F018-P

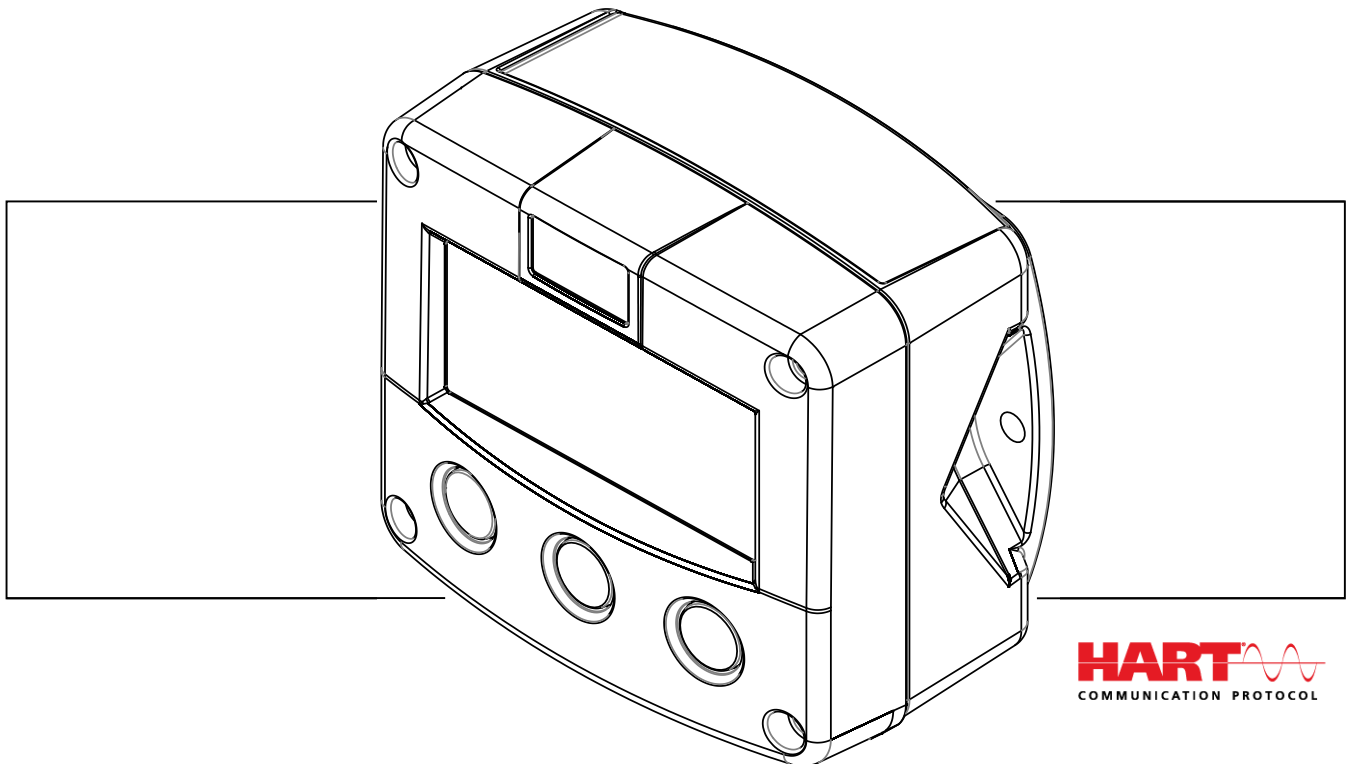## FLOWRATE MONITOR / TOTALIZER

with LINEARIZATION, HIGH/LOW FLOWRATE ALARMS, SCALED PULSE OUTPUT, ANALOG OUTPUT and optional HART communication

HART
COMMUNICATION PROTOCOL

Signal input flowmeter: pulse, Namur and coil

Output: one scaled pulse ref. accumulated total or one flowrate alarm.

Options: HART Communication, Backlight and *Intrinsically Safe*

CE ⟨Ex⟩ IEC IECEx CSA FM APPROVED

SAFETY INSTRUCTIONS

WARNING

- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- LIFE SUPPORT APPLICATIONS: The F018-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 F018-P, the installer has to discharge himself by touching a well-grounded object.
- The F018-P must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).
- Intrinsically Safe applications: follow the instructions as mentioned in Chapter 5 and consult "Fluidwell F0..-..-XI - Documentation for Intrinsic Safety""

DISPOSAL OF ELECTRONIC WASTE

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

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F018-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 F018-P.
- Check all connections, settings and technical specifications of the various peripheral devices with the F018-P supplied.
- Open the casing 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 casing classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

The daily use of the F018-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 F018-P as well as most of the options available. For additional information, please contact your supplier.

A hazardous situation may occur if the F018-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 F018-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 F018-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.*

CONTENTS MANUAL

1 INTRODUCTION

1.1 SYSTEM DESCRIPTION OF THE F018-P

Functions and features

The flowrate / monitor model F018-P features a 15 point linearization table, a scaled pulse output and high and low flowrate alarms. Furthermore the unit has a HART–enabled analog output (4..20mA) which represents the current flowrate. This product has been designed with a focus on:

- One multi-purpose pulse input;
- Flowrate and Totalizer functionality with 15 point linearization table;
- One analog output 4..20mA;
- HART communication for configuring unit and monitoring process;
- Multidrop communication possible;
- Device description (DD) available for use with a HART handheld or HART Host;
- Intrinsic safety for use in hazardous applications;
- Transmitting possibilities with one configurable pulse or alarm output;
- several mounting possibilities with GRP or aluminum enclosures for industrial surroundings.

Flowmeter input

This manual describes the F018-P with a <u>pulse type</u> input from the flowmeter "-P version". The F018-P can be output loop powered or it can be powered by an external power supply. Sensor power is only available when the unit is powered by an external power supply.

One flowmeter with a passive or active pulse, Namur or coil signal output can be connected to the F018-P. To power the sensor, the PD option is available.
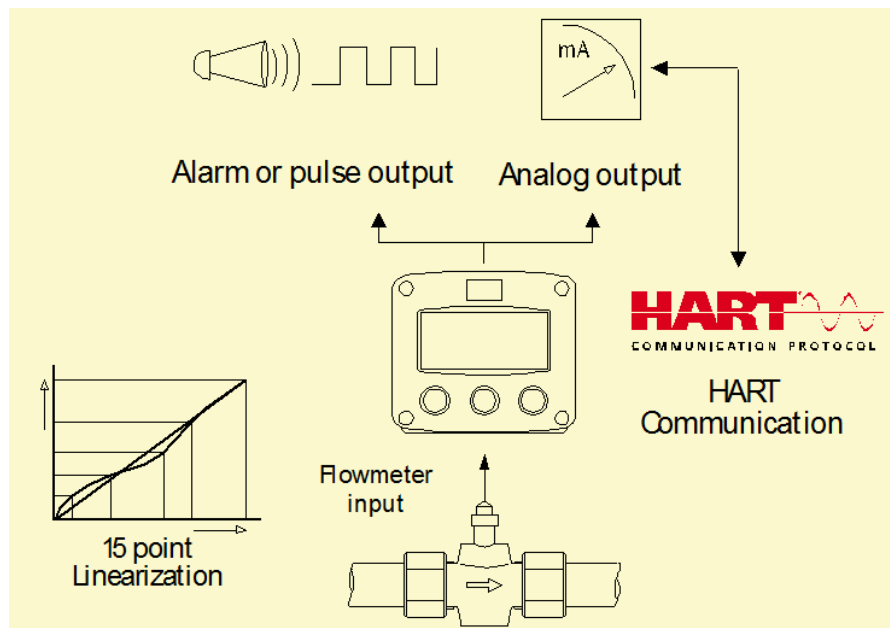
Fig. 1: Typical application for the F018-P.

Configuration of the F018-P

The F018-P has been designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F018-P according to your specific requirements.

It includes several important features, such as K-Factor, measurement units, signal selection etc. All setting are stored in EEPROM memory and will not be lost in the event of power failure. To extend the battery-life time, please use of the power-management functions as described in chapter 0.

Display information

The F018-P has a large transflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.

Flowrate and totals can be displayed either with the small 8mm digits or with the 17mm digits.

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

2   OPERATIONAL

2.1   GENERAL IN FORMATION

Caution !

- The F018-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.

This chapter describes the daily use of the F018-P. This instruction is meant for users / operators.

2.2   CONTROL PANEL

The following keys are available:
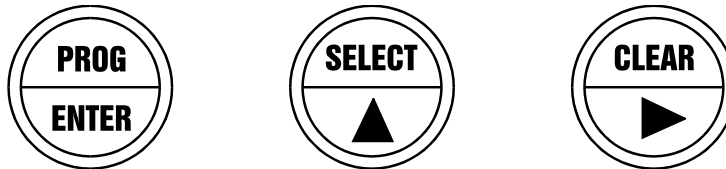
Fig. 2: Control panel.

Functions of the keys

This key is used to program and save new values or settings.

It is also used to gain access to SETUP-level; please read chapter 3.

This key is used to SELECT accumulated total

The arrow-key ▲ is used to increase a value after PROG has been pressed or to configure the F018-P; please read chapter 3.

Press this key twice to CLEAR the value for total.

The arrow-key ▶ is used to select a digit after PROG has been pressed or to configure the F018-P; please read chapter 3.

2.3   OPERATOR INFORMATION AND FUNCTIONS

In general, the F018-P will always function at Operator level. The information displayed is dependent upon the SETUP-settings. The signal from the connected sensor is processed by the F018-P in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.

Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

- **Display flowrate / total or Flowrate**
  This is the main display information of the F018-P. After selecting any other information, it will always return to this main display automatically.
  Total is displayed on the upper-line of the display and flowrate on the bottom line.
  It is possible to display flowrate only with the large 17mm digits; in this instance press the SELECT-key to read the total.
  When "-------" is shown, then the flowrate value is too high to be displayed. The arrows ⬍ indicate the increase/decrease of the flowrate trend.

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

- **Display accumulated total**
  When the SELECT-key is pressed, total and accumulated total are displayed. The accumulated total cannot be re-initialized. The value will count up to 99,999,999,999. The unit and number of decimals are displayed according to the configuration settings for total.

- **Alarm**
  When "alarm" is displayed, please consult Appendix B: problem solving.

- **Low-battery alarm**
  When the battery voltage drops, it must be replaced. At first "low-battery" will flash, but as soon as it is displayed continuously, the battery MUST be replaced shortly after!
  Only original batteries supplied by the manufacturer may be used, else the guarantee and liability will be terminated. The remaining lifetime after the first moment of indication is generally several days up to some weeks.

Fig. 4: Example of low-battery alarm.

- **Flowrate alarm**
  When the actual flowrate is outside the allowed range, an alarm message will be displayed indicating the type of alarm: "LO RATE", "HI RATE".
  The alarm is terminated automatically as soon as the flowrate is within its range again.

Programming the flowrate alarm values

This function might not be accessible due to a configuration setting.

Note !

When the SELECT-key is pressed a few times, following flowrate alarm values are displayed:

- low flowrate alarm: enter here 40 L/min for example
- high flowrate alarm: enter here 200 L/min for example

To change the alarm value, the following procedure must be executed:

- press PROG: the word "PROGRAM" will flash or a pass code will be requested,
- use ▸ to select the digits and ▲ to increase that value,
- confirm the new alarm value by pressing ENTER.

Fig. 5: Example of display information during programming minimum flowrate.

When data is altered but ENTER has not been pressed yet, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER during three seconds: the former value will be reinstated.

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 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 F018-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.

3.2   PROGRAMMING SETUP-LEVEL

3.2.1   GENERAL INFORMATION

Configuration of the F018-P is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows ↕ will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the F018-P will exit SETUP automatically.

SETUP can be reached at all times while the F018-P remains fully operational.

Note !

A pass code may be required to enter SETUP.

Without this pass code access to SETUP is denied.

To enter SETUP-level:
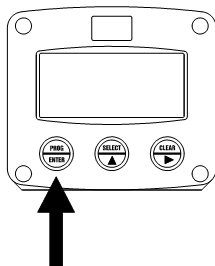
Press the PROG/ENTER key for 7 seconds.

Matrix structure SETUP-level:
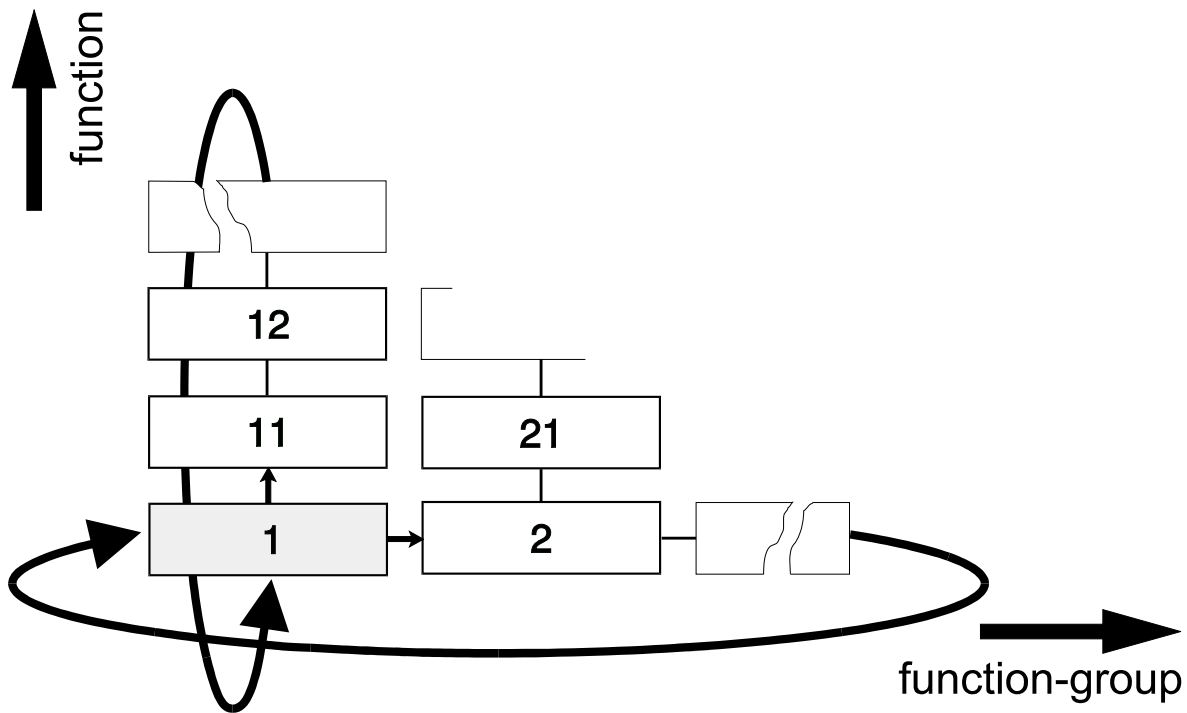
SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:

SETUP is divided into several function groups and functions.
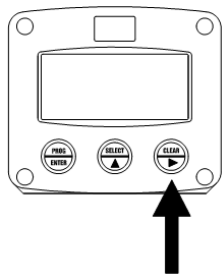
Select the function group with the CLEAR/ ▸ key.
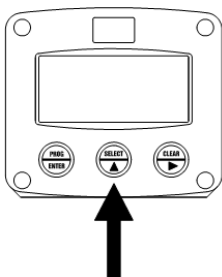
Select the function with the SELECT/▲ key.

