E018-P

EXPLOSION PROOF FLOWRATE INDICATOR / TOTALIZER

HART COMMUNICATION FOUNDATION

Signal input flowmeter: pulse, NAMUR and coil

Signal outputs: Analog referenced flowrate and scaled or unscaled pulse referenced total

Remote control: External reset with clear-lock

Options: HART communication and external reset

C US

FM APPROVED

E-Series - Explosion proof indicators for hazardous areas.

SAFETY INSTRUCTIONS

- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- LIFE SUPPORT APPLICATIONS: The E018-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 E018-P, the installer has to discharge himself by touching a well-grounded object.
- The E018-P must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).
- Do connect a proper grounding to the housing as indicated if the E018-P is used on a ship, truck or other application with no ground. The earth lead between the housing and the removable terminal-block may never be removed.

DISPOSAL OF ELECTRONIC WASTE

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

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 E018-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 the mains voltage and information on the manufacturer's plate before installing the E018-P.
- Check all connections, settings and technical specifications of the various peripheral devices with the E018-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 E018-P only if all leads are free of potential.
- 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 danger, 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 E018-P is described in chapter 2 “Operational”. 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 E018-P as well as most of the options available. For additional information, please contact your supplier.

A hazardous situation may occur if the E018-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 E018-P or connected instruments.

A "**caution !**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the E018-P or connected instruments

*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.*

WARRANTY AND TECHNICAL SUPPORT

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

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Software version	: 03.07.xx
Manual	: TU-E018-P-M_v0203_03_EN.docx
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1 INTRODUCTION

1.1 SYSTEM DESCRIPTION

Functions and features

The flowrate / totalizer model E018-P is an explosion proof microprocessor driven instrument designed to linearize the flowmeter's flow curve and to show the flowrate, the total and the accumulated total.

This product 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 designed to be just 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.
- 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) HART communication for configuring unit and monitoring process.

Flowmeter input

This manual describes the unit with a pulse type input from the flowmeter "-P version".

One flowmeter with a passive or active pulse, Namur or sine wave (coil) signal output can be connected to the E018-P. To power the sensor, several options are available.

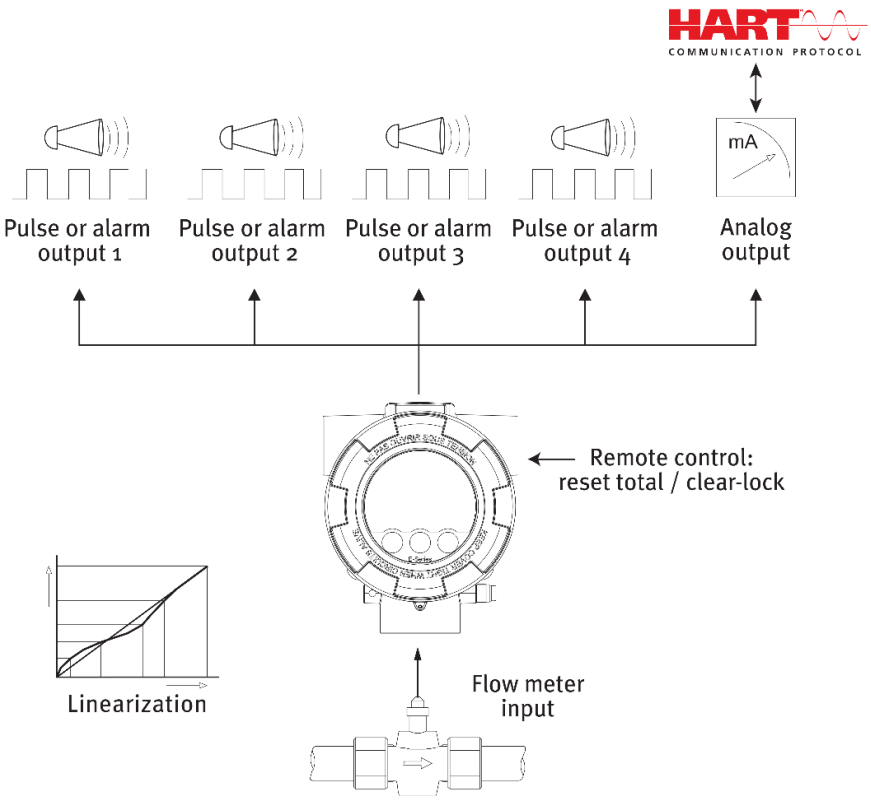


Fig. 1: Typical application for the E018-P

Standard outputs

- Configurable pulse output to transmit pulses representing a certain linearized total quantity. The pulse length can be set as desired with a maximum frequency of 500Hz for output R1 and R2 and 4Hz for output R3 and R4..
- Unscaled frequency output for retransmission of the incoming pulses as robust square wave forms.
- Up to 4 configurable alarm outputs: flow rate alarm, high-, low-, high-high- or low-low-flow rate alarm. Switched as long as the flow rate is too high or too low.
- Configurable linear 4-20mA isolated analog output with 12-bits resolution representing the actual flowrate.
  Flowrate levels as well as the minimum and maximum signal output can be tuned.

Configuration

The E018-P has been designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your E018-P according to your specific requirements.
It includes several important features, such as K-Factor, 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, please use of the power-management functions as described in chapter 3.

Display information

The E018-P has a large LCD with all kinds of symbols and digits to display measurement units, status information, trend-indication and key-word messages.
Flowrate and totals can be displayed either with the 11 small 7mm (0.28”) digits or with the 7 large 12mm (0.47”) digits. Additionally, the E018 has an analog speedometer to show the actual flowrate.

Backlight

A backlight is standard available. The intensity can be set as desired (externally powered only).
The backlight can even be used in battery powered applications: it will be switched on, at a fixed intensity, during a limited period of time and will switch off automatically, 3 seconds after a key touch.

Note !

For loop powered applications only, the backlight will not come on because of limited power.

Options

The following options are available: mechanical relay, power- and sensor-supply options.

2 OPERATIONAL

2.1 GENERAL INFORMATION

This chapter describes the daily use of the E018-P. This instruction is meant for users / operators.

- The E018-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 the front of this manual.

2.2 CONTROL PANEL

The optical keys are operated through the glass. The following keys are available:

Fig. 2: Control panel, optical keys

Functions of the keys

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

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

CLEAR-key
This key is used to CLEAR the value of total.
The CLEAR-key also provides access to historical day totals (or optional data logging).

Use of optical keys

The optical keys are designed to operate stable and will not be activated when the glass surface is not clean. However, 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.

Unlock / lock optical keys

To prevent any undesired operation of the optical keys and to save battery power, an automatic key-lock function is implemented. This function can be disabled at SETUP-menu Others.

When the optical keys are locked, the key lock symbol is shown at the top of the display as shown below.

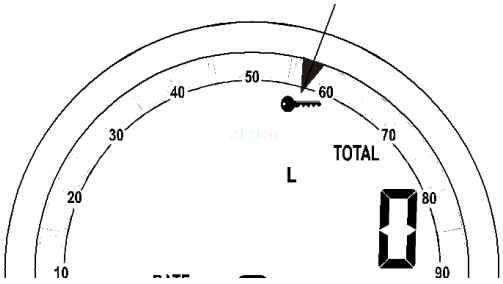


Fig. 3: Control panel, disable optical keys

To unlock the optical keys, the operator need to 'activate' the keys by pressing any of the keys for about 1 to 2 seconds. After activation, the backlight will light up (if enabled) and the display will hint the following sequence of keys for the operator to briefly touch after each other:

PROG – SELECT – CLEAR

When the sequence is successfully executed, the optical keys will be unlocked and the key lock symbol will disappear.

The optical keys are automatically locked after 30 seconds of inactivity. However, to lock the optical keys manually, touch the PROG and CLEAR key simultaneously for 3 seconds.

Enable or disable optical keys with on-off switch

Directly below 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. When the optical keys are disabled the key lock symbol will appear in the display and operation of the unit can only be performed with the mechanical push buttons.

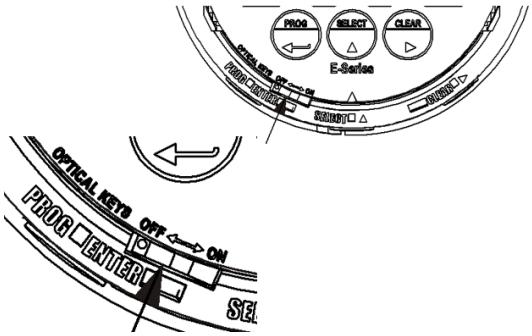


Fig. 4: Control panel, ON/OFF optical keys

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.

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 – SELECT – CLEAR. They operate in the same manner as the optical keys, and when pressed, the optical keys are disabled for 30 seconds to prevent any interference.

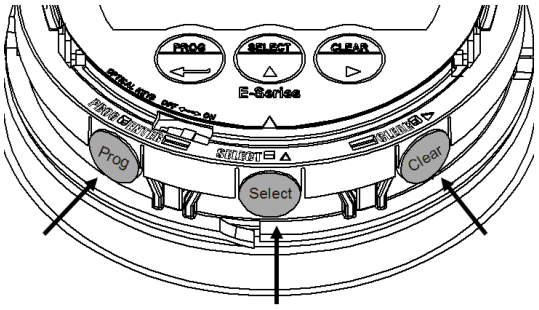


Fig. 5: Control panel, Push button operation

2.3 OPERATOR INFORMATION AND FUNCTIONS

Note !

Be aware that the optical keys may be locked and will not function.
Unlock the optical keys as described before.

By default, the E018-P will act at Operator level. The information displayed is dependent upon the SETUP-settings. Signals generated by the connected flowmeter are measured by the E018-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.

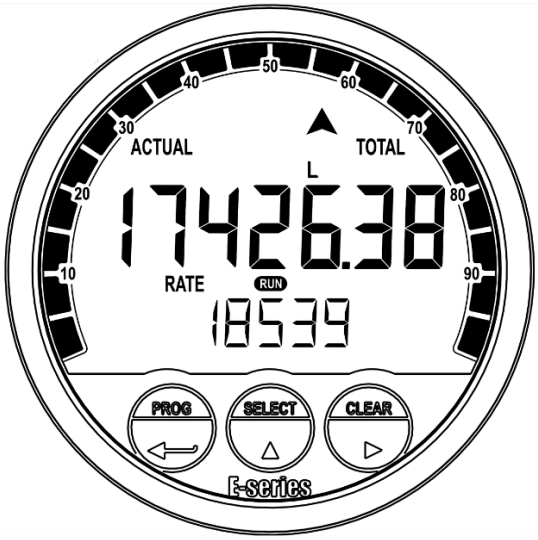


Fig. 6: Example of display information during process

For the Operator, the following functions are available:

Display process values

On the main screen, the primary process values of the E018-P are shown. By default, Total is shown on the upper-line of the display and Flowrate on the bottom line.
In the configuration settings for Display, this can be changed to show only Flowrate on the large 12mm digits or to show Total and Accumulated Total simultaneously. When Flowrate is shown, the arrows ▲▼ indicate the trend (increase or decrease) of the flowrate.
By pressing the SELECT-key, the operator can scroll through the screens showing the various process values. After 30 seconds of inactivity, the display will automatically return to the main screen.

The following table shows the available information:

Display information	SETUP-item **FUNCTION**		
	Total	**Flowrate**	**Acc. Total**
MAIN SCREEN	Total * Flowrate	Flowrate	Total * Acc. Total
SCREEN 1	Total * Acc. Total	Total * Acc. Total	Total * Flowrate
SCREEN 2 **	Alarm Lo-Lo	Alarm Lo-Lo	Alarm Lo-Lo
SCREEN 3 **	Alarm Lo	Alarm Lo	Alarm Lo
SCREEN 4 **	Alarm Hi	Alarm Hi	Alarm Hi
SCREEN 5 **	Alarm Hi-Hi	Alarm Hi-Hi	Alarm Hi-Hi

* *When total is shown on the display, it can be cleared by pressing the CLEAR-key twice.*
** *Available when display of alarm-values is enabled in SETUP-menu Display.*

Flowrate alarm indications

When the flowrate monitoring function is enabled and high or low flow is detected, the alarm-flag is shown on the display and the information on the bottom line will toggle between the normal information and an indication of the flowrate alarm (e.g. LO-LO ALARM).

Clear total

The value for Total can be cleared and reset to zero. This action does not influence the value of Accumulated Total or Current Day Total.
To clear Total, press the CLEAR-key when Total is shown on the display and the display will show the flashing text “PUSH CLEAR”. When the CLEAR-key is pressed a second time, Total is set to zero. To avoid clearing Total at this point, press the PROG- or SELECT-key or wait for 20 seconds.

Note !

- *If the ‘Total CLEAR password’ is set in the configuration settings for Total, the operator is asked to enter the password before the “PUSH CLEAR” text is shown. The correct password needs to be entered before Total can be cleared. (See paragraph 3.2.3.)*
- *The IB option (external reset) allows clearing of total via an external pushbutton. This clear action operates in parallel with the clear action via the control panel but does not require any extra confirmation or password. When the external connection is permanently closed, Total still counts but the ”Clear Total” function via the control panel is disabled.*

Display flowrate

Internally, the flowrate is calculated up to 8 times a second, To obtain a readable value, the flowrate shown on the display is updated once every second. Flowrate is shown, based on the configuration settings for Flowrate, with the configured number of decimals. The configured unit and time unit are indicated on the bottom line of the display.

When “-------“ is shown, the flowrate value is too high to be displayed. The arrows ▲ and ▼ indicate the trend (increase or decrease) of the flowrate.

Display total and accumulated total

A resettable Total and non-resettable Accumulated Total are available. The Total value can count up to 9.999.999 before rolling over to zero; the Accumulated total can count up to 99.999.999.999 before rolling over.
The unit and number of decimals are displayed according to the configuration settings for Total.

Display speedometer flowrate

Along the edge of the display, a percentage based impression of the actual flowrate is shown. The speedometer consists of 20 segments which run from 0 to 100% in increments of 5%. This function can be enabled or disabled in the SETUP-menu Display.

2.4 OPERATOR ALARMS

Low-battery alarm (Type PB only)

During operation the battery voltage drops. When the battery voltage becomes too low, the battery indicator comes on to show that the operation and indication become less reliable. When the battery indicator is on, install a fresh and new battery (as soon as possible) to keep a reliable operation and indication.

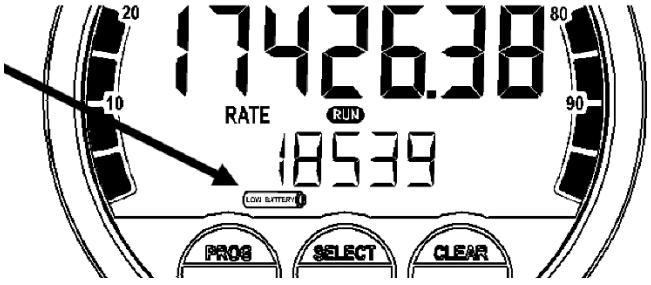


Fig. 7: Example of low-battery alarm

Alarm

When an internal alarm condition occurs, the alarm-flag is shown on the display.
After pressing the SELECT-key several times, the display will show the alarm code.
Please see Appendix B: Problem solving for an explanation of the available alarm codes.

3 CONFIGURATION

3.1 INTRODUCTION

This and the following chapters are exclusively meant for electricians and non-operators. In these, an extensive description of all software settings and hardware connections are 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 manual before carrying out its instructions.
- The E018-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by authorized personnel.
- Take careful notice of the “Safety rules, instructions and precautionary measures” in the front of this manual.

3.2 PROGRAMMING SETUP-LEVEL

WARNING

Changing the settings of the E018-P may have an influence on the current operation of the device, even when SETUP-level is still active.

Make sure that the unit is not being used for any application when altering the settings.

Note !

Be aware that the optical keys may be locked and will not function.

Unlock the optical keys as described before.

3.2.1 ENTERING SETUP-LEVEL

Configuration of the E018-P is done at SETUP-level, which can be reached at all times while the E018-P remains fully operational. At SETUP-level the display will deactivate the RUN indicator and activate the SETUP indicator.

