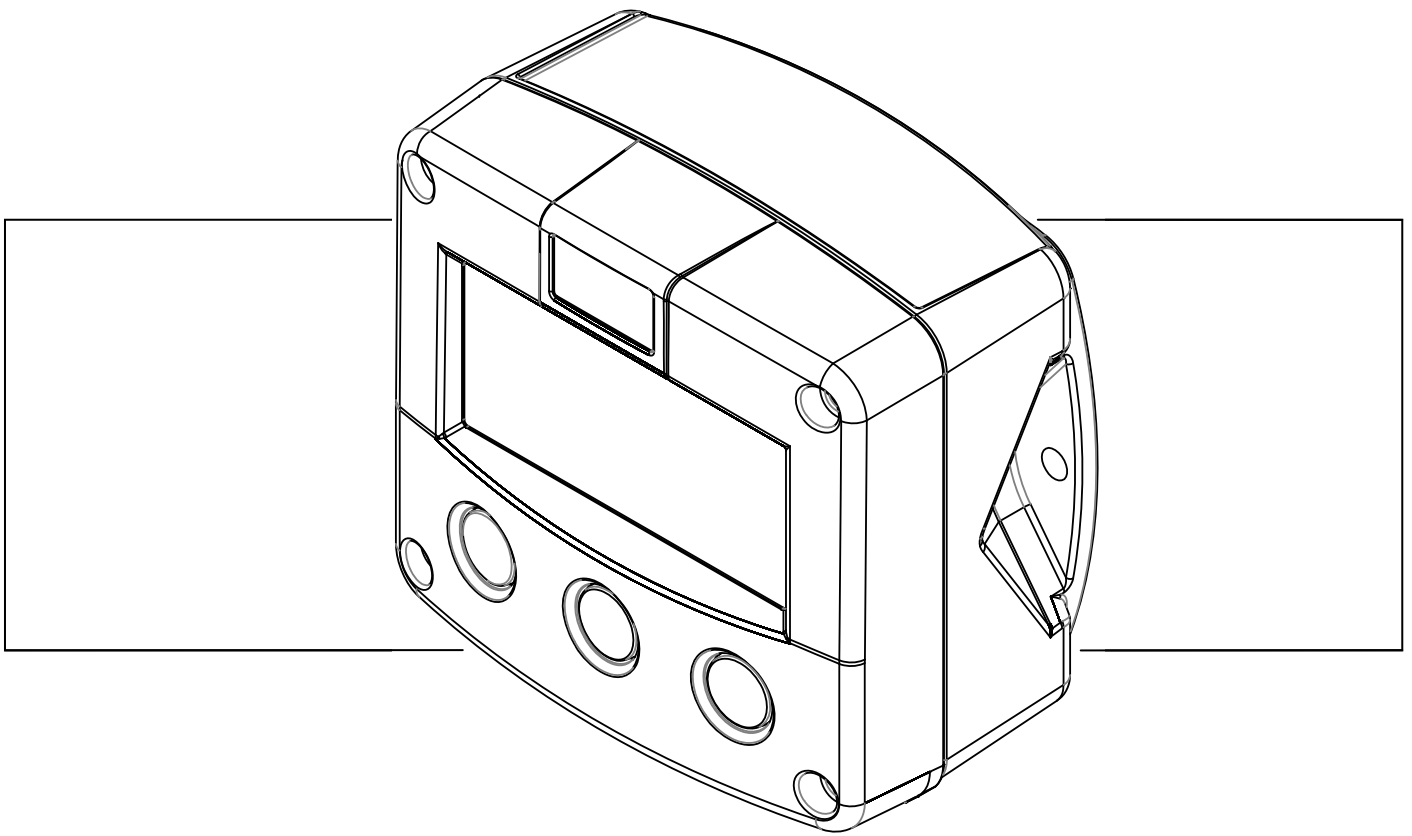


F120-A

Flowrate controller



Signal input flowmeter: (0)4-20mA

Control output: (0)4-20mA/ 0-10V

Options: Intrinsically Safe, Modbus communication and backlight





SAFETY INSTRUCTIONS

- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- **LIFE SUPPORT APPLICATIONS:** The F120-A 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 F120-A 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 F120-A 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 F120-A 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 F120-A 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 F120-A or connected instruments.



Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F120-A or connected instruments.



Note !

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

Hardware version:	02.01.xx
Software version:	02.05.xx
Manual :	HF120AEN_v0501_04
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1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F120-A

Functions and features

The PI controller model F120-A is a microprocessor driven instrument designed to control the flowrate.

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 aluminum or GRP enclosures for harsh industrial surroundings,
- ability to process all types of flowmeter signals,
- transmitting possibilities with communication option,

Flowmeter input

This manual describes the unit with a (0)4-20mA type input from the flowmeter "-A version". Other versions are available to process frequencies or 0-10V flowmeter signals.

One flowmeter with a passive or active (0)4-20mA signal output can be connected to the F120-A. To power the sensor, several options are available.

Standard outputs

- Configurable linear (0)4-20mA or 0-10V analog output with 10-bits resolution to control a valve or pump.

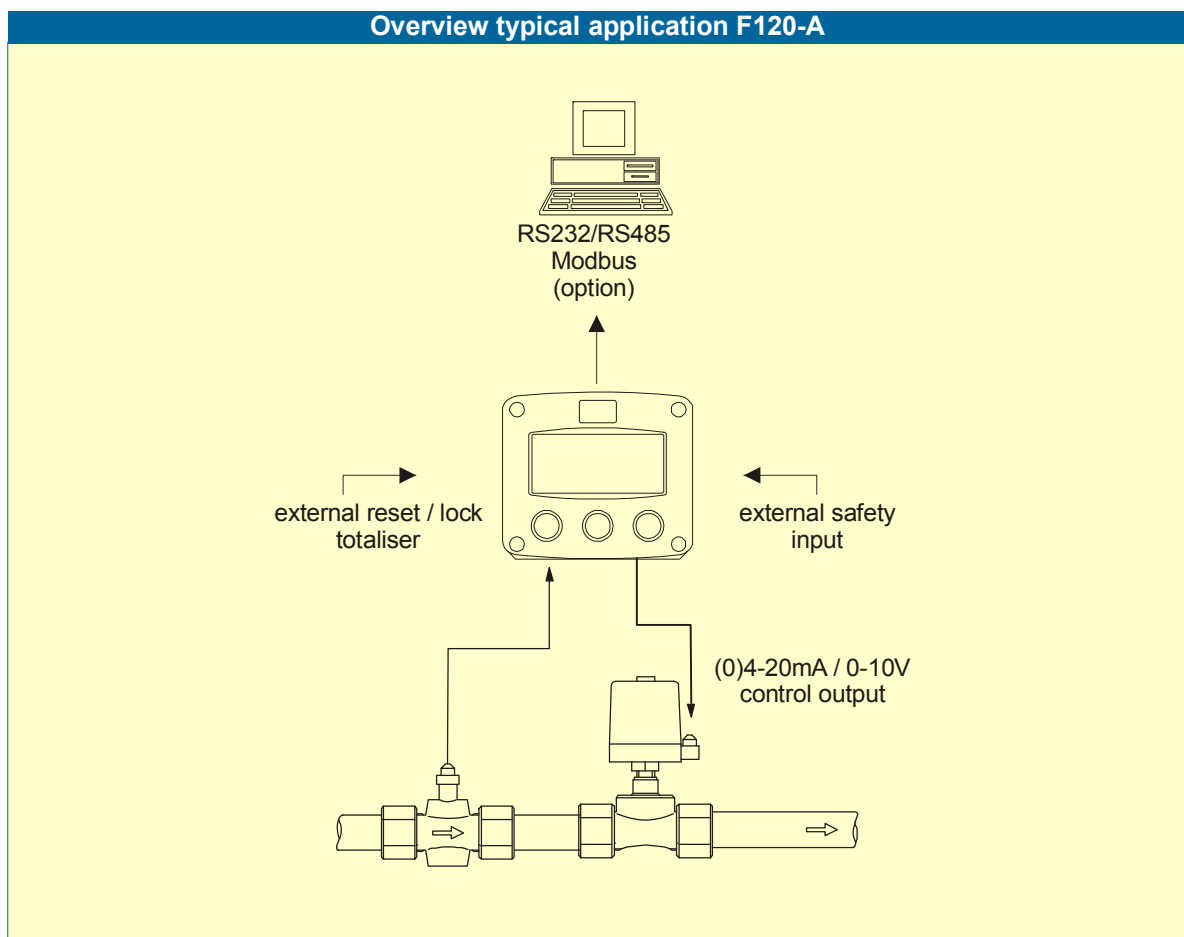


Fig. 1: Typical application for the F120-A.

Configuration of the unit

The F120-A was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F120-A according to your specific requirements. SETUP includes several important features, such as Span, measurement units, signal selection etc. All settings 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 transreflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.

Options

The following options are available: isolated or active 4-20mA / 0-10V / 0-20mA analog output, full Modbus communication RS232/485/TTL (also battery powered), intrinsic safety, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure and LED backlight.

2. OPERATIONAL

2.1. GENERAL



- *The F120-A 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 F120-A. 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 and to enter the operator mode menu. It is also used to gain access to SETUP-level; please read chapter 3.



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



The arrow-key ▼ is used to decrease a value after PROG has been pressed while > is used to select a digit or SETUP function.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F120-A will always act at Operator level. The information displayed is dependant upon the SETUP-settings. All pulses generated by the connected flowmeter are measured by the F120-A 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.

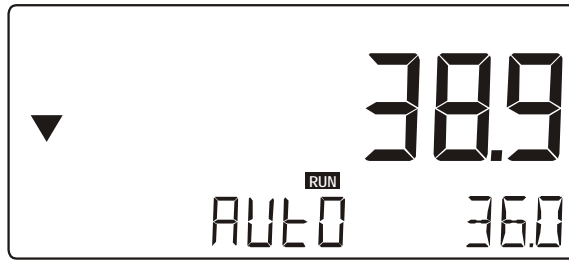
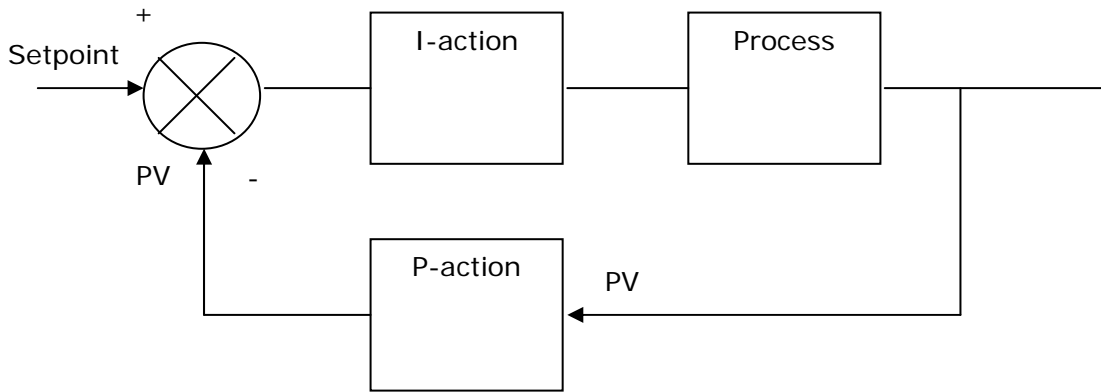


Fig. 3: Example of display information during process.

