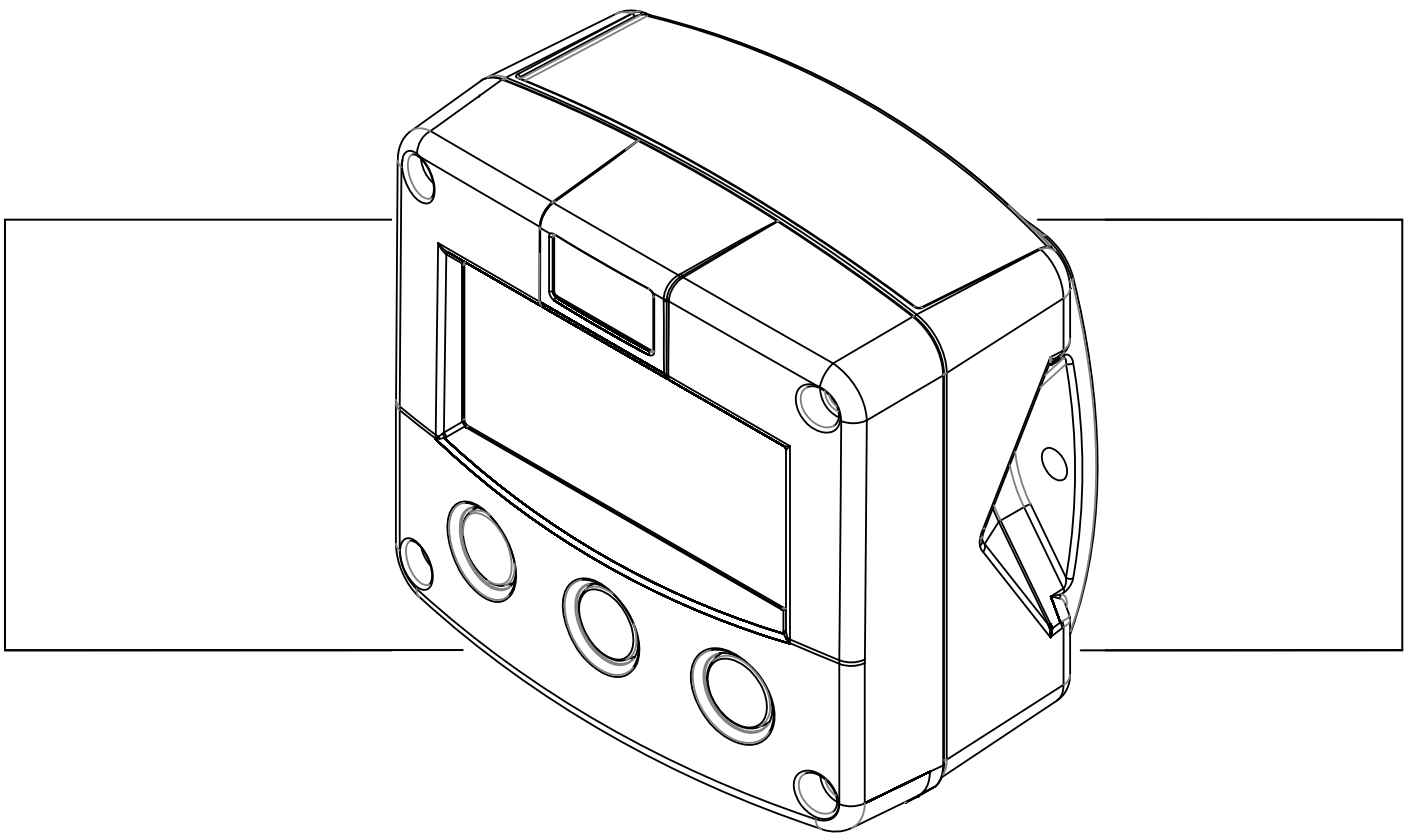


F170-A

LEVEL MONITOR

WITH HIGH / LOW LEVEL ALARMS



Signal input sensor: (0)4-20mA

Signal outputs: 4-20mA ref. level

Alarm outputs: maximum four level alarms

Options: Intrinsically Safe, Modbus communication, loop power



SAFETY INSTRUCTIONS



- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- **LIFE SUPPORT APPLICATIONS:** The F170-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 F170-A has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.
- **Intrinsically Safe applications: follow the instructions as mentioned in Chapter 5 and consult “Fluidwell F1...-XI - Documentation for Intrinsic Safety”.**

DISPOSAL



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

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F170-A implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the F170-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 F170-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 F170-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 F170-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	:	HF170AEN_v0501_05
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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.

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1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F170-A

Functions and features

The level indicator model F170-A is a microprocessor driven instrument designed to display the level and percentage as well as monitoring the level with three alarm values for a low-low, low, high and high-high level. This product has been designed with a focus on:

- ultra-low power consumption to allow long-life battery powered applications (option PB and PC),
- intrinsic safety for use in hazardous applications (option XI),
- several mounting possibilities with ABS or aluminum enclosures for harsh industrial surroundings,
- ability to process all types of level signals,
- transmitting possibilities with analog, alarm relay and communication option outputs.

Sensor input

This manual describes the unit with one analog 4-20mA input for the level sensor "-A version". Other versions are available to process 0-10V or resistance signals.

To power the sensor, several options are available.

Standard outputs

- Configurable alarm outputs: two, three or four alarm outputs, depending on the unit ordered. The functionality of the output can be user defined.
- Configurable passive linear 4-20mA analog output with 10-bits resolution mirroring the actual level. The minimum and maximum signal output can be tuned.

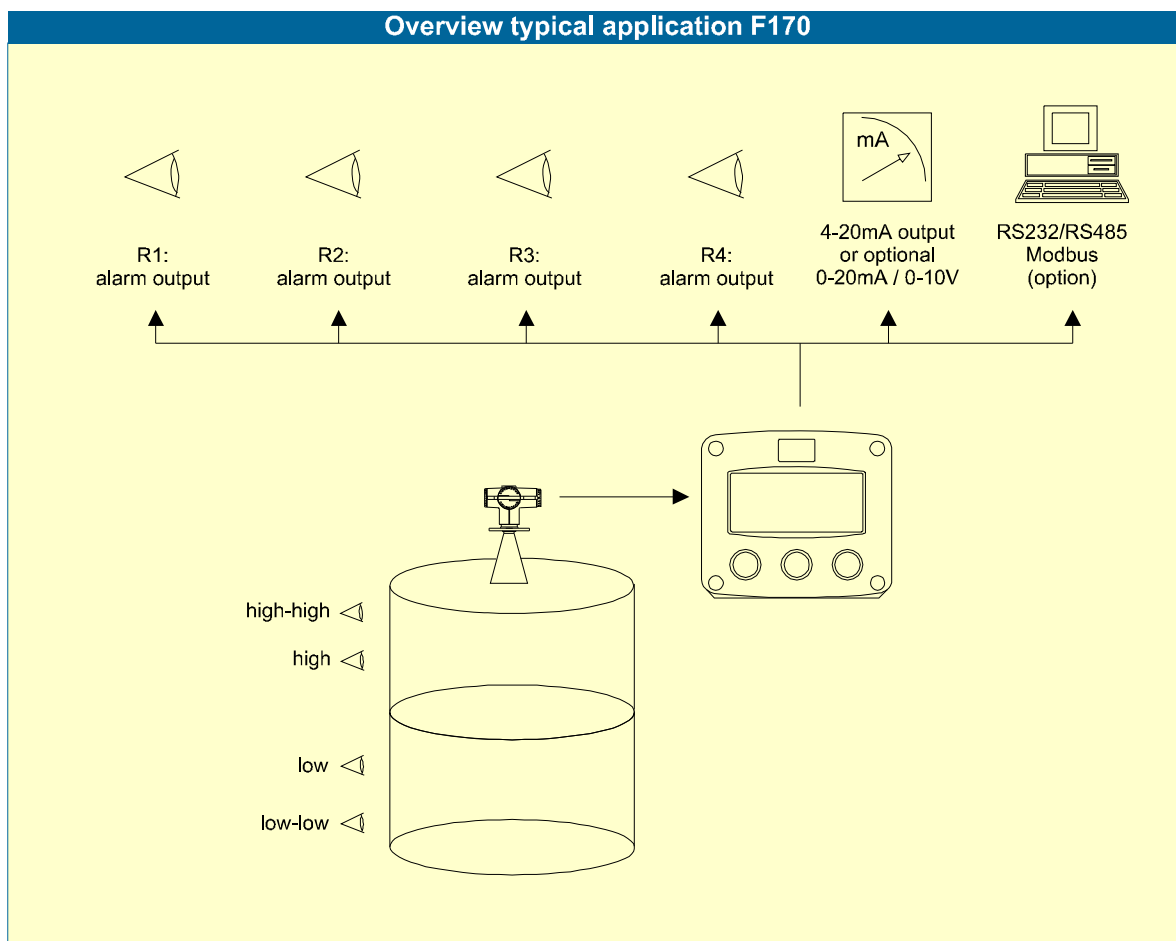


Fig. 1: Typical application for the F170-A.

Configuration of the unit

The F170-A was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F170-A according to your specific requirements. SETUP includes several important features, such as Span, measurement units, signal settings etc. All settings 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 transfective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.

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 relays or active outputs, sensor supply options and power supply options, including loop power (see the "170-A-PL" manual). Enclosures include panel-mount, wall-mount, weather-proof and flame proof enclosure.



Important

Note !

The number of alarm outputs is related to the options ordered:

- Standard: three outputs
- option PF - with 24 V AC/DC mains supply: three outputs
- option PM - with 80-230V mains supply: three outputs
- option XI - Intrinsically safe: two outputs
- option OS - relay board with 24V AC/DC mains supply: four relays.

2. OPERATIONAL

2.1. GENERAL



- *The F170-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 F170-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 get access to SETUP-level; please read chapter 3.



This key is used to SELECT other display information or to increase a value.
The arrow-key ▲ is used to configure the unit; please read chapter 3.



This key is used to SELECT other display information or to select a digit.
The arrow-key ► is used to configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F170-A will always act function at Operator level. The information displayed is dependant up on the SETUP-settings. The sensor signal will be measured by the F170-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 level:**

This is the main display information of the F170-A. After selecting any other information, it will always return to this main display automatically. The level, percentage or height can be displayed with 17mm digits on the upper line. On the bottom line, the measuring unit will be displayed or the percentage or height.

When "-----" is shown, then the level value is too high to be displayed.

The arrows \blacktriangleleft indicate the increase/decrease of the level trend.

After pressing select, a second window is available with percentage or contents (depending on the setup configuration).

- **Programming the high / low level alarm values:**

Remark: this function might not be accessible: it depends on the configuration of the unit..

When the SELECT-key is pressed a few times, the alarm values for low and high level will be displayed. To change the alarm value, following procedure must be execute:

- 1) press PROG: the word "PROGRAM" will be flashing,
- 2) use \blacktriangleright to select the digits and \blacktriangleup to increase that value,
- 3) set the new alarm value by pressing ENTER.



Fig. 4: Example display information during programming maximum level.

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 for a few seconds: the former value will be reinstated.

- **Level alarm:**

When the actual level is outside the allowed range, an alarm message will be displayed at the bottom line of the display indicating the type of alarm: "LO LEVEL ", "HI LEVEL" or "HI-LO LEVEL".

The alarm is terminated automatically as soon as the level is in its range again. Due to the setup configuration it might be that the level is outside it's range without an immediate alarm.
- **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 01-04:**

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

3. CONFIGURATION

3.1. INTRODUCTION

This and the following chapters are exclusively meant for electricians and non-operators. In these, an extensive description of all software settings and hardware connections are provided.



- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F170-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

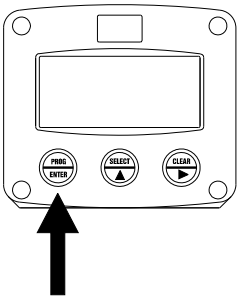
Configuration of the F170-A is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows \blacktriangleleft will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically.

SETUP can be reached at all times while the F170-A remains fully operational.



