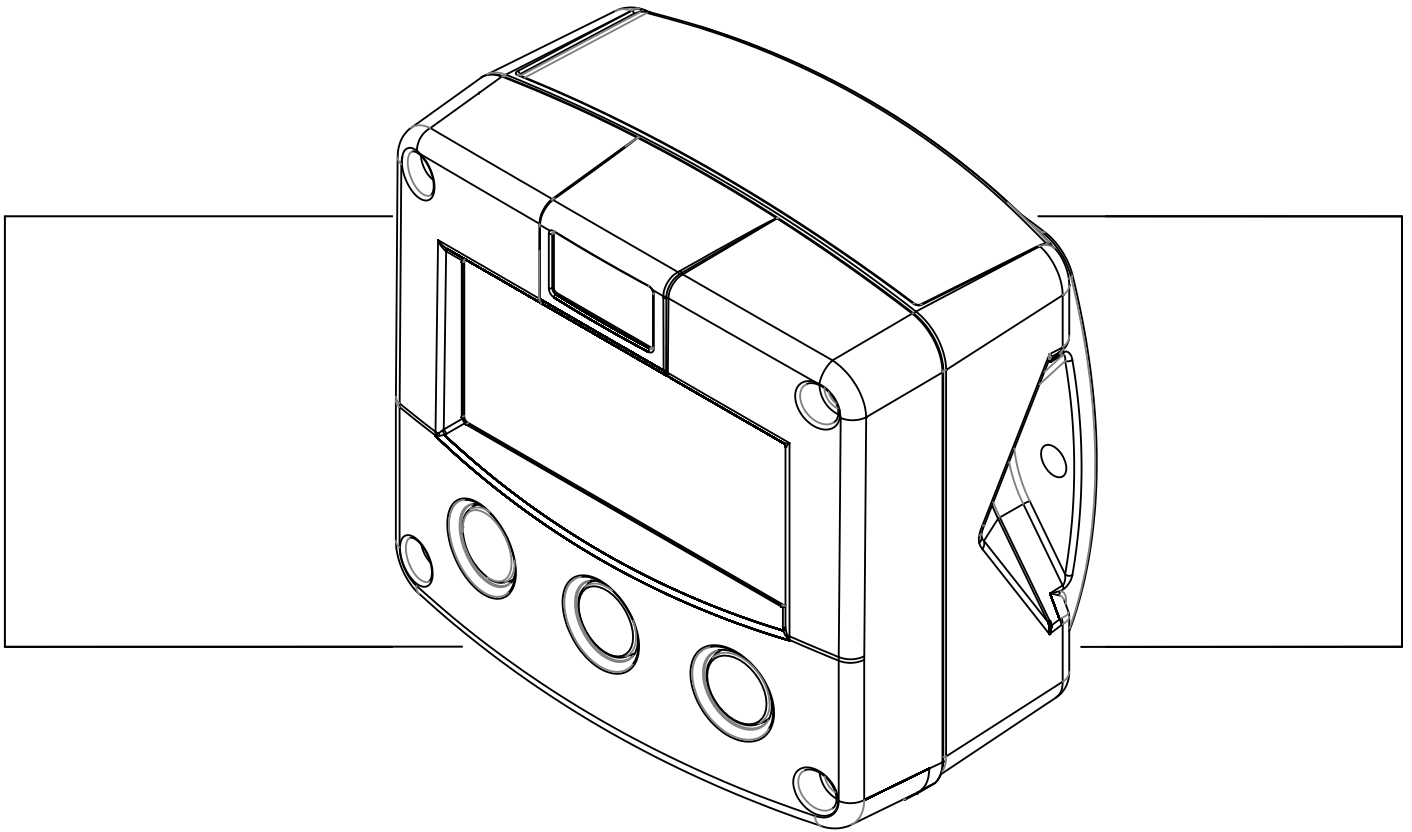


F170-A

LEVEL INDICATOR WITH HIGH / LOW ALARMS



Signal input sensor: (0)4-20mA

Signal outputs: (0)4-20mA/ 0-10V ref. level, height, percentage

Alarm outputs: maximum four level alarms

Options: Intrinsically Safe, Modbus communication, backlight



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 metal enclosure as indicated if the F170-A has an incoming power line which carries a 115-230V AC. The Protective Earth (PE) wire may never be disconnected or removed.
- **Intrinsically safe applications:** follow the instructions as mentioned in Chapter 5 and consult “Fluidwell F1...-XI - Documentation for Intrinsic safety”.

DISPOSAL OF ELECTRONIC WASTE



- The WEEE Directive requires the recycling of disposed electrical and electronic equipment in the European Union. When the WEEE Directive does not apply to your region, we support its policy and ask you to be aware on how to dispose of this product.
- The crossed out wheeled bin symbol as illustrated and found on our products tells that this product shall not be disposed of into the general waste system or into a landfill.
- At the end of its life, equipment shall be disposed of according to the local regulations regarding waste of the electrical and the electronic equipment.
- Please contact your local dealer, national distributor or the manufacturer's Technical helpdesk for information on the product disposal.

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.
- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- 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 enclosure 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 the classification of the enclosure (see manufacture's plate and chapter 4).
- 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 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 manual describes the standard unit as well as the available options. 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 damage of the F170-A or connected instruments.



A "**caution !**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F170-A 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.

WARRANTY AND TECHNICAL SUPPORT

For warranty and technical support for your Fluidwell products, visit our internet site www.fluidwell.com or contact us at support@fluidwell.com.

Hardware version	:	03.01.xx
Software version	:	03.05.03
Manual	:	FW_F170A_v1901_02_EN.docx
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CONTENTS MANUAL

Safety instructions	2
Disposal of electronic waste	2
Safety rules and precautionary measures	2
About the operation manual	3
Warranty and technical support	3
Contents manual.....	4
1. Introduction.....	6
1.1. System description of the F170-A.....	6
2. Operational	8
2.1. General	8
2.2. Control panel.....	8
2.3. Operator information and functions.....	8
3. Configuration	11
3.1. Introduction	11
3.2. Programming SETUP-menu	11
3.2.1. General	11
3.2.2. Overview functions SETUP MENU	14
3.2.3. Explanation of SETUP menu 1 – Level	15
3.2.4. Explanation of SETUP menu 2 – Height.....	16
3.2.5. Explanation of SETUP menu 3 – Alarm.....	16
3.2.6. Explanation of SETUP menu 4 – Display	17
3.2.7. Explanation of SETUP menu 5 – Power Management.....	17
3.2.8. Explanation of SETUP menu 6 – Sensor.....	18
3.2.9. Explanation of SETUP menu 7 – Analog output.....	19
3.2.10. Explanation of SETUP menu 8 – Relay output.....	20
3.2.11. Explanation of SETUP menu 9 – Communication	21
3.2.12. Explanation of SETUP menu a – Others	21
4. Installation	22
4.1. General directions	22
4.2. Installation - surrounding conditions	22
4.3. Dimensions- Enclosure	23
4.4. Installing the hardware.....	25
4.4.2. Protective Earth (PE) connections	26
4.4.3. Aluminum enclosure - Field mounted	27
4.4.4. Aluminum enclosure - Panel mounted.....	28
4.4.5. Plastic (GRP) enclosure.....	29
4.4.6. Terminal connectors	30
4.4.7. sensor supply	31
5. Intrinsically safe applications.....	36
5.1. General information and instructions	36
5.2. Terminal connectors Intrinsically safe applications.....	38
5.3. Configuration examples Intrinsically Safe applications.....	40
5.4 Battery replacement instructions.....	42
5.4.1. Safety instructions.....	42
5.4.2. Replace the battery (hazardous area)	42
5.4.3. Disposal of batteries	42
6. Maintenance.....	43
6.1. General directions	43
6.2. Repair.....	43
6.3. Repair policy	43

Appendix A: Technical specification.....44

Appendix B: Problem solving47

Appendix C: Communication variables48

Declaration of Conformity.....52

Index of this manual53

List of figures in this manual.....53

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F170-A

Functions and features

The level indicator F170-A is a microprocessor driven instrument designed to display the level and percentage as well as monitoring the level with four 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 (type PB / PC),
- intrinsic safety for use in hazardous applications (type XI),
- several mounting possibilities with aluminum or GRP enclosures for harsh industrial surroundings,
- ability to process all types of signals,
- transmitting possibilities with analog, alarm and communication (option) outputs.

Sensor input

This manual describes the unit with one analog (0)4-20mA input for the level sensor "-A version". To power the sensor, several options are available.

Standard outputs

- Configurable alarm outputs: two, three or four alarm outputs, depending on the configuration ordered. The functionality of the output can be user defined.
- Configurable passive linear (0)4-20mA / 0-10V analog output with 10-bits resolution representing the actual level. The minimum and maximum signal output can be tuned.

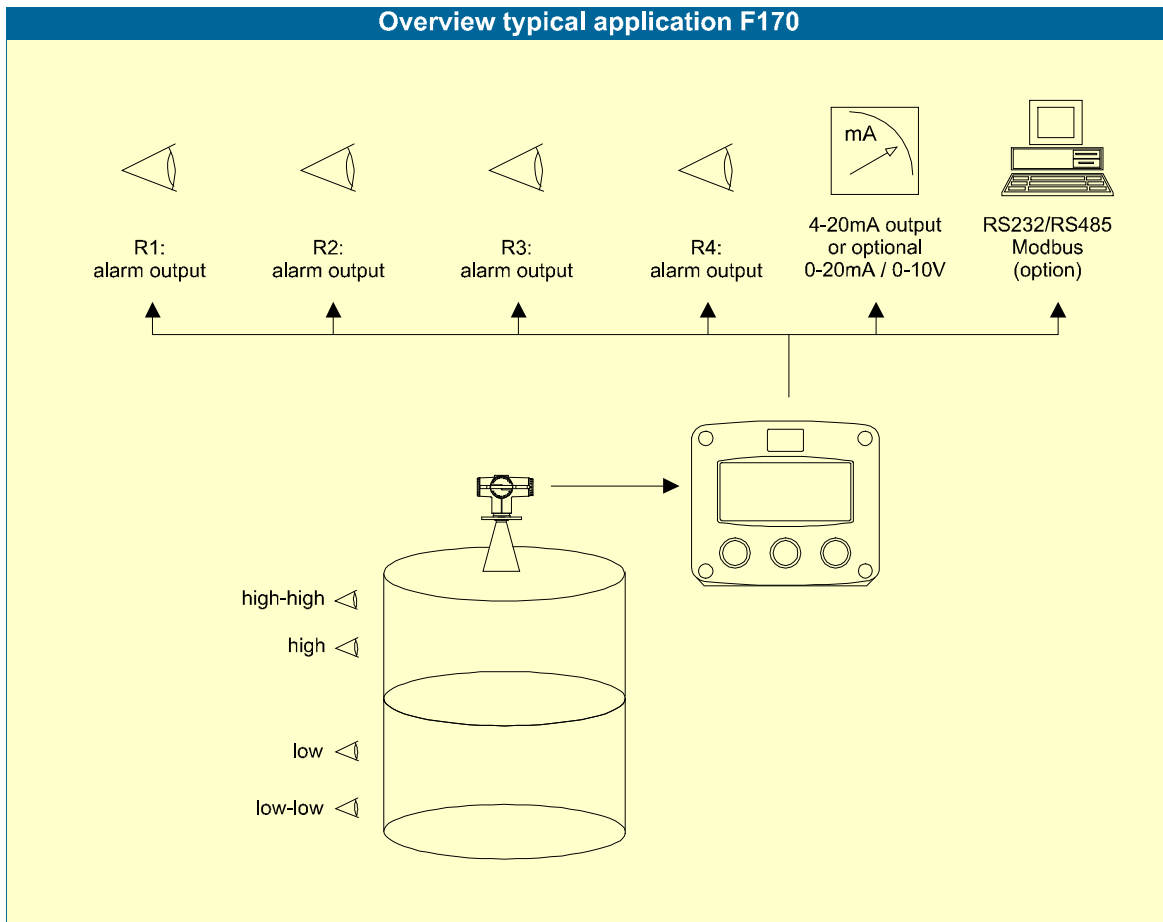


Fig. 1: Typical application for the F170-A.

Configuration of the unit

The F170-A was designed to be implemented in many types of applications. For that reason, a SETUP-menu 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 LCD to show the measuring units, the status information, the trend-indication and the 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, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure.

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 the SETUP-menu ; 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 configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F170-A will always act at Operator level. The information displayed is dependent upon the SETUP-settings. The signal generated by the connected sensor is 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 / height / percentage**

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 displayed information depends on the configuration setting. When "-----" is shown, the value is too high to be displayed. The arrows \blacktriangle indicate the increase/decrease of the level trend.

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

Remark: this function might not be accessible: it depends on the configuration of the unit. The alarm value is related to level, height or percentage (depends on configuration setting).

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

- 1) press PROG: the word "PROGRAM" will be flashing,
- 2) use \blacktriangleright to select the digits and \blacktriangle to change the blinking digit,
- 3) set the new alarm value by pressing the PROG/ENTER key.



Fig. 4: Example of display information during programming.

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

- **Alarm**

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

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 its range without an immediate alarm.

- **Clear Alarm outputs**

The Operator has the possibility to clear the alarm outputs, e.g. to turn off an alarm bell. This feature can be enabled individually for each output in SETUP-menu 8. When the clear action is performed, all enabled outputs that are connected to an active alarm status will be cleared. To do so, press the CLEAR/ \blacktriangleright key at operator level when the actual measurement value is shown. The text "CLEAR OUTPUTS" is shown and pressing the CLEAR/ \blacktriangleright key again will clear the outputs. To avoid a reset at this stage, press any other key or wait for 20 seconds.



Caution !

Be aware that only the output(s) is cleared; the alarm itself remains available and visible on the display. When the same or an additional alarm (re-)occurs, the output(s) is triggered again!

- **Low-battery alarm**

When the battery voltage drops, it must be replaced.

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.



Fig. 5: Example of low battery alarm.

- **Alarm**

When the "ALARM"-flag is displayed on the screen without an additional alarm message, an internal alarm has occurred. 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 this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Make sure, the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the enclosure cover is removed or the panel cabinet has been opened (danger from electrical shock). The enclosure may only be opened by trained persons authorized by the operator of the facility.
- Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.

3.2. PROGRAMMING SETUP-MENU

3.2.1. GENERAL

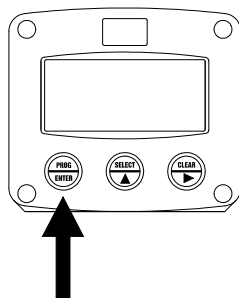
Configuration of the F170-A is done via the SETUP-menu. The SETUP-menu is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows  will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed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



Note !

