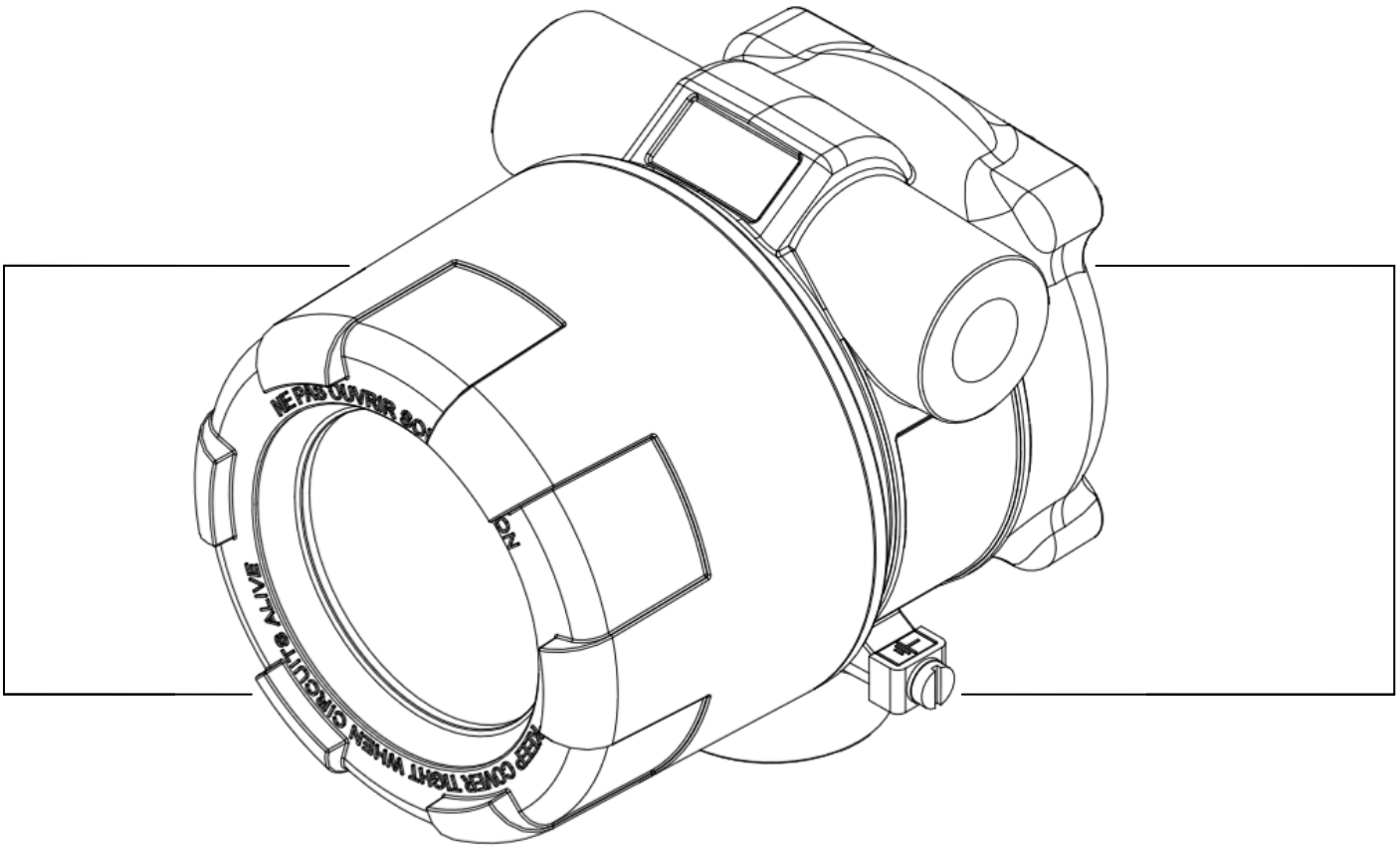
Explosion Proof Flowrate Indicator/Totalizer with Linearization

Owner's Manual – Model E112-P



Signal input flowmeter: pulse, Namur and coil

Signal outputs: Analog referenced flowrate and pulse referenced total

Remote control: External reset with clear-lock

Options: Modbus/USB Communication

SAFETY INSTRUCTIONS

- *Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.*

- *LIFE SUPPORT APPLICATIONS: The E112-P is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a 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.*

- *Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.*

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

- *Do connect a proper grounding to the aluminum / stainless steel enclosure as indicated if the E112-P is used on a ship, truck or other application with no ground. The green / yellow wire between the enclosure and terminal-block may never be removed.*

DISPOSAL

At the end of its life this product should be disposed of according to local regulations regarding waste electronic equipment. If a battery is present 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.

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the E112-P implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check all connections, settings and technical specifications of the various peripheral devices with the E112-P supplied.
- Never open the enclosure in hazardous areas while connected to power supplying or consuming devices other than the internal battery supply. Open the enclosure only if all leads are free of current.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the enclosure classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:
- The daily use of the unit is described in chapter 2 "Operation". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

This operation manual describes the standard unit as well as most of the options available. For additional information, please contact your supplier.

A hazardous situation may occur if the E112-P is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:

A "**warning**" indicates actions or procedures which, if not performed correctly, may lead to personal injury, a safety hazard or damage of the E112-P or connected instruments.


Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the E112-P or connected instruments.


Note !

A "**note**" indicates actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

Hardware version:	03.01.xx
Software version:	03.03.xx
Manual :	GPI-E112-P-MAN-EN_v0102_01
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CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE E112-P

Functions and features
The flowrate / totalizer model E112-P is an explosion proof microprocessor driven instrument designed to to linearize the flowmeters flow curve and display the flowrate, total and accumulated total.

The E-series product line has been designed with a focus on:
- User-friendliness: operation through the glass without removing the cover.
- Good readings in full sunlight and darkness through a bright backlight.
- Mounting flexibility: multiple solutions for sensor mounting, including 1” NPT or M25 bottom entry as well as suitable for wall or pipe mount applications.
- Ruggedness for harsh surrounding: not just designed to be explosion proof.
- Usability: wide operational temperature, high ingress protection rating and international certification.
- Installation friendly design: spacious cabling area, plug and play cable connection and easy removable electronic module.
- Aluminum enclosure with high quality industrial two component coating.
- Stainless steel 316L enclosure available for offshore applications.
- Ease for the Operator: functional information and identical operation as all F- and D-series of Fluidwell.
- 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.

Flowmeter input
This manual describes the unit with a pulse type input from the flowmeter "-P version". Other versions, (0)4-20mA or 0-10V flowmeter signals, are pending.
One flowmeter with a passive or active pulse, Namur or sine wave (coil) signal output can be connected to the E112-P. To power the sensor, several options are available.

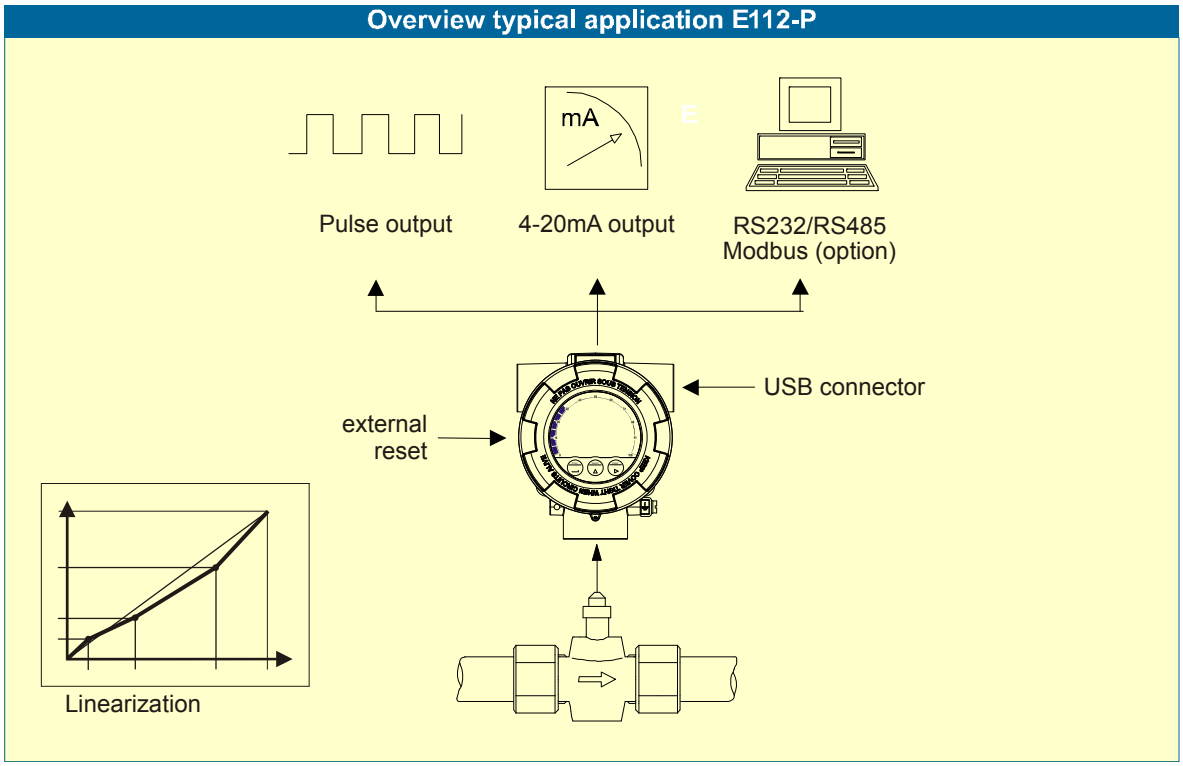


Fig. 1: Typical application for the E112-P

Standard outputs

- Configurable pulse output: a scaled pulse representing a certain linearized total quantity. Maximum frequency 500Hz. The pulse length can be set as desired.
- Configurable linear 4-20mA isolated analog output with 12-bits resolution representing the actual linearized flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.

Configuration of the unit

The highly praised configuration structure is identical to any other Fluidwell product while the clear texts reduce potential mistakes. Once familiar with one product, you are able to control them all, often without a manual: if you know one – you know them all.
The E112-P has been designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure the E112-P according to your specific requirements.
SETUP includes several important features, such as K-factors, measurement units, signal selection etc. All settings are stored in an EEPROM memory and will not be lost in the event of a power failure or a drained battery.
To extend the battery life time (option), please make use of the power-management functions as described in chapter 3.2.3.

Display information

The unit has a large LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.
Flowrate and totals can be displayed either with the small 7mm (0.28”) (11) digits or with the large 12mm (0.47”) (7) digits. The E112 shows the operator an analog speedometer reflecting the actual flowrate.

A backup of the total and accumulated total in EEPROM memory is made every minute.

Backlight

A backlight is standard available. The intensity can be set as desired with SETUP 3.3. (externally powered only).
In battery powered applications it will be switched on during a limited period of time at a fixed intensity and will switch off automatically within 30 seconds after the key touch.
For loop powered applications only, the backlight will not function.

Options

The following options are available:

- Full Modbus communication RS232, RS485 or USB,
- Mechanical relay(s),
- Power- and Sensor-supply.

2. OPERATIONAL

2.1. GENERAL

Caution !

- *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.*
- *Take careful notice of the "Safety rules, instructions and precautionary measures "in front of this manual.*

This chapter describes the daily use of the E112-P. This instruction is meant for users / operators.

2.2. CONTROL PANEL

The following three optical keys, operated through glass, are available:

Fig. 2: Optical keys Control Panel

Use of optical keys:
The optical keys are designed to operate stable and will not be activated when the glass surface is not clean. Keep the glass surface clean to avoid false key activations (false activations reduce battery lifetime). Also do not mount objects within 100mm in the front of the product (shiny surfaces could cause false activations). It is not necessary to touch the glass for activation. Activating by touching the clean glass surface normally also works fine, but in case of detection problems try not to touch the glass.

Enable optical keys
The optical keys are disabled after 30 seconds when enabled at SETUP 9.5. A key lock symbol will appear at the top of the display to indicate this.
To enable the optical keys, touch briefly after each other all three keys in the following order:
PROG – SELECT – CLEAR.
The display will hint this sequence. The key lock symbol will disappear when the sequence is successfully executed.

Disable optical keys
To disable the optical keys touch simultaneously the PROG and CLEAR keys for 3 seconds (or wait for 30 seconds). The key lock symbol will appear as shown.

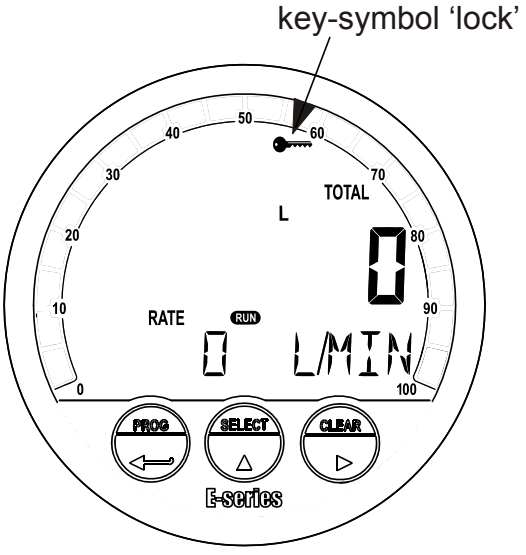


Fig. 3: Locked keyboard - optical keys

Enable or disable optical keys with on-off switch
Under the optical keys an on-off switch is located to enable or disable the optical keys. Move this switch to the right to enable or to the left to disable the optical keys. The key lock symbol will appear in the display.

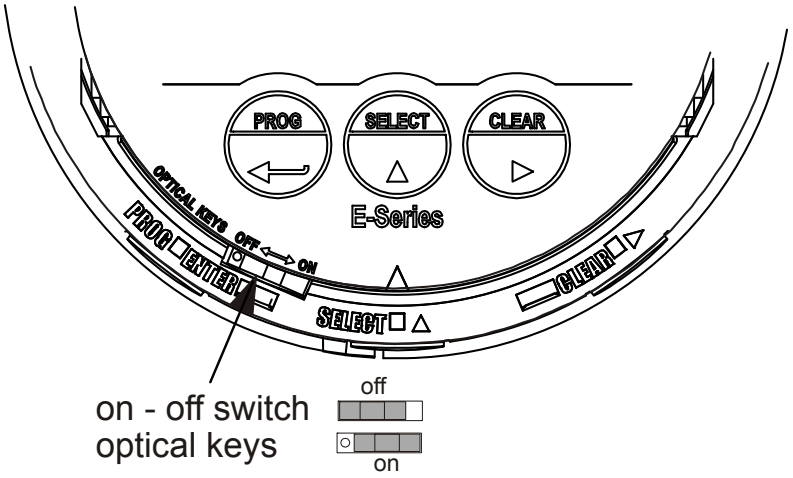


Fig. 4: On-Off switch optical keys

Note: For battery powered applications it is recommended to switch off the optical keys when possible to save on power consumption significantly.

Push button operation
Next to the three optical keys also three push buttons are available when the cover is removed.
Make sure the key lock is active before removing the cover to prevent unwanted actions.

In Fig. 5 is shown where the push buttons are located, together with their functionality (standard order).
On the side of the collar of the display three black mechanical push buttons are present in the same order as the optical keys, PROG/ENTER – SELECT – CLEAR. They operate in the same manner as the optical keys.

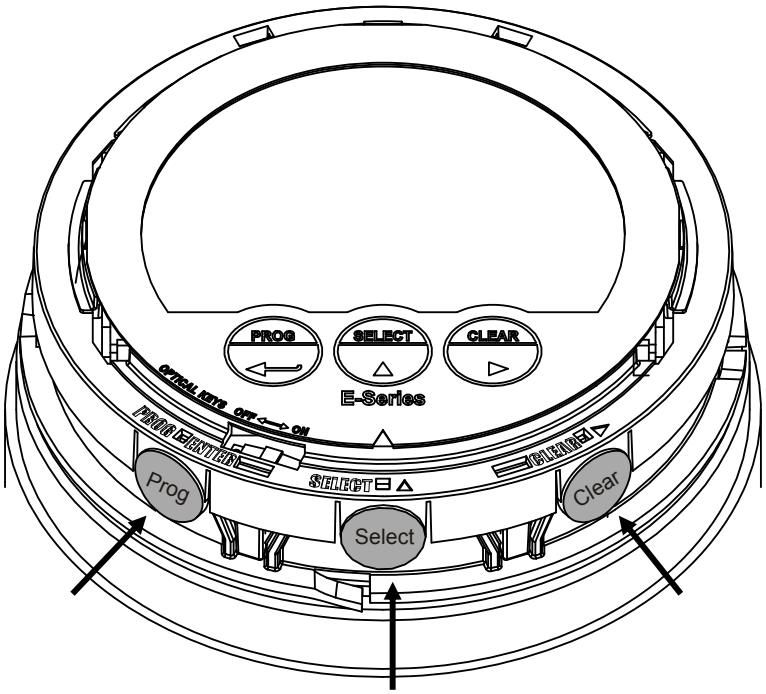


Fig. 5: Push buttons Control Panel

Functions of the keys

This key is used to program and save new values or settings.
To gain access to SETUP-level; please read chapter 3.

This key is used to SELECT accumulated total.
The arrow-key ▲ is used to increase a value after PROG has been pressed or to configure the unit; please read chapter 3.

Press this key twice to CLEAR the value for total.
The arrow-key ▶ is used to select a digit after PROG has been pressed or to configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

Note !

Note: *Check the key lock and unlock before operation Unlock the optical keys as described on page 7.*

By default, the E112-P will act at Operator level. The information displayed depends on the SETUP-settings. Signals generated by the connected flowmeter are measured by the E112-P in the background. The display values are however updated depending on the selected refresh rate. After pressing a key, the display will be refreshed 8 times per second, after 30 seconds it will return to the selected setting.

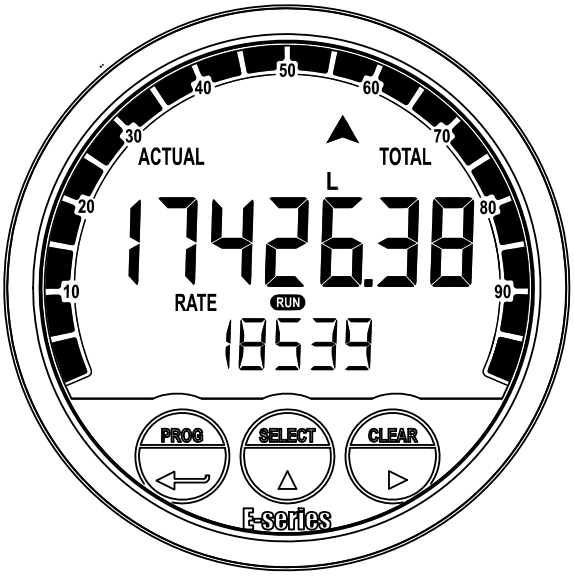


Fig. 6: Example of display information during process

For the Operator, the following functions are available:

- **Display flowrate / total or flowrate**
  This is the main display information of the E112-P. After selecting any other information, it will always return to this main display automatically.
  Total is displayed on the upper-line of the display and flowrate on the bottom line.
  It is possible to display flowrate only with the large 12mm digits; in this instance press the SELECT-key to read the total.
  When "-------" is shown, the flowrate value is too high to be displayed.
  The arrows ▲▼ indicate the increase/decrease of the flowrate trend.

- **Clear total**
  The value for total can be re-initialized. To do so, press CLEAR twice. After pressing CLEAR once, the flashing text "PUSH CLEAR" is displayed. To avoid a reset of the total at this stage, press another key than CLEAR or wait for 20 seconds. After clear or 20 seconds the default display mode is restored. Reset of total DOES NOT influence the accumulated total.

Note !

Note: The IB option allows clear total also via an external pushbutton. This clear functions in parallel with the clear action via the control panel but does not require an extra confirmation. When the switch is closed, Total still counts but the ”Clear Total” function is disabled.

- **Display accumulated total**
  When the SELECT-key is pressed, total (upper line) and accumulated total (lower line) are displayed. The accumulated total cannot be reset. The value will count up to 99.999.999.999. The unit and number of decimals are displayed according to the configuration settings for total. After 20 seconds the default display mode is restored.

- **Display speedometer flowrate**
  The display shows around the edge a percent based impression of the actual flowrate. The speedometer consists of 20 segments which run from 0 to 100%. This function can be enabled or disabled with SETUP 3.4 - Bargraph. The range of the speedometer can be set with SETUP 3.5 - Ratespan.