Operation:

The IP algorithm used in the F120-A :



Only the Integral action works at a deviation (set-point –process value) change, so there is no aggressive change in the control output . In this way the control method produces stable control, but react not as quick as a normal PI controller.

▪ **Selection and programming Operation mode:**

By pressing the PROG-button, “Control” is displayed and the following operation modes can be selected: Hand and Auto.

The value is changed directly from the keyboard by using the “▲” UP-button and the “▼” DOWN-button. The longer you press the button, the quicker the value change.

▪ **“Hand” mode**

In this mode the control output (CO) can be manipulated directly. In the “Hand” mode, there is no loop connection between process value and the control output.

In the “hand” mode, 0% corresponds with the minimum output signal (most applications 4mA) and 100% with the maximum output signal (20mA).

The top line displays the process value (flow).

▪ **“Auto” mode**

In this mode the local set-point can be set. The set-point can be changed, using the “▲” button (UP) and the “▼” button (down).

Both set-point and process value are displayed as a percentage.

▪ **Run / Safety mode**

Via an external input closure the control output can be set to a predefined value.

During this safety mode, the message “SAFETY” is displayed.

Addition display information

Following information can be selected after pressing the "PROG" and the "▼" button simultaneously:

- actual flowrate
- actual total

- **Actual flow rate:**

The actual flow rate is displayed in the selected measurement and time unit.

- **Actual total:**

Note: This function might not be accessible or visible due to a configuration settings.



Note !

Use the "SELECT" button to select the actual total. Total is displayed in the selected measuring unit.

Clear total

The value for total can be re-initialized. To do so, select Total and press PROG followed by "▼" - "▼". After pressing "▼" once, the flashing text "PUSH CLEAR" is displayed.

To avoid re-initialization at this stage, press another key than STOP or wait for 20 seconds.

- **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.

- **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.



- *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 F120-A 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.*

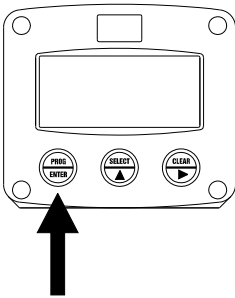
3.2. PROGRAMMING SETUP-LEVEL

3.2.1. GENERAL

Configuration of the F120-A is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows \blacktriangle 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 F120-A remains fully operational.

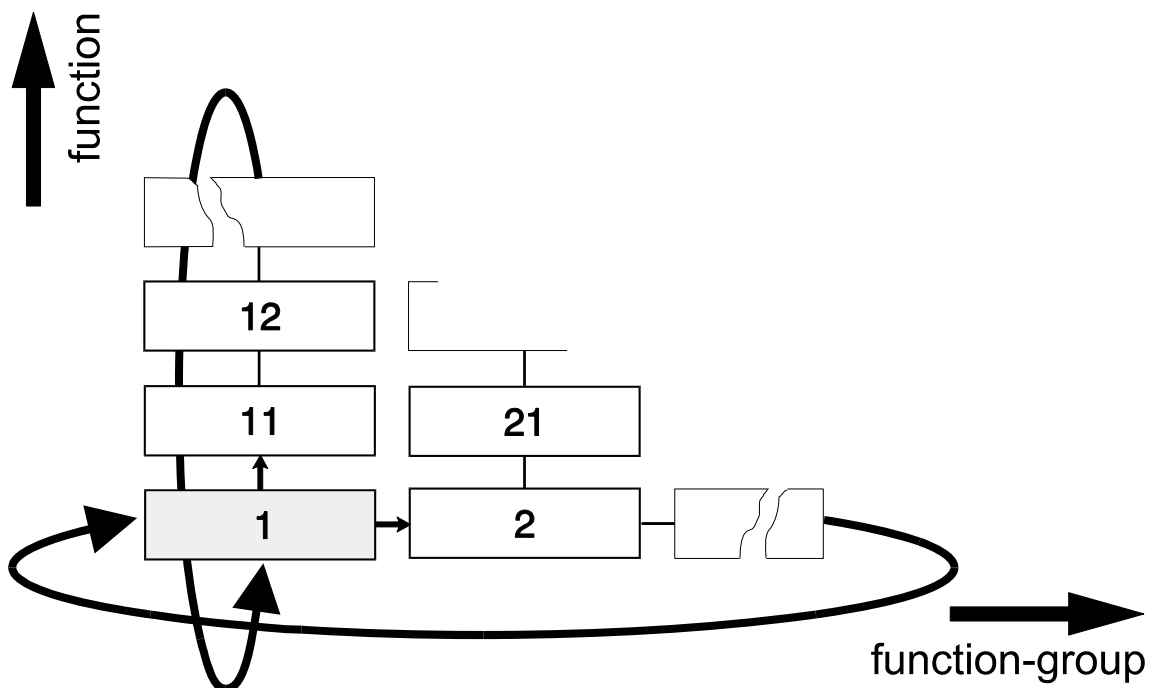
Note: A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.

To enter SETUP-level:



Press  for 7 seconds

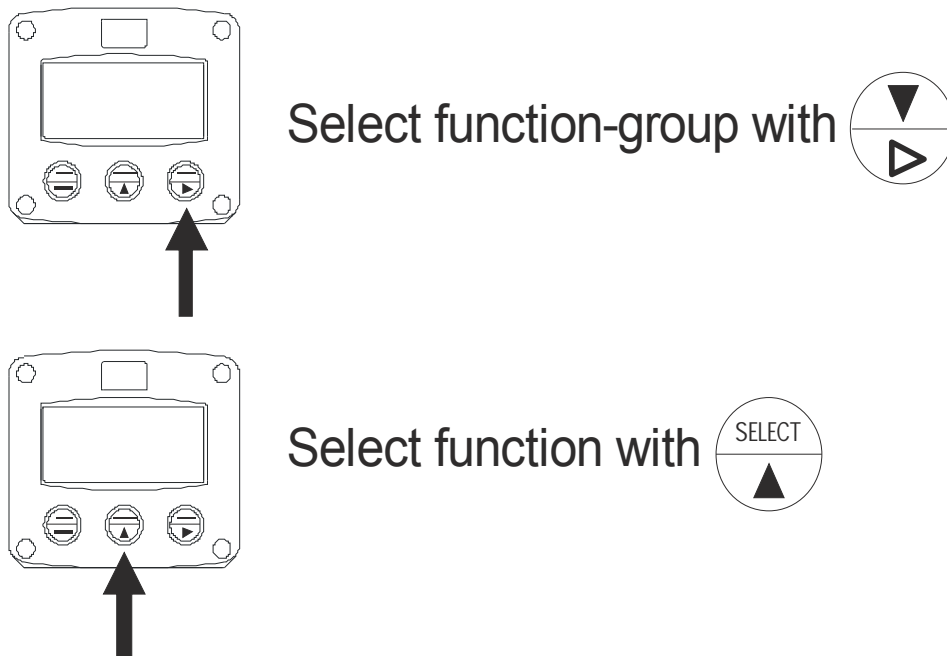
Matrix structure SETUP-level:



SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:

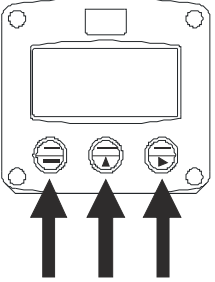
SETUP is divided into several function groups and functions.






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  briefly; **PROGRAM** will start flash



b) select or enter value with  and / or 

c) press  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.

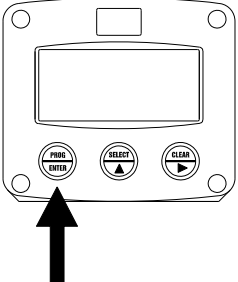
If the new value is invalid, the increase sign  or decrease-sign  will be displayed while you are programming.


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

To return to OPERATOR-level:



Press  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 - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	SPAN	0.000001 - 999,999 unit/second
	14	DECIMALS SPAN	0 - 6
	15	DISPLAY	Enable - disable
2	FLOWRATE		
	21	UNIT	mL, L, m3, mg, g, kg, ton, GAL, bbl, lb, cf, rev, no unit
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	SPAN	0.000001 - 999,999 unit/time-unit
	25	DECIMALS SPAN	0 - 6
3	SETPOINT		
	31	SV MIN - flow limit LO (set-point)	0.0 - 100.0 %
	32	SV MAX - flow limit HI (set-point)	0.0 - 100.0 %
4	CONTROL		
	41	ACTION	Direct - reverse
	42	PB (Proportional band) PCT	0.0 - 999.9 %
	43	IT (Integration time) SEC	0.0 - 6000.0 seconds
	44	STARTUP	Continue – Hand – Safety
5	POWER MANAGEMENT		
	51	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	52	BATTERY MODE	operational - shelf
6	FLOWMETER		
	61	FORMULA	interpolation, square root
	62	FILTER	00 - 99
	63	CUT-OFF	0.0 - 99.9%
	64	CALIBRATE LOW	default - calibrate - calibrate set
	65	CALIBRATE HIGH	default - calibrate - calibrate set
7	ANALOG OUTPUT – CO (CONTROL OUTPUT)		
	71	CO MIN - Low limit	0.0 - 100.0 %
	72	CO MAX - High limit	0.0 - 100.0 %
	73	CO SAFE - safety value	0.0 - 100.0 %
	74	TUNE MIN - 4mA / 0V	0 - 9,999 (=0%)
	75	TUNE MAX- 20mA / 10V	0 - 9,999 (=100%)
8	COMMUNICATION		
	81	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	82	ADDRESS	1 - 255
	83	MODE	RTU - off
9	OTHERS		
	91	TYPE / MODEL	F120-A
	92	SOFTWARE VERSION	02.05.xx
	93	SERIAL NO.	Xxxxxxx
	94	PASSWORD	0000 – 9999
	95	TAGNUMBER	0000000 – 9999999

3.2.3. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL	
MEASUREMENT UNIT 11	<p>SETUP - 11 determines the measurement unit for total. The following units can be selected:</p> <p style="text-align: center;">L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit).</p> <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.</p>
DECIMALS 12	<p>The decimal point determines for total the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">000000 - 111111.1 - 22222.22 - 3333.333</p>
SPAN 13	<p>With the span, the flowmeter signal is converted to a quantity. The span for Total is determined on the basis of the measurement unit (setting 11) and the flowrate per second at 20mA (or max signal). Enter the span in whole numbers (decimals are set with SETUP 14). The more accurate the span, the more accurate the functioning of the system will be:</p> <p>Example 1 Calculating the Span. <i>Let us assume that the flowmeter generates 20mA at a rate of 652.31 USGAL per hour, the selected unit is barrels. There are 42 gallons in one barrel; so the rate is 652.31/42 is 15.53119 barrels/hour. This is 0.0043142 barrels/second, which is the span. Enter for SETUP - 13: "004314" and for SETUP - 14 "6".</i></p> <p>Example 2 Calculating the Span. <i>Let us assume that the flowmeter generates 20mA at a flowrate of 2,481.3 Liters/minute and the selected unit is "cubic meters / m3". The rate per second is 2,481.3÷60 is 41.355 L/sec. This is 0.041355 m3/sec., which is the span. Enter for SETUP - 13: "041355" and for SETUP - 14 - decimals span "6".</i></p>
DECIMALS SPAN 14	<p>This setting determines the number of decimals for the Span (SETUP 13). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this function influences the accuracy of the Span indirectly. This setting has NO influence on the displayed number of digits for total (SETUP 12)!</p>
DISPLAY 15	<p>With this setting it is determined if Total will be displayed at Operator level or not.</p>

