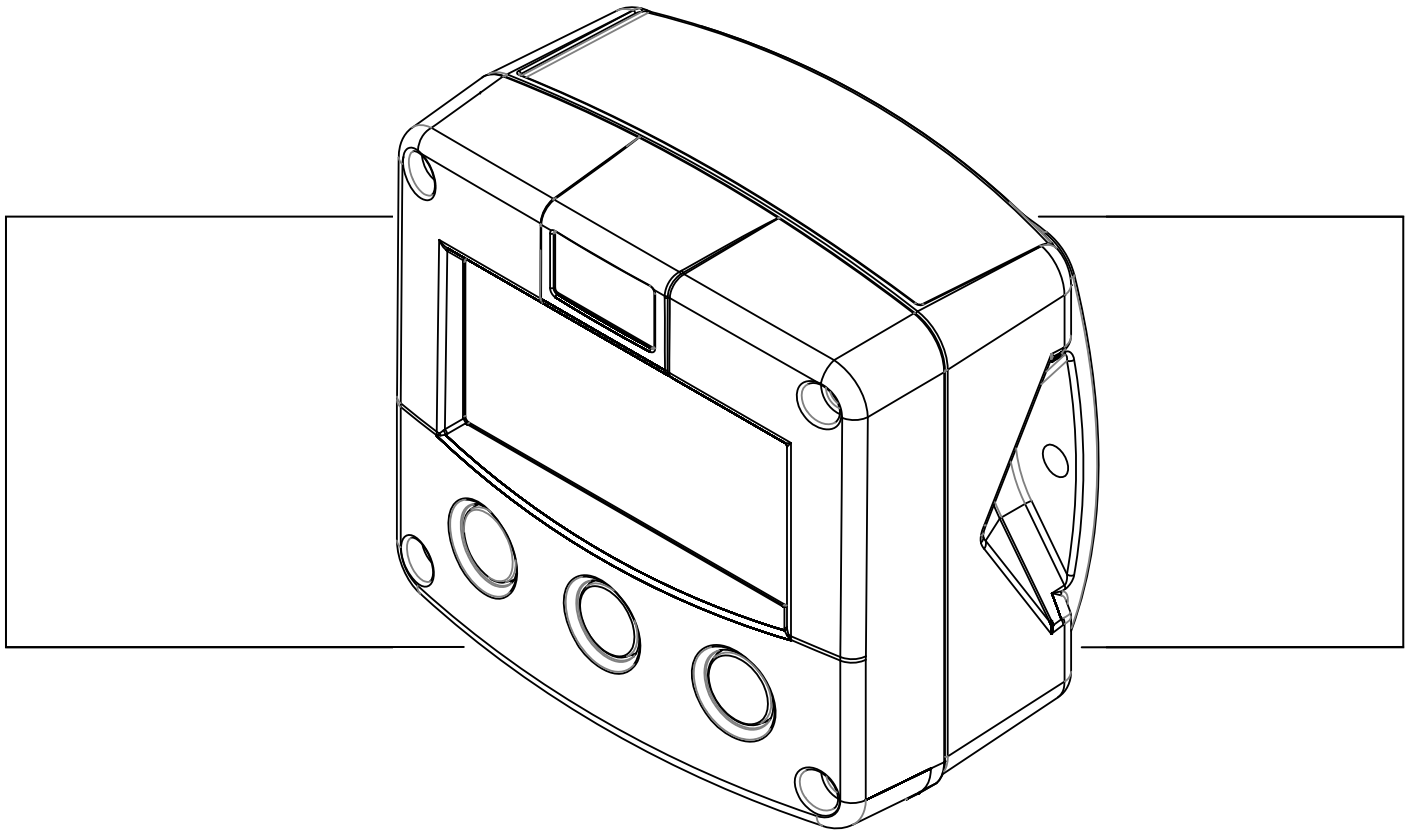
F118-A

FLOWRATE INDICATOR / TOTALIZER

WITH LINEARISATION AND HIGH / LOW ALARMS



Signal input flowmeter: (0)4-20mA

Analog output: 4-20mA ref. flowrate and pulse ref. total.

Switch outputs: high / low alarms and / or pulse ref. total.

Options: Intrinsically Safe, Modbus communication.

F-Series - Field mounted indicators for safe and hazardous areas. More info: www.fluidwell.com/fseries

SAFETY INSTRUCTIONS

- *Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.*
- *LIFE SUPPORT APPLICATIONS: The F118-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 (type HA/HU) as indicated if the F118-A has been supplied with the 115-230V AC power-supply (type PM/PN). 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 F118-A implemented without a preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and de-mounting 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 F118-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". This instruction is meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide an extensive description of all software settings and installing the hardware.

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 F118-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 destruction of the F118-A or connected instruments.


Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect function of the F118-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	:	HF118AEN_v0501_06
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Information in this manual is subject to change without prior notice. The manufacturer is not responsible for mistakes in this material or for incidental damage caused as a direct or indirect result of the delivery, performance or use of this material.

CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F118-A

Functions and features
The flowrate / totalizer model F118-A is a microprocessor driven instrument designed to linearize the flowmeters flowcurve and to display flowrate, total and accumulated total. Moreover, two alarm values can be set to monitor the flowrate.
This product has been designed with a focus on:
- ultra-low power consumption to allow long-life battery powered applications (type PB),
- 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 analog / pulse and communication (option) outputs.

Flowmeter input
This manual describes the unit with a analog type input from the flowmeter "-A version". Other versions are available to process pulses or 0-10V flowmeter signals.
One flowmeter with a (0)4-20mA signal output can be connected to the F118-A. To power the sensor, several options are available.

Standard outputs
- Two / three configurable outputs: high or low flowrate alarm, all alarms or pulse output.
- Configurable pulse output: a scaled pulse mirroring a certain linearised total quantity. Maximum frequency 60Hz.; the pulse length can be set from 7,8msec up to 2 seconds.
- Configurable passive linear 4-20mA analog output with 10-bits resolution mirroring the actual linearised flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.

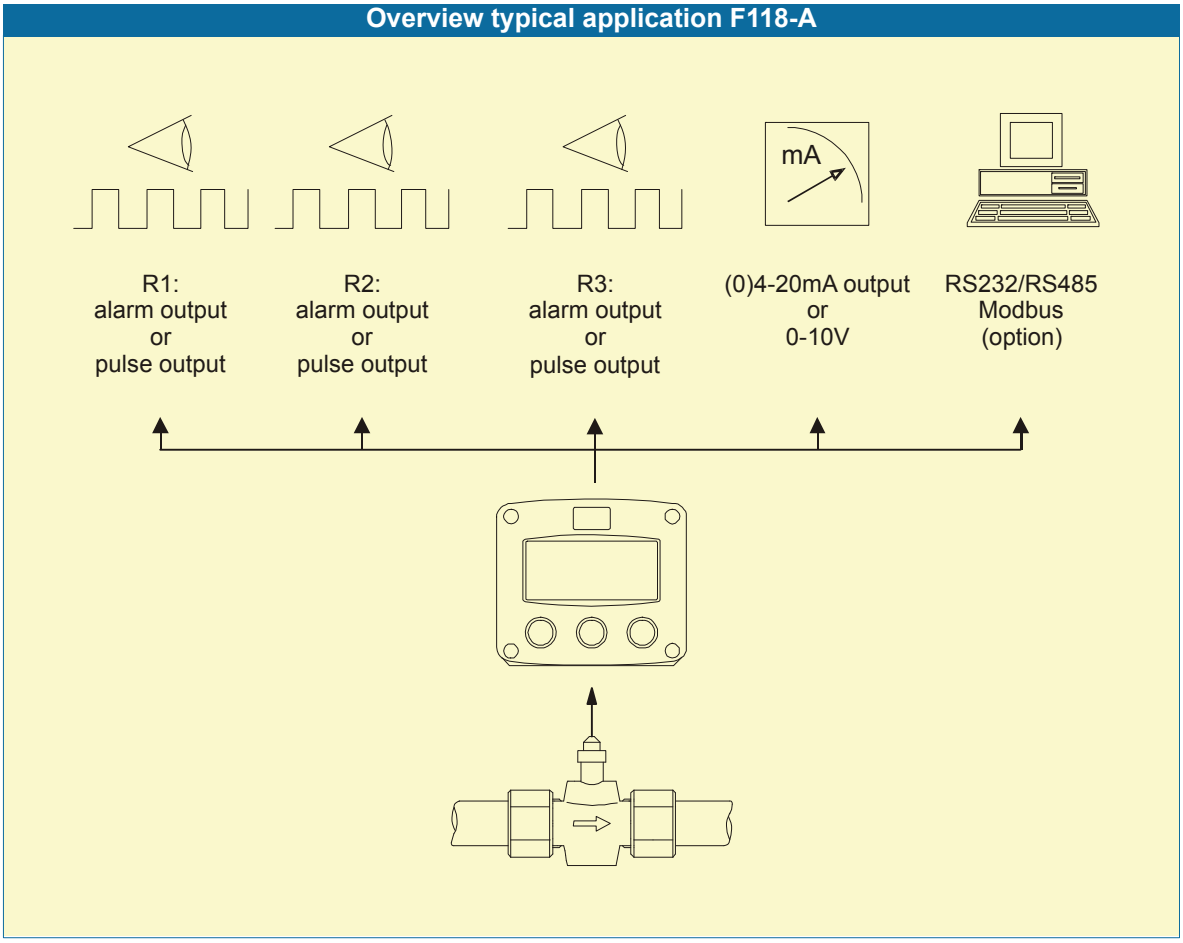


Fig. 1: Typical application for the F118-A.

Configuration of the unit
The F118-A was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F118-A according to your specific requirements.
SETUP includes several important features, such as K-factors, measurement units, signal selection etc. All setting as are stored in EEPROM memory and will not get lost in case of power break-down or empty 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 can be displayed either with the small 8mm digits or with the 17mm digits.
A backup of the total and accumulated total in EEPROM memory is made every minute.

Options
Following options are available: isolated or active 4-20mA / 0-10V / 0-20mA analog output, full Modbus communication RS232/485 (also battery powered), intrinsic safety, mechanic 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 F118-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 F118-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.
It is also used to gain access to SETUP-level; please read chapter 3.

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

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

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F118-A will always function at Operator level. The information displayed is dependant upon the SETUP-settings. All pulses generated by the connected flowmeter are measured by the F118-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.

For the Operator, the following functions are available:

- **Display flowrate / total**
  This is the main display information of the F118-A. After selecting any other information, it will always return to this main display automatically.
  Total is displayed on the upper-line of the display and flowrate on the bottom line.
  When "-------" is shown, then the flowrate value is too high to be displayed. The arrows ⬍ indicate the increase/decrease of the flowrate trend.

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

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

- **Programming the flowrate alarm values**

Note !

Note: *This function might not be immediately accessible due to a configuration setting.*

When the SELECT-key is pressed a few times, following flowrate alarm values are displayed:
- low flowrate alarm: enter here 40 L/min for example,
- high flowrate alarm: enter here 200 L/min for example,

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

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

Fig. 4: Example of display information during programming minimum flowrate.

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

- **Flowrate alarm**

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

- **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.

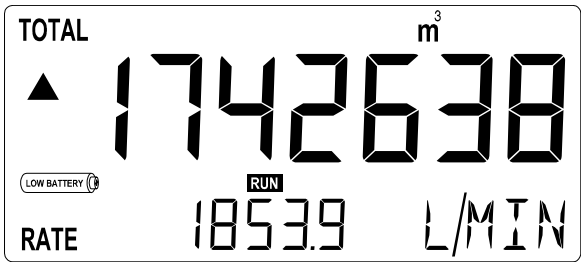


Fig. 5: Example of low-battery alarm.

- **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 F118-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

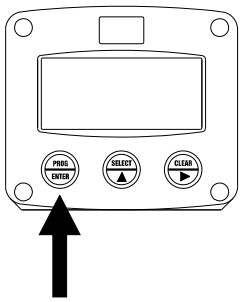
3.2.1. GENERAL

Configuration of the F118-A 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 F118-A remains fully operational.

Note !