- **Low-battery alarm (Type PB only)**
  In time the battery voltage drops, and therefore the battery should be replaced. The battery status is shown as follows: If the battery is ok the indicator is not shown, when the battery reaches end of life at first the indicator is displayed continuously. We recommend replacing the battery as soon as possible. At the moment the indicator starts to flash the device functionality cannot be guaranteed anymore and the battery MUST be replaced!

Note !

Note: Only replace with original batteries supplied by the manufacturer , else the guarantee and liability will be terminated. The remaining lifetime after the first moment of indication depends on a lot of conditions but is at least a few days. Refer to section 6.3 for replacement instructions.

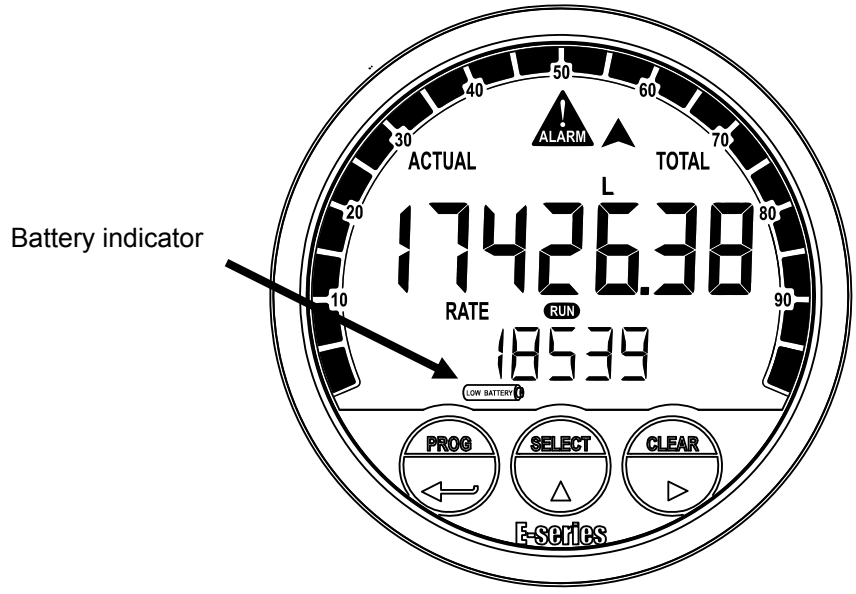


Fig. 7: Example of low-battery alarm.

- **Alarm**

  When ALARM is flashing please consult Appendix B: **Problem Solving**.

3. CONFIGURATION

3.1. INTRODUCTION

This and the following chapters are exclusively meant for trained electricians and non-operators. In these, an extensive description of all software settings and hardware connections is provided.

Caution !

- *Mounting, electrical installation, start-up and maintenance of the 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 E112-P is correctly wired up according to the wiring diagrams. The enclosure may only be opened by trained personnel.*
- *Take careful notice of the "Safety rules, instructions and precautionary measures "in the front of this manual.*

3.2. PROGRAMMING SETUP LEVEL

Note !

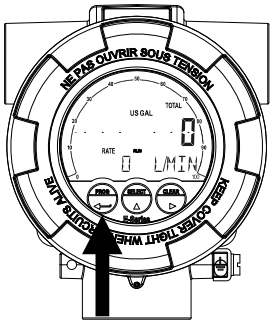
Note: *Be aware that the optical keys may be locked and will not function. Unlock the optical keys as described on page 7.*

Configuration of the E112-P is done at SETUP level. SETUP level is reached by pressing the PROG/ENTER key for 7 seconds; at which time will be displayed. To return to the operator level, press PROG for three seconds or do not press any key for 2 minutes, the unit will exit SETUP automatically.
SETUP can be reached at all times while the E112-P remains fully operational. Be aware that in this case any change to the settings may have an influence on the operation. The 'setup' indicator will be activated and the 'run' indicator will be deactivated.

Note !

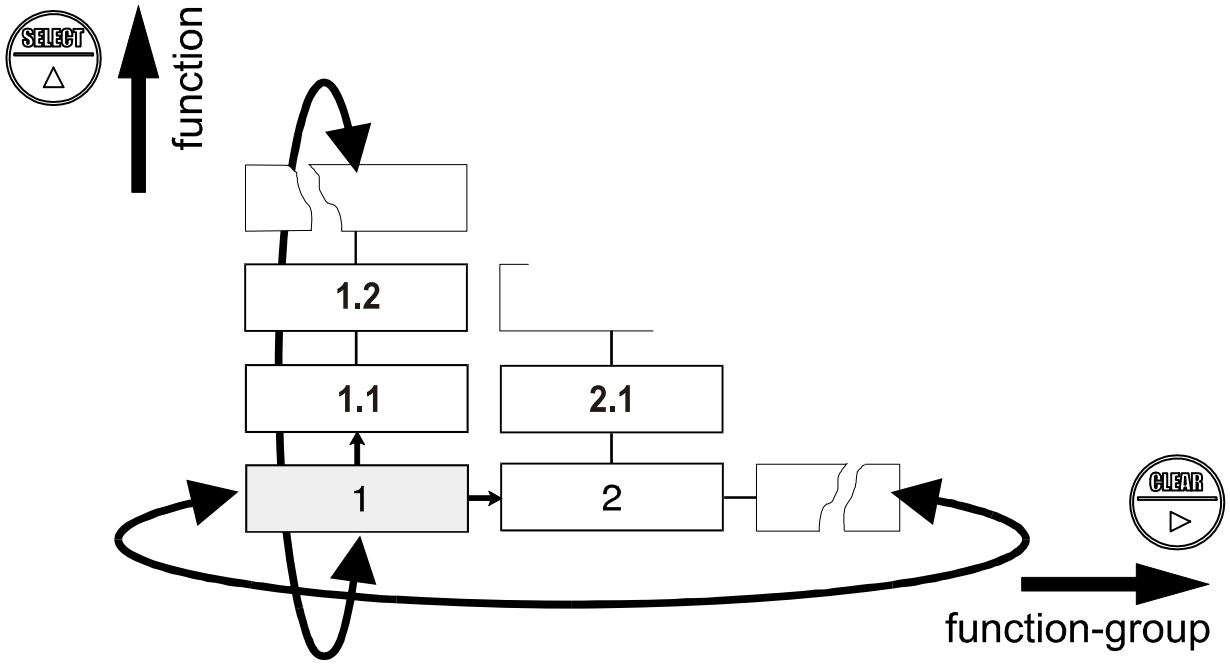
Note: *A password may be required to enter SETUP. Without the correct password access to SETUP is denied.*

To enter SETUP-level:



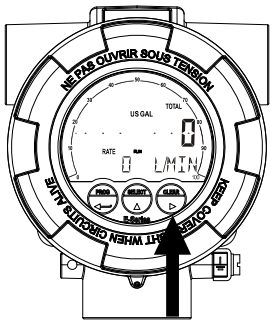
Press PROG for 7 seconds

Matrix structure SETUP-level:

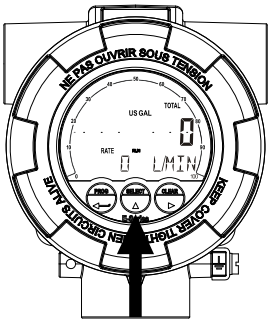


SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:
SETUP is divided into several function groups and functions.



Select function-group with 



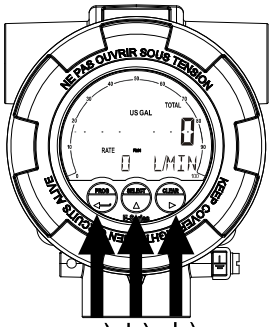
Select function with 

Each function has a unique number, which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function-group and the second figure the sub-function. Additionally, each function is expressed with a keyword.

After selecting a sub-function, the next main function is selected by scrolling through all "active" sub-functions (e.g. 1▲, 1.1▲, 1.2▲, 1.3▲, 1.4▲, 1▶, 2▶, 3▲, 3.1 etc.).

Scrolling back function group is done by pressing PROG (e.g. 4 ↵, 3 ↵, 2 ↵, 1 ↵)
Scrolling back a sub-function is done by pressing CLEAR (e.g. 1.4▶, 1.3▶, 1.2▶, 1.1▶),

To change or select a value:



a) b) b) c)

a) press PROG briefly **PROGRAM** will start flashing

b) select or enter value with SELECT △ and / or CLEAR ▷

c) press PROG to confirm the value / selection

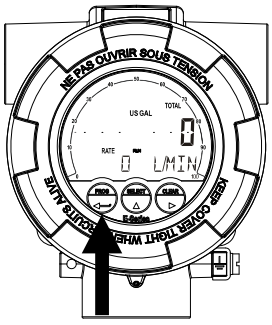
To change a value, use ► to select the digits and ▲ to increase that value, the digit to be increased blinks.
To select a setting, both ▲ and ► can be used.
If the new value is invalid, the increase sign▲ or decrease-sign▼ will be displayed while you are programming.

When data is altered but ENTER is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for three seconds. In that case the PROG-procedure will be left automatically and the former value reinstated.

Note !

Note: *Alterations will only be set after ENTER has been pressed and the program indicator is off and the SETUP indicator is back on!*

To return to OPERATOR-level:



Press PROG for 3 seconds

In order to return to the operator level, PROG will have to be pressed for three seconds. Also, when no keys are pressed for 2 minutes, SETUP will be left automatically. The RUN indicator will appear.

3.3. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	1.1	UNIT	L - m³ – US gal – I gal – cf – Oil bbl – kg – ton – US ton – lb – none
	1.2	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	1.3	MULTIPLY FACTOR	x1 - x10 - x100 - x1000
	1.4	K-FACTOR:	0.000010 - 9,999,999
	1.5	DECIMALS K-FACTOR	0 - 6
2	**FLOWRATE**		
	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
	2.2	TIME UNIT	/sec - /min - /hour - /day
	2.3	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	2.4	CALCULATION	per 1 - 255 pulses
	2.5	CUT-OFF	0.1 - 999.9 seconds
	2.6	K-FACTOR	0.000010 - 9,999,999
	2.7	DECIMALS K-FACTOR	0 - 6
3	**DISPLAY**		
	3.1	FUNCTION	total - flowrate
	3.2	LCD NEW	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	3.3	BACKLIGHT	0% – 20% -40% – 60% – 80% - 100%
	3.4	BARGRAPH	disable - enable
	3.5	RATESPAN	0000000 - 9999999
4	**FLOWMETER**		
	4.1	SIGNAL	NPN - NPN_LP - REED - REED_LP - PNP - PNP_LP - NAMUR - Coil_Hi - Coil_Lo - Act_8.2 (8.2 DC) - Act_24 (24 DC)
	4.2	K- FACTOR UNIT	L - m3 – US GAL – IGAL – cf – oil bbl – kg – ton – US ton - lb
	4.3	K-FACTOR:	0.000010 - 9,999,999
	4.4	DECIMALS K-FACTOR	0 - 6
5	**LINEARIZE**		
	5.1	FREQ. / M-FACTOR 1	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	5.2	FREQ. / M-FACTOR 2	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	5.3	FREQ. / M-FACTOR 3	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	..	..	……..
	5.F	FREQ. / M-FACTOR 15	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	5.G	LINEARIZATION	enable / disable
	5.H	DECIMALS FREQUENCY	00000 - 1111.1 - 222.22 - 33.333
6	**ANALOG**		
	6.1	OUTPUT	disable - enable
	6.2	RATE-MIN 4mA	0000000 - 9999999
	6.3	RATE-MAX 20mA	0000000 - 9999999
	6.4	CUT-OFF	0.0 - 9.9%
	6.5	TUNE-MIN	0000 - 9999
	6.6	TUNE-MAX	0000 - 9999
	6.7	FILTER	00 - 99
7	**PULSE**		
	7.1	WIDTH	0.000 – 9.999
	7.2	DECIMALS	00000 - 1111.1 - 222.22 - 33.333
	7.3	AMOUNT	0000000 - 9999999
8	**COMMUNICATION**		
	8.1	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	8.2	ADDRESS	001 - 255
	8.3	MODE	Bus rtu – bus asc - off
9	**OTHERS**		
	9.1	TYPE / MODEL	E112-P
	9.2	SOFTWARE VERSION	03:03:xx
	9.3	SERIAL NO.	-
	9.4	PASS CODE	0000 - 9999
	9.5	KEYBOARD LOCK	enable - disable
	9.6	TAGNUMBER	0000000 - 9999999

3.4. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL	
UNIT **1.1**	**Note:** *First set the flowmeter unit at SETUP 4.2. It has a direct influence on this Total unit setting. Change of the type of flowmeter unit (SETUP 4.2) will cause this Total unit to jump to the default setting of the new flowmeter unit type.* SETUP – 1.1 determines the measurement unit for Total, accumulated Total and pulse output. The total unit that can be chosen depends on the type of flowmeter unit set at SETUP 4.2. The following can be selected: Volumetric: l - m3 – US gal – I gal – cf – Oil bbl – (no unit). Mass: kg – ton – US ton – lb – (no unit). **Note:** *If 'no unit' is chosen, the automatic unit conversion is not possible. In that case the Total K-factor and its decimals need to be set at 1.4 and 1.5.*
DECIMALS **1.2**	The decimal point determines for Total and accumulated Total the number of decimals. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333
FACTOR X **1.3**	This setting determines the multiplication factor of the Total. This makes it possible to show up to 3 digits more of the Total/accumulated Total. The amount shown is a rounded number. The following can be selected: x1 – x10 – x100 – x1000
WARNING	**These menu items are only available when the automatic unit conversion is not possible; If 'no unit' is chosen at SETUP 1.1, SETUP 1.4 K-factor and 1.5 Decimals show up in the SETUP menu and must be set.**
K-FACTOR **1.4**	With the Total K-factor, the flowmeter pulse signals are converted to a total unit. The Total K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 1.1).. The more accurate the Total K-factor, the more accurate the functioning of the system will be.
DECIMALS **1.5**	This setting determines the number of decimals for the Total K-factor entered. (SETUP 1.4). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 Please note that this setting influences the total K-factor. (i.e. the position of the decimal point and thus the value given) This setting has NO influence on the displayed number of decimals for total (SETUP 1.2)!

Note !

2 - FLOWRATE

Note: *These settings also influence the analog output.*

Note !

UNIT **2.1**	**Note:** First set the flowmeter unit at SETUP 4.2. This setting has a direct influence on the Total unit setting. Change of the type of flowmeter unit (volumetric or mass) will cause the setting of the Flowrate unit (2.1) to automatically change to the default unit of that type SETUP – 2.1 determines the measurement unit for flowrate. The flowrate unit that can be chosen depends on the type of flowmeter unit (volumetric or mass) set at SETUP 4.2. The following can be selected: Volumetric: ml - l - m3 – US gal – I gal– Oil bbl – cf – (rev - none - scf - nm3 - nL – p). Mass: mg – g - kg – ton – US ton – lb – (rev - none - scf - nm3 - nL – p). **Note:** *If one of the none-convertible units 'rev - none - scf - nm3 - nL or p' is chosen, the automatic unit conversion is not possible. In that case the Flowrate K-factor and its decimals need to be set at 2.6 and 2.7.*
TIME UNIT **2.2**	The flowrate can be calculated per second (/SEC), minute (/MIN), hour (/HR) or day (/DAY). **Note:** *Changes to SETUP 2.2 Time unit has an effect on the analog output settings of SETUP 6.2 Rate Min and SETUP 6.3 Rate Max and SETUP 3.5 Ratespan.* *Don't forget to update these settings after a change!*
DECIMALS **2.3**	This setting determines for flowrate the number of decimals. The following can be selected: 00000 - 1111.1 - 2222.22 - 3333.333 **Note:** Changes to SETUP 2.3 Decimals will also change the decimal setting of SETUP 6.2 Rate Min and SETUP 6.3 Rate Max and SETUP 3.5 Ratespan. Therefore it is wise to first determine the required decimals for the flowrate!
CALCULATION **2.4**	The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 255 pulses. ***Note:*** *This setting does influence the update time for the analog output directly (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses.* ***Note:*** *The lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).* ***Note:*** *For low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.* ***Note:*** *For high frequency application (above 1kHz) program a value of 50 or more pulses.*
CUT-OFF TIME **2.5**	With this setting, a minimum flow requirement threshold is determined, if during this time less than XXX-pulses (SETUP 2.6) are generated, the flowrate will be displayed as zero. The cut-off time has to be entered in seconds - maximum time is 999.9 seconds (about 15 minutes).

Note !

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Note !

	**These menu items are only available when the automatic unit conversion is not possible; If 'rev - none - scf - nm3 - nL or p' is chosen at SETUP 2.1, SETUP 2.6 K-factor and 2.7 Decimals show up in the SETUP menu and must be set**
K-FACTOR **2.6**	With the Flowrate K-factor, the flowmeter pulse signals are converted to a flowrate unit. The Flowrate K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 2.1),. The more accurate the K-factor, the more accurate the functioning of the system will be. Alteration of the K-Factor will have consequences for Operator and SETUP-level values!
DECIMALS **2.7**	This setting determines the number of decimals for the Flowrate K-factor (SETUP 2.6). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 **Note:** *SETUP 2.7 influences the Flowrate K-factor setting only. This setting has NO influence on the displayed number of decimals for "Flowrate" (SETUP 2.3)!*

Note !

3 - DISPLAY	
FUNCTION **3.1**	The large 12mm (0.47") digits can be set to display total, flowrate or accumulated total. When "total" is selected, total is displayed with the large 12mm (0.47") digits and flowrate is displayed with the 7 mm (0.28") digits simultaneously. When "flowrate" is selected, only flowrate will be displayed with the large 12mm (0.47") digits together with its measuring unit while total will be displayed after pressing SELECT. When "accumulated total" is selected, total is displayed with the large 12mm (0.47") digits and accumulated total is displayed with the 7 mm (0.28") digits simultaneously.
When battery powered, the user can expect reliable measurement over a long period of time. The E112-P has several smart power management functions to extend the (optional) battery life time significantly next to permanently disabling the optical keys. The following functions can be set:	
LCD NEW **3.2**	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display refresh rate, it is **strongly advised** to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signals will be generated in the normal way. The following refresh rates can be selected: fast - 1 sec - 3 sec - 15 sec - 30 sec - off. *(read 3 sec as a refreshment every 3 seconds, 30 sec as a refreshment every 30 seconds)* When "off" is selected the display will be automatically switched off after 30 seconds since the last action. The display will return again after touching one of the keys.
BACKLIGHT **3.3**	The unit is provided with a backlight. The backlight brightness can be adjusted from off (0) to a 100% in steps of 20%. The following can be selected: $0^{\%}$ – $20^{\%}$ – $40^{\%}$ – $60^{\%}$ – $80^{\%}$ – $100^{\%}$ For battery powered untis the brightness will not change. **Note:** *When the unit is only loop powered it cannot make use of the backlight. In that case an external supply is required.*

Note !

BARGRAPH **3.4**	The unit has a speedometer display which offers a quick impression of the actual flow rate. This graph on the display can be switched on or off. The following can be selected: enable – disable
RATESPAN **3.5**	With Ratespan the range of the speedometer can be set. The display shows 0 – 100 with 20 blocks so each block is 5% of the 100% range set here. The following can be selected: 0000.000 - 9999999 The number of decimals displayed depends upon SETUP 2.3.

4 - FLOWMETER

SIGNAL
4.1

The E112-P is able to handle several types of input signal. The type of flowmeter signal is selected with SETUP 4.1.
Note: *The selections "Active pulse input" offer a pulse detection level of 50% of the supply voltage.*
Read also par. 4.5. Terminal S1-S6 Flowmeter Input.

Note !

TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mV	REMARK
NPN	NPN input	100K pull-up	6 kHz.	(open collector)
NPN - LP	NPN input with low pass filter	100K pull-up	2.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1M pull-up	1.2 kHz.	
REED - LP	Reed-switch input with low pass filter	1M pull-up	120 Hz.	Less sensitive
PNP	PNP input	51K pull-down	6 kHz.	
PNP - LP	PNP input with low pass filter	51K pull-down	700 Hz.	Less sensitive
NAMUR	Namur input	820 Ohm pull-down	4 kHz.	External power required
COIL HI	High sensitive sine-wave (coil) input	-	20mVp-p.	Sensitive for disturbance!
COIL LO	Low sensitive sine-wave (coil) input	-	90mVp-p.	Normal sensitivity
ACT_8.1	Active pulse input 8.2 VDC	3K9 pull-down	10KHz.	External power required
ACT_24	Active pulse input 24 VDC	3K pull-down	10KHz.	External power required

Total/Flowrate unit must be a convertible unit to make use of the automatic unit conversion. If both units are none-convertible, menu items 4.2 to 4.4 will disappear and the units, K-factors and K-factor decimals must be specifically set at menu 1 - Total and 2 – Flowrate.

