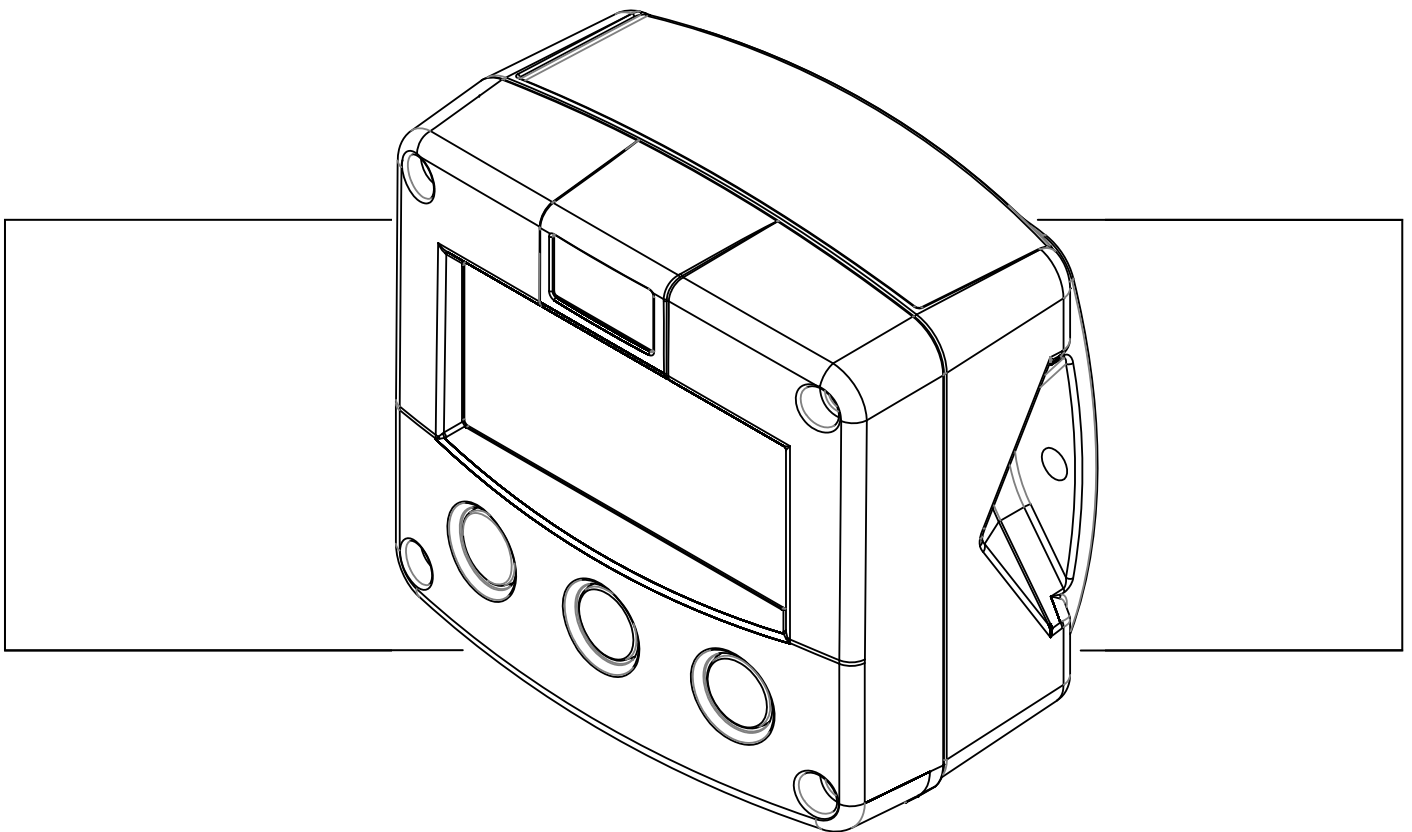


# *F131-P*

*BATCH-CONTROLLER*



*Signal input flowmeter: pulse, Namur and coil*

*Status inputs: start and stop*

*Signal outputs: two control outputs for two stage control, or  
one control output and pulse output ref. total*

*Signal outputs: 4-20mA ref. flowrate and pulse ref. total*

*Options: Intrinsically Safe, Modbus communication*



## SAFETY INSTRUCTIONS



- *Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.*
- *LIFE SUPPORT APPLICATIONS: The F131-P is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.*
- *Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.*
- *This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).*
- *Do connect a proper grounding to the aluminum casing (option HA/HU) as indicated if the F131-P has been supplied with the 115-230V AC power-supply option PM. The green/yellow wire between the back-casing and removable terminal-block may never be removed.*
- *Intrinsically Safe applications: follow the instructions as mentioned in Chapter 5 and consult "Fluidwell F1...-XI - Documentation for Intrinsic Safety".*

## DISPOSAL



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

## SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F131-P implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the F131-P supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

## ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

- The daily use of the unit is described in chapter 2 "Operation". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

This operation manual describes the standard unit as well as most of the options available. For additional information, please contact your supplier.

**A hazardous situation may occur if the F131-P 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 F131-P or connected instruments.



Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F131-P or connected instruments.



Note !

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

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Software version	:	02.05.xx
Manual	:	HF131PEN_v0501_05
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**Information in this manual is subject to change without prior notice. The manufacturer is not responsible for mistakes in this material or for incidental damage caused as a direct or indirect result of the delivery, performance or use of this material.**

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# CONTENTS MANUAL

Safety instructions .....	2
Disposal .....	2
Safety rules and precautionary measures .....	2
About the operation manual .....	3
Contents manual.....	4
1. Introduction .....	5
1.1. System description of the F131-P .....	5
2. Operational.....	7
2.1. General .....	7
2.2. Control panel.....	7
2.3. Operator information and functions .....	8
3. Configuration.....	10
3.1. Introduction .....	10
3.2. Programming SETUP-level.....	10
3.2.1. General .....	10
3.2.2. Overview functions SETUP level .....	13
3.2.3. Explanation OF SETUP-functions.....	14
1 - Preset .....	14
2 - Flowrate .....	15
3 - Overrun.....	16
4 - Display .....	16
5 - Power management .....	16
6 - Flowmeter .....	17
7 - Analog output.....	18
8 - Relay output.....	20
9 - Communication (optional).....	21
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
4.4.1. Introduction .....	25
4.4.2. Voltage selection sensor supply .....	26
4.4.3. Terminal connectors .....	27
5. Intrinsically safe applications.....	35
5.1. General information and instructions .....	35
5.2. Terminal connectors Intrinsically Safe applications .....	36
5.3. Configuration Examples.....	38
5.4. Battery replacement instructions.....	41
6. Maintenance.....	42
6.1. General directions .....	42
Appendix A: Technical specification .....	43
Appendix B: Problem solving.....	46
Appendix C: Communication variables.....	47
Index of this manual.....	51

# 1. INTRODUCTION

## 1.1. SYSTEM DESCRIPTION OF THE F131-P

### Functions and features

The batch controller model F131-P is a microprocessor driven instrument designed for batching and filling of small batch sizes up to large quantities as well as displaying the flowrate, total and accumulated total.

This product has been designed with a focus on:

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

### Flowmeter input

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

One flowmeter with a passive or active pulse, Namur or coil signal output can be connected to the F131-P. To power the sensor, several options are available.

### Standard outputs

- Two transistor or relay (option) outputs: for two-stage control or one stage control with pulse output. The configurable pulse output offers a scaled pulse mirroring a certain totalised quantity. Maximum frequency 60Hz.; the pulse length can be set from 7,8msec up to 2 seconds.
- Configurable passive linear 4-20mA analog output with 10-bits resolution mirroring the actual flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.

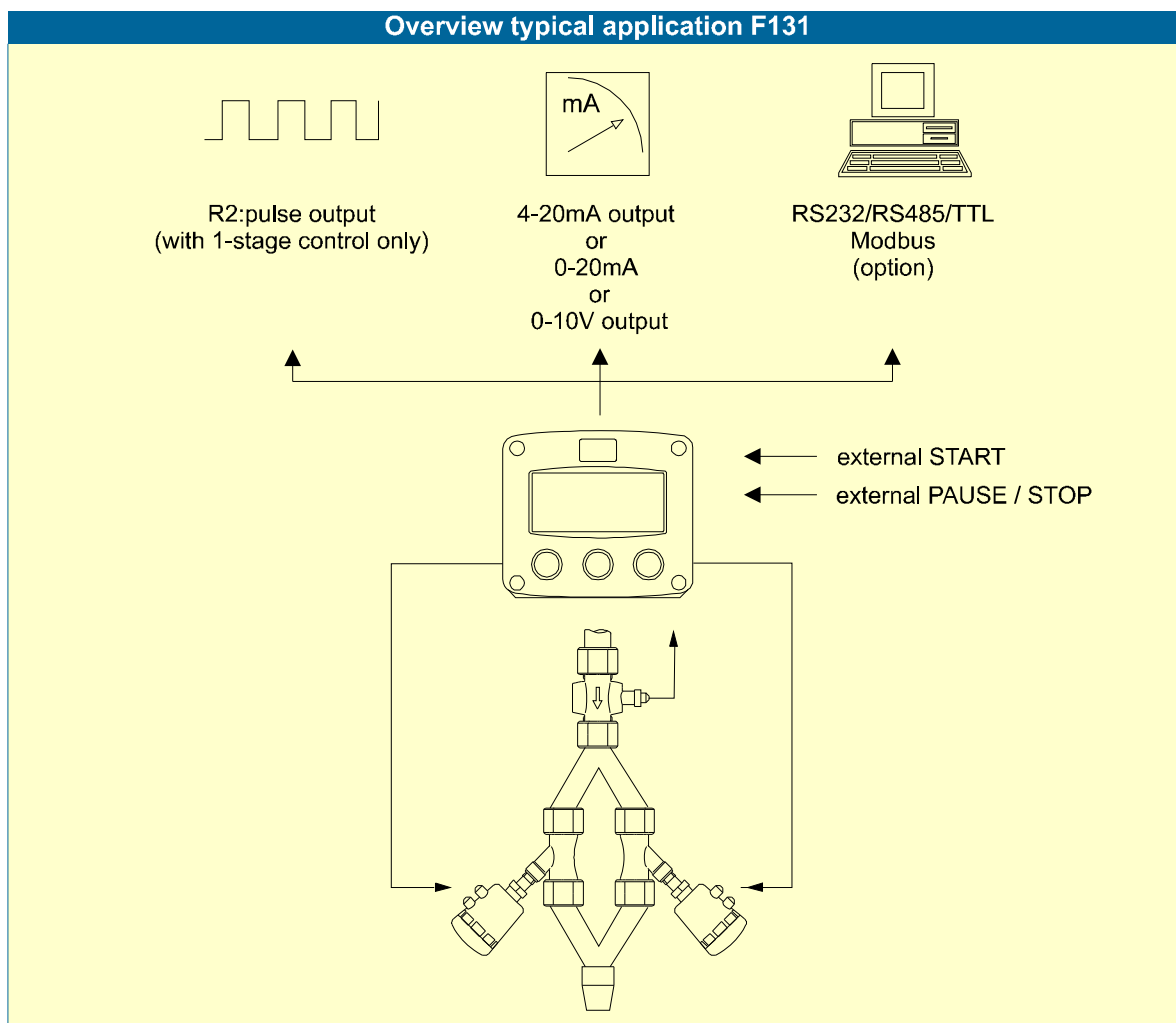


Fig. 1: Typical application for the F131-P.

**Configuration of the unit**

The F131-P was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F131-P according to your specific requirements. SETUP includes several important features, such as K-factors, measurement units, signal selection etc. All settings are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery.

To extend the battery-life time (option), please make use of the power-management functions as described in chapter 3.2.3.

**Display information**

The unit has a large transreflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.

A backup of the total and accumulated total in EEPROM memory is made every minute.

**Options**

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

## 2. OPERATIONAL

### 2.1. GENERAL



- *The F131-P 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 F131-P. This instruction is meant for users / operators.

### 2.2. CONTROL PANEL

The following keys are available:

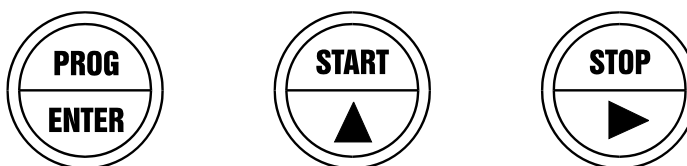


Fig. 2: Control Panel.

#### Functions of the keys



This key is used to program and save new values or settings.  
It is also used to gain access to SETUP-level; please read chapter 3.



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



Press STOP to "PAUSE" the batch process. When this key is pressed twice, the process is completely finished and can't be continued.  
STOP is also used to select Total and accumulated total.  
After PROG has been pressed, the arrow-key ► is used to select a value

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F131-P will always function at Operator level. The information displayed is dependant upon the SETUP-settings. All pulses generated by the connected flowmeter are measured by the F131-P 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.

▪ **To enter a batch quantity**

To change the PRESET-value, following procedure must be followed:

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



Fig. 3: Example display information during programming preset value.

When data is altered but ENTER has not been pressed yet, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER during three seconds: the former value will be reinstated. The PRESET-value can be used time after time till a new value is programmed.



Please note that alterations will only be set after ENTER has been pressed!

▪ **Batch maximum**

When you program a new value which is not valid - the batch size is too large - the decrease-sign ▼ will be displayed while you are programming; the new value will not be accepted!

▪ **Starting up the batch process**

The batch process can only be started up when "READY" is displayed. The batch process is started-up by pressing the START-key. Depending on the SETUP-settings, one or two relays will be switched. The arrows at the display indicate if the ACTUAL-value is / was counting up or down.

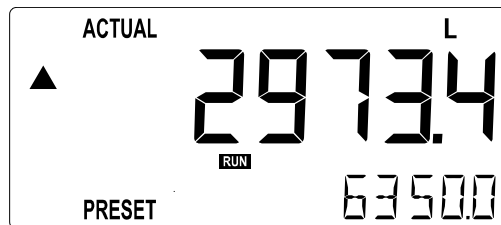


Fig. 4: Example display information during and at the end of the process.



- **Interrupting and ending the batch process**

When STOP is pressed once, the batch process will be temporarily interrupted; the actual values are not lost. At the display, the word "PAUSE" will be flashing. From this stage, the batch process can be resumed with the START-key.

The process can be ended entirely at all times by pressing STOP twice in which case the actual values are "lost" and the system returns to steady state: the batch can not be resumed.

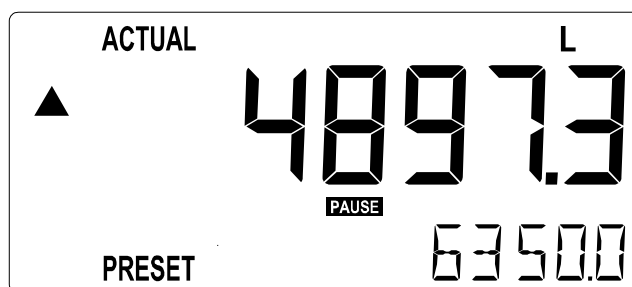


Fig. 5: Example display information when interrupted.

- **Flowrate indication**

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

During batching, the actual flowrate will be displayed on the bottom-line of the display. It depends on the configuration settings if flowrate is displayed continuously or alternating with the preset value.