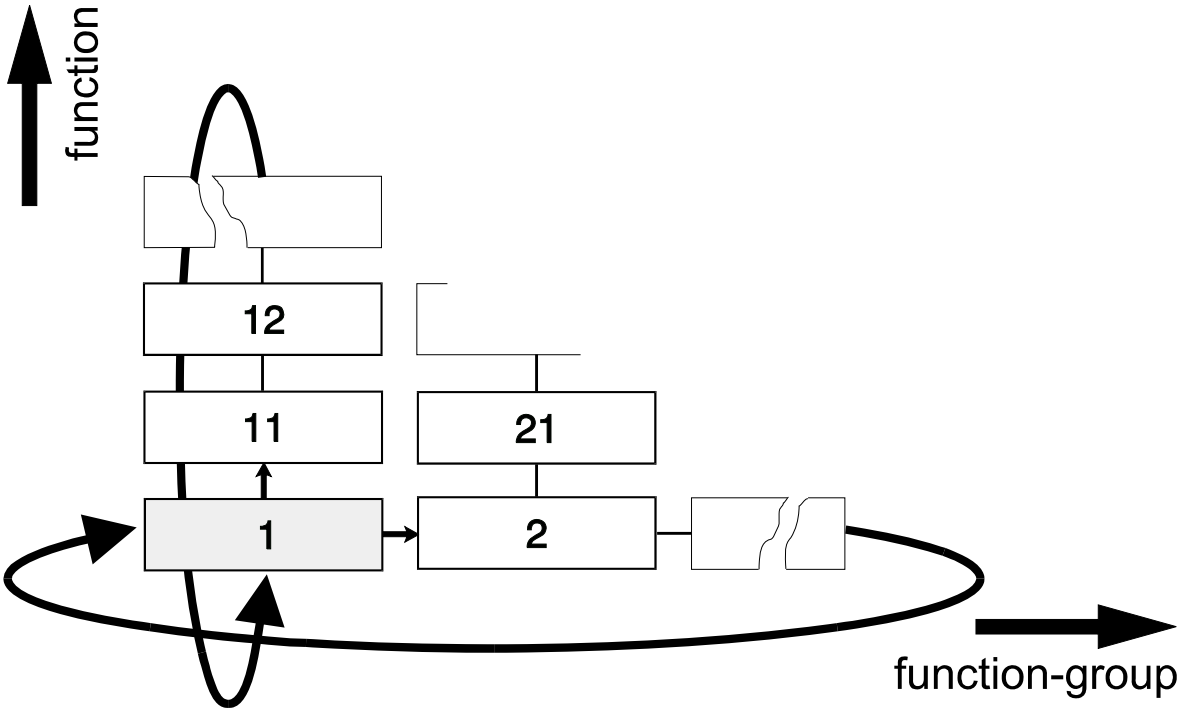
Note: *A password may be required to enter SETUP. Without this password access to SETUP is denied.*

To enter SETUP-level:



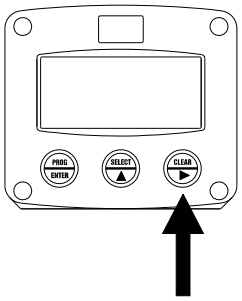
Press PROG/ENTER for 7 seconds

Matrix structure SETUP-level:

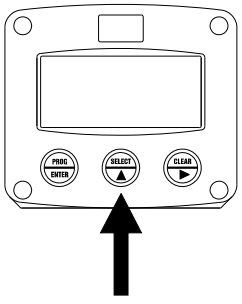


SCROLLING THROUGH SETUP-LEVEL

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



Select function-group with CLEAR ▶

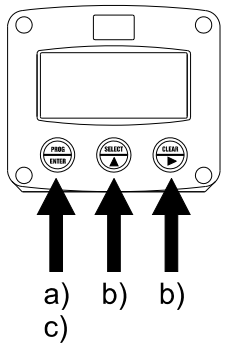


Select function with SELECT ▲

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 function. Additionally, each function is expressed with a keyword.

After selecting a sub-function, the next main function is selected after scrolling through all "active" sub-functions (e.g. 1▲, 11▲, 12▲, 13▲, 14▲, 1▶, 2▶, 3▲, 31 etc.).

To change or a select a value or 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.

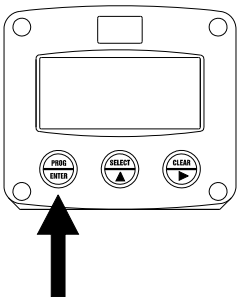
To change a value, use ▶ to select the digits and ▲ to increase that value.
To select a setting, both ▲ and ▶ can be used.
When the new value is not valid, the increase sign ▲ or decrease-sign ▼ will be displayed while you are programming.

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**		
	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
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	**ALARM**		
	31	ALARM SET	operator - setup level
	32	FLOWZERO	default - no relays - ignore
	33	ALARM LOW	0000.000 - 9,999,999
	34	ALARM HIGH	0000.000 - 9,999,999
	35	DELAY ALARM LOW	0.1 - 999.9 seconds
	36	DELAY ALARM HIGH	0.1 - 999.9 seconds
4	**POWER MANAGEMENT**		
	41	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	42	BATTERY MODE	operational - shelf
5	**FLOWMETER**		
	51	FORMULA	interpolation, square root
	52	FILTER	00 - 99
	53	CUT-OFF	0.0 - 99.9%
	54	CALIBRATE LOW	(0)4mA
	55	CALIBRATE HIGH	20mA
6	**LINEARISATION**		
	61	% / M-FACTOR 1	0.01% – 99.99% / 0 – 9.999999
	62	% / M-FACTOR 2	0.01% – 99.99% / 0 – 9.999999
	63	% / M-FACTOR 3	0.01% – 99.99% / 0 – 9.999999
	..	..	……..
	6A	% / M-FACTOR 10	0.01% – 99.99% / 0 – 9.999999
	6B	LINEARISATION	enable / disable
7	**ANALOG**		
	71	OUTPUT	disable - enable
	72	RATE MIN - (0)4mA / 0V	0000.000 - 9,999,999
	73	RATE MAX - 20mA / 10V	0000.000 - 9,999,999
	74	TUNE MIN - 4mA / 0V	0 - 9,999
	75	TUNE MAX- 20mA / 10V	0 - 9,999
8	**RELAYS**		
	81	OUTPUT R1	off - low - high - all - pulse
	82	OUTPUT R2	off - low - high - all - pulse
	83	OUTPUT R3	off - low - high - all - pulse
	84	UNIT WIDTH	0 - 250
	85	IMPULSE PER	X,XXX,XXX quantity
9	**COMMUNICATION**		
	91	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	92	ADDRESS	1 - 255
	93	MODE	rtu - off
A	**OTHERS**		
	A1	TYPE / MODEL	
	A2	SOFTWARE VERSION	
	A3	SERIAL NO.	
	A4	PASSWORD	0000 - 9999
	A5	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION SETUP-FUNCTIONS

1 - TOTAL	
MEASUREMENT UNIT **11**	SETUP - 11 determines 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 Span 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
SPAN **13**	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. 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. **Example 1:** **Calculating the span for Total.** *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".* **Example 2:** **Calculating the span for Total** *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".*
DECIMALS SPAN **14**	This setting determines the number of decimals for the Span (SETUP 13). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 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)!

2 - FLOWRATE

The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate.
The display update time for flowrate is one second or more.
Note: *these settings also influence the analog output.*

MEASUREMENT UNIT **21**	SETUP - 21 determines 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 Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span 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
SPAN **24**	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. 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. **Example 1** **Calculating the span for flowrate** *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".* **Example 2** **Calculating the span for flowrate** *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".*
DECIMALS SPAN **25**	This setting determines the number of decimals for Span (SETUP 24). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 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)!

3 - ALARM

Note !

With these settings, it is determined how the flowrate will be monitored and the functionality of the transistor / relay outputs (terminals 03-04, 05-06 and 15-16) be determined.
Note: *for transistor / relay output functions: read SETUP 8 "relays".*

SET ALARM **31**	This function determines if the flowrate alarm values can be set at both Operator level and SETUP-level or SETUP-level only. If SETUP has been selected, the alarm values are still visible for the Operator but can not be changed.
FLOW ZERO **32**	When the flowrate is zero, then it is possible to ignore or disable the flowrate monitoring. The following settings can be selected: DEFAULT: in case of a low-flowrate alarm and zero flow, it will switch the alarm output and indicate the alarm on the display. NO RELAY: in case of a low-flowrate alarm and zero flow, it won't switch the alarm output but will indicate the alarm on the display only. IGNORE: in case of a low-flowrate alarm and zero flow, it won't switch the alarm output and nothing will be indicated on the display.
ALARM VALUE LOW **33**	The low alarm is set with this setting. An alarm will be generated as long as the flowrate lower as this. With value 0.0 this function is disabled.
ALARM VALUE HIGH **34**	The high alarm is set with this setting. An alarm will be generated as long as the flowrate higher as this. With value 0.0 this function is disabled.
DELAY TIME ALARM LOW **35**	An alarm generated by SETUP 33 "low" can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM HIGH **36**	An alarm generated by SETUP 34 "high" can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.

4 - POWER MANAGEMENT

When used with the internal battery option, the user may hold the concern of reliable measurement over a long period of time. The F118-A has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

LCD NEW **41**	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 be FAST during 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 **42**	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 !

5 - FLOWMETER

SIGNAL
51

The F118-A can process the 4-20mA signal in two ways:

- Interpolation: the signal is processed linear

  R = S x I

- Square root: for differential pressure

  R = S $\sqrt{}$ I

where:
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.

FILTER
52

Note !

The analog output signal of a flowmeter does mirror the actual flow. This signal is measured several times a second by the F118-A. The value measured is a "snap-shot" of the real flow as it will be fluctuating. With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value.
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:

FILTER
53

This function is used to stabilize the analog output signal.
The output value is update every 0.1 second. With the help of this digital filter a more stable but less actual reading can be obtained.
The filter principal is based on three input values: the filter level (01-99), the last analog output value and the last average value. The higher the filter level, the longer the response time on a value change will be.
Below, several filter levels with there response times are indicated:

FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.3 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

Continued next page >>>

5 - FLOWMETER (CONTINUED)

CUT-OFF
54

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%.

Examples:

FUNCTION (setup 51)	SPAN (setup 13/24)	REQUIRED CUT-OFF	CUT-OFF (setup 63)	REQUIRED OUTPUT
interpolation	450 L/min	25 L/min	25/450 x 100%=5.5%	16mA x 5.5% + 4mA = 4.88mA
square root	450 L/min	25 L/min	$(25/450)^2$ x 100%=0.3%	16mA x 0.3% + 4mA = 4.05mA

TUNE MIN / 4MA
55

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.

- *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!*

After pressing PROG, three settings can be selected:
- 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.

TUNE MAX / 20MA
56

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.

- *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!*

After pressing PROG, three settings can be selected:
- 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.

6 - LINEARISATION

The linearisation function is available to approach the real flowcurve better as with the general Span entered with setup 14 and 24. This to obtain a more accurate flowrate, total and accumulated total as well as the analog and pulse output at any flowmeter signal.
A maximum of 15 linearisation-positions can be entered while the interpolation will calculate any other position in-between.

For each linearisation position, the percentage of signal and the Meter Factor (MF) must be entered.