K FACTOR UNIT
4.2

SETUP - 4.2 determines the measurement unit for the flowmeter.
With automatic unit conversion the units for Total and Flowrate are derived from this setting. The following can be selected:

L - m3 – US GAL – IGAL – cf – oil bbl – kg – ton – US ton - lb

Note: *Change of the type of flowmeter unit (volumetric or mass) will cause the setting of the Total unit (SETUP 1.1) and Flowrate unit (2.1) to automatically change to the default unit of that type.*

Note !

Note: *Change of the flowmeter unit will not change the amount displayed for Total and accumulated Total.*

Note !

K-FACTOR **4.3**	The flowmeter has his own K-factor which is set here. With the Flowmeter K-factor, the flowmeter pulse signals are converted to the flowmeter unit. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 4.2), for example per cubic meter. The more accurate the Flowmeter K-factor, the more accurate the functioning of the system will be. **Example 1:** **Calculating the Flowmeter K-factor.** *Assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m3". A cubic meter consists of 1000 parts of one liter which implies 2,481.3 pulses per m3. So, the K-factor is 2,481.3. Enter for SETUP – 4.2: "2481300" and for* SETUP *– 4.3 - decimals K-factor "3".* **Example 2:** **Calculating the Flowmeter K-factor.** *Assume that the flowmeter generates 6.5231 pulses per gallon and the selected measurement unit is gallons. So, the K-Factor is 6.5231. Enter for* SETUP *– 4.2 "6523100" and for* SETUP *– 4.3 decimals K-factor "6".*
DECIMALS **4.4**	This setting determines the number of decimals for the Flowmeter K-factor entered. (SETUP 4.3). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 **Note:** *This setting influences the Flowmeter K-factor. (i.e. the position of the decimal point and thus the value given)*

Note !

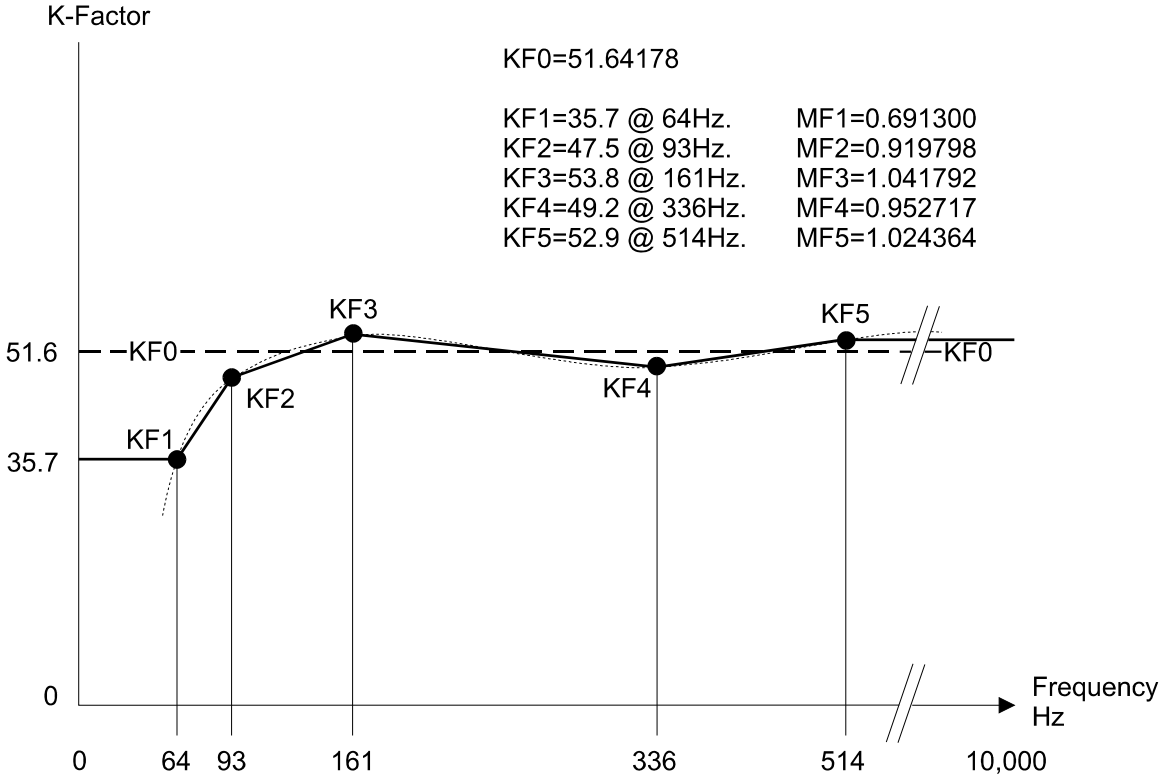
5 - LINEARIZE

The linearization function is available to approach the real flow curve better as with the general K-factor (KF0). This to obtain a more accurate flowrate, total and accumulated total as well as the analog and pulse output at any flowmeter frequency.
A maximum of 15 linearization-positions can be entered while the interpolation will calculate any other position in-between.

For each linearization position, the frequency and a Meter Factor (MF) must be entered.
The Meter Factor for each frequency is calculated with following formula:

$$\text{Meter-Factor} = \frac{\text{K-Factor at flowrate X}}{\text{KF0}}$$

The lowest frequency and MF you enter will be valid from 0Hz. The highest frequency and MF will be valid till 10KHz. It is advised to enter the frequencies in increasing order, however it is not necessary. Please have a look at following example to understand the method of linearization:



FREQUENCY / M-FACTOR 5.1 TO 5.F	The frequency is displayed at the bottom line of the display. The maximum frequency is 9,999.9 Hz. With value 0.0Hz, the M-Factor is disabled. (Please read Setup function 5.H - decimals frequency) The M-Factor is displayed at the top-line of the display. The minimum value to be entered is 0.000001 and the maximum value is 9.999999. **Note:** *This value has always six decimals while the "dot" is not displayed.* Most M-factors will be around 1.000000 like 0.945354 or 1.132573.
DISABLE / ENABLE 5.G	With this setup function, you can easily enable / disable the linearization function.
DECIMALS FREQUENCY 5.H	For the frequency, following decimal positions can be selected: 00000 - 1111.1 - 222.22 - 33.333

Note !

6 - ANALOG OUTPUT

An analog 4-20mA signal is generated according to the flowrate with a 12 bits resolution. The settings for flowrate (SETUP 2) influence the analog output directly.
The relationship between rate and analog output is set with the following functions:

OUTPUT **6.1**	The analog output can be disabled. In case of a passive analog output 3.5mA will be generated if a power supply is available but the output is disabled. The following can be selected: enable – disable
RATE MIN **6.2**	Enter here the flowrate at which the output should generate the minimum signal (4mA) - in most applications at flowrate "zero". The number of decimals displayed depends upon SETUP 2.3. The time and measuring units (L/min for example) depend upon SETUP 2.1 and 2.2 and are displayed during editing.
RATE MAX **6.3**	Enter here the flowrate at which the output should generate the maximum signal (20mA) - in most applications at maximum flow. The number of decimals displayed depends upon SETUP 2.3. The time and measuring units (L/min for example) depend upon SETUP 2.1 and 2.2 and are displayed during editing.
CUT-OFF **6.4**	To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16mA, (or 20mA). When the flow is less than the required rate, the current will be the minimum signal (4mA). **Examples:**

4MA (SETUP **6.2**)	**20MA** (SETUP **6.3**)	**CUT-OFF** (SETUP **6.4**)	**REQUIRED RATE**	**OUTPUT**
0 L/min	100 L/min	2%	(100-0)*2% = 2.0 L/min	4+(16*2%) = 4.32mA
20 L/min	800 L/min	3.5%	(800-20)*3.5%= 27.3 L/min	4+(16*3.5%)=4.56mA

TUNE MIN / 4MA **6.5** 	The initial minimum analog output value is 4mA. However, this value might differ slightly due to external influences such as temperature for example. The 4mA value can be tuned precisely with this setting. ▪ *Before tuning the signal, be sure that the analog signal is not being used for any application!* After pressing PROG, the current will be about 4mA. The current can be increased / decreased with the arrow-keys and is directly active. Press ENTER to store the new value. Remark: the analog output value can be programmed “up-side-down” if desired, so 20mA at minimum flowrate and 4mA at maximum flowrate for example!
TUNE MAX / 20MA **6.6** 	The initial maximum analog output value is 20mA. However, this value might differ slightly due to external influences such as temperature for example. The 20mA value can be tuned precisely with this setting. ▪ *Before tuning the signal, be sure that the analog signal is not being used for any application!* After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is directly active. Press ENTER to store the new value. Remark: the analog output value can be programmed “up-side-down” if desired, so 4mA at maximum flowrate and 20mA at minimum flowrate for example!

Continued next page >>>

6 - ANALOG OUTPUT (CONTINUED)

FILTER **6.7**	This function is used to stabilize the analog output signal. The output value is updated every 0.1 second. With the help of this digital filter a more stable but less precise reading can be obtained. 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 on a value change will be. Below, several filter levels with their response times are indicated:			
FILTER VALUE	**RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS**			
	50% INFLUENCE	**75% INFLUENCE**	**90% INFLUENCE**	**99% INFLUENCE**
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.1 second	0.2 second	0.4 second	0.7 second
03	0.2 second	0.4 second	0.6 second	1.2 seconds
05	0.4 second	0.7 second	1.1 seconds	2.1 seconds
10	0.7 second	1.4 seconds	2.2 seconds	4.4 seconds
20	1.4 seconds	2.8 seconds	4.5 seconds	9.0 seconds
30	2.1 seconds	4 seconds	7 seconds	14 seconds
50	3.5 seconds	7 seconds	11 seconds	23 seconds
75	5.2 seconds	10 seconds	17 seconds	34 seconds
99	6.9 seconds	14 seconds	23 seconds	45 seconds

7 - PULSE

One transistor or relay output is available as scaled pulse output according to the accumulated total.

WIDTH **7.1**	The pulse width determines the time that the output will be active; in other words the pulse duration. The pulse width is set in milliseconds in the range 0.001 - 9.999 sec. Value “zero” will disable the pulse output. ***Note:*** *The pulse signal always has a 50% duty cycle, hence the minimum time between the pulses is equal to the pulse width setting. If the frequency should go out of range - when the flowrate increases for example - an internal buffer will be used to "store the missed pulses": As soon as the flowrate slows down, the buffer will be "emptied".* *It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within its range!*
DECIMALS **7.2**	This setting determines the decimal position for SETUP 7.3. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333
AMOUNT **7.3**	A pulse will be generated every time a certain quantity is added to the total. Enter this quantity here while taking the decimal position of SETUP 7.2 into account. The following can be selected: 0000.000 - 9999999

8 - COMMUNICATION (OPTIONAL)	
The functions described below deal with hardware that is not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.	
BAUDRATE **8.1**	For external control, the following communication speeds can be selected: 1200 - 2400 - 4800 - 9600 baud
BUS ADDRESS **8.2**	For communication purposes, a unique identity can be attributed to every E112-P. This address can vary from 1-255.
MODE **8.3**	The communication protocol is Modbus ASCII or RTU mode. Select OFF, to disable this communication function. BUS ASC – BUS RTU – OFF

9 - OTHERS	
TYPE OF MODEL **9.1**	For support and maintenance it is important to have information about the characteristics of the E112-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
VERSION SOFTWARE **9.2**	For support and maintenance it is important to have information about the characteristics of the E112-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
SERIAL NUMBER **9.3**	For support and maintenance it is important to have information about the characteristics of the E112-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
PASSWORD **9.4**	All SETUP values can be password protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
KEYBOARD LOCK **9.5**	To avoid undesired use of the optical keyboard it can be locked automatically after 30 seconds by enabling this function.
TAGNUMBER **9.6**	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

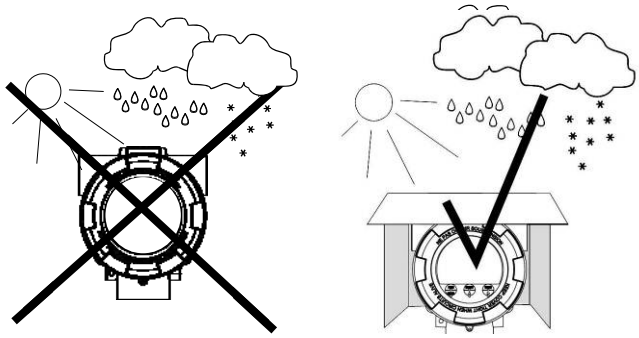
4. INSTALLATION

4.1. GENERAL DIRECTIONS

Caution !

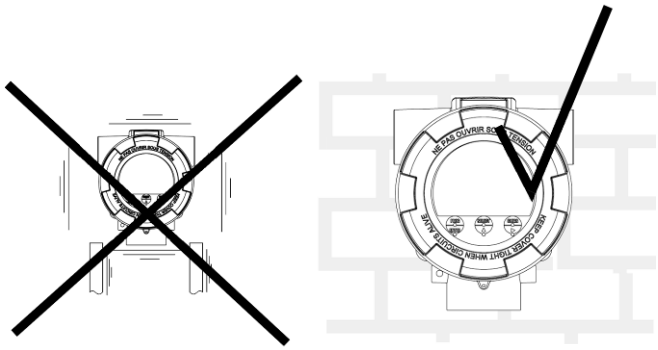
- *Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The E112-P may only be operated 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 E112-P is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the enclosure cover is removed or the panel cabinet has been opened (danger from electrical shock). The enclosure may only be opened by trained personnel.*
- *Take careful notice of the "Safety rules, instructions and precautionary measures" at the front of this manual.*

4.2. INSTALLATION / SURROUNDING CONDITIONS



Take the relevant IP classification of the enclosure into account (see manufactures plate). Even an IP67 (NEMA 4X) enclosure should NEVER be exposed to strongly varying (weather) conditions.

When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture for instance by placing a dry sachet of silica gel inside the enclosure.



Mount the E112-P on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE

Aluminum / Stainless steel enclosures:

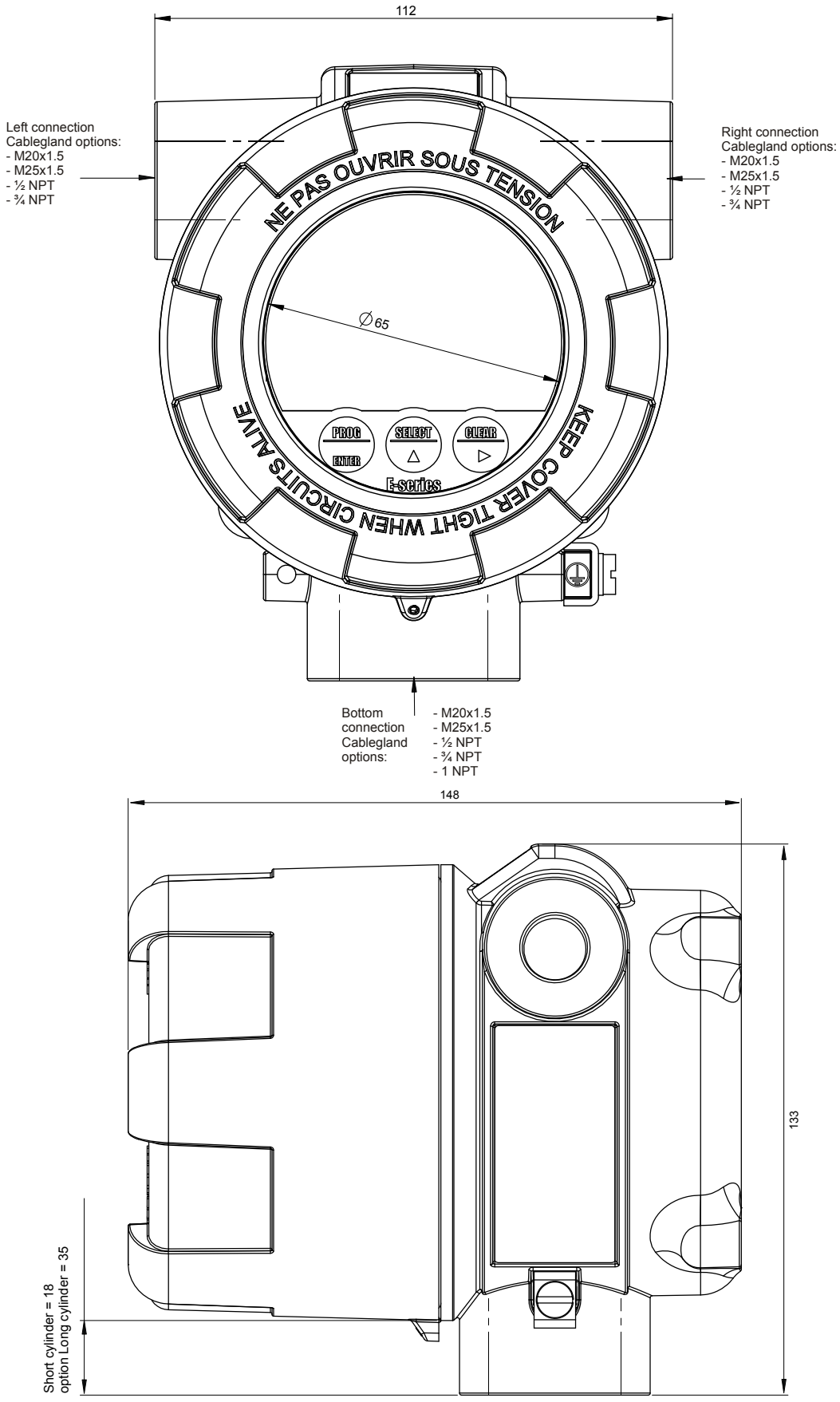


Fig. 8: Dimensions aluminum / Stainless Steel enclosures.¾

4.4. INSTALLING THE HARDWARE

4.4.1. INTRODUCTION

- *Avoid Electro static discharge, it inflicts irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.*
- *This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).*
- *The display inside the enclosure can be turned 90° so the enclosure can be mounted in four positions.*

Aluminum / Stainless Steel enclosures

- *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.*
- *Do ground the aluminum / stainless steel enclosure properly with green/ yellow PE wire as indicated to the Protective Earth terminal.*
- *The installation must comply with national 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).*

