# USER GUIDE FOR LEVEL INDICATING CONTROLLER LFC128-2

| | |
|---|---|
| LFC128-2-MN-EN-01 | JUN-2020 |

*This document is applied for the following products*

| | | | | | |
|---|---|---|---|---|---|
| **SKU** | LFC128-2 | **HW Ver.** | 1.0 | **FW Ver.** | 1.1 |
| **Item Code** | LFC128-2 | Level Indicating Controller, 4AI/DI, 4DI, 4xRelay, 1xPulse Output, 2 x RS485/ModbusRTU-Slave Communication | | | |
| | | | | | |

# 1. Functions Change Log

| HW Ver. | FW Ver. | Release Date | Functions Change |
|---|---|---|---|
| 1.0 | 1.1 | JUN-2020 | |
| | | | |

# 2. Introduction

LFC128-2 is an advanced level display controller. The product integrates Modbus RTU interface to help PLC / SCADA / BMS and any IoT port can connect to monitor. LFC128-2 has a simple yet powerful design with 4 AI / DI, 4 DI, 4 Relays, 1 Pulse pulse output, 2 RS485 Slave ModbusRTU allowing them to connect with multiple devices easily. With advanced technology that provides high stability and reliability, many functions, easy installation with touch screen and friendly interface helps visually monitor level.




LFC128-2-H1.PNG

# 3. Specification

| | |
|---|---|
| Digital Inputs | 04 x Ports, opto-coupler, 4.7 kohms input resisrtance, 5000V rms isolation, Logic 0 (0-1VDC), Logic 1 (5-24VDC), Functions: logic status 0/1 or Pulse counting (32 bit counter with max 4kHz pulse) |
| Analog Inputs | 04 x Ports, select between 0-10VDC input or 0-20mA input, 12 bit Resolution, can be configured as Digital input by DIP switch (max 10VDC input)<br>The AI1 port is a 0-10 VDC / 4-20 mA level sensor connection port |
| Relay Output | 04 x Ports, electro-mechanical Relays, SPDT, contact rating 24VDC/2A or 250VAC/5A, LED indicators |
| Pulse Output | 01 x Ports, open-collector, opto-isolation, max 10mA and 80VDC, On/off control, Pulser (max 2.5Khz, max 65535 Pulses) or PWM (max 2.5Khz) |
| Communication | 02 x ModbusRTU-Slave, RS485, speed 9600 or 19200, LED indicator |
| Reset button | For resetting 02 x RS485 Slave port to default setting (9600, None parity, 8 bit) |
| Screen type | Touch screen |
| Power supply | 9..36VDC |
| Consumption | 200mA @ 24VDC supply |
| Mounting type | Panel mount |
| Terminal Block | pitch 5.0mm, rating 300VAC, wire size 12-24AWG |
| Working temperature/humidity | 0..60 degC / 95%RH non-condensing |
| Dimension | H93xW138xD45 |
| Net weight | 390 grams |

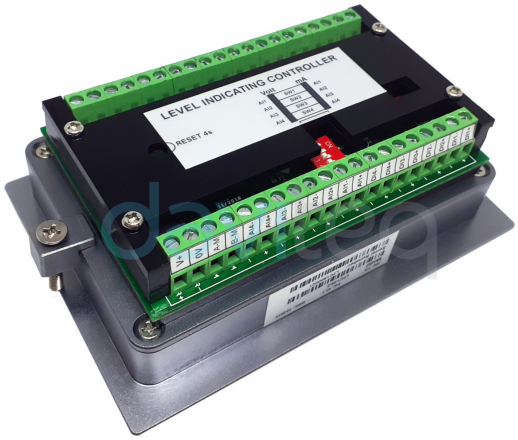
# 4. Product Pictures

LEVEL INDICATING CONTROLLER
LFC128-2

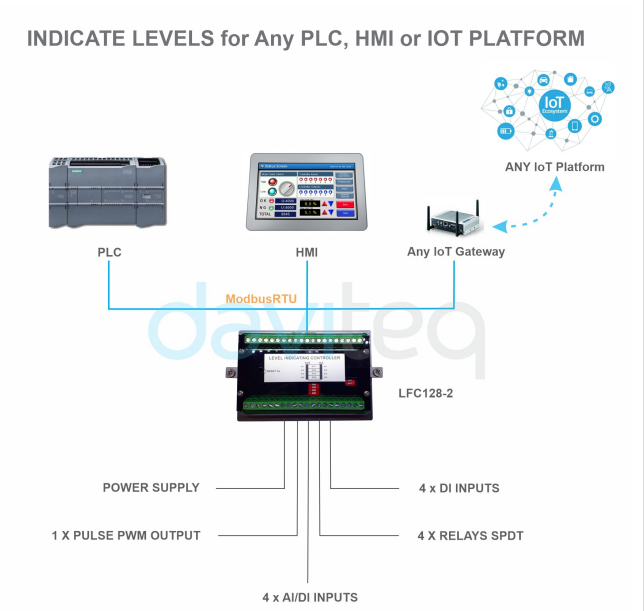



LFC128-2-H1.PNG

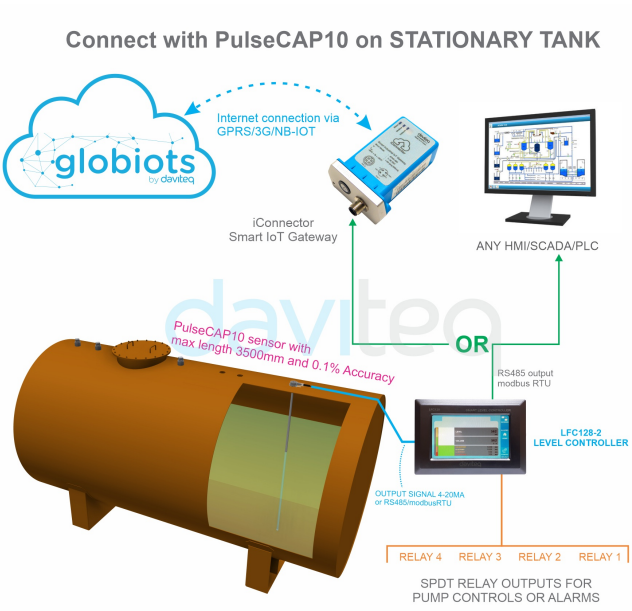
LEVEL INDICATING CONTROLLER
(backside)



