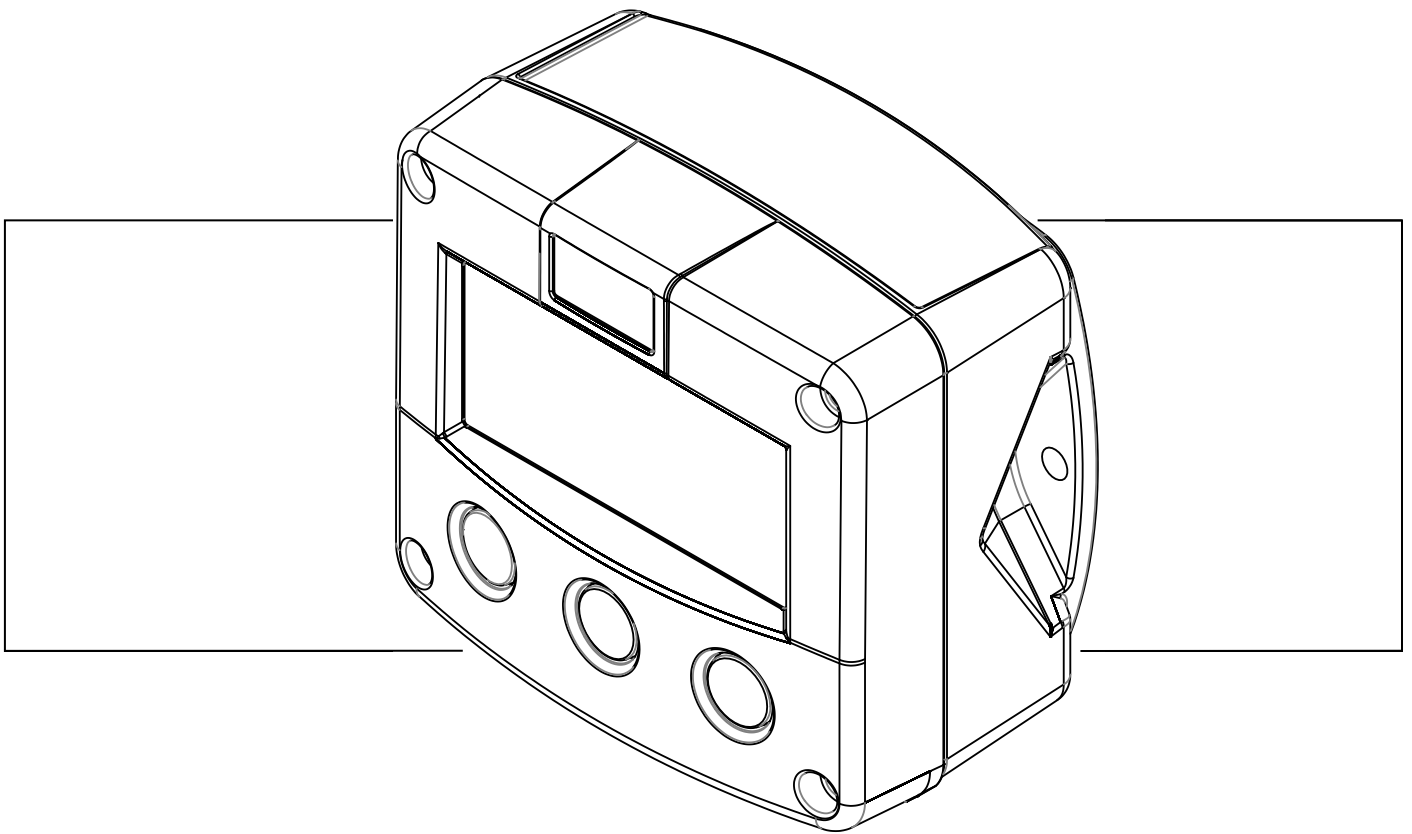


F131-P

BATCH CONTROLLER

with two-stage control, analog and pulse outputs



Signal input flowmeter: pulse, Namur and coil

External controls: start and stop

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

Analog outputs: (0)4-20mA / 0-10V ref. flow rate

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 metal enclosure as indicated if the F131-P 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 F131-P 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 F131-P 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 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 F131-P is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this 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.

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.

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Software version : 03.01.xx
Manual : FW_F131P_v1901_02_EN.docx
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1. INTRODUCTION

1.1. SYSTEM DESCRIPTION

Functions and features

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

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),
- ability to process all types of flowmeter signals;
- transmitting possibilities with analog, pulse and communication outputs;
- several mounting possibilities with GRP or aluminum enclosures for industrial surroundings.

Flowmeter input

This manual describes the unit with a pulse_input from the flowmeter. Other versions are available to process (0)4-20mA signals.

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

Standard outputs

- Two passive transistor or relay outputs: for two- or one stage control with pulse output.
- Pulse output to transmit a pulse that represents a totalized quantity as programmed.
- Linear (0)4-20mA or 0-10V analog output to represent the actual flow rate as programmed. The (0)4-20mA or 0-10V signal limits can be tuned.

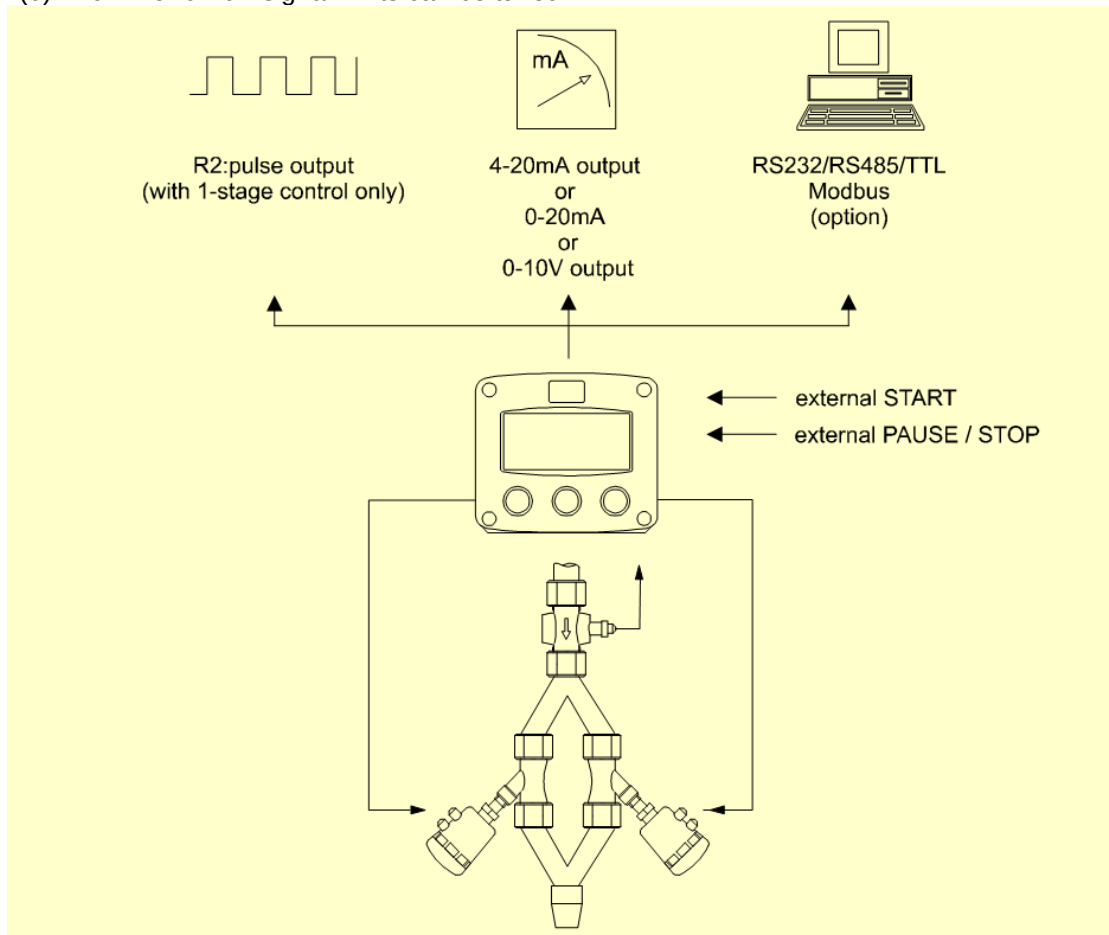


Fig. 1: Typical application

Configuration of the unit

The F131-P is designed for use in many types of applications. For that reason, a setup menu is available to program the F131-P according to your specific requirements.

The setup includes several important features, such as K-Factors, engineering units, signal selection, power management (to extend battery life-time), etc. All settings are stored in a non-volatile memory and therefore kept in the event of a power failure or an exhausted battery.

Display information

The unit has a LCD with (optional) backlight to show the process information, status and alarm messages. The display refresh rate is programmed in the setup menu.

At a key press, the display refresh rate will switch to FAST for 30 seconds. When 'OFF' is selected, the display goes off after 30 seconds after the last key press. The display temporarily comes on after a key press.

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

Options

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

2. OPERATIONAL



- 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.
- 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.

2.1. CONTROL PANEL

The control panel has three keys. The available keys are:



Fig. 2: Control Panel

Functions of the keys



This key is used to program and save new values or settings.
The PROG/ENTER key is also used to gain access to the setup menu (read chapter 3).



This key is used to START the batch process.
The START/▲ key is also used to increase a value after the PROG/ENTER key has been pressed (read chapter 3).



This key is used to pause or stop the batch process. When the batch process is stopped, it cannot be continued. The STOP/► key is also used to select the total and the accumulated total.
The STOP/► key is also used to select a digit or an option after the PROG/ENTER key has been pressed (read chapter 3).

2.2. OPERATOR INFORMATION AND FUNCTIONS

In general, the F131-P operates in the operator mode. The shown information depends on the settings which are made in the setup menu.
The signal from the connected sensor is processed by the F131-P in the background, independent from the selected display refresh rate.

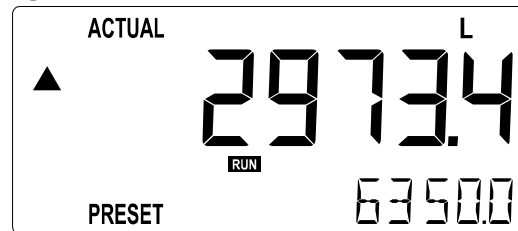


Fig. 3: Process information (typical)

▪ To enter a batch quantity (change the preset)

You can only change the preset when the READY indicator is on.

1. Press the PROG/ENTER key until the PROGRAM indicator starts to blink.
2. Use the START/▲ and STOP/► key to change the value.
3. Momentarily, press the PROG/ENTER key to confirm the new preset.



Fig. 4: Program preset value (typical)

If you do not press the PROG/ENTER key to confirm, your selection is not saved.
The PRESET value can be used time after time till a new value is programmed.



Note !

Changes are only saved when you press the PROG/ENTER key.

▪ Leading zero

The amount of leading zeros is dependent on the batch maximum setting. In the program mode the leading zeros will show. When you confirm the selection with the *PROG/ENTER* key, the F131-P will hide the leading zeros in the operational preset menu.



Note !

It is not possible to enter a preset value which exceeds the batch maximum setting. E.g. if the batch maximum is set to 20000, it will not be possible to program a preset 21000. If you want to program a preset 21000, you must change the batch maximum setting.

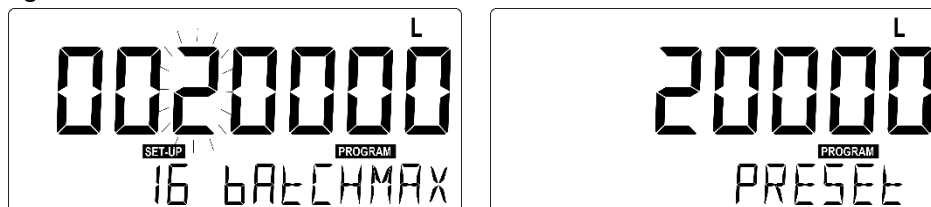


Fig. 5: Leading zero (typical)

▪ Batch maximum/minimum

When you program a new value which is not valid, the decrease-sign ▼ (batch too big, program a smaller batch) or the increase-sign ▲ (batch too small, program a bigger batch) will show.

▪ To start the batch process

The batch process can only be started when "READY" is shown. The batch process is started 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 counting up or down.

▪ To interrupt or to stop the batch process

When the *STOP/▶* key is pressed once, the batch process is paused; the actual values are not lost. At the display, the word "PAUSE" blinks. In this case the, the batch process can be resumed with the *START/▲* key.

When the *STOP/▶* key is pressed two times, the batch process is stopped completely. In this case the actual values are "lost" and the system returns to steady state: the batch process cannot be resumed.

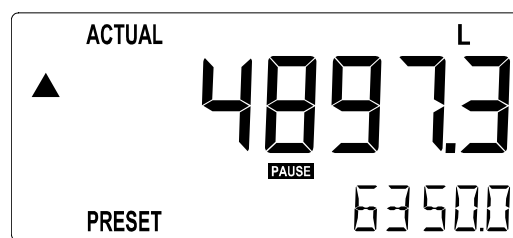


Fig. 6: Process paused (typical)

▪ Flow rate indication



Note !

This function might not be available: it depends on the configuration of the unit.

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

▪ Clear batch total

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

▪ Display accumulated total

When the *STOP/▶* key is pressed, total and accumulated total are shown. The accumulated total cannot be reset. The value will count up to 99,999,999,999. The unit and number of decimals are shown according to the configuration settings for total.

▪ Low-battery alarm



Note !

Only use original batteries. Original batteries can be ordered at the manufacturer. The use of unapproved batteries will void the warranty.

At the end of the battery's life-time, the voltage starts to drop. When the voltage becomes too low, the battery indicator comes on. When the battery indicator is on, install a new and fresh battery as soon as possible.



Fig. 7: Low-battery alarm (typical)

- **No-flow alarm**

The F131-P offers a no-flow monitoring feature: When the flowmeter does not generate a signal during a certain (preset) time period, the F131-P will shut-off the control output(s) and bring the batch controller in alarm status.

