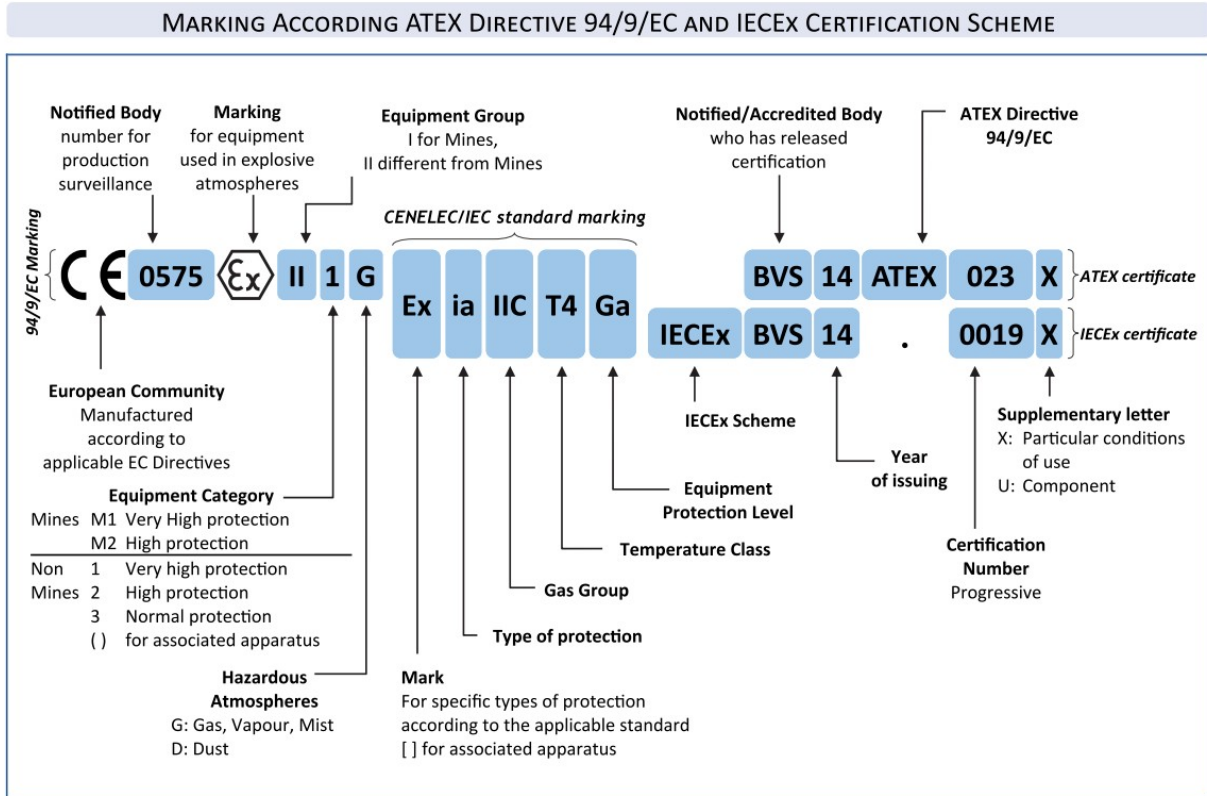
- $U_o= 13.6Vdc$
- $I_o= 42mA$
- $P_o = 140mW$
- C_o (IIC) = 0.82uF
- L_o (IIC) = 20.5mH
- L_o/R_o (IIC) = 251.2uH/ohm

WARNING:

- Power Supply maximum prospective current allowed <50A. Use external fuse with a nominal breaking capacity $\geq 1500A$ and $I_n = 1A$.
- The frame (metallic enclosure) is connected to earth and to the negative of the power supply; take count of this in the installation of the equipment.
- The supplied cable glands and plug shall be used for direct entry in the enclosure; appropriate (for the EPL) cable glands and blanking elements, shall always be used
- Do not power supply in EX area before completing the mechanical and electrical installation
- Do not open when energized

- Do not use probe cables (power and data) longer than 50m.