Use the control panel to access SETUP-level

PROG

PROG-key

To enter SETUP-level, press the PROG-key for 7 seconds at OPERATOR-level.

During this time, the symbol will be displayed.

When SETUP-level is entered, a password might be required to continue. You can enter the password by following the procedure for programming values as described in the following paragraphs.

Note !

A password may be required to enter SETUP.

Without this password access to SETUP is denied.

3.2.2 NAVIGATING THROUGH SETUP-LEVEL

Each function has a unique menu-number, which is displayed below the SETUP indicator at the bottom of the display. The menu-number is a combination of two figures, e.g. 1.2. The first number indicates the function-group and the second number indicates the function. Additionally, each function and function-group is expressed with a keyword.

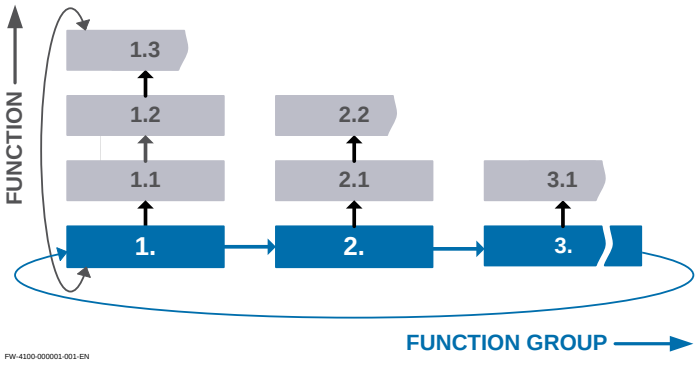


Fig. 8: SETUP matrix structure

Use the control panel to navigate through SETUP-level

PROG-key
When a function is selected, this key is used to start the programming sequence.
When only a function group is selected (and no function), this key is used to scroll back a function group (e.g. 3 → 2 → 1 → 3).

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

CLEAR-key
This key is used to select the previous function in the list (e.g. 1.2 → 1.1 → 1 → 2). When the bottom of the list is reached, it will return to the function group selection. When only a function group is selected (and no function), this key is used to scroll to the next function group. (e.g. 1 → 2 → 3 → 1).

3.2.3 PROGRAMMING SEQUENCE

After selecting a function at SETUP-level, a new value can be programmed using the control panel. A function either contains a value (a number with optionally a decimal point, e.g. 123.45) or a list with items (e.g. Disable – Enable).

For each function that needs to change, navigate to that function and follow the steps indicated below. During the programming sequence, the display will deactivate the SETUP indicator and activate the PROGRAM indicator.

Note !

When programming new values, alterations will only be set after the PROG-key has been pressed to confirm the new value! (STEP 3)

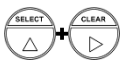
Step 1: Starting the programming sequence

PROG-key
When a function is selected at SETUP-level, this key is used to start the programming sequence.

Step 2a: Changing a value

SELECT-key
This key is used to increment the selected digit or to select de next position of the decimal point.
When the entered value is out of range, the increase sign ▲ or decrease-sign ▼ will be displayed while you are programming. If this value is confirmed by pressing the PROG-key, the value will be brought within a valid range automatically.

CLEAR-key
This key is used to select the next digit. If a decimal point can be set, this will be included in the sequence as well (e.g. [decimal point] → digit 1 → digit 2→ digit 3 → [decimal point].
Note that the selected decimal point is flashing when is can be changed. When no decimal point is selected, all available decimals will be flashing on the display to indicate this when the sequence reaches the decimal point.



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

Step 2b: Changing the selected item in a list

SELECT-key
This key is used to select the next item in the list (e.g. Disable → Enable).
At the end of the list, the selection will wrap around to the first selection.

CLEAR-key
This key is used to select the previous item in the list (e.g. Enable → Disable).
At the bottom of the list, the selection will wrap around to the last selection.

Step 3: Finishing the programming sequence

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

3.2.4 RETURNING TO OPERATOR-LEVEL

When all settings are configured correctly, the unit can be returned to OPERATE-level.
Please keep a record of all settings for later reference.

Use the control panel to return to OPERATE-level

PROG-key
In order to return to the operator level, press the PROG-key for three seconds.
When no keys are pressed for 2 minutes, SETUP-level will be left automatically.

3.3 CONFIGURATION SETTINGS

All settings of the E018-P can be set via the control panel. As an alternative, you can also use a HART communicator or the Remote Configuration Software which you can find on our website or through your supplier.
Depending on the type of communication interface your device has, you might need a specific communication cable, which is available through your supplier.

3.3.1 OVERVIEW FUNCTIONS SETUP-LEVEL

1	**TOTAL**		
	1.1	UNIT	L – m3 – US gal – I gal – cf – oil bbl – kg – ton – US ton – lb – (none)
	1.2	DECIMALS	0 – 0.1 – 0.02 – 0.003
	1.3	K-FACTOR	0.000010 – 9999999
	1.4	CLEAR PASSWORD	000 – 999
2	**FLOWRATE**		
	2.1	UNIT	mL – L – m3 – g – kg – ton – US ton – US gal – I gal – Oil bbl – lb – cf – rev – none – scf – nm3 – nL
	2.2	TIME	/sec – /min – /hour – /day
	2.3	DECIMALS	0 – 0.1 – 0.02 – 0.003
	2.4	K-FACTOR	0.000010 – 9999999
	2.5	CALCULATION	per 1 – 255 pulses
	2.6	CUT-OFF	0.1 – 999.9 seconds
	2.7	DAMPING	0.1 – 999.9 seconds
3	**ALARM**		
	3.1	FLOWZERO	default – no relays – ignore
	3.2	ALARM LL	0000.000 – 9999999
	3.3	ALARM LO	0000.000 – 9999999
	3.4	ALARM HI	0000.000 – 9999999
	3.5	ALARM HH	0000.000 – 9999999
	3.6	DELAY LL	0.0 – 999.9 seconds
	3.7	DELAY LO	0.0 – 999.9 seconds
	3.8	DELAY HI	0.0 – 999.9 seconds
	3.9	DELAY HH	0.0 – 999.9 seconds
4	**DISPLAY**		
	4.1	FUNCTION	total – flowrate – acc. total
	4.2	ALARMSET	operator – setup – hidden
	4.3	LCD NEW	fast – 1 sec – 3 sec – 15 sec – 30 sec – off
	4.4	BACKLIGHT (brightness)	0% – 20% – 40% – 60% – 80% – 100%
	4.5	BL ALARM	off – flash – on (red backlight indication during flowrate alarm condition)
	4.6	BARGRAPH	enable – disable
	4.7	RATESPAN	0000000 – 9999999
5	**FLOWMETER**		
	5.1	SIGNAL	NPN – NPN_LP – REED – REED_LP – PNP – PNP_LP – NAMUR – Coil_Hi – Coil_Lo – Act_8.2 (8.2V DC) – Act_24 (24V DC)
6	**LINEARISE**		
	6.1	FREQ. / M-FACTOR 1	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	6.2	FREQ. / M-FACTOR 2	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	6.3	FREQ. / M-FACTOR n	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	↕	↕	↕
	6.F	FREQ. / M-FACTOR 15	0000.1 – 9999.9 Hz / 0.000001 – 9.999999
	6.G	LINEARIZATION	enable – disable
	6.H	DECIMALS FREQUENCY	0 – 0.1 – 0.02 – 0.003
7	**ANALOG**		
	7.1	RATE-MIN (4mA)	-999999 – 999999
	7.2	RATE-MAX (20mA)	-999999 – 999999
	7.3	TUNE-MIN (4mA)	0000 – 9999
	7.4	TUNE-MAX (20mA)	0000 – 9999

8	**PULSE**		
	8.1	RELAY 1	off – lo-lo – lo – hi – hi-hi – all – scaled pulse – retransmission
	8.2	RELAY 2	off – lo-lo – lo – hi – hi-hi – all – scaled pulse
	8.3	RELAY 3	off – lo-lo – lo – hi – hi-hi – all – scaled pulse
	8.4	RELAY 4	off – lo-lo – lo – hi – hi-hi – all – scaled pulse
	8.5	WIDTH	0.000 – 9.999 sec
	8.6	AMOUNT	0000.001 – 9999999
9	**COM-HART**		
	9.1	ADDRESS	0 – 63
	9.2	LOOP CURRENT	enable – disable
	9.3	LOOP TEST	Off – set 4mA (fixed) – set 20mA (fixed)
10	**OTHERS**		
	10.1	MODEL	E018-P
	10.2	SOFTWARE VERSION	xx:xx:xx
	10.3	SERIAL NO	xxxxxxx
	10.4	PASSWORD	0000 – 9999
	10.5	KEY LOCK	enable – disable
	10.6	TAG NO	0000000 – 9999999

3.3.2 EXPLANATION OF SETUP-MENU 1 – TOTAL

Caution !

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

Note !

- *The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate.*
- *Please see paragraph 3.3.6. for an explanation and examples on calculating and configuring the K-factors for Total and Flowrate.*

1	**TOTAL**	
1.1	UNIT	This setting determines the measurement unit for total, accumulated total and the scaled pulse output. The following units can be selected: l – m3 – US gal – I gal – cf – Oil bbl – kg – ton – US ton – lb - ---- (no unit).
1.2	DECIMALS	The decimal point determines for Total and accumulated Total the number of digits following the decimal point. The following can be selected: 0, 0.1, 0.02, 0.003
1.3	K-FACTOR	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. Note ! *After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.*
1.4	CLEAR PASSWORD	Clearing Total by the Operator can be password protected. This protection is disabled with value 000 (zero). A 3 digit password can be programmed, for example 123.

3.3.3 EXPLANATION OF SETUP-MENU 2 – FLOWRATE

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

- *The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate.*
- *The display update time for flowrate is one second or more.*
- *Please see paragraph 3.3.6. for an explanation and examples on calculating and configuring the K-factors for Total and Flowrate.*

2	**FLOWRATE**	
2.1	UNIT	This setting determines the measurement unit for flowrate. The following units can be selected: mL; L; m3; US gal; I gal; cf; oilbbl; nL; nm3; scf; g; kg; ton; lb; US ton; rev; ---- (none) *Alteration of the measurement unit will NOT affect operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.*
2.2	TIME	The flowrate can be calculated per /sec - /min - /hour - /day.
2.3	DECIMALS	This setting determines for flowrate the number of decimals. The following can be selected: 0; 0.1; 0.02; 0.003. *Changes to the number of decimals (SETUP 2.3) will also change the decimal setting for the URV and LRV (SETUP 7.1 and SETUP 7.2) and RATE SPAN (SETUP 4.7). Therefore it is best practice to first determine the required decimals for the flowrate!*
2.4	K-FACTOR	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. *After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.*
2.5	CALCULATION	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. • *This setting does influence the update time for the analog output directly (maximum update 8 times a second). If the output response is too slow, decrease the number of pulses.* • *The lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).* • *For low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.* *For high frequency application (above 1kHz) program a value of 50 or more pulses.* • *Keep in mind that values higher than 200 in combination with low frequencies, will result in slow updates of the indicated flow rate and analog output.*
2.6	CUT-OFF	With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 2.5) are generated, the flowrate will be displayed as zero. The cut-off time has to be entered in seconds - maximum time is 999 seconds (about 15 minutes).

2.7	DAMPING	This sets the step-response time of the flowrate measurement. The step-response time is the time it takes for the displayed value (and thus the analog output value) to reach 63% of the final value. For example, when the flowrate increases from 10 to 100 l/s and the damping is set to 10 seconds, the analog output (and the displayed value) will increase to: 10 + 0,63 x (100-10) = 66l/sec after 10 sec. eventually it will display 100 l/sec.

3.3.4 EXPLANATION OF SETUP-MENU 3 – ALARM

The following settings determine how the flowrate will be monitored and the functionality of the transistor outputs D1-D4 and optional relay outputs D5-D6, when configured to transmit the alarm status in the Pulse output menu (SETUP-menu 8).

Note !

- *For transistor / relay output functions: read SETUP-menu 8 – Pulse output.*
- *The flowrate alarms are visible in HART.*
  - A low alarm will set dev.statusbit 14.5
  - A high alarm will set dev.statusbit 14.6

3	**ALARM**	
3.1	FLOWZERO	When the flowrate is zero, then it is possible to ignore or disable the flowrate monitoring. The following settings can be selected: DEFAULT: in case of a low-flowrate alarm and zero flow, it will switch the alarm output and indicate the alarm on the display. NO RELAY: in case of a low-flowrate alarm and zero flow, it won't switch the alarm output but will indicate the alarm on the display only. IGNORE: in case of a low-flowrate alarm and zero flow, it won't switch the alarm output and nothing will be indicated on the display.
3.2	ALARM LL	The low-low alarm is set with this setting. An alarm will be generated as long as the flowrate is lower as this. With value 0.0 this function is disabled.
3.3	ALARM LO	The low alarm is set with this setting. An alarm will be generated as long as the flowrate is lower as this. With value 0.0 this function is disabled.
3.4	ALARM HI	The high alarm is set with this setting. An alarm will be generated as long as the flowrate is higher as this. With value 0.0 this function is disabled.
3.5	ALARM HH	The high-high alarm is set with this setting. An alarm will be generated as long as the flowrate is higher as this. With value 0.0 this function is disabled.
3.6	DELAY LL	An alarm generated by SETUP 3.2 “low-low” can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.
3.7	DELAY LO	An alarm generated by SETUP 3.3 “low” can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.
3.8	DELAY HI	An alarm generated by SETUP 3.4 “high” can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.
3.9	DELAY HH	An alarm generated by SETUP 3.5 “high-high” can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.

3.3.5 EXPLANATION OF SETUP-MENU 4 - DISPLAY

4	**DISPLAY**	
4.1	FUNCTION	This setting determines which information is shown on the main screen. The function can be set to indicate **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. • When "accumulated total" is selected, total is displayed with the large digits and accumulated total is displayed with the small digits simultaneously. When SELECT is pressed on the main screen, the operator can scroll through the various process values. See chapter 2 for more information on operator information and functions.
4.2	ALARMSET	This function determines if the flowrate alarm values can be set at both Operator level and SETUP-level or SETUP-level only, and if the alarm values are visible at operator level. Note ! *If SETUP has been selected, the alarm values are still visible for the Operator but cannot be changed. If Hidden has been selected, the alarm values are invisible.*
	Note !	*When battery powered, the user can expect reliable measurement over a long period of time. The E018-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:*
4.3	LCD NEW	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 output signals are generated in the normal way. The following can be selected: FAST – 1 sec – 3 sec – 15 sec – 30 sec – OFF When “off” is selected the display will switch off automatically. When an update rate other than “fast” is selected, pressing a key will switch the update rate to “fast” for 30 seconds. After this time, the display will return to the configured update rate (or switch off). Note ! *After a button has been pressed by the operator - the display refresh rate will always switch to fast for 30 seconds.* *When 'OFF' is selected, the display will temporarily turn on after touching one of the keys and turn off automatically after 30 seconds.*
4.4	BACKLIGHT	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 units the brightness is not adjustable. Note ! *When the unit is only loop powered it cannot make use of the backlight. In that case an external supply is required.*
4.5	BL ALARM	In case the E018-P generates a flowrate alarm, the backlight can be set to change to red. Following selections are available: OFF: during flowrate alarm the color is white ON: during flowrate alarm the color is red FLASH: during flowrate alarm the color flashes red

4.6	BARGRAPH	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
4.7	RATESPAN Note !	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: 0000000 – 9999999 *The number of decimals displayed depends upon SETUP 2.3.*

3.3.6 EXPLANATION OF SETUP-MENU 5 – FLOWMETER

The E018-P is not equipped with an automatic unit conversion feature. This means that different K-Factors for Total and Flowrate must be entered manually. This gives you the possibility to have absolute freedom in configuring the various measurement units to your needs.

To setup the K-factors for Total and Flowrate, follow this procedure:

1. SETUP 5.1: Select the correct type of flow meter signal
2. SETUP 1.1: Select the desired measuring unit for Total
3. SETUP 1.2: Enter the (average) K-factor shown on the certificate.
   If the measurement unit on the certificate is different than the desired measuring unit for total, the K-factor needs to be calculated (see example below).
4. SETUP 2.1: Select the desired measuring units for (accumulated) Total.
5. SETUP 2.2: Select the desired interval time for Flow rate
6. SETUP 2.3: Enter the (average) K-factor shown on the certificate.
   If the measurement unit on the certificate is different than the desired measuring unit for total, the K-factor needs to be calculated (see example below).

