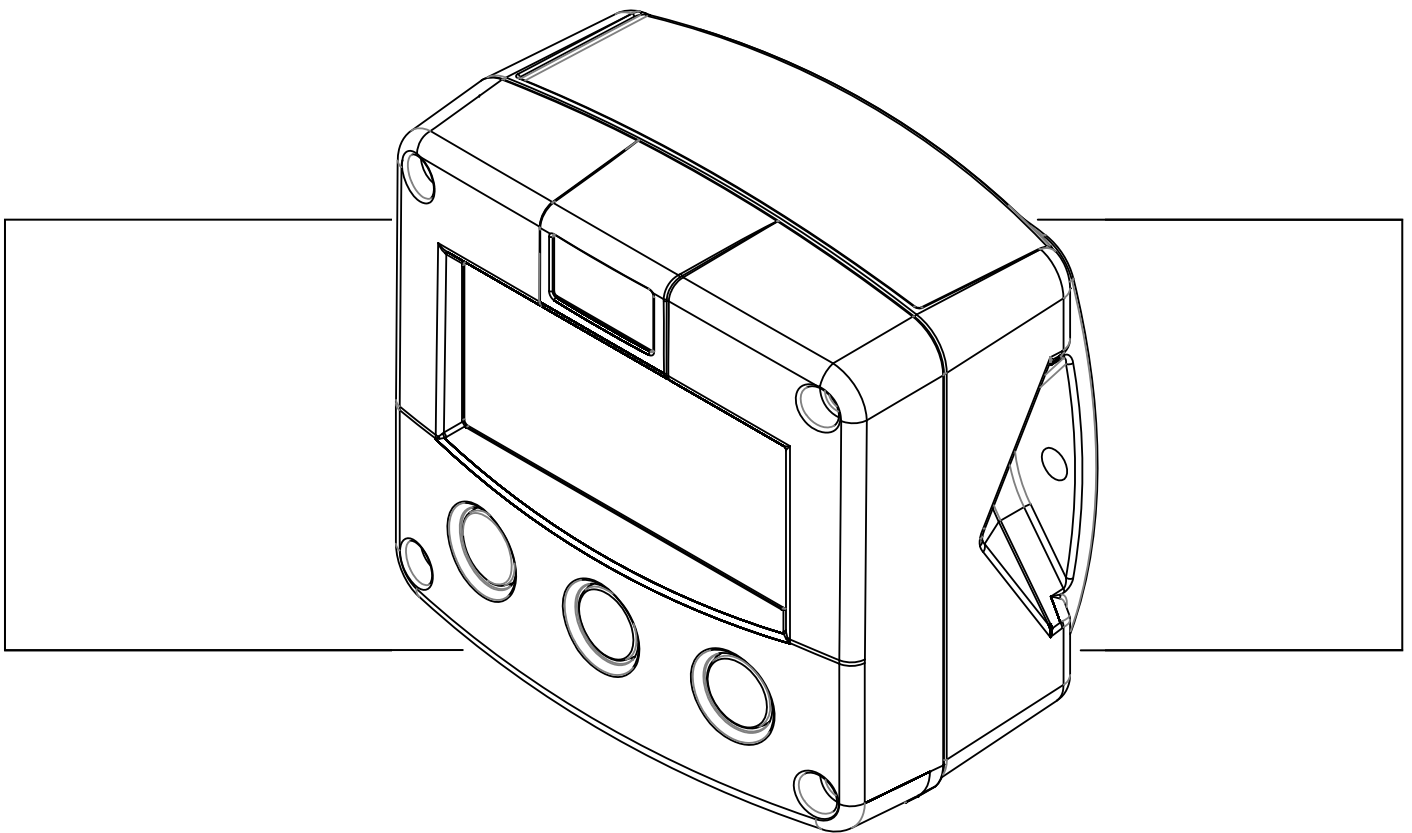# F113-A-AP-Hx-OS-PD-Xx-Zx

FLOWRATE INDICATOR / TOTALIZER

WITH FOUR HIGH / LOW FLOWRATE ALARMS

Signal input flowmeter: (0)4-20mA

Analog output: (0)4-20mA / 0-10V reflecting flowrate

Switch outputs: four scaled pulse or flowrate alarm outputs

Options: Modbus communication and backlight

$C\epsilon$

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 F113-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 F113-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.**

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 F113-A-OS 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 F113-A-OS 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 F113-A-OS 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 F113-A-OS or connected instruments.

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F113-A-OS or connected instruments.

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

Hardware version	:	02.01.xx
Software version	:	02.05.xx
Manual	:	HF113AEN_OS_v0501_05
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CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F113-A-OS

Functions and features

The flowrate / totalizer model F113-A-OS is a microprocessor driven instrument designed to display flowrate, total and accumulated total as well as the monitoring of the flowrate for high / low values. This product has been designed with a focus on:

- ultra-low power consumption to allow long-life battery powered applications (type PB),
- several mounting possibilities with aluminum or GRP enclosures for harsh industrial surroundings,
- ability to process all types of flowmeter signals,
- transmitting possibilities with analog / pulse / alarm and communication (option) outputs.

Flowmeter input

This manual describes the unit with a <u>analog type</u> 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 F113-A. To power the sensor, several options are available.