2 - FLOWRATE

MEASUREMENT UNIT 21	<p>SETUP - 21 determines the measurement unit for flowrate for flow:</p> <p style="text-align: center;">mL, L, m3, mg, g, kg, ton, GAL, bbl, lb, cf, rev, no unit, SCF, nm3, nL, P</p> <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.</p>
TIME UNIT 22	The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).
DECIMALS 23	<p>This setting determines for flowrate the number of digits following the decimal point for flow A. The following can be selected:</p> <p style="text-align: center;">00000 - 1111.1 - 2222.22 - 3333.333</p>
SPAN 24	<p>With the span, the flowmeter signal is converted to a quantity. The span for flowrate is determined on the basis of the selected measurement unit and time unit at 20mA (or maximum signal). Enter the span in whole numbers (decimals are set with SETUP 25). The more accurate the span, the more accurate the functioning of the system will be:</p> <p>Example 1 Calculating the span for flowrate <i>Let us assume that the flowmeter generates 20mA at a flowrate of 2,481.3 Liters/minute, the selected unit is "Liters" and time unit "minute". The span is 2481.3 Enter for SETUP - 24: "248130" and for SETUP - 25 - decimals span "2".</i></p> <p>Example 2 Calculating the span for flowrate <i>Let us assume that the flowmeter generates 20mA at a rate of 652.31 USGAL per hour, the selected unit is USG and the time unit is minute. The span is 652.31 / 60 minutes is 10.87183 (GPM). Enter for SETUP - 24: "108718" and for SETUP - 25 "4".</i></p>
DECIMALS SPAN 25	<p>This setting determines the number of decimals for the Span (SETUP 24). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this SETUP - influences the accuracy of the Span indirectly. This setting has NO influence on the displayed number of digits for "flowrate" (SETUP 23)!</p>

3 - SETPOINT

SV MIN FLOW LIMIT LO (SETPOINT) 32	This setting determines lowest allowed set-point for the "auto mode": 0.0 - 100.0 % (usually 0%).
SV MAX FLOW LIMIT HI (SETPOINT) 33	This setting determines maximum allowed set-point for the "auto mode": 0.0 - 100.0 %

4 - CONTROL

Below settings for the PI algorithm used in the Fluidwell F120-A:

CONTROL ACTION (ACTION) 41	Enter here how the control action should be defined: Direct - Reverse Direct: if process value PV increases, the control output CO increases as well. Reverse: if process value PV increases, the control output CO decreases.
PROPORTIONAL BAND (PB PCT) 42	The proportional band describes the process value variation span, which is expressed as a percentage (%) and is required to change the control output from 0 – 100%. Setting range: 0.1 to 999.9 %
INTEGRATION TIME I-TIME (IT SEC) 43	An integral action continually increases and decreases the output in proportion to the integrated to the integrated deviation. Setting range : 0.0 – 6000.0 seconds (value 0.0 seconds disables this function)
STARTUP 44	This function allows the F120-A to start-up after a power-shutdown in a safe mode. Three selections can be made: Safety: it continues with the safety value as programmed with SETUP 83. Hand: it continues with the last value as entered in the Hand-mode. Continue: it remains with the last control mode at the moment of power shutdown.

5 - POWER MANAGEMENT

When used with the internal battery option, the user can expect reliable measurement over a long period of time. The F120-A has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

LCD NEW 51	<p>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; the signal will be processed and the output signals will be generated in the normal way. The following can be selected:</p> <p style="text-align: center;">Fast - 1 sec - 3 sec - 15 sec - 30 sec - off.</p> <p>Example 3: Battery life-time <i>battery life-time with a FAST update: about 3 years.</i> <i>battery life-time with a 1 sec update: about 7 years.</i></p> <p>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.</p>
BATTERY-MODE 52	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 !

6 - FLOWMETER

SIGNAL 61	<p>The F120-A can process the 4-20mA signal in two ways:</p> <ul style="list-style-type: none"> ▪ Interpolation: the signal is processed linear $R = S \times I$ <ul style="list-style-type: none"> ▪ Square root: for differential pressure $R = S \sqrt{I}$ <p>where:</p> <p>R = Rate: the calculated flowrate S = Span: the maximum flowrate at 20mA. The span is programmed with setting 24 for flowrate and with setting 13 for total. I = Input: the scaled analog value; in these formulas value 0 (zero) for (0)4mA and value 1 (one) for 20mA.</p>																																																							
FILTER 62	<p>The analog output signal of a flowmeter does mirror the actual flow. This signal is measured several times a second by the F120-A. The value measured is a "snap-shot" of the real flow. With the help of this digital filter a more stable and accurate reading can be obtained while the filter level can be set to a desired value.</p> <p>The filter principal is based on three input values: the filter level (01-99), the last measured analog value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with there response times are indicated:</p>																																																							
FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE.																																																							
	TIME IN SECONDS																																																							
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 20%;">50% INFLUENCE</th> <th style="width: 20%;">75% INFLUENCE</th> <th style="width: 20%;">90% INFLUENCE</th> <th style="width: 25%;">99% INFLUENCE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">01</td> <td>filter disabled</td> <td>filter disabled</td> <td>filter disabled</td> <td>filter disabled</td> </tr> <tr> <td style="text-align: center;">02</td> <td>0.3 seconds</td> <td>0.5 seconds</td> <td>1.0 seconds</td> <td>1.8 seconds</td> </tr> <tr> <td style="text-align: center;">03</td> <td>0.5 seconds</td> <td>1.0 seconds</td> <td>1.5 seconds</td> <td>3 seconds</td> </tr> <tr> <td style="text-align: center;">05</td> <td>1.0 seconds</td> <td>1.8 seconds</td> <td>2.8 seconds</td> <td>5.3 seconds</td> </tr> <tr> <td style="text-align: center;">10</td> <td>1.8 seconds</td> <td>3.5 seconds</td> <td>5.6 seconds</td> <td>11 seconds</td> </tr> <tr> <td style="text-align: center;">20</td> <td>3.5 seconds</td> <td>7.0 seconds</td> <td>11 seconds</td> <td>23 seconds</td> </tr> <tr> <td style="text-align: center;">30</td> <td>5.3 seconds</td> <td>10 seconds</td> <td>17 seconds</td> <td>34 seconds</td> </tr> <tr> <td style="text-align: center;">50</td> <td>8.8 seconds</td> <td>17 seconds</td> <td>29 seconds</td> <td>57 seconds</td> </tr> <tr> <td style="text-align: center;">75</td> <td>13 seconds</td> <td>26 seconds</td> <td>43 seconds</td> <td>86 seconds</td> </tr> <tr> <td style="text-align: center;">99</td> <td>17 seconds</td> <td>34 seconds</td> <td>57 seconds</td> <td>114 seconds</td> </tr> </tbody> </table>		50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE	01	filter disabled	filter disabled	filter disabled	filter disabled	02	0.3 seconds	0.5 seconds	1.0 seconds	1.8 seconds	03	0.5 seconds	1.0 seconds	1.5 seconds	3 seconds	05	1.0 seconds	1.8 seconds	2.8 seconds	5.3 seconds	10	1.8 seconds	3.5 seconds	5.6 seconds	11 seconds	20	3.5 seconds	7.0 seconds	11 seconds	23 seconds	30	5.3 seconds	10 seconds	17 seconds	34 seconds	50	8.8 seconds	17 seconds	29 seconds	57 seconds	75	13 seconds	26 seconds	43 seconds	86 seconds	99	17 seconds	34 seconds	57 seconds	114 seconds
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Continued next page >>>																																																								



Note !

6 - FLOWMETER (CONTINUED)

CUT-OFF 63	<p>To ignore e.g. leakage of the flow or vibration, a low-flow cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the analog value is less then required with this setting, the signal will be ignored. The cut-off value can be programmed is the range 0.0 - 99.9%.</p> <p>Examples:</p>			
FUNCTION (setup 61)	SPAN (setup 13/24)	REQUIRED CUT-OFF	CUT-OFF (setup 63)	REQUIRED OUTPUT
interpolation	450 L/min	25 L/min	$25/450 \times 100\% = 5.5\%$	$16\text{mA} \times 5.5\% + 4\text{mA} = 4.88\text{mA}$
square root	450 L/min	25 L/min	$(25/450)^2 \times 100\% = 0.3\%$	$16\text{mA} \times 0.3\% + 4\text{mA} = 4.05\text{mA}$

CALIBRATE MIN / 4mA 64	<p>With this setting it is possible to calibrate the input value for (0)4mA as the signal from the flowmeter might not be exact 4.0 mA (or 0.0 mA) at flowrate zero. This function will measure the real output value at flow zero.</p> <ul style="list-style-type: none"> ▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i> <p>After pressing PROG, three settings can be selected:</p> <ul style="list-style-type: none"> ▪ CALIBRATE: with this setting, the input will be calibrated with the actual "(0)4mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be more than the calibrated value before the signal will be processed. ▪ DEFAULT: with this setting, the manufactures value is re-installed. ▪ CAL SET: to select the last calibrated value.
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CALIBRATE MAX / 20mA 65	<p>With this setting it is possible to calibrate the input value for 20mA as the signal from the flowmeter might not be exact 20.0 mA at maximum flowrate. This function will measure the real output value at maximum flowrate.</p> <ul style="list-style-type: none"> ▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i> <p>After pressing PROG, three settings can be selected:</p> <ul style="list-style-type: none"> ▪ CALIBRATE: with this setting, the input will be calibrated with the actual "20mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be less than the calibrated value for a reliable measurement. ▪ DEFAULT: with this setting, the manufactures value is re-installed. ▪ CAL SET: to select the last calibrated value.
------------------------------------	--



7 - ANALOG OUTPUT

A linear analog (0)4-20mA / 0-10V signal is generated to control the flowrate.