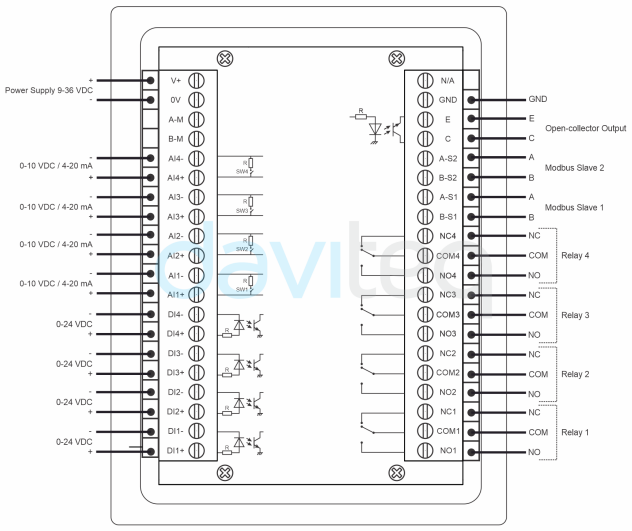

LFC128-2-H2.PNG



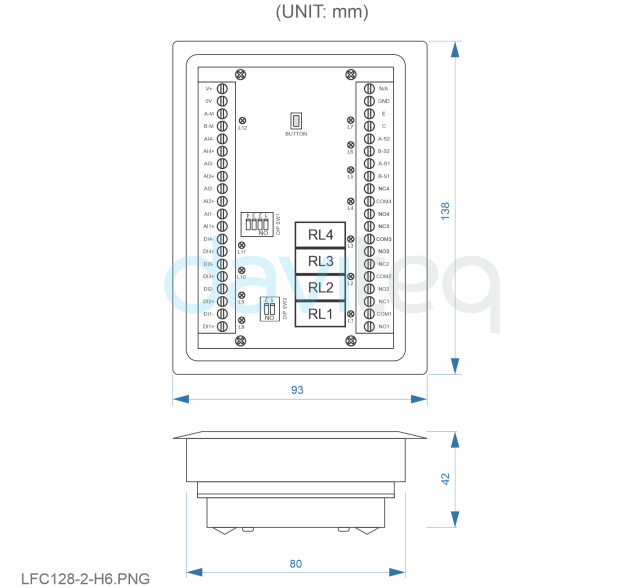

LFC128-2-H3.PNG




LFC128-2-H4.PNG

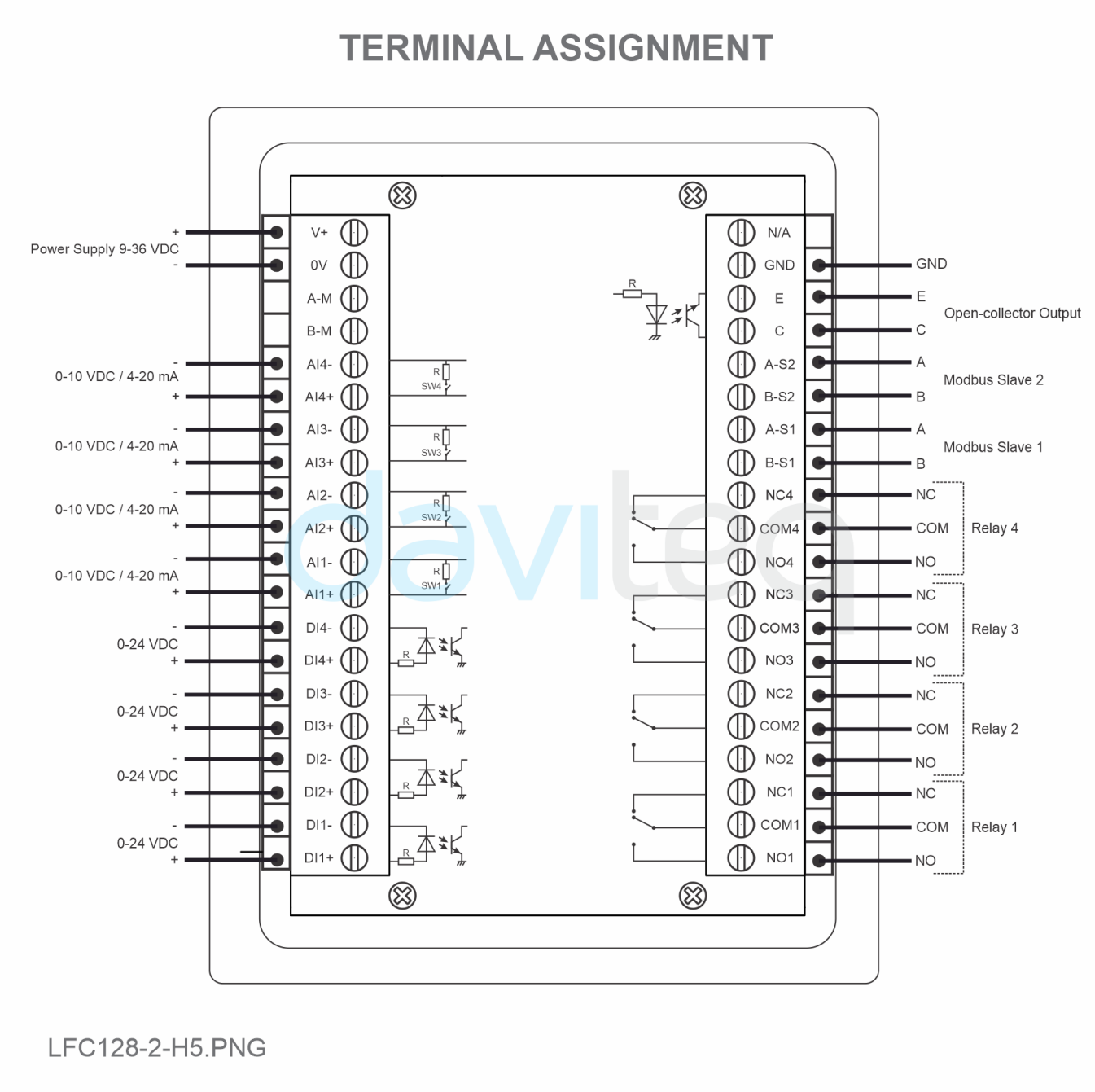



LFC128-2-H5.PNG

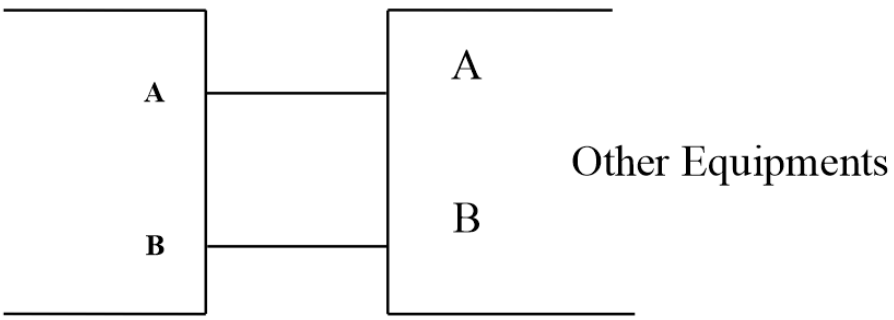



LFC128-2-H6.PNG

# 5. Operation Principle




## 5.1 Modbus communication




02 x RS485/ModbusRTU-Slave

**Protocol:** Modbus RTU

**Address:** 1 - 247, 0 is the Broadcast address

**Baud rate:** 9600 , 19200

**Parity:** none, odd, even

Status indicator LED:

- Led on: modbus communication OK
- Led blinking: received data but modbus communication incorrect, due to wrong Modbus configuration: address, baudrate
- Led off: LFC128-2 received no data, check the connection