The Meter Factor for each linearisation step is calculated with following formula:

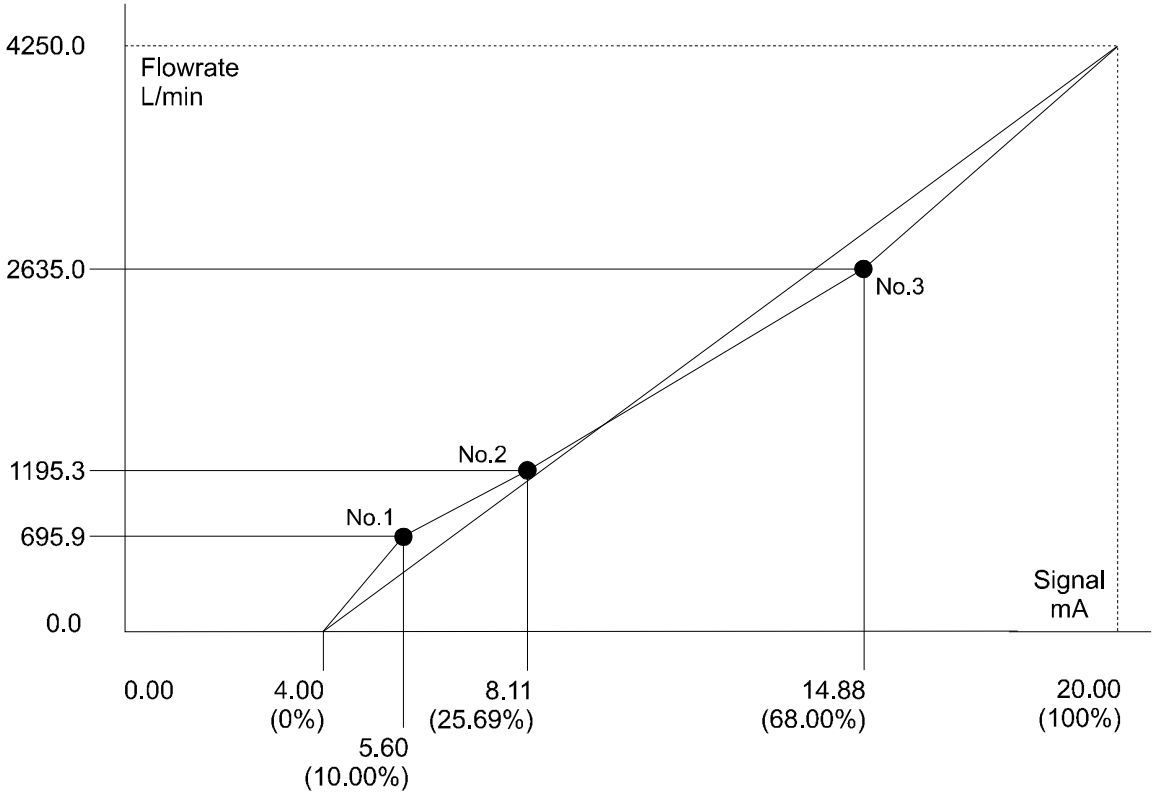
$$\text{Meter-Factor} = \frac{\text{measured flow}}{\text{calculated flow}}$$

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

No.1:
The measured flow is 695.9 L/min @ 5.60mA
(5.60 - 4.00) / (20.00 - 4.00) x 100% = 10.00% of signal
At 10% of the signal, you would expect: 4250.0 x 10% = 425.0 L/min
The M-Factor for No.1 is: 695.9 / 425.0 = 1.636471

No.2:
The measured flow is 1195.3 L/min @ 8.11mA
(8.11 - 4.00) / (20.00 - 4.00) x 100% = 25.69% of signal
At 25.69% of the signal, you would expect: 4250.0 x 25.69% = 1091.7 L/min
The M-Factor for No.2 is: 1195.3 / 1091.7 = 1.094898

No.3:
The measured flow is 2635.0 L/min @ 14.88mA
(14.88 - 4.00) / (20.00 - 4.00) x 100% = 68.00% of signal
At 68.00% of the signal, you would expect: 4250.0 x 68.00% = 2890.0 L/min
The M-Factor for No.3 is: 2635.0 / 2890.0 = 0.911765



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6 - LINEARISATION (CONTINUED)

PERCENTAGE / M-FACTOR 61 TO 6A	The percentage is displayed at the bottom line of the display. With value 0% the M-Factor is disabled. The M-Factor is displayed at the top-line of the display. The minimum value to be entered is 0.000001 and the maximum value is 9.999999. *Please note that this value has always six decimals while the "dot" is not displayed.* Most M-factors will be around 1.000000 like 0.945354 or 1.132573.
DISABLE / ENABLE 6B	With this setup function, you can easily enable / disable the linearisation function.

Note !

7 - ANALOG OUTPUT

A linear 4-20mA signal (type AB: 0-20mA or type AU: 0-10V) output signal is generated according to the flowrate with a 10 bits resolution. The settings for flowrate (SETUP - 2) influences the analog output directly.
Note: *When the analog-output is not used, please make sure that setting 71 is disabled, else the battery life-time will be reduced significantly!*
When a power supply is available but the output is disabled, a 3.5mA signal will be generated.
The relationship between rate and analog output is set with following functions:

Note !

DISABLE / ENABLE 71	The D/A converter has a relatively high power consumption. If the analog output will not be used, select "disable" to switch-off the converter. For more information read par. 4.4.3.
MINIMUM FLOWRATE 72	Enter here the flowrate according which the output should generate a 4mA signal (or 0mA / 0V) - in most applications at flowrate "zero". The number of decimals displayed is according to SETUP 23. The time and measuring units (L/min for example) are according SETUP 21 and 22 but can not be displayed.
MAXIMUM FLOWRATE 73	Enter here the flowrate according which the output should generate a 20mA (or 10V) - in most applications at maximum flow. The number of decimals displayed is according to SETUP 23. The time and measuring units (L/min for example) are according SETUP 21 and 22 but can not be displayed.
TUNE MIN / 4MA 74	The initial minimum analog output value is 4mA (or 0mA / 0V). However, this value might slightly differ due to external influences such as temperature for example The 4mA value (or 0mA / 0V) can be tuned exactly with this setting. ▪ *Before tuning the signal, be sure that the analog signal is not used for any application!* After pressing PROG, the current will be about 4mA (or 0mA / 0V). The current can be increased/decreased with the arrow-keys and is directly active. Press ENTER to store the new value.
TUNE MAX / 20MA 75	The initial maximum analog output value is 20mA (or 10V). However, this value might slightly differ due to external influences such as temperature for example The 20mA value (or 10V) can be tuned exactly with this setting. ▪ *Before tuning the signal, be sure that the analog signal is not used for any application!* After pressing PROG, the current will be about 20mA. The current can be increased/decreased with the arrow-keys and is directly active. Press ENTER to store the new value.

WARNING

WARNING

8 - RELAY OUTPUT

Note !

With the exception of the Intrinsically Safe version, three transistor outputs are available or one transistor output plus two electro-mechanical relay outputs.
Note: *the alarm settings - SETUP 3 - need to correspond with the selections below.*

Note !

OUTPUT R1 TRANSISTOR / RELAY 81

Assign the output function to R1 - terminal 05-06:
high alarm, low alarm, flowrate alarm or pulse output (max 5Hz)
Note: *Intrinsically safe applications: this setting has no influence on any output; please read 83: R3.*

OUTPUT R2 TRANSISTOR / RELAY 82

Assign the output function to R2 - terminal 03-04:
high alarm, low alarm, flowrate alarm or pulse output (max 60Hz)

Note !

OUTPUT R3 TRANSISTOR 83

Assign the output function to R3 - terminal 15-16 - which is always a transistor output:
high alarm, low alarm, flowrate alarm or pulse output (max 60Hz)
Note: *Intrinsically safe applications: This output is assigned to output R1 and not R3.*

Note !

PERIOD TIME PULSE OUTPUT 84

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 85

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.

9 - COMMUNICATION (OPTIONAL)

Functions as described below deal with hardware that are 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 91

For external control, following communication speeds can be selected:

1200 - 2400 - 4800 - 9600 baud

BUS ADDRESS 92

For communication purposes, a unique identity can be attributed to every F118-A. This address can vary from 1-255.

MODE 93

The communication can only be executed according Modbus protocol RTU mode (ASCII is not available for this model).
With OFF, the communication is disabled.

A - OTHERS	
TYPE OF MODEL **A1**	For support and maintenance it is important to have information about the characteristics of the F118-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 **A2**	For support and maintenance it is important to have information about the characteristics of the F118-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 **A3**	For support and maintenance it is important to have information about the characteristics of the F118-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.
PASSWORD **A4**	All SETUP-values can be password protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER **A5**	For identification of the unit and communication purposes, a unique tagnumber of maximum 7 digits can be entered.

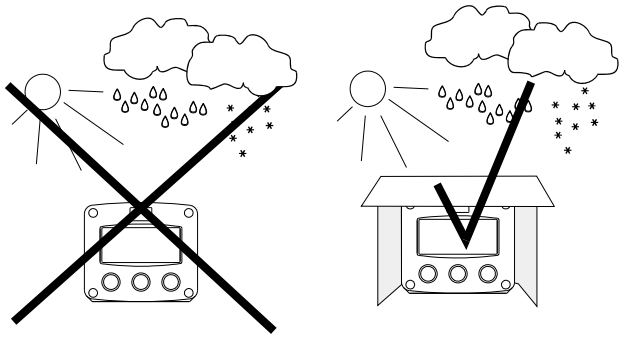
4. INSTALLATION

4.1. GENERAL DIRECTIONS

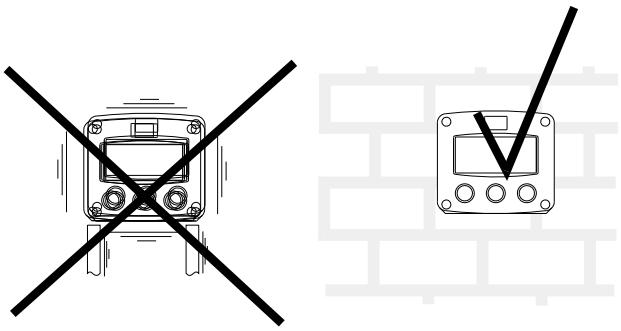
Caution !

- 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 F118-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 F118-A on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE

Aluminum enclosures:

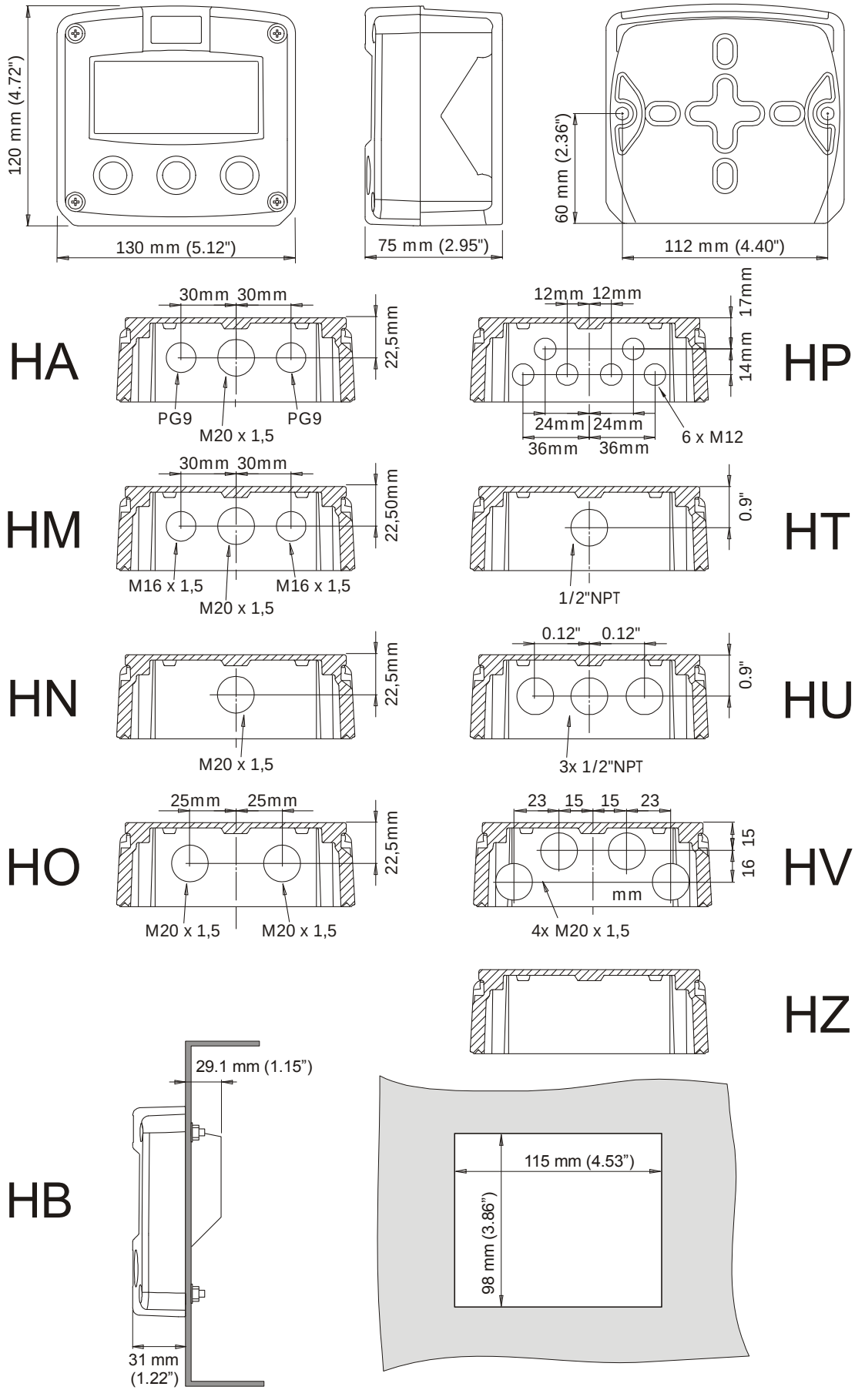
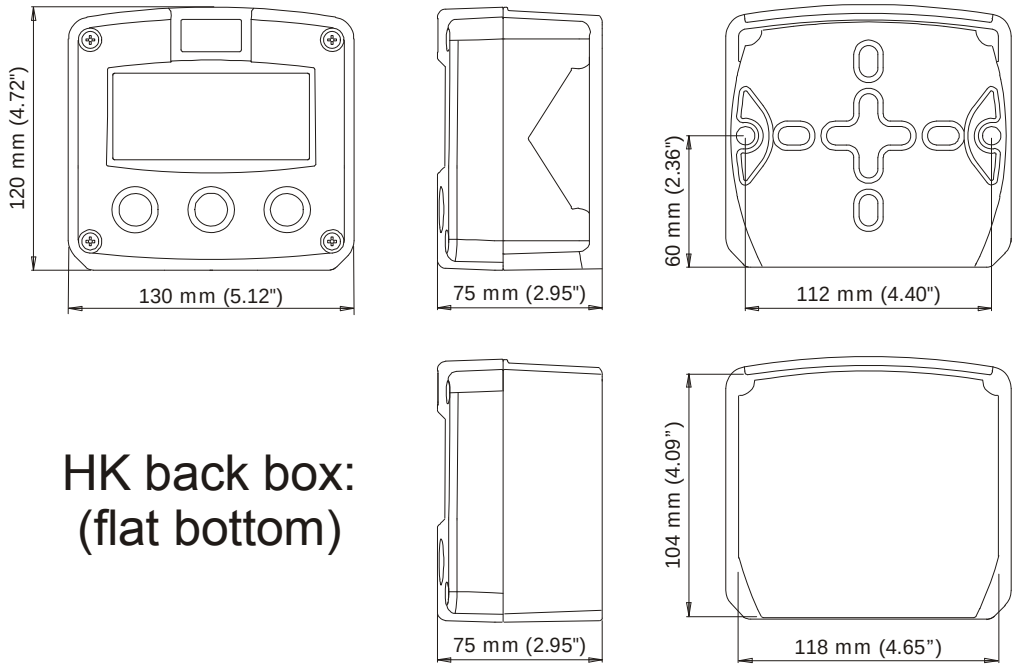
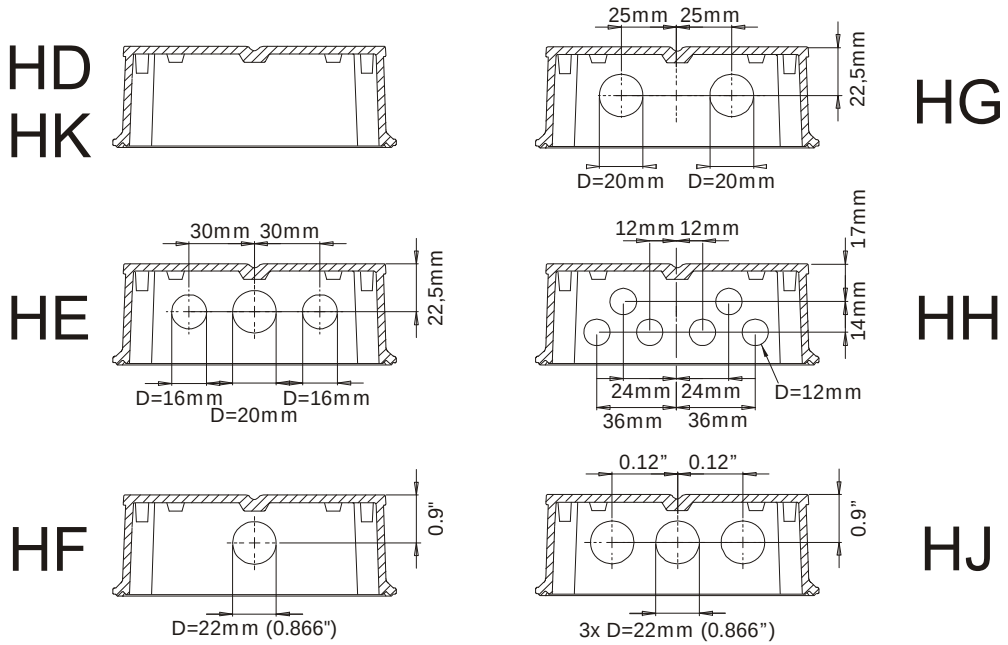


Fig. 6: Dimensions aluminum enclosures.

GRP enclosures:





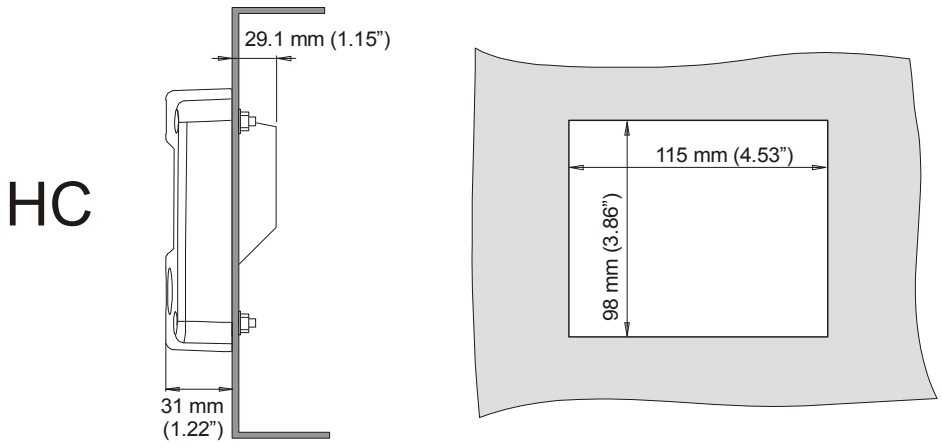


Fig. 7: Dimensions GRP enclosures.

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 F118-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.

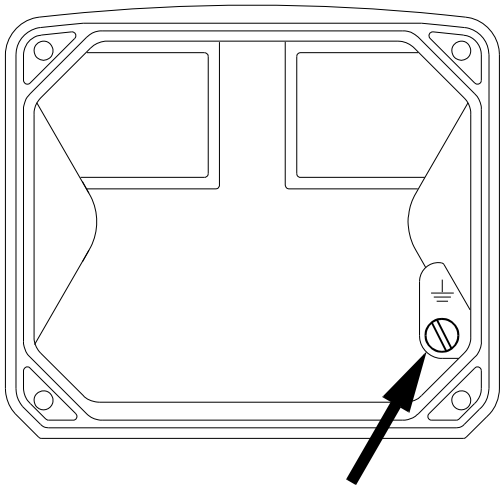


Fig. 8: Grounding aluminum enclosure with type PM 115-230V AC.

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 offers a 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 is not a power output! All energy used by the flowmeters pick-up influences the battery life-time directly.*

Option PD-PN: 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 with the three switches inside the enclosure.

WARNING

- *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 terminals after which the internal plastic cover can be removed. The switches are located in the top left corner (option PD) or on the right hand (option PM) as indicated:

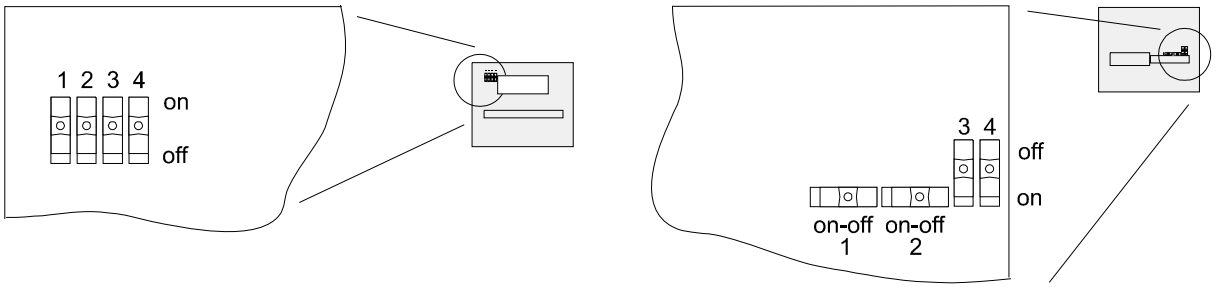


Fig. 9: switch position voltage selection (option PD and PM).

Switch positions

SENSOR A	
SWITCH 1	VOLTAGE
on	3.2 V DC
off	switch 3+4

SENSOR B	
SWITCH 2	VOLTAGE

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 14.
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

For Intrinsically Safe applications: read chapter 5.

The following terminal connectors are available:

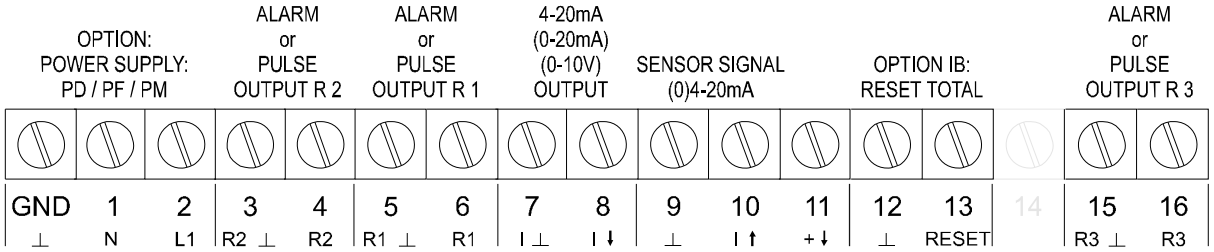


Fig. 10: Overview of terminal connectors standard configuration F118-A and options.