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

After selecting a sub-function, the next main function is selected by scrolling through all "active" sub-functions (e.g. 1▲, 11▲, 12▲, 13▲, 14▲, 1 ▸, 2 ▸, 3▲, 31 etc.). The "CLEAR" button can be used to jump a step back if you missed the desired function.

To change or select a value:
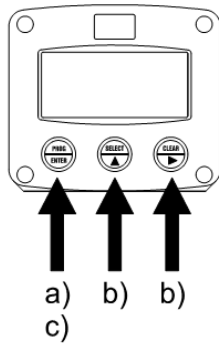
- Momentarily, press the PROG/ENTER key.
  The program indicator start to flash.
- Select or enter a value with the SELECT/▲ key and/or
  the CLEAR/▸ key.
- Press the PROG/ENTER key to confirm the value/selection.

a) b) b)
c)

To change a value, use ▸ to select the digits and ▲ to increase that value.

To make a value negative, press ▸ and ▲ simultaneously.

If the new value is invalid, the increase sign▲ or decrease-sign▼ will be displayed while you are programming.

To select a setting, ▲ is used to select in one direction and ▸ can be used to select in the other direction.

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

Alterations will only be set after ENTER has been pressed!

Note !

To return to OPERATOR-level:
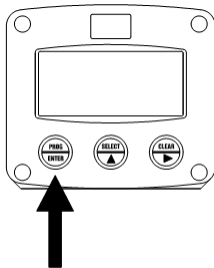
Press the PROG/ENTER key for 3 seconds.

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

### 3.2.2 OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	11	UNIT	L - m^3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K-FACTOR:	0.000010 - 9,999,999
	14	DECIMALS K-FACTOR	0 - 6
2	**FLOWRATE**		
	21	UNIT	l/min – l/hr – m^3/sec – m^3/min – m^3/hr – m^3/day – g/sec – g/min - g/hr – kg/sec – kg/min – kg/hr – kg/day – ton/min – ton/hr – ton/day – gal/sec – gal/min – gal/hr – gal/day – bbl/sec – bbl/min – bbl/hr – bbl/day – lb/sec – lb/min – lb/hr – lb/day – cf/sec – cf/min – cf/hr – rev/sec – rev/min – none – l/sec
	22	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	23	K-FACTOR	0.000010 - 9,999,999
	24	DECIMALS K-FACTOR	0 - 6
	25	CALCULATION	per 1 - 255 pulses
	26	CUT-OFF	0.1 - 999.9 seconds
	27	DAMPING	0.1 - 999.9 seconds
3	**ALARM**		
	31	ALARM SET	Operate – Setup -- Hide
	32	FLOW ZERO	Default – No Relay – Ignore
	33	ALARM LO	-999,999 .. 999,999
	34	ALARM HI	-999,999 .. 999,999
	35	DELAY LO	0..999.9 sec
	36	DELAY HI	0..999.9 sec
	37	REL OUT	Lo – Hi – Lo+Hi – Pulse – Off
4	**DISPLAY**		
	31	FUNCTION	total - flowrate
	32	LCD NEW	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	33	BACKLIGHT	off - green - amber
	34	BACKLIGHT ALARM	Off – on – flash
	35	BL. BRIGHTNESS	1 - 5
	36	BATTERY MODE	operational - shelf
5	**FLOWMETER**		
	51	SIGNAL	npn - npn_lp - reed - reed_lp - pnp - pnp_lp - namur - coil_hi - coil_lo - active

SETUP FUNCTIONS AND VARIABLES			
6	**LINEARIZATION**		
	61	FREQ. / M-FACTOR 1	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	62	FREQ. / M-FACTOR 2	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	…	FREQ. / M-FACTOR …	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	6F	FREQ. / M-FACTOR 15	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	6G	LINEARIZATION	enable / disable
	6H	DECIMALS FREQUENCY	00000 - 1111.1 - 222.22 - 33.333
7	**ANALOG**		
	71	PV LRV	-999,999 – 999,999
	72	PV URV	-999,999 – 999,999
	73	LOOP CURRENT MODE	Enabled - Disabled
	74	LOOP TEST	Off – Set 4mA – Set 20mA
	75	TUNE LO	660
	76	TUNE HI	3300
8	**PULSE**		
	81	PULSE WIDTH	0.001 - 9.999 sec
	82	DECIMALS	0 - 1 - 2 - 3
	83	IMPULSE PER	X-quantity
	84	REL OUT	Lo – Hi – Lo+Hi – Pulse – Off
9	**OTHERS**		
	91	TYPE / MODEL	F018-P
	92	SOFTWARE VERSION	03.xx.xx
	93	SERIAL NO.	xxxxxxx
	94	PASSWORD	0000 - 9999
	95	POLL ADDRESS	0..63
	96	TAGNUMBER	0000000 - 9999999

3.2.3 EXPLANATION OF SETUP-MENU 1 - TOTAL

SETUP FUNCTIONS AND VARIABLES		
1	**TOTAL**	
11	UNIT	SETUP - 21 determines the measurement unit for total and accumulated total. The following units can be selected: L - m3 - kg - lb. - GAL - USGAL - bbl - ---- (no unit). Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.
12	DECIMALS	The decimal point determines for total and accumulated total the number of digits following the decimal point. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333
13	K-FACTOR:	With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 21), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be. **Example 1:** **Calculating the K-factor.** Let us assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m3". A cubic meter consists of 1000 parts of one liter which implies 2,481.3 pulses per m3. So, the K-factor is 2,481.3. Enter for SETUP 23: "2481300" and for SETUP 24 - decimals K-factor "3". **Example 2:** **Calculating the K-factor.** Let us assume that the flowmeter generates 6.5231 pulses per gallon and the selected measurement unit is gallons. So, the K-Factor is 6.5231. Enter for SETUP 23: "6523100" and for SETUP 14 decimals K-factor "6".
14	DECIMALS K-FACTOR	This setting determines the number of decimals for the K-factor entered. (SETUP 23). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 Please note that this setting influences the accuracy of the K-factor indirectly (i.e. the position of the decimal point and thus the value given). This setting has NO influence on the displayed number of digits for total (SETUP 22)!

3.2.4   EXPLANATION OF SETUP-MENU 2 - FLOWRATE

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.

SETUP FUNCTIONS AND VARIABLES		
2	**FLOWRATE**	
21	UNIT	SETUP - 11 determines the measurement unit for flowrate.
		The following units can be selected:
		l/min – l/hr – nm^3/sec – nm^3/min – nm^3/hr – nm^3/day – g/sec – g/min - g/hr – kg/sec – kg/min – kg/hr – kg/day – ton/min – ton/hr – ton/day – gal/sec – gal/min – gal/hr – gal/day – bbl/sec – bbl/min – bbl/hr – bbl/day – lb/sec – lb/min – lb/hr – lb/day – cf/sec – cf/min – cf/hr – rev/sec – rev/min – none – l/sec
		Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.
22	DECIMALS	This setting determines for flowrate the number of digits following the decimal point. The following can be selected:
		0000000 - 111111.1 - 22222.22 - 3333.333.
23	K-FACTOR	With the K-factor, the flowmeter pulse signals are converted to a flowrate.
		The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per liter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 23.
24	DECIMALS K-FACTOR	This setting determines the number of decimals for the K-factor (SETUP 13). The following can be selected:
		0 - 1 - 2 - 3 - 4 - 5 - 6
		Please note that this SETUP - influences the accuracy of the K-factor indirectly. This setting has NO influence on the displayed number of digits for "flowrate" (SETUP 12)!
25	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.
	Note !	• the lower the number of pulses, the higher the power consumption of the F018-P 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) do program a value of 100 or more pulses.
26	CUT-OFF	With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 15) 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).
27	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.

3.2.5   EXPLANATION OF SETUP-MENU 3 - ALARM

With these settings, it is determined how the flowrate will be monitored and the functionality of the transistor / relay output (terminals 7-8) is set.

SETUP FUNCTIONS AND VARIABLES		
3	**ALARM**	
31	ALARM SET	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.
		If SETUP has been selected, the alarm values are still visible for the Operator but cannot be changed. If Hide has been selected, the alarm values are invisible.
32	FLOW ZERO	When the <u>flowrate is zero</u>, 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.
33	ALARM LO	The low alarm is set with this setting. An alarm will be generated as long as the flowrate is lower than this value.
		With value 0 this function is disabled.
34	ALARM HI	The high alarm is set with this setting. An alarm will be generated as long as the flowrate is higher than this value.
		With value 0 this function is disabled.
35	DELAY LO	An alarm generated by SETUP 32 "low" can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, an alarm will be generated.
36	DELAY HI	An alarm generated by SETUP 33 "high" can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, an alarm will be generated.
37	REL OUT	One transistor or relay output is available to transmit the alarm condition or to generate the scaled pulse output.
		Assign with this function the type of signal to be transmitted:
		low flowrate alarm, high flowrate alarm, both alarms or pulse output.
		This setting is equal to setting 84.
	Note !	*Both flowrate alarms are visible in HART.* • A low alarm will set device status bit 14.5 • A high alarm will set device status bit 14.6

3.2.6   EXPLANATION OF SETUP-MENU 4 - DISPLAY

SETUP FUNCTIONS AND VARIABLES		
4	**DISPLAY**	
41	FUNCTION	The large 17mm digits can be set to display: flowrate, total or accumulated total. By pressing SELECT you can scroll through the various values. After 30 seconds of inactivity, the display will return to show its main information.
42	LCD NEW	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is **strongly advised** to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signal will be generated in the normal way. The following can be selected: Fast - 1 sec - 3 sec - 15 sec - 30 sec - off. **Example battery life-time with a coil pick-up:** • 1kHz pulse and FAST update: about 2 years. • 1kHz pulse and 1 sec update: about 5 years.
	Note !	*The functions below will only effect the optional LED-backlight.*
43	BACKLIGHT	If a LED backlight has been supplied, it can be turned on or off.
44	BACKLIGHT ALARM	In case the F018-P generates a flowrate alarm, the backlight can be set to change to red. Following selections are available: ON: during flowrate alarm the color is red. OFF: during flowrate alarm the color is according to setting 43. FLASH: during flowrate alarm the color flashes red.
43	BL. BRIGHTNESS	The backlight brightness is adjustable. The following can be selected: 1 - 5 1 (one) is minimum and 5 (five) is maximum brightness.
44	BATTERY MODE	The F018-P has two modes: operational or shelf. After "shelf" has been selected, the F018-P can be stored for several years; it will not process the sensor signal; the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the F018-P again, press the SELECT/▲ key twice.

3.2.7   EXPLANATION OF SETUP-MENU 5 - FLOWMETER

The F018-P is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 51. Read also chapter. 4.4.

SETUP FUNCTIONS AND VARIABLES				
5	**FLOWMETER**			
51	SIGNAL			
	TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mV	REMARK
	NPN	NPN input	100 kΩ pull-up	6 kHz.	(open collector)
	NPN - LP	NPN input with low pass filter	100 kΩ pull-up	1.2 kHz.	(open collector) less sensitive
	REED	Reed-switch input	1 mΩ pull-up	600 Hz.	
	REED - LP	Reed-switch input with low pass filter	1 mΩ pull-up	120 Hz.	Less sensitive
	PNP	PNP input	47 kΩ pull-down	6 kHz.	
	PNP - LP	PNP input with low pass filter	100 kΩ pull-down	1.2 kHz.	Less sensitive
	NAMUR	Namur input	820 Ω pull-down	4 kHz.	External power required
	COIL HI	High sensitive coil input	-	20 mV p.t.p.	Sensitive for disturbance!
	COIL LO	Low sensitive coil input	-	90 mV p.t.p.	Normal sensitivity
	ACT_8.2	Active pulse input detection level 8.2V DC	47 kΩ	10 kHz.	External power required
	ACT_12	Active pulse input detection level 12V DC	47 kΩ	10 kHz.	External power required
	ACT_24	Active pulse input detection level 24V DC	47 kΩ	10 kHz.	External power required

3.2.8 EXPLANATION OF SETUP-MENU 6 - LINEARIZATION

The linearization function is available to approach the real flow curve better as with the general K-factor (KF0) entered with setup 14 and 24. This to obtain a more accurate flowrate, total and accumulated total as well as a 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:

$$MF = \frac{\text{K-Factor at flow rate X}}{KF0}$$

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.
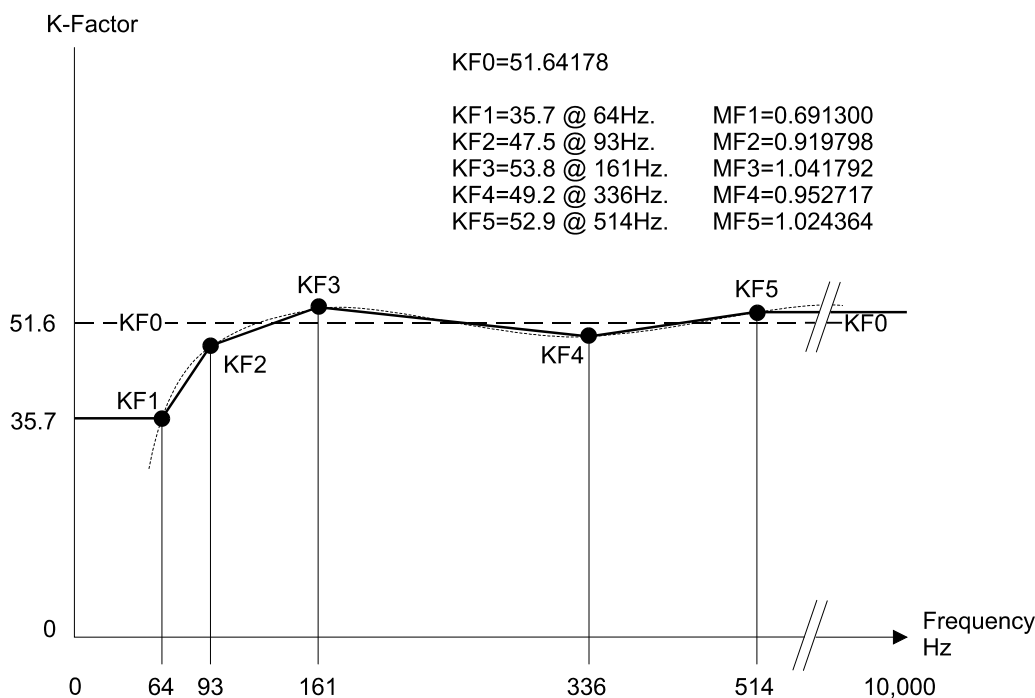
Example

Fig. 6: Example of linearization calculation - Flow curve.

