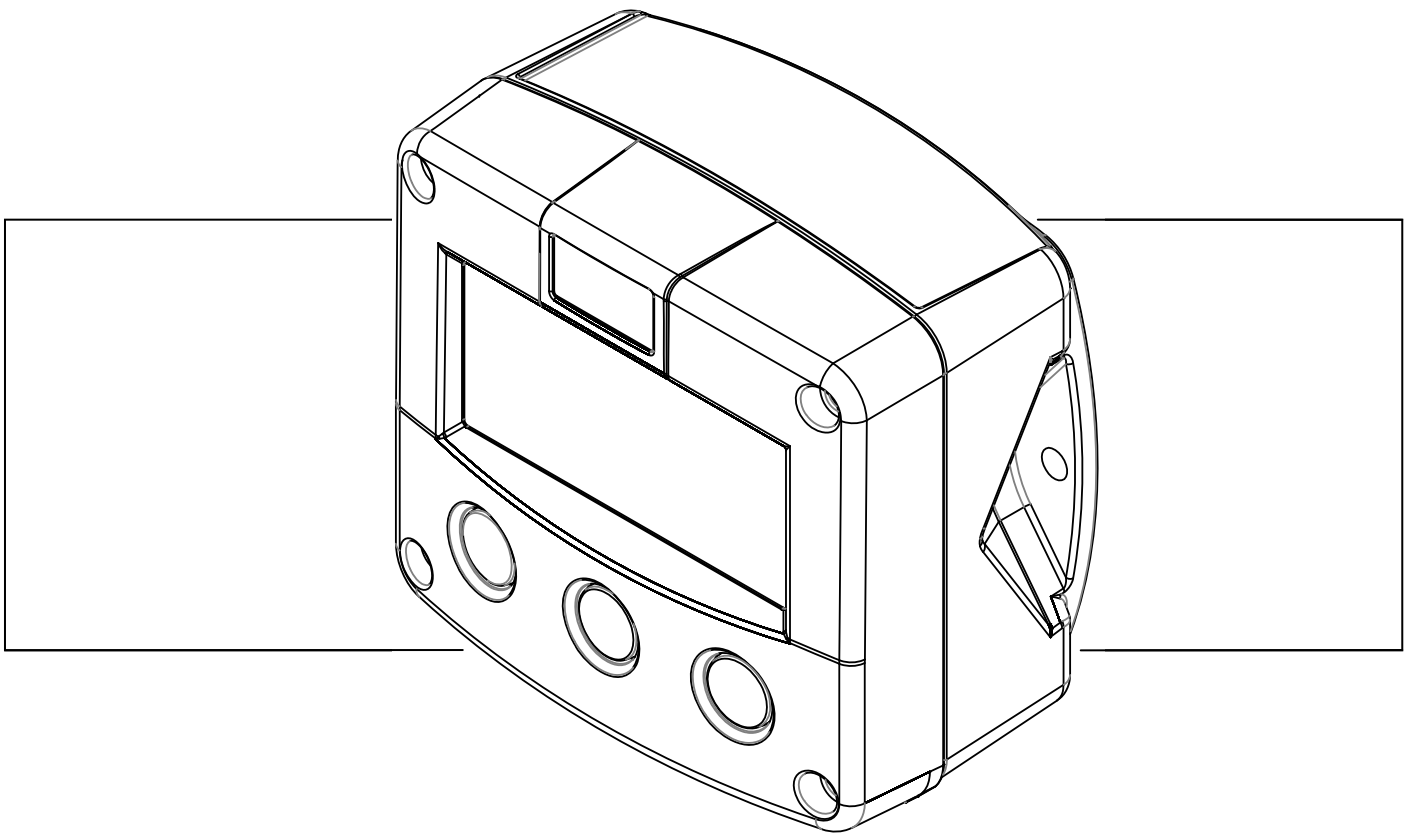# F111-P

DUAL FLOWRATE INDICATOR / TOTALIZER

Signal input flowmeters: pulse, Namur and coil

Signal outputs: two pulse outputs ref. total

Options: Intrinsically Safe, Modbus communication

SAFETY INSTRUCTIONS

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

- LIFE SUPPORT APPLICATIONS: The F111-P is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.

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

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

- Do connect a proper grounding to the aluminum casing as indicated if the F111-P has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.

- Intrinsically Safe applications: follow the instructions as mentioned in Chapter 5 and consult "Fluidwell F1..-..-XI - Documentation for Intrinsic Safety".

DISPOSAL

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

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F111-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 unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the F111-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 unit is described in chapter 2 "Operation". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

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

A hazardous situation may occur if the F111-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 F111-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 F111-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.

Hardware version	:	02.01.xx
Software version	:	02.04.xx
Manual	:	HF111PEN_v0501_05
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CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F111-P

Functions and features
The dual flowrate / totalizer model F111-P is a microprocessor driven instrument designed to display flowrate, total and accumulated total of two completely separated flow measurement systems.
This product has been designed with a focus on:
- ultra-low power consumption to allow long-life battery powered applications (type PB / PC),
- intrinsic safety for use in hazardous applications (type XI),
- several mounting possibilities with ABS or aluminum enclosures for harsh industrial surroundings,
- ability to process all types of flowmeter signals,
- transmitting possibilities with pulse and communication (option) outputs.

Flowmeter input
This manual describes the unit with a pulse type input from the flowmeter "-P version". Other versions are available to process (0)4-20mA or 0-10V flowmeter signals.
Two flowmeters with a passive or active pulse, Namur or coil signal output can be connected to the F111-P. To power the sensors, several options are available.

Standard outputs
- For each flowmeter input, one configurable pulse output: a scaled pulse mirroring a certain totalised quantity. Maximum frequency 60Hz.; the pulse length can be set from 7,8msec up to 2 seconds.
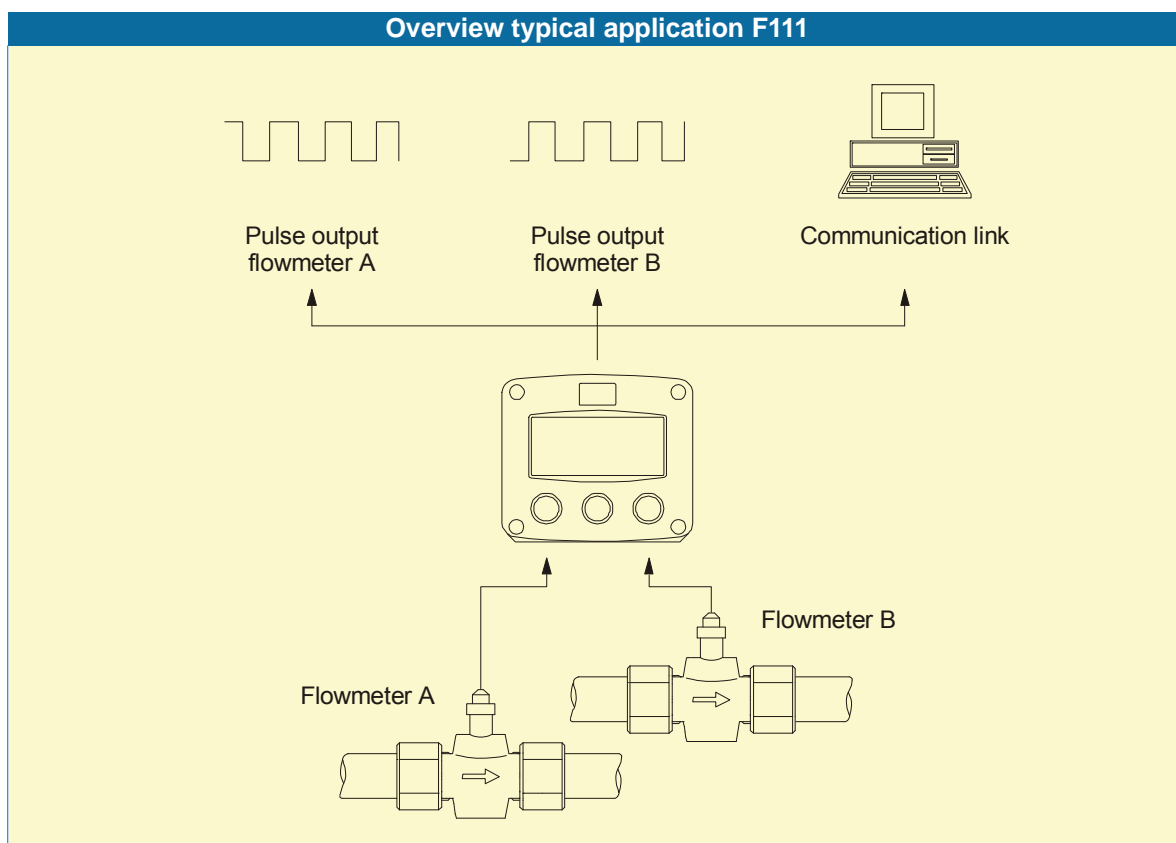

Fig. 1: Typical application for the F111-P.

Configuration of the unit
The F111-P was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F111-P according to your specific requirements. SETUP includes several important features, such as K-factors, measurement units, signal selection etc. All setting are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery.
To extend the battery-life time (option), please make use of the power-management functions as described in chapter 3.2.3.

Display information
The unit has a large transflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.
Flowrate and totals of each flow can be displayed either with the small 8mm digits or with the 17mm digits. A toggle function is available to show the information of each flow automatically during 6 seconds. A backup of the totals and accumulated totals in EEPROM memory is made every minute.

Options
The following options are available: full Modbus communication RS232/485 (also battery powered), intrinsic safety, mechanical relay or active outputs, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure.

2.   OPERATIONAL

2.1.   GENERAL

Caution !

- *The F111-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 F111-P. This instruction is meant for users / operators.

2.2.   CONTROL PANEL

The following keys are available:

PROG ENTER   SELECT ▲   CLEAR ▶
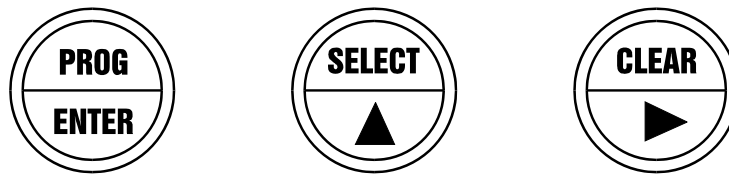
Fig. 2: Control Panel.

Functions of the keys

PROG ENTER

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.

SELECT ▲

This key is used to SELECT the information of each flow by hand.
The arrow-key ▲ is used to increase a value after PROG has been pressed or to configure the unit; please read chapter 3.

CLEAR ▶

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

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F111-P will always function at Operator level. The information displayed is dependant upon the SETUP-settings. All pulses generated by the connected flowmeters are measured by the F111-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**
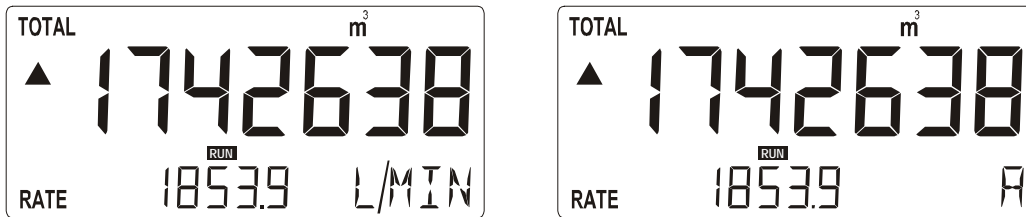 For each flow, total is displayed on the upper-line of the display and flowrate on the bottom line. Also the infomation "flow A" or "flow B" will be displayed.
  It is possible to display flowrate only with the large 17mm digits; in this instance press the SELECT-key to read the total.
  When "-------" is shown, then the flowrate value is too high to be displayed. The arrows ⭥ indicate the increase/decrease of the flowrate trend.
  If activated, all information will be displayed step by step with the automatic toggle function; else you have to select the infomation manually.

▪ **Clear total**
  The value for total can be re-initialized. To do so, select the desirered total and 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**
  If this function is activated, accumulated Total will be displayed after pressing the SELECT-key a few times. 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.

▪ **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 official batteries may be used, or else the guarantee 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

▪ **Alarm 01-03**
  When "alarm" is displayed, please consult Appendix B: problem solving.