Example: Calculating the K-factor.

To manually calculate the K-factor to enter for total or flowrate, follow this example:
Assume that the flowmeter generates 65.231 pulses per US gallon and the required measurement unit is cubic foot / ft^3. A cubic foot consists of 7.48052 gallon which implies 487.9618 pulses per cubic feet. So, the K-Factor to enter is 487.9618.

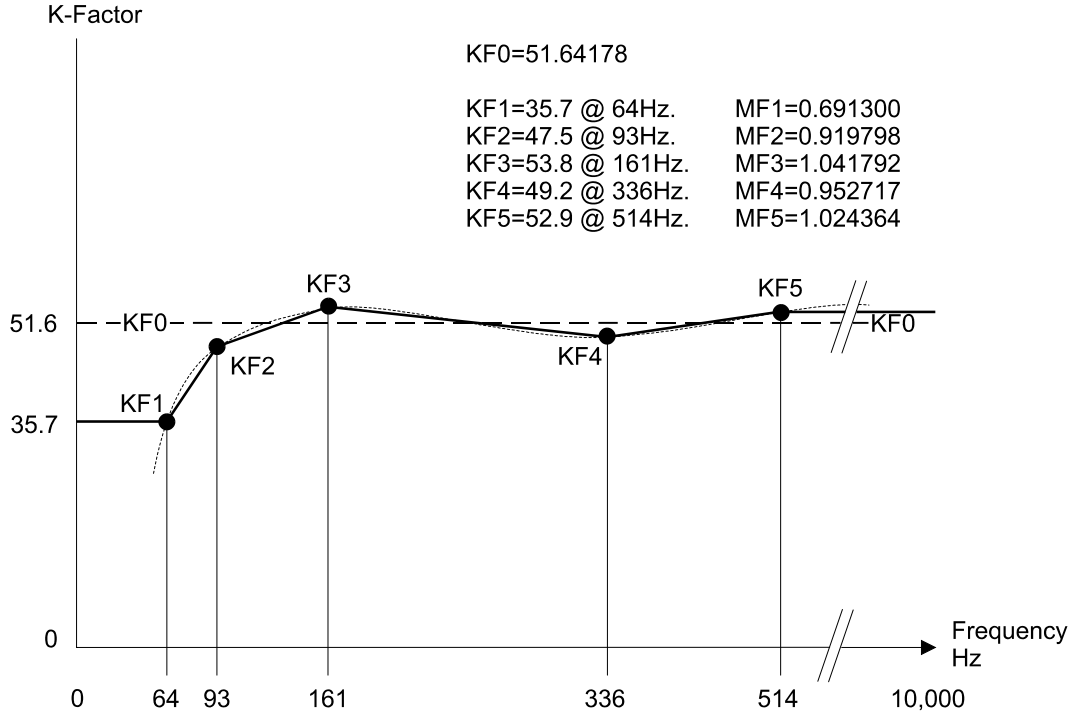
5	**FLOWMETER**				
5.1	SIGNAL Note !	The E018-P is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 5.1. The settings with LP are used to apply a build-in low-pass filter. See also chapter. 4.4. *The selections "Active pulse input" offer a pulse detection level of 50% of the supply voltage.*			
	TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mVpp	REMARK
	NPN	NPN input	100 kΩ pull-up	max. 6 kHz.	(open collector)
	NPN - LP	NPN input with low pass filter	100 kΩ pull-up	max. 2.2 kHz.	(open collector) less sensitive
	REED	Reed-switch input	1 MΩ pull-up	max. 1.2k Hz.	
	REED - LP	Reed-switch input with low pass filter	1 MΩ pull-up	max. 120 Hz.	Less sensitive
	PNP	PNP input	51 kΩ pull-down	max. 6 kHz.	
	PNP - LP	PNP input with low pass filter	51 kΩ pull-down	max. 700 Hz.	Less sensitive
	NAMUR	NAMUR input	820 Ω pull-down	max. 4 kHz.	External power required
	COIL HI	High sensitive coil input	-	min. 20 mVpp.	Sensitive for interference!
	COIL HI (option ZF)			min. 10 mVpp.	
	COIL HI (option ZG)			min. 5 mVpp.	
	COIL LO	Low sensitive coil input	-	min. 90 mVpp	Normal sensitivity
	8-1 DC	Active pulse input detection level 3.9 Vdc	3k9 Ω pull-down	max. 10 kHz.	External power required
	24 DC	Active pulse input detection level 11 Vdc	3 k Ω pull-down	max. 10 kHz.	External power required

3.3.7 EXPLANATION OF SETUP-MENU 6 - 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:

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

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:



6.	LINEARIZATION	
6.1 ↕ 6.F	FREQ. / M-FACTOR 1 ↕ FREQ. / M-FACTOR 15	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. Most M-factors will be around 1.000000 like 0.945354 or 1.132573. 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 5.H – decimals frequency.)
6.G	LINEARIZATION	With this setup function, you can easily enable / disable the linearization function.
6.H	DECIMALS FREQUENCY	This setting determines the number of decimals for the frequency entered. The following can be selected: 0 – 0.1 – 0.02 – 0.003

3.3.8 EXPLANATION OF SETUP-MENU 7 – ANALOG OUTPUT

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

RATE-MIN and RATE-MAX correspond with the HARD-variables PV URV and PV LRV, and define the range of the analog output.
The number of decimals displayed for RATE-MIN and RATE-MAX depend upon SETUP 2.3. However, if previously a value was entered that does not fit on the display (e.g. via the HART interface), the number of displayed decimals is reduced to fit the most significant digits on the display.
The time and measuring units (L/min for example) are dependent upon SETUP 2.1 and SETUP 2.2 and are displayed during editing.

Example: Calculating the actual output current

Suppose RATE-MIN (PV-URV) is set at 1600 l/sec and RATE-MAX (PV-LRV) is set at 0 l/sec.

What value will the analog output be at when the actual flowrate is 1000 l/sec?

- Analog output current = 1000/1600 * (20mA-4mA) + 4mA = 14mA

7	**ANALOG**	
7.1	RATE-MIN (4mA) 	*Primary Variable Lower Range Value (PV-LRV)* Enter here the flowrate at which the output should generate the minimum signal (4mA) – in most applications at flowrate “0”. *If desired, you can program the analog output 'up-side-down'. The* 4mA *represents the maximum flow rate.* *For example do enter 800 L/min.*
7.2	RATE-MAX (20mA) 	*Primary Variable Upper Range Value (PV-URV)* Enter here the flowrate at which the output should generate the maximum signal (20mA) – in most applications at maximum flow. *If desired, you can program the analog output 'up-side-down'. The 20*mA *represents the minimum flow rate.* *For example do enter 0 L/min.*
7.3	TUNE-MIN 	The initial minimum analog output value is 4mA. However, this value might differ slightly due to ambient 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 PROG to store the new value.
7.4	TUNE-MAX 	The initial maximum analog output value is 20mA. However, this value might differ slightly due to ambient 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.

3.3.9 EXPLANATION OF SETUP-MENU 8 – PULSE OUTPUT

The pulse output menu configures the behavior of the digital output signals. As standard, four transistor outputs are available (Type OT): D1, D2, D3 and D4. For each of these outputs the output functionality can be configured.
Optionally, two relay outputs are available (Type OR): D5 and D6. The output functionality of these outputs corresponds to the functionality of outputs D3 and D4 (respectively).

The following modes of operation can be available for each output:

- **Off** the output is switched-off.
- **Lo-Lo** the output shows the presence of a Lo-Lo flowrate alarm
- **Lo** the output shows the presence of a Lo flowrate alarm
- **Hi** the output shows the presence of a Hi flowrate alarm
- **Hi-Hi** the output shows the presence of a Hi-Hi flowrate alarm
- **All** the output shows the presence of *any* flowrate alarm
- **Pulse** a scaled pulse is sent on the output with the WIDTH set at SETUP 8.5, every time the accumulated total has increased with the AMOUNT set at SETUP 8.6.
- **Retransmit** the unscaled incoming pulse from the flowmeter is retransmitted on the output.

- *The digital (transistor) outputs D1 and D2 have a maximum frequency of 500Hz, digital outputs D3 and D4 have a maximum frequency of 4Hz.*
- *Be sure that the output frequencies of the optional digital (relay) outputs D5 and D6 do not exceed 0.5Hz, else the relay life time and reliability will be reduced significantly.*

8	**PULSE OUTPUT**	
8.1	RELAY 1	This setting is used to select the output functionality of digital output D1. Following functions are available: off – lo-lo – lo – hi – hi-hi – all – pulse – retransmit *The **retransmit mode** is often used when sinus / non-square wave input signals are present (e.g. coil signals) that need to be transmitted as robust square wave forms.*
8.2	RELAY 2	This setting is used to select the output functionality of digital output D2. Following functions are available: off – lo-lo – lo – hi – hi-hi – all – pulse
8.3	RELAY 3	This setting is used to select the output functionality of digital outputs D3 and D5 (option). Following functions are available: off – lo-lo – lo – hi – hi-hi – all – pulse
8.4	RELAY 4	This setting is used to select the output functionality of digital outputs D4 and D6 (option). Following functions are available: off – lo-lo – lo – hi – hi-hi – all – pulse
8.5	WIDTH	When scaled pulse output is selected, 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. The value "zero" will disable the pulse output. *The scaled 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!*
8.6	AMOUNT	One pulse is generated every X-quantity measured. If for example you want 100 pulses per gallon: do enter 0.01 GAL (this means one pulse every 0.01 GAL, so 100 pulses per gallon). The following can be selected: 000.000 – 9999999 *After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.*

3.3.10 EXPLANATION OF SETUP-MENU 9 - COM-HART

The E018-P can optionally be equipped with a communication interface using the HART protocol (Type CR). Please consult Appendix C for a more detailed explanation of the protocol, data types and available commands.

9	**COM-HART**	
9.1	ADDRESS Note !	0..63 HART bus address *When an address other than 0 is selected, the loop current mode is **not updated** to automatically work in multidrop mode.* *If the E018-P is used in multidrop mode, the loop current mode must be set to disabled manually (SETUP 9.2).*
9.2	LOOP CURRENT Note !	Loop current mode is used when the E018-P is used in a multidrop bus configuration. By disabling the loop current, the output current is set to 4mA and several HART units can be connected to the same bus. Following selections are available: enabled: Normal mode, output current follows flowrate disabled: Fixed mode, output current is fixed on 4mA *If the E018-P is used in multidrop mode, be sure to configure each HART device on the bus with a different bus address (SETUP 9.1).*
9.3	LOOP TEST Note !	The loop test is meant to temporarily fixate the output current to 4mA or 20mA for calibration purposes. When SETUP-level is left and the E018-P returns to operator level, this setting is reset and the output current functions as before. Following selections are available: off: Output current set to normal set 4mA: Output current set to 4mA set 20mA: Output current set to 20mA • *The loop test function only works if the loop mode (SETUP 9.2) has been set to 'enabled'.* • *The loop test function is reset to 'off' when SETUP-level is left or the E018-P is restarted.*

3.3.11 EXPLANATION OF SETUP-MENU 10 - OTHERS

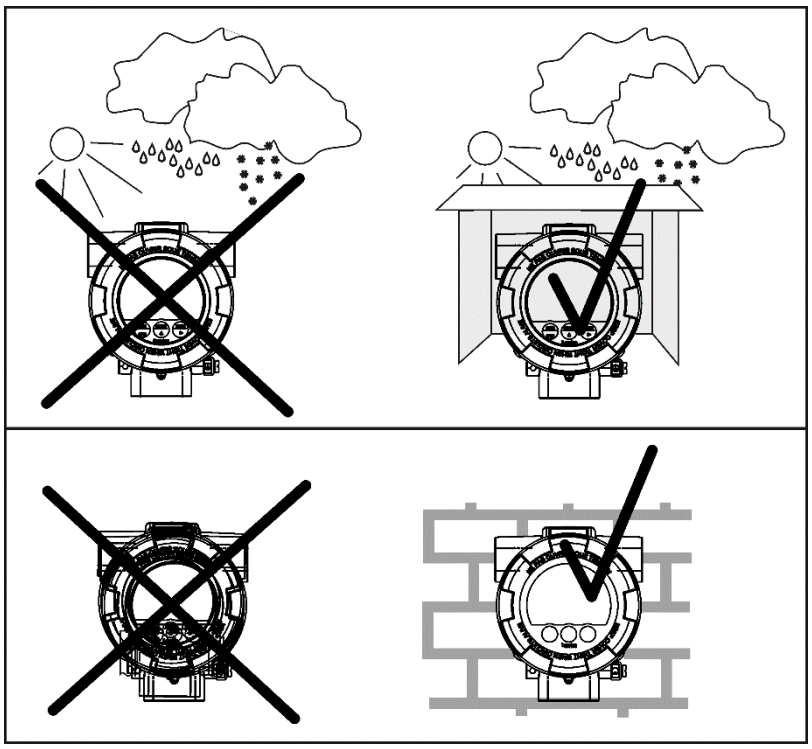
10	**OTHERS**	
10.1	MODEL	For support and maintenance it is important to have information about the characteristics of the E018-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
10.2	SOFTWARE VERSION	
10.3	SERIAL NO.	
10.4	PASSWORD	All SETUP values can be password protected. This protection is disabled with value 0000 (zero). A 4 digit password can be programmed, for example 1234.
10.5	KEY LOCK Caution !	To avoid undesired use of the optical keyboard it can be locked automatically after 30 seconds by enabling this function. **In battery supplied applications, activation of the keyboard can trigger the backlight to come on. Since regular false triggers can wear out the battery quite quickly, it is advised to leave the keyboard lock function enabled so the backlight only comes on when any of the optical keys is detected for at least 1 second. The keyboard lock function also uses less battery power.**
10.6	TAG-NO	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

- 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 E018-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the “Safety rules, instructions and precautionary measures” at the front of this manual.

4.2 INSTALLATION / SURROUNDING CONDITIONS



Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP66 / IP67 / TYPE 4X casing 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 by placing a dry sachet of silica gel, for example, inside the instrument case.

Mount the E018-P on a solid structure to avoid vibrations

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

4.3 MECHANICAL INSTALLATION

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.
- Possible electrostatic hazard – clean only with a moist cloth. Use only in fixed installations and do not place in areas with rapid airflow.