Standard outputs

- Max. four configurable alarm outputs: flowrate alarm, high-, low-, high-high- or low-low-flowrate alarm. Switched as long as the flowrate is too high or too low.
- Max. four configurable pulse outputs: a scaled pulse mirroring a certain totalized quantity. Maximum frequency 0.5Hz.; 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 flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.
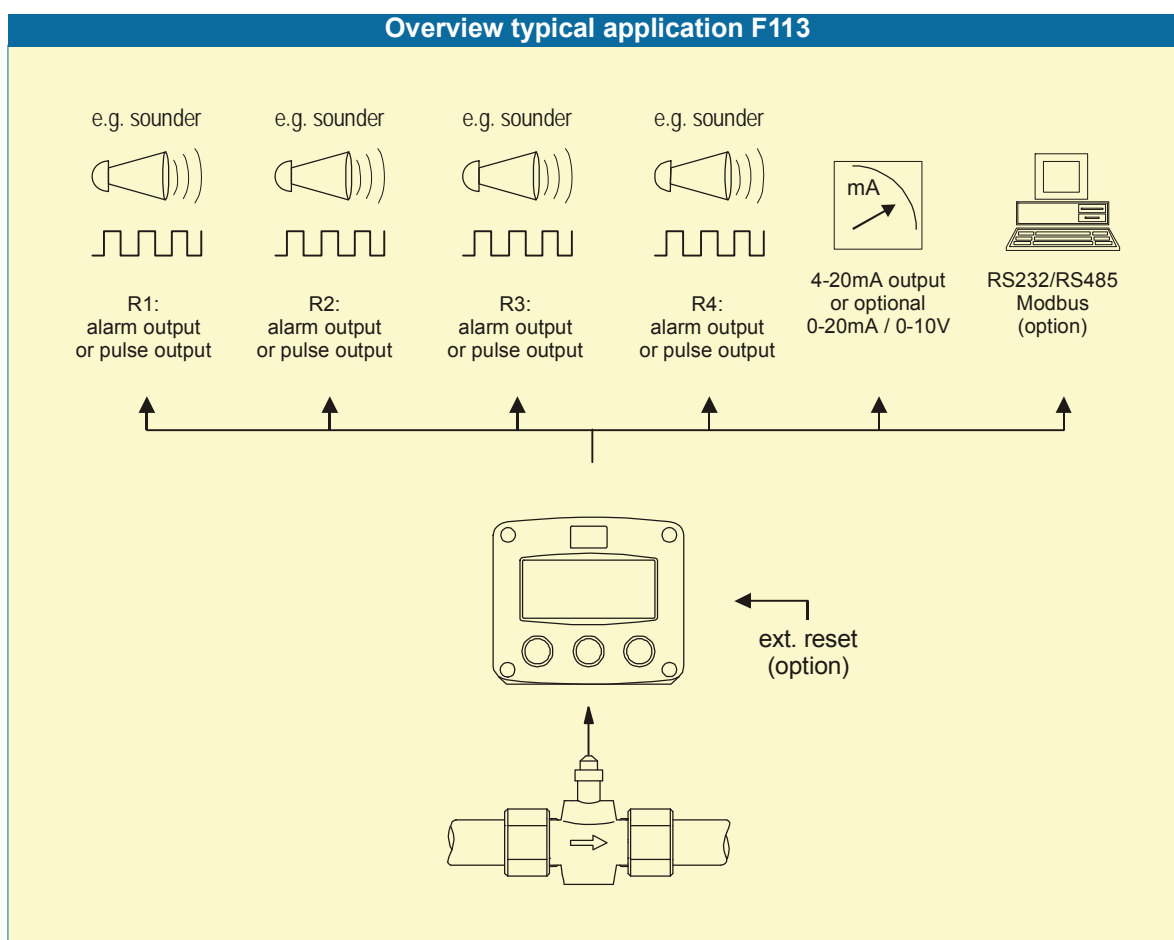

Fig. 1: Typical application for the F113-A-OS.

Configuration of the unit
The F113-A-OS was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F113-A-OS according to your specific requirements. SETUP includes several important features, such as Span, measurement units etc. All setting are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery. To extend the battery-life time (option), please make use of the power-management functions as described in chapter 3.2.3.

Display information
The unit has a large transflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.
Flowrate and totals 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
The 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, mechanical relay or active outputs, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure.

2. OPERATIONAL

2.1. GENERAL

Caution !

The F113-A-OS 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 F113-A-OS. This instruction is meant for users / operators.

2.2. CONTROL PANEL

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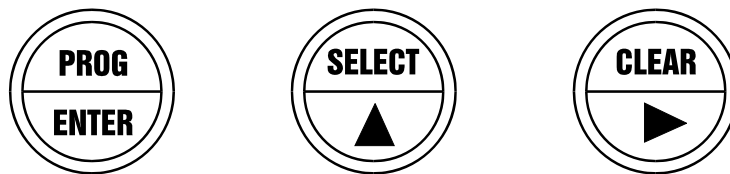
Fig. 2: Control Panel.

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 F113-A-OS will always function at Operator level. The information displayed is dependant upon the SETUP-settings. The signal generated by the connected flowmeter is measured by the F113-A-OS in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.

Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

▪ **Display flowrate / total or flowrate**
This is the main display information of the F113-A-OS. After selecting any other information, it will always return to this main display automatically.
Total is displayed on the upper-line of the display and flowrate on the bottom line.
It is possible to display flowrate only with the large 17mm digits; in this instance press the SELECT-key to read the total.
When "-------" is shown, then the flowrate value is too high to be displayed. The arrows ⬍ indicate the increase/decrease of the flowrate trend.

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

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

▪ **Programming the flowrate alarm values**

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

Note !

When the SELECT-key is pressed a few times, following flowrate alarm values are displayed:
  ▪ low-low flowrate alarm (LL): enter here 20 L/min for example,
  ▪ low flowrate alarm: enter here 40 L/min for example,
  ▪ high flowrate alarm: enter here 200 L/min for example,
  ▪ high-high flowrate alarm (HH): enter here 250 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", "HI RATE", "LO-LO RATE" or "HI-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 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. 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 F113-A-OS 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 F113-A-OS 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 F113-A-OS remains fully operational.

Note !

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

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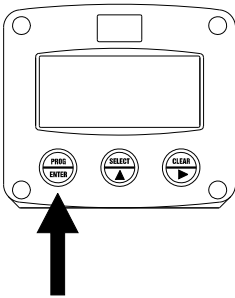
Press (PROG ENTER) for 7 seconds

Matrix structure SETUP-level:

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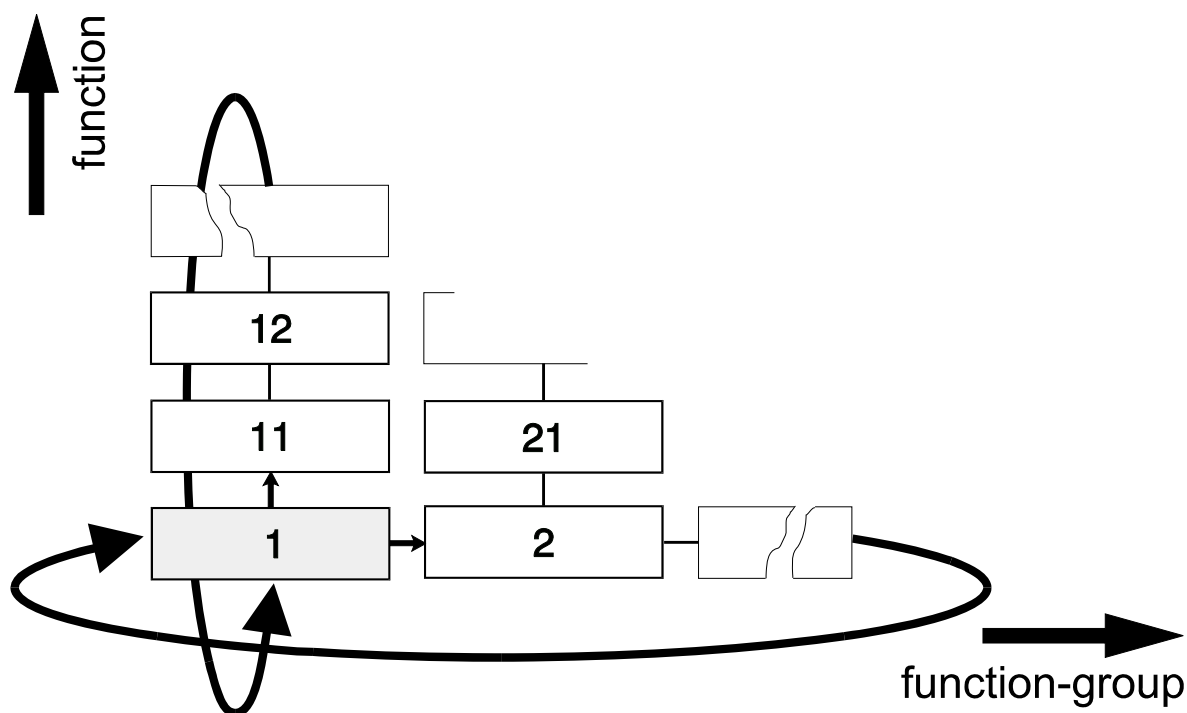
Selection of function-group and function:
SETUP is divided into several function groups and functions.
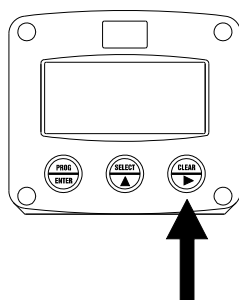
Select function-group with CLEAR ▶
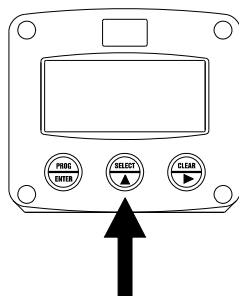
Select function with SELECT ▲