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.*
- *The F111-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

Configuration of the F111-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 unit will exit SETUP automatically.
SETUP can be reached at all times while the F111-P remains fully operational.

Note !

Note: *A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.*

To enter SETUP-level:
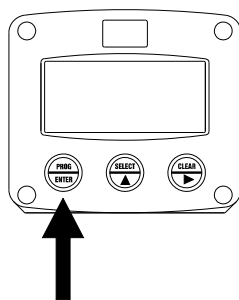
Press (PROG ENTER) for 7 seconds

Matrix structure SETUP-level:
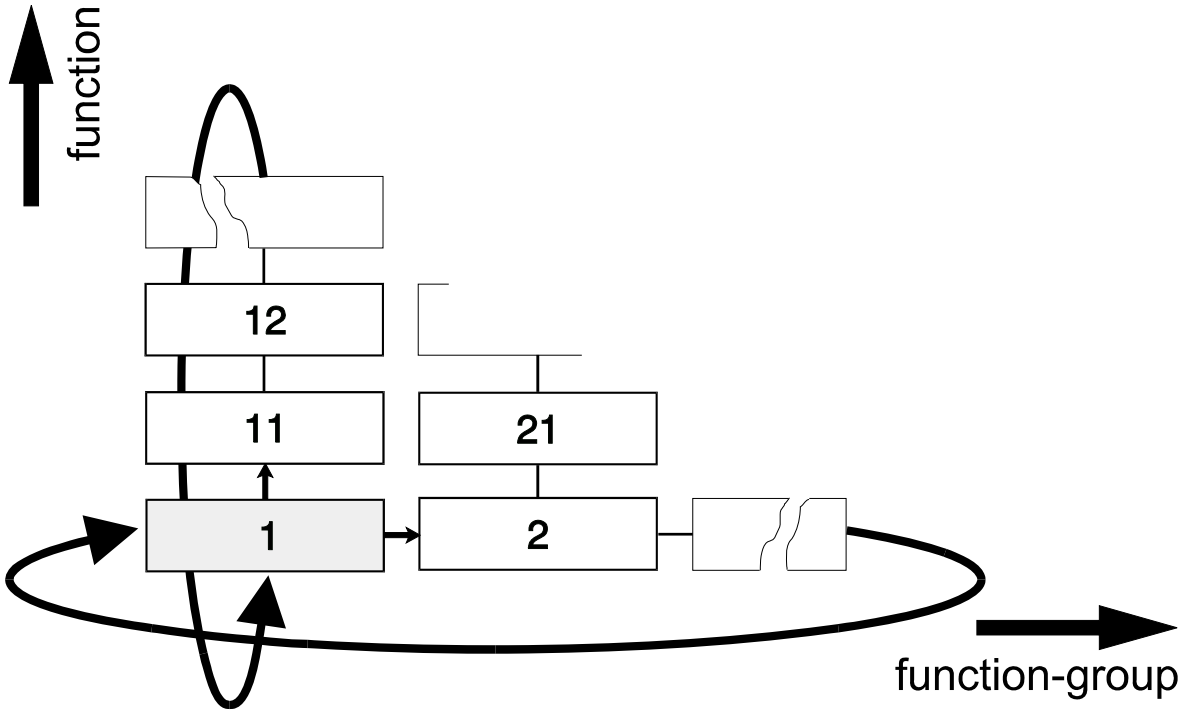
SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:
SETUP is divided into several function groups and functions.
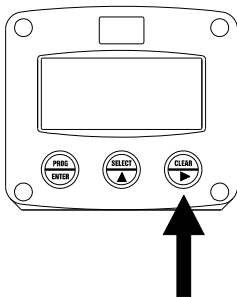
Select function-group with CLEAR ▶
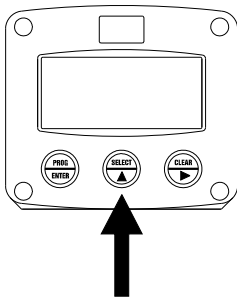
Select function with SELECT ▲

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.).

To change or select a value:
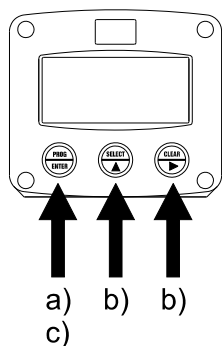
a) press [PROG ENTER] briefly; **PROGRAM** will start flash

b) select or enter value with [SELECT ▲] and / or [CLEAR ▶]

c) press [PROG ENTER] to confirm the value / selection.

a)   b)   b)
c)

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

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

Note !

Note: alterations will only be set after ENTER has been pressed!

To return to OPERATOR-level:
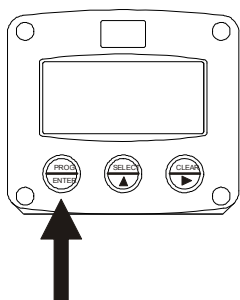
Press [PROG ENTER] for 3 seconds

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 A**		
	11	UNIT	L - m3 - 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 A**		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	K-FACTOR	0.000010 - 9,999,999
	25	DECIMALS K-FACTOR	0 - 6
	26	CALCULATION	per 1 - 255 pulses
	27	CUT-OFF	0.1 - 999.9 seconds
3	**TOTAL B**		
	31	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	32	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	33	K-FACTOR:	0.000010 - 9,999,999
	34	DECIMALS K-FACTOR	0 - 6
4	**FLOWRATE B**		
	41	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	42	TIME UNIT	sec - min - hour - day
	43	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	44	K-FACTOR	0.000010 - 9,999,999
	45	DECIMALS K-FACTOR	0 - 6
	46	CALCULATION	per 1 - 255 pulses
	47	CUT-OFF	0.1 - 999.9 seconds
5	**DISPLAY**		
	51	FUNCTION	total - flowrate
	52	DISPLAY	toggle - hand
	53	ACCUMULATED TOTAL	enable - disable
6	**POWER MANAGEMENT**		
	61	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	62	BATTERY MODE	operational - shelf
7	**SENSOR**		
	71	SIGNAL A	npn - npn_lp - reed - reed_lp - pnp - pnp_lp - namur - coil_hi - coil_lo - act_8.1 - act_12 - act_24
	72	SIGNAL B	npn - npn_lp - reed - reed_lp - pnp - pnp_lp - namur - coil_hi - coil_lo - act_8.1 - act_12 - act_24
8	**IMPULSE A**		
	81	PERIOD TIME	0 - 250
	82	IMPULSE PER	X,XXX,XXX quantity
9	**IMPULSE B**		
	91	PERIOD TIME	0 - 250
	92	IMPULSE PER	X,XXX,XXX quantity
A	**COMMUNICATION**		
	A1	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	A2	ADDRESS	1 - 255
	A3	MODE	ASCII - rtu - off
B	**OTHERS**		
	B1	TYPE / MODEL	
	B2	SOFTWARE VERSION	
	B3	SERIAL NO.	
	B4	PASS CODE	0000 - 9999
	B5	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL - A	
Input A and B are completely separated. Setup 1 and 2 are available to enter the configuration settings for flowmeter A.	
MEASUREMENT UNIT 11	SETUP - 11 determines for flowmeter input "A" the measurement unit for total, accumulated total and pulse output. 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.
DECIMALS 12	The decimal point determines for total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333
K-FACTOR 13	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 11), 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 - 13: "2481300" and for SETUP - 14 - 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 - 13: "6523100" and for SETUP - 14 decimals K-factor "6".*
DECIMALS K-FACTOR 14	This setting determines the number of decimals for the K-factor entered. (SETUP 13). 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 12)!

2 - FLOWRATE - A

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.
Note: these settings also influence the analog output.

MEASUREMENT UNIT **21**	SETUP - 21 determines for flowmeter input "A" the measurement unit for flowrate. The following units can be selected: mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P. 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.
TIME UNIT **22**	The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).
DECIMALS **23**	This setting determines for flowrate the number of digits following the decimal point. The following can be selected: 00000 - 1111.1 - 2222.22 - 3333.333
K-FACTOR **24**	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 21), for example per liter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.
DECIMALS K-FACTOR **25**	This setting determines the number of decimals for the K-factor (SETUP 24). 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 23)!
CALCULATION **26**	The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 255 pulses. *Note: this setting does influence the update time for the analog output directly (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses.* *Note: the lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).* *Note: for low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.* *Note: for high frequency application (above 1kHz) do program a value of 50 or more pulses.*
CUT-OFF TIME **27**	With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 26) 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).

Note !

3 - TOTAL - B

Input A and B are completely separated. Setup 3 and 4 are available to enter the configuration settings for flowmeter B.

MEASUREMENT UNIT **31**	SETUP - 31 determines for flowmeter input "B" the measurement unit for total, accumulated total and pulse output. 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.
DECIMALS **32**	The decimal point determines for total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333
K-FACTOR **33**	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 31), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.
DECIMALS K-FACTOR **34**	This setting determines the number of decimals for the K-factor entered. (SETUP 33). 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 32)!

4 - FLOWRATE - B

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.
Note: these settings also influence the analog output.

MEASUREMENT UNIT **41**	SETUP - 41 determines for flowmeter input "B" the measurement unit for flowrate. The following units can be selected: mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P. 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.
TIME UNIT **42**	The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).
DECIMALS **43**	This setting determines for flowrate the number of digits following the decimal point. The following can be selected: 00000 - 1111.1 - 2222.22 - 3333.333
K-FACTOR **44**	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 41), for example per liter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.
DECIMALS K-FACTOR **45**	This setting determines the number of decimals for the K-factor (SETUP 44). 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 43)!
CALCULATION **46**	The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 255 pulses. *Note: this setting does influence the update time for the analog output directly (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses.* *Note: the lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).* *Note: for low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.* *Note: for high frequency application (above 1kHz) do program a value of 50 or more pulses.*
CUT-OFF TIME **47**	With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 46) 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).

Note !

5 - DISPLAY

FUNCTION 51	The large 17mm digits can be set to display the total or flowrate. When "total" is selected, both total and flowrate are displayed simultaneously. When "flowrate" is selected, only flowrate will be displayed with it's measuring unit while total will be displayed after pressing SELECT.
DISPLAY 52	This function determines if the main display information - flowrate/total - of both flows is displayed automatically or after pressing the SELECT button. With "toggle", the main information of one flow will be displayed during 7 seconds followed by the other flow for 7 seconds etc. etc. With "hand", all info must be selected manually.
ACC TOTAL 53	Accumulated total of both flows can be switched off to make the operator level less complicated. Note that accumulated total will be calculated at all times even when this display-function disabled.

6 - POWER MANAGEMENT

When used with the internal battery option, the user can expect reliable measurement over a long period of time. The F111-P has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

LCD NEW 61	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 signals will be generated in the normal way. The following can be selected: Fast - 1 sec - 3 sec - 15 sec - 30 sec - off. **Example 3:** **Battery life-time** *battery life-time with a coil pick-up, 1KHz. pulses and FAST update: about 2 years.* *battery life-time with a coil pick-up, 1KHz. pulses and 1 sec update: about 5 years.* *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 be switched off after 30 seconds and will be switched on as soon as a button has been pressed.*
BATTERY-MODE 62	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not count pulses, the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the unit again, press the SELECT-key twice.

Note !

Note !

7 - SENSOR				
SIGNAL A **71**	The F111-P is able to handle several types of input signal. The type of flowmeter pickup / signal for input A is selected with SETUP 51. *Note: The selections "active pulse" offer a detection level of 50% of the supply voltage.* *Note: Signal selection for flowmeter A and B are complete independend.* Read also par. 4.4.3. Flowmeter input terminal 09-14.			
TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / MV	REMARK
NPN	NPN input	100K pull-up	6 kHz.	(open collector)
NPN - LP	NPN input with low pass filter	100K pull-up	2.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1M pull-up	1.2 kHz.	
REED - LP	Reed-switch input with low pass filter	1M pull-up	120 Hz.	Less sensitive
PNP	PNP input	100K pull-down	6 kHz.	
PNP - LP	PNP input with low pass filter	100K pull-down	700 Hz.	Less sensitive
NAMUR	Namur input	820 Ohm pull-down	4 kHz.	External power required
COIL HI	High sensitive coil input	-	20mV p.t.p.	Sensitive for disturbance!
COIL LO	Low sensitive coil input	-	90mV p.t.p.	Normal sensitivity
ACT_8.1	Active pulse input 8.1 VDC	3K9	10KHz.	External power required
ACT_12	Active pulse input 12 VDC	4K	10KHz.	External power required
ACT_24	Active pulse input 24 VDC	3K	10KHz.	External power required
SIGNAL B **72**	This function determines the input signal for input B. All signal types are as according to the description of setup 71.			