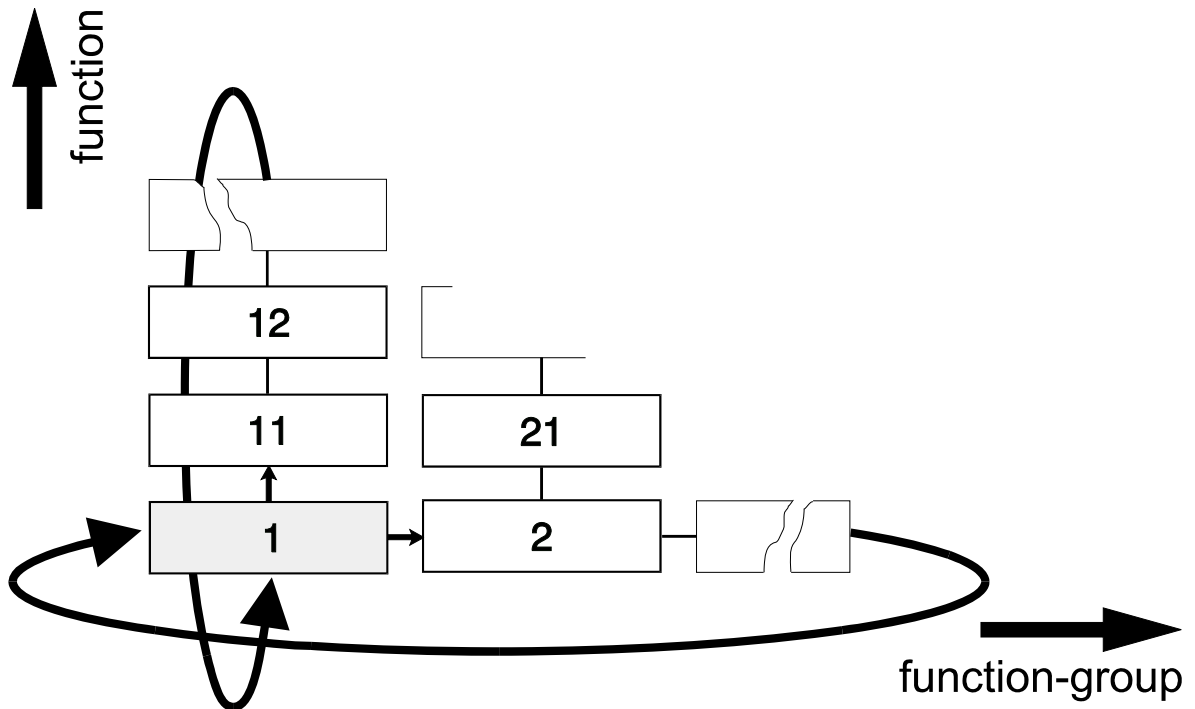
Note: A password may be required to enter SETUP. Without this password access to SETUP is denied.

To enter SETUP-level:



Press  for 7 seconds

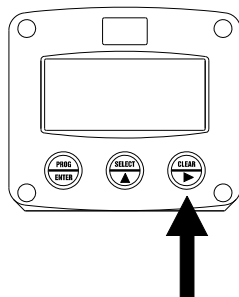
Matrix structure SETUP-level:



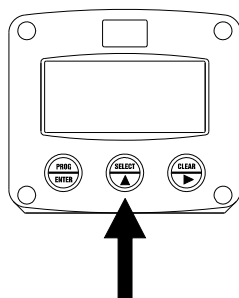
SCROLLING THROUGH SETUP-LEVEL

Selection function-group and function:

SETUP is divided into several function groups and functions.



Select function-group with



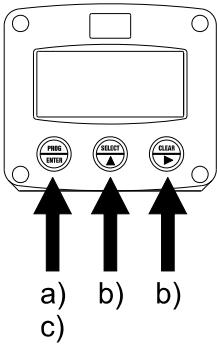
Select function with





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  briefly; **PROGRAM** will start flash

b) select or enter value with  and / or 

c) press  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.

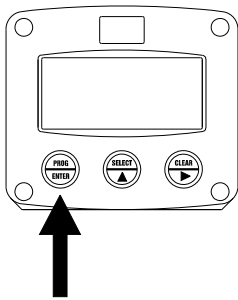
When the new value is not valid, the increase sign  or decrease-sign  will be displayed while you are programming.

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

To return to OPERATOR-level:



Press  for 3 seconds

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

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	LEVEL		
	11	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	SPAN	0.000001 - 999,999 unit
	14	DECIMALS SPAN	0 - 6
	15	OFFSET	-999,999 - +999,999 units
2	HEIGHT		
	21	UNIT	m - mm - cm - mtr - inch - ft - mmwk - mmwc - cmwk - cmwc - mwk - mwc - inwc - ftwc - mbar - bar - psi - no unit.
	22	DECIMALS	0 - 1 - 2 (Ref: displayed value)
	23	SPAN	0.01 to 999,999 unit
	24	DECIMALS SPAN	0 - 6
	25	OFFSET	-999,999 to +999,999 unit
3	ALARM		
	31	EMPTY	default - no relays - ignore
	32	ALARM LOW-LOW	-999.999 – 999.999 unit
	33	ALARM LOW	-999.999 – 999.999 unit
	34	ALARM HIGH	-999.999 – 999.999 unit
	35	ALARM HIGH-HIGH	-999.999 – 999.999 unit
	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	ALARM SET	operator - setup - hidden - off
	42	FUNCTION	level - level+height - level+percentage - height - height+percentage, percentage
5	POWER MANAGEMENT		
	51	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	52	BATTERY MODE	operational - shelf
6	SENSOR		
	61	FORMULA	interpolation, square root
	61	FILTER	00 - 99
	62	CUT-OFF	0.0 - 99.9%
	63	CALIBRATE LOW	(0)4mA
	64	CALIBRATE HIGH	20mA
7	ANALOG		
	71	OUTPUT	disable - enable
	72	INPUT	level – height - percentage
	73	(0)4mA (0V)	0000.000 - 9,999,999
	74	20mA (10V)	0000.000 - 9,999,999
	75	CUT-OFF	0.0 - 9.9%
	76	TUNE MIN - 4mA / 0V	0 - 9,999
	77	TUNE MAX- 20mA / 10V	0 - 9,999
	78	FILTER	00 - 99
8	RELAYS		
	81	OUTPUT R1	low-low - low - high - high-high - all - off
	82	OUTPUT R2	low-low - low - high - high-high - all - off
	83	OUTPUT R3	low-low - low - high - high-high - all - off
	84	OUTPUT R4	low-low - low - high - high-high - all - off
9	COMMUNICATION		
	91	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	92	ADDRESS	1 - 255
	93	MODE	RTU - off
A	OTHERS		
	A1	MODEL AND TYPE	F170-A
	A2	SOFTWARE VERSION	xx.xx.xx
	A3	SERIAL NO.	xxxxxxx
	A4	PASSWORD	0000 - 9999
	A5	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION SETUP-FUNCTIONS

1 - LEVEL	
MEASUREMENT UNIT 11	<p>SETUP - 11 determines the measurement unit for level. The following units can be selected:</p> <p style="text-align: center;">mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P.</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span has to be adapted as well; the calculation is not done automatically.</p>
DECIMALS 12	<p>This setting determines for level the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">00000 - 1111.1 - 2222.22 - 3333.333</p>
SPAN 13	<p>With the span, the sensor signal is converted to a quantity. The span for level is determined on the basis of the selected measurement unit 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.</p> <p>Example 1 Calculating the span for level <i>Let us assume that the sensor generates 20mA at a level of 2,481.3 Liters, the selected unit is "Liters". The span is 2481.3 Enter for SETUP - 13: "24813" and for SETUP - 14 - decimals span "1".</i></p> <p>Example 2 Calculating the span for level <i>Let us assume that the sensor generates 20mA at a level of 652.31 USGAL, the selected unit is USG. The span is 652.31. Enter for SETUP - 13: "652.31 and for SETUP - 14 "2".</i></p>
DECIMALS SPAN 14	<p>This setting determines the number of decimals for Span (SETUP 13). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p>
OFFSET 15	<p>Enter here the "not measured" quantity which is below the sensor, in case a pressure transducer e.g. is used to measure the quantity. A negative offset can be entered by pressing the middle and right button simultaneously.</p>

2 - HEIGHT

If desired the height of the level column can be calculated and displayed.	
MEASUREMENT UNIT 21	<p>SETUP 21 determines the measurement unit for height. The following units can be selected:</p> <p style="text-align: center;">mm - cm - m - mtr - inch - ft - mmwk - mmwc - cmwk - cmwc mwk - mwc - inwc - ftwc - mbar - bar - psi - no unit.</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span (23) has to be adapted as well; the calculation is not done automatically.</p>
DECIMALS 22	<p>This setting determines for height the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">00000 - 1111.1 - 2222.22</p>
SPAN 23	<p>With the span, the sensor signal is converted to a height. The span for height is determined on the basis of the selected measurement unit at 20mA. The more accurate the span, the more accurate the functioning of the system will be :</p> <p>Example Calculating the span for height <i>Let us assume that the sensor generates 20mA at a level of 2,481.3 cm, the selected unit is "cm". The span is 2481.3 Enter for SETUP - 23: "2481.3".</i></p>
DECIMALS SPAN 24	<p>This setting determines the number of decimals for Span (SETUP 13). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p>
OFFSET 25	<p>Enter here the "not measured" height which is below the sensor, in case a pressure transducer is used for example to measure the level. Also, a negative offset can be entered: do press the middle and right button simultaneously.</p>

3 - ALARM



Note !

With these settings, it is determined how the level will be monitored and the functionality of the transistor / relay outputs be determined.
Please be aware that the alarm levels are based on the displayed values and can be programmed at operator level as well (see setup 4 – “display”). Moreover, the function be locked (setup 32–35).
Note: for transistor / relay output functions: read **SETUP 8 “relays”**.

EMPTY 31	When the <u>level is zero</u> , then it is possible to ignore or disable the level monitoring. The following settings can be selected: DEFAULT: in case of a low-level alarm and level zero, it will switch the alarm output and indicate the alarm on the display. NO RELAY: in case of a low-level alarm and level zero, it won't switch the alarm output but will indicate the alarm on the display only. IGNORE: in case of a low-level alarm and level zero, 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 level is lower as this value. With value -999999 this function is disabled. (A negative value can be entered by pressing the middle and right button simultaneously.)
ALARM VALUE LOW 33	The low alarm is set with this setting. An alarm will be generated as long as the level is lower as this value. With value -999999 this function is disabled. (A negative value can be entered by pressing the middle and right button simultaneously.)
ALARM VALUE HIGH 34	The high alarm is set with this setting. An alarm will be generated as long as the level is higher as this value. With value 999999 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 level is higher as this value. With value 999999 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 level 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 level 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 level 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 level is still incorrect after this delay time, then an alarm will be generated.

4 - DISPLAY



Note !

ALARM SET 41	With this function the functionality for the operator is determined: Operator: the operator can change the alarm values Setup: the operator can only read the alarm values Hidden: the alarm values are not visible for the operator Off: alarm is disabled
FUNCTION 42	With the function, the displayed information is selected: Level main info: level Level + height main info: level, bottom line height Level + percent main info: level, bottom line percentage Height main info: height Height + percent main info: height, bottom line percentage Percentage main info: percentage Important: this selection does influence the alarm values: the alarm values are linked to the main info displayed!!

5 - 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 F170-A has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

LCD NEW 51

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 FAST update: about 1 years.

battery life-time with 1 sec update: about 3 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 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 !

6 - SENSOR

SIGNAL 61

The F170-A can process the (0)4-20mA signal in two ways:

- Interpolation: the signal is processed linear

$$L = S \times I$$

- Square root: for differential pressure

$$L = S \sqrt{I}$$

where:

L = Level: the calculated level

S = Span: the maximum level at 20mA. The span is programmed with setting 14.

I = Input: the scaled analog value; in these formulas value 0 (zero) for (0)4mA and value 1 (one) for 20mA.