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

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

To change or select a value:
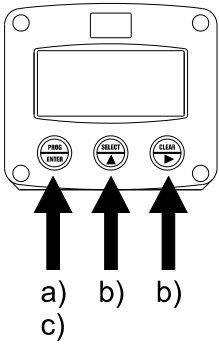
a) press (PROG ENTER) briefly; `PROGRAM` will start flash

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

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

a) b) b)
c)

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

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

Note !

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

To return to OPERATOR-level:
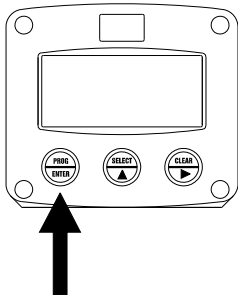
Press (PROG ENTER) for 3 seconds

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

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	14	SPAN	0.000001 - 999,999 unit/second
	13	DECIMALS SPAN	0 - 6
2	**FLOWRATE**		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	SPAN	0.000001 - 999,999 unit/time-unit
	25	DECIMALS SPAN	0 - 6
3	**ALARM**		
	31	FLOWZERO	default - no relays - ignore
	32	ALARM LOW-LOW	0000.000 - 9,999,999
	33	ALARM LOW	0000.000 - 9,999,999
	34	ALARM HIGH	0000.000 - 9,999,999
	35	ALARM HIGH-HIGH	0000.000 - 9,999,999
	36	DELAY ALARM low-low	0.1 - 999.9 seconds
	37	DELAY ALARM LOW	0.1 - 999.9 seconds
	38	DELAY ALARM HIGH	0.1 - 999.9 seconds
	39	DELAY ALARM high-high	0.1 - 999.9 seconds
4	**DISPLAY**		
	41	SET ALARM	operator - setup
	42	FUNCTION	total - flowrate
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	(0)4mA
	65	CALIBRATE HIGH	20mA
7	**ANALOG**		
	71	OUTPUT	disable - enable
	72	4mA / 0V	0000.000 - 9,999,999
	73	20mA / 10V	0000.000 - 9,999,999
	74	CUT-OFF	0.0 - 9.9%
	75	TUNE MIN - 4mA / 0V	0 - 9,999
	76	TUNE MAX- 20mA / 10V	0 - 9,999
	77	FILTER	00 - 99
8	**IMPULSE**		
	81	OUTPUT R1	high - low - high-high - low-low - rate - pulse
	82	OUTPUT R2	high - low - high-high - low-low - rate - pulse
	83	OUTPUT R3	high - low - high-high - low-low - rate - pulse
	84	OUTPUT R4	high - low - high-high - low-low - rate - pulse
	85	PERIOD TIME	0 - 250
	86	IMPULSE PER	X,XXX,XXX quantity
9	**COMMUNICATION**		
	91	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	92	ADDRESS	1 - 255
	93	MODE	ASCII - RTU - off
A	**OTHERS**		
	A1	TYPE / MODEL	F113-A
	A2	SOFTWARE VERSION	_ _._ _._ _
	A3	SERIAL NO.	#######
	A4	PASS CODE	0000 - 9999
	A5	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION OF 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 (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: **Example 1** **Calculating the Span.** *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".* **Example 2** **Calculating the Span.** *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".*
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 - scf - Nm3 - NL - P. 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 (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: **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 the 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)!

Note !

3 - ALARM	
With these settings, it is determined how the flowrate will be monitored and the functionality of the relay outputs (terminals 10-17) be determined. *Note: for relay output functions: read also SETUP 8 "relays".*	
FLOW ZERO **31**	When the <u>flowrate is zero</u>, 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 - LOW** **32**	The low-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 **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.
ALARM VALUE **HIGH - HIGH** **35**	The high-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 - LOW** **36**	An alarm generated by SETUP 32 "low-low" can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM **LOW** **37**	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** **38**	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.
DELAY TIME ALARM **HIGH - HIGH** **39**	An alarm generated by SETUP 35 "high-high" can be ignored during X-time period. If the actual flowrate is still incorrect after this delay time, then an alarm will be generated.

4 - DISPLAY

SET ALARM 41	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.
FUNCTION 42	The large 17mm digits can be set to display total or flowrate. When "total" is selected, both total and flowrate are displayed simultaneously. When "flowrate" is selected, only flowrate will be displayed with it's measuring unit while total will be displayed after pressing SELECT.

5 - POWER MANAGEMENT

When used with the internal battery option (no option for the F113-A-OS), the user can expect reliable measurement over a long period of time. The F113-A-OS 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; the signal will be processed 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 FAST update: about 3 years.* *battery life-time with a 1 sec update: about 7 years.* *Note: after a button has been pressed by the operator - the display refresh rate will always switch to FAST for 30 seconds. When "OFF" is selected, the display will be switched off after 30 seconds and will be switched on as soon as a button has been pressed.*
BATTERY-MODE 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 process the signal, the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the unit again, press the SELECT-key twice.

Note !

5 - FLOWMETER	
SIGNAL **51**	The F113-A can process the 4-20mA signal in two ways: ▪ Interpolation: the signal is processed linear $$R = S \times I$$ ▪ 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**	The analog output signal of a flowmeter does mirror the actual flow. This signal is measured several times a second by the F113-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. 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:

Note !

