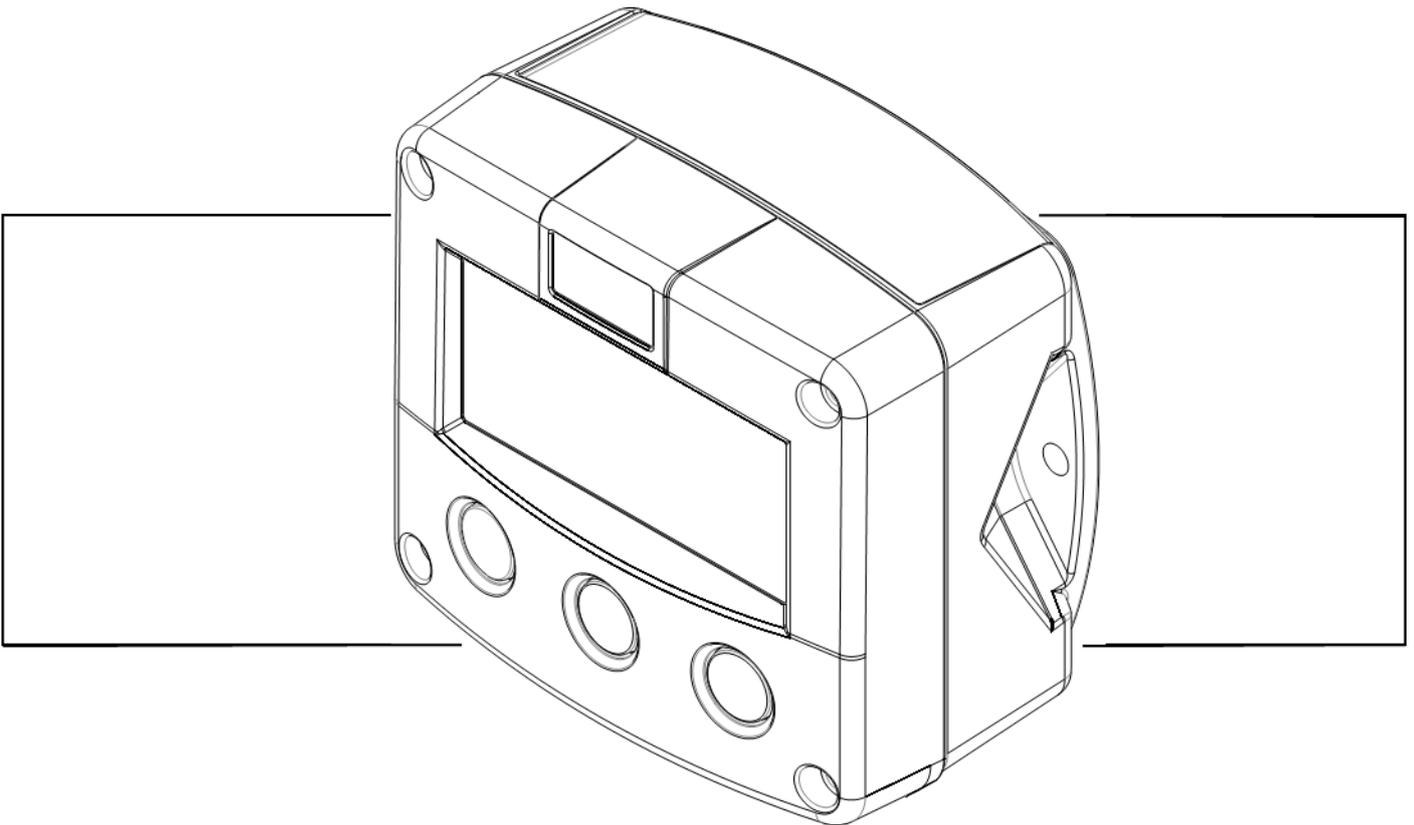


# **F103 WP**

**WEATHERPROOF FLOW TOTALIZER / FLOW LOGGER**  
*with linearization, analog and pulse outputs*



***Signal input flowmeter: pulse, isolated active pulse and coil.***

***Signal outputs: analog 4-20mA reflecting flow rate, pulse retransmission and scaled pulse reflecting total.***

***Hazardous area: Class I, Division 2, Groups A-D, T5***

***Options: Datalogging (Flow Logger), Modbus communication, external reset and backlight.***



## SAFETY INSTRUCTIONS



- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- **LIFE SUPPORT APPLICATIONS:** The F103-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).
- Connect a proper grounding to the metal enclosure as indicated in the F103-P manual. The Protective Earth (PE) wire may never be disconnected or removed.

## 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 procedures as described in this manual are not followed.
- Modifications of the F103-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 F103-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, he must inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

## ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

- The daily use of the F103-P is described in chapter 2 "Operational". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

This operation manual describes the standard F103-P as well as most of the options available. For additional information, please contact your supplier.

**A hazardous situation may occur if the F103-P is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:**



A "**warning !**" indicates actions or procedures which, if not performed correctly, may lead to personal injury, a safety hazard or damage of the F103-P or connected instruments.



A "**caution !**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F103-P or connected instruments



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

## WARRANTY AND TECHNICAL SUPPORT

For warranty and technical support for your products, please contact your supplier.

## MODEL REFERENCE

The **F103 WP** is currently available in two main models: a *Weatherproof Flow Totalizer* and a *Weatherproof Flow Logger*. These main models are reflected in the configuration code of the F103 as shown in the table below. Besides the default configuration, several more types and options are available which are explained in more detail throughout this manual.

Model	Default configuration
F103 WP Weatherproof Flow Totalizer	F103-P-AH-CH-HGL-IB-IG-OG-PB-PX-XN-ZX
F103 WP Weatherproof Flow Logger	F103-P-AH-CH-HGL-IB-IG-OG-PB-PX-XN-ZL

This manual describes all F103-P-XN models: suitable for use in Class I, Div. 2, Groups A-D, T5.

Hardware version : 03.02.xx / 03.51.xx  
 Software version : 03.07.xx  
 Manual : TU-F103-P-XN-M\_v2002\_04\_EN.docx  
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# 1 INTRODUCTION

## 1.1 SYSTEM DESCRIPTION OF THE F103-P

### Functions and features

The flow rate / totalizer, model F103-P is a microprocessor driven instrument designed to linearize the flowmeters flow curve and to show the flow rate, the 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).
- Non-Incendive for use in Class I, Division 2 for use in hazardous applications (type XN) in Canada and the US.
- Several mounting possibilities with aluminum, stainless steel or plastic enclosures for harsh industrial surroundings.
- Ability to process all types of flowmeter signals.
- Transmitting possibilities with analog / pulse and communication outputs.

### Flowmeter input

This manual describes the F103-P with a pulse type input from the flowmeter “-P version”.

One flowmeter with a passive or active pulse or coil signal output can be connected to the F103-P. To power the sensor, several options are available.

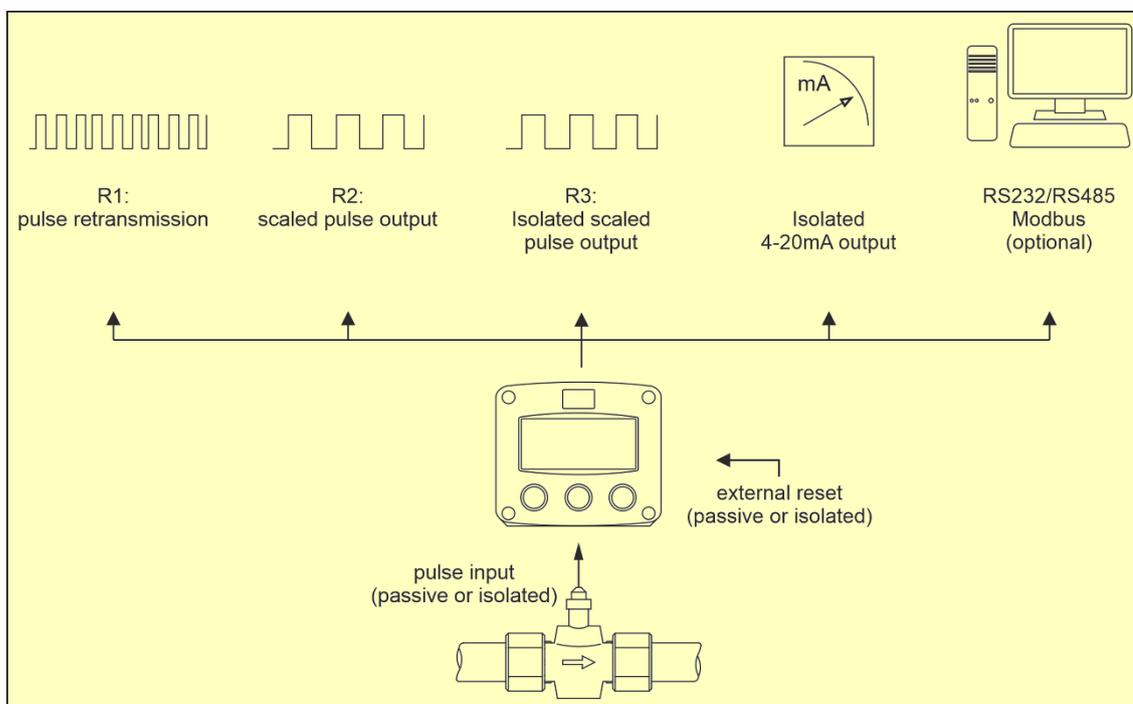


Fig. 1: Typical application for the F103-P

### Standard outputs

- Configurable pulse output to transmit pulses representing a certain linearized total quantity. The pulse length can be set as desired with a maximum frequency of 500Hz.
- Unscaled frequency output for retransmission of the incoming pulses as robust square wave forms.
- Configurable linear 4-20mA isolated analog output with 12-bits resolution representing the actual linearized flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.

### Configuration

The F103-P has been designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F103-P according to your specific requirements. It includes several important features, such as K-Factor, measurement units, signal selection etc. All settings are stored in an EEPROM memory and will not be lost in the event of a power failure or a drained battery.

To extend the battery-life time, please use of the power-management functions as described in chapter 3.

### Display information

The F103-P has a large LCD with all kinds of symbols and digits to display measurement units, status information, trend-indication and key-word 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.

### Backlight

A backlight is available as an option (Type -ZB). The intensity can be set as desired.



Note !

*To use the backlight, the unit must be powered externally.  
With battery power or loop power the backlight will not work.*

### Options

The following options are available: full Modbus communication via RS485 (also battery powered), powerful data logging, certification to Class I – Division 2, isolated inputs and outputs, wall-mount and weather-proof enclosures and LED backlight.

## 2 OPERATIONAL

### 2.1 GENERAL INFORMATION

This chapter describes the daily use of the F103-P. This instruction is meant for users / operators.



Caution !

- The F103-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Take careful notice of the “Safety rules, instructions and precautionary measures” in the front of this manual.

### 2.2 CONTROL PANEL

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



Fig. 2: Control panel

#### Functions of the keys



#### PROG-key

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



#### SELECT-key

This key is used to SELECT the displayed information, like accumulated total and flowrate.



#### CLEAR-key

This key is used to CLEAR the value of total.  
The CLEAR-key also provides access to historical day totals (or optional data logging).

### 2.3 OPERATOR INFORMATION AND FUNCTIONS

By default, the F103-P will act at Operator level. The information displayed is dependent upon the SETUP-settings. Signals generated by the connected flowmeter are measured by the F103-P in the background. The display values are however updated depending on the selected refresh rate. After pressing a key, the display will be refreshed 8 times per second, after 30 seconds it will return to the selected setting.



Fig. 3: Example of display information during process

For the Operator, the following functions are available:

#### Display process values

On the main screen, the primary process values of the F103-P are shown. By default, Total is shown on the upper-line of the display and Flowrate on the bottom line.

In the configuration settings for Display, this can be changed to show only Flowrate on the large 12mm digits or to show Total and Accumulated Total simultaneously. When Flowrate is shown, the

arrows ▲ ▼ indicate the trend (increase or decrease) of the flowrate.

By pressing the SELECT-key, the operator can scroll through the screens showing the various process values. After 30 seconds of inactivity, the display will automatically return to the main screen.

The following table shows the available information:

Display information	SETUP-item FUNCTION		
	Total	Flowrate	Acc. Total
MAIN SCREEN	Total * Flowrate	Flowrate	Total * Acc. Total
SCREEN 1	Total * Acc. Total	Total * Acc. Total	Total * Flowrate
SCREEN 2 **	Current day total	Current day total	Current day total
SCREEN 3 **	Previous day total	Previous day total	Previous day total

\* When total is shown on the display, it can be cleared by pressing the CLEAR-key twice.

\*\* Available when daily totals are enabled in SETUP-menu Display.

### Clear total

The value for Total can be cleared and reset to zero. This action does not influence the value of Accumulated Total or Current Day Total.

To clear Total, press the CLEAR-key when Total is shown on the display and the display will show the flashing text "PUSH CLEAR". When the CLEAR-key is pressed a second time, Total is set to zero. To avoid clearing Total at this point, press the PROG- or SELECT-key or wait for 20 seconds.



Note !

- If the 'Total CLEAR password' is set in the configuration settings for Total, the operator is asked to enter the password before the "PUSH CLEAR" text is shown. The correct password needs to be entered before Total can be cleared. (See paragraph 3.2.3.)
- The IB option (external reset) allows clearing of total via an external pushbutton. This clear action operates in parallel with the clear action via the control panel but does not require any extra confirmation or password. When the external connection is permanently closed, Total still counts but the "Clear Total" function via the control panel is disabled.

### Display flowrate

Internally, the flowrate is calculated up to 8 times a second, To obtain a readable value, the flowrate shown on the display is updated once every second. Flowrate is shown, based on the configuration settings for Flowrate, with the configured number of decimals. The configured unit and time unit are indicated on the bottom line of the display.

When "-----" is shown, the flowrate value is too high to be displayed. The arrows ▲ and ▼ indicate the trend (increase or decrease) of the flowrate.

### Display total and accumulated total

A resettable Total and non-resettable Accumulated Total are available. The Total value can count up to 9.999.999 before rolling over to zero; the Accumulated total can count up to 99.999.999.999 before rolling over.

The unit and number of decimals are displayed according to the configuration settings for Total.

### Display current day total and previous day total

Two additional non-resettable totals are available: Current Day Total and Previous Day Total. These totals are shown in the same unit and decimals as set in the configuration settings for Total.

At a specific time of day, the Current Day Total is copied to the Previous Day Total after which the measurement of Current Day Total is restarted (reset to zero). The moment at which this action is performed is called 'contract hour'. The contract hour can be configured in the configuration settings for Total in steps of 1 hour.



Note !

- 'Current Day Total' is often referred to as 'Daily Total'.
- The Current Day Total shows the quantity that is measured since last contract hour, and is a 'running' value.
- The Previous Day Total shows the total quantity that was measured the day before, and is a 'fixed' value.
- Both Current Day Total and Previous Day Total cannot be reset manually.

### Display historical day totals

Besides directly reviewing the Current Day Total and Previous Day Total, a list of the last 15 Previous Day Totals can be reviewed. To enter the list, press the CLEAR-key for 3 seconds. Use the SELECT- and CLEAR-key to scroll up and down through the list of Previous Day Totals. The number that is displayed on the left side of the bottom line indicates the age of the shown Previous Day Total, in days. Note that the entry with age '00' represents the (running) Current Day Total.



**Fig. 4: Example of historical day total from 8 days ago**

To return to the main display information again, press the PROG-key during 3 seconds or wait for 3 minutes.

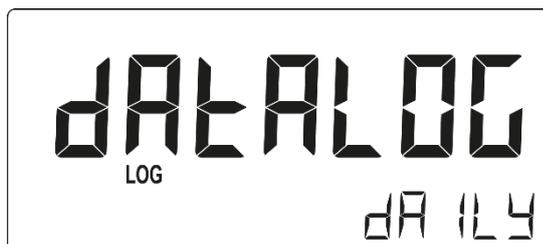


Note !

*When ordered with Type ZL - Datalogging, the historical day totals are not available. Instead, powerful data and event logging functions and logbooks are available.*

### Display data and event log records (with Type ZL)

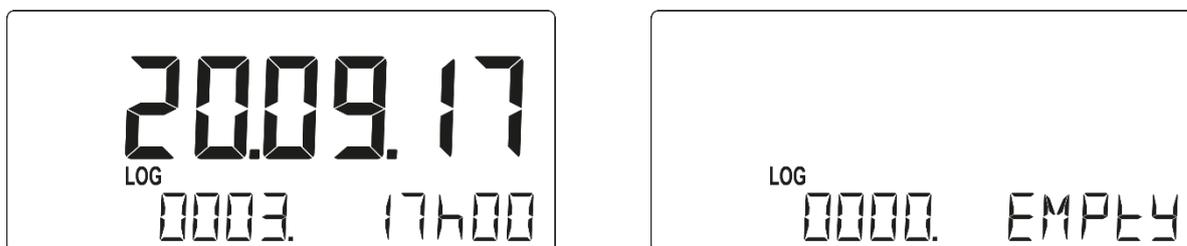
The data log function stores data records based on interval, daily contract hour and events in 3 separate logbooks. To review the records on the display, press the CLEAR-key for 3 seconds to enter the DATALOG menu. Select the required logbook INTERVAL, DAILY or EVENT by using the SELECT- and CLEAR-key and press the PROG-key to enter the selected logbook.



**Fig. 5: Example of logbook selection screen**

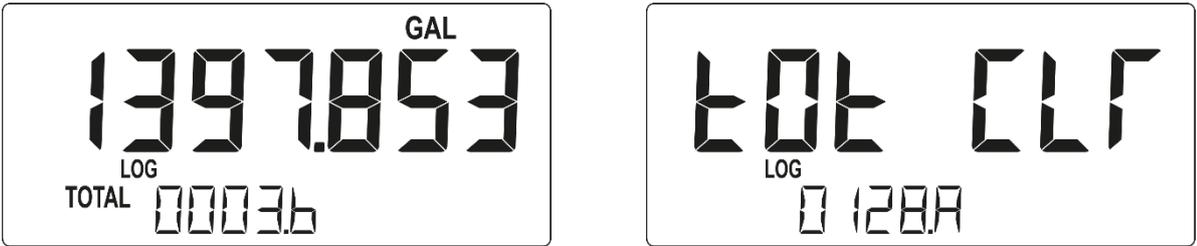
After entering, the record selection list of the logbook is shown (when EMPTY is displayed, the selected logbook does not contain any records) and the SELECT- and CLEAR-key can be used to scroll up and down through the list of records..