8 - PULSE OUTPUT A

For each flowmeter input A and B, one transistor or mechanic relay output is available as scaled pulse output according to the accumulated total.

PERIOD TIME PULSE OUTPUT INPUT A 81	The period time determines the time that the transistor or relay will be switched; in other words the pulse length. The minimum time between the pulses is as long as the period time. One period is approx. 7.8 msec. If the value selected is "zero", the pulse output is disabled. The maximum value is 255 periods. *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 reduces again, 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 it's range*

NUMBER OF PERIODS	PERIOD TIME	MAX. FREQUENCY
0	disabled	disabled
1	0,0078 seconds	64 Hz.
2	0,0156 seconds	32 Hz.
3	0,0234 seconds	21 Hz.
64	0,5000 seconds	1 Hz.
255	1,9922 seconds	0.25 Hz.

PULSE PER INPUT A 82	According to the measurement unit settings for total, a pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account.

Note !

9 - PULSE OUTPUT B

For each flowmeter input A and B, one transistor or mechanic relay output is available as scaled pulse output according to the accumulated total.

PERIOD TIME PULSE OUTPUT INPUT B 91	This setup function determines the pulse length for **input B** as described accordingly for input A - setup 81.
PULSE PER INPUT A 92	This setup function determines the quantity for **input B** as described accordingly for input A - setup 82.

A - COMMUNICATION (OPTIONAL)	
The functions described below deal with hardware that is not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.	
BAUDRATE **A1**	For external control, the following communication speeds can be selected: 1200 - 2400 - 4800 - 9600 baud
BUS ADDRESS **A2**	For communication purposes, a unique identity can be attributed to every F111-P. This address can vary from 1-255.
MODE **A3**	The communication protocol is Modbus ASCII or RTU mode. Select OFF, to disable this communication function.

| B - OTHERS	
TYPE OF MODEL **B1**	For support and maintenance it is important to have information about the characteristics of the F111-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
VERSION SOFTWARE **B2**	For support and maintenance it is important to have information about the characteristics of the F111-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
SERIAL NUMBER **B3**	For support and maintenance it is important to have information about the characteristics of the F111-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.
PASS CODE **B4**	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.
TAGNUMBER **B5**	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

4. INSTALLATION

4.1. GENERAL DIRECTIONS

Caution !

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F111-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
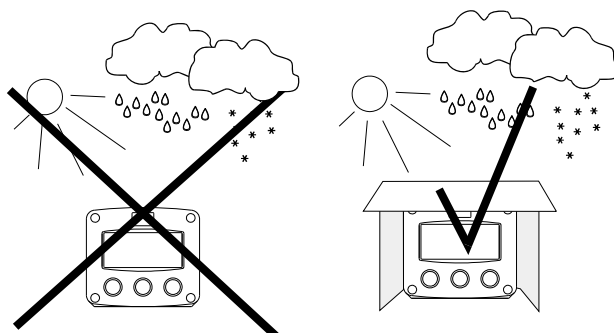
Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions.
When panel-mounted, the unit is IP65 (NEMA 4X)!
When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.
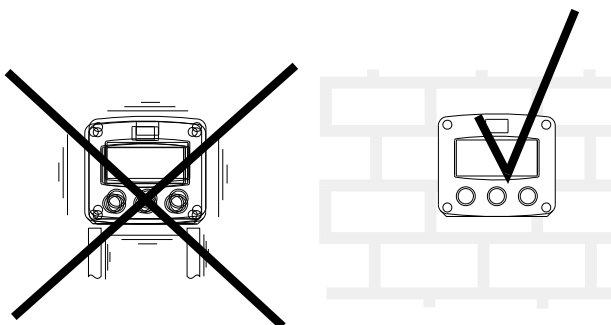
Mount the F111-P on a solid structure to avoid vibrations.
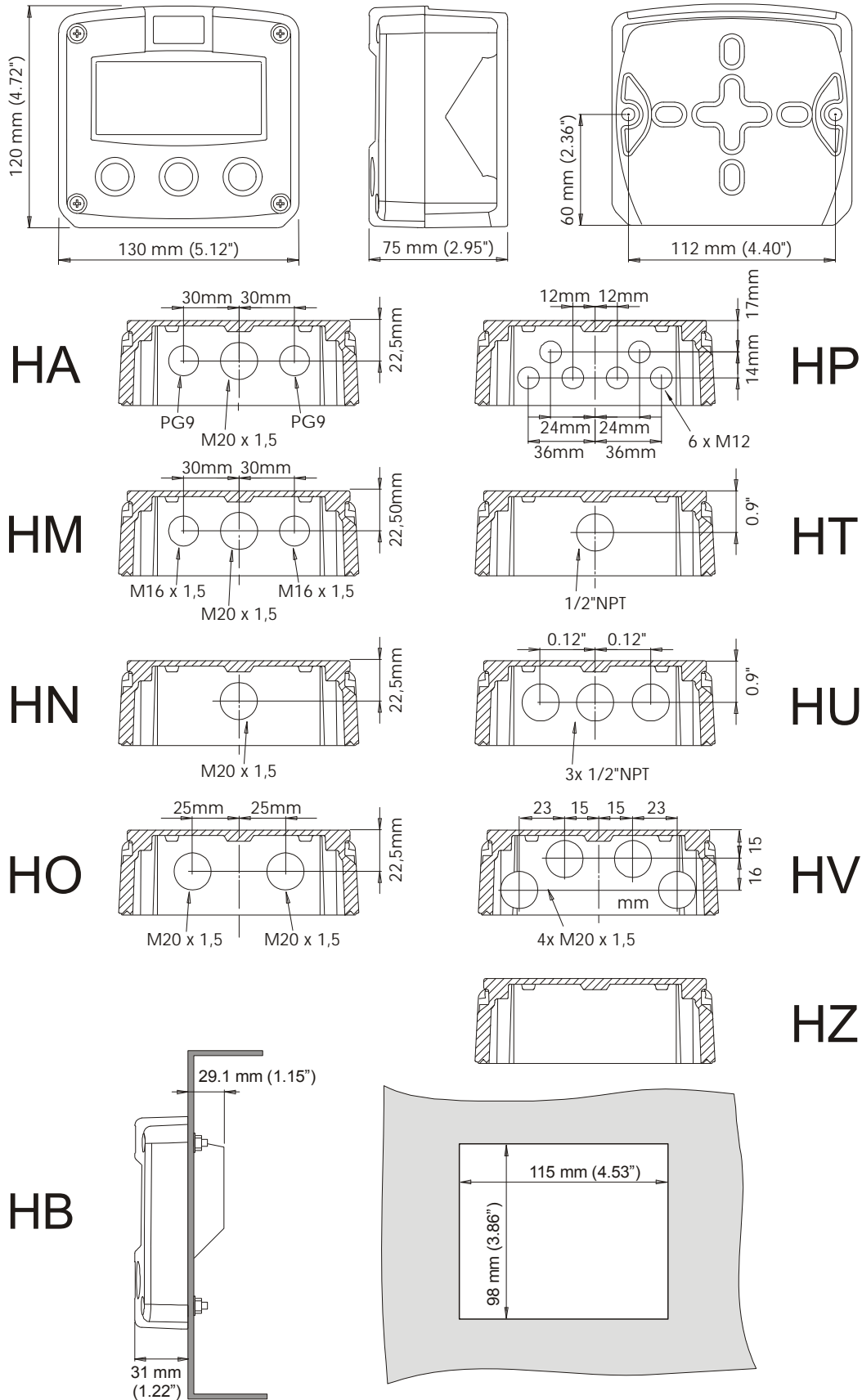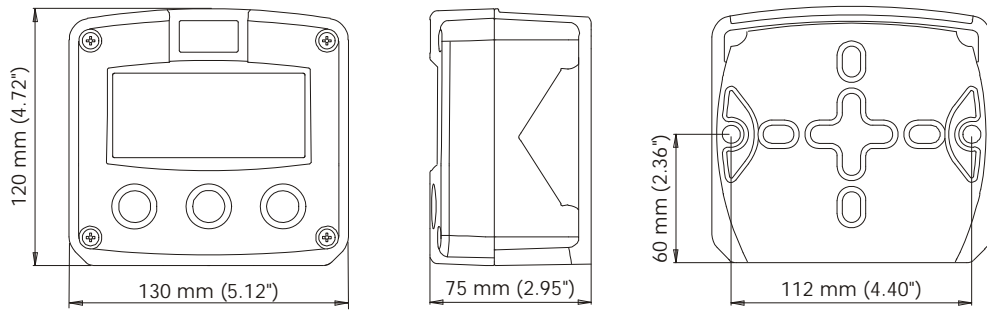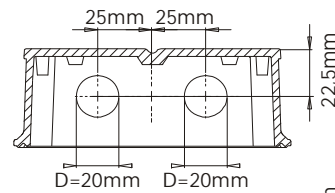
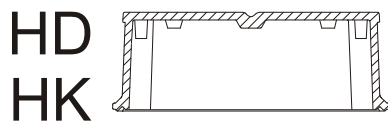### 4.3. DIMENSIONS- ENCLOSURE

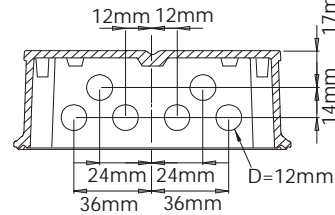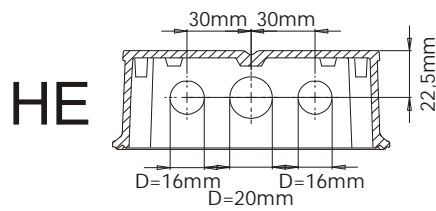**Aluminum enclosures:**

Fig. 5: Dimensions aluminum enclosures.

HF111PEN_v0501_05

GRP enclosures:

HK back box:
(flat bottom)

HD
HK

HG

HE

HH

HF

HJ

HC
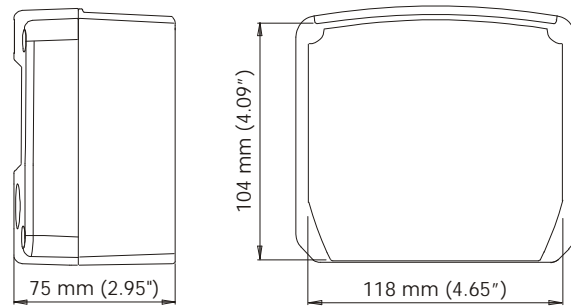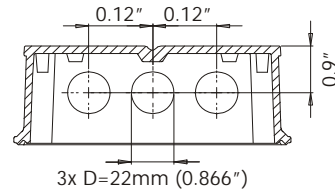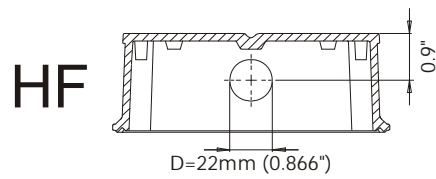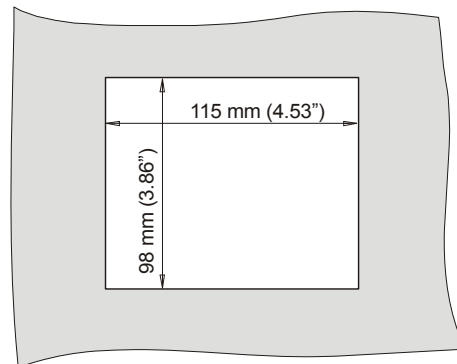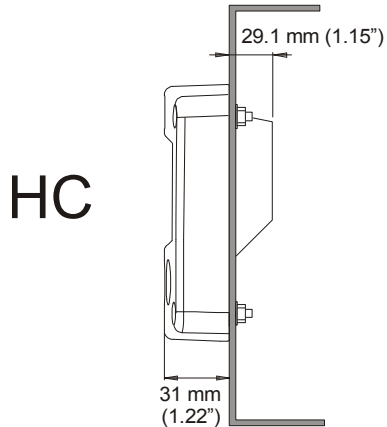
Fig. 6: Dimensions GRP enclosures

4.4. INSTALLING THE HARDWARE

4.4.1. INTRODUCTION

⚠️ WARNING

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

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

⚠️ WARNING

Aluminum enclosures
▪ When installed in an aluminum enclosure and a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, 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 iron/steel is excluded.