The range of the analog output is set with the following functions:

CONTROL OUTPUT CO MIN - LOW LIMIT 71	<p>With this function, the value for the minimum control output is set. The value has to be entered as a percentage of the maximum output value as tuned with setting 74 / 75. Example: 10% means that the output value will not come below be 5.6mA for example.</p>
CONTROL OUTPUT CO MAX - HIGH LIMIT) 72	<p>With this function, the value for the maximum control output is set. The value has to be entered as a percentage of the maximum output value as tuned with setting 74 / 75. Example: 90% means that the output value will not come above be 18.4mA for example.</p>
CONTROL OUTPUT SAFETY 73	<p>With the external input (terminals 15-16), the safety mode can be enabled. With this setting the control output value is defined for the safety mode. As long as the contact is made, this value will be transmitted. After releasing, the former value and function will be reinstalled. The value has to be entered as a percentage of the maximum output value as tuned with setting 74 / 75. Example: 50% means that the safety output will be 12mA for example.</p>
TUNE MIN / 4MA 74	<p>The initial minimum analog output value is (0)4mA or 0V. However, this value might differ slightly due to external influences such as temperature for example. The (0)4mA or 0V value can be tuned precisely with this setting.</p> <ul style="list-style-type: none"> ▪ <i>Before tuning the signal, be sure that the analog signal is not being used for any application!</i> <p>After pressing PROG, the current will be about 4mA (or 0mA / 0V). The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed “up-side-down” if desired, so 20mA at minimum flowrate for example!</p>
TUNE MAX / 20MA 75	<p>The initial maximum analog output value is 20mA (or 10V). However, this value might differ slightly due to external influences such as temperature for example. The 20mA value (or 10V) can be tuned precisely with this setting.</p> <ul style="list-style-type: none"> ▪ <i>Before tuning the signal, be sure that the analog signal is not being used for any application!</i> <p>After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed “up-side-down” if desired, so 4mA at maximum flowrate for example!</p>



Note !



8 - COMMUNICATION (OPTIONAL)

The functions described below deal with hardware that is not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.

BAUDRATE 81	For external control, the following communication speeds can be selected: 1200 - 2400 - 4800 - 9600 baud
BUS ADDRESS 82	For communication purposes, a unique identity can be attributed to every F120-A. This address can vary from 1-255.
MODE 83	The communication protocol is Modbus RTU mode. Select OFF, to disable this communication function.

9 - OTHERS

TYPE OF MODEL 91	For support and maintenance it is important to have information about the characteristics of the F120-A. 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 92	For support and maintenance it is important to have information about the characteristics of the F120-A. 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 93	For support and maintenance it is important to have information about the characteristics of the F120-A. 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 94	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 95	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

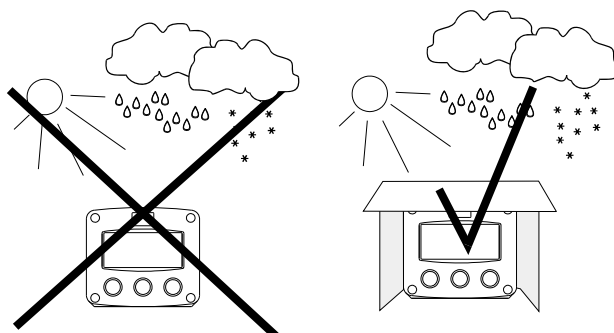
4. INSTALLATION



4.1. GENERAL DIRECTIONS

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F120-A 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.

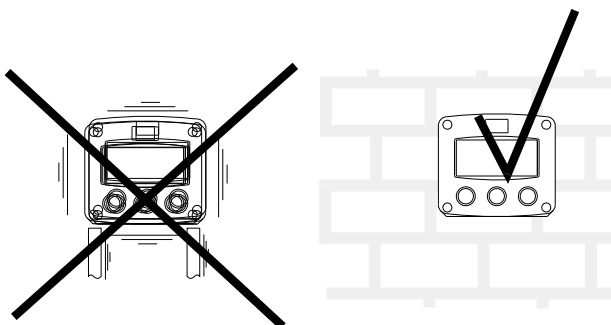
4.2. INSTALLATION / SURROUNDING CONDITIONS



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 F120-A on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE

Aluminum enclosures:

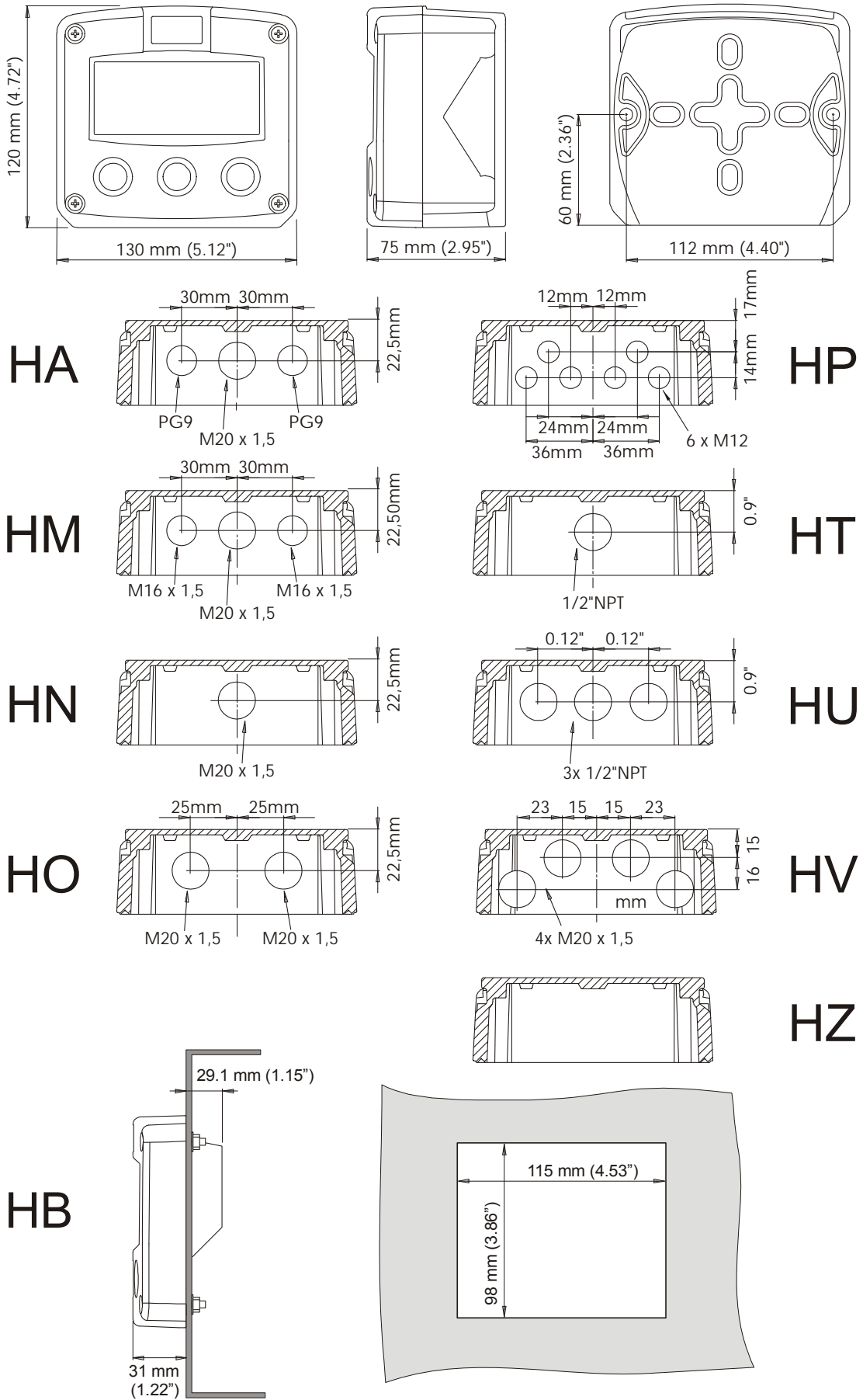
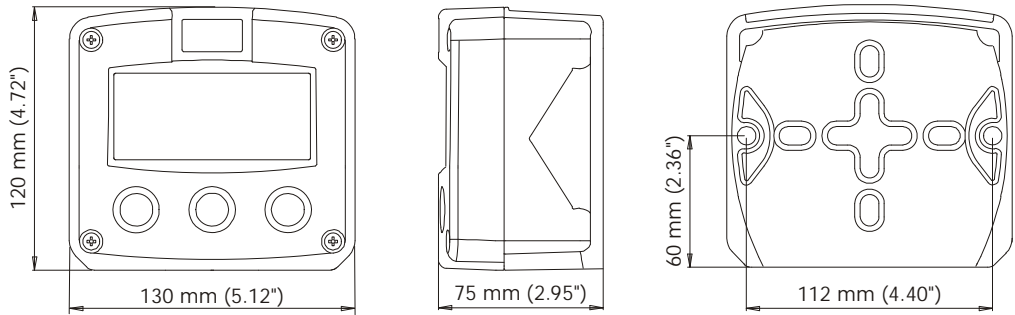
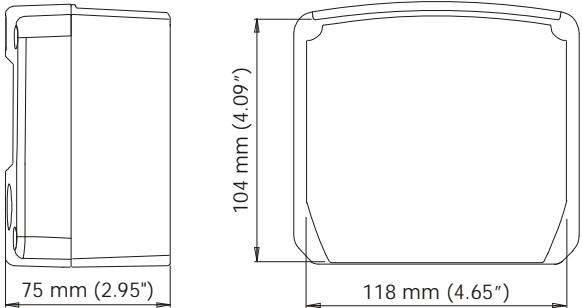


Fig. 5: Dimensions aluminum enclosures.

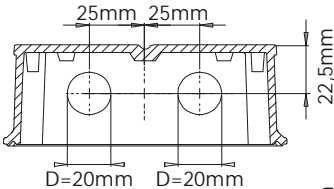
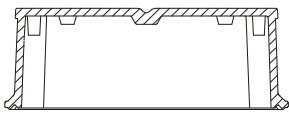
GRP enclosures:



HK back box:
(flat bottom)

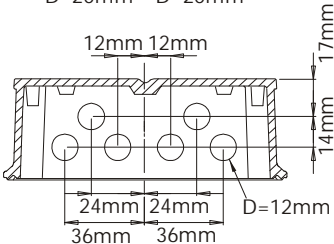
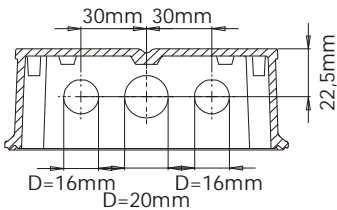


HD
HK



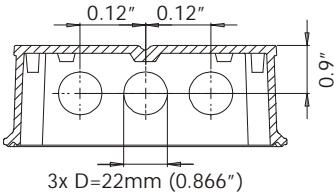
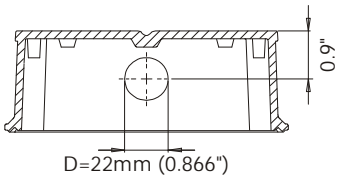
HG

HE



HH

HF



HJ

HC

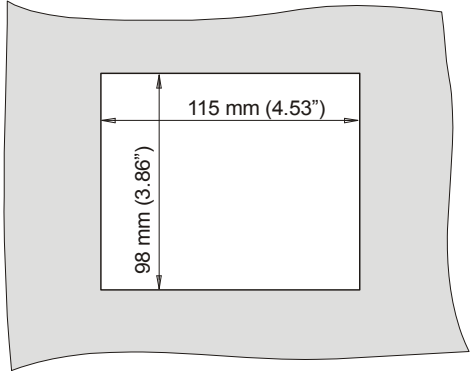
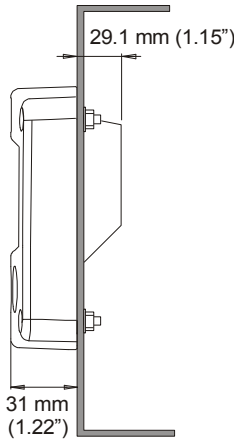


Fig. 6: Dimensions GRP enclosures.