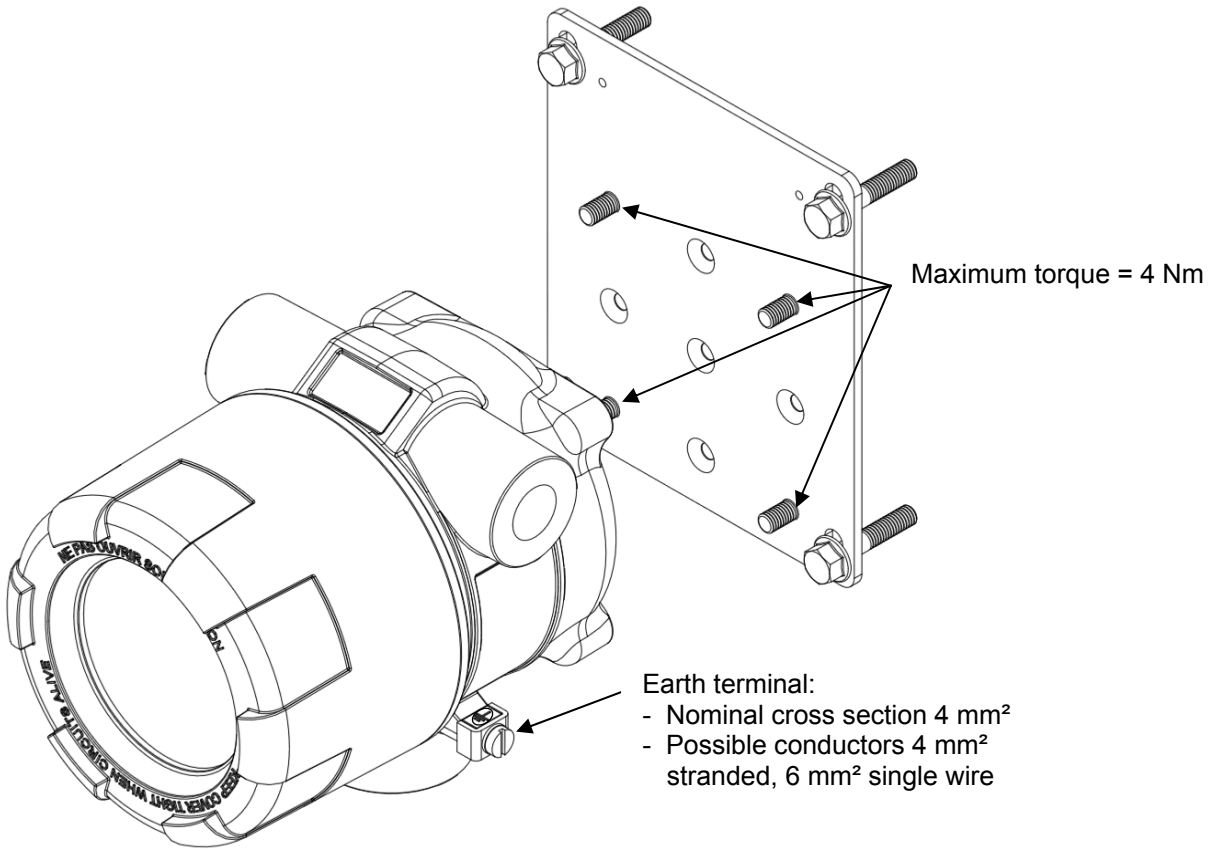


Fig. 9: Grounding enclosure

Pipe mount with bracket and hose clamps

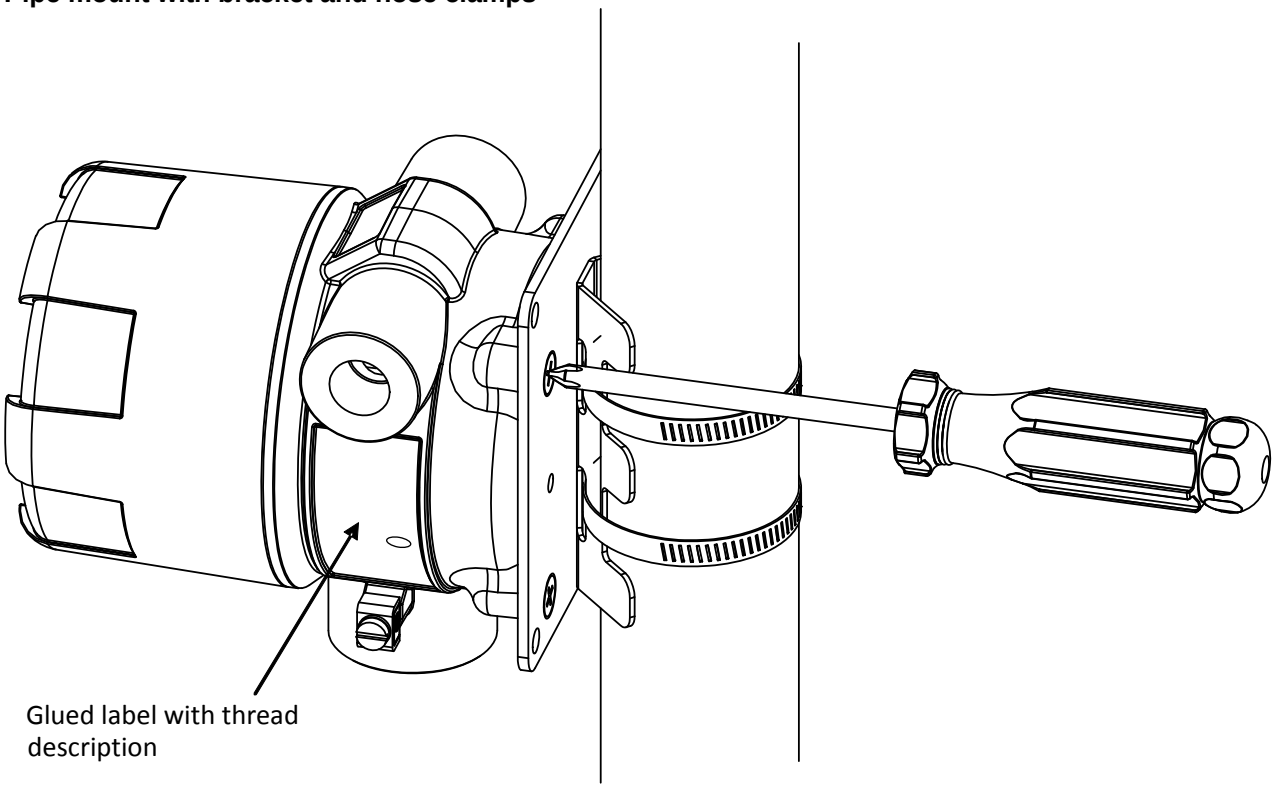


Fig. 10: Pipe mount option

For Class 1 applications make sure to apply proper internal (as well as external) grounding to PE terminal as shown in Fig 11.

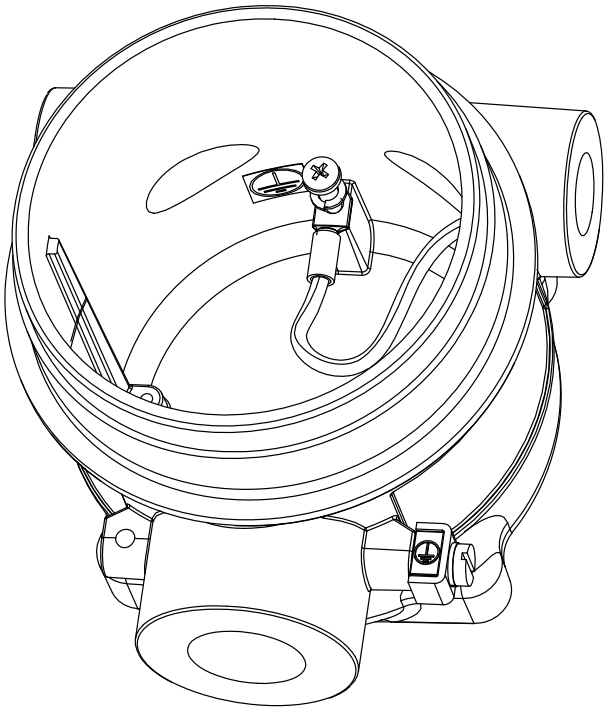


Fig. 11: Grounding enclosure internally

Use an M4 bolt with spring washer and apply at least 3 full turns. See table “Terminal Connections” in Appendix A for the appropriate wiring.

FOR INSTALLATION, PAY EMPHATIC ATTENTION TO THE fOLLOWING:

- Use Ex-d cable glands with effective IP67 (NEMA4X) seals for the cables used.
- For unused cable entries fit IP67 (NEMA4X) blind plugs.
- Make a reliable ground connection to the metal enclosure.
- Use only an effective screened cable for the input signal, and grounding of its screen to terminal S1 (GND) AND to the enclosure or at the sensor itself, whichever is appropriate to the application. Be careful not to create ground loops!.

- For battery supplied equipment: DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.
- Without thermal separator, the process temperature shall not exceed the specified maximum ambient temperature.
- When the enclosure temperature exceeds 70 °C / 158 °F, apply suitable cable and gland for this temperature.
- When included in the shipment, the plugs supplied must be used.

The E-series can be connected to another Ex-d enclosure following the compulsory conditions below:

- The part which is used for the connection between the two volumes must be Ex-d certified,
- The connected enclosure must be Ex-d certified with its own electrical equipment inside (i.e. pickup coil or other sensors),
- For the short cylinder version, the volume of empty space inside this added volume must not represent more than 13,5 cm^3,
- There may be no generation of heat in the added enclosure,
- There may be no added electrical energy in the added enclosure; any energy which comes from the E-series is already taken into account in the E-series certificate.

4.4.2. SEAL CONDUITS/ENCLOSURE

For FM Group A,B,C,D and CSA group B,C,D:
"SEAL ALL CONDUITS WITHIN 18 INCHES"

For CSA Group A:
"SEAL IMMEDIATELY AT ENCLOSURE WALL"

4.4.3. SPECIAL CONDITIONS FOR SAFE USE

The painted aluminum enclosure shall be installed in such a way that danger of ignition due to electrostatic discharge is avoided.

4.4.4. FLAMEPROOF JOINTS

(Clause 5: EN/IEC 60079-1:2007)

There are 4 types of joints between inner and outside of the E-type enclosure which are flameproof:

1. The cement between glass and cover (length ≥10mm)
2. Thread between body/cover M100x1.5 (Tolerance 6g/6H min. 8 full threads engaged)
3. Thread for conduit opening left and right:
   i. M20 x 1.5, M25 x 1.5, (for metric: Tolerance 6g/6H min. 8 full threads engaged)
   ii. ½ NPT, ¾ NPT. (for NPT: Tolerance ANSI/ASME B1.20.1)
4. The process opening:
   i. M20 x 1.5, M25 x 1.5 (for metric: Tolerance 6g/6H min. 8 full threads engaged)
   ii. ½ NPT, ¾ NPT, 1 NPT (for NPT: Tolerance ANSI/ASME B1.20.1)

All flameproof joints are designed for :

- Volume 500 < V ≤ 2000 cm^3.
- Group IIC enclosures

Use certified / Ex-d cable glands

- All NPT threads (cable entry openings) are in accordance with ANSI/ASME B1.20.1.
- All Metric threads (cable entry openings, thread between body and cover and threaded holes for feed thru capacitors) are in accordance with fit class 6g/6H (ISO 965-1 and 965-3).

When installed according to this manual, this product will meet the directives and standards as listed in Appendix A of this manual.

4.4.5 ELECTRICAL SAFETY

The following environmental conditions and safety parameters apply when installing the E112-P.

Relative humidity:	< 90% RH.
Outdoor use:	suitable for outdoor use.
IP and NEMA rating:	IP66, IP67 and NEMA4X.
Supply voltage fluctuation:	+/- 10% unless stated otherwise.
Means of protection:	Class I.
Over-voltage category:	II.
Pollution degree:	3 (external environment), 2 (internal environment).
Ambient:	-40 °C to +70 °C, -40 °F to + 158 °F.
Altitude:	up to 2000 m.

The following supply ratings apply for the various installed options (not mentioned options implies no or neglect able influence on the ratings)

Installed option	Input	Supply Voltage range	Maximum supply current	Remark
PD	P2 or P6	24-27VDC	110 mA	With 2xOR option
PD	P2 or P6	9-27VDC	75 mA	Without OR option
PX	P2 or P6	9-27VDC	50 mA	Without OR option
PB	Battery connector	Typical 3.6V. Only use Fluidwell replacements	10 mA	Without OR option
AH	A1/A2	11-27VDC	25 mA	AH only not suitable for OR

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

The output relay (OR option) is of type SPDT and has the following contact ratings:

Load type & Voltage	Current
Maximum resistive load at 30 Vdc, 125 Vac or 250 Vac.	Max. 2 A
Maximum inductive load (for pilot duty applications) at 30 Vdc, 125 Vac or 250 Vac.	Max. 0.5 A

All wiring must be in accordance with local codes and regulations.

In case this instrument is connected to a supply by means of a permanent connection a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

Except for the relay outputs R7 to R10 all connections to the unit shall be low voltage defined as “SELV” circuit per IEC 60950-1.

The equipment shall be supplied from a "SELV" circuit defined as per IEC 60950-1.

A suitable power supply should be considered in end-use equipment. The power supply must be in compliance with a limited-energy circuit (maximum available current of 8 A). If the power supply cannot be in compliance with a limited-energy circuit:
For safety install an overcurrent protection device (such as fuse) with adequate breaking capacity close to the instrument.
- Fuse type: Time-lag fuse (Approved fuse according to IEC60127-2 and/or UL248-14)
- Fuse rating: Rated current: 5 A

The installation must comply with national requirements (e.g. in Canada, the Canadian Electrical Code, C22.1, Part 1 and in USA, the National Electrical Code, NFPA 70, Article 500-series and ANSI/ISA-RP 12).

4.4.6. VOLTAGE SELECTION SENSOR SUPPLY

Type PB / PX - Pickup element supply:
Terminal S3 provides a power limited reference voltage of 3.0 V DC (Coil signals 1.2V) to supply the signal output of the flowmeter. Output impedance is 2700 ohms, power is limited to 3.3 mW under short circuit conditions.

Note !

Note: *This voltage MAY NOT be used to power the flowmeters electronics, converters etc, as it will not provide adequate sustained power! All energy from these terminals will directly influence the battery life-time. It is strongly advised to use a "zero power" pickup such as a coil or reed-switch when operating without external power. It is possible to use some low power NPN or PNP output signals, but also then the battery life time will be significantly reduced (consult your distributor).*

Type PD: Sensor supply: 8.2V - 12V or 24 V (Vin P2 minus 1V) DC:
With this option, a supply derived from the input supply becomes available. The output voltage of P3 can be adjusted by means of switches J1 and J2 on the back of the PCB (see figure 12) See the label or **Appendix A**, section **"Sensor excitation"**, for the exact ratings of terminal P3.

Note !

Note: *8.2V DC supply requires an input voltage of 9-27V and 12V DC supply requires an input voltage of 13-27V.*

Note !

Note: The output is protected against overload. In case of an overload also the functionality of the E112-P is affected!

The voltage is selected with the two switches inside the casing.

The switches are located at the bottom center (type PD):

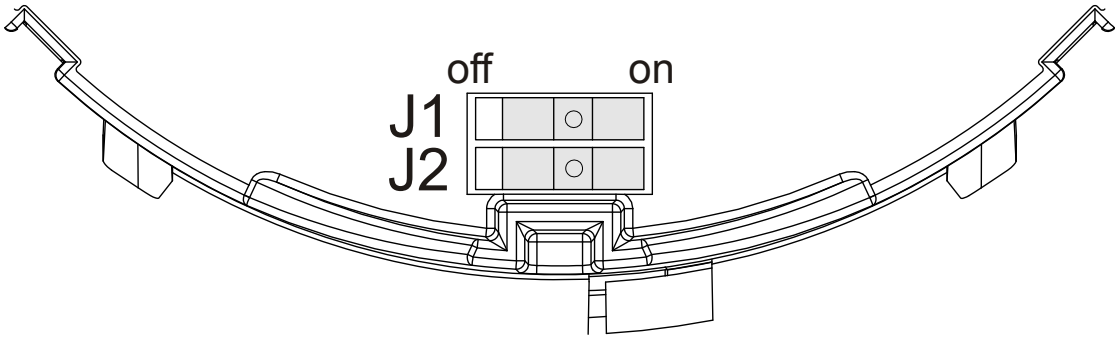


Fig. 12: Switch setting sensor supply voltage

Switch positions: the combination of these switches determine the voltage as indicated.

VOLTAGE SELECTION		
SWITCH J1	SWITCH J2	VOLTAGE
off ←	off ←	8.2 V DC
off ←	on →	12 V DC
on →	on X	Input V DC

4.5. OVERVIEW OF TERMINAL CONNECTORS

The following terminal connectors are available:

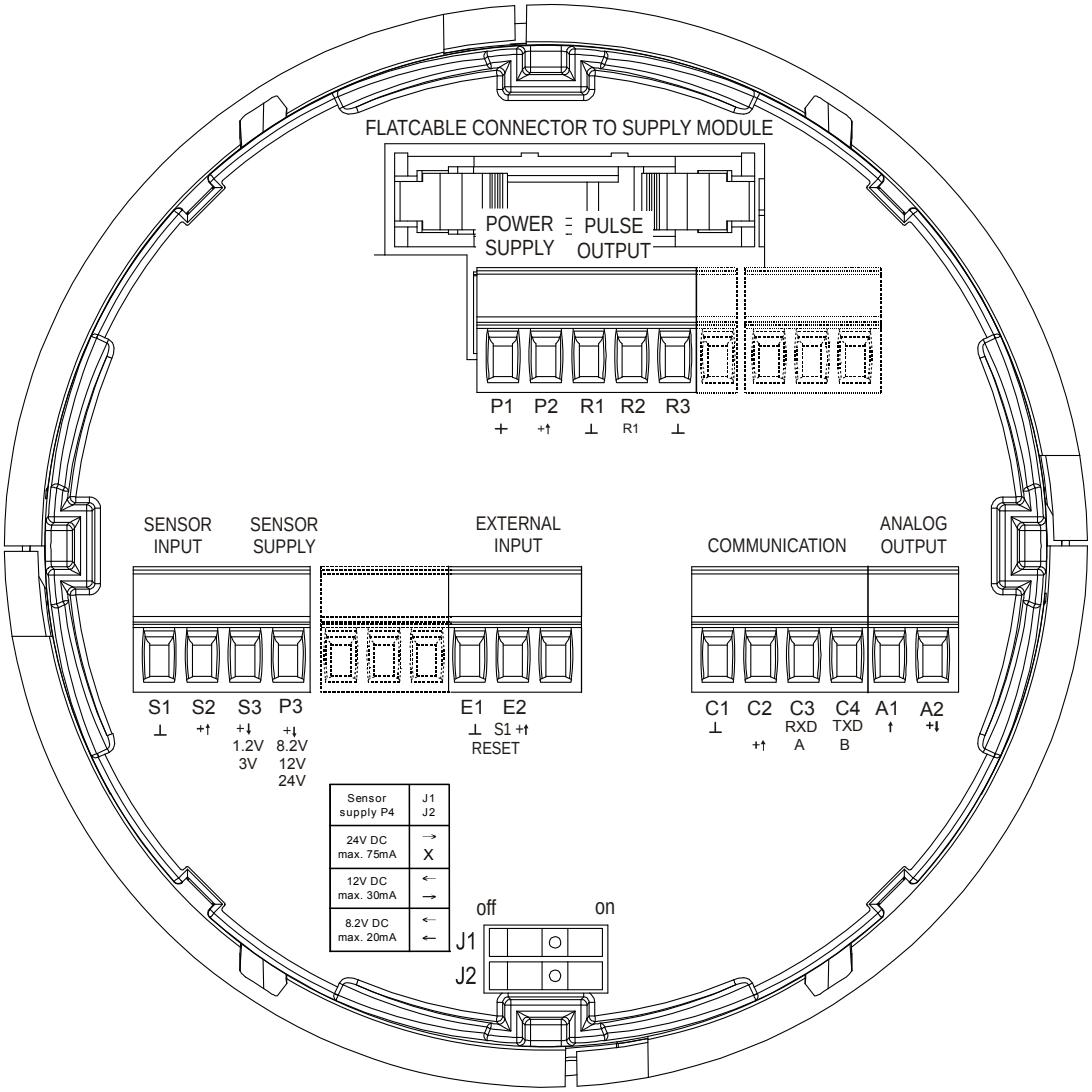


Fig. 13: Overview of main electronics module terminal connectors

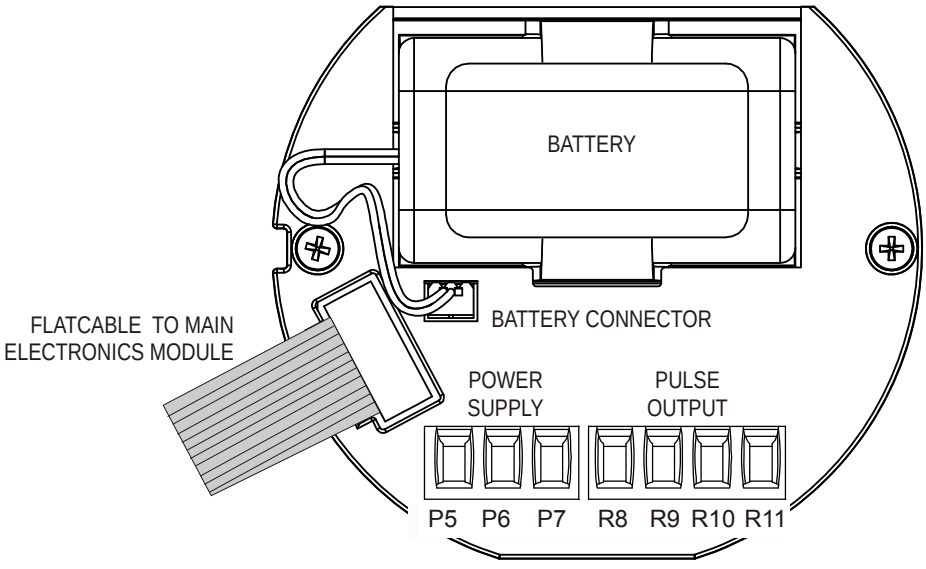


Fig. 14: Overview of supply module terminal connectors

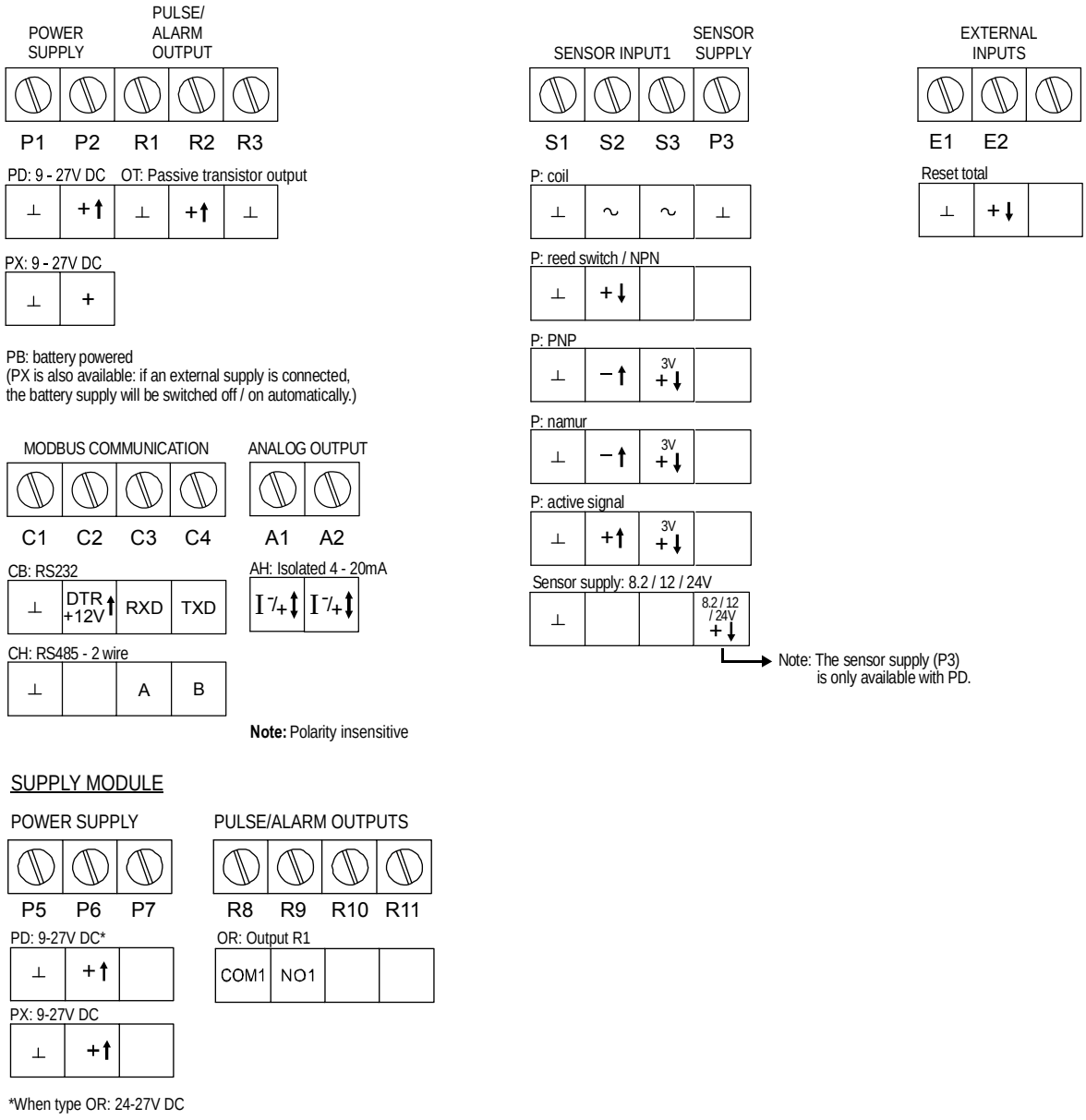


Fig. 15: Overview of terminal connectors

4.5.1. TERMINAL CONNECTORS:

Terminal P1-P2: Power Supply - type PD/PX:
Connect an external power supply of 9-27VDC to these terminals.
When power is applied to these terminals, discharge of the (optional) internal battery will be disabled.
See also 4.4.6 VOLTAGE SELECTION SENSOR SUPPLY.

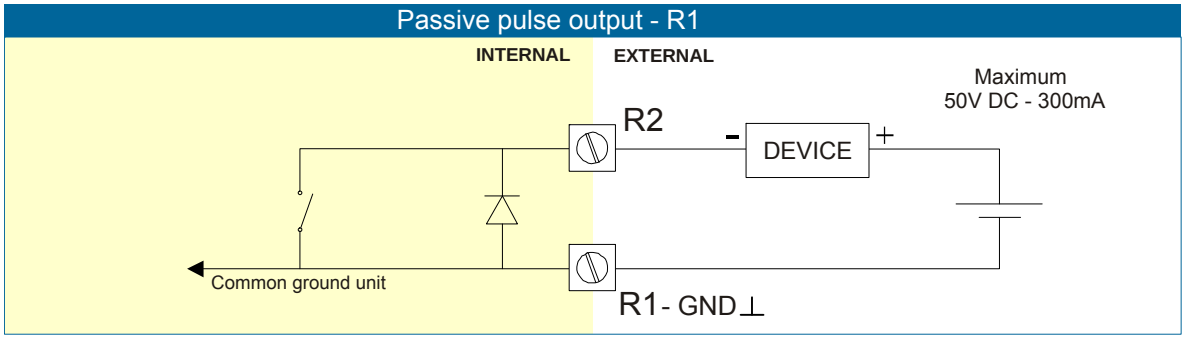
Power requirements for sensor supply P3:
8.2V supply requires 9-27V
12V supply requires 13-27V
24V = P2– 1V (max 27V)

Terminal R1-R2; (scaled) pulse output R1:
Setup 7 (par. 3.4.) determines the pulse output function. The maximum pulse frequency of this output is 60Hz.

Type OT:
A passive transistor output is available with this option. Max. driving capacity 300mA@50V DC.

Note !

Note: R1 is a common ground (GND) terminal.



Type OR:

Note !

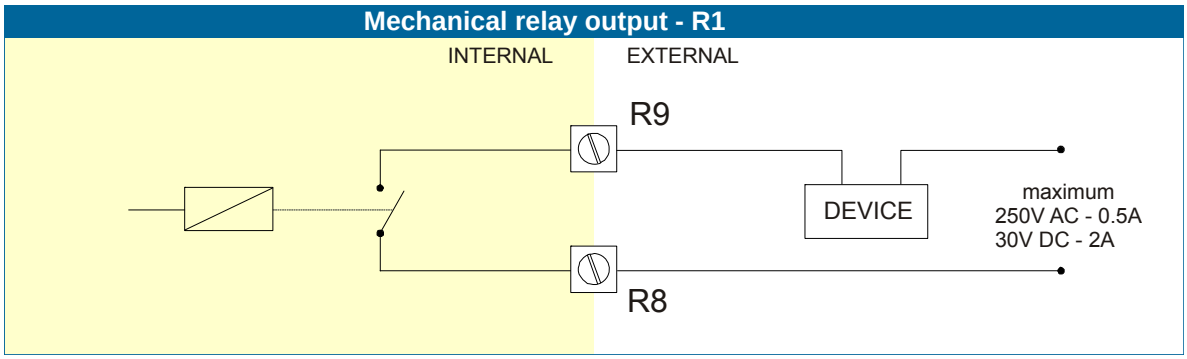
Note: *If the OR option is present use power supply terminals P5-P6.*

The functionality of the relay outputs are programmed through the SETUP menu, see par. 3.2.2. for more details. Max. switch power 240V 0,5A per output. (Requires power supply type PD).

Be sure that the output frequency does not exceed 5Hz, else the relay life time and reliability will be reduced significantly.

Note !

Note: *With OR option the minimum supply voltage is limited to 24VDC!*

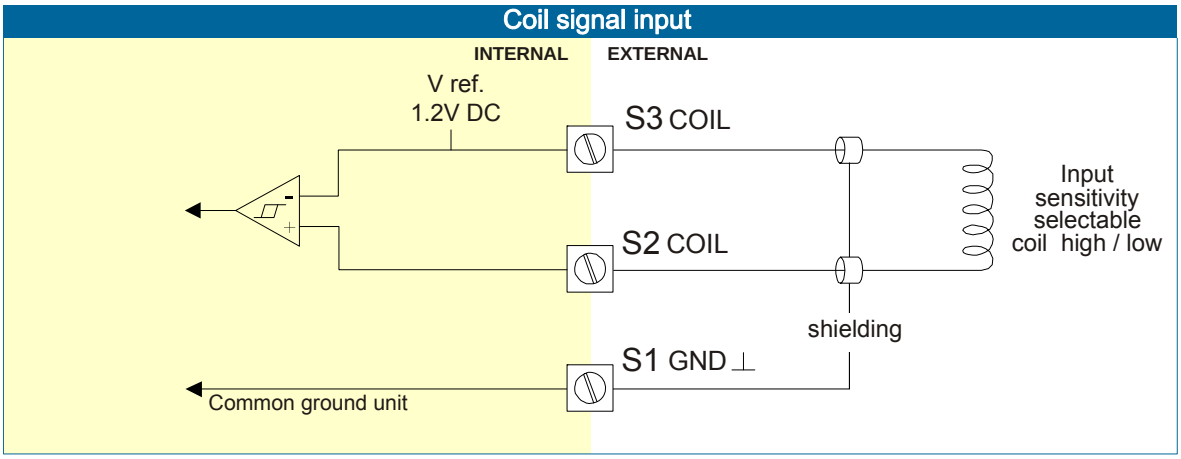


TERMINAL S1-S3; FLOWMETER INPUTS:
Three basic types of flowmeter signals can be connected to the unit: pulse, active pulse or sine-wave (coil). The screen of the signal wire must be connected to the common ground terminal (unless earthed at the sensor itself).
The sensor output should match with the selected flowmeter setting during SETUP (read par. 3.4.).

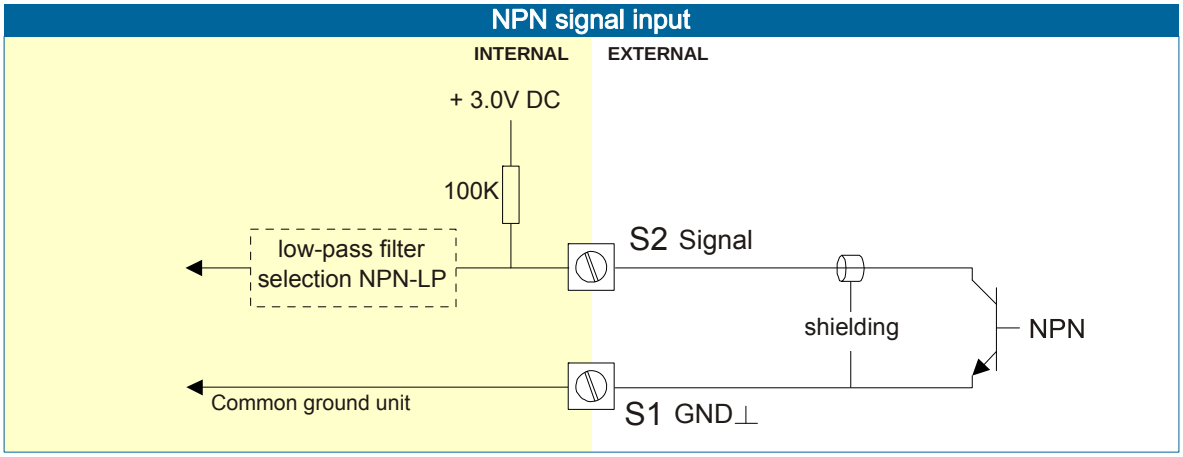
Sine-wave signal (Coil):
The E112-P is suitable for use with flowmeters which have a coil output signal. Two sensitivity levels can be selected with the SETUP-function:

COIL LO: sensitivity from about 90mVp-p.
COIL HI: sensitivity from about 20mVp-p.

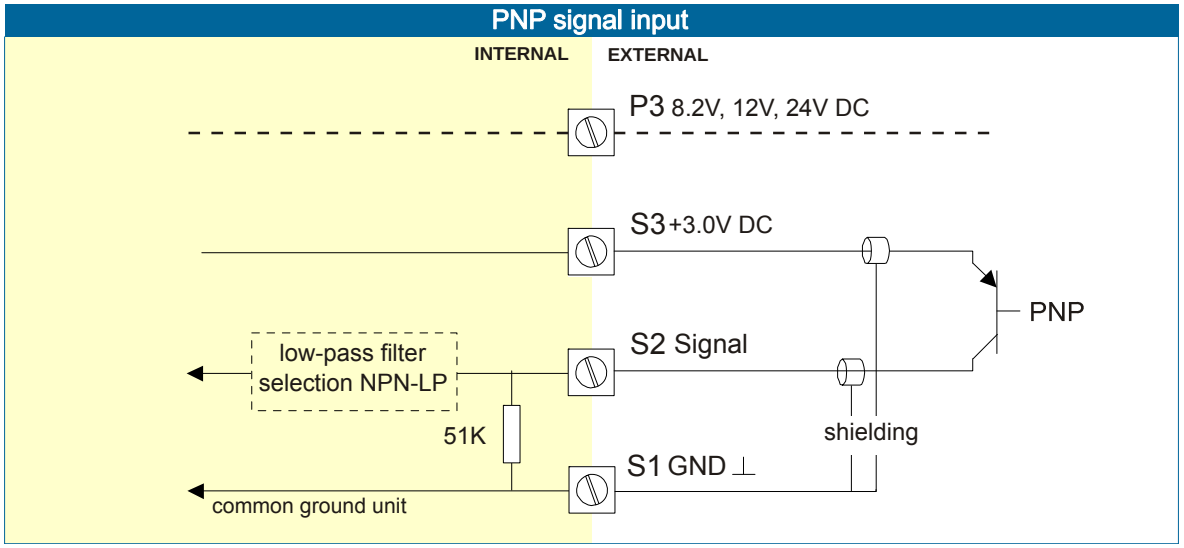
Type ZF offers for setting COIL HI: sensitivity from about 10mVp-p.
Type ZG offers for setting COIL HI: sensitivity from about 5mVp-p.



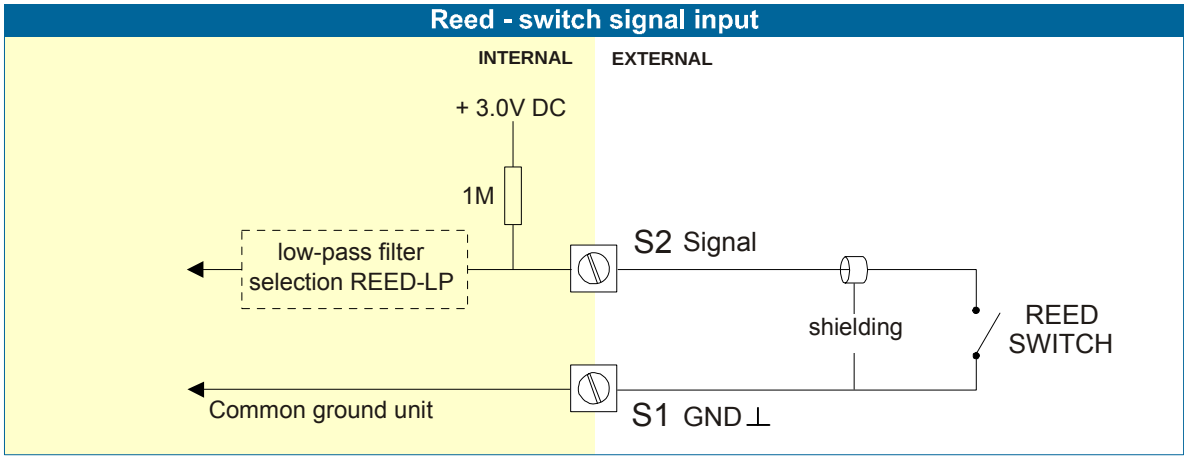
Pulse-signal NPN / NPN-LP:
The E112-P is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the signal should be bigger than 1.4V or lower than 1.0V under all circumstances. It is advised to use a sensor which is normally open and is closed for a small time (less power consumption). For better noise immunity and if no high sensor input frequencies are expected it is advised to select signal setting NPN-LP - low-pass signal noise filter which limits the maximum input frequency, to avoid pulse bounce (read par. 3.4.).



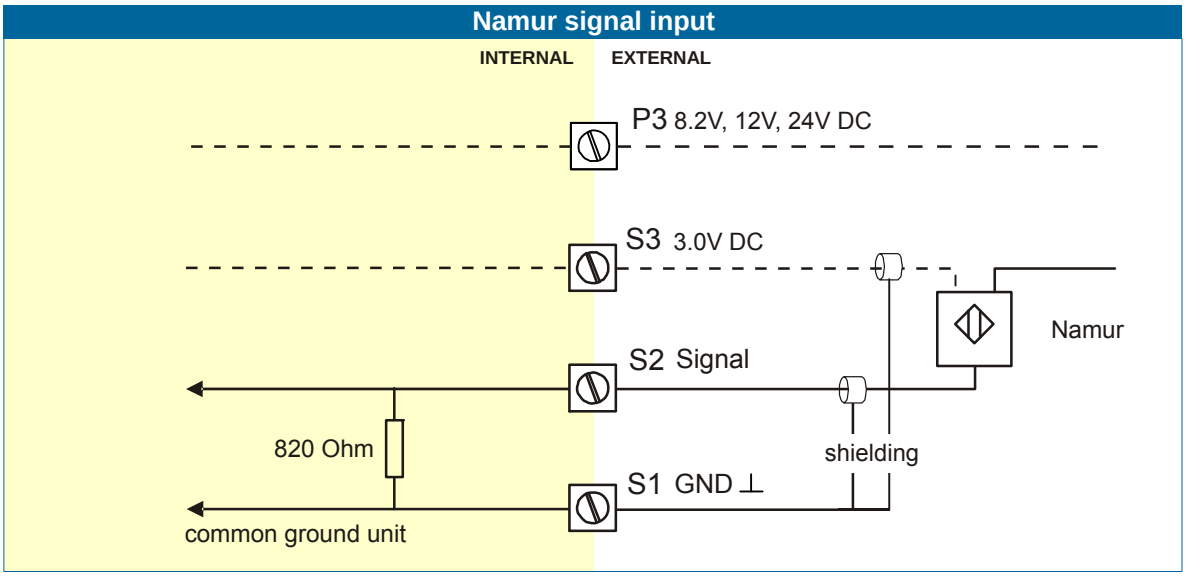
Pulse-signal PNP / PNP-LP:
The E112-P is suitable for use with flowmeters which have a PNP output signal. 3.0V is offered on terminal S3 which has to be switched by the sensor to terminal S2 (SIGNAL). For reliable pulse detection, the signal should be bigger than 1.4V or lower than 1.0V under all circumstances. It is advised to use a sensor which is normally open and is closed for a small time (less power consumption). For better noise immunity and if no high sensor input frequencies are expected it is advised to select signal setting PNP-LP - low-pass signal noise filter which limits the maximum input frequency, to avoid pulse bounce (read par. 3.4.).
A sensor supply voltage of 8.2, 12 or 24V DC can be provided with power supply type PD.



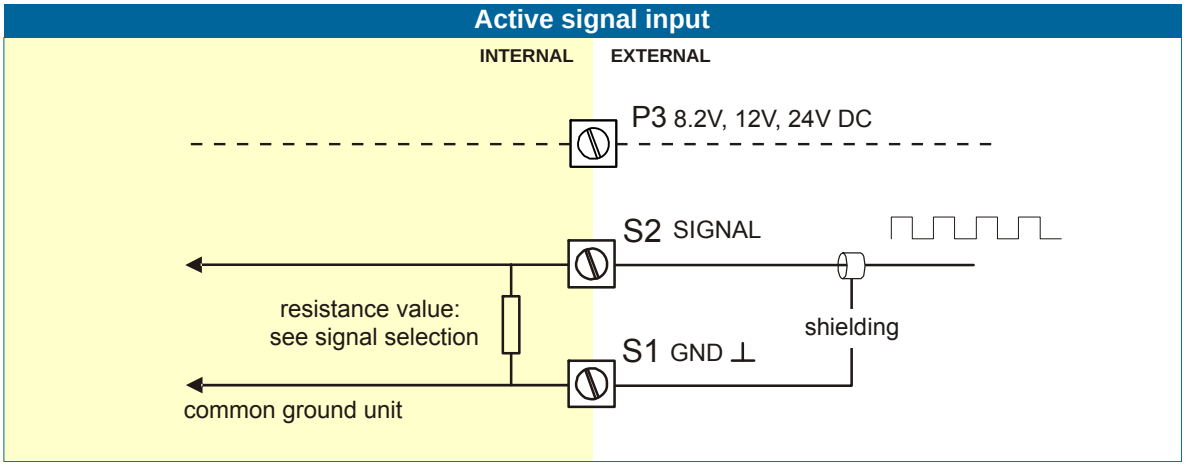
Reed-switch:
The E112-P is suitable for use with flowmeters which have a reed-switch. To avoid pulse bounce from the reed-switch, it is advised to select REED LP - low-pass noise filter, which limits the maximum input frequency (read par. 3.4.). Make sure the contact resistance of the reed switch is less than 1V@2uA=500k Ohm.