▪ Do ground the aluminum enclosure properly as indicated, if the F111-P has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.
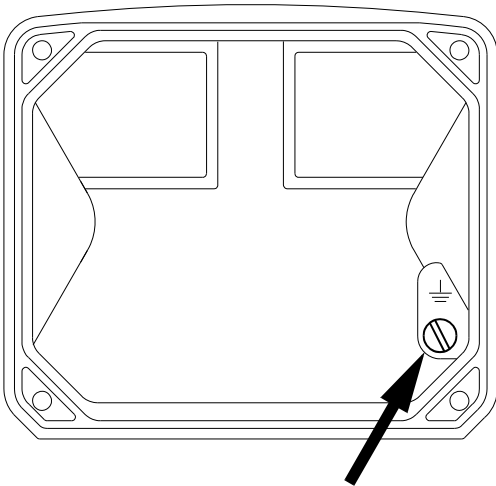
Fig. 7: Grounding aluminum enclosure with type PM 115-230V AC

FOR INSTALLATION, PAY EMPHATIC ATTENTION TO:

▪ Separate cable glands with effective IP67 (NEMA4X) seals for all wires.
▪ Unused cable entries: ensure that you fit IP67 (NEMA4X) plugs to maintain rating.
▪ A reliable ground connection for both the sensor, and if applicable, for the metal casing.
▪ An effective screened cable for the input signal, and grounding of its screen to terminal 9 (GND) or at the sensor itself, whichever is appropriate to the application.

4.4.2.   VOLTAGE SELECTION SENSOR SUPPLY

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

Battery powered and output loop-powered applications:
Terminal 11 provides a limited supply voltage of 3.2 V DC (coil signals 1.2V) for the signal output of the flowmeter.
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. 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-PM: Sensor supply: 3.2V - 8.2V - 12V or 24 V:
With this option, a real power supply for the sensor is available. The flowmeter can be powered with 8.2 - 12 or 24 V DC (max. 50mA@24V). The voltage is selected by the three switches inside the enclosure.

- *Warning: be sure that all the leads to the terminals are disconnected from the unit when the internal plastic protection cover has been removed !*
- *HIGH VOLTAGE 400V !! NEVER connect the mains power supply to the unit when the plastic protection cover has been removed !!!*

First, remove the terminal strip(s) after which the internal plastic cover can be removed. The switches are located in the top left corner (type PD) or on the right hand (type PF / PM) as indicated:
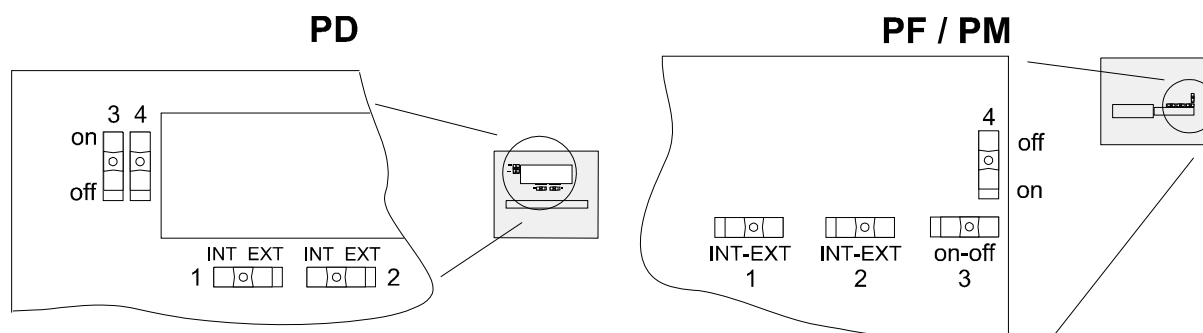
Fig. 8: switch position voltage selection (type PD, PF and PM)

Switch positions

SENSOR A	
SWITCH 1	VOLTAGE
internal	3.2 V DC
external	switch 3+4

SENSOR B	
SWITCH 2	VOLTAGE
internal	3.2 V DC
external	switch 3+4

VOLTAGE SELECTION		
SWITCH 3	SWITCH 4	VOLTAGE
on	on	8.2 V DC
off	on	12 V DC
on	off	12 V DC
off	off	23 V DC

Function switch 1:   voltage selection sensor A - terminal 11.
Function switch 2:   voltage selection sensor B - terminal 11.
Function switch 3+4:   the combination of these switches determine the voltage as indicated.
                          Do move switch 1 and / or switch 2 to the OFF position to enable the
                          selected voltage with switch 3+4.

4.4.3. TERMINAL CONNECTORS

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

The following terminal connectors are available:

OPTION: POWER SUPPLY: PD / PF / PM			PULSE OUTPUT B		PULSE OUTPUT A		POWER SUPPLY 8-24V DC (standard)		INPUT A SENSOR SIGNAL PULSE INPUT			INPUT B SENSOR SIGNAL PULSE INPUT		
GND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
⊥	N	L1	R2 ⊥	R2	R1 ⊥	R1	⊥	+ ↑	⊥	SIGNAL	+ ↓	⊥	SIGNAL	+ ↓
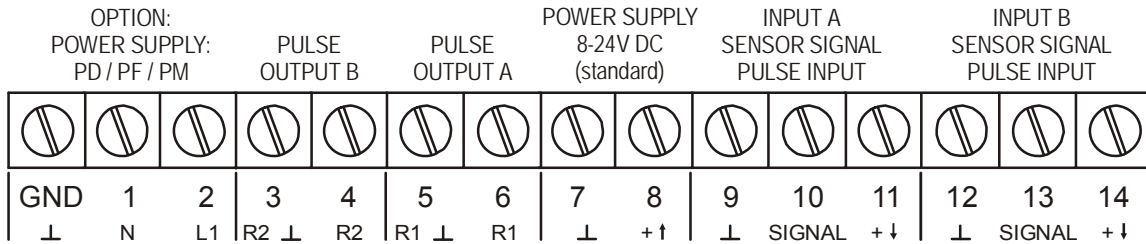
Fig. 9: Overview of terminal connectors standard configuration F111-P and options

REMARKS: TERMINAL CONNECTORS:

Power Supply: Terminal GND- 01- 02 <u>only available with type PD, PF or PM</u>:

TYPE		SENSOR SUPPLY	Terminal			backlight	TYPE AA	TYPE AU	type OA	type OR
			GND	01	02					
PD	8-24V AC	8,2-12-24V max 50mA		AC	AC		◊	◊	◊	
PD	8-30V DC	8,2-12-24V max 50mA	L-	L+			◊	◊	◊	
PF	24V AC ± 15%	8,2-12-24V max 50mA		AC	AC		◊	◊		◊
PF	24V DC ± 15%	8,2-12-24V max 50mA	L-	L+			◊	◊		◊
PM	115-230V AC ± 15%	8,2-12-24V max 50mA	EARTH	AC	AC		◊	◊	◊	◊

Φ = standard   ◊ =option

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

Terminal 03-04; transistor or relay output R2:
Setup 83 - 84 (par. 3.4.4.) determines the pulse output function related to sensor input B.
The maximum pulse frequency of this output is 60Hz. If a relay output option has been supplied, be sure that the output frequency does not exceed 5Hz or else the life-time of the relay will be reduced significantly.

Terminal 05-06; transistor or relay output R1:
Setup 91 - 92 (par. 3.4.4.) determines the pulse output function related to sensor input B.
The maximum pulse frequency of this output is 60Hz. If a relay output option has been supplied, be sure that the output frequency does not exceed 5Hz or else the life-time of the relay will be reduced significantly.

Type OT:
A <u>passive</u> transistor output is available with this option. Max. driving capacity 300mA@50V DC.
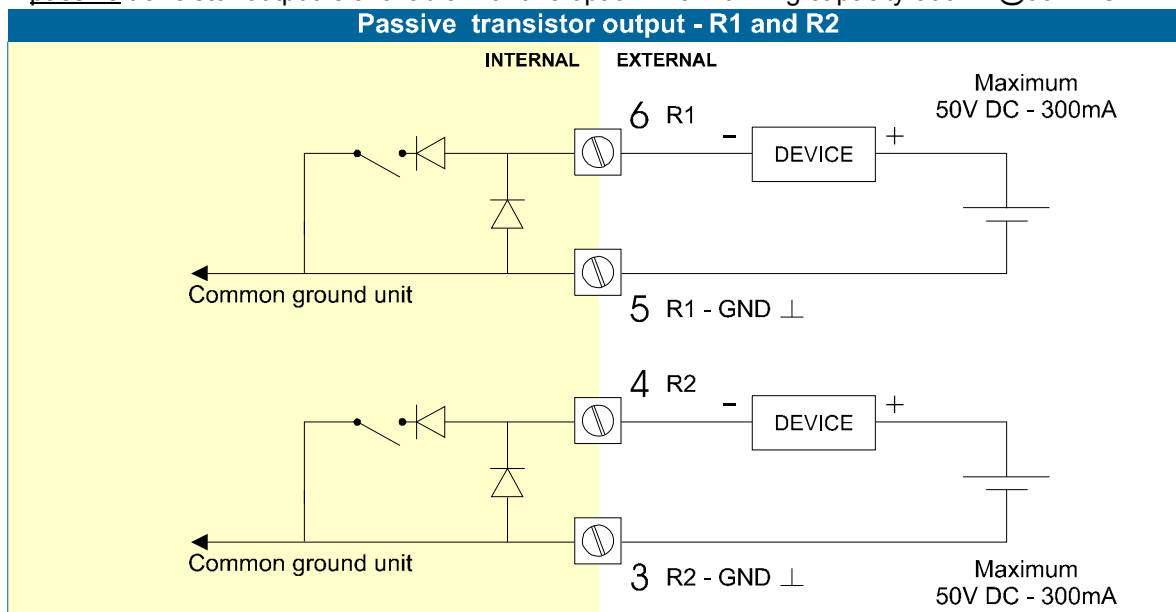
Type OA:
An <u>active 24V DC signal</u> is available with this option.
Max. driving capacity 50mA@24V per output. (Requires power supply type PD / PF / PM).

Type OR:
A mechanical relay output is available with this option.
Max. switch power 240V 0,5A per output. (Requires power supply type PF / PM).
If this option has been supplied: be sure that the output frequency does not exceed 5Hz else the life-time of the relay is influenced significantly.