REMARKS: TERMINAL CONNECTORS:

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

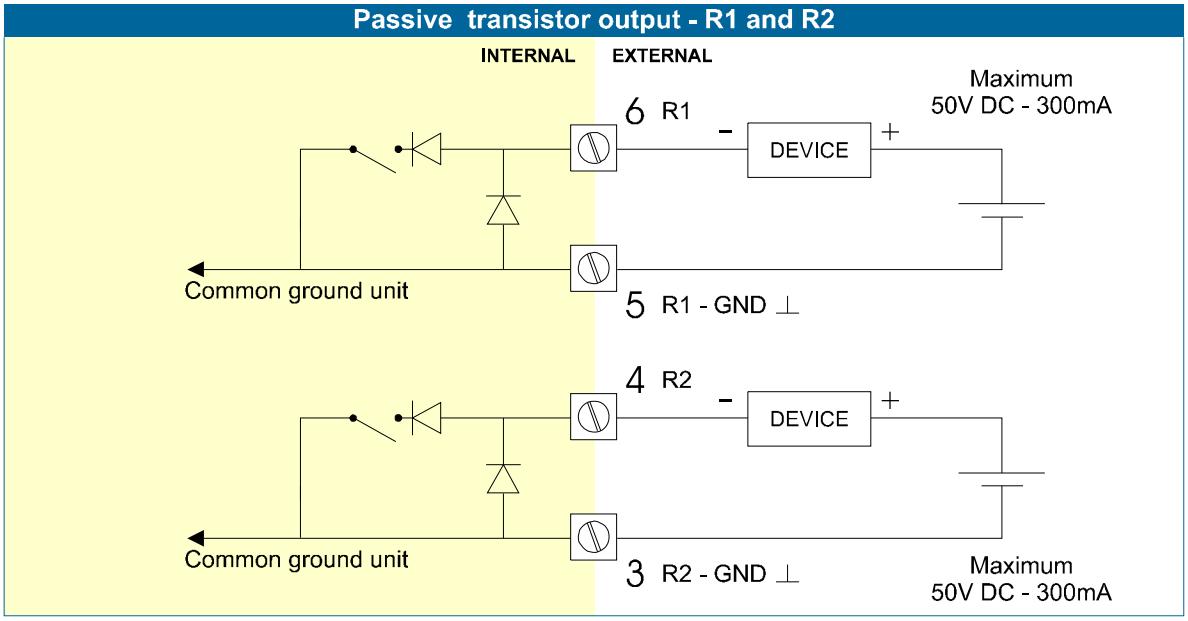
TYPE	SENSOR SUPPLY	Terminal			backlight	TYPE AA	TYPE AU	Type OA	Type OR
		GND	01	02					
PD 8-24V AC	8,2-12-24V max. 50mA		AC	AC	◊	◊	◊	◊	
PD 8-30V DC	8,2-12-24V max. 50mA	L-	L+		◊	◊	◊	◊	
PF 24V AC ± 15%	8,2-12-24V max. 400mA		AC	AC	◊	◊	◊		◊
PF 24V DC ± 15%	8,2-12-24V max. 400mA	L-	L+		◊	◊	◊		◊
PM 115-230V AC ± 15%	8,2-12-24V max. 400mA	EARTH	AC	AC	◊	◊	◊	◊	◊
Note PF / PM	The total consumption of the sensors and outputs may not exceed 400mA@24V								

◊=option

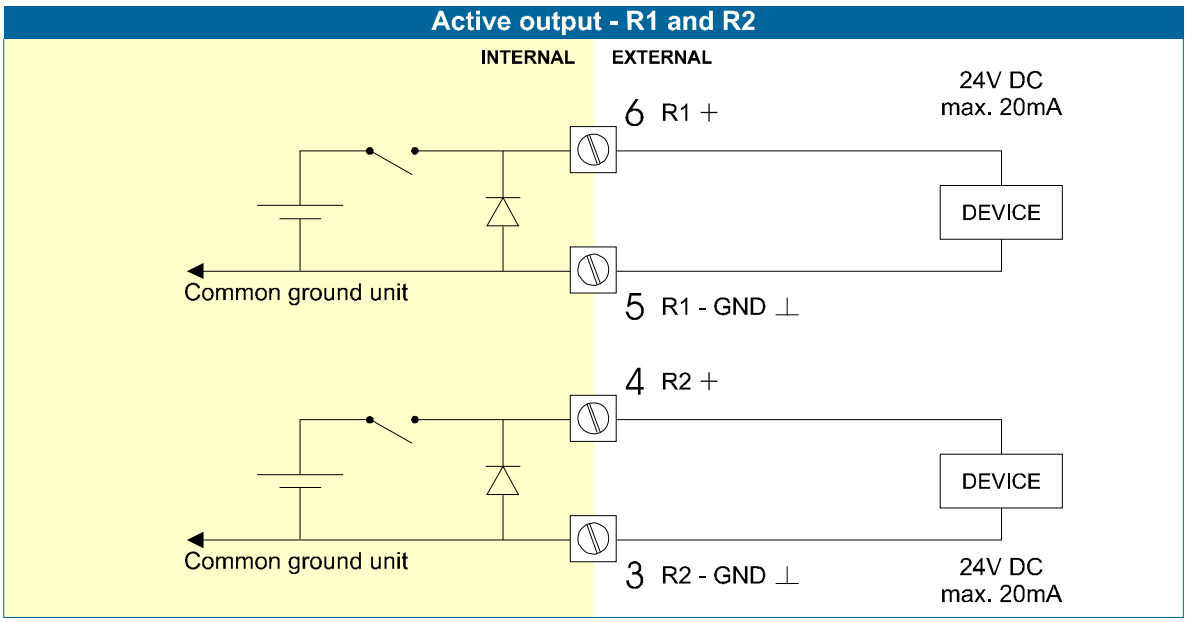
For Intrinsically Safe applications: read chapter 5.

Terminal 03-04; transistor type OT - output R2:
This output is always a fast output. With SETUP 8, the function of this output is set to a flowrate alarm output or pulse output.
If pulse output function is selected: 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.

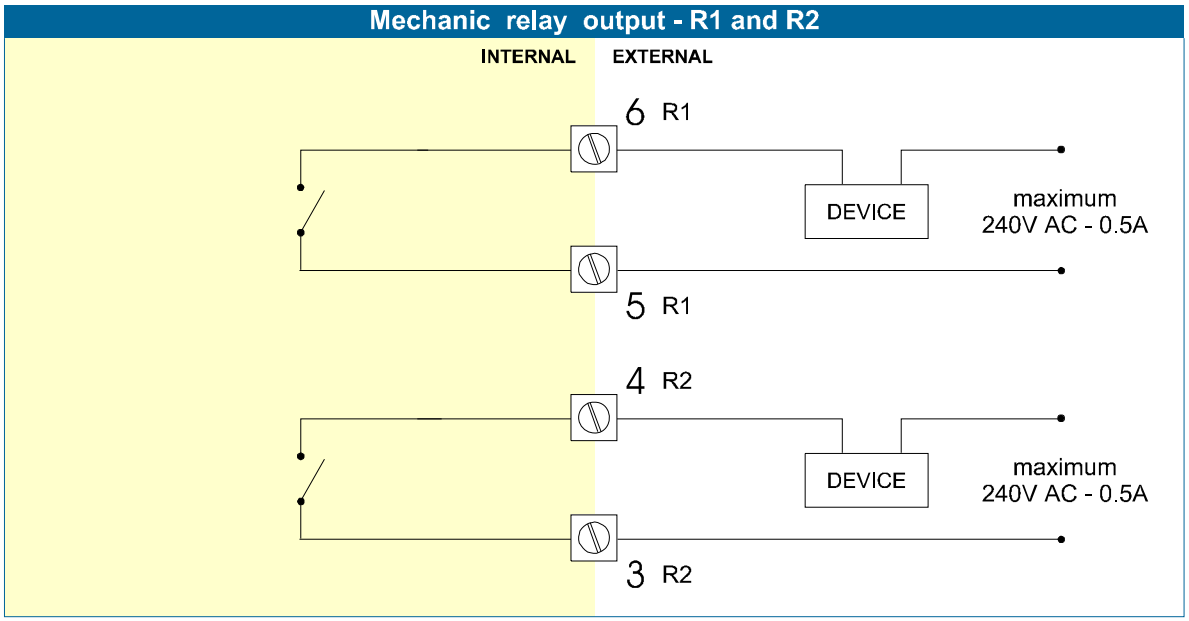
Terminal 05-06; transistor type OT - output R1:
This output is always a slow output. With SETUP 8, the function of this output is set to a flowrate alarm output or pulse output.
If pulse output function is selected: the maximum pulse frequency of this output is 5Hz.



Type OA:
An active 24V DC signal flowrate alarm output or pulse output is available with this option.
Max. driving capacity 20mA@24V per output. (Requires power supply type PD / PF / PM).

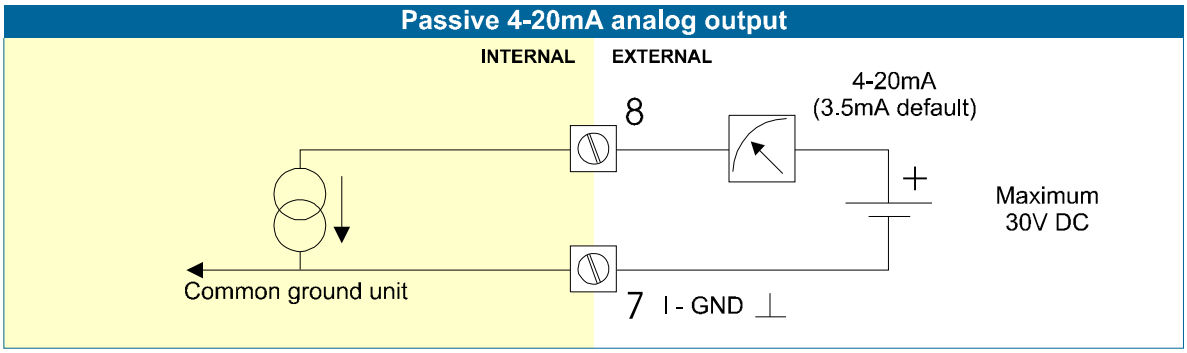


Type OR:
A mechanical relay output flowrate alarm output or pulse output is available with this option.
Max. switch power 240V 0,5A per output. (Requires power supply type PF / PM).

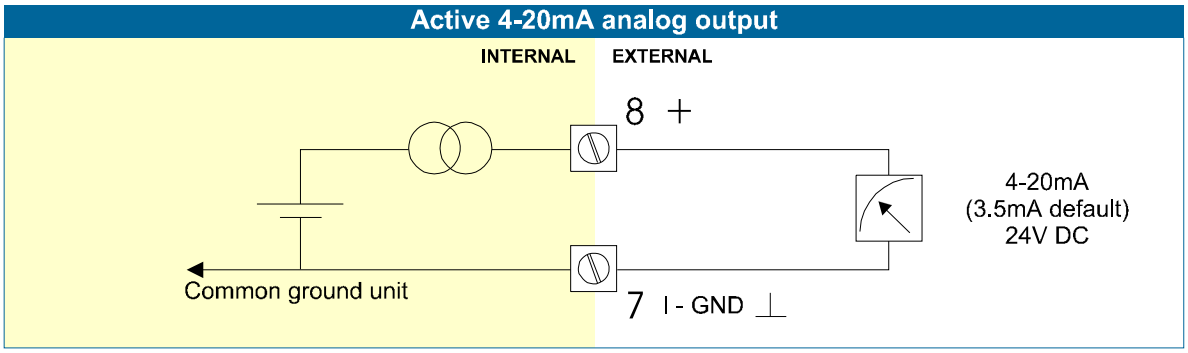


Terminal 07-08 POWER SUPPLY type PX - output loop powered:
Connect an external power supply of 8-24 volts AC or 8-30VDC to these terminals or a 4-20mA loop. For a DC supply: connect the "**-**" to terminal 7 and the "**+**" to terminal 8. When power is applied to these terminals, the (optional) internal battery will be disabled / enabled automatically to extend the battery life time. (Only valid for standard passive output).

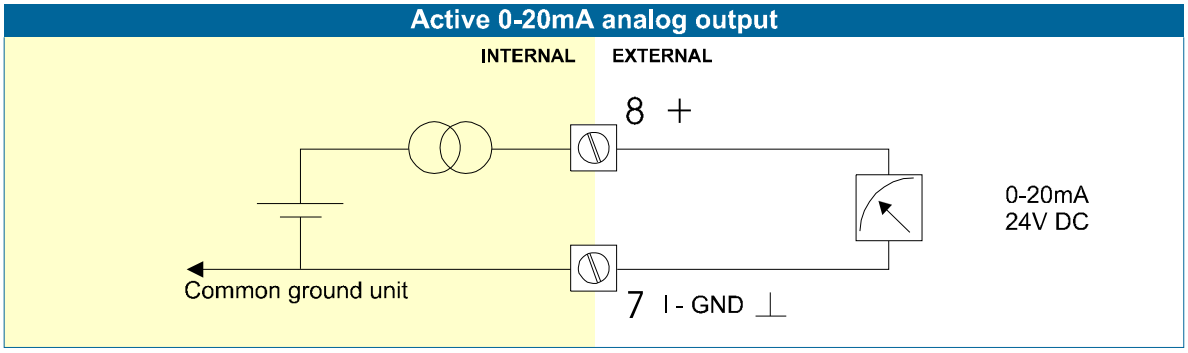
Terminal 07-08 analog output (passive) (SETUP 6) :
A 4-20mA current-sinking signal proportional to the flowrate is available as standard.
A DC power supply should be connected to terminal 07 and 08, the current is then regulated by unit. This DC supply is also used to power the unit (output loop-powered). When a power supply is connected but the output is disabled, a 3.5mA signal will be generated.
Max. driving capacity 1000 Ohm.