4.3.1 DIMENSIONS – ENCLOSURE

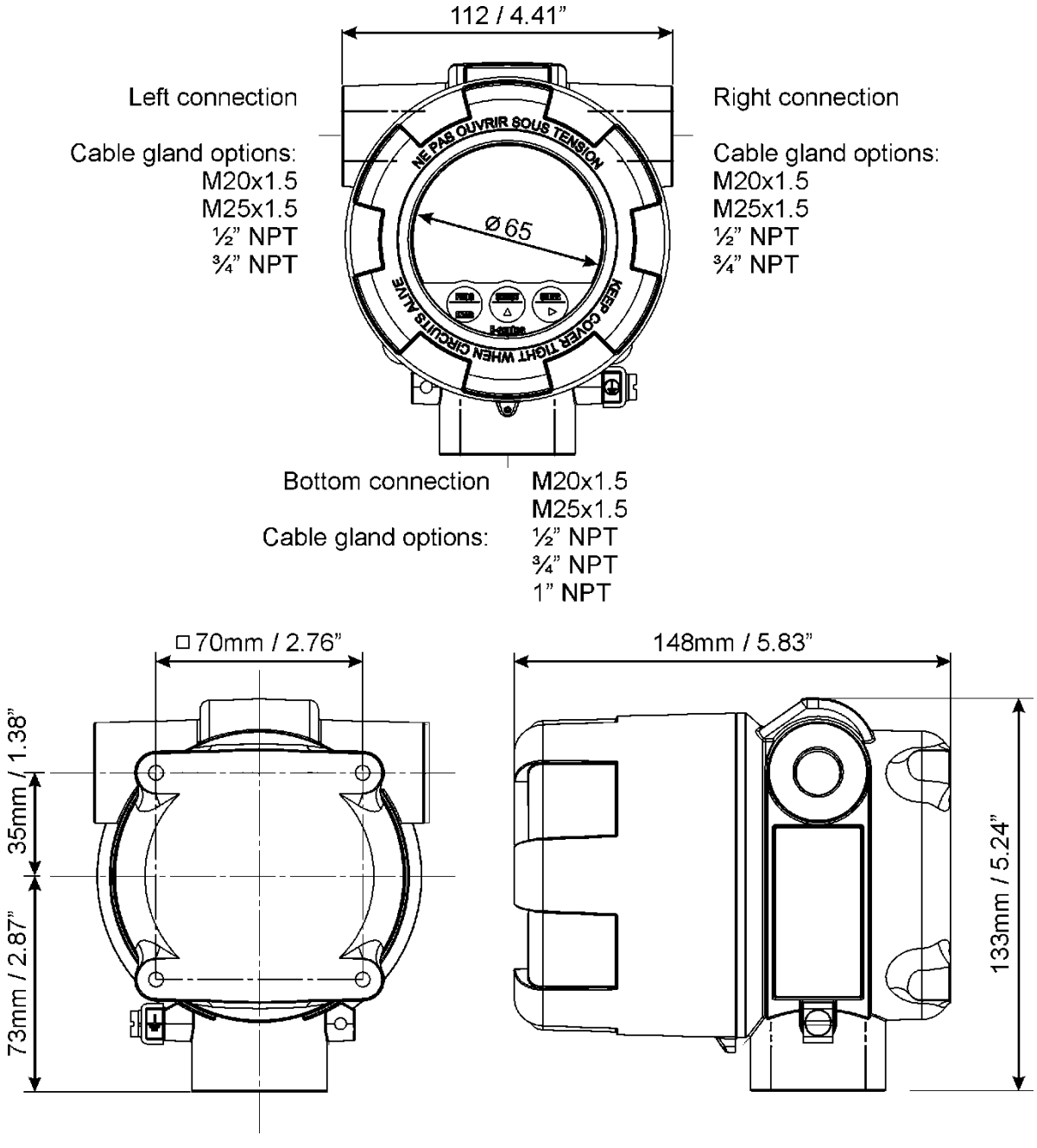


Fig. 9: Dimensions – Aluminum / Stainless Steel enclosures

4.3.2 MOUNTING

Note !

The display inside the enclosure can be installed in four positions:
0°; 90°; 180°; 270°, so the enclosure can be installed in four positions.

The enclosure can be installed on a wall by using the mounting plate (accessory) or pipe mounted with the bracket and hose clamps (accessory).

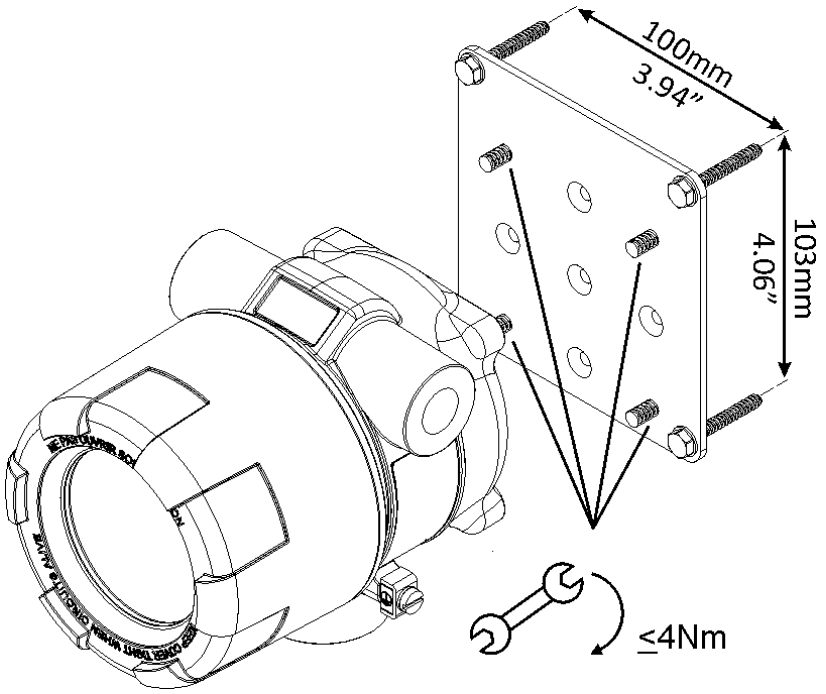


Fig. 10: Installation – Plate mounted

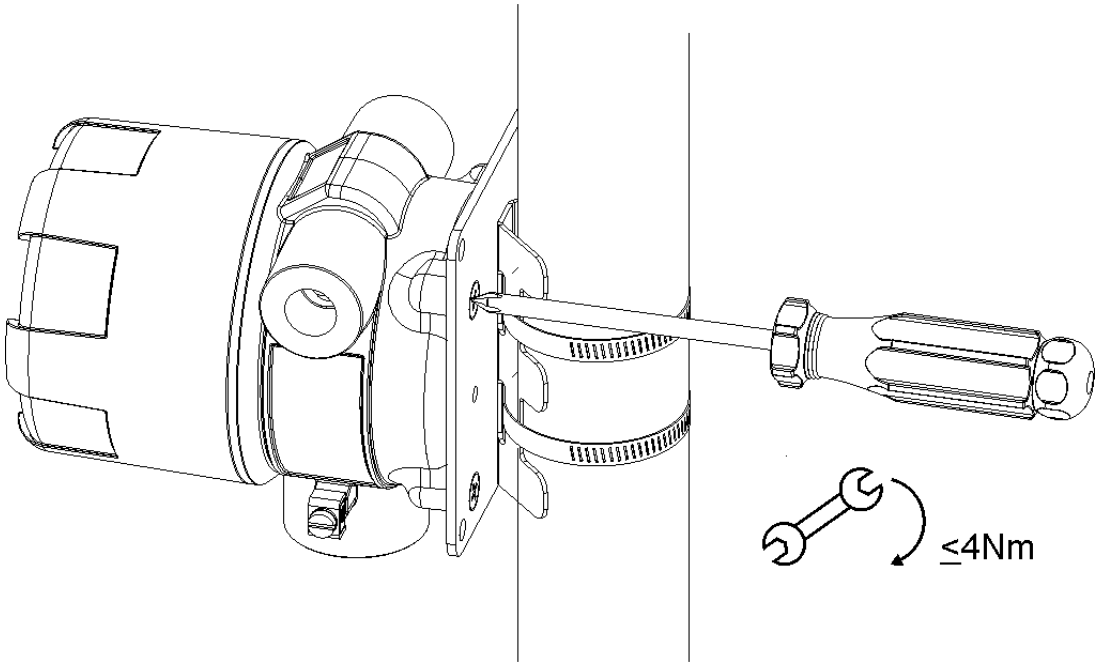


Fig. 11: Installation – Pipe mounted

4.3.3 SEALING CONDUITS / ENCLOSURE

- For FM Group A,B,C,D : “SEAL ALL CONDUIT ENTRIES WITHIN 18 INCHES”.
- For CSA group B,C,D: “SEAL ALL CONDUIT ENTRIES WITHIN 18 INCHES”.
- For CSA group A: “FOR GROUP A SEAL AT ENCLOSURE WALL”

4.3.4 FLAMEPROOF JOINTS

- Clause 5: EN/IEC 60079-1:2007 (Use certified / Ex d cable glands).
- All flameproof joints are designed for:
  - Volume $500 < V \leq 2000$ cm³;
  - Group IIC enclosures.

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:
   - M20 x 1.5, M25 x 1.5, (for metric: Tolerance 6g/6H min. 8 full threads engaged);
   - ½ NPT, ¾ NPT. (for NPT: Tolerance ANSI/ASME B1.20.1).
4. The process opening:
   - M20 x 1.5, M25 x 1.5 (for metric: Tolerance 6g/6H min. 8 full threads engaged);
   - ½ NPT, ¾ NPT, 1 NPT (for NPT: Tolerance ANSI/ASME B1.20.1);
   - 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 + 965-3).

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

4.3.5 CONNECTION TO OTHER ENCLOSURES

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 cm³;
- 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 ELECTRICAL INSTALLATION

DO NOT OPEN AN INSTALLED ENCLOSURE WHEN CIRCUITS ARE ALIVE.
For battery supplied equipment:
DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.

- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the E018-P, the installer has to discharge himself by touching a well-grounded object.
- The E018-P must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).

- 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 a 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).

- Use Ex-d cable glands with effective IP67 (TYPE4X) seals for the cables used;
- For unused cable entries fit Ex-d blind plugs with effective IP67 (TYPE 4X) seals;
- 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!
- 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;
- The cable entry plugs mounted into the enclosure shall comply with the requirements of the type of protection used.
- Make sure to apply proper internal and external grounding to PE terminals as indicated in below figure by the arrows.
  Use following wiring for PE terminal: Stranded conductor:4 mm², Single conductor: 6 mm².

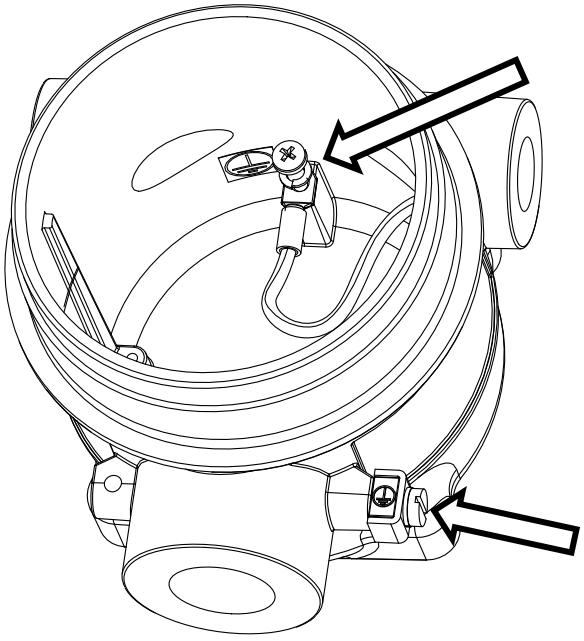


Fig. 12: Grounding enclosure

4.4.1 ELECTRICAL SAFETY

Please consult the table with environmental conditions and safety parameters shown at the beginning of this chapter.

- 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 R8 to R11 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).

The following supply ratings apply for the various installed options within the E-series product. This allows for suitable selection of the power supply and overcurrent protection.
(not mentioned options implies no or neglectable influence on the ratings)

Installed option	Input	Supply Voltage range	Maximum supply current	Remark
PD	P6	24-27Vdc	110 mA	With 2xOR option
PD	P2	9-27Vdc	75 mA	Without OR option
PX	P2	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 SPST 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

4.4.2 VOLTAGE SELECTION SENSOR SUPPLY

Type PB / PX – Pickup element supply

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

Note !

This voltage MAY NOT be used to power the flowmeters electronics, converters etc, as it will not provide adequate sustained power ! All energy used by the flowmeters pick-up will directly influence the battery life-time (type PB). 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 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 !

- *8.2V DC supply requires an input voltage of 9-27V, maximum output current: 20mA; 12V DC supply requires an input voltage of 13-27V, maximum output current: 30mA; 24V DC supply = V-input – 1V (max 27V), maximum output current: 75mA.*
- *The output is protected against overload. In case of an overload also the functionality of the E018-P is affected!*

The voltage is selected with the two switches at the rear of the Main Electronics Module (MEM). The switches are located at the bottom center (type PD):

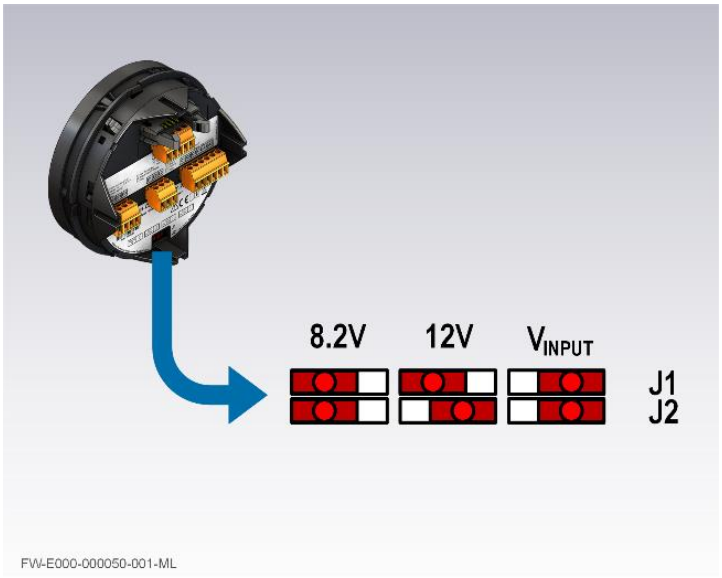


Fig. 13: Voltage selection – Sensor supply (P3)

4.5 OVERVIEW OF TERMINAL CONNECTORS

The following terminal connectors are available for the Main Electronics Module (MEM):

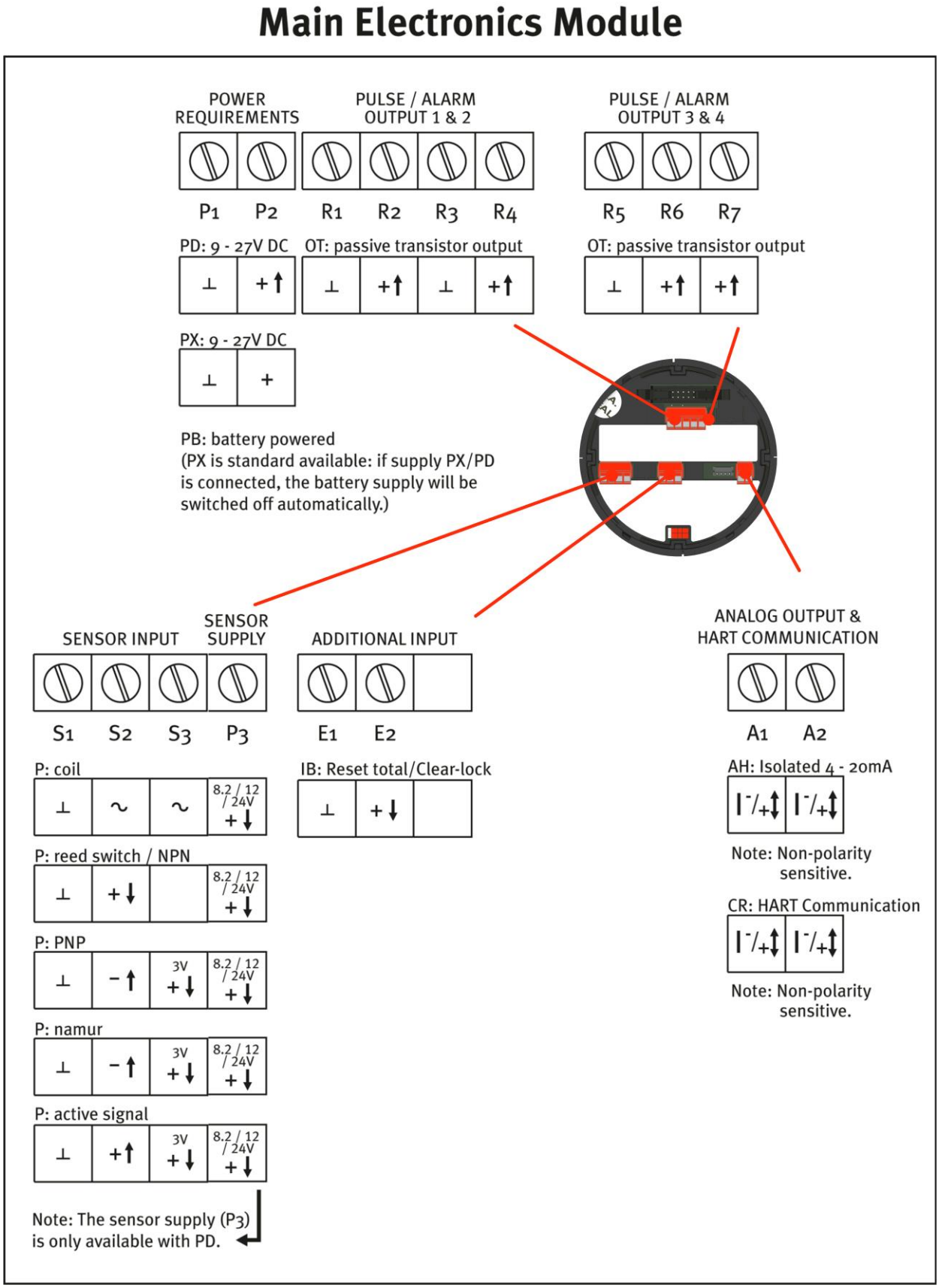


Fig. 14: Terminals connectors MEM – standard and options

The following terminal connectors are available for the option OR – Mechanical relays (RSM Relay Supply Module):