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

6 - FLOWMETER (CONTINUED)

| CUT-OFF 63 | 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 61)	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 64 | 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. |

WARNING

| TUNE MAX / 20MA 65 | 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. |

WARNING

7 - ANALOG OUTPUT

A linear analog (0)4-20mA or 0-10V signal is generated according to the flowrate with a 10 bits resolution. The settings for flowrate (SETUP - 2) influence the analog output directly.
The relationship between rate and analog output is set with the following functions:

DISABLE / ENABLE 71	The analog output can be disabled. 3.5mA will be generated if a power supply is available but the output is disabled (this is not valid in case type AB or AU has been supplied).
MINIMUM FLOWRATE 72	Enter here the flowrate at which the output should generate the minimum signal (0/4mA or 0V) - in most applications at flowrate "zero". The number of decimals displayed depend upon SETUP 23. The time and measuring units (L/min for example) are dependant upon SETUP 21 and 22 but are not displayed.
MAXIMUM FLOWRATE 73	Enter here the flowrate at which the output should generate the maximum signal (20mA or 10V) - in most applications at maximum flow. The number of decimals displayed depend upon SETUP 23. The time and measuring units (L/min for example) are dependant upon SETUP 21 and 22 but can not be displayed.
CUT-OFF 74	To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16mA, (or 20mA or 10V). When the flow is less than the required rate, the current will be the minimum signal (0/4mA or 10V). **Examples:**

4mA (SETUP 72)	20mA (SETUP 73)	CUT-OFF (SETUP 74)	REQUIRED RATE	OUTPUT
0 L/min	100 L/min	2%	(100-0)*2% = 2.0 L/min	4+(16*2%) = 4.32mA
20 L/min	800 L/min	3.5%	(800-20)*3.5%= 27.3 L/min	4+(16*3.5%)=4.56mA

TUNE MIN / 4MA 75	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. Before tuning the signal, be sure that the analog signal is not being used for any application! After pressing PROG, the current will be about 4mA (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!	⚠ **WARNING**
TUNE MAX / 20MA 76	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. Before tuning the signal, be sure that the analog signal is not being used for any application! After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is <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!	⚠ **WARNING**

7 - ANALOG OUTPUT (CONTINUED)

FILTER 77	This function is used to stabilize the analog output signal. The output value is updated every 0.1 second. With the help of this digital filter a more stable but less precise 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 their 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	0.1 second	0.2 second	0.4 second	0.7 second
03	0.2 second	0.4 second	0.6 second	1.2 seconds
05	0.4 second	0.7 second	1.1 seconds	2.1 seconds
10	0.7 second	1.4 seconds	2.2 seconds	4.4 seconds
20	1.4 seconds	2.8 seconds	4.5 seconds	9.0 seconds
30	2.1 seconds	4 seconds	7 seconds	14 seconds
50	3.5 seconds	7 seconds	11 seconds	23 seconds
75	5.2 seconds	10 seconds	17 seconds	34 seconds
99	6.9 seconds	14 seconds	23 seconds	45 seconds

8 - RELAY OUTPUT

These settings determine the function of the switch outputs.

Note: the alarm settings - SETUP 3 - need to correspond with the selections below.

Note: For pulse output functions: as mechanic relay outputs have been supplied, do limit the output frequency to max. 0.5Hz,, else the life time will be reduced significantly.

OUTPUT R1 81	Assign the output function to R1: high alarm, low alarm, high-high alarm, low-low alarm, flowrate alarm or pulse output.
OUTPUT R2 82	Assign the output function to R2: high alarm, low alarm, high-high alarm, low-low alarm, flowrate alarm or pulse output.
OUTPUT R3 83	Assign the output function to R3: high alarm, low alarm, high-high alarm, low-low alarm, flowrate alarm or pulse output.
OUTPUT R4 84	Assign the output function to R4: high alarm, low alarm, high-high alarm, low-low alarm, flowrate alarm or pulse output.

Note !

Note !

Continued next page >>>

8 - RELAY OUTPUT (CONTINUED)

PERIOD TIME **PULSE OUTPUT** **85**	The period time determines the time that the 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:*** • *As mechanic relays are used for the pulse output(s), it is recommended to reduce the max. output frequency to 0.5Hz, else the life time will be reduced significantly.* • *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
64	0,5000 seconds	1 Hz.
255	1,9922 seconds	0.25 Hz.

PULSE PER **86**	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)

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 **91**	For external control, the 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 F113-A-OS. This address can vary from 1-255.
MODE **93**	The communication protocol is Modbus ASCII or RTU mode. Select OFF, to disable this communication function.

A - OTHERS

|	
TYPE OF MODEL **A1**	For support and maintenance it is important to have information about the characteristics of the F113-A-OS. 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 F113-A-OS. 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 F113-A-OS. 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 **A4**	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 **A5**	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

4. INSTALLATION

4.1. GENERAL DIRECTIONS

Caution !