**After batching, following functions are available:**

- **Clear total**

The value for total can be re-initialized. To do so, select Total and press PROG followed by STOP - STOP. After pressing STOP once, the flashing text "PUSH STOP" is displayed. To avoid re-initialization at this stage, press another key than STOP or wait for 20 seconds. Re-initialization of total DOES NOT influence the accumulated total.

- **Display accumulated total**

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

- **Low-battery alarm**

When the battery voltage drops, it must be replaced. At first "low-battery" will flash, but as soon as it is displayed continuously, the battery MUST be replaced shortly after! Only official batteries may be used, or else the guarantee will be terminated. The remaining lifetime after the first moment of indication is generally several days up to some weeks.



Fig. 6: Example of low-battery alarm.

- **Alarm 01-03**

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

### 3. CONFIGURATION

#### 3.1. INTRODUCTION

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




- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F131-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

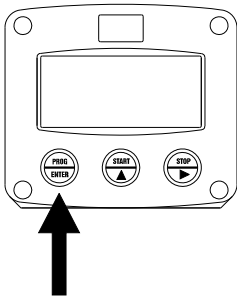
#### 3.2. PROGRAMMING SETUP-LEVEL

##### 3.2.1. GENERAL

Configuration of the F131-P is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows  $\blacktriangle$  will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically. SETUP can be reached at all times while the F131-P remains fully operational.

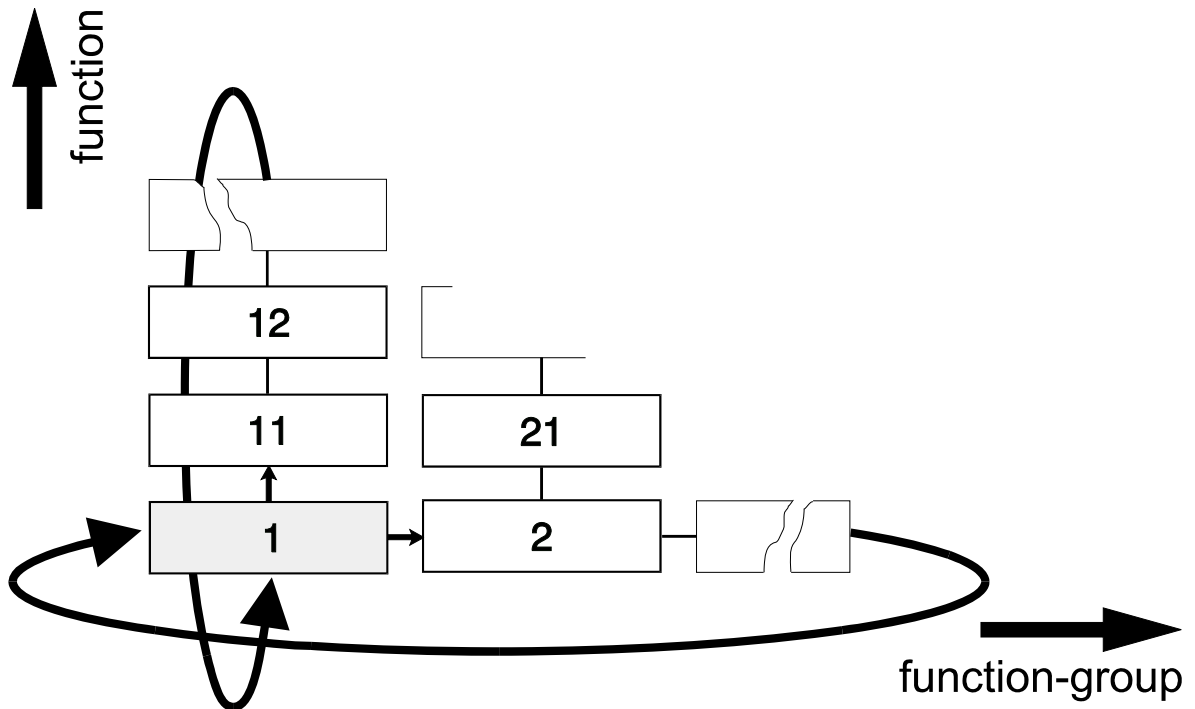
 **Note:** A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.

To enter SETUP-level:



Press  for 7 seconds

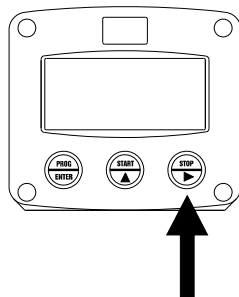
**Matrix structure SETUP-level:**



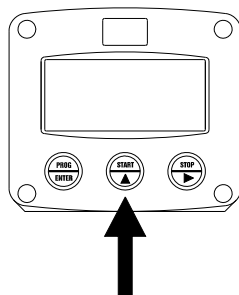
**SCROLLING THROUGH SETUP-LEVEL**

**Selection of function-group and function:**

SETUP is divided into several function groups and functions.



Select function-group with



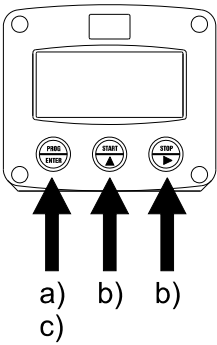
Select function with









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



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



To change or select a value:



- a) press  briefly; **PROGRAM** will start flash
- b) select or enter value with  and / or 
- c) press  to confirm the value / selection.

To change a value, use  to select the digits and  to increase that value.

To select a setting, both  and  can be used.

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

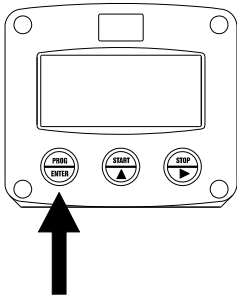
When data is altered but ENTER is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for three seconds: the PROG-procedure will be left automatically and the former value reinstated.



Note !

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

To return to OPERATOR-level:



Press  for 3 seconds

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

## 3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

<b>SETUP FUNCTIONS AND VARIABLES</b>			
<b>1</b>	<b>PRESET</b>		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K-FACTOR:	0.000010 - 9,999,999
	14	DECIMALS K-FACTOR	0 - 6
	15	BATCH MAXIMUM	X,XXX,XXX quantity
<b>2</b>	<b>FLOWRATE</b>		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	K-FACTOR	0.000010 - 9,999,999
	25	DECIMALS K-FACTOR	0 - 6
	26	CALCULATION	per 1 - 255 pulses
	27	CUT-OFF	0.1 - 999.9 seconds
<b>3</b>	<b>OVERRUN</b>		
	31	OVERRUN	disable - enable
	32	TIME	0.1 - 999.9 seconds
<b>4</b>	<b>DISPLAY</b>		
	41	DISPLAY	increase - decrease
	42	FLOWRATE	off - batch - toggle
<b>5</b>	<b>POWER MANAGEMENT</b>		
	51	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	52	BATTERY MODE	operational - shelf
<b>6</b>	<b>FLOWMETER</b>		
	61	SIGNAL	npn - npn_lp - reed - reed_lp - pnp - pnp_lp - namur - coil_hi - coil_lo - act_8.1 - act_12 - act_24
<b>7</b>	<b>ANALOG</b>		
	71	OUTPUT	disable - enable
	72	4mA / 0V	0000.000 - 9,999,999
	73	20mA / 10V	0000.000 - 9,999,999
	74	CUT-OFF	0.0 - 9.9%
	75	TUNE MIN - 4mA / 0V	0 - 9,999
	76	TUNE MAX- 20mA / 10V	0 - 9,999
	77	FILTER	00 - 99
<b>8</b>	<b>RELAYS</b>		
	81	RELAYS	1-step / 2-step
	82	PRECLOSE	X,XXX,XXX quantity
	83	PERIOD TIME	0 - 250
	84	IMPULSE PER	X,XXX,XXX quantity
	85	IMPULSE ACCORDING	total - batch
<b>9</b>	<b>COMMUNICATION</b>		
	91	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	92	ADDRESS	1 - 255
	93	MODE	ASCII - rtu - off
<b>A</b>	<b>OTHERS</b>		
	A1	TYPE / MODEL	
	A2	SOFTWARE VERSION	
	A3	SERIAL NO.	
	A4	PASSWORD	0000 - 9999
	A5	TAGNUMBER	0000000 - 9999999

## 3.2.3. EXPLANATION OF SETUP-FUNCTIONS

<b>1 - PRESET</b>	
<b>MEASUREMENT UNIT 11</b>	<p>SETUP - 11 determines the measurement unit for preset, total, accumulated total and pulse output. The following units can be selected:</p> <p style="text-align: center;">L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit).</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.</p>
<b>DECIMALS 12</b>	<p>The decimal point determines for preset, total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">000000 - 111111.1 - 22222.22 - 3333.333</p>
<b>K-FACTOR 13</b>	<p>With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be.</p> <p><b>Example 1: Calculating the K-factor.</b> <i>Let us assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m3". A cubic meter consists of 1000 parts of one liter which implies 2,481.3 pulses per m3. So, the K-factor is 2,481.3. Enter for SETUP - 13: "2481300" and for SETUP - 14 - decimals K-factor "3".</i></p> <p><b>Example 2: Calculating the K-factor.</b> <i>Let us assume that the flowmeter generates 6.5231 pulses per gallon and the selected measurement unit is gallons. So, the K-Factor is 6.5231. Enter for SETUP - 13: "6523100" and for SETUP - 14 decimals K-factor "6".</i></p>
<b>DECIMALS K-FACTOR 14</b>	<p>This setting determines the number of decimals for the K-factor entered. (SETUP 13). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this setting influences the accuracy of the K-factor indirectly. (i.e. the position of the decimal point and thus the value given) This setting has NO influence on the displayed number of digits for total (SETUP 12)!</p>
<b>BATCH MAXIMUM 15</b>	<p>This function limits the operator to enter a new preset-value which is more as the entered batch maximum.</p>

## 2 - FLOWRATE

The settings for preset and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate. The display update time for flowrate is one second or more.

**Note:** *these settings also influence the analog output.*

<b>MEASUREMENT UNIT 21</b>	<p>SETUP - 21 determines the measurement unit for flowrate. The following units can be selected:</p> <p style="text-align: center;">mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.</p>
<b>TIME UNIT 22</b>	The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).
<b>DECIMALS 23</b>	<p>This setting determines for flowrate the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">00000 - 1111.1 - 2222.22 - 3333.333</p>
<b>K-FACTOR 24</b>	With the K-factor, the flowmeter pulse signals are converted to a flowrate. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 21), for example per liter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.
<b>DECIMALS K-FACTOR 25</b>	<p>This setting determines the number of decimals for the K-factor (SETUP 24). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this SETUP - influences the accuracy of the K-factor indirectly. This setting has NO influence on the displayed number of digits for "flowrate" (SETUP 23)!</p>
<b>CALCULATION 26</b>	<p>The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 255 pulses.</p> <p><b>Note:</b> <i>this setting does influence the update time for the analog output directly (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses.</i></p> <p><b>Note:</b> <i>the lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).</i></p> <p><b>Note:</b> <i>for low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.</i></p> <p><b>Note:</b> <i>for high frequency application (above 1kHz) do program a value of 50 or more pulses.</i></p>
<b>CUT-OFF TIME 27</b>	<p>With this setting, you determine a minimum flow requirement threshold, if during this time less than XXX-pulses (SETUP 26) are generated, the flowrate will be displayed as zero.</p> <p>The cut-off time has to be entered in seconds - maximum time is 999 seconds (about 15 minutes).</p>



Note !

### 3 - OVERRUN

Overrun can occur at the end of the batch process, as a result of slowness of a valve / pump. Consequently, the accuracy is less. With this function, the F131-P analyses the actual overrun characteristic after every batch. This information is used to correct the overrun automatically.

<b>OVERRUN</b> 31	For an accurate overrun correction, it is necessary that the flow meter meets certain technical demands, such as "high resolution" and shows no "false" overrun due to a slow update time. Do not enable this function if the flow meter does not meet these technical demands.
<b>OVERRUN TIME</b> 32	The overrun characteristic of the system will be analyzed during a certain time after the batch. In this way, false signal generated through leakage are eliminated. Enter here the expected time needed by the system to stop a batch. It is advisable to provide extra time in order to avoid an incorrect overrun correction or false leakage alarms. <i>Note that the next batch can only be started after elapsing of this overrun time!</i> The minimum overrun time is 0.1 second, maximum 999.9 seconds.

### 4 - DISPLAY

<b>DISPLAY</b> 41	The large 17mm digits can be set to display the actual batched quantity (increase) OR to display the remaining quantity to be batched (decrease).
<b>FLOWRATE</b> 42	This setting determines if the calculated flowrate will be displayed. Three setting can be set: <ul style="list-style-type: none"> <li>▪ off: flowrate will not be displayed</li> <li>▪ batch: after pressing start, the flowrate will be displayed till the end of the batch. In this case, we advise you to set setting 41 to "decrease"</li> <li>▪ toggle: flowrate is displayed alternating with the preset value.</li> </ul>

### 5 - POWER MANAGEMENT

When used with the internal battery option, the user can expect reliable measurement over a long period of time. The F131-P has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

<b>LCD NEW</b> 51	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is <b>strongly advised</b> to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signals will be generated in the normal way. The following can be selected: <p style="text-align: center;">Fast - 1 sec - 3 sec - 15 sec - 30 sec - off.</p> <p><b>Example 3: Battery life-time</b>  <i>battery life-time with a coil pick-up, 1KHz. pulses and FAST update: about 2 years.</i>  <i>battery life-time with a coil pick-up, 1KHz. pulses and 1 sec update: about 5 years.</i></p> <p><b>Note:</b> after a button has been pressed by the operator - the display refresh rate will always switch to FAST for 30 seconds. When "OFF" is selected, the display will be switched off after 30 seconds and will be switched on as soon as a button has been pressed.</p>
<b>BATTERY-MODE</b> 52	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not count pulses, the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the unit again, press the SELECT-key twice.



Note !



## 6 - FLOWMETER

TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / MV	REMARK
NPN	NPN input	100K pull-up	6 kHz.	(open collector)
NPN - LP	NPN input with low pass filter	100K pull-up	2.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1M pull-up	1.2 kHz.	
REED - LP	Reed-switch input with low pass filter	1M pull-up	120 Hz.	Less sensitive
PNP	PNP input	100K pull-down	6 kHz.	
PNP - LP	PNP input with low pass filter	100K pull-down	700 Hz.	Less sensitive
NAMUR	Namur input	820 Ohm pull-down	4 kHz.	External power required
COIL HI	High sensitive coil input	-	20mV p.t.p.	Sensitive for disturbance!
COIL LO	Low sensitive coil input	-	90mV p.t.p.	Normal sensitivity
ACT_8.1	Active pulse input 8.1 VDC	3K9	10KHz.	External power required
ACT_12	Active pulse input 12 VDC	4K	10KHz.	External power required
ACT_24	Active pulse input 24 VDC	3K	10KHz.	External power required



Note !

**SIGNAL 61**

The F131-P is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 61.  
**Note:** The selections "active pulse" offer a detection level of 50% of the supply voltage.  
 Read also par. 4.4.3. Flowmeter input terminal 09-11.

## 7 - ANALOG OUTPUT

A linear 4-20mA signal (option AB: 0-20mA or option AU: 0-10V) output signal is generated according to the flowrate with a 10 bits resolution. The settings for flowrate (SETUP - 2) directly influence the analog output.

**Note:** When the analog output is not used, please make sure that setting 71 is disabled, or else the battery life time will be reduced significantly!