The "PAUSE" and "ALARM" indicators come on and NO FLOW is shown. Press the STOP/ ► key to confirm the alarm status and note that the "PAUSE" indicator stays on. Now you can cancel or continue the batch (after you have solved the possible problem).

- **Alarm**

When the alarm indicator is shown, refer to Appendix B: Problem Solving.

3. CONFIGURATION

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.

The setup menu is used to program the F131-P.

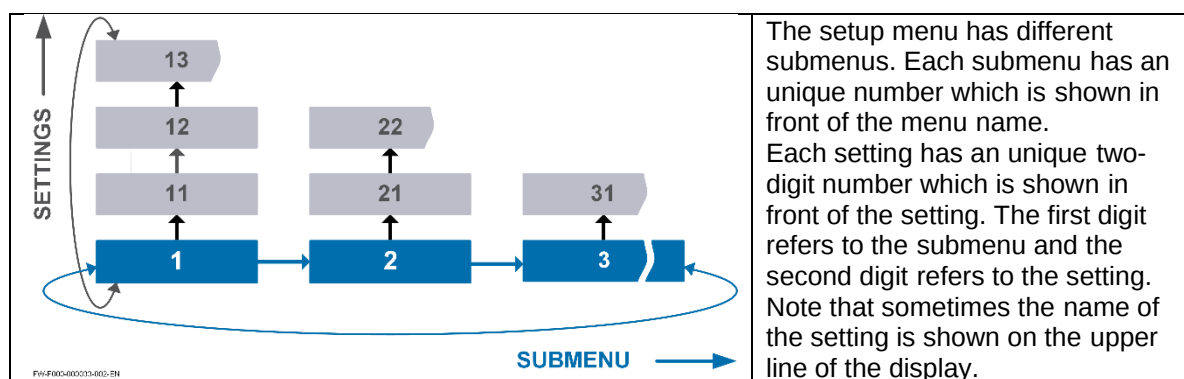
The setup menu is accessible at all times while the F131-P remains fully operational. Be aware that in this case any change to the settings may have an influence on the operation.



Note !

It is possible to prevent access to the setup menu with a password. A password may be required to enter the setup menu. Without this password, access is denied.

3.1. HOW TO PROGRAM THE F131-P



How to enter the setup menu

When the setup menu is protected by a password, the F131-P asks for a password to access the setup menu. When in the operator mode, press and hold the PROG/ENTER key for 7 seconds to access the setup menu.

How to navigate in the setup menu

The setup menu has different submenus to program the F131-P. For navigation, the submenus and the settings are identified with numbers (for the submenu: e.g. 1; for the setting: e.g. 12.).

The STOP/► key and the PROG/ENTER key are used for navigation. The explanation assumes that you are in the submenu PRESET.

Action	Result	Remark
1 Press the STOP/► key to select the next submenu.	• The submenu FLOW RATE shows	-
2 Press again to go to the next submenu.	• The submenu OVERRUN shows.	-
3 Momentarily, press the PROG/ENTER key to select the previous submenu.	• The submenu FLOW RATE shows	-
4 Press again to go to the previous submenu.	• The submenu PRESET shows	-

The START/▲ key and the STOP/► key are used for navigation.

The explanation assumes that you are in the submenu PRESET. When you are:

- in the first setting and you navigate to the previous setting, the F131-P goes back to the related main menu.
- in the last setting and you navigate to the next setting, the F131-P goes to the related main menu.

Action	Result	Remark
1 Press the START/▲ key to select the first setting.	• The setting UNIT shows.	-
2 Press the START/▲ key again to go to the next setting.	• The setting DECIMALS shows.	-
3 Press the STOP/► key to select the previous setting.	• The setting UNIT shows.	-
4 Press the STOP/► key again to go to the previous setting.	• The submenu PRESET shows	This is normal behavior because the setting UNIT is the first setting of the submenu PRESET.

How to make a setting



Caution !

Changes are only saved when you press the PROG/ENTER key.

The explanation assumes that you are in the submenu PRESET and the setting UNIT. When you do not want to save the change, wait for approximately 20 seconds or press and hold the PROG/ENTER key for approximately 3 seconds.

Action	Result	Remark
1 Momentarily, press the PROG/ENTER key.	• The PROG indicator blinks. • The engineering unit L shows.	To access the setting.
2 Press the START /▲ key to select the next engineering unit.	• The PROG indicator blinks. • The engineering unit m ³ shows.	If you wait too long, the program mode goes off and changes are not saved, this is normal behavior.
3 Press the START /▲ key to select the next engineering unit.	• The PROG indicator blinks. • The engineering unit US GAL shows.	-
4 Press the STOP /► key to select the previous engineering unit	• The PROG indicator blinks. • The engineering unit m ³ shows.	-
5 To confirm the changes: Momentarily, press the PROG/ENTER key.	• The PROG indicator goes off. • The change is saved. • The engineering unit m ³ shows.	If you do not press the PROG/ENTER key to confirm, your selection is not saved.
To discard the changes: Press and hold the PROG/ENTER key for approximately 3 seconds.	• The PROG indicator goes off. • The change is discarded. • The engineering unit L shows.	-

3.2. SETUP MENU - SETTINGS

1	PRESET		
	11	unit	L; m ³ ; kg; lb; GAL; USGAL; bbl; no unit
	12	decimals	0000000; 111111.1; 22222.22; 3333.333
	13	K-factor:	0.000010 - 9999999
	14	decimals K-factor	0 - 6
	15	batch-min	0000000 - 9999999
	16	batch-max	0000000 - 9999999
2	FLOW RATE		
	21	unit	mL; L; m ³ ; mg; g; kg; ton; gal; bbl; lb; cf; rev; - - - - (no unit); scf; nm ³ ; nL; p
	22	time	/sec; /min; /hour; /day
	23	decimals	0000000; 111111.1; 22222.22; 3333.333
	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
3	OVERRUN		
	31	overrun	disable; enable
	32	time	0.1 - 999.9 seconds
4	ALARM		
	41	no flow	disable; enable
	42	time	0.1 - 999.9 seconds
5	DISPLAY		
	51	display	increase; decrease
	52	flow rate	off; batch; toggle
	53	light	0% (off); 20%; 40%; 60%; - 80%; 100% (full brightness)
6	POWER MANAGEMENT		
	61	LCD new	fast; 1 sec; 3 sec; 15 sec; 30 sec; off
	62	battery mode	operational; shelf
7	FLOWMETER		
	71	signal	npn; npn-lp; reed; reed-lp; pnp; pnp-lp; namur; coil-hi; coil-lo; 8-1 DC; 12 DC; 24 DC
8	ANALOG		
	81	output	disable; enable
	82	rate-min	0000.000 - 9999999
	83	rate-max	0000.000 - 9999999
	84	cut-off	0.0 - 9.9%
	85	tune-min	0 - 9999
	86	tune-max	0 - 9999
	87	filter	01 - 99
9	RELAYS		
	91	relays	1-step; 2-step
	92	preclose	0000.000 - 9999999
	93	width	0.001 - 9.999
	94	decimals	0000000; 111111.1; 22222.22; 3333.333
	95	amount	0000.001 - 9999999
	96	pulse	total; batch
A	COMMUNIC(ATION)		
	A1	speed	1200; 2400; 4800; 9600
	A2	address	1 - 247
	A3	mode	bus-rtu; bus-asc; off
B	OTHERS		
	B1	model	F131-P
	B2	software version	nn:nn:nn
	B3	serial no.	nnnnnnnn
	B4	password	0000 - 9999
	B5	tag-nr	0000000 - 9999999

3.2.1. EXPLANATION OF SETUP MENU 1 - PRESET

UNIT 11 	This setting is used to select the engineering unit for the indication of the batch total, the accumulated total and the pulse output. <i>When you change the engineering unit, you must recalculate and reprogram the K-factor for the (accumulated) total. When you recalculate and reprogram the K-Factor, the history for (accumulated) batch total is not correct anymore, because the (accumulated) batch total is not recalculated. For future reference, best practice is to make a note of the accumulated total before you program the recalculated K-Factor.</i>
DECIMALS 12	This setting is used to set the amount of digits behind the decimal point for the (accumulated) total indication.
K-FACTOR 13 	This setting is used to set the K-Factor for the total. 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 engineering unit, for example per m³. A more accurate K-Factor (more decimals, as set in decimals K-Factor) allows for a more accurate operation of the system. Example 1: Calculating the K-Factor. The flowmeter generates 2.4813 pulses per liter and the selected unit is m³. A cubic meter consists of 1000 liter which gives 2.4813 pulses*1000 liter=2481.3 pulses per m³. So, the K-Factor is 2481.3. Enter for the Flowmeter K-Factor: 24813 and for the flowmeter K-Factor decimals: 1. Example 2: Calculating the K-Factor. The flowmeter generates 6.5231 pulses per gallon and the selected engineering unit is gallons. So, the K-Factor is 6.5231. Enter for the Flowmeter K-Factor: 65231 and for the Flowmeter K-Factor decimals: 4. <i>When you recalculate and reprogram a new K-Factor, the history for (accumulated) batch total is not correct anymore, because the (accumulated) batch total is not recalculated. For future reference, best practice is to make a note of the accumulated total before you program the recalculated K-Factor.</i>
DECIMALS K-FACTOR 14	This setting is used to set the amount of digits behind the decimal point for the K-Factor.
BATCH MIN 15	This setting is used to set the lower limit for a batch volume. An operator cannot set a batch volume which is beyond the lower limit.
BATCH MAX 16	This setting is used to set the upper limit for a batch volume. An operator cannot set a batch volume which is beyond the upper limit.

3.2.2. EXPLANATION OF SETUP MENU 2 - FLOW RATE

The settings for total and flow rate are entirely separate. In this way, different engineering units can be used for each e.g. cubic meters for total and liters for flow rate.

UNIT 21 	This setting is used to select the engineering unit for the indication of the flow rate. <i>Alteration of the engineering unit will have consequences for operator and SETUP-level values, they will not be automatically recalculated to the value of the new selected unit. The K-factor has to be adapted as well; the calculation is not done automatically.</i>
TIME 22 	This setting is used to set the time unit for the flow rate calculation. Note that the flow rate is given in engineering unit/time unit, e.g. liters/minute (l/min). <i>When you change this setting, also recalculate and change the settings for the analog rate-min and analog rate-max.</i>
DECIMALS 23	This setting is used to set the amount of digits behind the decimal point for the flow rate indication.
K-FACTOR 24	This setting is used to set the K-Factor for the flow rate. 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 engineering unit, for example per m³. A more accurate K-Factor (more decimals, as set in decimals K-Factor) allows for a more accurate operation of the system.
DECIMALS K-FACTOR 25	This setting is used to set the amount of digits behind the decimal point for the K-Factor.

CALCULATION 26	The flow rate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flow rate will be. The maximum value is 255 pulses. This setting does influence the update interval for the flow rate and thus, indirectly the update interval of the analog output.. (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses. For low frequency applications (< 10Hz): do not program more than 10 pulses, else the update time will be very slow. For high frequency applications (> 1kHz): do program 50 or more pulses.
CUT-OFF 27	This setting is used to set the threshold for a minimum flow. If during this time less than XXX-pulses are generated (refer to Calculation), the flow rate will be shown as zero. The cut-off has to be entered in seconds.

3.2.3. EXPLANATION OF SETUP MENU 3 - OVERRUN

Due to system parameters which are beyond the settings of the batch controller, an overrun can occur at the end of a batch. The batch controller analyzes the overrun volume and automatically corrects the volume each time after each batch (self learning).

OVERRUN 31	For an accurate overrun correction, it is necessary that the flowmeter 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 is not compatible to this function.
TIME 32	The overrun characteristic of the system will be analyzed during a certain time after the batch relay has been de-energized. 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 !</i>

3.2.4. EXPLANATION OF SETUP MENU 4 - ALARM

The F131-P offers a no-flow monitoring feature: When the flowmeter does not generate a signal during a certain (preset) time period, the F131-P will shut-off the control output(s) and bring the batch controller in alarm status.

NO-FLOW 41	This setting is used to program the behavior of the no-flow alarm. When the flow rate is zero, it is possible to ignore or disable the no-flow monitoring.
TIME 42	This setting is used to set a delay time for the related alarm. When the alarm condition is still valid after the delay time, an alarm is given.

3.2.5. EXPLANATION OF SETUP MENU 5 - DISPLAY

DISPLAY 51	This setting is used to set the behavior of the counter during a batch process: count down (quantity to do) or count up (quantity done).
FLOW RATE 52	This setting is used to determine how the flow rate will be shown during a batch process. The settings are: - off: flow rate will not be shown; - batch after the start, the flow rate will be shown till the end of the batch. (advise: set the display to setting "decrease"; - toggle: flow rate is shown alternating with the preset value.
LIGHT 53	The backlight brightness can be adjusted from 0% (off) to 100% (full brightness) in steps of 20%. When the F131-P is only loop powered, the backlight is disabled. An external power supply is required to supply the backlight.

3.2.6. EXPLANATION OF SETUP MENU 6 - POWER MANAGEMENT

When used with the internal battery option (type PB/PC), 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.

LCD NEW 61	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display refresh rate, it is strongly advised to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signals will be generated in the normal way. At a key press, the display refresh rate will switch to FAST for 30 seconds. When 'OFF' is selected, the display goes off after 30 seconds after the last key press. The display temporarily comes on after a key press. Example battery life-time with a coil pick-up: • 1kHz pulse and FAST update: about 2 years; • 1kHz pulse and 1 sec update: about 5 years.
BATTERY MODE 62	The F131-P has two modes: operational or shelf. After "shelf" has been selected, the F131-P can be stored for several years; it will not process the sensor signal; the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the F131-P again, press the START/▲ key two times.