Mechanic relay output - R1 and R2
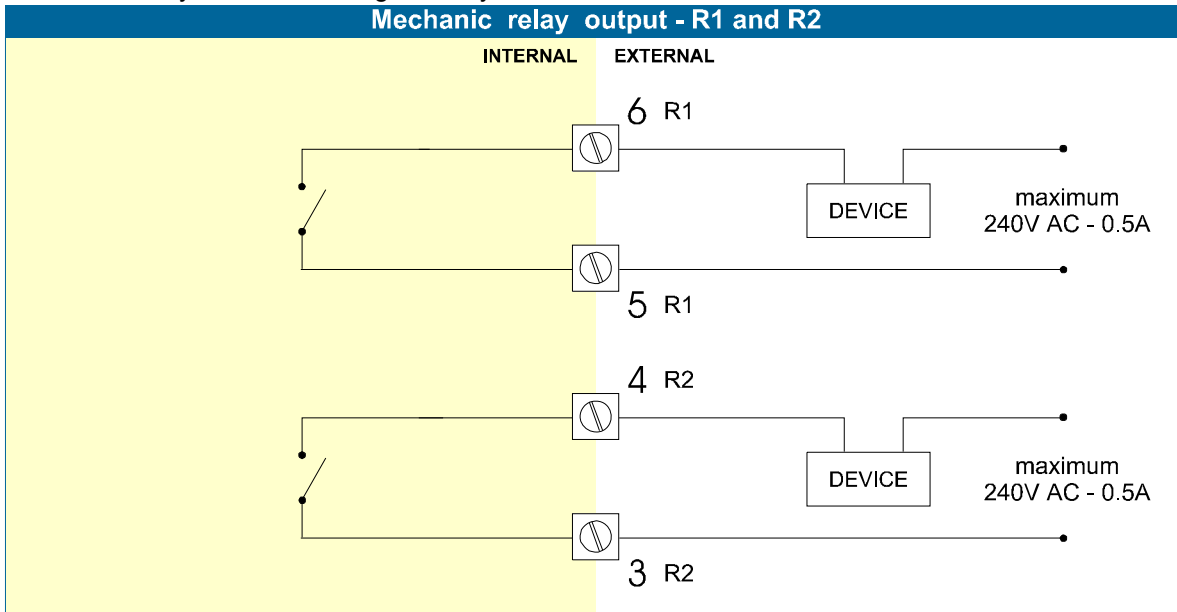
Terminal 07-08 POWER SUPPLY:
Connect an external power supply of 8-24 volts AC or 8-30VDC to these terminals.
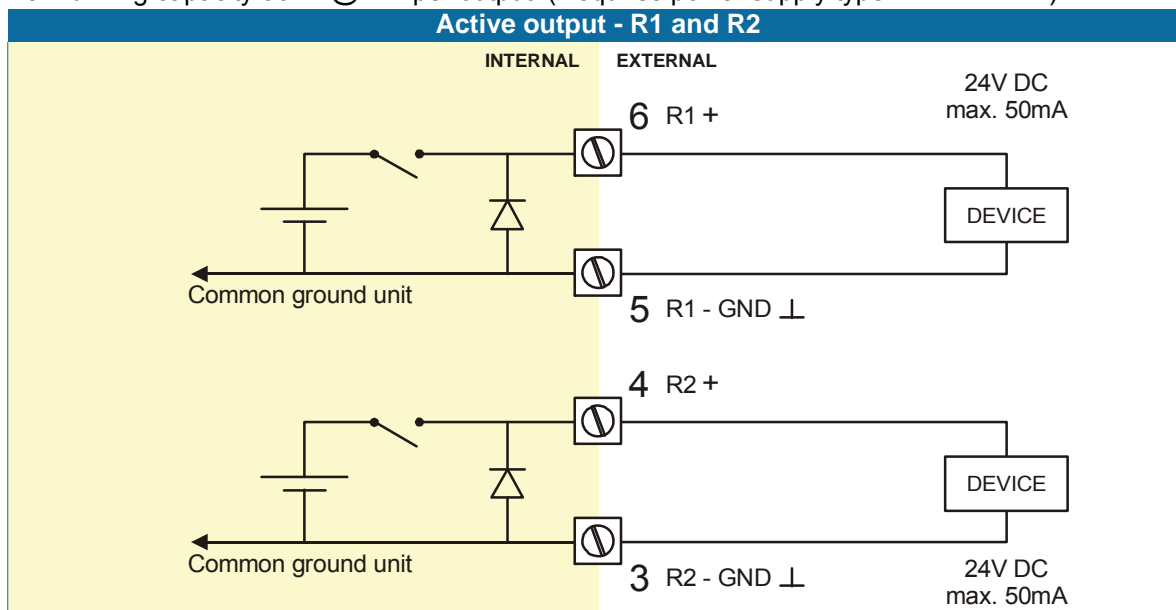For a DC supply: connect the "**-**" to terminal 7 and the "**+**" to terminal 8. When power is applied to these terminals, the (optional) internal battery will be disabled / enabled automatically to extend the battery life time.

Terminal 09-11; Sensor input - type P:
Three basic types of flowmeter signals can be connected to the unit: pulse, active pulse or coil. The screen of the signal wire must be connected to the common ground terminal 09.(unless earthed at the sensor itself) The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected with the correct SETUP-function (read par. 3.2.3.)

Coil-signal:
The F111-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 120mV peak to peak.
        COIL HI: sensitivity from about 20mV peak to peak.
Type ZF offers for setting COIL HI : sensitivity from about 10mV peak to peak.
Type ZG offers for setting COIL HI : sensitivity from about 5mV peak to peak.

Coil signal input
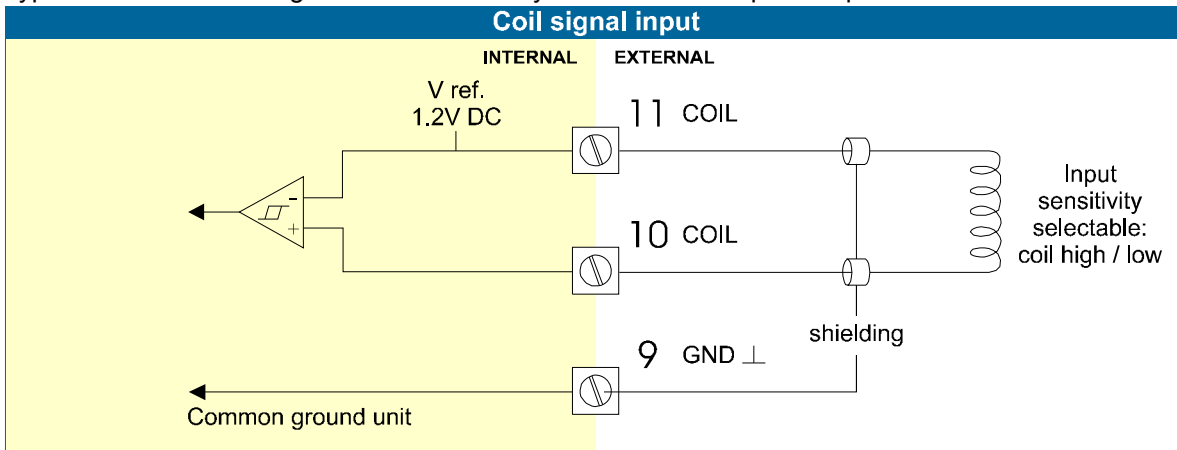
Pulse-signal NPN / NPN-LP:

The F111-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 par. 3.2.3.
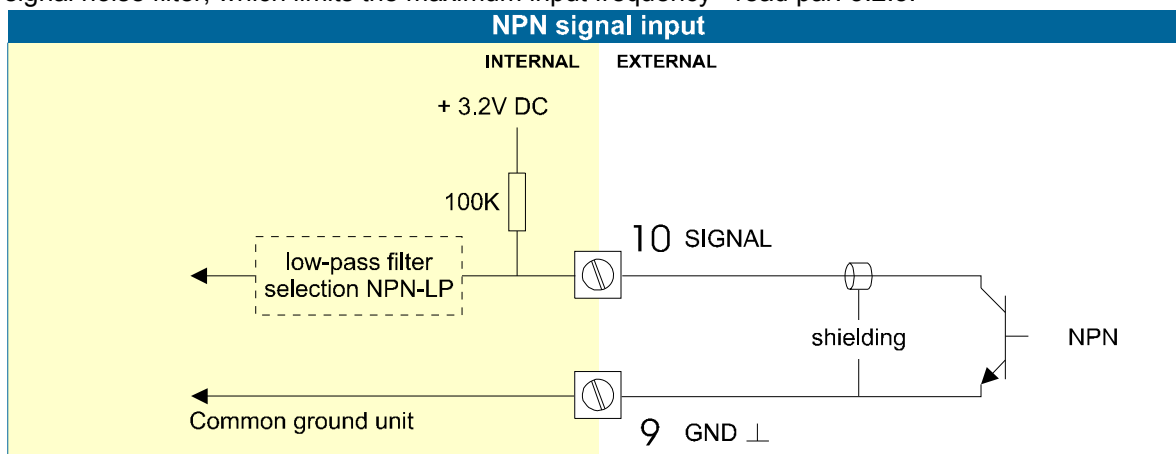
Pulse-signal PNP / PNP-LP:

The F111-P is suitable for use with flowmeters which have a PNP output signal. 3.2V is offered on terminal 11 which has to be switched by the sensor to terminal 10 (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 par. 3.2.3.
A sensor supply voltage of 8.1 -12 or 24V DC can be provided via types PD-PM.
For a signal detection level of 50% of the supply voltage: please refer to "active signals".
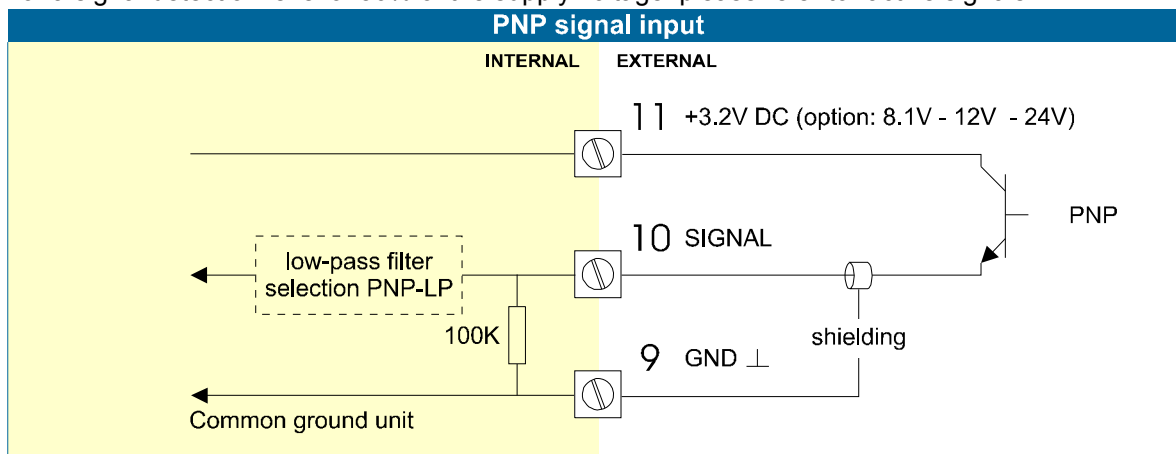
Active signals 8.1V - 12V and 24V:

If a sensor gives an active signal, please read par. 3.2.3. The detection levels are 50% of the selected supply voltage; approximately 4V (ACT_8.1) or 6V (ACT_12) or 12V (ACT_24).
Active signal selection may well be desired in the case of types PD-PM being supplied for sensor supply.

HF111PEN_v0501_05
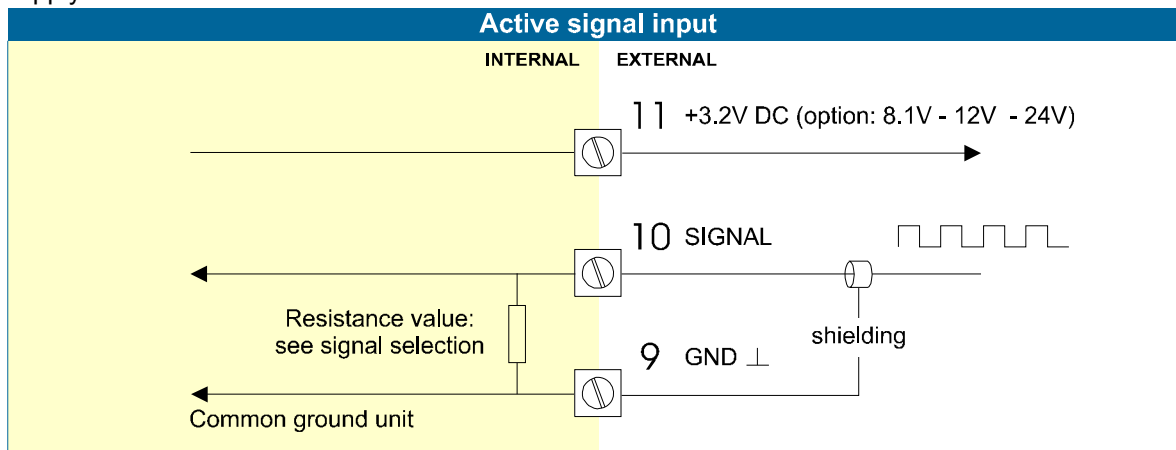
Reed-switch:
The F111-P is suitable for use with flowmeters which have a reed-switch. To avoid pulse bounce from the reed-switch, it is advised to select REED LP - low-pass filter (read par. 3.2.3.)

