DANIEL®
XRT TOTALIZER
USER MANUAL

Decades Proven. Field Chosen.™

CONTENTS

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1   ABOUT THIS MANUAL

1.1   HOW TO USE THIS MANUAL

This operation manual is divided into two main parts:

- The daily use of the E112-P is described in **Section 4: Operation [»9].** These instructions are meant for users.

- All subsequent sections and appendices are meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

Always follow the instructions in this manual, especially the safety information. For additional information, please contact your supplier.

1.2   USE OF PICTOGRAMS

A hazardous situation may occur if the unit is not used for the purpose it was designed for or is used incorrectly. The following pictograms inform you of important information:

⚠ **WARNING**

A warning indicates a hazardous situation that could cause injury or death.

⚠ **CAUTION**

A caution indicates a condition that could cause:

- Moderate/minor personal injury or equipment damage.

- Incorrect functioning of the unit or connected instruments.

NOTE
A note informs you of important information.

1.3   WARRANTY AND TECHNICAL SUPPORT

For warranty and technical support for your products, please contact your supplier.

1.4   MODEL REFERENCE

Hardware version:	13.03.xx
Software version:	03.07.xx
Document version:	DA_E112-P_M_v0301-01_EN
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2 SAFETY

2.1 PERSONAL SAFETY

- Explosion hazard: Never open the unit in a hazardous area when it is connected to a power supply or a consuming device other than the internal battery supply.

- Risk of electric shock: Only open the unit if all leads are free of potential electrical energy.

- Immediately inform the person responsible for the installation if you:
  - detect errors or danger.
  - disagree with the safety precautions.

2.2 END-USER RESPONSIBILITIES

- Installation, use, and servicing of the unit must be done by authorized technicians.

- This unit is not designed for use in life support appliances, devices, or systems where malfunction of the product could result in personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.

- Check all connections, settings and technical specifications of all peripheral devices supplied with the unit.

- The unit must be installed in accordance with the EMC (Electro Magnetic Compatibility) guidelines.

- If the unit is used on a ship, truck or somewhere else with no ground, connect an appropriate grounding to the housing as described in the "Installation" chapter of this manual. Never remove the earth lead between the housing and the removable terminal-block.

- The local labor and safety laws, and regulations must be adhered to.

- Modifying the unit without prior written consent from the manufacturer will result in the immediate termination of product liability and the warranty period.

- The manufacturer accepts no responsibility whatsoever if the safety information and instructions in this manual are not observed.

2.3 POTENTIAL EQUIPMENT DAMAGE

- Before installing the unit, check the mains voltage and information on the manufacturer's label for product configuration.

- Electro Static Discharge (ESD) causes irreparable damage to electronics. When installing or opening the unit, wear an ESD ground strap that is correctly grounded and first discharge yourself by touching a grounded object.

- Never touch the electronic components.

- Never expose the unit to conditions than may exceed the enclosure classification (see the manufacturer's label for certification data; also refer to **Section 6.1: Installation / environmental conditions [»35]).**

2.4 DISPOSAL OF ELECTRONIC WASTE

At the end of its life this product should be disposed of according to the (inter)national regulations regarding waste electronic equipment. If a battery is installed in this product it should be disposed of separately. The separate collection and recycling of your waste equipment will help to conserve natural resources and ensure that it is recycled in a manner that protects the environment.

3   INTRODUCTION

3.1   SYSTEM DESCRIPTION

The flowrate indicator / totalizer model E112-P (also referred to as a unit) is an explosion proof microprocessor-driven instrument designed to linearize the flowmeter's flow curve and to show the current flowrate, the totalized flow and the accumulated totalized flow, current and previous day total, and several historical day totals.

FIG. 1: THE E112-P
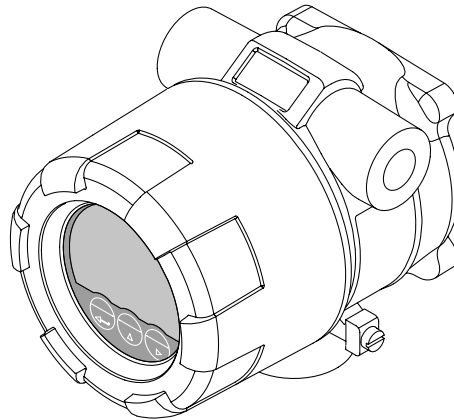
This manual describes the daily use, configuration and installation of the standard unit (with pulse input from a flowmeter) and its available options. The following figure shows the E112-P used in a typical application.

FIG. 2: TYPICAL APPLICATION

Scaled pulse output   Analog output   Modbus communication
                                                  RS485/RS232 (option)

external reset

linearisation   pulse
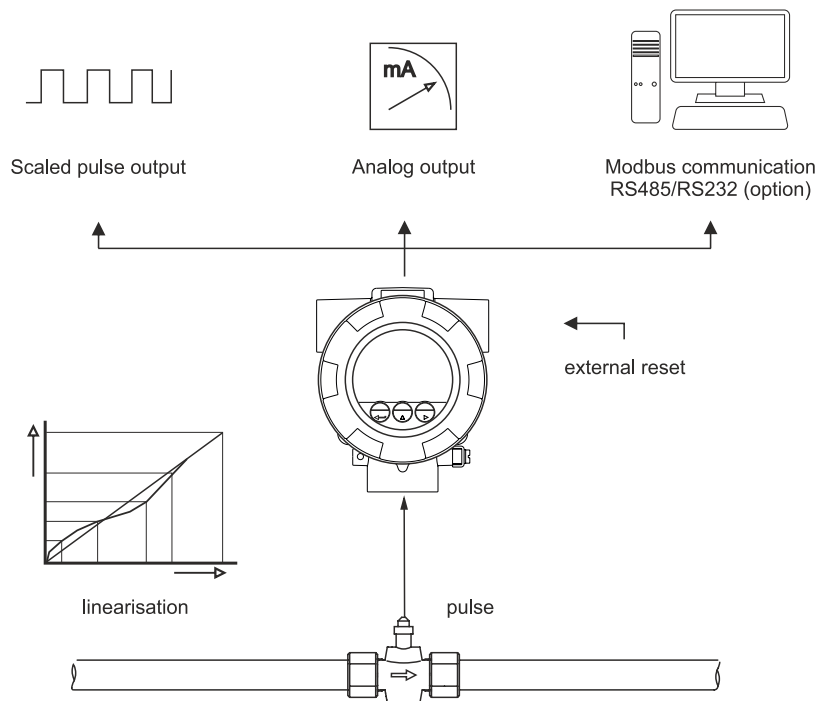
3.2   PRODUCT FEATURES

The main features of the unit are:

- User-friendliness: optical keys for through-the-glass operation (no need to touch the glass or remove the cover).

- Bright backlight enables good readings in full sunlight and darkness.

- Usability: wide operational temperature, high ingress protection rating and international certification.

- PC configuration software making configuration quick and easy.

- Rugged design for harsh environments: not just designed to be explosion proof.

- Aluminum enclosure with high quality industrial two component coating or stainless steel 316L enclosure for offshore applications.

- Mounting flexibility: multiple solutions for sensor mounting, including 1" NPT or M25 bottom entry; suitable for wall or pipe mount applications.

- Installation friendly design: spacious cabling area, plug and play cable connection and easy to remove electronic module.

- Ability to process any type of sensor signal.

- Multiple power supply options to suit any application, including long-life battery supply.

- Configurable pulse and analog signal outputs and optional communication outputs.

Standard inputs

- One flowmeter with a passive or active pulse, NAMUR or coil signal output can be connected to the E112-P. Several options are available for powering the sensor.

- Status input to reset total remotely or to lock the 'clear total' key.

Standard outputs

- Configurable pulse output to transmit pulses representing a certain linearized total quantity. The pulse length can be set as desired with a maximum frequency of 500 Hz.

- Unscaled frequency output for retransmission of the incoming pulses as robust square wave forms.

- Configurable linear 4-20mA isolated analog output with 12-bits resolution representing the actual linearized flowrate. Flowrate levels and the minimum and maximum signal output can be tuned.

Control panel

The unit is equipped with a control panel with three optical keys and a large backlit Liquid Cristal Display (LCD) with various symbols and digits to display/control measurement units, status information, trend-indication, and key-word messages.

Configuration

The unit can be used for many types of application and has both a SETUP mode as well as a PC connection for configuring it to your requirements. It includes several important features, such as K-Factor, measurement units and signal selection.

All settings are stored in an EEPROM memory so they will not be lost if there is a power failure or the battery is drained. For information on how to extend the battery life, consult **Section 5.2.4: Saving battery lifetime (type PB) [»19].**

Options

Available options are:

- power and sensor supply
- mechanical relay
- full Modbus communication RS232/485 or USB (also battery powered)
- powerful data logging

3.3   INSTALLATION EXAMPLE

Following parts can be recognized in below installation example.

FIG. 3: INSTALLATION EXAMPLE E112-P
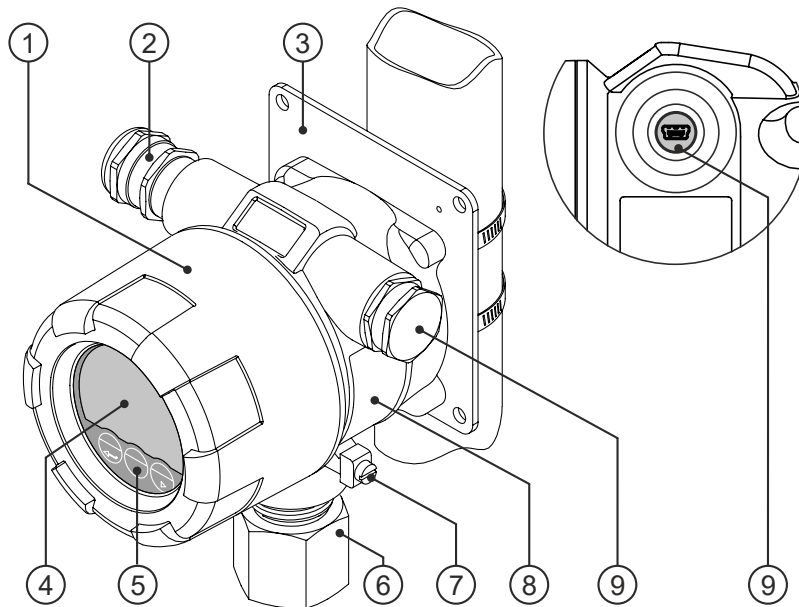
1. Cover	4. Display	7. Grounding
2. Armed cable connection	5. Optical touch keys	8. Labels
3. Pipe mounting plate	6. Process mount	9. USB connection

4 OPERATION

> ⚠️ **CAUTION**
>
> This unit may only be operated by authorized and trained personnel who have read and understood this manual, particularly **Section 2: Safety [»5].**

4.1 INTRODUCTION

This chapter describes the daily use and operation of the E112-P. For this, the unit is equipped with a control panel that provides the operator with various functions, information and operating modes.

4.1.1 OPERATING MODES

The following operating mode are available:

- **OPERATOR**-mode
  This is the default mode of operation and mode indicator **RUN** is shown on the display. This mode is available for all operators and gives access to most other modes. The available functions and rights depend on the type of unit and configured settings. The unit will always return to this mode when there is no user interaction for some time in any of the other modes.

- **LOG**-mode
  When the unit is equipped with a logging function (like historical day totals), this mode is used to access the logged data. The mode indicator **LOG** is shown on the display and, depending on the type of unit, functions like logbook-selection and printing become available.

- **SETUP**-mode
  This mode allows to review all configuration settings using a SETUP-menu. The mode indicator **SETUP** is shown on the display and access can be restricted via a password. After selecting a configuration item, it can be changed using the PROGRAM-mode.

- **PROGRAM**-mode
  This mode is used to change settings in the SETUP-menu, enter values in OPERATOR-mode or enter a password. When a setting is being changed, this is indicated by the mode indicator **PROG** on the display.

The following paragraphs describe the modes of operation in more detail. SETUP-mode and PROGRAM-mode are described in **Section 5: Configuration [»17].**

4.2 CONTROL PANEL

The control panel is located on the front side of the E-Series and consists of the following parts:

- A Liquid Cristal Display (LCD) to show process values and various other information.

- Three optical keys (PROG, SELECT, CLEAR) to control the unit during operation.

- A backlight to illuminate the display.

When the front cover is removed (only during service in non-hazardous area), the following parts also become available:

- The Main Electronics Module (MEM)

- Three mechanical keys to control the unit during service.

- A switch to completely disable the optical keys.

These parts are explained in **Section 5.2: Operating the Main Electronics Module (MEM) [»17].**

> ⚠️ **WARNING**
>
> **Explosion risk: never open the housing when explosive atmosphere is present.**
>
> Opening and servicing of the unit may only be carried out by authorized and trained personnel who have read and understood this manual, particularly **Section 2: Safety [»5].**

4.2.1 DISPLAY

Inside the E112-P, all inputs (such as sensors and switches) and outputs (such as relays and current loop) are continuously processed in the background. The relevant process information is then displayed on a selection of screens when the unit is in OPERATOR-mode.

Normally, the information shown on the display is updated depending on the refresh rate selected in the configuration settings. However, by pressing any of the keys, the display switches to refreshing the information 8 times per second. After 30 seconds of key inactivity, the display returns to the configured refresh rate.

The display contains one line with large digits at the top and one line with small digits at the bottom. The top line is mainly used to display key process information, while the bottom line usually displays less important information or system messages. Both lines are surrounded by various symbols to indicate operating mode, function, status and measurement unit. The following image shows this in more detail:

FIG. 4: DISPLAY LAYOUT AND IMPORTANT SYMBOLS

1. Optical keys: PROG, SELECT, CLEAR

2. Small digits – bottom line

3. Current function – bottom line

4. Large digits – top line

5. Measuring unit – top line

6. Current function – top line

7. Key lock symbol (for optical keys)
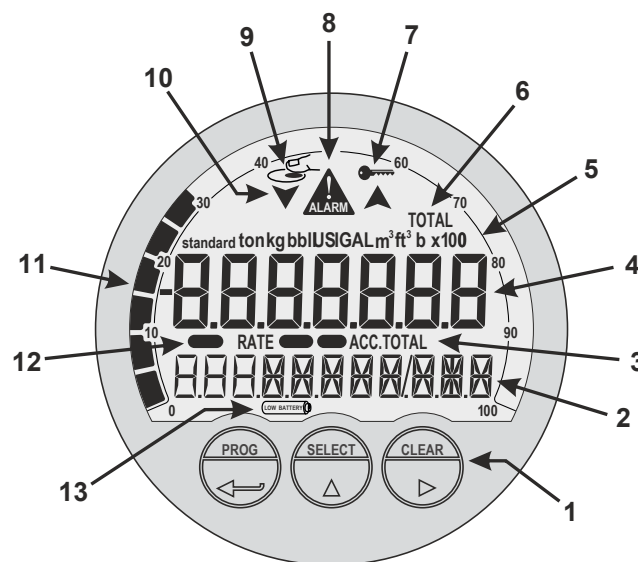
8. Alarm indication symbol

9. Optical keys activation indicator

10. Trend indication arrows (increase / decrease)

11. Speedometer

12. Mode indicators: RUN, SETUP, PROG

13. Low battery indicator

4.2.2 OPTICAL KEYS

The optical keys are used to control the unit 'through the glass' without the need to open the enclosure. To activate an optical key, position a finger (clean and without gloves) in front of the glass above the indicated area for PROG, SELECT or CLEAR. Correct key operation will result in the activation indicator ⟲ to show on the display. After the indicator is shown, the finger can be removed and the selected key 'is pushed'.

The optical keys only work reliably when the glass is clean. Try to avoid actually touching the glass as this could leave smudges. Clean the glass regularly with a lint free cloth dampened with (soapy) water.

False activation or bad responses of the optical keys can also be caused by:

- Dirt, grease or dust on the glass.

- Shiny surfaces positioned up to 100 mm (4 inches) in front of the display.

Key lock function

To prevent any erroneous operations due to false optical key activation, a key lock function is implemented. When the function is enabled (default), the optical keys are automatically locked if no optical key is activated for 30 seconds.

⚠ CAUTION

- False optical key activations can cause erroneous operation and reduce the battery lifetime significantly. Therefore, it is advised to keep the key lock function enabled.

- When battery powered, the backlight will only come on after the unlock sequence is finished.

The Key lock symbol ⚿ appears at the top of the display to indicate that the keys are locked or disabled:

FIG. 5: KEY LOCK SYMBOL
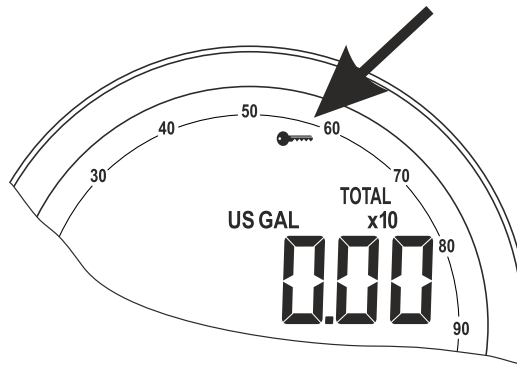
To unlock the optical keys, an unlock sequence needs to be performed. Start the unlock sequence by activating any of the optical keys. The display will now prompt the operator to activate each optical key in sequence: PROG > SELECT > CLEAR.

When successful, the Key lock symbol ⚿ disappears and the optical keys can be used to control the unit. To lock the optical keys again, wait for 30 seconds or push the PROG and CLEAR keys simultaneously for 3 seconds.

(Temporarily) Disabled optical keys

To save battery lifetime and to prevent unwanted access or operation, the optical keys can be disabled completely. Additionally, after using the mechanical pushbuttons, the optical keys are automatically disabled for 30 seconds.

When the optical keys are disabled, the Key lock symbol ⚿ is shown continuously and the display does not prompt for the unlock sequence. **See Section 5.2: Operating the Main Electronics Module (MEM) [»17]** for more information.

4.2.3 BACKLIGHT

The E112 is equipped with a backlight to illuminate the display for improved readability. Depending on the type of supply the backlight functions as follows:

- When the unit is powered by an external power supply, the backlight is on continuously and its intensity can be adjusted in the configuration settings.

- When the unit is battery powered, the backlight remains off until a key is pressed or the unlock sequence is finished. To safe battery life, the backlight operates at a fixed minimum intensity and turns off again after 3 seconds of inactivity.

- When the unit is used in a loop powered application, the backlight will not come on because only limited power is available.

4.3 OPERATOR FUNCTIONS

NOTE

Before operating the unit, check that the ☛ symbol is not shown on the display.

Otherwise, unlock the optical keys as described in **Section 4.2.2: Optical keys [»10].**

Functions of the keys in operator mode

The following functions are available:

PROG-key

This key is used to program and save new values or settings. The PROG-key is also used to gain access to SETUP mode, see **Section 5: Configuration [»17].**

SELECT-key

This key is used to select the displayed information, like accumulated total and flowrate.

CLEAR-key

This key is used to clear the value of total.

The CLEAR-key also provides access to the LOG-mode, to review historical day totals (or optional data logging).

Selecting displayed information

By pressing the SELECT-key, all relevant information can be reviewed on the display. When no key is pressed for 20 seconds, the display will jump back to the main screen. The following image of the display shows the main screen with Total shown on the top line and Flowrate on the bottom line.

FIG. 6: EXAMPLE OF DISPLAY INFORMATION
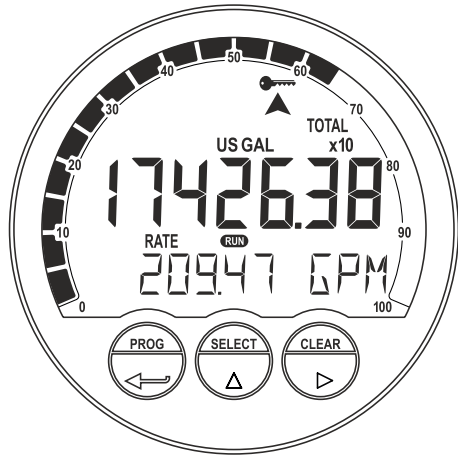
The following table shows the available display information screens, determined by the configuration settings for Display. If an operator alarm occurs, this will also be shown on the same screen – see **Section 4.5: Operator alarms [»14].**

| Display information | **SETUP 3.1: DISPLAY > FUNCTION [»25]** | | |
	= TOTAL	**= FLOWRATE**	**ACC. TOTAL**
TABLE 2-3: 2818 DUAL CHANNEL PREAMPLIFIER PERFORMANCE			
MAIN SCREEN	Total[1] Flowrate	Flowrate	Total[1] Acc. Total
SCREEN 1	Total[1] Acc. Total	Total[1] Acc. Total	Total[1] Flowrate
SCREEN 2 [2]	Current day Total		
SCREEN 3 [2]	Previous day Total		
INTERNAL ERROR [3]	Internal alarm code		

[1] When total is shown on the display, it can be cleared (reset to '0') by pressing the CLEAR-key twice.
[2] Only available when day totals are enabled in SETUP 3.2: DISPLAY > DAY TOTALS [»26].
[3] If an internal error occurs, an additional screen becomes available to show the internal alarm code.

Clearing Total

The measured flow is added to the various counters (like Total) of the unit. Only Total is resettable, Accumulated total and day totals are non-resettable. The operator can clear Total by executing following steps:

1. Make sure Total is shown on the display.

2. Push the CLEAR-key. The display shows the message 'PUSH CLEAR' on the bottom line and Total on the top line.

3. To clear Total, push the CLEAR-key again. To cancel the operation, push any other key or wait for 20 seconds.

4. Check that Total is reset to '0' (this action DOES NOT reset the Accumulated total).

NOTE
- If a password is assigned in **SETUP** 1.5: TOTAL > CLEAR PASSWORD [»24], the operator is prompted to enter the password before Total can be reset.

- Type IB – External reset allows to clear Total via an external pushbutton. This clear action operates in parallel with the clear total procedure of the control panel but does not require any extra confirmation or password. When the external pushbutton connection is permanently closed, Total continues to count but cannot be reset to zero via the control panel anymore.

4.4   DISPLAYED INFORMATION

4.4.1   FLOWRATE

The main screen shows the primary process values of the unit. By default, Total is shown on the upper line of the display and Flowrate on the bottom line:

- The flowrate calculation is based on the configuration settings for **SETUP** **2: FLOWRATE [»24]**, and Flowrate is shown with the configured number of decimals.

- The configured unit and time unit are indicated on the bottom line of the display. If there isn't enough room available, the display will toggle between unit and time unit.

- "–––––" indicates that the flowrate value is too large to be displayed.

- The arrows ▲ and ▼ indicate the trend (increase or decrease) of the flowrate.

- The flowrate is calculated and processed 8 times per second. To obtain a readable value, the flowrate shown on the display is updated once every second.

Speedometer

A speedometer view of the actual flowrate can be shown along the top edge of the display. It contains 20 segments from 0 to 100%. The speedometer is configured in **SETUP**   **3: DISPLAY [»25].**

4.4.2   TOTAL AND ACCUMULATED TOTAL

Measured flow is added to the counters for Total and Accumulated total continuously. When displayed, Total is shown on the upper line and Accumulated total on the lower line:

- Total will count up to 9.999.999 before rolling over to '0' and can be reset to zero by the operator – see **Section : Operator functions [»12].**

- Accumulated total will count up to 99.999.999.999 before rolling over to '0' and cannot be reset.

- Measurement unit and number of decimals of the counters are set in **SETUP** **1: TOTAL [»23].**

4.4.3   CURRENT DAY TOTAL AND PREVIOUS DAY TOTAL

Two additional non-resettable totals are available: Current Day Total and Previous Day Total. These totals are shown in the same unit and decimals as set in the configuration settings for Total. Enable or disable the day totals in **SETUP** **3.2: DISPLAY > DAY TOTALS [»26].**

At a specific time of day, the Current Day Total is copied to the Previous Day Total after which the measurement of Current Day Total is restarted (reset to zero). The moment at which this action is performed is called 'contract hour'. The contract hour can be configured in **SETUP** **1.6: TOTAL > CONTRACT HOUR [»24] in steps of 1 hour.**

NOTE
- Current Day Total' is often referred to as 'Daily Total'.

- The Current Day Total shows the 'running' quantity that is measured since last contract hour. The Previous Day Total shows the 'fixed' quantity that was measured the day before.

- Both Current Day Total and Previous Day Total cannot be reset manually.