3.2.7. EXPLANATION OF SETUP MENU 7 - FLOWMETER

SIGNAL 71		With this setting the type of flowmeter output is selected. The settings with LP (low-pass) filter are used to apply a build-in noise reduction. <i>Selections "active pulse" offer a detection level of 50% of the supply voltage.</i>		
	Note !			
TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mV	REMARK
NPN	NPN input	100 kΩ pull-up	max.6 kHz.	(open collector)
NPN - LP	NPN with low pass filter	100 kΩ pull-up	max.1.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1 MΩ pull-up	max.1.2 kHz.	
REED - LP	Reed-with low pass filter	1 MΩ pull-up	max.120 Hz.	Less sensitive
PNP	PNP input	100K pull-down	max.6 kHz.	
PNP - LP	PNP with low pass filter	100K pull-down	max.1.2 kHz.	Less sensitive
NAMUR	NAMUR input	820 Ω pull-down	max.4 kHz.	External power required
COIL-HI	High sensitive coil input	-	min. 20 mV _{pp}	Sensitive for interference!
COIL-HI (option ZF)			min. 10 mV _{pp}	
COIL-HI (option ZG)			min. 5 mV _{pp}	
COIL LO	Low sensitive coil input	-	min. 80 mV _{pp}	Normal sensitivity
8-1 DC	Active pulse input detection level 8.2V DC	3K9	max.10KHz.	External power required
12 DC	Active pulse input detection level 12V DC	4K	max.10KHz.	External power required
24 DC	Active pulse input detection level 24V DC	3K	max.10KHz.	External power required

3.2.8. EXPLANATION OF SETUP MENU 8 - ANALOG OUTPUT

A linear 4-20mA signal (option AB: 0-20mA or option AU: 0-10V) output signal is generated that represents the flow rate. The settings for the flow rate influence the analog output directly. The relationship between the flow rate and the analog output is set with the following settings.

OUTPUT 81 	If the analog output is not used, select disable to minimize the power consumption (e.g. save battery life-time). <i>Option AP: When a power supply is available but the output is disabled, a 3.5mA signal will be generated.</i>
RATE-MIN 82	Enter here the flow rate at which the output should generate the minimum signal (0)4mA or 0V - in most applications at zero flow. The number of decimals shown depend upon setup 23. The engineering units/time (e.g. L/min) are dependent upon setup 21 and 22.
RATE-MAX 83	Enter here the flow rate at which the output should generate the maximum signal (20mA or 10V) - in most applications at maximum flow. The number of decimals shown depend upon setup 23. The engineering units/time (e.g. L/min) are dependent upon setup 21 and 22.
CUT-OFF 84	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, 20mA or 10V. When the flow is less than the required rate, the current will be the minimum signal (0)4mA or 0V. Example: Calculate the cut-off. Rate-min: 0L/min [4mA], Rate-max: 100 L/min [16mA], Cut-off: 2% Required rate [L/min]: (rate-max - rate-min)*cut-off: (100-0)*2%=2 L/min Output [mA]: rate-min + (rate-max*cut-off): 4+(16*2%)=4.32mA
TUNE-MIN 85  	The (0)4mA or 0V value can be tuned precisely with this setting. The initial minimum analog output value is (0)4mA or 0V. However, this value might differ slightly due to ambient influences such as temperature for example. Before tuning the signal, be sure that the analog signal is not being used for any application! After pressing PROG, the current will be about 4mA (0mA or 0V). The current can be increased / decreased with the arrow keys and is directly active. Press ENTER to store the new value. <i>If required, you can program the analog output 'up-side-down'. The (0)4mA or 0V represents the maximum flow rate and the 20mA or 10V represents the minimum flow rate.</i>
TUNE-MAX 86  	The 20mA or 10V value can be tuned precisely with this setting. The initial maximum analog output value is 20mA or 10V. However, this value might differ slightly due to ambient influences such as temperature for example. Before tuning the signal, be sure that the analog signal is not being used for any application! After pressing PROG, the current will be about 20mA or 10V. The current can be increased / decreased with the arrow keys and is directly active. Press ENTER to store the new value. <i>If required, you can program the analog output 'up-side-down'. The (0)4mA or 0V represents the maximum flow rate and the 20mA or 10V represents the minimum flow rate.</i>
FILTER 87	This setting is used to stabilize the output signal. With the help of this digital filter a more stable but less actual representation of the flow rate can be obtained. The filter principal is based on three input values: the filter level (01-99), the last calculated flow rate and the last average value. The higher the filter level, the longer the response time on a value change will be.

3.2.9. EXPLANATION OF SETUP MENU 9 - RELAYS

Two control outputs are available to control relays or valves. Relay 2 can also be used as pulse output according the batch total (actual) or accumulated total.

RELAYS 91	This submenu is used to set the function of related output. 1-Step: The F131-P is used for one-stage batch control while R2 is used as a scaled pulse output. 2-Step: The F131-P is used for two-stage batch control.
PRECLOSE 92	According to the setting 91 - 2-step, relay two will be used to control a second 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 preclose is set to zero, relay 2 will switch simultaneously with relay 1.
 Note !	<i>The settings: width, decimals, amount and pulse are only valid when relay 2 is used as a scaled pulse output. A scaled pulse output is used to indicate that the batch or accumulated total has increased with the value as set in the setup 95.</i>
WIDTH 93	When relay 2 is used as a scaled pulse output: The pulse width determines the time that the output will be active; in other words the pulse duration. Value "zero" will disable the pulse output. The pulse signal always has a 50% duty cycle, hence the minimum time between the pulses is equal to the pulse width setting. If the frequency should go out of range – when the flow rate increases for example – an internal buffer will be used to "store the missed pulses": As soon as the flow rate slows down, the buffer will be "emptied". <i>It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within its range!</i>
DECIMALS 94	This setting is used to set the amount of digits behind the decimal point for the amount.
AMOUNT 95	A pulse will be generated every time a certain quantity is added to the total. Enter this quantity here while taking the decimals for pulse into account.
PULSE 96  Note !	The pulse generation is controlled by the batch total or the accumulated total. <i>When set to "batch", the buffer (setting: Width) will be emptied when a new batch is started.</i>

3.2.10. EXPLANATION OF SETUP MENU A - COMMUNICATION (OPTION)

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.

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.

SPEED A1	This setting is used to set the Baudrate.
ADDRESS A2	This setting is used to set the communication address for the F131-P.
MODE A3	This setting is used to set the Modbus transmission mode. Select OFF to disable the communication.

3.2.11. EXPLANATION OF SETUP MENU B - OTHERS

For support and maintenance it is important to have information about the characteristics of the F131-P. Your supplier will ask for this information when support is required.

MODEL B1	This setting shows the model name.
SOFTWARE VERSION B2	This setting shows the version number of the firmware (software).
SERIAL NO B3	This setting shows the serial number.
PASSWORD B4	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.
TAG-NR B5	This setting is used to set a tag number for the F131-P.

4. INSTALLATION

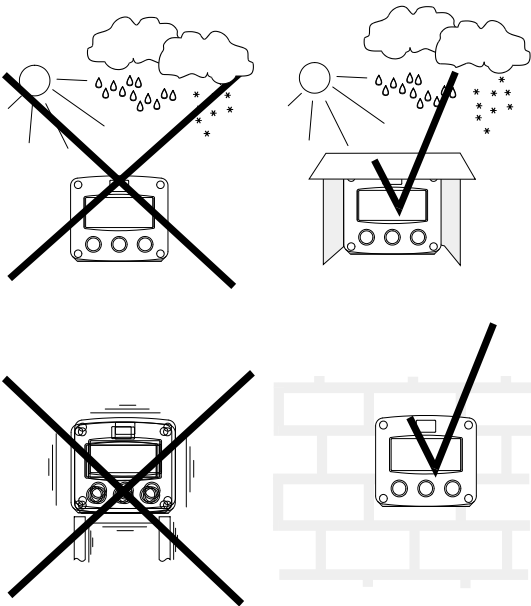
4.1. General directions



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 F131-P 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):

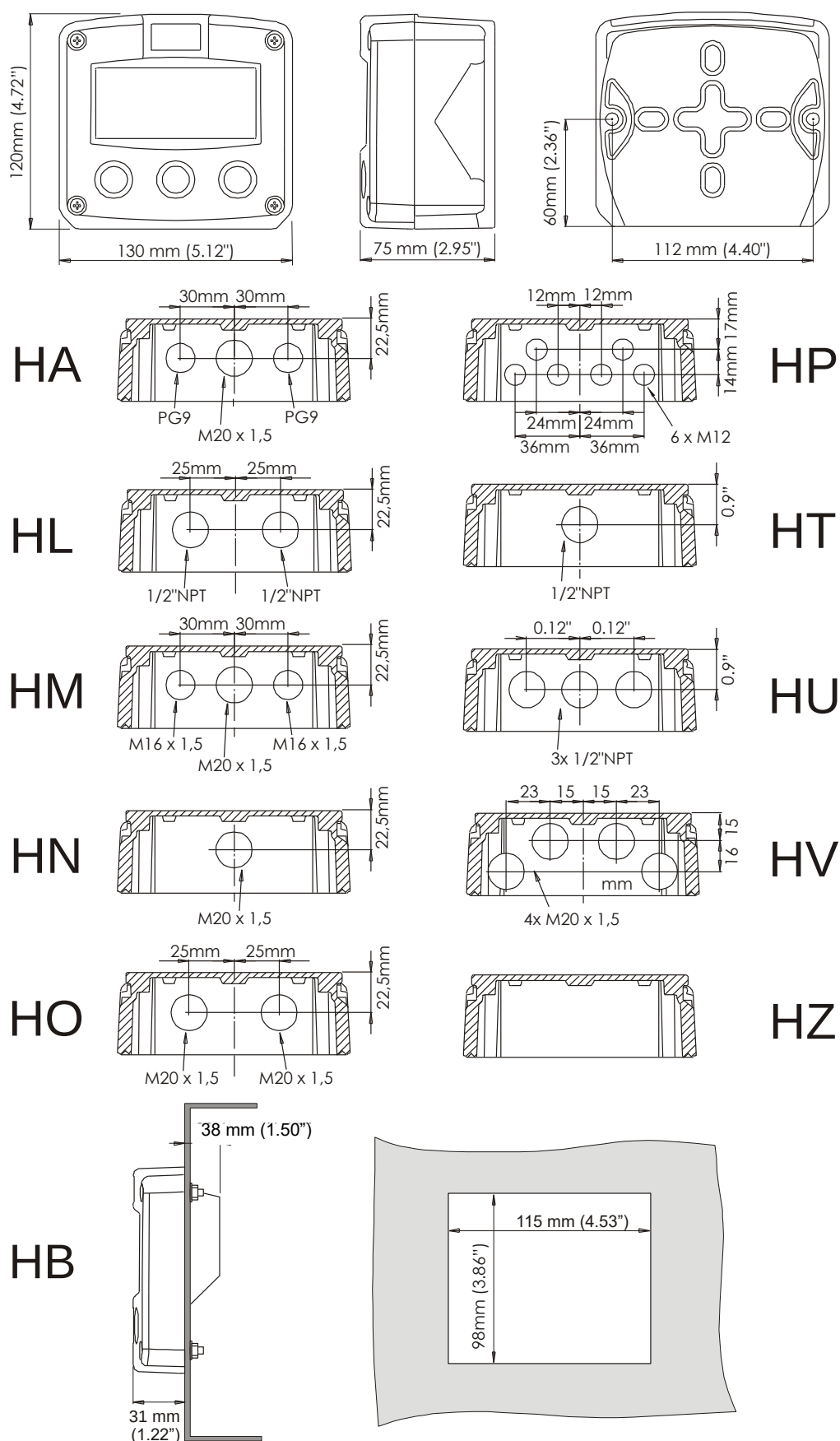


Fig. 8: Aluminum and stainless enclosures – Dimensions

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

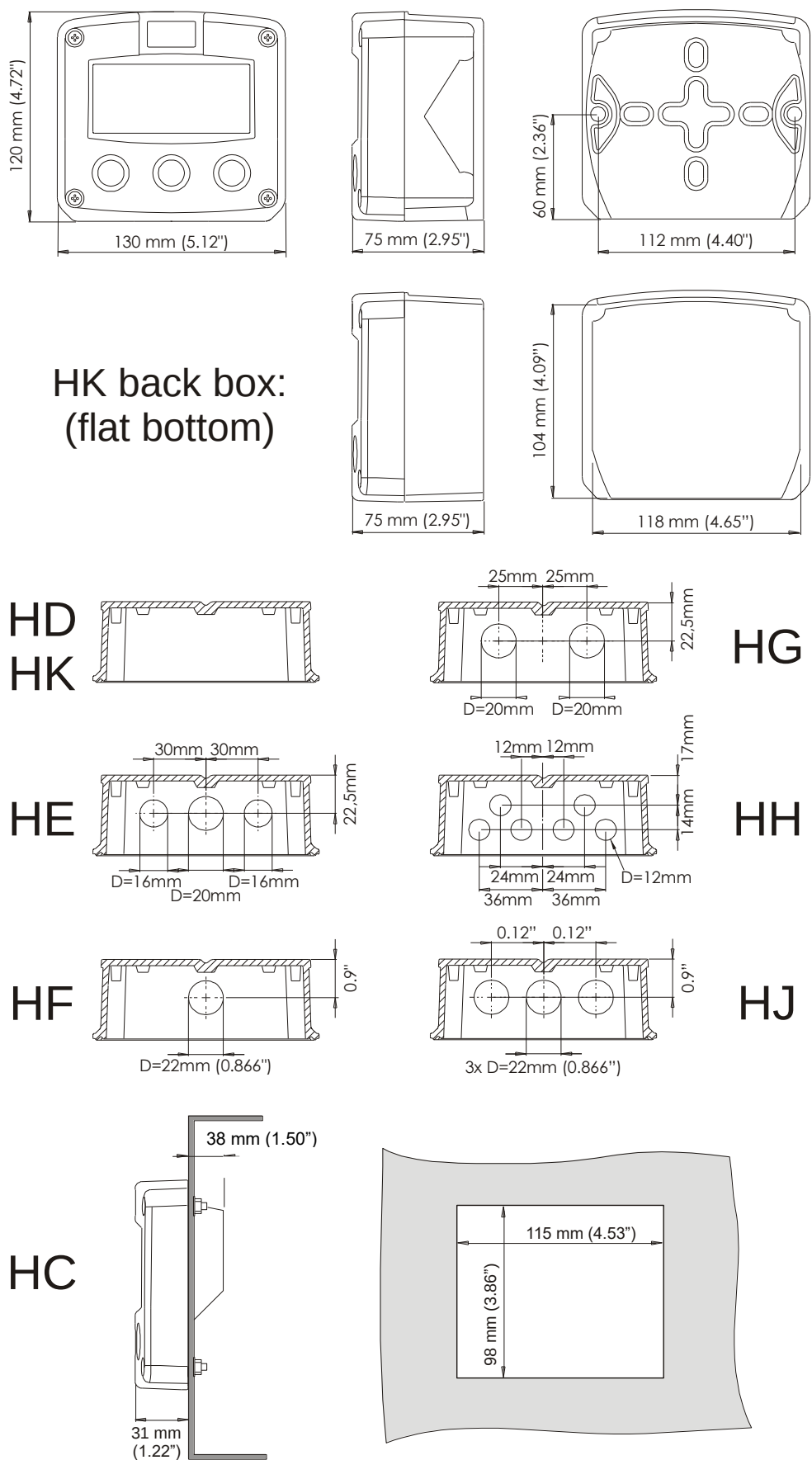


Fig. 9: GRP enclosures - Dimensions

4.4. INSTALLING THE HARDWARE



- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the F131-P , the installer has to discharge himself by touching a well-grounded object.
- D 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 F131-P . 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 F131-P 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: ensure 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 F131-P 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.