Reed - switch signal input
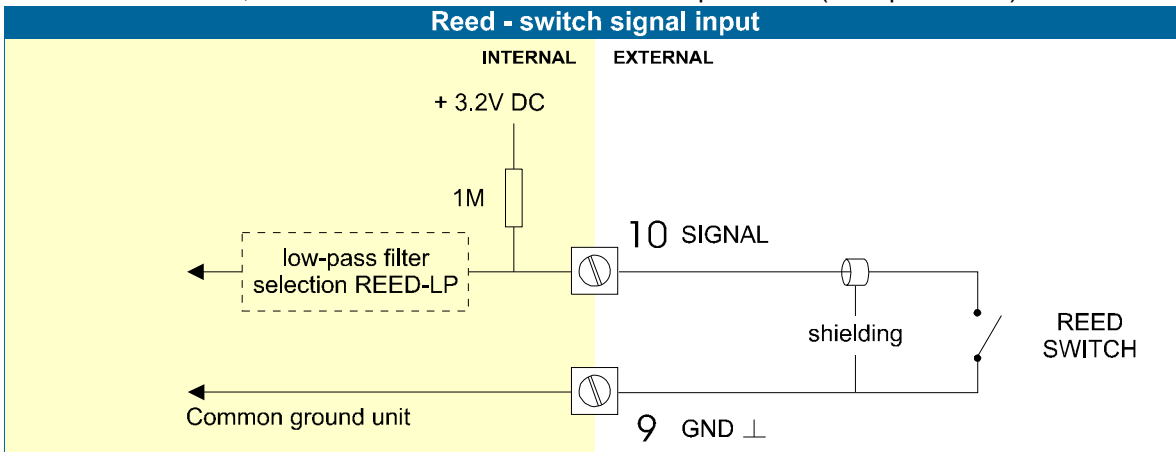
NAMUR-signal:
The F111-P is suitable for flowmeters with an Namur signal. The standard F111-P is not able to power the Namur sensor, as an external power supply for the sensor is required. However, a 8.2V sensor supply voltage (terminal 11) can be provided via types PD-PM.

Namur signal input
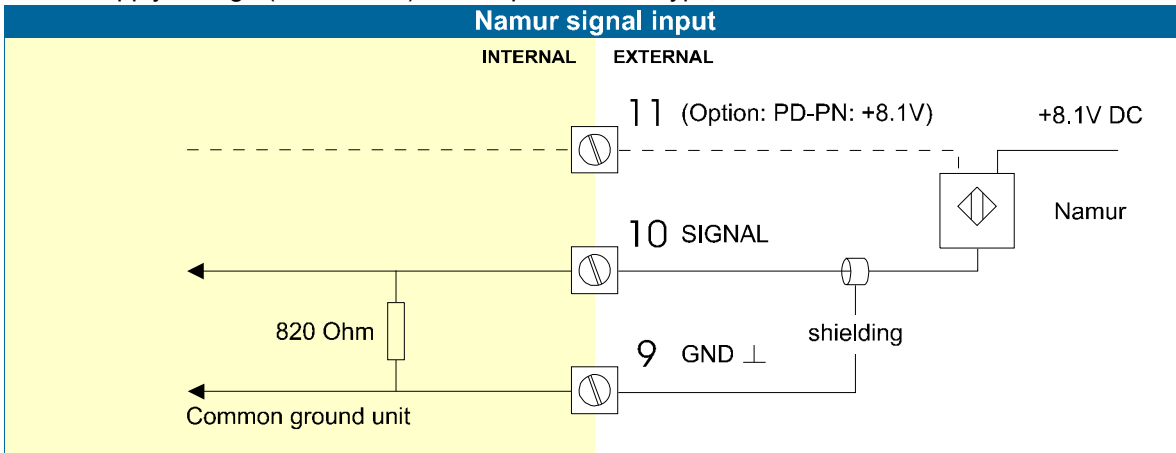
Terminal 12-14; Flowmeter input B:
Exactly as described for the flowmeter A, three basic types of flowmeter signals can be connected for flowmeter input B. Please refer to the descriptions per flowmeter type as describer for flowmeter A. The 9-10-11 do correspond with the terminals 12-13-14.

Terminal 26 - 31: communication RS232 / RS485 - type CB / CH / CI / CT:
see the manufacturer's plate.
- Full serial communications and computer control in accordance with RS232 (length of cable max. 15 meters) or RS485 (length of cable max. 1200 meters) is possible.
- Read the Modbus communication protocol and Appendix C.
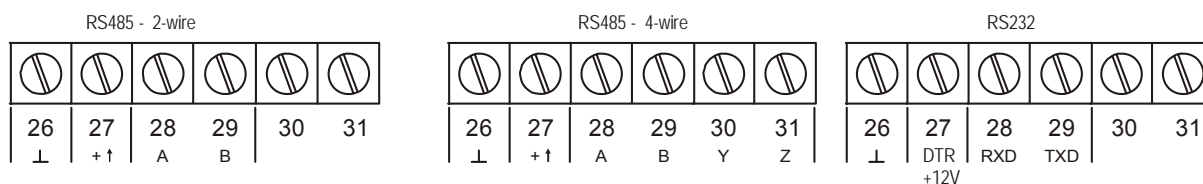
Fig. 10: Overview terminal connectors communication option

When using the RS232 communication option, terminal 27 is used for supplying the interface.
Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (+12V).
If no active signal is available it is possible to connect a separate supply between terminals 26 and 27 with a voltage between 8V and 24V.

Terminal 26-31: backlight option - type ZB:
Note: if the unit is supplied with a power supply type PF or PM, the backlight supply is integrated, so the text following is not applicable.
To power the backlight, provide a 12-24V DC to terminal 26 (-) and 27 (+). An external trimmer 1kOhm trimmer can be used to tune the brightness of the backlight, or if not desired, a short-cut between these terminals have to be made which will result in the maximum brightness.
Note: Intrinsically Safe as well as 4-wire RS485 communication is not possible in combination with option ZB.
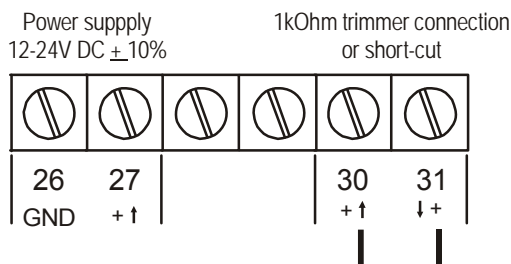
Fig. 11: Overview terminal connectors backlight option

5. INTRINSICALLY SAFE APPLICATIONS

5.1. GENERAL INFORMATION AND INSTRUCTIONS

Caution !

Cautions
- 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.
- To maintain the degree of protection of at least IP65 in accordance with IEC 60529, certified cable entries in accordance with IEC 61241-0 must be used and correctly installed. Unused openings must be closed with suitable blanking elements.
- When the enclosure of the Indicator is made of aluminum alloy, when used in a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, 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 iron/steel is excluded.
- Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.

WARNING

Safety Instructions
- 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 IEC 60079-11.
- For the combined connection of the different supply, input and output circuits, the instructions in this manual must be observed.
- From the safety point of view the circuits shall be considered to be connected to earth.
- 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 03ATEX1074 X.
- For installation under IECEx scheme: this intrinsically safe device must be installed in accordance the product certificate IECEx DEK 11.0042X.
- Exchange of Intrinsically Safe battery FWLiBAT-0xx with certificate number KEMA 03ATEX1071 U or IECEx KEM 08.0005U is allowed in Hazardous Area. See paragraph 5.4. for detailed battery replacement instructions.

Note !

Please Note
- Certificates, safety values and declaration of compliance can be found in the document named: "Fluidwell F1..-..-XI - Documentation for Intrinsic Safety".
- 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.

Label information (inside and outside the enclosure)
Indicated labels on the back cover (below) and on the inside
cover (right) show the type labels for intrinsically safe
certified units.
For details on usage see the separate "Fluidwell F1..-..-IX
Documentation for Intrinsic Safety".

```
S/N:  1101001                                          CE  [X]  [i]
                                                       0344
Remark: consult the manual.              www.fluidwell.com
[!]  Battery powered applications:
     Replace with certified FW-LiBat-0xx battery only!
Made by Fluidwell bv - Voltaweg 23, Veghel, The Netherlands
Tamb: -40°C ... +70°C / -40°F ... +158°F               IP6x
Intrinsically Safe - Possible static hazard - Do not rub

(Ex)   II 1 G     Ex ia IIB / IIC T4 Ga
       II 1 D     Ex ia IIIC T100°C Da IP6x
       KEMA 03ATEX1074 X - IECEx DEK 11.0042X

Please note that the special conditions for safe use mentioned
in both the certificate and the installation instructions must be
observed for the connection of power supply to both input
and/or output circuits.
                    MODEL: F1xx-P-XI
              Primary signal input: pulse, coil, namur
```

```
                         MODEL: F1xx-P-XI
S/N: 1101001     Primary signal input: pulse, coil, namur
IP67          Intrinsically Safe - Possible static hazard - Do not rub     CE
                 Tamb: -40°C ... +70°C / -40°F ... +158°F                  0344

          (Ex)   II 1 G     Ex ia IIB / IIC T4 Ga
                 II 1 D     Ex ia IIIC T100°C Da IP6x
          KEMA 03ATEX1074 X  -  IECEx DEK 11.0042X

     Made by Fluidwell bv - Voltaweg 23, Veghel, The Netherlands - www.fluidwell.com
```

Serial number and year of production
This information can be looked-up on the display:
See setup function (par. 3.2.2.) for details.

```
YEAR | WEEK | NUMBER

 0324 167

 SET-UP
 93  SER IALNR
```
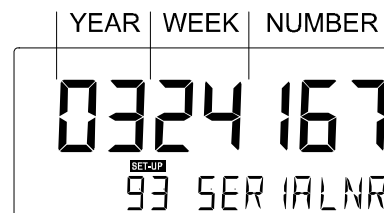
5.2.   TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS

Note !

The unit is classified as group IIB/IIIC by default.

Classification of the unit as group IIC is only possible under the following conditions:
- The indicator is either supplied by
  - the internal supply (option -PC); or
  - the external supply connected to terminals 0 and 1 (option -PD); or
  - the circuit supply connected to terminals 7 and 8 (standard);
  The maximum values for any of those circuits are those as defined for group IIB/IIIC;
- No other active external intrinsically safe circuits may be connected to the indicator, with
  exception of circuits connected to terminals 3 and 4 and/or terminals 5 and 6; the maximum
  values for any of those circuits are those as defined for group IIB/IIIC

Terminal connectors F111-P-XI:
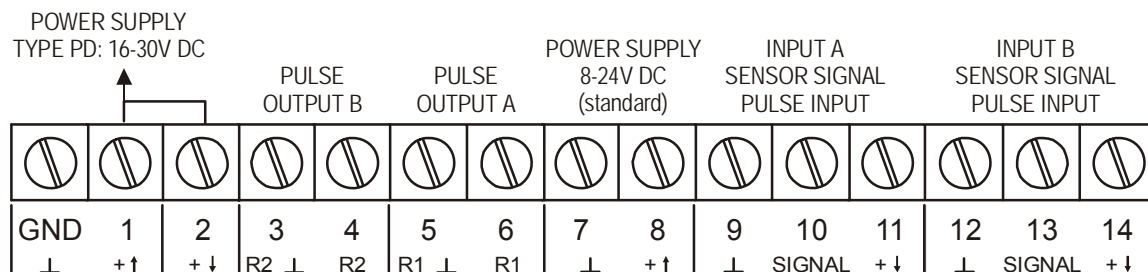
Fig. 12: Overview terminal connectors XI - Intrinsically Safe applications.

Explanation Intrinsically Safe options:

Type PD - Intrinsically Safe power supply and sensor supply - Terminal GND- 01 and 11.

TYPE		SENSOR SUPPLY	Terminal		
			GND	01	02
PD	Input voltage: 16-30V DC	3,2 - 8,1V	L-	L+	output voltage is according the input voltage; internally linked with terminal 01.

Terminal 02: this terminal offers the same voltage as connected to terminal 01.
Terminal 11: this terminal offers a 3.2V or 8.1V to power the sensor.
This voltage is selected with the switch(es) inside the enclosure. First, remove the terminals after which the internal plastic cover can be removed.