Historical day totals

Besides directly reviewing the Current Day Total and Previous Day Total, a list of the last 15 Previous Day Totals is saved.
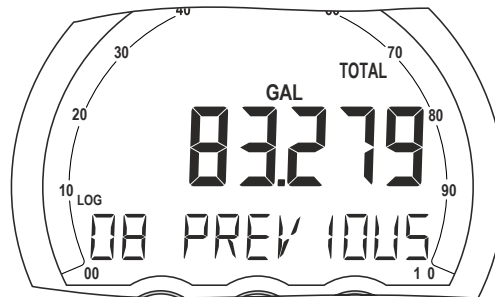
The list can be reviewed in LOG-mode in the following way:

1. From OPERATOR-mode, press the CLEAR-key for 3 seconds.

2. Press the SELECT- and CLEAR-keys to scroll up and down through the list of Previous Day Totals. The number that is displayed on the left of the bottom line indicates the age of the shown Previous Day Total, in days. Note that the entry with age '00' represents the (running) Current Day Total.

3. To return to the OPERATOR-mode again, press the PROG-key for 3 seconds or wait for 3 minutes.

NOTE
When ordered with Type ZL - Datalogging, the historical day totals are not available. Instead, logbooks with powerful data and event logging functions are available.

4.5 OPERATOR ALARMS

4.5.1 LOW BATTERY

When a battery is used to supply the unit (Type PB) and the battery voltage becomes too low during operation, the battery indicator comes on to warn that the unit is becoming less reliable. It is advised to install a new battery (as soon as possible) as described in **Section 7.3: Replace battery [»55].**
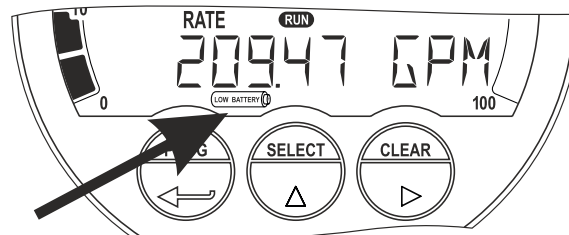
4.5.2 INTERNAL ERROR

When an internal error occurs, the alarm flag starts flashing to indicate this. If the alarm flag shows because of an internal error, the alarm code can be displayed by pushing the SELECT-key repeatedly until the internal alarm screen is shown. See **Section B: Troubleshooting [»61]** for a description of the codes.

FIG. 9: DISPLAY WITH ALARM FLAG AND INTERNAL ALARM SCREEN
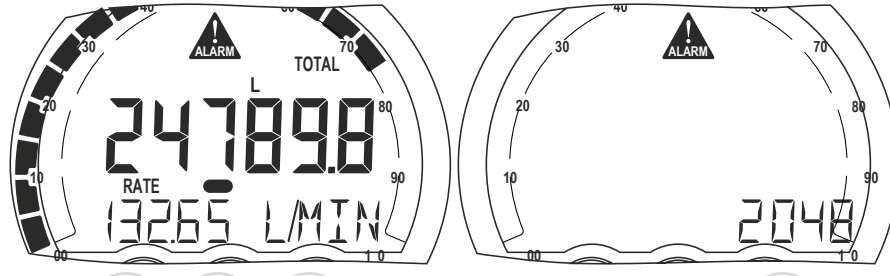
4.6 DATALOGGING (WITH TYPE ZL)

The data log function stores data records based on interval, daily contract hour and events in 3 separate log-books. The logbooks and records can be reviewed in LOG-mode in the following way:

1. From OPERATOR-mode, press the CLEAR-key for 3 seconds.

2. Select the logbook by using the SELECT- and CLEAR-keys and open the logbook by pressing the PROG-key.

FIG. 10: LOGBOOK SELECTION SCREEN
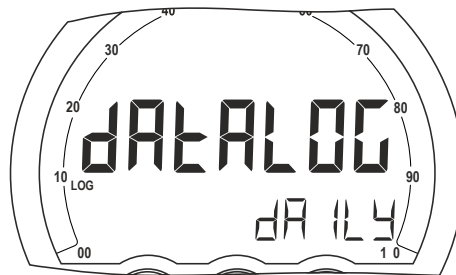
The data log function stores data records based on interval, daily contract hour and events in 3 separate log-books. The logbooks and records can be reviewed in LOG-mode in the following way:

1. From OPERATOR-mode, press the CLEAR-key for 3 seconds.

2. Select the logbook by using the SELECT- and CLEAR-keys and open the logbook by pressing the PROG-key.

3. After opening a logbook, the list with available records is shown with the newest (most recent) record selected. Every record has a sequence number (record number), shown on the bottom side, accompanied by the date and time the record was created. Use the SELECT- and CLEARkeys to scroll up and down through the list. When the down-arrow ▲ is shown on the display, the start of the list is reached (newest record), when the up-arrow ▼ is shown, the end of the list is reached (oldest record).

FIG. 11: EXAMPLE OF RECORD LIST WITH RECORD 0003 SELECTED (L) AND EMPTY RECORD LIST (R)
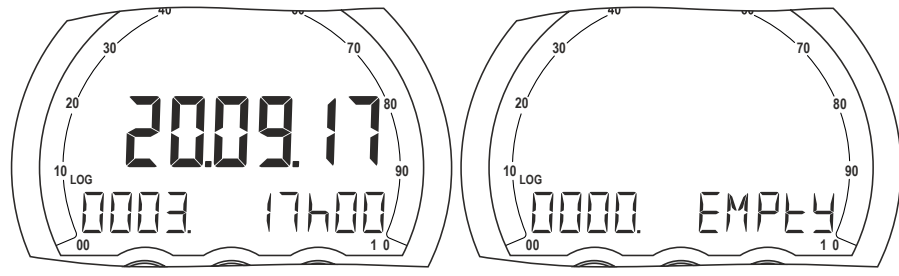
4. When the desired record is selected, press PROG-key again to review the details of the record. Use the SELECT- and CLEAR-keys to scroll through the data in the record, indicated by a lettersuffix behind the record number (for example 1234.A → 1234.B → 1234.C →1234.A).

FIG. 12: EXAMPLE OF INTERVAL RECORD 0003.B: TOTAL (L) AND EVENT RECORD 0128.A: TOTAL CLEAR (R)
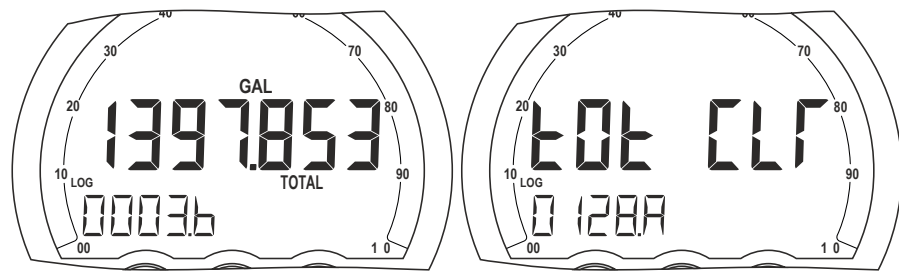
5. To leave the record details and return to the record selection list, press the PROG-key again.

6. To leave LOG-mode completely and return to OPERATOR-mode, press the PROG-key for 3 seconds or wait 3 minutes.

7. To select a different logbook, return to OPERATOR-mode and perform the procedure again.

The following table shows the available logbooks and record data in LOG-mode:

Logbook	Record data
INTERVAL	Recorded interval data (empty when none)
1234.A	Rate
1234.B	Total
1234.C	Accumulated total
DAILY	Recorded daily log data (empty when none)
1234.A	Rate
1234.B	Total
1234.C	Accumulated total

Logbook	Record data
EVENTS	Recorded events (empty when none)
1234.A	Event name
1234.B	(if applicable for the event) Modbus register number
1234.C	(if applicable for the event) Old setting of the Modbus register number
1234.D	(if applicable for the event) New setting of the Modbus register number
Note: The 1234 in the above table represents the sequence number of the record.	

5   CONFIGURATION

5.1   INTRODUCTION

This chapter describes how technicians can use configuration settings to configure the unit for optimal functionality.

Configuration of the E112-P can be done through:

- SETUP-mode using the optical keys (with cover installed)
- SETUP-mode using the mechanical keys (push buttons) (without cover)
- PC configuration tool using a communication option

5.2   OPERATING THE MAIN ELECTRONICS MODULE (MEM)

⚠️ **WARNING**

Explosion risk: never open the housing when explosive atmosphere is present.

Opening and servicing of the unit may only be carried out by authorized and trained personnel who have read and understood this manual, particularly **Section 2: Safety [»5].**

⚠️ **CAUTION**

Before opening the enclosure, consult **Section 6.2.3: Opening, assembling and closing the unit [»39].**

During normal operation, the cover of the unit is installed and all configuration settings can be reviewed and changed in SETUP-mode using the optical keys. When the cover is removed during installation and servicing, the optical keys do not function and the Main Electronics Module becomes available, which offers different possibilities to configure the unit.

FIG. 13: EXPLODED VIEW INDICATING MAIN COMPONENTS
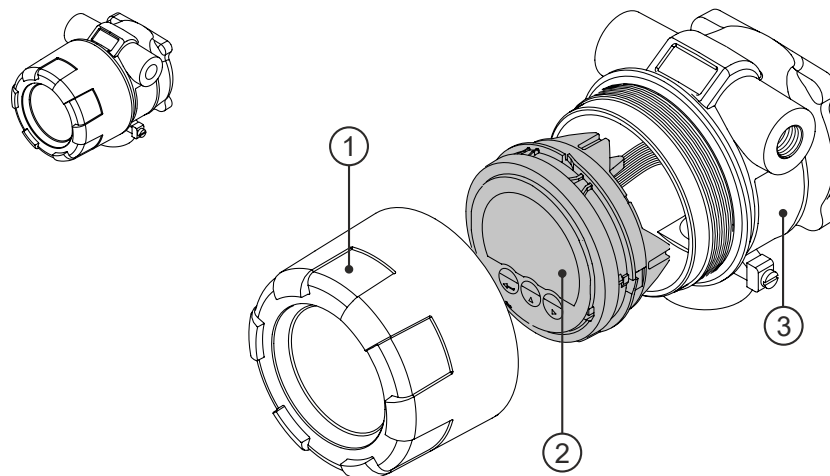
1. Cover   2. Main Electronics Module (MEM)   3. Body

5.2.1   CONFIGURING USING PC CONFIGURATION TOOL

Configuration of the E112-P can be done using a PC with our free of charge Remote Configuration Tool software. Consult **Section D: Remote Configuration Tool [»70]** for details. Connection to a PC is made by means of the communication port, located at the back side of the MEM.

FIG. 14: USB CONNECTION BETWEEN MEM AND PC
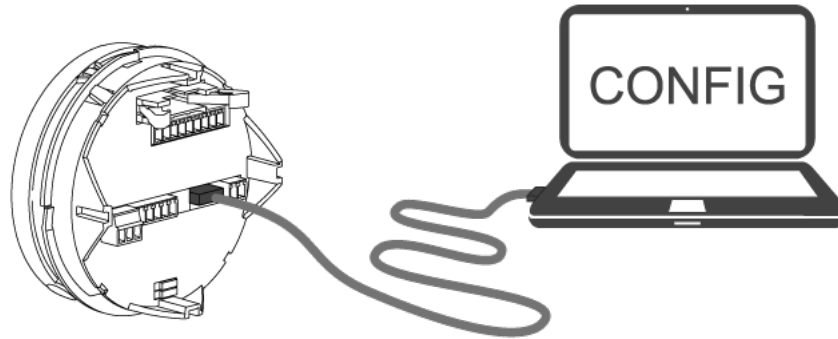
All settings available in the PC Configuration tool correspond with menu items available in SETUPmode. Please see **Section 5.5: SETUP menu explanations [»23].**

5.2.2   MECHANICAL KEYS

A quick and convenient way to configure the E112-P is by means of SETUP-mode and three mechanical keys (push buttons) at the side of the MEM (available with the cover removed).

FIG. 15: CONTROL PANEL PUSHBUTTONS
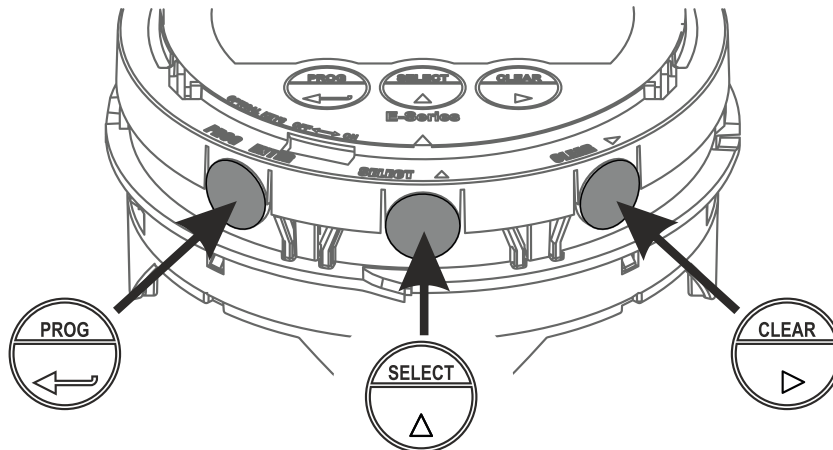
The mechanical keys copy the functionality of the corresponding optical keys at the front side of the MEM. After operating the mechanical keys, the optical keys are disabled for 30 seconds to avoid interference and to allow to replace the cover. The Key lock symbol indicates that the optical keys are temporarily disabled, see **Section 4.2.2: Optical keys [»10].**

5.2.3   OPTICAL KEYS SWITCH

The optical keys can be disabled to save battery power or to avoid false activation under some circumstances. The switch can be found at the outside rim of the MEM.

The Key lock symbol ☞ is shown on the display when the optical keys are disabled, see Section 4.2.2: Optical keys [»10]. The mechanical keys always remain active.

FIG. 16: DISABLE SWITCH FOR OPTICAL KEYS
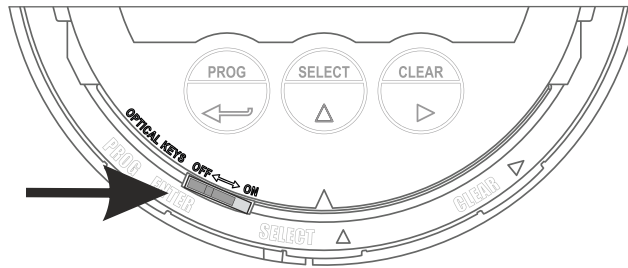
Use this switch to permanently disable the optical keys:

- **Enable**: move to the right / ON position.

- **Disable:** move to the left / OFF position.

5.2.4 SAVING BATTERY LIFETIME (TYPE PB)

In case of a battery powered application, lifetime of the battery is an important subject. To prolong the battery lifetime as much as possible, it is strongly advisable to use only necessary functions, and disable functions if not in use. Factors that influence battery life are:

- Analog output signal

- Display update: the fast display update setting uses significantly more power

- Pulse output signal

- Communication

- Optical key activity

- Low temperatures: the available power will be less due to battery chemistry

- NPN and PNP inputs consume more energy than coil inputs

- High input frequency.

NOTE

For battery powered applications, disable the optical keys with the switch on the MEM where possible to significantly reduce power consumption.

5.3 CONFIGURING USING SETUP MODE

For an overview of Operating modes, see **Section 4.1.1: Operating modes [»9].**

⚠ **CAUTION**

Changing settings may influence current operation

In SETUP mode the unit remains fully operational. Make sure the unit is not being used for any application when changing settings.

5.3.1 ENTERING SETUP MODE

1. Check if the Key lock symbol ⊶ is displayed on the screen. If necessary, unlock the keys by entering the unlock sequence (see **Section 4.2.2: Optical keys [»10]**).

2. Press the PROG-key for 7 seconds making sure ☞ is continually displayed while pressing. You may be prompted to enter a password (do so as described in **Section 5.3.3: Changing configuration settings [»20]**).

3. The ⒮ETUP indicator is now activated on the display and the ⓇUN indicator is deactivated.

5.3.2 NAVIGATING THE SETUP MENU

The SETUP menu contains several menu groups, which each contain various menu items. Each menu item has a unique number which is displayed below the ⒮ETUP indicator at the bottom of the display. Additionally, each menu item is expressed with a keyword.

The menu number is a combination of two figures separated by a dot:

*   the first figure indicates the selected menu group (e.g. 1. TOTAL).

*   the second figure indicates the menu item (e.g. 1.1 UNIT).

The following image shows the layout of the menu structure:

FIG. 17: SETUP MENU LAYOUT AND NAVIGATION
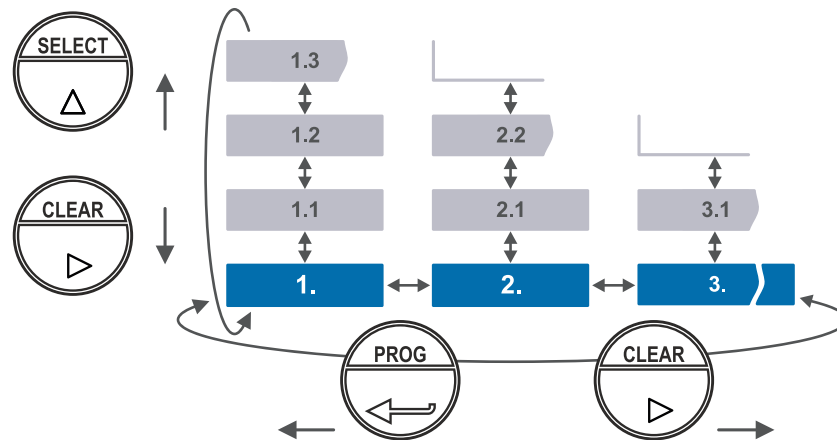
Navigate the SETUP menu with the following functions:

PROG-key

When a menu item is selected (e.g. 1.1), this key is used to start the programming sequence.

When a menu group is selected (and no function), this key is used to scroll back a group (e.g. 3. → 2. → 1. → 3. → 2. …)

SELECT-key

This key is used to select the next menu item in the list (e.g. 1. → 1.1 → 1.2 → 1.3 → 1. …). When the top of the list is reached, it will wrap around and return to the menu group selection.

CLEAR-key

This key is used to select the previous menu item in the list (e.g. 1.3 → 1.2 → 1.1 → 1. → 2. …). When the bottom the list is reached, it returns to the menu group selection. When a menu group is selected (and no item), this key is used to scroll to the next group (e.g. 1. → 2. → 3. → 1. → 2. …)

5.3.3 CHANGING CONFIGURATION SETTINGS

A menu item either contains a value (a number with optionally a decimal point and sign, e.g. -123.45) or a selection list (e.g. L – m³ - USGAL). After a menu item is selected in the SETUP menu, a new value can be programmed by performing the following steps. During the programming sequence, the **PROG** indicator is flashing on the display.

Step 1: Start the programming sequence:

PROG-key

When a menu item is selected in the SETUP menu, this key is used to start the programming sequence.

Step 2a: Change a value

SELECT-key

This key is used to increment the selected digit or to select de next position of the decimal point.

When the entered value is out of range, the increase sign ▲ or decrease-sign ▼ will be displayed; the value will be automatically brought within range when confirmed later.

CLEAR-key

This key is used to select the next digit. If a decimal point can be set, this will be included in the sequence as well (e.g. [decimal point] → digit 1 → digit 2 → digit 3 → [decimal point].

The selected decimal point is flashing when is can be changed. When no decimal point is selected, all available decimals will be flashing on the display to indicate this when the sequence reaches the decimal point.

SELECT-key + **CLEAR**-key
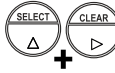
The combination of the SELECT-key and CLEAR-key is used to select a negative value. When a value can also be entered as a negative number, pressing the SELECTkey and CLEAR-key simultaneously will toggle the '−' (minus) sign on and off.

Step 2b: Change the selection in a list

SELECT-key

This key is used to select the next item in the list (e.g. L → m³ → USGAL)

At the end of the list, the selection will wrap around to the first selection.

CLEAR-key

This key is used to select the previous item in the list (e.g. USGAL → m³ → L).

At the bottom of the list, the selection will wrap around to the last selection.

Step 3: Finish the programming sequence

PROG-key

During the programming sequence, this key is used to confirm the new value and return to SETUP mode. To cancel the operation, either press the PROG-key for 3 seconds or wait for 20 seconds: the programming sequence is cancelled and the former value is reinstated.

5.3.4 RETURNING TO OPERATOR MODE

When all configuration settings are set correctly, return to OPERATOR mode by pressing the PROG-key for three seconds, or do not press any key for 2 minutes to return automatically. The 🆁🆄🅽 indicator is now activated on the display and the 🆂🅴🆃🆄🅿 indicator is deactivated.

5.4 SETUP MENU OVERVIEW

All unit settings can be configured from the control panel. You can also use the Remote Configuration Software, which can be downloaded from our website or is available from your supplier (see **Section D: Remote Configuration Tool [»70]**).

1	TOTAL		DEFAULT
1.1	UNIT	L, m3, US gal, I gal, cf, oil bbl, kg, ton, US ton, lb, (none)	L
1.2	DECIMALS	0, 0.1, 0.02, 0.003	0
1.3	K-FACTOR	auto, 0.000010 - 9999999	auto
1.4	FACTOR-X	x1, x10, x100, x1000	x1
1.5	CLEAR PASSWORD	000 - 999 (000 = disabled)	000
1.6	CONTRACT HOUR	00:00 (24h format)	00:00
1.7	CURRENT DAY TOTAL	xxxxxxx	-
1.8	PREVIOUS DAY TOTAL	xxxxxxx	-

2	FLOWRATE		DEFAULT
2.1	UNIT	mL, L, m3, mg, g, kg, ton, US ton, US gal, I gal, Oil bbl, lb, cf, rev, none, scf, nm3, nL, p	L
2.2	TIME	/sec - /min - /hour - /day	/min
2.3	DECIMALS	0, 0.1, 0.02, 0.003	0
2.4	K-FACTOR	auto, 0.000010 - 9999999	auto
2.5	CALCULATION	Per 1 - 255 pulses	10 pulses
2.6	CUT-OFF	0.1 - 999.9 seconds	30.0 sec

3	DISPLAY		DEFAULT
3.1	FUNCTION	total, flowrate, acc. total	total
3.2	DAY TOTALS	off, operate, hidden	off
3.3	LCD NEW	fast, 1 sec, 3 secs, 15 secs, 30 secs, off	1 sec
3.4	BACKLIGHT (BRIGHTNESS)	0%, 20%, 40%, 60%, 80%, 100%	100%
3.5	BARGRAPH	enable, disable	enable
3.6	RATESPAN	0000000 - 9999999	1000

4	FLOWMETER		DEFAULT
4.1	SIGNAL	NPN, NPN_LP, REED, REED_LP, PNP, PNP_LP, NAMUR, Coil_Hi, Coil_Lo, Act_8.2 (8.2V DC), Act_24 (24V DC)	Coil_Lo
4.2	UNITS	hand, auto-vol, auto-mass	auto-vol
4.3	UNIT	Auto-vol: L, m3, US GAL, IGAL, cf, oil bbl Auto mas: kg, ton, US ton, lb	L
4.4	K-FACTOR	0.000010 - 9999999	1

5	LINEARIZATION		DEFAULT
5.1...F	FREQ. / M-FACTOR 1 ... 15	Frequency: 0000.1 - 9999.9 Hz M-Factor: 0.000001 - 9.999999	0.0 Hz 1.000000
5.G	LINEARIZATION	enable, disable	disable
5.H	DECIMALS FREQUENCY	0, 0.1, 0.02, 0.003	0.1

6	ANALOG OUTPUT		DEFAULT
6.1	OUTPUT	enable, disable	disable
6.2	RATE MIN (4MA)	0.000 - 9999999	0
6.3	RATE MAX (20MA)	0.000 - 9999999	99999
6.4	CUT-OFF	0.0 - 9.9 %	0.0 %
6.5	TUNE MIN (4MA)	0000 - 9999	-
6.6	TUNE MAX (20MA)	0000 - 9999	-
6.7	FILTER	01 - 99 (01 = off)	01

7	PULSE OUTPUT		DEFAULT
7.1	MODE	disable, scaled, retransmit	disable
7.2	WIDTH	0.000 - 9.999 sec (0.000 = off)	0.000
7.3	AMOUNT	0000.000 - 9999999 per pulse	1000 L per pulse

8	MODBUS COMMUNICATION		DEFAULT
8.1	SPEED	1200, 2400, 4800, 9600, 9600HP, 19200, 38400	9600
8.2	ADDRESS	001 - 247	1
8.3	MODE	off, bus asc, bus rtu	bus rtu
8.4	DATABITS	8 bits, 7 bits	8 bits
8.5	PARITY	none, even, odd	none

For E112-P without data logging (without type -ZL)

9	OTHERS (WITHOUT TYPE ZL)		DEFAULT
9.1	MODEL	-	-
9.2	SOFTWARE VERSION	xx.xx.xx	-
9.3	SERIAL NUMBER	xxxxxxx	-
9.4	TIME	00:00:00 - 23:59:59 (hh.mm.ss)	00:00:00
9.5	PASSWORD	0000 - 9999 (0000 = off)	0000
9.6	KEY LOCK	enable, disable	enable
9.7	TAG NUMBER	0000000 - 9999999	0000000

For E112-P with data logging (with type -ZL)

9	OTHERS (WITHOUT TYPE ZL)		DEFAULT
9.1	LOG INTERVAL	off - 5 min - 10 min - 15 min - 30 min - 1 hr - 2 hr - 4 hr - 6 hr - 8 hr	off
9.2	DAILY LOG	off - single - dual	off
9.3	DAILY 1	00:00 - 23:59 (hh:mm)	00:00
9.4	DAILY 2	00:00 - 23:59 (hh:mm)	00:00
9.5	TIME	00:00:00 - 23:59:59 (hh.mm.ss)	00:00:00
9.6	DATE	00.01.01 - 99.12.31 (yy.mm.dd)	00.01.01

10	OTHERS (WITH TYPE ZL)		DEFAULT
10.1	MODEL	-	-
11.2	SOFTWARE VERSION	xx.xx.xx	-
10.3	SERIAL NUMBER	xxxxxxx	-
10.4	PASSWORD	0000 - 9999 (0000 = off)	0000
10.5	KEY LOCK	enable, disable	enable
10.6	TAG NUMBER	v	0000000

5.5   SETUP MENU EXPLANATIONS

5.5.1   MENU 1: TOTAL

⚠ **CAUTION**

First set up the flowmeter in **4: FLOWMETER** as this directly affects the settings/measurement units in the **Total** menu.