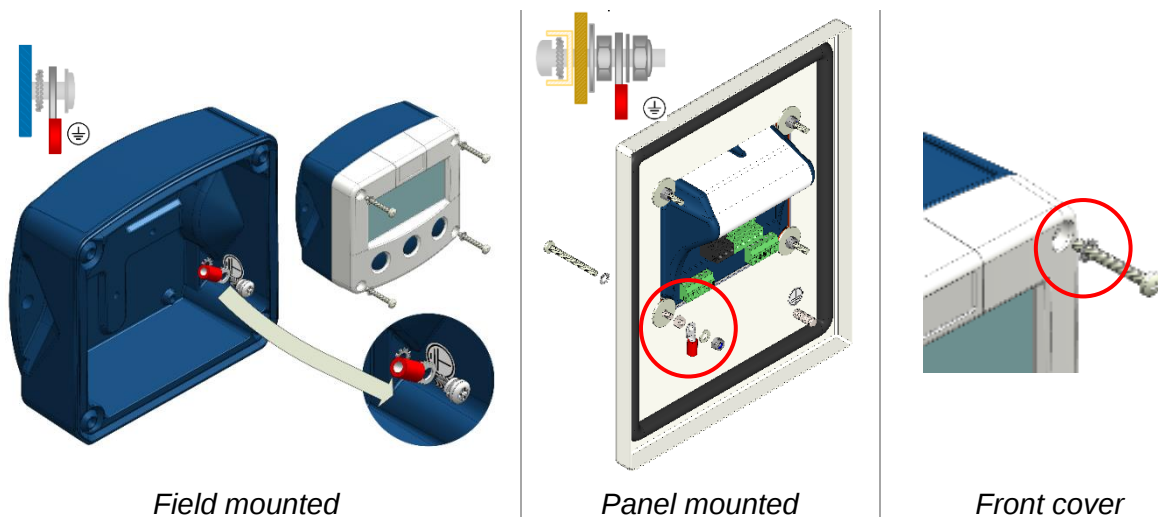


Fig. 10: Protective Earth (PE) connections on metal enclosure

Plastic enclosure

When the F131-P 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 F131-P 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

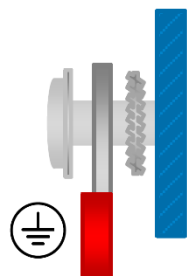


Risk of damage to equipment!

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.

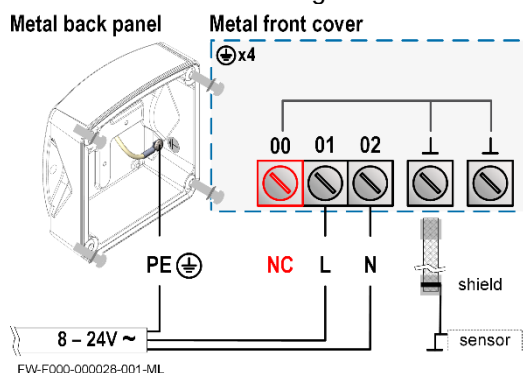
The PE connection

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.

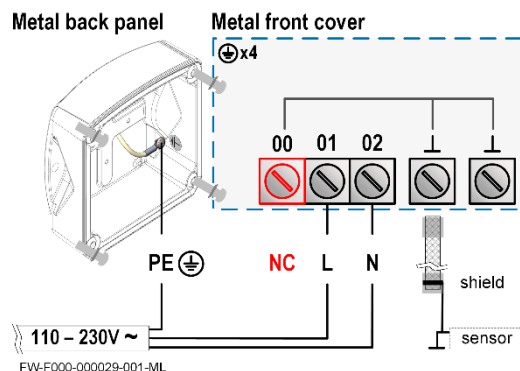


The PE connection in the metal back panel is made with a serrated washer, a terminal, a washer and a screw.

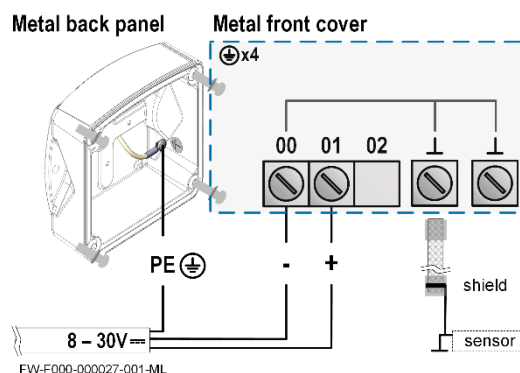
The PE connection to the metal cover is made with the serrated washers and the mounting screws.



Type OR (8-24V AC)



Type PM (110-230V AC)

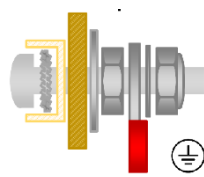


Type OR (8-30V DC)

4.4.4. ALUMINUM ENCLOSURE - PANEL MOUNTED

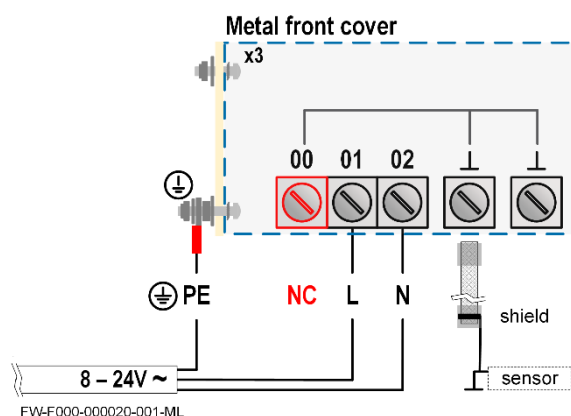
The PE connection

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

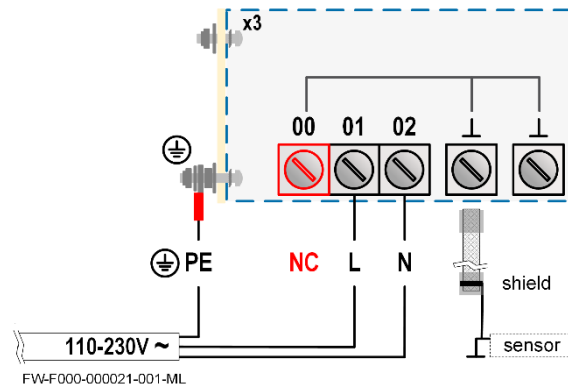


The PE connection to the metal cover is made with the serrated washers and the mounting screws.

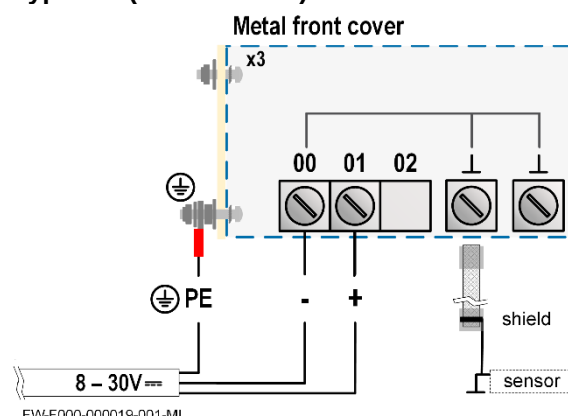
The PE connection to the panel is made with the washer, the nut, the terminal, the washer and a lock nut.



Type OR (8-24V AC)



Type PM (110-230V AC)

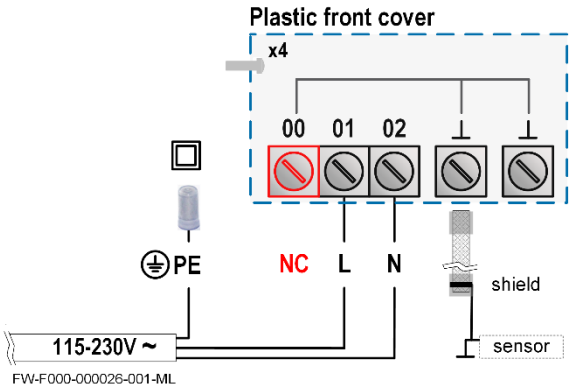


Type OR (8-30V DC)

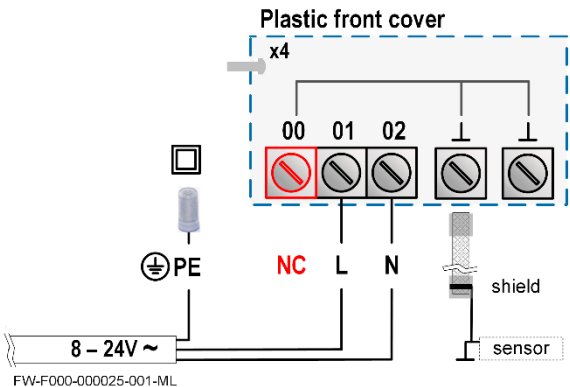
4.4.5. PLASTIC (GRP) ENCLOSURE

The PE connection

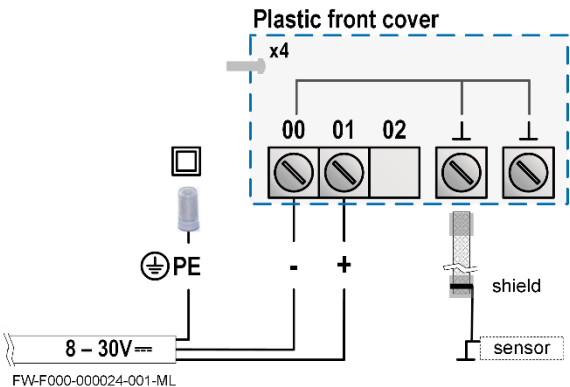
The F131-P in a GRP enclosure meets the requirements of class 2 (double insulated). Therefore the incoming PE wire is terminated with an insulating end cap.



Type PM (110-230V AC)



Type OR (8-24V AC)



Type OR (8-30V DC)

4.4.6. TERMINAL CONNECTORS

Refer to Appendix A: Technical Specification

	Power supply			2-stage/Pulse Output 2		Batch Output 1		Analog Output		Sensor A Input		Sensor A Supply	External Start		External Stop		
	00	01	02	03	04	05	06	07	08	09	10	11	12	13		15	16
PD; PF ~		L	N									+↓					
PD; PF ≡	-	+										+↓					
PM ~		L	N									+↓					
PX ≡	-	+										+↓					
P										⊥	⌋↑		⊥	Start↑		⊥	Stop↑
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) by software setting (Coil; Reed)

PD; PF; PM

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

1.2; 3V ≡
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-F131-000001-001-EN

Fig. 11: Overview of terminal connectors - Standard configuration and options

4.4.7. SENSOR SUPPLY

For option 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 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). The sensor supply is fixed: 1.2V DC or 3V DC (set by the firmware).

For option PD; PF; PM:

It is possible to supply the sensor with different voltages. You can set the voltage with the switches. Internal power is only applicable for low power sensors (Coil, Reed). External power is only available when the main external power supply is connected.

The sensor supply voltage is selectable: 1.2; 3; 8.2; 12 or 24V DC.

Set the sensor supply

1. Make the F131-P safe. If applicable, mind the battery power.
2. Open the F131-P 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 F131-P .



Risk of electrocution - High voltage!

Make sure, all the leads to the terminals are disconnected from the F131-P and NEVER connect the mains power supply to the unit when the protection cover has been removed!

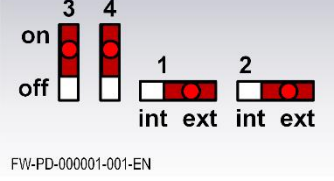
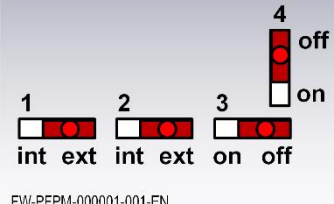
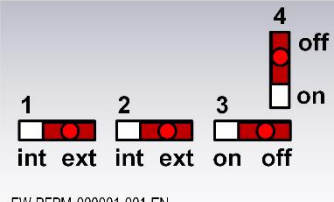
Type PD	Power supply in: 8-24V AC / 8-30V DC				
 Switch location (typical)	Sensor A		V_{out} selection		Sensor supply out
	1	2	3	4	NOTE: Use an AC autotransformer (spartrafo) with galvanic isolation.
	int	-	off	off	Coil 1.2V DC; <1mA
	ext	-	on on off	on off off	Reed 3V DC; <1mA 8.2V DC; 50mA (max) 12V DC; 50mA (max) 24V DC; 50mA (max)
Type PF	Power supply in: 24V AC / 24V DC $\pm 10\%$				
 Switch location (typical)	Sensor A		V_{out} selection		Sensor supply out
	1	2	3	4	
	int	-	off	off	Coil 1.2V DC; <1mA
	ext	-	on on off	on off off	Reed 3V DC; <1mA 8.2V DC; 400mA (max) 12V DC; 400mA (max) 24V DC; 400mA (max)
Type PM	Power supply in: 115V AC - 230V AC $\pm 10\%$				
 Switch location (typical)	Sensor A		V_{out} selection		Sensor supply out
	1	2	3	4	
	int	-	off	off	Coil 1.2V DC; <1mA
	ext	-	on on off	on off off	Reed 3V DC; <1mA 8.2V DC; 400mA (max) 12V DC; 400mA (max) 24V DC; 400mA (max)

Fig. 12: Sensor supply voltage - Switch setting

Terminal 03-04; transistor or relay output R2:

This output is designed to drive a low-power device (e.g. relay) to control the batch process. Relay 1 is switched-on during the whole process while relay 2 can be used for two-stage control or as pulse output.