SETUP FUNCTIONS AND VARIABLES		
6	**LINEARIZATION**	
61 6F	FREQ. / M-FACTOR	The frequency is displayed at the bottom line of the display.
		The maximum frequency is 9,999.9 Hz. With value 0.0Hz, the M-Factor is disabled. (Please read Setup function 6A - decimals frequency)
		The M-Factor is displayed at the top-line of the display. The minimum value to be entered is 0.000001 and the maximum value is 9.999999.
	Note !	*This value always has six decimals while the "dot" is not displayed.* *Most M-factors will be around 1.000000 like 0.945354 or 1.132573.*
6G	LINEARIZATION	The following can be selected: enable – disable
6H	DECIMALS FREQUENCY	This setting determines for frequency the number of digits following the decimal point. The following can be selected: 00000 - 1111.1 - 222.22 - 33.333

3.2.9 EXPLANATION OF SETUP-MENU 7 - ANALOG

A linear analog 4 - 20mA signal is generated according to the linearized flowrate. The settings for flowrate (SETUP - 2) influence the analog output directly.

The relationship between rate and analog output is set with the following functions.

PV LRV and PV URV define de range of the analog output. Suppose the flowrate is 1000 l/s

If URV is set at 1600 l/s and LRV is set at 0 l/s, then the output current will be:

1000/1600 * (20mA-4mA) + 4mA = 14mA.

⚠ WARNING **Before changing these settings, be sure that the analog signal is not being used for any application!**

SETUP FUNCTIONS AND VARIABLES		
7	**ANALOG**	
71	PV-LRV	Primary variable Lower Range Value
		This setting sets the flowrate value at which the analog output should generate 4mA.
		The decimals, unit and time unit are according setting 21 and 22.
	Note !	*The analog output value can be programmed "up-side-down" if desired by switching the PV LRV and PV URV value. Please enter the high flowrate value here*
72	PV-URV	Primary variable Upper Range Value
		This setting sets the flowrate value at which the analog output should generate 20mA.
		The decimals, unit and time unit are according setting 21 and 22.
	Note !	*The analog output value can be programmed "up-side-down" if desired by switching the PV LRV and PV URV value. Please enter the low flowrate value here.*
73	LOOP CURRENT MODE	Loop current mode sets the output current fixed to 4mA (for multidrop purposes) or in normal mode.
74	LOOP TEST	The loop test is meant to be able to calibrate the 4 and 20 mA values with setting 75 and 76.
	Note !	*The loop current mode has to be set to 'enabled' for this loop test to function! After a reset or power loss, this setting is reset to off, which means normal operation.*
75	TUNE LO	The initial minimum analog output value is 4mA. However, this value might differ slightly due to external influences such as temperature for example. The 4mA value can be tuned precisely with this setting.
		After pressing PROG, the current will be about 4mA. The current can be increased / decreased with the arrow-keys.
		The new value will become active after pressing ENTER.
76	TUNE HI	The initial maximum analog output value is 20mA. However, this value might differ slightly due to external influences such as temperature for example. The 20mA value can be tuned precisely with this setting.
		After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys. T
		he new value will become active after pressing ENTER.

3.2.10 EXPLANATION OF SETUP-MENU 8 - PULSE OUTPUT

SETUP FUNCTIONS AND VARIABLES		
8	**PULSE OUTPUT**	
81	PULSE WIDTH	The pulse width determines the time that the output will be switched; in other words the pulse length. The minimum time between the pulses is as long as the period time (50/50 duty cycle).
		The pulse width is set in milliseconds in the range 0.001 - 9.999 sec.
		Value "zero" disable the pulse output.
	Note !	*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!*
82	DECIMALS	This setting determines the decimal position for setting 63.
	Note !	*The measuring unit is according to setting 11 (for total).*
83	PULSE PER	A pulse will be generated every X-quantity.
		Enter this quantity here while taking the displayed decimal position and measuring unit into account.
84	RELAY OUT	One transistor or relay output is available to transmit the alarm condition or to generate the scaled pulse output.
		Assign with this function the type of signal to be transmitted:
		low flowrate alarm, high flowrate alarm, both alarms or pulse output.
		This setting is equal to setting 37.

3.2.11 EXPLANATION OF SETUP-MENU 9 - OTHERS

| SETUP FUNCTIONS AND VARIABLES		
7	**OTHERS**	
91	TYPE / MODEL	For support and maintenance it is important to have information about the characteristics of the F018-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.
92	SOFTWARE VERSION	For support and maintenance it is important to have information about the characteristics of the F018-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.
93	SERIAL NO.	For support and maintenance it is important to have information about the characteristics of the F018-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.
94	PASS CODE	All SETUP-values can be pass code protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
95	POL ADDRESS	0..63 HART address
96	TAGNUMBER Note !	For identification of the F018-P and communication purposes, a unique tag number of maximum 7 digits can be entered. *Three separate tags are present in the F018p:* • Tagnumber: 7 digit number, visible in menu 9.6 AND via HART • Short HART tag: 8 alphanumeric characters, available via HART • Long HART tag: 32 alphanumeric characters, available via HART

4 INSTALLATION

4.1 GENERAL DIRECTIONS

Caution !

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

- The F018-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
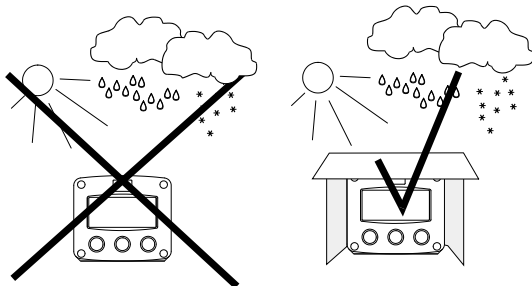
Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67, Type 4(X) casing should NEVER be exposed to strongly varying (weather) conditions.

When panel-mounted, the F018-P is IP65 Type 4(X)!

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.
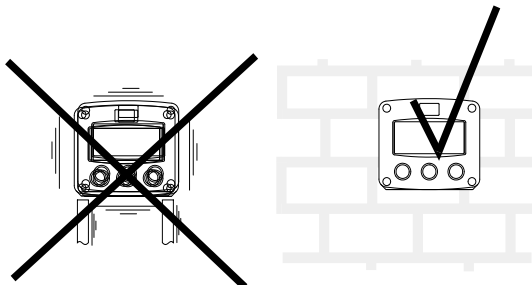
Mount the F018-P on a solid structure to avoid vibrations.

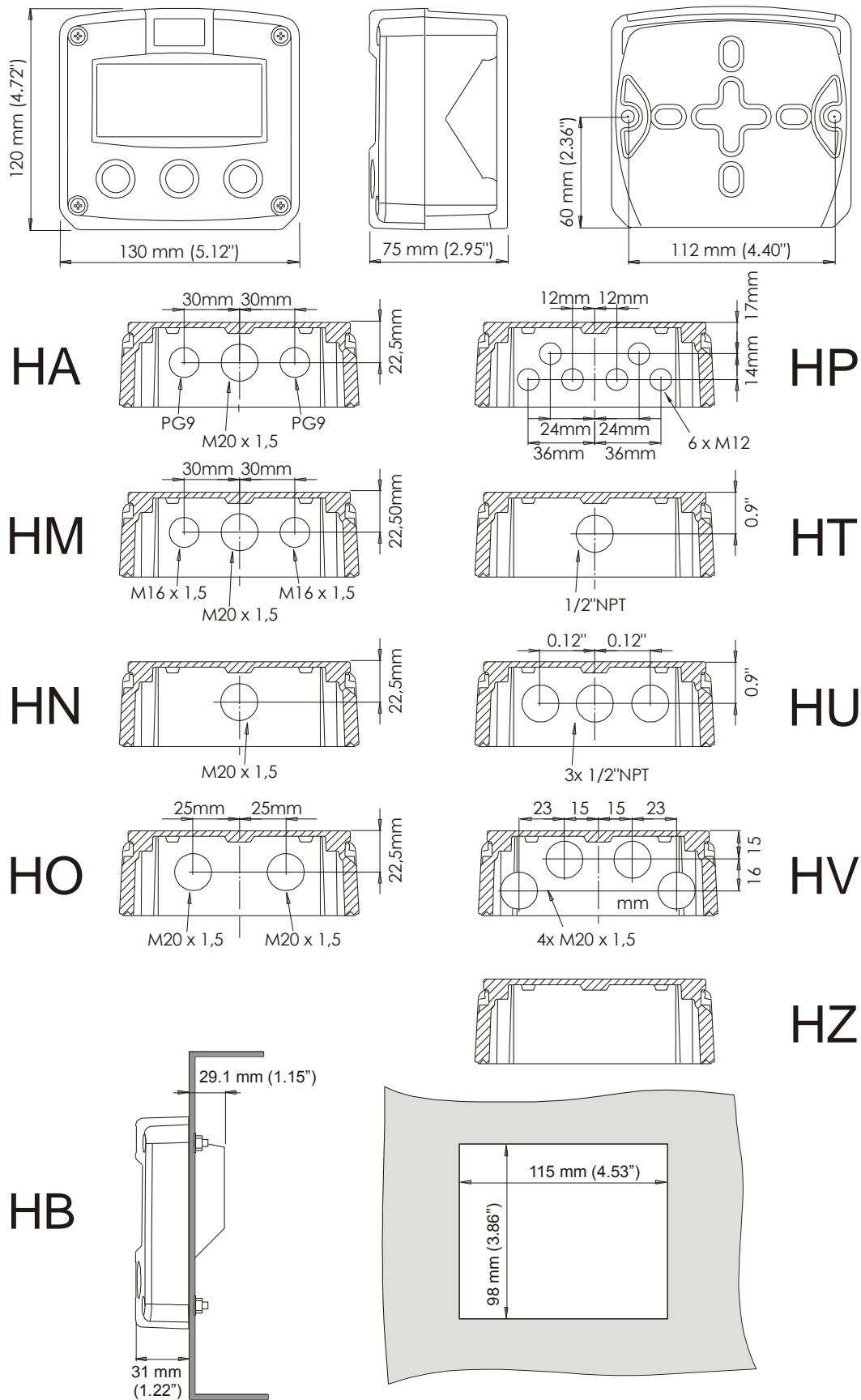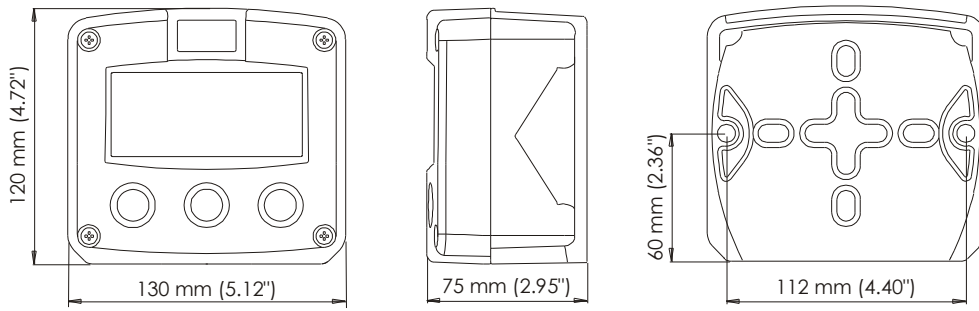## 4.3 DIMENSIONS- ENCLOSURE

Aluminum enclosures:

Fig. 7: Dimensions Aluminum enclosures.
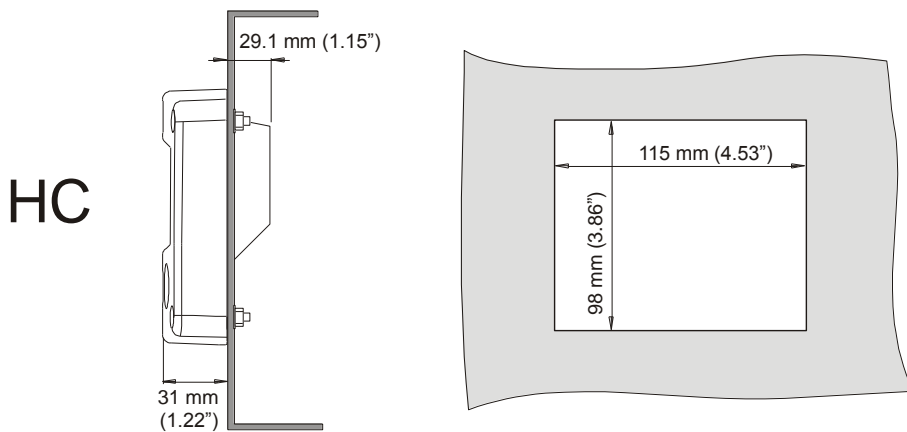
GRP enclosures:

HK back box:
(flat bottom)
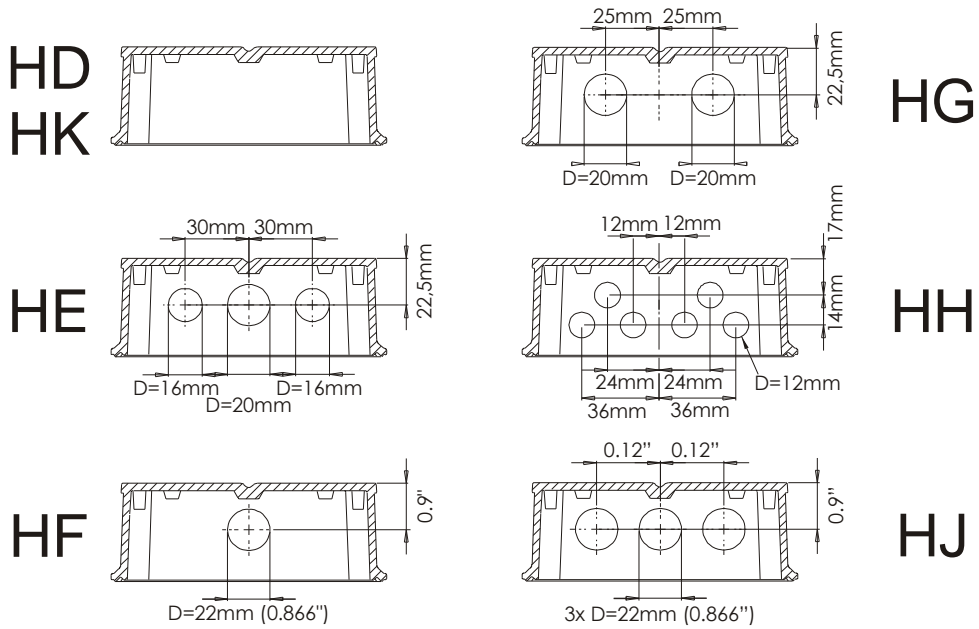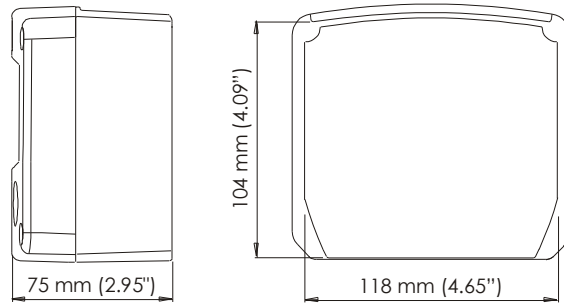
Fig. 8: Dimensions GRP enclosures.