When a power supply is available but the output is disabled, a 3.5mA signal will be generated.

The relationship between rate and analog output is set with the following functions:



<b>DISABLE / ENABLE 71</b>	The D/A converter has a relatively high power consumption. If the analog output is not being used, select "disable" to switch-off the converter. For more information read par. 4.4.3.
----------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>MINIMUM FLOWRATE 72</b>	Enter here the flowrate at which the output should generate a 4mA signal (or 0mA / 0V) - in most applications at flowrate "zero". The number of decimals displayed depend upon SETUP 23. The time and measuring units (L/min for example) are dependant upon SETUP 21 and 22 but are not displayed.
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<b>MAXIMUM FLOWRATE 73</b>	Enter here the flowrate at which the output should generate a 20mA (or 10V) - in most applications at maximum flow. The number of decimals displayed depend upon SETUP 23. The time and measuring units (L/min for example) are dependant upon SETUP 21 and 22 but can not be displayed.
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<b>CUT-OFF 74</b>	To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16mA (or 20mA / 10V). When the flow is less than the required rate, the current will be 4mA.
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**Examples:**

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

<b>TUNE MIN / 4MA 75</b>	<p>The initial minimum analog output value is 4mA (or 0mA / 0V). However, this value might differ slightly due to external influences such as temperature for example. The 4mA value (or 0mA / 0V) can be tuned precisely with this setting.</p> <ul style="list-style-type: none"> <li>▪ <b><i>Before tuning the signal, be sure that the analog signal is not being used for any application!</i></b></li> </ul> <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.</p>
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<b>TUNE MAX / 20MA 76</b>	<p>The initial maximum analog output value is 20mA (or 10V). However, this value might differ slightly due to external influences such as temperature for example. The 20mA value (or 10V) can be tuned precisely with this setting.</p> <ul style="list-style-type: none"> <li>▪ <b><i>Before tuning the signal, be sure that the analog signal is not being used for any application!</i></b></li> </ul> <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.</p>
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Continued next page >>>

## 7 - ANALOG OUTPUT (CONTINUED)

<b>FILTER 77</b>	<p>This function is used to stabilize the analog output signal. The output value is updated every 0.1 second. With the help of this digital filter a more stable but less precise reading can be obtained. The filter principal is based on three input values: the filter level (01-99), the last analog output value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with their response times are indicated:</p>			
<b>FILTER VALUE</b>	<b>RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS</b>			
	<b>50% INFLUENCE</b>	<b>75% INFLUENCE</b>	<b>90% INFLUENCE</b>	<b>99% INFLUENCE</b>
<b>01</b>	filter disabled	filter disabled	filter disabled	filter disabled
<b>02</b>	0.1 second	0.2 second	0.4 second	0.7 second
<b>03</b>	0.2 second	0.4 second	0.6 second	1.2 seconds
<b>05</b>	0.4 second	0.7 second	1.1 seconds	2.1 seconds
<b>10</b>	0.7 second	1.4 seconds	2.2 seconds	4.4 seconds
<b>20</b>	1.4 seconds	2.8 seconds	4.5 seconds	9.0 seconds
<b>30</b>	2.1 seconds	4 seconds	7 seconds	14 seconds
<b>50</b>	3.5 seconds	7 seconds	11 seconds	23 seconds
<b>75</b>	5.2 seconds	10 seconds	17 seconds	34 seconds
<b>99</b>	6.9 seconds	14 seconds	23 seconds	45 seconds

## 8 - RELAY OUTPUT

Two one open-collector outputs (Optional: mechanic relays or active outputs) are available to control relays or small valves (max. 50VDC – 300mA).

Relay 2 can also be used as pulse output according the batch total (actual) or accumulated total.

*Please note: if the communication option has been supplied, the pulse output functions 83, 84 and 85 are not available.*



Note !

<b>1-STEP / 2-STEP 81</b>	With this setting, the function of relay is <i>Select "2-step" to executed batches with a two-stage valve.</i> <i>Select "1-step" to be able to use relay 2 as pulse output relay.</i>	
<b>PRECLOSE QUANTITY 82</b>	According to the setting 81 - 2-step, relay two will be used to control a valve for the batch process. If the product is batched in two steps, the switch-off-moment for relay 2 has to be set. The switch moment is based on the remaining quantity before the end of batch. If the preclose quantity is set to zero, it will switch simultaneously with relay 1.	
<b>PERIOD TIME PULSE OUTPUT 83</b>	According to the setting 81 - 1-step, relay 2 can be used as a scaled pulse output. The period time determines the time that the transistor or relay will be switched; in other words the pulse length. The minimum time between the pulses is as long as the period time. One period is approx. 7.8 msec. If the value selected is "zero", the pulse output is disabled. The maximum value is 255 periods. <b>Note:</b> <i>If the frequency should go out of range - when the flowrate increases for example - an internal buffer will be used to "store the missed pulses": As soon as the flowrate reduces again, the buffer will be "emptied".</i> <i>It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within it's range</i>	
	<b>NUMBER OF PERIODS</b>	<b>PERIOD TIME</b>
	0	disabled
	1	0,0078 seconds
	2	0,0156 seconds
	3	0,0234 seconds
	64	0,5000 seconds
	255	1,9922 seconds
		<b>MAX. FREQUENCY</b>
		disabled
		64 Hz.
		32 Hz.
		21 Hz.
		1 Hz.
		0.25 Hz.
<b>PULSE PER 84</b>	According to the measurement unit settings for preset, a scaled pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account.	
<b>PULSE ACCORDING ACC. TOTAL / BATCH 85</b>	With this function, it is determined if a pulse will be generated according the quantity batched or according accumulated total. With setting "batch" the pulse generator will be set to zero when a new batch is started up.	



Note !

## 9 - COMMUNICATION (OPTIONAL)

The functions described below deal with hardware that is not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.	
<b>BAUDRATE</b> 91	For external control, the following communication speeds can be selected:  1200 - 2400 - 4800 - 9600 baud
<b>BUS ADDRESS</b> 92	For communication purposes, a unique identity can be attributed to every F131-P. This address can vary from 1-255.
<b>MODE</b> 93	The communication protocol is Modbus ASCII or RTU mode. Select OFF, to disable this communication function.

## A - OTHERS

<b>TYPE OF MODEL</b> A1	For support and maintenance it is important to have information about the characteristics of the F131-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
<b>VERSION SOFTWARE</b> A2	For support and maintenance it is important to have information about the characteristics of the F131-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
<b>SERIAL NUMBER</b> A3	For support and maintenance it is important to have information about the characteristics of the F131-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
<b>PASS CODE</b> A4	All SETUP-values can be pass code protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
<b>TAGNUMBER</b> A5	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

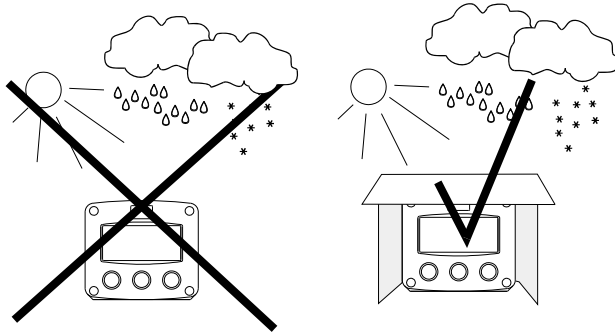
## 4. INSTALLATION



### 4.1. GENERAL DIRECTIONS

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F131-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the " Safety rules, instructions and precautionary measures " at the front of this manual.

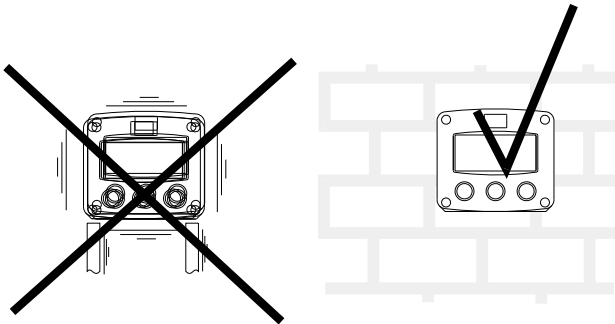
### 4.2. INSTALLATION / SURROUNDING CONDITIONS



Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions.

When panel-mounted, the unit is IP65 (NEMA 4X)!

When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.



Mount the F131-P on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE  
Aluminum enclosures:

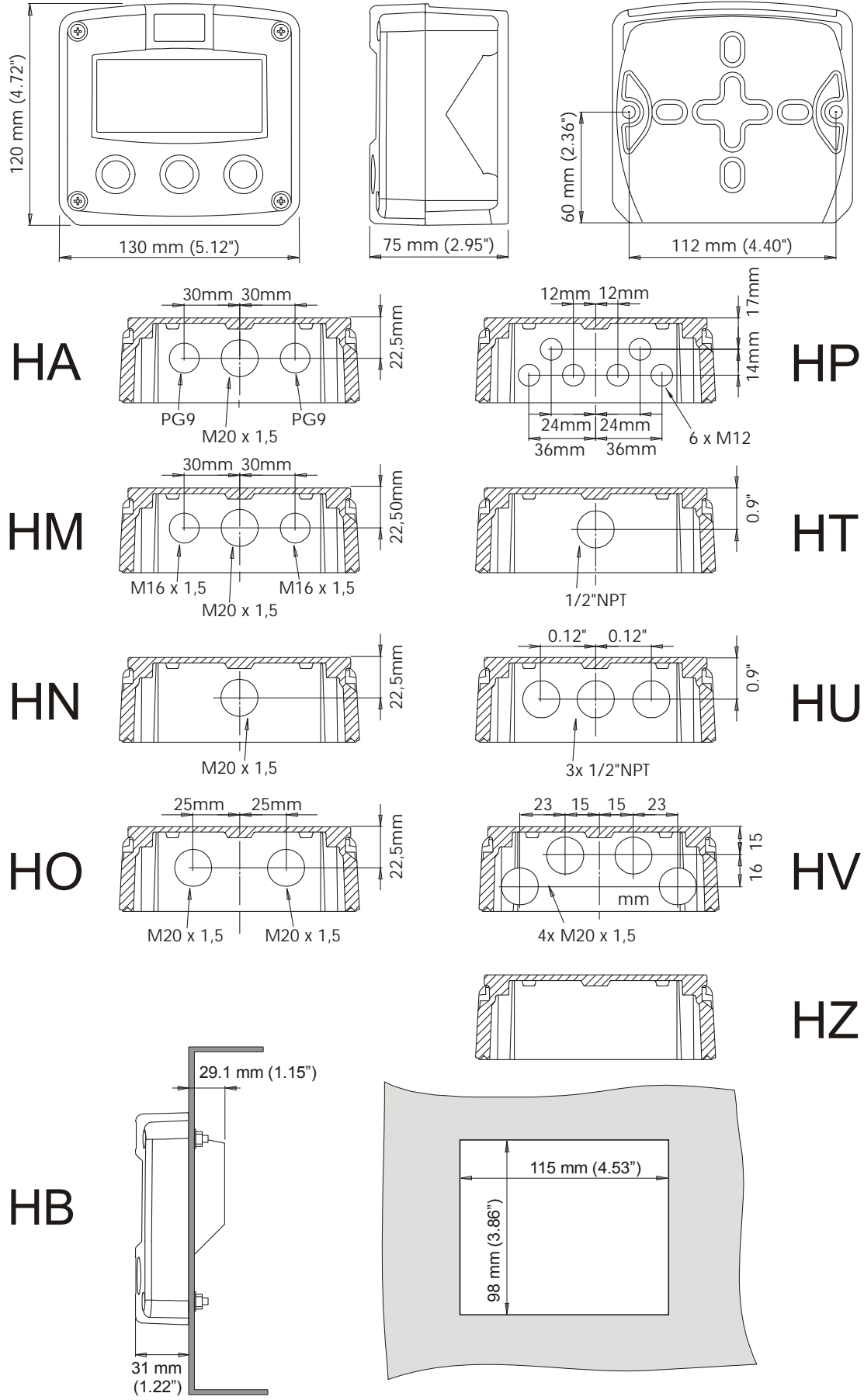
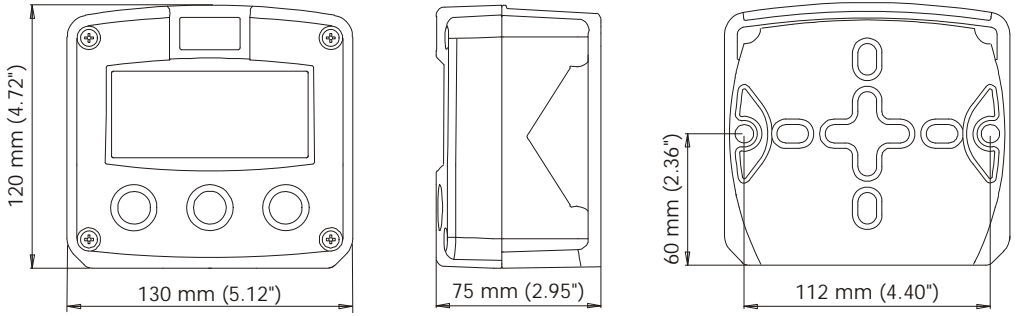
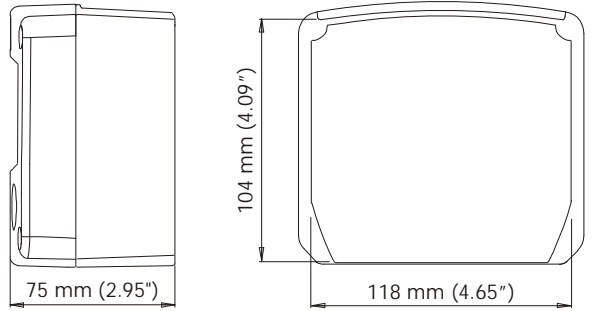


Fig. 7: Dimensions aluminum enclosures.

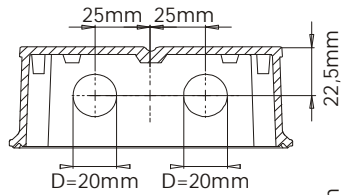
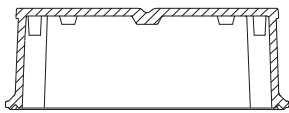
GRP enclosures:



HK back box:  
(flat bottom)

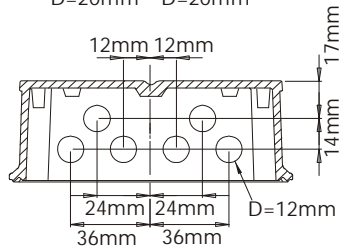
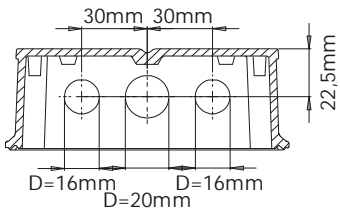


HD  
HK



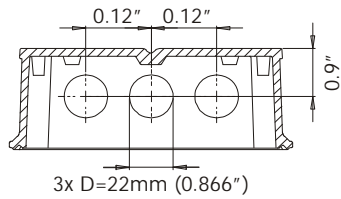
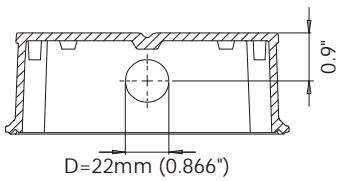
HG

HE



HH

HF



HJ

HC

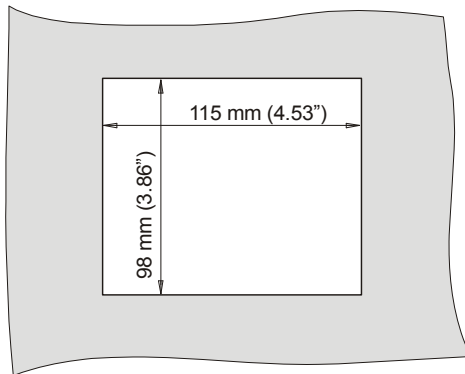
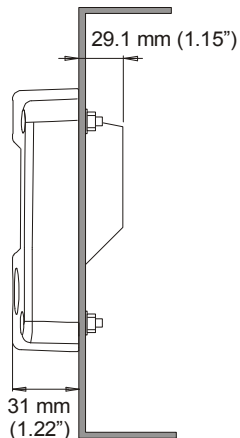


Fig. 8: Dimensions GRP enclosures.