## Memmap resgisters

READ uses command 03, WRITE uses command 16

**Default configuration:**

- Address: 1
- Baudrate slave 1: 9600
- Parity slave 1: none
- Baudrate slave 2: 9600
- Parity slave 2: none

| Modbus Register | Hex adr | # of registers | Description | Range | Default | Format | Property | Comment |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 2 | device info | | LFC1 | string | Read | |
| 8 | 8 | 1 | DI1___DI2: digital status | 0-1 | | uint8 | Read | H_byte: DI1<br>L_byte: DI2 |
| 9 | 9 | 1 | DI3___DI4: digital status | 0-1 | | uint8 | Read | H_byte: DI3<br>L_byte: DI4 |
| 10 | A | 1 | AI1___AI2: digital status | 0-1 | | uint8 | Read | H_byte: AI1<br>L_byte: AI2 |
| 11 | B | 1 | AI3___AI4: digital status | 0-1 | | uint8 | Read | H_byte: AI3<br>L_byte: AI4 |
| 12 | C | 1 | AI1: analog value | | | uint16 | Read | |
| 13 | D | 1 | AI2: analog value | | | uint16 | Read | |
| 14 | E | 1 | AI3: analog value | | | uint16 | Read | |
| 15 | F | 1 | AI4: analog value | | | uint16 | Read | |
| 16 | 10 | 2 | AI1: scaled value | | | float | Read | |
| 18 | 12 | 2 | AI2: scaled value | | | float | Read | |
| 20 | 14 | 2 | AI3: scaled value | | | float | Read | |
| 22 | 16 | 2 | AI4: scaled value | | | float | Read | |
| 24 | 18 | 1 | relay 1 | 0-1 | | uint16 | Read | |
| 25 | 19 | 1 | relay 2 | 0-1 | | uint16 | Read | |
| 26 | 1A | 1 | relay 3 | 0-1 | | uint16 | Read | |
| 27 | 1B | 1 | relay 4 | 0-1 | | uint16 | Read | |
| 28 | 1C | 1 | open collector ctrl | | 0-3 | uint16 | Read/Write | 0: off<br>1: on<br>2: pwm, pulse continuously<br>3: pulse, when enough pulse number, ctrl = 0 |
| 30 | 1E | 2 | counter DI1 | | | uint32 | Read/Write | counter writable, erasable |
| 32 | 20 | 2 | counter DI2 | | | uint32 | Read/Write | counter writable, erasable |
| 34 | 22 | 2 | counter DI3 | | | uint32 | Read/Write | counter writable, erasable |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 36 | 24 | 2 | counter DI4 | | | uint32 | Read/Write | counter writable, erasable |
| 38 | 26 | 2 | counter AI1 | | | uint32 | Read/Write | counter writable, erasable, max frequency 10Hz |
| 40 | 28 | 2 | counter AI2 | | | uint32 | Read/Write | counter writable, erasable, max frequency 10Hz |
| 42 | 2A | 2 | counter AI3 | | | uint32 | Read/Write | counter writable, erasable, max frequency 10Hz |
| 44 | 2C | 2 | counter AI4 | | | uint32 | Read/Write | counter writable, erasable, max frequency 10Hz |
| 46 | 2E | 2 | DI1: time on | | | uint32 | Read/Write | sec |
| 48 | 30 | 2 | DI2: time on | | | uint32 | Read/Write | sec |
| 50 | 32 | 2 | DI3: time on | | | uint32 | Read/Write | sec |
| 52 | 34 | 2 | DI4: time on | | | uint32 | Read/Write | sec |
| 54 | 36 | 2 | AI1: time on | | | uint32 | Read/Write | sec |
| 56 | 38 | 2 | AI2: time on | | | uint32 | Read/Write | sec |
| 58 | 3A | 2 | AI3: time on | | | uint32 | Read/Write | sec |
| 60 | 3C | 2 | AI4: time on | | | uint32 | Read/Write | sec |
| 62 | 3E | 2 | DI1: time off | | | uint32 | Read/Write | sec |
| 64 | 40 | 2 | DI2: time off | | | uint32 | Read/Write | sec |
| 66 | 42 | 2 | DI3: time off | | | uint32 | Read/Write | sec |
| 68 | 44 | 2 | DI4: time off | | | uint32 | Read/Write | sec |
| 70 | 46 | 2 | AI1: time off | | | uint32 | Read/Write | sec |
| 72 | 48 | 2 | AI2: time off | | | uint32 | Read/Write | sec |
| 74 | 4A | 2 | AI3: time off | | | uint32 | Read/Write | sec |
| 76 | 4C | 2 | AI4: time off | | | uint32 | Read/Write | sec |
| 128 | 80 | 2 | counter DI1 | | | uint32 | Read | counter cannot write, erase |
| 130 | 82 | 2 | counter DI2 | | | uint32 | Read | counter cannot write, erase |
| 132 | 84 | 2 | counter DI3 | | | uint32 | Read | counter cannot write, erase |
| 134 | 86 | 2 | counter DI4 | | | uint32 | Read | counter cannot write, erase |
| 136 | 88 | 2 | counter AI1 | | | uint32 | Read | counter cannot write, erase; max frequency 10Hz |
| 138 | 8A | 2 | counter AI2 | | | uint32 | Read | counter cannot write, erase; max frequency 10Hz |
| 140 | 8C | 2 | counter AI3 | | | uint32 | Read | counter cannot write, erase; max frequency 10Hz |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 142 | 8E | 2 | counter AI4 | | | uint32 | Read | counter cannot write, erase; max frequency 10Hz |
| 256 | 100 | 1 | modbus address slave | 1-247 | 1 | uint16 | Read/Write | |
| 257 | 101 | 1 | modbus baudrate slave 1 | 0-1 | 0 | uint16 | Read/Write | 0: 9600, 1: 19200 |
| 258 | 102 | 1 | modbus parity slave 1 | 0-2 | 0 | uint16 | Read/Write | 0: none, 1: odd, 2: even |

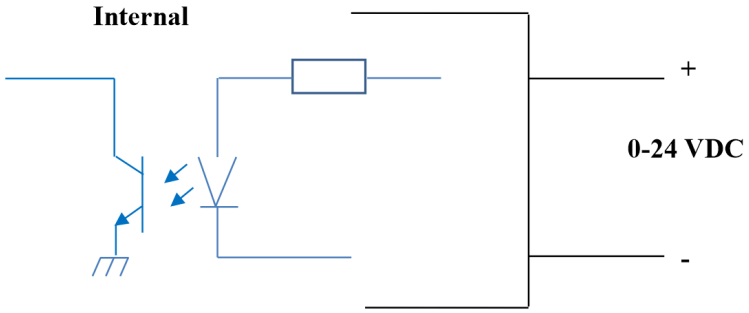
## 5.2 Reset Button

When holding the reset button for 4 seconds, LFC 128-2 will reset the default configuration to 02 x RS485 / Modbus RTU-Slave.