4.4   INSTALLING THE HARDWARE

4.4.1   INTRODUCTION

WARNING (⚠)

- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the F018-P, the installer has to discharge himself by touching a well-grounded object.

- This F018-P must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).

- This chapter shows general information regarding the electrical installation of your indicator. Chapter 5 gives additional specific information regarding intrinsically safe installation and overrules the information given in this chapter.
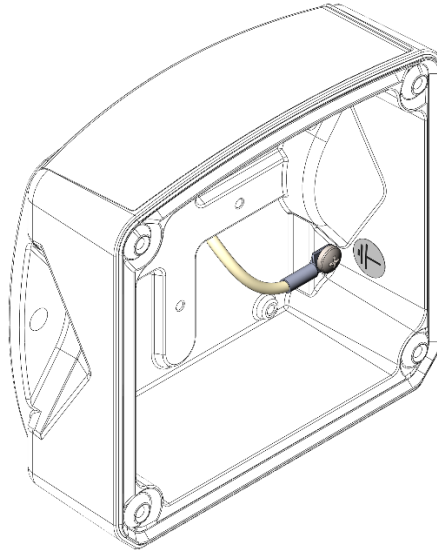
Fig. 9: Grounding aluminum enclosure with option PM 115-230 V AC.

FOR INSTALLATION, PAY EMPHATIC ATTENTION TO:

- Separate cable glands with effective IP67, Type 4(X) seals for all wires.

- Unused cable entries: ensure that you fit IP67, Type 4(X) plugs to maintain rating.

- A reliable ground connection for both the sensor, and if applicable, for the metal casing (above).

- An effective screened cable for the input signal, and grounding of its screen to the "⊥" terminal or at the sensor itself, whichever is appropriate to the application.

4.4.2 TERMINAL CONNECTORS SAFE AREA APPLICATIONS

Note ! *For <u>Intrinsically Safe</u> applications: read chapter 5.*

The following terminal connectors are available:

Fig. 10: Overview of terminal connectors F018-P-(PB / PD / PX) and options.
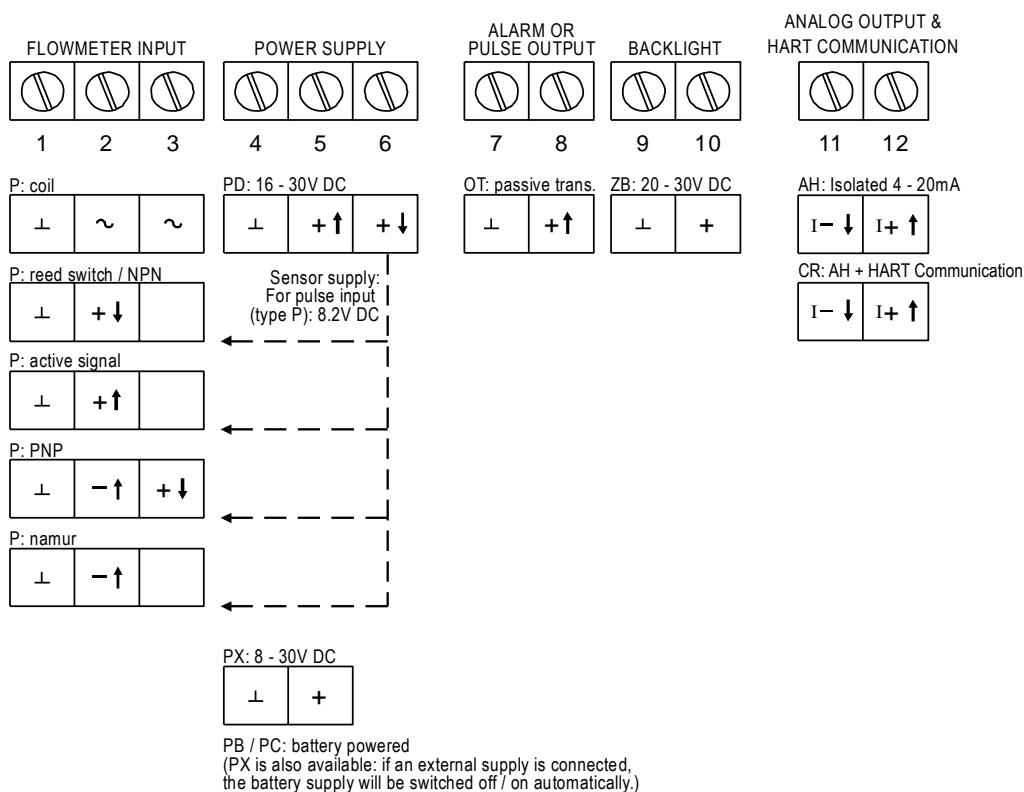
SENSOR SUPPLY

Type PX
as standard, all indicators are supplied with terminal 4 and 5 to power the product externally

WARNING

Type PB
offers - additional to type PX - an internal lithium battery.
This standard battery MAY NOT BE USED in hazardous area.
Please consult the replacement instructions in paragraph 5.4.

Type PB / PD / PX - terminal 3: sensor supply 1.2V - 3.2V:
Terminal 3 provides a limited supply voltage of 3.2 V DC (coil signals 1.2V) for the signal output of the flowmeter.

Type PD - terminal 6: sensor supply 8.2V:
Terminal 6 offers - additional to type PX - a real sensor supply output of 8.2V DC to power a Namur sensor for example

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).*

REMARKS: TERMINAL CONNECTORS:

Terminals 1-3; Flowmeter input:

Three basic types of flowmeter signals can be connected to the F018-P: pulse, active pulse or coil.
The screen of the signal wire must be connected to the common ground terminal

The input signal type has to be selected with the correct SETUP-function (read chapter 3).

The F018-P is suitable for use with flowmeters which have a coil output signal.

Two sensitivity levels can be selected with the SETUP-function:

- COIL LO: sensitivity from about 90mVp-p.
- COIL HI: sensitivity from about 20mVp-p.
- Type ZF (option): offers for setting COIL HI : sensitivity from about 10mVp-p.
- Type ZG (option): offers for setting COIL HI : sensitivity from about 5mVp-p.

Fig. 11: Terminal connections - Coil signal input.

Pulse-signal NPN / NPN-LP:

The F018-P is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency (read chapter 3).
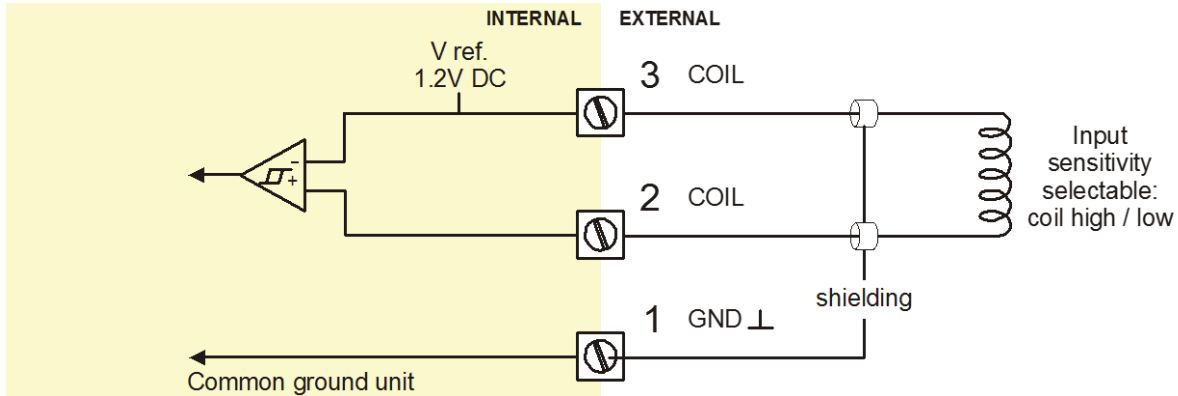
Fig. 12: Terminal connections - NPN signal input.

Pulse-signal PNP / PNP-LP:

The F018-P is suitable for use with flowmeters which have a PNP output signal. Terminal 3 offers 3.2V which has to be switched by the sensor to terminal 2 (SIGNAL). For a reliable pulse detection, the pulse amplitude has to go above 1.2V. Signal setting PNP-LP employs a low-pass signal noise filter, which limits the maximum input frequency (read chapter 3).
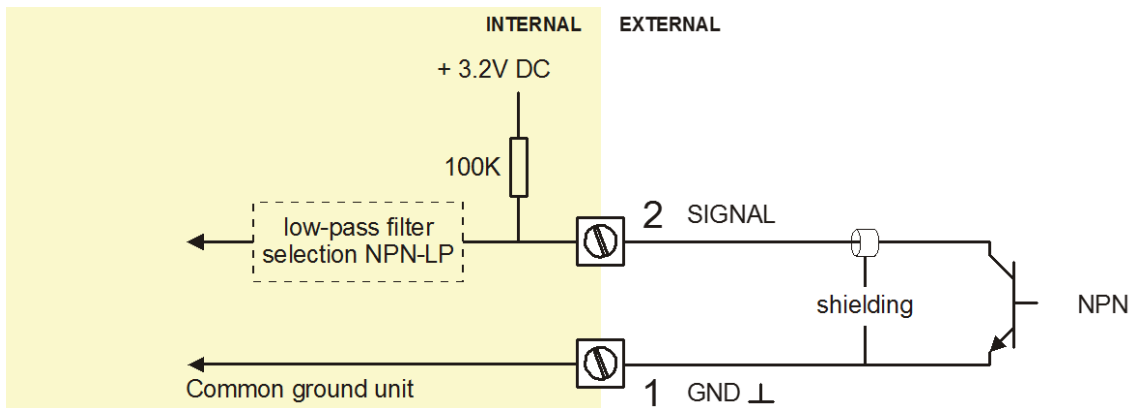
A sensor supply voltage of 8.1V DC can be provided with option PD on terminal 6.
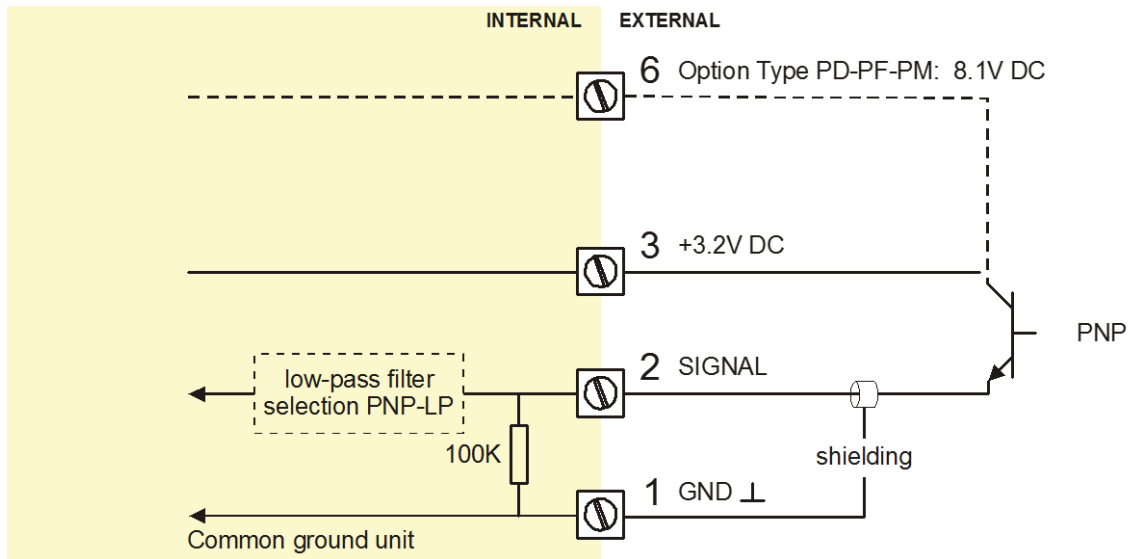
Fig. 13: Terminal connections - PNP signal input.