If the measurement unit is changed in **4.2: FLOWMETER > UNITS**, the unit in **1.1: TOTAL > UNIT** will change to the default setting.

⚠ **CAUTION**

When a different unit is selected, the actual total values are NOT recalculated.

1	TOTAL	
1.1	UNIT	Determines the measurement unit for total, accumulated total, and the scaled pulse output. The available measurement units are controlled by the units selected in **4.2: FLOWMETER > UNITS:** AUTO-VOL: L – M3 – US GAL – I GAL – CF – OIL BBL – NL – NM3; AUTO-MAS: KG – TON – US TON – LB HAND: L – M3 – US GAL – I GAL – CF – OIL BBL – KG – TON – US TON – LB – NL – NM3 – ---- (NO UNIT).
1.2	DECIMALS	Determines for Total and Accumulated Total the number of digits after the decimal point.
1.3	K-FACTOR	This value is used to convert the flowmeter pulse signals into a total unit. The K-Factor is based on the number of pulses generated by the flowmeter per selected measurement unit, as defined in **1.1: TOTAL > UNIT.** The more accurate the **K-Factor**, the more accurate the system. **NOTE** This setting can only be changed if the automatic unit conversion in **4.2: FLOWMETER > UNITS** is set to Hand. Otherwise, K-factor conversion will be Auto. **NOTE** After pressing PROG, the decimal point will start to flash. The decimal position can then be changed by pressing the SELECT-key, then press the CLEAR key to set the digits.
1.4	FACTOR-X	Determines the multiplication factor of Total and Accumulated Total. It also applies to the Current and Previous Day Totals. This makes it possible to display up to 3 more digits of the Total/ accumulated Total. The amount is shown as a rounded number.
1.5	CLEAR PASSWORD	A password can be set up to prevent the operator from accidentally clearing the Total. This password can have up to 3 digits, for example 123. To disable password protection, enter three zeros (000).

1	TOTAL	
1.6	CONTRACT HOUR	The contract hour can be set to any hour of the day in steps of 1 hour. When the system clock reaches the time set in Contract hour: • the Current Day Total is copied to the Previous Day Total. • the Current Day Total measurement is then restarted (reset to zero). ⚠ **CAUTION** **If the unit does not have type "ZL – Data logging", the clock will be interrupted if there is a power down. When the unit is powered up again, the operator will be prompted to enter the correct system time. If the clock is not initialized, measurements and calculations will still proceed normally. However, when the Daily Total feature is enabled, detection of Contract hour and the updating of Current day total and Previous day total will not be done at the correct time.**
1.7	CURRENT DAY TOTAL	Shows the amount/volume of totalized product since the last contract hour. This a 'running' totalizer and cannot be reset to zero. See **Section 4.4.3: Current day total and Previous day total [»13]** for information on reviewing more day totals.
1.8	PREVIOUS DAY TOTAL	Shows the amount/volume of totalized product between the last contract hour and the contract hour before that. This totalizer cannot be reset to zero. See **Section 4.4.3: Current day total and Previous day total [»13]** for information on reviewing more historical day totals.

5.5.2   MENU 2: FLOWRATE

⚠ **CAUTION**

First set up the flowmeter in **SETUP** **4: FLOWMETER** as this directly affects the settings/measurement units in this menu **(Flowrate).**

If the type of flowmeter unit is changed in **SETUP** **4.2: FLOWMETER > UNITS** or **4.3: FLOWMETER > UNIT**, the units in **2.1: FLOWRATE > UNIT** will change to the default setting of the selected flowmeter.

If the settings in **SETUP** **2.1: FLOWRATE > UNIT**, **2.2: FLOWRATE > TIME**, or **2.3: FLOWRATE > DECIMALS** are changed, this will directly affect the analog output settings in **6.2: ANALOG OUTPUT > RATE MIN (4MA)**, **6.3: ANALOG OUTPUT > RATE MAX (20MA)**, and the displayed bargraph in **3.6: DISPLAY > RATESPAN**.

Therefore, you should first determine the required settings for the flowrate.

2	FLOWRATE	
2.1	UNIT	Determines the measurement unit for the flowrate. The type of unit that can be selected depends on the flowmeter unit (volumetric or mass) selected in **4.2: FLOWMETER > UNITS.** The following can be selected: AUTO-VOL: mL - L - m3 - US GAL - I GAL - cf - Oil bbl - nL - nm3 - scf AUTO-MAS: mg - g - kg - ton - lb - US ton Hand: mL - L - m3 - US GAL - I GAL - cf - Oil bbl - nL - nm3 - scf - mg - g - kg - ton - lb - US ton - rev - P - (no unit)
2.2	TIME	Determines the time interval (sec, min, hour or day) for calculating the flowrate.
2.3	DECIMALS	Determines the number of decimals for the flowrate.
2.4	K-FACTOR	This value is used to convert the flowmeter pulse signals to a flowrate unit. The **K-factor** is based on the number of pulses generated by the flowmeter per measurement unit selected in **2.1: FLOWRATE > UNIT.** The more accurate the **K-factor**, the more accurate the system. **NOTE** This setting can only be changed if the automatic unit conversion in **4.2: FLOWMETER > UNITS** is set to Hand. Otherwise, K-factor conversion will be Auto.

2	FLOWRATE	
		NOTE After pressing PROG, the decimal point will start to flash. The decimal position can then be changed by pressing the SELECT-key, then press the CLEAR key to set the digits.
2.5	CALCULATION	The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses measured, the more accurate the flowrate. **NOTE** • This setting directly influences the update time for the analog output (maximum update 8 times a second). If the output response is too slow, decrease the number of pulses. • The lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications). • For low frequency applications (below 10 Hz), do not program more than 10 pulses, otherwise the update time will be very slow. For high-frequency applications (above 1 kHz), enter a value of 50 pulses or more. • Keep in mind that values higher than 200 in combination with low frequencies will result in slow updates of the indicated flowrate and analog output.
2.6	CUT-OFF	Determines a minimum threshold for the required flow. If during this time less than XXX pulses are generated as set in **2.5: FLOWRATE > CALCULATION**, the flowrate will be displayed as zero. The cut-off time has to be entered in seconds. The maximum time is 999.9 seconds (approximately 15 minutes).

5.5.3 MENU 3: DISPLAY

3	DISPLAY	
3.1	FUNCTION	Determines which information is shown on the main screen. • **Total:** Total is displayed with the large 12 mm (0.47") digits; Flowrate is displayed with the 7 mm (0.28") digits simultaneously. • **Flowrate:** Only Flowrate is displayed with the large 12 mm (0.47") digits together with the measuring unit. • **Accumulated total:** Total is displayed with the large digits; Accumulated total is displayed with the small digits simultaneously. When SELECT is pressed on the main screen, the operator can scroll through the various process values. See **Section 4: Operation [»9]** for more information on operator information and functions.
3.2	DAY TOTALS	A basic data log function is available to register Current Day Total and Previous Day Total. This setting determines the availability at the operator level: • **Off:** Current Day Total and Previous Day Total are not available. • **Operator:** Current Day Total and Previous Day Total are available at the operator level by pressing the SELECT key several times. At setup level, they can be viewed at 〔SETUP〕 **1.7: TOTAL > CURRENT DAY TOTAL and 1.8: TOTAL > PREVIOUS DAY TOTAL.** • **Hidden:** Current Day Total and Previous Day Total are only available at 〔SETUP〕 **1.7: TOTAL > CURRENT DAY TOTAL and 1.8: TOTAL > PREVIOUS DAY TOTAL**. **NOTE** When this function is enabled, a list of the last 15 historical day totals is available and can be reviewed from the operator level. See **Section 4: Operation [»9]** for information on reviewing historical day totals.

3	DISPLAY	
3.3	LCD NEW	Calculating the display information significantly affects the power consumption. When the application does not require a fast display refresh rate, it is strongly advised to select a slow refresh rate. Information will not be lost, every pulse will be counted, and the output signals will be generated in the normal way. The following can be selected: fast, 1 sec, 3 secs, 15 secs, 30 secs, off When "off" is selected, the display switches off automatically. When an update rate other than "fast" is selected, pressing a key will switch the update rate to "fast" for 30 seconds. After this time, the display will return to the configured update rate (or switch off). **NOTE** Save battery lifetime by choosing an update time of 1 second or longer. **NOTE** After the operator has pressed a button, the display refresh rate will always switch to fast for 30 seconds. When 'OFF' is selected, the display will: temporarily turn on after one of the keys is touched; and automatically turn off after 30 seconds.
3.4	BACKLIGHT (BRIGHTNESS)	The unit has a backlight. The backlight brightness can be adjusted from off (0%) to max (100%) in steps of 20%. **NOTE** • The brightness cannot be adjusted for battery powered units. • When the unit is only loop powered, it cannot use the backlight. An external supply is required instead.
3.5	BARGRAPH	The unit has a speedometer/bar graph around the edge of the display that gives a quick impression of the actual flowrate. The following can be selected: • **Enable:** the bar graph is switched on. • **Disable:** the bar graph is switched off.
3.6	RATESPAN	Sets the range of the speedometer. The display shows 0 – 100 and has 20 blocks. Therefore, each block represents 5% of the total range. **NOTE** The number of decimals displayed depends on **2.3: FLOWRATE > DECIMALS.**

5.5.4 MENU 4: FLOWMETER

To simplify the configuration of the Flowmeter, Total and Flowrate settings, the E112-P has an automatic unit conversion feature. To use this feature, you only have to enter the average K-factor and the related measurement unit.

Advantages/features:

• The same K-factor calculation is used for Total and Flowrate.

• All configuration is done in the Flowmeter menu.

The measurement units can be set for volume or mass units. Refer to the test/calibration certificate provided with your flowmeter. The automatic unit conversion feature can be set to 'Hand', allowing for independent configuration of total and flowrate, for example, when:

• measurement units are not supported, i.e. 'revolutions', or

• volume and mass units are used simultaneously.

Use the following procedure to set up the automatic unit conversion:

1. 4.1: FLOWMETER > SIGNAL: Select the correct type of flowmeter signal.

2. 4.2: FLOWMETER > UNITS: Select the type of measurement unit (volume or mass) shown on the certificate.

3. 4.3: FLOWMETER > UNIT: Select the measuring unit shown on the certificate.

4. 4.4: FLOWMETER > K-FACTOR: Enter the (average) K-factor shown on the certificate.

5. 1.1: TOTAL > UNIT: Select the desired measuring units for (accumulated) Total.

6. 2.1: FLOWRATE > UNIT: Select the desired measuring units for Flowrate.

For a detailed description and tutorials on the automatic unit conversion feature, refer to our website (or ask your supplier).

Example: How to manually calculate the K-factor for total or flowrate:

• The Flowmeter generates 65.231 pulses per US gallon.

• The required measurement unit is cubic feet (ft3).

• A cubic foot = 7.48052 gallons.

Formula

Pulse per US gallon x cubic foot (in gallons) = **K-factor**

65.231 x 7.48052 = **487.9618**

For this example, enter **487.9618** as the K-factor for total or flowrate.

4	FLOWMETER				
4.1	SIGNAL	\multicolumn{4}{l}{Selects the type of flowmeter pickup / signal. The unit can process several types of input signal. The settings with LP are used to apply a built-in lowpass filter. Also see **Section 6.4.10: Terminals S1-S3: Flowmeter input [»49]** for more information.}			

NOTE
The selections "Active pulse input" offer a pulse detection level of about 50% of the selected active pulse voltage.

TYPE OF SIGNAL		EXPLANATION	RESISTANCE	FREQ / mVpp	REMARKS
NPN		NPN input	100 kΩ pull-up	max. 6 kHz	Open collector
NPN - LP		NPN input with low pass filter	100 kΩ pull-up	max. 2.2 kHz	Open collector Less sensitive
REED		Reed-switch input	1 MΩ pull-up	max. 1.2 kHz	
REED - LP		Reed-switch input with low pass filter	1 MΩ pull-up	max. 120 Hz	Less sensitive
PNP		PNP input	51 kΩ pull-down	max. 6 kHz	
PNP - LP		PNP input with low pass filter	51 kΩ pull-down	max. 700 Hz	Less sensitive
NAMUR		NAMUR input	820 Ω pull-down	max. 4 kHz	External sensor power required
COIL HI		Coil input high sensitivity	-	min. 20 mVpp	Sensitive for interference!
	Type ZF			min. 10 mVpp	
	Type ZG			min. 5 mVpp	

4	FLOWMETER				
	TYPE OF SIGNAL	**EXPLANATION**	**RESISTANCE**	**FREQ / mVpp**	**REMARKS**
	NPN	NPN input	100 kΩ pull-up	max. 6 kHz	Open collector
	NPN - LP	NPN input with low pass filter	100 kΩ pull-up	max. 2.2 kHz	Open collector Less sensitive
	REED	Reed-switch input	1 MΩ pull-up	max. 1.2 kHz	
	REED - LP	Reed-switch input with low pass filter	1 MΩ pull-up	max. 120 Hz	Less sensitive
	PNP	PNP input	51 kΩ pull-down	max. 6 kHz	
	PNP - LP	PNP input with low pass filter	51 kΩ pull-down	max. 700 Hz	Less sensitive
	NAMUR	NAMUR input	820 Ω pull-down	max. 4 kHz	External sensor power required
	COIL HI	Coil input high sensitivity	-	min. 20 mVpp	Sensitive for interference!
	Type ZF			min. 10 mVpp	
	Type ZG			min. 5 mVpp	
	COIL LO	Coil input low sensitivity	-	min. 90 mVpp	Normal sensitivity
	8-1 DC	Active pulse input detection level 3.9 Vdc	3k9 Ω pull-down	max. 10 kHz	External power required
	24 DC	Active pulse input detection level 11 Vdc	3 k Ω pull-down	max. 10 kHz	External power required
4.2	UNITS	Enables automatic unit conversion for volumetric flows or mass flows. When Hand is selected, automatic unit conversion is disabled. **NOTE** To make use of automatic unit conversion, Total and Flowrate must have a convertible unit. If this is not possible, Hand should be chosen. This will cause 4.4: FLOWMETER > K-FACTOR and 4.3: FLOWMETER > UNIT to disappear in the Flowmeter menu. The K-factor must then be set at (SETUP) 1.3: TOTAL > K-FACTOR and menu 2.4: FLOWRATE > K-FACTOR.			
4.3	UNITS	Determines the measurement unit for the flowmeter. When automatic unit conversion is used, the units for Total and Flowrate are derived from this setting. **NOTE** • If the type of measurement unit is changed (volumetric or mass), 1.1: TOTAL > UNIT and 2.1: FLOWRATE > UNIT will automatically change to the default setting. • Changing the flowmeter unit will not change the amount displayed for Total and Accumulated Total.			
4.4	K-FACTOR	Converts the flowmeter pulse signals to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per measurement unit selected in **4.3: FLOWMETER > UNIT.** The more accurate the K-factor, the more accurate the system. **NOTE** After pressing PROG, the decimal point will start to flash. The decimal position can then be changed by pressing the SELECT-key, then press the CLEAR key to set the digits.			

5.5.5 MENU 5: LINEARIZATION

Linearization principle

In normal situations, the calculation of flow is based on flowmeters that follow an 'ideal line' and give a fixed number of pulses over the entire frequency range to represent a certain amount. The calculation uses an average K-factor KF0, which is entered at **4.4: FLOWMETER > K-FACTOR.**

Since many flowmeters do not follow this 'ideal line', the linearization function can be used to reflect the actual flow curve better. This allows for more accurate flowrate and totalization values, as well as improved analog and pulse output values over the frequency range of the flowmeter. The linearization function uses linearization points to calculate new K-factors based on the measured flowmeter frequency. As shown in the chart below, each point consists of a frequency and a Meter Factor (MFx, indicating the deviation of the K-factor KFx from the average K-factor KF0).

FIG. 18: EXAMPLE OF K-FACTORS AND LINEARIZATION POINTS

KF0=51.64178

KF1=35.7 @ 64Hz.　　MF1=0.691300
KF2=47.5 @ 93Hz.　　MF2=0.919798
KF3=53.8 @ 161Hz.　　MF3=1.041792
KF4=49.2 @ 336Hz.　　MF4=0.952717
KF5=52.9 @ 514Hz.　　MF5=1.024364
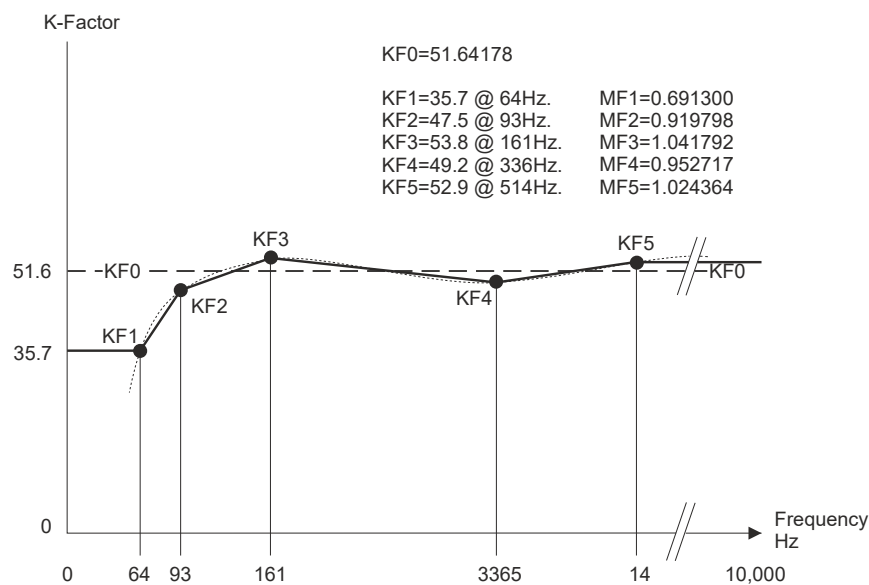
When a new frequency is measured, the corresponding Meter Factor is calculated by interpolating between the linearization points. The new Meter Factor is then used to calculate the actual K-factors for flowrate and total using this formula:

$$K-factor = MF * KF0$$

When the measured frequency is below the lowest or above the highest frequency given in the linearization points, the Meter Factor belonging to that frequency is used.

Entering linearization points

A table of 15 linearization points can be entered into the unit. It is advised to enter the linearization points in increasing order of frequency; however, this is not mandatory. The linearization points are usually located at frequencies where the linear behavior of the flowmeter changes. Linearization points that are not used can be disabled by entering a frequency of 0 Hz. The following formula can be used to calculate the Meter Factors for the linearization points:

$$Meter\ factor = \frac{K-factor\ @\ flow\ rate\ X}{KF0}$$

In this formula, the value of KF0 represents the average K-factor of the flowmeter and KFx @ flow x represents the actual K-factor (derived from the actual flow) at the selected frequency (note that the K-factors must be in the same engineering units (e.g. pulses / GAL) to perform the calculation).

⚠ **CAUTION**

The K-factor entered at **4.4: FLOWMETER > K-FACTOR** must be identical to the KF0 used in the calculations of the M-Factors.

5	LINEARIZATION	
5.1...F	FREQ. / M-FACTOR 1 ... 15	The M Factor is displayed on the top line of the display. A value between 0.000001 and 9.999999 can be entered. Most M-factors will be around 1.000000, for example 0.945354 or 1.132573. The frequency is displayed on the bottom line of the display. The maximum frequency is 9,999.9 Hz. When 0.0 Hz is selected, the M Factor is disabled (**SETUP** **5.H: LINEARIZATION > DECIMALS FREQUENCY [»29]**).
5.G	LINEARIZATION	This setting is used to easily enable or disable the linearization function. When linearization is disabled, the K-factor set at 4.**4: FLOWMETER > K-FACTOR** will be used for the calculation of total and flowrate. When linearization is enabled, the K-factor set at **4.4: FLOWMETER > K-FACTOR** will be used as KF0 in the linearized calculations for total and flowrate.
5.H	DECIMALS FREQUENCY	Determines the number of decimals for the frequency entered.

5.5.6 MENU 6: ANALOG OUTPUT

An analog 4-20 mA signal is generated according to the flowrate with a 12 bits resolution. The settings for Flowrate influence the analog output directly and should be configured first. The relationship between rate and analog output is set with the following functions.

6	ANALOG OUTPUT	
6.1	OUTPUT	If the analog output is not used, it can be disabled to minimize power consumption and save battery life. When the output is disabled, a current of about 2 mA is generated and the unit can still be supplied from this signal (provided a power supply is connected). **NOTE** While powering-up the loop, the initial current is approximately 2 mA. When the output is enabled, it can take a few seconds before the correct current is generated.
6.2	RATE MIN (4MA)	Enter the flowrate at which the output should generate the minimum signal (4 mA) – in most applications at flowrate "0". The number of decimals displayed depends on the settings in **2.3: FLOW-RATE > DECIMALS.** The measuring units and the time (L/min for example) depend on the settings in **2.1: FLOWRATE > UNIT and 2.2: FLOWRATE > TIME** and are displayed during editing. **NOTE** If required, you can program the analog output 'up-side-down'. The 4 mA then represents the maximum flowrate. For example, enter 800 L/min.
6.3	RATE MAX (20MA)	Enter the flowrate at which the output should generate the maximum signal (20 mA) – in most applications at maximum flow. The number of decimals displayed depends on the settings in **2.3: FLOWRATE > DECIMALS.** The measuring units and the time (L/min for example) depend on the settings in **2.1: FLOWRATE > UNIT** and **2.2: FLOWRATE > TIME** and are displayed during editing. **NOTE** If required, you can program the analog output 'up-side-down'. The 20 mA then represents the minimum flowrate. For example, enter 0 L/min.

6	ANALOG OUTPUT	
6.4	CUT-OFF	A low flow cut-off can be set as a percentage of the full range of 16 mA, for example, to ignore leakage. When the flow is less than the required rate, the current will be the minimum signal (4 mA, or 20mA when the analog output is programmed 'up-side-down').

Cut-off	Rate-min 4 mA	Rate-max 20 mA	Required rate before reading	Output at required rate
2.0%	0 L/min	100 L/min	(100-0)*2.0% + 0 = 2.0 L/min	4 + (16*2.0%) = 4.32 mA
3.5%	20 L/min	800 L/min	(800-20)*3.5% + 20 = 27.3 L/min	4 + (16*3.5%) = 4.56 mA
3.5% up-side-down	800 L/min	20 L/min	(800-20)*3.5% + 20 = 27.3 L/min	20 - (16*3.5%) = 19.44 mA

6.5	TUNE MIN (4MA)	Use this setting to precisely tune the minimum analog output value (initial value is 4 mA). This value can differ slightly due to ambient influences such as temperature. **NOTE** Before tuning the signal, make sure the analog signal is not being used for any application. After pressing PROG, the current will be about 4 mA. The current can be increased / decreased with the arrow-keys and is directly active. Press PROG to store the new value.
6.6	TUNE MAX (20MA)	Use this setting to precisely tune the maximum analog output value (initial value is 20 mA). This value can differ slightly due to ambient influences such as temperature. **NOTE** Before tuning the signal, make sure the analog signal is not being used for any application. After pressing PROG, the current will be about 20 mA. The current can be increased / decreased with the arrow-keys and is directly active. Press PROG to store the new value.
6.7	FILTER	Stabilizes the analog output signal. The output value is updated 8 times a second. This digital filter setting produces a more stable but less actual reading. The filter principal is based on three input values: the filter level (01-99), the last analog output value, and the last average value. The higher the filter level, the longer the response time of a changed value.