NAMUR-signal:
The E112-P is suitable for flowmeters with a Namur signal. The standard E112-P is not able to power the Namur sensor. If required the Namur sensor can be supplied via the 8.2V sensor supply (terminal P3), only available with power supply type PD. See paragraph 3.4. for more information.

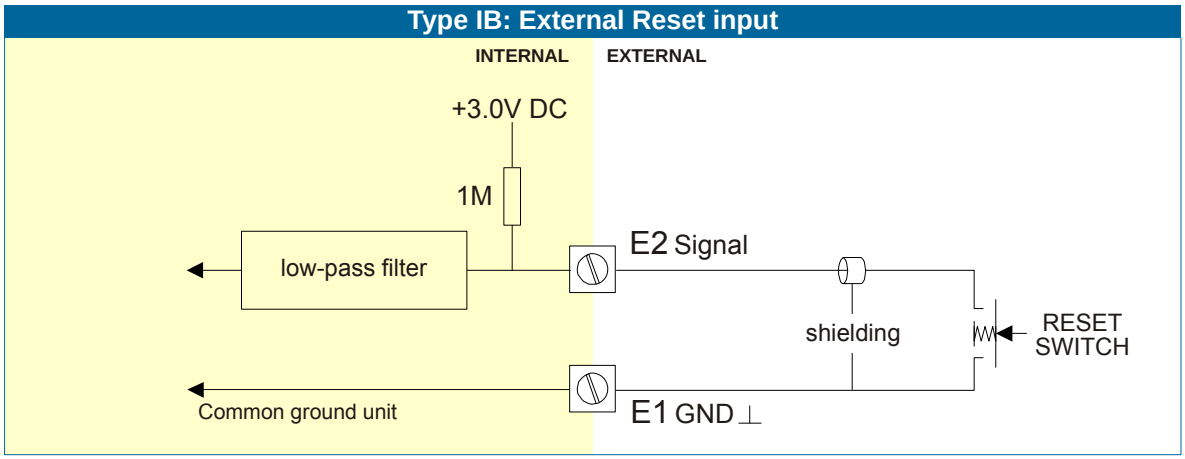


Active signals 8.2V and 24V:
The E112-P is suitable for flowmeters with an Active signal. The detection levels are about 50% of the selected supply voltage; approximately 4V (ACT_8.1) or 12V (ACT_24). See par. 3.4. for more information. Active signal selection may well be desired in the case of power supply type PD being supplied for sensor supply.



Terminal E1-E2 - External Reset with clear-lock- Type IB:
With this function the total can be reset to zero with an external switch. The total resets at the moment a falling edge is detected (the moment the switch *closes)*. During close the ”Clear Total” function is disabled (see chapter 2). Make sure the contact resistance of the switch is less than 0.8V@2uA=400k Ohm.
A reset pulse should last for at least 200ms

The input must be switched with a normally open contact to GND.



Terminal C1-C4 - Communication RS232/RS485 (option) - Type CB/CH:
- Serial communications on hardware layers RS232 (length of cable max. 5 meters), RS485 (length of cable max. 1200 meters) and USB (max 5 m) are possible. Make sure that the hardware layer specific requirements are met to achieve reliable communication.
- Read the Modbus communication protocol and Appendix C.

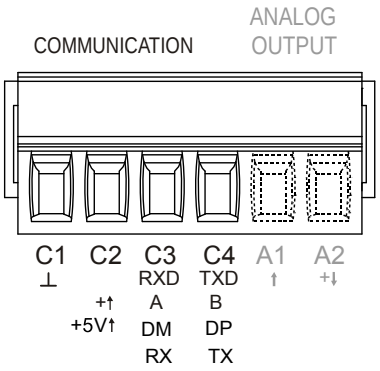
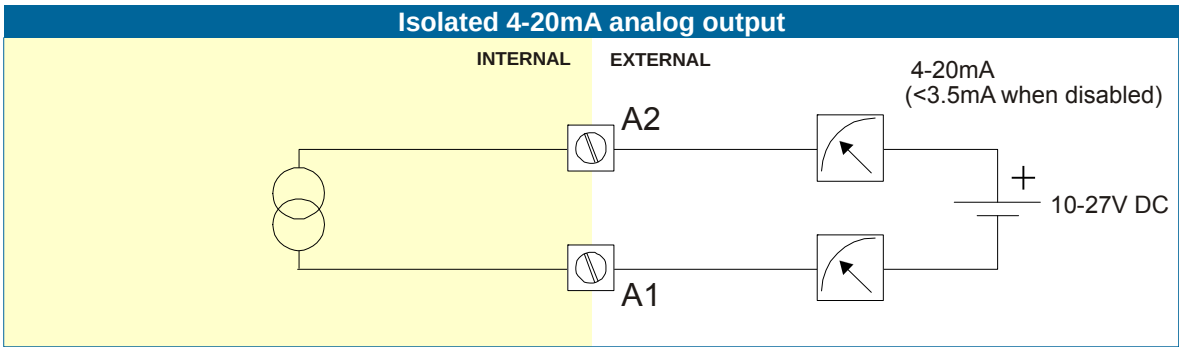


Fig. 16: Overview terminal connectors communication options.

When using the RS232 communication option, terminal C2 can 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 terminals C1 and C2 with a voltage between 6V and 10V.

Terminal A1-A2 Isolated analog output (type AH):

The flowrate proportional output (AH) is standard available. This output is an isolated 4-20mA output with the possibility to power the device via the 4-20mA loop. It is polarity insensitive.
When the output is disabled, the current is by default limited to 3.5mA.
Max. driving capacity 1000 Ohm @ 27VDC.
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 30mA). This makes that the resistance of other loop-devices in total may not exceed 670 Ohm. E.g. 18Vdc allows 250 Ohm.



5. MAINTENANCE

5.1. GENERAL DIRECTIONS

- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel. Personnel must read and understand this Operating Manual before carrying out its instructions. 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 enclosure cover is removed (danger from electrical shock). The enclosure may only be opened by trained personnel.*
- *Take careful notice of the "Safety rules, instructions and precautionary measures" in front of this manual.*

The E112-P does not require special maintenance unless it is used in low-temperature applications or surroundings with high humidity (above 90% annual mean). It is the user's responsibility to take all precautions to dehumidify the internal atmosphere of the E112-P in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the enclosure just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

Note: *Due to incompatibility do not use silica gel in environments where Hydrogen fluoride, strong acids and strong bases are to be expected.*

Battery life-time:
It is influenced by several issues:

- Type of sensor: NPN and PNP inputs consume more energy than coil inputs.
- Input frequency: the higher the frequency, the shorter the battery life-time.
- Flowrate calculation: the lower number of pulses (SETUP 2.4) the shorter the battery life-time.
- Analog output signal; should be disabled if not in use; (SETUP 6.1).
- Display update: fast display update uses more power; SETUP 3.2.
- Optical keys activity: if possible turn off the optical keys with the on-off switch.
- Pulse output and communications, reduced activity extends battery life-time.
- Low temperatures; the available power will be less due to battery chemistry.

Note: *It is strongly advised to disable unused functions.*

Check periodically:
- The condition of the enclosure, cable glands and front glass window.
- The input/output wiring for reliability and aging symptoms.
- The process accuracy. As a result of wear and tear, re-calibration of the flowmeter might be necessary. Do not forget to re-enter any subsequent K-factor alterations.
- The indication for low-battery.
- Clean the enclosure with soapy-water. Do not use any aggressive solvents as these might damage the polyester coating.

5.2. REPAIR

This product cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer or his authorized agent.

5.3. OPENING AND CLOSING THE ENCLOSURE

OPENING

- Always first clean the enclosure before opening.
- Disconnect mains.
- Make sure area is safe.
- When opened do not touch display, front-label and glass surface of cover.
- Make sure no dust or other particles settle on the mentioned components.

CLOSING

- Make sure no dust or other particles are present on the mentioned components, otherwise clean with a dust-free dry cloth.
- Make sure the supply module is placed flat on the bottom of the enclosure.
- Place the cover and screw hand tight.
- Make sure again that the supply module is in the required position.
- Check the optical key functionality, if not good, clean again.

Note: Not taking the above in account could hamper the optical key functionality.

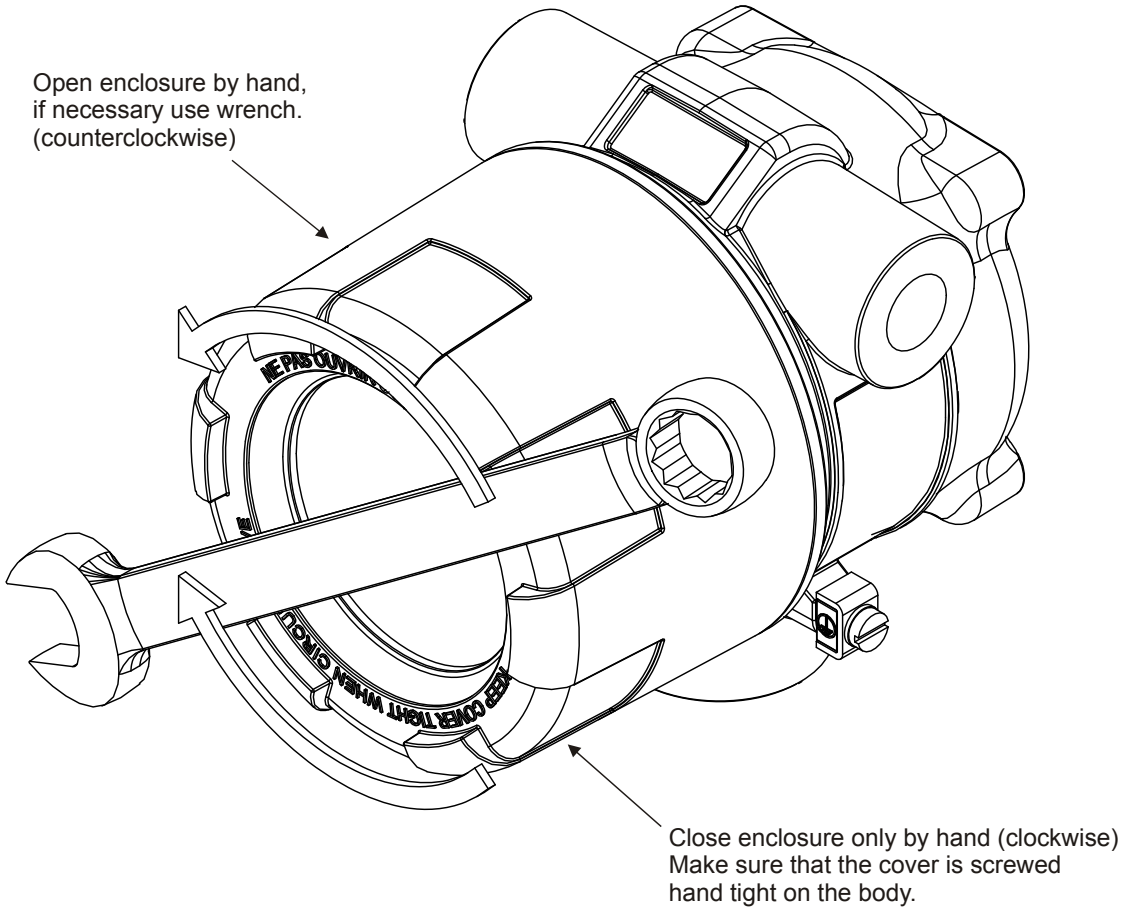


Fig. 17: Opening and closing the enclosure

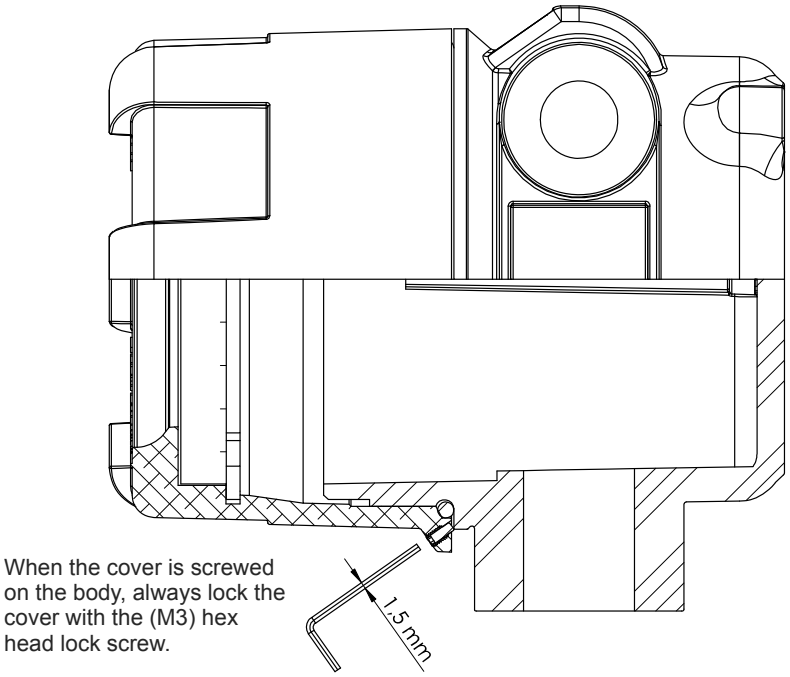


Fig. 18: Locking the cover

5.3.1 REPLACING THE PB-BATTERY

Replace the PB battery only by a type supplied by the manufacturer or his authorized agent.

Apply the following steps for battery replacement:

- Make sure the PB battery should be replaced by means of checking:
  - The battery-empty symbol is on (continuously or blinking)
  - The device is off (PB supply only)
- Safe area (no explosion possible).
- In case of OR, disconnect mains to the OR contacts!
- Carefully disconnect the battery by means of pulling straight and gently on the wires.
- It is allowed to pull the empty battery out of its clamp by means of the wires.
- Dispose of the old battery.
- Place a new battery in the clamp (equal position of the wires as the one removed).
- Place the battery connector.
- Check functionality: no battery low sign anymore within X seconds

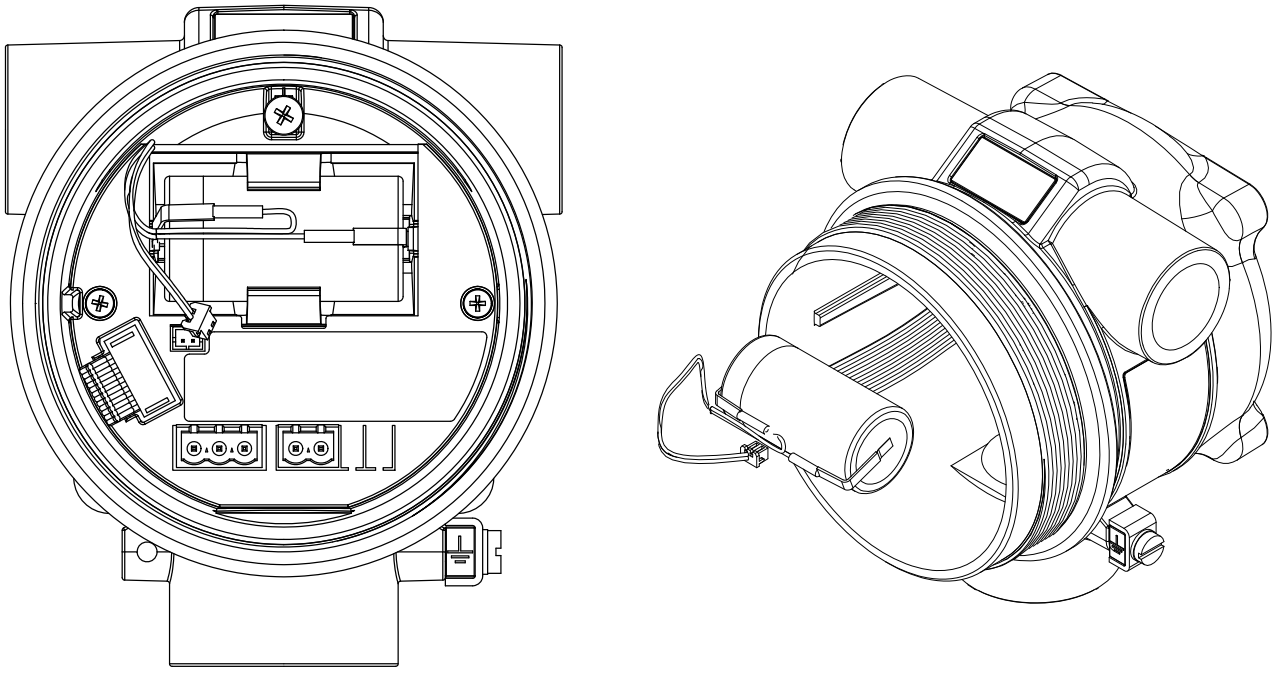


Fig. 19: PB battery replacement

5.3.2 REPLACING THE COIN CELL ZL BATTERY

Replace the coin cell battery only by type Panasonic BR1225A for industrial temperature range. Uses of other 1225 types is possible but always make sure the battery operating temperature range matches the operating range of the application.

At least the following:
- Make sure the ZL battery should be replaced by means of checking (before removing any supply):
- The text: RTC-BAT-LO is displayed every 5 seconds for 1 second
- Safe area (no explosion possible)
- Disconnect all connectors from the supply module except the battery connector
- Disconnect all connectors on the PCB circuit holder except the flatcable connector
    - The flatcable connector may also be removed, but this disconnects the PB supply and therefor the RTC has to be set to the actual time/date.

Apply the following steps for battery replacement:

1) After removal of the front cover of the enclosure, carefully extract the PCB circuit holder from the enclosure.

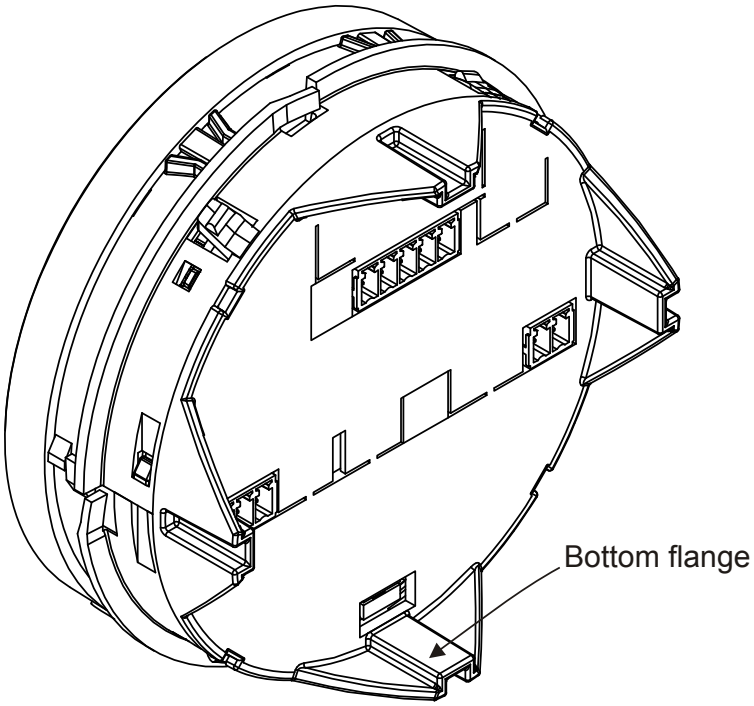


Fig. 20: Rear view PCB circuit holder with cover

2) Remove connectors. Remove back cover by carefully pulling the bottom flange. This makes it possible to leave the flat cable connector present during replacement of the battery.