FILTER 62

The analog output signal of a sensor does mirror the actual level. This signal is measured several times a second by the F170-A. The value measured is a "snap-shot" of the real level 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:

Continued next page >>>

6 - SENSOR (CONTINUED)														
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										
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										
CUT-OFF 63	<p>To ignore e.g. vibration, a low-level cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the analog value is less then required with this setting, the signal will be ignored. The cut-off value can be programmed is the range 0.0 - 99.9%.</p> <p>Examples:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 15%;">SPAN (setup 13)</th> <th style="width: 15%;">REQUIRED CUT-OFF</th> <th style="width: 15%;">CUT-OFF (setup 63)</th> <th style="width: 40%;">REQUIRED OUTPUT</th> </tr> </thead> <tbody> <tr> <td></td> <td>450 L</td> <td>25 L</td> <td>$25/450 \times 100\% = 5.5\%$</td> <td>$16\text{mA} \times 5.5\% + 4\text{mA} = 4.88\text{mA}$</td> </tr> </tbody> </table>					SPAN (setup 13)	REQUIRED CUT-OFF	CUT-OFF (setup 63)	REQUIRED OUTPUT		450 L	25 L	$25/450 \times 100\% = 5.5\%$	$16\text{mA} \times 5.5\% + 4\text{mA} = 4.88\text{mA}$
	SPAN (setup 13)	REQUIRED CUT-OFF	CUT-OFF (setup 63)	REQUIRED OUTPUT										
	450 L	25 L	$25/450 \times 100\% = 5.5\%$	$16\text{mA} \times 5.5\% + 4\text{mA} = 4.88\text{mA}$										
TUNE MIN / 4MA 64	<p>With this setting it is possible to calibrate the input value for (0)4mA as the signal from the sensor might not be exact 4.0 mA (or 0.0 mA) at level zero. This function will measure the real output value at flow zero.</p> <ul style="list-style-type: none"> ▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i> <p>After pressing PROG, three settings can be selected:</p> <ul style="list-style-type: none"> ▪ CALIBRATE: with this setting, the input will be calibrated with the actual "(0)4mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be more than the calibrated value before the signal will be processed. ▪ DEFAULT: with this setting, the manufactures value is re-installed. ▪ CAL SET: to select the last calibrated value. 													
TUNE MAX / 20MA 64	<p>With this setting it is possible to calibrate the input value for 20mA as the signal from the sensor might not be exact 20.0 mA at maximum level. This function will measure the real output value at maximum level.</p> <ul style="list-style-type: none"> ▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i> <p>After pressing PROG, three settings can be selected:</p> <ul style="list-style-type: none"> ▪ CALIBRATE: with this setting, the input will be calibrated with the actual "20mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be less than the calibrated value for a reliable measurement. ▪ DEFAULT: with this setting, the manufactures value is re-installed. ▪ CAL SET: to select the last calibrated value. 													



7 - ANALOG OUTPUT

A linear 4-20mA signal (option AB: 0-20mA or option AU: 0-10V) output signal is generated according to the calculated level, height or percentage with a 10 bits resolution.

Note: When the analog-output is not used, please make sure that setup 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:

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.

INPUT 72 Enter here whether the analog output value should be based on level (setup 1), height (setup 2) or percentage of the input.

MINIMUM LEVEL 73 Enter here the level according which the output should generate a 4mA signal (or 0mA / 0V) - in most applications at level "zero". The units and number of decimals displayed in this screen depend on the settings chosen in setup 72: They correspond to the values set for level (setup 1) or height (setup 2). When percentage is chosen they reflect "%" and one decimal. Note that the units cannot be displayed.

MAXIMUM LEVEL 74 Enter here the level according which the output should generate a 20mA (or 10V) - in most applications at maximum level. The units and number of decimals displayed in this screen depend on the settings chosen in setup 72: They correspond to the values set for level (setup 1) or height (setup 2). When percentage is chosen they reflect "%" and one decimal. Note that the units cannot be displayed.

CUT-OFF 75 A low-level cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the level is less than the required rate, the current will be 4mA.
Examples:

4mA (SETUP 73)	20mA (SETUP 74)	CUT-OFF (SETUP 75)	REQUIRED RATE	OUTPUT
0 L	100 L	2%	$(100-0)*2\% = 2.0 \text{ L}$	$4+(16*2\%) = 4.32\text{mA}$
20 L	800 L	3.5%	$(800-20)*3.5\% = 27.3 \text{ L}$	$4+(16*3.5\%) = 4.56\text{mA}$

TUNE MIN / 4MA 76 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 directly active. Press ENTER to store the new value.

Remark: the analog output value can be programmed "up-side-down" if desired, so 20mA at minimum level for example!

TUNE MAX / 20MA 77 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 directly active. Press ENTER to store the new value.

Remark: the analog output value can be programmed "up-side-down" if desired, so 4mA at maximum level for example!

Continued next page >>>



Note !



7 - ANALOG OUTPUT (CONTINUED)

FILTER 78	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			
7	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

With "SETUP 2", four alarm levels can be entered. Based on the options order, the F170-A will have 2, 3 or 4 alarm outputs.

Note: If the unit is Intrinsically Safe, it will have two alarm outputs.

If option OS (relay board) is supplied, it will have four alarm outputs. Else it has three alarm outputs.

OUTPUT R1 81	Assign the output function to output R1. Following can be selected: low-low - low - high - high-high alarm - all alarms - off
OUTPUT R2 82	Assign the output function to output R2. Following can be selected: low-low - low - high - high-high alarm - all alarms - off
OUTPUT R3 83	Assign the output function to output R3. Following can be selected: low-low - low - high - high-high alarm - all alarms - off
OUTPUT R4 84	Assign the output function to output R4. Following can be selected: low-low - low - high - high-high alarm - all alarms - off

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 F170-A. This address can vary from 1-255.
MODE 93	The communication is executed according Modbus protocol RTU mode. With OFF, the communication is disabled.

A - OTHERS

For support and maintenance it is important to have information about the characteristics of your F170-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.

MODEL AND TYPE A1	This window shows the model number of this product (F170-A).
VERSION SOFTWARE A2	This window shows the software version running in the F170-A.
SERIAL NUMBER A3	This window shows the unique serial number of this F170-A.
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 tag number of maximum 7 digits can be entered.

4. INSTALLATION

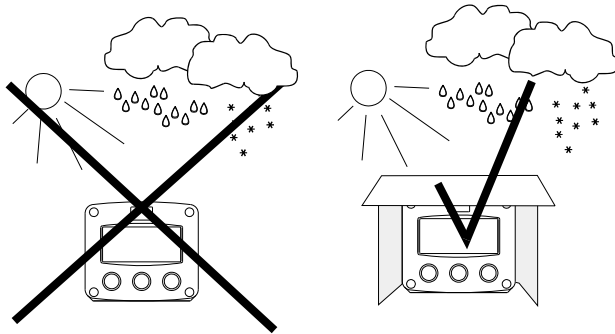


Caution !

4.1. GENERAL DIRECTIONS

- *Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F170-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.*

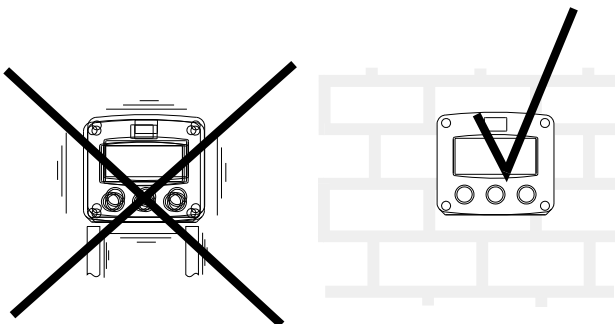
4.2. INSTALLATION / SURROUNDING CONDITIONS



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 F170-A on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE

Aluminum enclosures:

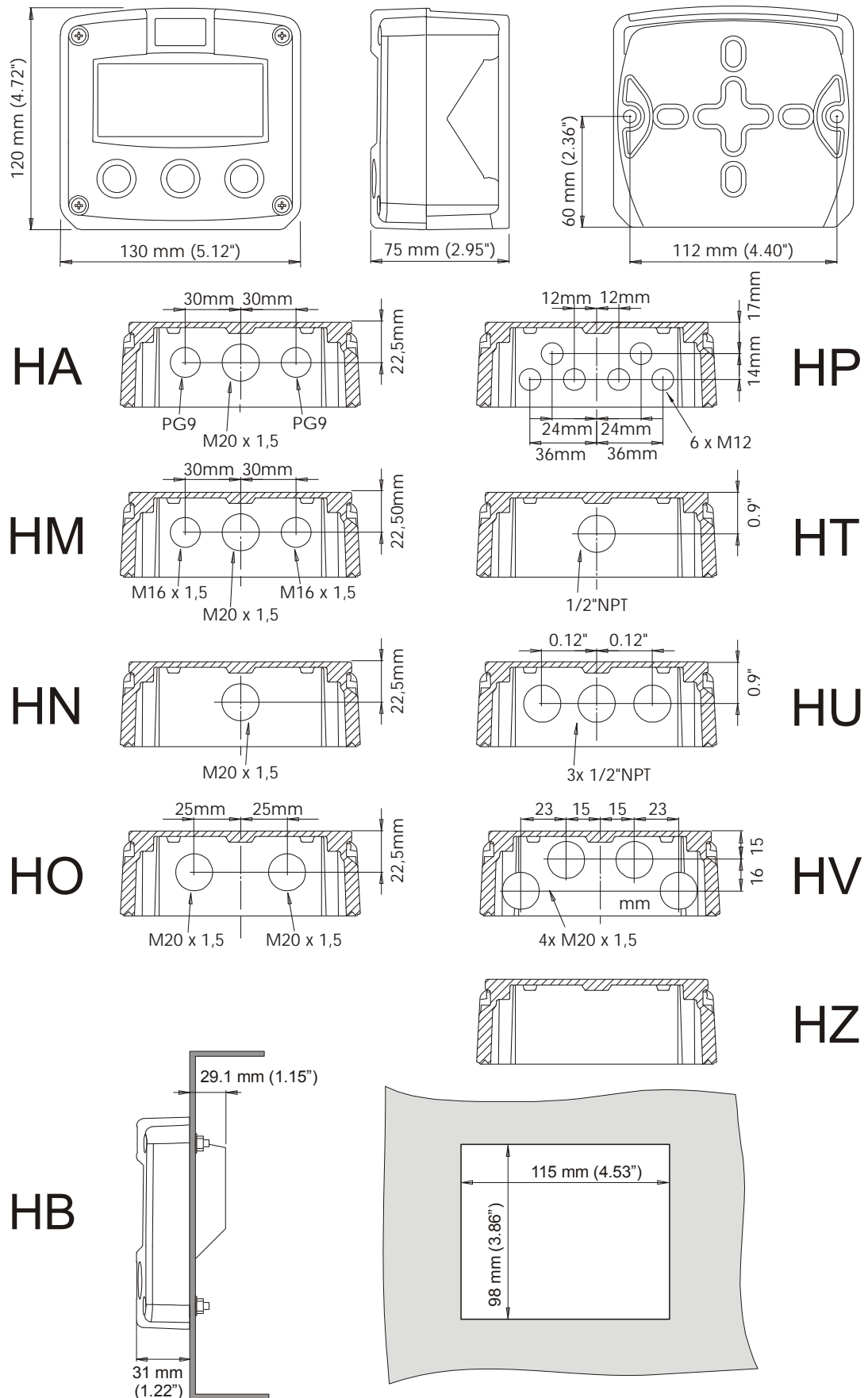
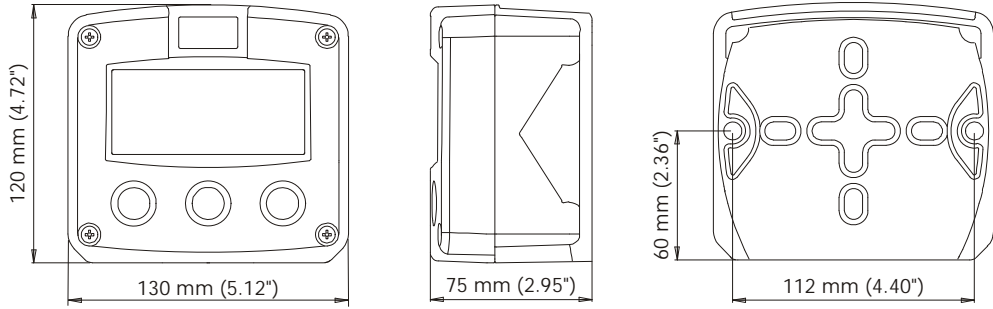


Fig. 6: Dimensions aluminum enclosures.