Active signal:

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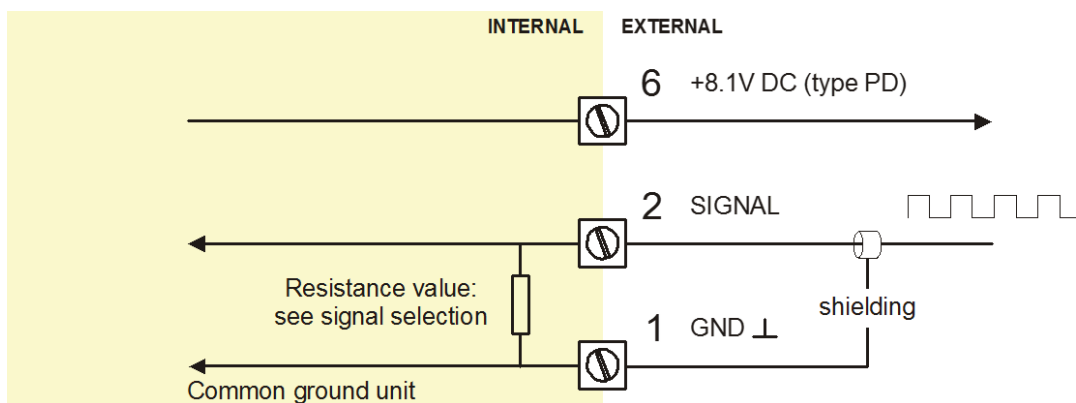

Fig. 14: Terminal connections - Active signal input.

Reed-switch:

The F018-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 filter (read chapter 3).
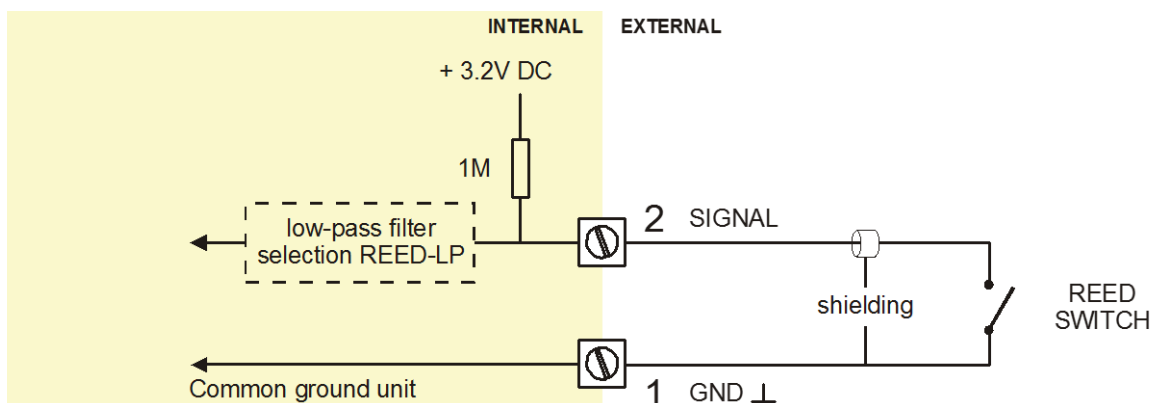
Fig. 15: Terminal connections - Reed-switch signal input.

NAMUR-signal:
The F018-P is suitable for flowmeters with an NAMUR signal. The standard F018-P is not able to power the NAMUR sensor, as an external power supply for the sensor is required. However, a 8.2V sensor supply voltage (terminal 6) can be provided with type PD.
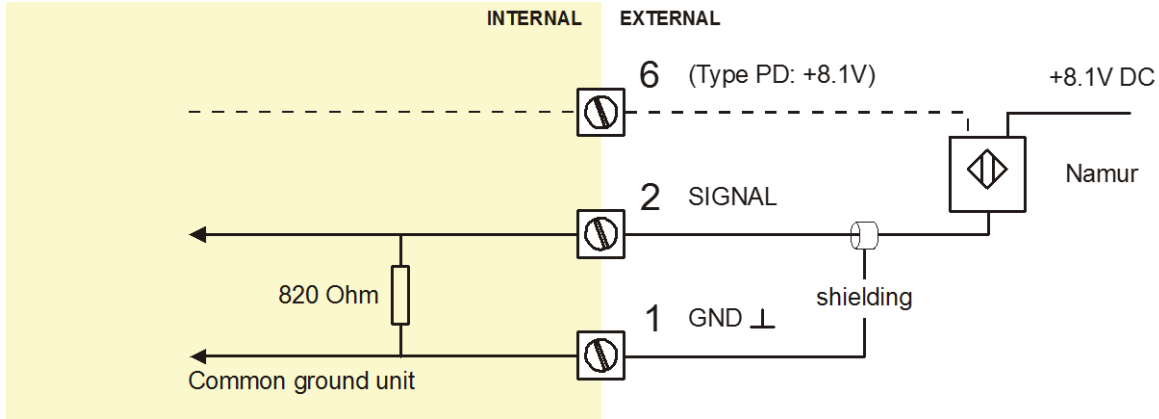
Fig. 16: Terminal connections - NAMUR signal input.

Terminal 4-5: Power supply - type PX (default) and PD (option)::
To power the unit an internal battery can be used (type PB / PC) and / or an external DC power supply of 8-30V DC (type PX) or 16-30V DC (type PD).

Connect the "**-**" to terminal 4 and the "**+**" to terminal 5. When power is applied to these terminals, the optional internal battery will be disabled / enabled automatically to extend the battery life time.

Terminal 6: Power supply type PD: 8.2V sensor supply.
With this option, a limited power supply for the sensor is available, for example to power a Namur sensor. It offers 8.2V DC (max. 5mA).

Note!   This terminal is only available if option PD has been ordered

Terminal 7-8; Alarm output – type OT:
With SETUP 33 and SETUP 34, the function of this output is set to a low or high flowrate alarm or a pulse output.

A <u>passive</u> transitor output is available with this option.
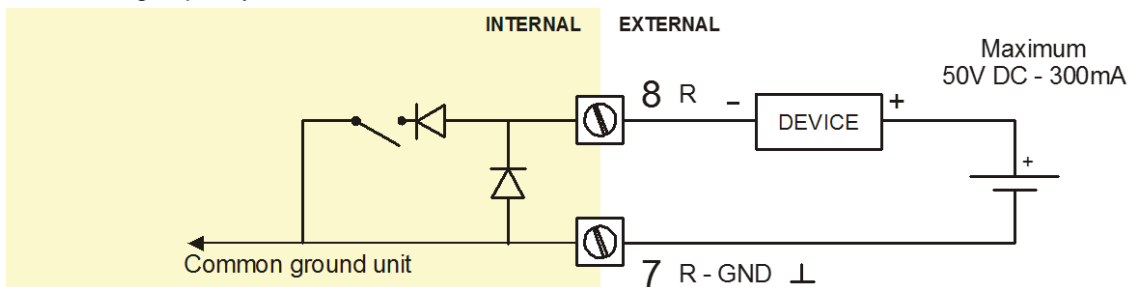
Max. driving capacity 300mA@50V DC.

Fig. 17: Terminal connections - Alarm output.

Terminal 9-10: Power supply backlight - type ZB (option):

To power the backlight, a voltage in the range 20-30V DC has to be connected.

Maximum current 30mA. Connect the "**-**" to terminal 9 and the "**+**" to terminal 10.
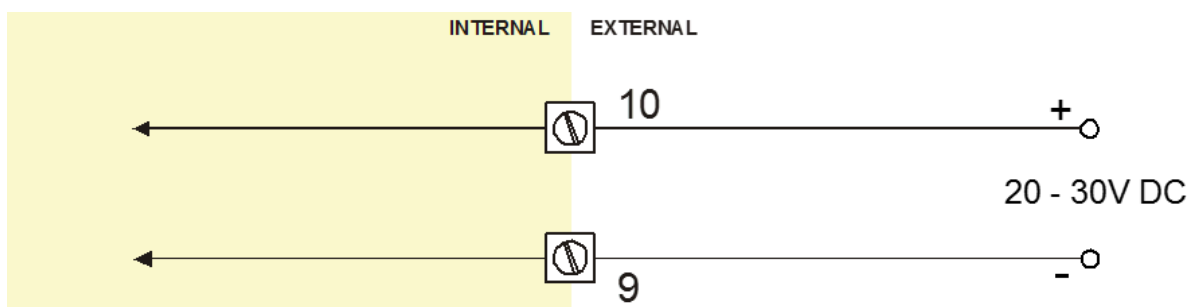
Fig. 18: Terminal connections - Backlight (ZB).

Terminal 11-12: Analog output + Output loop power – type AH:

An isolated passive 4-20mA signal proportional to the calculated flowrate is available with this option. When the output is disabled, a 4.0mA signal will be generated on these terminals.

Please note that terminals 11 and 12 are polarity insensitive.
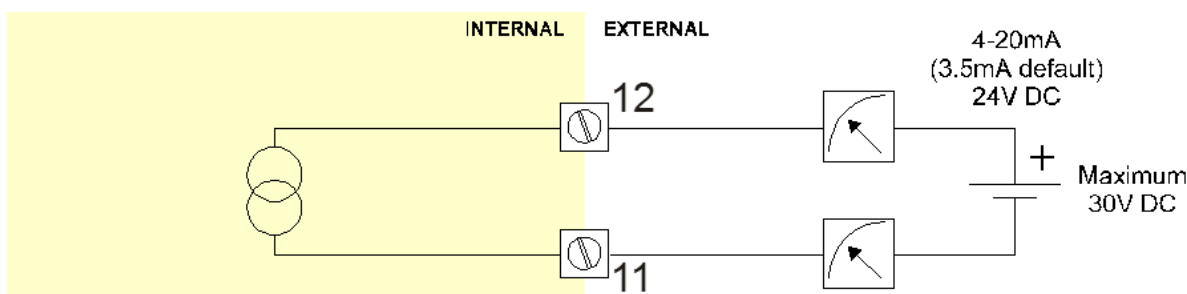
Fig. 19: Terminal connections - Isolated passive 4-20mA signal.

Terminal 11-12: HART Communication – type CR (option):

The F018-P is suitable for connecting a HART master device. This HART master device is connected to terminals 11 and 12 to enable HART communication with the F018-P.
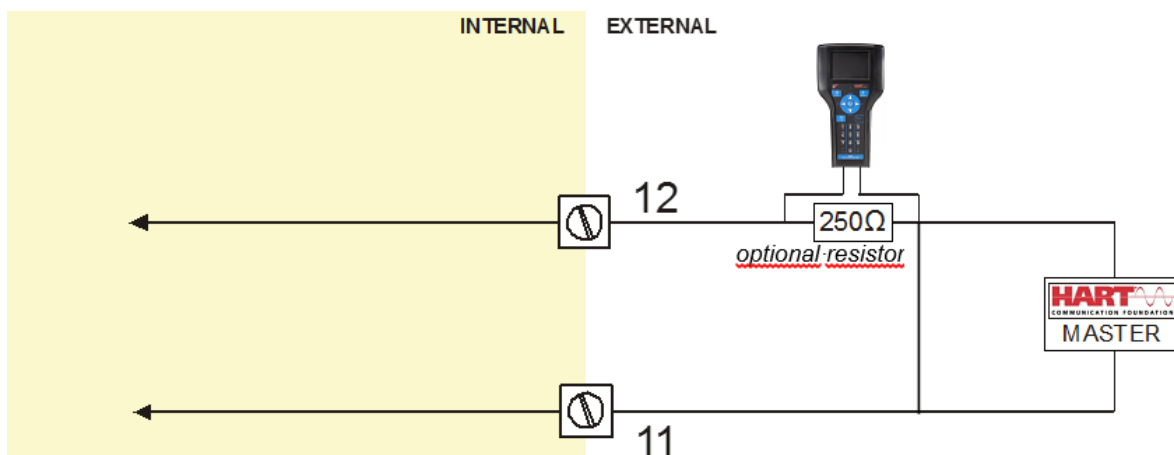
Fig. 20: Terminal connections - HART communication.

HART Hand-Held device:

Most HART hosts/DCS systems have an internal loop resistor (impedance) so a handheld can be connected anywhere in the loop, in parallel with a device (e.g. over terminals 11 and 12 of the F018-P), without disconnecting any terminals.

When the resistance of the loop is less than 120 ohm, a resistor has to be added in the loop. This typically happens when the F018p is powered directly from a power supply and is only connected to via a Hand-Held device. Typical loop resistance inserted by HART hosts/DCS systems is 250 ohm.

Please consult Appendix C: Hart Communication for more information regarding the HART interface.

5 INTRINSICALLY SAFE APPLICATIONS

5.1 GENERAL INFORMATION AND INSTRUCTIONS

Safety instructions

- Certificates, safety values, control drawing and declaration of compliance can be found in the document named: "Fluidwell F0..-..-XI - Documentation for Intrinsic Safety"
- For installation under ATEX directive: this intrinsically safe device must be installed in accordance with the ATEX directive 94/9/EC and the product certificate KEMA 05ATEX1168 X.
- For installation under IECEx scheme: this intrinsically safe device must be installed in accordance the product certificate IECEx KEM 08.0006X.
- Exchange of Intrinsically Safe battery FWLiBAT-00x with certificate number KEMA 03ATEX1071 U or IECEx KEM 08.0005U is allowed in Hazardous Area. See paragraph 6.4. for battery replacement instructions.
- When the enclosure of the indicator is made of aluminum alloy, when used in a potentially explosive atmosphere requiring apparatus of EPL Ga, the indicator shall be installed so, that even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.
- When two or more active intrinsically safe circuits are connected to the indicator, in order to prevent voltage and/or current addition, applicable to the external circuits, precautions must be taken to separate the intrinsically safe circuits in accordance with EN 60079-11.
- To maintain the degree of protection of at least IP65 in accordance with IEC 60529, suitable cable entries and blanking elements must be used and correctly installed.
- For enclosures and windows with a high surface resistance, potential charging hazard exists. Do not rub these surfaces of the indicator. Clean window and enclosure with a moist cloth only.
- Chapter 4 shows general information regarding the electrical installation of your indicator. This chapter gives additional specific information regarding intrinsically safe installation and overrules the information given in chapter 4.

- Mounting, electrical installation, start-up and maintenance of this device 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.
- This device 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 cabinet has been opened (danger of electric shock). 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.

- Special conditions for safe use mentioned in both the certificate and the installation instructions must be observed for the connection of power to both input and / or output circuits.
- When installing this device in hazardous areas, the wiring and installation must comply with the appropriate installation standards for your industry.
- Study the following pages with wiring diagrams per classification.

Serial number and year of production

This information can be looked-up on the display: setup function (read chapter 3).
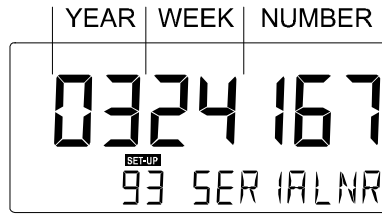
Fig. 21: Example serial number.