## 4.4. INSTALLING THE HARDWARE



### 4.4.1. INTRODUCTION

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

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



### Aluminum enclosures

- When installed in an aluminum enclosure and a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.
- Do ground the aluminum enclosure properly as indicated, if the F131-P has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.

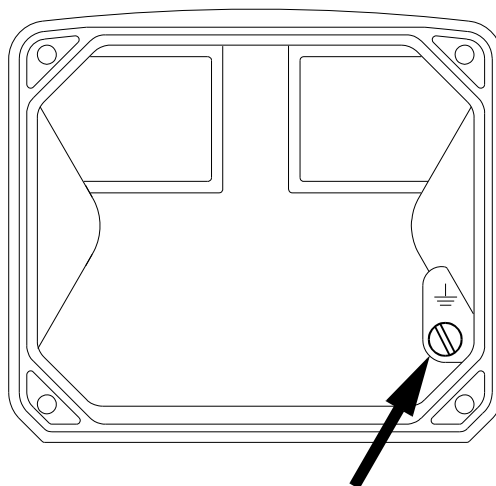


Fig. 9: Grounding aluminum enclosure with type PM 115-230V AC.

### FOR INSTALLATION, PAY EMPHATIC ATTENTION TO:

- Separate cable glands with effective IP67 (NEMA4X) seals for all wires.
- Unused cable entries: ensure that you fit IP67 (NEMA4X) plugs to maintain rating.
- A reliable ground connection for both the sensor, and if applicable, for the metal casing.
- An effective screened cable for the input signal, and grounding of its screen to terminal 9 (GND) or at the sensor itself, whichever is appropriate to the application.

4.4.2. VOLTAGE SELECTION SENSOR SUPPLY

For **Intrinsically Safe** applications: read chapter 5.

**Battery powered and output loop-powered applications:**

Terminal 11 provides a limited supply voltage of 3.2 V DC (coil signals 1.2V) for the signal output of the flowmeter.

**Note:** This voltage MAY NOT be used to power the flowmeters electronics, converters etc, as it will not provide adequate sustained power ! All energy used by the flowmeters pick-up will directly influence the battery life-time. it is strongly advised to use a "zero power" pickup such as a coil or reed-switch when operating without external power. It is possible to use some low power NPN or PNP output signals, but the battery life time will be significantly reduced. (consult your distributor)



**Option PD / PF / PM: Sensor supply: 3.2V - 8.2V - 12V or 24 V:**

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

- Warning: be sure that all the leads to the terminals are disconnected from the unit when the internal plastic protection cover has been removed !
- HIGH VOLTAGE 400V !! NEVER connect the mains power supply to the unit when the plastic protection cover has been removed !!!

First, remove the terminal strip(s) after which the internal plastic cover can be removed. The switches are located in the top left corner (option PD) or on the right hand (option PM) as indicated:

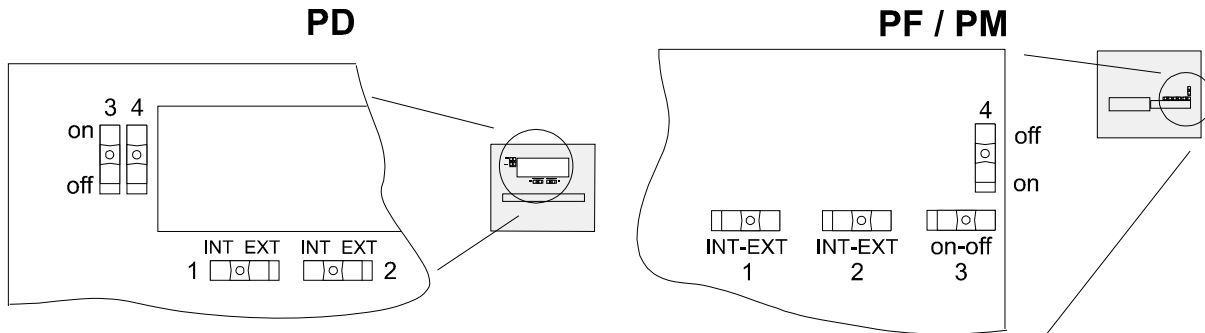


Fig. 10: switch position voltage selection (option PD / PF / PM).

**Switch positions**

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

SENSOR B	
SWITCH 2	VOLTAGE
internal	3.2 V DC
external	switch 3+4

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

- Function switch 1:** voltage selection sensor A - terminal 11.
- Function switch 2:** not available for this Model.
- Function switch 3+4:** the combination of these switches determine the voltage as indicated. If switch 1 and 2 are both set to position OFF than the selected voltage with switch 3+4 is valid for both sensors.

**4.4.3. TERMINAL CONNECTORS**

For *Intrinsically Safe* applications: read chapter 5.

The following terminal connectors are available:

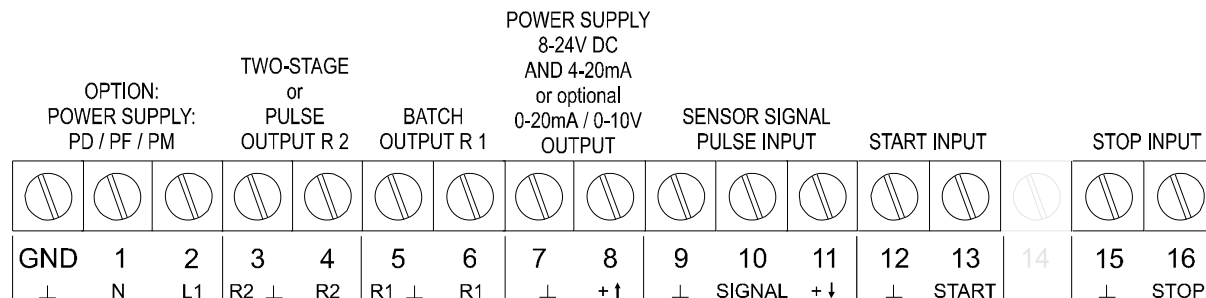


Fig. 11: Overview of terminal connectors standard configuration F131-P and options.

**REMARKS: TERMINAL CONNECTORS:**

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

OPTION	SENSOR SUPPLY	Terminal			backlight	OPTION AA	OPTION AU	option OA	option OR
		GND	01	02					
PD 8-24V AC	8,2-12-24V max 50mA		AC	AC		◇	◇	◇	
PD 8-30V DC	8,2-12-24V max 50mA	L-	L+			◇	◇	◇	
PF 24V AC ± 15%	8,2-12-24V max 50mA		AC	AC		◇	◇		◇
PF 24V DC ± 15%	8,2-12-24V max 50mA	L-	L+			◇	◇		◇
PM 115-230V AC ± 15%	8,2-12-24V max 50mA	EARTH	AC	AC		◇	◇	◇	◇

Φ = standard ◇ = option

For *Intrinsically Safe* applications: read chapter 5.

**Terminal 03-04; transistor or relay output R2:**

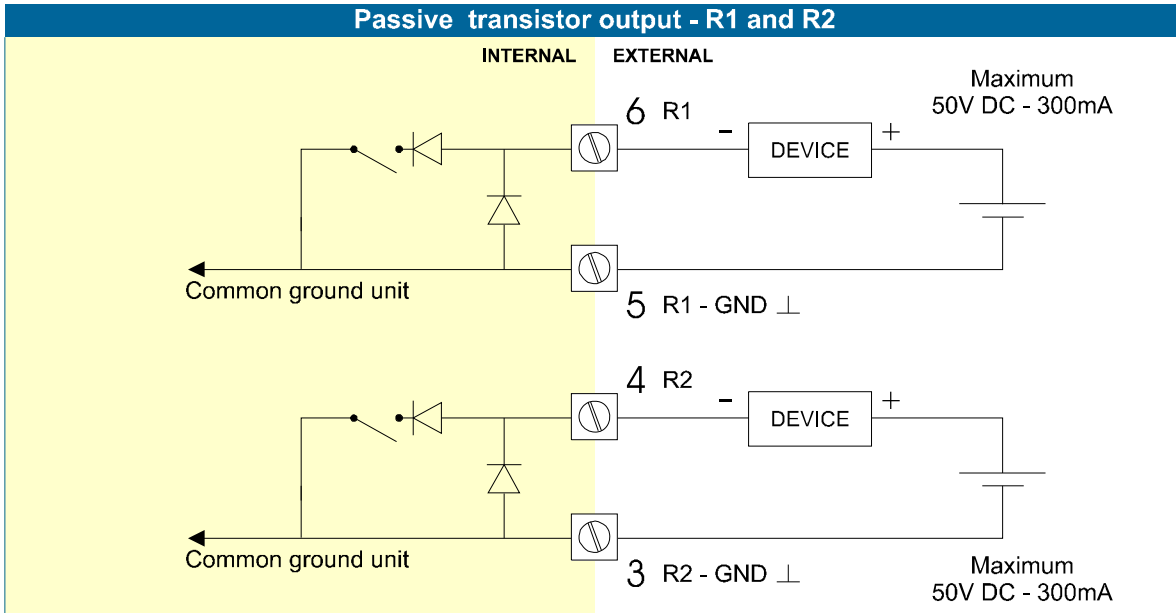
This output is available to drive a low-power device (e.g. relays) to control the batch process. Relay 1 is switched-on during the whole process while relay 2 can be used for two-step control or as pulse output. In case of a pulse output function: the maximum pulse frequency of this output is 60Hz.



*Please note: if the communication option has been supplied, the pulse output function is not available.*

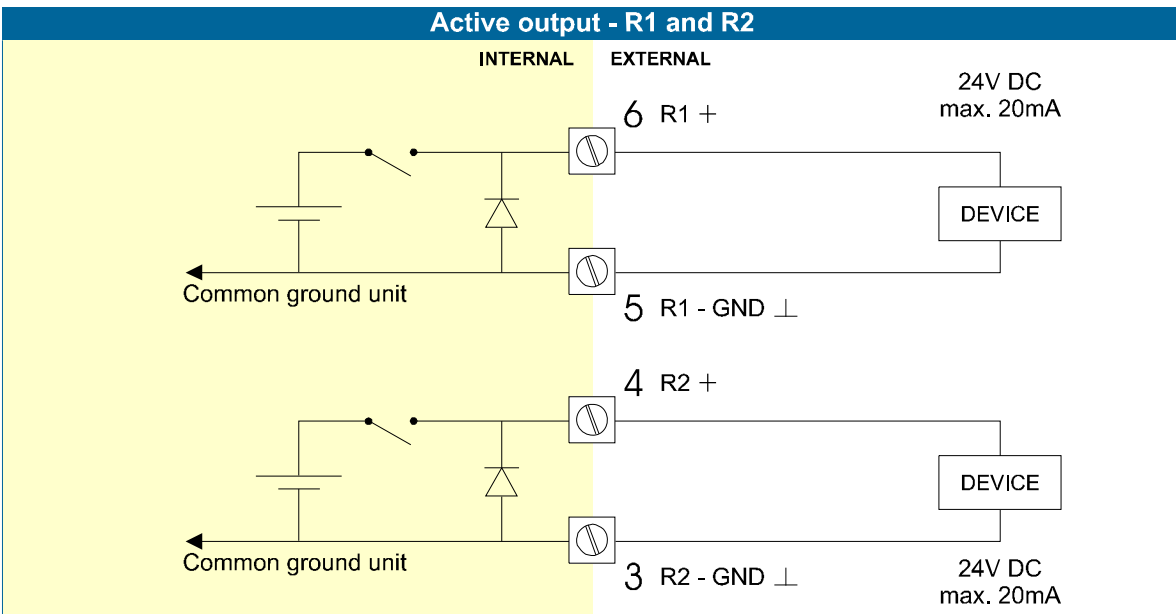
**Terminal 05-06; transistor or relay output R1:**

This output is available to drive a low-power device (e.g. relays) to control the batch process. Relay 1 is switched-on during the whole batch process.



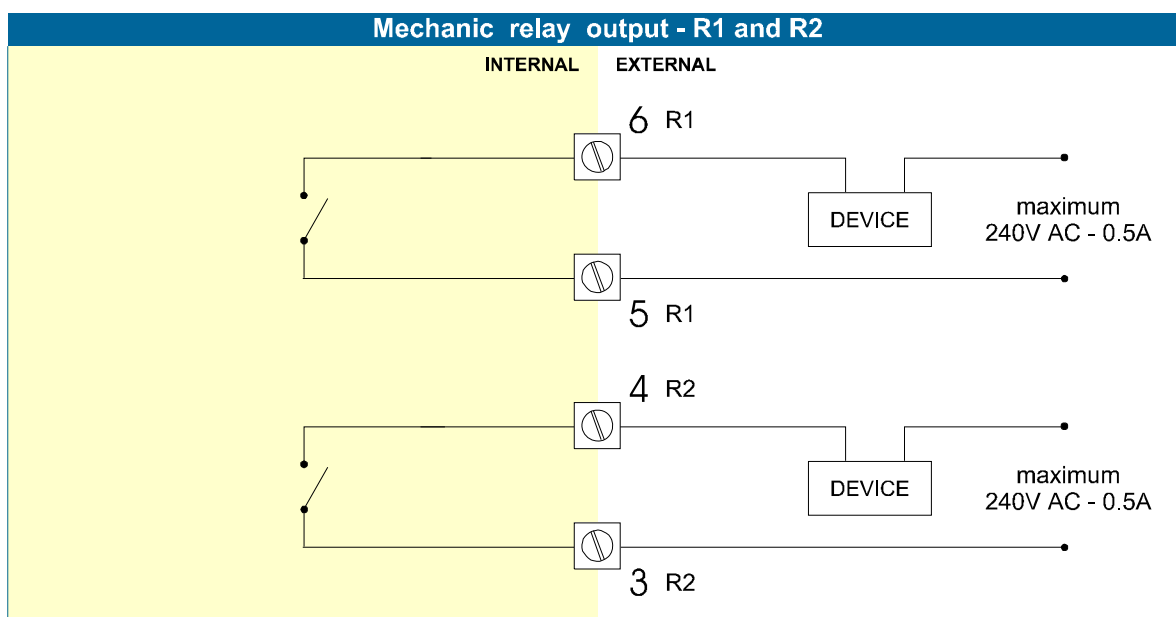
**Option OA: :**

An active 24V DC signal according to the functions R1 and R2 is available with this option. Max. driving capacity 20mA@24V per output. (Requires power supply option PD / PF / PM).