Default Modbus RTU Configuration:

- Address: 1
- Baud Rate: 9600
- Parity: none

## 5.3 Digital Input




**Specification:**

- 04 channels DI, isolated
- Input Resistance: 4.7 kΩ
- Isolation Voltage: 5000Vrms
- Logic level 0: 0-1V
- Logic level 1: 5-24V
- Function:
  - Read logic 0/1
  - Pulse Counter

### 5.3.1 Read the logical state 0/1

Logic value in Modbus Memory Map: 0-1

Registers to store logic values in the Modbus Memory Map:

- DI1__DI2: digital status: stores the logical state of channel 1 and channel 2.
  - H_byte: DI1
  - L_byte: DI2
- DI3__DI4: digital status: store the logical state of channel 3 and channel 4.
  - H_byte: DI3
  - L_byte: DI4

### 5.3.2 Pulse Counter

Counter value in Modbus Memory Map, when adding the number exceeds the threshold, it will automatically return: 0 - 4294967295 (32bits)

The register that stores Counter value in the Modbus Memory Map cannot be erased:

- Counter DI1: stores the logic state of channel 1
- Counter DI2: stores the logic state of channel 2
- Counter DI3: store the logic state of channel 3
- Counter DI4: stores the logic state of channel 4

The register that stores Counter value in the Modbus Memory Map cannot be erased:

- None reset counter DI1: stores the logic state of channel 1
- None reset counter DI2: stores the logic state of channel 2
- None reset counter DI3: stores the logic state of channel 3
- None reset counter DI4: stores the logic state of channel 4

**Pulse Counter Mode:**

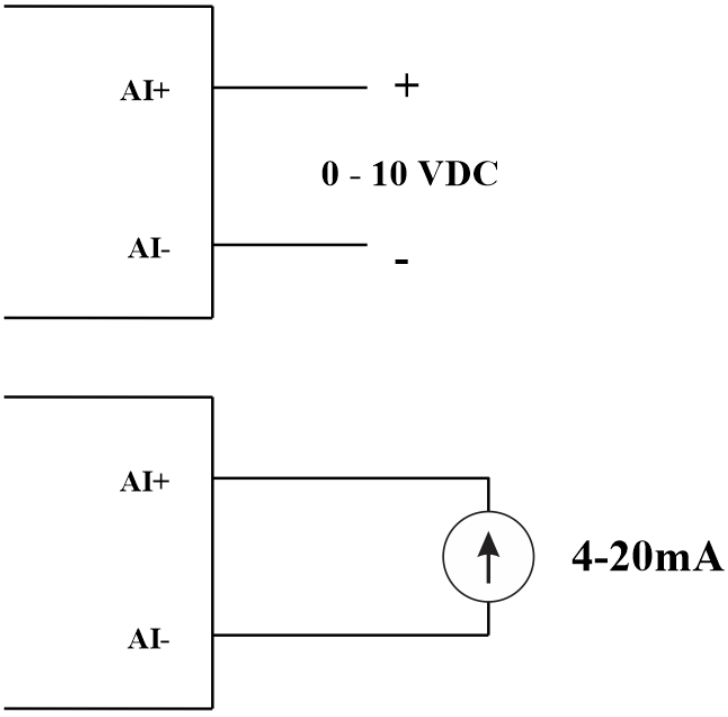
Low-speed pulse count less than 10Hz with filter, anti-jamming:

- Set register "counter DI1: filter time" = 500-2000: Channel 1 counts pulses less than 10Hz
- Set register "counter DI2: filter time" = 500-2000: Channel 2 counts pulses less than 10Hz
- Set register "counter DI3: filter time" = 500-2000: Channel 3 counts pulses less than 10Hz
- Set register "counter DI4: filter time" = 500-2000: Channel 4 counts pulses less than 10Hz

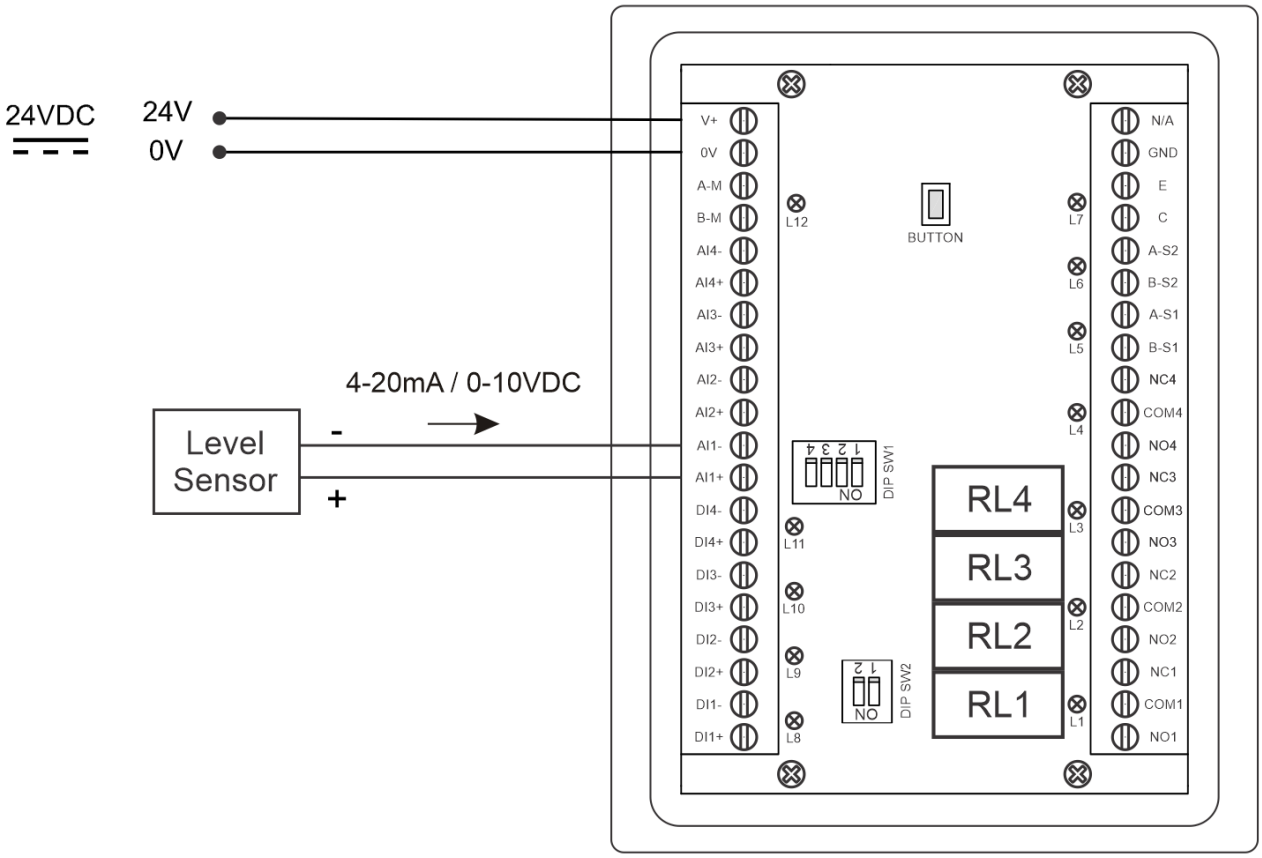
High-speed pulse count with max 2KHz frequency without filter:

- Set register "counter DI1: filter time" = 1: channel 1 counts pulses with Fmax = 2kHz
- Set register "counter DI2: filter time" = 1: channel 2 counts pulses with Fmax = 2kHz
- Set register "counter DI3: filter time" = 1: channel 3 counts pulses with Fmax = 2kHz
- Set register "counter DI4: filter time" = 1: channel 4 counts pulses with Fmax = 2kHz