Every record has a sequence number (record number), shown below LOG on the bottom left side, accompanied by the date and time the record was created. When the down-arrow is shown on the left side of the display, the start of the list is reached (newest record); when the up-arrow is shown, the end of the list is reached (oldest record).



**Fig. 6: Example of record list with record 0003 selected (l) and empty record list (r).**

When the correct record is selected in the list, press the PROG-key again to review the details of the record. Use the SELECT- and CLEAR-key to scroll through the details, indicated by a letter-suffix behind the record number (e.g. 15.A → 15.B → 15.C → 15.A)).



**Fig. 7: Example of interval record 0003.B: Total (l) and event record 0128.A: Total Clear (r)**

To leave the record details and return to the record selection list, press the PROG-key again. To leave the DATALOG menu completely, press the PROG-key again for 3 seconds and the display will return to OPERATE level.

The following table shows the menu structure behind the DATALOG menu:

<b>INTERVAL</b>	Empty or recorded interval data
----.A	Rate
----.B	Total
----.C	Accumulated total
<b>DAILY</b>	Empty or recorded daily log data
----.A	Rate
----.B	Total
----.C	Accumulated total
<b>EVENTS</b>	Empty or recorded events
----.A	Event name
----.B	(if applicable for the event) Modbus register number
----.C	(if applicable for the event) Old setting of the Modbus register number
----.D	(if applicable for the event) New setting of the Modbus register number

Note: the ---- in the above table represents the sequence number of the record.

**2.4 OPERATOR ALARMS**

**Low-battery alarm (Type PB only)**

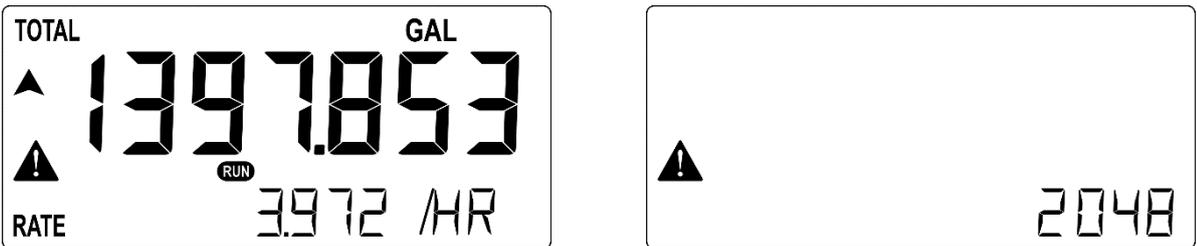
When the unit is supplied by battery, the battery voltage drops during operation. When it becomes too low, the battery indicator comes on to indicate that the battery needs to be replaced. Please install a fresh and new battery (as soon as possible) to keep a reliable operation and indication.



**Fig. 8: Example of low-battery alarm**

**Alarm**

When an internal alarm condition occurs, the alarm-flag is shown on the display. After pressing the SELECT-key several times, the display will show the alarm code:



**Fig. 9: Example of alarm-flag during operation (l) and alarm code display (r)**

Please see Appendix B: Problem solving for an explanation of the available alarm codes.

## 2.5 QUICK SETUP

The Quick Setup allows users to quickly setup the most often used settings of the F103-P without having to go through the entire list of menu's and settings of the Full Setup.

### Entering

The Quick Setup can be reached from operator level by simply pressing the PROG-key.



Note !

*To use the Quick Setup, it must be enabled at SETUP-menu OTHERS: QUICK SETUP. The Quick Setup is enabled by default and can be disabled to prevent unauthorized access.*

### Navigating

When the Quick Setup menu is entered, a welcome screen is shown. From this point, you can navigate to the next menu item by pressing the SELECT-key. Press the CLEAR-key to navigate to the previous menu item or leave the Quick Setup when the welcome screen is shown.



Note !

*When a setting in the Quick Setup menu shows **-OTHER-** or starts showing **NO EDIT** when a programming sequence is started, the current settings made in the Full Setup menu are not compatible with the Quick Setup menu and changing this setting requires more configuration effort. The selected setting should then be changed in the Full Setup menu.*

### Programming

Changing settings in the Quick Setup is done in the same way as changing settings in the Full Setup. The following steps show a summary of this procedure, paragraph 3.2.3 shows the full explanation of the procedure for programming values.

#### Step 1: Starting the programming sequence



**PROG-key**

After selecting the required setting, press this key to start the programming sequence.

#### Step 2: Changing the value or selection



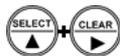
**SELECT-key**

Press this key to select the next item in the list (e.g. Disable → Enable), to increment the selected digit or to select the next position of the decimal point.



**CLEAR-key**

Press this key to select the previous item in the list (e.g. Enable → Disable ) or to select the next digit / decimal point.



**SELECT-key + CLEAR-key**

The combination of the SELECT-key and CLEAR-key is used to select a negative value. When a value can also be entered as a negative number, press the SELECT-key and CLEAR-key simultaneously to toggle the '-' (minus) sign on and off.

#### Step 3: Finishing the programming sequence



**PROG-key**

During the programming sequence, press this key to confirm the new value. To cancel the programming sequence, either press the PROG-key for 3 seconds or wait for 20 seconds: the sequence is cancelled and the former value is reinstated.

### Returning

To leave the Quick Setup menu, return to the welcome screen and press the CLEAR-key. Or, alternatively, press the PROG-key for several seconds anywhere inside the Quick Setup menu and the unit will return to operate level.

### Quick Setup menu

The following table shows the settings that are available in the Quick Setup menu. The numbers shown in the column **SETUP** indicate the corresponding setting in the Full Setup menu and are explained in detail in paragraph 3.3.

Q-MENU	CATEGORY	SETTING	SELECTIONS §	SETUP																												
-	Q-SETUP		Quick Setup menu welcome screen: Press SELECT to enter the menu, press CLEAR to leave.																													
1	FLOWM	SIG	Flowmeter signal type: Coil_Hi – Coil_Lo – Isolated Active Signal	5.1																												
2 #	FLOWM	UNIT	Flowmeter unit (automatic volume unit conversion enabled): CF, Lit, GAL, BBL, M3	5.3																												
3 #	FLOWM	K-F	Flowmeter K-factor (automatic volume unit conversion enabled): 0.000010 – 9999999 pulses / unit	5.4																												
4 #	TOTAL	UNIT	Total unit (automatic volume unit conversion enabled): CF, Lit, GAL, BBL, M3	1.1																												
5 #	TOTAL	FACTOR-X	Total multiplication factor: x1 – x1000	1.4																												
6	TOTAL	DECIMALS	Flowrate number of decimals: 0 – 0.1 – 0.02 – 0.003	1.2																												
7 #	RATE	UNIT	Flowrate unit (automatic volume unit conversion enabled): CF, Lit, GAL, BBL, M3	2.1																												
8	RATE	TIME	Flowrate time base: /sec – /min – /hour – /day	2.2																												
9	RATE	DECIMALS	Flowrate decimals: 0 – 0.1 – 0.02 – 0.003	2.3																												
10	ANA	OUTPUT	Analog output: enable – disable	7.1																												
11	ANA	ZERO	Analog output zero point (4mA) 0000.000 – 9999999 [rate unit / rate time]	7.2																												
12	ANA	SPAN	Analog output span point (20mA): 0000.000 – 9999999 [rate unit / rate time]	7.3																												
13	PULSE	HZ	Scaled pulse output maximum frequency: <table border="1" data-bbox="646 1272 1236 1547"> <thead> <tr> <th>Selection</th> <th>Pulse width</th> <th>Selection</th> <th>Pulse width</th> </tr> </thead> <tbody> <tr> <td>disable</td> <td>0.000 sec</td> <td>62.5 Hz</td> <td>0.008 sec</td> </tr> <tr> <td>0.1 Hz</td> <td>5.000 sec</td> <td>100 Hz</td> <td>0.005 sec</td> </tr> <tr> <td>0.5 Hz</td> <td>1.000 sec</td> <td>125 Hz</td> <td>0.004 sec</td> </tr> <tr> <td>1.0 Hz</td> <td>0.500 sec</td> <td>166 Hz</td> <td>0.003 sec</td> </tr> <tr> <td>10.0 Hz</td> <td>0.050 sec</td> <td>250 Hz</td> <td>0.002 sec</td> </tr> <tr> <td>50.0 Hz</td> <td>0.010 sec</td> <td>500 Hz</td> <td>0.001 sec</td> </tr> </tbody> </table>	Selection	Pulse width	Selection	Pulse width	disable	0.000 sec	62.5 Hz	0.008 sec	0.1 Hz	5.000 sec	100 Hz	0.005 sec	0.5 Hz	1.000 sec	125 Hz	0.004 sec	1.0 Hz	0.500 sec	166 Hz	0.003 sec	10.0 Hz	0.050 sec	250 Hz	0.002 sec	50.0 Hz	0.010 sec	500 Hz	0.001 sec	8.1
Selection	Pulse width	Selection	Pulse width																													
disable	0.000 sec	62.5 Hz	0.008 sec																													
0.1 Hz	5.000 sec	100 Hz	0.005 sec																													
0.5 Hz	1.000 sec	125 Hz	0.004 sec																													
1.0 Hz	0.500 sec	166 Hz	0.003 sec																													
10.0 Hz	0.050 sec	250 Hz	0.002 sec																													
50.0 Hz	0.010 sec	500 Hz	0.001 sec																													
14	PULSE	AMT	Scaled pulse output amount: 0000.000 – 9999999 [total unit / pulse]	8.3																												
15	PULSE	S. S.	Solid state output for scaled pulse output: enable – disable	8.2																												
16	COM.	ADDRESS	Modbus communication address: 001 – 247	9.2																												
17	COM.	SPEED	Modbus communication speed: 1200 – 2400 – 4800 – 9600 – 9600HP – 19200 – 38400 – 57600	9.1																												

*Note §:* When settings have been made in the full setup that are not compatible with certain settings in the quick setup, those settings cannot be changed in the quick setup and the display will show **NO EDIT** when attempting to start a programming sequence. When it is not possible to display the current value of the setting, the display will show **-OTHER-**. To change and review these settings, the full setup should be used.

*Note #:* When automatic unit conversions is disabled in full SETUP-menu 5 – Flowmeter, the following changes are made to the Quick Setup menu:

- the settings for FLOWMETER UNIT and K-FACTOR (menu 2 and 3) will not be shown in.
- the settings for TOTAL UNIT, TOTAL FACTOR-X and FLOWRATE UNIT (menu 4,5,7) cannot be changed.

### 3 CONFIGURATION

#### 3.1 INTRODUCTION

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



Caution !

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this manual before carrying out its instructions.
- The F103-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by authorized personnel.
- Take careful notice of the “Safety rules, instructions and precautionary measures” in the front of this manual.

#### 3.2 PROGRAMMING SETUP-LEVEL



*Changing the settings of the F103-P may have an influence on the current operation of the device, even when SETUP-level is still active.  
Make sure that the unit is not being used for any application when altering the settings.*

##### 3.2.1 ENTERING SETUP-LEVEL

Configuration of the F103-P is done at SETUP-level, which can be reached at all times while the F103-P remains fully operational. At SETUP-level the display will deactivate the **RUN** indicator and activate the **SETUP** indicator.

To enter the Quick Setup menu, please see paragraph 2.4.

##### Use the control panel to access SETUP-level



##### PROG-key

To enter SETUP-level, press the PROG-key for 7 seconds at OPERATOR-level. During this time, the symbols ▲ ▼ will be displayed.

When SETUP-level is entered, a password might be required to continue. You can enter the password by following the procedure for programming values as described in the following paragraphs.

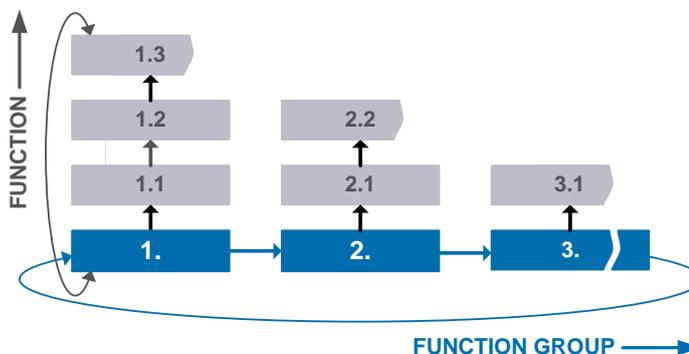


Note !

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

##### 3.2.2 NAVIGATING THROUGH SETUP-LEVEL

Each function has a unique menu-number, which is displayed below the **SETUP** indicator at the bottom of the display. The menu-number is a combination of two figures, e.g. 1.2. The first number indicates the function-group and the second number indicates the function. Additionally, each function and function-group is expressed with a keyword.



FW-4100-020001-001-EN

Fig. 10: SETUP matrix structure

### Use the control panel to navigate through SETUP-level



#### PROG-key

When a function is selected, this key is used to start the programming sequence.  
When only a function group is selected (and no function), this key is used to scroll back a function group (e.g. 3 → 2 → 1 → 3).



#### SELECT-key

This key is used to select the next function in the list (e.g. 1 → 1.1 → 1.2 → 1). When the top of the list is reached, it will wrap around and return to the function group selection.



#### CLEAR-key

This key is used to select the previous function in the list (e.g. 1.2 → 1.1 → 1 → 2).  
When the bottom of the list is reached, it will return to the function group selection.  
When only a function group is selected (and no function), this key is used to scroll to the next function group. (e.g. 1 → 2 → 3 → 1).

### 3.2.3 PROGRAMMING SEQUENCE

After selecting a function at SETUP-level, a new value can be programmed using the control panel. A function either contains a value (a number with optionally a decimal point, e.g. 123.45) or a list with items (e.g. Disable – Enable).

For each function that needs to change, navigate to that function and follow the steps indicated below. During the programming sequence, the display will deactivate the **SETUP** indicator and activate the **PROGRAM** indicator.



Note !

*When programming new values, alterations will only be set after the PROG-key has been pressed to confirm the new value! (STEP 3)*

#### Step 1: Starting the programming sequence



#### PROG-key

When a function is selected at SETUP-level, this key is used to start the programming sequence.

#### Step 2a: Changing a value



#### SELECT-key

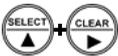
This key is used to increment the selected digit or to select the next position of the decimal point.  
When the entered value is out of range, the increase sign ▲ or decrease-sign ▼ will be displayed while you are programming. If this value is confirmed by pressing the PROG-key, the value will be brought within a valid range automatically.



#### CLEAR-key

This key is used to select the next digit. If a decimal point can be set, this will be included in the sequence as well (e.g. [decimal point] → digit 1 → digit 2 → digit 3 → [decimal point]).

Note that the selected decimal point is flashing when it can be changed. When no decimal point is selected, all available decimals will be flashing on the display to indicate this when the sequence reaches the decimal point.



#### SELECT-key + CLEAR-key

The combination of the SELECT-key and CLEAR-key is used to select a negative value. When a value can also be entered as a negative number, pressing the SELECT-key and CLEAR-key simultaneously will toggle the '–' (minus) sign on and off.

**Step 2b: Changing the selected item in a list****SELECT-key**

This key is used to select the next item in the list (e.g. Disable → Enable).  
At the end of the list, the selection will wrap around to the first selection.

**CLEAR-key**

This key is used to select the previous item in the list (e.g. Enable → Disable ).  
At the bottom of the list, the selection will wrap around to the last selection.

**Step 3: Finishing the programming sequence****PROG-key**

During the programming sequence, this key is used to confirm the new value and return to SETUP-level. To cancel the operation, either press the PROG-key for 3 seconds or wait for 20 seconds: the programming sequence is cancelled and the former value is reinstated.

**3.2.4 RETURNING TO OPERATOR-LEVEL**

When all settings are configured correctly, the unit can be returned to OPERATE-level.  
Please keep a record of all settings for later reference.

**Use the control panel to return to OPERATE-level****PROG-key**

In order to return to the operator level, press the PROG-key for three seconds.  
When no keys are pressed for 2 minutes, SETUP-level will be left automatically.

### 3.3 CONFIGURATION SETTINGS

All settings of the F103-P can be set via the control panel. As an alternative, you can also use the Remote Configuration Software which you can find on our website or through your supplier. Depending on the type of communication interface your device has, you might need a specific communication cable, which is available through your supplier.