GRP enclosures:



HK back box:
(flat bottom)

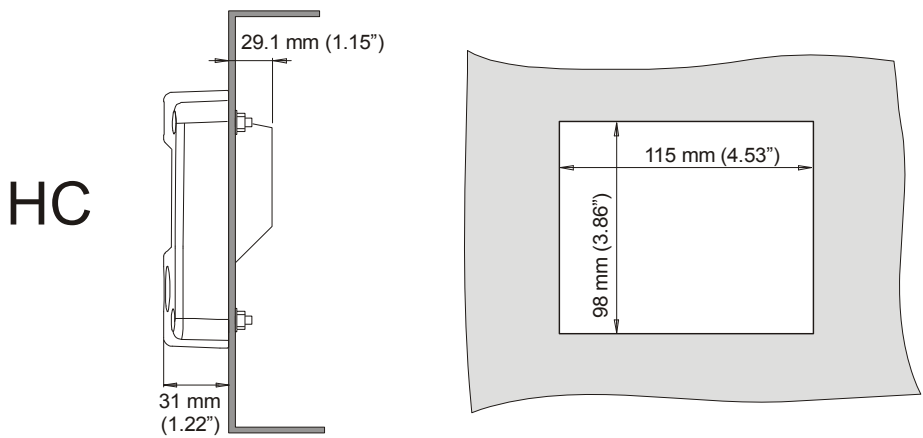
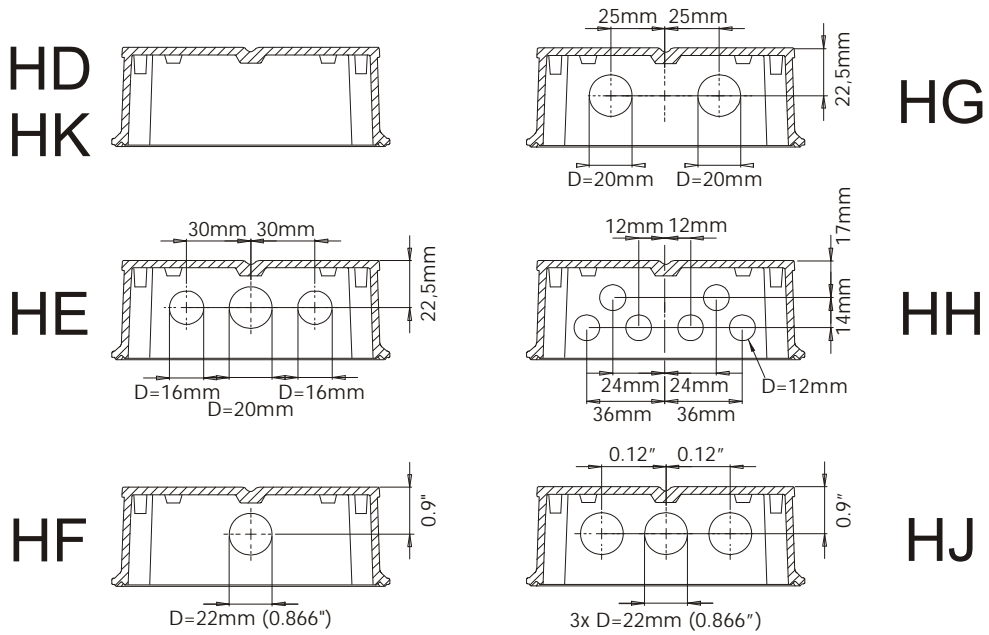
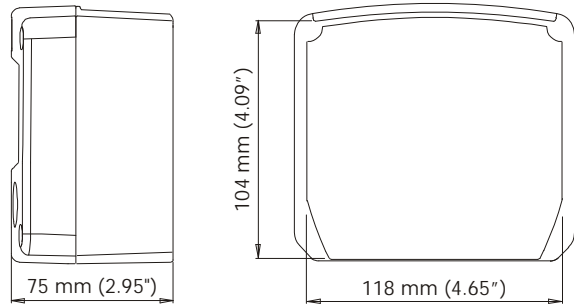


Fig. 7: Dimensions GRP enclosures.

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 F170-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.

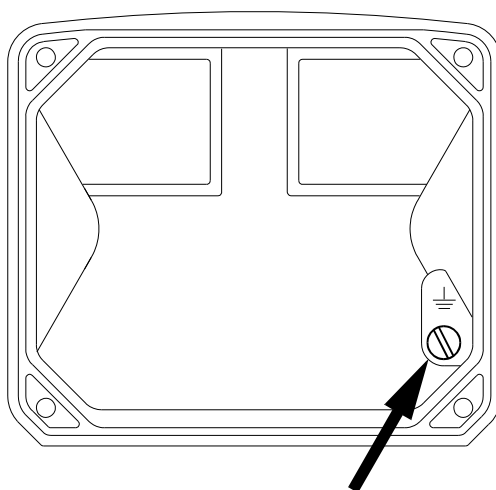


Fig. 8: Grounding aluminum enclosure with type PM 115-230V AC.

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 Intrinsically Safe applications: read chapter 5.

Option PB / PC / PX (AP) - battery powered and output loop-powered applications:

Terminal 11 provides a limited supply voltage of 3.2 V DC for the signal output of the sensor.



Note: This voltage MAY NOT be used to power the sensors electronics, converters etc, as it will not provide adequate sustained power! All energy used by the sensors pick-up will directly influence the battery life-time.

Option PD / PF / PM: 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.



- **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 !! DISCONNECT** the mains power supply to the unit before removing the plastic protection cover !!!

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) or on the right hand (option PM) as indicated:

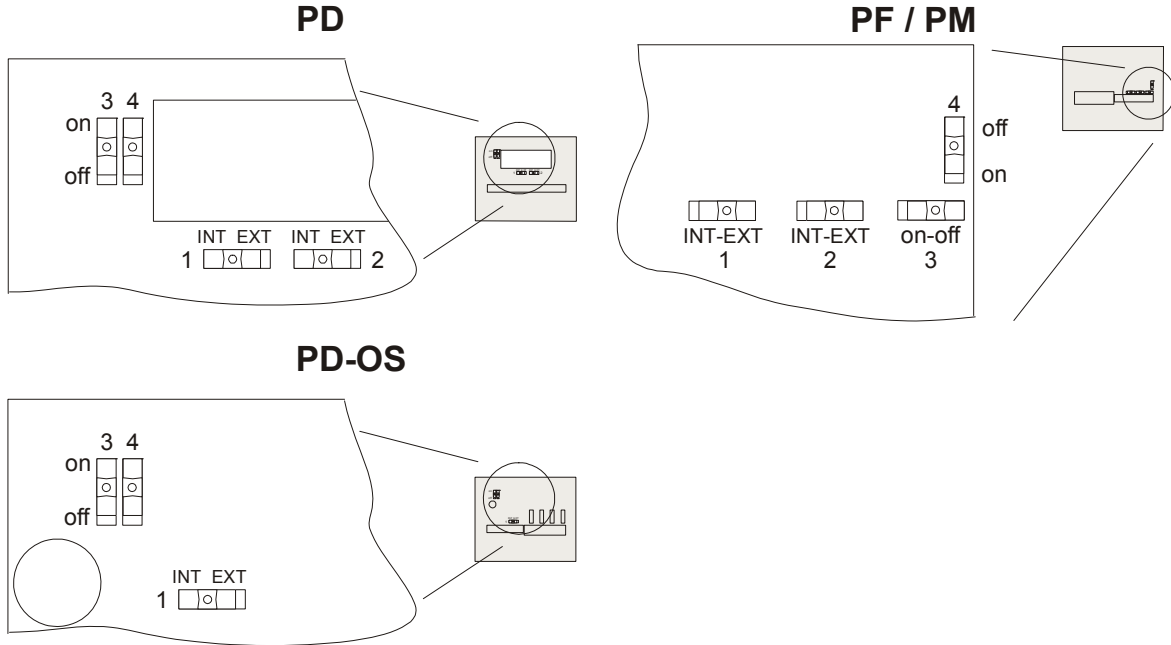


Fig. 9: switch position voltage selection (option PD, PF/PM and PD-OS).

Switch positions

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

SENSOR B	
SWITCH 2	VOLTAGE

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

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

Function switch 2: not available for this Model.

Function switch 3+4: the combination of these switches determine the voltage as indicated.

4.4.3. TERMINAL CONNECTORS

For Intrinsically Safe applications: read chapter 5.

When looking at the back of the F170-A you will see the terminal connectors roughly in the middle of the unit. The number of the terminal connectors installed may vary, depending on options.

The following terminal connectors can be available:

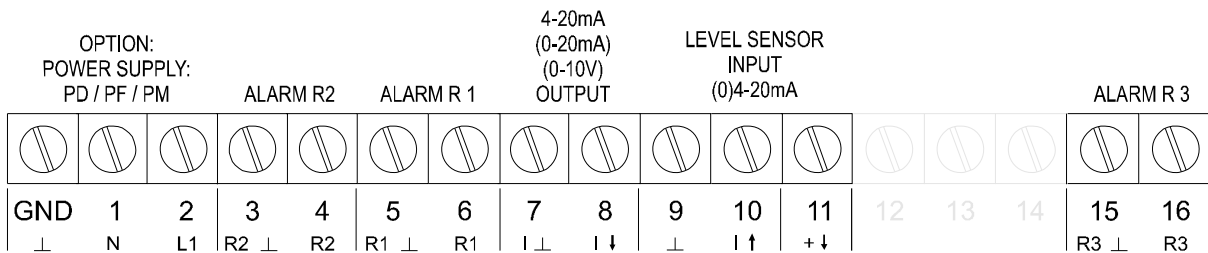


Fig. 10: Overview of terminal connectors of the F170-A.

POWER SUPPLY CONNECTOR OPTIONS

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

TYPE	SENSOR SUPPLY	Terminal			backlight	OPTION AA	OPTION AU	option OA	option OR
		GND	01	02					
PD 8-24V AC	8,2 / 12 / 24V max. 50mA		AC	AC	◇	◇	◇	◇	
PD 8-30V DC	8,2 / 12 / 24V max. 50mA	L-	L+		◇	◇	◇	◇	
PF 24V AC ± 15%	8,2 / 12 / 24V max. 400mA		AC	AC	◇	◇	◇		◇
PF 24V DC ± 15%	8,2 / 12 / 24V max. 400mA	L-	L+		◇	◇	◇		◇
PM 115-230V AC ± 15%	8,2 / 12 / 24V max. 400mA	EARTH	AC	AC	◇	◇	◇	◇	◇
Note PD	do not use a AC autotransformer (Spartrafo) without a galvanic isolation.								
Note PF / PM	The total consumption of the sensors and outputs may not exceed 400mA@24V								

◇=option

Terminal 07-08 POWER SUPPLY - output loop powered (option PX):

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, option AP).



Note: For use in combination with an analog output see "Analog output option AP" !

ALARM OUTPUT CONNECTOR OPTIONS

Terminal 03-04 and terminal 05-06; transistor or relay output R1 and R2:

These outputs are alarm outputs according setup 81 and setup 82.