RESPONSE TIME ON STEP CHANGE OF INPUT VALUE (IN % OF END VALUE)				
Filter value	**50%**	**75%**	**90%**	**99%**
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.1 sec	0.2 sec	0.4 sec	0.7 sec
03	0.2 sec	0.4 sec	0.6 sec	1.2 sec
05	0.4 sec	0.7 sec	1.1 sec	2.1 sec
10	0.7 sec	1.4 sec	2.2 sec	4.4 sec
20	1.4 sec	2.8 sec	4.5 sec	9 sec
30	2.1 sec	4.1 sec	7 sec	14 sec
50	3.5 sec	7 sec	11 sec	23 sec
75	5 sec	10 sec	17 sec	34 sec
99	7 sec	14 sec	23 sec	45 sec

5.5.7   MENU 7: PULSE OUTPUT

The "Pulse" menu configures the behavior of the digital output signals. As standard, one transistor output is available (Type OT): D1. Its function is based on the mode selected at **7.1: PULSE OUTPUT > MODE.**

Optionally, one relay output is available (Type OR): D5. Its output functionality corresponds to the functionality of output D1.

⚠️ **CAUTION**

The digital (transistor) output D1 has a maximum frequency of 500 Hz (scaled pulse output).

Make sure the output frequency of the optional digital (relay) output D5 does not exceed 0.5 Hz, otherwise the relay lifetime and reliability will be reduced significantly.

7	PULSE OUTPUT	
7.1	MODE	The following modes of operation are available for the digital outputs: • **Disabled:** the output is switched off. • **Scaled:** each time the accumulated total has increased with the Amount set at **7.3: PULSE OUTPUT > AMOUNT,** a pulse will be sent on the output with the Width set at **7.2: PULSE OUTPUT > WIDTH**. • **Retransmit:** the unscaled incoming pulse from the flowmeter is retransmitted on the output. **NOTE** The **Retransmit** mode is often used when sinus / non-square wave input signals are present (for example, coil signals) that need to be transmitted as robust square wave forms. The max. frequency is 10kHz with 50% duty cycle and a minimum on and off time of 50µs.
	NOTE When **Retransmit** is selected, the menus **7.2: PULSE OUTPUT > WIDTH** and **7.3: PULSE OUTPUT > AMOUNT** will disappear.	
7.2	WIDTH	When scaled pulse output is selected, the pulse width determines the time that the output will be active, that is, the duration of the pulse. The pulse width is set in milliseconds in the range 0.001 – 9.999 sec. The value "zero" will disable the pulse output. **NOTE** The scaled pulse signal always has a 50% duty cycle. This means the minimum time between pulses is equal to the pulse width setting. If the frequency goes out of range (for example when the flowrate increases), an internal buffer stores the missed pulses. As soon as the flowrate slows down, the buffer is emptied. Pulses can be missed due to a buffer-overflow, therefore it is advisable to program this setting within its range.
7.3	AMOUNT	One pulse is generated for every X-quantity measured. For example, if 100 pulses per gallon are required, enter 0.01 GAL. 0.01 GAL x 100 pulses = 1 gallon **NOTE** After pressing PROG, the decimal point will start to flash. The decimal position can then be changed by pressing the SELECT-key, then press the CLEAR key to set the digits.

5.5.8   MENU 8: MODBUS COMMUNICATION

The E112-P can optionally be equipped with a communication interface that uses the Modbus protocol (Type CB/CH/CU). See **Section C: Modbus communication [»63]** for a detailed explanation of the protocol, data types, and available registers.

8	MODBUS COMMUNICATION	
8.1	SPEED	Sets the baud rate. This setting should match the speed used on the communications bus. The following communication speeds can be selected: 1200, 2400, 4800, 9600, 9600HP, 19200, 38400
		NOTE Communication speeds from 9600HP and upwards are more power consuming. When used with battery power, it is advised to set the speed at 9600 or lower.
8.2	ADDRESS	Configures the bus address of your device on the communication bus.
8.3	MODE	Configures the Modbus communication mode of your device on the communication bus.
8.4	DATABITS	Configures the number of data bits. This setting should match the number used on the communications bus. Select 8 bit for Modbus RTU and 7 or 8 bits for Modbus ASCII.
8.5	PARITY	Configures the parity mode. This setting should match the parity mode used on the communications bus.

5.5.9   MENU 9: OTHERS (WITHOUT TYPE ZL)

NOTE
When the E112-P is ordered with the datalogging option (type ZL), this menu is replaced by the menus described in **Menu 9: Datalogging (with type ZL) [»32]** and **Menu 10: Others (with type ZL) [»34]**

9	OTHERS (WITHOUT TYPE ZL)	
9.1	MODEL	Provides important information on your unit. This information may be required for maintenance, support and upgrade purposes.
9.2	SOFTWARE VERSION	Provides important information on your unit. This information may be required for maintenance, support and upgrade purposes.
9.3	SERIAL NUMBER	Provides important information on your unit. This information may be required for maintenance, support and upgrade purposes.
9.4	TIME	Shows and sets the system clock. The system clock is used by the Daily Total feature to detect when the contract hour (as set in ⬛SETUP **1.6: TOTAL > CONTRACT HOUR [»24]**) is reached. The format is HH.MM.SS in 24 hour notation.
		NOTE The accuracy of the system clock is limited and it will be interrupted if there is a power-down. When the unit is powered up again and the Daily Total feature is enabled, the operator will be prompted to enter the correct system time.
		NOTE If the unit has the Data logging option (type ZL), an accurate battery-backed real-time clock is included that will continue to keep time in case of a total power down.
		⚠ **CAUTION** If the clock is not initialized, all measurements and calculations are performed as normal. However, when Daily total is enabled, detection of Contract hour and the updating of Current day total and Previous day total will not be done at the correct time.
9.5	PASSWORD	All SETUP values can be password protected. A four-digit password can be programed, for example 1234. To disable password protection, enter four zeros (0000).

9	OTHERS (WITHOUT TYPE ZL)	
9.6	KEY LOCK	To prevent misuse of the optical keyboard it can be locked automatically after 30 seconds by enabling this function. ⚠ **CAUTION** In battery supplied applications, the backlight can come on each time the keyboard is activated. As this can quickly degrade the battery, it is advised to leave the keyboard lock function enabled so that the backlight only comes on when an optical key is pressed for at least one second. The keyboard lock function also uses less battery power.
9.7	TAG NUMBER	For identification of the unit and communication purposes, a unique tag number of maximum seven digits can be entered.

5.5.10 MENU 9: DATALOGGING (WITH TYPE ZL)

The data log module records the performance of the E112-P and the amount of medium that passes the sensor (flowmeter) with respect to the time and date.

The following type of records are created:

Interval records

The interval log records the data, as a snapshot, at a specific time interval. When the maximum number of records is reached (1000), the oldest record is overwritten by the newest record.

Each interval record contains the following data:

- a sequence number
- a date/time stamp
- the actual flowrate
- the total
- the accumulated total

Daily records

The daily log records the daily record in the Daily logbook. This is done at one or two predetermined time(s) in the day; for example, before or at the end of a so called contract hour. This function can be used to determine the total of the previous contract hour, or trend the total over a certain period of time.

When the maximum number of records is reached (1000), the oldest record is overwritten by the newest record.

FIG. 19: SINGLE DAILY LOG (TYPICAL)
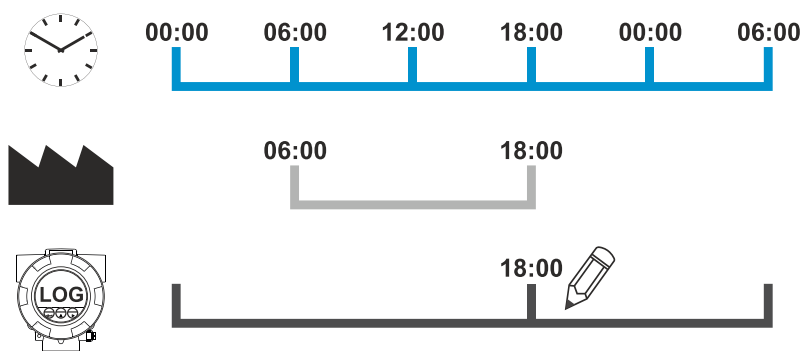
FIG. 20: DUAL DAILY LOG (TYPICAL)
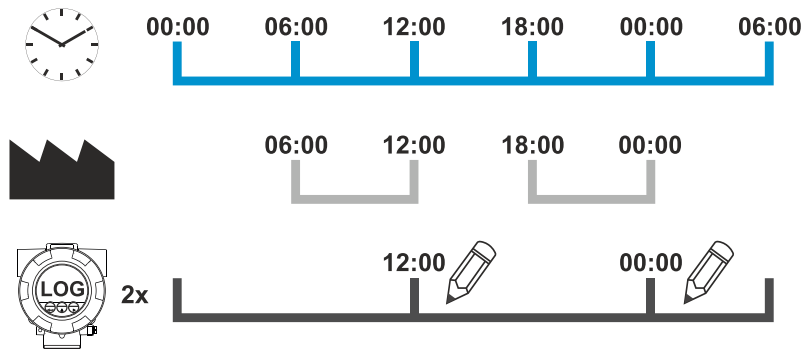
Each daily record contains the following data:

- a sequence number

- a date/time stamp

- the actual flowrate

- the accumulated total

- the total

Event records

The event log records the events that happen during operation in the Event logbook. These events have a generic or specific content (manufacturer defined). For every event that occurs, one record is stored in the logbook. When the maximum number of records is reached (500), the oldest record is overwritten by the newest record.

Each event record contains the following data:

- a sequence number

- (as applicable) an event type number

- a date/time stamp

- (as applicable) an event content description

Reading the data log records

The recorded data can be accessed at operator level (see Section 4: Operation [»9]), or via the PC based data log application (see **Section D: Remote Configuration Tool [»70]**), which can read out and store the records.

The application requires a serial communication connection (for example, RS485, USB), and a specific communication cable depending on the type of communication interface your device has.

The software and cable can be ordered from on our website or are available from your supplier.

9	DATALOGGING (WITH TYPE ZL)	
9.1	LOG INTERVAL	Selects the interval at which an interval record is created. The interval log logbook can hold up to 1000 records. When it is full, it will overwrite the oldest record first.
9.2	DAILY LOG	Selects how many times a day a daily record is created. The daily log logbook can hold up to 1000 records. When it is full, it will overwrite the oldest record first. **NOTE** As well as the Daily log setting, a Current Day Total and Previous Day Total are available. These are independent from the datalog function and have their own contract hour. For more information, see ⬛SETUP **1: TOTAL [»23].**
9.3	DAILY 1	Sets the first contract hour for the daily log records. The format is HH:MM in 24 hour notation.
9.4	DAILY 2	Sets the second contract hour for the daily log records. The format is HH:MM in 24 hour notation.
9.5	TIME	Shows and sets the system clock. The system clock is used by the Daily Total feature and the datalog function. The format is HH.MM.SS in 24 hour notation.
9.6	DATE	Shows and sets the system date. The system date is used by the datalog function. The format is YY.MM.DD

5.5.11 MENU 10: OTHERS (WITH TYPE ZL)

| 10	OTHERS (WITH TYPE ZL)	
10.1	MODEL	Provides important information on your unit. This information may be required for maintenance, support and upgrade purposes.
10.2	SOFTWARE VERSION	Provides important information on your unit. This information may be required for maintenance, support and upgrade purposes.
10.3	SERIAL NUMBER	Provides important information on your unit. This information may be required for maintenance, support and upgrade purposes.
10.4	PASSWORD	All SETUP values can be password protected. A four-digit password can be programed, for example 1234. To disable password protection, enter four zeros (0000).
10.5	KEY LOCK	To prevent misuse of the optical keyboard it can be locked automatically after 30 seconds by enabling this function. ⚠ **CAUTION** In battery supplied applications, the backlight can come on each time the keyboard is activated. As this can quickly degrade the battery, it is advised to leave the keyboard lock function enabled so that the backlight only comes on when an optical key is pressed for at least one second. The keyboard lock function also uses less battery power.
10.6	TAG NUMBER	For identification of the unit and communication purposes, a unique tag number of maximum seven digits can be entered.

6 INSTALLATION

⚠️ **CAUTION**

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.

- The E112-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.

- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.

- Take careful notice of the **Section 2: Safety [»5]** at the front of this manual.

6.1 INSTALLATION / ENVIRONMENTAL CONDITIONS

Take the relevant IP classification of the enclosure into account (see identification plate). Even an enclosure rated for IP67 / TYPE 4(X) should NEVER be exposed to strongly varying (weather) conditions. When used in very cold environment or varying climatic conditions, inside the instrument case, take the necessary precautions against moisture. Mount the E112-P onto a solid structure to avoid vibrations.
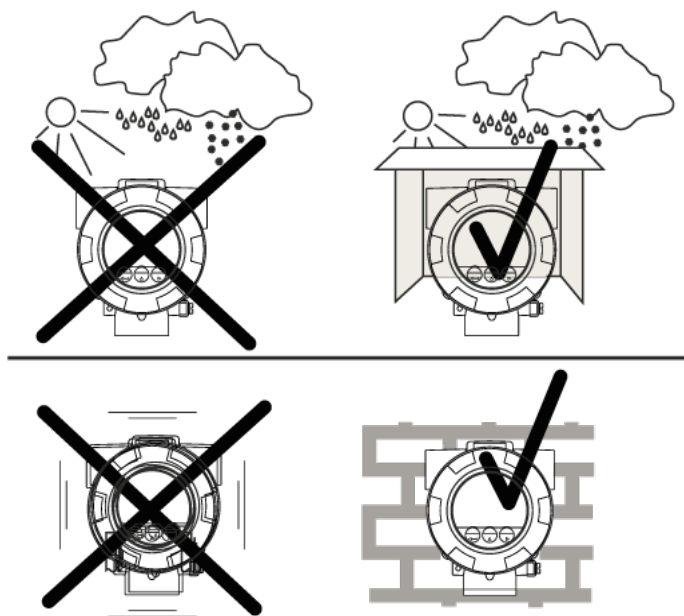
For use in Safe Areas, also known as Ordinary Locations, and Hazardous Locations, the following conditions apply:

Relative humidity:	< 90% RH
IP and NEMA rating:	IP66, IP67 and NEMA Type 4X
Supply voltage fluctuation:	+/- 10% unless stated otherwise
Means of protection:	Class I
Over-voltage category:	II
Pollution degree:	2 (internal environment), 3 (external environment)
Ambient temperature:	-40 °C to +70 °C (-40 °F to + 158 °F)
Altitude:	up to 2000 meters (6600 feet)

6.2 HANDLING THE E-SERIES ENCLOSURE

6.2.1 MAIN PARTS

FIG. 21: EXPLODED VIEW
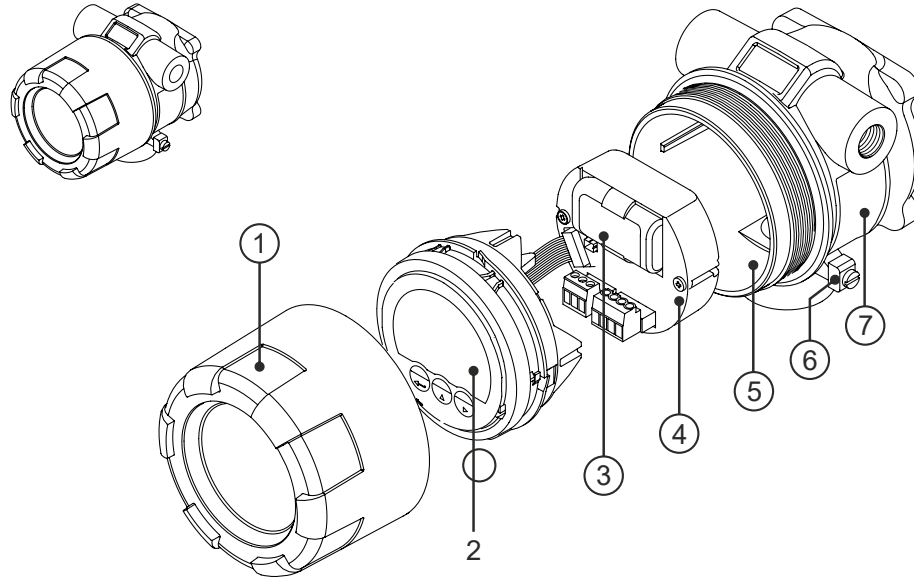
1. Cover

2. Main Electronics Module (MEM)

3. Battery

4. Supply Module (RSM or BSM)

5. Body

6. Grounding terminal

7. Label

FIG. 22: MAIN ELECTRONIC MODULE AND TWO TYPES OF SUPPLY MODULE (BSM, RSM)
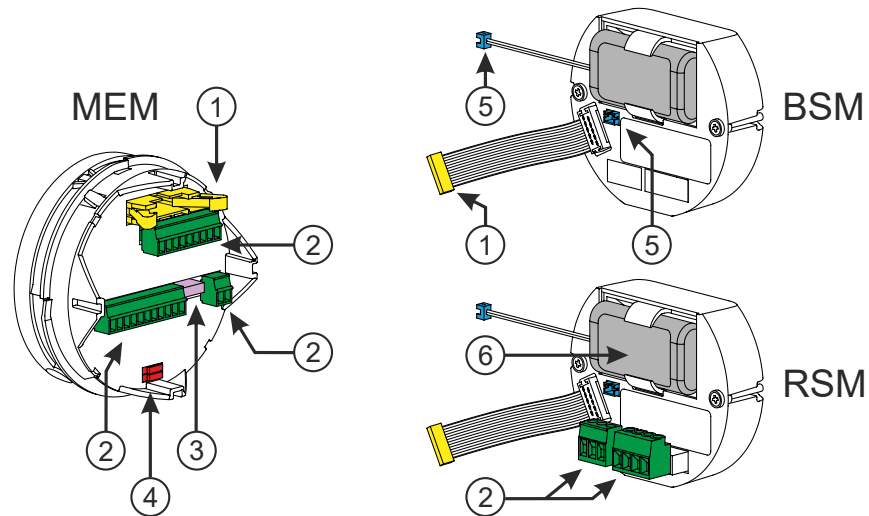
1. Flatcable connector

2. Terminal connectors

3. PC configuration / communication connector

4. Sensor supply voltage selection switches

5. Battery connector

6. Battery

6.2.2   IDENTIFICATION

Your product is supplied with two external and several internal labels.

Configuration label

All E-Series enclosures are supplied with a weatherproof configuration label placed on the outside of the unit. Information on this label includes the configuration options chosen for your product.

FIG. 23: CONFIGURATION LABEL
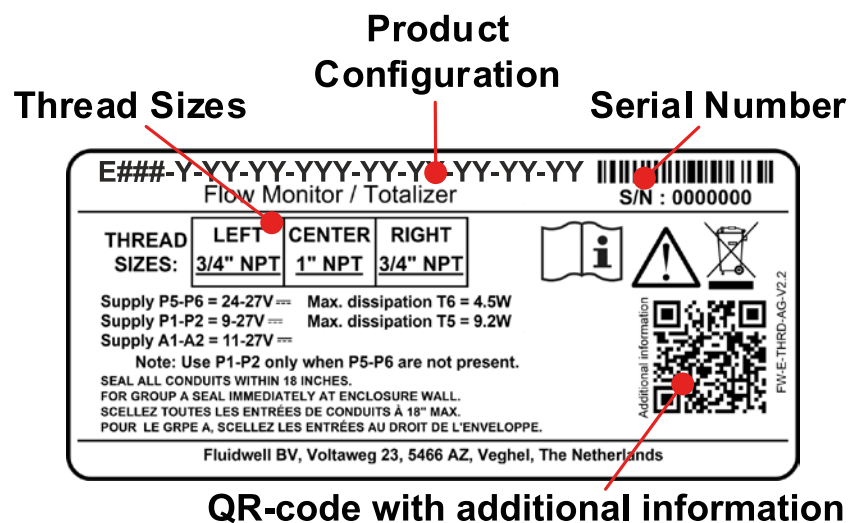
Certification label

Also located on the outside, the Certification Label shows important certification information of your product.

FIG. 24: CERTIFICATION LABEL
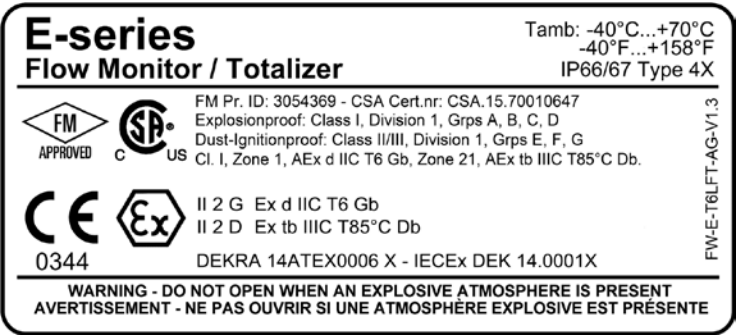
Installation labels

At the inside, several labels can be found. These labels indicate serial number of the electronics, product configuration and connectors, and more.

The MEM is supplied with two labels.

FIG. 25: EXAMPLE MEM LABELING
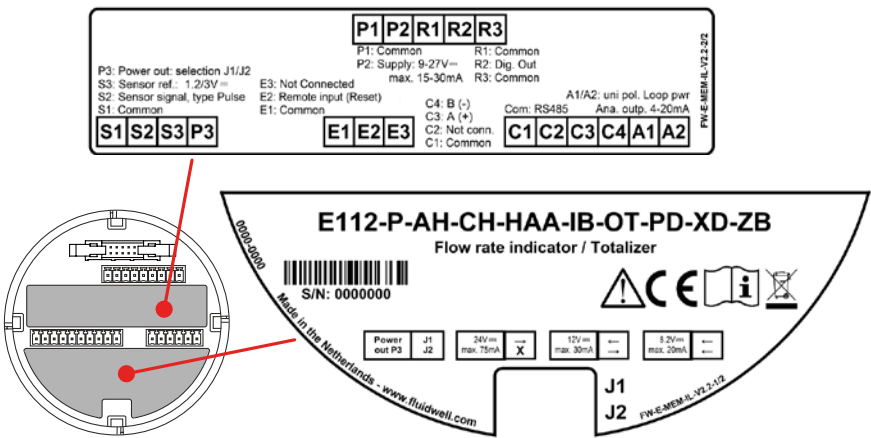
The Supply Module is also labeled. Depending on product type your product can be supplied with an RSM or a BSM.

FIG. 26: EXAMPLE RSM LABELING (PB-OR TYPE)

FIG. 27: EXAMPLE BSM LABELING (PB TYPE)
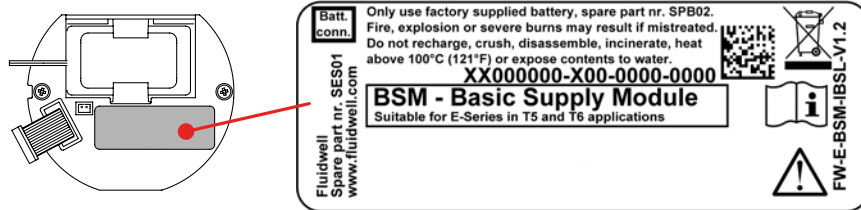
6.2.3   OPENING, ASSEMBLING AND CLOSING THE UNIT

⚠ CAUTION

Explosion risk: never open the housing when explosive atmosphere is present. Safety risk: do not open an installed enclosure when circuits are alive.

Opening the cover

1. Loosen the fixing screw.

1,5mm
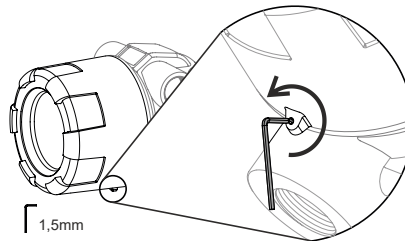
2. By hand (or gently with a wrench if tight), turn the cover counter-clockwise until it is free of the housing. Make sure the MEM inside doesn't fall out or gets damaged. Remove the cover carefully.

3. Store the cover in a safe location. Make sure the mounting thread and glass screen are protected and the fixing screw is not lost.
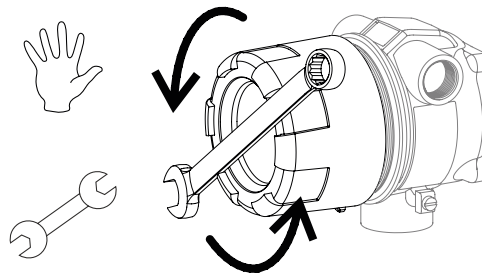
Removing the MEM

1. Mind the wiring! Carefully lift out the MEM to remove it from the housing.

2. Unlock and carefully disconnect the flat cable connector.

3. Disconnect all other cable connectors from the MEM.

4. Store the MEM in a clean, safe location ensuring that the LCD and keyboard is protected.

5. If applicable: protect the housing and connectors against ingress of contamination.
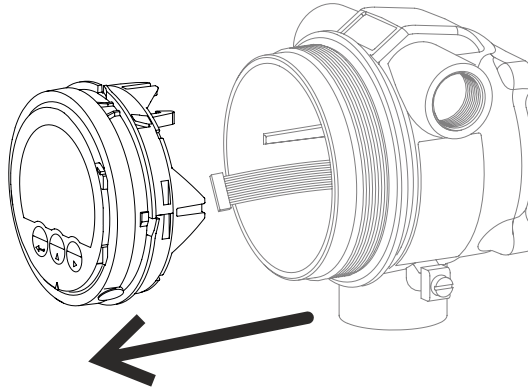
Re-assembling the unit

1. If applicable: check that the battery is installed correctly in the supply module BSM/RSM and that the battery cable is correctly inserted into its connector. See **Section 7.3: Replace battery [»55]** for battery replacement.