## 5.4 Analog Input




04 AI channels, no isolation (**AI1 is a 4-20mA / 0-5 VDC / 0-10 VDC level sensor input** )




Use DIP SW to configure Analog input: 0-10V, 0-20mA




| Value | Type of AI |
|---|---|
| 0 | 0-10 V |
| 1 | 0-20 mA |

**Input type:**

- Measure voltage: 0-10V
- Measure current: 0-20mA
- The configuration for **AI** reads the same logical state as **DI**, but it is not isolated with a pulse range of **0-24V**

**Input impedance**:

- Measure voltage: 320 kΩ
- Measure the current: 499 Ω

### 5.4.1 Read the Analog value

Resolution 12 bits

Non-Linearity: 0.1%

Analog value in Modbus Memory Map: 0-3900

Analog value register in the Modbus Memory Map:

- AI1 analog value: store the Analog value of channel 1
- AI2 analog value: stores the Analog value of channel 2
- AI3 analog value: store the Analog value of channel 3
- AI4 analog value: store the Analog value of channel 4

### 5.4.2 AI configuration works as DI

No isolation

AI Configure AI to read the same logic state as DI with pulse amplitude from 0-24V

There are 2 counter threshold AIx: logic threshold 0 and counter AIx: threshold logic 1 in the modbus table: 0-4095

- Analog Analog value of AI <counter AIx: threshold logic 0: is considered Logic 0 status of AI
- Analog Analog value of AI> counter AIx: threshold logic 1: is considered to be Logic 1 state of AI
- Counter AIx: threshold logic 0 = <Analog value of AI <= counter AIx: threshold logic 1: is considered to be the constant logic state

Logic Logical status value of AI in Modbus Memory Map table: 0-1

The register stores logical values in Modbus Memory Map:

- AI1___AI2: digital status: stores the logical state of channel 1 and channel 2.
  - H_byte: AI1
  - L_byte: AI2
- AI3___AI4: digital status: stores the logical state of channel 1 and channel 2.
  - H_byte: AI3
  - L_byte: AI4

### 5.4.3 Pulse Counter AI max 10Hz

Counter value in Modbus Memory Map, when adding the number beyond the threshold, it will automatically return: 0 - 4294967295 (32bits)

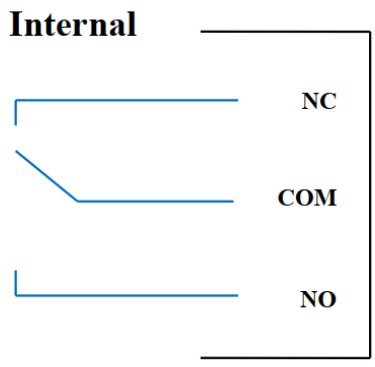
The register that stores Counter value in the Modbus Memory Map cannot be erased:

- Counter AI1: stores the logic state of channel 1
- Counter AI2: save logic state of channel 2
- Counter AI3: save logic state of channel 3
- Counter AI4: save logic state of channel 4

The register that stores Counter value in the Modbus Memory Map cannot be erased:

- None reset counter AI1: stores the logic state of channel 1
- None reset counter AI2: stores the logic state of channel 2
- None reset counter AI3: stores the logic state of channel 3
- None reset counter AI4: save logic state of channel 4

## 5.5 Relay



04 channel Relay SPDT NO / NC

Contact rating: 2A / 24VDC, 0.5A / 220VAC

There are status LEDs:

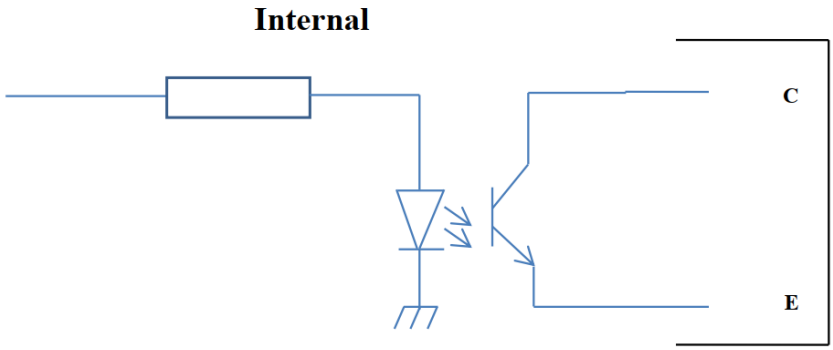
- Led on: Close Contact
- Led off: Open Contact

| Default Relay Register | Status of relays when resetting power supplies |
|---|---|
| 3 | Operate according to the Alarm configuration |

**Alarm Configuration:**

- **HIHI** : Relay 4 On
- **HI** : Relay 3 On
- **LO** : Relay 2 On
- **LOLO**: Relay 1 On

## 5.6 Pulse Output




01 isolated open-collector channel

**Opto-coupler:** Source current Imax = 10mA, Vceo = 80V

**Functions:** On / Off, pulse generator, PWM

### 5.6.1 On/Off Function

Set the Open-collector register in the Modbus Memory Map table:

- Set Open-collector register: 1 => Pulse Output**ON**
- Set Open-collector register: 0 => Pulse Output**OFF**

### 5.6.2 Pulse generator

Pulse output transmits a maximum of 65535 pulses, with Fmax 2.5kHz

Configure the following registers in the Modbus Memory Map table:

- Set register "open collector: pulse number": 0-65535 => Pulse Number = 65535: broadcast 65535 pulses
- Set register "open collector: time cycle": (0-65535) x0.1ms => Time Cycle = 4: Fmax 2.5kHz
- Set register "open collector: time on": (0-65535) x0.1ms => Time On: is the logic time 1 of the pulse
- Set the register "open collector ctrl" = 3 => configure the Pulse Output to generate a pulse and start to pulse, generate a sufficient number of pulses in the "open collector: pulse number" register => stop pulse generator and register " open collector ctrl ”= 0

### 5.6.3 PWM

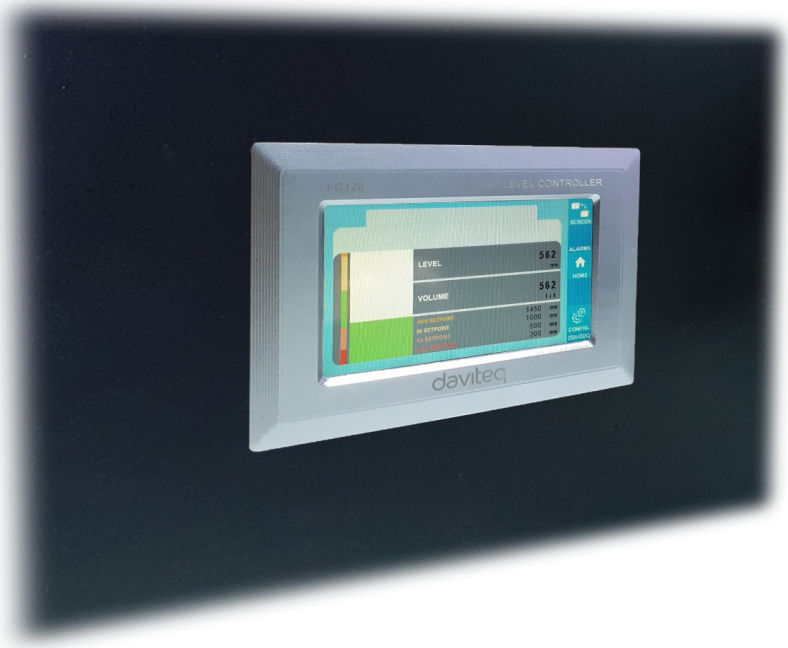
Max frequency 2.5kHz

Configure the following registers in the Modbus Memory Map table:

- Set the register "open collector ctrl" = 2 => configure Pulse Output PWM function
- Set register "open collector: time cycle": (0-65535) x0.1ms => Time Cycle = 4: Fmax 2.5kHz
- Set register "open collector: time on": (0-65535) x0.1ms => Time On: is the logic time 1 of the pulse

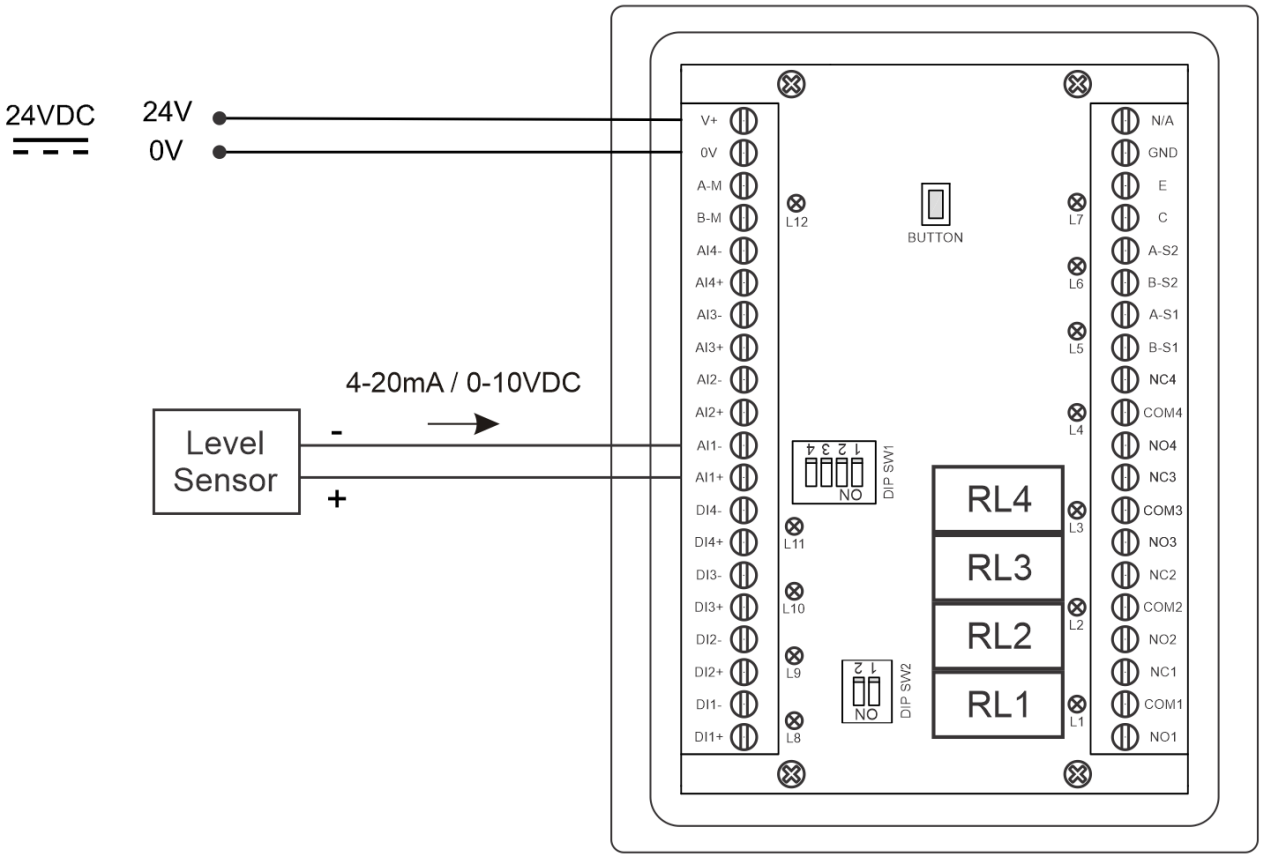
# 6. Installation

## 6.1 Installation method



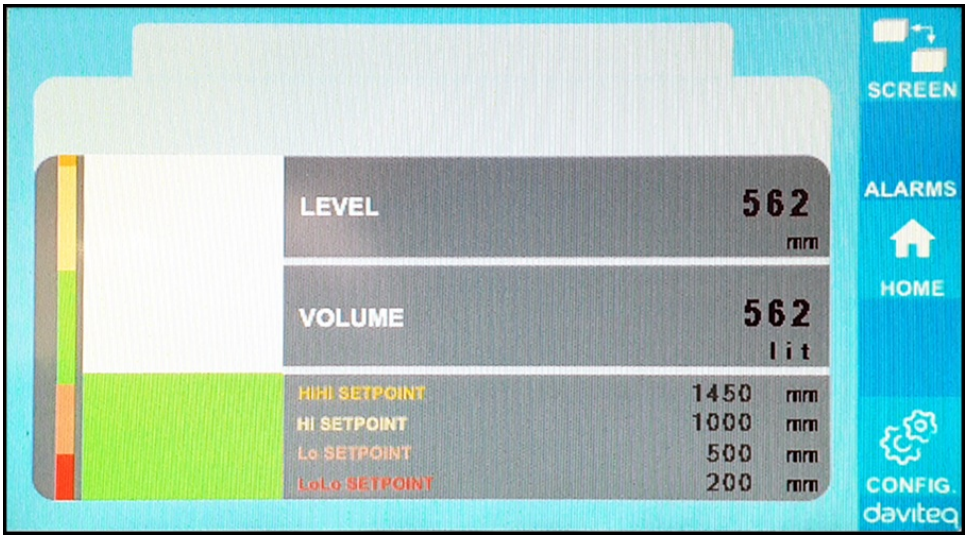

**Panel mount**

## 6.2 Wiring with Level Sensor



# 7. Configuration

## 7.1 Home Screen




**SCREEN:** Switch to 2nd screen with more detailed information

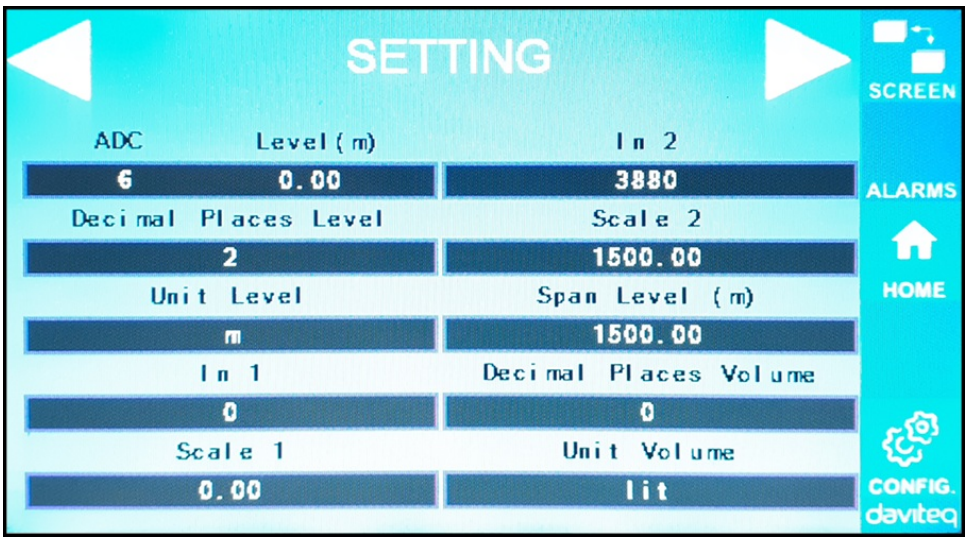
**ALARMS:** Show Level Alert

**HOME:** Return to Home Screen

**CONFIG. (Default Password: a):** Go to Setting Screen

## 7.2 Setting screen (Default Password: a)

### 7.2.1 Screen 1




**ADC:** Raw signal value of channel AI1

**Level (Unit):** The level corresponds to the ADC signal after configuration

**Decimal Places Level:**Decimal number of digits after the dot of Level 0-3 (00000, 1111.1, 222.22, 33.333)

**Unit level:** level units, 0-3 (0: mm, 1: cm, 2: m, 3: inch)

**In 1:** Enter the ADC value