**Option OR: :**

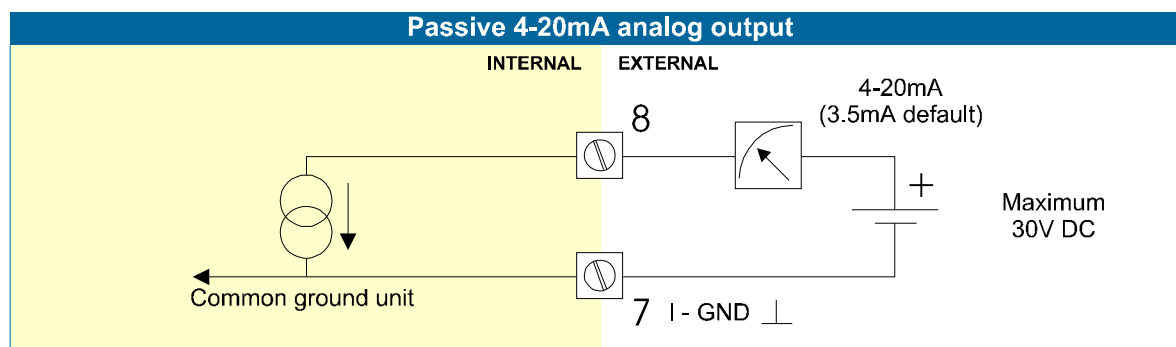
A mechanical relay output according the functions R1 and R2 is available with this option.  
Max. switch power 240V-0,5A per output. (Requires power supply option PF / PM).

**Terminal 07-08 POWER SUPPLY F131-P - output loop powered:**

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

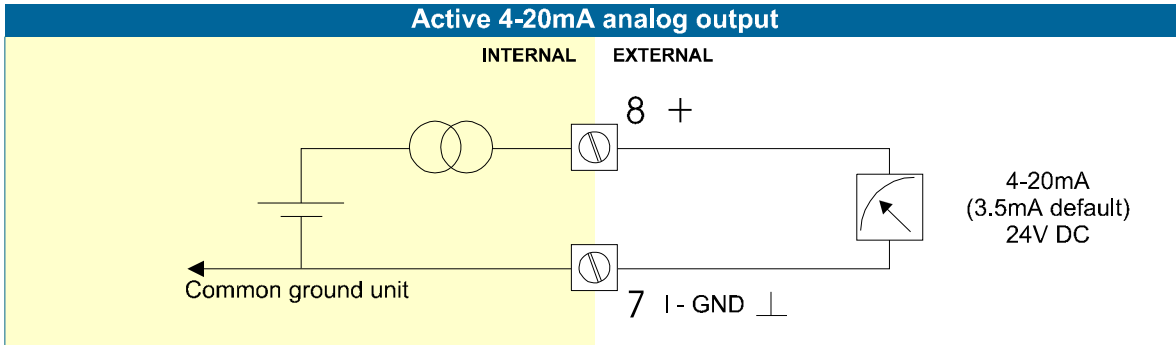
**Terminal 07-08 analog output (passive) (SETUP 6) :**

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



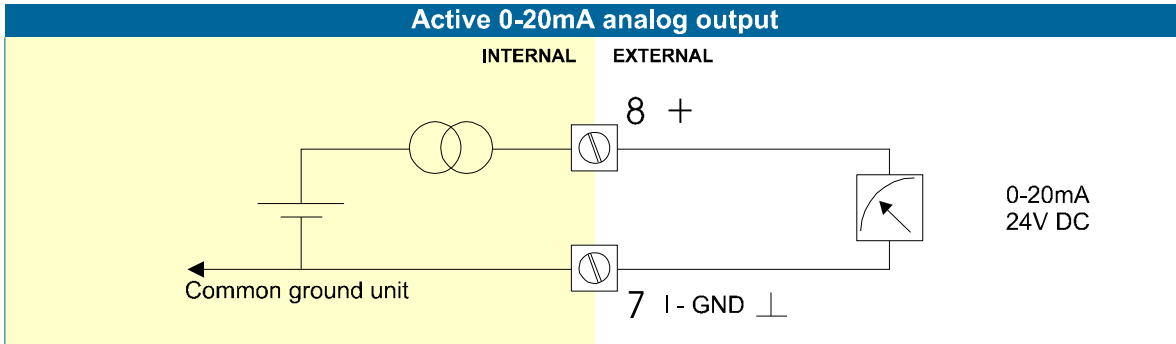
**Option AA:**

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



**Option AB:**

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

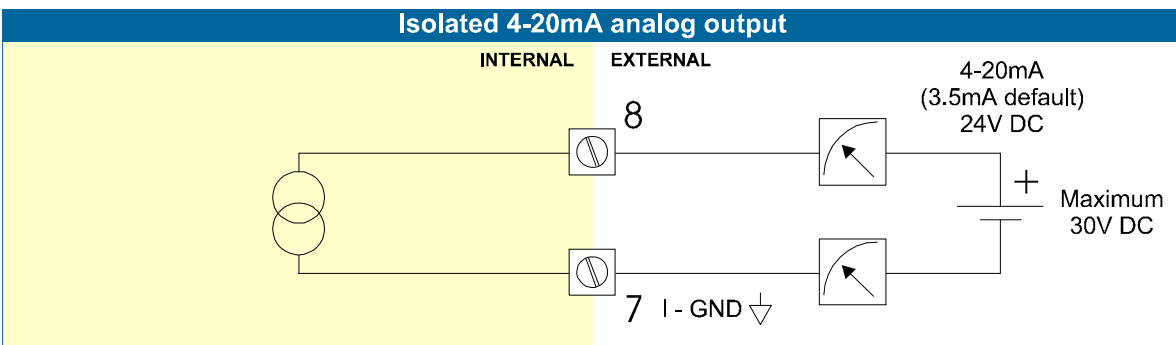


**Option AF:**

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

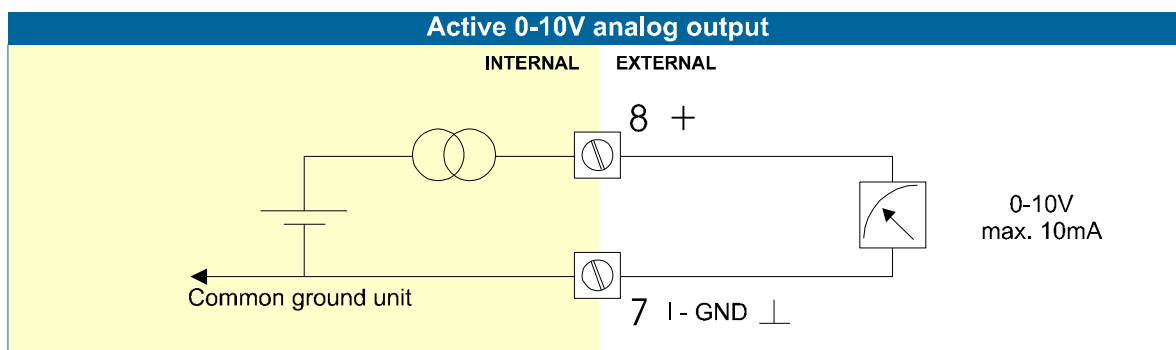
**Option AI:**

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



**Option AU:**

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

**Terminal 09-11; Flowmeter input:**

Three basic types of flowmeter signals can be connected to the unit: pulse, active pulse or coil. The screen of the signal wire must be connected to the common ground terminal 09. (unless earthed at the sensor itself) The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected with the correct SETUP-function (read par. 3.2.3.)

**Coil-signal:**

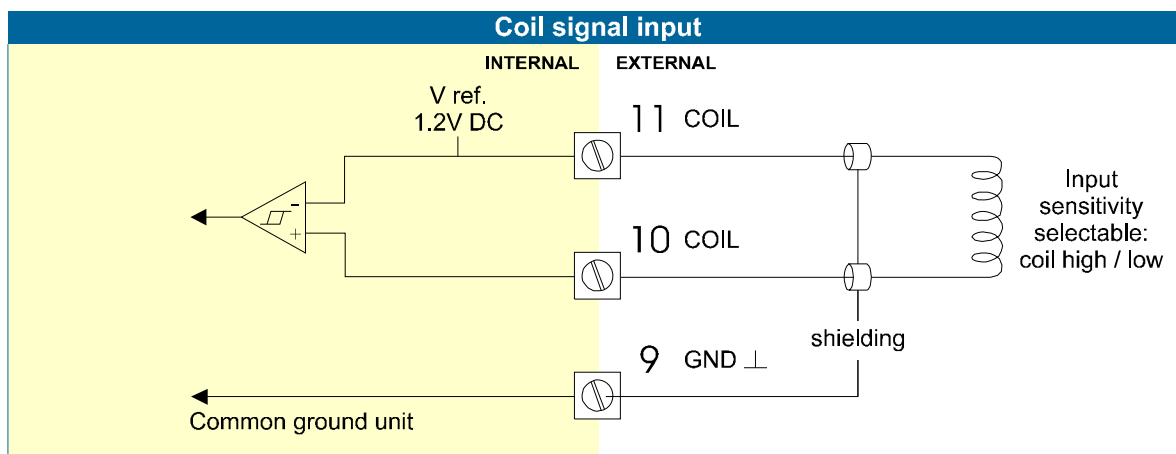
The F131-P is suitable for use with flowmeters which have a coil output signal. Two sensitivity levels can be selected with the SETUP-function:

COIL LO: sensitivity from about 120mV peak to peak.

COIL HI: sensitivity from about 20mV peak to peak.

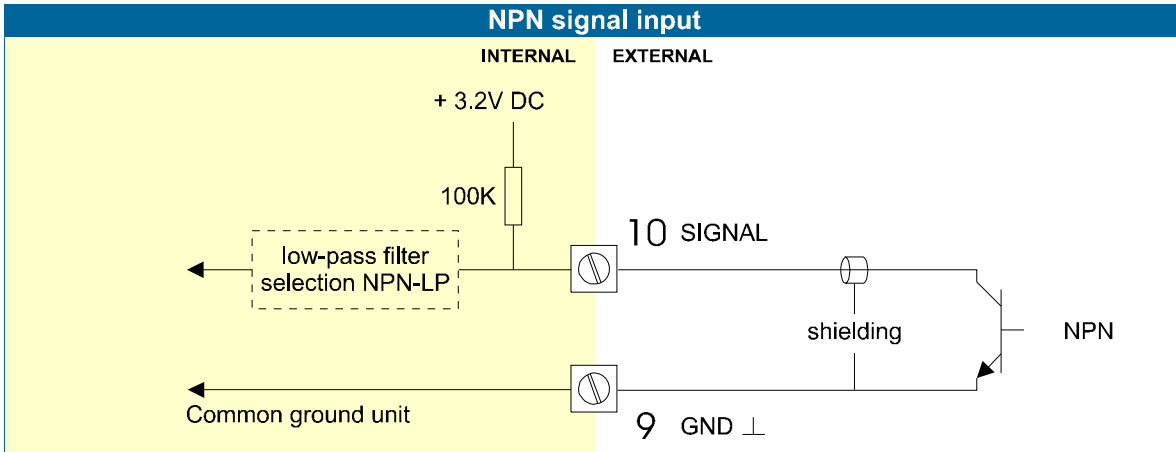
Option ZF offers for setting COIL HI : sensitivity from about 10mV peak to peak.

Option ZG offers for setting COIL HI : sensitivity from about 5mV peak to peak.



**Pulse-signal NPN / NPN-LP:**

The F131-P is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency - read par. 3.2.3.

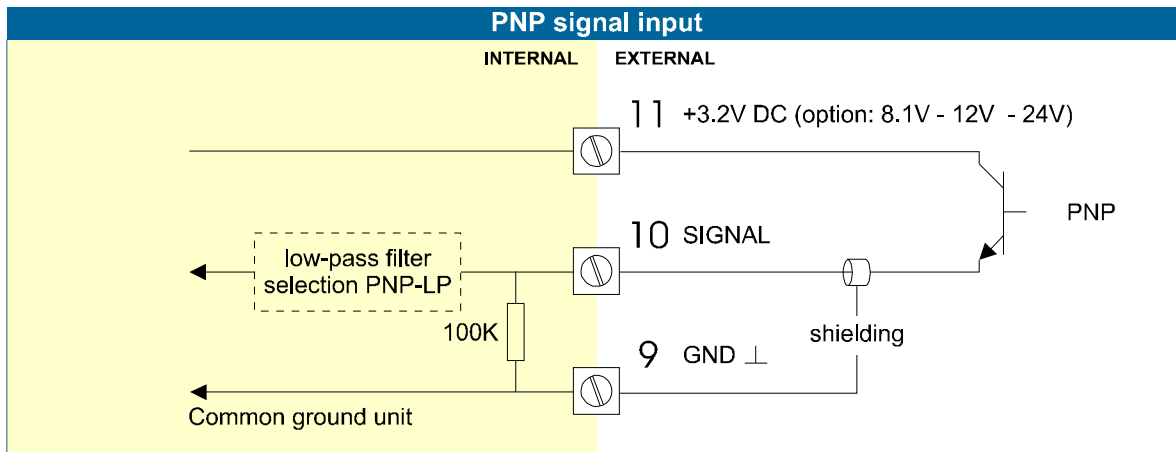


**Pulse-signal PNP / PNP-LP:**

The F131-P is suitable for use with flowmeters which have a PNP output signal. 3.2V is offered on terminal 11 which has to be switched by the sensor to terminal 10 (SIGNAL). For a reliable pulse detection, the pulse amplitude has to go above 1.2V. Signal setting PNP-LP employs a low-pass signal noise filter, which limits the maximum input frequency - read par. 3.2.3.

A sensor supply voltage of 8.1 -12 or 24V DC can be provided via options PD-PM.

For a signal detection level of 50% of the supply voltage: please refer to "active signals".