#### 3.3.1 OVERVIEW FUNCTIONS SETUP-LEVEL

<b>1</b>	<b>TOTAL</b>		
1.1	UNIT	L – m3 – US gal – l gal – cf – oil bbl – kg – ton – US ton – lb – nL – nm3 – (none)	
1.2	DECIMALS	0 – 0.1 – 0.02 – 0.003	
1.3	K-FACTOR	AUTO, 0.000010 – 9999999	
1.4	FACTOR-X	x1 – x1000	
1.5	CLEAR PASSWORD	000 – 999	
1.6	CONTRACT HOUR	00:00 (24h format)	
1.7	CURRENT DAY TOTAL	xxxxxxx	
1.8	PREVIOUS DAY TOTAL	xxxxxxx	
<b>2</b>	<b>FLOWRATE</b>		
2.1	UNIT	mL – L – m3 – mg – g – kg – ton – US ton – US gal – l gal – Oil bbl – lb – cf – rev – scf – nm3 – nL – p – (none)	
2.2	TIME	/sec – /min – /hour – /day	
2.3	DECIMALS	0 – 0.1 – 0.02 – 0.003	
2.4	K-FACTOR	AUTO, 0.000010 – 9999999	
2.5	CALCULATION	per 1 – 999 pulses	
2.6	CUT-OFF	0.1 – 999.9 seconds	
<b>3</b>	<b>DISPLAY</b>		
3.1	FUNCTION	total – flowrate – acc. total	
3.2	DAY TOTALS	off – operate – hidden	
3.3	BACKLIGHT (brightness)	0% – 20% – 40% – 60% – 80% – 100%	
<b>4</b>	<b>POWERMAN</b>		
4.1	LCD NEW	fast – 1 sec – 3 sec – 15 sec – 30 sec – off	
4.2	BATTERY MODE	operate - shelf	
<b>5</b>	<b>FLOWMETER</b>		
5.1	SIGNAL	NPN – NPN_LP – REED – REED_LP – PNP – PNP_LP – Coil_Hi – Coil_Lo – Isolated Active Signal	
5.2	UNITS	hand – auto-vol – auto-mas	
5.3	UNIT	Auto-vol: L – m3 – US GAL – lGAL – cf – oil bbl Auto mas: kg – ton – US ton – lb	
5.4	K-FACTOR	0.000010 – 9999999	
<b>6</b>	<b>LINEARIZE</b>		
6.1	FREQ. / M-FACTOR 1	0000.1 – 9999.9 Hz / 0.000001 – 9.999999	
6.2	FREQ. / M-FACTOR 2	0000.1 – 9999.9 Hz / 0.000001 – 9.999999	
6.3	FREQ. / M-FACTOR n	0000.1 – 9999.9 Hz / 0.000001 – 9.999999	
↑	↑	↑	
6.F	FREQ. / M-FACTOR 15	0000.1 – 9999.9 Hz / 0.000001 – 9.999999	
6.G	LINEARIZATION	enable – disable	
6.H	DECIMALS FREQUENCY	0 – 0.1 – 0.02 – 0.003	

<b>7 ANALOG</b>		
7.1	OUTPUT	enable – disable
7.2	RATE-MIN (4mA)	0000000 – 9999999
7.3	RATE-MAX (20mA)	0000000 – 9999999
7.4	CUT-OFF	0.0 – 9.9%
7.5	TUNE-MIN (4mA)	0000 – 9999
7.6	TUNE-MAX (20mA)	0000 – 9999
7.7	FILTER	1 – 99
<b>8 PULSE</b>		
8.1	WIDTH	0.000 – 9.999 sec
8.2	SOLID STATE OUTPUT	enable – disable
8.3	AMOUNT	0000.000 – 9999999
<b>9 COM-MOVB</b>		
9.1	SPEED	1200 – 2400 – 4800 – 9600 – 9600HP – 19200 – 38400 - 57600
9.2	ADDRESS	001 – 247
9.3	MODE	off – bus asc – bus rtu
9.4	DATABITS	8 bits – 7 bits
9.5	PARITY	none – even – odd

**For F103-P without data logging (without type -ZL)**

<b>10 OTHERS</b>		
10.1	MODEL	F103-P
10.2	SOFTWARE VERSION	xx.xx.xx
10.3	SERIAL NO	xxxxxxx
10.4	TIME	HH:MM:SS (24 hour format)
10.5	PASSWORD	0000 – 9999
10.6	QUICK SETUP	enable – disable
10.7	TAG NO	0000000 – 9999999

**For F103-P with data logging (with type -ZL)**

<b>10 DATALOG</b>		
10.1	LOG INT	off – 1 min – 5 min – 10 min – 15 min – 30 min – 1 hr – 2 hr – 4 hr – 6 hr – 8 hr
10.2	DAILY LOG	off – single – dual
10.3	DAILY 1	00:00 – 23:59
10.4	DAILY 2	00:00 – 23:59
10.5	TIME	HH:MM:SS (24 hour format)
10.6	DATE	YY.MM.DD
<b>11 OTHERS</b>		
11.1	MODEL	F103-P
11.2	SOFTWARE VERSION	xx.xx.xx
11.3	SERIAL NO	xxxxxxx
11.4	PASSWORD	0000 – 9999
11.5	QUICK SETUP	enable – disable
11.6	TAG NO	0000000 – 9999999

### 3.3.2 EXPLANATION OF SETUP-MENU 1 – TOTAL



Caution !

- First setup the flowmeter at SETUP MENU 5 - Flowmeter. It has a direct influence on the settings for Total.
- Change of the type of flowmeter unit (SETUP 5.2 and SETUP 5.3) will cause the Total unit to jump to the default setting of the new flowmeter unit type.
- When a different unit is selected, the actual total values are NOT recalculated!

1		TOTAL
1.1	UNIT	<p>This setting determines the measurement unit for (accumulated) total and the scaled pulse output. The measurement units which are available, are controlled from the UNITS which are selected in the flowmeter menu.</p> <p>AUTO-VOL: L – m3 – US gal – l gal – cf – Oil bbl – nL – nm3            AUTO-MAS: kg – ton – US ton – lb            HAND: l – m3 – US gal – l gal – cf – Oil bbl – kg – ton – US ton – lb – nL – nm3 – ---- (no unit)</p>
1.2	DECIMALS	<p>The decimal point determines for Total and accumulated Total the number of digits following the decimal point.</p> <p>The following can be selected:            0, 0.1, 0.02, 0.003</p>
		<p> <b>Caution !</b> The next menu item can be modified only if the automatic unit conversion in SETUP 5.2, Flowmeter-units, is set to Hand. Else, the display will show “AUTO”.</p>
1.3	K-FACTOR	<p>With the Total K-Factor, the flowmeter pulse signals are converted to a total unit. The Total K-Factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 1.1). The more accurate the Total K-Factor, the more accurate the functioning of the system will be.</p> <p> <b>Note !</b> After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.</p>
1.4	FACTOR-X	<p>This setting determines the multiplication factor of Total and Accumulated Total and is also applicable to the Current and Previous Day Totals. This functions allows to show 3 digits more of the Total / accumulated Total. The amount shown is a rounded number. The following can be selected:            x1 – x1000</p> <p>When activated, the display will indicate an M on the display (e.g. when combined with the unit CF it will indicate MCF).</p>
1.5	CLEAR PASSWORD	<p>Clearing Total by the Operator can be password protected. This protection is disabled with value 000 (zero). A 3 digit password can be programmed, for example 123.</p>
1.6	CONTRACT HOUR	<p>The contract hour can be set in steps of 1 hour to any hour of the day. When the system clock reaches the time set in the contract hour, the Current Day Total is copied to the Previous Day Total, after which the measurement of the Current Day Total is restarted (reset to zero).</p> <p> <b>Caution !</b> <i>Without type ZL – Data logging, the clock will be interrupted in case of a power-down. When the unit is powered up again, the display will immediately ask the operator to enter the correct system time. Without an initialized clock, all measurements and calculations are performed as normal. However, when the Daily Total feature is enabled, the detection of contract hour and updating the Current and Previous Day Totals will not be done at the correct time.</i></p>
1.7	CURRENT DAY-TOTAL	<p>This setting shows the amount of product totalized, since the last contract hour. This a ‘running’ totalizer and cannot be reset to zero.</p>
1.8	PREVIOUS DAY-TOTAL	<p>This setting shows the amount of product totalized, before the last contract hour. This totalizer cannot be reset to zero. See chapter 2 for information on reviewing more historical day totals.</p>

### 3.3.3 EXPLANATION OF SETUP-MENU 2 – FLOWRATE



Caution !

- First setup the flowmeter at SETUP MENU 5 - Flowmeter. It has a direct influence on the settings for Flowrate.
- Change of the type of flowmeter unit (SETUP 5.2 and SETUP 5.3) will cause the flowrate unit to jump to the default setting of the new flowmeter unit type.
- Changes to SETUP 2.1 Unit, SETUP 2.2 Time unit and SETUP 2.3 Decimals have an effect on the analog output settings of SETUP 7.2 Rate Min and SETUP 7.3 Rate Max. Therefore it is best practice to first determine the required settings for the flowrate!

2 FLOWRATE		
2.1	UNIT	<p>This setting determines the measurement unit for flowrate and the analog output. The measurement units which are available, are controlled from the UNITS which are selected in the flowmeter menu.</p> <p>AUTO-VOL: mL - L - m3 - US GAL - I GAL - cf - Oil bbl - nL - nm3 - scf</p> <p>AUTO-MAS: mg - g - kg - ton - lb - US ton</p> <p>HAND: mL - L - m3 - US GAL - I GAL - cf - Oil bbl - nL - nm3 - scf - mg - g - kg - ton - lb - US ton - rev - P - ---- (no unit)</p>
2.2	TIME	The flowrate can be calculated per /sec - /min - /hour - /day.
2.3	DECIMALS	<p>This setting determines for flowrate the number of decimals. The following can be selected:</p> <p>0, 0.1, 0.02, 0.003</p>
		 <p><b>The next menu item can be modified only if the automatic unit conversion in SETUP 5.2, Flowmeter-units, is set to Hand. Else, the display will show "AUTO".</b></p>
2.4	K-FACTOR	<p>With the Flowrate K-factor, the flowmeter pulse signals are converted to a flowrate unit. The Flowrate K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 2.1).</p> <p>The more accurate the K-factor, the more accurate the functioning of the system will be.</p> <p><i>After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.</i></p>
		 <p>Note !</p>
2.5	CALCULATION	<p>The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 999 pulses.</p> <ul style="list-style-type: none"> <li>• <i>This setting does influence the update time for the analog output directly (maximum update 8 times a second). If the output response is too slow, decrease the number of pulses.</i></li> <li>• <i>The lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).</i></li> <li>• <i>For low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow. For high frequency application (above 1kHz) program a value of 50 or more pulses.</i></li> <li>• <i>Keep in mind that values higher than 200 in combination with low frequencies, will result in slow updates of the indicated flow rate and analog output.</i></li> <li>• <i>For applications with strongly varying frequencies or unstable or pulsating flow, setting the number of pulses to higher numbers might result in a more stable flow reading.</i></li> </ul>
		 <p>Note !</p>
2.6	CUT-OFF	<p>With this setting, a minimum flow requirement threshold is determined. If during this time less than XXX-pulses (SETUP 2.5) are generated, the flowrate will be displayed as zero.</p> <p>The cut-off time has to be entered in seconds – maximum time is 999.9 seconds (approximately 15 minutes).</p>

### 3.3.4 EXPLANATION OF SETUP-MENU 3 - DISPLAY

3		DISPLAY
3.1	FUNCTION	<p>This setting determines which information is shown on the main screen. The function can be set to indicate <b>total</b>, <b>flowrate</b> or <b>accumulated total</b>.</p> <ul style="list-style-type: none"> <li>When "total" is selected, total is displayed with the large 12mm (0.47") digits and flowrate is displayed with the 7 mm (0.28") digits simultaneously.</li> <li>When "flowrate" is selected, only flowrate will be displayed with the large 12mm (0.47") digits together with its measuring unit.</li> <li>When "accumulated total" is selected, total is displayed with the large digits and accumulated total is displayed with the small digits simultaneously.</li> </ul> <p>When SELECT is pressed on the main screen, the operator can scroll through the various process values. See chapter 2 for more information on operator information and functions.</p>
3.2	DAY TOTALS	<p>A basic data log function is available to register Current Day Total and Previous Day Total. This function sets the availability at operator level:</p> <ul style="list-style-type: none"> <li><b>Off:</b> Current Day Total and Previous Day Total are not available.</li> <li><b>Operator:</b> Current Day Total and Previous Day Total are available at operator level by pressing the SELECT key several times. At SETUP-level, they can be reviewed at SETUP 1.7 and SETUP 1.8.</li> <li><b>Hidden:</b> Current Day Total and Previous Day Total are only available at SETUP 1.7 and SETUP 1.8.</li> </ul> <p> <i>Note!</i> <i>When this function is enabled, a list of the last 15 historical day totals is available and can be reviewed from operator level. Please see paragraph 2.3 for more information.</i></p>
3.3	BACKLIGHT	<p>The unit can be provided with a backlight (Type -ZB). The backlight brightness can be adjusted from 0% (off) to 100% in steps of 20%. The following can be selected: 0% - 20% - 40% - 60% - 80% - 100%</p> <p> <i>Note!</i> <i>To use the backlight, the unit must be powered externally. With battery power or loop power the backlight will not work.</i></p>

### 3.3.5 EXPLANATION OF SETUP-MENU 4 – POWER MANAGEMENT

When battery powered, the user can expect reliable measurement over a long period of time. The F103-P has several smart power management functions to extend the (optional) battery life time significantly. The following settings are available:

4		POWERMAN
4.1	LCD NEW	<p>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 output signals are generated in the normal way. The following can be selected: FAST – 1 sec – 3 sec – 15 sec – 30 sec – OFF</p> <p> <i>Note!</i> <i>After a button has been pressed by the operator - the display refresh rate will always switch to fast for 30 seconds. When 'OFF' is selected, the display will temporarily turn on after touching one of the keys and turn off automatically after 30 seconds.</i></p>
4.2	BATTERY MODE	<p>The F103-P has two modes: operational or shelf. When "shelf" is selected, the F103-P shuts down and can be stored for several years: it will not process the sensor signal and the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the F103-P again, press the SELECT/▲-key two times.</p>

### 3.3.6 EXPLANATION OF SETUP-MENU 5 – FLOWMETER

To simplify the configuration of the Flowmeter, total and flow rate settings, the F103-P is equipped with an automatic unit conversion feature. This avoids different K-Factor calculations for Total and Flowrate and all configuration is done inside the Flowmeter menu. To use the automatic unit conversion, you only need to enter the (average) K-Factor and the related measurement unit. These can be found on the test/calibration certificate that came with your flowmeter.

For a detailed description and tutorials on the automatic unit conversion function, please refer to our website or your supplier.

To setup the automatic unit conversion, follow this procedure:

1. SETUP 5.1: Select the correct type of flow meter signal
2. SETUP 5.2: Select the type of measurement unit used on the certificate: volume or mass
3. SETUP 5.3: Select the measuring unit according to the certificate
4. SETUP 5.4: Enter the (average) K-factor shown on the certificate.
5. SETUP 1.1: Select the desired measuring units for (accumulated) Total.
6. SETUP 2.1: Select the desired measuring units for Flow rate

The automatic unit conversion can handle either volume or mass units. For measurement units which are not supported, for example 'revolutions' or the use of volume and mass units simultaneously, the automatic unit conversion can be set to 'Hand', allowing total and flowrate to be configured independently.

#### Example: Calculating the K-factor.

To manually calculate the K-factor to enter for total or flowrate, follow this example:

Assume that the flowmeter generates 65.231 pulses per US gallon and the required measurement unit is cubic foot / ft<sup>3</sup>. A cubic foot consists of 7.48052 gallon which implies 487.9618 pulses per cubic feet. So, the K-Factor to enter is 487.9618.

5		FLOWMETER				
5.1	SIGNAL	The F103-P is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 5.1. The settings with LP are used to apply a build-in low-pass filter. See also chapter. 4.4.				
		TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mVpp	REMARK
		NPN	NPN input	100 kΩ pull-up	max. 6 kHz.	(open collector)
		NPN - LP	NPN input with low pass filter	100 kΩ pull-up	max. 2.2 kHz.	(open collector) less sensitive
		REED	Reed-switch input	1 MΩ pull-up	max. 1.2k Hz.	
		REED - LP	Reed-switch input with low pass filter	1 MΩ pull-up	max. 120 Hz.	Less sensitive
		PNP	PNP input	51 kΩ pull-down	max. 6 kHz.	
		PNP - LP	PNP input with low pass filter	51 kΩ pull-down	max. 700 Hz.	Less sensitive
		COIL HI	Coil input High sensitivity	-	min. 20 mVpp.	Sensitive for interference!
		COIL LO	Coil input Low sensitivity	-	min. 90 mVpp	Normal sensitivity
	ISOLATED ACTIVE SIGNAL	Active pulse input detection level 3 V	4.7 kΩ	max. 3.5 kHz.	Active pulse 3-30V	
5.2	UNITS	With this setting the automatic unit conversion is enabled for volumetric flows or mass flows. When Hand is selected, the automatic unit conversion is disabled. The following can be selected: AUTO-VOL, AUTO-MASS, HAND				
		<b>To make use of the automatic unit conversion, Total and Flowrate must have a convertible unit. If this is not possible, HAND should be chosen. This will cause SETUP 5.3 and SETUP 5.4 to disappear and the unit, K-factor and K-factor decimals must be specifically set at SETUP-menu 1 – Total and SETUP-menu 2 – Flowrate.</b>				

5.3	K-FACTOR UNIT	<p>This setting determines the measurement unit for the flowmeter. With automatic unit conversion, the units for Total and Flowrate are derived from this setting. The following can be selected:                  AUTO-VOL: L – m3 – US gal – l gal – cf – Oil bbl                  AUTO-MAS: kg – ton – US ton – lb</p> <p> Note !</p> <ul style="list-style-type: none"> <li>• Changing the type of flowmeter unit (volumetric or mass) causes the settings of the Total (SETUP 1.1) and Flowrate (SETUP 2.1) to automatically change to the default unit of that type.</li> <li>• Change of the flowmeter unit will not change the amount displayed for Total and accumulated Total.</li> </ul>
5.4	K-FACTOR	<p>With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 5.3), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be.</p> <p> Note !</p> <p>After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.</p>

### 3.3.7 EXPLANATION OF SETUP-MENU 6 – LINEARIZE

#### Linearization principle

In normal situations, the calculation of flow is based on flowmeters that follow an ‘ideal line’ and give a fixed number of pulses over the entire frequency range to represent a certain amount. The calculation uses an average K-factor (the so-called *KF0*), which is entered at SETUP-menu 5 (when automatic unit conversion is disabled, SETUP-menu 1 and 2). Since many flowmeters do not follow this ‘ideal line’, the linearization function can be used to reflect the actual flow curve better. This allows for more accurate flowrate and totalization values, as well as improved analog and pulse output values over the frequency range of the flowmeter.

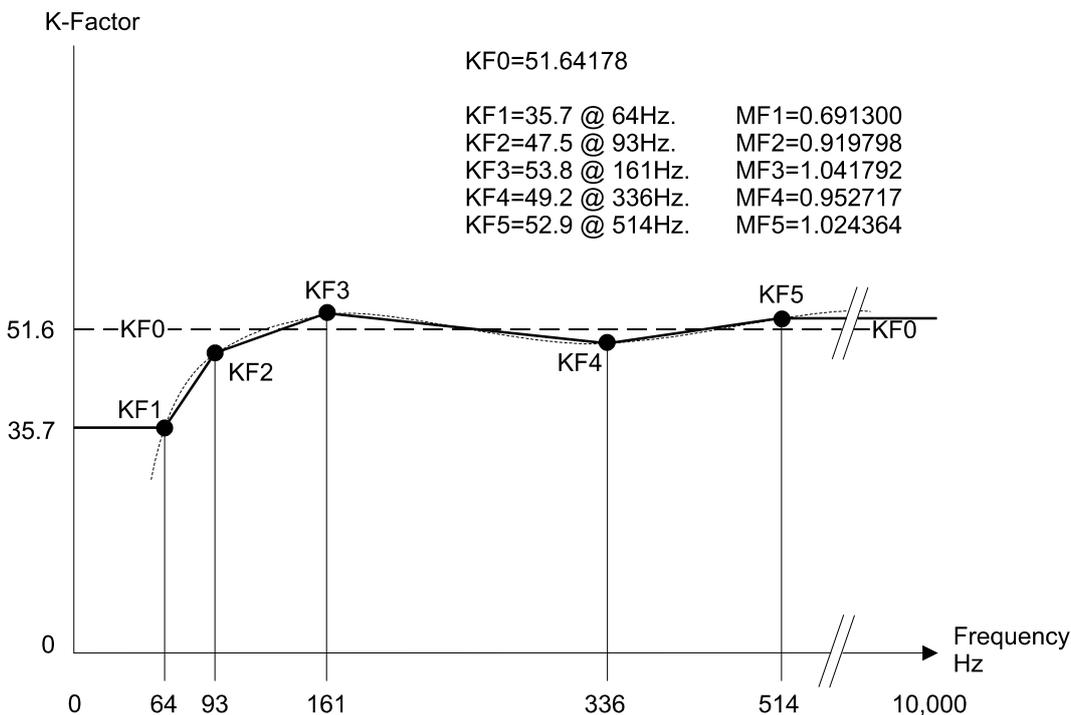


Fig. 11: Example of K-Factors and linearization points

The linearization function uses linearization points to calculate new K-factors based on the measured flowmeter frequency. As shown in the chart above, each point consists of a frequency and a Meter Factor (*MF<sub>x</sub>*, indicating the deviation of the K-factor *KF<sub>x</sub>* from the average K-factor *KF0*). When a new frequency is measured, the corresponding Meter Factor is calculated by interpolating between the linearization points. The new Meter Factor is then used to calculate the actual K-factors for flowrate and total using this formula:

$$K\text{-factor} = MF * KF0$$

When the measured frequency is below the lowest or above the highest frequency given in the linearization points, the Meter Factor belonging to that frequency is used.