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 designed to drive a low-power device (e.g. relay) to control the batch process. Relay 1 is switched-on during the whole batch process.

Option OT:

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

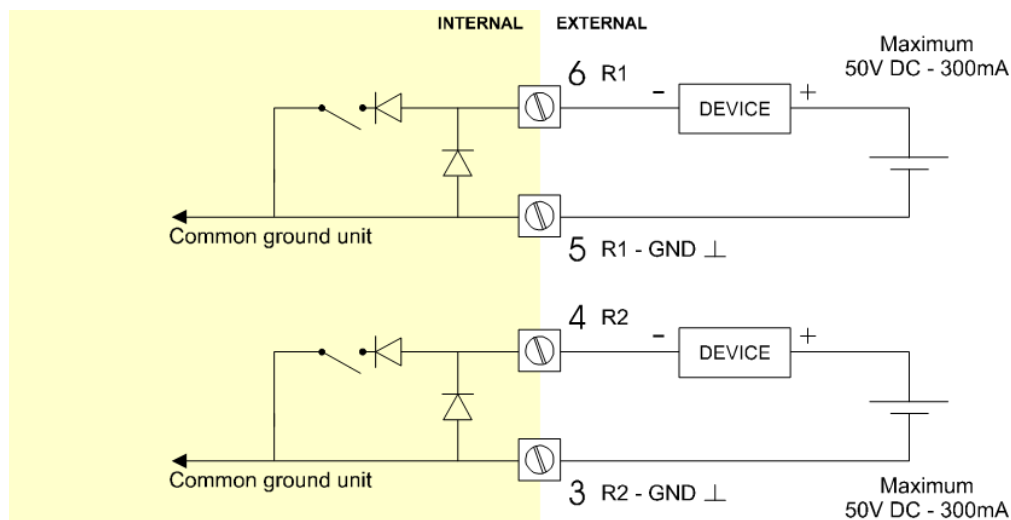


Fig. 13: Terminal connections - Passive transistor output (typical)

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 type PD/PF/PM).

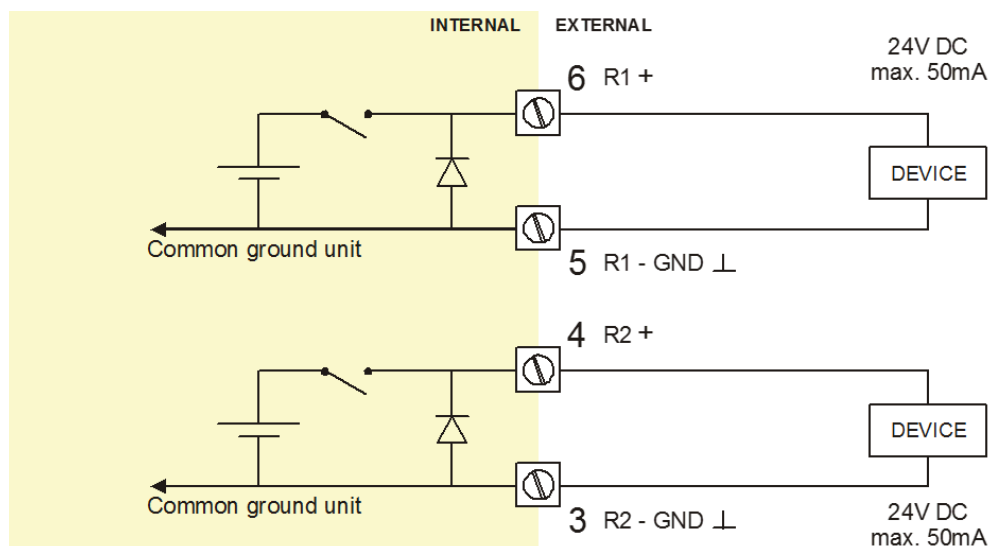


Fig. 14: Terminal connections - Active output (typical)

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 type PD/PF/PM).

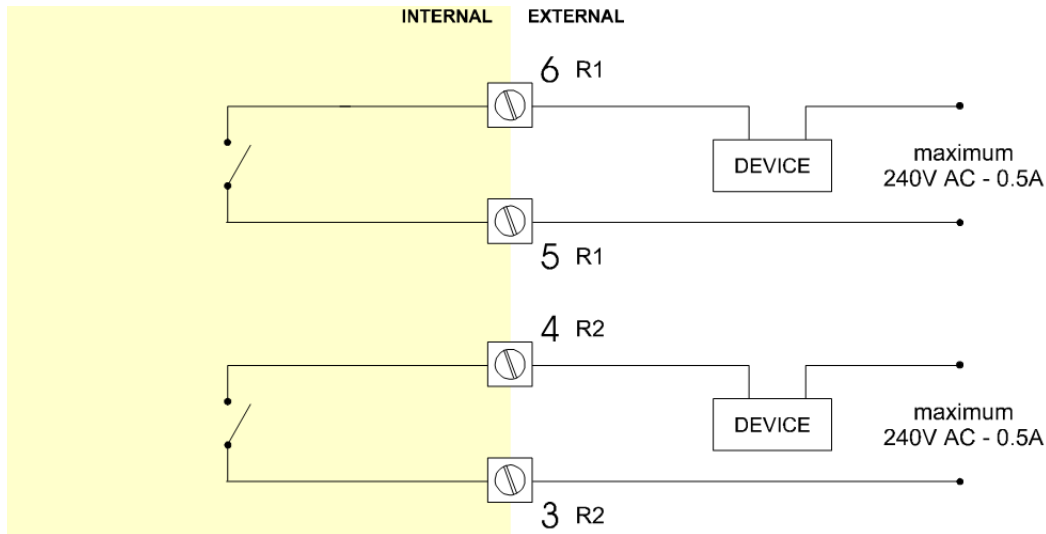


Fig. 15: Terminal connections - Mechanical relay output (typical)

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

Connect an external power supply of 8-30VDC to these terminals or a (0)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 (passive) (SETUP 6) :

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

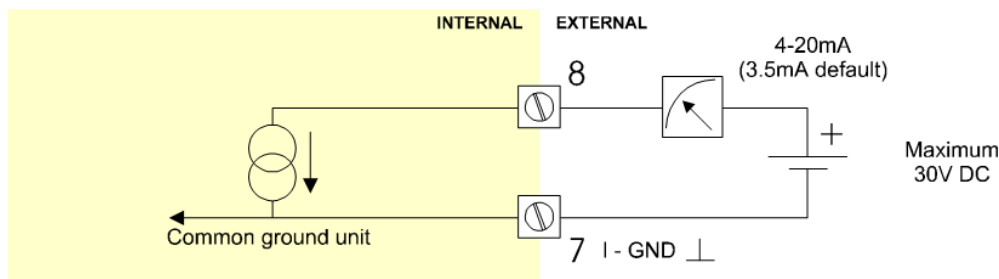


Fig. 16: Terminal connections - Passive 4-20mA analog output (typical)

Option AA:

An active 4-20mA signal proportional to the flow rate 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).

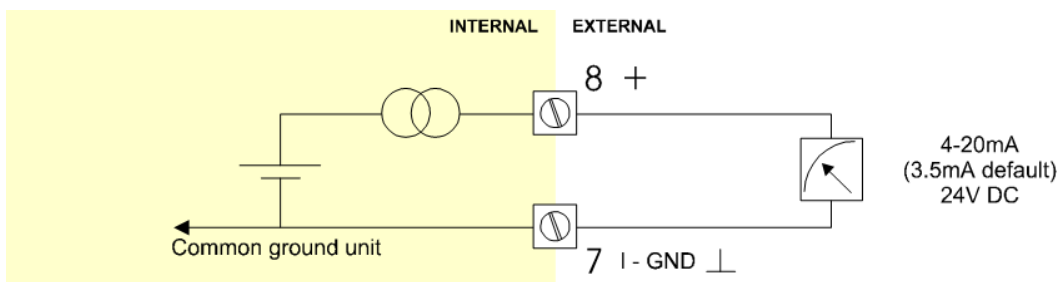


Fig. 17: Terminal connections - Active 0-10V analog output (typical)

Option AB:

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

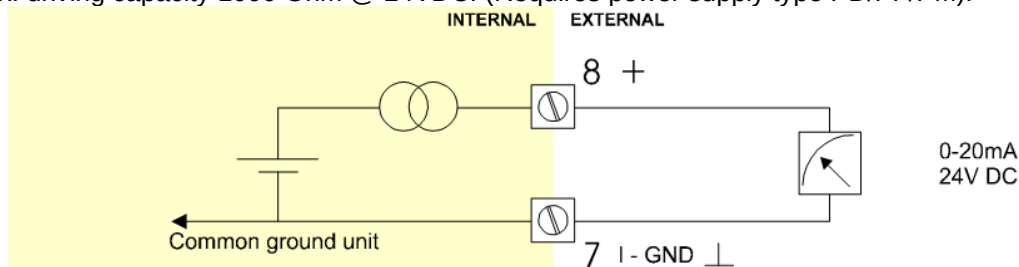


Fig. 18: Terminal connections - Active 0-20mA analog output (typical)

Option AF:

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

Option AI:

An isolated 4-20mA signal proportional to the flow rate 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.

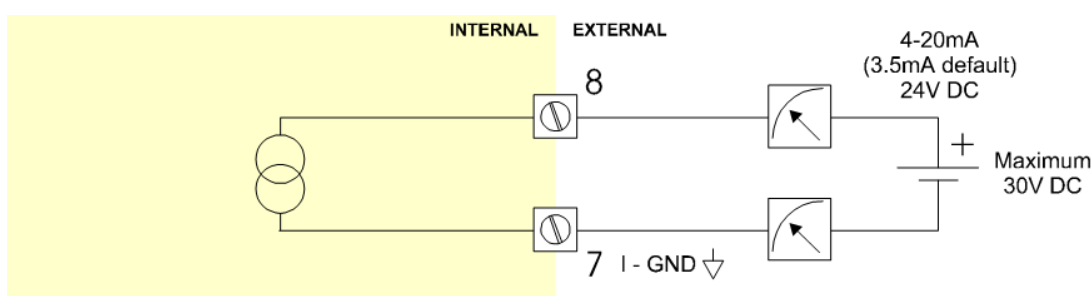


Fig. 19: Terminal connections - Isolated 4-20mA analog output (typical)

Option AU:

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

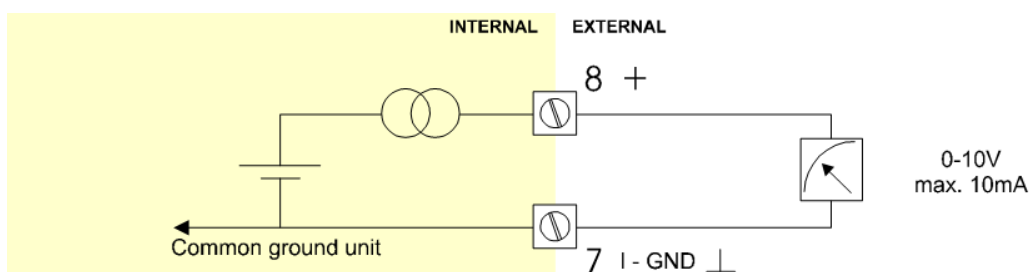


Fig. 20: Terminal connections - Active 0-10V analog output (typical)

Terminal 09-11; Flowmeter input:

Three basic types of flowmeter signals can be connected to the unit: pulse, active pulse or sine-wave (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 in the flowmeter setup (read chapter 3).

Sine-wave signal (Coil):

The F131-P is suitable for use with flowmeters which have a coil output signal.

Two sensitivity levels can be selected:

- COIL-LO: sensitivity from about 80mV_{pp};
- COIL-HI: sensitivity from about 20mV_{pp};
- type ZF, COIL-HI: sensitivity from about 10mV_{pp};
- type ZG, COIL-HI: sensitivity from about 5mV_{pp}.

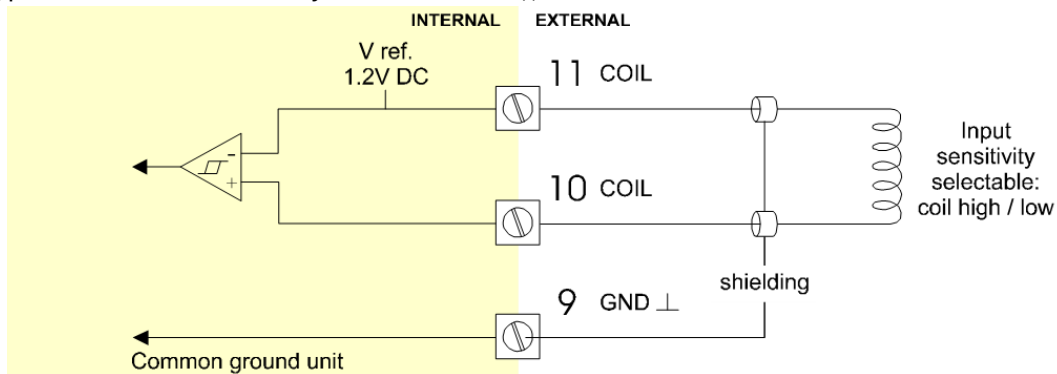


Fig. 21: Terminal connections - Coil signal input (typical)

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 chapter 3).