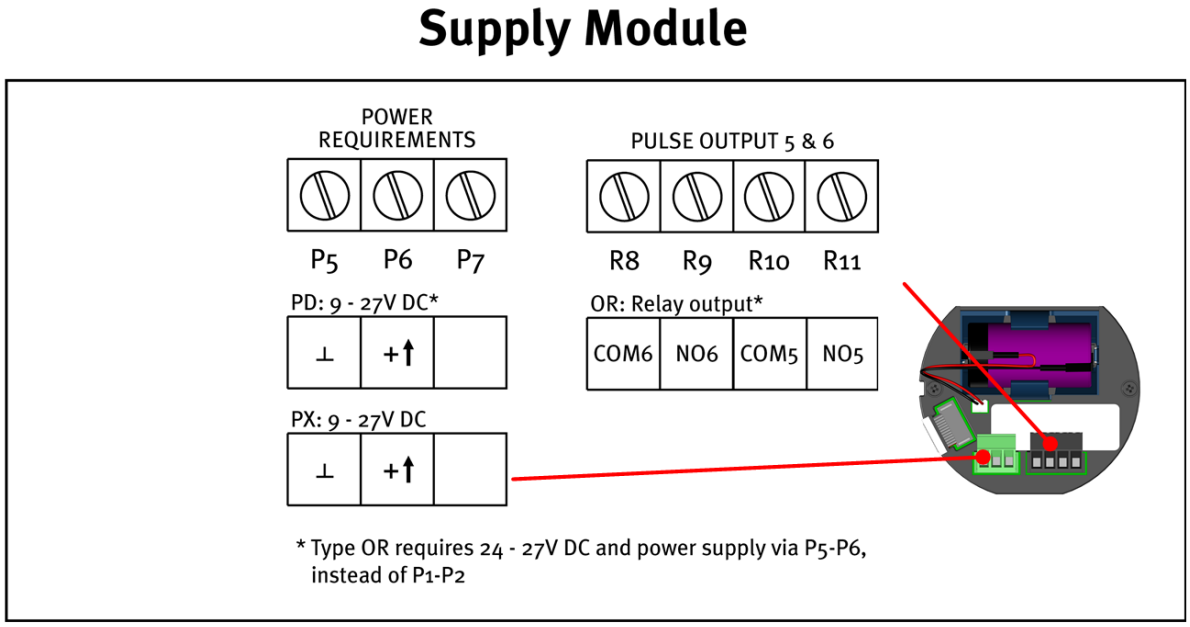


Fig. 15: Terminal connectors RSM

4.6 TERMINAL CONNECTORS

4.6.1 TERMINAL P1-P2 AND P5-P6: 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 4.4.2: VOLTAGE SELECTION SENSOR SUPPLY.

Power requirements for sensor supply P3:

- 8.2V sensor supply requires 9-27V;
- 12V sensor supply requires 13-27V;
- 24V = V-input – 1V (max 27V).

4.6.2 TERMINAL R1-R7 AND R8-R11: DIGITAL OUTPUTS D1-D4 AND D5-D6

The functionality of the digital outputs is programmed through the PULSE menu (SETUP-menu 8). See paragraph 3.3.9 for more details.

Note !

- *The digital (transistor) outputs D1 and D2 have a maximum frequency of 500Hz, outputs D3 and D4 have a maximum frequency of 4Hz.*
- *Be sure that the output frequencies of the optional digital (relay) outputs D5 and D6 do not exceed 0.5Hz, else the relay life time and reliability will be reduced significantly.*
- *When **retransmit mode** is selected in the RELAY 1 menu (SETUP 8.1), only Type OT digital output D1 (on terminals R1-R2) will retransmit the frequency of the flowmeter signal. The other outputs will behave as configured in the menu.*

Type OT

Four passive transistor outputs are available, two with a maximum pulse frequency of 500Hz (D1 and D2) and 2 with a maximum pulse frequency of 4Hz (D3 and D4). Max. driving capacity 300mA@50V DC.

Note !

With type OT:

- *Terminals R1, R3 and R5 are common ground (GND) terminals.*
- *The output functionality of digital outputs D5 and D6 corresponds to the functionality of digital outputs D3 and D4 (respectively)*
- *When **retransmit mode** is selected the minimum on and off-time is 50µs.*

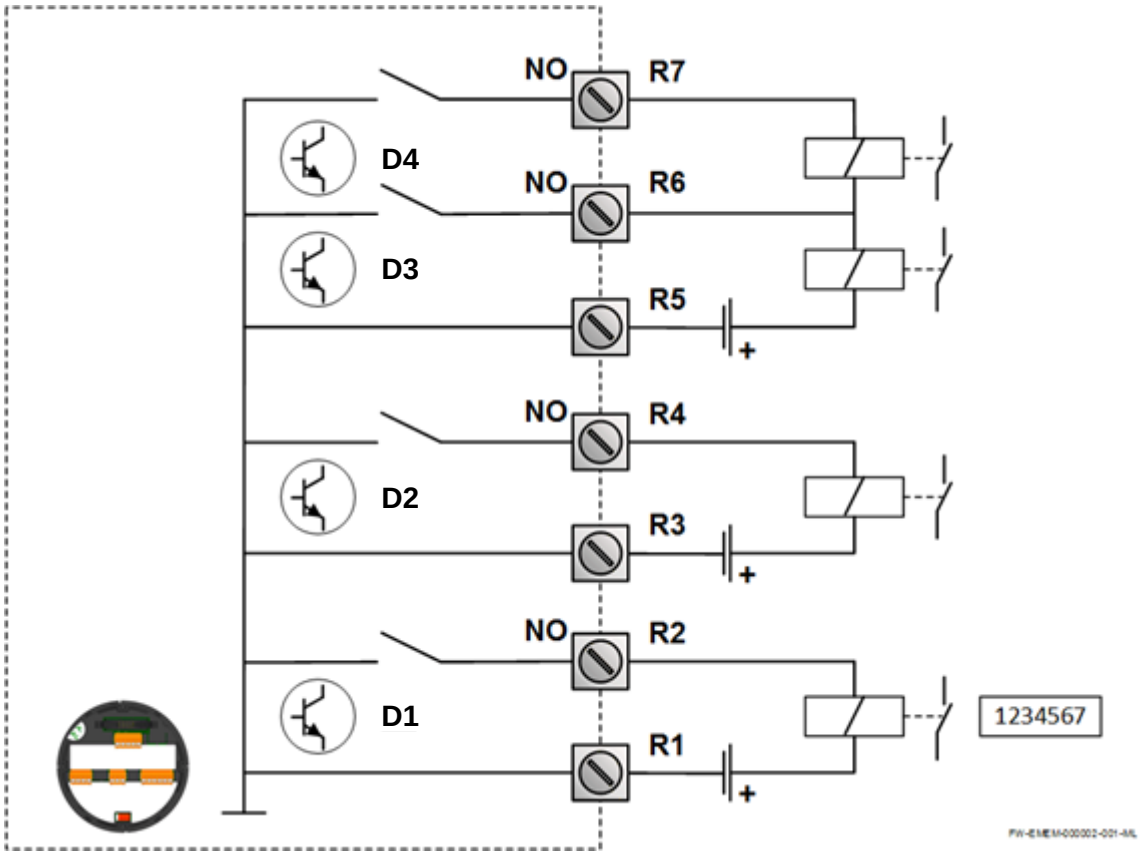


Fig. 16: Terminal connections – Transistor outputs D1 – D4

Type OR

Two mechanical normally open relay outputs are available with a maximum frequency of 0.5Hz (D5 and D6). Max. switch power 240V 0.5A per output.

Note !

With type OR:

- *Use power supply terminals P5-P6.*
- *The required supply voltage is 24 - 27V DC!*
- *Be sure that the output frequency does not exceed 0.5Hz, else the relay life time and reliability will be reduced significantly.*
- *The output functionality of digital outputs D5 and D6 corresponds to the functionality of digital outputs D3 and D4 (respectively).*
- ***When retransmit mode is selected, the relays are not activated.***

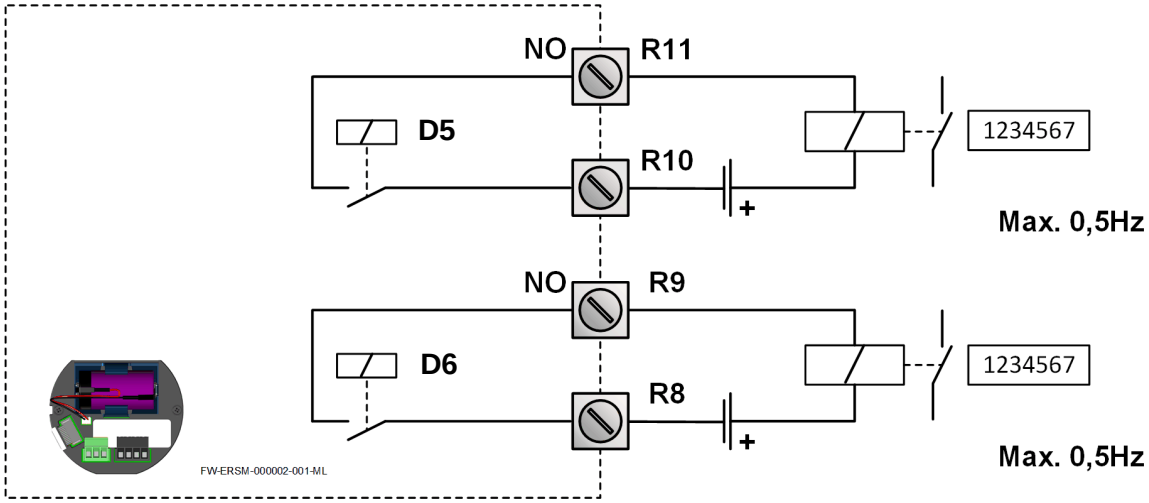


Fig. 17: Terminal connections – Mechanical relay outputs D5 – D6

4.6.3 TERMINAL S1-S3: FLOWMETER INPUT

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 (see paragraph 3.3.6 for more information).

Sine-wave signal (Coil)

The E018-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 90mVpp.
- COIL HI: sensitivity 20mVpp.
- Type ZF offers for setting COIL HI: sensitivity 10mVpp.
- Type ZG offers for setting COIL HI: sensitivity 5mVpp.

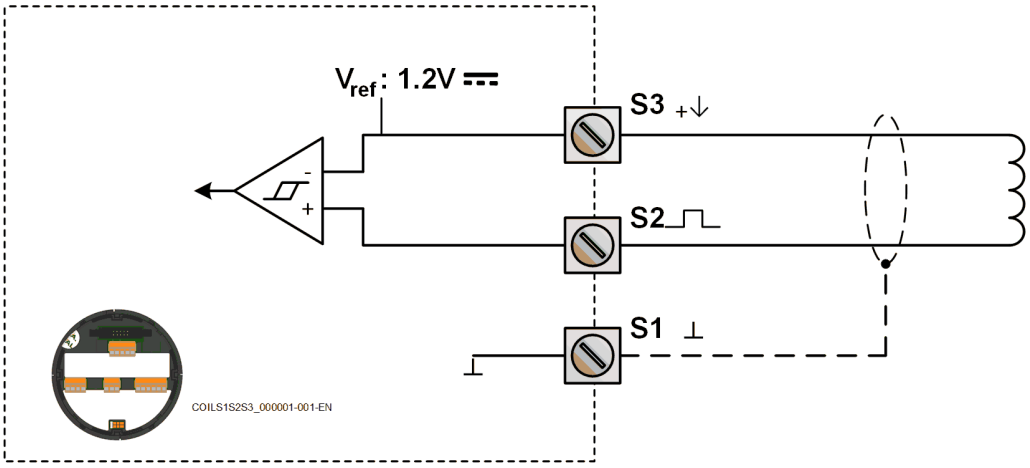


Fig. 18: Terminal connections – Coil signal input

Pulse-signal NPN / NPN-LP

The E018-P is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the signal should be above 1.4V or below 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 (see paragraph 3.3.6 for more information).

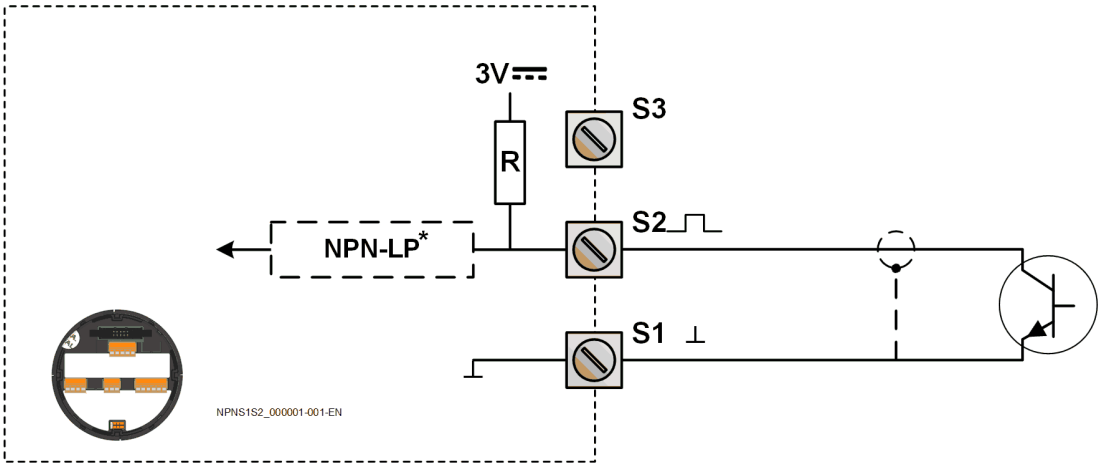


Fig. 19: Terminal connections – NPN signal input

Pulse-signal PNP / PNP-LP

The E018-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 above 1.4V or below 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 (see paragraph 3.3.6 for more information).

A sensor supply voltage of 8.2, 12 or 24V DC can be provided with power supply type PD.

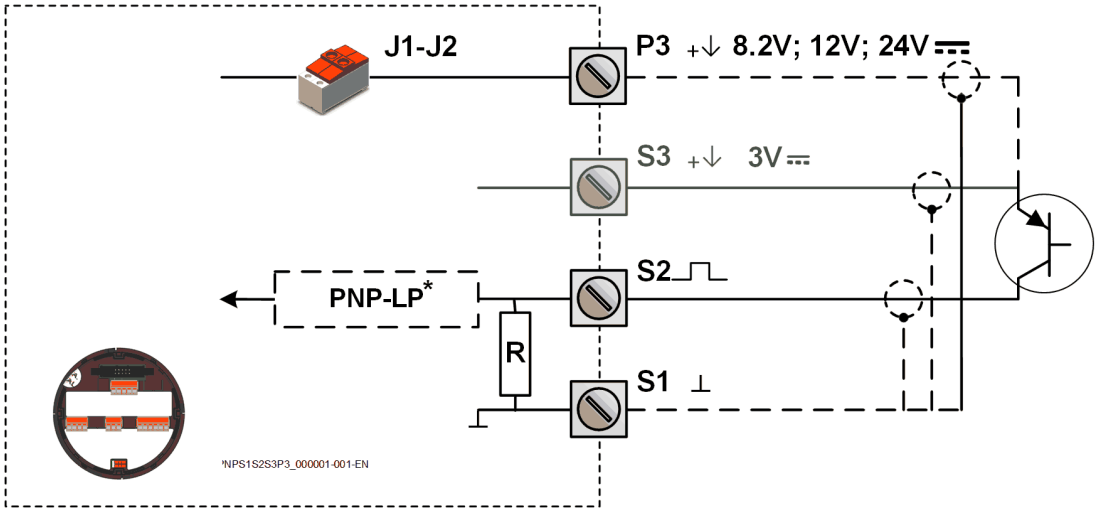


Fig. 20: Terminal connections – PNP signal input

Reed-switch

The E018-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 (see paragraph 3.3.6 for more information). Make sure the contact resistance of the reed switch is less than 1V@2uA=500k Ohm.