8.2 Marking instructions and type of protection



<h2>Gas Groups</h2>	
Gas Groups	Gases are classified according to the ignitability of the gas/air mixture as defined in EN/IEC 60079-20-1
IIA	Acetic Acid, Acetone, Ammonia, Butane, Cyclohexane, Propane, Gasoline (petrol), Methane (natural gas, non-mining), Toluene, Xylene. Methanol (methyl alcohol), Propane-2-ol (iso-propyl alcohol)
IIB	Group IIA gases plus, Di-ethyl ether, Ethylene, Ethanol Methyl ethyl ketone (MEK), Propane-1-ol (n-propyl alcohol)
IIC	Group IIA and IIB gases plus, Acetylene, Hydrogen

ELECTRICAL APPARATUS FOR GAS AND DUST EXPLOSIVE ATMOSPHERES

Type of protection	Concept	Code	EPL	IEC /CENELEC standard	US Division Standard	US Zone Standard	Canadian Div. Standard	Canadian Zone Standard
Gas								
General requirements		-	-	60079-0	FM3600	60079-0	-	60079-0
Intrinsic Safety	Energy limitation	Ex ia Ex ib Ex ic	Ga or Ma Gb or Mb Gc	60079-11	FM3610/UL913	60079-11	C22.2 No. 157	60079-11
Intrinsically Safe systems	Energy limitation	Ex ia Ex ib Ex ic	Ga Gb Gc	60079-25	-	-	-	-
Increased Safety	Non sparking	Ex e	Gb or Mb	60079-7	-	60079-7	-	60079-7
Type n (non sparking/non incendive)		Ex nA Ex nC	Gc	60079-15	FM3611	60079-15	C22.2 No. 213	60079-15
Flameproof / Expl. Proof	Explosion containment	Ex d	Gb or Mb	60079-1	FM3615/UL1203	60079-1	C22.2 No. 30	60079-1
Powder filling		Ex q	Gb or Mb	60079-5	-	60079-5	-	60079-5
Type n (enclosed-break)		Ex nC	Gc	60079-15	FM3611	60079-15	C22.2 No. 213	60079-15
Encapsulation	Separation of explosive atmosphere from ignition	Ex ma Ex mb Ex mc	Ga or Ma Gb or Mb Gc	60079-18	-	60079-18	-	60079-18
Type n (sealed/hermetically sealed)		Ex nC	Gc	60079-15	FM3611	60079-15	C22.2 No. 213	60079-15
Pressurization		Ex pv Ex px Ex py Ex pz	Gb or Gc Gb or Mb Gb Gc	60079-2	FM3620/ NFPA 496	-	-	60079-2
Oil immersion		Ex o	Gb	60079-6	-	60079-6	-	60079-6
Type n (restricted breathing)		Ex nR	Gc	60079-15	-	-	-	60079-15
Special requirements		-	Ga	60079-26	-	-	-	-
Dust								
Intrinsic Safety	Energy limitation	Ex ia Ex ib Ex ic	Da Db Dc	60079-11	FM3610/UL913	60079-11	C22.2 No. 157	60079-11
Dust ignition proof	Separation of explosive atmosphere from ignition	Ex ta Ex tb	Da Db	60079-31	FM3616/UL1203	-	C22.2 No. 25	60079-31
Dust tight		Ex tc	Dc		FM3611/ ANSI/ISA 12.12.01	-		
Encapsulation		Ex ma Ex mb Ex mc	Da Db Dc	60079-18	-	60079-18	-	60079-18
Pressurization		Ex pD	Db or Dc	61241-4	NFPA 496	-	-	61241-4

8.3 Maintenance and restoration

In case of failure or other information, please contact:

- support@fafnir.de

The following spare parts are available:

- Display Board FLD-03 p/n P.30009.ASY.000037
- Display Board FLD-04 p/n P.30009.ASY.000038
- External I/F Board p/n P.3000.PCB.000017
- Flameproof enclosures p/n P.30009.PCH.000076 (3 x ½" NPT female hole) or p/n P.30009.PCH.000081 (3 x M20 female hole)
- Cable gland (brass nickel plated) ½" NPT p/n P.30009.PCH.000078 or M20 p/n P.30009.PCH.000082
- Hole plug (brass nickel plated) (½" NPT p/n P.30009.PCH.000077 or M20 p/n P.30009.PCH.000083

INOX AISI 316 cable gland and hole plug, can be supplied on request.