Label information pulse input type - F0..P-XI (inside and outside the enclosure)
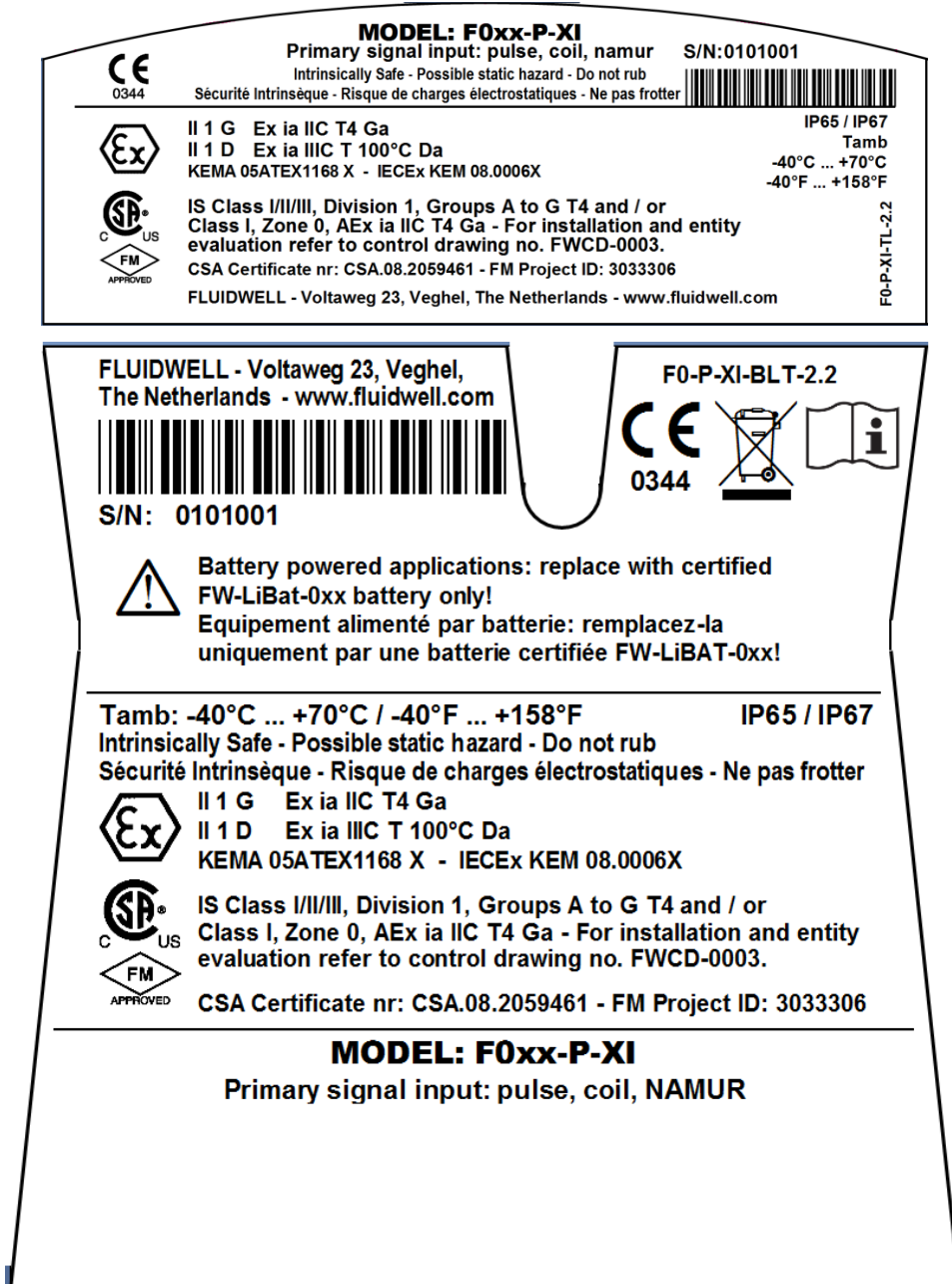
Fig. 22: Label information - Intrinsically Safe application.

5.2 TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS

Terminal connectors F018-P-AH-CR-(PC / PD / PX)-XI-(ZB):
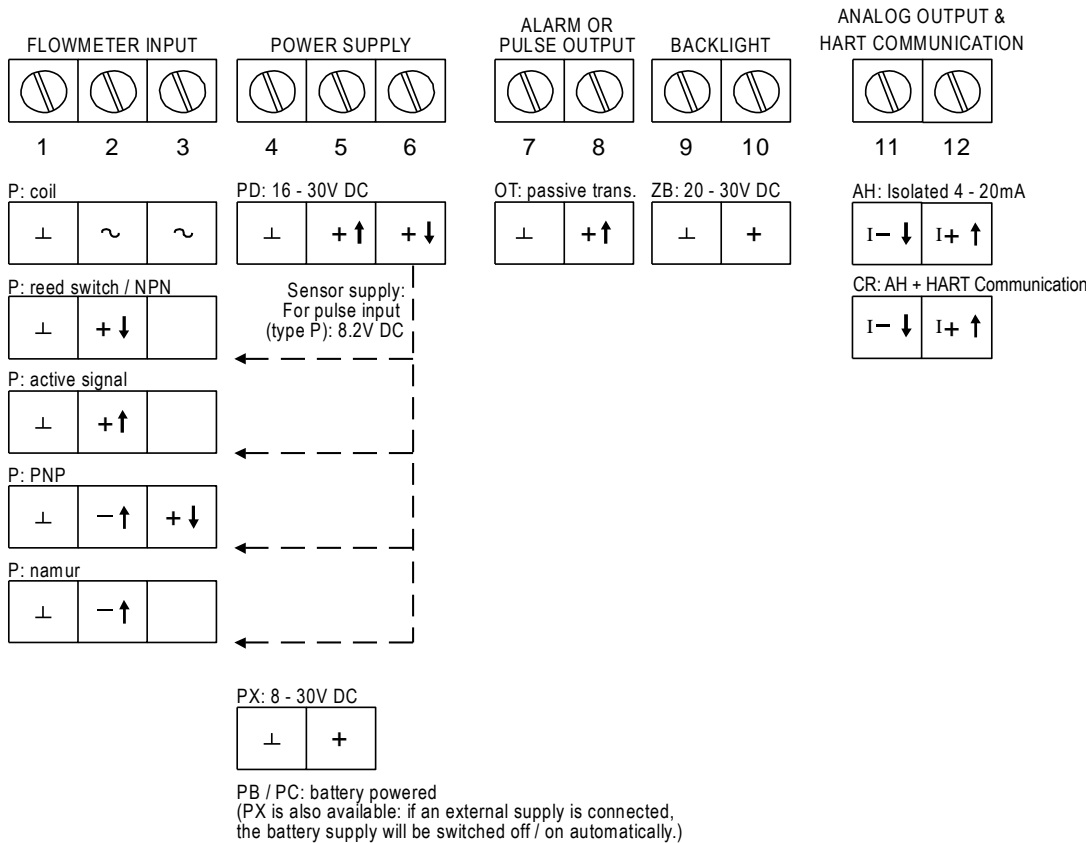
Fig. 23: Overview terminal connectors XI - Intrinsically Safe application.

Note !

WARNING

- **Type PX**:
  as standard, all intrinsically product are supplied with terminal 4 and 5 to power the product externally.

- **Type PC**:
  offers - additional to type PX - an internal intrinsically safe lithium battery. This ATEX / IECEx certified battery (FW-LiBAT) may be replaced in hazardous area, but only with a new certified FW-LiBAT battery. Please consult replacement instructions in chapter 5.4

- **Type PD**:
  offers with terminal 6 - additional to type PX - a real sensor supply of 8.2V DC to power a Namur sensor for example.

5.3   CONFIGURATION EXAMPLES INTRINSICALLY SAFE APPLICATIONS

5.3.1   F018-P-AH-CR-OT-PX-XI-(ZB) - Ex ia IIC/IIIC

Fig. 24: F018-P-AH-CR-OT-PX-XI-(ZB) – EX IA IIc/IIIC - Intrinsically Safe application.

*

Sensor supply voltage for pulse type P: Terminal 3: 1.2-3.2V DC.

Please note: Type PX may be used in combination with the battery (Type PC).

PX will power the F018-P, the battery will be disabled automatically until the power is disconnected.

5.3.2   F018-P-AH-CR-OT-PX-XI-(ZB) - Ex ia IIC/IIIC

Fig. 25: F018-P-AH-CR-OT-PX-XI-(ZB) - Intrinsically Safe application.

*

Sensor supply voltage for pulse type P: Terminal 3: 1.2-3.2V DC.

Please note: Type PX may be used in combination with the battery (Type PC).

PX will power the F018-P, the battery will be disabled automatically until the power is disconnected.

5.3.3   F018-P-AH-CR-OT-PD-XI-ZB

Fig. 26: F018-P-AH-CR-OT-PD-XI-ZB - Intrinsically Safe application.

*

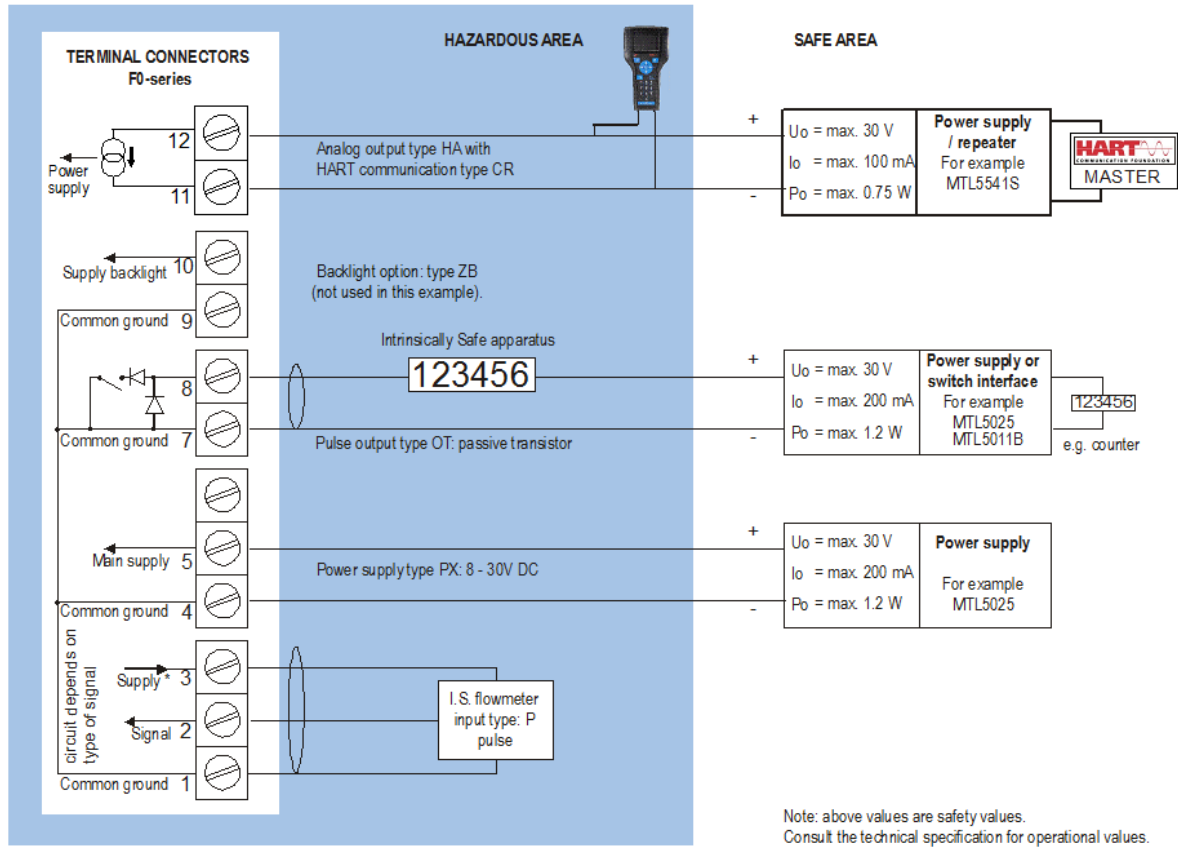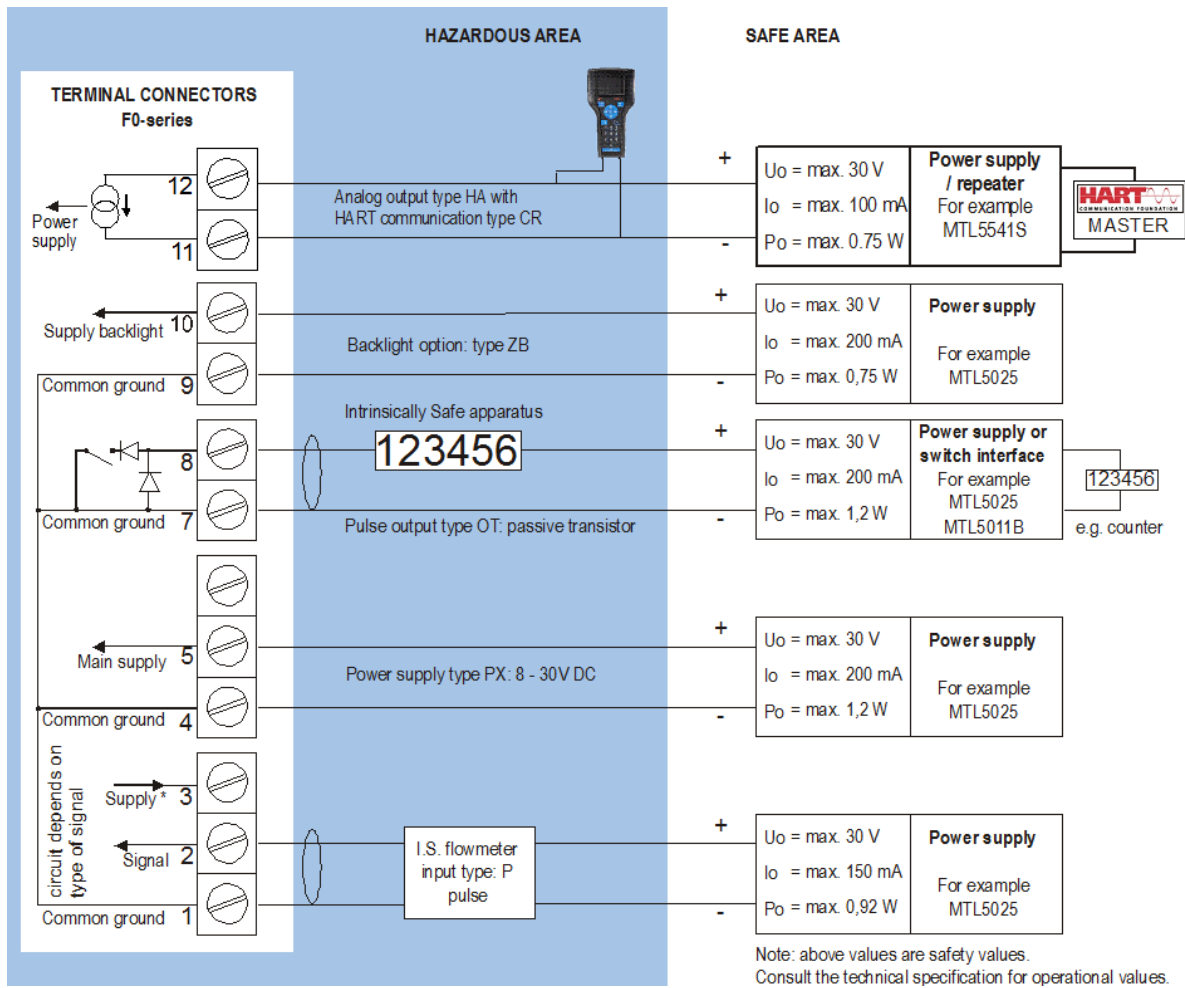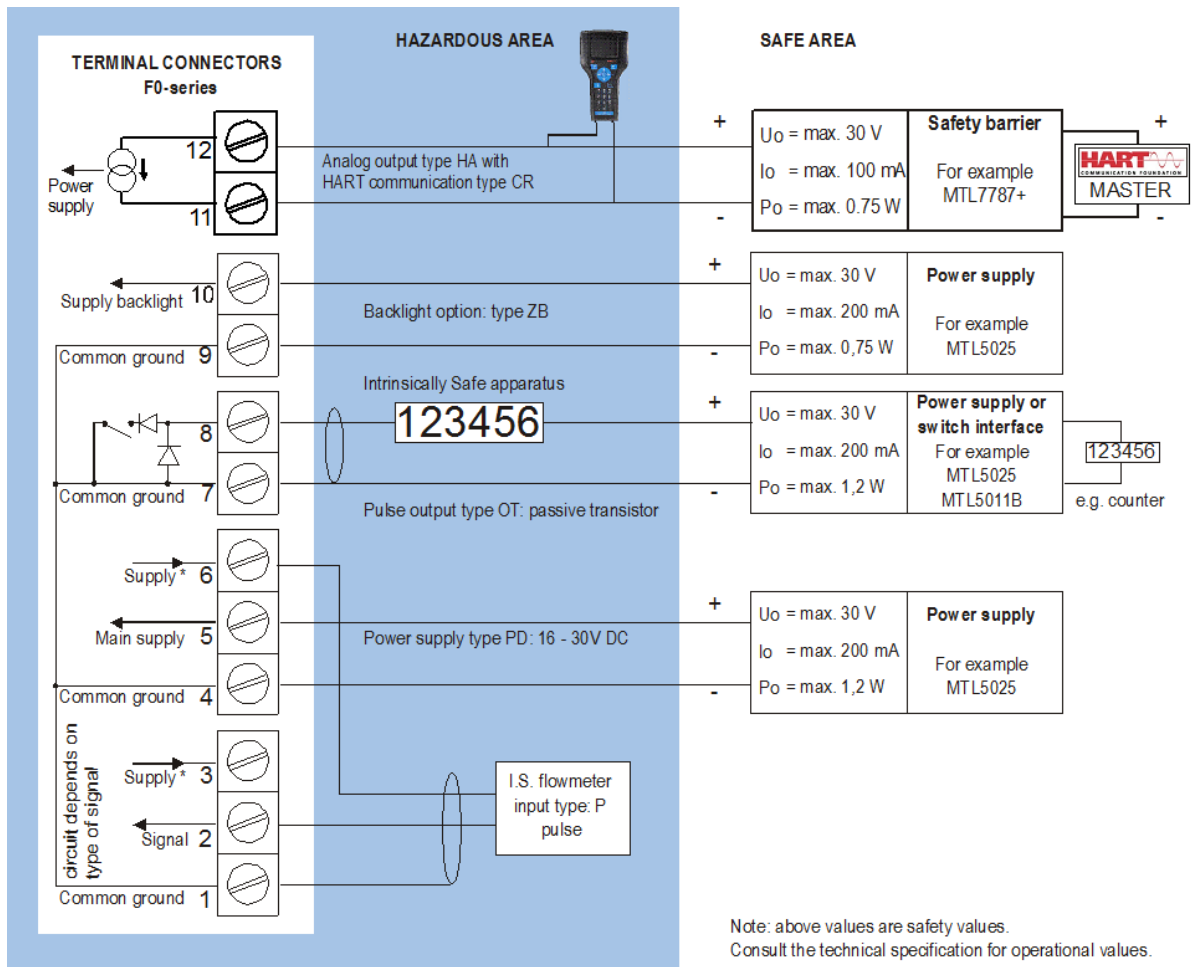Sensor supply voltage for pulse type P: Terminal 3: 1.2-3.2V DC.