Switch position terminal 11		Switch position terminal 14	
SWITCH 1	VOLTAGE	SWITCH 2	VOLTAGE
on	8.1 V DC	on	8.1 V DC
off	3.2 V DC	off	3.2 V DC

Fig. 13: Switch position voltage selection type PD-XI.

5.3. CONFIGURATION EXAMPLES INTRINSICALLY SAFE APPLICATIONS

Fig. 14: Configuration example 1 Intrinsically Safe.
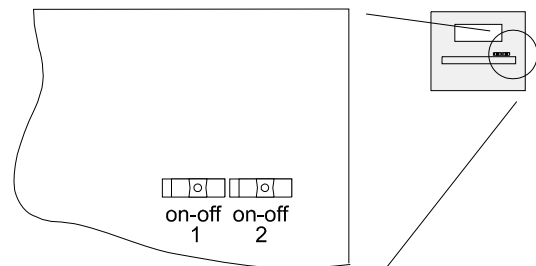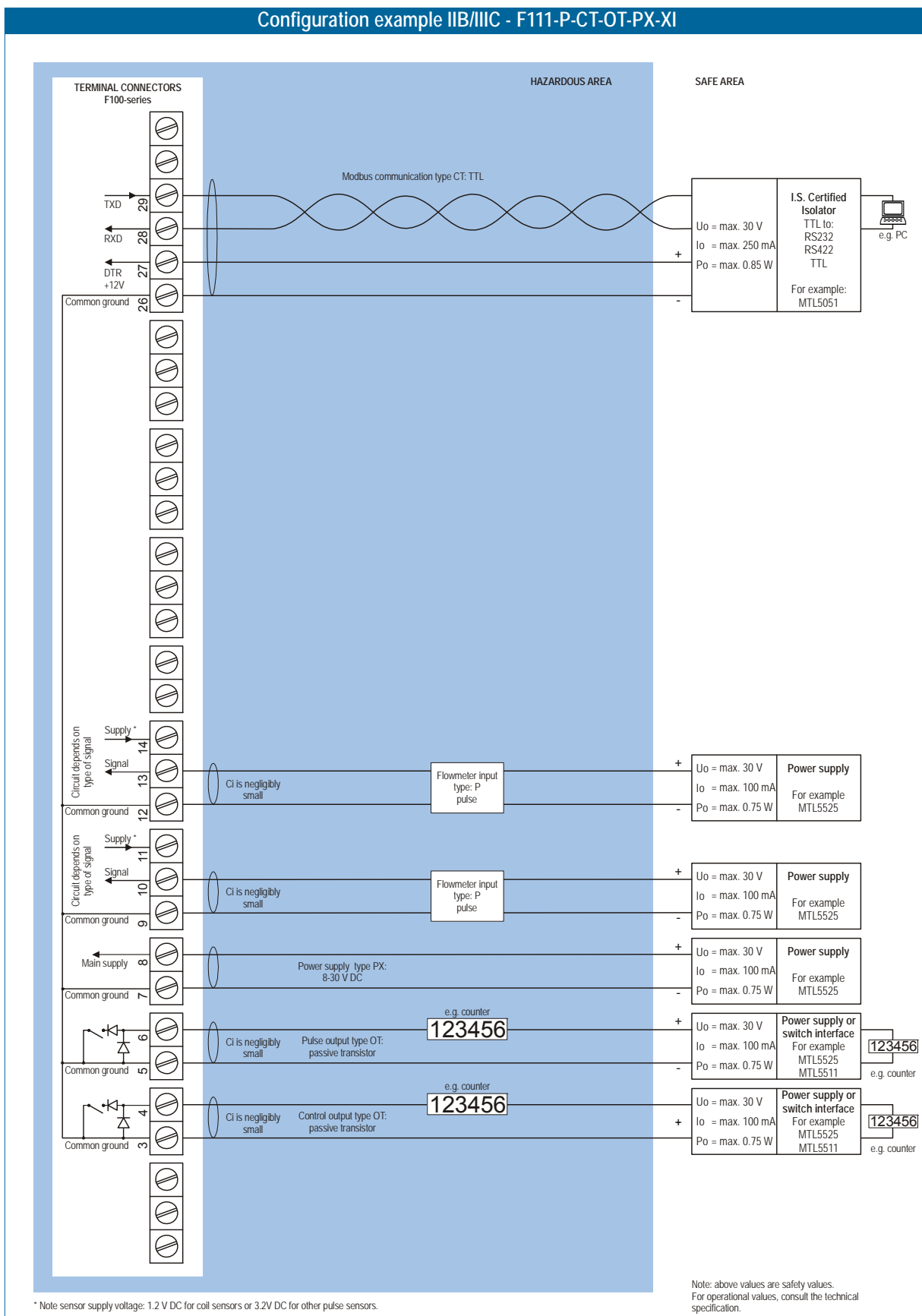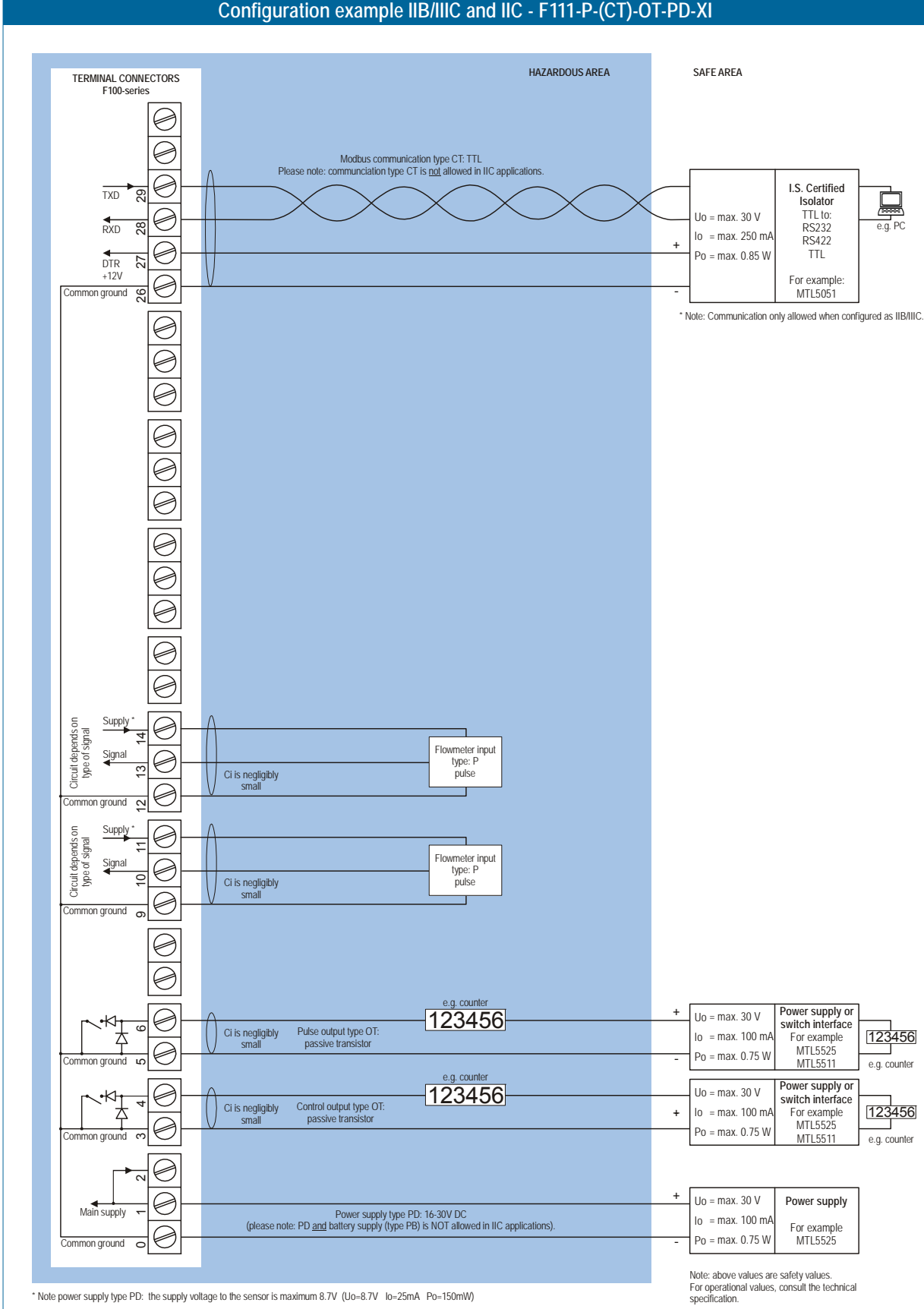
Fig. 15: Configuration example 2 Intrinsically Safe.

5.4 BATTERY REPLACEMENT INSTRUCTIONS

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 before carrying out the replacement procedure.
- Always follow the instructions listed in the supplied Battery Replacement Instruction Sheet.
- Batteries pose an environmental hazard. Return used batteries to a recycling point.

☝ Caution !

Safety instructions for hazardous areas

- Verify the correct battery is supplied: **Only batteries with indicated 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 recommends FW-LiBAT batteries (manufactured by Fluidwell bv) only**.

Battery replacement procedure

✎ Note !

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

FW-LiBAT-001 battery	**FW-LiBAT-021 battery**
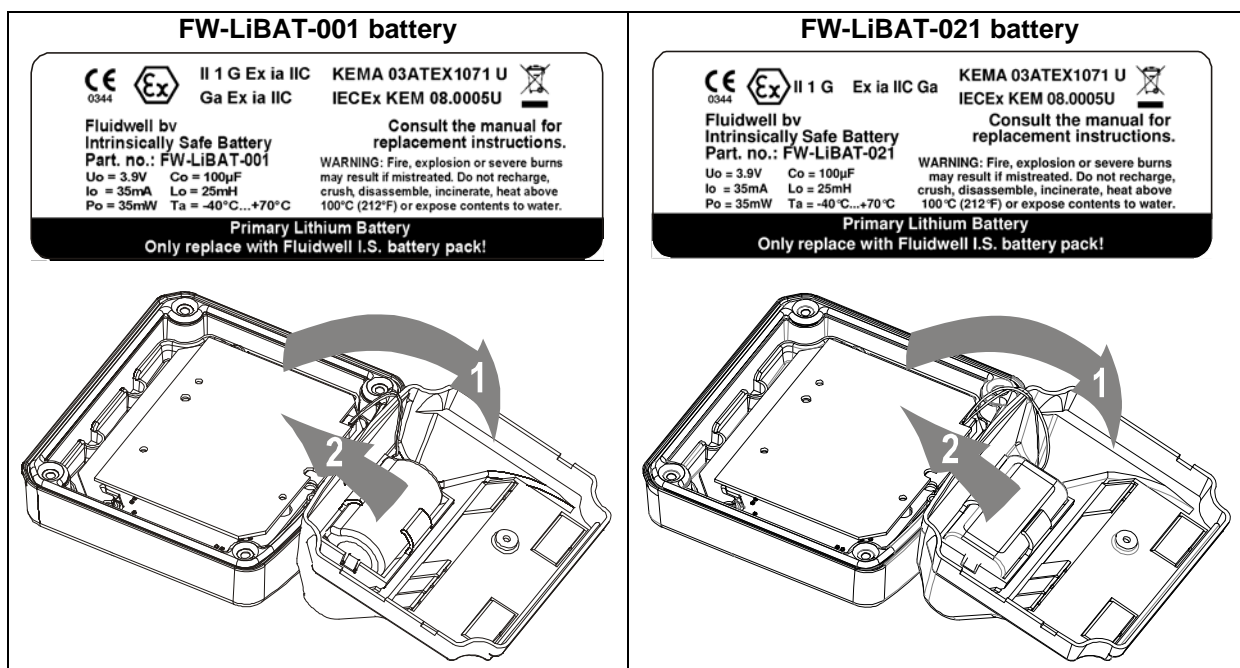
1. To replace the battery, open the unit to gain access to the back inside cover of the unit.
2. Unplug the field connectors from the back inside of the unit.
3. Remove the screw that holds the plastic inside cover.
4. Open the cover and unplug the battery connector.
5. Remove the battery from the inside 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

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.*
- *The F111-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 " in the front of this manual.*

The F111-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 F111-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:
It is influenced by several issues :

- Type of sensor: read chapter 3.2.3. NPN and PNP inputs consume more energy than coil inputs.
- Input frequency: the higher the frequency, the shorter the battery life-time.
- Flowrate calculation: the lower number of pulses (SETUP 26 and 46) the shorter the battery life-time.
- Display update: fast display update uses significantly more power; SETUP 61.
- Pulse output and communications .
- Low temperatures; the available power will be less due to battery chemistry.