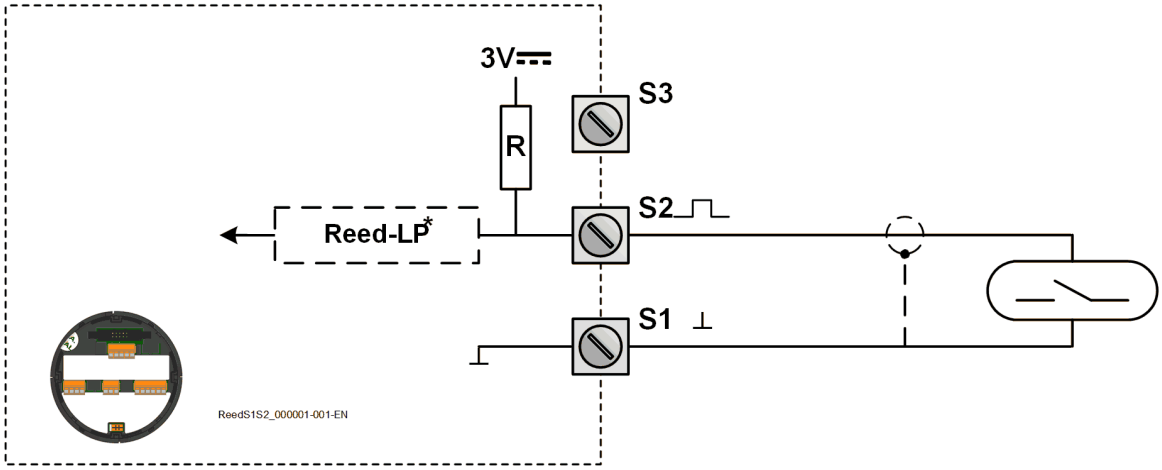


Fig. 21: Terminal connections – Reed-switch signal input

NAMUR-signal

The E018-P is suitable for flowmeters with a NAMUR signal. The standard E018-P-PX 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 3.3.6 for more information.

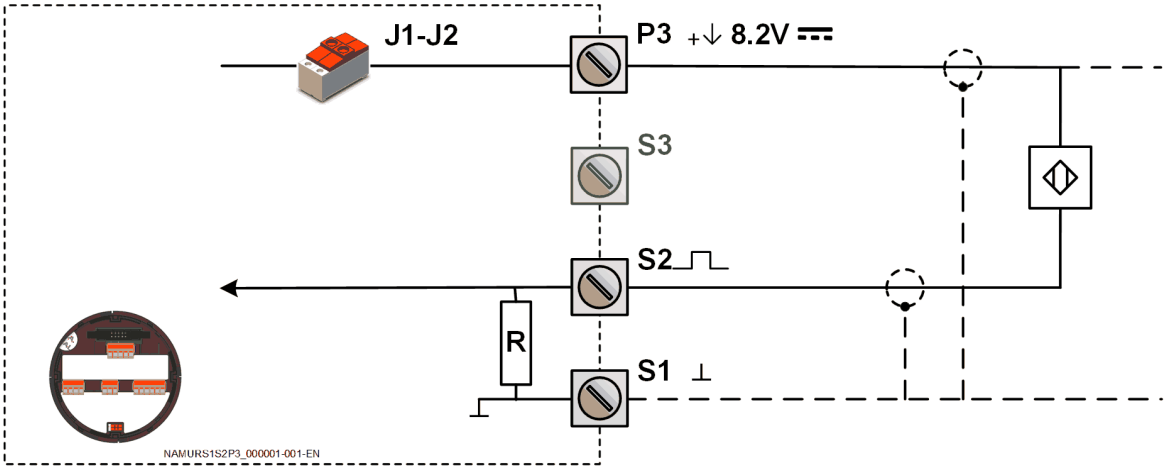


Fig. 22: Terminal connections – NAMUR signal input

Active signals 8.2V and 24V

The E018-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 paragraph 3.3.6 for more information.

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

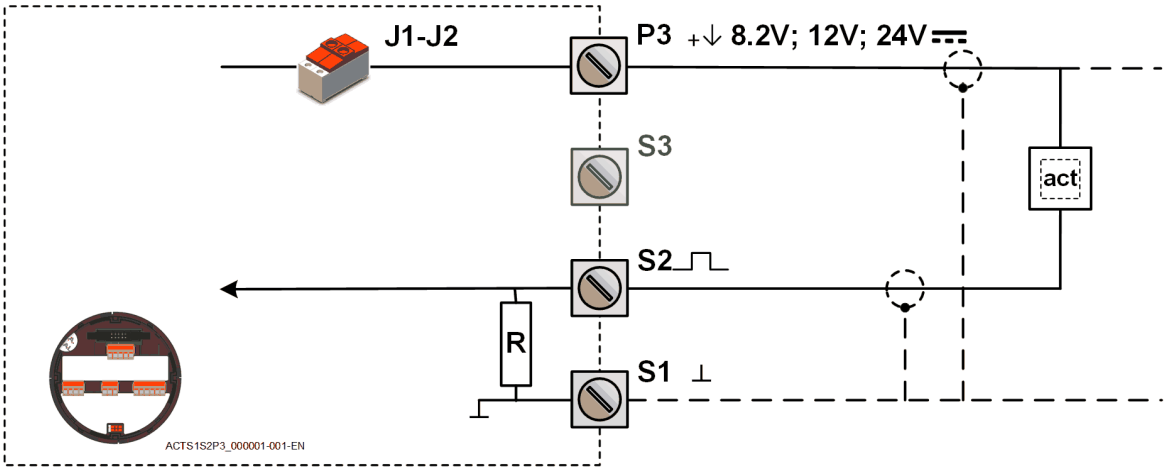


Fig. 23: Terminal connections – Active signal input

4.6.4 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)*.

To disable the function ”Clear Total” through the glass (IR keys - see chapter 2), keep this input closed.

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.

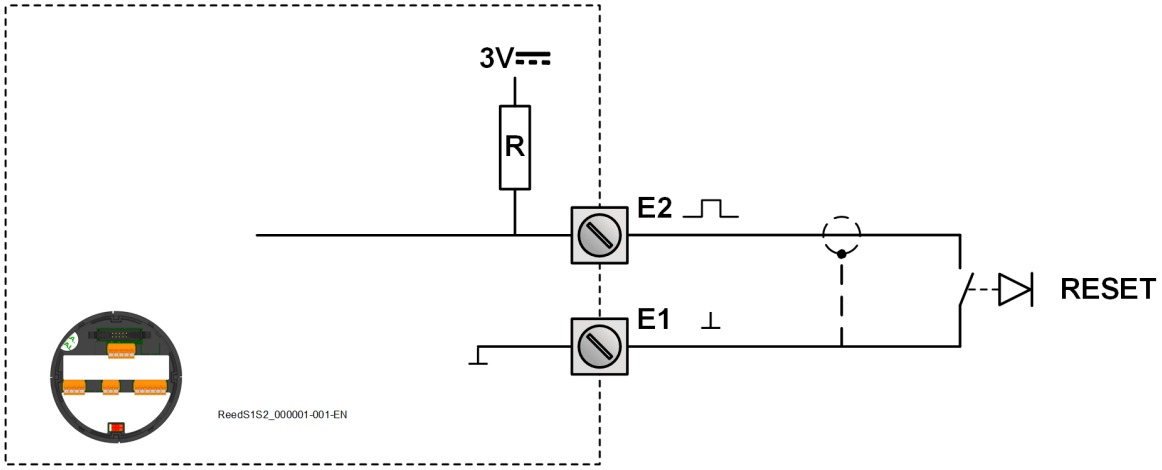


Fig. 24: Terminal connections – External reset input

4.6.5 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 Non-polarity sensitive.

When the output is disabled, the current is by default limited to 2mA. Max. driving capacity 1000 Ohm @ 27V DC. 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.

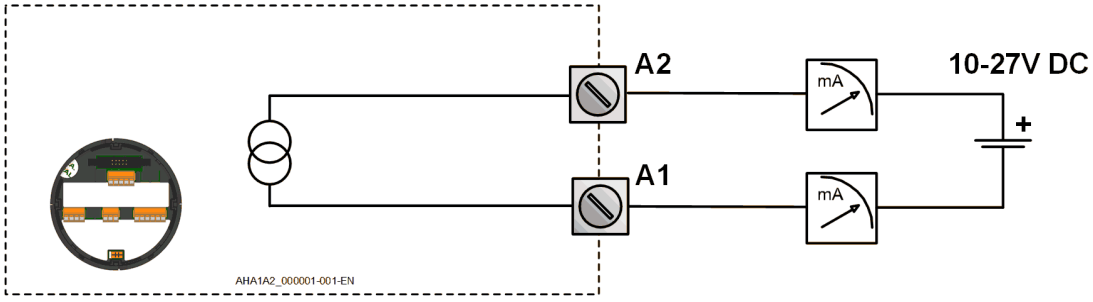


Fig. 25: Terminal connections – Isolated 4-20mA analog output

Terminal A1-A2; HART Communication – Type CR:

The E018-P is suitable for connecting a HART master device. This HART master device is connected to Terminal A1 and Terminal A2 to enable HART communication with the unit.

Optionally, a HART communicator can be connected in the loop as well, provided that a suitable resistance is inserted in the loop.

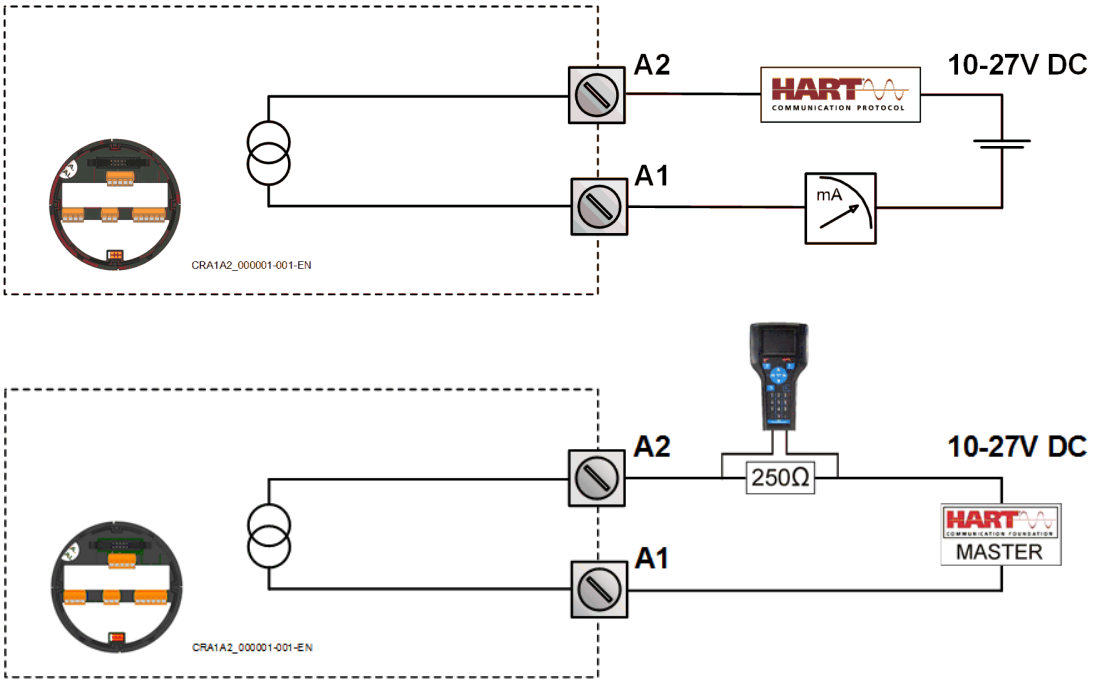


Fig. 26: Terminal connectors – Isolated 4-20mA analog output with HART devices

5 MAINTENANCE

5.1 GENERAL DIRECTIONS

- 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. Take careful notice of the “Safety rules, instructions and precautionary measures” in the front of this manual.
- The E018-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.
- Take careful notice of the “Safety rules, instructions and precautionary measures” in the front of this manual.

The E018-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 users responsibility to take all precautions to dehumidify the internal atmosphere of the E018-P in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

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 strongly advised to use only necessary functions.
E.g. disable analog output signal if not in use.

It is influenced by several issues :

- Display update: fast display update uses significantly more power.
- Pulse output.
- Low temperatures; the available power will be less due to battery chemistry.
- NPN and PNP inputs consume more energy than coil inputs.
- High input frequency.
- Communication.
- Optical key activity.

Check periodically

- The condition of the enclosure, cable glands and front panel.
- 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 a lint-free cloth, soaked with a mild soap solution or fresh water.

5.2 INSTRUCTIONS FOR REPAIR

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

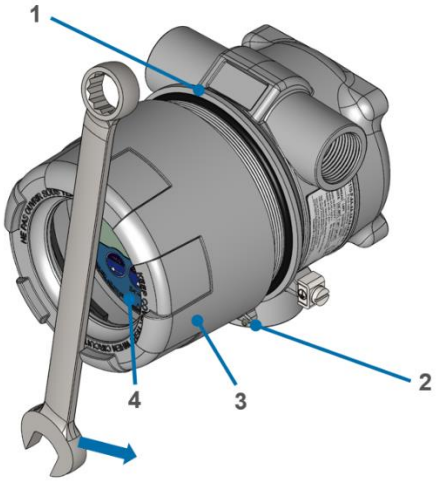
5.3 OPEN AND CLOSE THE E-SERIES

WARNING

DO NOT OPEN AN INSTALLED ENCLOSURE WHEN CIRCUITS ARE ALIVE.
For battery supplied equipment:
DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.

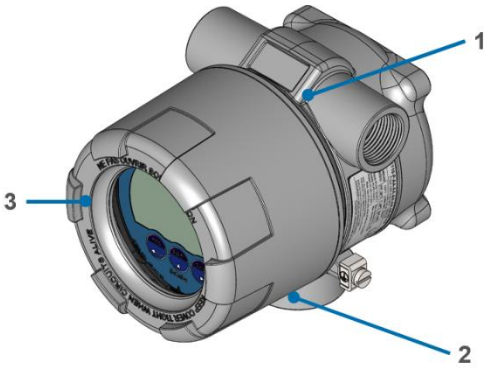
5.3.1 REMOVE THE COVER

1. Make the E-Series and the environment safe.
2. Unlock the set screw (2) to release the cover (3).
3. Use a wrench to turn the cover (3) counter-clockwise to release the cover (3).
4. Mind the Main Electronics Module (4) and carefully remove the cover (3) from the housing (1).
5. Keep the cover (3), with the glass facing upwards, in a clean and safe location.



5.3.2 INSTALL THE COVER

1. On the first two wire threads and O-ring, apply a very thin layer of the specified anti-seize compound.
2. Hold the cover (3) in the correct position for installation.
3. By hand, turn the cover (3) clockwise onto the housing (1) until the O-ring is tight to meet the required IP or TYPE protection rating.
4. Refer to chapter: Remove the cover; Lock the cover with the set screw (2) to safety the cover (3).