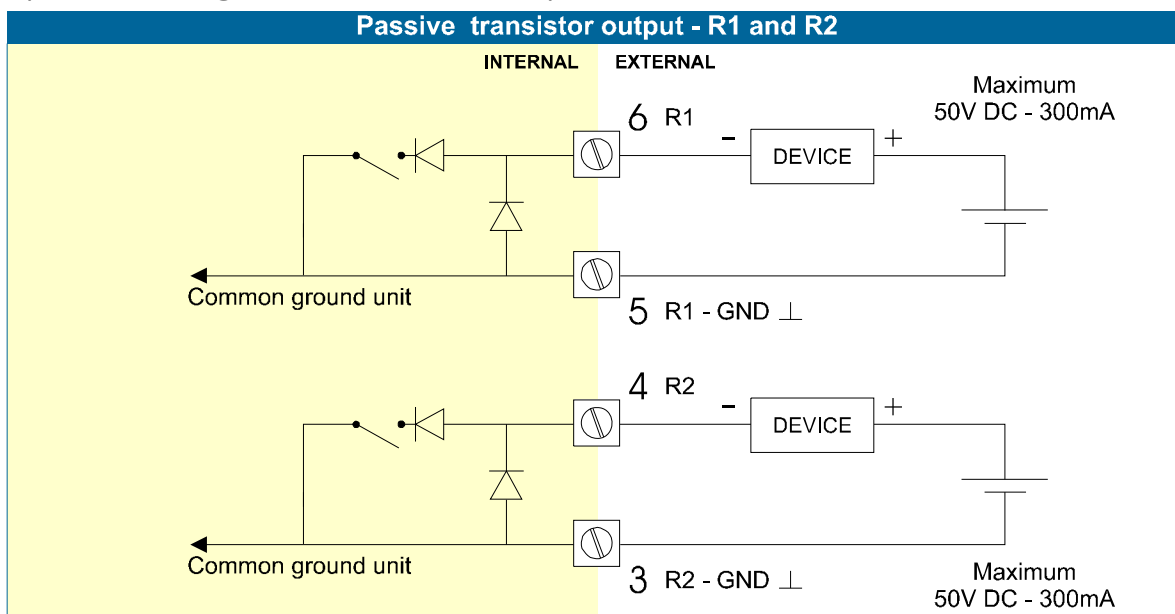
They can be delivered in various configurations.



Note: R1 is wired to terminal 05-06. R2 is wired to terminal 03-04.

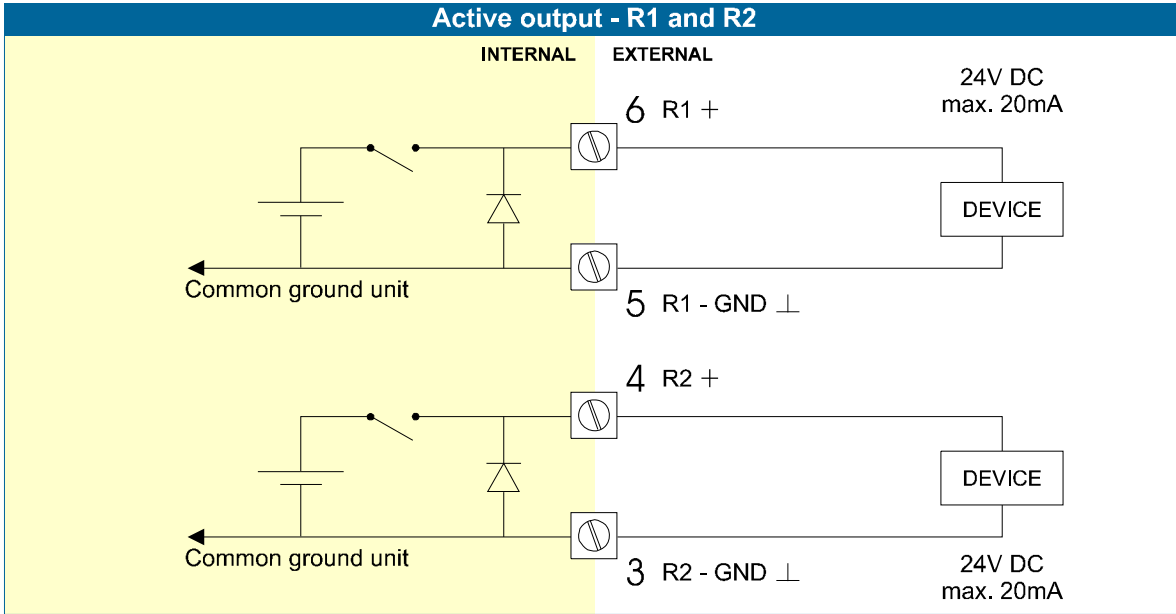
Alarm option OT:

A passive 300mA@50VDC NPN transistor output.



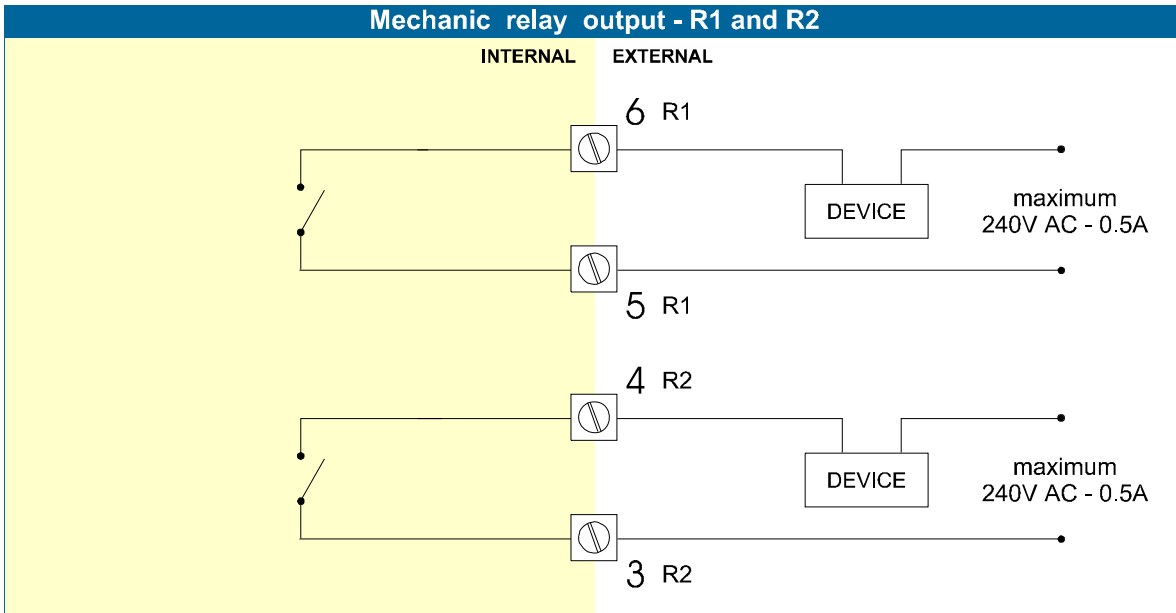
Alarm option OA:

An active 24V DC signal according the alarm settings is available with this option.
 Max. driving capacity 20mA@24V per output. (Requires power supply option PD, PF or PM).



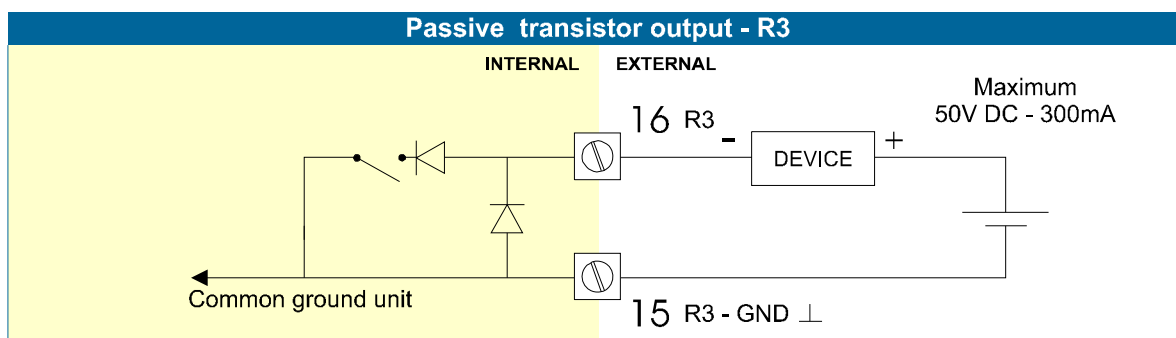
Alarm option OR:

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



Terminal 15-16; transistor or relay output R3:

This additional output is an alarm output according setup 83.

**ANALOG OUTPUT OPTIONS:**

The analog output can be used to output the measured value and/or serve as a power supply (option AP). The following analog output configurations are available.

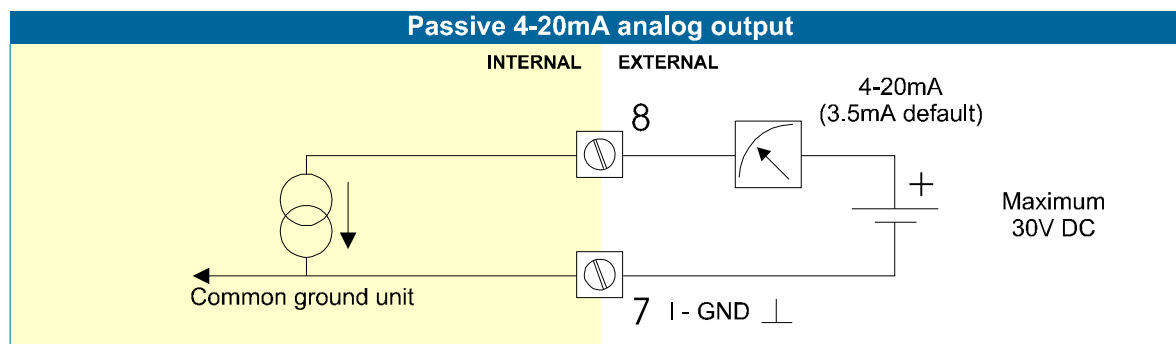
Analog output option AP (output loop powered):

A 4-20mA current-sinking signal proportional to the level 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.

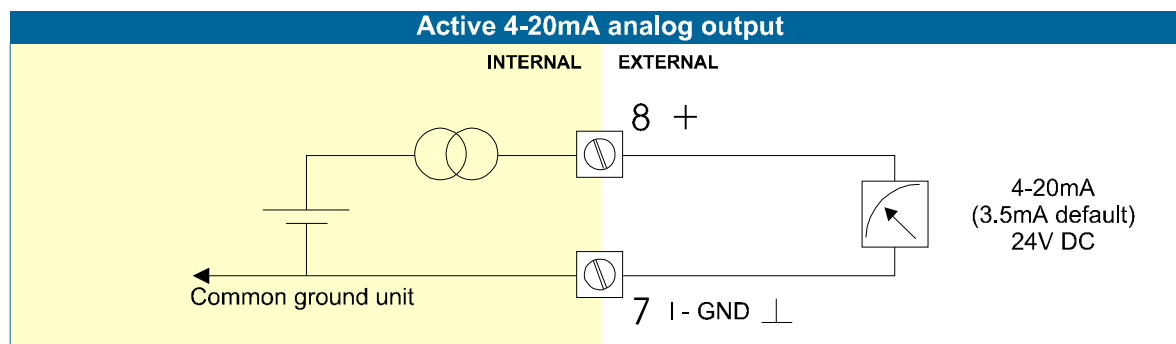
Max. driving capacity 1000 Ohm.

**Analog output option AA:**

An active 4-20mA signal proportional to the level is available with this option.

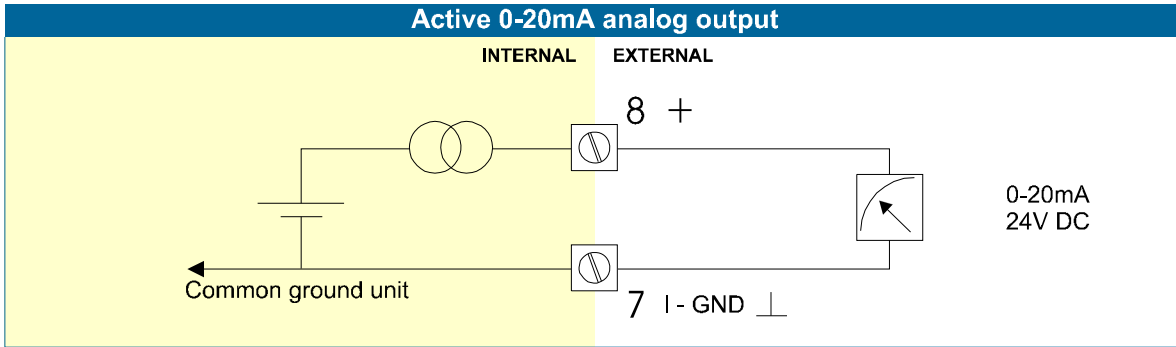
When the output is disabled, a 3.5mA signal will be generated on these terminals.