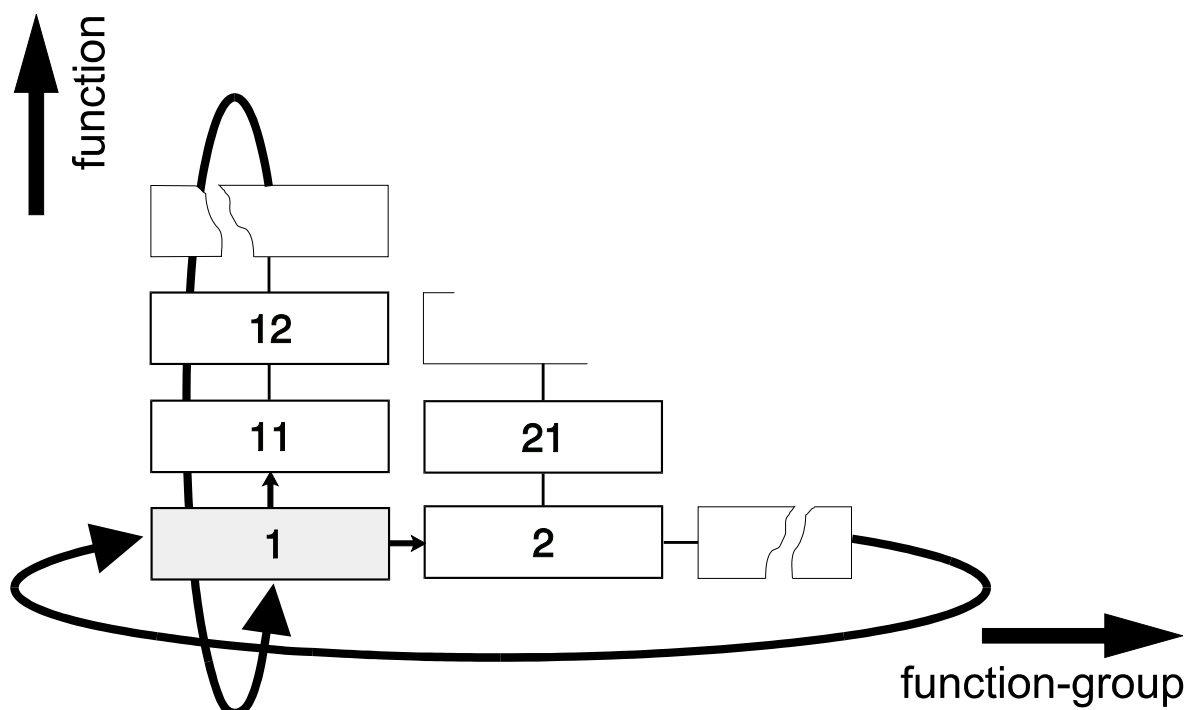
Note: A password may be required to enter SETUP.
Without this password access to SETUP is denied.

To enter the SETUP-menu:



Press  for 7 seconds

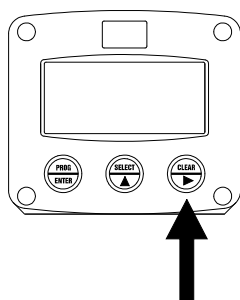
Matrix structure of the SETUP-menu:



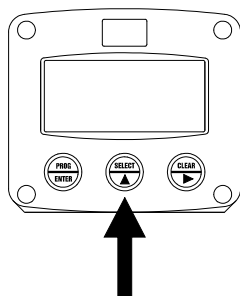
SCROLLING THROUGH SETUP-MENU

Selection function-group and function:

SETUP is divided into several function groups and functions.



Select function-group with



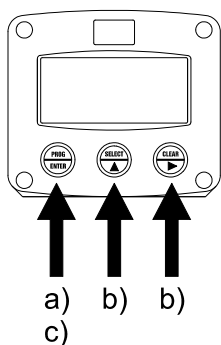
Select function with





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 \blacktriangle , 11 \blacktriangle , 12 \blacktriangle , 13 \blacktriangle , 14 \blacktriangle , 1 \blacktriangleright , 2 \blacktriangleright , 3 \blacktriangle , 31 etc.).



To change or 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.

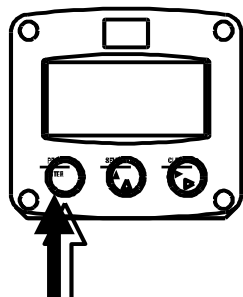
When data is altered but ENTER is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for three seconds: the PROG-procedure will be left automatically and the former value reinstated.



Note !

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 MENU

SETUP FUNCTIONS AND VARIABLES			
1	LEVEL		
	1.1	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	1.2	DECIMALS	0000000 - 111111.1 - 22222.22 - 3333.333
	1.3	SPAN	0.000001 - 999,999 unit
	1.4	DECIMALS SPAN	0 - 6
	1.5	OFFSET	-999,999 - +999,999 units
2	HEIGHT		
	2.1	UNIT	mm - cm - m - mtr - inch - ft - mmwk - mmwc - cmwk - cmwc - mwk - mwc - inwc - ftwc - mbar - bar - psi - no unit.
	2.2	DECIMALS	0 - 1 - 2 (Ref: displayed value)
	2.3	SPAN	0.000001 - 999,999 unit
	2.4	DECIMALS SPAN	0 - 6
	2.5	OFFSET	-999,999 - +999,999 units
3	ALARM		
	3.1	INPUT	level - height - percentage
	3.2	EMPTY	default - no relays - ignore
	3.3	ALARM LOW-LOW	-999.999 - 999,999
	3.4	ALARM LOW	-999.999 - 999,999
	3.5	ALARM HIGH	-999.999 - 999,999
	3.6	ALARM HIGH-HIGH	-999.999 - 999,999
	3.7	DELAY ALARM LOW-LOW	0.0 - 999.9 seconds
	3.8	DELAY ALARM LOW	0.0 - 999.9 seconds
	3.9	DELAY ALARM HIGH	0.0 - 999.9 seconds
	3.A	DELAY ALARM HIGH-HIGH	0.0 - 999.9 seconds
4	DISPLAY		
	4.1	ALARM SET	operator – setup – hidden – off
	4.2	FUNCTION	level - level and height - level and percentage – height – height and percentage, percentage
	4.3	LIGHT BACKLIGHT	0 – 20 – 40 – 60 – 80 – 100%
	4.4	BACKLIGHT ALARM	off - on – flash
5	POWER MANAGEMENT		
	5.1	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	5.2	BATTERY MODE	operational - shelf
6	SENSOR		
	6.1	FILTER	1 - 99
	6.2	CUT-OFF	0.0 - 99.9%
	6.3	CALIBRATE LOW (4mA)	default – calibrate – cal set
	6.4	CALIBRATE HIGH (20mA)	default – calibrate – cal set
7	ANALOG		
	7.1	OUTPUT	disable - enable
	7.2	INPUT	Level - height - percentage
	7.3	LEVEL MINIMUM	-999.999 - 999,999
	7.4	LEVEL MAXIMUM	-999.999 - 999,999
	7.5	CUT-OFF	0.0 - 9.9%
	7.6	TUNE MIN - 4mA / 0V	0 - 9,999
	7.7	TUNE MAX- 20mA / 10V	0 - 9,999
	7.8	FILTER	1 - 99
8	RELAYS		
	8.1	RELAY TEST	disable – all off – all on – relay 1 – relay 2 – relay 3 – relay 4
	8.2	RELAY 1	off - low-low - low - high - high-high - all
	8.3	RELAY 2	off - low-low - low - high - high-high - all
	8.4	RELAY 3	off - low-low - low - high - high-high - all
	8.5	RELAY 4	off - low-low - low - high - high-high - all
	8.6	CLEAR 1	disable - enable

	8.7	CLEAR 2	disable - enable
	8.8	CLEAR 3	disable - enable
	8.9	CLEAR 4	disable - enable
9	COMMUNICATION		
	9.1	MODE	off – bus asc – bus rtu
	9.2	SPEED	1200 - 2400 - 4800 - 9600 – 9600HP - 19200 - 38400
	9.3	DATABITS	7 bits - 8 bits
	9.4	PARITY	none - even - odd
	9.5	ADDRESS	1 – 247
	9.6	TRANSMIT DELAY	0 – 255 ms
A	OTHERS		
	A.1	MODEL	F170-A
	A.2	SOFTWARE VERSION	xx-xx-xx
	A.3	SERIAL NO.	xxxxxxx
	A.4	PASSWORD	0000 - 9999
	A.5	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION OF SETUP MENU 1 – LEVEL

UNIT 1.1	<p>SETUP – 1.1 determines the measurement unit for the displayed level and alarm values.</p> <p>The following units can be selected:</p> <p style="text-align: center;">L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit).</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values.</p> <p>Please note that the Span has to be adapted as well; the calculation is not done automatically.</p>
DECIMALS 1.2	<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;">0000000 - 111111.1 - 22222.22 - 3333.333</p>
SPAN 1.3	<p>With the span, the sensor signal is converted to a quantity.</p> <p>The span for level is determined on the basis of the selected measurement unit at 20mA.</p> <p>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 – 1.3: "2481.3".</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 – 1.3: "652.31".</i></p>
DECIMALS SPAN 1.4	<p>This setting determines the number of decimals for Span (SETUP 1.3). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p>
OFFSET 1.5	<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.</p> <p>Also, a negative offset can be entered: do press the middle and right button simultaneously.</p>

3.2.4. EXPLANATION OF SETUP MENU 2 – HEIGHT

If desired the height of the level column can be calculated and displayed.	
UNIT 2.1	<p>SETUP – 2.1 determines the measurement unit for height.: The following units can be selected:</p> <p>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 (2.3) has to be adapted as well; the calculation is not done automatically.</p>
DECIMALS 2.2	<p>This setting determines for height the number of digits following the decimal point. The following can be selected: 00000 - 1111.1 - 2222.22</p>
SPAN 2.3	<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 > next page <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 – 2.3: "2481.30".</i></p>
DECIMALS SPAN 2.4	<p>This setting determines the number of decimals for Span (SETUP 2.3). The following can be selected:</p> <p>0 - 1 - 2 - 3 - 4 - 5 - 6</p>
OFFSET 2.5	<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>

3.2.5. EXPLANATION OF SETUP MENU 3 – ALARM



Note !

<p>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 can be programmed at operator level as well. Moreover, the function can be locked or hidden (SETUP 4.1). Note: for transistor / relay output functions: read <i>SETUP Menu 8 – Relay Output</i></p>	
INPUT 3.1	The alarm function can be set to monitor either level, height or percentage (of the sensor input signal).
EMPTY 3.2	<p>The behavior of the monitoring function for low and low-low alarm values can be adjusted for those cases where the sensor input signal is at its lowest value (4mA, 0% or below its cut-off point), for example when the tank is empty.</p> <p>The following can be selected: DEFAULT: Normal behavior: a low / low-low alarm condition switches on the alarm output(s) and the display will indicate the alarm status. NO RELAY: A low / low-low alarm condition will NOT switch on the alarm output(s), the alarm status is indicated on the display. IGNORE: A low / low-low alarm condition is completely ignored: no output will be switched and no indication on the display.</p>
ALARM LOW - LOW 3.3	The low-low alarm is set with this setting. An alarm will be generated as long as the value lower as this value.
ALARM LOW 3.4	The low alarm is set with this setting. An alarm will be generated as long as the value is lower as this value.

ALARM HIGH 3.5	The high alarm is set with this setting. An alarm will be generated as long as the value is higher as this value.
ALARM HIGH - HIGH 3.6	The high-high alarm is set with this setting. An alarm will be generated as long as the value is higher as this value.
DELAY TIME ALARM LOW - LOW 3.7	An alarm generated by SETUP 3.3 "low-low" can be ignored during X-time period. If the actual value is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM LOW 3.8	An alarm generated by SETUP 3.4 "low" can be ignored during X-time period. If the actual value is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM HIGH 3.9	An alarm generated by SETUP 3.5 "high" can be ignored during X-time period. If the actual value is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM HIGH - HIGH 3.A	An alarm generated by SETUP 3.6 "high-high" can be ignored during X-time period. If the actual value is still incorrect after this delay time, then an alarm will be generated.

3.2.6. EXPLANATION OF SETUP MENU 4 – DISPLAY

ALARM SET 4.1	This function determines if the level alarm values can be set at both Operator level and SETUP-level (operator), SETUP-level only (setup), are hidden for the operator (hidden) or disabled (off).
FUNCTION 4.2	Determine the displayed information: <u>Level</u> : only the level is displayed with the big digits <u>Level and height</u> : as LEVEL plus the height at the bottom line. <u>Level and percentage</u> : as LEVEL plus the percentage of the level value <u>Height</u> : only the height is displayed with the big digits <u>Height and percentage</u> : as height plus the percentage of the level value. <u>Percentage</u> : only the percentage is displayed with the big digits
The functions below will only effect the optional LED-backlight.	
LIGHT 4.3	If a LED backlight has been supplied, the intensity can be set in the range 0 – 100%
BACKLIGHT ALARM 4.4	In case the F170-A generates an alarm, the backlight can be set to change to red. Following selections are available: OFF: this function is disabled ON: during an alarm the color is red. FLASH: during an alarm the color flashes red / white.



3.2.7. EXPLANATION OF SETUP MENU 5 – POWER MANAGEMENT

When used with the internal battery option (type PB / PC), 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 5.1	<p>The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is <u>strongly advised</u> to select a slow refresh-rate. Please understand that NO information will be lost; the signal will be processed and the output-signals will be generated in the normal way. The following can be selected:</p> <p style="text-align: center;">Fast - 1 sec - 3 sec - 15 sec - 30 sec - off.</p> <p>Example 3: Battery life-time <i>battery life-time with FAST update: about 1 years.</i> <i>battery life-time with 1 sec update: about 3 years.</i></p> <p>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.</p>
BATTERY-MODE 5.2	<p>The unit has two modes: operational or shelf.</p> <p>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 are stored. In this mode, power consumption is extremely low.</p> <p>To wake-up the unit again; press the SELECT-key twice.</p>





Note !

3.2.8. EXPLANATION OF SETUP MENU 6 – SENSOR

FILTER 6.1	<p>The analog output signal of a sensor represents 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.</p> <p>The filter principal is based on three input values: the filter level (01-99), the last measured sensor input signal 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:</p>			
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
CUT-OFF 6.2	<p>To ignore e.g. vibration, a low-level cut-off can be set as percentage over the full range of 16mA (or 20mA). When the sensor input signal is less than required with this setting, the signal will be ignored.</p> <p>The cut-off value can be programmed is the range 0.0 - 99.9%.</p> <p>Example:</p>			
	SPAN (setup 1.3)	REQUIRED CUT-OFF	CUT-OFF (setup 6.2)	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 6.3	<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 minimum signal. This function will measure the real output value at minimum signal.</p> <div style="display: flex; align-items: center;">  <div> <p>▪ 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!</p> <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 sensor input signal must be higher 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. </div> </div>			
TUNE MAX / 20mA 6.4	<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 signal. This function will measure the real output value at maximum level.</p> <div style="display: flex; align-items: center;">  <div> <p>▪ 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!</p> <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 sensor input signal must be lower 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. </div> </div>			

3.2.9. EXPLANATION OF SETUP MENU 7 – ANALOG OUTPUT

A linear 4-20mA signal (type AB: 0-20mA or type AU: 0-10V) output signal is generated according with a 10 bits resolution.				
DISABLE / ENABLE 7.1		The analog output can be disabled. In case of a passive analog output type AP, 3.5mA will be generated if a power supply is available but the output is disabled.		
INPUT 7.2		The analog output can be set either for level, height or percentage (of level).		
MINIMUM OUTPUT 7.3		Enter here the value according which the output should generate a 4mA signal (or 0mA / 0V) - in most applications at minimum signal.		
MAXIMUM OUTPUT 7.4		Enter here the value according which the output should generate a 20mA (or 10V) - in most applications at maximum signal.		
CUT-OFF 7.5		A low-level cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the value is less than the cut-off value, the current will be 4mA. Examples:		
4mA (SETUP 7.3)	20mA (SETUP 7.4)	CUT-OFF (SETUP 7.5)	REQUIRED LEVEL	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 7.6		<p>The initial minimum analog output value is 0/4mA or 0V. However, this value might differ slightly due to external influences such as temperature for example. The 0/4mA or 0V value can be tuned precisely with this setting.</p> <p> Before tuning the signal, be sure that the analog signal is not being used for any application!</p> <p>After pressing PROG, the current will be about 4mA (or 0mA / 0V). The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed “up-side-down” if desired, so 20mA at minimum level for example!</p>		
TUNE MAX / 20mA 7.7		<p>The initial maximum analog output value is 20mA (or 10V). However, this value might differ slightly due to external influences such as temperature for example. The 20mA value (or 10V) can be tuned precisely with this setting.</p> <p> Before tuning the signal, be sure that the analog signal is not being used for any application!</p> <p>After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed “up-side-down” if desired, so 4mA at maximum level for example!</p>		
FILTER 7.8		<p>This function is used to stabilize the analog output signal. The output value is update eight times per 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 their response times are indicated:</p>		
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
02		0.1 second	0.2 second	0.4 second
03		0.2 second	0.4 second	0.6 second
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


3.2.10. EXPLANATION OF SETUP MENU 8 – RELAY OUTPUT



Note !