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F113-A-OS 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
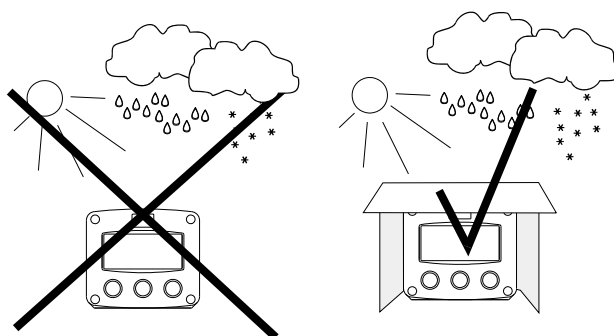
Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions.
When panel-mounted, the unit is IP65 (NEMA 4X)!
When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.
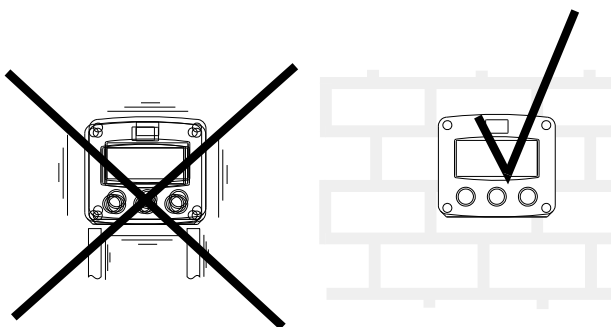
Mount the F113-A-OS on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE
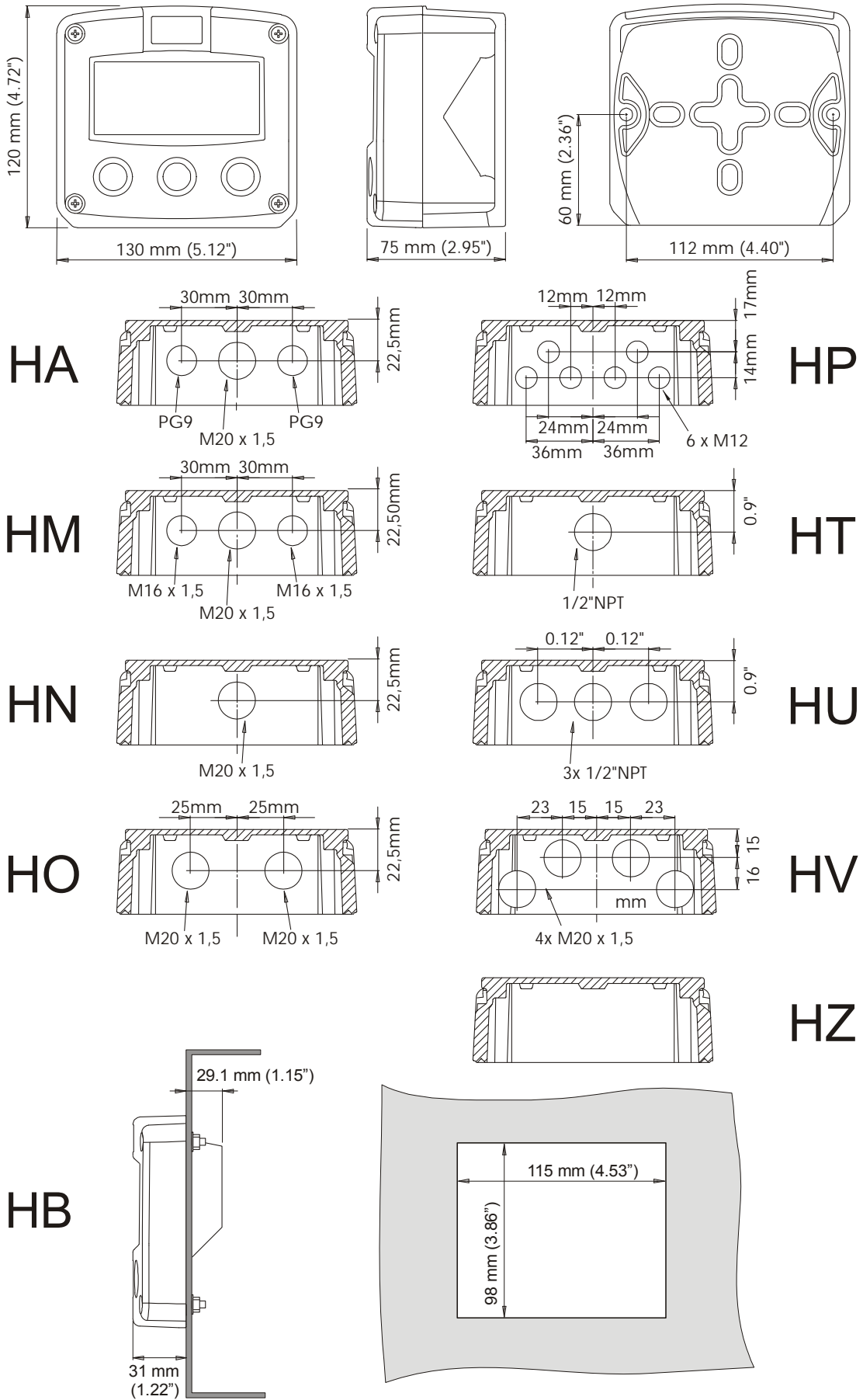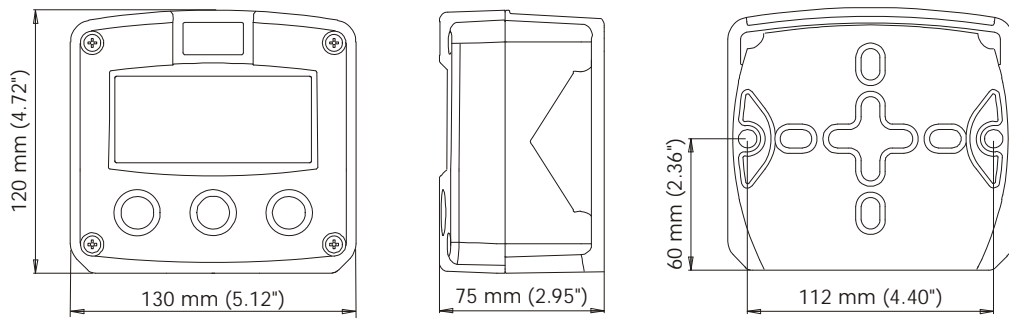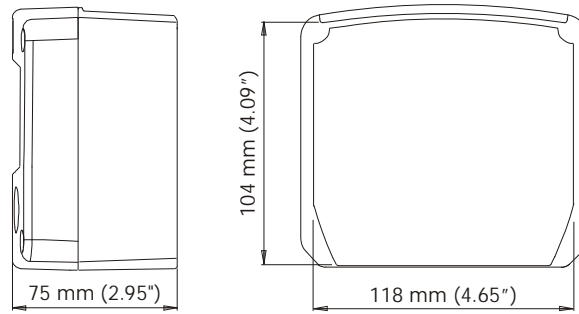**Aluminum enclosures:**

HA

HM

HN

HO

HP

HT

HU

HV

HZ

HB

Fig. 7: Dimensions aluminum enclosures.

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GRP enclosures:

120 mm (4.72")

130 mm (5.12")

75 mm (2.95")

60 mm (2.36")

112 mm (4.40")

HK back box:
(flat bottom)

104 mm (4.09")

75 mm (2.95")

118 mm (4.65")

HD
HK

25mm   25mm

22.5mm

HG

D=20mm   D=20mm

HE

30mm   30mm

22.5mm

D=16mm   D=16mm
D=20mm

HH

12mm 12mm

17mm

14mm

24mm   24mm   D=12mm
36mm   36mm

HF

0.9"

D=22mm (0.866")

HJ

0.12"   0.12"

0.9"

3x D=22mm (0.866")

HC

29.1 mm (1.15")

31 mm
(1.22")

115 mm (4.53")

98 mm (3.86")
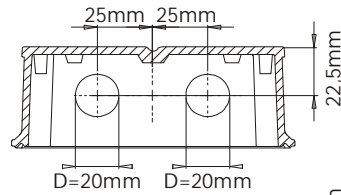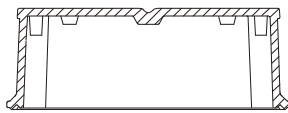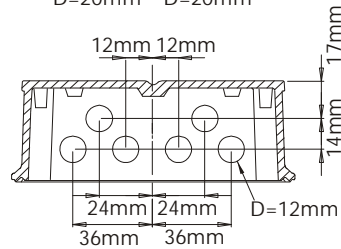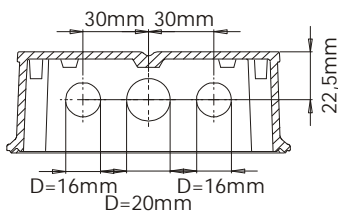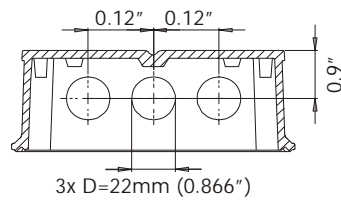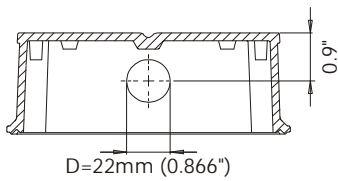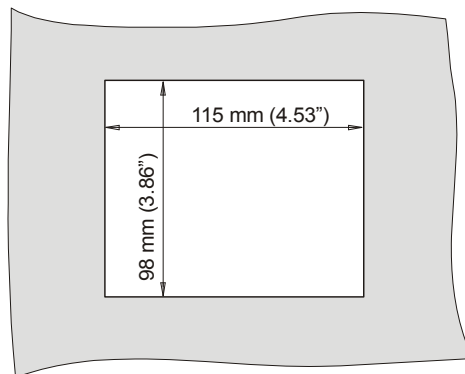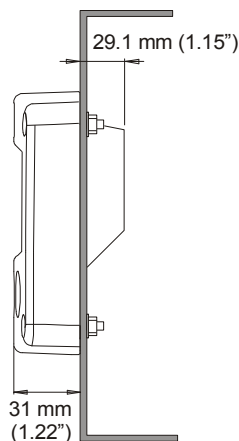
Fig. 8: Dimensions GRP enclosures.