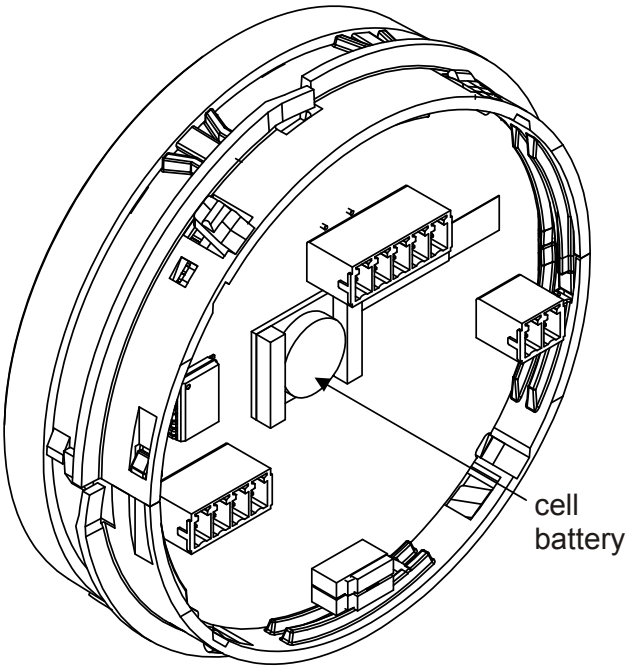


Fig. 21: Rear view PCB circuit holder without cover

3) Remove and replace the battery, with + side (text) up. Avoid touching the battery by hand, for example by using nonconductive tweezers or gloves.

4) Dispose of the old battery as chemical waste or as per local regulations.

5) Reinstall the cover, check the RTC settings and check if the battery low message does not show anymore.

6) Reconnect the connectors and close the enclosure.

6 LABEL

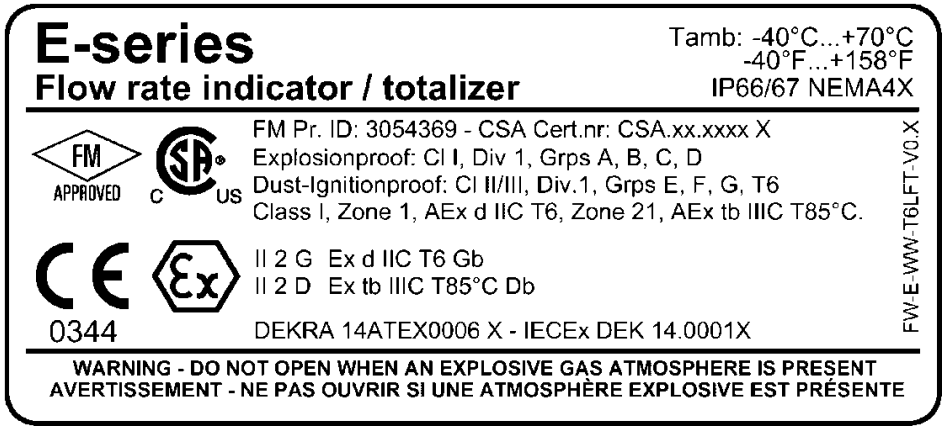
6.1. GENERAL REMARKS REGARDING THE LABELS SHOWN

Two labels will be fitted on the E-series enclosure: one showing the certification data, the other showing the thread sizes, type number, serial number and address applied.

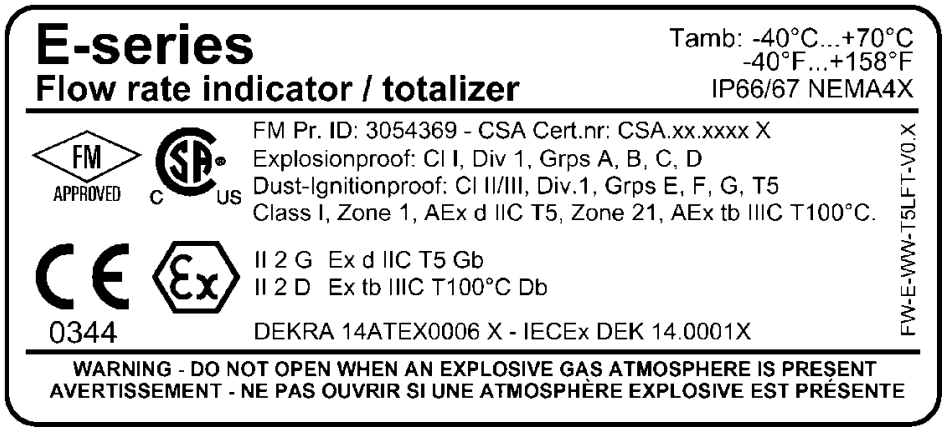
6.2. LABEL WITH CERTIFICATION DATA

The E-series comes in two temperature classes, T5 as well as T6. T6 classified versions consume 4.5 watts or less (e.g. when supplied from a barrier, battery and/or distribution network). T5 classified versions consume 9.2 watts or less (e.g. with additional power module).

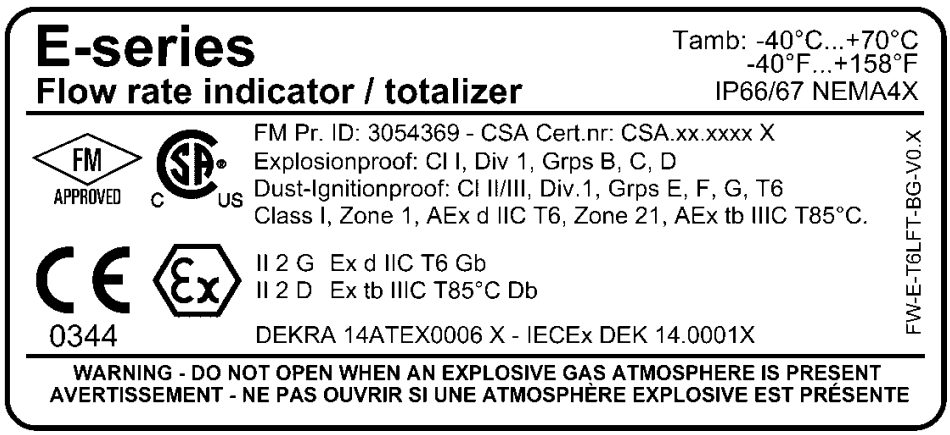
E-series external label for enclosures with direct passage or feed-through, temperature class T6:



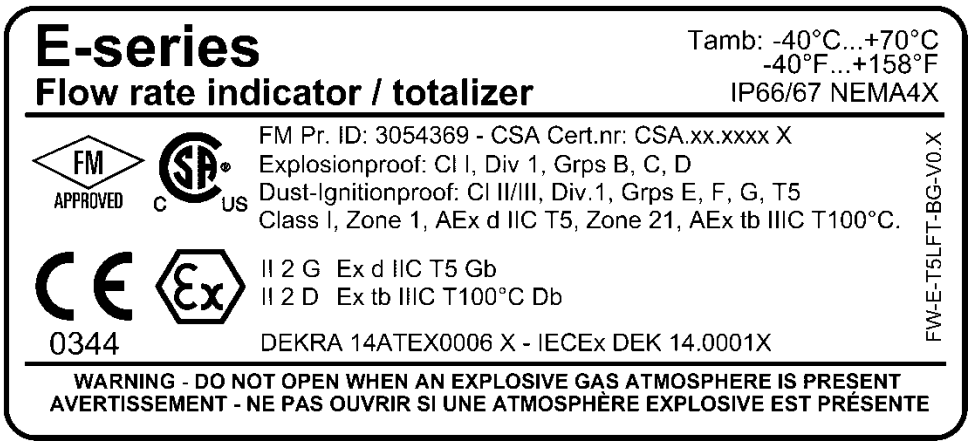
E-series external label for enclosures with direct passage or feed-through, temperature class T5:



E-series external label for enclosures with cylindrical joint, temperature class T6:



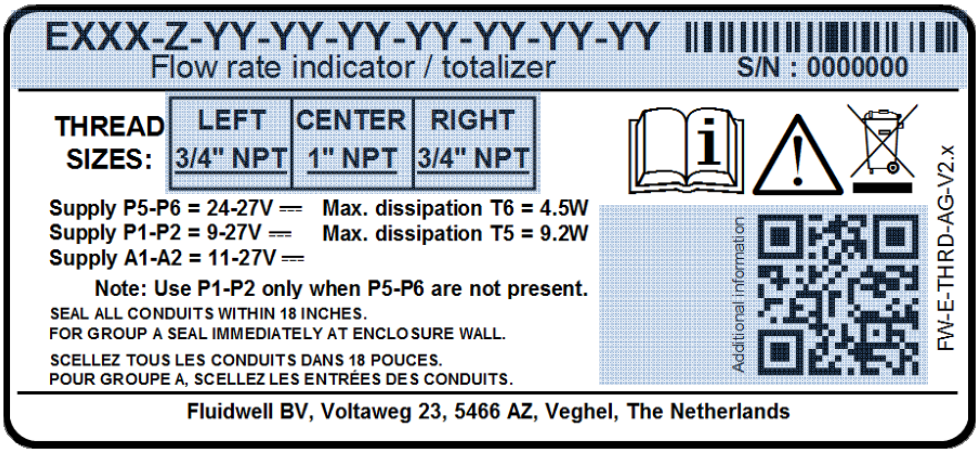
E-series external label for enclosures with cylindrical joint, temperature class T5:



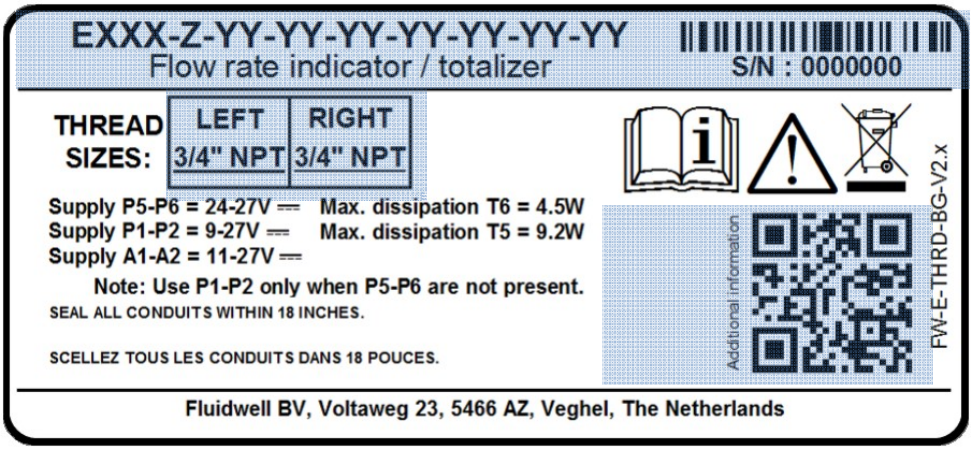
6.3. LABEL WITH THREAD SIZES.

The thread sizes will be indicated on the label as per the drawings below.

E-series external thread label for enclosures with direct passage or feed-through:



Thread label for enclosures with cylindrical joint.



Note 1: The labels shown may also include preliminary certification data for FM and CSA certification. These certifications are currently not present on the E-Series but are expected to become available in 2015. Until that time, the logo's and certification data are not printed on the labels. The specific certification data may change when the certificates become available.

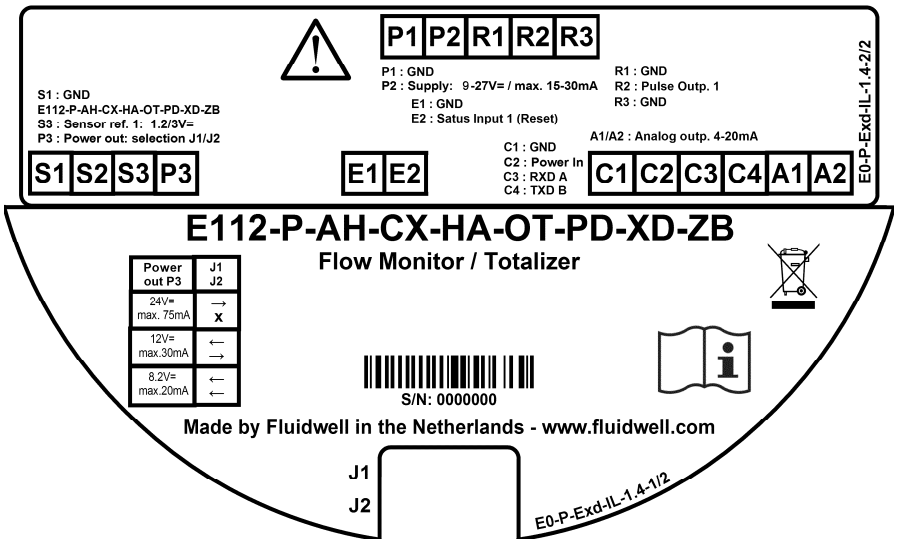
Note 2: The thread label is freely changeable within the gray shaded areas. If not already present on the certification label, an optional date code can be included as well. Thread sizes shown may vary. The model designation Exxx-Z… and the text below it are subject to change to indicate the specific hardware and software functionality. All model configurations that are safety related (like –PD, –OR) will always be shown.

The label will match the certification data and markings as stated in **Appendix A: Specifications**.

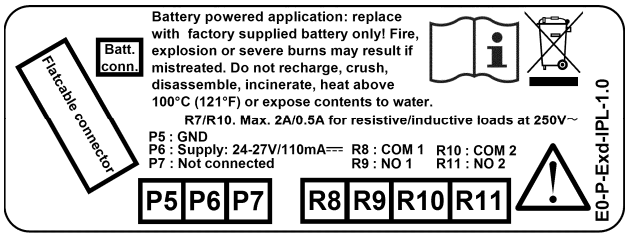
6.4. INTERNAL LABELS.

The labels below are to be found on the main electronics module and supply module inside the enclosure.

on main electronics module:



on supply module:



These labels are subject to change depending on the model options chosen.

APPENDIX A: TECHNICAL SPECIFICATIONS

GENERAL

Display	
Type	High intensity transflective numeric and alphanumeric LCD, UV-resistant. With bi-color backlight. Intensity can be adjusted via the keyboard.
Note:	When battery powered, the backlight is only operational during setup to extend battery lifetime.
Dimensions	65 x 45 mm (2.56" x 1.77")
Digits	Seven 12mm (0.47") and eleven 7mm (0.28"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Speedometer	The black indicators around the edge run from 0 to 100% in 20 blocks, each block is 5%.

Enclosure	
Window	Glass.
Sealing	Silicone.
Control Keys	Three optical keys with operation through the glass front window.

Aluminum Enclosure	
General	Die-cast aluminum EX d enclosure
Rating	IP67 / NEMA 4X / NEMA 7 / NEMA 8 / NEMA 9.
Dimensions	112 x 133 x 148mm (4.41" x 5.24" x 5.83") - W x H x D.
Weight	1300 gr.
Type HA	Entry threads: 2 x 3/4"NPT / 1 x 1"NPT
Type HB	Entry threads: 3 x 3/4"NPT
Type HC	Entry threads: 2 x 1/2"NPT / 1 x 1"NPT
Type HD	Entry threads: 2 x 1/2"NPT / 1 x 3/4"NPT
Type HG	Entry threads: 2 x M20 / 1 x M25
Type HH	Entry threads: 3 x M25

Stainless Steel Enclosure	
General	Stainless steel EX d enclosure
Rating	IP67 / NEMA 4X / NEMA 7 / NEMA 8 / NEMA 9.
Dimensions	112 x 133 x 148mm (4.41" x 5.24" x 5.83") - W x H x D.
Weight	3600 gr.
Type HN	Entry threads: 2 x 3/4"NPT / 1 x 1"NPT
Type HO	Entry threads: 3 x 3/4"NPT
Type HP	Entry threads: 2 x 1/2"NPT / 1 x 1"NPT
Type HR	Entry threads: 2 x 1/2"NPT / 1 x 3/4"NPT
Type HU	Entry threads: 2 x M20 / 1 x M25
Type HV	Entry threads: 3 x M25

Operating temperature	
Operational	-40°C to +70°C (-40°F to +158°F)

Power requirements	
Type PB	Lithium battery - life-time depends upon settings - up to several years.
Note:	*When battery powered, the backlight is operational in a limited way to save power.*
Type PD	9-27V DC. Power consumption max. 4.5 W (T6) or 9.2 W (T5).
Type PX	9 – 27V DC. Power consumption max. 4.5 W (T6) or 9.2 W (T5).
Type AH	Loop powered, analog output. 11 – 27V DC, Output disabled <3.5mA. Power consumption max. 675 mW (25mA) at 27V DC.
Note:	*The loop powered analog output cannot power the backlight, mechanical relay output (OR) or the real sensor supply (terminal P3).*

Sensor excitation	
Type AH/PB/PX	Terminal S3: 3V DC for pulse signals and 1.2V DC for coil pick-up.
Note:	*This is not a real sensor supply. Only suitable for pulse sensors with a very low power consumption like coils (sine wave) and reed-switches. I_{out} max. 100uA*
Type PD	Terminal P3: 8.2 – 12 and 24V DC 8.2V DC – I_{out} max. 20mA (Supply voltage should be at least 12V) 12V DC – I_{out} max. 30mA (Supply voltage should be at least 15V) 24V DC – I_{out} max. 75mA (this voltage varies depending on the input supply voltage and is approximately 1V lower)

Terminal connections	
P1-P3, S1-S6, R1-R6, E1-E3 Type:	Removable plug-in terminal strip with screw terminals IEC: 320V / 17.5A / 0.2-1.5 mm² UL: 300V / 10A / AWG 28 – AWG 16 Screw tightening with 0.4-2.5 sized blade with torque: 0.2 – 0.25 Nm Cable stripping length 7mm
P5-P7, R7-R10	Removable plug-in terminal strip with screw terminals IEC: 400V / 23A / 0.2-4 mm² UL: 300V / 20A / AWG 30 – AWG 12 Screw tightening with 0.6-3.5, PH0, PZ0 sized blade with torque: 0.4 – 0.5 Nm Cable stripping length 7mm
PE external / internal	External: nominal cross section 4 mm², possible conductors 4 mm² / AWG 12 stranded, 6 mm² / AWG 10 single wire. Internal: cross-section area of bonding conductor shall be at least 1,0 mm² / 18 AWG.
Note:	All wiring must be in accordance with local codes and regulations.

Data protection	
Type	EEPROM backup of settings. Backup of running totals every minute. Data retention at least 10 years.
Password	Configuration settings can be password protected.

Hazardous area	
Explosion proof	**ATEX approvals:** **power consumption ≤ 4.5 W** II 2 G Ex d IIC T6 Gb II 2 D Ex tb IIIC T85°C Db **power consumption ≤ 9.2 W** II 2 G Ex d IIC T5 Gb II 2 D Ex tb IIIC T100°C Db **IECEx approval:** **power consumption ≤ 4.2 W** Ex d IIC T6 Gb Ex tb IIIC T85 °C Db **power consumption ≤ 9.2 W** Ex d IIC T5 Gb Ex tb IIIC T100 °C Db **CSA (c us) approval:** Pending according XP Cl I, Div 1, Grps A, B, C, D. DIP Cl II/III, Div 1, Grps E, F, G. T5/T6. **FM approval:** Pending according XP Cl I, Div 1, Grps A, B, C, D. DIP Cl II/III, Div 1, Grps E, F, G. T5/T6. Ambient Ta: -40°C to +70°C (-40°F to +158°F) Enclosure: IP66/67, NEMA 4X

Directives & Standards	
EMC	EN 61326-1 and FCC 47 CFR part 15
Low voltage	EN/IEC 61010-1
ATEX / IECEx	EN/IEC 60079-0, EN/IEC 60079-1, EN/IEC 60079-7, EN/IEC 60079 -31
FM	FM Class No. 3600, FM Class No. 3615
CSA	CSA 22.2 No. 30, CSA 22.2 No.94-M91
IP & NEMA	EN 60529 & NEMA 250

INPUTS

Flowmeter	
Type P	Coil/sine wave (minimum 20mVp-p 90mVpp– sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8/12/24V DC.
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.
Option ZF	coil sensitivity 10mVpp
Option ZG	coil sensitivity 5mVpp.

External	
Type	Internally pulled-up switch contact Function acts at falling edge (Vin < 0.8V)
Function	• Terminal input to reset total remotely. • If this terminal input is closed, the “clear total” function is disabled.
Duration	Minimum pulse duration 200msec.

OUTPUTS

Analog output	
Type AH	Galvanically isolated, loop powered 4 – 20mA output
Function	Transmitting flowrate.
Accuracy	12 bit. Error < 0.1%. Analog output signal can be scaled to any desired range.