Please note: Type PX may be used in combination with the battery (Type PC).

PX will power the F018-P, the battery will be disabled automatically until the power is disconnected.

5.4 BATTERY REPLACEMENT

5.4.1 SAFETY INSTRUCTIONS

WARNING

- Fire, explosion or severe burns may result if mistreated. Do not recharge, crush, disassemble, incinerate, heat above 100°C (212°F) or expose contents to water.

- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained personnel authorized by the plant operator. Personnel must read and understand this Instruction Sheet before carrying out this procedure

Caution !

- Verify if the correct battery is supplied:
  Only batteries with shown Ex label are certified for replacement and use in hazardous areas. Batteries for use in safe areas have no Ex label. DO NOT EXCHANGE.
  Using the wrong type of battery can pose a SERIOUS RISK.

- For use in hazardous areas Fluidwell advises FW-LiBAT batteries (manufactured by Fluidwell BV) only.

5.4.2 REPLACE THE BATTERY

Note !

Depending on the production batch, one of the two visualized Intrinsically Safe certified battery types may have been installed in the unit. They are interchangeable.

1. To replace the battery, open the unit to gain access to the back inside cover of the unit.
2. Unplug the field connectors from the back inside of the unit.
3. Remove the two screws that hold the plastic inside cover.
4. Open the cover and unplug the battery connector.
5. Remove the battery from the inside of the plastic cover. Do not remove the battery clip!
6. Install the new battery and re-assemble the unit in reverse order.
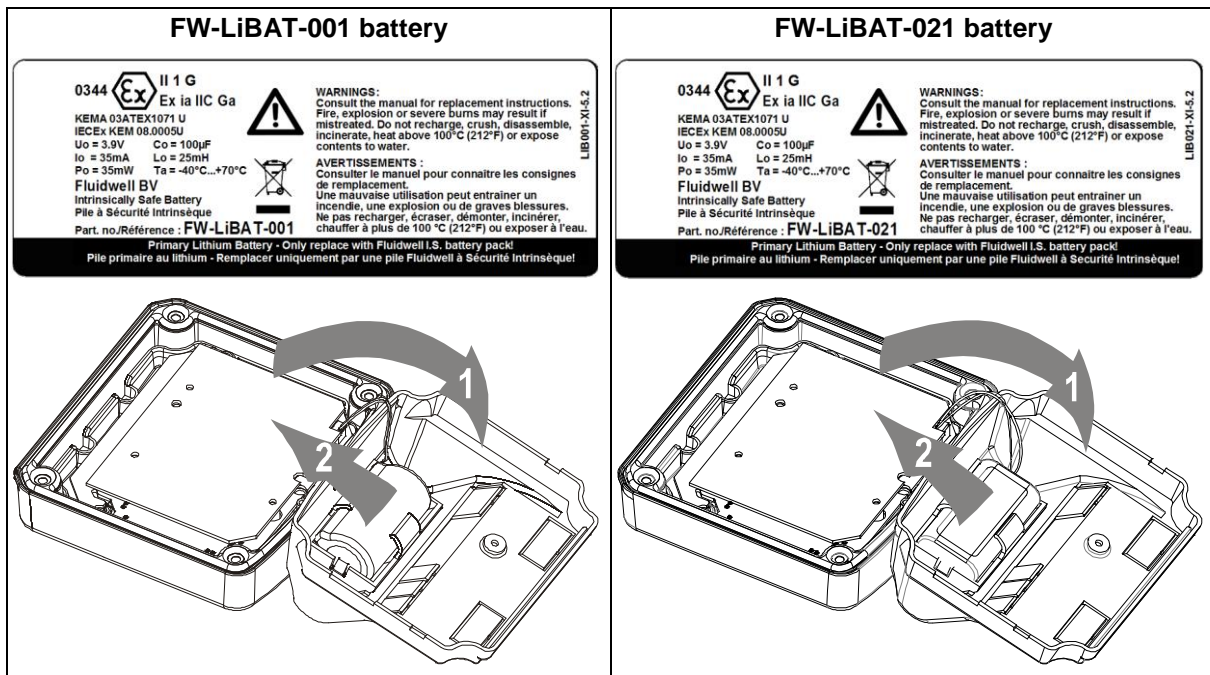7. Start-up the unit

Fig. 27: FWLiBAT for use in hazardous area - Replacement.

5.4.3 DISPOSAL OF BATTERIES

Batteries pose an environmental hazard.
Do not dispose of as trash or incinerate.
Return used batteries to a recycling point.

6   MAINTENANCE

6.1   GENERAL DIRECTIONS

Caution !

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions. Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.

- The F018-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 F018-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 F018-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.

Battery life-time:

Note !

It is strongly advised to use only necessary functions.

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.

Check periodically:
- The condition of the casing, 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 casing with soapy-water. Do not use any aggressive solvents as these might damage the coating.

6.2   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.

Appendix A. TECHNICAL SPECIFICATION

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Dimensions	90 x 40mm (3.5"x 1.6")
Digits	Seven 17mm (0.67") and eleven 8mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Type ZB (option)	Bi-color configurable LED-backlight - green or amber. Intensity adjustable from the keyboard.

Enclosures	
General	Die-cast aluminum or GRP (Glassfibre Reinforced Polyamide) enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material.
Control Keys	Three industrial micro-switch keys. UV-resistant silicone keypad.
Painting	Aluminum enclosure only: UV-resistant 2-component industrial painting.
Panel-mount enclosures	Dimensions: 130 x 120 x 60mm (5.10" x 4.72" x 2.38") – LxHxD.
Classification	IP65 / TYPE 4
Panel cut-out	115 x 98mm (4.53" x 3.86") LxH.
Type HC	GRP panel-mount enclosure
Type HB	Aluminum panel-mount enclosure
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95") – LxHxD.
Classification	IP67 / TYPE 4X
Aluminum enclosures	
Type HA	Drilling: 2x PG9 – 1x M20.
Type HM	Drilling: 2x M16 – 1x M20.
Type HN	Drilling: 1x M20.
Type HO	Drilling: 2x M20.
Type HP	Drilling: 6x M12.
Type HT	Drilling: 1x ½"NPT.
Type HU	Drilling: 3x ½"NPT.
Type HV	Drilling: 4x M20
Type HZ	No drilling.
GRP enclosures	
Type HD	No drilling.
Type HE	Drilling: 2x 16mm (0.63") – 1x 20mm (0.78").
Type HF	Drilling: 1x 22mm (0.87").
Type HG	Drilling: 2x 20mm (0.78").
Type HJ	Drilling: 3x 22mm (0.87").
Type HH	Drilling: 6x 12mm (0.47").
Type HK	Flat bottom - no drilling.
ABS enclosure	
Type HS	Silicone free ABS enclosure with EPDM and PE gaskets. UV-resistant polyester keypad. (no drilling)

Operating temperature	
Operational	-40°C to +80°C (-40°F to +178°F).
Intrinsically Safe	-40°C to +70°C (-40°F to +158°F).

Power requirements	
Type AH	10-30V DC. Power consumption max. 0.7 Watt.
Type PB	Lithium battery - life-time depends upon settings - up to 5 years.
Type PC	Intrinsically Safe lithium battery - life-time depends upon settings - up to 5 years.
Type PD	16-30 V DC. Power consumption max. 1 Watt.
Type PX	8-30 V DC (also available with PB / PC). Power consumption max. 0.3 Watt.
Type ZB	20-30V DC. Power consumption max. 1 Watt. Note: with type PF / PM: internally powered.
Note !	PB: *For intrinsically safe applications, Not available.*
Note !	IS application: For intrinsically safe applications, consult the safety values in the certificate.

Sensor excitation	
Type PB / PC / PX Note !	Sensor supply voltage: 3.2V DC for pulse signals and 1.2V DC for coil pick-up. This is not a real sensor supply. Only suitable for sensors with a very low power consumption like coils (sine wave) and reed-switches. Analog sensors type A / U: sensor supply not available
Type PD	Sensor supply output 8.2V DC, max. 5mA (additional to type PX sensor excitation options).

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm2 and 2.5mm2

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

Hazardous area (option)	
Intrinsically safe Type XI	**ATEX certificate KEMA 05ATEX1168 X :** II 1 G Ex ia IIC T4 Ga II 1 D Ex ia IIIC T 100°C Da **IECEx certificate IECEx KEM 08.0006X :** Ex ia IIC T4 Ga Ex ia IIIC T 100°C Da **CSA certificate CSA.08.2059461, FM project ID 3033306:** IS Class I/II/III, Division 1, Groups A to G T4 Class I, Zone 0, AEx ia IIC T4 Ga
Explosion proof Type XF	ATEX approval ref.: II 2 GD EEx d IIB T5. Weight appr. 15kg. Dimensions of enclosure: 350 x 250 x 200mm (13.7" x 9.9" x 7.9") LxHxD.

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 60079-11; EN/IEC 60079-26
RoHS	EN 50581
IP & NEMA	EN 60529; NEMA 250
HART	HCF Verified, ID6039

INPUT

Flowmeter	
Linearization	Fifteen free definable linearization positions with interpolation function.
Type P	Coil/sine wave (minimum 20mVpp or 80mVpp - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals.
Frequency	Minimum 0 Hz - maximum 7 kHz for flowrate.
	Maximum frequency depends on signal type and internal low-pass filter.
	E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.
Option ZF	coil sensitivity 10mVpp.
Option ZG	coil sensitivity 5mVpp.