Note !

Note: It is strongly advised to disable unused functions.

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 polyester coating.

APPENDIX A: TECHNICAL SPECIFICATION

GENERAL

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
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	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications. Power requirements: 12-24V DC + 10% or type PD, PF, PM. Power consumption max. 1 Watt.

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 / NEMA4X
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 / NEMA4X
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 +176°F)
Intrinsically Safe	-40°C to +70°C (-40°F to +158°F)

Power supply	
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	8-24V AC / DC + 10%. Power consumption max. 10 Watt. Intrinsically safe: 16-30V DC; power consumption max. 0.75 Watt.
Type PF	24V AC / DC + 10%. Power consumption max. 15 Watt.
Type PL	Input loop powered from sensor signal 4-20mA (type A, non IS).
Type PM	115-230V AC + 10%. Power consumption max. 15 Watt.
Type PX	Output loop powered: 8-30V DC. Power consumption max. 0.5 Watt.
Note PF / PM	The total consumption of the sensors`, backlight and outputs may not exceed 400mA@24V.
Note I.S. applications	For intrinsically safe applications, consult the safety values in the certificate.

Sensor excitation	
Type PB / PC / PX	3.2V DC for pulse signals and 1.2V DC for coil pick-up. Note: This is not a real sensor supply. Only suitable for pulse sensors with a very low power consumption like coils (sine wave) and reed-switches.
Type PD	1.2 / 3.2 / 8.2 / 12 and 24V DC - max. 50mA@24V DC
Type PD-XI	Intrinsically safe: Pulse signals: 1.2 / 3.2 / 8.2 - max. 7mA@8.2V DC. Analog signals: the sensor supply voltage is according to the power supply voltage connected to terminal 1. Also terminal 2 offers the same voltage.
Type PF / PM	1.2 / 3.2 / 8.2 / 12 and 24V DC - max. 400mA@24V DC.

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm2 and 2.5mm2 (Type PM / PF)

Data protection	
Type	EEPROM backup of all setting. 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 approval:
	    II 1 G Ex ia IIB/IIC T4 Ga
	    II 1 D Ex ia IIIC T100°C Da IP6x
	
	IECEx approval:
	Ex ia IIB/IIC T4 Ga
	Ex ia IIIC T100°C Da IP6x

Explosion proof Type XD/XF	ATEX approval ref.: <EX> 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.

Environment	
Electromagnetic compatibility	Compliant ref: EN 61326 (1997), EN 61010-1 (1993).

INPUTS

Flowmeter	
Type P	Coil/sine wave (minimum 20mVpp or 80mVpp - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8 - 12 and 24V.
Frequency	Minimum 0 Hz - maximum 7 kHz for total and flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.
Type A	(0)4-20mA - with signal calibration feature. Resolution: 14 bit.
Type U	0-10 V - with signal calibration feature at any voltage within range. Resolution: 14 bit.
Accuracy	0.05%. Low level cut-off programmable.
Span	0.000010 - 9,999,999 with variable decimal position.
Update time	Four times a second.
Voltage drop	2.5 Volt.
Load impedance	3kOhm
Relationship	Linear and square root calculation.
Note	For signal type A and U: external power to sensor is required; e.g. type PD.

OUTPUTS

Transistor outputs	
Type OT	two passive transistor outputs - not isolated.
Load	max. 50V - 300mA
Function	pulse output - transmitting accumulated total related to flow A and B.
Pulse output	Max. frequency 60Hz. Pulse length user definable between 7,8msec up to 2 seconds.
Type OA	Active 24V DC output; max. 50mA per output (requires type PD, PF or PM).
Type OR	Electro-mechanical relay output; max. switch power 230V AC - 0,5A (requires PF or PM).

Communication option	
Type	RS232 or RS485 (2-wire or 4-wire).
Protocol	Modbus RTU
Speed	1200 - 2400 - 4800 - 9600 baud
Addressing	maximum 255 addresses.
Functions	reading display information, reading / writing all settings.

OPERATIONAL

Operator functions	
Displayed functions	- total and/or flowrate of flow A. - total and accumulated total of flow A. - total and/or flowrate of flow B. - total and accumulated total of flow B. - total of each flow can be reset to zero by pressing the CLEAR-key twice.

Total	
Digits	7 digits.
Units	L, m3, GAL, USGAL, KG, lb, bbl, no unit.
Decimals	0 - 1 - 2 or 3.
Note 1	total can be reset to zero.
Note 2	all settings are availble for both flows, completely separated.

Accumulated total	
Digits	11 digits.
Units / decimals	according to selection for total.

Flowrate	
Digits	7 digits.
Units	mL, L, m3, Gallons, KG, Ton, lb, bl, cf, RND, ft3, scf, Nm3, Nl, igal - no units.
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.
Note	all settings are availble for both flows, completely separated.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F111-P is going to be installed or while it is in operation.

Flowmeter does not generate pulses:
Check:
- Signal selection SETUP - 71,
- Pulse amplitude (par. 4.4.3.),
- Flowmeter, wiring and connection of terminal connectors (par. 4.4.3.),
- Power supply of flowmeter (par. 4.4.2.).

Flowmeter generates "too many pulses":
Check:
- Settings for total and Flowrate: SETUP 11-14 and 21-27 or 31-34 and 41 - 47,
- Type of signal selected with actual signal generated - SETUP - 71,
- Sensitivity of coil input - SETUP - 71 or 72 and par. 4.4.3.
- Proper grounding of the F111-P - par. 4.4.1.
- Use screened wire for flowmeter signals and connect screen to terminal 9. (unless connected at sensor)

Pulse output does not function:
Check:
- SETUP 81 or 91 - pulse per "x" quantity; is the value programmed reasonable and will the maximum output be under 20Hz?
- SETUP 82 or 92 - impulse width; is the external device able to recognize the selected pulse width and frequency?

Flowrate displays "0 / zero" while there is flow (total is counting):
Check:
- SETUP 22 / 25 or 42 / 45: are the K-factor and time unit correct?
- SETUP 26 / 27 or 46 / 47: The unit has to count the number of pulses according to SETUP 26 / 46 within the time according to SETUP 27 / 47. Make sure that 27 / 47 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 26 / 46.

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 5-digit error code. The codes are:

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

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: COMMUNICATION VARIABLES

Remarks:
▪ Below, an overview of the F111-P specific variables; other common variables are described in the standard table.
▪ All numbers are underline decimal numbers, unless otherwise noted.
▪ The following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
CONFIGURATION VARIABLES F111-P - SETUP-LEVEL:				
TOTAL A				
32 (20h)	unit	1	0=L 1=m3 2=kg 3=lb 4=gal 5=usgal 6=bbl 7=none	
33 (21h)	decimals	1	0…3	
34 (22h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR37)
37 (25h)	decimals K-factor	1	0…6	
FLOWRATE A				
48 (30h)	unit	1	0=mL 1=L 2=m3 3=mg 4=g 5=kg 6=ton 7=gal 8=bbl 9=lb 10=cf 11=rev (revolutions for RPM) 12=none	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0…1	
51 (33h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals K-factor	1	0…6	
55 (37h)	number of pulses	1	1..255	
56 (38h)	cut-off time	2	1 .. 9999	steps of 100ms

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
234 EAh	minimum flowrate	3	0-9,9999	decimals: see 50 (32h)
237 EDh	maximum flowrate	3	0-9,9999	decimals: see 50 (32h)
TOTAL B				
40 (28h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR43)
43 (2Bh)	decimals K-factor	1	0…6	
FLOWRATE B				
227 (E3h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR230)
230 (E6h)	decimals K-factor	1	0…6	
231 (E7h)	number of pulses	1	1..255	
232 (E8h)	cut-off time	2	1 .. 9999	steps of 100ms
DISPLAY				
64 (40h)	display function	1	0=total 1=flowrate	
65 (41h)	acc total	1	0=of 1=on	
66 (42h)	toggle	1	0=of 1=on	
POWERMANAGEMENT				
80 (50h)	LCD update time	1	0=fast 1=1sec 2=3sec 3=15sec 4=30sec 5=off	
81 (51h)	power-mode battery	1	0=operational 1=shelf	
FLOWMETER				
96 (60h)	flowmeter signal A	1	0=npn 1=npn-lp 2=reed 3=reed LP 4=pnp 5=pnp-lp 6=namur 7=coil hi 8=coil lo	
97 (61h)	flowmeter signal B B	1	0=npn 1=npn-lp 2=reed 3=reed LP 4=pnp 5=pnp-lp 6=namur 7=coil hi 8=coil lo	

PULSE OUTPUT				
128 (80h)	impulse width A	1	0..255	
129 (81h)	pulse per X quantity A	3	1..9999999	unit, decimals acc. var32 -33
84h	impulse width B	1	0..255	
85h	pulse per X quantity B	3	1..9999999	unit, decimals acc. var32 -33
OTHERS				
168 (A8h)	pass code	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER F111-P VARIABLES FOR COMMUNICATION

TOTAL A - variable number 236h – 6 bytes
TOTAL B - variable number 436h – 6 bytes

Read total: The value of total read using RS communications might differ from the value that appears on the display. This is due to the fact that the display can only display up to seven digits (for example when two decimals are selected for total and total has a value of 123456,78 the display will show 23456,78 while communication will read a "total" of 12345678 and a "total decimals" of 2).

Write total: total can only be cleared. This means writing a value different from 0 will result in the reply of an error message. Only writing 6 bytes of zero's to total will be accepted.

ACCUMULATED TOTAL A - variable number 230h – 6 bytes
ACCUMULATED TOTAL B - variable number 430h – 6 bytes

Read acc. total: A difference between the read value and the display value, as explained for "Read total", might appear here too.

Write acc. total: Not possible.

When reading or writing total or accumulated total it should be noted that the used values are given including the decimals. This means that a read/write to one of these variables should be accompanied with a read/write to the variable that holds the number of decimals for this variable:

    Example: read var. 566 for total:
    Read var. 33 for total decimals and calculate the real value of total by multiplying total with $10^{-(total\ decimals)}$

FLOWRATE A - variable number 23Ch – 4 bytes
FLOWRATE B - variable number 24Ch – 4 bytes

Read flowrate: The value difference as mentioned with total/acc. total might appear here too.

Write flowrate: Not possible.

INDEX OF THIS MANUAL

LIST OF FIGURES IN THIS MANUAL

NOTES

LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL - A	Enter your settings here		
11 unit	L		
12 decimals	0000000		
13 K-factor	0000001		
14 decimals K-factor	0		

SETTING	DEFAULT	DATE :	DATE :
2 - FLOWRATE - A			
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 K-factor	0000001		
25 decimals K-factor	0		
26 calculation / pulses	010		
27 cut-off time	30.0 sec.		
3 - TOTAL - B		Enter your settings here	
31 unit	L		
32 decimals	0000000		
33 K-factor	0000001		
34 decimals K-factor	0		
4 - FLOWRATE - B			
41 unit	L		
42 time unit	/min		
43 decimals	0000000		
44 K-factor	0000001		
45 decimals K-factor	0		
46 calculation / pulses	010		
47 cut-off time	30.0 sec.		
5 - DISPLAY			
51 function	total		
52 display	toggle		
53 accumulated total	enable		
6 - POWER MANAGEMENT			
61 LCD-new	1 sec.		
7 - FLOWMETER			
71 signal - flow A	coil-lo		
72 signal - flow B	coil-lo		
8 - PULSE OUTPUT - A			
81 impulse width - flow A	000 periods		
82 pulse per - flow A	0001000		
9 - PULSE OUTPUT - B			
91 impulse width - flow A	000 periods		
92 pulse per - flow A	0001000		
A - COMMUNICATION			
A1 baud-rate	2400		
A2 address	1		
A3 mode	BUS-RTU		
B - OTHERS			
B4 pass code	0000		
B5 tagnumber	0000000		