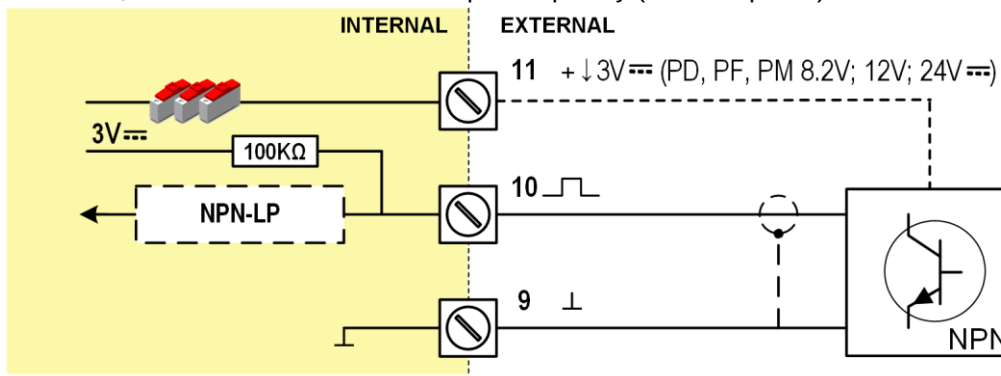


Fig. 22: Terminal connections - NPN signal input (typical)

Pulse-signal PNP / PNP-LP:

The F131-P is suitable for use with flowmeters which have a PNP output signal. 3V 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 chapter 3).

A sensor supply voltage of 8.2, 12 or 24V DC can be provided with power supply type PD, PF, PM. For a signal detection level of 50% of the supply voltage: please refer to "active signals".

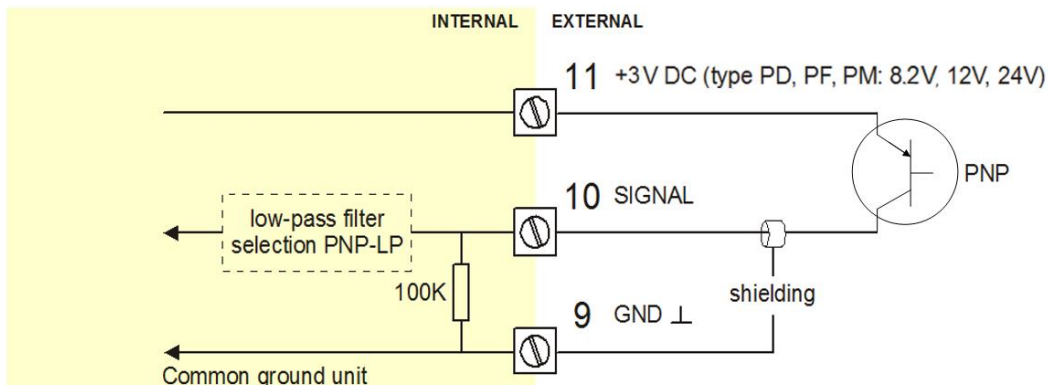


Fig. 23: Terminal connections - PNP signal input (typical)

Active signal 8.2V, 12V and 24V:

If a sensor gives an active signal (read chapter 3). The detection levels are 50% of the selected supply voltage; approx. 4V (8-1 DC) or 6V (12 DC) or 12V (24 DC). Active signal selection may well be desired in case of power supply type PD, PF, PM is available for sensor supply.

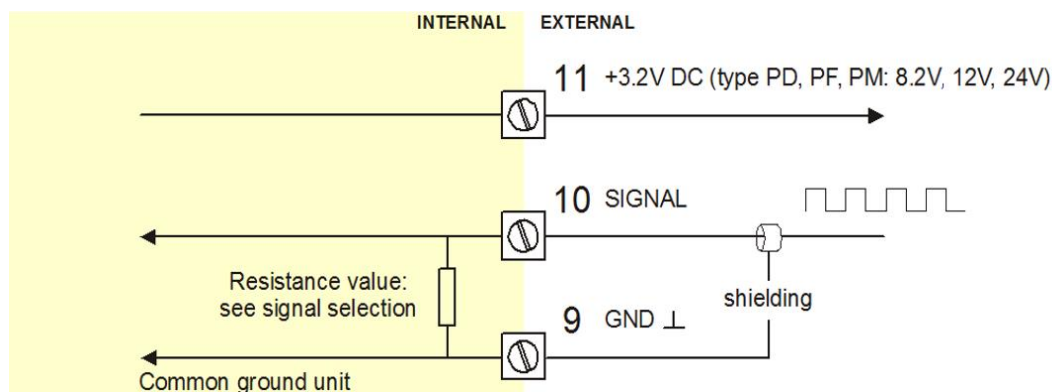


Fig. 24: Terminal connections - Active signal input (typical)

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 chapter 3).

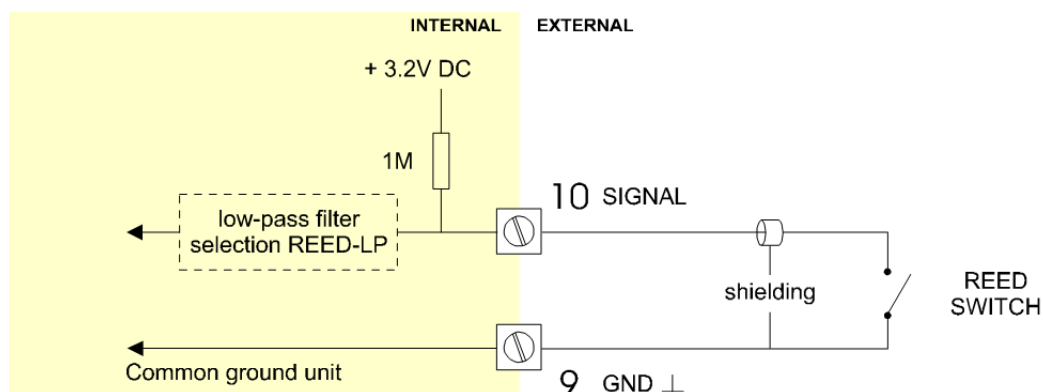


Fig. 25: Terminal connections - Reed-switch signal input (typical)

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 with power supply type PD, PF, PM.

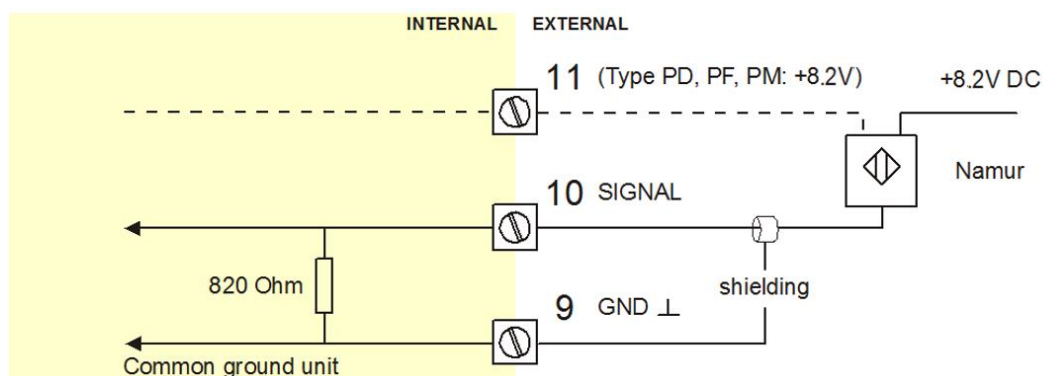


Fig. 26: Terminal connections - NAMUR signal input (typical)

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.

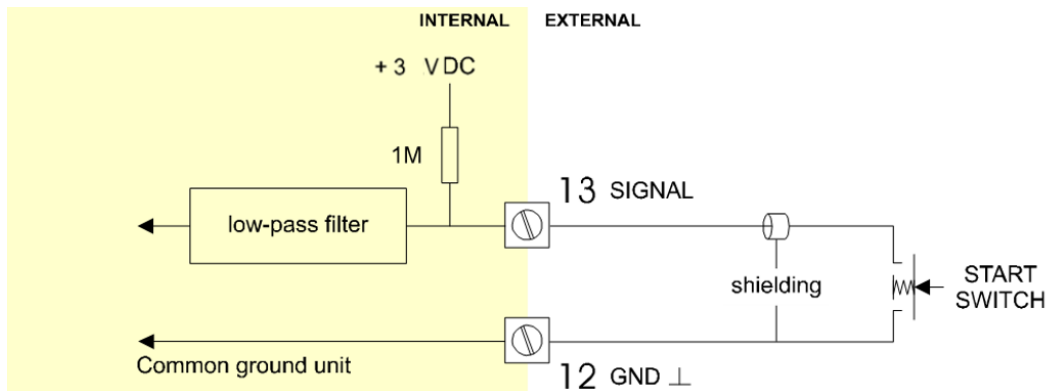


Fig. 27: Terminal connections - External start (typical)

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.

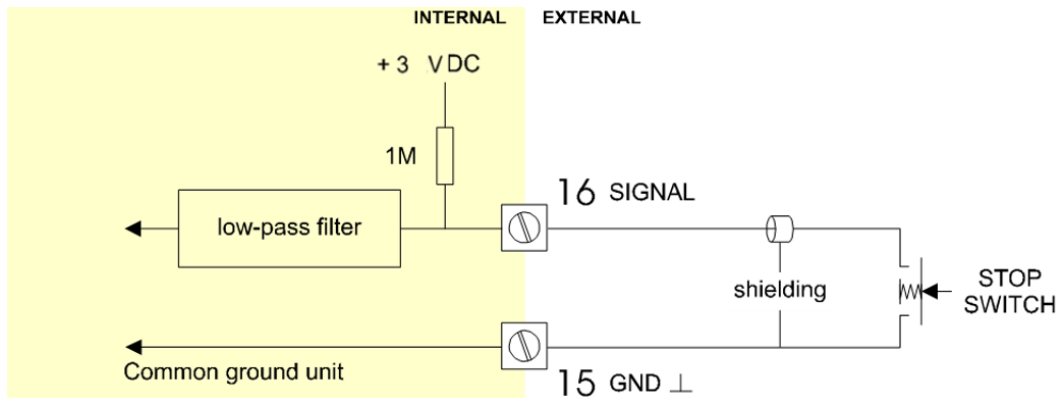


Fig. 28: Terminal connections - External stop (typical)

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.

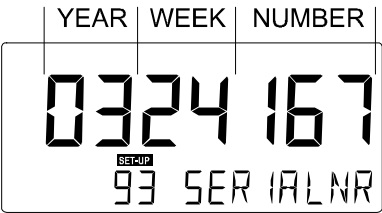


Fig. 29: Example serial number (typical)

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

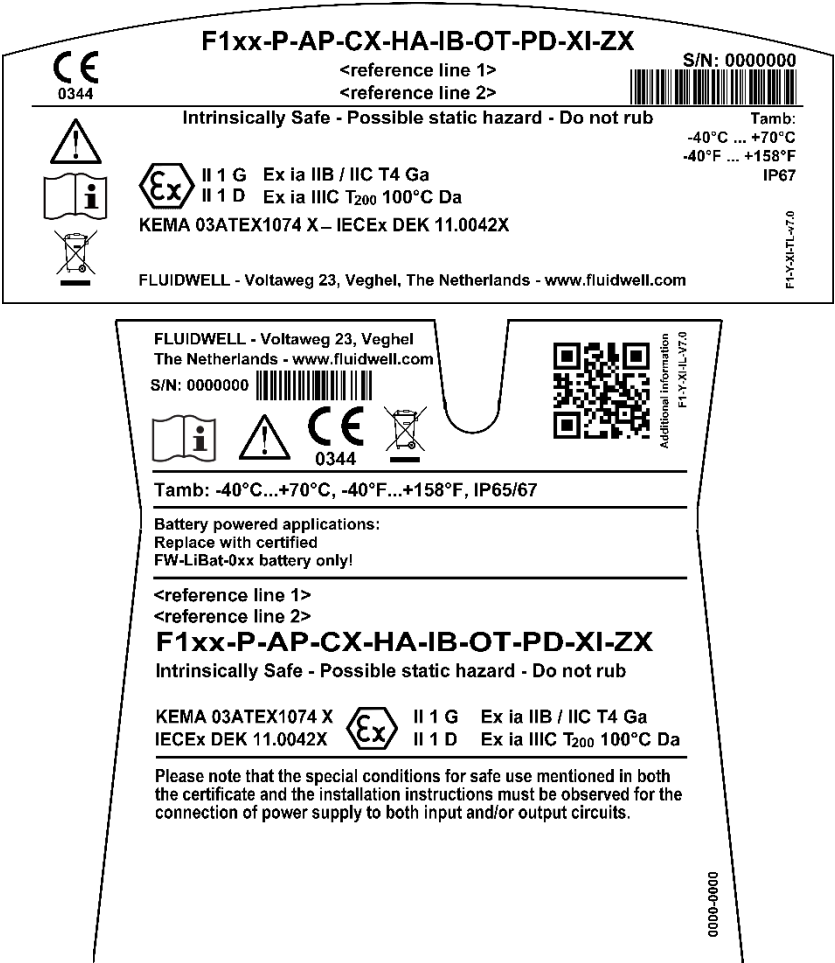


Fig. 30: Label information - Intrinsically safe application (typical)

5.2. TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS



Note !

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

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

The indicator is either supplied by

- the internal supply (option -PC);
- the external supply connected to terminals 0 and 1 (option -PD);
- 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:

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

	Power supply			2-stage/Pulse Output 2		Batch Output 1		Analog Output		Sensor A Input		Sensor A Supply	External Start		External Stop			
	00	01	02	03	04	05	06	07	08	09	10	11	12	13		15	16	
PD ==	-	+										+↓						
PX ==	-	+										+↓						
P																		
OT				⊥		⊥					⊥			⊥	Start↑		⊥	Stop↑
AF; AP								I-	I+									



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



PX Sensor supply A (11) by software setting (Coil; Reed) 1.2; 3V

PD Sensor supply A (11) by switch 1, 2, 3 and 4 8.2 ---



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

	Printer (DTR = 12V DC)					
						
CT	⊥	+ DTR	RxD↑	TxD↓		

FW-F131-000002-001-EN

Fig. 31: 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 flow rate is available with this option. When the output is disabled, a 3.5mA signal will be generated. Max. driving capacity 1000 Ohm @ 30V DC.