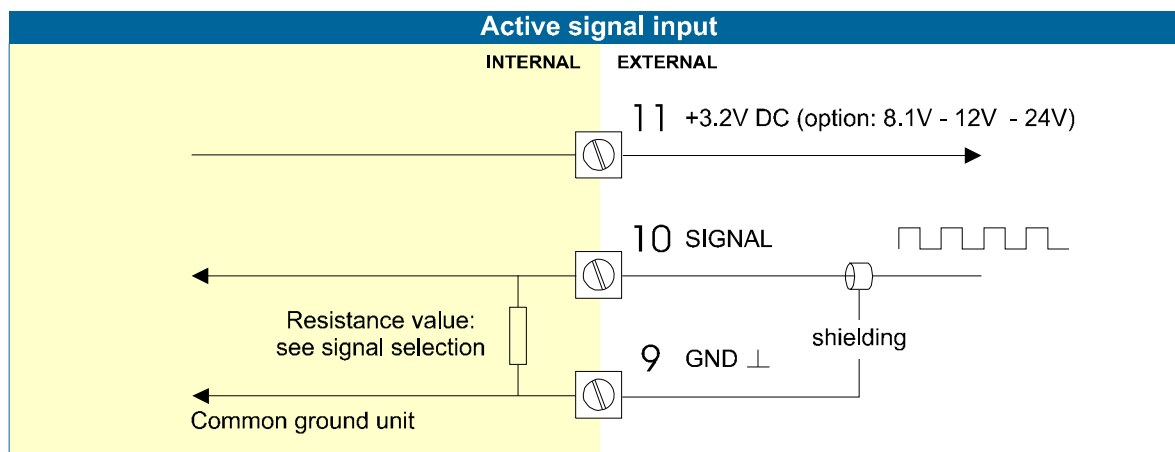




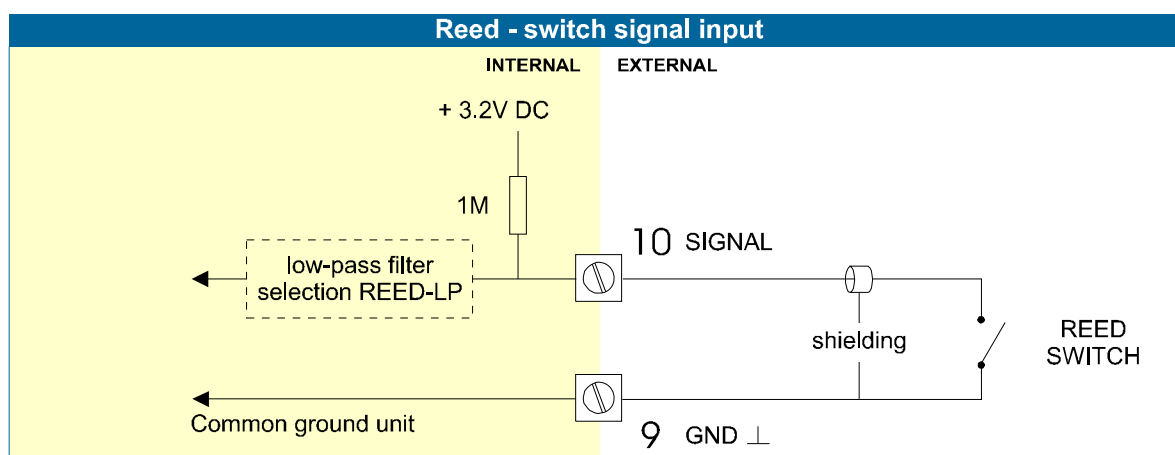
**Active signals 8.1V - 12V and 24V:**

If a sensor gives an active signal, please read par. 3.2.3. The detection levels are 50% of the selected supply voltage; approximately 4V (ACT\_8.1) or 6V (ACT\_12) or 12V (ACT\_24).

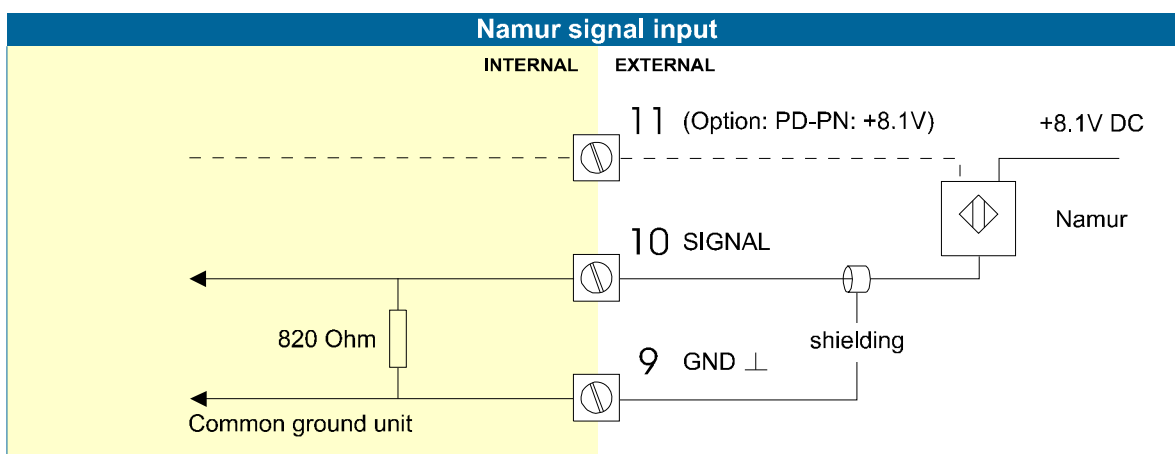
Active signal selection may well be desired in the case of options PD-PM being supplied for sensor supply.

**Reed-switch:**

The F131-P is suitable for use with flowmeters which have a reed-switch. To avoid pulse bounce from the reed-switch, it is advised to select REED LP - low-pass filter (read par. 3.2.3.)

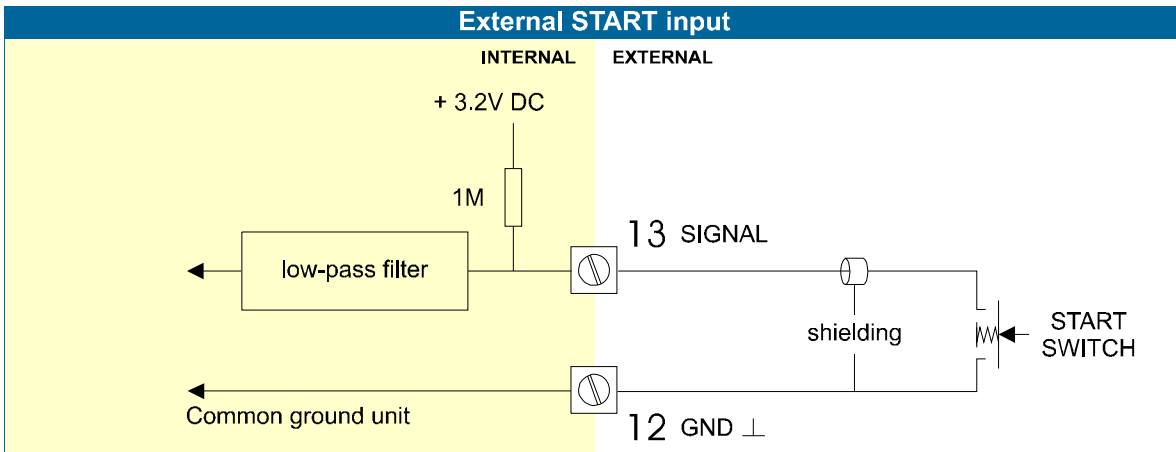
**NAMUR-signal:**

The F131-P is suitable for flowmeters with an Namur signal. The standard F131-P is not able to power the Namur sensor, as an external power supply for the sensor is required. However, a 8.2V sensor supply voltage (terminal 11) can be provided via options PD-PM.



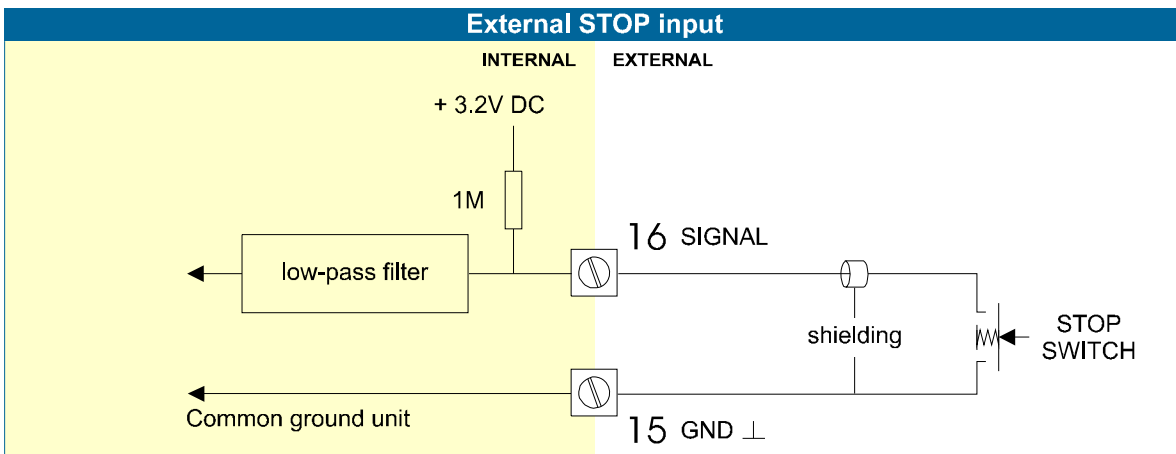
**Terminal 12-13; external START:**

With this function, the batch controller can be started with an external switch. The input must be switched with a potential free contact to the GND-terminal number 12 for at least 0.3 seconds.



**Terminal 15-16; external STOP:**

With this function, the batch controller can be interrupted or cancelled with an external switch. The input must be switched once for interruption or switch twice for cancellation with a potential free contact to the GND-terminal number 15 for at least 0.3 seconds.



**Option - communication/printer RS232/RS485:**

- see the manufacturer's plate.
- Full serial communications and computer control in accordance with RS232 (length of cable max. 15 meters) or RS485 (length of cable max. 1200 meters) is possible.
- Read the Modbus communication protocol and Appendix C.

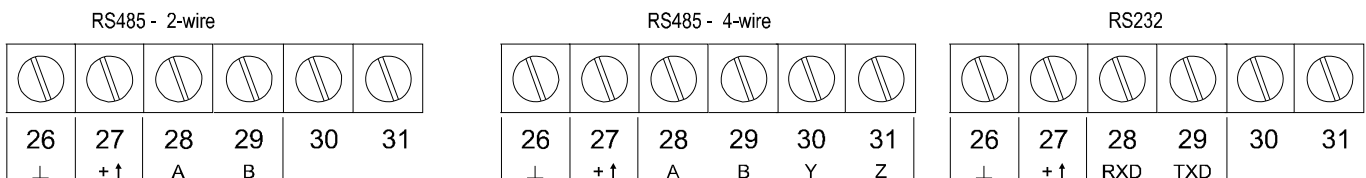


Fig. 12: Overview terminal connectors communication option.

## 5. INTRINSICALLY SAFE APPLICATIONS

### 5.1. GENERAL INFORMATION AND INSTRUCTIONS



Caution !

#### Cautions

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



#### Safety Instructions

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



Note !

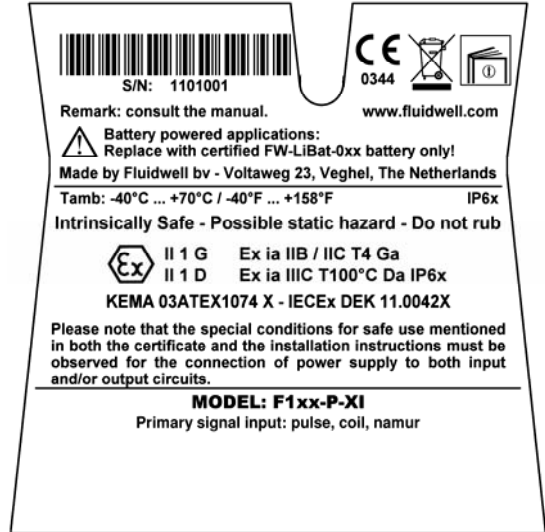
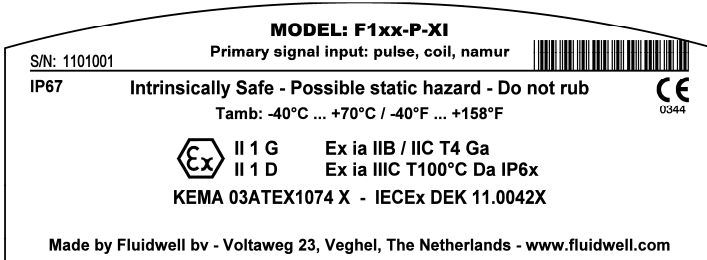
#### Please Note

- Certificates, safety values and declaration of compliance can be found in the document named: "Fluidwell F1...-XI - Documentation for Intrinsic Safety".
- Special conditions for safe use mentioned in both the certificate and the installation instructions must be observed for the connection of power to both input and / or output circuits.
- When installing this device in hazardous areas, the wiring and installation must comply with the appropriate installation standards for your industry.
- Study the following pages with wiring diagrams per classification.

**Label information (inside and outside the enclosure)**

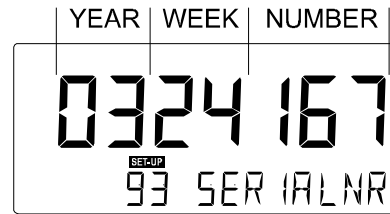
Indicated labels on the back cover (below) and on the inside cover (right) show the type labels for intrinsically safe certified units.

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



**Serial number and year of production**

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



**5.2. TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS**



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

Classification of the unit as group IIC is only possible under the following conditions:

- The indicator is either supplied by
  - the internal supply (option -PC); or
  - the external supply connected to terminals 0 and 1 (option -PD); or
  - the circuit supply connected to terminals 7 and 8 (option -AP);
 The maximum values for any of those circuits are those as defined for group IIB/IIIC;
- No other active external intrinsically safe circuits may be connected to the indicator, with exception of circuits connected to terminals 3 and 4 and/or terminals 5 and 6; the maximum values for any of those circuits are those as defined for group IIB/IIIC

**Terminal connectors F131-P-XI:**

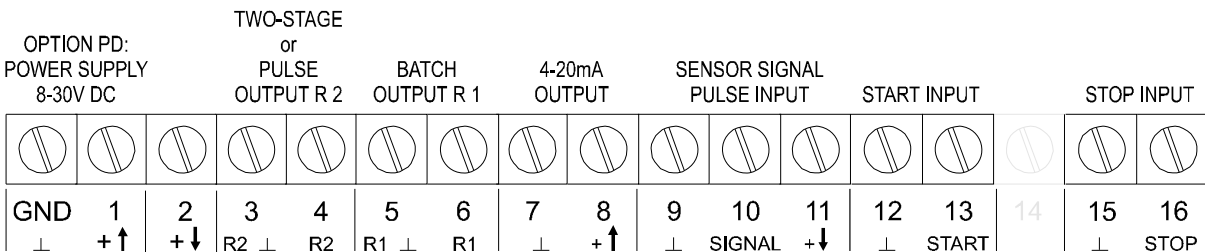


Fig. 13: Overview terminal connectors XI - Intrinsically Safe applications.

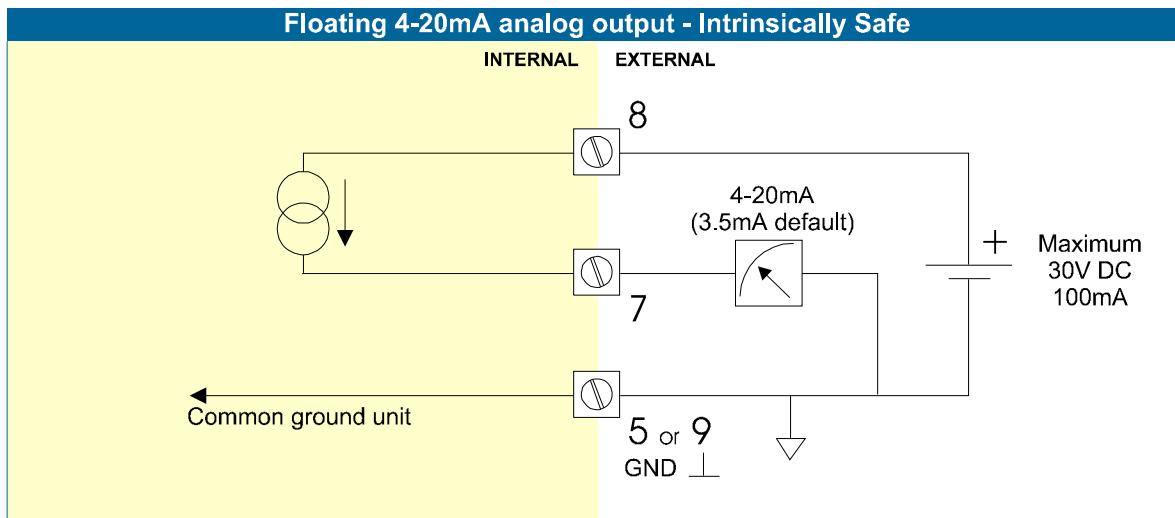
**Explanation Intrinsically Safe options:**

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

A floating 4-20mA signal proportional to the flowrate is available with this option.