<p>With "SETUP 3", four alarm levels can be entered. Based on the options ordered, the F173-A will have 2, 3 or 4 alarm outputs.</p> <p>If the unit is Intrinsically Safe, it will have two alarm outputs. If type OS (relay board) has been supplied, it will have four alarm outputs. Otherwise, it will have three alarm outputs.</p>	
RELAYTST 9.1	<p>With RELAY TEST, the normal control of the relays will be overridden for a short period of time. This function is typically used during installation to check wiring and performance.</p> <p>Select the desired relay or "all on" to switch the relay immediately. When "all off" is selected, all outputs are disabled.</p> <p>After testing, select "disable" to return to normal operation function.</p> <p>The following can be selected: disable – all off – all on – relay 1 – relay 2 – relay 3 – relay 4</p> <p><i>Please note: when SETUP is left or the device is restarted, this setting is automatically restored to 'disable' so normal operation is restarted.</i></p>
RELAY 1 9.2	<p>Assign the output function to output R1.</p> <p>The following can be selected: low-low - low - high - high-high alarm - all alarms - off</p>
RELAY 2 9.3	<p>Assign the output function to output R2.</p> <p>The following can be selected: low-low - low - high - high-high alarm - all alarms - off</p>
RELAY 3 9.4	<p>Assign the output function to output R3.</p> <p>The following can be selected: low-low - low - high - high-high alarm - all alarms - off</p>
RELAY 4 9.5	<p>Assign the output function to output R4.</p> <p>The following can be selected: low-low - low - high - high-high alarm - all alarms - off</p>
<p>The functions below allow the operator to clear the alarm outputs, while the cause of the alarm is still be available. Clearing will only switch-off the appropriate alarm output(s) but not the visible alarm indication on the display! In case the alarm situation reoccurs or a new alarm arises, the alarm relay(s) are triggered again. See chapter 2: Clear alarm outputs for an instruction on how to clear the alarm outputs at operator level.</p>	
CLEAR 1 9.6	<p>Enable this setting when the Operator is allowed to clear the alarm output status of RELAY 1. The following can be selected: disable – enable</p>
CLEAR 2 9.7	<p>Enable this setting when the Operator is allowed to clear the alarm output status of RELAY 2. The following can be selected: disable – enable</p>
CLEAR 3 9.8	<p>Enable this setting when the Operator is allowed to clear the alarm output status of RELAY 3. The following can be selected: disable – enable</p>
CLEAR 4 9.9	<p>Enable this setting when the Operator is allowed to clear the alarm output status of RELAY 4. The following can be selected: disable – enable</p>

3.2.11. EXPLANATION OF SETUP MENU 9 – COMMUNICATION

<p>This product is designed for the connection to a communication network. Products with a communication option do not include cyber security functions. Fluidwell cannot take any responsibility for the cyber security, omissions or errors in the communication safety. To maintain a secure operation, automation and control, it is the sole responsibility of the owner to install and manage the appropriate safety measures to protect the network, the product and the communication against any kind of security breaches.</p> <p>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.</p>	
MODE A.1	<p>This setting is used to set the Modbus transmission mode. Select OFF to disable the communication.</p>
SPEED A.2	<p>This setting is used to set the baud rate and should match the speed used on the communications bus.</p> <p>The following communication speeds can be selected: 1200 – 2400 – 4800 – 9600 – 9600HP – 19200 – 38400</p> <p> <i>Communication speeds from 9600HP and upwards are more power consuming. When used with battery power, it is advised to set the speed at 9600 or lower.</i></p> <p>Note !</p>
DATABITS A.3	<p>This setting determines for communication the number of data bits. Select 8 bit for BUS-RTU and 7 bits for BUS-ASC.</p>
PARITY A.4	<p>As demanded by the connected equipment, select a parity bit (odd, even or none).</p>
ADDRESS A.5	<p>This setting is used to set the communication address for the F173-A. This address can vary from 1-247.</p>
TRANSMIT DELAY A.6	<p>This setting is used to configure and additional delay between receiving a Modbus message and transmitting the reply.</p> <p>The transmit delay is useful on communications busses to allow drivers to switch between transmitting and receiving, such as RS485.</p> <p>The delay can vary from 0-255 msec and is set to 15ms by default.</p>

3.2.12. EXPLANATION OF SETUP MENU A – OTHERS

MODEL A.1	<p>This setting shows the model name.</p>
VERSION SOFTWARE A.2	<p>This setting shows the version number of the firmware (software).</p>
SERIAL NUMBER A.3	<p>This setting shows the serial number.</p>
PASSWORD A.4	<p>This setting is used to set a password (pin code) to limit the access for the setup menu. Only persons who know the pin code can access the setup menu. The pin code 0000 disables the pin code to allow for access by any person.</p>
TAGNUMBER A.5	<p>This setting is used to set a tag number for the F170-A .</p>

4. INSTALLATION

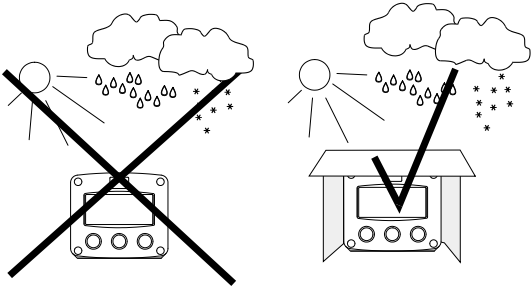
4.1. GENERAL DIRECTIONS



Caution !

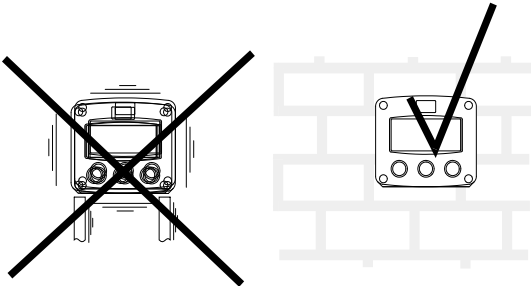
- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Make sure, the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the enclosure cover is removed or the panel cabinet has been opened (danger from electrical shock). The enclosure may only be opened by trained persons authorized by the operator of the facility.
- 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 enclosure into account (see identification plate). Even an enclosure rated for IP67 / TYPE 4(X) should NEVER be exposed to strongly varying (weather) conditions.

When used in very cold surroundings or varying climatic conditions, inside the instrument case, take the necessary precautions against moisture



Mount the F170-A onto a solid structure to avoid vibrations..

For use in Safe and Hazardous Areas (or Locations), the following conditions apply:

Relative humidity:	< 90% RH
Outdoor use:	suitable for outdoor use
IP and TYPE rating:	IP65 (panel mount), IP67 (field mount) and Type 4X
Supply voltage fluctuation:	As indicated by the supply range (e.g. 10V to 30V), otherwise +/- 10% unless stated otherwise
Means of protection:	Intrinsically safe: IS Ordinary locations: Class I (PE connected metal enclosure) Class II (non-metallic enclosure)
Over-voltage category:	II (when supplied from mains)
Pollution degree:	2 (internal environment), 3 (external environment)
Ambient:	Intrinsically safe: -40 °C to +70 °C, -40 °F to +158 °F (limited to +50 °C, 122 °F for EPL Da) Ordinary locations: -40 °C to +80 °C, -40 °F to +176 °F
Altitude:	up to 2000 m

4.3. DIMENSIONS- ENCLOSURE

Aluminum and stainless enclosures (where "H" turns to "HS" for stainless, e.g. HA → HSA):

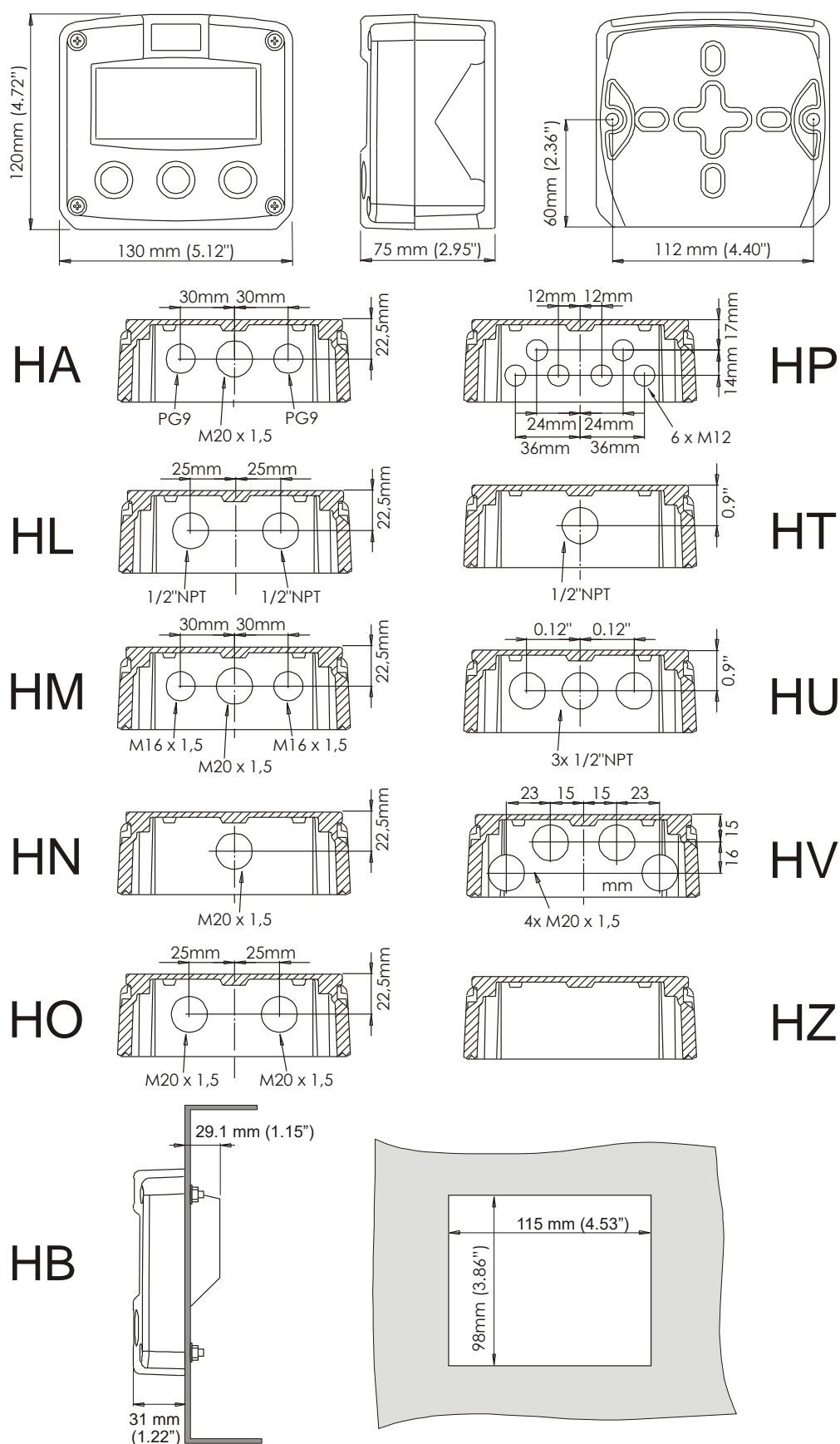


Fig. 6: Aluminum and stainless enclosures – Dimensions

Optionally, metal enclosures are available with a 15 mm, 0.6" deeper rear cover.

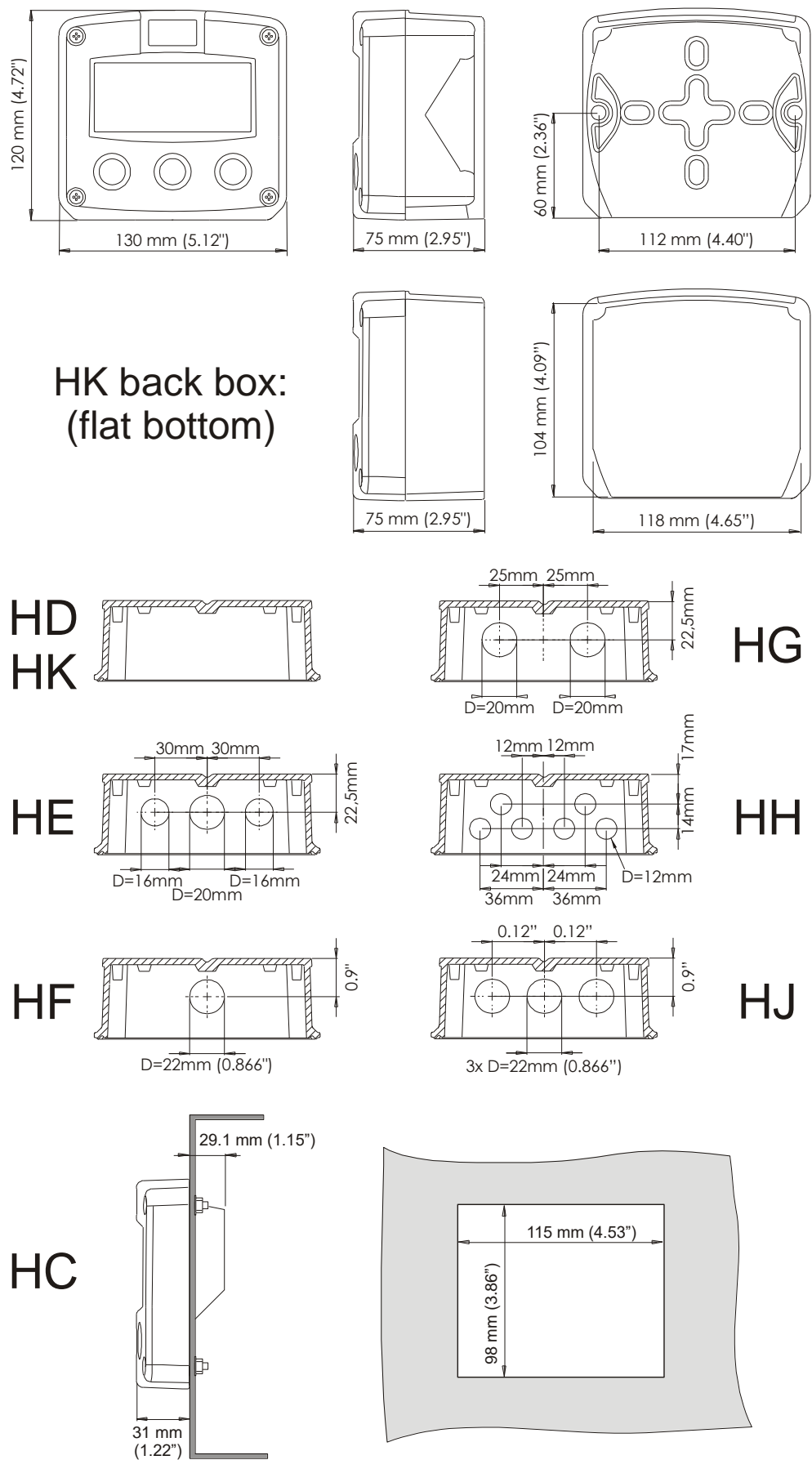


Fig. 7: GRP enclosures - Dimensions

4.4.**INSTALLING THE HARDWARE**

- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the F170-A , the installer has to discharge himself by touching a well-grounded object.
- For reasons of ESD and safety, always ground the metal enclosure properly as indicated, especially if the unit has been supplied with the 115-230V AC power-supply type PM or relays type OR. It is the responsibility of the installer to install, connect and test the Protective Earth connections in accordance with the (inter)national Rules and Regulations.
- This chapter shows general information regarding the electrical installation of the F170-A . Chapter 5 gives additional specific information regarding Intrinsically safe installation and overrules the information given in this chapter.



- 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 not blend metal front covers with non-metallic rear covers, vice versa and / or cable glands. A metal cover on a non-metallic rear cover could lead to ESD. A metal cable gland in a non-metallic enclosure could invalidate isolation.