4.4. INSTALLING THE HARDWARE



4.4.1. INTRODUCTION

- 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).



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 F120-A 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.

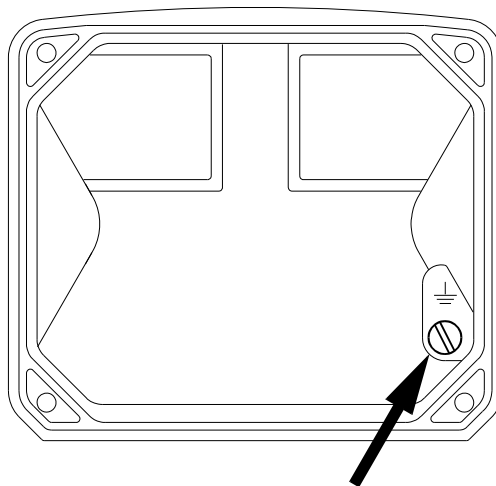


Fig. 7: Grounding aluminum enclosure with type PM 115-230V AC.

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

Type PB / PC / PX (AP) - 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 !

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 / PF / PM: Sensor supply: 1.2 / 3.2V / 8.2V / 12V or 24 V DC:

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.

Total power consumption PD: max. 50mA@24V and PF / PM: max. 400mA@24V.

The voltage is selected with 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:

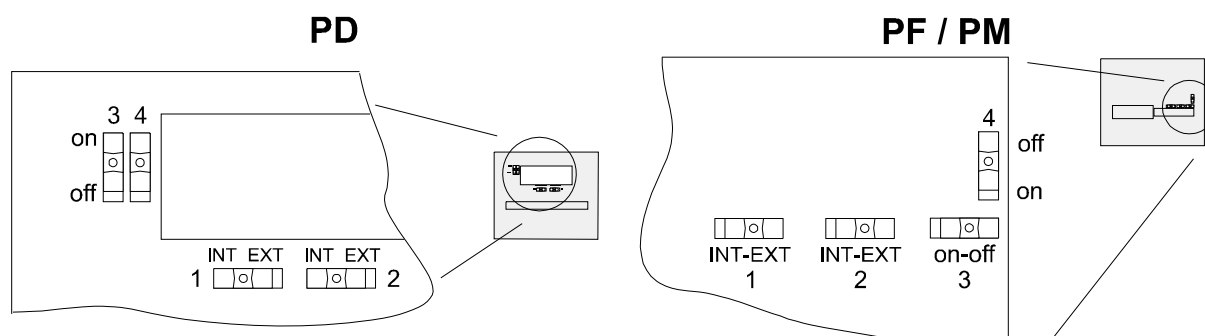


Fig. 8: Switch setting sensor supply voltage.

Switch positions

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

SENSOR B	

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

Function switch 1: voltage selection sensor A - terminal 11.

Function switch 2: not available

Function switch 3+4: the combination of these switches determine the voltage as indicated. If switch 1 and 2 are both set to position OFF than the selected voltage with switch 3+4 is valid for both sensors.

4.4.3. TERMINAL CONNECTORS

The following terminal connectors are available:

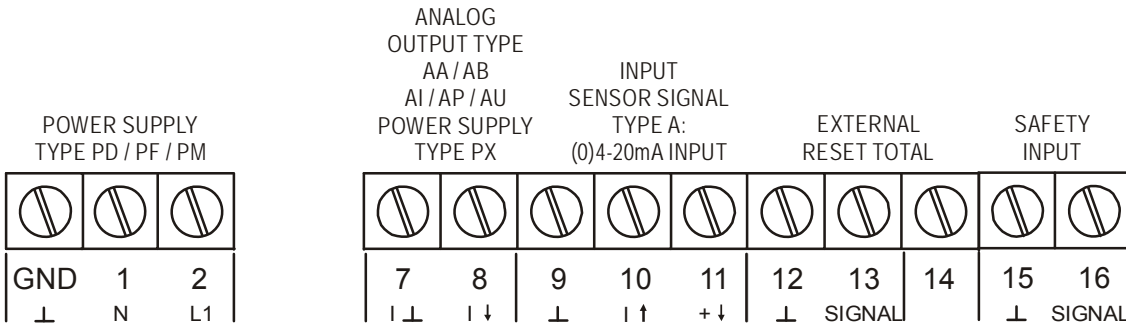


Fig. 9: Overview of terminal connectors standard configuration F120-A and options.

REMARKS: TERMINAL CONNECTORS:

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

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. 400mA		AC	AC	◇	◇	◇		◇
PF 24V DC ± 15%	8,2 / 12 / 24V max. 400mA	L-	L+		◇	◇	◇		◇
PM 115-230V AC ± 15%	8,2 / 12 / 24V max. 400mA	EARTH	AC	AC	◇	◇	◇	◇	◇
Note PD	do not use a AC autotransformer (Spartrafo) without a galvanic isolation.								
Note PF / PM	The total consumption of the sensors and outputs may not exceed 400mA@24V								

◇=option



Note !

Note: for power supply type PX: please read Terminal 07-08 !

Terminal 07-08; basic POWER SUPPLY - type PX - output loop powered:

Connect an external power supply of 8-30VDC to these terminals or a 4-20mA loop.

Do 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.



Caution ! *Only valid for standard passive output type AP!*

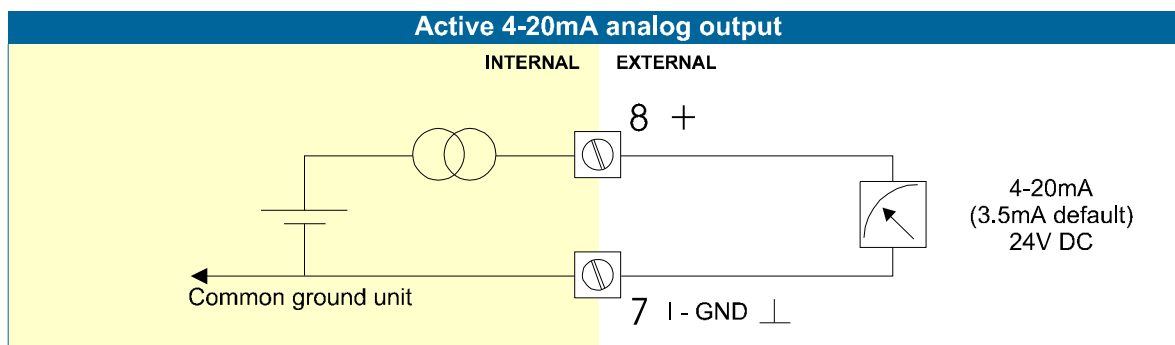
Terminal 07-08 analog output (SETUP 7) :

This is the IP control output.

Type AA:

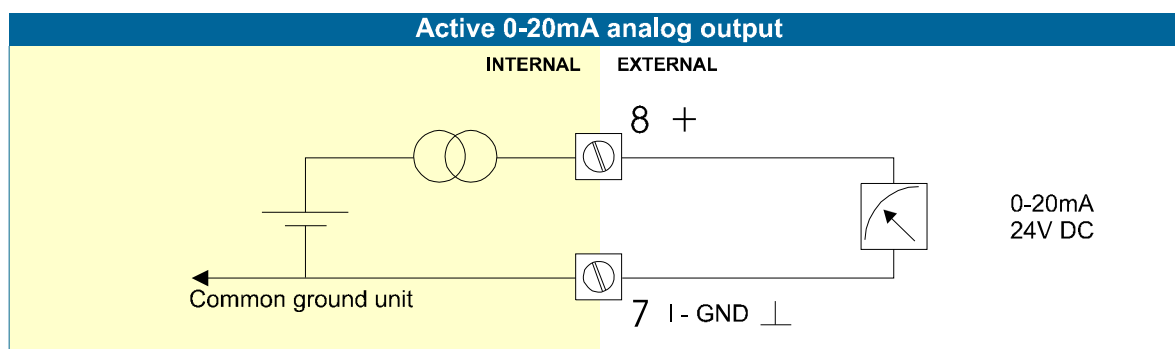
An active 4-20mA signal control output is available with this option.

Max. driving capacity 1000 Ohm @ 24VDC. (Requires power supply type PD / PF / PM).

**Type AB:**

An active 0-20mA signal control output is available with this option.

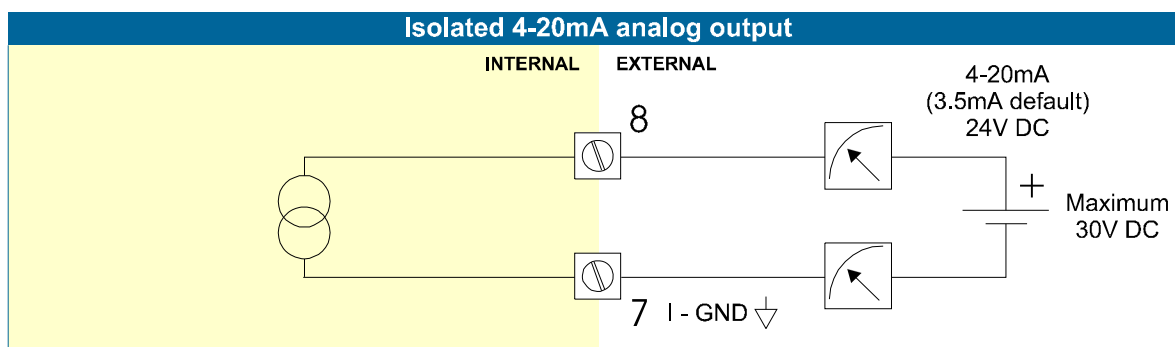
Max. driving capacity 1000 Ohm @ 24VDC. (Requires power supply type PD / PF / PM).

**Type AI:**

An isolated passive 4-20mA signal control output is available with this option.

Max. driving capacity 1000 Ohm @ 30VDC.

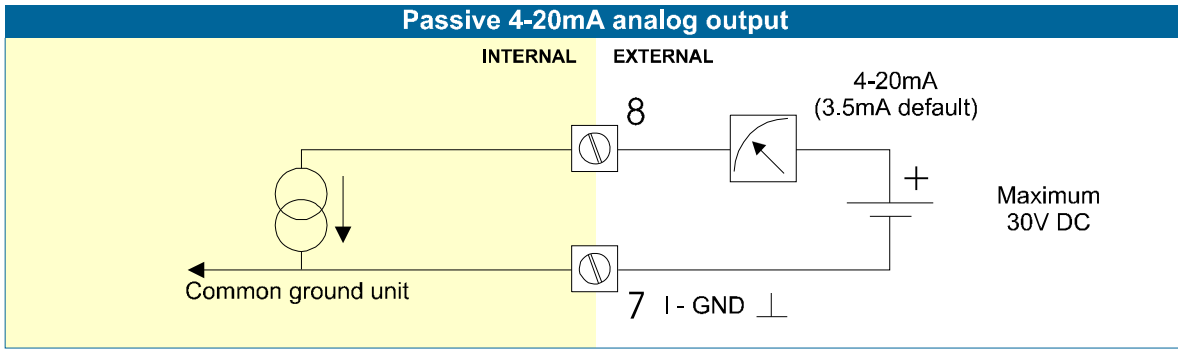
This option can be used with a battery powered unit but the life time of the battery is about 2 -3 years.