Digital output(s)	
Function	One pulse output – transmitting accumulated total.
Frequency	Max. 500Hz. Pulse length user definable between 1msec up to 10 seconds.
Type OT	Passive transistor output (NPN) – not isolated. Load max. 50V DC – 300mA@25°C.
Type OR	Output Relay, contact rating 2 A for resistive loads, 0.5 A for inductive loads. At 30 Vdc or 125 - 250 Vac.

Communication option	
Functions	Reading display information, reading / writing all configuration settings.
Protocol	Modbus RTU and ASCII
Speed	1200 - 2400 - 4800 - 9600 baud
Addressing	maximum 255 addresses.
Type CB	RS232
Type CH	RS485 2-wire
Type CU	USB

OPERATIONAL

Operator functions	
Displayed functions	• total and/or flowrate. • total and accumulated total.
note:	total can be reset to zero by pressing the CLEAR-key twice.
	• Indicating speedometer for flowrate.

Note !

Total	
Digits	7 digits.
Units	oil bbl – cf - igal – US gal - m3 - L - no unit
Decimals	0 - 1 - 2 or 3.
Note	Total can be reset to zero.

Note !

Accumulated total	
Digits	11 digits.
Units / decimals	according to selection for total.
Note	Accumulated total cannot be reset to zero.

Note !

Flowrate	
Digits	7 digits.
Units	rev - cf – oil bbl – I gal - US gal - m3 - l - ml – P - NL - Nm3 - scf - no unit
Bargraph speedometer	20 blocks, each block is 5% of total span
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the E112-P is going to be installed or while it is in operation.

Flowmeter does not generate pulses:
Check:
- Signal selection SETUP – 4.1,
- Pulse amplitude (par. 4.4.3.),
- Flowmeter, wiring and connection of terminal connectors (par. 4.4.3.),
- Power supply of flowmeter (par. 4.4.2.).

Flowmeter generates "too many pulses":
Check:
- Settings for Total and Flowrate,
- Type of signal selected with actual signal generated.
- Sensitivity of coil input.
- Proper grounding of the E112-P, avoid ground loops.
- Use screened wire for flowmeter signals and connect screen to the ground input terminal of the flowmeter input.

Analog output does not function properly:
Check:
- SETUP 5.1 - is the function enabled?
- SETUP 5.2 / 5.3: are the flow-levels programmed correctly?
- Connection of the external power-supply according to the specification.

Pulse output does not function:
Check:
- SETUP 7.1 - pulse per “x” quantity; is the value programmed reasonable?
- SETUP 7.2 - impulse width; is the external device able to recognize the selected pulse width and frequency?

Flowrate displays "0 / zero" while there is flow (total is counting):
Check:
- SETUP 2.2 / 2.5: are the K-factor and time unit correct?
- SETUP 2.6 / 2.7: The unit has to count the number of pulses according to SETUP 2.6 within the time according to SETUP 2.7. Make sure that 2.7 is set to 10.0 seconds for example: the result is that the unit has at least 10 seconds time to measure the number of pulses according to SETUP 2.6.

Linearization does not work:
Check:
- SETUP 5.G: is the function enabled?
- SETUP 5.1-5.F: are all M-Factors and the frequency entered correctly?

The password is unknown:
If the password cannot be retrieved, there is only one possibility left: call your supplier.

ALARM
When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the 5-digit error code. The codes are:

0001: irrecoverable display-data error: data on the display might be corrupted.
0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.
0003: error 1 and error 2 occurred simultaneously

If the alarm occurs more often or stays active for a long time, please contact your supplier.

APPENDIX C: MODBUS COMMUNICATION VARIABLES

GENERAL

The tables below show the various variables that can be used for communication.
The E112-P 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).

Currently, the functions supported are function 3 Read Holding Registers (4X references) and function 16 Preset Multiple Registers (4X references). The shown communication variables, indicated by the column VAR, show protocol addressed in decimal representation, followed by its hexadecimal representation (0x0000). When the PLC address range is required (4X references typically used by PLCs), please add a value of 40001 to the protocol address. E.g. reading the serial number with PLC-based addressing means reading 165 + 40001 = register 40166.

Variables spanning multiple registers use 'little-endian' data representation. This means that the lowest register holds the least significant word of the variable. Although most Modbus masters will support variables that span 2 registers, variables spanning more registers sometimes require you to manually calculate the resulting value.

Following example shows how data is represented and how this calculation can be accomplished:

For a total-value of 158928, the following register data has been received by the Modbus master:

register 566 = 0x6CD0 = 27856
register 567 = 0x0002 = 2
register 568 = 0x0000 = 0

If we interpret this as a long integer value, it's value would be: 0x0000.0002.6CD0 = 158928.
*If this value needs to be calculated: 0*65536*65536 + 2*65536 + 27856 = 158928.*

For additional information regarding using your Fluidwell Modbus device, please read the 'Fluidwell General Modbus Communication Protocol' and 'Modbus troubleshooting guide' that are available through our website or your distributor.

RUNTIME VARIABLES OF THE E112-P

VAR	RUN-TIME VALUES	REGs	R/W	TYPE	VALUE / REMARKS
572d 0x23C	flow rate	2d	r	uint32	0…9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
566d 0x236	total	3d	r	uint48	0…9999999999 Representation: unit, decimals depending on variables 32, 33
560d 0x230	accumulated total	3d	r	uint48	0…99999999999999 Representation: unit, decimals depending on variables 32, 33
37d 0x025	error status	1d	r	uint16	Bitfield: 0x0001=Display error 0x0002=EEPROM error 0x0004=EEPROM initialization error 0x0010= IO configuration error 0x0020= IO configuration error 0x0040=Linearization error (calculated M-factor out of range)

Reading flowrate, total or accumulated total: The returned values are given including the decimals and represent the actual value. The given value may differ from the value that is displayed on the display – this is due to the fact that the display is limited in the number of digits and may have a slower update rate set. 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 the setting in "total decimals" which is in this case 2)..

Clearing total: It is possible to clear the total counter by means of writing 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.

SETUP VARIABLES OF THE E112-P

VAR	TOTAL	REGs	R/W	TYPE	VALUE / REMARKS		
32 0x020	unit	1	r/w	uint8	0=none 3= igal 6=L	1= oil bbl 4= US gal	2=cf 5=m3
33 0x021	decimals	1	r/w	uint8	0…3		
?? 0x0??	X factor	1	r/w	uint8	0=x1 3=x1000	1=x10	2=x100
34 0x022	K-factor	2	r/w	uint32	1...9999999 Representation: 0.000010…9999999 depending on variable 54: decimals K-factor.		
37 0x025	decimals K-factor	1	r/w	uint8	0…6		
VAR	**FLOWRATE**	**REGs**	**R/W**	**TYPE**	**VALUE / REMARKS**		
48 0x030	unit	1	r/w	uint8	0=mL 3=mg 6=ton 9=lb 12=none 15=NL	1=L 4=g 7=gal 10=cf 13=scf 16=p	2=m3 5=kg 8=bbl 11=rev 14=NM3
49 0x031	time unit	1	r/w	uint8	0=sec 3=day	1=min	2=hour
50 0x032	decimals	1	r/w	uint8	0…3		
55 0x037	number of pulses	1	r/w	uint8	1...255		
56 0x038	cut-off time	1	r/w	uint16	1...9999 Representation: 0.0001 – 9.999 sec		
51 0x033	K-factor	2	r/w	uint32	1...9999999 Representation: 0.000010…9999999 depending on variable 54: decimals K-factor.		
54 0x036	decimals K-factor	1	r/w	uint8	0…6		
VAR	**DISPLAY**	**REGs**	**R/W**	**TYPE**	**VALUE / REMARKS**		
64 0x040	display function	1	r/w	uint8	0=total	1=flowrate	
80 0x050	LCD update time	1	r/w	uint8	0=fast 3=15sec	1=1sec 4=30sec	2=3sec 5=off
67 0x043	backlight brightness	1	r/w	uint8	0=off 3=60%	1=20% 4=80%	2=40% 5=100%
58 0x03A	bargraph enable	1	r/w	uint8	0=disable	1=enable	
59 0x03B	Bargraph range	3	r/w	uint32	0…9999999		

VAR	FLOWMETER	REGs	R/W	TYPE	VALUE / REMARKS
96 0x060	flowmeter signal	1	r/w	uint8	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.8.1V 10=act. 12V 11=act.24V
32d 0x020	Unit K-factor	1	r/w	uint8	0=none 1= oil bbl 2=cf 3= igal 4= US gal 5=m^3 6=L
34d 0x022	K-factor	2	r/w	uint32	1...9999999 Representation: 0.000010…9999999 depending on variable 54: decimals K-factor.
37d 0x025	decimals K-factor	1	r/w	uint8	0…6
VAR	**LINEARISATION**	**REGs**	**R/W**	**TYPE**	**VALUE / REMARKS**
1024 (400h)	linearization table entry	3	r/w	struct 2x uint24	The linearization table is an **INDEXED** variable. Reading and writing the entries of the linearization tables 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.) The 3 registers represent a structure containing 2 variables of each 3 bytes. The three least significant bytes (register 400 and LSB of register 401) contain the frequency part, the three most significant bytes (MSB of register 401 and register 402) contain the M-factor part. Valid range for the frequency is 0.000 to 9999Hz. Decimal point dependant 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.
1038 (40Eh)	linearization on/off	1			0=disable 1=enable
1039 (40Fh)	Decimals	1			0…3 This variable selects the number of decimals used for the frequencies entered in the linearization table.
VAR	**ANALOG OUTPUT**	**REGs**	**R/W**	**TYPE**	**VALUE / REMARKS**
112 0x070	analog output	1	r/w	uint8	0=disable 1=enable
113 0x071	minimum rate	2	r/w	uint32	0…9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
116 0x074	maximum rate	2	r/w	uint32	0…9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
119 0x077	cut off percentage	1	r/w	uint8	0...99 Representation: 0.0 – 9.9%
120 0x078	tune minimum rate	1	r/w	uint16	0...9999
122 0x07A	tune maximum rate	1	r/w	uInt16	0...9999
99 0x063	filter	1	r/w	uint8	0...99

VAR	PULSE OUTPUT	REGs	R/W	TYPE	VALUE / REMARKS
128 0x080	impulse time width	1	r/w	uint8	0…9999 Representation: 0.001 – 9.999 sec
130 0x082	Impulse quantity decimals	1	r/w	uint8	0…3
129 0x081	pulse per X quantity	2	r/w	uint32	1...9999999 Representation: 0.000001…9999999 depending on variables 130, 32
VAR	**COMMUNICATION**	**REGs**	**R/W**	**TYPE**	**VALUE / REMARKS**
144 0x090	speed (baudrate)	1	r/w	uint8	0=1200 1=2400 2=4800 3=9600
145 0x091	Modbus address	1	r/w	uint8	1…255
146 0x092	Modbus mode	1	r/w	uint8	0=off 1=RTU 2=ASCII
VAR	**OTHERS**	**REGs**	**R/W**	**TYPE**	**VALUE / REMARKS**
160 0x0A0	model number	1	r	uint16	0…9999
173 0x0AD	model suffix	1	r	char	Representation:ASCII character
162 0x0A2	firmware version	2	r	uint32	0…999999 Representation: xx.xx.xx
165 0x0A5	serial number	2	r	uint32	0…9999999
168 0x0A8	password	1	r	uint16	0…9999
139 0x08B	keyboard lock	1	r/w	uint8	0=disable 1=enable
170 0x0AA	tag number	2	r/w	uint32	0...9999999

APPENDIX D TYPE OR MODEL CODING ON THREAD SIZE LABEL

In addition to the thread sizes the thread size label will also show information regarding the exact model or type code. The code uses letter and digit combinations. The model designation E112-P… is subject to change to indicate the specific hardware and software functionality. All model configurations that are safety related (like –PD, –OR) will always be shown. The table below gives an overview of the currently available model types and is subject to change.

Ordering information: E112	-P	-AH	-C	-H	-IB	-OT	-P	-XD	-Z
Flowmeter input signal									
A Pending: (0)4 - 20mA input.									
P Pulse input: coil, npn, pnp, namur, reed-switch.									
U Pending: 0 - 10V DC input.									
Analog output signal									
AH Galvanically isolated, loop powered 4-20mA output.									
Communication									
CB RS232 communication - Modbus RTU.									
CH RS485 communication - 2wire - Modbus RTU.									
CU USB communication incl. EXd plug - requires HA / HB / HH / HN / HO or HV.									
CX No communication.									
Aluminum EXd enclosure, IP67 / NEMA4X									
HA Entry threads: 2 x 3/4"NPT / 1 x 1"NPT.									
HB Entry threads: 3 x 3/4"NPT.									
HC Entry threads: 2 x 1/2"NPT / 1 x 1"NPT.									
HD Entry threads: 2 x 1/2"NPT / 1 x 3/4"NPT.									
HG Entry threads: 2 x M20 / 1 x M25.									
HH Entry threads: 3 x M25.									
Stainless steel 316L EXd enclosure, IP67 / NEMA4X									
HN Entry threads: 2 x 3/4"NPT / 1 x 1"NPT.									
HO Entry threads: 3 x 3/4"NPT.									
HP Entry threads: 2 x 1/2"NPT / 1 x 1"NPT.									
HR Entry threads: 2 x 1/2"NPT / 1 x 3/4"NPT.									
HU Entry threads: 2 x M20 / 1 x M25.									
HV Entry threads: 3 x M25.									
Additional input signal									
IB Remote input to reset total or to lock the "clear total" button.									
Digital output signal									
OR Mechanical make-and-break relay - requires type PD.									
OT Passive transistor output - standard configuration.									
Power requirements									
PB Lithium battery powered.									
PD 9 - 27V DC + sensor supply.									
PX Basic power input 8 - 27V DC (no real sensor supply).									
Hazardous area									
XD Explosion proof enclosure according ATEX and IECEx (CSA and FM pending).									
Other options									
ZF Coil input 10mVpp.									
ZG Coil input 5mVpp.									
ZL Data logging to survey information.									
ZX No options, backlight is included as standard.									

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LIST OF FIGURES IN THIS MANUAL

DECLARATION OF CONFORMITY

Declaration of Conformity

Fluidwell E- series indicators

Veghel, February 2015

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 Harmonized Standards, when installed and operated according to the manual:

EMC Directive 2004/108/EC	EN61000-6-2:2005, EN61000-6-3:2007 EN61326-1:2006
RoHS Directive 2011/65/EU	EN 50581:2012
ATEX Directive 94/9/EC	EN60079-0:2012 EN60079-1:2007 EN60079-31: 2009
Protective system for power consumption ≤ 4.2W:	II 2 G Ex d IIC T6 Gb II 2 D Ex tb IIIC T85 °C Db
Protective system for power consumption ≤ 9.2W:	II 2 G Ex d IIC T5 Gb II 2 D Ex tb IIIC T100 °C Db
Certificate:	DEKRA 14ATEX0006 X

Notified body 0344: DEKRA Certification BV, Meander 1051, 6825 MJ, Arnhem, The Netherlands.

Additionally, for options applicable or safe area versions:
Low Voltage Directive 2006/95/EC EN61010-1: 2010
The last two digits of the year in which the CE marking was affixed: 13.

Fluidwell BV

I. Meij, Product Manager

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

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IBAN: NL73 INGB 0666 3960 78
USD account no.: 02.20.81.771
IBAN: NL22 INGB 0022 0817 71

All agreements, sales and deliveries are in accordance with our General Terms and Conditions which are available on our website or upon request. Any other conditions are herewith explicitly rejected by us.

LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL		Enter your settings here	
1.1 unit	L		
1.2 decimals	0000000		
1.3 multiply factor	x1		
1.4 K-factor	0000001		
1.5 decimals K-factor	0		
2 - FLOWRATE			
2.1 unit	L		
2.2 time unit	/min		
2.3 decimals	0000000		
2.4 calculation / pulses	010		
2.5 cut-off time	30.0 sec.		
2.6 K-factor	0000001		
2.7 decimals K-factor	0		
3 - DISPLAY			
3.1 function	total		
3.2 LCD-new	1 sec		
3.3 backlight	0		
3.4 bargraph	enable		
3.5 ratespan	1000		
4 - FLOWMETER			
4.1 signal	coil-lo		
4.2 unit K-factor	L		
4.3 K-factor	0000001		
4.4 decimals K-factor	0		
5 - LINEARIZE			
5.1 frequency	0.0Hz		
M-Factor	1.000000		
5.2 frequency	0.0Hz		
M-Factor	1.000000		
5.3 frequency	0.0Hz		
M-Factor	1.000000		
5.4 frequency	0.0Hz		
M-Factor	1.000000		
5.5 frequency	0.0Hz		
M-Factor	1.000000		
5.6 frequency	0.0Hz		
M-Factor	1.000000		
5.7 frequency	0.0Hz		
M-Factor	1.000000		
5.8 frequency	0.0Hz		
M-Factor	1.000000		
5.9 frequency	0.0Hz		
M-Factor	1.000000		

SETTING	DEFAULT	DATE :	DATE :
5 – LINEARIZE (cont)		Enter your settings here	
5.A frequency	0.0Hz		
M-Factor	1.000000		
5.B frequency	0.0Hz		
M-Factor	1.000000		
5.C frequency	0.0Hz		
M-Factor	1.000000		
5.D frequency	0.0Hz		
M-Factor	1.000000		
5.E frequency	0.0Hz		
M-Factor	1.000000		
5.F frequency	0.0Hz		
M-Factor	1.000000		
6G linearization	disabled		
6H decimals frequency	1111.1		
6 - ANALOG OUTPUT			
6.1 output	disabled		
6.2 min. flowrate 4-mA	0000000		
6.3 max. flowrate 20mA	9999999		
6.4 cut off percentage	0.0%		
6.5 tune min - 4mA	0208		
6.6 tune max - 20mA	6656		
6.7 filter	0 (off)		
7 - PULSE			
7.1 width	000 periods		
7.2 decimals	0		
7.3 amount	0001000		
8 - COMMUNICATION			
8.1 baud-rate	9600		
8.2 address	1		
8.3 mode	BUS-RTU		
9 - OTHERS			
9.1 model	E112-P	E112-P	E112-P
9.2 software version	03-03_ _	03-03_ _	03-03_ _
9.3 serial number			
9.4 password	0000		
9.5 keyboard lock	enabled		
9.6 tagnumber	0000000		

Limited Warranty Policy

Great Plains Industries, Inc. 5252 E. 36th Street North, Wichita, KS USA 67220-3205, hereby provides a limited warranty against defects in material and workmanship on all products manufactured by Great Plains Industries, Inc. This product includes a 2 year warranty. Manufacturer's sole obligation under the foregoing warranties will be limited to either, at Manufacturer's option, replacing or repairing defective Goods (subject to limitations hereinafter provided) or refunding the purchase price for such Goods theretofore paid by the Buyer, and Buyer's exclusive remedy for breach of any such warranties will be enforcement of such obligations of Manufacturer. The warranty shall extend to the purchaser of this product and to any person to whom such product is transferred during the warranty period.

The warranty period shall begin on the date of manufacture or on the date of purchase with an original sales receipt. This warranty shall not apply if:

A. the product has been altered or modified outside the warrantor's duly appointed representative;

B. the product has been subjected to neglect, misuse, abuse or damage or has been installed or operated other than in accordance with the manufacturer's operating instructions.

To make a claim against this warranty, contact the GPI Customer Service Department at 316-686-7361 or 888-996-3837. Or by mail at:

Great Plains Industries, Inc.
5252 E. 36th St. North,
Wichita, KS, USA 67220-3205

If you are outside North or South America contact:

Great Plains Industries – Australia
1/16 Atkinson Road,
Taren Point NSW 2229, Sydney, Australia

The company shall, notify the customer to either send the product, transportation prepaid, to the company at its office in Wichita, Kansas, or to a duly authorized service center. The company shall perform all obligations imposed on it by the terms of this warranty within 60 days of receipt of the defective product.

GREAT PLAINS INDUSTRIES, INC., EXCLUDES LIABILITY UNDER THIS WARRANTY FOR DIRECT, INDIRECT, INCIDENTAL AND CONSEQUENTIAL DAMAGES INCURRED IN THE USE OR LOSS OF USE OF THE PRODUCT WARRANTED HEREUNDER.

The company herewith expressly disclaims any warranty of merchantability or fitness for any particular purpose other than for which it was designed.

This warranty gives you specific rights and you may also have other rights which vary from U.S. state to U.S. state.

Note: In compliance with MAGNUSON MOSS CONSUMER WARRANTY ACT – Part 702 (governs the resale availability of the warranty terms).

Wichita · Sydney · Mexico City

GREAT PLAINS INDUSTRIES GPI

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