4.4.1. GENERAL INSTALLATION GUIDELINES

- The F170-A that came with a power module type PM; 110V-230V AC or type PD/PF with an option OR (the relays can handle 110V-230V AC) shall be connected to the Protective Earth (PE) stud which is installed in the metal back panel. The metal front panel is connected to the Protective Earth by the mounting screws and serrated washers.
- For V AC applications, the terminal 00 shall not be connected to avoid earth loops. For V DC applications, the terminal 00 shall be connected to the common (do NOT use for PE).
- The wire screens (shield) are meant to prevent electromagnetic interference and shall be, galvanic isolated, connected to the common ground terminals that belong to the specific sensor connection. The wire screens shall be terminated at one side to prevent wire loops. Inside of the Fluidwell unit, the different common ground terminals are connected to each other. It is advised, as illustrated, to terminate the wire screens in the vicinity of the sensor and to insulated the wire screen with a shrink tube at the Fluidwell unit side.
- Separate cable glands with effective IP67 / TYPE 4(X) seals for all wires.
- Unused cable entries: make sure that you fit IP67 / TYPE 4(X) plugs to maintain rating.
- A reliable ground connection for both the sensor, and if applicable, for the metal enclosure (above).
- An effective screened cable for the input signal, and grounding of its screen to the “⊥ “ terminal or at the sensor itself, whichever is appropriate to the application.

4.4.2. PROTECTIVE EARTH (PE) CONNECTIONS

Inside the unit, different types of bonding and earthing are used. The common ground is mostly used for termination of the wire shields; the Protective Earth (PE) is used for electrical safety. For externally powered installations, route the Protective Earth (PE) grounding conductor into the enclosure together with the incoming power conductors.



Risk of damage to equipment!

Be very careful when connecting terminal 00 / GND to Protective Earth (PE).

This terminal is internally connected to the common ground of the system and (especially when multiple power supplies are connected) the PE connection can cause ground loop currents that could damage the equipment.

Metal enclosure

When the F170-A is supplied with a metal enclosure (aluminum or stainless steel), the enclosure must be grounded in accordance with national and local electrical codes. To ground the field mounted unit, the PE conductor must be connected to the PE stud which is located in the metal back cover, as indicated in the image below. To connect the conductor, a screw (M4 x 6mm) with a serrated washer, a terminal and a washer is used (torque: 2 Nm). The metal front cover is connected to the Protective Earth by the mounting screws with serrated washers. To ground the panel mounted unit, the PE conductor must be connected to the metal front cover through one of the four mounting screws. For this purpose, an additional nut, terminal and washer is supplied.

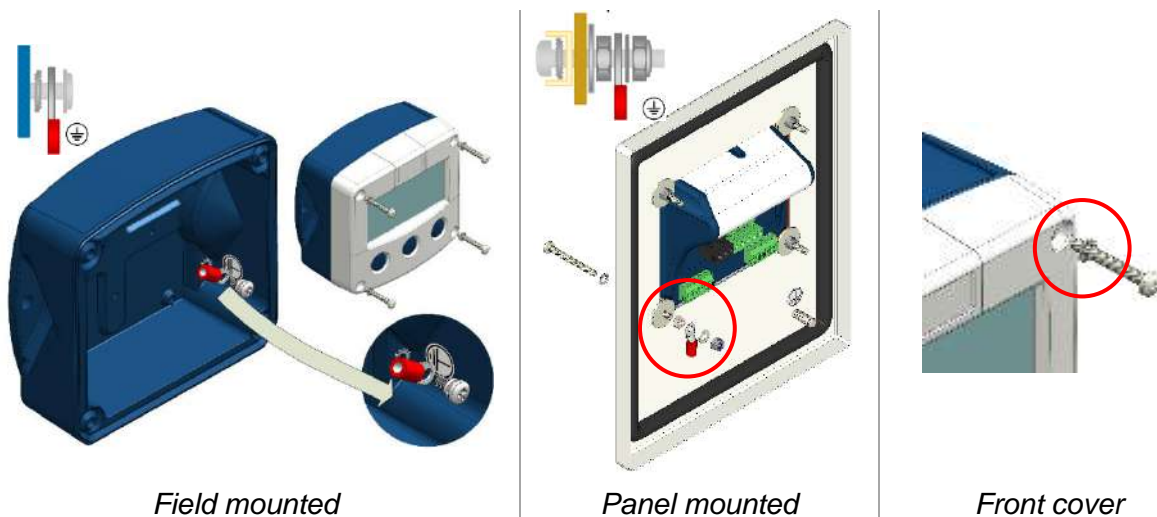


Fig. 8: Protective Earth (PE) connections on metal enclosure

Plastic enclosure

When the F170-A is supplied with a non-metal enclosure (e.g. plastic), the field mount enclosure meets the requirements of class 2 (double insulated). Therefore any incoming PE conductor can be terminated with an insulating end cap.

When the F170-A is panel mounted, the installation class and protective earth requirements depend on the panel or type of cabinet.

4.4.3. ALUMINUM ENCLOSURE - FIELD MOUNTED

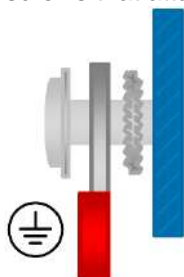


Risk of damage to equipment!

Do not use the terminal 00 to connect the protective earth wire, the 00 and the common ground terminals are internally connected. Be careful, to prevent damage to equipment when you connect different power supplies (sensor, PLC, etc.). Inside the Fluidwell display, the common grounds are internally connected to each other.

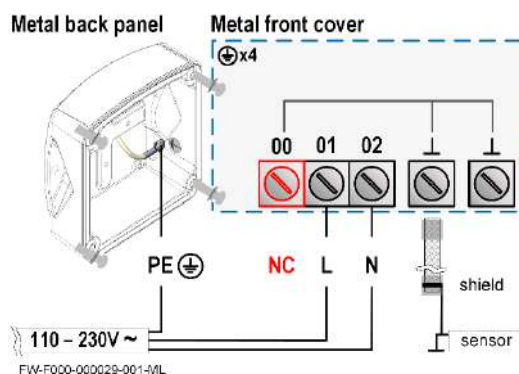
The PE connection

The PE connection is made with the PE stud inside the back panel and the 4 mounting screws that attach the cover to the back panel.

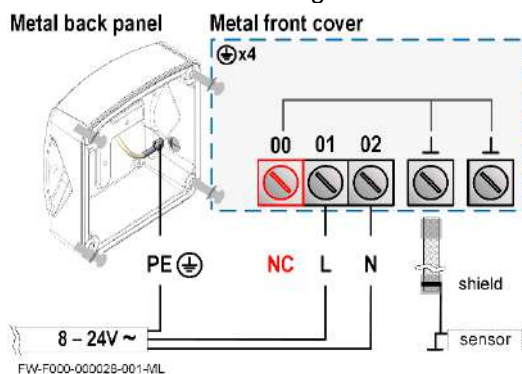


The PE connection in the metal back panel is made with a serrated washer, a terminal, a washer and a screw.

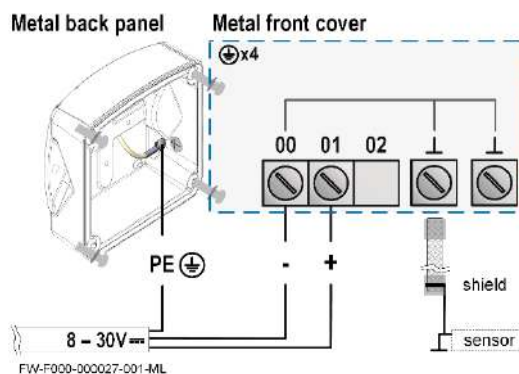
The PE connection to the metal cover is made with the serrated washers and the mounting screws.



Type PM (110-230V AC)



Type OR (8-24V AC)

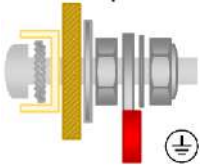


Type OR (8-30V DC)

4.4.4. ALUMINUM ENCLOSURE - PANEL MOUNTED

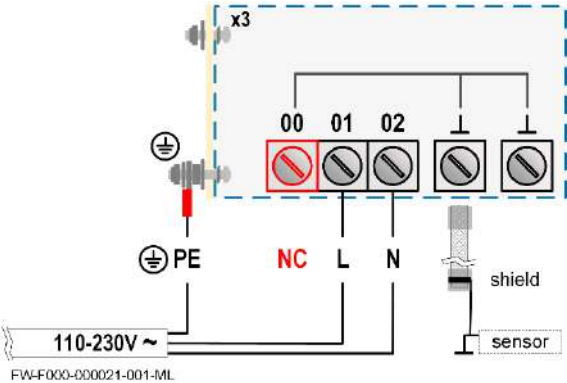
The PE connection

The PE connection is made with one of the mounting screws that attaches the front panel to the panel.

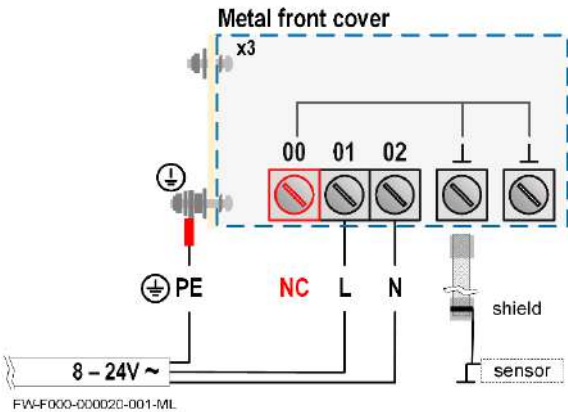


The PE connection to the metal cover is made with the serrated washers and the mounting screws.

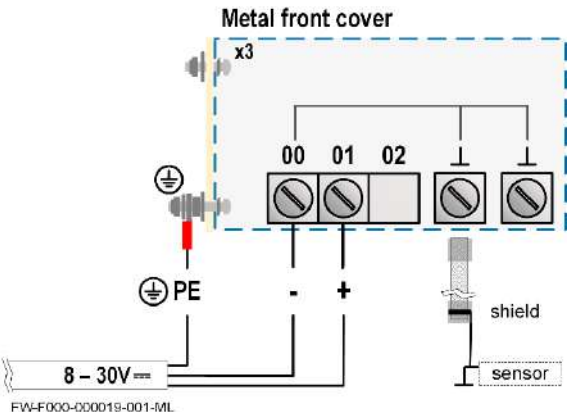
The PE connection to the panel is made with the washer, the nut, the terminal, the washer and a lock nut.



Type PM (110-230V AC)



Type OR (8-24V AC)

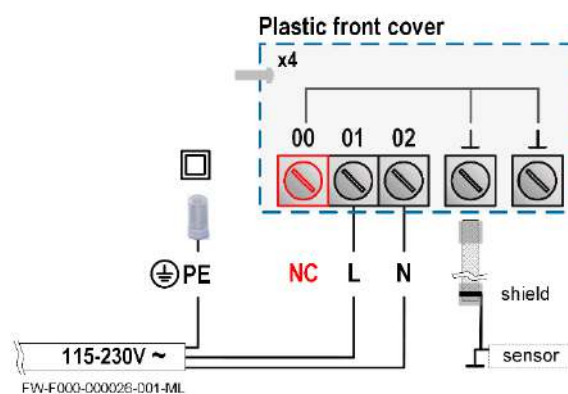


Type OR (8-30V DC)

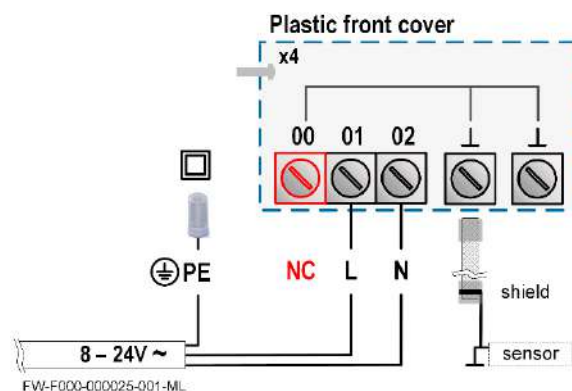
4.4.5. PLASTIC (GRP) ENCLOSURE

The PE connection

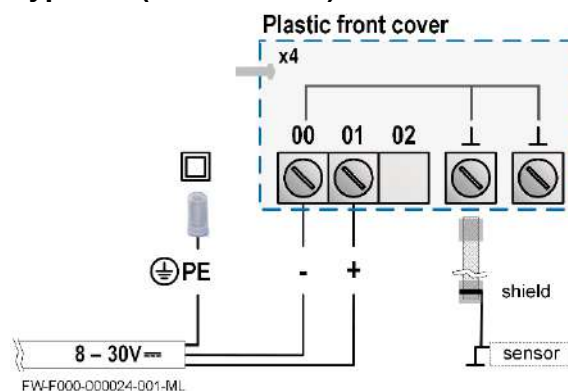
The F170-A in a GRP enclosure meets the requirements of class 2 (double insulated). Therefore the incoming PE wire is terminated with an insulating end cap.



Type PM (110-230V AC)



Type OR (8-24V AC)



Type OR (8-30V DC)

4.4.6. TERMINAL CONNECTORS



The following paragraphs describe the terminal connections and configurations that are specific for types of supply PM, PF, PD and PX in combination with types OA, OT and OR.

For **type PD-OS (4 mechanical relay outputs)**, please consult the addendum to this manual specific for this type: **‘F1xx-A-PD-OS Addendum / Installation Guide’**



For Intrinsically safe applications: read chapter 5.
Refer to Appendix A: Technical Specification

	Power supply			Alarm Output 2		Alarm Output 1		Analog Output		Sensor A Input		Sensor A Supply	Alarm Output 3			
	00	01	02	03	04	05	06	07	08	09	10	11			15	16
PD; PF ~		L	N									+↓				
PD; PF ≡	-	+										+↓				
PM ~		L	N									+↓				
PX ≡	-	+										+↓				
A										⊥	↗↖					
OA; OT				⊥	↘	⊥	↘								⊥	↘
OR				com	NO	com	NO									
AA; AB; AI; AP								I-	I+							
AU								U-	U+							
A-PL										I-	I+					

PB; PC

Battery supply: 3.6V ≡
(PX remains available, battery supply operates as back-up power)

PX

Sensor supply A (11) fixed

3V ≡

PD; PF; PM

Sensor supply A (11) by switch 1, 2, 3 and 4

8.2; 12; 24V ≡

⊕

Fieldmount: use the PE terminal and the mounting screws/serrated washers.
Panel mount: create a PE terminal by the mounting screws/serrated washers.

Communication
(DTR = 12V DC)

	26	27	28	29	30	31
CB	⊥	+ DTR	RxD↑	TxD↓		
CH	⊥		A	B		
CI	⊥		A	B	Y	Z

FW-F173-000001-001-EN

Fig. 9: Overview of terminal connectors - Standard configuration and options

4.4.7. SENSOR SUPPLY

For type PB/PC; PX; AP: There is no real sensor supply out available. Only a limited power supply is available. This power supply MAY NOT be used to supply the sensor electronics, converters etc. as it will not provide adequate sustained power ! All energy used by the sensor will directly influence the battery life-time.

For type PD; PF; PM: It is possible to supply the sensor with different voltages. You can set the voltage with the switches. Internal power is not suitable to drive an analog sensor. External power is only available when the main external power supply is connected.

The sensor supply voltage is selectable: 3; 8.2; 12 or 24V DC.

Set the sensor supply

1. Make the F170-A safe. If applicable, mind the battery power.
2. Open the F170-A and carefully remove the cable-connectors and the protective cover.
3. Find and set the switches and select the V_{out} as required.
4. Close the protective cover and install the cable connectors.
5. Close the F170-A .



Risk of electrocution - High voltage!

Make sure, all the leads to the terminals are disconnected from the F170-A and NEVER connect the mains power supply to the unit when the protection cover has been removed!