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

Max. driving capacity 1000 Ohm @ 30V DC.



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

OPTION	SENSOR SUPPLY	Terminal			
		GND	01	02	
PD	Input voltage: 8-30V DC	3,2 - 8,1V	L-	L+	output voltage is according the input voltage; internally linked with terminal 01.

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

Terminal 11: this terminal offers a 3.2V or 8.1V to power the sensor.

This voltage is selected with the switch(es) inside the enclosure. First, remove the terminals after which the internal plastic cover can be removed.

Switch position terminal 11		Switch position no function	
SWITCH 1	VOLTAGE	SWITCH 2	
on	8.1 V DC	not available	
off	3.2 V DC		

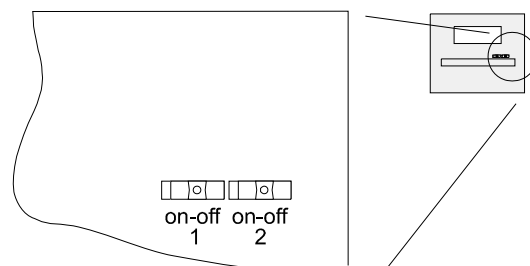


Fig. 14: Switch position voltage selection option PD-XI.

5.3 CONFIGURATION EXAMPLES

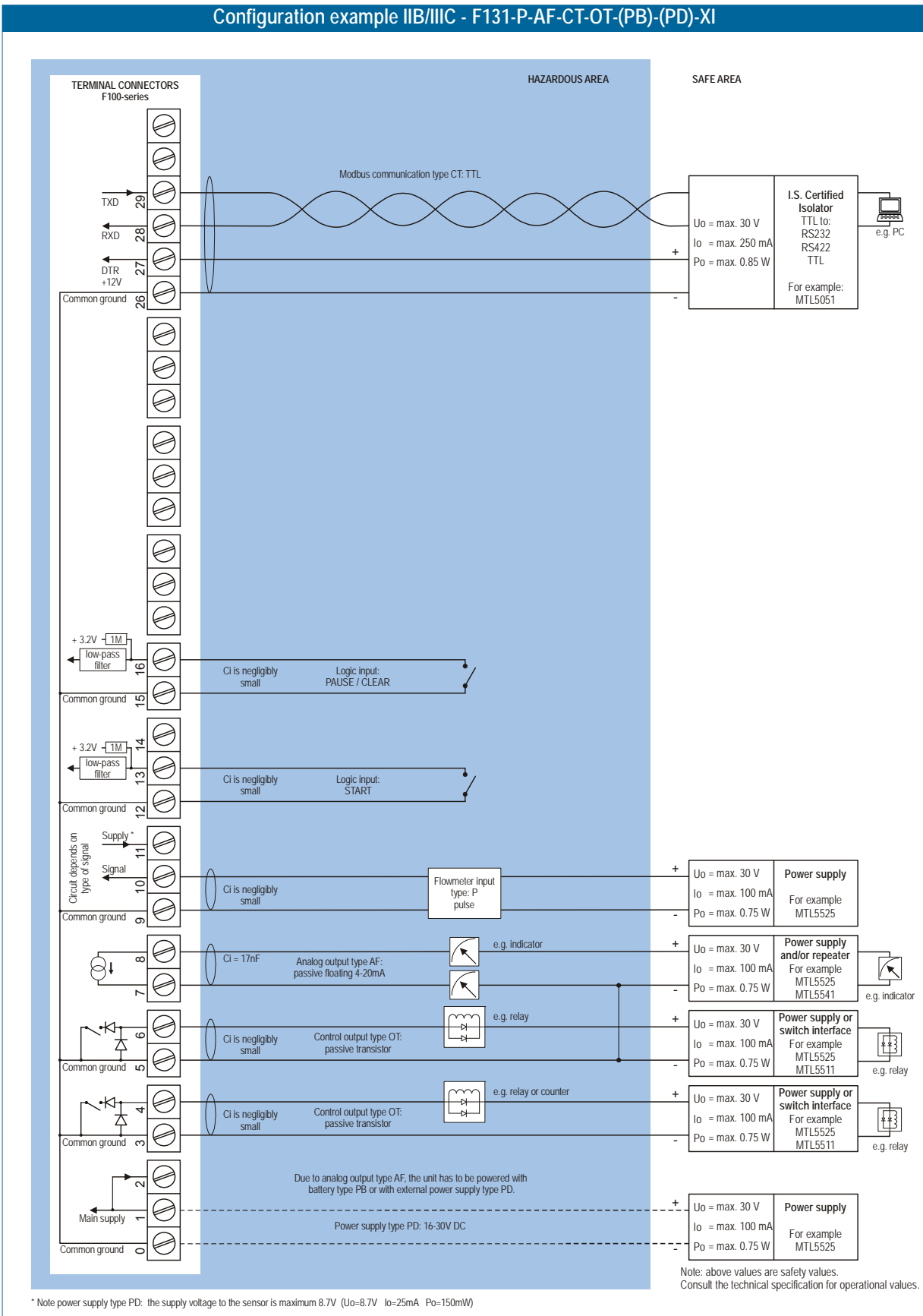


Fig. 15: Configuration example 1 Intrinsically Safe

Configuration example IIB/IIIC - F131-P-AP-CT-OT-(PD)-XI

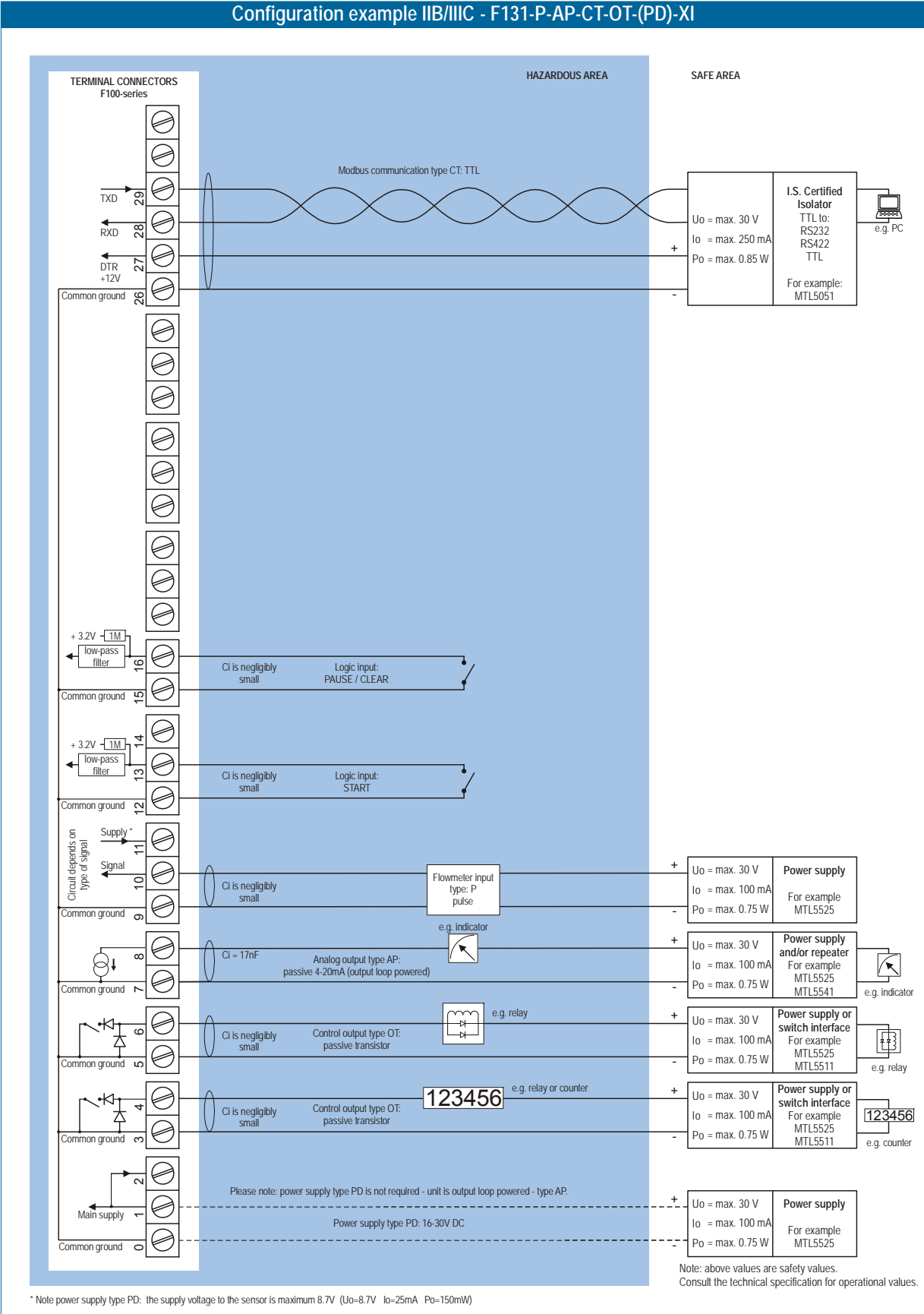
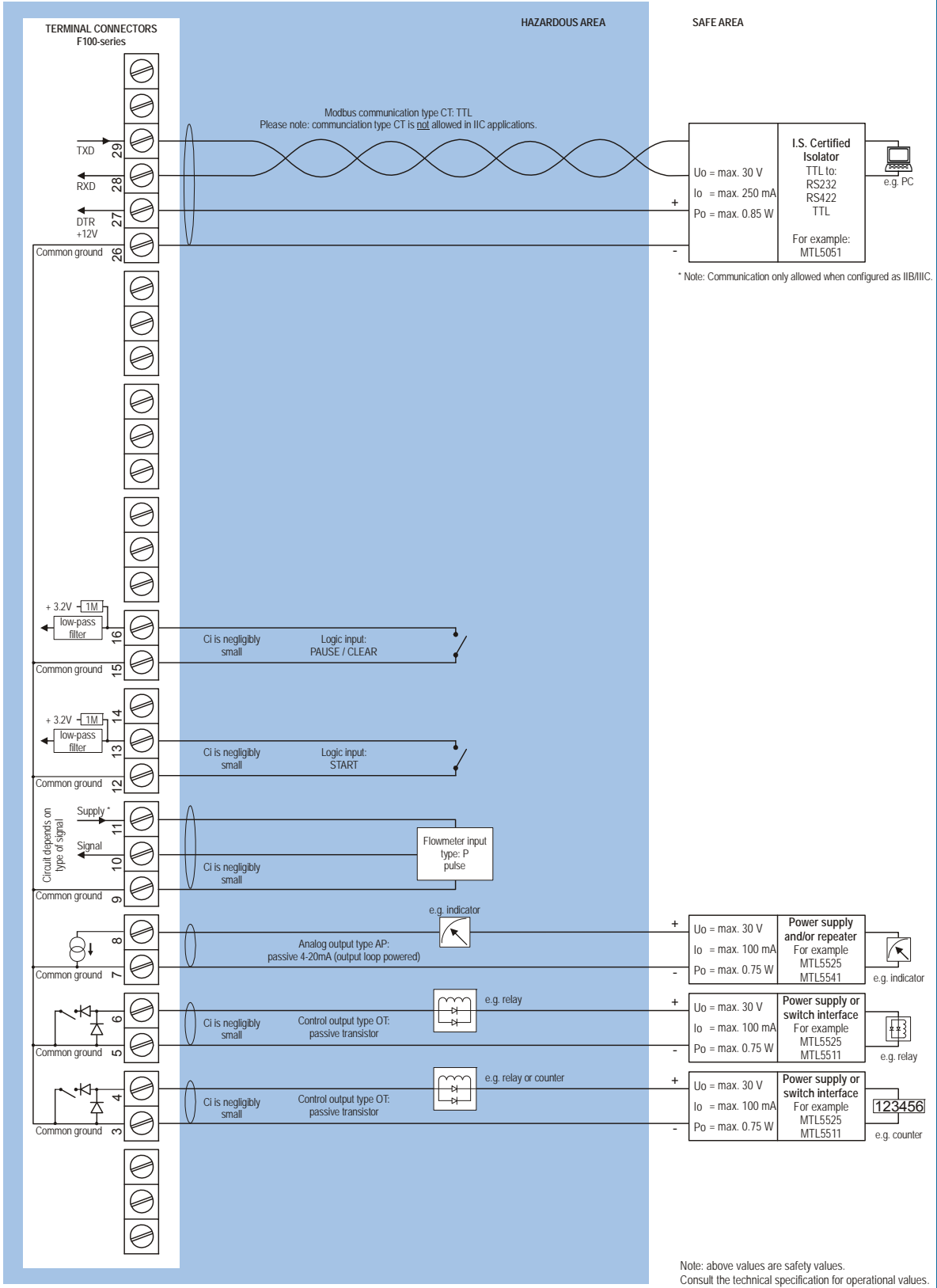


Fig. 16: Configuration example 2 Intrinsically Safe

Configuration example IIB/IIIC and IIC - F131-P-AP-(CT)-OT-XI



\* Note sensor supply voltage: 1.2 V DC for coil sensors or 3.2V DC for other pulse sensors.

Fig. 17: Configuration example 3 Intrinsically Safe



## 5.4 BATTERY REPLACEMENT INSTRUCTIONS



### Safety Instructions

- **Fire, explosion or severe burns may result if mistreated.** Do not recharge, crush, disassemble, incinerate, heat above 100°C (212°F) or expose contents to water.
- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained personnel authorized by the plant operator. Personnel must read and understand this instruction before carrying out the replacement procedure.
- Always follow the instructions listed in the supplied Battery Replacement Instruction Sheet.
- Batteries pose an environmental hazard. Return used batteries to a recycling point.



Caution !