Type AP:

A passive 4-20mA signal control output is available with this option.

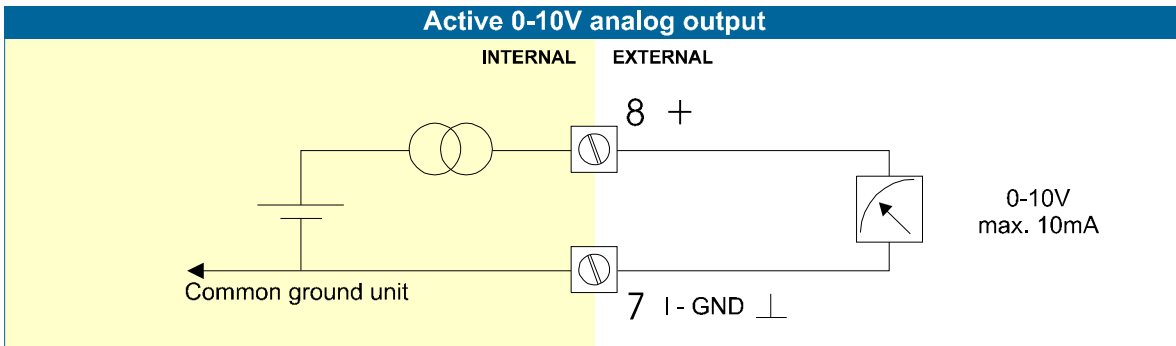
Max. driving capacity 1000 Ohm. This output does loop power the unit as well (type PX).



Type AU:

A 0-10VDC signal control output is available with this option.

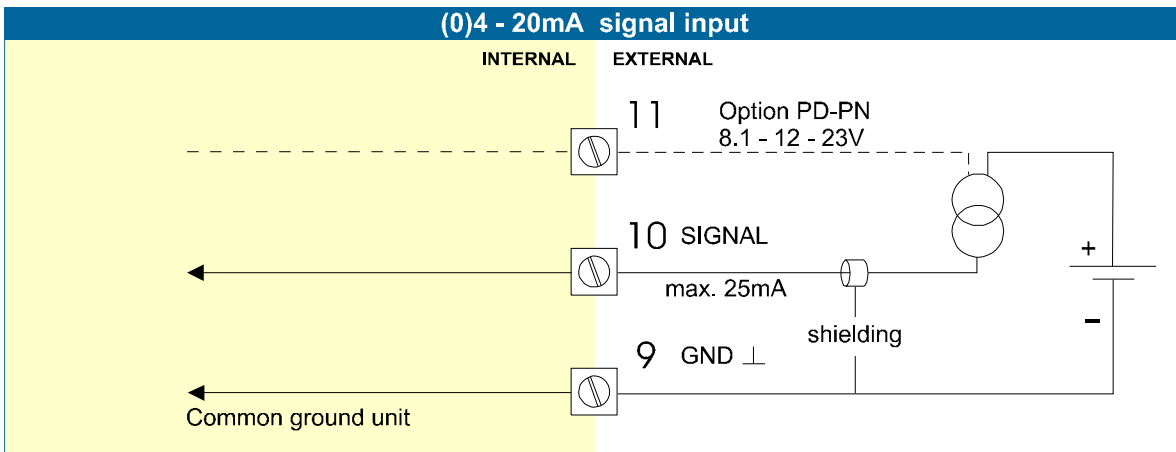
Max. load 10mA @ 10VDC. (Requires power supply type PD / PF / PM).



Terminal 09-11: Type A – Flowmeter input (general)

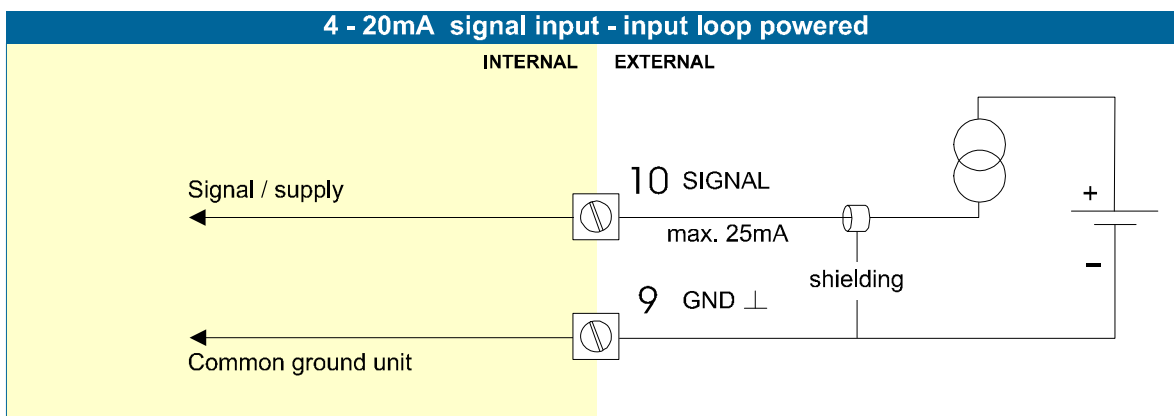
The F120-A requires a (0)4-20mA flowmeter signal which will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.

For intrinsically safe applications (without input loop power): please read chapter 5.



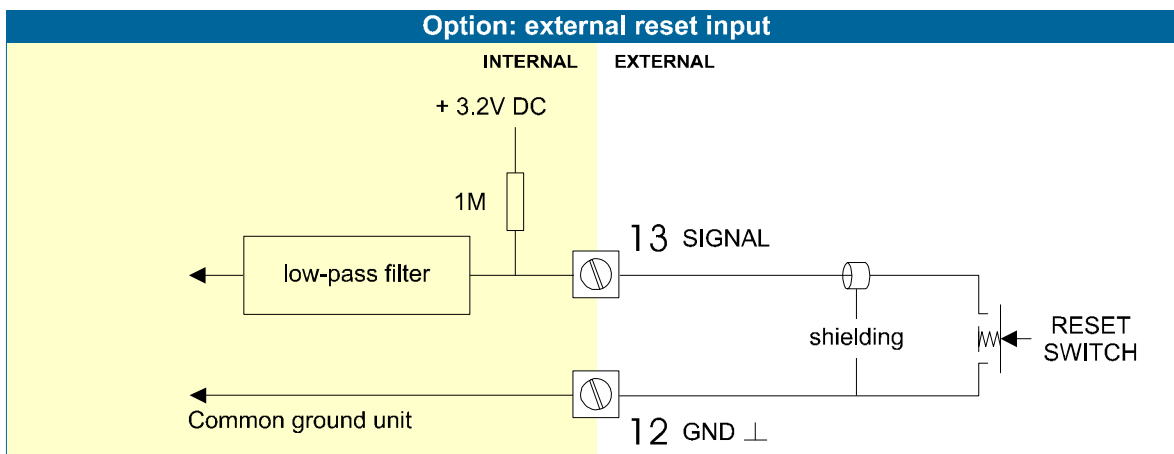
Terminal 09-10: Type A-PL – Flowmeter input / power supply:

The F120-A-PL requires a 4-20mA flowmeter signal which has a double function: The signal will be processed 4 times a second with a 14 bits accuracy and the unit will be powered from the sensor signal (input loop powered). The input is not isolated and not intrinsically safe.



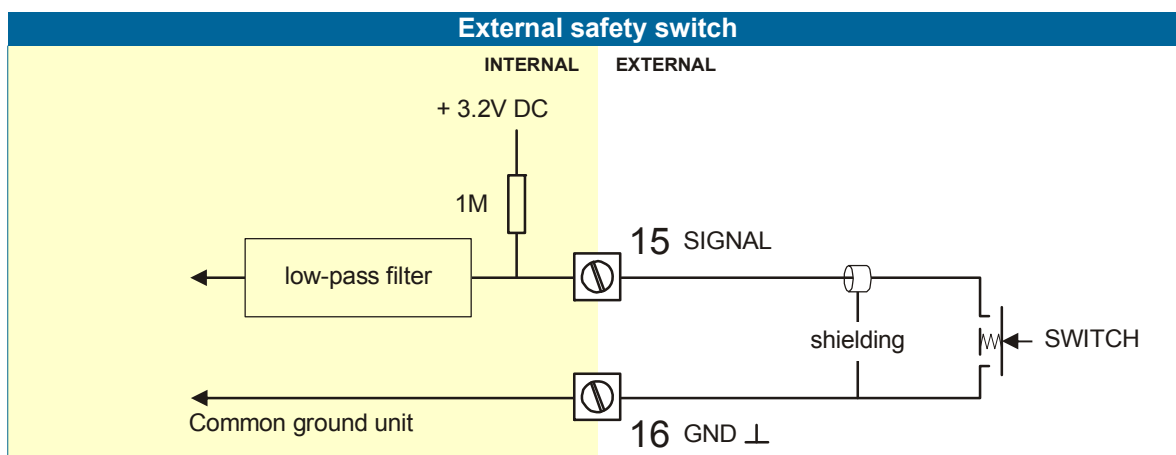
Type IB - Terminal 12-13; external reset (option):

With this function, the total can be reset to zero with an external switch. The input must be switched with a potential free contact to the GND-terminal number 12.



Terminal 15-16; safety mode:

With this function, the controller can be switched to a safety mode by making this contact. As long as this input is closed, the control output (terminal 7+8) will be according to the setting 83.



Terminal 26-31: type CB / CH / CI / CT - communication RS232 / RS485 / TTL (option)

- 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.

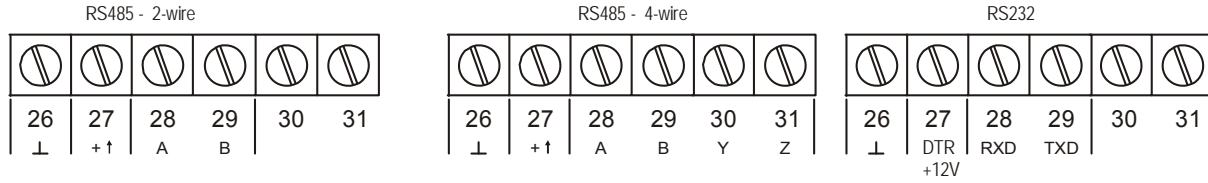


Fig. 10: Overview terminal connectors communication option.

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 - type ZB (option):



Note: if the unit is supplied with a power supply type PD, 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 type ZB, except if a PD, PF or PM power supply is being used.

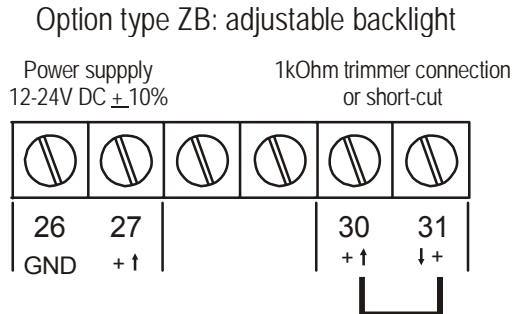


Fig. 11: Overview terminal connectors backlight option.