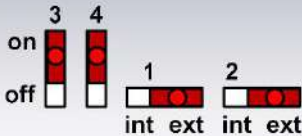
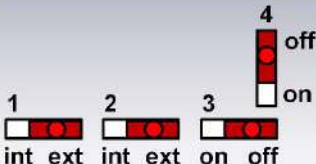
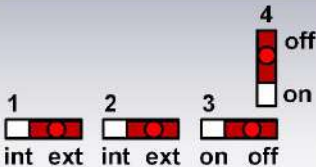
Type PD		Power supply in: 8-24V AC / 10-30V DC				
<div><p>FW-PD-000001-001-EN</p><p>Switch location (typical)</p></div>		Sensor A		V _{out} selection		Sensor supply out
		1	2	3	4	NOTE: Use an AC autotransformer (spartrafo) with galvanic isolation.
		int	-	off	off	Not suitable for analog sensors 3V DC; <1mA
		ext	-	on on off	on off off	8.2V DC @8V _{in} AC / 10V _{in} DC 12V DC @10V _{in} AC / 14V _{in} DC 24V DC @18V _{in} AC / 26V _{in} DC
Type PF		Power supply in: 15-24V AC / 20-30V DC				
<div><p>FW-PFPM-000001-001-EN</p><p>Switch location (typical)</p></div>		Sensor A		V _{out} selection		Sensor supply out
		1	2	3	4	
		int	-	off	off	Not suitable for analog sensors 3V DC; <1mA
		ext	-	on on off	on off off	8.2V DC @8V _{in} AC / 10V _{in} DC 12V DC @10V _{in} AC / 14V _{in} DC 24V DC @18V _{in} AC / 26V _{in} DC
Type PM		Power supply in: 115V - 230V AC				
<div><p>FW-PFPM-000001-001-EN</p><p>Switch location (typical)</p></div>		Sensor A		V _{out} selection		Sensor supply out
		1	2	3	4	
		int	-	off	off	Not suitable for analog sensors 3V DC; <1mA
		ext	-	on on off	on off off	8.2V DC 12V DC 24V DC

Fig. 10: Sensor supply voltage - Switch setting

Terminal 03-04; alarm output R2 and Terminal 05-06; alarm output R1:

Type OA

Two active 24V DC signal alarm outputs are available with this option. Max. driving capacity 50mA@24V per output. (Requires power supply type PD/PF/PM or PX min. 24V DC).

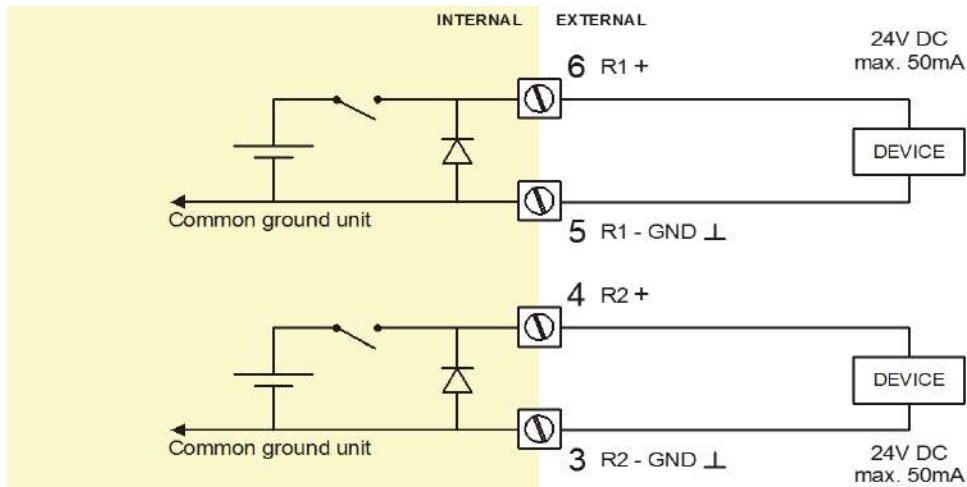


Fig. 11: Terminal connections - Active output (typical)

Type OR:

Two mechanical relay outputs are available with this option.

Max. switch power 240V 0.5A per output. (Requires power supply type PD/PF/PM).

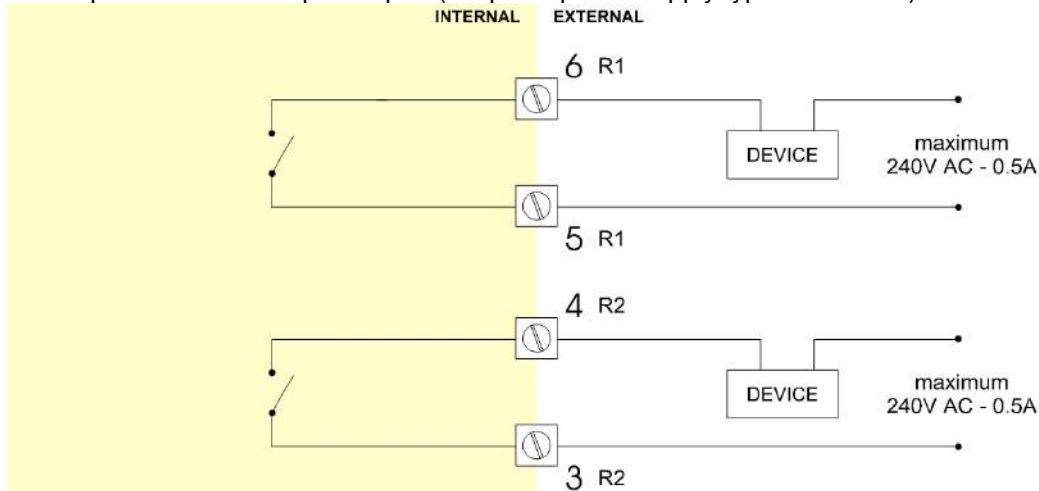


Fig. 12: Terminal connections - Mechanical relay output (typical)

Type OT:

Two passive transistor outputs are available with this option. Max. driving capacity 300mA@50V DC.

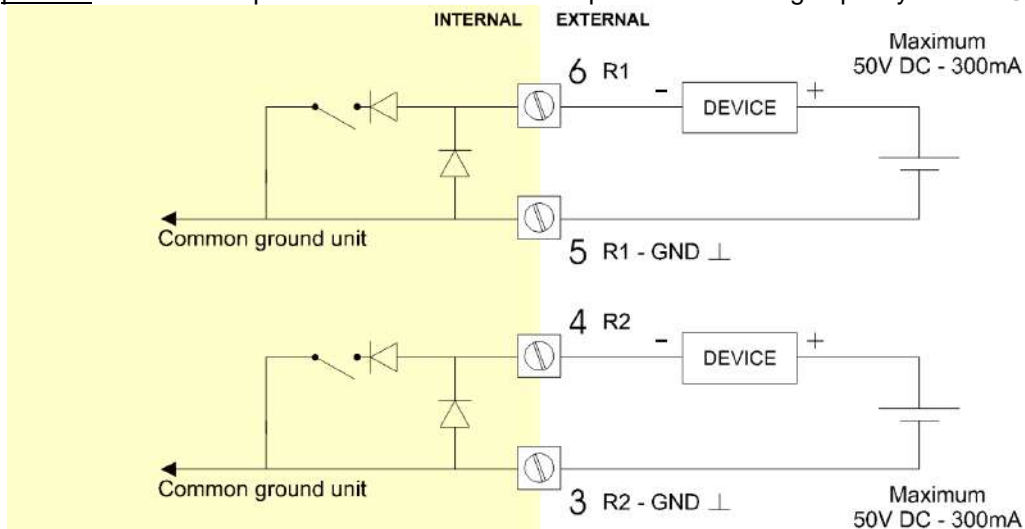


Fig. 13: Terminal connections - Transistor output (typical)

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

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

Do connect the "-" to terminal 7 and the "+" to terminal 8. When power is applied to these terminals, the (optional) internal battery will be disabled / enabled automatically to extend the battery life time.

Terminal 07-08 analog output (SETUP 7) :

An analog output signal proportional to the level, height or percentage (see setup 8.2) is available as standard.

Type AA:

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

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

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

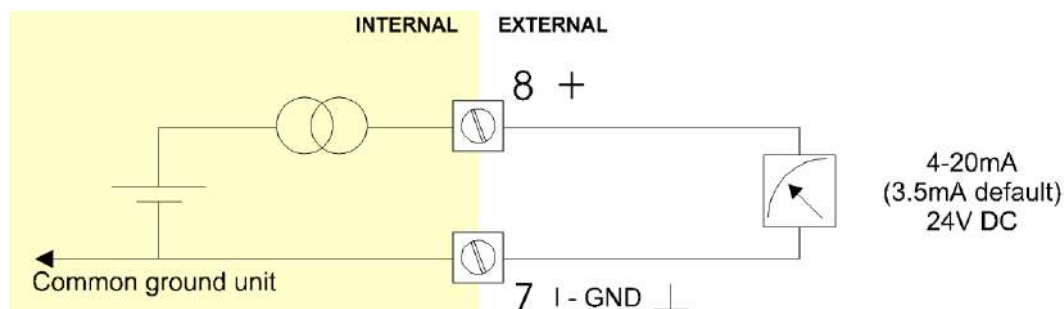


Fig. 14: Terminal connections - 4-20mA analog output (typical)

Type AB:

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

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

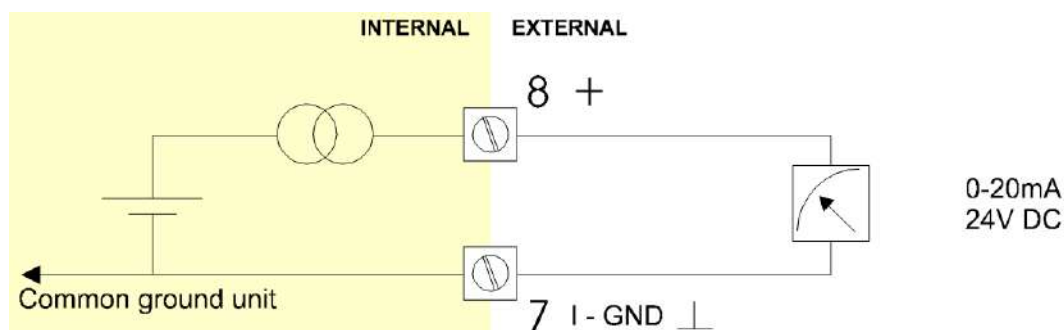


Fig. 15: Terminal connections - Active 0-20mA analog output (typical)

Type AF:

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

Type AI:

An isolated 4-20mA signal 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 used with a battery powered unit but the life time of the battery is about 2 -3 years.

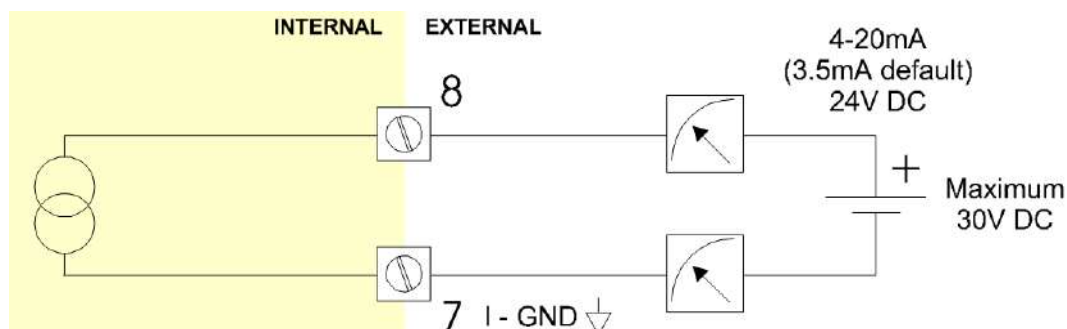


Fig. 16: Terminal connections - Isolated 4-20mA analog output (typical)

Type AP:

A passive 4-20mA signal is available with this option. When a power supply is connected but the output is disabled, a 3.5mA signal will be generated.

Max. driving capacity 1000 Ohm. This output does loop power the unit as well.

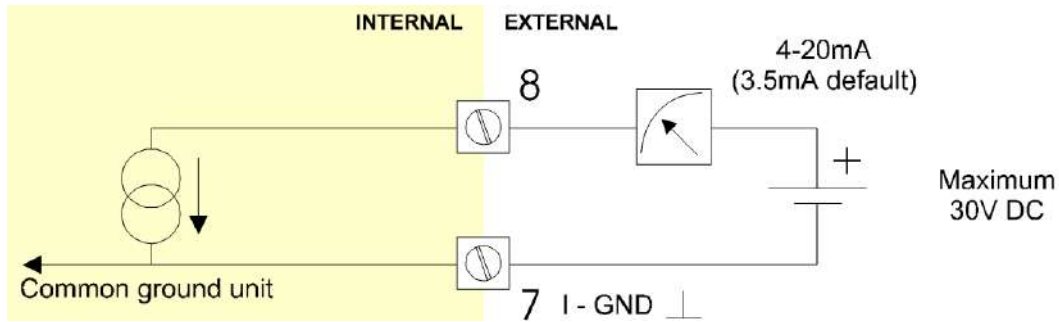


Fig. 17: Terminal connections - Passive 4-20mA analog output (typical)

Type AU:

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

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

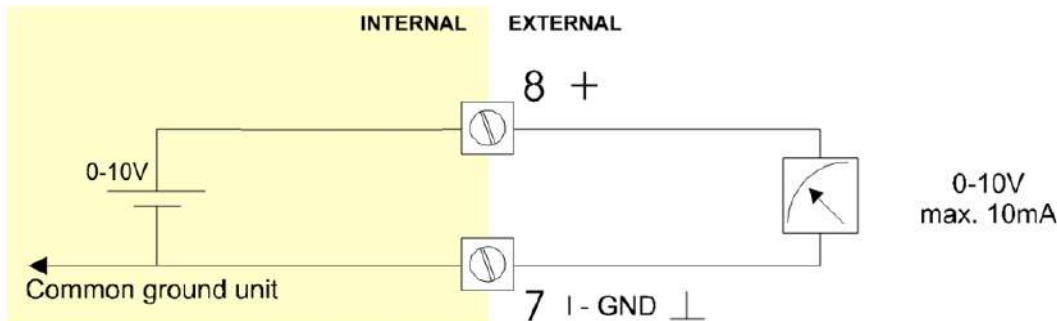


Fig. 18: Terminal connections - Active 0-10V analog output (typical)

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

The F170-A requires a (0)4-20mA sensor signal which will be processed 4 times a second with a 16 bits accuracy. The input is not isolated.

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

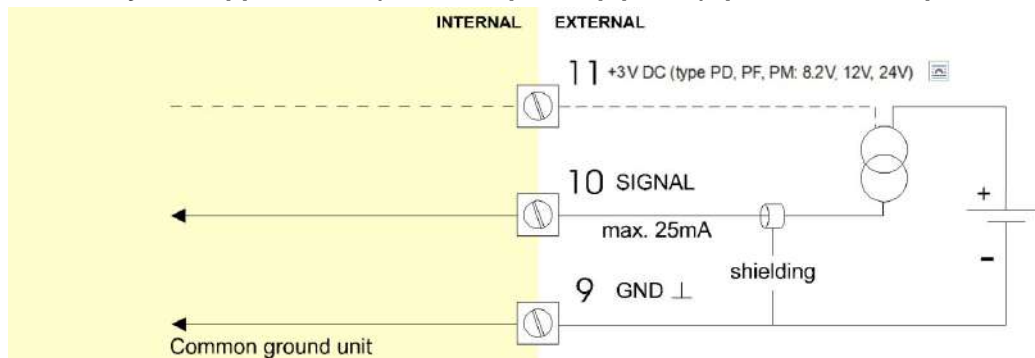


Fig. 19: Terminal connections - Analog signal input (typical)

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

The F170-A-PL requires a 4-20mA sensor signal which has a double function:

The signal will be processed 4 times a second with a 16 bits accuracy and the unit will be powered from the sensor signal (input loop powered). The input is not isolated and not intrinsically safe.