### Safety instructions for hazardous areas

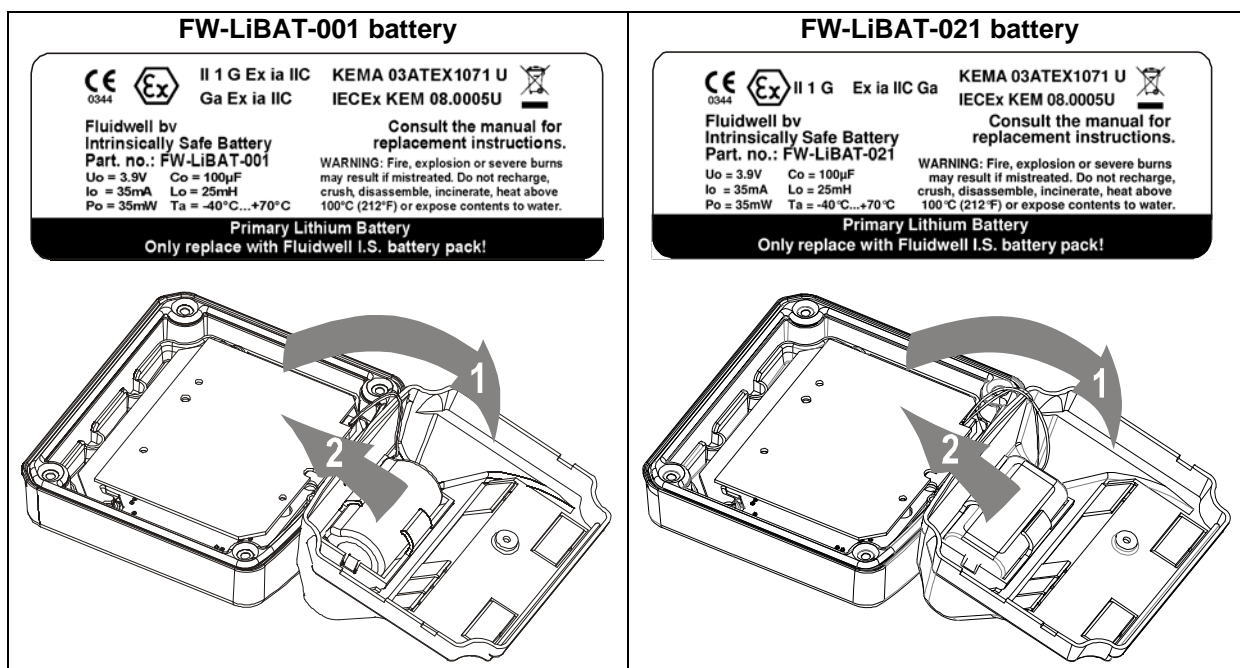
- Verify the correct battery is supplied: **Only batteries with indicated Ex label are certified for replacement and use in hazardous areas.** Batteries for use in safe areas have no Ex label. **DO NOT EXCHANGE:** Using the wrong type of battery can pose a SERIOUS RISK.
- **For use in hazardous areas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

### Battery replacement procedure



Note !

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



1. To replace the battery, open the unit to gain access to the back inside cover of the unit.
2. Unplug the field connectors from the back inside of the unit.
3. Remove the screw that holds the plastic inside cover.
4. Open the cover and unplug the battery connector.
5. Remove the battery from the inside of the plastic cover. *Do not remove the battery clip!*
6. Install the new battery and re-assemble the unit in reverse order.
7. Start-up the unit

## 6. MAINTENANCE

### 6.1. GENERAL DIRECTIONS



- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F131-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

The F131-P 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 F131-P in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

#### **Battery life-time:**

It is influenced by several issues :

- Type of sensor: read chapter 3.2.3. NPN and PNP inputs consume more energy than coil inputs.
- Input frequency: the higher the frequency, the shorter the battery life-time.
- Flowrate calculation: the lower number of pulses (SETUP 26) the shorter the battery life-time.
- Analog output signal; be sure that an external power supply is connected or that the function is disabled if not in use; or else it will have a major influence on the battery life-time (SETUP 71).
- Display update: fast display update uses significantly more power; SETUP 51.
- Pulse output and communications .
- Low temperatures; the available power will be less due to battery chemistry.



**Note:** *It is strongly advised to disable unused functions.*

#### **Check periodically:**

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

## APPENDIX A: TECHNICAL SPECIFICATION

### GENERAL

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

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


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

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

Sensor excitation	
Standard / option PB	Supply voltage: 3.2V DC for pulse signals and 1.2V DC for coil pick-up.
Option PD	Sensor supply voltage 8 - 12 and 24V DC - max. 50mA@24V DC
Option PM	Sensor supply voltage 8 - 12 and 24V DC - max. 100mA@24V DC

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm <sup>2</sup> and 2.5mm <sup>2</sup>

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

Hazardous area (optional)	
Intrinsically safe Option XI	<b>ATEX approval:</b>  II 1 G Ex ia IIB/IIC T4 Ga II 1 D Ex ia IIIC T100°C Da IP6x  <b>IECEx approval:</b> Ex ia IIB/IIC T4 Ga Ex ia IIIC T100°C Da IP6x
Explosion proof Option XD/XF	ATEX approval ref: II 2 EEx d IIB T5. Weight appr. 20kg. Dimensions of enclosure: 218 x 418 x 213mm (8.58" x 16.45" x 8.38") LxHxD.

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

## INPUTS

Flowmeter	
Type P	Coil/sine wave (minimum 20mVpp or 80mVpp - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8 - 12 and 24V.
Frequency	Minimum 0 Hz - maximum 7 kHz for total and flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.
Type A	(0)4-20mA - with signal calibration feature. Resolution: 14 bit.
Type U	0-10 V, 0-5 V, 1-5 V - with signal calibration feature. Resolution: 14 bit.
Accuracy	0.05%. Low level cut-off programmable.
Span	0.000010 - 9,999,999 with variable decimal position.
Update time	Four times a second.
Voltage drop	2.5 Volt.
Load impedance	3kOhm
Relationship	Linear and square root calculation.
Note	For signal type A and U: external power to sensor is required; e.g. option PD.

## OUTPUTS

Analog output	
Type	4-20mA - passive output - not isolated.
Resolution	10-bit.
Accuracy	< 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm
Function	transmitting flowrate.
Option AA	Active 4-20mA output (requires option PD or PM).
Option AB	Active 0-20mA output (requires option PD or PM).
Option AF	Floating 4-20mA output for Intrinsically Safe applications
Option AI	Galvanically isolated output - also for battery powered models.
Option AU	Active 0-10V output (requires option PD or PM).

Transistor outputs	
Type OT	two passive transistor outputs - not isolated.
Load	max. 50V DC - 300mA
Function	User defined: batch process two stage control or scaled pulse output acc. batch or acc. total.
Pulse output	Max. frequency 60Hz. Pulse length user definable between 7,8msec up to 2 seconds.
Type OA	Active 24V DC output; max. 50mA per output (requires option PD or PM).
Type OR	Mechanic relay output; max. switch power 230V AC - 0,5A (requires option PD or PM).

Communication option	
Type	RS232 or RS485 (2-wire or 4-wire).
Protocol	Modbus ASCII / RTU
Speed	1200 - 2400 - 4800 - 9600 baud
Addressing	maximum 255 addresses.
Functions	reading display information, reading / writing all settings.
Remark	Pulse output feature is not available.

## OPERATIONAL

Operator functions	
Functions	<ul style="list-style-type: none"> <li>enter a preset value,</li> <li>start / interrupt and stop the batch process,</li> <li>total can be reset to zero.</li> </ul>
Displayed information	<ul style="list-style-type: none"> <li>preset value and / or flowrate,</li> <li>running batch total or remaining quantity,</li> <li>total and accumulated total.</li> </ul>

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

Accumulated total	
Digits	11 digits.
Units / decimals	according to selection for total.

Flowrate	
Digits	7 digits.
Units	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.

## APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F131-P is going to be installed or while it is in operation.

### Flowmeter does not generate pulses:

Check:

- Signal selection SETUP - 61,
- Pulse amplitude (par. 4.4.3.),
- Flowmeter, wiring and connection of terminal connectors (par. 4.4.3.),
- Power supply of flowmeter (par. 4.4.2.).

### Flowmeter generates "too many pulses":

Check:

- Settings for total and Flowrate: SETUP 11-14 and 21-27,
- Type of signal selected with actual signal generated - SETUP - 61,
- Sensitivity of coil input - SETUP - 61 and par. 4.4.3.
- Proper grounding of the F131-P - par. 4.4.1.
- Use screened wire for flowmeter signals and connect screen to terminal 9. (unless connected at sensor)

### Analog output does not function properly:

Check:

- SETUP 71 - is the function enabled?
- SETUP 72 / 73: are the flow-levels programmed correctly?
- connection of the external power-supply according to the specification.

### Pulse output does not function:

Check:

- SETUP 81 - pulse per "x" quantity; is the value programmed reasonable and will the maximum output be under 20Hz?
- SETUP 82 - impulse width; is the external device able to recognize the selected pulse width and frequency?

### Flowrate displays "0 / zero" while there is flow (total is counting):

Check:

- SETUP 22 / 25: are the K-factor and time unit correct?
- SETUP 26 / 27: The unit has to count the number of pulses according to SETUP 26 within the time according to SETUP 27. Make sure that 27 is set to 10.0 seconds for example : the result is that the unit has at least 10 seconds time to measure the number of pulses according to SETUP 26.

### The pass code is unknown:

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

### ALARM

When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the 5-digit error code. The codes are:

0001: irrecoverable display-data error: data on the display might be corrupted.

0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.

0003: error 1 and error 2 occurred simultaneously

If the alarm occurs more often or stays active for a longer time, please contact your supplier.

## APPENDIX C: COMMUNICATION VARIABLES

### Remarks:

- Below, an overview of the F131-P specific variables; other common variables are described in the standard table.
- All numbers are decimal numbers, unless otherwise noted.
- The following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

CONFIGURATION VARIABLES F131-P - SETUP-LEVEL:				
VAR	DESCRIPTION	BYTES	VALUE	REMARKS
<b>PRESET / TOTAL</b>				
32 (20h)	unit	1	0=L 1=m3 2=kg 3=lb 4=gal 5=usgal 6=bbl 7=none	
33 (21h)	decimals	1	0...3	
34 (22h)	K-factor	3	1...9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR37)
37 (25h)	decimals K-factor	1	0...6	
218 DAh	batch maximum	3	0-9,999,999	decimals: see 33 (21h)
<b>FLOWRATE</b>				
48 (30h)	unit	1	0=mL 1=L 2=m3 3=mg 4=g 5=kg 6=ton 7=gal 8=bbl 9=lb 10=cf 11=rev (revolutions) 12=none 13=scf 14=NM3 15=NL 16=p	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0...3	
51 (33h)	K-factor	3	1...9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals K-factor	1	0...6	
55 (37h)	number of pulses	1	1..255	
56 (38h)	cut-off time	2	1 .. 9999	steps of 100ms

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
<b>OVERRUN</b>				
192 (C0h)	overrun time	2	1...9,999	steps of 0.1 second
194 (C2h)	disable/enable overrun	1	0=disable 1=enable	
<b>DISPLAY</b>				
195 (C3h)	increase / decrease	1	0=decrease 1=increase	
<b>POWERMANAGEMENT</b>				
80 (50h)	LCD update time	1	0=fast 1=1sec 2=3sec 3=15sec 4=30sec 5=off	
81 (51h)	power-mode battery	1	0=operational 1=shelf	
<b>FLOWMETER</b>				
96 (60h)	flowmeter signal	1	0=npn 1=npn-lp 2=reed 3=reed LP 4=PNP 5=PNP-lp 6=namur 7=coil hi 8=coil lo	
<b>ANALOG OUTPUT</b>				
112 (70h)	analog output	1	0=disable 1=enable	
113 (71h)	minimum rate	3	0..9999999	unit, time, decimals acc. var48-50
116 (74h)	maximum rate	3	0..9999999	unit, time, decimals acc. var48-50
119 (77h)	cut off percentage	1	0..99	steps of 0.1%
120 (78h)	tune minimum rate	2	0..9999	
122 (7Ah)	tune maximum rate	2	0..9999	
99 (63h)	filter	1	0....99	



VAR	DESCRIPTION	BYTES	VALUE	REMARKS
<b>OTHERS</b>				
168 (A8h)	pass code	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table
<b>BATCH MODE</b>				
223 DFh	batch mode	1	1 = Batch running 2 = Batch pausing 4 = Batch finished 8 = Batch in overtime	read only
<b>PRESET</b>				
200 (C8h)	preset quantity	3	0-9,999,999	decimals: see 33 (21h)

### OTHER F131-P VARIABLES FOR COMMUNICATION

#### **ACTUAL - variable number 208 (DOh) – 6 bytes**

**READ ACTUAL:** The value of actual read using communication might differ from the value that appears on the display. This is due to the fact that the display can only display up to seven digits (e.g. when two decimals are selected for "preset" and actual has a value of 123456,78 the display will show 23456,78 while communication will read an "actual" of 12345678 and a "actual decimals" of 2).

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

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

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

**ACCUMULATED TOTAL** - variable number 560 (230h) – 6 bytes

Read acc. total:           A difference between the read value and the display value, as explained for “Read total”, might appear here too.  
Write acc. total:           Not possible.

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

**Example: read var. 566 for total:**

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

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

Read flowrate:           The value difference as mentioned with total/acc. total might appear here too.  
Write flowrate:           Not possible.

## INDEX OF THIS MANUAL

accumulated Total	9	Low-battery alarm	9
active output	28	main-function	11
actual settings	53	maintenance	42
analog		model	21
0-10V output	31	NAMUR-signal	33
floating output.	37	Operator level	8
flowrate min.	18	pass code	21, 46
intrinsically safe output.	37	power supply - loop powered	29
isolated output.	30	power supply intrinsically safe	37
output loop powered.	29	preset	
passive output.	29	max. batch size	14
batch maximum	8	Preset	
battery life time	16, 42	batch maximum	8
Clear Total	9	enter batch value	8
Coil-signal	31	Problem solving	46
communication	34	pulse output	27
family-specific variables	47	pulse length / period time	20
terminal connection	34	pulse per quantity	20
Configuration	10	Pulse-signal NPN/PNP	32
Dimension enclosures	23, 24	Reed-switch:	33
display		Relay output	20, 29
function	16	serial number	21
display update	16	SETUP-level	10
flowmeter		START	8
signal	17	Start, external input	34
Flowmeter input	31	STOP	9
flowrate		stop, external input	34
calculation	15	subfunction	11
decimals	15	tagnumber	21
decimals k-factor	15	Technical specification	43
measuring unit	15	terminal connectors	27
time unit	15	total	
Installation	22	decimals	14
Intrinsic safety	35	decimals k-factor	14
Intrinsically Safe options	37	k-factor	14, 15
IP classification	22	measuring unit	14
keys	7	transistor output	28
low-battery	9	version software	21

## LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE :	DATE :
<b>1 - PRESET</b>	Enter your settings here		
11 unit	L		
12 decimals	0000000		
13 K-factor	0000001		
14 decimals K-factor	0		
15 max. batch size	0		
<b>2 - FLOWRATE</b>			
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 K-factor	0000001		
25 decimals K-factor	0		
26 calculation / pulses	010		
27 cut-off time	30.0 sec.		

SETTING	DEFAULT	DATE :	DATE :
<b>3 - OVERRUN</b>			
31 overrun	disabled		
32 overrun quantity	0 L		
<b>4 - DISPLAY</b>			
41 display	increase		
42 flowrate	off		
<b>5 - POWER MANAGEMENT</b>			
51 LCD-new	1 sec.		
52 mode	operational		
<b>6 - FLOWMETER</b>			
61 signal	coil-lo		
<b>7 - ANALOG OUTPUT</b>			
71 output	disabled		
72 min. flowrate 4-mA	0000000		
73 max. flowrate 20mA	9999999		
74 cut off percentage	0.0%		
75 tune min - 4mA	0208		
76 tune max - 20mA	6656		
77 filter	01 (off)		
<b>8 - RELAY OUTPUT</b>			
81 relays	1-step		
82 preclose quantity	0		
84 impulse width	010 periods		
85 pulse per	0001000		
86 pulse according	batch		
<b>9 - COMMUNICATION</b>			
91 baud-rate	2400		
92 address	1		
93 mode	BUS-ASC		
<b>A - OTHERS</b>			
A4 pass code	0000		
A5 tagnumber	0000000		