### Entering linearization points

A table of 15 linearization points can be entered into the unit. It is advised to enter the linearization points in increasing order of frequency; however, this is not mandatory. The linearization points are usually located at frequencies where the linear behavior of the flowmeter changes. Linearization points that are not used can be disabled by entering a frequency of 0 Hz.

The following formula can be used to calculate the Meter Factors for the linearization points:

$$\text{Meter Factor } MF_x = \frac{KF_x @ \text{flow } x}{KF_0}$$

In this formula, the value of  $KF_0$  represents the average K-factor of the flowmeter and  $KF_x @ \text{flow } x$  represents the actual K-factor (derived from the actual flow) at the selected frequency (note that the K-factors must be in the same engineering units (e.g. pulses / GAL) to perform the calculation).



Caution !

The K-factor entered at SETUP-menu 5 must be identical to the  $KF_0$  used in the calculations. If automatic unit conversion is disabled, the K-factors entered at SETUP-menu 1 and 2 can have different engineering units, but make sure they represent the same 'average value' as  $KF_0$ .

6 LINEARIZATION		
6.1 ↑ 6.F	FREQ. / M-FACTOR 1 ↑ FREQ. / M-FACTOR 15	The M Factor is displayed on the top line of the display. A value between 0.000001 and 9.999999 can be entered. Most M-factors will be around 1.000000, for example 0.945354 or 1.132573.  The frequency is displayed on the bottom line of the display. The maximum frequency is 9999.9 Hz. When value 0.0Hz is entered, the M-Factor is disabled. (Read also SETUP 6.H – decimals frequency.)
6.G	LINEARIZATION	This setting is used to easily enable or disable the linearization function. When linearization is disabled, the K-factor set at SETUP-menu 4 – Flowmeter (or alternatively SETUP-menu 1 – Total and SETUP-menu 2 – Flowrate when automatic unit conversion is disabled) will be used for the calculation of total and flowrate. When linearization is enabled, the K-factor set at SETUP-menu 4 – Flowmeter (or alternatively SETUP-menu 1 – Total and SETUP-menu 2 – Flowrate when automatic unit conversion is disabled) will be used as $KF_0$ in the linearized calculations for total and flowrate.
6.H	DECIMALS FREQUENCY	This setting determines the number of decimals for the frequency entered. The following can be selected: 0 – 0.1 – 0.02 – 0.003

### 3.3.8 EXPLANATION OF SETUP-MENU 7 - ANALOG OUTPUT

An analog 4-20mA signal is generated according to the flowrate with a 12 bits resolution. The settings for Flowrate (SETUP-menu 2) influence the analog output directly and should be configured first. The relationship between rate and analog output is set with the following functions.

7 ANALOG OUTPUT		
7.1	OUTPUT	If the analog output is not used, it can be disabled to minimize power consumption and safe battery life. When the output is disabled, a current of about 2mA is generated and the unit can still be supplied from this signal (provided a power supply is connected). The following can be selected: enable – disable   <i>Note !</i> While powering-up the loop, the initial current is approx. 2mA. When the output is enabled, it can take a few seconds before the correct current is generated.

7.2	RATE-MIN (4mA)	<p>Enter the flowrate at which the output should generate the minimum signal (4mA) – in most applications at flowrate “0”.</p> <p>The number of decimals displayed depend upon SETUP 2.3.</p> <p>The measuring unit and time (L/min for example) depend on settings SETUP 2.1 and SETUP 2.2 and are displayed during editing.</p> <p> Note !</p> <p><i>If desired, you can program the analog output 'up-side-down'. The 4mA represents the maximum flow rate.</i></p> <p><i>For example: enter 800 L/min.</i></p>																																		
7.3	RATE-MAX (20mA)	<p>Enter the flowrate-at which the output should generate the maximum signal (20mA) – in most applications at maximum flow.</p> <p>The number of decimals displayed depend upon SETUP 2.3.</p> <p>The measuring unit and time (L/min for example) depend on settings SETUP 2.1 and SETUP 2.2 and are displayed during editing.</p> <p> Note !</p> <p><i>If desired, you can program the analog output 'up-side-down'. The 20mA represents the minimum flow rate.</i></p> <p><i>For example: enter 0 L/min.</i></p>																																		
7.4	CUT-OFF	<p>A low flow cut-off can be set as a percentage of the full range of 16mA, for example, to ignore leakage.</p> <p>As long as the flowrate is less than the required rate, the output current will be to minimum signal (4mA normally, 20mA in case the analog output is programmed 'up-side-down').</p> <p>See following examples for setting the cut-off value:</p>																																		
		<table border="1"> <thead> <tr> <th>CUT-OFF %</th> <th>RATE-MIN 4mA</th> <th>RATE-MAX 20mA</th> <th>REQUIRED RATE</th> <th>OUTPUT</th> </tr> </thead> <tbody> <tr> <td>2%</td> <td>0 L/min</td> <td>100 L/min</td> <td><math>(100-0)*2\% = 2.0</math> L/min</td> <td><math>4+(16*2\%) = 4.32</math>mA</td> </tr> <tr> <td>3.5%</td> <td>20 L/min</td> <td>800 L/min</td> <td><math>(800-20)*3.5\% = 27.3</math> L/min</td> <td><math>4+(16*3.5\%) = 4.56</math>mA</td> </tr> </tbody> </table>	CUT-OFF %	RATE-MIN 4mA	RATE-MAX 20mA	REQUIRED RATE	OUTPUT	2%	0 L/min	100 L/min	$(100-0)*2\% = 2.0$ L/min	$4+(16*2\%) = 4.32$ mA	3.5%	20 L/min	800 L/min	$(800-20)*3.5\% = 27.3$ L/min	$4+(16*3.5\%) = 4.56$ mA																			
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7.5	TUNE MIN (4mA)	<p>Use this setting to precisely tune the minimum analog output value (initial value is 4 mA). This value can differ slightly due to ambient influences such as temperature.</p> <p> <b>Before tuning the signal, be sure that the analog signal is not being used for any application!</b></p> <p>After pressing PROG, the current will be about 4mA. The current can be increased / decreased with the arrow-keys and is directly active. Press PROG to store the new value.</p>																																		
7.6	TUNE MAX (20mA)	<p>Use this setting to precisely tune the maximum analog output value (initial value is 20 mA). This value can differ slightly due to ambient influences such as temperature.</p> <p> <b>Before tuning the signal, be sure that the analog signal is not being used for any application!</b></p> <p>After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is directly active. Press PROG to store the new value.</p>																																		
7.7	FILTER	<p>The analog output signal is updated 8 times per second and an instable flowrate can cause a varying output current.</p> <p>With the help of this filter function a more stable but less precise output current can be obtained. The filter principal is based on three input values: filter level (01-99), previous filter value and actual flowrate.</p> <p>Higher filter levels cause the output current to be more stable but take longer to reach its final value. Lower filter levels cause the output to be less stable but more responsive. This is indicated in table below.</p>																																		
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20	1.4 sec	2.8 sec	4.5 sec	9.0 sec
30	2.1 sec	4 sec	7 sec	14 sec
50	3.5 sec	7 sec	11 sec	23 sec
75	5.2 sec	10 sec	17 sec	34 sec
99	6.9 sec	14 sec	23 sec	45 sec

### 3.3.9 EXPLANATION OF SETUP-MENU 8 – PULSE OUTPUT

The pulse output menu configures the behavior of the digital output signals. As standard, two transistor outputs D1 and D2 are available (type OT). Optionally, an additional solid state output (D3) is available (type OG).

Digital output D1 is used to retransmit the unscaled incoming pulse from the flowmeter. This is often used when sinus / non-square wave input signals are present (e.g. coil signals) that need to be transmitted as robust square wave forms.

Digital output D2 and D3 are used transmit a scaled pulse, which is configured in this menu.



Note !

- The digital (transistor) output D1 can retransmit input frequencies up to 10 kHz and requires a minimum on and off-time of 50  $\mu$ s.
- The digital (transistor) output D2 has a maximum frequency of 500 Hz.
- The digital (solid state) output D3 has a maximum frequency of 50 Hz. When using this output, be sure to set SETUP 8.1: WIDTH to 10 ms or higher.

8		PULSE OUTPUT																																
8.1	WIDTH	<p>The pulse width determines the time that the output will be active; in other words the pulse duration. The pulse width is set in milliseconds in the range 0.001 – 9.999 sec.</p> <p>The value “zero” will disable the pulse output.</p> <p><i>The scaled 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 flowrate increases for example – an internal buffer will be used to “store the missed pulses”: As soon as the flowrate slows down, the buffer will be “emptied”.</i></p> <p><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></p> <table border="1"> <thead> <tr> <th colspan="4">FREQUENCY SETTINGS FOR SCALED PULSE OUTPUT IN QUICK SETUP MENU</th> </tr> <tr> <th>Frequency (Hz)</th> <th>Width (sec)</th> <th>Frequency (Hz)</th> <th>Width (sec)</th> </tr> </thead> <tbody> <tr> <td>disable</td> <td>0.000 s</td> <td>62.5 Hz</td> <td>0.008 s</td> </tr> <tr> <td>0.1 Hz</td> <td>5.000 s</td> <td>100 Hz</td> <td>0.005 s</td> </tr> <tr> <td>0.5 Hz</td> <td>1.000 s</td> <td>125 Hz</td> <td>0.004 s</td> </tr> <tr> <td>1.0 Hz</td> <td>0.500 s</td> <td>166 Hz</td> <td>0.003 s</td> </tr> <tr> <td>10.0 Hz</td> <td>0.050 s</td> <td>250 Hz</td> <td>0.002 s</td> </tr> <tr> <td>50.0 Hz</td> <td>0.010 s</td> <td>500 Hz</td> <td>0.001 s</td> </tr> </tbody> </table>	FREQUENCY SETTINGS FOR SCALED PULSE OUTPUT IN QUICK SETUP MENU				Frequency (Hz)	Width (sec)	Frequency (Hz)	Width (sec)	disable	0.000 s	62.5 Hz	0.008 s	0.1 Hz	5.000 s	100 Hz	0.005 s	0.5 Hz	1.000 s	125 Hz	0.004 s	1.0 Hz	0.500 s	166 Hz	0.003 s	10.0 Hz	0.050 s	250 Hz	0.002 s	50.0 Hz	0.010 s	500 Hz	0.001 s
FREQUENCY SETTINGS FOR SCALED PULSE OUTPUT IN QUICK SETUP MENU																																		
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50.0 Hz	0.010 s	500 Hz	0.001 s																															
8.2	SOLID STATE OUTPUT	<p>This functions allows you to enable or disable solid state output D3. When enabled, the output will follow the scaled pulse output as configured in SETUP 8.1: WIDTH and SETUP 8.3: AMOUNT.</p> <p><i>To preserve battery power, it is advised to disable the solid state output when it is not used.</i></p> <p><i>Solid state output D3 has a maximum frequency of 50 Hz. When using this output, set the PULSE OUTPUT FREQUENCY in the quick setup menu to 50 Hz or lower, or set SETUP 8.1: WIDTH to 0.010 sec or higher.</i></p>																																
8.3	AMOUNT	<p>One pulse is generated every X-quantity measured. If for example you want 100 pulses per gallon: do enter 0.01 GAL (this means one pulse every 0.01 GAL, so 100 pulses per gallon).</p> <p><i>After pressing PROG, the decimal point will be flashing. The decimal position can be changed now by pressing the ▲-key.</i></p>																																

### 3.3.10 EXPLANATION OF SETUP-MENU 9 – MODBUS COMMUNICATION (OPTION)

The F103-P can optionally be equipped with a communication interface using the Modbus protocol (Type CX/CH). See Appendix C for a detailed explanation of the protocol, data types and available registers.

9		COM-MODB
9.1	SPEED	<p>This setting is used to set the baud rate and should match the speed used on the communications bus.</p> <p>The following communication speeds can be selected: 1200 – 2400 – 4800 – 9600 – 9600HP – 19200 – 38400</p> <p> <i>Communication speeds from 9600HP and upwards are more power consuming. When used with battery power, it is advised to set the speed at 9600 or lower.</i></p>
9.2	ADDRESS	This setting is used to configure the bus address of your device on the communications bus. This address can vary from 001-247.
9.3	MODE	<p>This setting is used to configure the Modbus communication mode of your device on the communications bus.</p> <p>The following modes can be selected: ASCII –RTU – OFF</p>
9.4	DATABITS	<p>This setting is used to configure the number of data bits and should match the number used on the communications bus.</p> <p>Select 8 bit for Modbus RTU and 7 or 8 bits for Modbus ASCII.</p>
9.5	PARITY	<p>This setting is used to configure the parity mode and should match the parity mode used on the communications bus.</p> <p>Available settings are ODD – EVEN – NONE</p>

### 3.3.11 EXPLANATION OF SETUP-MENU 10 – OTHERS (WITHOUT TYPE ZL)

10		OTHERS
10.1	MODEL	<p>For support and maintenance it is important to have information about the characteristics of the F103-P. Your supplier will ask for this information in case of a serious breakdown or to assess the suitability of your model for upgrade considerations.</p>
10.2	SOFTWARE VERSION	
10.3	SERIAL NO.	
10.4	TIME	<p>This setting can show and set the system clock. The system clock is used by the Daily Total feature to detect when the contract hour (as set in SETUP 1.6) is reached.</p> <p>The format is HH.MM.SS in 24 hour notation.</p> <p> <i>The accuracy of the system clock is limited and in case of a power-down, the clock will be interrupted as well. When the unit is powered up again and the Daily Total feature is enabled, the display will immediately ask the operator to enter the correct system time.</i></p> <p><i>With the Data logging option (type ZL), an accurate battery-backed real time clock is included which will continue to keep time in case of a total power down.</i></p> <p> <b>Without an initialized clock, all measurements and calculations are performed as normal.</b></p> <p><b>However, when the Daily Total feature is enabled, the detection of contract hour and updating the Current and Previous Day Totals will not be done at the correct time.</b></p>
10.5	PASSWORD	<p>All SETUP values can be password protected.</p> <p>This protection is disabled with value 0000 (zero).</p> <p>A 4 digit password can be programmed, for example 1234.</p>
10.6	QUICK SETUP	<p>This setting determines the availability of the Quick Setup Menu at operator level. The following can be selected: enable – disable</p> <p> <i>Read chapter 2 for more information on the Quick Setup Menu.</i></p>
10.7	TAG-NO	<p>For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.</p>



Note !

When the F103-P is ordered with the datalogging option (type ZL), SETUP-menu 10 is extended to SETUP-menu 10 and SETUP-menu 11, as shown in the following paragraphs.

### 3.3.12 EXPLANATION OF SETUP-MENU 10 - DATALOGGING (WITH TYPE ZL)

The function of the data log module is to record the performance of the F103-P and the amount of the medium that passed the sensor (e.g. flowmeter) with respect to the time and the date.

The following type of records are made by the data log module:

#### Interval records

The interval log is used to record the data, as a snapshot, at a specific time interval. When the maximum amount of records is made (1000), the eldest record is overwritten by the newest record.

Each interval record contains the following data:

- a sequence number
- a date/time stamp
- the actual flowrate
- the total
- the accumulated total

#### Daily records

The daily log is used to record the daily record in the Daily logbook. This is done at one or two pre-determined time(s) in the day, e.g. before or at the end of a so called contract hour. This function is meant to determine, by hand, the total of the previous contract hour or to trend the total over a certain period of time. When the maximum amount of records is made (1000), the eldest record is overwritten by the newest record.

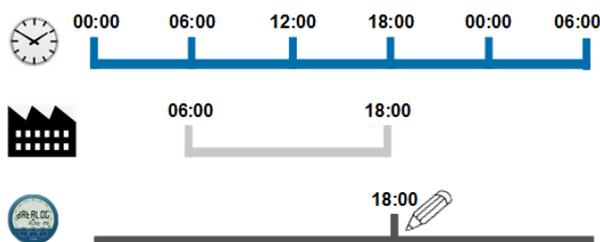


Fig. 12: Single daily log (typical)

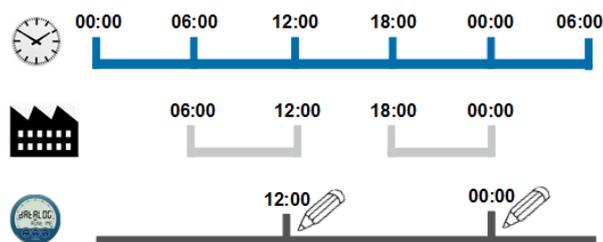


Fig. 13: Dual daily log (typical)

Each daily record contains the following data:

- a sequence number
- a date/time stamp
- the actual flowrate
- the total
- the accumulated total

#### Event records

The event log is used to record the events that happen during operation in the Event logbook. These events have a generic or specific content (manufacturer defined). For every event that occurs, one record is stored in the logbook. When the maximum amount of records is made (500), the eldest record is overwritten by the newest record.

Each event record contains the following data:

- a sequence number
- a date/time stamp
- (as applicable) an event type number
- (as applicable) an event content description

#### Reading the data log records

The recorded data is accessible at operator level (see chapter 2) or via the PC based data log application (Remote Configuration Software) which can read out and store the records.

The application requires a serial communication connection (e.g. RS485, USB), and depending on the type of communication interface your device has, you might need a specific communication cable. The software and cable are available on our website or through your supplier.