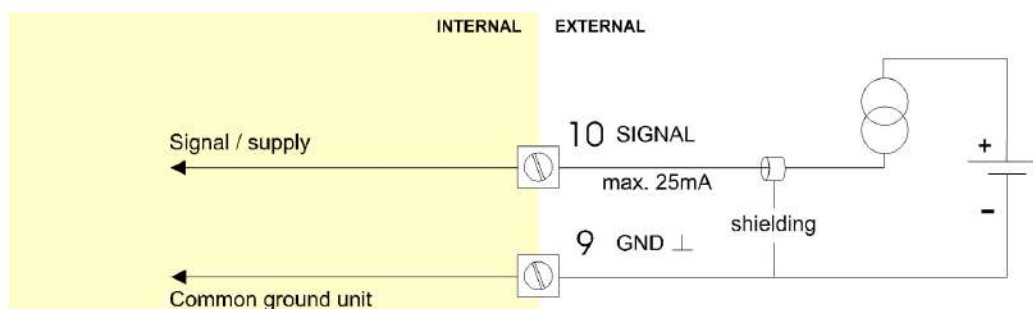


Fig. 20: Terminal connections - Analog signal input – Loop-powered (typical)

Terminal 15-16; alarm output R3:

Type OA:

An active 24V DC signal output is available with this option.

Max. driving capacity 50mA@24V per output. (Requires power supply type PD/PF/PM).

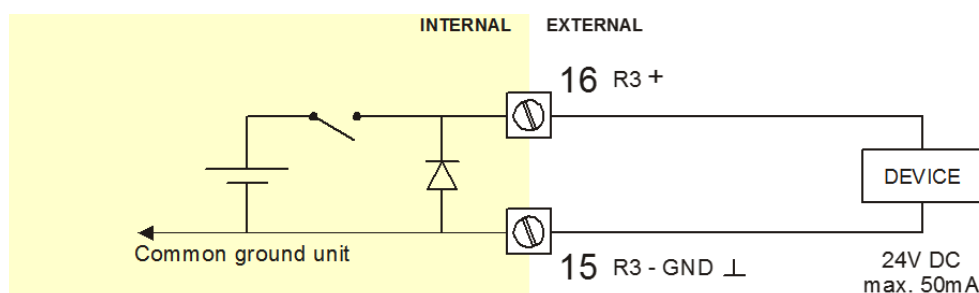


Fig. 21: Terminal connections - Active output (typical)

Type OT:

A passive transistor output is available with this option. Max. driving capacity 300mA@50V DC.

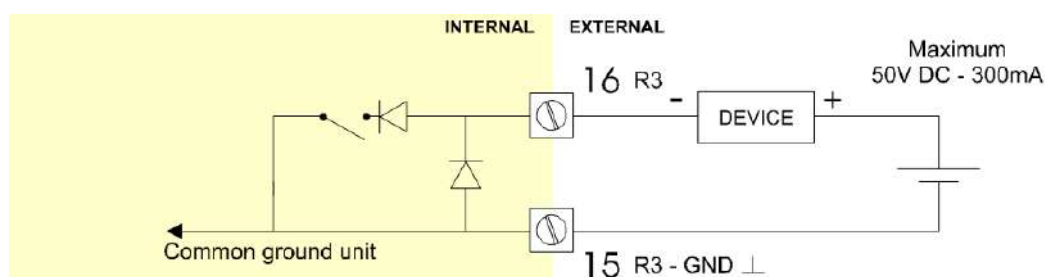


Fig. 22: Terminal connections - Pulse output (typical)

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

For connections, refer to figure: Overview of terminal connectors - Standard configuration and options.

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.

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 00 - 01: type ZB backlight (option):

If the unit is supplied with a power supply:

- type PD, PF or PM, the backlight supply is integrated.
- type PX, use the terminals 00 and 01 to supply the backlight.

The backlight intensity is set in the setup menu: Display.

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 persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Make sure the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the enclosure cover is removed or the panel cabinet has been opened (danger from electrical shock). The enclosure may only be opened by trained persons authorized by the operator of the facility.
- To maintain the degree of protection of at least IP65 in accordance with IEC 60529, suitable cable entries and blanking elements must be used and correctly installed.
- Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.
- Chapter 4 shows general information regarding the electrical installation of your indicator. This chapter gives additional specific information regarding Intrinsically safe installation and overrules the information given in chapter 4.



Specific conditions of use:

Specific conditions of 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 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.**
- **For EPL Da the ambient temperature T_a shall not exceed 50 °C.**



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 EN 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 latest ATEX directive and product certificate KEMA 03ATEX1074 X.
- For installation under IECEx scheme: this Intrinsically safe device must be installed in accordance the product certificate IECEx DEK 11.0042X.
- Exchange of Intrinsically safe battery FWLiBAT-0xx with certificate number KEMA 03ATEX1071 U or IECEx KEM 08.0005U is allowed in Hazardous Area. Read chapter 5.4 for battery replacement instructions.
- For reasons of ESD and safety, always ground the metal enclosure properly as indicated in section "4.4. Installing the hardware" of this manual.
- Do not blend metal front covers with non-metallic rear covers, vice versa and / or cable glands. A metal cover on a non-metallic rear cover could lead to ESD. A metal gable gland in a non-metallic enclosure could invalidate isolation.
- For enclosures and windows with a high surface resistance, potential charging hazard exists. Do not rub these surfaces of the indicator. Clean window and enclosure only with a lint-free cleaning cloth made damp with a mild soap solution.



Note !

Please note

- Certificates, safety values, control drawing and declaration of conformity can be found in the document named: "Fluidwell F1...-XI - Documentation for Intrinsic safety".
- 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.

Serial number and year of production

This information can be looked-up in the setup menu: Others.



Fig. 23: Example serial number (typical)

Label information – F1xx-...-XI (inside and outside the enclosure)



Fig. 24: Label information - Intrinsically safe application (typical)

5.2. TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS



The unit is classified as group IIB/IIIC by default

Note !

- Classification of the unit as group IIC is only possible under the following conditions:
The indicator is either supplied by
- the internal supply (type PC);
 - the external supply connected to terminals 0 and 1 (type PD);
 - the circuit supply connected to terminals 7 and 8 (type 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:

For intrinsically safe applications, consult the safety values in the certificate.

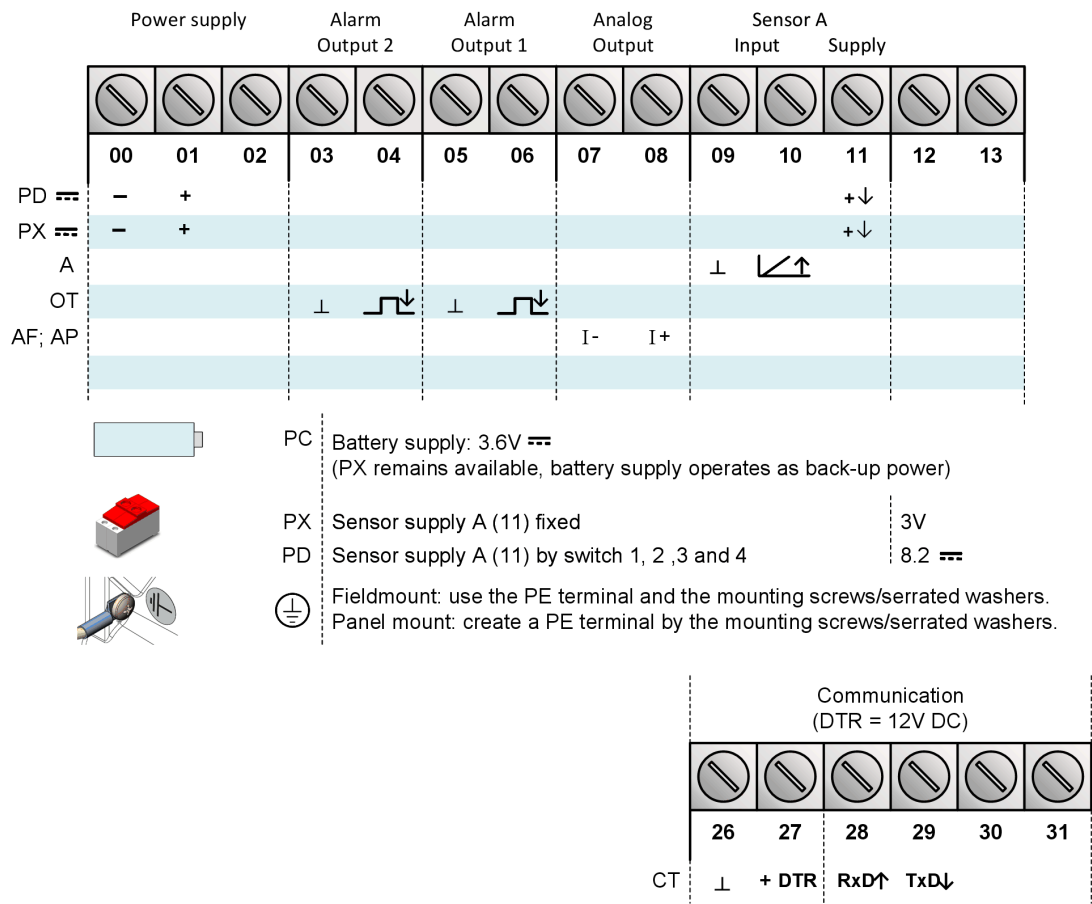


Fig. 25: Overview terminal connectors - Intrinsically safe (typical)

Explanation Intrinsically safe options:

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

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

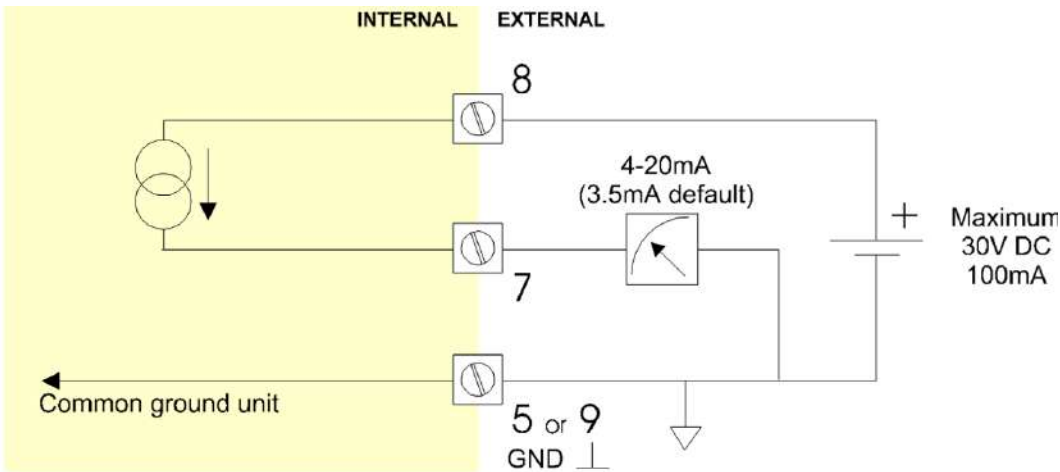


Fig. 26: Terminal connections - Intrinsically safe floating 4-20mA analog output (typical)

For option PD-XI: It is possible to supply the sensor with different voltages. You can set the voltage with the switches. Internal power is not suitable for analog sensors. External power is only available when the main external power supply is connected. The sensor supply voltage is fixed: 8.2V DC.

Set the sensor supply

1. Make the F170-A safe. If applicable, mind the battery power.
2. Open the F170-A and carefully remove the cable-connectors and the protective cover.
3. Find and set the switches and select the V_{out} as required.
4. Close the protective cover and install the cable connectors.
5. Close the F170-A .



Risk of electrocution - High voltage!

Make sure, all the leads to the terminals are disconnected from the F170-A and NEVER connect the mains power supply to the unit when the protection cover has been removed!

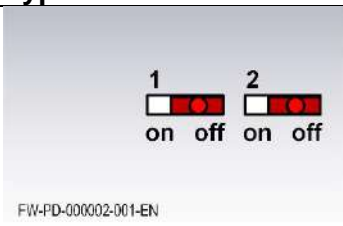
Type PD-XI		Power supply in: 16-30V DC / max. 1W			
 Switch location (typical)		Sensor		Sensor supply out	
		A			
		1	2		
		off	-		Not suitable for analog sensors 3V DC; <1mA
		on	-		8.2V DC; 7mA (max)

Fig. 27: Sensor supply voltage - Switch setting (Intrinsically safe)

5.3. CONFIGURATION EXAMPLES INTRINSICALLY SAFE APPLICATIONS

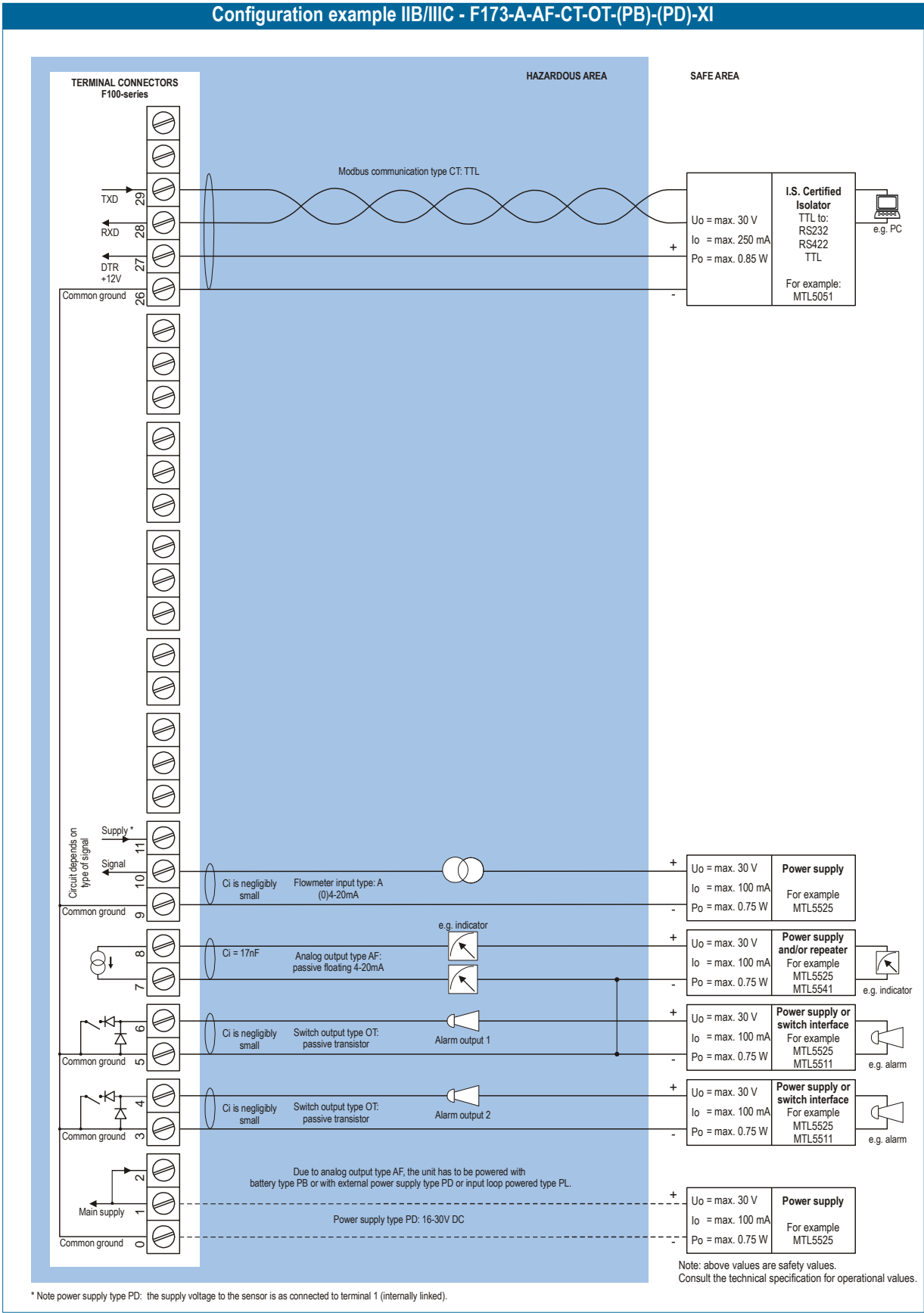


Fig. 28: Configuration example Intrinsically safe.