Type AA:
An active 4-20mA signal proportional to the flowrate is available with this option.
When the output is disabled, a 3.5mA signal will be generated on these terminals.
Max. driving capacity 1000 Ohm @ 24VDC. (Requires power supply type PD / PF / PM).

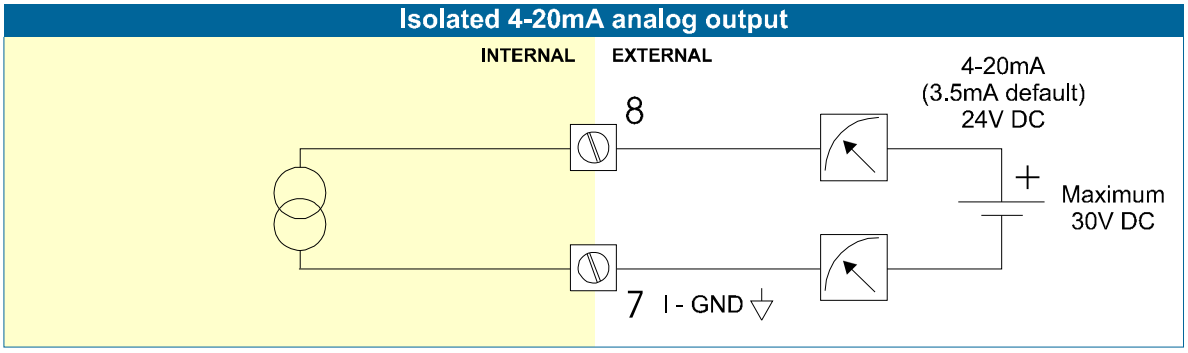


Type AB:
An active 0-20mA signal proportional to the flowrate is available with this option.
Max. driving capacity 1000 Ohm @ 24VDC. (Requires power supply type PD / PF / PM).

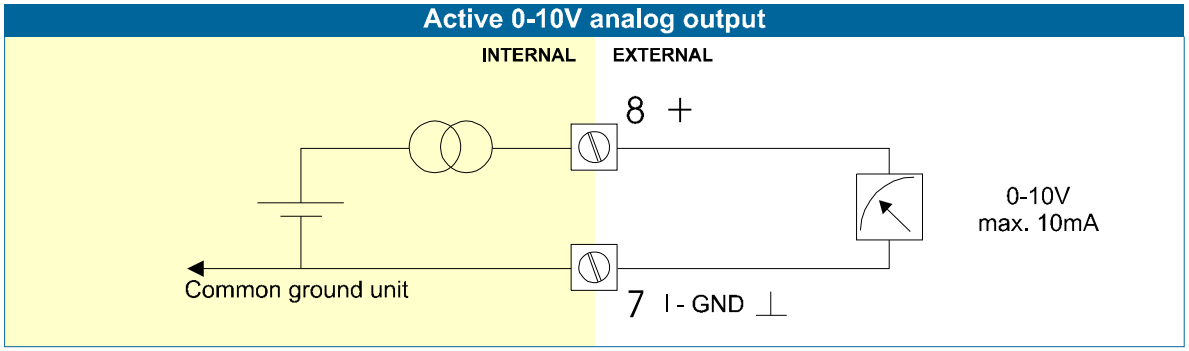


Type AF:
For the Intrinsically Safe floating 4-20mA signal: please read Chapter 5.

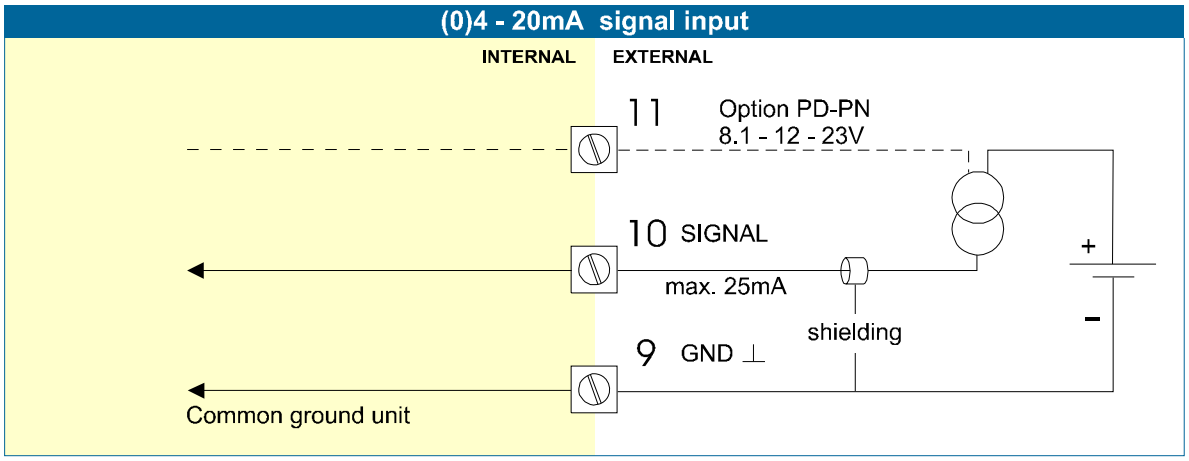
Type AI:
An isolated 4-20mA signal proportional to the flowrate is available with this option.
When the output is disabled, a 3.5mA signal will be generated on these terminals.
Max. driving capacity 1000 Ohm @ 30VDC.
This option can be battery powered but the life time of the battery is about 2 -3 years.



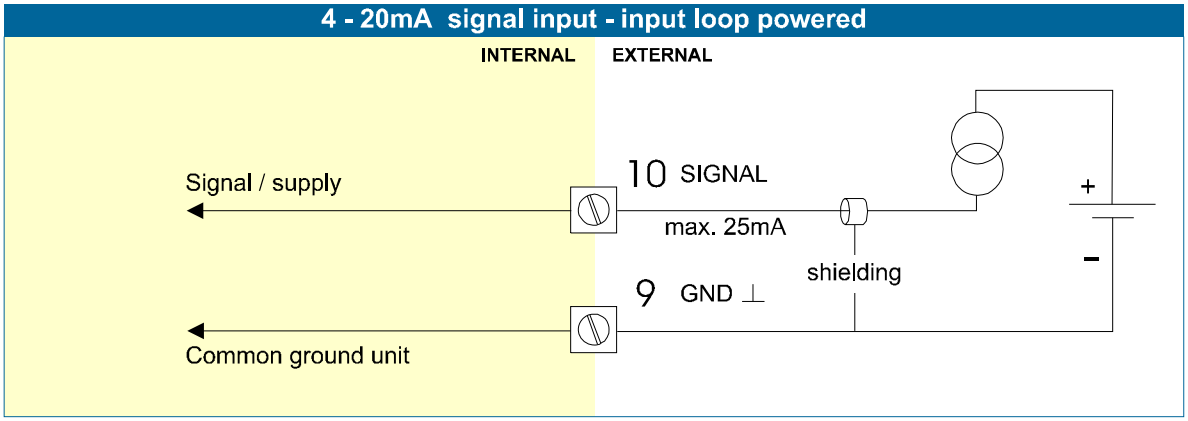
Type AU:
A 0-10VDC signal proportional to the flowrate is available with this option.
Max. load 10mA @ 10VDC. (Requires power supply type PD / PF / PM).



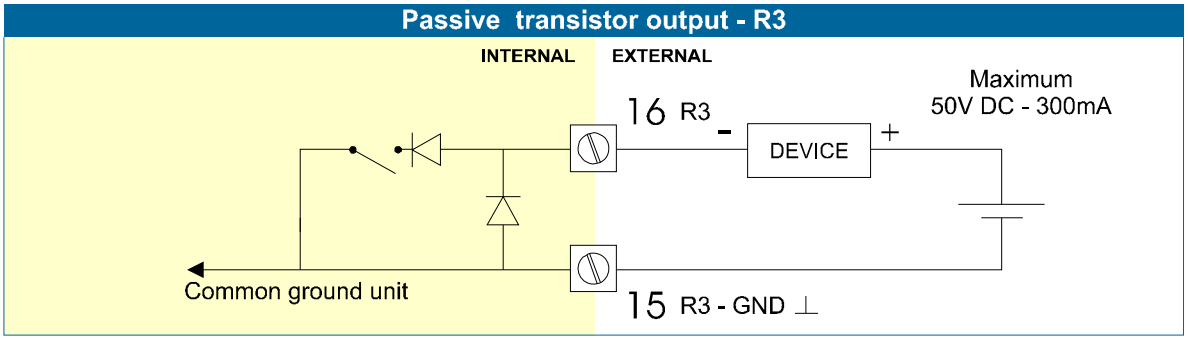
Terminal 09-11: Type A – Flowmeter input (general)
The F118-A requires a (0)4-20mA flowmeter signal which will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.
For Intrinsically safe applications (without input loop power): please read chapter 5.



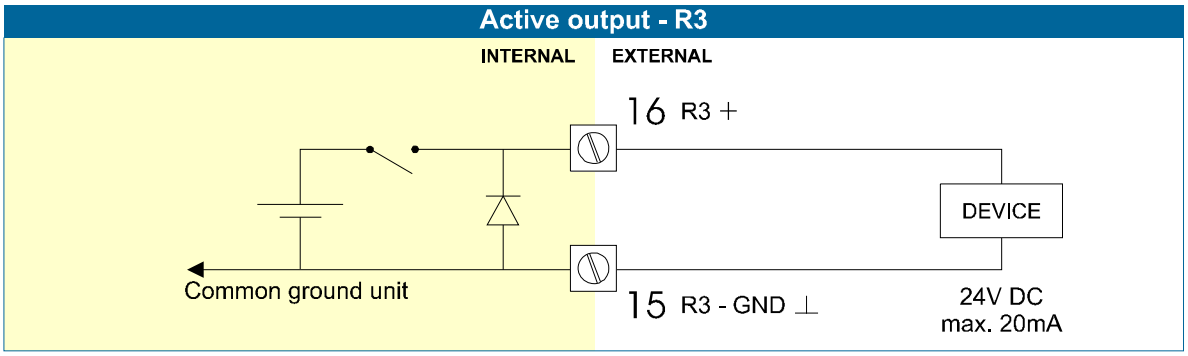
Terminal 09-10: Type A-PL – Flowmeter input / power supply:
The F118-A-PL requires a 4-20mA flowmeter signal which has a double function:
The signal will be processed 4 times a second with a 14 bits accuracy and the unit will be powered from the sensor signal (input loop powered). The input is not isolated and not intrinsically safe.



Terminal 14-15; transistor output R3:
This output is always a fast transistor output. With SETUP 8, the function of this output is set to a flowrate alarm output or pulse output.
If used as a pulse output: the maximum frequency of this output is 60Hz.



Type OA:
An active 24V DC flowrate alarm output or pulse output is available with this option.
Max. driving capacity 20mA@. (Requires power supply type PD / PF / PM).



Terminal 26 - 31: communication RS232/RS485 - type CB / CH / CI / CT:

- 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.