2. If applicable: plug the cable connectors with connected wiring into the RSM.

3. Position the MEM in front of the housing and plug the cable connectors with connected wiring into the back of the MEM.

4. Connect the flat cable between the Supply Module and the MEM and lock it in place.

5. Making sure the wiring is not damaged or pinched, insert the MEM into the housing in one of the four positions (0°; 90°; 180°; 270° so the display is best readable).
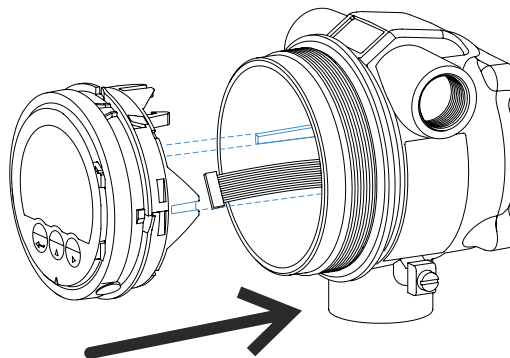
Closing the cover

1. Apply a very thin layer of the specified antiseize compound (see **Section A: Technical specification [»57]**) on the first two wire threads and O-ring of the housing.
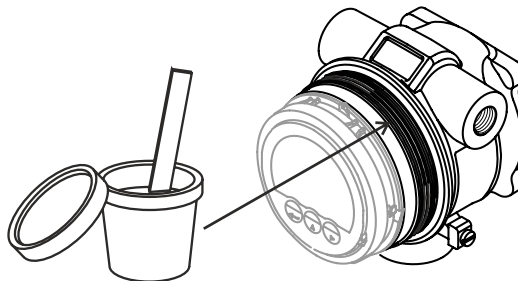
2. Hold the cover in the correct position for installation.

3. By hand, screw the cover clockwise onto the housing until the O-ring is tight to meet the required IP or TYPE protection rating.
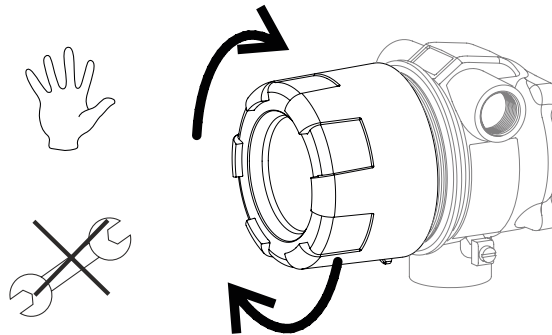
4. Lock the cover in place with the fixing screw.

1,5mm
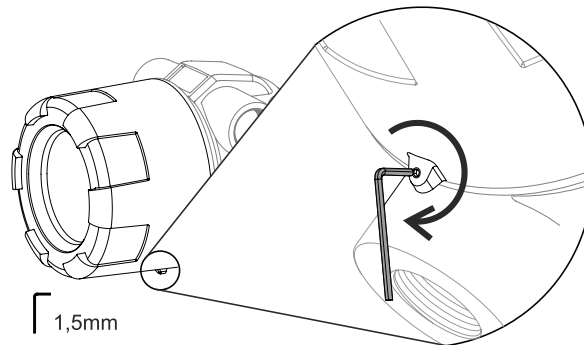
6.2.4 TEST UNIT

After powering up: check all functions of the display to ensure that all connections are correct.

Action	Result	Notice
Check the battery level indicator is not lit	If indicator is lit, replace the battery as described in **Section 7.3: Replace battery [»55]**	Only replace with original batteries supplied by the manufacturer
Press the PROG button for at least 7 seconds	• The SETUP indicator comes on continuously • SETUP menu 1 shows	After a few seconds, the backlight goes off. This is normal behavior to save battery power.
Press CLEAR	SETUP menu 2 shows	
Press SELECT	SETUP menu 21 shows	
Press and hold PROG for at least 3 seconds	The display goes to the OPERATION menu and the RUN icon is displayed	The unit is ready for use
Check the process accuracy	Re-calibration of the flowmeter might be necessary	Do not forget to re-enter any subsequent K-factor alterations

6.3   MECHANICAL INSTALLATION

6.3.1   INSTALLATION PRECAUTIONS

Please adhere to the following instructions and conditions:

⚠ **WARNING**

Explosion hazard: The painted aluminum unit must be installed and maintained as follows to avoid danger of ignition due to electrostatic discharge:

- Use only in fixed installations.

- Do not place unit in areas with rapid airflow.

- Clean only with a moist cloth.

⚠ **WARNING**

Seal conduits / enclosure

- For FM Group A,B,C,D: "SEAL ALL CONDUIT ENTRIES WITHIN 18 INCHES".

- For CSA Group B,C,D: "SEAL ALL CONDUIT ENTRIES WITHIN 18 INCHES".

- For CSA Group A: "SEAL AT ENCLOSURE WALL".

⚠ **WARNING**

Use certified cable glands and conduit sealing devices.

All flameproof joints are designed for:

- Volume: 500 cm³ < V ≤ 2000 cm³.

- Group IIC enclosures.

Flameproof joints

The E112-P has 4 flameproof joints:

- Cement between glass and cover (length ≥10 mm)

- Thread between body and cover: M100x1.5 (8 full threads engaged)

- Thread for conduit opening left and right:
    - M20 x 1.5, M25 x 1.5, (8 full threads engaged)
    - ½ NPT, ¾ NPT

- Thread for process opening:
    - M20 x 1.5, M25 x 1.5, (8 full threads engaged)
    - ½ NPT, ¾ NPT, 1 NPT

- All metric threads comply with fit class 6g/6H (ISO 965-1 + 965-3)

- All NPT threads comply with ANSI/ASME B1.20.1.

Connecting enclosures

Only connect the E112-P to another Ex-d enclosure when the following conditions are satisfied:

- The part used to connect the two volumes is Ex-d certified.

- The connected enclosure is Ex-d certified for its own internal electrical equipment (i.e. pickup coil or other sensors).

- The volume of empty space inside this added volume must not exceed 13.5 cm³.

- • The extra enclosure may not generate any heat.

- • The E112-P is certified for a maximum permitted electrical energy; the extra enclosure may not add any electrical energy.

6.3.2   MECHANICAL DIMENSIONS

FIG. 28: MECHANICAL DIMENSIONS OF THE E-SERIES ENCLOSURE
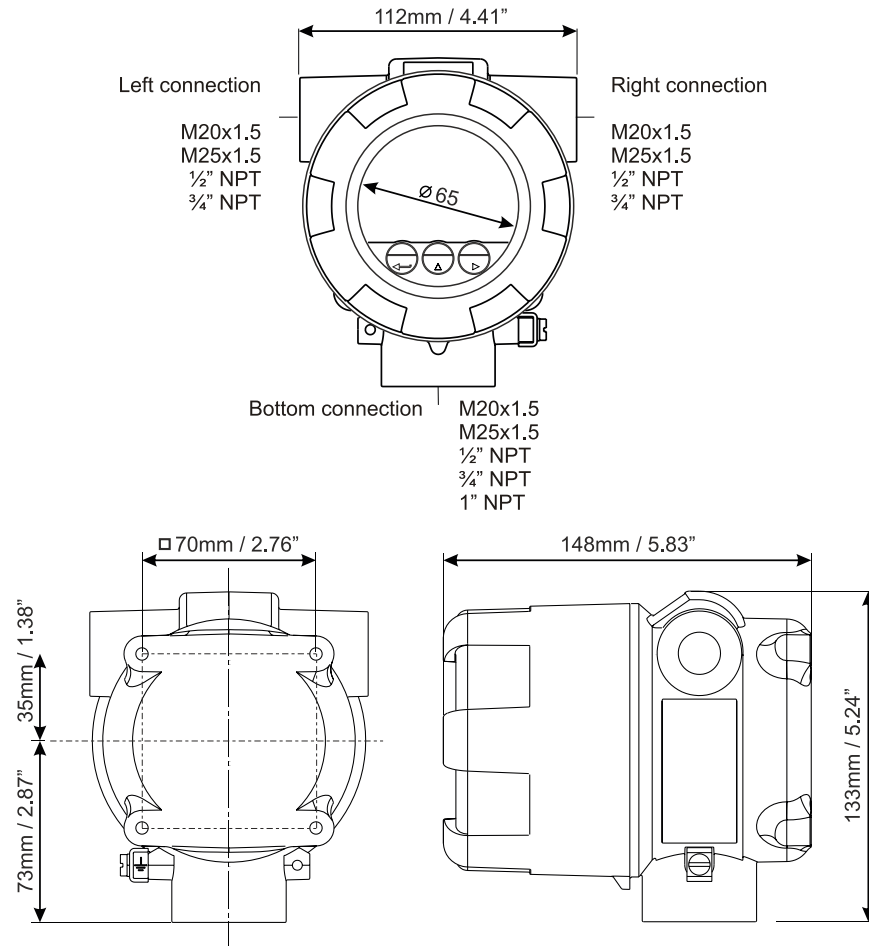
6.3.3   MOUNTING THE UNIT

The Main Electronics Module (MEM) can be placed into the body in 4 directions (0° – 90° – 180° – 270°). This allows the unit to be mounted in any direction while still allowing the MEM to be installed in a 'readable' position.
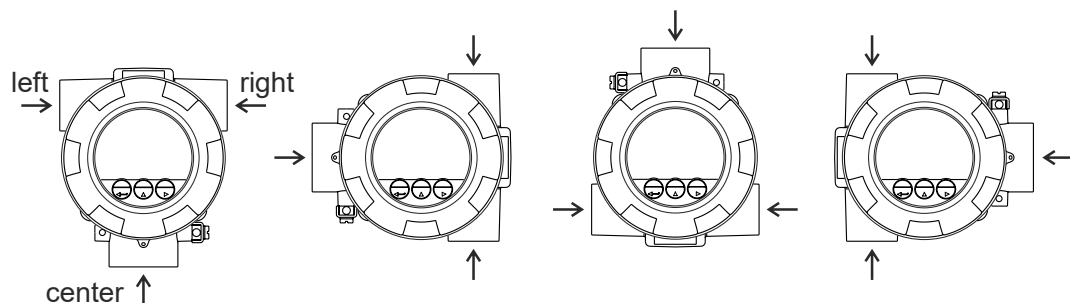
By rotating the unit, the process and conduit openings can be placed in the required direction. Note that the thread sizes of the openings indicated by "left – right – center" correspond with the information on the configuration label attached to the outside of the product.

⚠ CAUTION
When mounting the unit, leave the cover on as much as possible to prevent damage to the thread winding. Only remove cover and MEM after mounting.

The following options are available to mount the unit:

- Directly on a panel.

- Directly onto the flowmeter using the large connector on the bottom of the housing.

- On a pipe using the bracket and hose clamps (accessory ACE04).

- On a wall using the wall mounting plate (accessory ACE03).

Mount unit on a panel

1. Mount the unit with four M6 bolts as shown. The thread depth in the body is max. 10mm (0.39")

2. Remove the cover and the MEM (see **Section 6.2.3: Opening, assembling and closing the unit [»39]**)

3. Attach electrical cabling (see **Section 6.4: Electrical installation [»44]**)
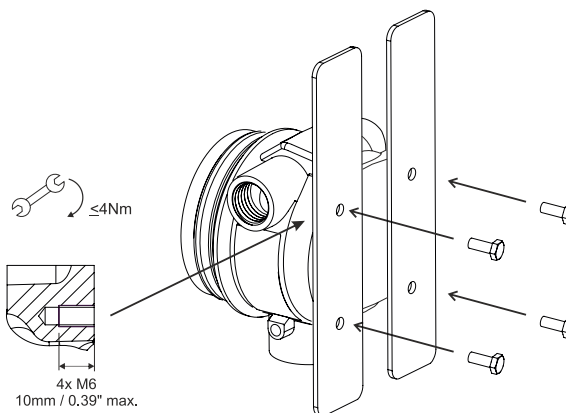
Mount unit on a flowmeter

1. Remove the cover and the MEM (see **Section 6.2.3: Opening, assembling and closing the unit [»39]**)

2. If present, remove the cap from the bottom connector of the housing.

3. Position the unit over the connector on the flowmeter.

4. Carefully insert the required cabling from the flowmeter through the connector opening into the base of the housing.

5. Add approved lubricating oil onto the windings of the bottom connector, and screw the housing clockwise onto the flowmeter connector until it is sufficiently tight to meet the required IP or TYPE protection rating.

6. Attach the electrical cabling (see **Section 6.4: Electrical installation [»44]**).
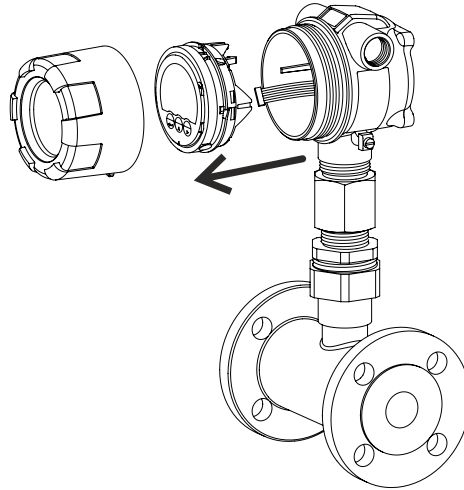
Mount unit on a pipe

1. Use the pipe mount accessories (ACE04) to attach the unit as shown and follow the Assembly Instructions as supplied with the accessory.

2. Remove the cover and the MEM (see **Section 6.2.3: Opening, assembling and closing the unit [»39]**).

3. Attach the electrical cabling (see **Section 6.4: Electrical installation [»44]**).
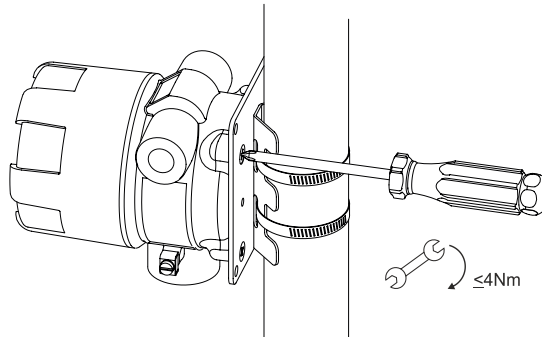
Mount unit on a wall

1. Use the wall mount accessories (ACE03) to attach the unit as shown and follow the Assembly Instructions as supplied with the accessory.

2. Remove the cover and the MEM (see **Section 6.2.3: Opening, assembling and closing the unit [»39]**).

3. Attach the electrical cabling (see **Section 6.4: Electrical installation [»44]**).
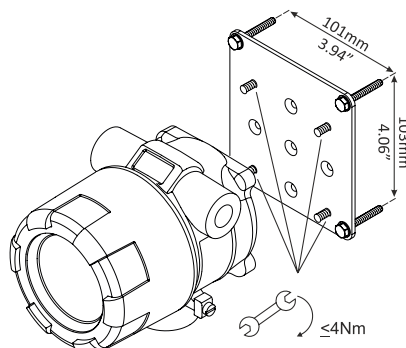
6.4   ELECTRICAL INSTALLATION

When connecting cabling to the MEM and RSM (if applicable), always pull the cabling first through the appropriate housing connector without stretching the cabling.

Remove the numbered connectors from the rear of the MEM to connect all cabling. After connecting cabling, plug the connectors into the RSM first and then into the rear of the MEM when reinserting the MEM back into the housing.

6.4.1   ELECTRICAL PRECAUTIONS

⚠ **WARNING**
Explosion hazard

• A live circuit can cause an explosion. Do not open a powered-up unit when explosive atmosphere is present.

• For battery powered equipment, never open the housing when explosive atmosphere is present.

• When installed in a potentially explosive atmosphere that requires apparatus of equipment protection level Gb and Db, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and aluminum/steel is excluded.

⚠ **CAUTION**
Electrical precautions

• Ensure the unit is correctly wired according to the wiring diagrams and complies with local codes and regulations.

• If this unit has a permanent connection (switch or circuit-breaker) to a supply, it must be:

    • installed near the unit and within easy reach of the operator,

    • marked as the disconnecting device for the unit.

• Except for the relay outputs R8 to R11, all unit connections must be low voltage defined as "SELV" circuit per IEC 60950-1.

• The unit must be supplied from a "SELV" circuit defined as per IEC 60950-1.

• A suitable power supply should be considered in end-use equipment. This supply should comply with a limited-energy circuit (maximum available current of 8 A); if not in compliance, install an overcurrent protection device (e.g. fuse) close to the instrument with adequate breaking capacity:

   • Fuse type: Time-lag (approved according to IEC60127-2 and/or UL248-14),

    • Fuse rating: Current: 5 A.

• Use Ex-d cable glands with effective IP67 (TYPE4X) seals when connecting cables. Fit Ex-d IP67 (TYPE4X) blind plugs to unused cable entries.

• The cable entry plugs mounted in the housing must comply with the requirements of the protection type used.

⚠ **CAUTION**
Equipment damage from electrical discharge

• Electro static discharge can inflict irreparable damage to electronics! Before installing cabling, always first discharge yourself by touching a well-grounded object.

• Always install the unit according to the EMC guidelines (Electro Magnetic Compatibility) and according to local requirements (e.g. in Canada, the Canadian Electrical Code, C22.1, Part 1 and in USA, the National Electrical Code, NFPA 70 and ANSI/ISA-RP 12).

⚠ **CAUTION**

Risk of short circuits and overheating

- Use only an effective screened cable for the input signal and ground it to terminal S1 (GND) AND to the housing, or at the sensor itself, whichever is appropriate to the application. Be careful not to create ground loops.

- Without a thermal separator, the process temperature shall not exceed the specified maximum ambient temperature.

- If, due to internal dissipation, the housing temperature exceeds 70 °C / 158 °F, use suitable cable and gland to withstand high temperatures.

6.4.2   GROUNDING OF THE ENCLOSURE

For Class 1 applications make sure to apply proper in- and external grounding to PE terminal, as shown. PE terminal: stranded conductor 4 mm2, single conductor 6 mm^2.

FIG. 29: GROUNDING OF ENCLOSURE
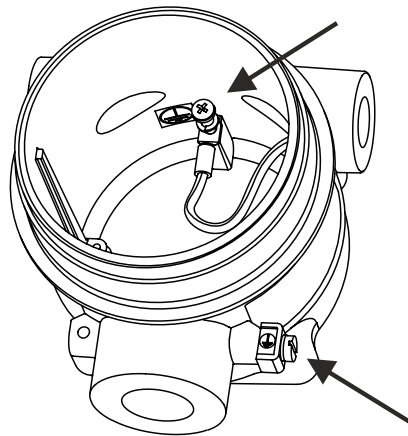
6.4.3   ELECTRICAL RATINGS

The following supply ratings apply for installed options of the E-Series (other options have negligible influence on the ratings). Use these ratings to select the suitable power supply and overcurrent protection.

Type	Input	Supply voltage range	Maximum supply current	Remark
PD-OR	P6	24-27 VDC	110 mA	Type OR
PD-OT	P2	9-27 VDC	75 mA	Not Type OR
PX-OT	P2	9-27 VDC	50 mA	Not Type OR
AH	A1/A2	11-27 VDC	25 mA	Type AH is not suitable for Type OR

If a combination of inputs is used, use the maximum value mentioned!

The output relay (Type OR) is type SPST and has the following contact ratings:

Load type & voltage	Current
Resistive load at 30 VDC, 125 VAC or 250 VAC.	Max. 2 A
Inductive load (for pilot duty applications) at 30 VDC, 125 VAC or 250 VAC.	Max. 0.5 A

6.4.4 VOLTAGE SELECTION SENSOR SUPPLY

Type PB / PX – Pickup element supply

Terminal S3 provides a limited supply voltage of 3.2 VDC (coil signals 1.2 V) for the flowmeter signal output. Output impedance is 2700 ohms and power is limited to 3.3 mW under short circuit conditions.

NOTE
Limited power

This voltage MAY NOT be used to power the flowmeter electronics, converters, etc. as it will not provide adequate sustained power! All energy used by the flowmeter pickup will directly influence battery life (type PB). It is strongly advised to use a "zero power" pickup such as a coil or reedswitch when operating without external power. You can use some low power NPN or PNP output signals, but battery life will be significantly reduced (consult your distributor).

Type PD: Sensor supply: 8.2 VDC – 12 VDC or 24 VDC (Vin P2 minus 1 V)

This option provides a supply derived from the input supply. Adjust the P3 output voltage using switches J1 and J2 on the bottom rear of the MEM (Main Electronics Module) - see following figure.

FIG. 30: VOLTAGE SELECTOR SWITCH (TERMINAL CONNECTOR P3
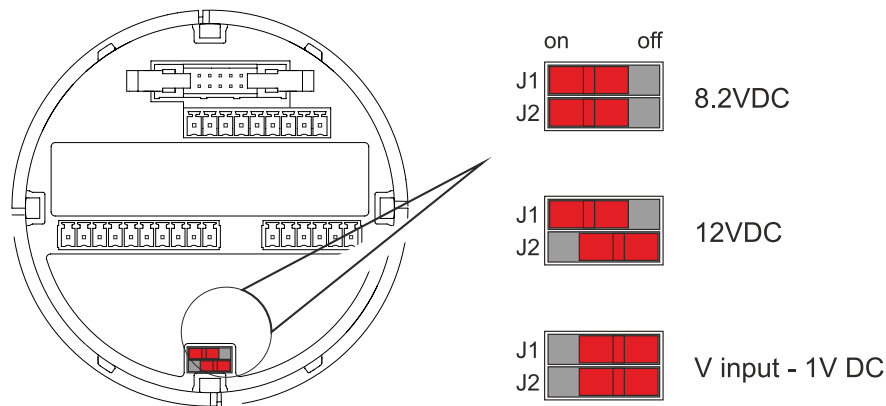
POWER SUPPLY 10 – 30 V DC (OFF = RIGHT POSITION)			
J1	**J2**	**External sensor supply voltage**	**Required supply voltage**
ON	ON	8.2 V DC (max. output 20 mA)	9 – 27 V DC
ON	OFF	12 V DC (max. output 30 mA)	13 – 27 V DC
OFF	OFF	Supply voltage - 1 V DC (max output 75 mA)	Up to 27 V DC

NOTE
Power overload

The sensor supply is protected against a power overload but an overload may affect the functionality of the unit (i.e. shutdown).

6.4.5 TERMINAL CONNECTORS – MEM

The following terminal connectors are available for the Main Electronics Modus (MEM).

FIG. 31: TERMINAL CONNECTORS MEM - UPPER ROW

POWER REQUIREMENTS

P1　P2

PULSE OUTPUT D1

R1　R2　R3

PD: 9 - 27V DC

⊥　+↑

OT: passive transistor output

⊥　+↑

PX: 9 - 27V DC

⊥　+
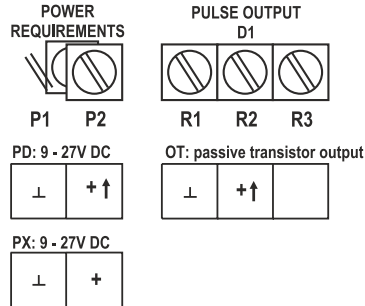
PB: battery powered
(PX: is standard available: if supply PX/PD is connected, the battery supply will be switched off automatically.