10 DATALOG		
10.1	LOG INT	This setting selects the interval at which an interval records is created. The interval log logbook can hold up to 1000 records. When it is full, it will overwrite the oldest record first. The following interval times are available: Off - 5 min - 10 min - 15 min - 30 min - 1 hr - 2 hr - 4 hr - 6 hr - 8 hr
10.2	DAILY LOG	This setting selects how many times a day a daily record is created. The daily log logbook can hold up to 1000 records. When it is full, it will overwrite the oldest record first. The following interval times are available: Off - single - dual  <i>Besides the daily log setting, a Current Day Total and a Previous Day Total are available. These are independent from the datalog function and have their own contract hour. See the settings for Total for more information.</i>
10.3	DAILY 1	This setting sets the first contract hour for the daily log records. The format is HH:MM in 24 hour notation.
10.4	DAILY 2	This setting sets the second contract hour for the daily log records. The format is HH:MM in 24 hour notation.
10.5	TIME	This setting can show and set the system clock. The system clock is used by the Daily Total feature and the datalog function. The format is HH.MM.SS in 24 hour notation.
10.6	DATE	This setting can show and set the system date. The system date is used by the datalog function. The format is YY.MM.DD

### 3.3.13 EXPLANATION OF SETUP-MENU 11 – OTHERS (WITH TYPE ZL)

11 OTHERS		
11.1	MODEL	For support and maintenance it is important to have information about the characteristics of the F103-P. Your supplier will ask for this information in case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
11.2	SOFTWARE VERSION	
11.3	SERIAL NO.	
11.4	PASSWORD	All SETUP values can be password protected. This protection is disabled with value 0000 (zero). A 4 digit password can be programmed, for example 1234.
11.5	QUICK SETUP	This setting determines the availability of the Quick Setup Menu at operator level. The following can be selected: enable – disable  <i>Read chapter 2 for more information on the Quick Setup Menu.</i>
11.6	TAG-NO	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

## 4 INSTALLATION

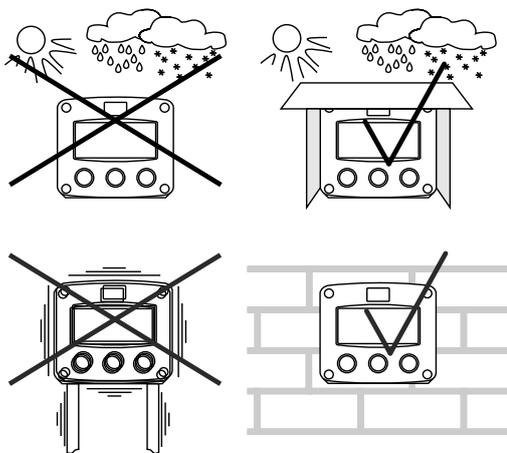
### 4.1 GENERAL DIRECTIONS



Caution !

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F103-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the "Safety rules, instructions and precautionary measures" at the front of this manual.

### 4.2 INSTALLATION / SURROUNDING CONDITIONS



Take the relevant IP classification of the enclosure into account (see identification plate). Even an enclosure rated for IP67 / TYPE 4X 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 F-Series onto a solid structure to avoid vibrations.

For use in Safe Areas, also known as Ordinary Locations, and Hazardous Locations, the following conditions apply:

Relative humidity:	< 90% RH
Outdoor use:	suitable for outdoor use
IP and TYPE rating:	Type 4X
Supply voltage fluctuation:	As indicated by the supply range (e.g. 6V to 30V)
Means of protection:	Division 2: energy limited Ordinary locations: Class I (PE connected metal enclosure) Class II (non-metallic enclosure)
Over-voltage category:	II
Pollution degree:	2 (internal environment), 3 (external environment)
Ambient:	-40 °C to +70 °C, -40 °F to +158 °F
Altitude:	up to 2000 m

### 4.3 HANDLING THE F-SERIES ENCLOSURE



**REPLACING BATTERIES, DISCONNECTING LIVE CIRCUITS OR OPENING INSTALLED ENCLOSURES MAY ONLY BE DONE WHEN THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.**

#### 4.3.1 IDENTIFICATION

To identify your F1-Series device, on the top-side of the unit, a label is applied. The labels shows the precise ordering code and specific certification data. The production date is either indicated by the 'MFG.DATE' or the first 4 digits of the serial number representing year and week number (YYWW).

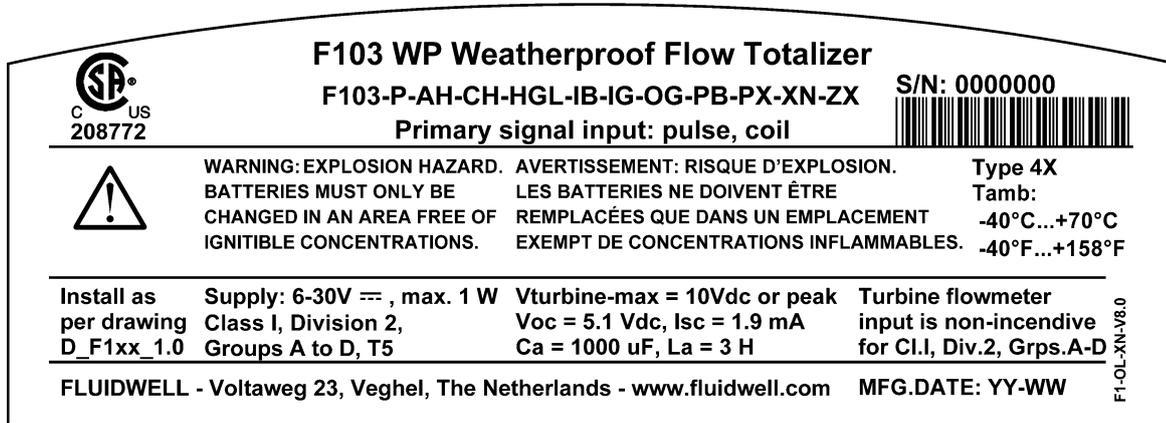
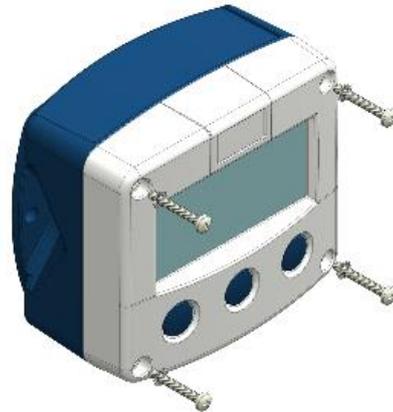


Fig. 14: Identification – Example of F1-Series type XN label

#### 4.3.2 OPENING / REMOVING THE COVER

To open the F-Series enclosure, the front cover needs to be removed. Please follow this procedure:

1. If necessary, clean the enclosure with an anti-static cloth made damp with a mild soap solution. Wait for the enclosure to dry before opening.
2. While loosening the screws, hold on to the front cover to prevent it from falling down.
3. Unscrew all 4 screws from the front of the enclosure and (if present) mind that the serrated washers are kept with the screws.
4. Carefully take the front cover away from the rear cover, minding that the wiring stays intact.
5. Depending on the work to be done, all terminal connectors can be removed from their mating parts and the front cover is now completely separate.



#### 4.3.3 CLOSING / REPLACING THE COVER

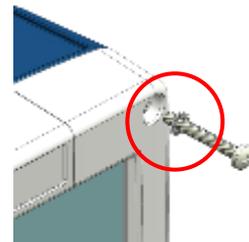
To replace the cover on the F-Series enclosure, follow this procedure:

1. Re-insert all terminals to their original position.
2. Carefully position the front cover onto the back cover, making sure that the gasket falls nicely into the gutter of the back cover.
3. Replace all 4 screws into the front cover and mind that the serrated washers are replaced (metal enclosure only).
4. Fasten all 4 screws in an alternating way so that the front cover is placed evenly across the edge of the back cover.

Tighten the 4 screws with the torque value for the type of enclosure as specified in following table:

Plastic enclosure:	1 Nm per screw
Aluminum enclosure:	1 Nm per screw
Aluminum w. extended back enclosure:	1 Nm per screw
Stainless steel enclosure:	2 Nm per screw

5. The F-Series in now ready to be returned to service.



#### 4.4 MECHANICAL INSTALLATION



When installed according to Class I, Division 2, the F-Series enclosure is not suitable for panel mount installation.

##### 4.4.1 DIMENSIONS – ALUMINUM ENCLOSURE – TYPE HA, HL...HZ, HAA ... HAZ

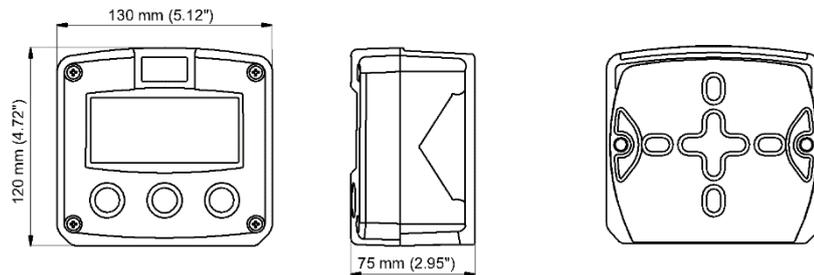


Fig. 15: Dimensions – Aluminum enclosures

##### 4.4.2 DIMENSIONS – ALUMINUM W. EXTENDED BACK ENCLOSURE – TYPE HBA ... HBZ

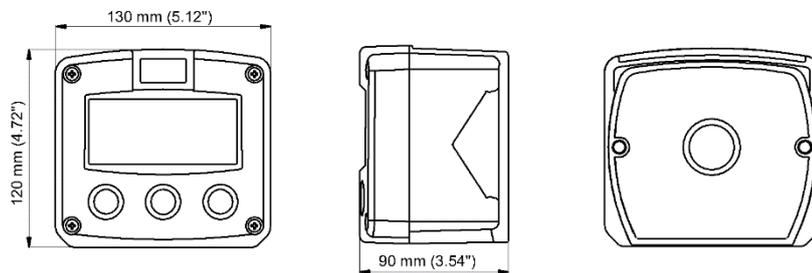


Fig. 16: Dimensions – Aluminum with extended back enclosures

##### 4.4.3 DIMENSIONS – STAINLESS STEEL ENCLOSURE – TYPE HSA ... HSZ

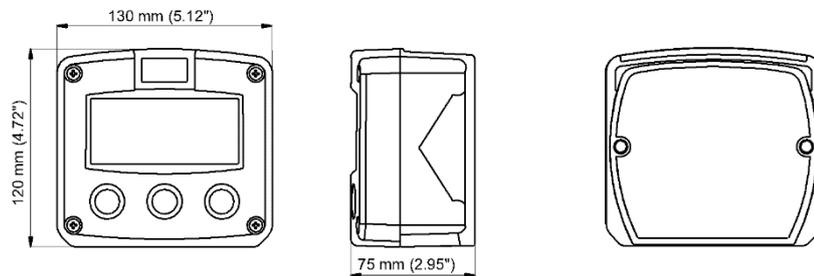


Fig. 17: Dimensions – Stainless Steel enclosures

##### 4.4.4 DIMENSIONS – PLASTIC ENCLOSURE – TYPE HGA ... HGZ

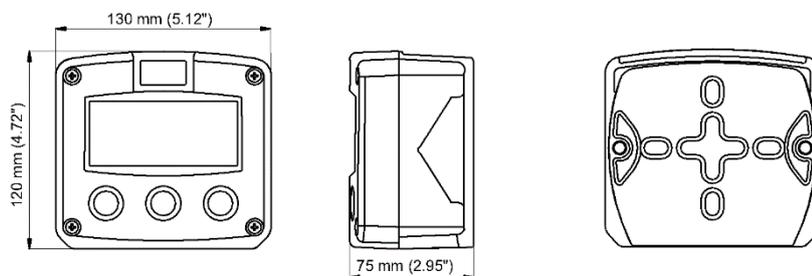


Fig. 18: Dimensions – Plastic enclosures

#### 4.4.5 USING CONDUITS AND CONDUIT HUBS WITH A PLASTIC ENCLOSURE

It is possible to use the plastic enclosure in combination with 1 or 2 conduit hubs of 1/2". For this purpose, two ordering types have been added:

- Type HGL:** 2x 1/2" conduit hub entries – fitted with internal earthing plate
- Type HGT:** 1x 1/2" conduit hub entry – fitted with internal earthing plate



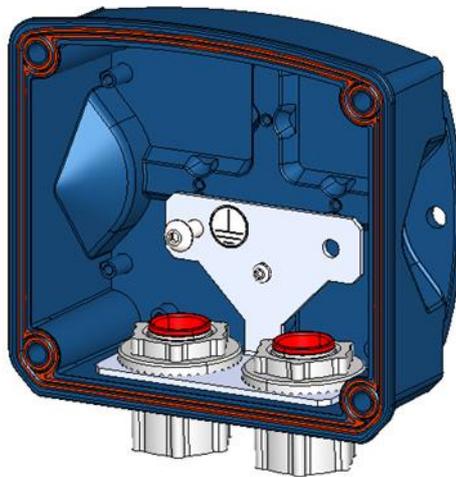
**Fig. 19: Dimensions – Plastic enclosures for conduit hubs**

The 1/2" conduit hubs are not delivered together with the unit and must be purchased separately. Please make sure to select conduit hubs that are suitable for the application and suitable for the hazardous area they are being installed into. The entry holes available for the conduit hubs are 7/8" / 22mm and must be able to accommodate a panel thickness of 5 mm. Furthermore, it is advised to limit the height the conduit hub intrudes into the enclosure to about 10mm.



**MAKE SURE THAT THE CONDUITS, CONDUIT HUBS AND PROTECTIVE EARTH CONDUCTOR ARE INSTALLED CORRECTLY TO ENSURE PROPER PROTECTION OF THE INSTALLATION.**

Because of the isolating nature of the plastic enclosure, an internal earthing plate is supplied where the conduit hub body is inserted into and screwed tight with the nut. This automatically connects the conduits to the earthing plate. On top of the earthing plate, provisions have been made to connect the external Protective Earth (PE) conductor.



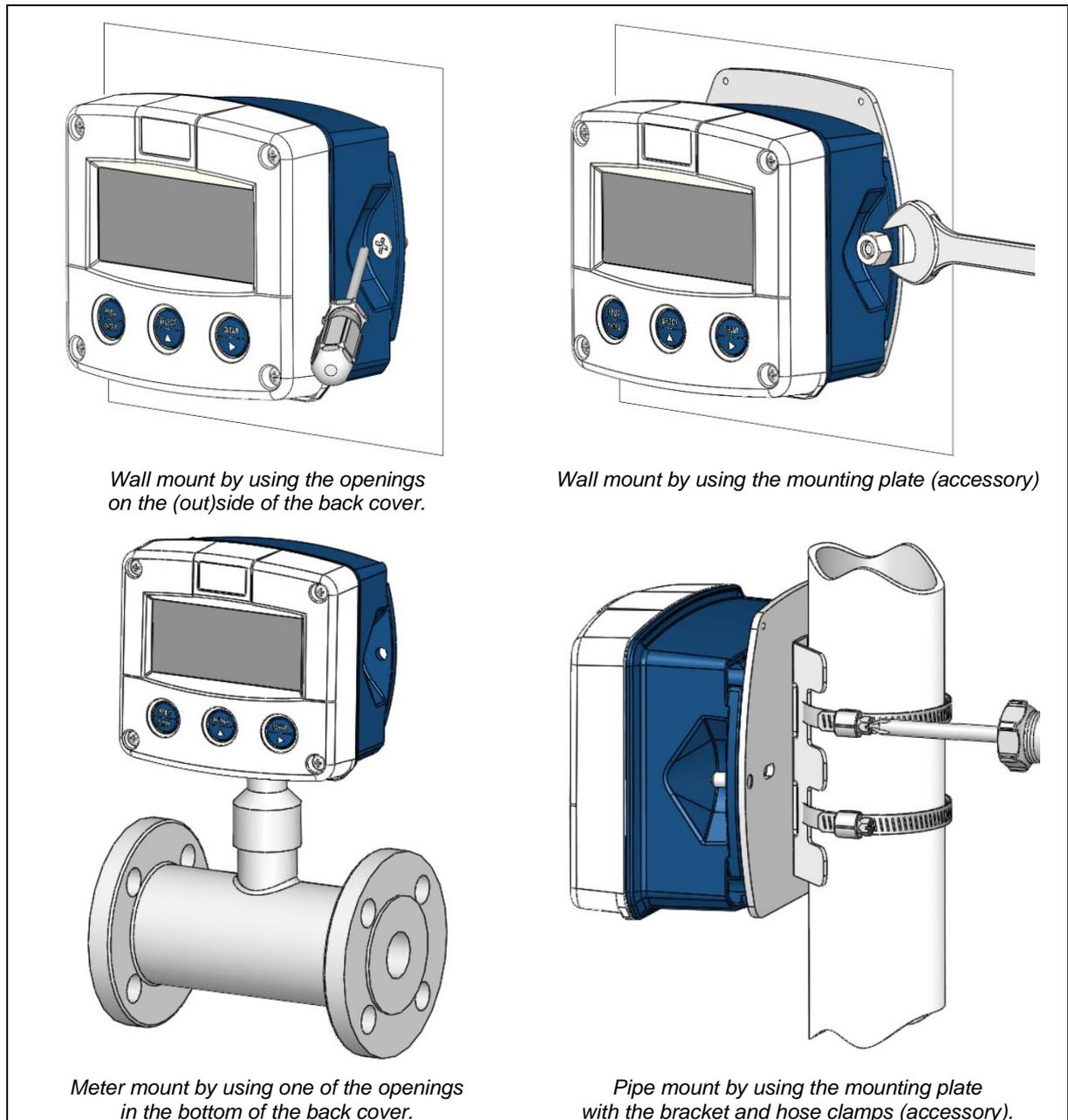
**Fig. 20: Plastic enclosure with conduit hubs and internal earthing plate**

Please see paragraph 4.5.2 for more information on the electrical installation of the Protective Earth.

#### 4.4.6 MOUNTING

The enclosure can be installed by itself or with the aid of a mounting plate in the configurations shown below. When the unit is installed on a wall or onto a meter, please use components and installation techniques that are suitable for the used materials.

When using the mounting plate, please follow the instructions that came with the accessories.



**Fig. 21: Installation – Mounting configurations**

## 4.5 ELECTRICAL INSTALLATION



### REPLACING BATTERIES, DISCONNECTING LIVE CIRCUITS OR OPENING INSTALLED ENCLOSURES MAY ONLY BE DONE WHEN THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.



- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the F103-P, the installer has to discharge himself by touching a well-grounded object.



- The F103-P must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).
- Do ground the aluminum / stainless steel enclosure properly with a PE wire as indicated to the Protective Earth terminal. It is the responsibility of the installer to install, connect and test the Protective Earth connections in accordance with the local and (inter)national Rules and Regulations.
- The installation must comply with (inter)national requirements and local ordinances. Within the United States all field wiring (for Class I, Div. 2) must conform to Article 501.10(B) of the National Electric Code, NFPA 70. Within Canada all field wiring must conform to Section J18-064 (for non-incendive field wiring) or J18-152 (for Class I, Div. 2 wiring), of the Canadian Electrical Code.

### 4.5.1 ELECTRICAL SAFETY

Please consult the table with environmental conditions and safety parameters shown at the beginning of this chapter.

#### General directions:

- Use (separate) cable glands with effective IP67 / TYPE 4(X) seals for all wires.
- For unused cable entries, fit blind plugs with effective IP67 / TYPE 4(X) seals.
- Make a reliable ground connection to the metal enclosure.
- Use effective screened cable for the input/output signals and provide grounding of its screen to the “L” terminal (for isolated signals the corresponding – terminal) or at the external device itself, whichever is appropriate to the application. Be careful not to create ground loops!
- All wiring must be in accordance with local codes and regulations.
- In case this instrument is connected to a supply by means of a permanent connection a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment. Furthermore, a protective over-current device with a maximum rating of 0.5A (e.g. fuse or circuit breaker) must be inserted in the positive supply line in safe area.
- The external power supply must be an approved ELV source, insulated from AC mains by double / reinforced insulation per CSA C22.2 No. 61010-1 / UL61010-1. All other inputs and outputs shall at least be reinforced insulated from mains.
- The installation must comply with (inter)national requirements and local ordinances. Within the United States all field wiring (for Class I, Div. 2) must conform to Article 501.10(B) of the National Electric Code, NFPA 70. Within Canada all field wiring must conform to Section J18-064 (for non-incendive field wiring) or J18-152 (for Class I, Div. 2 wiring), of the Canadian Electrical Code.

### 4.5.2 PROTECTIVE EARTH CONNECTIONS

Inside the F103-P, different types of bonding and earthing are used. The common ground is mostly used for termination of the wire shields and the Protective Earth (PE) is used for electrical safety. For DC-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 F103-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 F103-P, the PE conductor must be connected to the PE stud which is located in the metal back panel, 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 panel is connected to the Protective Earth by the mounting screws with serrated washers.

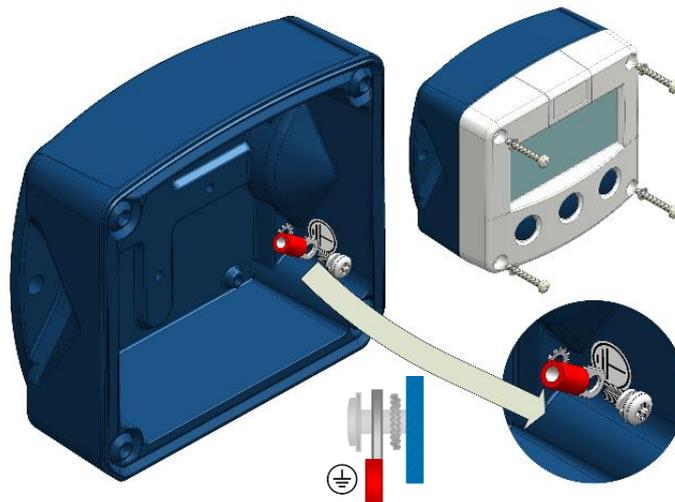


Fig. 22: Protective Earth (PE) connection on metal enclosure

### Metal enclosure with conduit hubs

When the F103-P is supplied with a metal enclosure (aluminum or stainless steel) and installed with conduit hubs, the conduit hubs are automatically grounded by the threaded connection with the metal enclosure. Make sure to order the F103-P with the correct drilling pattern and thread sizes.

### Plastic enclosure

When the F103-P is supplied with a non-metal enclosure (e.g. plastic), the enclosure meets the requirements of class 2 (double insulated). Therefore any incoming PE conductor can be terminated with an insulating end cap.

### Plastic enclosure with conduit hubs

When the F103-P is supplied with a non-metal enclosure (e.g. plastic) and installed with conduit hubs, the conduit hubs need to be grounded in accordance with national and local electrical codes. For this purpose, a metal grounding plate is inserted in the back panel into which the hubs are secured and the PE conductor must be connected, as indicated in the image below. To connect the conductor, a screw (M5 x 8mm) with a serrated washer, a terminal and a washer is used (torque: 2 Nm).

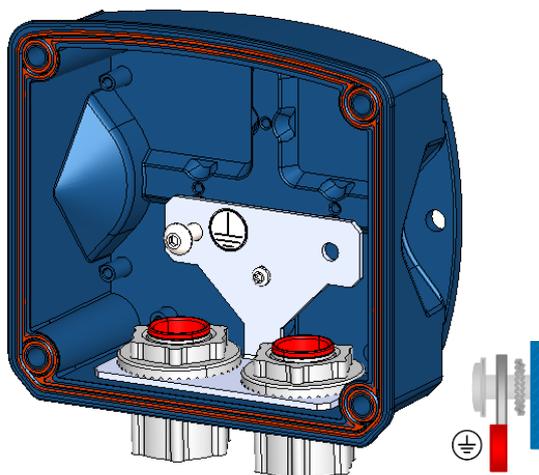


Fig. 23: Protective Earth (PE) connection on conduit hub grounding plate

### 4.5.3 FIELD WIRING CONNECTIONS



**When installing the F103-P in a hazardous area, do NOT install any wiring unless the area has been declassified or is known to be non-hazardous.**



- Do ground the aluminum / stainless steel enclosure properly with a PE wire as indicated to the Protective Earth terminal. It is the responsibility of the installer to install, connect and test the Protective Earth connections in accordance with the local and (inter)national Rules and Regulations.
- When a power supply is connected to the field wiring connections, please also consider the demands for power supply wiring shown in paragraph 4.5.4.
- The installation must comply with (inter)national requirements and local ordinances. Within the United States all field wiring (for Class I, Div. 2) must conform to Article 501.10(B) of the National Electric Code, NFPA 70. Within Canada all field wiring must conform to Section J18-064 (for non-incendive field wiring) or J18-152 (for Class I, Div. 2 wiring), of the Canadian Electrical Code.

All field wiring enters the F103-P through the bottom of the enclosure and connects to the circuit assembly inside the enclosure door. Wiring is routed through cable glands or up to two conduit hubs. Please make sure to order the F103-P with the correct drilling pattern and thread (metal) or hole (plastic) sizes.

The wire screens (shield) are meant to prevent electromagnetic interference and shall be terminated at one side to prevent ground loops. Connection of the screen can either be made to the common ground terminal or at the sensor itself, whichever is appropriate to the application. Inside of the Fluidwell unit, the various common ground terminals are connected to each other. It is advised to terminate the wire screens in the vicinity of the sensor and to insulate the wire screen with a shrink tube at the F103-P side.

### 4.5.4 POWER SUPPLY WIRING



- In case this instrument is connected to a supply by means of a permanent connection a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment. Furthermore, a protective over-current device with a maximum rating of 0.5A (e.g. fuse or circuit breaker) must be inserted in the positive supply line in safe area.
- The external power supply must be an approved ELV source, insulated from AC mains by double / reinforced insulation per CSA C22.2 No. 61010-1 / UL61010-1.

The F103-P can be powered from an external power supply or via the isolated 4-20mA current loop. An internal power supply is also available in the form of a lithium battery. When both external and internal power supplies are available, the internal power supply is interrupted and will act as a backup supply. Note that the optional backlight only works with the external power supply option PX.

### 4.5.5 SENSOR SUPPLY

#### For type PB / PX / AH

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 firmware).

## 4.6 TERMINAL CONNECTORS



Take careful notice of all safety and precautionary measures indicated in paragraph 4.4: Electrical Installation and review paragraph 4.4.3 and 4.4.4 before applying any field or power supply wiring.



To prevent the disconnection of live circuits in hazardous area, always use the supplied cable connectors with at least 5 poles to ensure proper strain relief.

### 4.6.1 OVERVIEW

The following terminal connectors are available on the F103-P:

Type PX: Power supply			Type OT: Output D2		Type OT: Output D1		Type AH: Isol. Ana.outp.		Input type P: Sensor signal			Type IB: Ext.clear	
00	1	2	3	4	5	6	7	8	9	10	11	12	13
⊥	+↑	NC	⊥	+↑	⊥	+↑	-↓	+↑	⊥		+↓	⊥	CLEAR

Type OG: Isol. output D3			Type IG: Isol. pulse in		Type IG: Isol. clear in		Type CH: RS485 communication					
14	15	16	17	18	19	20	C1	C2	C3	C4	C5	C6
NC	-↓	+↑	-↓	+↑	-↓	+↑	⊥	NC	A	B	NC	NC

Fig. 24: Overview of terminal connectors - Standard configuration

### 4.6.2 TERMINAL 00-01: POWER SUPPLY – TYPE PX

Connect an external power supply of 6-30VDC to these terminals. The connected supply is used to power the unit, the backlight and the sensor supply. When power is applied to these terminals, discharge of the (optional) internal battery will be disabled.

Please read **paragraph 4.4.4: Power supply wiring** for specific requirements.

### 4.6.3 TERMINAL 03-04 AND 05-06: DIGITAL OUTPUTS D1 AND D2 – TYPE OT / TYPE OG

Digital output D1 always functions in **retransmit mode** where the frequency of the flowmeter signal is retransmitted. This signal is often used when sinus / non-square wave input signals are present (e.g. coil signals) that need to be transmitted as robust square wave forms.

Digital output D2 offers a scaled pulse output and its function is determined by the settings of SETUP-menu 8: Pulse Output (see chapter 3).

If an isolated connection to a scaled pulse output is required, please see **Terminal 15-16: Isolated digital output D3 – Type OG**.

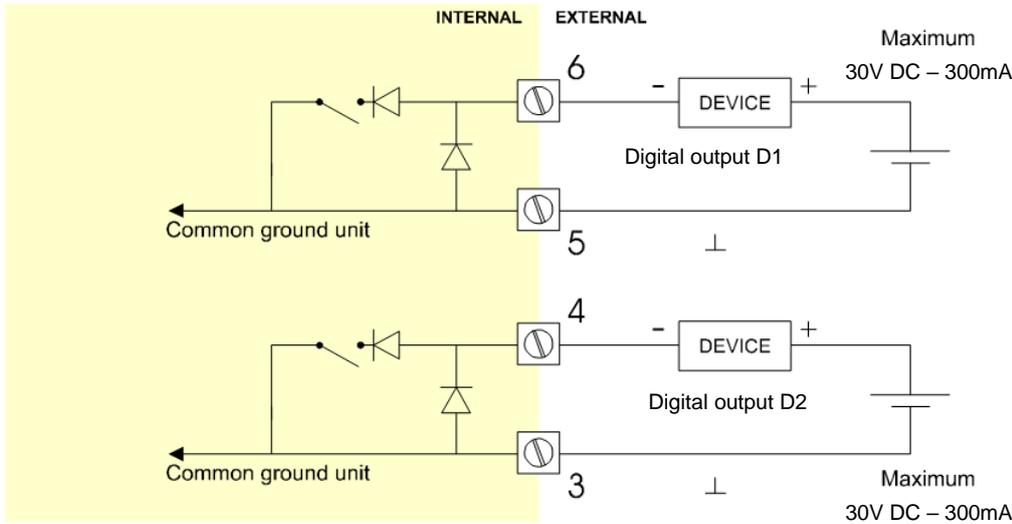


Note !

*Digital output D2 and digital output D3 are configured by the same settings of SETUP-menu 8: Pulse output. Please make sure to program the settings in such a way that the maximum output frequency is not exceeded (500Hz for D2 and 50Hz for D3).*

**Type OT / Type OG**

Two passive transistor outputs are available with this option with a maximum driving capacity of 300mA and 30V DC. The maximum pulse frequency of output D2 is 500Hz, for output D1 the minimum on and off-time is 50µs (max. 10kHz).

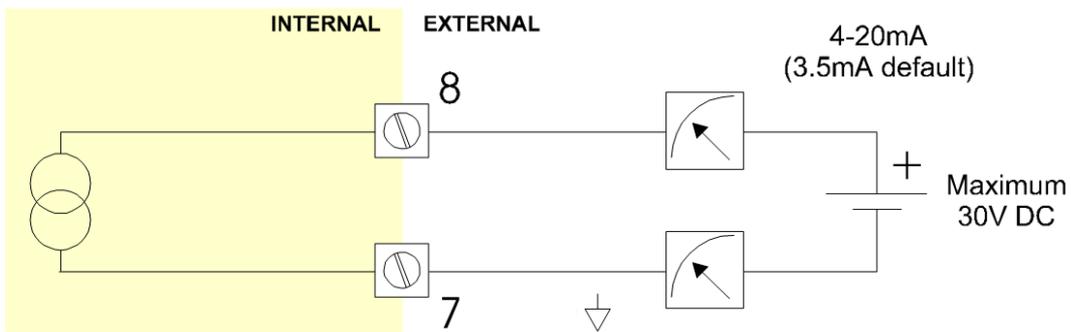


**Fig. 25: Terminal connections –Transistor outputs D1 and D2**

**4.6.4 TERMINAL 07-08: ANALOG OUTPUT – TYPE AH**

An analog output signal proportional to the flowrate is available as standard. The function of the analog output is determined by the settings of SETUP-menu 7: Analog output (see chapter 3). This output is a passive isolated 4-20mA output with the possibility to power the device via the 4-20mA loop. When the output is disabled, the current is by default about 3.5mA; when the output is enabled a current between 4-20mA is generated.

The analog output requires a minimum voltage of 10V across its terminals to function properly. This means that when connected to a 24V supply, the additional devices in the loop may take up a maximum of 14V, which equals a maximum driving capacity of 700 Ohm at 20mA. If the device is only powered by the loop the backlight will not be activated.



#### 4.6.5 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 SETUP-menu 5: Flowmeter (read chapter 3).

The following safety parameters are applicable to terminals 9, 10 and 11:

$V_{in-max}$	=	10 Vdc or peak
$V_{oc}$	=	5.1 Vdc
$I_{sc}$	=	1.9 mA
$P_o$	=	2.4 mW
$C_a$	=	1000 $\mu$ F
$L_a$	=	3 H

To connect an active flowmeter signal, please see **Terminal 17-18: Isolated pulse input – Type IG**.

#### Sine-wave signal (Coil)

The F103-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<sub>pp</sub>;
- COIL-HI: sensitivity from about 20mV<sub>pp</sub>;

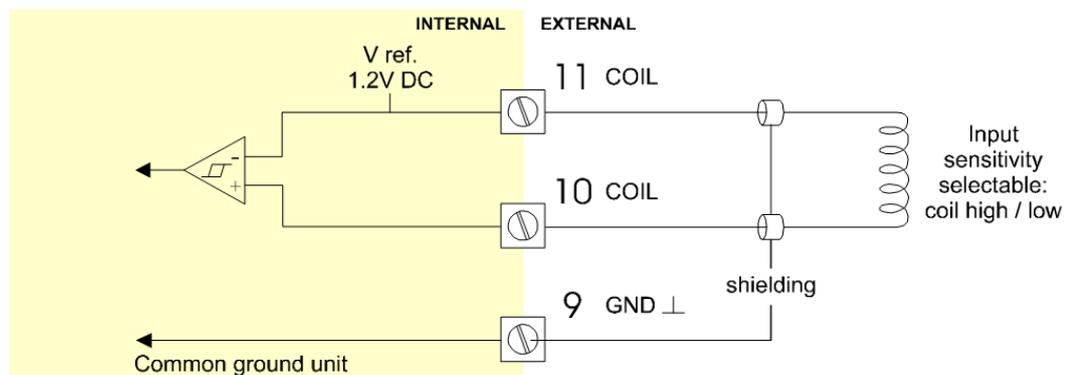


Fig. 27: Terminal connections - Coil signal input

#### Pulse-signal NPN / NPN-LP

The F103-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).

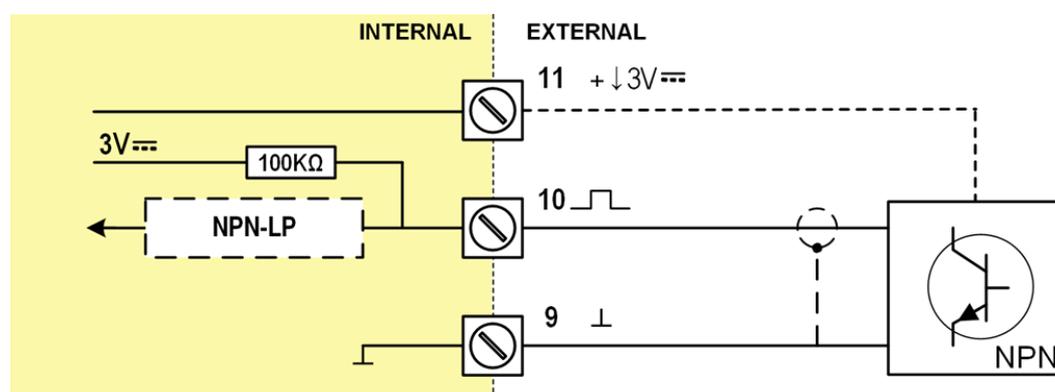
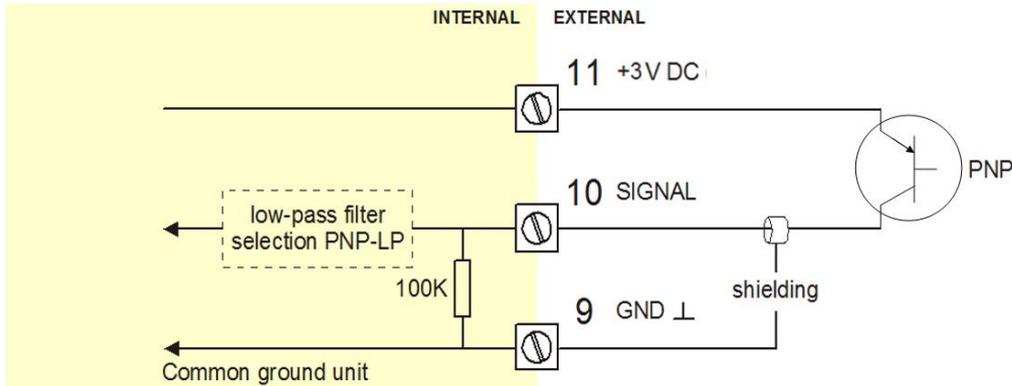


Fig. 28: Terminal connections – NPN signal input

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

The F103-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).