Output

Alarm and Pulse output	
Function	Pulse Output: Transmitting accumulated total.
	Alarm output: High, low or high and low flowrate alarm.
Frequency	max frequency 500Hz.
Type OT	One passive transistor output - not isolated. Load max. 50V DC - 300mA.

Analog output	
Function	Transmitting linearized flowrate.
Accuracy	12 bit, maximum stepsize 0.01mA
	Analog output signal can be scaled to any desired range.
Type AH	Galvanically isolated, loop powered 4 - 20mA output for Intrinsically Safe applications.
Linear overrang	-1.25% ± 0.1% … +3.125% ± 0.1% / 3.8mA … 20.5mA
Maximum current	106.125% / 21.0mA
Multidrop current draw	Parked @ 4.0mA

Communication (option)	
Function	Reading display information, reading / writing all configuration settings.
Type CR	HART Communication protocol, Revision 7.0.
Liftoff voltage	10V
Loop resistance	Typical 250 Ohm. Minimum 120 Ohm. Maximum 666 Ohm @ 24V.
Addressing	Selectable 0…63

Operational

Operator functions	
Displayed functions	• linearized total and/or flowrate.
	• linearized total and accumulated total.
	• total can be reset to zero by pressing the CLEAR-key twice.
	• alarm values low - high flowrate
	• alarm values can be entered (this function can be disabled).

Total	
Digits	7 digits.
Unit	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
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.

Flowrate	
Digits	7 digits.
Unit	l/min – l/hr – m3/sec – m3/min – m3/hr – m3/day – g/sec – g/min - g/hr – kg/sec – kg/min – kg/hr – kg/day – ton/min – ton/hr – ton/day – gal/sec – gal/min – gal/hr – gal/day – bbl/sec – bbl/min – bbl/hr – bbl/day – lb/sec – lb/min – lb/hr – lb/day – cf/sec – cf/min – cf/hr – rev/sec – rev/min – none – l/sec.
Decimals	0 - 1 - 2 or 3.

Alarm value	
Digits	7 digits.
Units	According to selection for flowrate.
Decimals	According to selection for flowrate.
Time units	According to selection for flowrate.
Type of alarm	low and high flowrate alarm. Includes delay time alarm and configurable alarm output.

Appendix B. PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F018-P is going to be installed or while it is in operation.

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

- SETUP 22 / 25: are the K-Factor time unit correct?

The pass code is unknown:
If the pass code is not 1234, 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 4-digit error code. When multiple error arise at the same time, their error codes are added and the sum is displayed. The codes are:

- 0001:
  irrecoverable display-data error: data on the display might be corrupted.
- 0002:
  irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.
- 0064:
  Linearization error (internal calculations out of bounds).
- 0128:
  The frequency is outside the linearization range as set with SETUP 6A (e.g. 222.22 results in a frequency range of 0 to 999.99 Hz. A solution is to reduce the number of digits for the frequency (e.g. from 222.22 to 1111.1 so the range becomes 0 to 9,999.9Hz in above example). Be aware that all frequencies have to be reprogrammed !!

The alarm condition will almost certainly be handled internally and if all mentioned values still appear correct, no intervention by the operator is needed. If the alarm occurs more often or stays active for a longer time, please contact your supplier.

Appendix C. HART COMMUNICATION

IDENTIFICATION			
Manufacturer Name	Fluidwell B.V.	Model Name	F018-P
Manufacture ID Code	0x6039	Device Type Code	0xE0EA
HART Protocol revision	7.0	Device revision	03.06.xx
Physical layer	FSK (Wired)	Device type / Physical category	DC-isolated Bus Device Transmitter
Device Description	Available	Description revision	01.01
	HCF SDC625 tokenized output: $Library$\6039\E0EA\0101.fm* Emerson 475 Field communicator: 6039E0EA0101.hdd		
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

HART Device Description

All standard HART configuration items are accessible without any special configuration. In order to be able to configure all settings of your F018-P HART device, your host or communicator requires the use of a specific HART Device Descriptor (DD), especially designed for the F018-P. These DD's can be downloaded from the HART Communication Foundations website (www.hartcomm.org) or the Fluidwell website (www.fluidwell.com).

HART VARIABLES

The following F018-P runtime variables are mapped to the HART dynamic device variables:

HART VARIABLES	
Type	F018-P-AH-CR
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 F018-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	Error register	14.0 Display error 14.1 Eeprom error 14.2 not used 14.3 not used 14.4 Low alarm error 14.5 High alarm error 14.6 Linearization error 14.7 Input frequency too high

Caution !

**Bit 14.0 and 14.1 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 F018-P totalizer and flowrate units as follows:

TOTALIZER			
F018-P	**HART**		
L	L		
m3	Std m3		
gal	impgal		
usgal	gal		
bbl	bbl		
kg	kg		
lb	lb		
-	none		

FLOWRATE (MASS)

F018-P	HART	F018-P	HART
g/sec	g/s	lb/sec	lb/s
g/min	g/min	lb/min	lb/min
g/hr	g/h	lb/hr	lb/h
kg/sec	kg/s	lb/day	lb/d
kg/min	kg/min		
kg/hr	kg/h	rev/sec	rev/s
kg/day	kg/d	rev/min	rpm
ton/min	metton/min	-	none
ton/hr	metton/hr		
ton/day	metton/d		

FLOWRATE (VOLUME)

F018-P	HART	F018-P	HART
l/sec	l/s	bbl/sec	bbl/s
l/min	l/min	bbl/min	bbl/min
l/hr	l/h	bbl/hr	bbl/h
m3/sec	cum/sec	bbl/day	bbl/d
m3/min	cum/min	cf/sec	cuft/s
m3/hr	cum/h	cf/min	cuft/min
m3/day	cum/d	cf/hr	cuft/h
gal/sec	gal/s		
gal/min	gal/min		
gal/hr	gal/h		
gal/day	gal/d		

Appendix D. DECLARATION OF CONFORMITY

Declaration of Conformity

Fluidwell F0-series indicators

Veghel, February 2016

We, Fluidwell BV, declare under our sole responsibility that the F0-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		EN61000-6-2:2005; EN61000-6-3:2007; EN61326-1:2013
RoHS Directive		EN 50581:2012
Low Voltage Directive	For options –PM or –OR:	EN61010-1:2010
ATEX Directive	For option –XI, intrinsically safe:	EN60079-0:2012 + A11; EN60079-11:2012; EN60079-26:2007
	Protective system:	Ⓔ II 1 G Ex ia IIC T4 Ga
		Ⓔ II 1 D Ex ia IIIC T100 °C Da
Certification	Certificates:	KEMA 05ATEX1168 X, Issue 4
	Notified body 0344:	DEKRA Certification BV, Meander 1051, 6825 MJ, Arnhem, the Netherlands.

Last two digits of the year in which the CE marking was affixed: 03.
Remark: compliance is not affected by standard EN60079-26:2015.

The object of the declaration above is in conformity with the relevant Union harmonisation legislation:

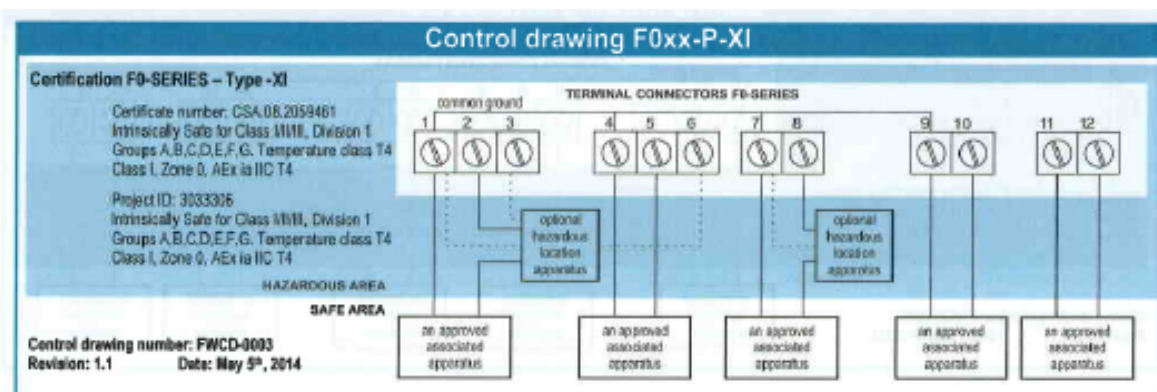|	until April 19th, 2016	from April 20th, 2016
EMC Directive	2004/108/EC	2014/30/EU
RoHS Directive	2011/65/EU	2011/65/EU
Low Voltage Directive	2006/95/EC	2014/35/EU
ATEX Directive	94/9/EC	2014/34/EU

Fluidwell BV

I. Meij, Manager Technology

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

Appendix E. CONTROL DRAWING

- The installation must comply with national requirements (e.g. in Canada, the Canadian Electrical Code, Part 1 Appendix F and in USA, the National Electrical Code, NFPA 70, Article 504 and ANSI/ISA-RP 12.6).

- Warning: Substitution of components may impair intrinsic safety.

- For the circuits connected to terminals 1, 2 and 3, 4 and 5, 7 and 8, 9 and 10, the output parameters of the connected barriers (up to 4) or hazardous location apparatus must meet the following requirements:

    V_{oc} $\leq$ The lowest V_{max} of the CSA / FM Approved apparatus in the circuit
    I_{sc} $\leq$ The lowest I_{max} of the CSA / FM Approved apparatus in the circuit
    P_{max} $\leq$ The lowest P_{max} of the CSA / FM Approved apparatus in the circuit
    C_a $\geq$ The sum of the cable capacitance and the internal capacitance C_i of each CSA / FM Approved apparatus installed in the circuit
    L_a $\geq$ The sum of the cable inductance and the internal inductance L_i of each CSA / FM Approved apparatus installed in the circuit

- For the circuits connected to terminals 1, 2 and 3, 4 and 6, 7 and 8, 11 and 12, the input parameters of the connected hazardous location apparatus must meet the following requirements:

    V_{max} $\geq$ The V_{oc} of the of the circuit
    I_{max} $\geq$ The I_{sc} of the circuit
    P_{max} $\geq$ The P_{max} of the circuit
    C_i $\leq$ The difference between the C_a of the circuit and the sum of the cable capacitance and the internal capacitance C_i of all other CSA / FM Approved apparatus installed in the circuit
    L_i $\leq$ The difference between the L_a of the circuit and the sum of the cable inductance and the internal inductance L_i of all other CSA / FM Approved apparatus installed in the circuit

- Hazardous Location Apparatus – switches, thermocouples or non-inductive resistance devices, or CSA / FM – Certified Apparatus – should be connected in accordance with the manufacturer's installation instructions.

- The cable parameters are determined by the parameters of the system into which the F0-Series General Purpose Indicators is connected.

- Only certified Intrinsically Safe Fluidwell battery type FW-LiBat-0xx may be used and replaced in hazardous area.

The entity parameters for F0-Series General Purpose Indicators, model F0xx-P-XI, are as follows:

Terminals 1 and 2 – Input parameters:	V_{max}	= 30V	C_i	= 0nF
	I_{max}	= 150mA	L_i	= 0mH
	P_{max}	= 0.92W		
Terminals 1 and 2 – Output parameters:	V_{oc}	= 5.4V	C_a	= 65 µF
	I_{sc}	= 2.4mA	L_a	= 1 H
	P_{max}	= 3.2mW		
Terminal 1 and 3 – Output parameters:	V_{oc}	= 5.4V	C_a	= 65 µF
	I_{sc}	= 2.1mA	L_a	= 1 H
	P_{max}	= 2.9mW		
Terminal 4 and 5 – Input parameters – Type -PD/-PX	V_{max}	= 30V	C_i	= 0nF
	I_{max}	= 200mA	L_i	= 0mH
	P_{max}	= 1.2W		
Terminal 4 and 6 – Output parameters – Type -PD	V_{oc}	= 8.7V	C_a	= 5.9 µF
	I_{sc}	= 12mA	L_a	= 240 mH
	P_{max}	= 72mW		
Terminal 7 and 8 – Input parameters – Type -OT	V_{max}	= 30V	C_i	= 0nF
	I_{max}	= 200mA	L_i	= 0mH
	P_{max}	= 1.2W		
Terminal 9 and 10 – Input parameters – Type -ZB	V_{max}	= 30V	C_i	= 0nF
	I_{max}	= 200mA	L_i	= 0mH
	P_{max}	= 0.75W		
Terminal 11 and 12 – Input parameters – Type -AH	V_{max}	= 30V	C_i	= 6.1nF
	I_{max}	= 100mA	L_i	= 0mH
	P_{max}	= 0.75W		

INDEX OF THIS MANUAL

LIST OF FIGURES F018-P

LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE:	DATE:

1 - TOTAL		Enter your settings here	
11 unit	L		
12 decimals	0000000		
13 K-factor	1		
14 decimals K-factor	0		

2 - FLOWRATE			
21 unit	L/min		
22 decimals	0000000		
23 K-factor	1		
24 decimals K-factor	0		
25 calculation	PLS 10		
26 cut-off [sec]	30.0		
27 damping [sec]	0.1		

3 - ALARM			
31 alarm set	operate		
32 flow zero	default		
33 alarm lo	0		
34 alarm hi	0		
35 delay lo	0.0		
36 delay hi	0.0		
37 rel out	hi-lo		

LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE:	DATE:

4 - DISPLAY		Enter your settings here	
41 function	rate		
42 lcd new [sec]	1		
43 backlight	off		
44 bl alarm	off		
45 brightness	5		
46 battery mode	operate		

5 - FLOWMETER			
51 signal	npn		

6 - LINEARIZE			
61 frequency/m-factor 1	0.0 /1000000		
↕	↕		
6F frequency/m-factor 15	0.0 /1000000		
6G linear	disable		
6H decimals	1111.1		

7 ANALOG			
71 pv - lrv	0		
72 pv - urv	1600		
73 loop current	enabled		
74 loop test	off		
75 tune lo	660		
76 tune high	3300		

8- IMPULSE			
81 width	0.000		
82 decimals	0000000		
83 impulse	1000		
84 rel out	hi-lo		

9 - OTHERS			
91 model	F018-P	F018-P	F018-P
92 software version	03.06.04	03.____.____	03.____.____
93 serial number	_ _ _ _ _ _ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _
94 password	0000		
95 address	00		
95 tag-nr	0000000		