5. INTRINSICALLY SAFE APPLICATIONS

5.1. GENERAL INFORMATION AND INSTRUCTIONS



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.



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 with 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.



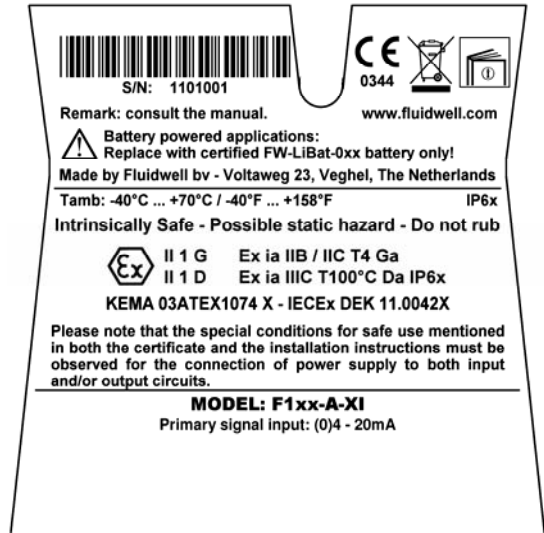
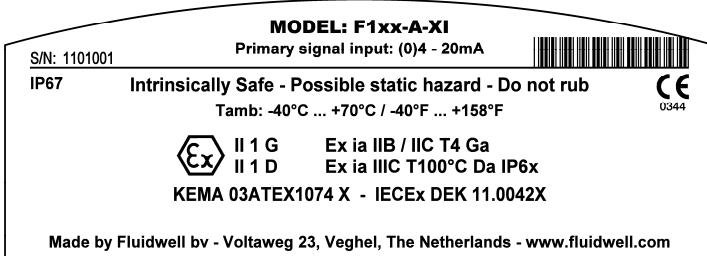
Please Note

- 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)

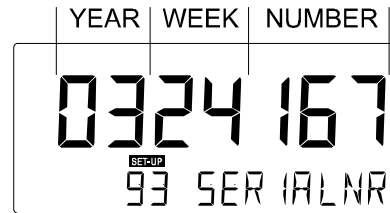
Indicated labels on the back cover (below) and on the inside cover (right) show the type labels for intrinsically safe certified units.

For details on usage see the separate “Fluidwell F1...-XI Documentation for Intrinsic Safety”.



Serial number and year of production

This information can be looked-up on the display: See setup function (par. 3.2.2.) for details.



5.2. TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS

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



Note !

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 (option -AP);
 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 F120-A-XI:

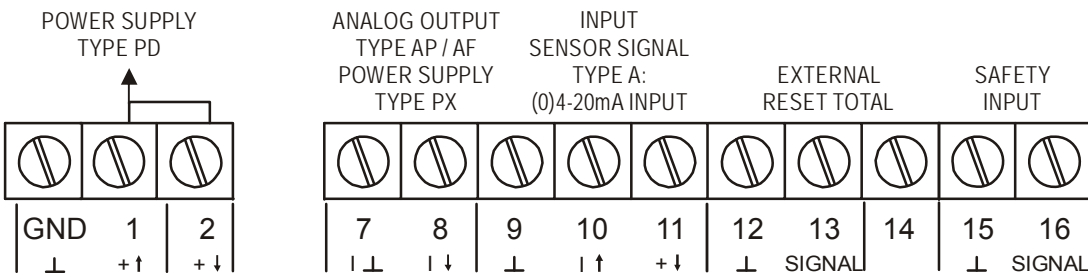


Fig. 12: Overview terminal connectors XI - Intrinsically Safe applications.

Explanation Intrinsically Safe options:

Type AF - Intrinsically Safe floating 4-20mA analog output - Terminal 7-8:

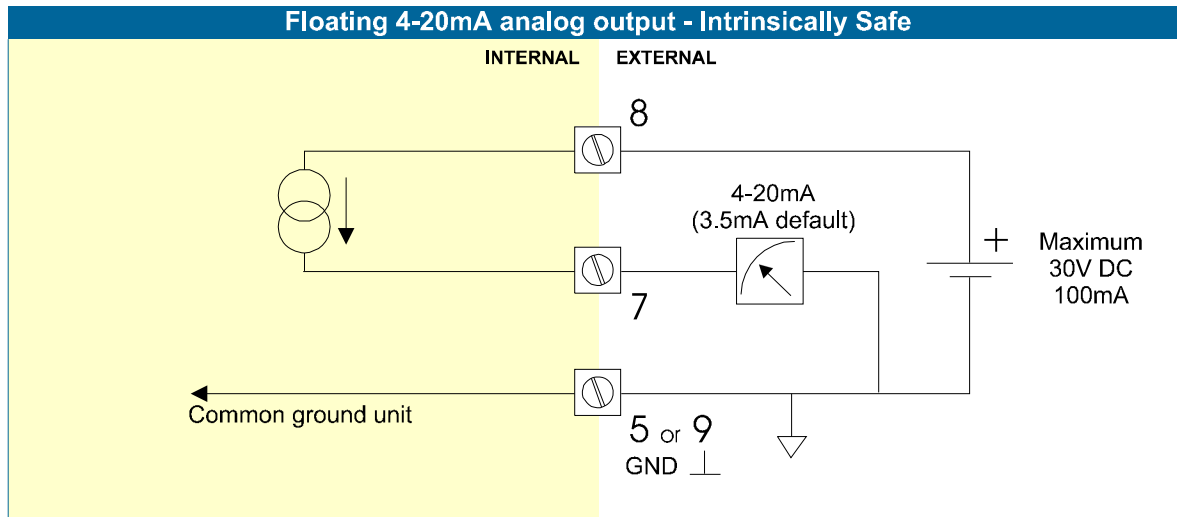
A floating 4-20mA signal control output is available with this option.

When the output is disabled, a 3.5mA signal will be generated.

Max. driving capacity 1000 Ohm @ 30V DC.



Note! It is required to link the minus from the analog output - terminal 7 - with a ground terminal of the unit; terminal: GND, 3, 5, 9, 12 or 15.



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

TYPE	SENSOR SUPPLY	Terminal			
		GND	01	02	
PD	Input voltage: 8-30V DC	3,2 - 8,1V	L-	L+	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 no function	
SWITCH 1	VOLTAGE	SWITCH 2	
on	8.1 V DC	not available	
off	3.2 V DC		

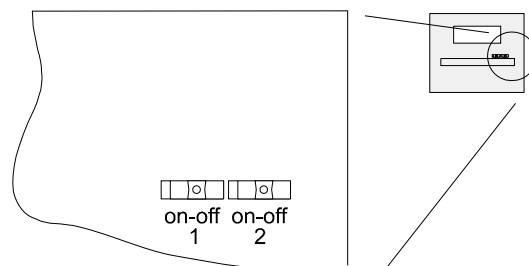


Fig. 13: Switch position voltage selection type PD-XI.

5.3. CONFIGURATION EXAMPLES INTRINSICALLY SAFE APPLICATIONS

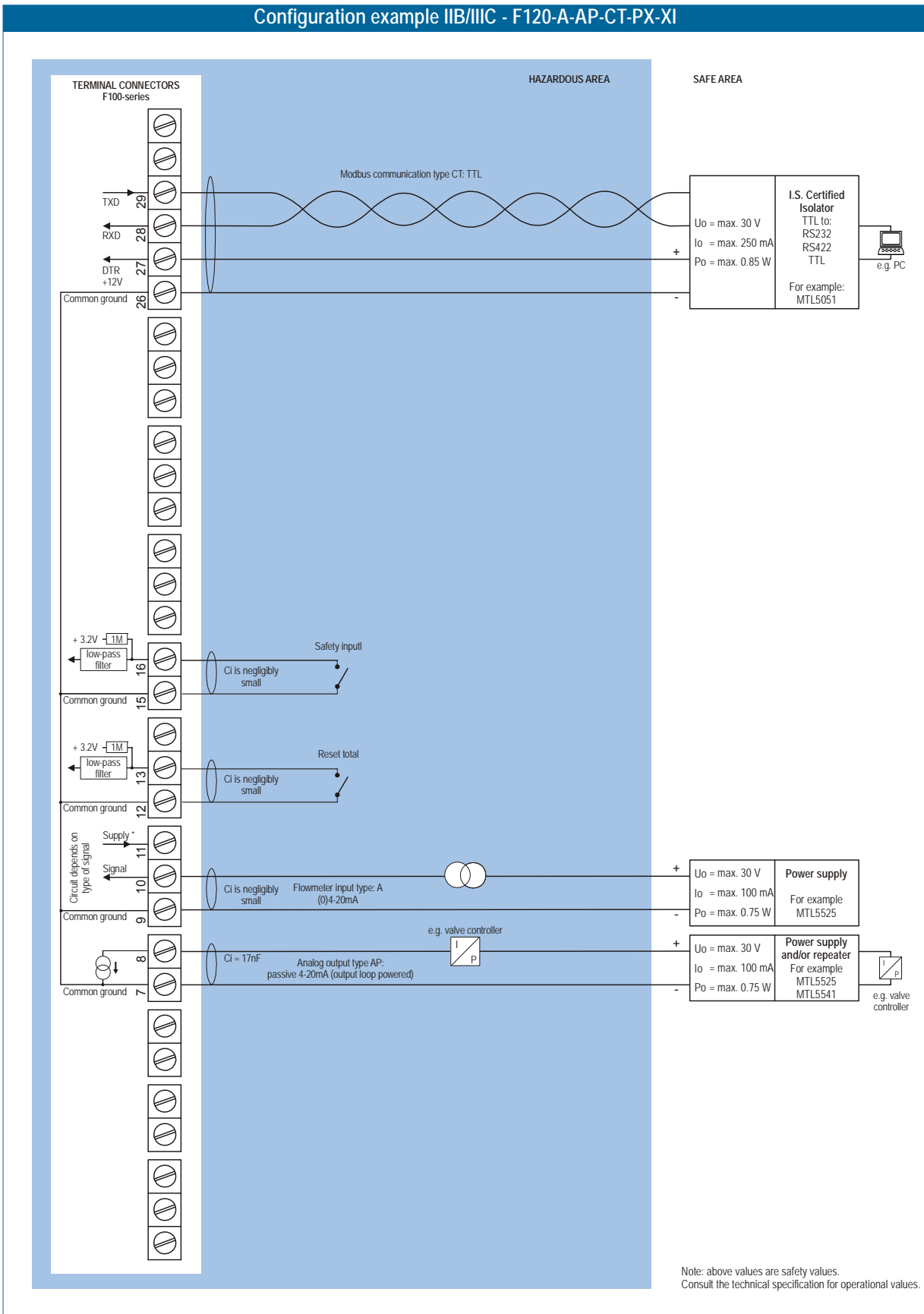


Fig. 14: Configuration example 1 Intrinsically Safe.