MEM
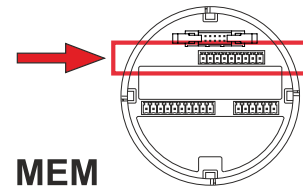
FIG. 32: TERMINAL CONNECTORS MEM - LOWER ROW

SENSOR INPUT　**SENSOR SUPPLY**

S1　S2　S3　P3

P: coil

⊥　～ 8.2 / 12 / 24V　+↓

P: reed switch / NPN

⊥　+　8.2 / 12 / 24V　+↓

P: PNP

⊥　—↑　3V +↓　8.2 / 12 / 24V　+↓

P: namur

⊥　—↑　3V +↓　8.2 / 12 / 24V　+↓

P: active signal

⊥　+↑　3V +↓　8.2 / 12 / 24V　+↓
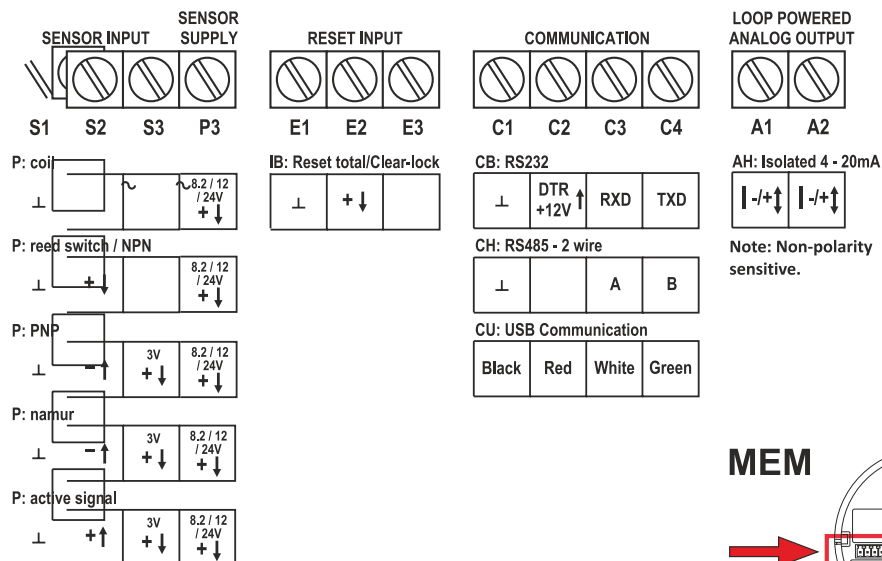
Note: The sensor supply (P3) is only available with PD.

RESET INPUT

E1　E2　E3

IB: Reset total/Clear-lock

⊥　+↓

COMMUNICATION

C1　C2　C3　C4

CB: RS232

⊥　DTR +12V↑　RXD　TXD

CH: RS485 - 2 wire

⊥　　A　B

CU: USB Communication

Black　Red　White　Green

LOOP POWERED ANALOG OUTPUT

A1　A2

AH: Isolated 4 - 20mA

I -/+↑　I -/+↑

Note: Non-polarity sensitive.

MEM
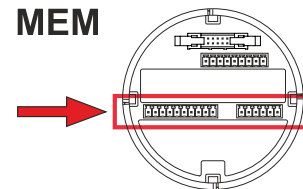
6.4.6   TERMINAL CONNECTORS – RSM

The following terminal connections are available for Relay Supply Module (RSM; option OR).

FIG. 33: TERMINAL CONNECTORS RSM
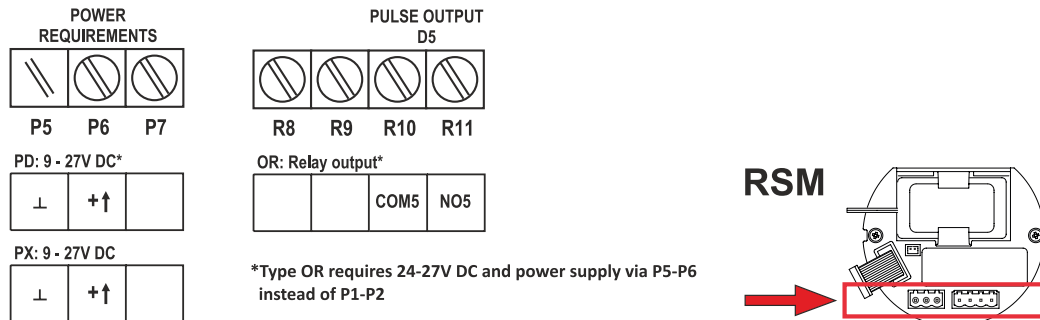
6.4.7   TERMINALS P1-P2 OR P5-P6: POWER SUPPLY – TYPE PD/PX

⚠ **CAUTION**
Power connection differs with or without Type OR

- Without Type OR, power should be connected to MEM terminals P1 and P2.

- With Type OR, power should be connected to RSM terminals P5 and P6.

Connect an external 9-27 VDC power supply to these terminals.

When power is applied to these terminals, discharge of the (optional) internal battery will be disabled. See also **Section 6.4.4: Voltage selection sensor supply [»46]**.

6.4.8   TERMINALS P3: SENSOR SUPPLY - TYPE PD

This terminal may be used for sensor supply. See **Section 6.4.4: Voltage selection sensor supply [»46]** for relevant information.

Power requirements for sensor supply P3:

- 8.2 V sensor supply requires 9-27 V

- 12 V sensor supply requires 13-27 V

- 24 V = V-input − 1V (max 27 V)

6.4.9   TERMINALS R1-R2 AND R10-R11: DIGITAL OUTPUTS D1 AND D5

The functionality of the digital output is programmed through ⟨SETUP⟩ **7: PULSE OUTPUT [»31]**.

- The digital (transistor) output D1 has a maximum frequency of 500Hz for scaled pulse and 10kHz for pulse retransmission.

- Be sure that the output frequency of the optional digital (relay) output D5 does not exceed 0.5 Hz, else the relay life time and reliability will be reduced significantly.

- When retransmit mode is selected, only Type OT output D1 (on terminals R1-R2) will retransmit the frequency of the flowmeter signal. In all other modes, Type OR output D5 will follow output D1.

Type OT

One passive transistor output (D1) is available with a maximum pulse frequency of 500 Hz. Max. driving capacity 300 mA @ 50 VDC.

- Terminals R1 and R3 are common ground (GND) terminals.

- When retransmit mode is selected the max. frequency is 10kHz with a 50% duty cycle and a minimum on and off- time of 50µs.

FIG. 34: TERMINALS R1-R2: TRANSISTOR OUTPUT D1
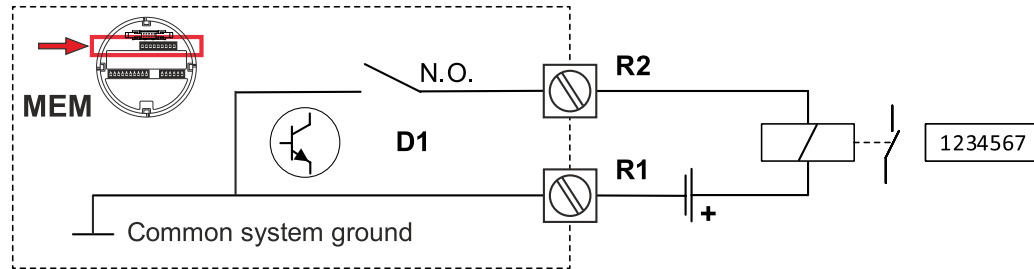
Type OR

One mechanical normally open relay output (D5) is available with a maximum pulse frequency of 0.5Hz. Max. switch power 240 V 0.5 A per output: With the OR option:

- Use power supply terminals P5-P6.

- The required supply voltage is 24 – 27 VDC!

- Be sure that the output frequency does not exceed 0.5 Hz, else the relay life time and reliability will be reduced significantly.

- The output functionality of digital output D5 corresponds to the functionality of digital output D1.

- When **retransmit mode** is selected, the relays are not activated.

FIG. 35: TERMINALS R10-R11: MECHANICAL RELAY OUTPUT D5
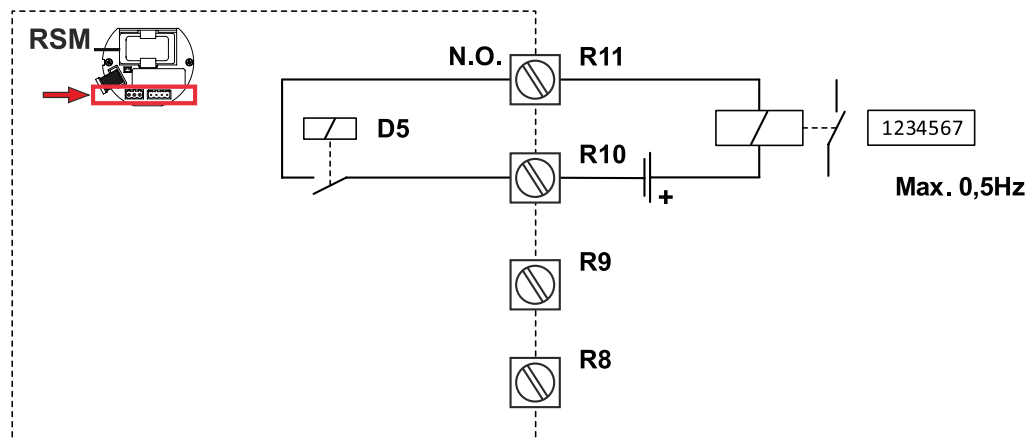
6.4.10 TERMINALS S1-S3: FLOWMETER INPUT

Three basic types of flowmeter signals can be connected to the unit: pulse, active pulse or sinewave (coil). The screen of the signal wire must be connected to the common ground terminal (unless earthed at the sensor itself).

The sensor output should match with the selected flowmeter setting assigned in **SETUP** **4: FLOWMETER [»27]**.

Sine-wave signal (Coil)

The unit can be used with flowmeters which have a coil output signal. Two sensitivity levels can be selected (see **SETUP** **4.1: FLOWMETER > SIGNAL [»27]**):

•   COIL LO: sensitivity 90 mVpp.

•   COIL HI: sensitivity 20 mVpp. (type ZF offers sensitivity 10 mVpp; type ZG offers sensitivity 5 mVpp).

FIG. 36: TERMINALS S1-S3: COIL SIGNAL INPUT
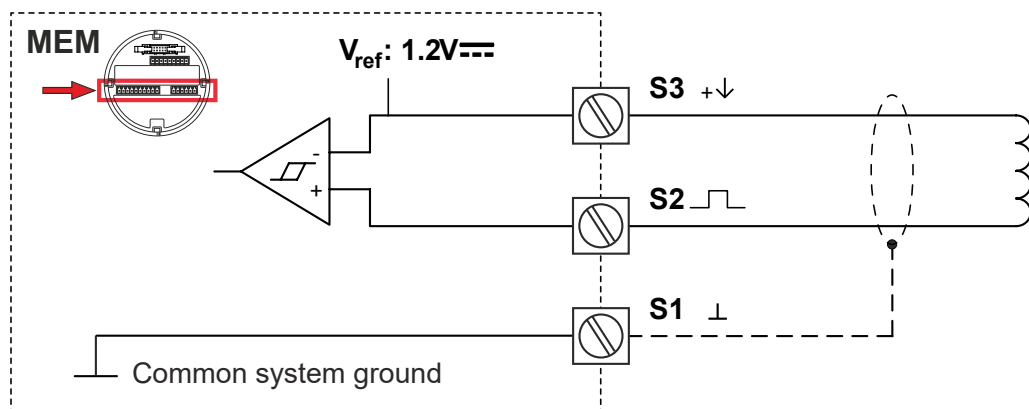
Pulse-signal NPN / NPN-LP

The unit is suitable for use with flowmeters which have a NPN output signal:

•   For reliable pulse detection under all circumstances, the signal should be above 1.4 V or below 1.0 V.

•   Preferably use a sensor which is normally open and briefly closed (less power consumption).

•   For better noise immunity (and if no high sensor input frequencies are expected), select signal setting NPN-LP – low-pass signal noise filter which limits the maximum input frequency and avoids pulse bounce (see **SETUP** **4.1: FLOWMETER > SIGNAL [»27]**).

FIG. 37: TERMINALS S1-S2: PULSE SIGNAL INPUT NPN
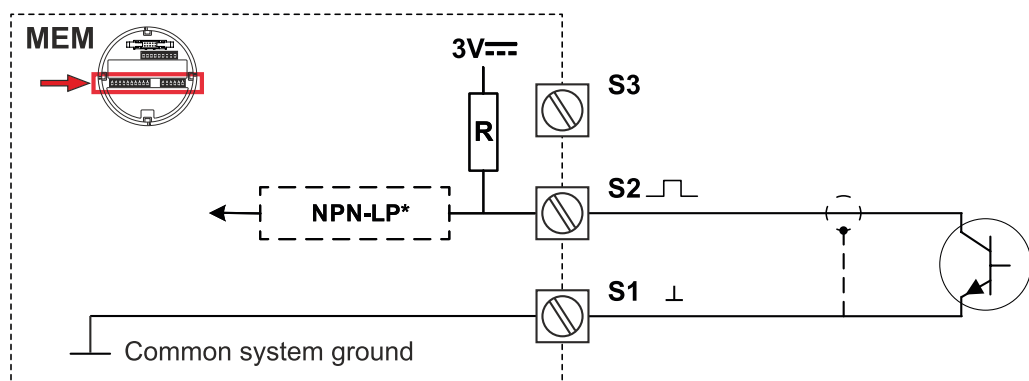
Pulse-signal PNP / PNP-LP

The unit is suitable for use with flowmeters which have a PNP output signal:

- 3.0 V is offered on terminal S3 which must be switched by the sensor to terminal S2 (SIGNAL).

- For reliable pulse detection, the signal must always be above 1.4 V or below 1.0 V.

- For less power consumption, use a sensor which is normally open and briefly closed.

- For better noise immunity and if no high sensor input frequencies are expected, select signal setting PNP-LP (low-pass signal noise filter) which limits the maximum input frequency to avoid pulse bounce (see SETUP **4.1: FLOWMETER > SIGNAL [»27]**).

Power supply type PD provides a sensor supply voltage of 8.2, 12, or 24 VDC.

FIG. 38: TERMINALS S1-S3 AND P3: PULSE SIGNAL INPUT PNP
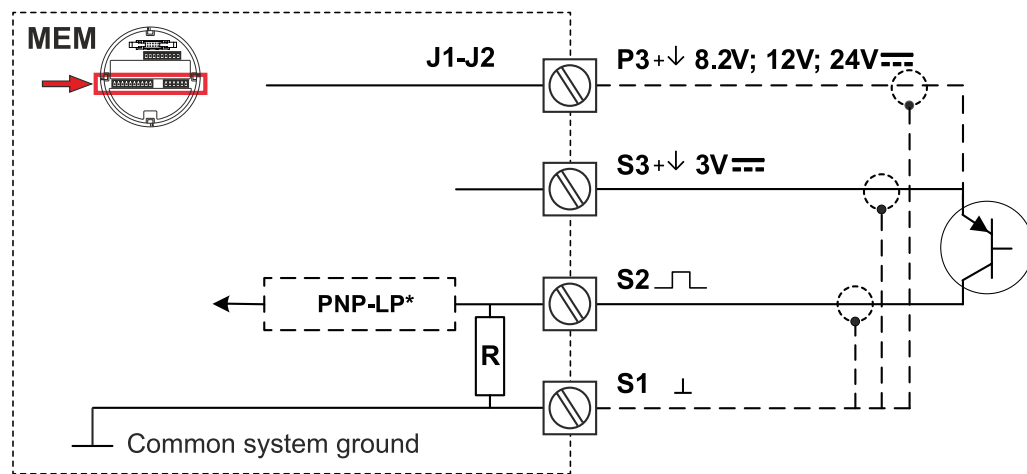
Reed switch

The unit can be used with flowmeters which have a reed switch. To avoid pulse bounce from the reed switch, it is advised to select REED LP – low-pass noise filter, which limits the maximum input frequency (see SETUP **4.1: FLOWMETER > SIGNAL [»27]**). Make sure the contact resistance of the reed switch is less than 1V@2uA=500 kOhm.

FIG. 39: TERMINALS S1-S2: REED SWITCH INPUT
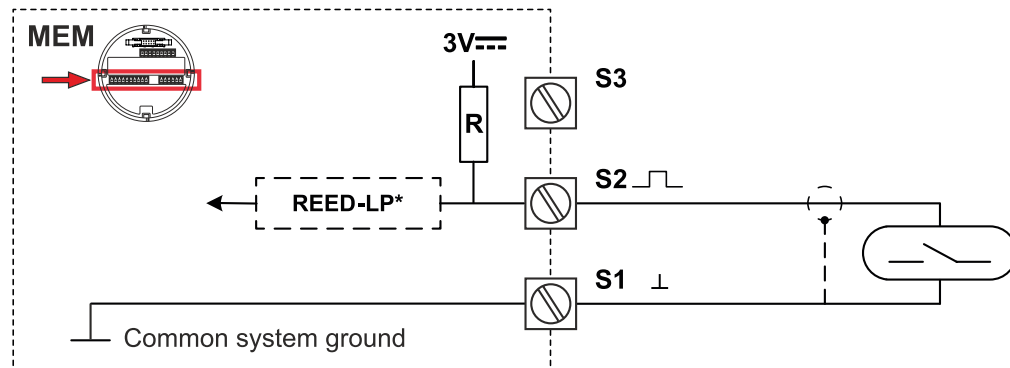
NAMUR signal

The unit is suitable for flowmeters with a NAMUR signal (units with PX cannot power the NAMUR sensor). If required the NAMUR sensor can be supplied via the 8.2 V sensor supply (terminal P3), only available with power supply type PD. See $\boxed{\text{SETUP}}$ **4: FLOWMETER [»27]** for more information.

FIG. 40: TERMINALS S1-S2 AND P3: NAMUR INPUT SIGNAL
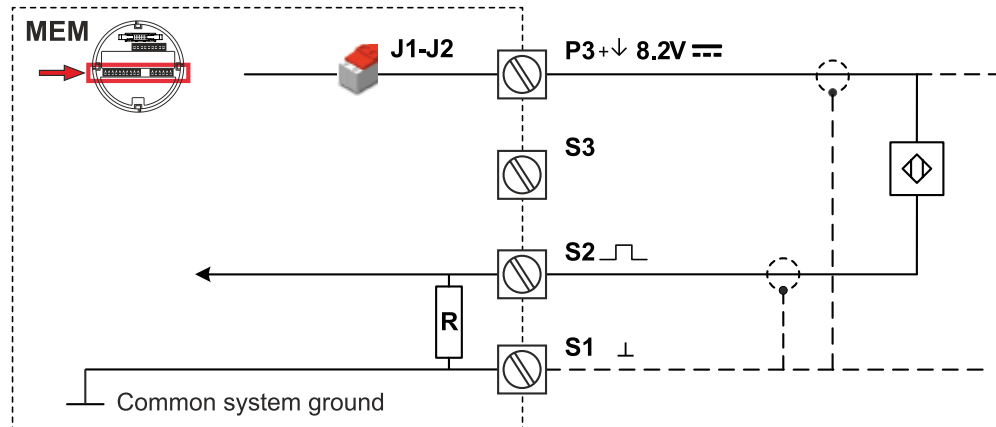
Active signals 8.2 V and 24 V

The unit is suitable for flowmeters with an Active signal. The detection levels are about 50% of the selected supply voltage; approximately 4 V (ACT_8.1) or 12 V (ACT_24). See $\boxed{\text{SETUP}}$ **4: FLOWMETER [»27]** for more information.

Active signal selection may be desired in the case of power supply type PD being supplied for sensor supply.

FIG. 41: TERMINALS S1-S2 AND P3: ACTIVE SIGNAL INPUTS 8.2 V AND 24 V
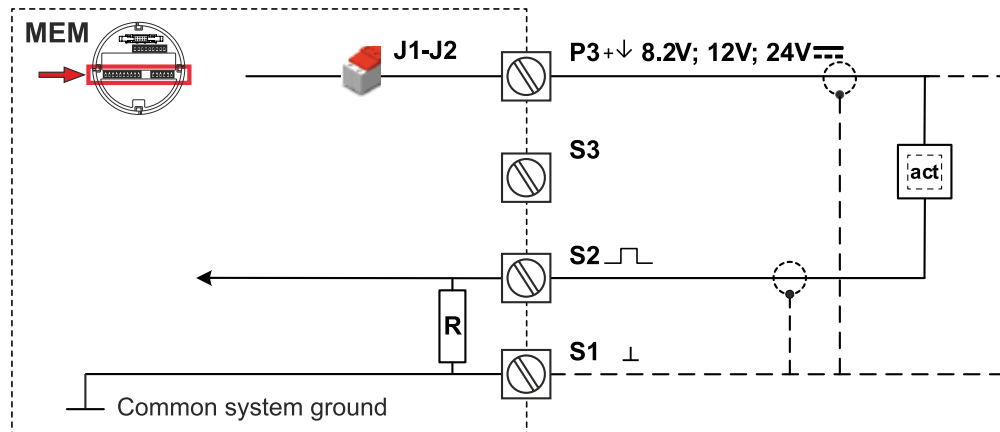
6.4.11 TERMINALS E1-E2: EXTERNAL RESET WITH CLEAR-LOCK - TYPE IB

Use this function to reset the total to zero with an external switch (pushbutton). The total resets the moment a falling edge is detected (the moment the switch closes).

To disable the ″Clear Total″-function of the optical keys, keep this input closed.

Make sure the contact resistance of the switch is less than 0.8 V@2uA = 400 kOhm. A reset pulse should last for at least 100 ms. The input must be switched with a normally open contact to GND.

FIG. 42: TERMINALS E1-E2: EXTERNAL RESET
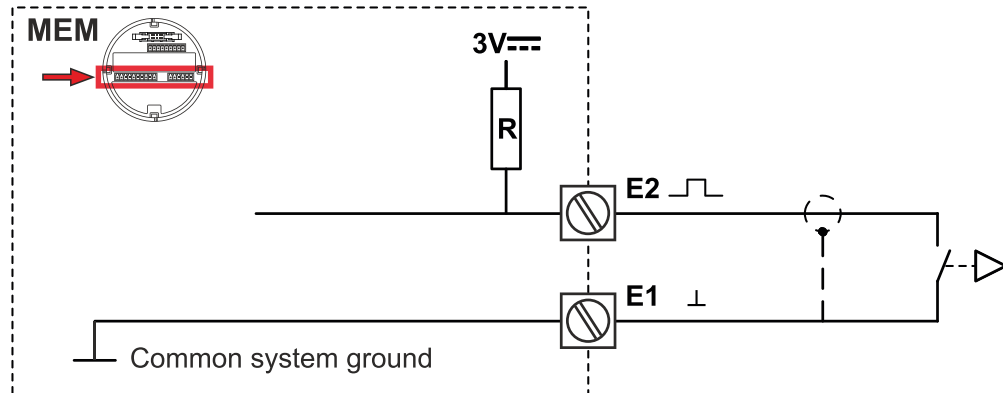
Read **Section C: Modbus communication [»63]**.