5.4 BATTERY REPLACEMENT – SUPPLY MODULE (IF INSTALLED)

WARNING

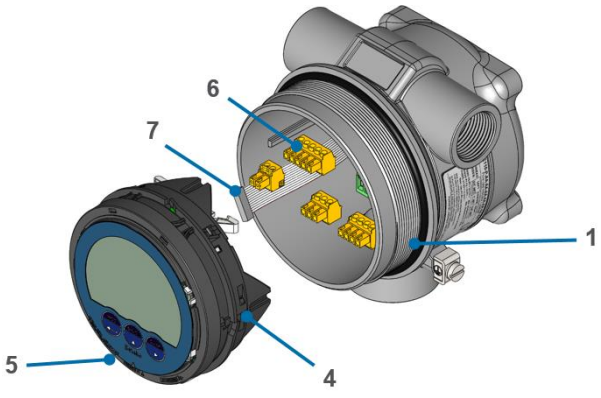
Only use batteries that are approved by the manufacturer.
Approved batteries can be ordered from your supplier.
THE USE OF UNAPPROVED BATTERIES CAN INVALIDATE EXPLOSION SAFETY.

Note !

This procedure assumes the E-Series and the environment are made safe.
This procedure assumes, the E-Series is opened.

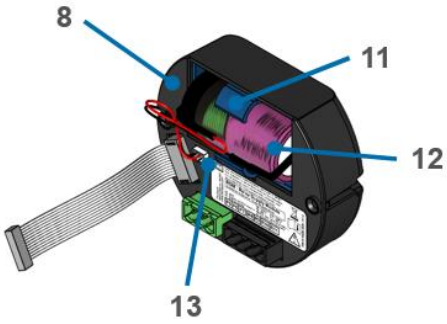
5.4.1 REMOVE THE MAIN ELECTRONICS MODULE (MEM)

1. Mind the wiring and carefully, pull to remove the MEM (4) from the housing (1).
2. Unlock and carefully disconnect the flatcable connector (7).
   Note that the MEM goes off.
3. Disconnect the connectors (6) from the MEM (4).
4. Protect the connectors (6, 7) against the ingress of contamination.
5. Keep the MEM (4) in a clean and safe location.



5.4.2 REMOVE THE BATTERY FROM THE SUPPLY MODULE (BSM OR RSM)

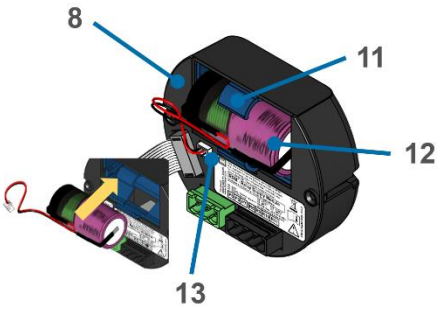
1. Disconnect the connector (13) from the Supply Module (8).
2. Carefully, remove the battery (12) from the battery holder (11).
3. As applicable discard or keep the battery (12) and the Supply Module (8) in a clean and safe location.



5.4.3 INSTALL THE BATTERY IN THE SUPPLY MODULE (BSM OR RSM)

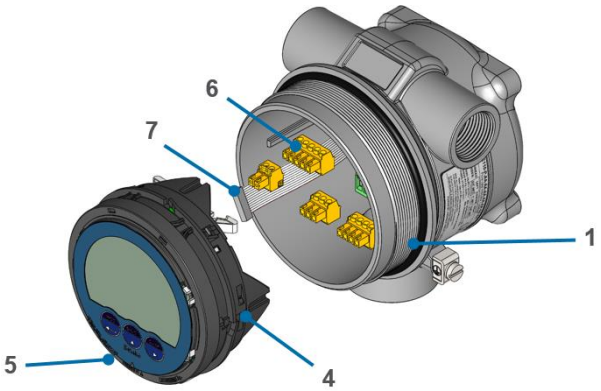
Handle the battery with care. A mistreated battery can become unsafe. Unsafe batteries can cause (serious) injury to persons.

1. Unpack the new battery (12).
2. Make sure, the new battery (12) shows no signs of damage or overheating.
3. Hold the battery (12) in the correct position for installation.
4. Carefully, install the battery (12) in the battery holder (11).
5. Carefully, install the connector (13).



5.4.4 INSTALL THE MAIN ELECTRONICS MODULE (MEM)

1. Install the connectors (6, 7) to the MEM (4).
2. Lock the flatcable connector (7) by hand and note that the MEM (4) comes on.
3. Hold the MEM (4) in the correct position for installation.
4. Mind the wiring and carefully move the MEM (4) into the housing (1).



5.4.5 TEST AND ADJUST THE E018-P

Note !

This procedure assumes that the E018-P is serviceable.

ACTION	RESULT	NOTICE
1. Make sure, the battery level indicator does not show.	• The battery indicator is off.	Only replace with original batteries supplied by the manufacturer.
2. At the side, press the PROG button for at least 7 seconds.	• The SETUP indicator comes on continuously. • SETUP-menu 1 is shown.	After a short period of time, the backlight goes off. This is normal behavior to save the battery power.
3. At the side, press the ► button.	• SETUP-menu 2 is shown.	
4. At the side, press the ▲ button.	• SETUP-menu 21 is shown.	
5. At the side, press and hold the PROG button for at least 3 seconds.	• The display returns to operation level and shows the RUN indicator.	The E018-P is ready for daily use.
6. Install the cover.	• The cover is installed and locked.	

5.4.6 JOB CLOSE UP

1. Do a test of the optical keys to make sure the E018-P is ready for daily use.
2. Remove all tools, materials and equipment from the work area.
3. Make sure, the work area is clean.
4. Dispose of the (electronic) waste in accordance with the (inter)national, the manufacturer's and the plant owner's standards and regulations.
5. For future reference, make a note in the maintenance log of the installation.
6. Ask the safety officer for permission to return the E018-P into service.
7. Return the E018-P into service.

6 LABELS

6.1 GENERAL REMARKS REGARDING THE SHOWN LABELS

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.

Note !

The labels below show a typical example for recognition. For the actual data, refer to the label which is attached to your unit or refer to the Appendix A; Technical specifications.

6.2 LABEL WITH CERTIFICATION DATA

The E-series comes in temperature class T6. T6 classified versions consume 4.5 watts or less.

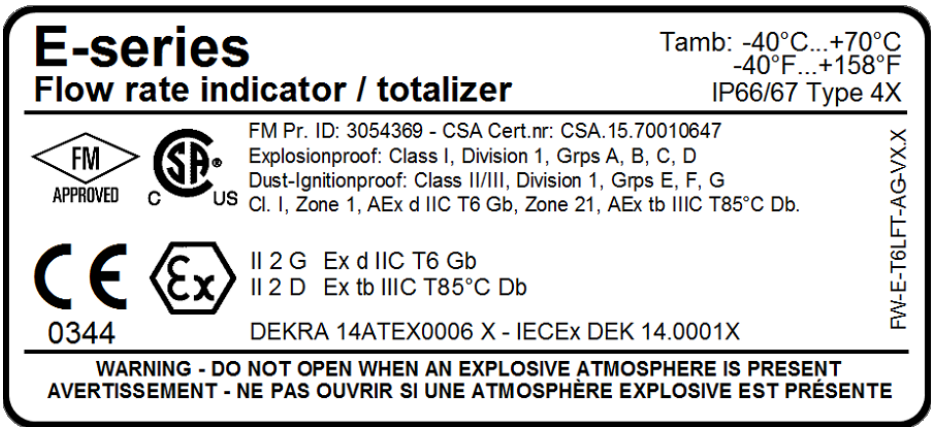


Fig. 27: External label Certification Data

6.3 LABEL WITH THREAD SIZES

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

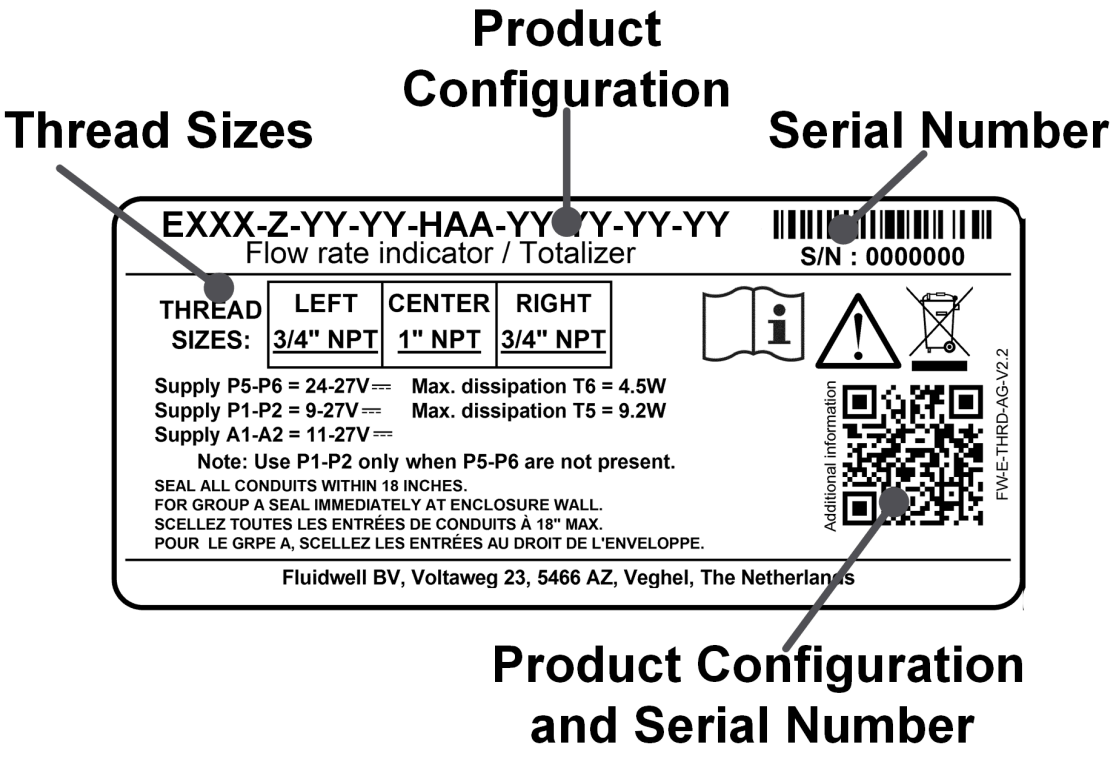


Fig. 28: Example external label Thread Sizes

6.4 INTERNAL LABELS.

Label on the main electronics module (MEM):

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

Labels attached to the Main Electronics Module (MEM) (typical example):

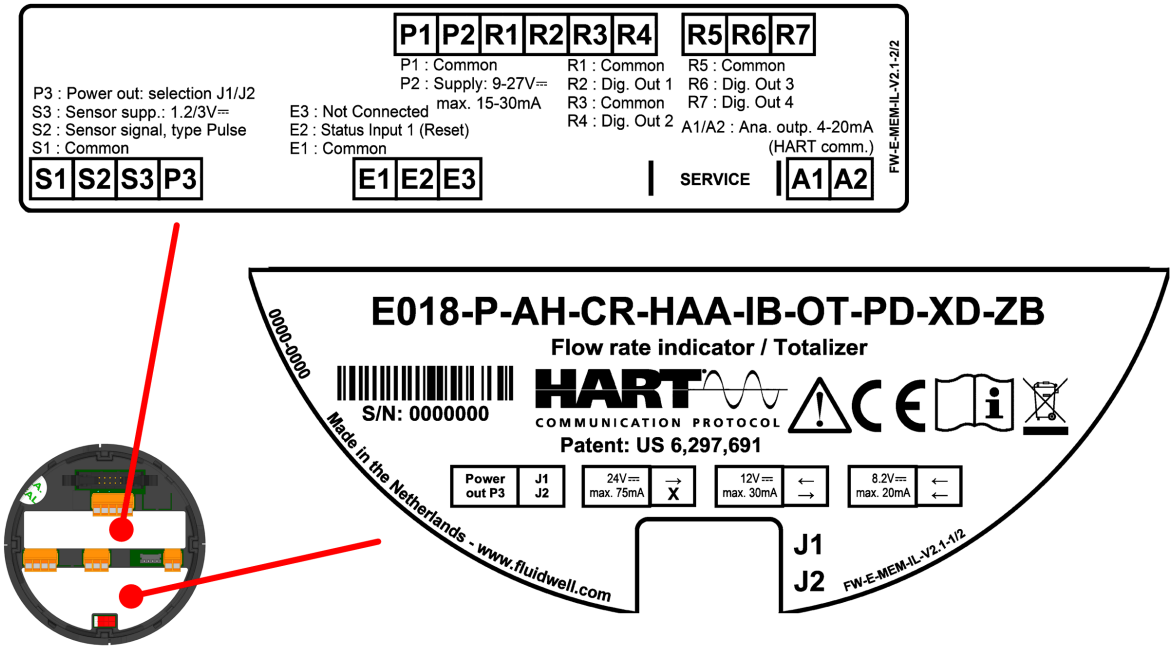


Fig. 29: Example Label on the Main Electronics Module (MEM)

Label attached to the Basic Supply Module (BSM) – option PB.

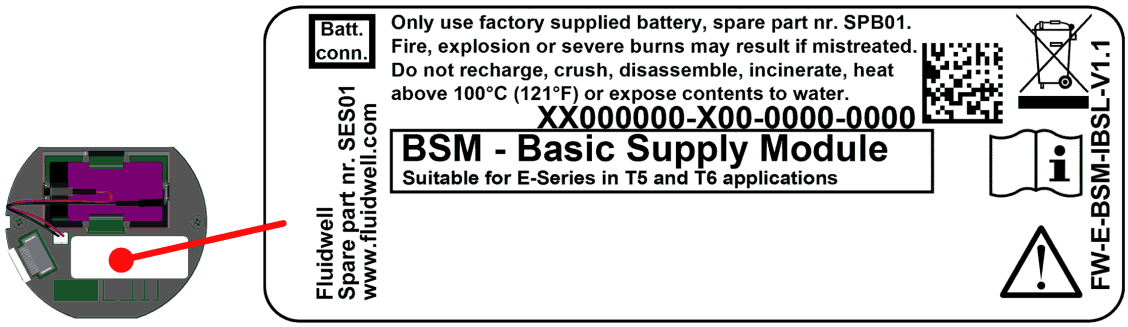


Fig. 30: Example Label on the Basic Supply Module (BSM)

Label attached to the Relay Supply Module (RSM) – option (PB)-OR.

Fig. 31: Example Label on the Basic Supply Module (BSM)

Appendix A. TECHNICAL SPECIFICATION

Display	
Type	High intensity numeric and alphanumeric LCD, UV-resistant, with bright backlight. Intensity can be adjusted via the keypad. Note ! *When battery powered, the backlight is only operational after a keypad touch to extend the battery lifetime.*
Dimensions	Ø 65 x 45mm (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	To indicate the actual flow rate, the bargraph runs from 0 to 100% in 20 blocks, each block is 5%.

Enclosures			
General	Aluminum or stainless steel EX-d enclosure with glass window.		
Sealing	Silicone.		
Control Keys	Three optical keys with operation through the glass front window.		
Rating	IP67 / TYPE 4X / TYPE 7 / TYPE 9.		
Type HA_	Die-cast aluminum EX d enclosure.		
Dimensions	112 x 133 x 148mm (4.41" x 5.24" x 5.83") – W x H x D.		
Weight	1300 gr.		
Type HS_	Stainless steel 316L Ex d enclosure.		
Dimensions	112 x 133 x 148mm (4.41" x 5.24" x 5.83") – W x H x D.		
Weight	3600 gr.		
Entry thread			
H_A	2 x ¾"NPT / 1 x 1"NPT	H_D	2 x ½"NPT / 1 x ¾"NPT
H_B	3 x ¾"NPT	H_G	2 x M20 / 1 x M25
H_C	2 x ½"NPT / 1 x 1"NPT	H_H	3 x M25

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

Power requirements	
Type PB	Long life Lithium battery – life-time depends upon settings and configuration – up to approx. 3 years Note ! *The battery can power the backlight for a short time after a keypad touch but cannot power the relay output (OR) or the real sensor supply (Terminal P3).*
Type PD	9 – 27V DC. Consumption max. 4.5W (sensor excitation included). In combination with relay output (type OR): 24-27V DC.
Type PX	9 – 27V DC. Consumption max. 3W.
Type AH	Loop powered, analog output. 11 – 27V DC, Min. 2mA. Consumption max. 675mW (25mA @ 27VDC). 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, I_{out} max. 100µA. Note ! *This is not a real sensor supply. Only suitable for sensors with a very low power consumption like coils (sine wave) and reed-switches.*
Type PD	Terminal P3 : 8.2 / 12 / 24V DC • 8.2V DC, Iout max. 20mA. • 12V DC, Iout max. 30mA. • 24V DC, Iout max. 75mA (this voltage varies depending on the input supply voltage)

Terminal connections	
Type	Removable plug-in terminal strip. Wire max. 1.5 mm^2 and 2.5 mm^2.