Configuration example IIB/IIIC and IIC - F173-A-AF-(CT)-OT-PD-XI

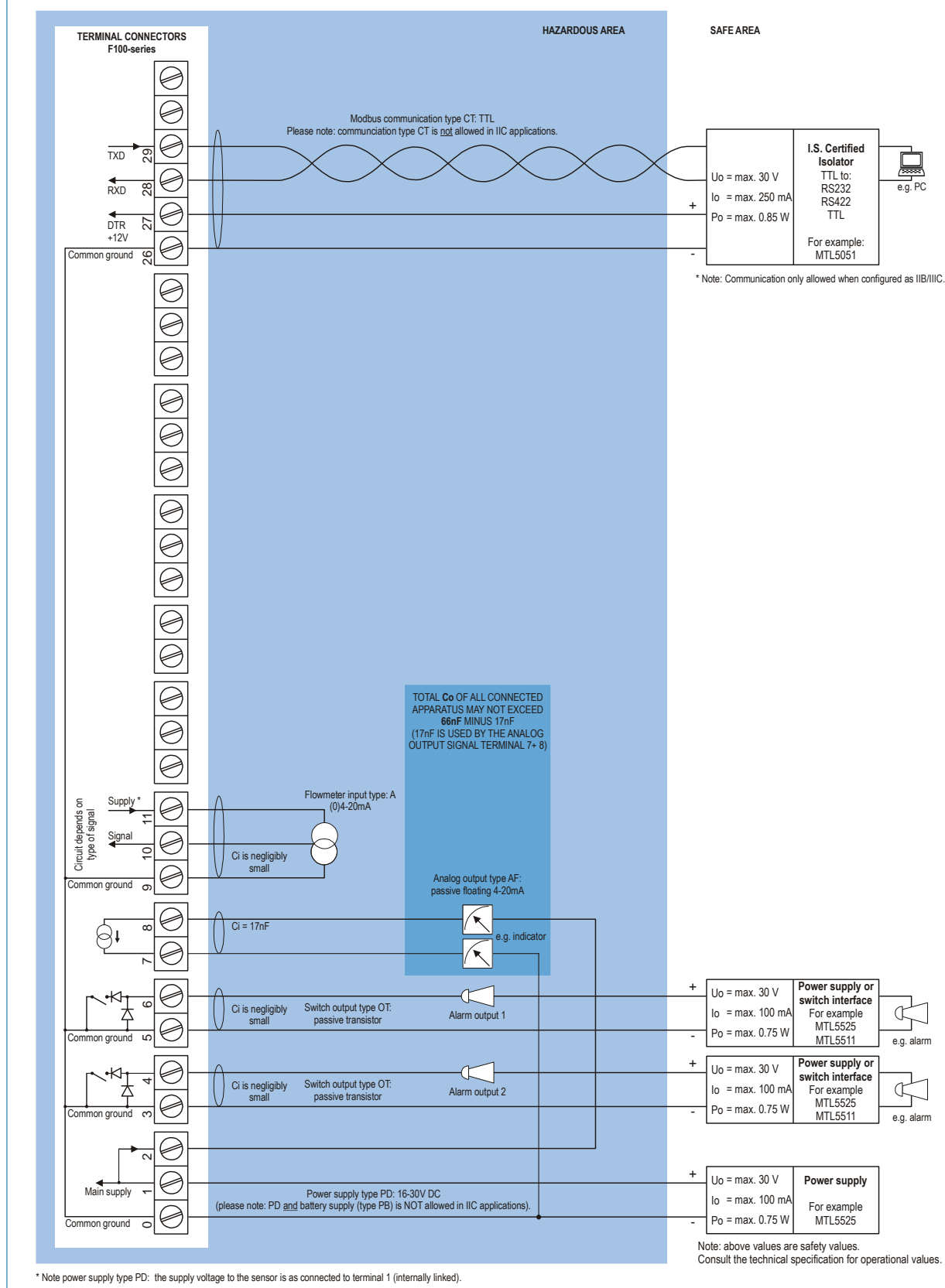


Fig. 29: Configuration example Intrinsically safe.

5.4 BATTERY REPLACEMENT INSTRUCTIONS

5.4.1. SAFETY INSTRUCTIONS



- Handle the battery with care. A mistreated battery can become unsafe. Unsafe batteries can cause (serious) injury to persons.
- Only use batteries which are certified for use in hazardous areas. The use of standard batteries in hazardous area's is not safe and prohibited. Batteries that are regarded as unsafe can cause (serious) injury to persons and damage to the property.
- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- Only use batteries which are certified for use in hazardous areas. The use of standard batteries in hazardous area's is not safe and prohibited. Batteries that are regarded as unsafe can cause (serious) injury to persons and damage to the property.
- For use in hazardous areas we advise to apply FW-LiBAT batteries only.



Caution !

5.4.2. REPLACE THE BATTERY (HAZARDOUS AREA)

The batteries are used to store electrical energy. The battery is a high power battery which must be treated carefully. When the battery is mistreated or damaged, there is a risk of a fire, an explosion and serious burns.

1. Mind that you cannot switch off a battery.
2. Make sure, it is safe to work on the battery system.
3. Handle the battery with the utmost care to prevent a short circuit and damage.
4. Do not recharge, crush, disassemble, incinerate, heat above its rated temperature or expose the contents to water.
5. Dispose of the battery in accordance with the (inter)national, the manufacturer's and the plant owner's standards and regulations.
6. Read and understand the instructions.
7. Get approval from the safety officer to do the work.
8. Lock-out/Tag-out the unit and related system.
9. Make sure, it is safe to do the work.



REMOVE THE BATTERY

1. If necessary, clean the enclosure with an anti-static cloth made damp with a mild soap solution.
2. Let the enclosure dry onto the air.
3. Carefully, open the enclosure.
4. Keep the removed parts in a clean location.
5. Get access to the battery.
6. Find the battery connector and disconnect the battery from the unit.
7. Remove and keep the battery from the unit.
8. Install an insulation tape over the battery connector to prevent a short circuit.

INSTALL THE BATTERY

1. Make sure, the new battery is certified for use in the unit.
2. Work as clean as possible, to prevent contamination to enter the unit.
3. Carefully, install the battery.
4. Make sure, the battery is correctly locked into the battery holder.
5. Install the battery connector.
6. Carefully assemble the unit and close the enclosure.
7. With the enclosure carefully closed, do a test of the unit.
8. If necessary, get access to the setup menu and make any adjustments to obtain the correct settings.

5.4.3. DISPOSAL OF BATTERIES



- Batteries pose an environmental hazard.
- Do not dispose of as general waste or incinerate.
- Return used batteries to a recycling point.

6. MAINTENANCE

6.1. GENERAL DIRECTIONS



Caution !

- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Make sure, the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the enclosure cover is removed or the panel cabinet has been opened (danger from electrical shock). The enclosure may only be opened by trained persons authorized by the operator of the facility.
- Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.

The F170-A does not require special maintenance unless it is used in low-temperature applications or surroundings with high humidity (above 90% annual mean). It is the users responsibility to take all precautions to dehumidify the internal atmosphere of the F170-A in such a way that no condensation will occur, e.g. to put a dose of desiccant (drying agent) inside the enclosure just before closing it. Furthermore, it is required to replace the desiccant periodically as advised by its supplier.

Battery life-time:

It is influenced by several issues:

- Analog output signal; be sure that an external power supply is connected or that the function is disabled if not in use; or else it will have a major influence on the battery life-time;
- Display update: fast display update uses significantly more power;
- Pulse output and communications;
- Low temperatures; the available power will be less due to battery chemistry.



Note !

It is strongly advised to disable the unused functions.

Check periodically:

- The condition of the enclosure, 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 not forget to re-enter any subsequent Span alterations.
- The indication for low-battery.
- Clean window and enclosure only with a lint-free cleaning cloth made damp with a mild soap solution.. Do not use any aggressive solvents as these might damage the coating.

6.2. REPAIR

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

6.3. REPAIR POLICY



If you have any problem with your Fluidwell product and you wish to repair it, please follow the procedure below:

- Obtain a Return Material Authorization (RMA) from your supplier or distributor Together with the RMA, you need to complete a repair form to submit detailed information about the problem.
- Send the product, within 30 days, to the address provided with the RMA. The physical return of your repair can only take place after the authorization of your repair application, as confirmed by the RMA number.

If the product is within the warranty period, it will be repaired or exchanged and returned within three weeks. If the product is no longer under warranty, you will receive a repair estimate.

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	LCD with LED backlight. Improved readability in full sunlight and darkness. Power requirements: 12-24V DC + 10% or type PD, PF, PM. Power consumption max. 1 Watt.
Enclosures	
General	Die-cast aluminum or GRP (Glass fiber Reinforced Polyamide) enclosure with Polycarbonate window, silicone 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") – WxHxD.
Classification	IP65 / TYPE 4(X)
Panel cut-out	115 x 98mm (4.53" x 3.86") LxH.
Type HC	GRP panel-mount enclosure
Type HB	Aluminum panel-mount enclosure
Type HSB	Stainless steel panel-mount enclosure
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95"/3.54") – WxHxD.
Classification	IP67 / TYPE 4(X)
Aluminum and stainless	where "H" turns to "HS" for stainless enclosures, e.g. HA → HSA
Type HA	Drilling: 2x PG9 – 1x M20.
Type HL	Drilling: 2x ½"NPT.
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)
Intrinsically safe	-40°C to +70°C (-40°F to +158°F); (limited to +50°C (122°F) for EPL Da)
Relative humidity	90%, no condensation allowed.
Power supply	
Type AP	8-30V DC; Power consumption max. 0.5 Watt.
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 / 8-30V DC; Power consumption max. 5 Watt.
Type PD-ZB	10-24V AC / 12-30V DC; Power consumption max. 5 Watt.
Type PD-XI	16-30V DC; Power consumption max. 1 Watt.
Type PF	15-24V AC / 20-30V DC; Power consumption max. 15 Watt.
Type PM	115-230V AC; Power consumption max. 15 Watt.
Type PX	8-30V DC; Power consumption max. 0.75 Watt.
Type PX-ZB	12-30V DC; Power consumption max. 1.5 Watt.
Type PX-XI	8-30V DC; Power consumption max. 0.75 Watt.
Note I.S. applications	For Intrinsically safe applications, consult the safety values in the certificate.

Sensor excitation	
Type PB / PC / PX	Not suitable to power a (0)4-20mA sensor
Type PD	3; 8.2; 12; 24V DC - max. 50mA@24V DC
Type PD-XI	The sensor supply voltage is according to power supply (internally connected)
Type PF / PM	3; 8.2; 12; 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 settings. Data retention at least 10 years.
Password	Configuration settings can be password protected.
Hazardous area	
Intrinsically safe Type XI	ATEX approval :  II 1 G Ex ia IIB/IIC T4 Ga II 1 D Ex ia IIIC T ₂₀₀ 100°C Da IECEx approval : Ex ia IIB/IIC T4 Ga Ex ia IIIC T ₂₀₀ 100°C Da
Explosion proof Type XF	ATEX approval:  II 2 G Ex d IIB T5 Gb II 2 D Ex t IIIB T100 °C Db Weight appr. 15 kg. Dimensions of enclosure: 350 x 250 x 200mm (13.7" x 9.9" x 7.9") WxHxD.
Directives and Standards	
EMC	EN 61326-1; FCC 47 CFR part 15
LVD	EN/IEC 61010-1
ATEX / IECEx	EN/IEC 60079-0; EN/IEC 60079-11
RoHS	EN 50581
IP & NEMA	EN 60529; NEMA 250
INPUTS	
Sensor	
Type A	(0)4-20mA - with signal calibration feature at any current within the range.
Accuracy	Resolution: 16 bit.. Error < 0.025mA / ±0.125% FS. Low level cut-off programmable.
Span	0.000010 - 9999999 with variable decimal position.
Update time	Four times a second.
Relationship	Linear calculation.
Note	External power to sensor is required; e.g. Type PD. Voltage drop: 2.5 Volt
OUTPUTS	
Analog output	
Function	transmitting level, height or percentage.
Accuracy	10 bit. Error < 0.05% - update 8 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 PD, PF, PM or PX).
Type AB	Active 0-20mA output (requires type PD, PF, PM or PX).
Type AF	Passive floating 4-20mA output for Intrinsically safe applications (requires type PC or PD).
Type AI	Passive galvanic isolated output (requires type PB, PD, PF, PL or PM).
Type AP	Passive 4-20mA output - output loop powered.
Type AU	Active 0-10V output (requires type PD, PF, PM or PX).
Switch output(s)	
Function	User defined: alarm outputs
Alarm output	lo-lo; lo; hi; hi-hi or all alarm based on level, height or percentage.
Type OA	Three active 24V DC output; max. 50mA per output (requires type PD, PF, PM or PX). Note: PX requires min. 24V DC power supply
Type OR	Two electro-mechanical relay outputs; max. switch power 230V AC - 0.5A and one OT or OA output (requires type PF or PM).
Type OS	Four electro-mechanical relay outputs; max. switch power 230V AC - 0.5A (requires type AP, OR and PD).
Type OT	Three passive transistor outputs - not isolated. Load: max. 50V DC - 300mA

Communication option	
Protocol	bus-rtu; bus-asc
Speed	1200 - 2400 - 4800 - 9600 – 9600HP - 19200 - 38400
Addressing	1 - 247
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"> • actual level • actual height • actual percentage • low-low alarm value • low alarm value • high alarm value • high-high alarm value <p>If enabled, the alarm can be cleared by the operator.</p>

Level	
Digits	7 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 - 2 or 3.

Percentage	
Digits	4 digits.
Units	%
Decimals	1

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 7.1: is the function enabled?
- SETUP 7.2: is the correct value selected (level, percentage, height)?
- SETUP 7.3 / 7.4: are the values for 4mA and 20mA programmed correctly?
- connection of the external power-supply according specification.

Alarm output does not function:

Check:

- SETUP 8.1 - 8.9: did you enable the relays correctly?
- SETUP 3.1 - is the correct value selected (level, percentage, height)?
- SETUP 3.3 - 3.6: are the correct alarm values programmed?
- SETUP 3.7 - 3.A: are the correct alarm delay times 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 error code. When multiple errors arise at the same time, their error codes are added and their sum is shown. The digital [d] codes are:

Not recoverable by the end user:

- [d] 0 = no error;
- [d] 1 = display error;
- [d] 2 = data-storage error;
- [d] 3 = error 1 + error 2 simultaneously;
- [d] 4 = initialization error;
- [d] 8 = analog input error.

For a not recoverable error, keep the error code at hand and contact your supplier.

APPENDIX C: COMMUNICATION VARIABLES

GENERAL

The product is fitted with the Modbus communication protocol and can be equipped with various physical interfaces like RS485 and RS232 (please see device datasheet for available options). The tables below show the various variables that can be accessed through the communication. Currently, the function codes supported are:

- function code 3 “Read Holding Registers” (4x references);
- function code 16 “Preset Multiple Registers” (4x references).

The table below shows the Modbus PDU addresses in a decimal format, followed by its hexadecimal representation (0x0000). When the PLC address range is required (4x references are typically used by PLCs), please add a value of 40001 to the Modbus PDU address. E.g. reading the serial number of the product with PLC-based addressing means: 165 + 40001 = register 40166.

The variables that consist of a multiple register must always read/write in 1 single action!

Please note that the MSW (most significant word) will always be placed in the lowest addressed register, the LSW (least significant word) will always be placed in the highest addressed register.. For additional information regarding using your Modbus device, please read our 'General Modbus Communication Protocol' and 'Modbus troubleshooting guide' that are available through our website or your distributor.