FIG. 43: TERMINALS C1-C4: COMMUNICATION
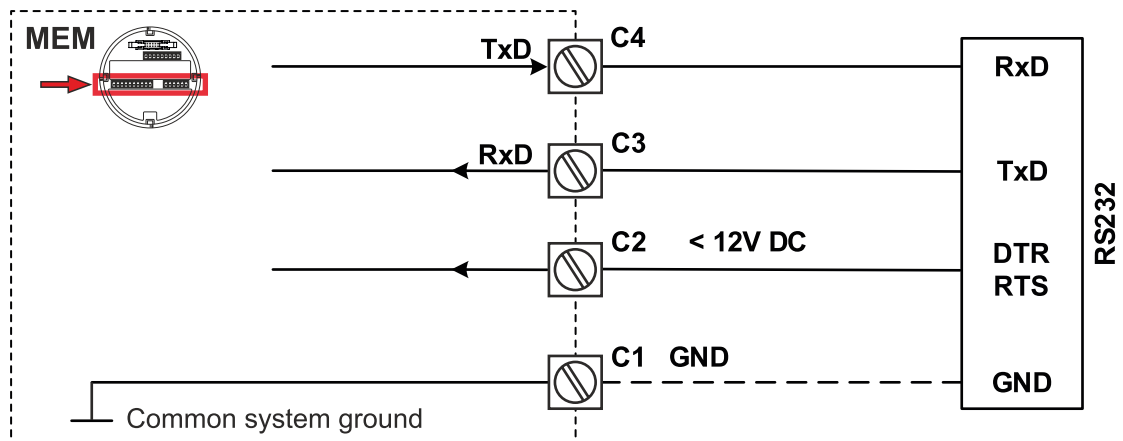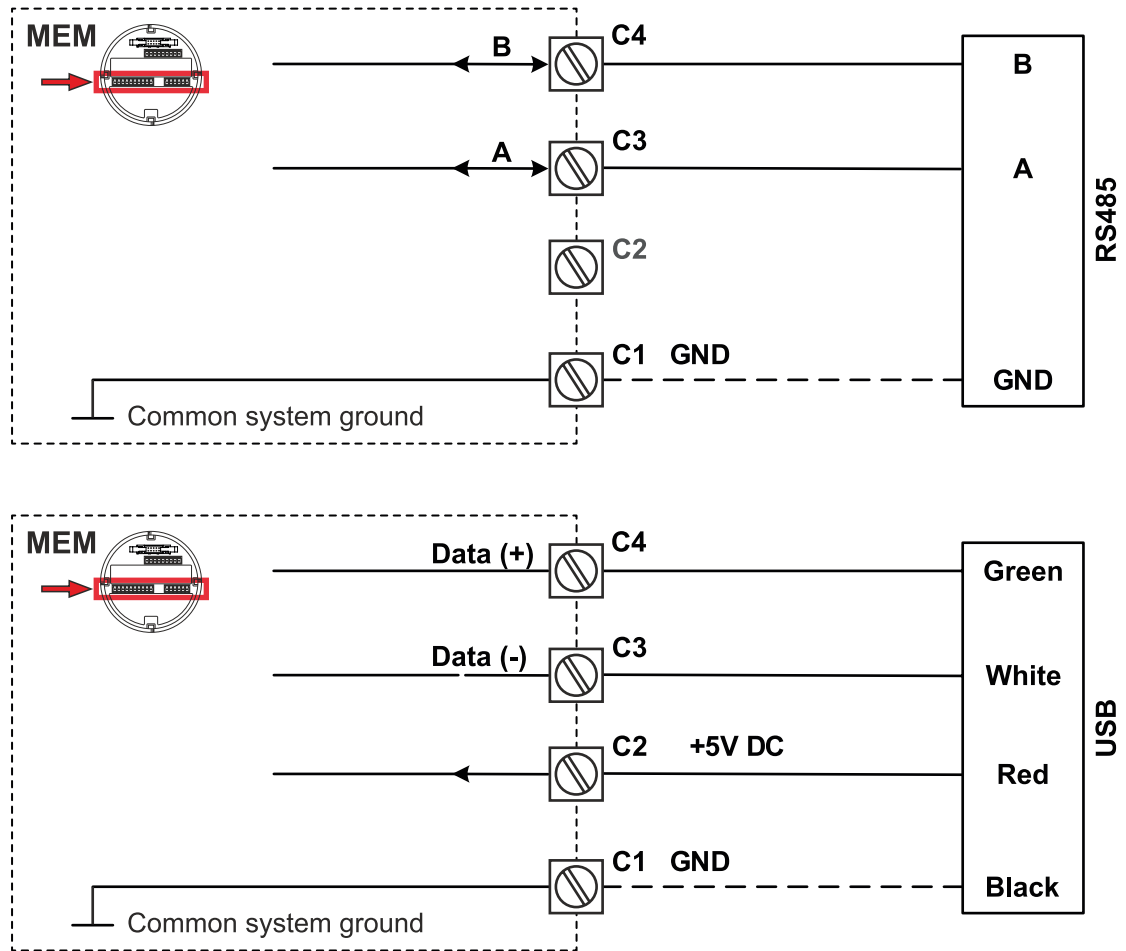
When using the RS232 communication option, terminal C2 must be used for supplying the interface. Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (current limited +12V). If no active signal is available it is possible to connect a separate supply between

6.4.12   TERMINALS A1-A2: ISOLATED ANALOG OUTPUT – TYPE AH

The flowrate proportional output (AH) is standard available. This output is an isolated 4-20 mA output with the possibility to power the device via the 4-20 mA loop. It is non-polarity sensitive.

When the output is disabled, the current is by default limited to 2 mA. Max. driving capacity 1000 Ohm @ 27 VDC. If only powered by the loop, the backlight will not be activated. The total loop resistance may not exceed 1000 Ohm and may not be less than 330 Ohm (at 30 mA). This means that the total resistance of other loop-devices may not exceed 670 Ohm.

FIG. 44: TERMINALS A1-A2: ANALOG OUTPUT
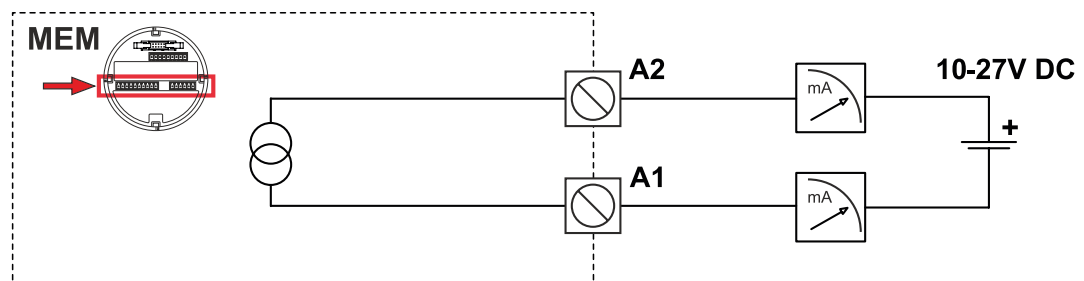
7 MAINTENANCE

⚠️ **CAUTION**

Product damage: Only trained and authorized personnel may maintain the unit. Always read and understand this manual (especially **Section 2: Safety [»5]**) before proceeding.

If the E112-P is damaged or faulty, it cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs can only be carried out by the manufacturer or their authorized agent.

The unit only requires occasional periodic maintenance unless it is used in low-temperature applications or environments with high humidity (above 90% annual mean). It is the user's responsibility to take all precautions to dehumidify the internal atmosphere of the unit in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing.

To prolong the battery lifetime as much as possible, it is also strongly advisable to use only necessary functions. Consult **Section 5.2.4: Saving battery lifetime (type PB) [»19]**.

The following are suggested periodic maintenance tasks.

7.1 CHECK FOR WEAR OR DAMAGE

1. Check the unit (including cable glands and wiring) for damage or aging symptoms.

2. Check the process accuracy. If necessary, re-calibrate the flowmeter. Do not forget to re-enter any updated K-factor values.

3. Check the battery indicator for low level; replace battery as necessary – see **Section 7.3: Replace battery [»55].**

7.2 CLEAN UNIT

1. Soak a lint-free cloth with mild soap solution or fresh water.

2. Clean the complete unit (including control panel) by gently wiping with the cloth taking care that no moisture enters the housing.

7.3 REPLACE BATTERY

⚠️ **WARNING**

Explosion risk: never open the housing when explosive atmosphere is present.

Safety risk: do not open an installed enclosure when circuits are alive.

⚠️ **WARNING**

USE OF UNAPPROVED OR DAMAGED BATTERIES CAN INVALIDATE EXPLOSION SAFETY.

• Only use batteries that are approved by the manufacturer. Approved batteries can be ordered from your supplier.

• A damaged battery is unsafe and can cause injury. Always handle the battery with care.

Follow the instructions shown in **Section 6.2.3: Opening, assembling and closing the unit [»39]**, to gain access to the MEM and BSM/RSM.

7.3.1   BATTERY REPLACEMENT SUPPLY MODULE BSM / RSM

Check new battery

Before exchanging the battery, make sure the new battery is undamaged, in good condition and suitable for use in the unit. Check that the marking on the battery correspond with the type of installation, as shown on the right.
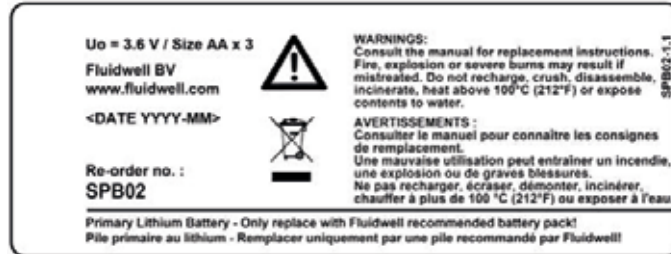
Remove old battery from BSM/RSM

1. Disconnect the battery connector cable from the Supply module.

2. Carefully remove the battery from the holder.

3. Store the old battery in a small plastic bag (e.g. the bag the new battery came in) or install an insulation tape over the battery connector to prevent a short circuit.

4. Dispose of the battery according to the local environment regulations.
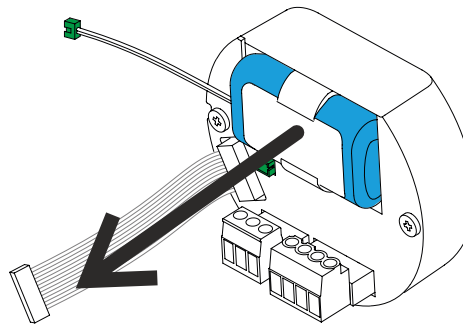
Insert new battery in BSM/RSM

1. Press the battery fully into the battery holder as shown in figure.

2. Carefully click the battery connector cable into its connection in the Supply module.
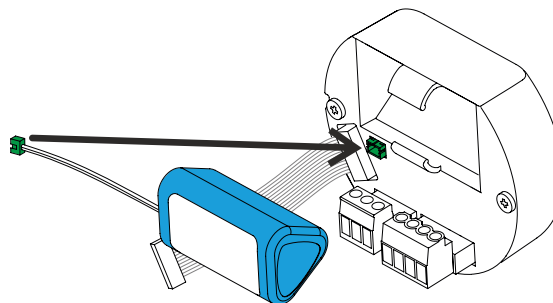
7.3.2 REPLACE CLOCK BATTERY (TYPE ZL)

Remove old battery from MEM.

1. Remove the back cover of the MEM by pushing one clip backwards with a small screwdriver while pulling the back cover. Repeat this with the next clip.

2. Carefully lift the back cover and remove the battery from the battery holder.

3. Dispose of the battery according to local regulations.
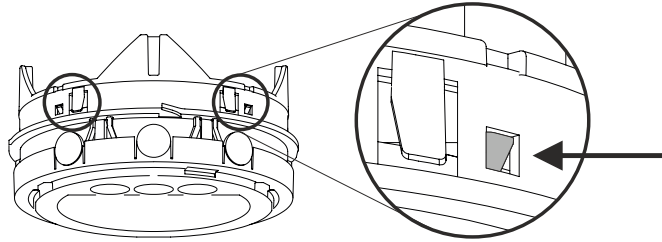
Insert new battery in MEM.

1. Unpack the new battery and ensure there are no signs of damage or overheating.

2. Press the battery fully into the battery holder as shown.

3. Carefully click the back cover into its original position on the MEM.

7.4 REPLACE SILICA GEL SACHET

NOTE

A silica gel sachet is not supplied with the product but may have been placed during or after installation to prevent condensation.

⚠️ **WARNING**

Incompatibility risk

Do not use silica gel in environments where hydrogen fluoride, strong acids and/or strong bases are to be expected

1. Follow the instructions shown in **Section 6.2.3: Opening, assembling and closing the unit [»39],** to gain access to the inside of the housing.

2. Remove old silica-gel sachet from housing and replace with a new dry sachet.

3. Dispose of waste in accordance with (inter)national, manufacturer and plant owner standards and regulations.

APPENDIX A - TECHNICAL SPECIFICATION

A.1 GENERAL

DISPLAY	
Type	High intensity numeric and alphanumeric LCD, UV-resistant, with bright backlight (intensity adjusted via the keypad)
Digits	Seven 12 mm (0.47") and eleven 7 mm (0.28"). Various symbols and measuring units.
Dimensions	Ø 65 x 45 mm (2.56" x 1.77")
Refresh rate	User definable: 8 times/sec − 30 secs.
Speedometer	Indicates the actual flowrate (bargraph runs from 0 to 100% in steps of 5%)

OPERATING TEMPERATURE	
Ambient	Indicates the actual flowrate (bargraph runs from 0 to 100% in steps of 5%)

ENCLOSURE	
Dimensions	112 x 133 x 148 mm (4.41" x 5.24" x 5.83") (WxHxD)
Protection method	ATEX/IECEx: Ex d, Ex t. US: XP, DIP.
Control keys	Three optical keys with operation through the glass front window
Sealant	Silicone and EPDM
Anti-seize compound	EPDM compliant silicone oil based grease (Ambergrease FG2 or equivalent)
Material (metal parts)	Type HA_: Die-cast aluminum AlSi8Cu3/AlSi9Cu3(Fe) (weight 1300 gram) Type HS_: Stainless steel 316L (weight 3600 gram)
Rating	IP66 / 67 / TYPE 4X / TYPE 7 / TYPE 9
Thread type H_A	2 x ¾"NPT / 1 x 1"NPT
Thread type H_B	3 x ¾"NPT
Thread type H_C	2 x ½"NPT / 1 x 1"NPT
Thread type H_D	2 x ½"NPT / 1 x ¾"NPT
Thread type H_G	2 x M20 / 1 x M25
Thread type H_H	3 x M25

TERMINAL CONNECTIONS	
Type	Removable plug-in terminal strip (wire max. 1.5 mm2 and 2.5 mm^2).

TERMINAL CONNECTIONS	
Backup	EEPROM backup of all settings (running totals every minute; data retention at least 10 years)
Password	Configuration settings can be password protected

TERMINAL CONNECTIONS	
Type PB	Long life lithium battery - lifetime depends upon settings and configuration (up to approx. 3 years). The battery can power the backlight briefly after a keypad touch but cannot power the relay output (OR) or the real sensor supply (Terminal P3).
Type PD	9 – 27 VDC. Consumption max. 4.5 W (sensor excitation and backlight included) in combination with relay output (type OR); 24-27 VDC
Type PX	9 – 27 VDC. Consumption max. 3 W (including backlight)
Type AH	Loop powered, analog output. 11 – 27 VDC, min. 2 mA; consumption max. 675 mW (25 mA @ 27 VDC). The loop powered analog output cannot power the backlight, mechanical relay output (type OR) or the real sensor supply (Terminal P3).

SENSOR EXCITATION	
Type AH/PB/PX	Terminal S3: 3 VDC for pulse signals and 1.2 VDC for coil pick-up, Iout max. 100 µA. This is not a real sensor supply. Only suitable for sensors with a very low power consumption like coils (sine wave) or reed switches.
Type PD	Terminal P3: • 8.2 VDC, Iout max. 20 mA • 12 VDC, Iout max. 30 mA • 24 VDC, Iout max. 75 mA (varies depending on input supply voltage)

A.2 INPUT

SENSOR EXCITATION	
Type P	Coil / sine wave (COIL-HI: 20 mVpp or COIL-LO: 90 mVpp sensitivity selectable), NPN, PNP, reed switch, NAMUR, active pulse signals 8 or 24 VDC
Frequency	Minimum 0 Hz - maximum 10 kHz for total and flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. reed switch with low-pass filter (max. frequency 120 Hz)
K-Factor	0.000010 - 9,999,999 with variable decimal position
Low-pass filter	Available for all pulse signals
Type ZF: Coil sensitivity	10 mVpp.
Type ZG: Coil sensitivity	5 mVpp.

RESET TOTAL	
Function	Terminal input to reset total remotely or to lock the "Clear total" button
Type IB	Internally pulled-up switch contact - NPN
Pulse duration	100 msec (minimum)

A.3   OUTPUT

DIGITAL OUTPUT	
Function	Transmitting linearized accumulated total (scaled pulse) or input pulse retransmission
Scaled output	Output D1: max. frequency 500 Hz. Output D5: max. frequency 4 Hz, recommended use below 0.5 Hz Pulse length user definable between 1msec up to 10 seconds
Retransmission output	Square wave output based on frequency of (sine wave or coil) input signal. Maximum frequency 10kHz with a 50% duty cycle, minimum on and off-time 50µs
Type OT	One passive transistor output (NPN) - not isolated. 300 mA – 50 V @ 25°C
Type OR	One isolated electro-mechanical relay output (NO). Maximum resistive load: 2A @ 250 VAC / 30 VDC. Maximum inductive load: 0.5 A (pilot duty applications). Note 1: Requires 24 – 27 VDC and supplied via P5 - P6. Note 2: Type OT remains available. Note 3: Not used in pulse retransmission mode

ANALOG OUTPUT	
Function	Transmitting linearized flowrate
Type AH	Galvanically isolated, loop powered 4 – 20 mA output
Accuracy	12 bit. Error 0.03% @ 20°C (Typical 45 ppm/°C). Can be scaled to any desired range
Supply voltage	10 V (lift-off voltage) - 27 VDC
Max load	700 ohm @ 24 VDC (24 V – 10 V / 20 mA)

COMMUNICATION	
Function	Reading display information, reading/writing all configuration settings, and data log extraction
Type CB	Modbus ASCII/RTU - RS232
Type CH	Modbus ASCII/RTU - RS485 2-wire, bus termination without resistor for low power solutions
Type CU	USB communication incl. Ex d plug (requires ¾"NPT or M25 side entry thread)
Type CX	No communication, remote configuration possible with accessory cable (ACE02)
Speed (baud)	1200 - 2400 - 4800 - 9600 - 9600HP - 19200 – 38400
Addressing	Maximum 247 addresses

A.4   OPERATIONAL

OPERATOR FUNCTIONS	
Displayed information	• Linearized flowrate, total and accumulated total • Current day total, previous day total and 15 historical day totals • Indicating speedometer for flowrate • Reviewing historical day totals or reviewing the various logbooks (Type ZL) • Total can be reset to zero by pressing the CLEAR-key twice

TOTAL	
Digits	7 digits
Unit	L, m3, US gal, igal, cf, Oil bbl, kg, ton, US ton, lb or none
Decimals	0 – 1 – 2 or 3
Note	Total can be reset to zero

DAILY TOTALS	
Digits	7 digits
Unit decimals	According to selection for total
Contract hour	00:00 – 23:00, settable per whole hour
Current day total	Running total, started at zero after the last contract hour
Previous day total	Fixed total, copied from current day total at the last contract hour
Historical day total	The last 15 previous day totals are stored and can be reviewed on the display
Note	Current day total cannot be reset to zero

ACCUMULATED TOTAL	
Digits	11 digits
Unit decimals	According to selection for total
Note	Accumulated total cannot be reset to zero

FLOW RATE	
Digits	Transmitting linearized flowrate
Units	Galvanically isolated, loop powered 4 – 20 mA output
Bar graph speedometer	20 blocks, each block is 5% of total span
Decimals	0 – 1 - 2 or 3
Time units	/sec - /min - /hr - /day

DATA LOGGING (TYPE ZL)	
Type ZL	Powerful data and event logging functions and logbooks are available. Log records go round trip, the oldest entries are overwritten when the logbook is full.
Note	When ordered with type ZL – Datalogging, standard basic day totals are not available.
Interval log	1000 records
Daily log	1000 records Single daily log: 1000 days, 1 record per day Dual daily log: 500 days, 2 records per day
Event log	500 records

A.5   DIRECTIVES/STANDARDS AND HAZARDOUS AREA CLASSIFICATION

APPLICABLE DIRECTIVES AND STANDARDS	
EU Directives	See **Section E: Legal information [»72]**
EMC	FCC 47 CFR part 15
CSA	CSA 22.2 No. 25, CSA 22.2 No. 30, CAN/CSA 22.2 No. 94-M91, CSA C22.2 No. 61010-1-12
FM	FM3600; FM3615; FM3616; FM3810
IP & TYPE	EN 60529; NEMA 250

HAZARDOUS AREA CLASSIFICATION	
ATEX	Gas: ⬡ II 2 G Ex d IIC T6 Gb. Dust: ⬡ II 2 D Ex tb IIIC T85°C Db.
IECEx	Gas: Ex d IIC T6 Gb. Dust: Ex tb IIIC T85°C Db.
CSA c-us	Class I, Division 1, Grps A, B, C, D Class II/III, Division 1, Grps E, F, G Class I, Zone 1, Aex d IIC T6/T5 Gb Zone 21, Aex tb IIIC T85°C/T100°C Db
FM	Class I, Division 1, Grps A, B, C, D Class II/III, Division 1, Grps E, F, G Class I, Zone 1, Aex d IIC T6/T5 Gb Zone 21, Aex tb IIIC T85°C/T100°C Db

APPENDIX B - TROUBLESHOOTING

Table 1 lists and describes how to troubleshoot problems that can occur when installing or operating the unit.

Table 2 lists internal alarm codes and conditions signaled by a blinking ALARM icon on the display. The alarm code can be displayed by pushing the SELECT-key repeatedly until the internal alarm screen is shown.

If an error or alarm code persists, contact your supplier.

TABLE 1: INSTALL AND CONFIGURATION ERRORS		
Observation	**Terminal connections**	**Check**
Flowmeter does not generate pulses	Signal selection in SETUP menu	🔧 **4.1: FLOWMETER > SIGNAL [»27]**
	Pulse amplitude	**Section 6.4.10: Terminals S1-S3: Flowmeter input [»49]**
	Flowmeter, wiring and connection of terminal connectors	**Section 6.4: Electrical installation [»44]**
	Power supply of flowmeter	**Section 6.4.4: Voltage selection sensor supply [»46]**
Flowmeter generates too many pulses	Settings for Total and Flowrate	🔧 **4: FLOWMETER [»27]**
	Type of signal selected with actual signal generated	🔧 **4: FLOWMETER [»27]**
	Sensitivity of coil input	🔧 **4: FLOWMETER [»27]**
	Grounding	Reconnect ground cables and avoid ground loops. Connect screen to the ground input terminal of the flowmeter input
	Wiring type	Use screened wire for flowmeter signals
Analog output does not function properly	Function mode	🔧 **6: ANALOG OUTPUT [»29]**
	Settings for min and max flowrate	**6.2: ANALOG OUTPUT > RATE MIN (4MA)** **6.3: ANALOG OUTPUT > RATE MAX (20MA)**
	Tuning of min and max output current	**6.5: ANALOG OUTPUT > TUNE MIN (4MA)** **6.6: ANALOG OUTPUT > TUNE MAX (20MA)**
	Connection of external power supply	**Section 6.4: Electrical installation [»44]**
Pulse output does not function	Function mode	🔧 **7: PULSE OUTPUT [»31]**
	Pulse per quantity	**7.3: PULSE OUTPUT > AMOUNT**
	Pulse width compatibility with external device	**7.2: PULSE OUTPUT > WIDTH**
Flowrate displays "0 / zero" while there is flow (total is counting)	K-factor and time unit	**2.2: FLOWRATE > TIME** **2.4: FLOWRATE > K-FACTOR**
	Flowrate calculation setting vs. flowrate cut-off.	**2.5: FLOWRATE > CALCULATION** **2.6: FLOWRATE > CUT-OFF** Example: If **cut-off** is set to 10.0 seconds the unit has at least 10 seconds to measure the number of pulses according to calculation.
Password is unknown/wrong		Call your supplier
Linearization does not work	Is the Linearization function enabled?	See **5: LINEARIZATION**
	Are all M-Factors and the frequency entered correctly?	

When multiple alarms occur, the error code shown is the sum of the error codes as given below. For example 0048 is a combination of error code 0016 and 0032.

TABLE 2: INTERNAL ALARMS	
Alarm	**Explanation**
0001	Display error
0002	Data storage error
0004	Initialization error
0008	Data-storage error data logging (type ZL)
0016	IO configuration error base
0032	IO configuration error interface
0064	Linearization error (M-factor out of range)
0128	Automatic K-factor conversion error

APPENDIX C - MODBUS COMMUNICATION

C.1 INTRODUCTION

The product is fitted with the Modbus communication protocol and can be equipped with various physical interfaces like RS485 and RS232 (please see device datasheet for available options).

The tables below show the various variables that can be accessed through the communication.

Currently, the function codes supported are:

- function code 3 "Read Holding Registers" (4x references)

- function code 16 "Preset Multiple Registers" (4x references)

The tables show the Modbus PDU addresses in a decimal format, followed by its hexadecimal representation (0x0000). When the PLC address range is required (4x references are typically used by PLCs), please use the holding register addresses.

Variables consisting of multiple registers

Several variables in the system are too big to fit in a single register and are spanned over multiple registers. Most Modbus masters support variables that span 2 or 4 registers in integer and floating point format. If your Modbus master does not support any of the supplied formats, select an integer based variable and calculate the corresponding value manually, as shown in the following example:

Example

1. Let's assume that variable accumulated total spans 3 registers with addresses 560, 561 and 562.

2. When a transmission is done, register 560 (the MSW - most significant word) arrives first, followed by register 561 in the middle and register 562 at the end (the LSW - least significant word). The following figure shows this and how to calculate the value.

FIG. 45: MULTIPLE REGISTER VARIABLE

ACCUMULATED TOTAL: [register 560 * 2^{32}] + [register 561 * 2^{16}] + [register 562*1]
Calculation [d]: [00001 * 4294967296] + [45236 * 65536] + [34756*1] = 7259588548
Calculation [h]: 0x[0001] [B0B4] [87C4] = 0x0001B0B487C4
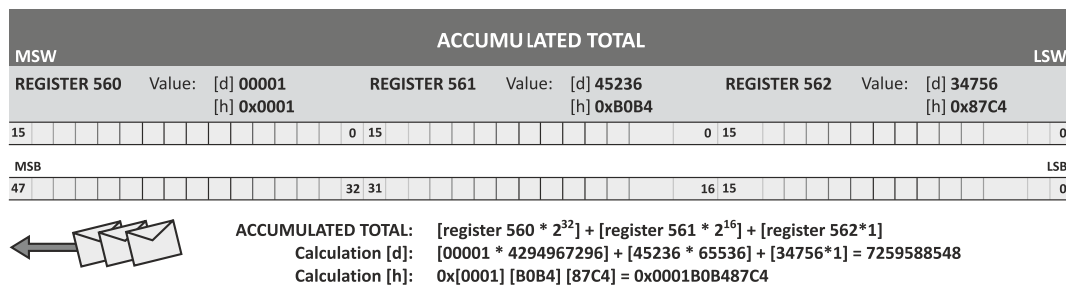
Datatypes

The following datatypes are used for Modbus communication with the unit:

Data type	Number of bytes	Number of registers (16 BIT)	Description
char	1	1	8 bits ASCII character
uint16	2	1	16 bits unsigned integer
uint32	4	2	32 bits unsigned integer
int32	4	2	32 bits signed integer
uint48	6	3	48 bits unsigned integer
uint64	8	4	64 bits unsigned integer
float32	4	2	32 bits floating point
float64	8	4	64 bits floating point

NOTE

When reading and writing integer-type variables, values are transmitted without the decimal point. For the correct representation, please see the remarks-field in the tables below. Variables spanning multiple registers use 'big-endian' data representation.