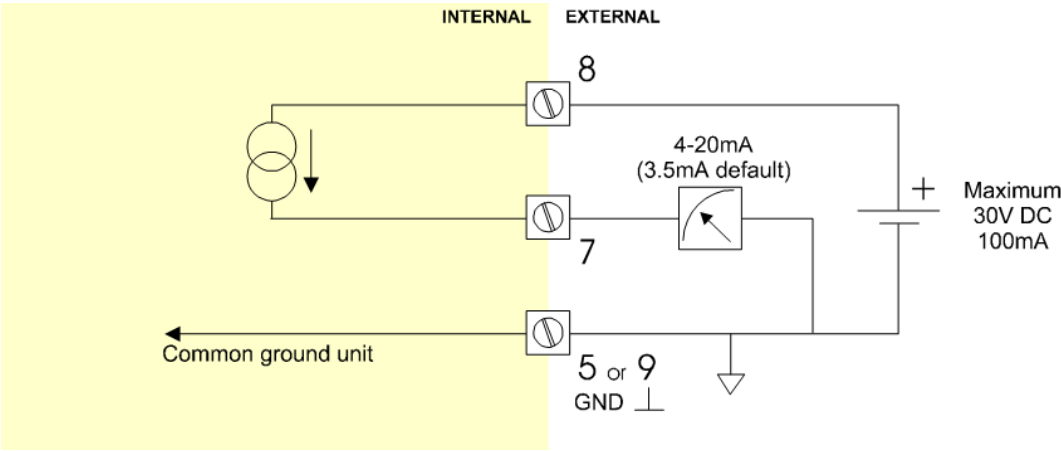


Fig. 32: Terminal connections - Intrinsically safe floating 4-20mA analog output (typical)

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 only applicable for low power sensors (Coil, Reed). The sensor supply is set by the firmware: 1.2V DC or 3V DC. 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 F131-P safe. If applicable, mind the battery power.
2. Open the F131-P 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 F131-P.



Risk of electrocution - High voltage!

Make sure, all the leads to the terminals are disconnected from the F131-P and NEVER connect the mains power supply to the unit when the protection cover has been removed!

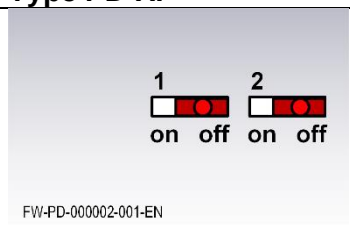
Type PD-XI		Power supply in: 16-30V DC / max. 0.75W			
 Switch location (typical)		Sensor		Sensor supply out	
		A			
		1	2		
		off	-		Coil 1.2V DC; <1mA Reed 3V DC; <1mA
		on	-		8.2V DC; 7mA (max)

Fig. 33: Switch position voltage selection option PD-XI

5.3 CONFIGURATION EXAMPLES

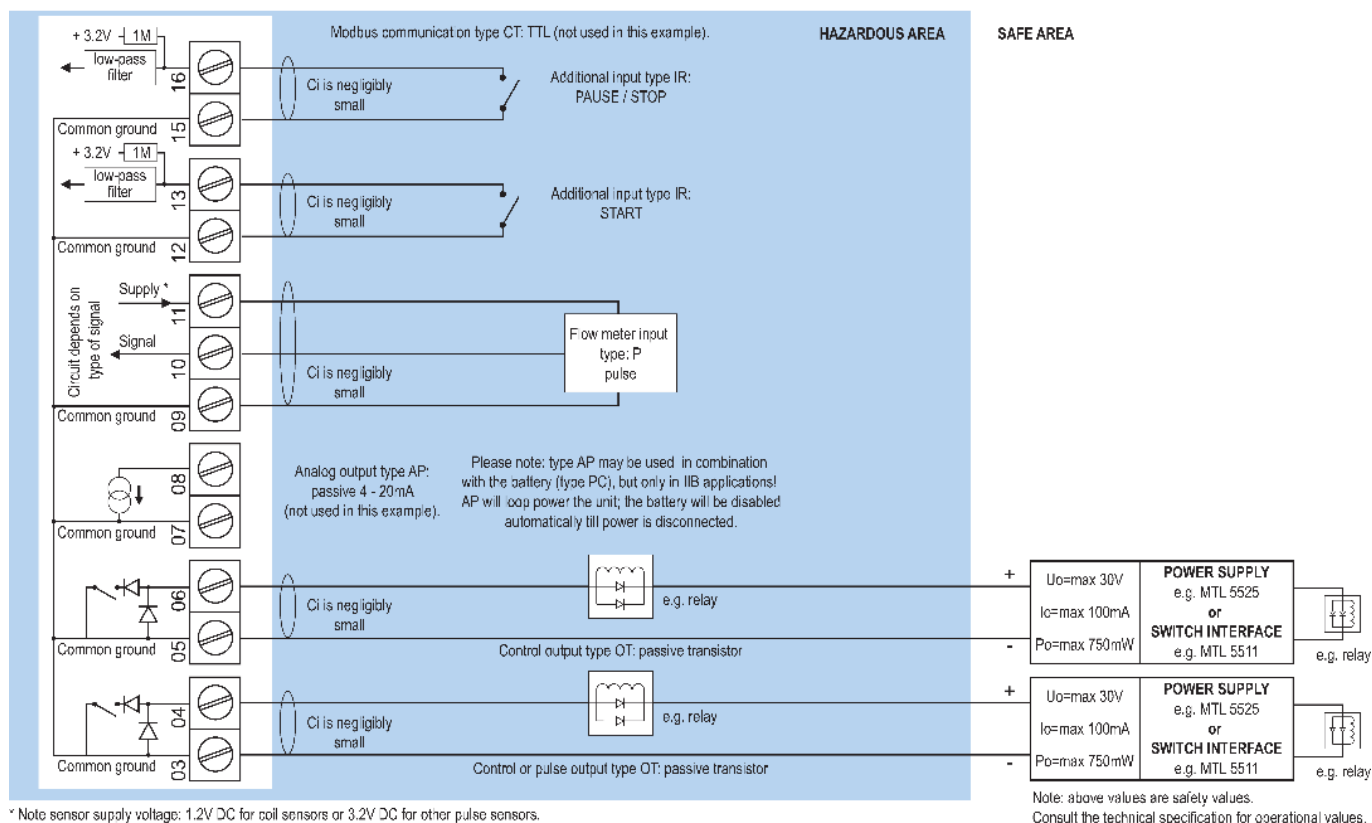
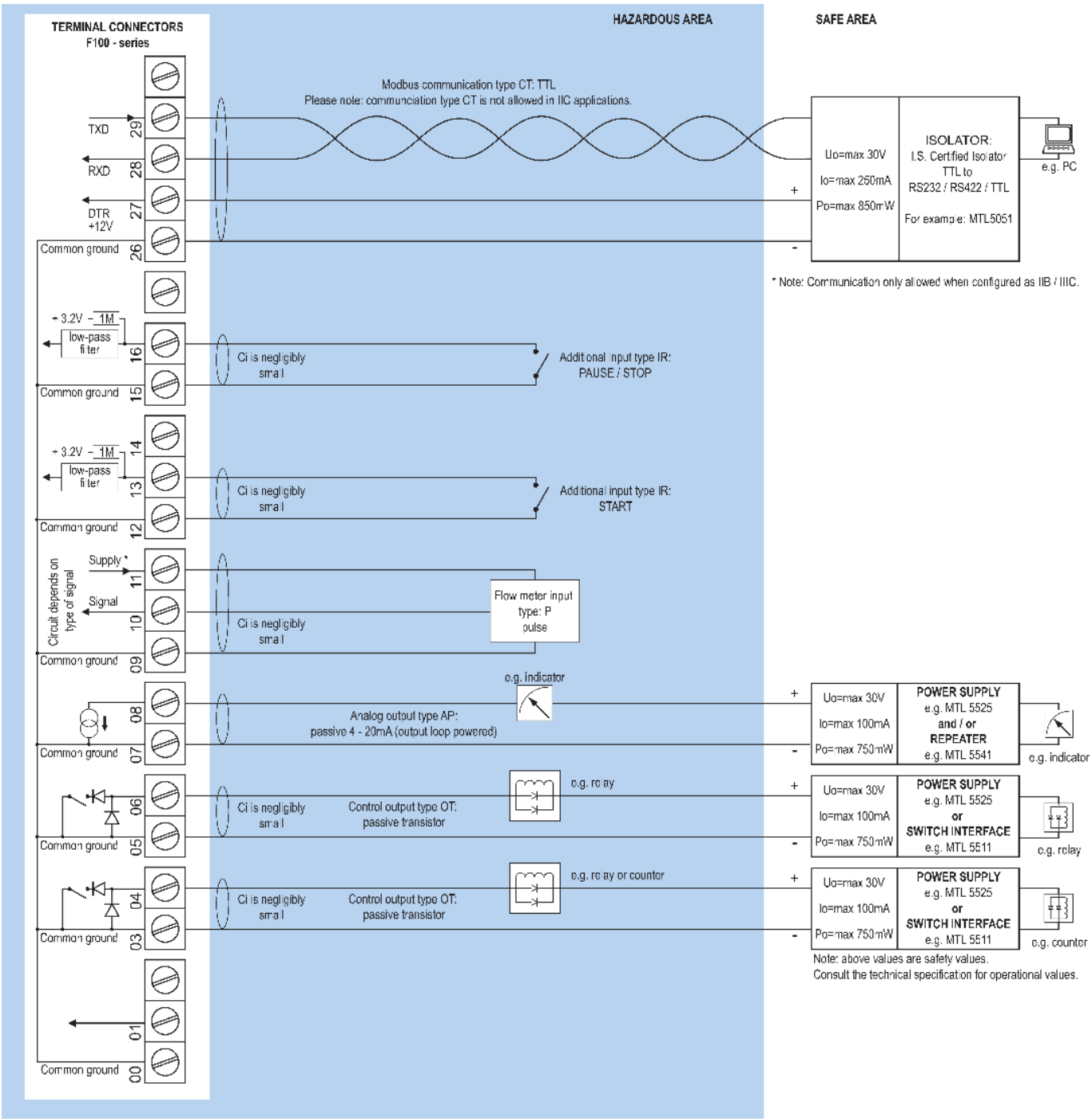


Fig. 34: F131-P-(AP)-(CT)-OT-PC-(PX)-XI - Battery powered - IIB/IIC – IIIC



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

Fig. 35: F131-P-AP-(CT)-OT-(PX)-XI - Output loop powered - IIB/IIC - IIIC

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.

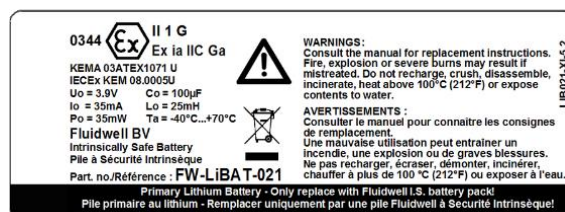
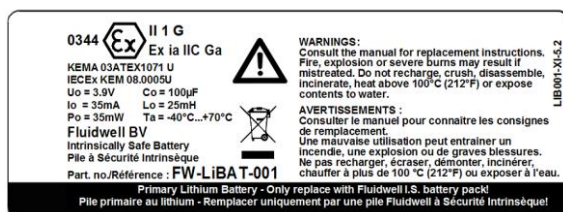


Caution !

5.4.2. REPLACE THE BATTERY

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 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, 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 :

- Type of sensor (read chapter 3): NPN and PNP inputs consume more energy than coil inputs;
- Input frequency: the higher the frequency, 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;
- 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 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.

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 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") – 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 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 + 10%. / 8-30V DC Power consumption max. 10 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	8-30V DC. Power consumption max. 0.5 Watt.
Type PD-XI / PX-XI	16-30V DC; Power consumption max. 0.75 Watt.
Type PX-ZB	12-30V DC. Power consumption max. 1 Watt.
Note PF / PM	The total consumption of the sensors', backlight and outputs may not exceed 400mA@24V.
Note I.S. applications	For intrinsically safe applications, consult the safety values in the certificate.

Sensor excitation	
Type PB / PC / PX	3V DC for low power pulse signals and 1.2V DC for coil pick-up.
Type PD	1.2; 3; 8.2; 12; 24V DC - max. 50mA@24V DC
Type PD-XI	Intrinsically safe: Pulse signals: 1.2; 3; 8.2 - max. 7mA@8.2V DC.
Type PF / PM	1.2; 3; 8.2; 12; 24V DC - max. 400mA@24V DC.

Terminal connections	
Type	Removable plug-in terminal strip. Wire max. 1.5m m ² and 2.5m m ²

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

Hazardous area (optional)	
Intrinsically safe Type XI	ATEX approval :  II 1 G Ex ia IIB/IIC T4 Ga II 1 D Ex ia IIIC 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	
Flowmeter	
Type P	nnp; npn-lp; reed; reed-lp; pnp; pnp-lp; namur; coil-hi; coil-lo; 8-1 DC; 12 DC; 24 DC
Frequency	Minimum 0 Hz - maximum 7 kHz for total and flow rate. 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 - 9999999 with variable decimal position.
Low-pass filter	nnp-lp; reed-lp; pnp-lp

OUTPUTS	
Analog output	
Type	4-20mA - passive output - not isolated.
Resolution	10-bit.
Accuracy	10 bit. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm
Function	transmitting flow rate.
Type AA	Active 4-20mA output (requires option PD or PM).
Type AB	Active 0-20mA output (requires option PD or PM).
Type AF	Passive floating 4-20mA output for Intrinsically safe applications (requires PC or PD).
Type AI	Passive galvanic isolated output (requires PB, PD, PF, PL or PM).
Type AU	Active 0-10V output (requires option PD or PM).