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



Analog output option AB:

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

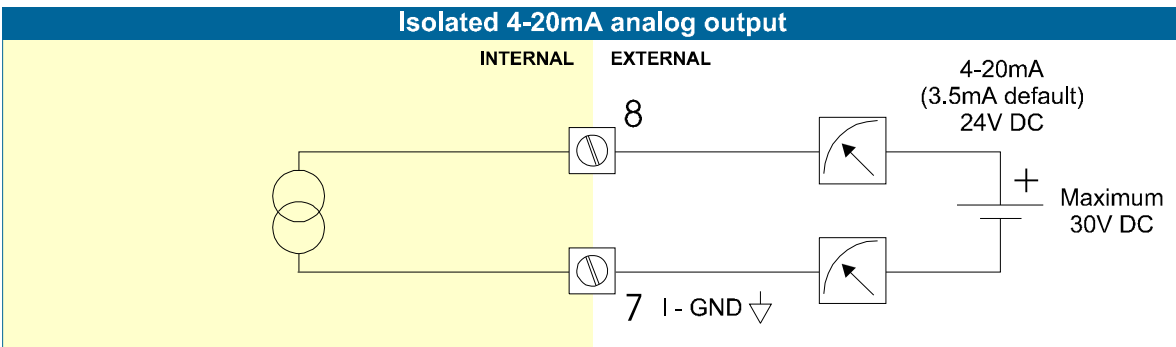


Analog output option AF:

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

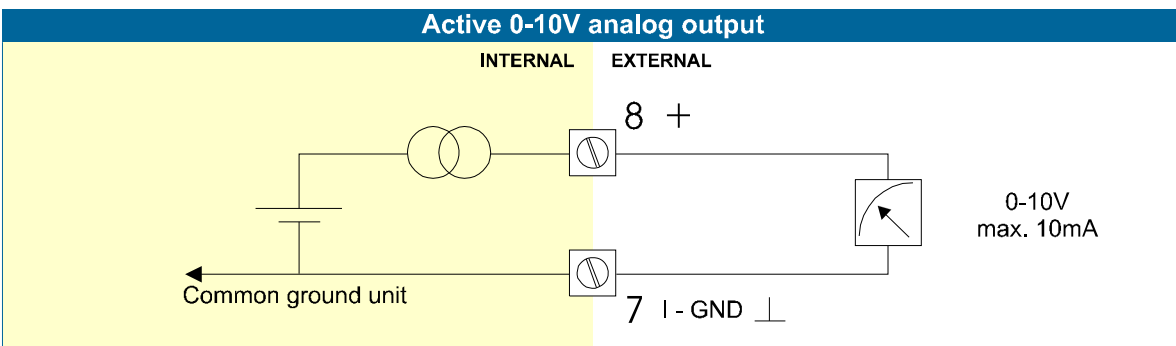
Analog output option AI:

An isolated 4-20mA signal proportional to the level 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.



Analog output option AU:

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

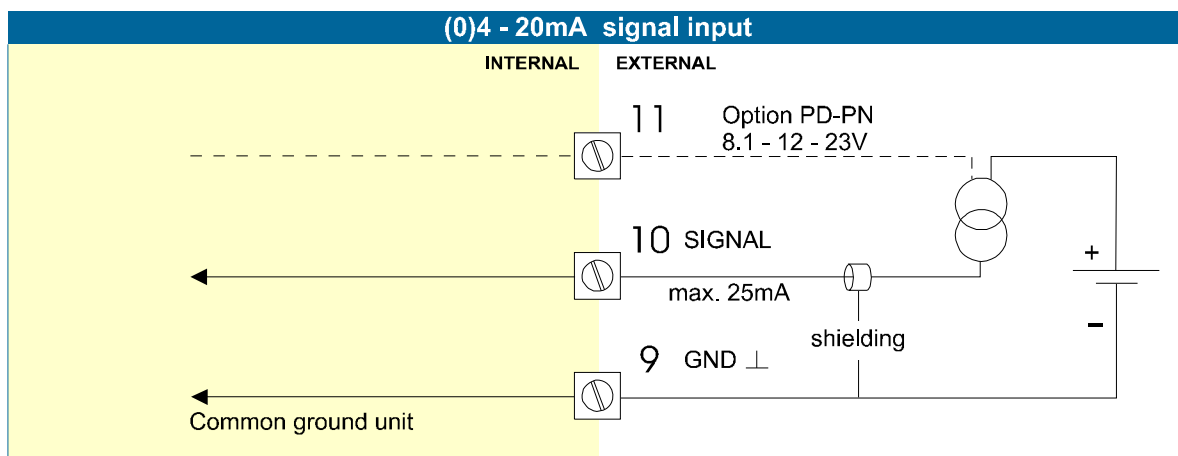


ANALOG INPUT OPTIONS:

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

The F170-A requires a (0)4-20mA level sensor signal which will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.

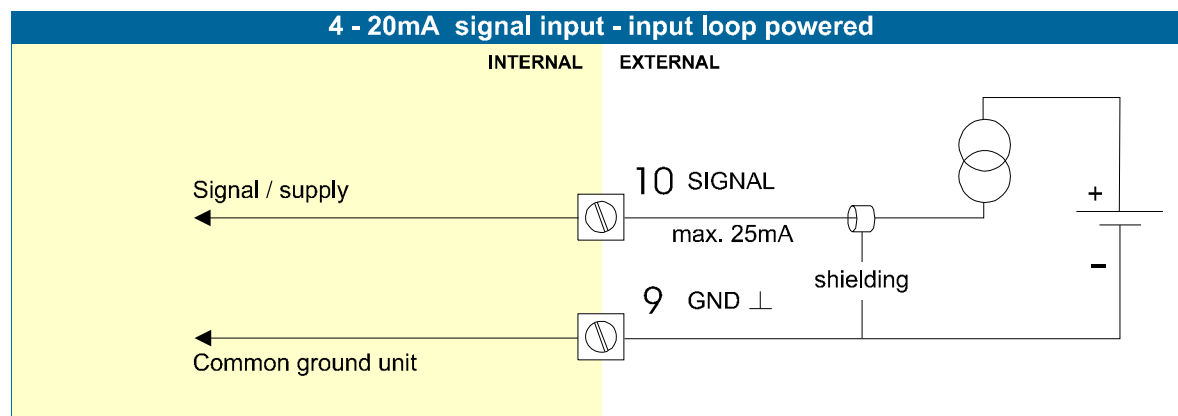
For Intrinsically safe applications (without input loop power): please read chapter 5.



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

The F170-A-PL requires a 4-20mA level sensor 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.



4.4.4 COMMUNICATION AND BACKLIGHT CONNECTOR

When looking at the back of the F170-A you will see the (optional) communication and backlight connector in the bottom right corner.

Option – MODBUS communication RS232/RS485:

- Communication options are CB (RS232), CH (RS485), CI (RS485, 4 wire), CT (RS232 TTL) and CX (no communication). For installed options see the manufacturer's plate.
- Full serial communications and computer control in accordance with RS232 (length of cable max. 15 meters) or RS485 (length of cable max. 1200 meters) is possible.
- Read the Modbus communication protocol and Appendix C.

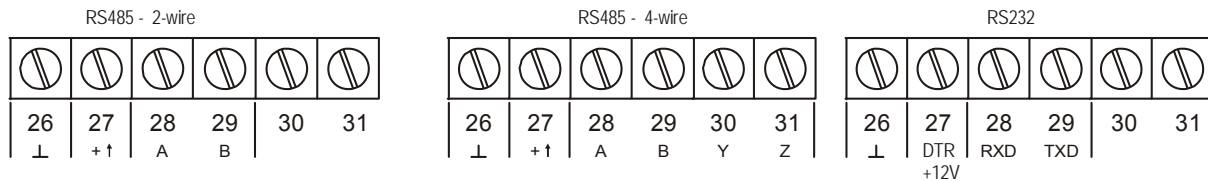


Fig. 11: Overview terminal connectors communication option.

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 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 below text 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.

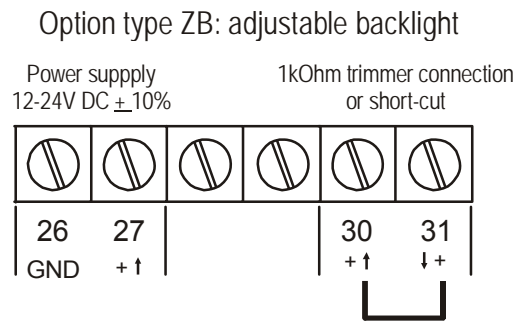


Fig. 12: Overview terminal connectors backlight option.

5. INTRINSICALLY SAFE APPLICATIONS

5.1. GENERAL INFORMATION AND INSTRUCTIONS



Caution !

Cautions

- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- This device may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the cabinet has been opened (danger of electric shock). The housing may only be opened by trained personnel.
- To maintain the degree of protection of at least IP65 in accordance with IEC 60529, certified cable entries in accordance with IEC 61241-0 must be used and correctly installed. Unused openings must be closed with suitable blanking elements.
- When the enclosure of the Indicator is made of aluminum alloy, when used in a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.
- Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.



Safety Instructions

- When two or more active intrinsically safe circuits are connected to the indicator, in order to prevent voltage and/or current addition, applicable to the external circuits, precautions must be taken to separate the intrinsically safe circuits in accordance with IEC 60079-11.
- For the combined connection of the different supply, input and output circuits, the instructions in this manual must be observed.
- From the safety point of view the circuits shall be considered to be connected to earth.
- For installation under ATEX directive: this intrinsically safe device must be installed in accordance with the ATEX directive 94/9/EC and the product certificate KEMA 03ATEX1074 X.
- For installation under IECEx scheme: this intrinsically safe device must be installed in accordance with the product certificate IECEx DEK 11.0042X.
- Exchange of Intrinsically Safe battery FWLiBAT-0xx with certificate number KEMA 03ATEX1071 U or IECEx KEM 08.0005U is allowed in Hazardous Area. See paragraph 5.4. for detailed battery replacement instructions.



Note !

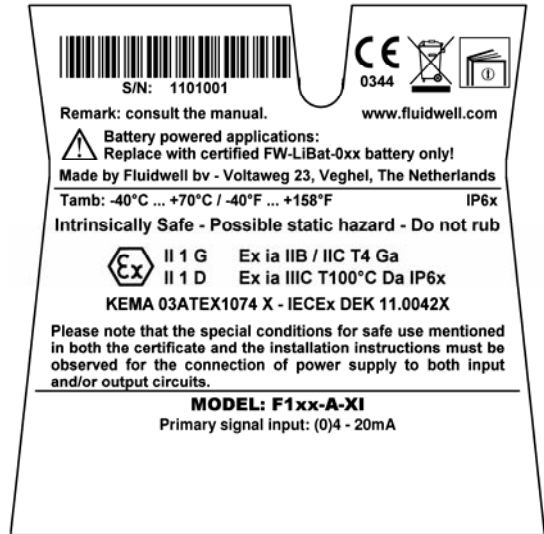
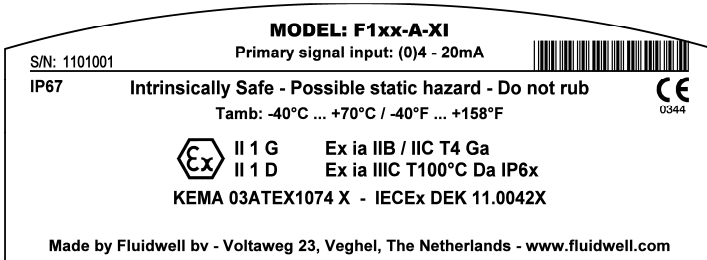
Please Note

- 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)

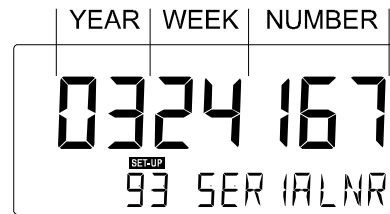
Indicated labels on the back cover (below) and on the inside cover (right) show the type labels for intrinsically safe certified units.