For more information about using your Modbus device, please read our 'General Modbus Communication Protocol' and 'Modbus Troubleshooting Guide' available through our website or your distributor.

C.2 RUNTIME VARIABLES OF THE UNIT

When reading runtime variables, the given value may differ slightly from the value that is displayed on the display – this is because the display is limited in the number of digits and may have a slower update rate.

When variables are read in integer format, the returned values are given including the decimals. For example, when two decimals are selected for total, and total has a value of 123456,78 the display will show 23456,78 while communication will read a "total" of 12345678 (note that the decimals should be adapted according to the setting in "total decimals", in this case 2).

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS
RUNTIME VARIABLES OF THE E112-P - INTEGER BASED – INDIVIDUAL READ						
[d] 255 [h] 0x00FF	40256	battery status	1	R	uint16	0 = unknown 1 = normal 2 = low battery
[d] 516 [h] 0x0204	40517	error status (bitfield)	1	R	uint16	[d] 0 = no error [d] 1 = display error [d] 2 = data-storage error [d] 4 = initialization error [d] 8 = data-storage error data logging (option ZL) [d] 16 = IO configuration error base [d] 32 = IO configuration error interface [d] 64 = Linearization error (M-factor out of range) [d] 128 = Automatic K-factor conversion error
[d] 560 [h] 0x0230	40561	accumulated total	3	R	uint48	0.000...99999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 566 [h] 0x0236	40567	total	3	R *	uint48	0.000...9999999999 Representation: unit, decimals depending on variables 32, 33
[d] 572 [h] 0x023C	40573	flowrate	2	R	uint32	0.000...9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 4640 [h] 0x1220	44641	Total command register	1	R/W	uint16	Commands: 0x0102 (258): Clear total
* Clearing total: Total can be cleared by writing the correct command to the total command register, as shown above. It is also still possible to use the old method: Write a value of 0 to all the 3 registers of total in a single write action. Writing any other value will result in the reply of an error message.						
Note: The runtime variables shown in above list must always be read or written individually, for the indicated number of registers, in 1 single action!						

	RUNTIME VARIABLES OF THE E112-P - INTEGER BASED – CONTIGUOUS READ					
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS
[d] 6146 [h] 0x1802	46147	total	4	R	uint64	0.000...9999999999 Representation: unit, decimals depending on variables 32, 33
[d] 6150 [h] 0x1806	46151	accumulated total	4	R	uint64	0.000...99999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 6154 [h] 0x180A	46155	flow rate	2	R	uint32	0.000...9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 6156 [h] 0x180C	46157	current day total	4	R	uint64	0.000...9999999999 Representation: unit, decimals depending on variables 32, 33
[d] 6160 [h] 0x1810	46161	previous day total	4	R	uint64	0.000...9999999999 Representation: unit, decimals depending on variables 32, 33
Note: The list of runtime variables shown above can be read as one contiguous list of registers. Unused registers return 0.						

	RUNTIME VARIABLES OF THE E112-P - FLOATING POINT BASED 32 BIT – CONTIGUOUS READ					
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS
[d] 6402 [h] 0x1902	46403	total	2	R	float32	0... 9999999 Representation: unit depending on variable 32
[d] 6404 [h] 0x1904	46405	accumulated total	2	R	float32	0... 99999999999 Representation: unit depending on variable 32
[d] 6406 [h] 0x1906	46407	flow rate	2	R	float32	0... 9999999 Representation: unit and time depending on variables 48, 49
[d] 6408 [h] 0x1908	46409	current day total	2	R	float32	0... 9999999 Representation: unit depending on variable 32
[d] 6410 [h] 0x190A	46411	previous day total	2	R	float32	0... 9999999 Representation: unit depending on variable 32
Note: The list of runtime variables shown above can be read as one contiguous list of registers. Unused registers return 0.						

RUNTIME VARIABLES OF THE E112-P - FLOATING POINT BASED 64 BIT – CONTIGUOUS READ

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS
[d] 6656 [h] 0x1A00	46657	total	4	R	float64	0... 9999999 Representation: unit depending on variable 32
[d] 6660 [h] 0x1A04	46661	accumulated total	4	R	float64	0... 99999999999 Representation: unit depending on variable 32
[d] 6664 [h] 0x1A08	46665	current day total	4	R	float64	0... 9999999 Representation: unit depending on variable 32
[d] 6408 [h] 0x1908	46409	previous day total	4	R	float64	0... 9999999 Representation: unit depending on variable 32

Note: The list of runtime variables shown above can be read as one contiguous list of registers. Unused registers return 0.

HISTORICAL PREVIOUS DAY TOTALS OF THE E112-P - INTEGER BASED – CONTIGUOUS READ

The read-out of historical previous day totals is done via 2 INDEXED variables containing the number of decimals and the value.
These 2 variables can be read as one contiguous list of 3 registers (in a single read action).
Reading is done by first selecting the right entry (day) through the index. Valid values for the index are 0...14, which correspond with
the previous day totals of 1 day old through 15 days old. Indexes outside this range will result in an error being sent back.
(See the communication-section of this appendix for setting the index and its extended functionality through variable 150 and 149).

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS
[d] 5888 [h] 0x1700	45889	previous day total decimals	1 INDEXED variable	R	uint8	0 ... 3
[d] 5889 [h] 0x1701	45890	previous day total	2 INDEXED variable	R	uint64	0.000... 9999999999 Representation: unit depends on variable 32, decimals depends on variables 5888 (0x1700)

C.3   CONFIGURATION VARIABLES OF THE UNIT

Reading and writing configuration variables:

When reading or writing configuration variables in integer format, the given values should take into account the number of decimals that are associated with that variable. For example, when a time-out setting has 1 decimal and is set to 15.5 seconds, the variable will contain a value of 155.

Please note that all configuration variables shown in the following tables must always be read or written individually, for the indicated number of registers, in 1 single action!

						MODBUS-REGISTERS: TOTAL				
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**				
[d] 32 [h] 0x0020	40033	unit	1	R/W	uint16	0 = none 1 = L 2 = m3	3 = US GAL 4 = I GAL 5 = CF	6 = OILBBL 7 = kg 8 = ton	9 = lb 10 = US ton	
[d] 33 [h] 0x0021	40034	decimals	1	R/W	uint16	0…3				
[d] 34 [h] 0x0022	40035	K-factor	2	R/W	uint32	1…9999999 Representation 0.000010…9999999: decimals depending on variable 37.				
[d] 37 [h] 0x0025	40038	K-factor decimals	1	R/W	uint16	0…6				
[d] 47 [h] 0x002F	40048	multiply factor	1	R/W	uint16	0=x1	1=x10	2=x100	3=x1000	
[d] 1052 [h] 0x041C	41053	clear total password	1	R/W	uint16	000…999 Setting 000 disables the clear total password feature.				
[d] 2146 [h] 0x0862	42147	contract hour	1	R/W	uint16	0…23 Hour				
[d] 2208 [h] 0x08A0	42209	current day total	4	R	uint64	0.000 … 99999999999 Representation: unit, decimals depending on variables 32, 33.				
[d] 2216 [h] 0x08A8	42217	previous day total	4	R	uint64	0.000 … 99999999999 Representation: unit, decimals depending on variables 32, 33.				

						MODBUS-REGISTERS: FLOWRATE				
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**				
[d] 48 [h] 0x0030	40049	unit	1	R/W	uint16	0=none 1=mL 2=L 3=m³ 4=US GAL	5=I GAL 6=CF 7=OilBBL 8=nL 9=nm³	10=SCF 11=mg 12=g 13=kg 14=ton	15=lb 16=US 17=rev 18=P	
[d] 49 [h] 0x0031	40050	time unit	1	R/W	uint16	0=/sec	1=/min	2=/hour	3=/day	
[d] 50 [h] 0x0032	40051	decimals	1	R/W	uint16	0…3				
[d] 51 [h] 0x0033	40052	K-factor	2	R/W	uint32	1…9999999 Representation: 0.000010…9999999 depending on variable 54: decimals K-factor				
[d] 54 [h] 0x0036	40055	K-factor decimals	1	R/W	uint16	0…6				
[d] 55 [h] 0x0037	40056	number of pulses	1	R/W	uint16	1…255				
[d] 56 [h] 0x0038	40057	cut-off time	1	R/W	uint16	1…9999 Representation: 0.0001…9.999sec				

MODBUS-REGISTERS: DISPLAY

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS			
[d] 64 [h] 0x040	40065	display function	1	R/W	uint16	0=total	1=flowrate	2=acc.total	
[d] 2147 [h] 0x863	42148	day totals	1	R/W	uint16	0=hidden	1=operate	2=off	
[d] 80 [h] 0x050	40081	LCD update time	1	R/W	uint16	0=fast 1=1sec	2=3sec 3=15sec	4=30sec 5=off	
[d] 67 [h] 0x043	40068	backlight brightness	1	R/W	uint16	0=off 1=20%	2=40% 3=60%	4=80% 5=100%	
[d] 58 [h] 0x03A	40059	bar graph enable	1	R/W	uint16	0=disable	1=enable		
[d] 59 [h] 0x03B	40060	bar graph range	2	R/W	uint32	0...9999999 Representation: unit, time, decimals depending on variables 48, 49, 50			

MODBUS-REGISTERS: FLOWMETER

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS			
[d] 96 [h] 0x060	40097	flowmeter signal	1	R/W	uint16	0=NPN 1=NPN LP 2=reed	3=reed LP 4=PNP 5=PNP LP	6=Namur 7=coil hi 8=coil lo	9=act 8.2V 10=act 24V
[d] 1051 [h] 0x41B	41052	K-factor unit type	1	R/W	uint16	0=hand	1=volumetric	2=mass	
[d] 1050 [h] 0x41A	41051	K-factor unit	1	R/W	uint16	0=none 1=L 2=m³	3=US GAL 4=I GAL 5=CF	6=OilBBL 7=kg 8=ton	9=LB 10=US ton
[d] 1046 [h] 0x416	41047	K-factor	2	R/W	uint32	1...9999999 Representation: 0.000010...9999999 depending on variable 54: decimals K-factor			
[d] 1049 [h] 0x419	41050	K-factor decimals	1	R/W	uint16	0...6			

MODBUS-REGISTERS: LINEARIZATION

The linearization table is an INDEXED variable. Reading and writing the entries of the linearization table is done by first selecting the entry through the index. Valid values for the index are 0...14, which correspond with the linearization table entries 1 through 15.
Indexes outside this range will result in an error being sent back. (See the communication-section of this appendix for setting the index and its extended functionality through variable 150 and 149).

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. OF REG'S	R/W	TYPE	VALUES / REPRESENTATION / REMARKS
[d] 1024 [h] 0x400	41025	linearization table entry	3 INDEXED variable	R/W	struct 2x uint24	The three registers represent a structure containing 2 variables of each 3 bytes. The three least significant bytes (PDU address 1024 and LSB of PDU address 1025) contain the frequency part, the three most significant bytes (MSB of PDU address 1025 and PDU address 1026) contain the Mfactor part. Valid range for the frequency is 0.000 to 9999Hz. Decimal point dependent on variable 1039. A value of 0 for frequency means that entry is disabled. Valid range for the M-factor 0.000000 to 9.999999.

						MODBUS-REGISTERS: LINEARIZATION			
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**			
[d] 1038 [h] 0x40E	41039	linearization on/off	1	R/W	uint16	0=disable	1=enable		
[d] 1039 [h] 0x40F	41040	decimals	1	R/W	uint16	0…3 This variable selects the number of decimals used for the frequencies entered in the linearization table.			

						MODBUS-REGISTERS: ANALOG OUTPUT			
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**			
[d] 112 [h] 0x070	40113	analog output	1	R/W	uint16	0=disable	1=enable		
[d] 113 [h] 0x071	40114	minimum rate	2	R/W	uint32	0.001…9999999 Representation: unit, time, decimals depending on variables 48, 49, 50.			
[d] 116 [h] 0x074	40117	maximum rate	2	R/W	uint32	0.001…9999999 Representation: unit, time, decimals depending on variables 48, 49, 50			
[d] 119 [h] 0x077	40120	cut-off percentage	1	R/W	uint16	0…99 Representation: 0.0…9.9%			
[d] 120 [h] 0x078	40121	tune minimum output	1	R/W	uint16	0…9999			
[d] 122 [h] 0x07A	40123	tune maximum output	1	R/W	uint16	0…9999			
[d] 127 [h] 0x07F	40128	filter	1	R/W	uint16	0…99			

						MODBUS-REGISTERS: PULSE OUTPUT			
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**			
[d] 141 [h] 0x08D	40142	pulse mode	1	R/W	uint16	0=disable	1=scaled	2=retrans	
[d] 128 [h] 0x080	40129	pulse time width	1	R/W	uint16	0…9999 Representation: 0.001…9.999sec			
[d] 130 [h] 0x082	40131	pulse per X quantity	2	R/W	uint32	1…9999999 Representation: 0.000001…9999999 depending on variable 133			
[d] 133 [h] 0x085	40134	pulse quantity decimals	1	R/W	uint16	0…3			

MODBUS-REGISTERS: MODBUS COMMUNICATION										
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**				
[d] 144 [h] 0x090	40145	speed (baudrate)	1	R/W	uint16	0=1200 1=2400	2=4800 3=9600	4=9600HP 5=19200	6=38400	
[d] 145 [h] 0x091	40146	modbus address	1	R/W	uint16	1...247				
[d] 146 [h] 0x092	40147	modbus mode	1	R/W	uint16	0=off	1=RTU	2=ASCII		
[d] 1271 [h] 0x4F7	41272	data bits	1	R/W	uint16	0=7bit	1=8bit			
[d] 1272 [h] 0x4F8	41273	parity	1	R/W	uint16	0=none	1=even	2=odd		
[d] 147 [h] 0x093	40148	delay	1	R/W	uint8	0...255ms delay between receiving a (valid) modbus command and sending the response				
[d] 150 [h] 0x096	40151	index	1	R/W	uint16	0...255 used for indexed values				
[d] 149 [h] 0x095	40150	index use	1	R/W	uint16	0=static	1=auto increment	2=auto decrement		
[d] 25 [h] 0x019	40026	reboot	1	R/W	uint16	Returns 0 on read Write 0xA50F for unit restart Write 0x5AF0 for factory settings				

MODBUS-REGISTERS: DATALOGGING (WITH TYPE ZL)									
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**			
[d] 576 [h] 0x240	40577	log interval	1	R/W	uint16	0=off 1=1min 2=5min	3=10min 4=15min 5=30min	6=1hr 7=2hrs 8=4hrs	9=6hrs 10=8hrs
[d] 577 [h] 0x241	40578	daily log	1	R/W	uint16	0=off	1=single	2=dual	
[d] 578 [h] 0x242	40579	daily1	1	R/W	uint16	00:00...23:59 Representation: hh:mm Stored decimal: 23:59 = 2359d = 0x0937			
[d] 580 [h] 0x244	40581	daily2	1	R/W	uint16	00:00...23:59 Representation: hh:mm Stored decimal: 23:59 = 2359d = 0x0937			
[d] 176 [h] 0x0B0	40177	local time	2	R/W	uint32	00:00:00...23:59:59 Representation: hh:mm:ss Stored decimal: 23:59:59 = 235959d = 0x0003.99B7			
[d] 179 [h] 0x0B3	40180	date	2	R/W	uint32	2000-01-01...2099-12-31 Representation: yyyy-mm-dd Stored decimal: 99-12-31 = 991231d = 0x000F.1FFF			

MODBUS-REGISTERS: OTHERS						
PDU ADDRESS	**HOLDING REGISTER**	**VARIABLE**	**NO. OF REG'S**	**R/W**	**TYPE**	**VALUES / REPRESENTATION / REMARKS**
[d] 160 [h] 0x0A0	40161	model number	1	R	uint16	0…9999
[d] 173 [h] 0x0AD	40174	model suffix	1	R	char	Representation: ASCII character
[d] 162 [h] 0x0A2	40163	firmware version	2	R	uint32	0…999999 Representation: xx.xx.xx
[d] 165 [h] 0x0A5	40166	serial number	2	R	uint32	0…9999999 Representation: xxxxxxx
[d] 176 [h] 0x0B0	40177	local time	2	R/W	uint32	00:00:00…23:59:59 Representation: hh:mm:ss Stored decimal: 23:59:59 = 235959d = 0x0003.99B7
[d] 168 [h] 0x0A8	40169	password	1	R	uint16	0…9999
[d] 139 [h] 0x08B	40140	keyboard lock	1	R/W	uint16	0=disable 1=enable
[d] 170 [h] 0x0AA	40171	tag number	2	R/W	uint32	0…9999999 Representation: xxxxxxx

APPENDIX D - REMOTE CONFIGURATION TOOL

D.1   INTRODUCTION

The free PC software can be downloaded and installed onto your computer system. The software package allows you to set the configurations as desired, up- or download the settings to the MEM and print a hardcopy for each product. With the software, programming of multiple products can be done very easy.
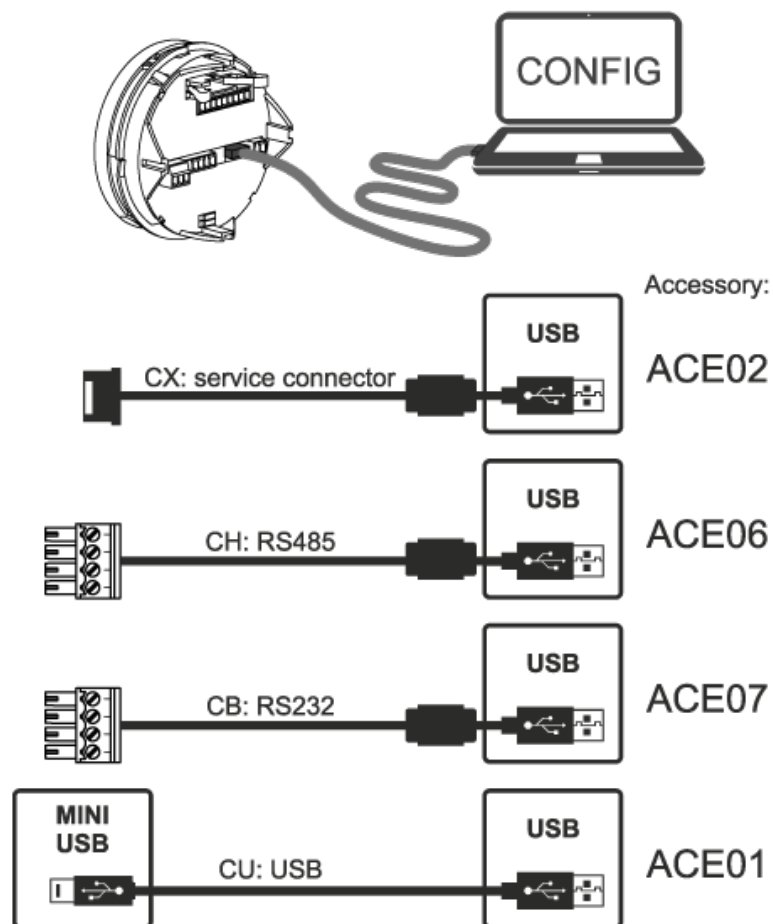
D.2   CABLE CONNECTION

⚠ CAUTION

Before opening the enclosure, consult **Section 6.2.3: Opening, assembling and closing the unit [»39]**.

To connect the MEM to a PC, a cable suitable for the supplied type of communication (CB, CH, CU, CX) should be used, as illustrated in the following image:

FIG. 46: CABLE CONNECTION BETWEEN MEM AND PC.

D.3   DOWNLOAD AND INSTALL

The Remote Configuration Tool software package can be downloaded from our website or your distributor and installed using the installation program. The installation also contains a Quickstart manual which gives detailed instructions on how to achieve a successful connection between PC and MEM.

FIG. 47: EXAMPLE OF PC CONFIGURATION TOOL WINDOW
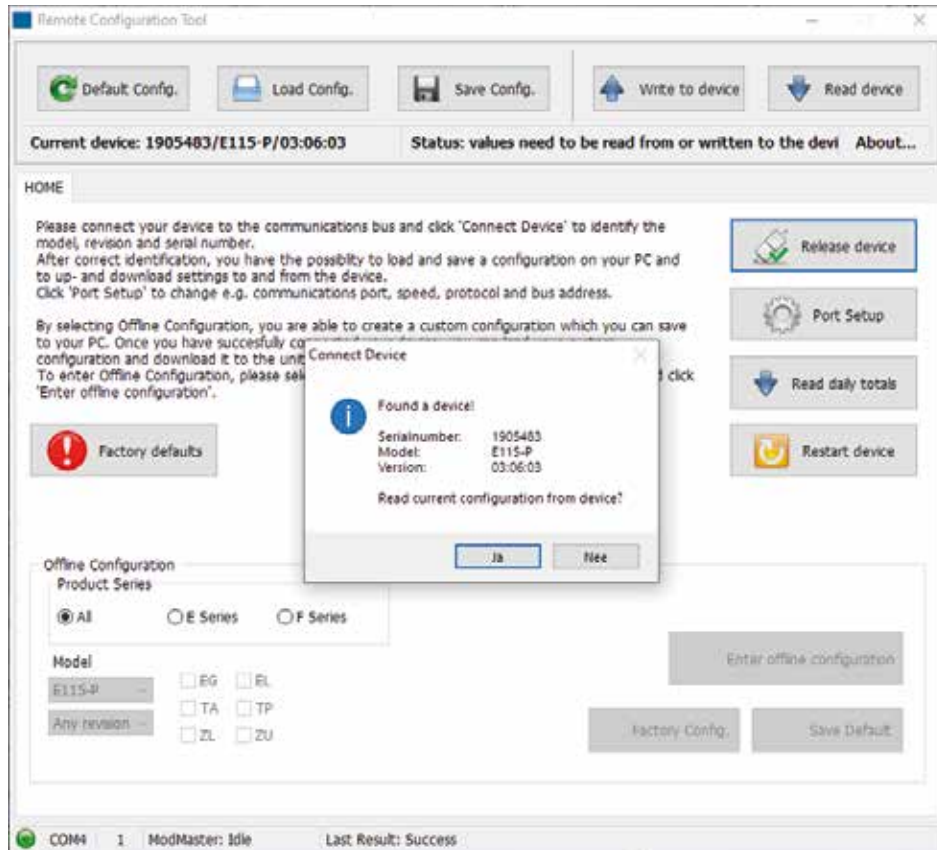
APPENDIX E - LEGAL INFORMATION

E.1   EU DECLARATION OF CONFORMITY

EU Declaration of Conformity

Fluidwell E-series indicators   Veghel, October 2017

We, Fluidwell BV, declare under our sole responsibility that the E-series indicators are designed and will operate conform the following applicable European Directives and Harmonised Standards, when installed and operated according to the related manual:

EMC Directive	**2014/30/EU**	EN61000-6-2:2005;
		EN61000-6-3: 2007 /A1:2011;
		EN61326-1:2013
RoHS Directive	**2011/65/EU**	EN 50581:2012
Low Voltage Directive	**2014/35/EU**	
	For options –PM or –OR:	EN61010-1:2010
ATEX Directive	**2014/34/EU**	EN60079-0:2012; EN60079-1:2007;
	For option –XD, flame proof:	EN60079-31:2009
	Protective system:	Ⓔ II 2 G Ex d IIC T6/T5 Gb
	(for power consumption up till 4.5 W / 9.2 W respectively)	Ⓔ II 2 D Ex tb IIIC T85 °C/T100 °C Db
Certification	Certificates:	DEKRA 14ATEX0006 X, Issue 1
	Notified body 0344:	DEKRA Certification BV,
		Meander 1051, 6825 MJ, Arnhem,
		the Netherlands.

Last two digits of the year in which the CE marking was affixed: 13.

Remark: compliance is not affected by standards EN60079-0/A11:2014, EN60079-1:2014 and EN60079-31:2014.

Fluidwell BV

I. Meij, Manager Technology

Fluidwell BV are ISO9001 certified by DEKRA Certification BV, Meander 1051, 6825 MJ, Arnhem, the Netherlands.

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