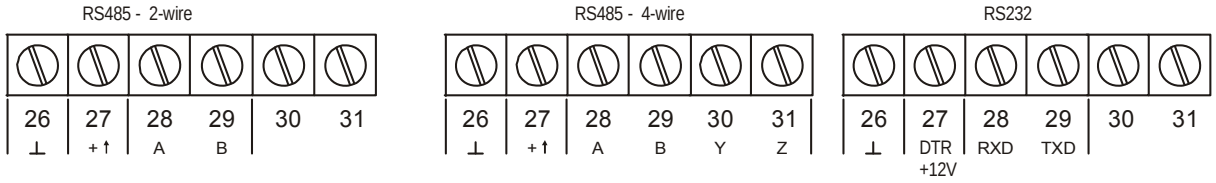


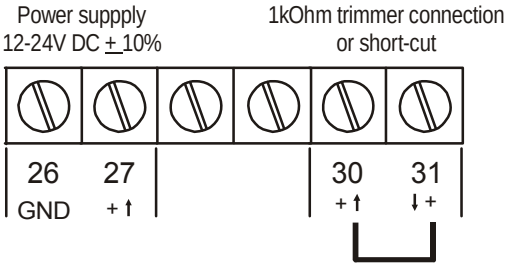
Fig. 11: Overview terminal connectors communication option.

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 separte supply between terminals 26 and 27 with a voltage between 8V and 24V.

Terminal 26-31: backlight option type ZB:

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.

Option type ZB: adjustable backlight



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.

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.

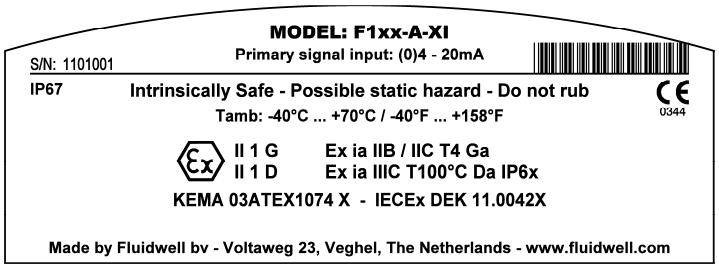

Note !

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.

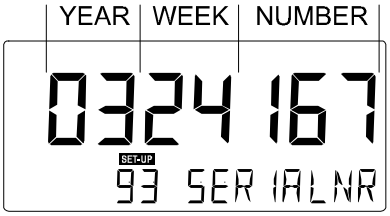
Label information (inside and outside the enclosure)

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..-..-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

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 (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 F118-A-XI:

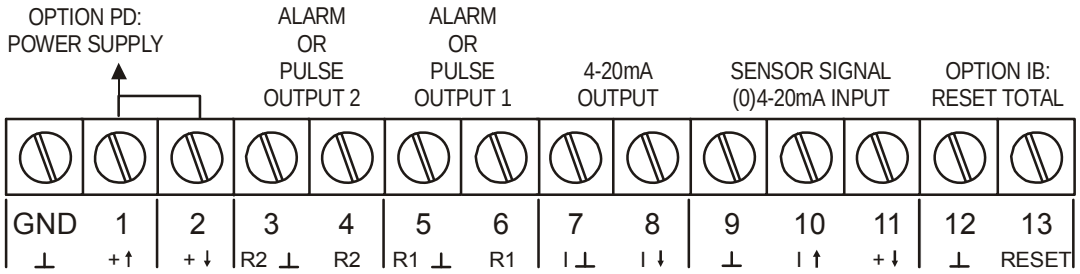
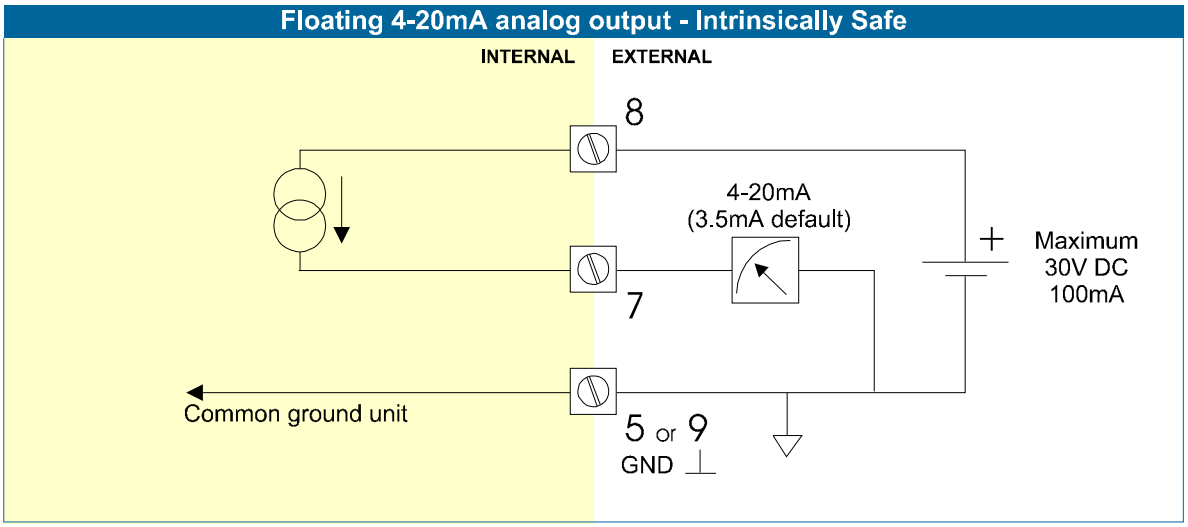


Fig. 12: Overview of Intrinisically Safe terminal connectors F118-A and options.

Explanation Intrinsically Safe options:

Option AF - Intrinsically Safe floating 4-20mA analog output:
A floating 4-20mA signal proportional to the flowrate is available with this option.
When the output is disabled, a 3.5mA signal will be generated.
Max. driving capacity 1000 Ohm @ 30VDC.



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

OPTION		SENSOR SUPPLY (TERMINAL 11 AND 14)	Terminal		
			GND	01	02
PD-XI	Input voltage: 8-30V DC	= input voltage	L-	L+	output voltage is according the input voltage; internally linked with terminal 01.

Terminal 02 and 11: these terminals offer the same voltage as connected to terminal 01.

5.3 CONFIGURATION EXAMPLES

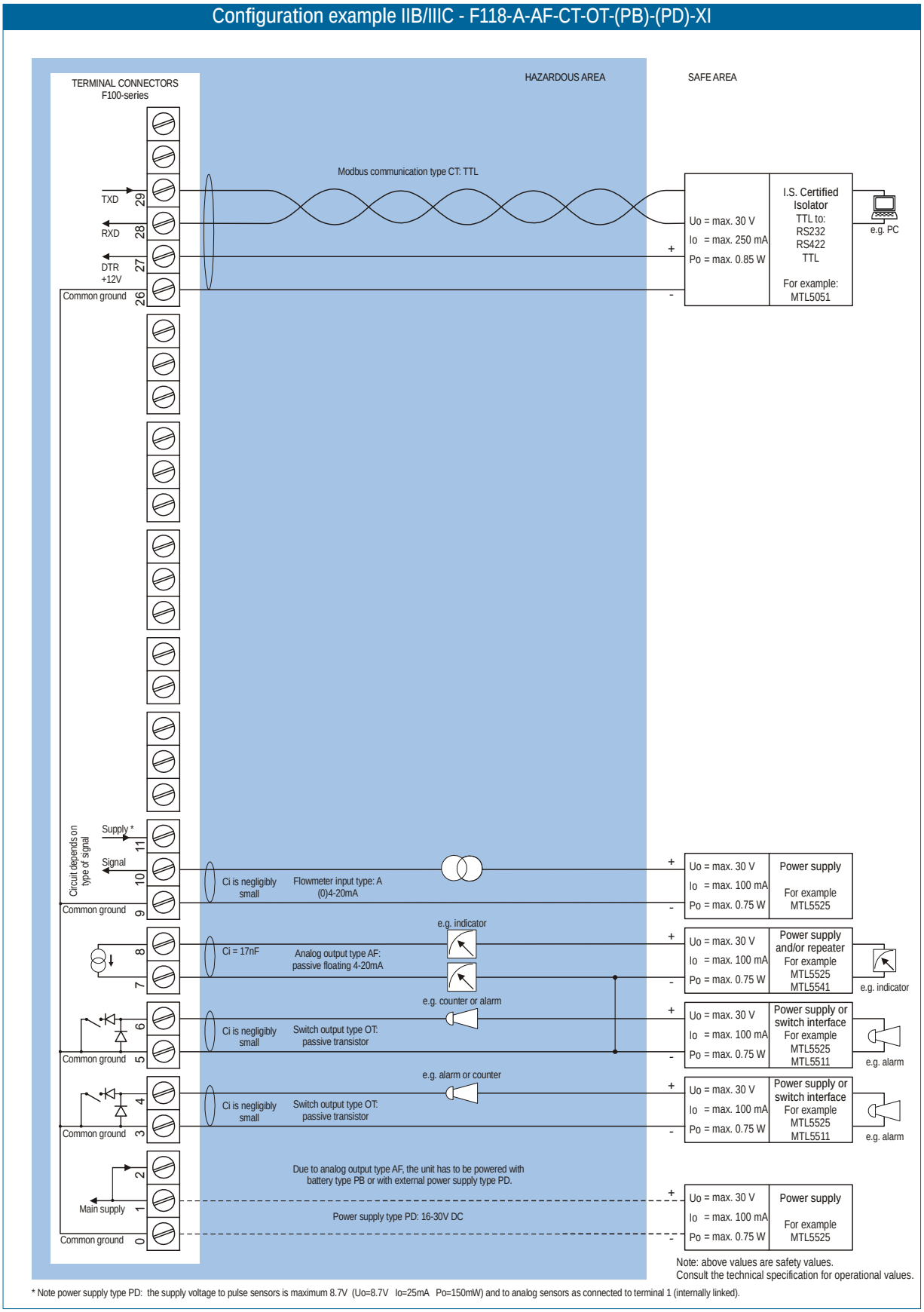


Fig. 13: Configuration example 1 Intrinsically Safe.

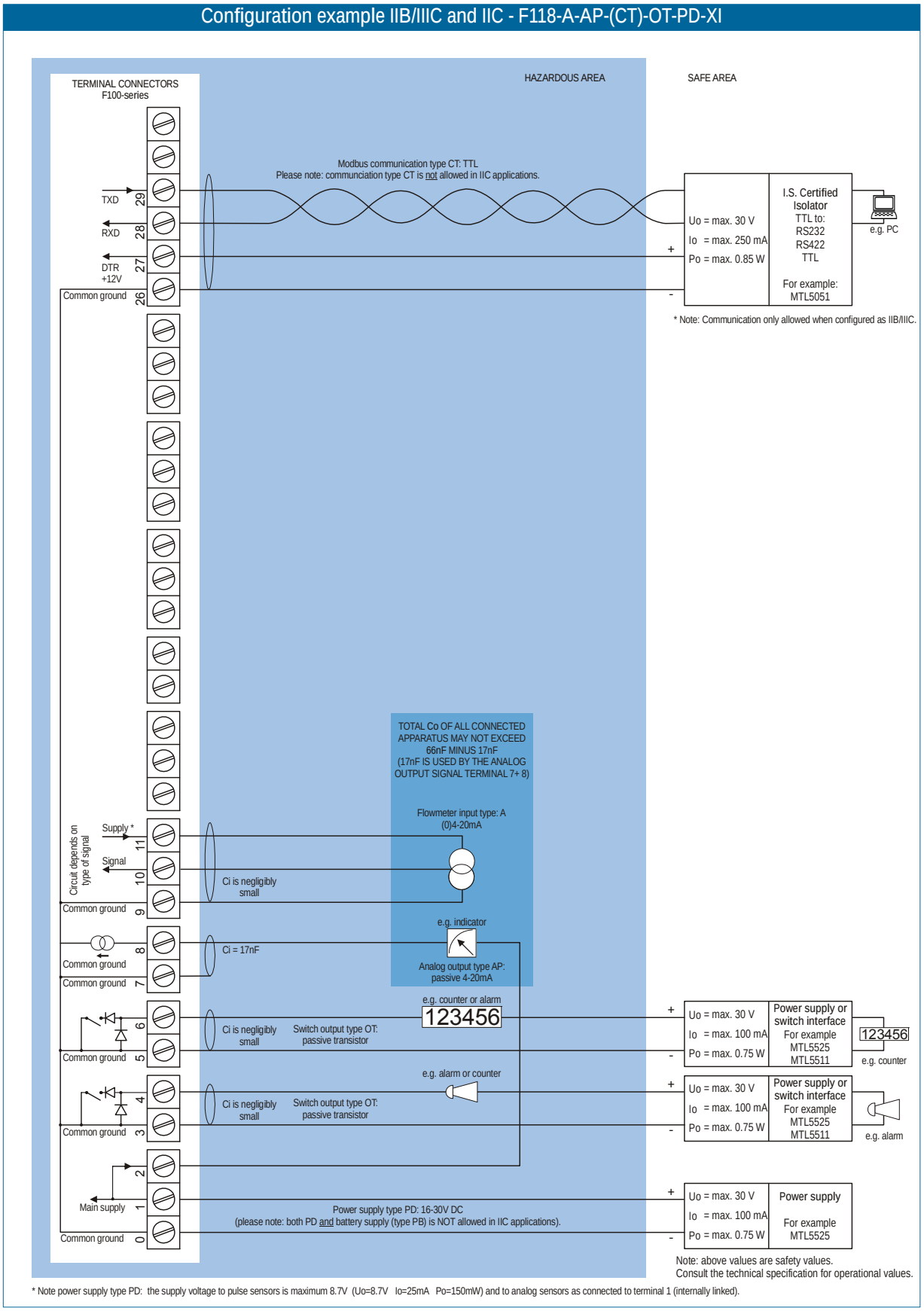


Fig. 14: Configuration example 2 Intrinsically Safe.