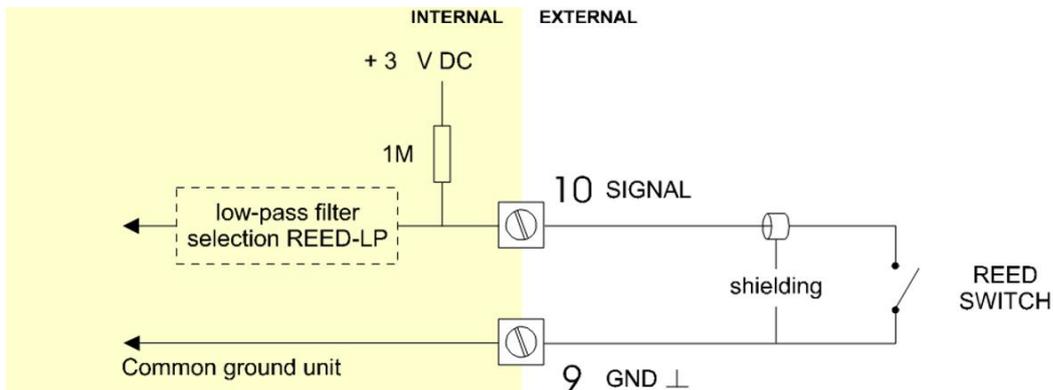
**Fig. 29: Terminal connections – PNP signal input**

When an external voltage needs to be used (e.g. if a higher voltage is required by the flowmeter), this voltage must be limited to the  $V_{in-max}$  of 10V dc.

Alternatively, an active flowmeter can be connected to the isolated pulse input which has higher maximum values; please see **Terminal 17-18: Isolated pulse input – Type IG**.

**Reed-switch**

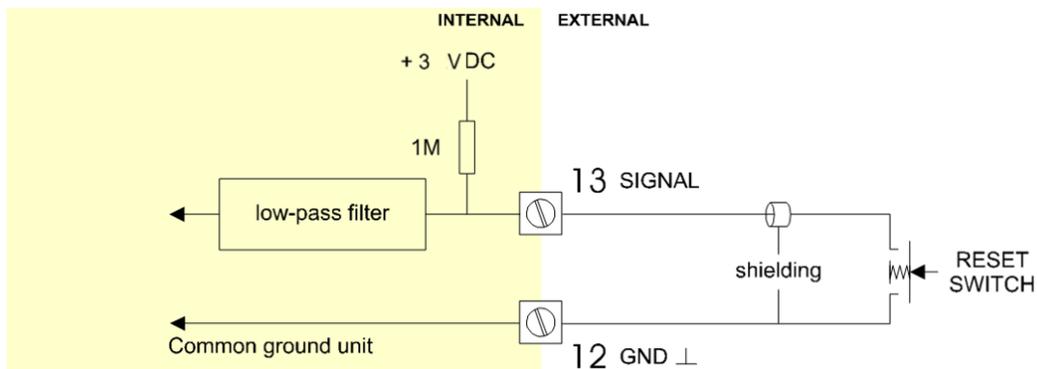
The F103-P is suitable for use with flowmeters which have a reed-switch. To avoid pulse bounce from the reed-switch, it is advised to select REED LP – low-pass filter (read chapter 3).



**Fig. 30: Terminal connections – Reed-switch input**

**4.6.6 TERMINAL 12-13: EXTERNAL RESET – TYPE IB**

With this function the total can be reset to zero with an external switch or passive signal. The Total resets only when the switch **opens**. When a Normally Closed (NC) contact is used, the local clear total function is disabled and a clear total is only possible with the external reset command. The input must be switched with a potential free contact to terminal 12 for at least 200ms.



**Fig. 31: Terminal connections – External reset input**

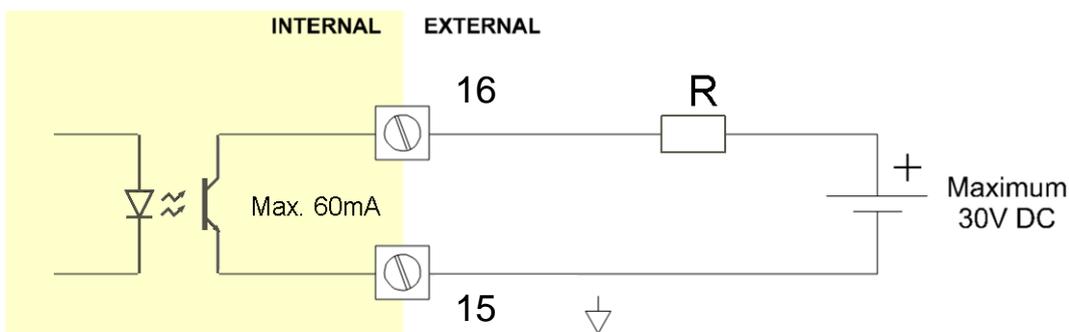
To connect an active signal to perform the reset function, please see **Terminal 19-20: Isolated reset input – Type IG**.

**4.6.7 TERMINAL 15-16: ISOLATED DIGITAL OUTPUT D3 – TYPE OG**

An isolated scaled pulse output with a maximum frequency of 50Hz is available on digital output D3 on terminals 15-16. The output can switch voltages from 3 – 30Vdc with a maximum current of 60mA. The function of digital output D3 is determined by the settings of SETUP-menu 8: Pulse Output (see chapter 3).



**Output D3 can handle a maximum current of 60mA. To limit the current, it may be necessary to include a resistor (R) in the circuit. Size the resistor to limit the current to 60mA.**



**Fig. 32: Terminal connections – Isolated digital output D3**

If a passive scaled pulse output with frequencies up to 500Hz is required, please see **Terminal 03-04 and 05-06: Digital outputs D1 and D2 – Type OT / Type OG**



- Digital output D2 and digital output D3 are configured by the same settings of SETUP-menu 8: Pulse output. Please make sure to program the settings in such a way that the maximum output frequency is not exceeded (500Hz for D2 and 50Hz for D3).
- If digital output D3 is not used, please disable it in the settings to preserve battery power.

#### 4.6.8 TERMINAL 17-18: ISOLATED PULSE INPUT – TYPE IG

The F103-P is suitable for use with an active flowmeter by connecting it to the isolated pulse input on terminals 17 and 18. The maximum frequency of the isolated pulse input is 3.5kHz and the active signal must switch between 0V and 3V ~ 30V to detect a pulse. The maximum current taken up by the input circuitry is 6mA.

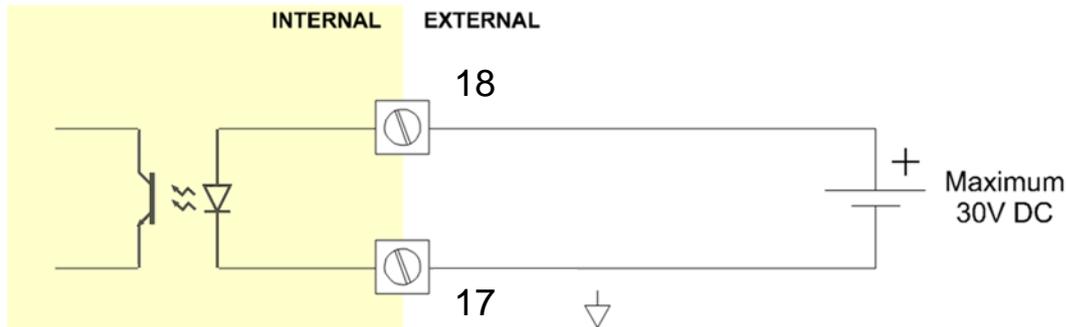


Fig. 33: Terminal connections – Isolated pulse input

To connect a passive flowmeter signal, please see **Terminal 09-11: Flowmeter input**.

#### 4.6.9 TERMINAL 19-20: ISOLATED RESET INPUT – TYPE IG

With this function the total can be reset to zero with an external active signal. The Total resets only when the voltage rises from 0V to a value above 3V.

The input must be activated with an active signal of 3-30V between terminals 19 and 20 and must remain active for at least 3 seconds to perform the reset. Afterwards, the input signal must remain at 0V for 3 seconds before a new clear action can be performed. The maximum current taken up by the input circuitry is 6mA.

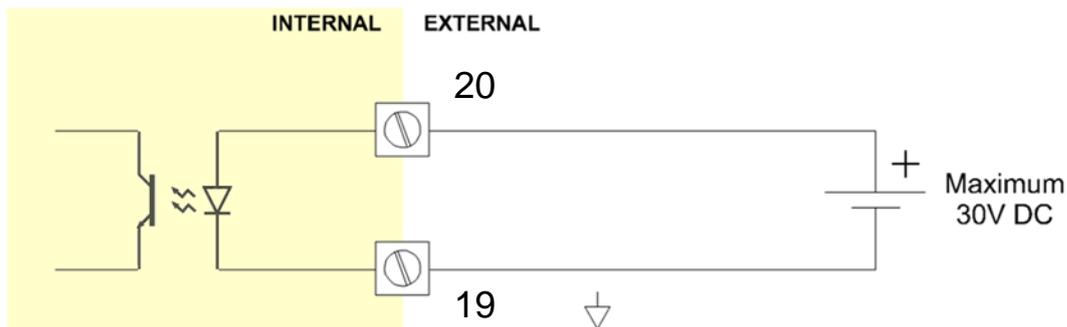


Fig. 34: Terminal connections – Isolated reset input

To connect a switch or passive signal to perform the reset function, please see **Terminal 12-13: External reset – Type IB**.

### 4.6.10 TERMINAL C1-C6: COMMUNICATION INTERFACE

The F103-P offers Modbus communication via a serial connection. Make sure that the hardware layer specific requirements are met to achieve reliable communication. Read the Modbus communication protocol and Appendix C.

Besides the use of any Modbus compliant master, we offer special configuration software to completely configure the F103 and read-out logged data, available on our website.



Note !

*Terminals C5 and C6 are not used and should not be connected.*

#### Type CH: RS485 (2 wire)

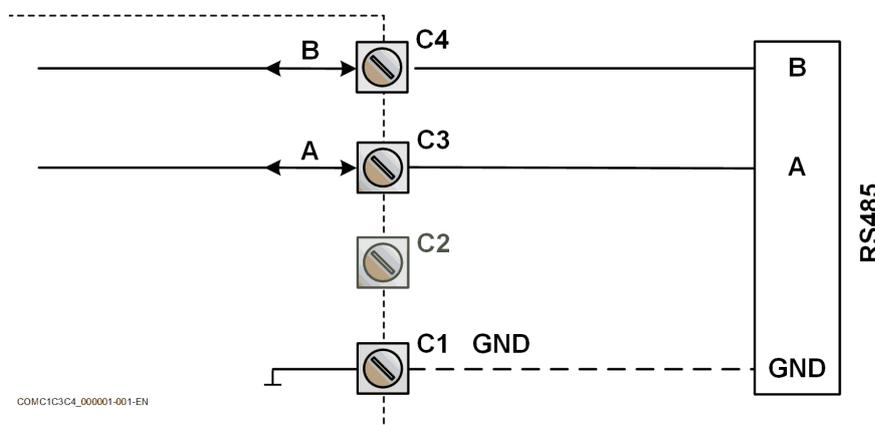
With type CH, an RS485 (length of cable max. 1200 meters) communications port is available. All connected devices on the bus, either in hazardous or safe area, must limit the voltages on terminals C3 and C4 between -7V and +12VDC with respect to terminal C1 / GND.

The RS485 interface is designed to work without terminations on the bus, due to power limitations.



Note !

*When the communication interface is configured as an RS485 port (type CH), it is suitable for use in hazardous area with a permanent connection.*



**Fig. 35: Terminal connectors – Communication – Type CH: RS485 (2 wire)**

#### Type CX: service port

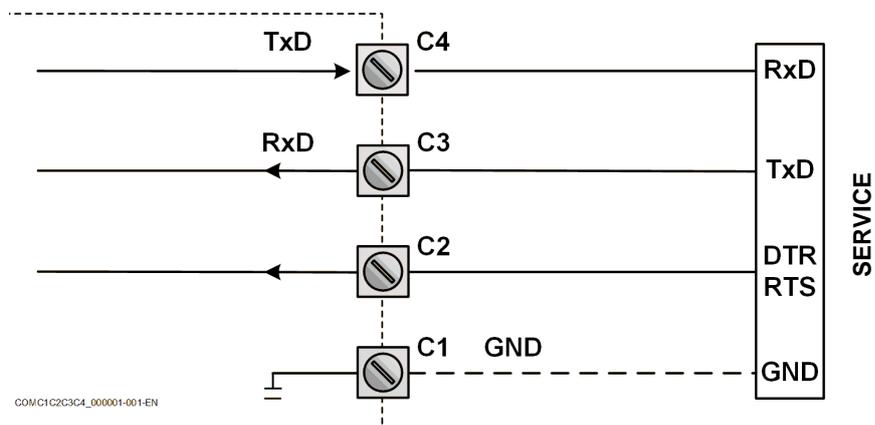
With type CX, a service port is available to configure the F103-P and read-out logged data via an external device, e.g. a laptop. The connection is not made with the standard type connectors, but the connections to terminals C1 through C4 are made via a special service connector.

To connect a laptop to the service port connector, a special cable is required which is available through your supplier or our website.



**When the communication interface is configured as a *service port* (type CX), it may only be used when the area is known to be non-hazardous.**

**The service port is not intended to be connected with a permanent connection.**



**Fig. 36: Terminal connectors – Communication – Type CX: service port**

## 5 MAINTENANCE

### 5.1 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 housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing 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 F103-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 F103-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

The battery life-time 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 enclosure, cable glands, hubs 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 window and enclosure only with a lint-free cleaning cloth made damp with a mild soap solution. Do not use any aggressive solvents as these might damage the coating.

### 5.2 INSTRUCTIONS FOR REPAIR

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

#### Repair policy

If you have any problem with your product and you wish to have it repaired, 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 and the reported problem falls under the warranty conditions, the product will be repaired or exchanged and returned within three weeks. Otherwise, you will receive a repair estimate.

### 5.3 BATTERY REPLACEMENT



**REPLACING BATTERIES, DISCONNECTING LIVE CIRCUITS OR OPENING INSTALLED ENCLOSURES MAY ONLY BE DONE WHEN THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.**



**THE USE OF UNAPPROVED BATTERIES CAN INVALIDATE EXPLOSION SAFETY. Only use batteries that are approved by the manufacturer. Approved batteries can be ordered from your supplier.**



- Handle the battery with the utmost care to prevent a short circuit and damage. A mistreated battery can become unsafe. Unsafe batteries can cause (serious) injury to persons. Do not recharge, crush, disassemble, incinerate, heat above its rated temperature or expose the contents to water.
- 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 the following batteries only:
  - Main battery: StdLiBAT021 - re-ordering number: SPB02.
  - Clock backup battery: Panasonic BR1225 A
- 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.

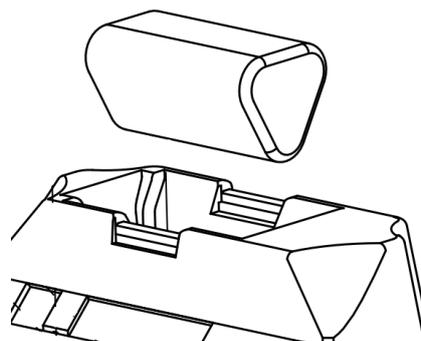
#### 5.3.1 REPLACE THE MAIN BATTERY – TYPE PB

To remove the main battery, follow these instructions:

1. Open the enclosure as indicated in section 4.3.
2. Locate the battery, open the Velcro fastener and remove the battery from its compartment.
3. Find the battery connector in the battery compartment and carefully disconnect the battery from the unit.
4. Store the old battery in a small plastic bag (e.g. the bag the new battery came in) or install an insulation tape over the battery connector to prevent a short circuit.

To install the new main battery, follow these instructions:

1. Make sure the new battery is undamaged, in good condition and suitable for use in the unit. (Type: StdLiBAT021 - re-ordering nr. SPB02)
2. Find the battery connector and carefully connect the battery to the unit.
3. Install the battery into its compartment and close the Velcro fastener around the battery.
4. Check that the battery is installed properly by checking that the screen has come on.
5. Close the enclosure as indicated in section 4.3.
6. If required, initialize the date and time on the unit.

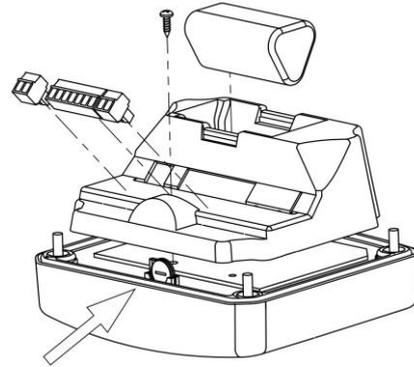


Uo = 3.6 V / Size AA x 3		<b>WARNINGS:</b> Consult the manual for replacement instructions. Fire, explosion or severe burns may result if mistreated. Do not recharge, crush, disassemble, incinerate, heat above 100°C (212°F) or expose contents to water.
Fluidwell BV www.fluidwell.com		<b>AVERTISSEMENTS:</b> Consulter le manuel pour connaître les consignes de remplacement. Une mauvaise utilisation peut entraîner un incendie, une explosion ou de graves blessures. Ne pas recharger, écraser, démonter, incinérer, chauffer à plus de 100 °C (212°F) ou exposer à l'eau.
<DATE YYYY-MM>		
Re-order no. : <b>SPB02</b>		
Primary Lithium Battery - Only replace with Fluidwell recommended battery pack! Pile primaire au lithium - Remplacer uniquement par une pile recommandée par Fluidwell!		

### 5.3.2 REPLACE THE CLOCK BACKUP BATTERY

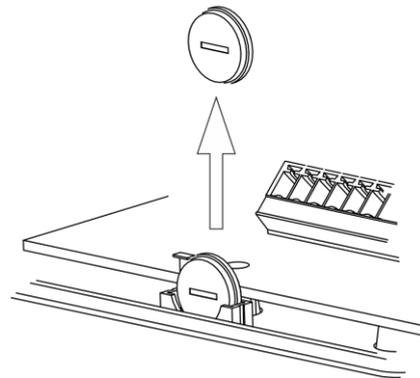
To remove the clock backup battery, follow these instructions:

1. Open the enclosure and remove the main battery as indicated in the previous section.
2. Remove all connectors.
3. Remove the two screws that fasten the plastic cover and then carefully remove the plastic cover.
4. Locate the backup battery and remove it from its socket by pushing the locking clip to the side.
5. Store the old battery in a small plastic bag (e.g. the bag the new battery came in) or install an insulation tape over the battery to prevent a short circuit.