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

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

Directives and Standards	
EMC	EN 61326-1; FCC 47 CFR part 15
LVD	EN/IEC 61010-1
ATEX / IECEx	EN/IEC 60079-0; EN/IEC 60079-1; EN/IEC 60079-31
CSA	CSA 22.2 No. 25, CSA 22.2 No. 30
FM	FM3600; FM3615; FM3616; FM3810
RoHS	EN 50581
IP & TYPE	EN 60529; NEMA 250

Input

Flowmeter	
Type P	Coil / sine wave (COIL-HI: 20mVpp or COIL-LO: 90mVpp sensitivity selectable), NPN, PNP, reed switch, NAMUR, active pulse signals 8 or 24V DC.
Frequency	Minimum 0Hz - maximum 10kHz for total and flow rate. Maximum frequency depends on signal type and internal low-pass filter. E.g. reed switch with low-pass filter: max. frequency 120Hz.
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.

Reset total	
General	Terminal input to reset total remotely or to lock the “clear total” button.
Type IB	Internally pulled-up switch contact - NPN.
Duration	Minimum pulse duration 100msec.

Output

Digital output	
General	Transmitting flowrate alarm status, linearized accumulated total (scaled pulse) or input pulse retransmission
Frequency	Alarm: Maximum update rate: 8Hz. Scaled: Output D1-D2: max. 500Hz. Output D3-D4: max. 4Hz. Output D5-D6: max. 4Hz, recommended use below 0.5Hz. Pulse length user definable between 1msec up to 10 seconds. Retransmission: Minimum pulse duration: 50µs, square wave output based on frequency of (sine wave or coil) input signal
Type OT	Four passive transistor outputs (NPN) - not isolated. 300mA - 50V @ 25°C.
Type OR Note !	Two isolated electro-mechanical relay outputs (NO). Maximum resistive load: 2A @ 250V AC / 30V DC. Maximum inductive load: 0,5A (pilot duty applications). • *Requires 24 - 27V DC and supplied via P5 - P6.* • *Type OT remains available.* • *Not used in pulse retransmission mode.*

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

Communication (option)	
Functions	Reading display information, reading / writing all configuration settings
Type CR	HART Communication protocol, Revision 7.0
Loop resistance	Between 250 and 1100Ω
Addressing	Maximum 32 addresses

Operational

Operator functions	
Displayed information	• Linearized flow rate and / or total. • Linearized total and accumulated total. • Indicating speedometer for flow rate • Total can be reset to zero by pressing the CLEAR-key twice

Total	
Digits	7 digits.
Unit	L, m3, US gal, I gal, cf, oil bbl, kg, ton, US ton, lb, (none)
Decimals	0 - 1 - 2 or 3.
Note !	*Total can be reset to zero.*

Accumulated total	
Digits	11 digits.
Unit / decimals	According to selection for total.
Note !	*Accumulated total cannot be reset to zero.*

Flow rate	
Digits	7 digits.
Units	mL, L, m3, g, kg, ton, US ton, US gal, I gal, Oil bbl, lb, cf, rev, none, scf, nm3, nL
Bargraph	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 E018-P is going to be installed or while it is in operation.

Flowmeter does not generate pulses

Check:

- Signal selection SETUP 5.1.
- Pulse amplitude (paragraph 4.6.3).
- Flowmeter, wiring and connection of terminal connectors (paragraph 4.6.3).
- Power supply of flowmeter (paragraph 4.4.2).

Flowmeter generates "too many pulses"

Check:

- Settings for Total and Flowrate.
- Type of signal selected with actual signal generated (paragraph 3.3.6).
- Sensitivity of coil input.
- Proper grounding of the E018-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 9.2: is the function enabled?
- SETUP 7.1 / 7.2: are the flow-levels programmed correctly?
- SETUP 7.3 / 7.4 / 9.3: are the 4mA and 20mA tuned correctly?
- Connection of the external power-supply according to the specification.

Pulse output does not function

Check:

- SETUP 8.1 / 8.2 / 8.3 / 8.4 – Relay 1,2,3,4: is the correct function selected?
- SETUP 8.5 - impulse width: is the external device able to recognize the selected pulse width and frequency?
- SETUP 8.6 - amount per “x” quantity: is the value programmed reasonable?

Flowrate displays "0 / zero" while there is flow (total is counting)

Check:

- SETUP 2.2 / 2.4: are the K-factor and time unit correct?
- SETUP 2.5 / 2.6 / 2.7: The unit has to count the number of pulses according to SETUP 2.5 within the time according to SETUP 2.6. Make sure that SETUP 2.6 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 2.5.

Linearization does not work

Check:

- SETUP 6.G: is the function enabled?
- SETUP 6.1-6.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 error code. The codes are:

[d] 1 = display error
[d] 2 = data-storage error
[d] 4 = initialization error
[d] 16 = IO configuration error base
[d] 32 = IO configuration error interface
[d] 64 = Linearization error (M-factor out of range)

When multiple alarms occur, the error code shown is the sum of the error codes as given above.
E.g. 0048 is a combination of error code 0016 and 0032.

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

Appendix C. HART COMMUNICATION

This chapter gives a detailed information on the supported HART-commands, variables and status bits present in the E018-P that are required to connect and operate your HART-enabled device.

HART - Highway Addressable Remote Transducer – is an industrial protocol that must be superimposed on a 4-20mA current loop signal. It is an open standard, and full details about HART can be obtained through the website of the FieldComm Group (previously HART Communication Foundation) at www.fieldcommgroup.org.

Device Descriptor

All standard HART configuration items are accessible without any special configuration. In order to be able to configure all settings of your E018-P HART device, your host or communicator requires the use of a specific HART Device Descriptor (DD), especially designed for the E018-P.
These DD's can be downloaded from the FieldComm Group website (www.fieldcommgroup.org) or the Fluidwell website (www.fluidwell.com).

IDENTIFICATION			
Manufacturer Name	Fluidwell B.V.	Model Name	E018-P
Manufacture ID Code	0x6039	Device Type Code	0xE2CD
HART Protocol revision	7.0	Revisions	Device Revision 0x03; Software Revision 0x01, Hardware Revision 0x00).
Physical layer	FSK, 4-wire high-impedance transmitter	Device type / Physical category	DC-isolated Bus Device Transmitter
Device ID	0x177864	Device profile	0x01
	HCF SDC625 tokenized output: Emerson 475 Field communicator:		
Universal commands	All universal commands (including command 38 and 48) are supported.		
Common practice commands	Following common practice commands are supported:		
	Command 34 Set PV damping value Command 35 Write PV Range Values Command 38 Reset configuration change flag Command 40 Enter/Exit Fixed Current Mode Command 42 Device Reset Command 45 Trim Loop current zero Command 46 Trim Loop current gain Read additional device status Command 48 Read additional device status Command 54 Read device variable information Command 59 Write Response Preambles Command 100 Write PV Alarm Code		
Number of device-specific commands	17 (+2 used indirectly)	Number of dynamic variables	3
Map-able dynamic variables	No	Additional device status flags	Yes
Burst mode	No	Alternative operating modes	No
Catch device variable	No	Write protection	No

Variables

The following E018-P runtime variables are mapped to the HART dynamic device variables:

HART VARIABLES	
Type	E018-P
PV (primary variable	Flowrate
SV(secondary variable)	Total
TV (tertiary variable)	Accumulated total
QV (quaternary variable)	Not used

Note !

The Flowrate value is permanently linked to the PV and the analog output.

Device status information

The E018-P returns its status in the device status byte available through command 48. When the status flag 'more status available' is set, command 48 can return the following status flags in its additional status bytes:

DEVICE STATUS INFORMATION		
BYTE	**DESCRIPTION**	**CONTENT**
14	E0 error register 1	Fld. Dev.stat 14-1 0x01: Display error Fld. Dev.stat 14-2 0x02: EEPROM error Fld. Dev.stat 14-3 0x04: not used Fld. Dev.stat 14-4 0x08: not used Fld. Dev.stat 14-5 0x10: Low alarm error Fld. Dev.stat 14-6 0x20: High alarm error Fld. Dev.stat 14-7 0x40: Linearization error
15	E0 error register 2	Fld. Dev.stat 15-1 0x01: Initialization error Fld. Dev.stat 15-2 0x02: Warning: Total was cleared (either via HART or by hand).

Caution !

FLD. DEV.STAT 14-1 AND FLD. DEV.STAT 14-2 ARE CRITICAL ERRORS AND RESULT IN THE DEVICE MALFUNCTION FLAG TO BE SET IN DEVICE STATUS.

Note !

The device malfunction is not expressed with Namur43-conditions but by means of a status flag in the device status through command 48.

Command specific response codes

The following response codes are valid for all implemented commands:

COMMAND SPECIFIC RESPONSE CODES		
CODE	**CLASS**	**DESCRIPTION**
0	Success	No command-specific errors
1	-	Undefined
2	Error	Invalid selection
3	Error	Passed parameter too big
4	Error	Passed parameter too small
5	Error	Too few data bytes received
6	Error	Device-specific command error
7	Error	In write protect mode

Units

The predefined units in HART are mapped to the E018-P totalizer and flowrate units as follows:

Totalizer			
Setup unit	**Display icon**	**DD unit**	**Hart unit number**
l	L	L	41
m3	M3	M3/Cum	43
US Gal	gal	gal	40
I GAL	gal	Imp gal.	42
Cf	ft3	Cuft	112
Oil bbl	bbl	bbl	46
kg	kg	kg	61
ton	ton	met ton	62
lb	lb	lb	63
US ton	ton	STon	64
none	----	none	251

Flowrate								
E018-P	**Time base: /sec**		**Time base: /min**		**Time base: /hour**		**Time base: /day**	
Unit	***Unit***	***Number***	***Unit***	***Number***	***Unit***	***Number***	***Unit***	***Number***
ml	ml/sec	246*	ml/min	247*	ml/hr	248*	ml/day	249*
L	l/sec	24	l/min	17	l/hr	138	l/day	240*
m3	m3/sec	28	m3/min	131	m3/hr	19	m3/day	29
USgal	gal/sec	22	gal/min	16	gal/hr	136	gal/day	235
Igal	Igal/sec	137	Igal/min	18	Igal/hr	30	Igal/day	31
cf	Cuft/sec	26	Cuft/min	15	Cuft/hr	130	Cuft/day	27
bbl	bbl/sec	132	bbl/min	133	bbl/hr	134	bbl/day	135
nl	Normal l/sec	176	Normal l/min	175	Normal l/hr	122	Normal l/day	174
nm3	Normal m3/sec	183	Normal m3/min	182	Normal m3/hr	121	Normal m3/day	181
scf	Std. Cuft/sec	186	Std. Cuft/min	123	Std. Cuft/hr	185	Std. Cuft/day	184
g	g/sec	70	g/min	71	g/hr	72	g/day	241*
kg	kg/sec	73	kg/min	74	kg/hr	75	kg/day	76
ton**	ton/sec	242*	tons/min	77	tons/hr	78	tons/day	79
lb	lb/sec	80	lb/min	81	lb/hr	82	lb/day	83
USTon	USton/sec	243*	USton/min	84	USton/hr	85	USton/day	86
rev	rev/sec	118	rev/min	119	rev/hr	244	rev/day	245
none	none/sec	251	none /min	251	none /hr	251	none /day	251

Appendix D. DECLARATION OF CONFORMITY

Count on us.

EU Declaration of Conformity

Fluidwell E-series indicators

Veghel, October 2017

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

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

Last two digits of the year in which the CE marking was affixed: 13.
Remark: compliance is not affected by standards EN60079-0/A11:2014, EN60079-1:2014 and EN60079-31:2014.

Fluidwell BV

I. Meij, Manager Technology

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

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USD account no: 02.20.81.771
IBAN: NL22 INGB 0022 0817 71

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Notes:

Notes:

LIST OF CONFIGURATION SETTINGS				
SETTING		DEFAULT	DATE:	DATE:
1	**TOTAL**		Enter your settings here	
1.1	UNIT	L		
1.2	DECIMALS	0000000		
1.3	K-FACTOR	0000001		
1.4	CLEAR PASSWORD	000		
2	**FLOWRATE**			
2.1	UNIT	L		
2.2	TIME	/min		
2.3	DECIMALS	0000000		
2.4	K-FACTOR	0000001		
2.5	CALCULATION	010		
2.6	CUT-OFF	30.0 sec.		
2.7	DAMPING	0.1		
3	**ALARM**			
3.1	FLOWZERO	ignore		
3.2	ALARM LOW-LOW	0		
3.3	ALARM LOW	0		
3.4	ALARM HIGH	0		
3.5	ALARM HIGH-HIGH	0		
3.6	DELAY ALARM LOW-LOW	0.0 sec		
3.7	DELAY ALARM LOW	0.0 sec		
3.8	DELAY ALARM HIGH	0.0 sec		
3.9	DELAY ALARM HIGH-HIGH	0.0 sec		
4	**DISPLAY**			
4.1	FUNCTION	flowrate		
4.2	SET ALARM	operator		
4.3	LCD NEW	1 sec		
4.4	BACKLIGHT	100%		
4.5	BACKLIGHT ALARM	off		
4.6	BARGRAPH	enabled		
4.7	RATESPAN	9999		
5	**FLOWMETER**			
5.1	SIGNAL	coil-lo		
6	**LINEARIZE**			
6.1	FREQUENCY 1	0.0Hz		
	M-FACTOR 1	1.000000		
6.2	FREQUENCY 2	0.0Hz		
	M-FACTOR 2	1.000000		
6.3	FREQUENCY 3	0.0Hz		
	M-FACTOR 3	1.000000		
6.4	FREQUENCY 4	0.0Hz		
	M-FACTOR 4	1.000000		

6	LINEARIZE (continued)			
6.5	FREQUENCY 5	0.0Hz		
	M-FACTOR 5	1.000000		
6.6	FREQUENCY 6	0.0Hz		
	M-FACTOR 6	1.000000		
6.7	FREQUENCY 7	0.0Hz		
	M-FACTOR 7	1.000000		
6.8	FREQUENCY 8	0.0Hz		
	M-FACTOR 8	1.000000		
6.9	FREQUENCY 9	0.0Hz		
	M-FACTOR 9	1.000000		
6.A	FREQUENCY 10	0.0Hz		
	M-FACTOR 10	1.000000		
6.B	FREQUENCY 11	0.0Hz		
	M-FACTOR 11	1.000000		
6.C	FREQUENCY 12	0.0Hz		
	M-FACTOR 12	1.000000		
6.D	FREQUENCY 13	0.0Hz		
	M-FACTOR 13	1.000000		
6.E	FREQUENCY 14	0.0Hz		
	M-FACTOR 14	1.000000		
6.F	FREQUENCY 15	0.0Hz		
	M-FACTOR 15	1.000000		
6.G	LINEARIZATION	disabled		
6.H	DECIMALS FREQUENCY	0.1		
7	**ANALOG OUTPUT**			
7.1	RATE-MIN (PV-LRV)	0		
7.2	RATE-MAX (PV-URV)	1600		
7.3	TUNE-MIN (4mA)	725		
7.4	TUNE-MAX (20mA)	3627		
8	**PULSE**			
8.1	RELAY 1	off		
8.2	RELAY 2	off		
8.3	RELAY 3	off		
8.4	RELAY 4	off		
8.5	WIDTH	000 sec		
8.6	AMOUNT	0001000		
9	**COM-HART**			
9.1	ADDRESS	00		
9.2	LOOP CURRENT	enabled		
9.3	LOOP TEST	off		
10	**OTHERS**			
10.1	MODEL	E018-P	E018-P	E018-P
10.2	SOFTWARE VERSION	03:_ _:_ _		
10.3	SERIAL NO	_ _ _ _ _ _ _		
10.4	PASSWORD	0000		
10.5	KEY LOCK	enabled		
10.6	TAG-NO	0000000		