Configuration example IIB/IIIC - F120-A-AF-CT-PD-XI

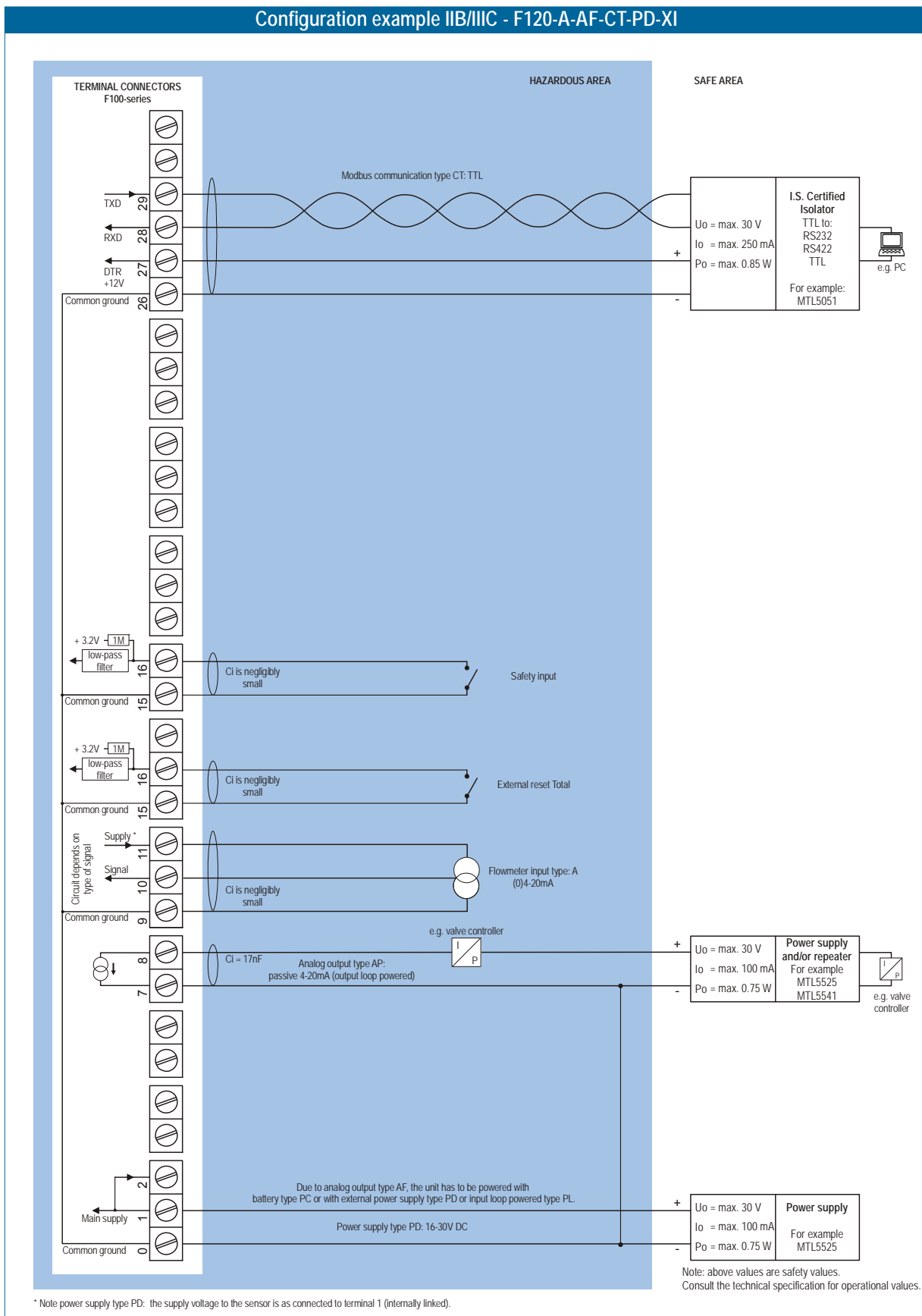


Fig. 15: Configuration example 2 Intrinsically Safe.

5.4 BATTERY REPLACEMENT INSTRUCTIONS



Safety Instructions

- **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.



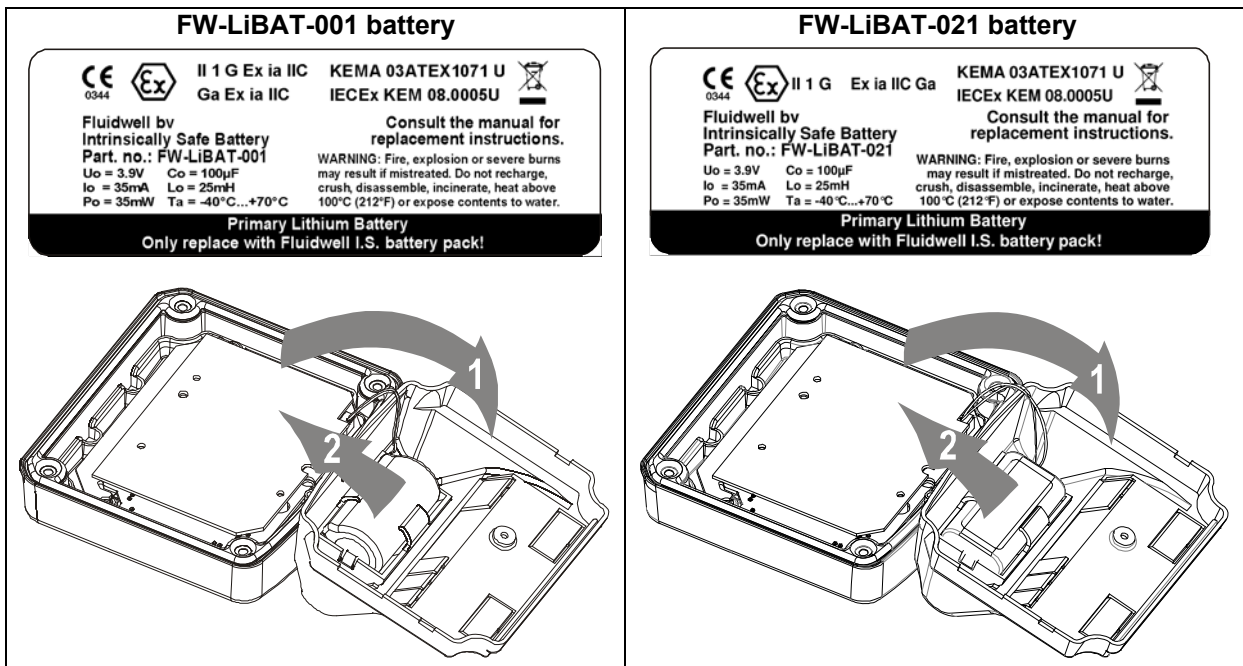
Safety instructions for hazardous areas

- 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 type batteries (manufactured by Fluidwell bv) only.**

Battery replacement procedure



Depending on the production batch, one of 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 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 F110-U 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 F120-A 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 F120-A 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 :

- Display update: fast display update uses significantly more power; SETUP 51.
- 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 Span 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. REPAIR

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

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-stabilized 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 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 HH	Drilling: 6x 12mm (0.47").
Option ZS	Silicone free ABS enclosure with EPDM and PE gaskets. UV-resistant polyester keypad. Note: this option comes with type HD only.


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. 1.5mm ² and 2.5mm ² (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 20mVp-p or 80mVp-p - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8 - 12 and 24V.
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.
Type A	(0)4-20mA - with signal calibration feature at any current within the range.
Type U	0-10 V - with signal calibration feature at any voltage within the range.
Accuracy	Resolution: 14 bit.. Error < 0.025mA / ±0.125% FS. 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

Analog output	
Function	IP Control output.
Accuracy	10 bit. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm
Type AA	Active 4-20mA output (requires type OA + PD, PF or PM).
Type AB	Active 0-20mA output (requires type OA + PD, PF or PM).
Type AF	Passive floating 4-20mA output for Intrinsically Safe applications (requires PC, PD or PL).
Type AI	Passive galvanically isolated output (requires PB, PD, PF, PL or PM).
Type AP	Passive 4-20mA output - output loop powered (type PX).
Type AU	Active 0-10V output (requires type OA + PD, PF or PM).

Transistor output(s)	
	>> only available for the F120-P <<
Pulse output	Max. frequency 60Hz. Pulse length user definable between 7,8msec up to 2 seconds.
Function	Two outputs: high and low flowrate.
Type OA	Active 24V DC transistor output; max. 50mA per output (requires type AA + PD, PF or PM).
Type OR	Isolated mechanic relay output; max. switch power 230V AC - 0,5A (requires type PF or PM).
Type OT	Passive transistor output - not isolated. Load max. 50V DC - 300mA.

Communication option	
Functions	reading display information, reading / writing all settings.
Protocol	Modbus RTU
Speed	1200 - 2400 - 4800 - 9600 baud
Addressing	maximum 255 addresses.
Type CB	RS232
Type CH	RS485 2-wire
Type CI	RS485 4-wire
Type CT	TTL Intrinsically Safe communication.
Type CX	no communication.

OPERATIONAL

Operator functions	
Displayed functions	<ul style="list-style-type: none"> • Set-point (percentage) • Process value (percentage) • Control action (hand, auto) • Total (resettable, engineering units) • Flowrate (engineering units) • Alarm value low flowrate (percentage) F120-P only!! • Alarm value high flowrate (percentage) F120-P only!!

Flowrate	
Digits	7 digits.
Units	mL, L, m3, Gallons, KG, Ton, lb, bl, cf, RND, ft3, scf, Nm3, NI, igal - no units.
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.

Total	
Digits	7 digits.
Units	L, m3, GAL, USGAL, KG, lb, bbl, no unit.
Decimals	0 - 1 - 2 or 3.
Note	total can be reset to zero.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F120-A is going to be installed or while it is in operation.

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.

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.

Above alarms can only be resolved by changing the configuration settings.

If several alarms are generated simultaneously, the alarm values are added together. (e.g. 0003 is error 0001 and error 0002).

APPENDIX C: COMMUNICATION VARIABLES

The F120-A can be supplied with Modbus communication.

Available on request – please contact your supplier.

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LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL	Enter your settings here		
11 unit	L		
12 decimals	0000000		
13 Span	0000001		
14 decimals Span	0		
15 display total	Disable		
2 - FLOWRATE			
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 Span	0000001		
25 decimals Span	0		
3 - SETPOINT			
31 SV minimum	0.0%		
32 SV maximum	100.0%		
4 - CONTROL			
41 Action	reverse		
42 Proportional band PB	500.0%		
43 Integration time I-time	5.0 sec.		
44 Start up	safety		
5 - POWER MANAGEMENT			
51 LCD-new	1 sec.		
52 mode	operational		
6 - FLOWMETER			
61 formula	interpolation		
62 filter	01 (off)		
63 cut-off %	00.0%		
64 calibrat. low-(0)4mA	default		
65 calibrat. high-20mA	default		
7 - ANALOG OUTPUT			
71 CO minimum (low limit_	0.0%		
72 CO maximum (high limit)	100.0%		
73 CO Safety mode	0.0%		
74 tune min - 0V	0160		
75 tune max - 10V	6656		
8 - COMMUNICATION			
81 baud-rate	2400		
82 address	1		
83 mode	BUS-RTU		
9 - OTHERS			
91 model	F120-A	F120-A	F120-A
92 software version			
93 serial number	02.05.____		
94 pass code	0000		
95 tagnumber	0000000		