Transistor outputs	
Function	User defined: batch process two stage control or scaled pulse output acc. batch or acc. total.
Pulse output	Max. frequency 500Hz. Pulse length user definable between 0.001 up to 9.999 seconds.
Type OA	Two active 24V DC transistor outputs; max. 50mA per output (requires type PD, PF or PM).
Type OR	Two mechanic relay outputs; max. switch power 230V AC - 0,5A (requires type PF or PM).
Type OT	Two passive transistor outputs - not isolated. Load max. 50V DC - 300mA.

Communication option	
Protocol	bus-rtu; bus-asc
Speed	1200; 2400; 4800; 9600
Address	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	
Functions	- enter a preset value, - start / interrupt and stop the batch process, - total can be reset to zero.
Shown information	- preset value and / or flow rate, - running batch total or remaining quantity, - total and accumulated total.
Preset / Total	
Digits	7 digits.
Units	L; m ³ ; GAL; USGAL; kg; lb; bbl; no unit.
Decimals	0000000; 111111.1; 22222.22; 3333.333
Note	total can be reset to zero.
Accumulated total	
Digits	11 digits.
Units / decimals	according to selection for total.
Flow rate	
Digits	7 digits.
Units	L; m ³ ; mg; g; kg; ton; GAL; bbl; lb; cf; rev; - - - (no unit); scf; N m ³ ; NI; P; mL
Decimals	0000000; 111111.1; 22222.22; 3333.333
Time units	/sec; /min; /hour; /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;
- Pulse amplitude;
- Flowmeter, wiring and connection of terminal connectors;
- Power supply of flowmeter.

Flowmeter generates "too many pulses":

Check:

- Settings for total and Flow rate;
- Type of signal selected with actual signal generated;
- Sensitivity of coil input;
- Proper grounding of the F131-P;
- Use screened wire for flowmeter signals and connect screen to terminal 9. (unless connected at sensor).

Analog output does not function properly:

Check:

- is the analog output enabled?
- are the flow-levels programmed correctly?
- connection of the external power-supply according to the specification.

Pulse output does not function:

Check:

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

Flow rate displays "0 / zero" while there is flow (total is counting):

Check:

- are the K-Factor and time unit correct?
- The unit has to count the number of pulses according to setup 26 within the time according to setup 27. Make sure, setup 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 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.

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!

Refer to the illustration:

For this example it is assumed that the variable accumulated total has 3 registers (words) with address 566, 567 and 568. When a transmission is done, register 566, which acts as the MSW, arrives first with bit 15 which is the MSB of the lowest addressed word, but is also the MSB (bit 47) of the complete variable that represents the Accumulated total.

Although most Modbus Masters will support variables that span 2 registers, variables spanning more registers sometimes require you to manually calculate the resulting value.

ACCUMULATED TOTAL																																															
MSW															LSW																																
REGISTER 566															REGISTER 567															REGISTER 568																	
[d] 00001															[d] 45236															[d] 34756																	
[h] 0001															[h] b0b4															[h] 87c4																	
15															0	15														0	15															0	
MSB																																															
47															32	31														16	15																

MSB																																LSB																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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FW-F000-000032-002-ENL

ACCUMULATED TOTAL: [register 566 * 4294967296] + [register 567 * 65536] + [register 568 * 1] =
[d] ACCUMULATED TOTAL: [00001 * 4294967296] + [45236 * 65536] + [34756 * 1] = 7259588540
[h] ACCUMULATED TOTAL: 0x[0001] [b0b4] [87c4] = 1B0B487BC

For additional information regarding using your Fluidwell Modbus device, please read the ‘Fluidwell General Modbus Communication Protocol’ and ‘Modbus troubleshooting guide’ that are available through our website or your distributor.

Runtime variables

PDU ADDRESS	REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 572d [h] 0x23C	40573	flow rate	2	R	uint32	0...9999999, Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 566d [h] 0x236	40567	total	3	R*	uint48	0...9999999999, Representation: unit, decimals depending on variables 32, 33
[d] 560d [h] 0x230	40561	accumulated total	3	R	uint48	0...99999999999999, Representation: unit, decimals depending on variables 32, 33
[d] 208 [h] 0x0d0	40209	batch total	3	R	uint48	0...9999999999, Representation: unit, decimals depending on variables 32, 33
[d] 200 [h] 0x0C8	40201	preset	2	R/ W	uint32	0...9999999999, Representation: unit, decimals depending on variables 32, 33
[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] 3 = error 1 + error 2 simultaneously [d] 4 =: initialization error

Reading flow rate, total or accumulated total: 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 is limited in the number of digits and may have a slower update rate set.

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 (note that the decimals should be adapted according the setting in "total decimals" which is in this case 2).

* **Clearing total:** It is possible to clear the total counter by means of writing a value of 0 to all the 3 registers of total/flow rate in a single write action. Writing any other value will result in the reply of an error message because the registers of total/flow rate are during operation read-only.

Setup variables

PDU ADDRESS	REGISTER	VARIABLE PRESET	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 32 [h] 0x020	40033	unit	1	r/w	uint16	0=none 3=kg 6= USGAL 1=L 4= lb 7=bbbl 2= m ³ 5=GAL
[d] 33 [h] 0x021	40034	decimals	1	r/w	uint16	0...3
[d] 34 [h] 0x022	40035	K-factor	2	r/w	uint32	1...9999999 Representation: 0.000010...9999999 depending on variable 34: K-factor decimals.
[d] 37 [h] 0x025	40038	K-factor decimals	1	r/w	uint16	0...6
[d] 6 [h] 0x006	40007	batch minimum	2	r/w	uint32	0-9999999 Representation: 0000000...9999999 depending on variable 33: decimals.
[d] 10 [h] 0x00a	40011	batch maximum	2	r/w	uint32	0-9999999 Representation: 0000000...9999999 depending on variable 33: decimals.

PDU ADDRESS	REGISTER	VARIABLE FLOW RATE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 48 [h] 0x030	40049	unit	1	r/w	uint16	0=mL 4=g 8=bbbl 12=none 1=L 5=kg 9=lb 13=scf 2= m ³ 6=ton 10=cf 14=NM ³ 3=mg 7=GAL 11=rev 15=NL 16=p
[d] 49 [h] 0x031	40050	time unit	1	r/w	uint16	0=sec 2=hour 3=day 1=min
[d] 50 [h] 0x032	40051	decimals	1	r/w	uint16	0...3
[d] 51 [h] 0x033	40052	K-factor	2	r/w	uint32	1...9999999 Representation: 0.000010...9999999 depending on variable 54: K-factor decimals.
[d] 54 [h] 0x036	40055	K-factor decimals	1	r/w	uint16	0...6
[d] 55 [h] 0x037	40056	Calculation	1	r/w	uint16	1...255 pulses

[d] 56 [h] 0x038	40057	Cut-Off	1	r/w	uint16	0.1 – 999.9 seconds, steps of 100ms
PDU ADDRESS	REGISTER	VARIABLE OVERRUN	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 194 [h] 0x0C2	40195	overrun	1	r/w	uint16	0=disable 1=enable
[d] 192 [h] 0x0C0	40193	time	2	r/w	uint32	0.1 – 999.9
PDU ADDRESS	REGISTER	VARIABLE ALARM	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 64 [h] 0x040	40065	no flow	1	r/w	uint16	0=disable 1=enable
[d] 67 [h] 0x043	40068	time	1	r/w	uint16	0.1 – 999.9
PDU ADDRESS	REGISTER	VARIABLE DISPLAY	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 195 [h] 0x0C3	40196	display	1	r/w	uint16	0=increase 1=decrease
[d] 64 [h] 0x040	40065	flow rate	1	r/w	uint16	0=off 1=batch 2=toggle
[d] 67 [h] 0x043	40068	backlight brightness	1	r/w	uint16	0=off 1=20% 2=40% 3=60% 4=80% 5=100%
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 1=1sec 2=3sec 3=15sec 4=30sec 5=off
[d] 81 [h] 0x051	40082	power mode	1	r/w	uint16	0=operational 1=shelf
PDU ADDRESS	REGISTER	VARIABLE FLOWMETER	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 96 [h] 0x060	40097	flowmeter signal	1	r/w	uint16	0=NPN 1=NPN LP 2=Reed 3=Reed LP 4=PNP 5=PNP LP 6=NAMUR 7=coil hi 8= coil lo 9=act 8.1V 10= act 12 V 11=act 24V
PDU ADDRESS	REGISTER	VARIABLE ANALOG	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 112 [h] 0x070	40113	analog output	1	r/w	uint16	0=disable 1=enable
[d] 113 [h] 0x071	40114	minimum rate	2	r/w	uint32	0...9999999, Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 116 [h] 0x074	40117	maximum rate	2	r/w	uint32	0...9999999, Representation: unit, time, decimals depending on variables 48, 49, 50
[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
[d] 196 [h] 0x0C4	40197	relays	1	r/w	uint16	0=1 step 1=2 step
[d] 197 [h] 0x0C5	40198	preclose	2	r/w	uint32	0000.000...9999999 depending on variable 33: decimals.
[d] 128 [h] 0x080	40129	pulse width	1	r/w	uint16	0.000 – 9.999 seconds (0=off)
[d] 133 [h] 0x085	40134	pulse decimals	1	r/w	uint16	0...3
[d] 130 [h] 0x082	40131	amount	2	r/w	uint32	0.001– 9999999 depending on variable 133: pulse decimals.

[d] 134 [h] 0x086	40135	pulse for	1	r/w	uint16	0=total 1=batch
PDU ADDRESS	REGISTER	VARIABLE COMMUNICATION	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 144 [h] 0x090	40145	speed (Baudrate)	1	r/w	uint16	0=1200 1=2400 2=4800 3=9600
[d] 145 [h] 0x091	40146	Modbus address	1	r/w	uint16	1...247
[d] 146 [h] 0x092	40147	Modbus mode	1	r/w	uint16	0=off 1=RTU 2=ASCII
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 number	2	r	uint32	0...9999999 Representation: nnnnnnn
[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

Process variables

PDU ADDRESS	REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 223 [h] 0x0DF	40224	batch mode	1	r	uint16	Bitfiel[d] 0=idle 1=running Bitfiel[d] 2=paused 4=finished Bitfiel[d] 8=in overrun
[d] 154 [h] 0x09A	40155	batch keylock	2	r/w	uint32	0.0...999.9 seconds
[d] 156 [h] 0x09C	40157	batch keylock mask (keys are not detected)	1	r	uint16	Bitfiel[d] prog=0x001 Bitfield start=0x002 Bitfield stop=0x003
[d] 157 [h] 0x09D	40158	batch command	1	r	uint16	1=start 2=pause 3=stop 4=release 5=reset Read out returns last executed command entered through communication. Before a new batch can be initiated through communication, the release command must be send. This way, when combined with the keylock, overwriting of batch information (total/preset) data can be prevented.
[d] 200 [h] 0x0C8	40201	preset quantity	2	r/w	uint32	0...9999999 depending on variable 33: decimals.

APPENDIX D. DECLARATION OF CONFORMITY



Count on us.

EU Declaration of Conformity

Fluidwell F1-series indicators

Veghel, January 2019

We, Fluidwell BV, declare under our sole responsibility that the F1-series indicators are designed and will operate conform the following applicable European Directives and Harmonised Standards, when installed and operated according to the related manual:

EMC Directive	2014/30/EU	EN61000-6-2:2016; EN61000-6-3: 2007 /A1:2011; EN61326-1:2013
RoHS Directive	2011/65/EU	EN 50581:2012
Low Voltage Directive	2014/35/EU	
	For options –PM or –OR:	EN61010-1:2010
ATEX Directive	2014/34/EU	EN60079-0:2018
	For option -XI, intrinsically safe:	EN60079-11:2012
	Protective system:	Ex II 1 G Ex ia IIB/IIC T4 Ga Ex II 1 D Ex ia IIIC T₂₀₀ 100 °C Da
Certification	For Groups II & III, surface installation Notified body 0344:	KEMA 03ATEX1074 X, Issue 6 DEKRA Certification BV, Meander 1051, 6825 MJ, Arnhem, the Netherlands.

Last two digits of the year in which the CE marking was affixed: 03.

Fluidwell BV

I. Meij, Manager Technology

Fluidwell BV are ISO9001 certified by DEKRA Certification BV, Meander 1051, 6825 MJ, Arnhem, The Netherlands.

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All agreements, sales and deliveries are in accordance with our General Terms and Conditions which are available on our website or upon request. Any other conditions are herewith explicitly rejected by us.

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NOTES

[illegible]

NOTES

[illegible]

List of configuration settings

SETTING		DEFAULT	DATE :	DATE :
1	PRESET	Enter your settings here		
11	unit	L		
12	decimals	0000000		
13	k-factor:	0000001		
14	decimals k-factor	0		
15	batch min	0		
16	batch max	0		
2	FLOW RATE			
21	unit	L		
22	time	/min		
23	decimals	0000000		
24	k-factor	0000001		
25	decimals k-factor	0		
26	calculation	010		
27	cut-off	30.0 sec.		
3	OVERRUN			
31	overrun	disable		
32	time	1.0		
4	ALARM			
41	no flow	disable		
42	time	10		
5	DISPLAY			
51	display	increase		
52	flow rate	off		
53	light	100%		
6	POWER MANAGEMENT			
61	LCD new	1 sec.		
62	battery mode	operational		
7	FLOWMETER			
71	signal	coil-lo		
8	ANALOG			
81	output	disable		
82	rate-min	0000000		
83	rate-max	9999999		
84	cut-off	0.0%		
85	tune-min	0208		
86	tune-max	6656		
87	filter	00 (off)		
9	RELAYS			
91	relays	1-step		
92	preclose	0		
93	width	0		
94	decimals	0		
95	amount	1000		
96	pulse	total		
A	COMMUNICATION			
A1	speed	9600		
A2	address	1		
A3	mode	BUS-RTU		
B	OTHERS			
B1	model	F131-P		
B2	software version			
B3	serial nr.			
B4	password	0000		

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