after putting 4 mA / 0 VDC into AI1 for calibration at 0 level

**Scale 1:** The level value displayed corresponds to the value entered in In 1 (usually 0)

**In 2:** Enter the ADC value after putting 20 mA / 10 VDC into AI1 for calibration at Full level

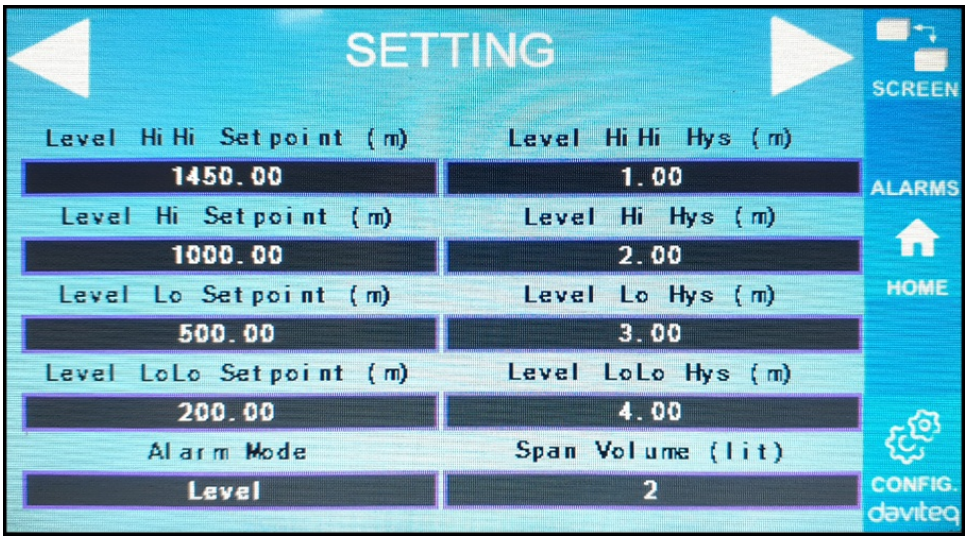
**Scale 2:** The level value displayed corresponds to the value entered in In 2

**Span Level:** Maximum value of Level (Span Level ≥ Scale 2)

**Decimal Places Volume:** Decimal number of digits after the dot of Volume 0-3 (00000, 1111.1, 222.22, 33.333)

**Unit Volume:** units of volume 0-3 (0: lit, 1: cm, 2: m3, 3:%)

## 7.2.2 Screen 2




**Level Hi Hi Set point (Unit):** High High level of Alarm Level

**Level Hi Hi Hys (Unit):** High High level hysteresis of Alarm Level

**Level Hi Set point (Unit):** High level of Alarm Level

**Level Hi Hys (Unit):** High level hysteresis of Alarm Level

**Level Lo Set point (Unit):** Low level of Alarm Level

**Level Lo Hys (Unit):** Low level hysteresis of Alarm Level

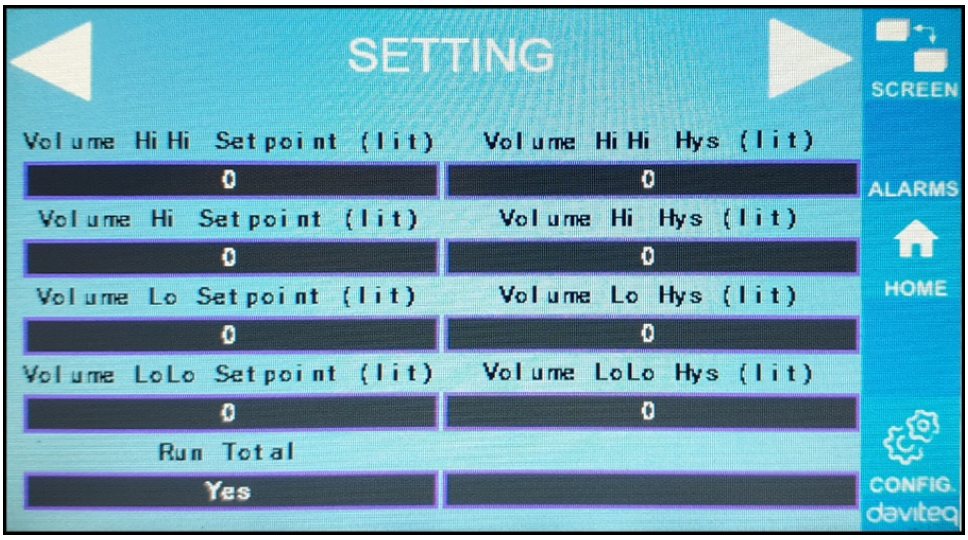
**Level Lo Lo Set point (Unit):** Low Low level of Alarm Level