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4.4. INSTALLING THE HARDWARE

4.4.1. INTRODUCTION

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

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

⚠ **WARNING**
Aluminum enclosures
- When installed in an aluminum enclosure and a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.

- Do ground the aluminum enclosure properly as indicated, if the F113-A-OS 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.
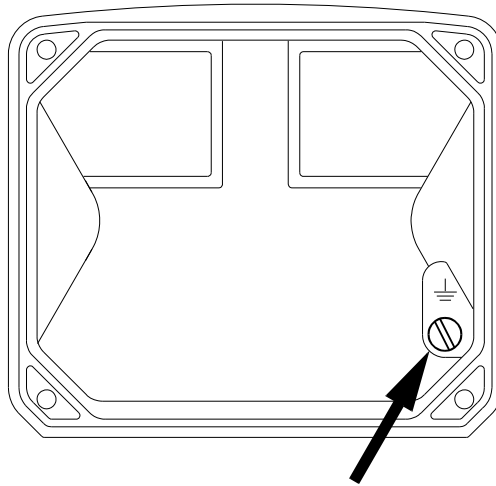
Fig. 9: Grounding aluminum enclosure with type PM 115-230V AC.

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

Option PD: Sensor supply: 3.2V, 8.2V, 12V or 24 V:
With this option, a real power supply for the sensor is available. The sensor can be powered with 8.2, 12 or 24 V DC (max. 50mA@24V). The voltage is selected by the three switches inside the enclosure.

First, remove the terminal strip(s) after which the internal plastic cover can be removed. The switches are located in the top left corner (option PD) as indicated:
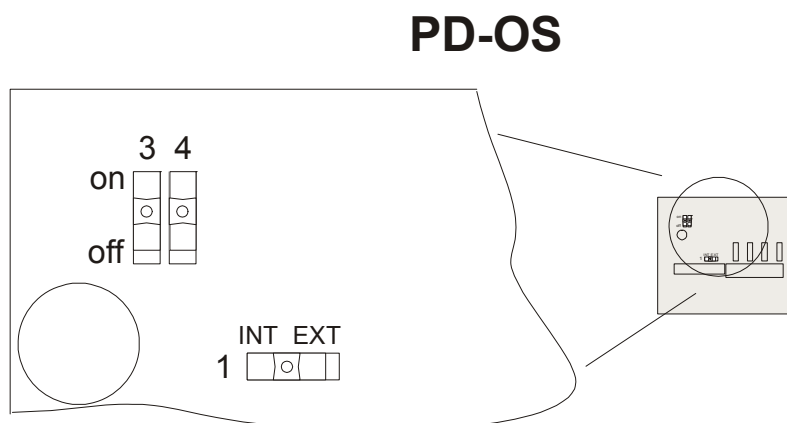
Fig. 10: switch position voltage selection (option PD and PD-OS).

Switch positions

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

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

Function switch 1:   voltage selection sensor internal (3.2V) or external (switch 3+4).
Function switch 3+4: the combination of these switches determine the voltage as indicated.

4.4.3. TERMINAL CONNECTORS

The following terminal connectors are available:

Fig. 11: Overview of terminal connectors standard configuration F113-A-OS and options.

REMARKS TERMINAL CONNECTORS:

Terminal GND- 01- 02; power supply - <u>only available with option PD</u>:

OPTION		SENSOR SUPPLY	Terminal			backlight				
			GND	01	02					
PD	24V AC	8.2, 12, 24V max 50mA		AC	AC	◊				
PD	24V DC	8.2, 12, 24V max 50mA	L-	L+		◊				
	Note PD	do not use a AC autotransformer (Spartrafo) without a galvanic isolation.								

◊=option

Terminal 03-05; Flowmeter input:

The F113-A requires a (0)4-20mA sensor signal which will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.
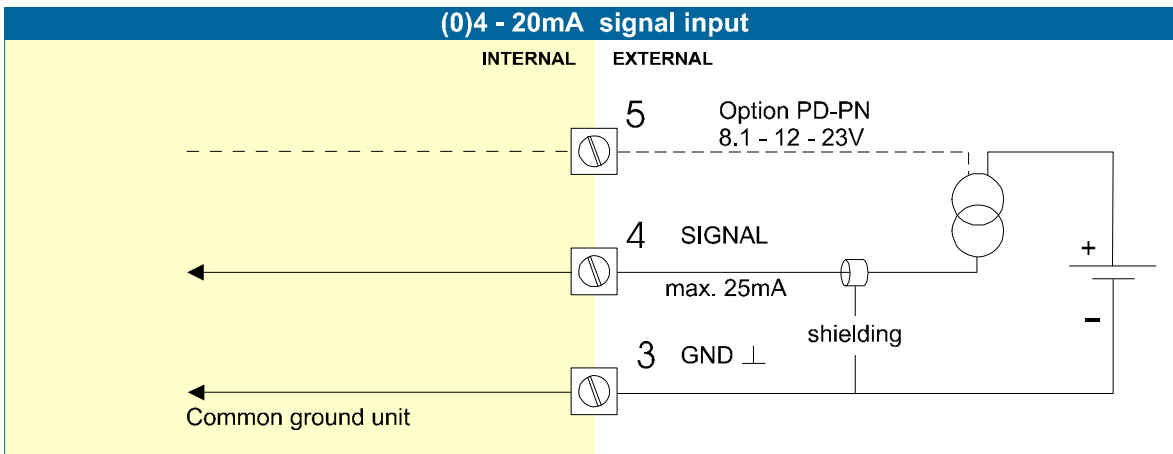
Type IB - Terminal 6-7; external reset:
With this function, the total can be reset to zero with an external switch. The input must be switched with a potential free contact to the GND-terminal number 12.

Terminal 08-09 analog output (passive) (SETUP 7) :
A 4-20mA current-sinking signal proportional to the level is available as standard.
A DC power supply should be connected to terminal 08 and 09, the current is then regulated by unit).
When a power supply is connected but the output is disabled, a 3.5mA signal will be generated.
Max. driving capacity 1000 Ohm.