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.

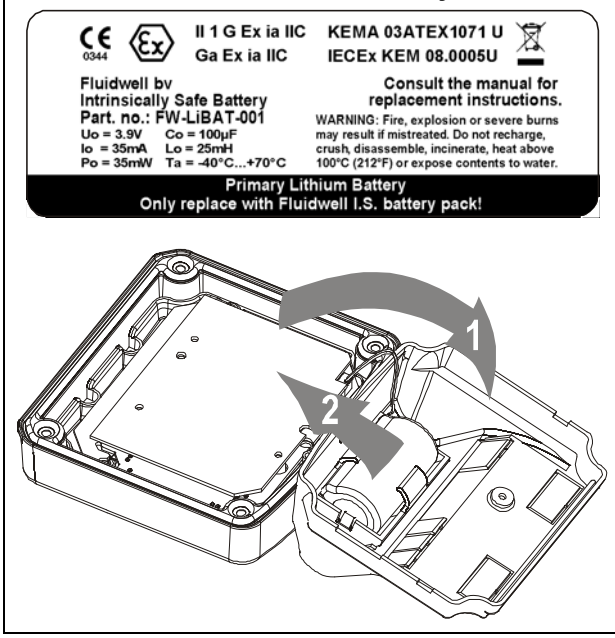
Safety instructions for hazardous areas

- 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 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.

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 F118-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 " in the front of this manual.*

The F118-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 customers responsibility to take all precautions to dehumidify the internal atmosphere of the F118-A in such a way that no condensation will occur, for example by placing dry silica-gel in the casing just before closing the enclosure.
Furthermore, is required to replace or dry the silica gel from time to time as advised by the silica gel supplier.

Battery life-time:
It is influenced by several issues as:
- Type of sensor: read chapter 3.2.3. NPN and PNP inputs consume more energy then coil inputs.
- Input frequency: the higher the frequency the shorter the battery life-time.
- Flowrate calculation: the lower number of pulses (SETUP 26) the shorter the battery life-time.
- Analog output signal; be sure that an external power supply is connected or that the function is disabled if not in use; else it has major influence on the battery life-time (SETUP 71).
- Display update: fast display update has major influence; SETUP 51.
- Pulse output and communication.
- 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 re-enter any subsequent K-factor alterations.
- The indication for low-battery.
- Clean the casing with soapy-water; don't 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-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
Aluminium 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 requirements	
Standard	Output loop powered: 8-28V DC (or AC) supply can be connected to power the unit.
Type PB	Long life Lithium battery - life-time depends upon settings - up to 5 years.
Type PD	8-28 V AC/DC.
Type PF	24-28V AC/DC.
Type PM	80-240V AC.

Sensor excitation	
Standard / type PB	Supply voltage: 3.2V DC for pulse signals and 1.2V DC for coil pick-up.
Type PD	Sensor supply: 8.2 - 12 and 24V DC - max. 50mA@24V DC
Type PF/PM	Sensor supply: 8.2 - 12 and 24V DC - max. 100mA@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 (optional)	
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: II 2 EEx d IIB T5. Weight appr. 20kg. Dimensions of enclosure: 278 x 358 x 270mm (10.94" x 14.09" x 10.63") LxHxD.

Environment	
Electromagnetic compatibility	Compliant ref: EN 61326 (1997), EN 61010-1 (1993), NAMUR NE21 (1998)

INPUTS

Flowmeter	
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.
Linearisation	15 positions with interpolation function; Meter-Factor versus percentage analog value.
Note	For signal type A and U: external power to sensor required; e.g. type PD.

OUTPUTS

Analog output	
Type	4-20mA - passive output - not isolated.
Resolution	10-bit.
Accuracy	< 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
Function	transmitting linearised flowrate.
Type AA	Active 4-20mA output (requires type PD, PF or PM).
Type AB	Active 0-20mA output (requires type PD, PF or PM).
Type AF	Floating 4-20mA output for Intrinsically Safe applications
Type AI	Galvanically isolated output - also for battery powered models.
Type AU	Active 0-10V output (requires type PD, PF or PM).

Transistor outputs	
Type OT	three passive transistor outputs - not isolated.
Load	max. 50V DC - 300mA
Function	User defined: flowrate alarm or pulse output.
Alarm output	low flowrate, high flowrate or flowrate alarm (both).
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 or PM).
Type OR	Electro-mechanical relay output; max. switch power 230V AC - 0,5A (requires type PD 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. • total and accumulated total. • total can be reset to zero by pressing the CLEAR-key twice. • alarm value's low and high flowrate • alarm value's can be entered (this function can be disabled)

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.

Accumulated total	
Digits	11 digits.
Units / decimals	according 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.

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

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F118-A is going to be installed or while it is in operation.

Flowmeter does not generate pulses:
Check:
- Signal selection SETUP - 51,
- 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,
- Type of signal with actual signal selection - SETUP - 51,
- Sensitivity of coil input - SETUP - 51 and par. 4.4.3.
- Proper grounding of the F118-A - par. 4.4.1.
- Use screened wire for flowmeter signals and connect screen to terminal 9.

Analog output does not function properly:
Check:
- SETUP 71 - is the function enabled?
- SETUP 72 / 73: are the flow-levels programmed correctly?
- connection of the external power-supply according specification.
- SETUP 27 - when 4mA should be generated as soon as the flowrate is zero, it might take this time worst case. To get a quick response, decrease this time according to you desired response time.

Pulse output does not function:
Check:
- SETUP 81 - pulse per X-quantity; is the value programmed reasonable and will the maximum output be under 20Hz?
- SETUP 82 - 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: are the K-factor and time unit correct?
- SETUP 26 / 27: The unit has to count the number of pulses according to SETUP 26 within the time according to SETUP 27. Make sure that 27 is set like 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.

The password is unknown:
If the password 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

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 F118-A specific variables; other common variables are described in the standard table.
- All numbers are decimal numbers, unless otherwise noted.
- 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.

CONFIGURATION VARIABLES F118-A - SETUP-LEVEL:				
VAR	**DESCRIPTION**	**BYTES**	**VALUE**	**REMARKS**
TOTAL				
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)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR37)
37 (25h)	decimals Span	1	0…6	
FLOWRATE				
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 13=scf 14=NM3 15=NL 16=p	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0…3	
51 (33h)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals span	1	0…6	

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)
205 CDh	delay time alarm min. flowrate	2	1…9,999	steps of 0.1 second
DDh	delay time alarm max. flowrate	2	1…9,999	steps of 0.1 second
44h	edit flowrate alarm	1	0=operator 1=SETUP level	
46h	alarm at flowrate zero	1	0=ignore 1=default 2=no relay	
68 (44h)	set flowrate monitor	1	0=operator level 1=SETUP level	
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				
98 (62h)	formula	1	0=linear 1=square root	
99 (63h)	filter	1	0….99	
100 (64h)	cut-off	2	0….999	steps of 0.1%
102 (66h)	calibration low (4mA)	1	0=default 1=calibrate 2=cal set	
103 (67h)	calibration high (20mA)	1	0=default 1=calibrate 2=cal set	
LINEARISATION				
10244 00h	linearisation table entry	6	m=0..9999999 / f=0..99999	**INDEXED** 3 bytes m-factor MS-part 3 bytes freq. LS-part. | m | m | m | f | f | f | MSB……..….LSB
10384 0Eh	linearisation on/off	1	0=disable 1=enable	
ANALOG OUTPUT				
112 (70h)	analog output	1	0=disable 1=enable	
113 (71h)	minimum rate	3	0..9999999	unit, time, decimals acc. var48-50
116 (74h)	maximum rate	3	0..9999999	unit, time, decimals acc. var48-50
120 (78h)	tune minimum rate	2	0..9999	
122 (7Ah)	tune maximum rate	2	0..9999	

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
PULSE OUTPUT				
128 (80h)	impulse width	1	0=off 1=short 2=long	
129 (81h)	pulse per X quantity	3	1..9999999	unit, decimals acc. var32 -33
OTHERS				
168 (A8h)	password	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER F118-A VARIABLES FOR COMMUNICATION

TOTAL - variable number 566 (236h) – 6 bytes

Read total: The value of total read using communication 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 - variable number 560 (230h) – 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: Impossible.

When reading or writing total or accumulated total it should be noted that the used values are given including the decimals. This means 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 $10^{-(\text{total decimals})}$

FLOWRATE - variable number 572 (23Ch) – 4 bytes

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

Write flowrate: Impossible.

INDEX OF THIS MANUAL

LIST OF FIGURES IN THIS MANUAL

NOTES

LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL			
11 unit	L		
12 decimals	0000000		
13 span	001600 /sec	/sec	/sec
14 decimals span	0		
2 - FLOWRATE			
21 unit	L		
22 time unit	/sec		
23 decimals	0000000		
24 span	001600 /min		
25 decimals span	0		
3 - ALARM		Enter your settings here	
31 alarm set	operator level		
32 flow zero	Ignore		
33 alarm value low	0		
34 alarm value high	0		
35 delay time alarm low	0.0 sec		
36 delay time alarm high	0.0 sec		
4 - POWER MANAGEMENT			
41 LCD-new	1 sec.		
42 mode	operational		
5 - FLOWMETER			
51 formula	interpolation		
52 filter	01 (off)		
53 cut-off %	00.0%		
54 calibrat. low-(0)4mA	default		
55 calibrat. high-20mA	default		
6 - LINEARISATION			
61 percentage %	0.0%		
M-Factor	1.000000		
62 percentage %	0.0%		
M-Factor	1.000000		
63 percentage %	0.0%		
M-Factor	1.000000		
64 percentage %	0.0%		
M-Factor	1.000000		
65 percentage %	0.0%		
M-Factor	1.000000		
66 percentage %	0.0%		
M-Factor	1.000000		
67 percentage %	0.0%		
M-Factor	1.000000		
68 percentage %	0.0%		
M-Factor	1.000000		
69 percentage %	0.0%		
M-Factor	1.000000		
6A percentage %	0.0%		
M-Factor	1.000000		
6B linearisation	disabled		

SETTING	DEFAULT	DATE :	DATE :
7 - ANALOG OUTPUT			
71 output	Disabled		
72 min. flowrate 4-mA	0000000		
73 max. flowrate 20mA	9999999		
74 tune min - 4mA	0160		
75 tune max - 20mA	6656		
8 - RELAY OUTPUT			
81 relay1	off		
82 relay 2	off		
83 relay 3	off		
84 impulse width	000 periods		
85 pulse per	0001000		
9 - COMMUNICATION			
91 baud-rate	2400		
92 address	1		
93 mode	BUS-RTU		
A - OTHERS			
A4 password	0000		
A5 tagnumber	0000000		

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