**Level Lo Lo Hys (Unit):** Low Low level hysteresis of Alarm Level

**Alarm Mode:** 0: Level, 1: Volume

**Span Volume(Unit):** Maximum value of the volume

## 7.2.3 Screen 3




**Volume Hi Hi Set point (Unit):** High High volume of Alarm Volume

**Volume Hi Hi Hys (Unit):** High High volume hysteresis of Alarm Volume

**Volume Hi Set point (Unit):** High volume of Alarm Volume

**Volume Hi Hys (Unit):** High volume hysteresis of Alarm Volume

**Volume Lo Set point (Unit):** Low volume of Alarm Volume

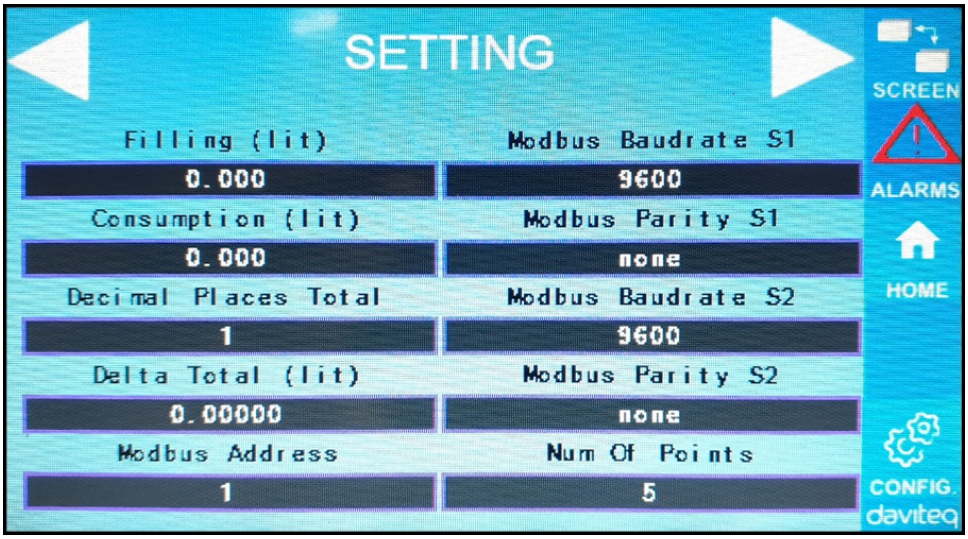
**Volume Lo Hys (Unit):** Low volume hysteresis of Alarm Volume

**Volume Lo Lo Set point (Unit):** Low Low volume of Alarm Volume

**Volume Lo Lo Hys (Unit):** Low Low volume hysteresis of Alarm Volume

**Run Total:** Run the total function. 0-1 (0: No 1: Yes)

## 7.2.4 Screen 4




**Filling (Unit):** Total function: total put into tank

**Consumption (Unit):** Total function: total consumption of the tank

**Decimal Places Total:** Decimal number of parameters Filling, Consumption, NRT Filling, NRT Consumption on display page (not the setting page)

**Delta Total (Unit):** Hysteresis level of the total function

**Modbus Address:** Modbus address of LFC128-2, 1-247

**Modbus Baurate S1:** 0-1 (0 : 9600 , 1 : 19200)

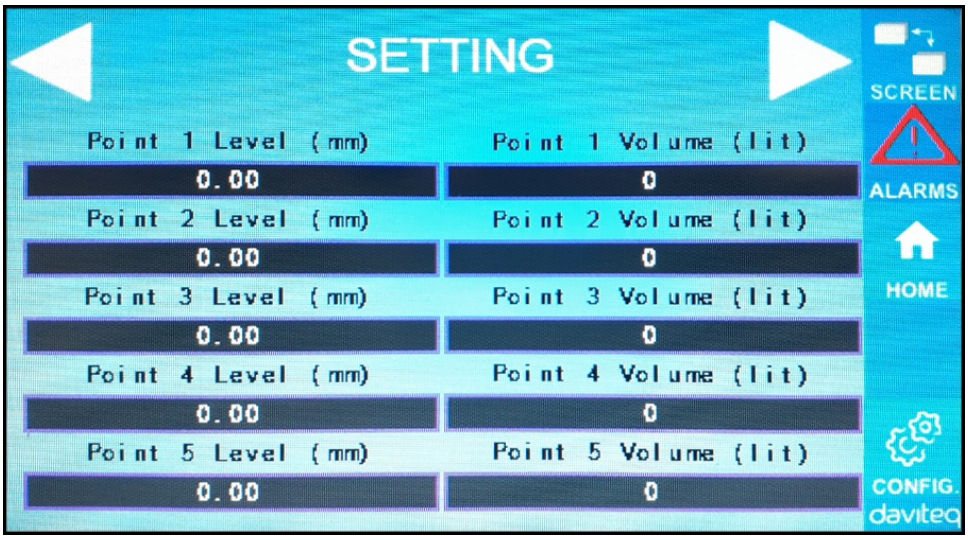
**Modbus Parity S1:** 0-2  (0: none, 1: odd, 2: even)

**Modbus Baurate S2:** 0-1 (0 : 9600 , 1 : 19200)

**Modbus Parity S2:** 0-2  (0: none, 1: odd, 2: even)

**Num of Points:** Number of points in the table to convert from level to volume, 1-166

## 7.2.5 Screen 5




**Point 1 Level (Level Unit):** Level at Point 1

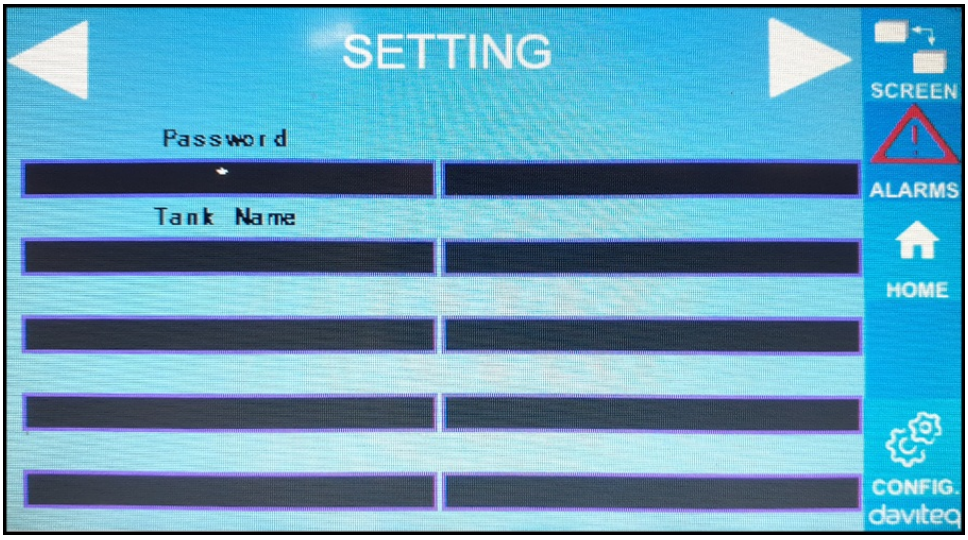
**Point 1 Volume (Volume Unit):** The corresponding volume at Point 1

- 
- 
- 

**Point 166 Level (Level Unit):** Fuel level at Point 166

**Point 166 Volume (Volume Unit):** The corresponding volume at Point 166

### 7.2.6 Screen 6




**Password:** Password to enter the Setting page, 8 ASCII characters

**Tank Name:** Tank name displayed on the main screen

# 8. Troubleshooting

| No. | Phenomena | Reason | Solutions |
|---|---|---|---|
| 1 | Modbus failed to communicate | Modbus LED Status:<br>• LED is off: received no data<br>• LED is blinking: the Modbus configuration is not the correct | • Check the connection<br>• Check the Modbus configuration: Address, Baud Rate, Parity |

| | | | |
|---|---|---|---|
| 2 | Timeout Modbus | Noise appears on the line | Configure Baudrate 9600 and use a twisted pair cable with anti-jamming protection |
| 3 | Sensor Disconnected | Sensor and LFC128 lost connection | • Checking connection<br>• Check sensor type (LFC128-2 only connects to 0-10VDC / 4-20mA analog sensor type)<br>• Check the switch to see if it is turned on correctly<br>• Check that the sensor connector is correct AI1 |
| 4 | Linearization table error | Error of conversion table from level to volume | Check the configuration of the conversion table from level to volume |

# 9. Support contacts


Manufacturer

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