Passive 4-20mA analog output

INTERNAL   EXTERNAL

9   4-20mA
(3.5mA default)

\+   Maximum
30V DC

Common ground unit

8   I - GND ⊥
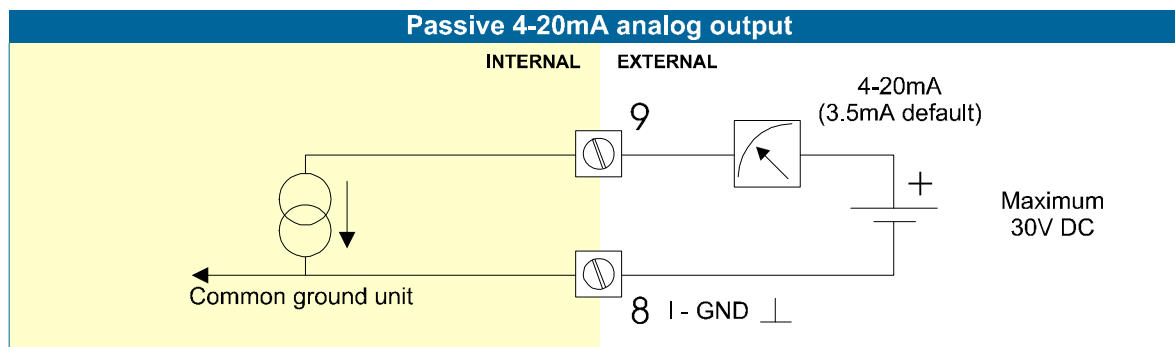
Terminal 10-11; relay output R3:
This output is an alarm or pulse output according setup 83.

Terminal 12-13; relay output R2:
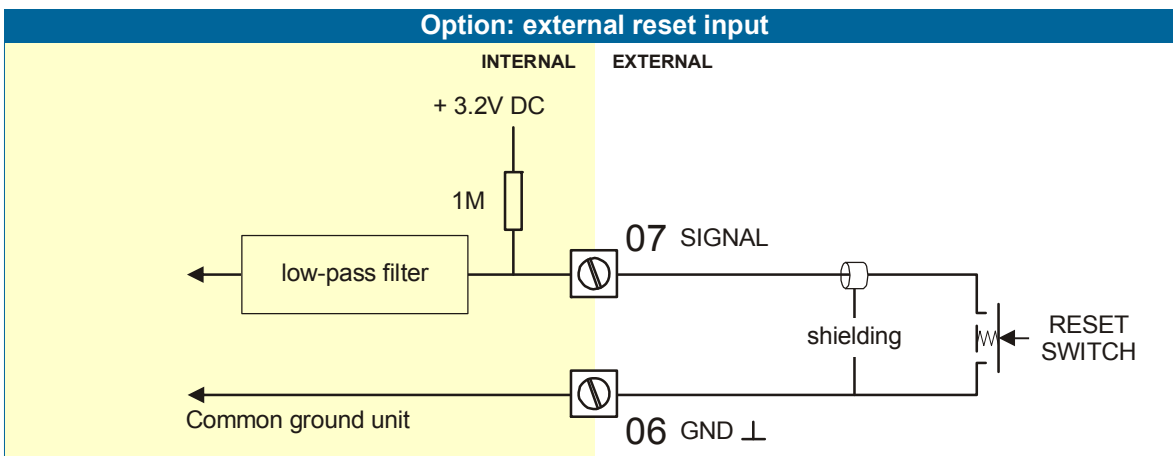This output is an alarm or pulse output according setup 82.

Terminal 14-15; relay output R1:
This output is an alarm or pulse output according setup 81.

Terminal 16-17; relay output R4:
This output is an alarm or pulse output according setup 84.

Mechanic relay output - R1, R2, R3, R4

INTERNAL   EXTERNAL

10 R3
DEVICE   maximum
240V AC - 0.5A
11 R3

12 R2
DEVICE   maximum
240V AC - 0.5A
13 R2

14 R1
DEVICE   maximum
240V AC - 0.5A
15 R1

16 R4
DEVICE   maximum
240V AC - 0.5A
17 R4

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.
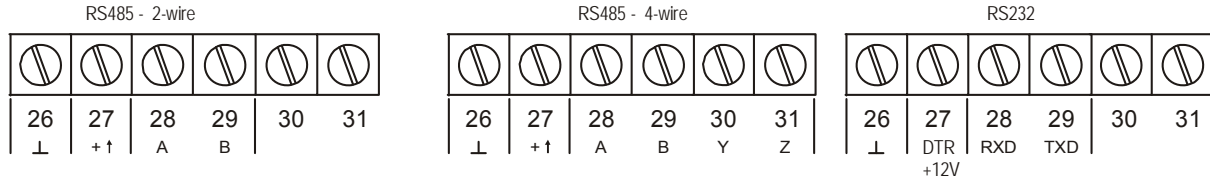
Fig. 12: Overview terminal connectors communication option.

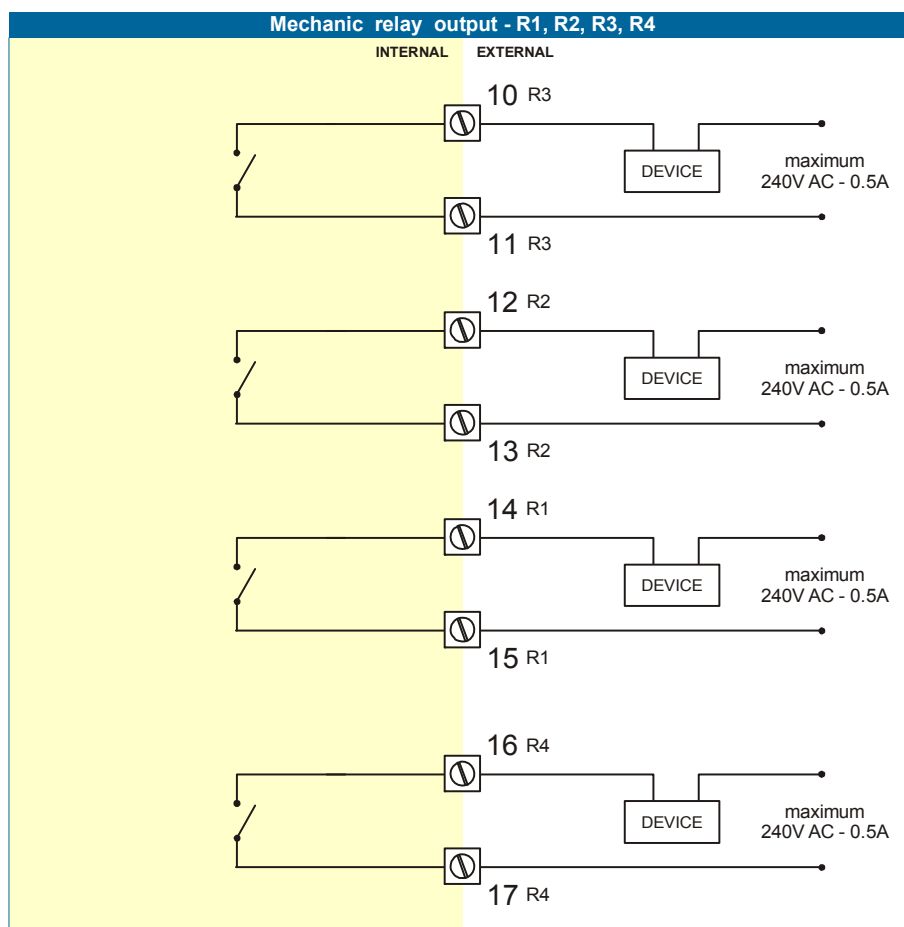When using the RS232 communication option, terminal 27 is used for supplying the interface. Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (+12V). If no active signal is available it is possible to connect a separate supply between terminals 26 and 27 with 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. 13: Overview terminal connectors backlight option.