Runtime variables

PDU ADDRESS	REGISTER	VARIABLE RUN TIME	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 572 [h] 0x23C	40573	level	2	R	int32 (signed)	-999999...999999, Representation: unit, decimals depending on variables 30, 32
[d] 588 [h] 0x24C	40589	height	2	R	int32 (signed)	-999999...999999, Representation: unit, decimals depending on variables 224, 226
[d] 44 [h] 0x02C	40045	percentage	1	R	uint16	0.0 ... 100.0 %
[d] 516 [h] 0x204	40517	error status (bitfield)	1	R	uint16	[d] 0 = no error [d] 1 = display error [d] 2 = data-storage error [d] 4 = initialization error [d] 8 = analog input error

Reading level, height or percentage: The returned values are given including the decimals and represent the actual value. The given value may differ from the value that is shown on the display – this is due to the fact that the display may have a slower update rate set.

Setup variables

PDU ADDRESS	REGISTER	VARIABLE LEVEL	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 48 [h] 0x030	40049	unit	1	r/w	uint16	0=none 2= m ³ 4= lb 6=USGAL 1=L 3=kg 5=gal 7=bbl
[d] 50 [h] 0x032	40051	decimals	1	r/w	uint16	0...3
[d] 51 [h] 0x033	40052	span	2	r/w	uint32	1...9999999 Representation: 0.000001...9999999 depending on variable 54: decimals span.
[d] 54 [h] 0x036	40055	decimals span	1	r/w	uint16	0...6
[d] 55 [h] 0x037	40056	offset	2	r/w	uint16	-999,999...999,999 Representation: depending on variable 50: decimals and variable 62: sign.
[d] 62 [h] 0x03E	40063	offset sign	1	r/w	uint16	0 = + 1 = - Sign for level offset (variable 55)

PDU ADDRESS	REGISTER	VARIABLE HEIGHT	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 224 [h] 0x0E0	40225	unit	1	r/w	uint16	0=m 5=ft 10=mmwk 15=bar 1=mm 6=mmwk 11=mmwc 16=psi 2= cm 7=mmwc 12=inwc 17=none 3=mtr 8=cmwk 13=ftwc 4=inch 9=cmwc 14=mbar
[d] 226 [h] 0x0E2	40227	decimals	1	r/w	uint16	0...3
[d] 227 [h] 0x0E3	40228	span	2	r/w	uint32	1...9999999 Representation: 0.000001...9999999 depending on variable 230: decimals span.
[d] 230 [h] 0x0E6	40231	decimals span	1	r/w	uint16	0...6
[d] 231 [h] 0x0E7	40232	offset	2	r/w	uint16	-999,999...999,999 Representation: depending on variable 226: decimals and variable 63: sign.
[d] 63 [h] 0x03F	40064	offset sign	1	r/w	uint16	0 = + 1 = - Sign for level offset (variable 231)

PDU ADDRESS	REGISTER	VARIABLE ALARM	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 69 [h] 0x045	40070	alarm input value	1	r/w	uint16	0= level 1=height 2=percent
[d] 70 [h] 0x046	40071	level zero	1	r/w	uint16	0=ignore 1=default 2=no relay
[d] 234 [h] 0x0EA	40235	alarm value low-low	2	r/w	uint32	0...9999999 Representation: -9999.999...9999999 depending on variable 69 and 250
[d] 250 [h] 0x0FA	40251	alarm value low-low sign	1	r/w	uint16	0 = + 1 = - Sign for alarm value low-low (variable 234)
[d] 240 [h] 0x0F0	40241	alarm value low	2	r/w	uint32	0...9999999 Representation: -9999.999...9999999 depending on variable 69 and 251
[d] 251 [h] 0x0FB	40252	alarm value low sign	1	r/w	uint32	0 = + 1 = - Sign for alarm value low (variable 240)
[d] 243 [h] 0x0F3	40244	alarm value high	2	r/w	uint32	0...9999999 Representation: -9999.999...9999999 depending on variable 69 and 252
[d] 252 [h] 0x0FC	40253	alarm value high sign	1	r/w	uint32	0 = + 1 = - Sign for alarm value high (variable 243)
[d] 237 [h] 0x0ED	40238	alarm value high-high	2	r/w	uint32	0...9999999 Representation: -9999.999...9999999 depending on variable 69 and 253
[d] 253 [h] 0x0FD	40238	alarm value high-high sign	1	r/w	uint32	0 = + 1 = - Sign for alarm value high-high (variable 237)

[d] 205 [h] 0x0CD	40206	delay time value low-low	1	r/w	uint16	0...999.9
[d] 246 [h] 0x0F6	40247	delay time value low	1	r/w	uint16	0...999.9
[d] 248 [h] 0x0F8	40249	delay time value high	1	r/w	uint16	0...999.9
[d] 222 [h] 0x0DE	40223	delay time value high-high	1	r/w	uint16	0...999.9

PDU ADDRESS	REGISTER	VARIABLE DISPLAY	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 68 [h] 0x044	40069	Alarm set	1	r/w	uint16	0=operate 1=setup
[d] 64 [h] 0x040	40065	display function	1	r/w	uint16	0= L (evel) 2=L+P 4=H+P 1= L+H 3=H (eight) 5=P (ercent)
[d] 67 [h] 0x043	40068	backlight brightness	1	r/w	uint16	0=off 2=40% 4=80% 1=20% 3=60% 5=100%
[d] 110 [h] 0x06E	40111	Backlight alarm	1	r/w	uint16	0=off 1=on 2=flash

PDU ADDRESS	REGISTER	VARIABLE POWER MANAGEMENT	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 80 [h] 0x050	40081	LCD update time	1	r/w	uint16	0=fast 2=3sec 4=30sec 1=1sec 3=15sec 5=off
[d] 81 [h] 0x051	40082	power mode	1	r/w	uint16	0=operational 1=shelf

PDU ADDRESS	REGISTER	VARIABLE SENSOR	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 99 [h] 0x063	40100	filter	1	r/w	uint16	1...99
[d] 100 [h] 0x064	40101	cut-off	1	r/w	uint16	0...999 Representation: 0.0 – 99.9%
[d] 102 [h] 0x066	40103	calibrate low	1	r/w	uint16	0=cal set 1=calibrate 2=default
[d] 103 [h] 0x067	40104	calibrate high	1	r/w	uint16	0=cal set 1=calibrate 2=default

PDU ADDRESS	REGISTER	VARIABLE ANALOG OUTPUT	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 112 [h] 0x070	40113	analog output	1	r/w	uint16	0=disable 1=enable
[d] 124 [h] 0x07C	40125	analog output input value	1	r/w	uint16	0= level 1=height 2=percent
[d] 113 [h] 0x071	40114	minimum value	2	r/w	uint32	0...9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 125 [h] 0x07D	40126	minimum value sign	1	r/w	uint32	0 = + 1 = - Sign for minimum value (variable 113)
[d] 116 [h] 0x074	40117	maximum value	2	r/w	uint32	0...9999999 Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 126 [h] 0x07E	40127	maximum value sign	1	r/w	uint32	0 = + 1 = - Sign for maximum value (variable 116)
[d] 119 [h] 0x077	40120	cut off percentage	1	r/w	uint16	0...99 Representation: 0.0 – 9.9%
[d] 120 [h] 0x078	40121	tune minimum rate	1	r/w	uint16	0...9999
[d] 122 [h] 0x07A	40123	tune maximum rate	1	r/w	uint16	0...9999
[d] 127 [h] 0x07F	40128	Filter	1	r/w	uint16	1...99

PDU ADDRESS	REGISTER	VARIABLE RELAYS	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
		relay test				Function only available through local keypad.
[d] 135 [h] 0x087	40136	relay 1	1	r/w	uint16	0=off 2=LO 4=HH 1=LL 3=HI 5=all
[d] 136 [h] 0x088	40137	relay 2	1	r/w	uint16	0=off 2=LO 4=HH 1=LL 3=HI 5=all
[d] 137 [h] 0x089	40138	relay 3	1	r/w	uint16	0=off 2=LO 4=HH 1=LL 3=HI 5=all
[d] 138 [h] 0x08A	40139	relay 4	1	r/w	uint16	0=off 2=LO 4=HH 1=LL 3=HI 5=all
[d] 192 [h] 0x0C0	40193	relay 1 clear	1	r/w	uint16	0=disable 1=enable
[d] 193 [h] 0x0C1	40194	relay 2 clear	1	r/w	uint16	0=disable 1=enable
[d] 194 [h] 0x0C2	40195	relay 3 clear	1	r/w	uint16	0=disable 1=enable
[d] 195 [h] 0x0C3	40196	relay 4 clear	1	r/w	uint16	0=disable 1=enable
[d] 4896 [h] 0x1320	44897	Clear relays command register	1	r/w	uint16	Writing value 1 to this registers executes the clear alarm outputs procedure.

PDU ADDRESS	REGISTER	VARIABLE COMMUNICATION	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 146 [h] 0x092	40147	Modbus mode	1	r/w	uint16	0=ASCII 1=RTU 2=OFF
[d] 144 [h] 0x090	40145	speed (baudrate)	1	r/w	uint16	0=1200 2=4800 4=9600H 6=38400 1=2400 3=9600 P 7= 5=19200
[d] 247 [h] 0x0F7	40248	databits	1	r/w	uint16	0=8bits 1=7bits
[d] 248 [h] 0x0F8	40249	parity	1	r/w	uint16	0=none 1=even
[d] 145 [h] 0x091	40146	Modbus address	1	r/w	uint16	1...247
[d] 147 [h] 0x093	40148	transmission delay	1	r/w	uint16	0...255 Representation: ms
[d] 150 [h] 0x096	40151	index	1	r/w	uint16	Index-value (0...255) for use with indexed variables (where applicable).
[d] 149 [h] 0x095	40150	Index use	1	r/w	uint16	0=static 1=increment 2=decrement
[d] 25 [h] 0x019	40026	reboot	1	r/w	uint16	Returns 0 on read. Write 0xA50F for unit restart Write 0xA5AF0 for factory settings

PDU ADDRESS	REGISTER	VARIABLE OTHERS	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 173 [h] 0x0AD	40174	model number	1	R	uint16	0...9999
[d] 160 [h] 0x0A0	40161	model suffix	1	R	char	Representation: ASCII character
[d] 162 [h] 0x0A2	40163	firmware version	2	R	uint32	0...999999 Representation: nn.nn.nn
[d] 165 [h] 0x0A5	40166	serial no	2	R	uint32	0...9999999 Representation: yy.ww.nnn
[d] 168 [h] 0x0A8	40169	password	1	R	uint16	0...9999
[d] 170 [h] 0x0AA	40171	tag-nr	2	r/w	uint32	0...9999999 Representation: nnnnnnn

INDEX OF THIS MANUAL

actual settings	54, 55	Intrinsic safety	36, 38
alarm		Intrinsically Safe options	39
set alarm operator level	18	IP classification	23
analog		keys	8
disable/enable	20	level	9
floating output.	39	alarm	9
intrinsically safe output.	39	alarm value	9
level min.	20	decimals	16
tune / calibrate	20	decimals Span	16
Analog output	33	measuring unit	16
backlight		Span	16
alarm color	18	Low-battery alarm	10
battery life time	18, 21, 43	main-function	12
communication	35	maintenance	43
family-specific variables	48	model	22
Configuration	11	operational	23, 43
Dimension enclosures	24	operator level	8
display		password	22, 47
function	18	power supply	33
display update	18	Problem solving	47
height		Sensor input	34
decimals	16	serial number	22
decimals Span	17	SETUP-level	11
measuring unit	16	subfunction	12
Span	17	tagnumber	22
high alarm output	32, 35	Technical specification	44
Installation	23	version software	22

LIST OF FIGURES IN THIS MANUAL

Fig. 1: Typical application for the F170-A.....	6
Fig. 2: Control panel.	8
Fig. 3: Example of display information during process.	8
Fig. 4: Example of display information during programming.	9
Fig. 5: Example of low battery alarm.	10
Fig. 6: Aluminum enclosures - Dimensions.....	23
Fig. 7: GRP enclosures - Dimensions.....	24
Fig. 8: Overview of terminal connectors - Standard configuration and options	30
Fig. 9: Sensor supply voltage - Switch setting	31
Fig. 10: Terminal connections - Active output (typical)	32
Fig. 11: Terminal connections - Mechanical relay output (typical)	32
Fig. 12: Terminal connections - Transistor output (typical)	32
Fig. 13: Terminal connections - 4-20mA analog output (typical).....	33
Fig. 14: Terminal connections - Active 0-20mA analog output (typical).....	33
Fig. 15: Terminal connections - Isolated 4-20mA analog output (typical).....	33
Fig. 16: Terminal connections - Passive 4-20mA analog output (typical).....	34
Fig. 17: Terminal connections - Active 0-10V analog output (typical).....	34
Fig. 18: Terminal connections - Analog signal input (typical).....	34
Fig. 19: Terminal connections - Analog signal input – Loop-powered (typical)	35
Fig. 20: Terminal connections - Active output (typical)	35
Fig. 21: Terminal connections - Pulse output (typical)	35
Fig. 22: Example serial number (typical).....	37
Fig. 23: Label information - Intrinsically safe application (typical).....	37
Fig. 24: Overview terminal connectors - Intrinsically safe (typical)	38
Fig. 25: Terminal connections - Intrinsically safe floating 4-20mA analog output (typical)	39
Fig. 26: Sensor supply voltage - Switch setting (Intrinsically safe)	39
Fig. 27: Configuration example Intrinsically safe.	40
Fig. 28: Configuration example Intrinsically safe.	41

LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE :	DATE :
1 - LEVEL			
1.1 unit	L		
1.2 decimals	0000000		
1.3 span	1600		
1.4 decimals span	0		
1.5 offset	0		
2 - HEIGHT			
2.1 unit	m		
2.2 decimals	0000000		
2.3 span	1600		
2.4 decimals span	0		
2.5 offset	0		
3 - ALARM			
3.1 input	level		
3.2 empty	ignore		
3.3 alarm low-low	0		
3.4 alarm low	0		
3.5 alarm high	0		
3.6 alarm high-high	0		
3.7 delay alarm low-low	0.0 sec		
3.8 delay alarm low	0.0 sec		
3.9 delay alarm high	0.0 sec		
3.A delay alarm high-high	0.0 sec		
4 - DISPLAY			
4.1 alarm set	operator		
4.2 function	level		
4.3 light	100%		
4.4 backlight alarm	off		
5 - POWER MANAGEMENT			
5.1 LCD-new	1 sec.		
5.2 mode	operational		
6 - SENSOR			
6.1 filter	01 (off)		
6.2 cut-off %	0.0%		
6.3 calibrate low-(0)4mA	default		
6.4 calibrate high-20mA	default		
7 - ANALOG OUTPUT			
7.1 output	disabled		
7.2 input	level		
7.3 min. level 4-mA	0		
7.4 max. level 20mA	99999		
7.5 cut off percentage	0.0%		
7.6 tune min - 4mA	0208		
7.7 tune max - 20mA	6656		
7.8 filter	01 (off)		

LIST OF CONFIGURATION SETTINGS (CONT)			
SETTING	DEFAULT	DATE :	DATE :
8 - RELAYS			
8.1 relay test	Disabled		
8.2 relay 1	Off		
8.3 relay 2	Off		
8.4 relay 3	Off		
8.5 relay 4	Off		
8.6 relay 1 clear	Disabled		
8.7 relay 1 clear	Disabled		
8.8 relay 1 clear	Disabled		
8.9 relay 1 clear	Disabled		
9 - COMMUNICATION			
9.1 mode	BUS-RTU		
9.2 speed	9600		
9.3 databits	8 bits		
9.4 parity	none		
9.5 address	1		
9.6 transmit delay	15 ms		
A - OTHERS			
A.1 model	F170-A	F170-A	F170-A
A.2 software version	03.xx.xx		
A.3 serial no	xxxxxxx		
A.4 password	0000		
A.5 tagnumber	0000000		