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

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 F170-A-XI:

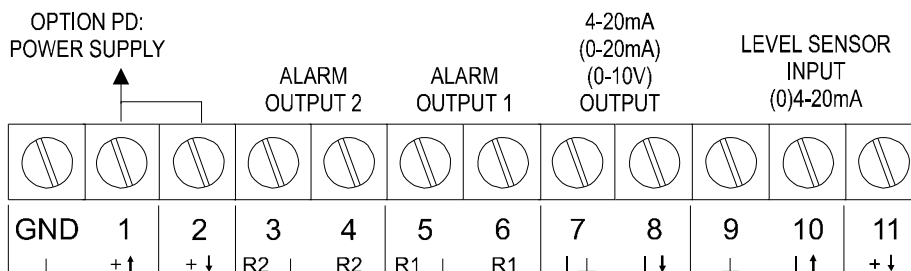


Fig. 13: Overview terminal connectors Intrinsically Safe option (XI).

Explanation Intrinsically Safe options:



Always use approved IS barriers to separate the safe area wiring from the hazardous area wiring, as indicated in below configuration examples.

Option PD – Intrinsically Safe power supply and sensor supply – Terminal GND- 01 and terminal 02 and 11.

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

Terminal 02: this terminal offers the same voltage as connected to terminal 01.

Terminal 11: this terminal offers a voltage determining on the position of switch 1.

To access the switches open the enclosure, disconnect the terminals and unscrew the plastic back cover. Carefully remove the back cover: the PCB and internal electronics are now exposed. The switches are located on the right hand side on the PCB – as indicated below:

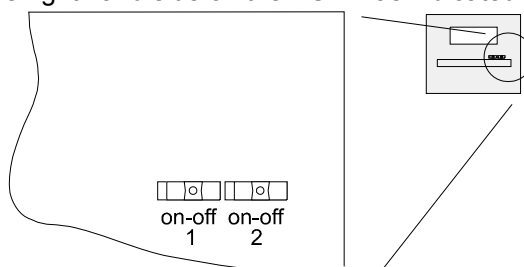


Fig. 14: Switch position voltage selection option PD-XI.

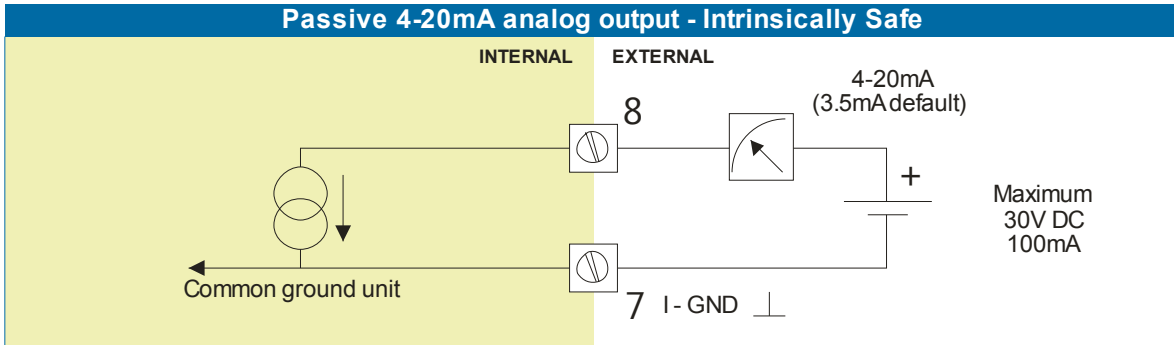
Switch position	
SENSOR A	
SWITCH 1	VOLTAGE
on	= input voltage
off	3.2 V DC

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

Function switch 2: no function (not available).

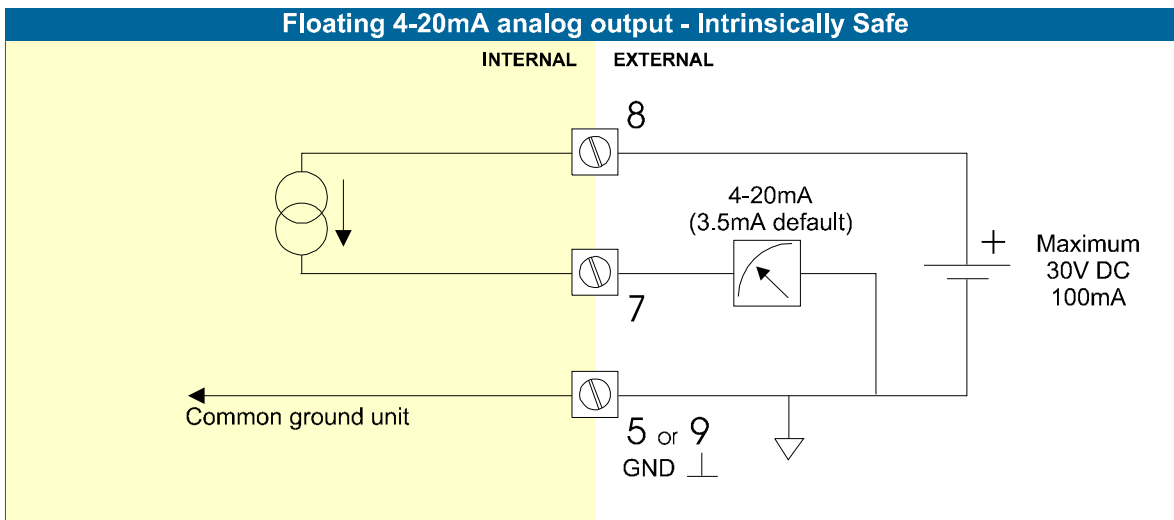
Option AP – Intrinsically Safe loop powered analog output:

- **As passive 40-20mA analog output**
 A 4-20mA current-sinking signal proportional to the level 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.
- **As external power supply**
 Connect an external power supply of 8-30VDC (or a 4-20mA loop) to these terminals. Connect the "-" to terminal 7 and the "+" (via an IS barrier!) to terminal 8. When power is applied to these terminals, the (optional) internal battery will be disabled automatically to extend the battery life time.



Option AF – Intrinsically Safe floating 4-20mA analog output:

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



5.3. CONFIGURATION EXAMPLES INTRINSICALLY SAFE APPLICATIONS

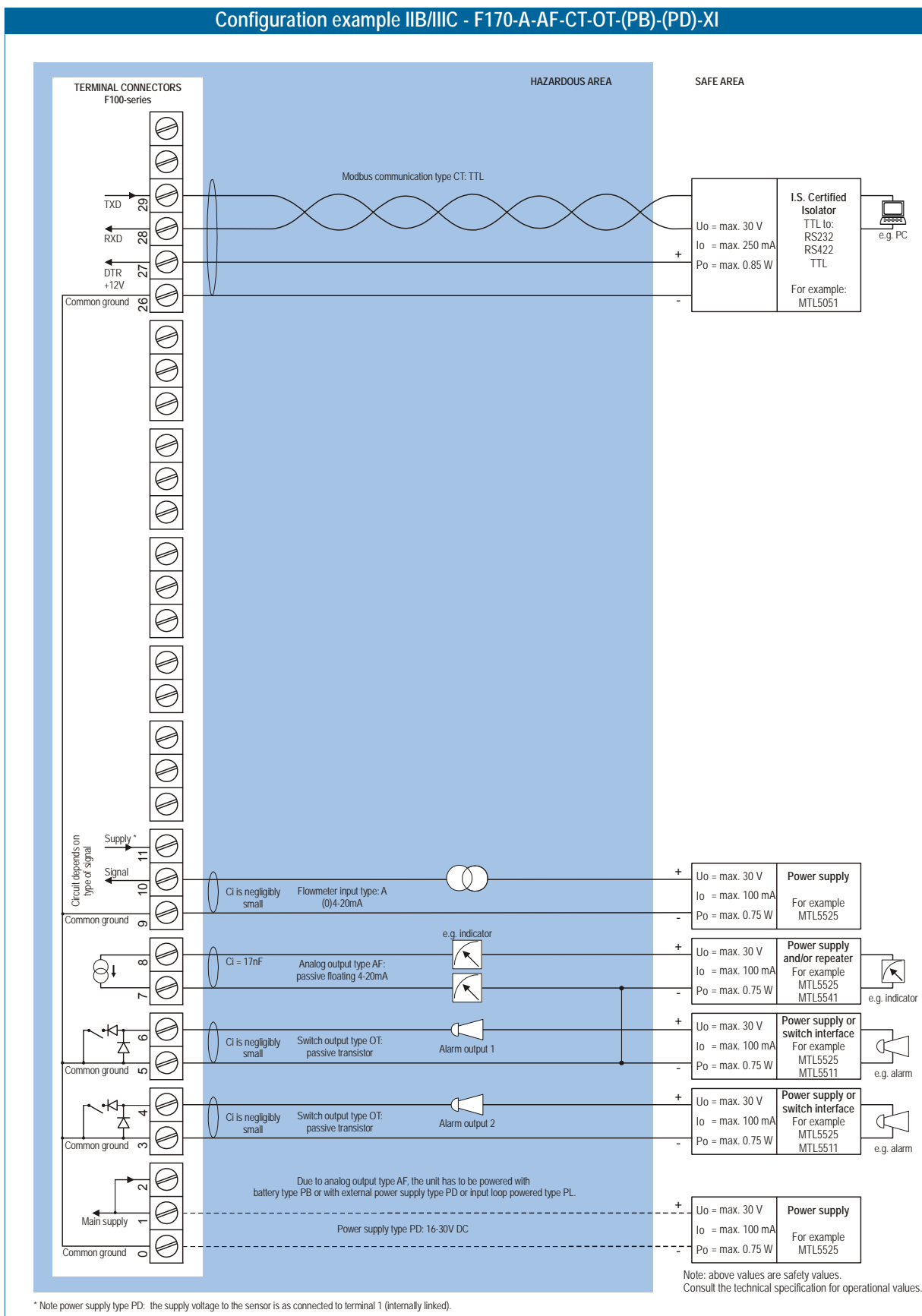


Fig. 15: Configuration example 1 Intrinsically Safe

Configuration example IIB/IIC and IIC - F170-A-AF-(CT)-OT-PD-XI

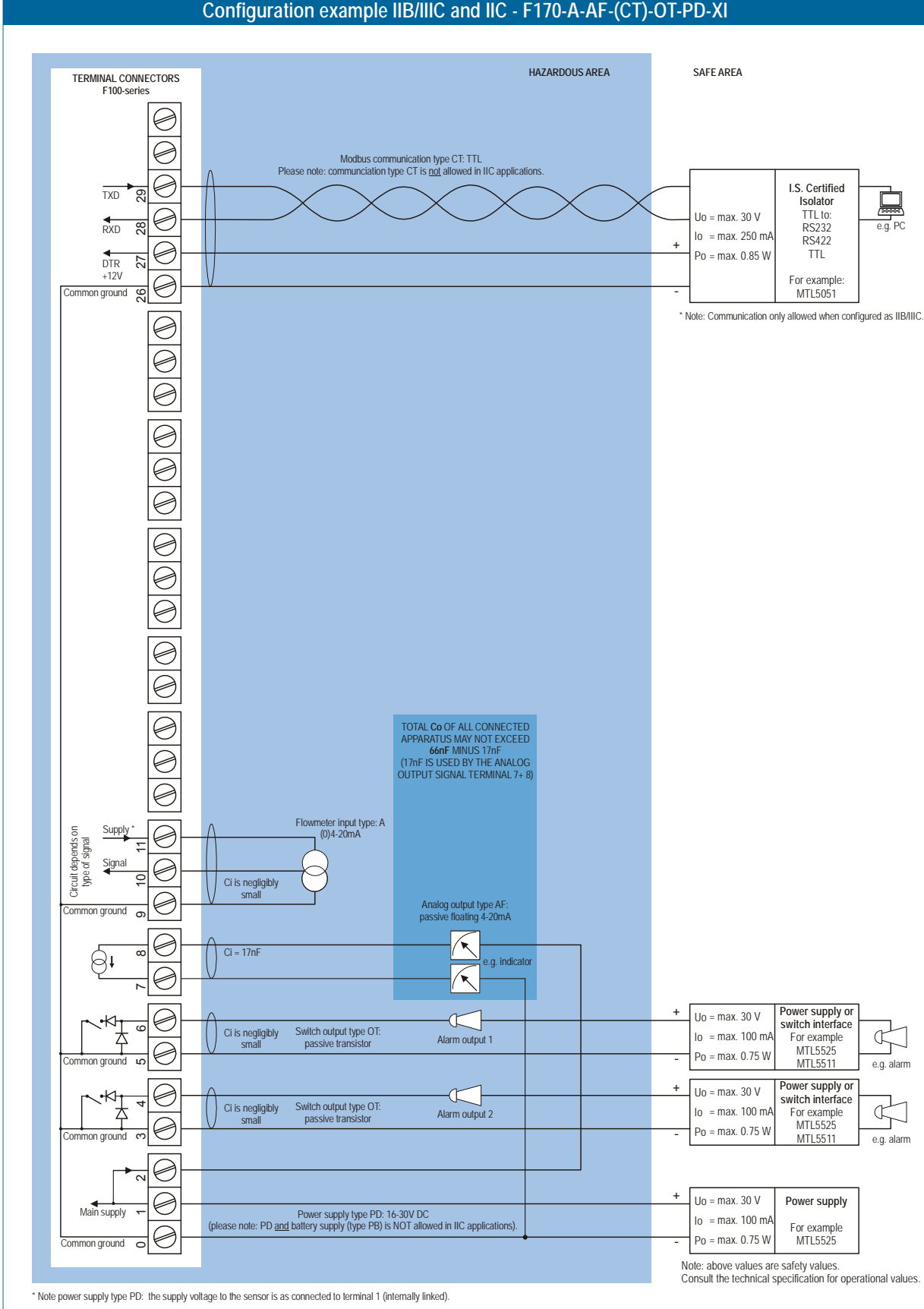


Fig. 16: Configuration example 2 Intrinsically Safe

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.



Caution !

Safety instructions for hazardous areas

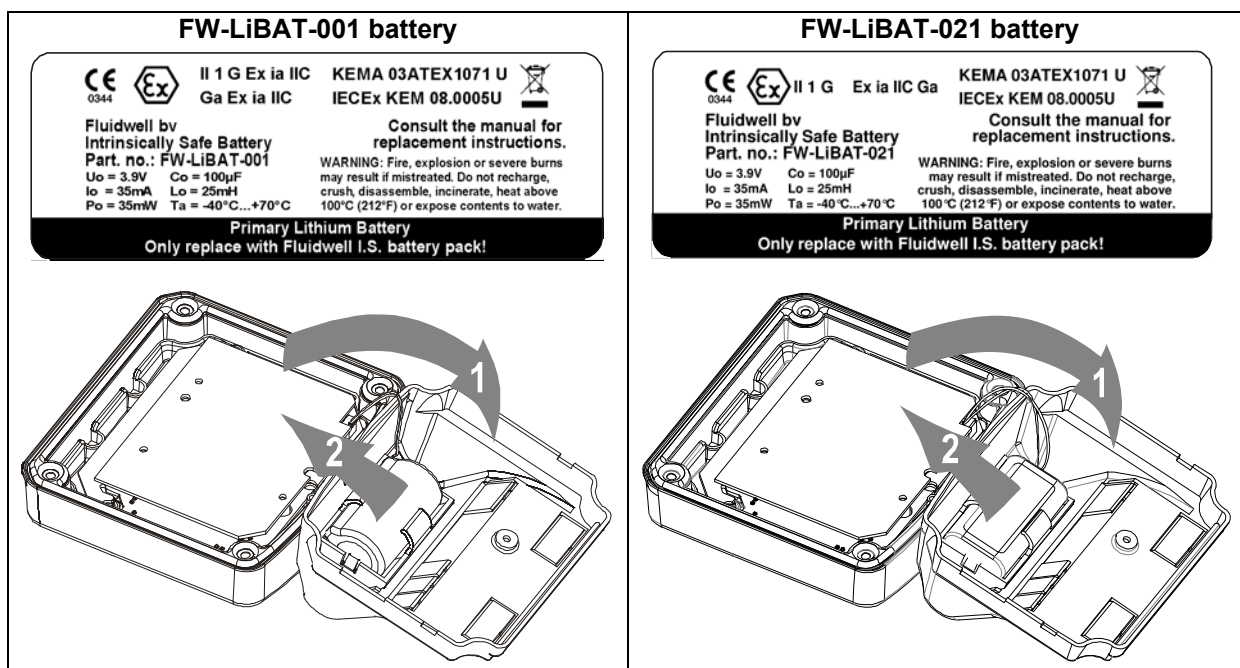
- Verify the correct battery is supplied: **Only batteries with indicated Ex label are certified for replacement and use in hazardous areas.** Batteries for use in safe areas have no Ex label. **DO NOT EXCHANGE:** Using the wrong type of battery can pose a SERIOUS RISK.
- **For use in hazardous areas Fluidwell recommends FW-LiBAT type batteries (manufactured by Fluidwell bv) only.**

Battery replacement procedure



Note !

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



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 F170-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.*

Battery life-time:

It is influenced by several issues as:

- 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).
- 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 sensor might be necessary. Do re-enter any subsequent Span 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.

6.2. REPAIR

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

APPENDIX A: TECHNICAL SPECIFICATION

GENERAL

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Digits	Seven 17mm (0.67") and eleven 8mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Type ZB	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications. Power requirements: 12-24V DC + 10% or type PD, PF, PM. Power consumption max. 1 Watt.

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


Operating temperature	
Operational	-40°C to +80°C (-40°F to +176°F)
Intrinsically Safe	-40°C to +70°C (-40°F to +158°F)

Power supply	
Type PB	Lithium battery - life-time depends upon settings - up to 5 years.
Type PC	Intrinsically Safe lithium battery - life-time depends upon settings - up to 5 years.
Type PD	8-24V AC / DC ± 10%. Power consumption max. 10 Watt. Intrinsically safe: 16-30V DC; power consumption max. 0.75 Watt.
Type PF	24V AC / DC ± 10%. Power consumption max. 15 Watt.
Type PL	Input loop powered from sensor signal 4-20mA (type A, non IS).
Type PM	115-230V AC ± 10%. Power consumption max. 15 Watt.
Type PX	Output loop powered: 8-30V DC. Power consumption max. 0.5 Watt.
Note PF / PM	The total consumption of the sensors, backlight and outputs may not exceed 400mA@24V.
Note I.S. applications	For intrinsically safe applications, consult the safety values in the certificate.

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

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm ² and 2.5mm ² (Type PM / PF)

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

Hazardous area (option)	
Intrinsically safe Type XI	ATEX approval:  II 1 G Ex ia IIB/IIC T4 Ga II 1 D Ex ia IIIC T100°C Da IP6x IECEx approval: Ex ia IIB/IIC T4 Ga Ex ia IIIC T100°C Da IP6x
Explosion proof Type XD/XF	ATEX approval ref.: <EX> II 2 GD EEx d IIB T5. Weight appr. 15kg. Dimensions of enclosure: 350 x 250 x 200mm (13.7" x 9.9" x 7.9") LxHxD.

INPUTS

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

Transistor output(s)	
Function	Two (intrinsically safe), three or four (type OS) alarm outputs.
Type OA	Three active 24V DC transistor output; max. 50mA per output (requires type AA + PD, PF or PM).
Type OR	Two mechanic relay output; max. switch power 230V AC - 0,5A (requires type PF or PM) and one OA or OT output.
Type OS	Four mechanic relay outputs; max. switch power 230V AC - 0,5A (requires type PD and AP). Not Intrinsically Safe.
Type OT	Two or three passive transistor output - not isolated. Load max. 50V DC - 300mA.

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

OPERATIONAL

Operator functions	
Displayed functions	<ul style="list-style-type: none"> level. height or percentage (or no indication). low-low alarm value (level, percentage or height) low alarm value (level, percentage or height) high alarm value (level, percentage or height) high-high alarm value (level, percentage or height) alarm value's can be entered (this function can be disabled or hidden).

Level	
Digits	6 digits.
Units	L, m3, GAL, USGAL, KG, lb, bbl, no unit.
Decimals	0 - 1 - 2 or 3.

Height	
Digits	6 digits.
Units	mm - cm - m - mtr - inch - ft - mmwk - mmwc - cmwk - cmwc - mwk - mwc - inwc - ftwc - mbar - bar - psi - no unit.
Decimals	0 - 1 or 2.

Percentage	
Digits	3 digits.
Decimals	1.

Alarm values	
Digits	6 digits.
Units	According to selection of main display information (level, percentage or height)
Decimals	According to selection of main display information (level, percentage or height)
Type of alarm	low and high level alarm. Includes delay time alarm and configurable alarm output.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F170-A 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 level-levels programmed correctly?
- connection of the external power-supply according specification.

Alarm output does not function:

Check:

- SETUP 81 - 84 - did you enable the relays?
- SETUP 3 - alarm: are the correct alarm values programmed

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

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

APPENDIX C: COMMUNICATION VARIABLES

Remarks:

- Below, an overview of the F170-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 F170-A - SETUP-LEVEL:				
VAR	DESCRIPTION	BYTES	VALUE	REMARKS
LEVEL				
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	
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	
ALARMS				
234 EAh	level low	3	0-9,9999	decimals: see 50 (32h)
237 EDh	level high	3	0-9,9999	decimals: see 50 (32h)
205 CDh	delay time alarm low level	2	1...9,999	steps of 0.1 second
DDh	delay time alarm high level	2	1...9,999	steps of 0.1 second
44h	edit level alarm	1	0=operator 1=SETUP level	
46h	alarm at level zero	1	0=ignore 1=default 2=no relay	
DISPLAY				
68 (44h)	set level 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	

SENSOR				
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
OTHERS				
168 (A8h)	password	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER F170-A VARIABLES FOR COMMUNICATION

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

READ LEVEL: The value difference as mentioned with total/acc. total might appear here too.

WRITE LEVEL: Impossible.

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LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE :	DATE :
1 - LEVEL	Enter your settings here		
11 unit	L		
12 decimals	0000000		
13 span	000001		
14 decimals span	0		
15 off set	0		
2 - HEIGHT			
21 unit	m		
22 decimals	000000		
23 span	000001 m		
24 decimals span	0		
25 offset	000000 m		

SETTING	DEFAULT	DATE :	DATE :
3 - ALARM			
31 level zero	default		
32 alarm low-low	0		
33 alarm low	0		
34 alarm high	0		
35 alarm high-high	0		
36 delay alarm low-low	0.0 sec		
37 delay alarm low	0.0 sec		
38 delay alarm high	0.0 sec		
39 delay alarm high-high	0.0 sec		
4 - DISPLAY			
41 alarm set	operator		
42 function	level		
5 - POWER MANAGEMENT			
51 LCD-new	1 sec.		
52 mode	operational		
6 - SENSOR			
60 formula	linear		
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 input	level		
73 min. level 4-mA	0000000		
74 max. level 20mA	9999999		
75 cut off percentage	0.0%		
76 tune min - 4mA	0208		
77 tune max - 20mA	6656		
78 filter	01 (off)		
8 - RELAY OUTPUT			
81 output R1	off		
82 output R2	off		
83 output R3	off		
84 output R4	off		
9 - COMMUNICATION			
91 baud-rate	2400		
92 address	1		
93 mode	BUS-ASC		
A - OTHERS			
A5 password	0000		
A6 tagnumber	0000000		