5.   MAINTENANCE

5.1.   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.
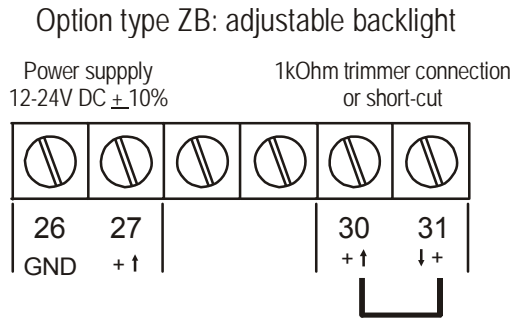- The F113-A-OS may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no 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 F113-A-OS 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 F113-A-OS 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.

Check periodically:

- The condition of the casing, cable glands and front panel.
- The input/output wiring for reliability and aging symptoms.
- The process accuracy. As a result of wear and tear, re-calibration of the flowmeter might be necessary. Do not forget to re-enter any subsequent K-factor alterations.
- Clean the casing with soapy-water. Do not use any aggressive solvents as these might damage the polyester coating.

5.2.   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.

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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.
Option ZB	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications. Power requirements: 12-24V DC + 10% or type PD, PF, PM. Power consumption max. 1 Watt.

Enclosures	
General	Die-cast aluminum or GRP (Glassfibre Reinforced Polyamide) enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material.
Control Keys	Three industrial micro-switch keys. UV-resistant silicone keypad.
Painting	Aluminum enclosure only: UV-resistant 2-component industrial painting.
Panel-mount enclosures	Dimensions: 130 x 120 x 60mm (5.10" x 4.72" x 2.38") – LxHxD.
Classification	IP65 / NEMA4X
Panel cut-out	115 x 98mm (4.53" x 3.86") LxH.
Type HC	GRP panel-mount enclosure
Type HB	Aluminum panel-mount enclosure
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95") – LxHxD.
Classification	IP67 / NEMA4X
Aluminum enclosures	
Type HA	Drilling: 2x PG9 – 1x M20.
Type HM	Drilling: 2x M16 – 1x M20.
Type HN	Drilling: 1x M20.
Type HO	Drilling: 2x M20.
Type HP	Drilling: 6x M12.
Type HT	Drilling: 1x ½"NPT.
Type HU	Drilling: 3x ½"NPT.
Type HV	Drilling: 4x M20
Type HZ	No drilling.
GRP enclosures	
Type HD	No drilling.
Type HE	Drilling: 2x 16mm (0.63") – 1x 20mm (0.78").
Type HF	Drilling: 1x 22mm (0.87").
Type HG	Drilling: 2x 20mm (0.78").
Type HJ	Drilling: 3x 22mm (0.87").
Type HH	Drilling: 6x 12mm (0.47").
Type HK	Flat bottom - no drilling.

Operating temperature	
Operational	-40°C to +80°C (-40°F to +176°F)

Power supply	
Type PD	8-24V AC / DC ± 10%. Power consumption max. 10 Watt. Intrinsically safe: 16-30V DC; power consumption max. 0.75 Watt.

Sensor excitation	
Type PD	1.2 - 3.2 - 8.2 - 12 and 24V DC - max. 50mA@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.

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 total and flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.
Type A	(0)4-20mA - with signal calibration feature 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	transmitting flowrate.
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 AP	Passive 4-20mA output - output loop powered (type PX).

Alarm / pulse outputs	
Function	User defined: flowrate alarm or pulse output.
Alarm output	low, high, low-low, high-high or flowrate alarm.
Pulse output	Max. frequency 60Hz. Pulse length user definable between 7,8msec up to 2 seconds.
Type OS	Four electro-mechanical relay outputs; max. switch power 230V AC - 0,5A (requires type AP, OR and PD).

Communication option	
Functions	reading display information, reading / writing all settings.
Protocol	Modbus ASCII or 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	• total and/or flowrate. • total and accumulated total. • total can be reset to zero by pressing the CLEAR-key twice. • alarm value's low - high - low-low and high-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 to selection for total.

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

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, high, low-low or high-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 F113-A-OS is going to be installed or while it is in operation.

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 to the specification.

Pulse output does not function:
Check:
- SETUP 84 - pulse per "x" quantity; is the value programmed reasonable and will the maximum output be under 0,5Hz?
- SETUP 85 - 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 Span and time unit correct?

The pass code is unknown:
If the pass code is not 1234, there is only one possibility left: call your supplier.

ALARM
When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the 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 F113-A-OS specific variables; other common variables are described in the standard table.
- All numbers are <u>decimal numbers</u>, unless otherwise noted.
- The following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
CONFIGURATION VARIABLES F113-A-OS - SETUP-LEVEL:
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	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0…1	
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	
DISPLAY				
64 (40h)	display function	1	0=total 1=flowrate	
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	
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
119 (77h)	cut off percentage	1	0..99	steps of 0.1%
120 (78h)	tune minimum rate	2	0..9999	
122 (7Ah)	tune maximum rate	2	0..9999	
99 (63h)	filter	1	0….99	

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)	pass code	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER F113-A-OS VARIABLES FOR COMMUNICATION

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

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

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

ACCUMULATED TOTAL - 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: Not possible.

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

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

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

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

Write flowrate: Not possible.

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LIST OF FIGURES IN THIS MANUAL

LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL	Enter your settings here		
11 unit	L		
12 decimals	0000000		
13 span	000001 /sec	/sec	/sec
14 decimals span	0		

SETTING	DEFAULT	DATE :	DATE :
2 - FLOWRATE			
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 span	000001 /min		
25 decimals span	0		
3 - ALARM	Enter your settings here		
31 flow zero	default		
32 alarm value low-low	0		
33 alarm value low	0		
34 alarm value high	0		
35 alarm value high-high	0		
36 delay time alarm low-low	0.0 sec		
37 delay time alarm low	0.0 sec		
38 delay time alarm high	0.0 sec		
39 delay time alarm high-high	0.0 sec		
4 - DISPLAY			
41 set rate min/max	operator level		
42 function	total		
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 output	disabled		
72 min. flowrate 4-mA	0000000		
73 max. flowrate 20mA	9999999		
74 cut off percentage	0.0%		
75 tune min - 4mA	0208		
76 tune max - 20mA	6656		
77 filter	01 (off)		
8 - PULSE OUTPUT			
81 relay1	off		
82 relay 2	off		
83 relay 3	off		
84 relay 4	off		
85 impulse width	000 periods		
86 pulse per	0001000		
9 - COMMUNICATION			
91 baud-rate	2400		
92 address	1		
93 mode	BUS-ASC		
A - OTHERS			
A4 pass code	0000		
A5 tagnumber	0000000		