To install the new clock backup battery, follow these instructions:

1. Make sure the new battery is undamaged, in good condition and suitable for use in the unit. (Type: Panasonic BR1225A or equivalent)
2. Locate the backup battery socket, push the locking clip to the side and insert the new battery into the socket while minding the correct orientation (as indicated by the image to the right).
3. Carefully replace the plastic cover and secure it with the two screws.
4. Replace all connectors to their original position.
5. Install the main battery and close the enclosure as indicated in the previous section.
6. Initialize the date and time on the unit.



### 5.3.3 DISPOSAL OF BATTERIES

Dispose of batteries in accordance with the (inter)national, the manufacturer's and the plant owner's standards and regulations.



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

## 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.
Enclosures	
General	Die-cast aluminum, Stainless Steel or GRP (Glassfibre Reinforced Polyamide) enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material.
Control Keys	Three industrial micro-switch keys. UV-stabilized silicone keypad.
Painting	Aluminum enclosure only: UV-resistant 2-component industrial painting.
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95") – LxHxD.
Classification	TYPE 4(X)
Material and drillings	
Aluminum	Type HA, HL ... HZ and HAA ... HAZ
Aluminum extended back	Type HBA ... HBZ
Stainless Steel	SS 316 L, Type HAS ... HSZ
Plastic	HGA ... HGZ
with conduit hub entries	HGL: 2x 1/2" conduit hub entries – fitted with internal earthing plate HGT: 1x 1/2" conduit hub entry – fitted with internal earthing plate
Operating temperature	
Operational	-40°C to +70°C (-40°F to +158°F)
Relative humidity	90%, no condensation allowed.
Power supply	
Type PB	Lithium battery - life-time depends upon settings - up to 5 years.
Type PX	6-30V DC; Power consumption max. 0.4 Watt.
Type PX-ZB	8-30V DC; Power consumption max. 1.0 Watt.
Sensor excitation	
Type PB / PX	3V DC for low power pulse signals and 1.2V DC for coil pick-up.
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	
Class I, Division 2	Groups A-D, T5 CSA C22.2 No. 213-17 ANSI/UL 121201-2019
Directives and Standards	
EMC	EN 61326-1; FCC 47 CFR part 15
LVD	CAN/CSA C22.2 No. 61010-1-12, UPD1:2015, UPD2:2016, AMD1:2018 UL 61010-1-12, AMD1:2018
RoHS	EN 50581
IP & TYPE	CSA C22.2 No. 94.2-15 UL 50E-2015
Terminals	
Type	PTR AKZ1550/___-3.81-GREEN
Torque	0.25 Nm
Minimum number of poles	Only connectors with a minimum of 5 connected poles are allowed.
Wire sizes	Solid: 0.14...1.5 mm <sup>2</sup> / Stranded: 0.14...1.5 mm <sup>2</sup> / Stranded with Ferrule: 0.25...1.0 mm <sup>2</sup>
Replacements	For suitable replacement connectors (cable part), please contact your supplier.

**Inputs**

<b>Flowmeter</b>	
Type P	
non-isolated	npn; npn-lp; reed; reed-lp; pnp; pnp-lp; coil-hi; coil-lo;
isolated (Type IG)	Active (3-30V 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	npn-lp; reed-lp; pnp-lp
Linearization	15 positions with interpolation function; Meter-Factor 0.000001 - 9.999999 versus Frequency 0.001 Hz - 9,999 Hz.
<b>Reset total</b>	
Type IB	External reset totalizer input signal
non-isolated	Make-and-break contact - Additional functionality to lock the RESET button of the keyboard (as long as this contact is being made). Duration minimum 200 msec. to reset Total.
isolated (Type IG)	Active (3-30V dc) Duration minimum 3 sec. to reset Total.

**Outputs**

<b>Analog output</b>	
Function	transmitting linearized flow rate.
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.
Lift off and maximum load	At least 10V required across terminals to function properly. Max. 700 Ohm @ 24V.
Type AH	Passive galvanic isolated output - output loop powered
<b>Digital output(s)</b>	
General	Transmitting accumulated total (scaled pulse) or input pulse retransmission
Frequency	Retransmission: Output D1: Minimum pulse duration: 50µs, square wave output based on frequency of (sine wave or coil) input signal Scaled: Output D2: max. 500Hz. Output D3: max. 50Hz. Pulse length user definable between 1msec up to 10 seconds.
Type OT	
non-isolated	Two passive transistor output. Load max. 30V DC – 300mA.
isolated (Type IG)	One passive solid state output. Load max. 30V DC – 60mA.
<b>Communication option</b>	
Protocol	bus-rtu; bus-asc
Speed	1200; 2400; 4800; 9600; 19200; 38400
Addressing	1 - 247
Type CH	RS485 2-wire
Type CX	Service connector – temporary use in non-hazardous area only. Requires special communication cable, available through your supplier.

**Operational**

<b>Operator functions</b>	
Displayed information	<ul style="list-style-type: none"> <li>• Linearized flow rate, total and accumulated total</li> <li>• Current Day total, previous day total and 15 historical day totals</li> <li>• Indicating speedometer for flow rate</li> <li>• Total can be reset to zero by pressing the CLEAR-key twice</li> <li>• Reviewing historical day totals or reviewing the various logbooks (Type ZL)</li> </ul>
<b>Total</b>	
Digits	7 digits.
Unit	L, m3, US gal, igal, cf, Oil bbl, kg, ton, US ton, lb or none.
Decimals	0 - 1 - 2 or 3.
 Note !	<i>Total can be reset to zero.</i>
<b>Daily totals</b>	
Digits	7 digits.
Unit / decimals	According to selection for total
Contract hour	0:00 – 23:00, settable per whole hour
Current day total	Running total, started at zero after the last contract hour
Previous day total	Fixed total, copied from current day total at the last contract hour
Historical day totals	The last 15 previous day totals are stored and can be reviewed on the display (without type ZL)
 Note !	<i>Current day total cannot be reset to zero.</i>
<b>Accumulated total</b>	
Digits	11 digits.
Unit / decimals	According to selection for total.
 Note !	<i>Accumulated total cannot be reset to zero.</i>
<b>Flow rate</b>	
Digits	7 digits.
Units	mL, L, m3, mg, g, kg, ton, US ton, US gal, igal, Oil bbl, lb, cf, rev, none, scf, nm3, nL or p.
Bargraph speedometer	20 blocks, each block is 5% of total span
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.
<b>Data logging (type ZL)</b>	
Type ZL	<p><i>Powerful data and event logging functions and logbooks are available. Log records go round trip, the oldest entries are overwritten when the logbook is full.</i></p> <p> Note ! <i>When ordered with Type ZL - Datalogging, the historical day totals are not available.</i></p>
Interval log	1000 records
Daily log	1000 records Single daily log: 1000 days, 1 record per day Dual daily log: 500 days, 2 records per day
Event log	500 records

## APPENDIX B. PROBLEM SOLVING

In this appendix, several problems are treated that can occur when the F103-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 F103-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 500Hz for output D2 and under 50 Hz for output D3?
- Solid state output: Is output D3 enabled in the configuration settings?
- 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 K-Factor and time unit configured correctly?
- 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.

### Linearization does not work:

Check:

- Is the function enabled?
- Are all M-Factors and frequencies entered correctly?

### The password is unknown:

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

## ALARM

When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the error code. When multiple errors arise at the same time, their error codes are added and their sum is shown. The digital [d] codes are:

### Not recoverable by the end user:

- [d] 0 = no error;
- [d] 1 = display error;
- [d] 2 = data-storage error;
- [d] 3 = error 1 + error 2 simultaneously;
- [d] 4 = initialization error.
- [d] 8 = I/O configuration error
- [d] 10 = linearization error (calculated M-Factor out of range)

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

## APPENDIX C. MODBUS COMMUNICATION

### 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:

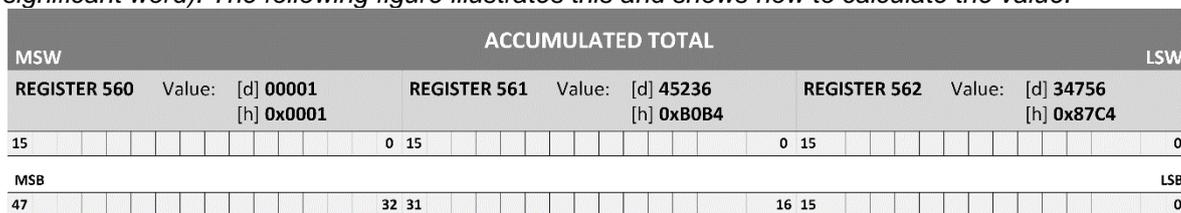
- function code 3 “Read Holding Registers” (4x references);
- function code 16 “Preset Multiple Registers” (4x references).

The tables show 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 use the holding registers addresses.

### Variables consisting of multiple registers

Several variables in the system are too big to fit in a single register and are spanned over multiple registers. Most Modbus masters support variables that span 2 or 4 registers in integer and floating point format. If your Modbus master does not support any of the formats we supply, select an integer based variable, and you can calculate the corresponding value manually, as shown in this example:

*Let’s assume that variable accumulated total spans 3 registers with address 560, 561 and 562. When a transmission is done, register 560 (which represents the MSW - most significant word) arrives first, followed by register 561 in the middle and register 562 at the end (the LSW - least significant word). The following figure illustrates this and shows how to calculate the value.*



FW-F000-000032-003-ML

ACCUMULATED TOTAL: [register 560 \* 2<sup>32</sup>] + [register 561 \* 2<sup>16</sup>] + [register 562 \* 1]  
 Calculation [d]: [00001 \* 4294967296] + [45236 \* 65536] + [34756 \* 1] = 7259588548  
 Calculation [h]: 0x[0001] [B0B4] [87C4] = 0x0001B0B487C4

### Datatypes

The following datatypes are used for Modbus communication with the F103-P:

DATA TYPE	NUMBER OF BYTES	NUMBER OF REGISTERS (16 BIT)	DESCRIPTION
char	1	1	8 bits ASCII character
uint16	2	1	16 bits unsigned integer
uint32	4	2	32 bits unsigned integer
int32	4	2	32 bits signed integer
uint48	6	3	48 bits unsigned integer
uint64	8	4	64 bits unsigned integer
float32	4	2	32 bits floating point
float64	8	4	64 bits floating point

Note: When reading and writing integer-type variables, values are transmitted without the decimal point.

For the correct representation, please see the remarks-field in the tables below.

Note: Variables spanning multiple registers use ‘big-endian’ data representation.

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

**Runtime variables of the F103-P**

Reading flow rate, total, accumulated total or current day totals: When reading runtime variables, the given value may differ slightly from the value that is displayed 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.

When variables are read in integer format, the returned values are given including the decimals. 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).

Runtime variables of the F103-P – Integer based – Individual read						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 255 [h] 0x00FF	40256	battery status	1	R	uint16	0 = unknown    1 = normal    2 = low battery
[d] 516 [h] 0x0204	40517	error status (bitfield)	1	R	uint16	[d] 0 = no error [d] 1 = display error [d] 2 = data-storage error [d] 4 = initialization error [d] 8 = data-storage error data logging (option ZL) [d] 64 = Linearization error (M-factor out of range) [d] 128 = Automatic K-factor conversion error
[d] 560 [h] 0x0230	40561	accumulated total	3	R	uint48	0.000...999999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 566 [h] 0x0236	40567	total	3	R*	uint48	0.000...999999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 572 [h] 0x023C	40573	flow rate	2	R	uint32	0.000...99999999 Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 4640 [h] 0x1220	44641	Total command register	1	R/W	uint16	Commands: 0x0102: Clear total
* Clearing total: Total can also be cleared by writing the correct command to the total command register, as shown above. It is also still possible to use the old method: Write a value of 0 to all the 3 registers of total in a single write action. Writing any other value will result in the reply of an error message.						
Note: The runtime variables shown in above list must always be read or written individually, for the indicated number of registers, in 1 single action!						

Runtime variables of the F103-P – Integer based – Contiguous read						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 6146 [h] 0x1802	46147	total	4	R	uint64	0.000...999999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 6150 [h] 0x1806	46151	accumulated total	4	R	uint64	0.000...999999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 6154 [h] 0x180A	46155	flow rate	2	R	uint32	0.000...99999999 Representation: unit, time, decimals depending on variables 48, 49, 50
[d] 6156 [h] 0x180C	46157	current day total	4	R	uint64	0.000...999999999999999 Representation: unit, decimals depending on variables 32, 33
[d] 6160 [h] 0x1810	46161	previous day total	4	R	uint64	0.000...999999999999999 Representation: unit, decimals depending on variables 32, 33
Note: The list of runtime variables shown above can be read as one contiguous list of registers. Unused registers return 0.						

### Historical previous day totals of the F103-P – Integer based – Contiguous read

The read-out of **historical previous day totals** is done via 2 INDEXED variables containing the number of decimals and the value. These 2 variables can be read as one contiguous list of 3 registers (in a single read action). Reading is done by first selecting the right entry (day) through the index. Valid values for the index are 0...14, which correspond with the previous day totals of 1 day old through 15 days old. Indexes outside this range will result in an error being sent back. (See the communication-section of this appendix for setting the index and its extended functionality through variable 150 and 149).

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 5888 [h] 0x1700	45889	Previous day total decimals	1 INDEXED variable	R	uint8	0...3
[d] 5889 [h] 0x1701	45890	Previous day total	2 INDEXED variable	R	uint64	0.000...9999999999 Representation: unit depends on variable 32, decimals depends on variables 5888 (0x1700)

### Runtime variables of the F103-P – Floating point based 32 bit

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 6402 [h] 0x1902	46403	total	2	R	float32	0...9999999 Representation: unit depending on variable 32
[d] 6404 [h] 0x1904	46405	accumulated total	2	R	float32	0...999999999999 Representation: unit depending on variable 32
[d] 6406 [h] 0x1906	46407	flow rate	2	R	float32	0...9999999 Representation: unit and time depending on variables 48, 49
[d] 6408 [h] 0x1908	46409	current day total	2	R	float32	0...9999999 Representation: unit depends on variable 32
[d] 6410 [h] 0x190A	46411	previous day total	2	R	float32	0...9999999 Representation: unit depends on variable 32

Note: The list of runtime variables shown above can be read as one contiguous list of registers. Unused registers return 0.

### Runtime variables of the F103-P – Floating point based 64 bit

PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 6656 [h] 0x1A00	46657	total	4	R	float64	0...9999999 Representation: unit depending on variable 32
[d] 6660 [h] 0x1A04	46661	accumulated total	4	R	float64	0...999999999999 Representation: unit depending on variable 32
[d] 6664 [h] 0x1A08	46665	current day total	4	R	float64	0...9999999 Representation: unit depends on variable 32
[d] 6668 [h] 0x1A0C	46669	previous day total	4	R	float64	0...9999999 Representation: unit depends on variable 32

Note: The list of runtime variables shown above can be read as one contiguous list of registers. Unused registers return 0.

### Configuration variables of the F103-P

Total						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 32 [h] 0x020	40033	unit	1	R/W	uint16	0=none      4= l GAL      8=ton      12=nm3 1=L          5=CF          9=lb 2= m3      6= OilBBL      10=us ton 3=US GAL      7=kg          11=nL
[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 37: decimals K-factor.
[d] 37 [h] 0x025	40038	K-factor decimals	1	R/W	uint16	0...6
[d] 47 [h] 0x02F	40048	multiply factor	1	R/W	uint16	0=x1          3=x1000
[d] 1052 [h] 0x41C	41053	clear total password	1	R/W	uint16	000 ... 999 Setting 000 disables the clear total password feature.
[d] 2146 [h] 0x862	42147	contract hour	1	R/W	uint16	0...23 Hour

[d] 2208 [h] 0x8A0	42209	Current day total	4	R	uint64	0.000...9999999999 Representation: unit, decimals depending on variables 32, 33
[d] 2216 [h] 0x8A8	42217	Previous day total	4	R	uint64	0.000...9999999999 Representation: unit, decimals depending on variables 32, 33

Flowrate						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 48 [h] 0x030	40049	unit	1	R/W	uint16	0=none    5=l GAL    10=SCF    15=lb 1=mL      6=CF       11=mg     16=US ton 2=L        7=OilBBL   12=g       17=rev 3=m <sup>3</sup> 8=nL        13=kg      18=P 4=US GAL   9=nm <sup>3</sup> 14=ton
[d] 49 [h] 0x031	40050	time unit	1	R/W	uint16	0=/sec    1=/min    2=/hour   3=/day
[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: decimals K-factor.
[d] 54 [h] 0x036	40055	K-factor decimals	1	R/W	uint16	0...6
[d] 55 [h] 0x037	40056	calculation nr of pulses	1	R/W	uint16	1...255
[d] 56 [h] 0x038	40057	cut-off time	1	R/W	uint16	1...9999 Representation: 0.0001 – 9.999 sec

Display						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 64 [h] 0x040	40065	display function	1	R/W	uint16	0=total    1=flowrate    2=acc.total
[d] 2147 [h] 0x863	42148	day totals	1	R/W	uint16	0=hidden   1=operate    2=off
[d] 80 [h] 0x050	40081	LCD update time	1	R/W	uint16	0= fast    2=3 sec    4=30 sec 1=1 sec    3=15 sec   5=off
[d] 67 [h] 0x043	40068	backlight brightness	1	R/W	uint16	0=off      2=40%      4=80% 1=20%      3=60%      5=100%

Flowmeter						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 96 [h] 0x060	40097	flowmeter signal	1	R/W	uint16	0=NPN      3=Reed LP    6=NAMUR    9=act 8.2V 1=NPN LP   4=PNP        7=coil hi   10=act 24V 2=Reed     5=PNP LP    8= coil lo
[d] 1051 [h] 0x41B	41052	K-factor - unit type	1	R/W	uint16	0=Hand    1=Volumetric 2=Mass
[d] 1050 [h] 0x41A	41051	K-factor - unit	1	R/W	uint16	0=none    3=US GAL    6= OilBBL   9=lb 1=L        4= l GAL    7=kg        10=us ton 2= m <sup>3</sup> 5=CF        8=ton
[d] 1046 [h] 0x416	41047	K-factor	2	R/W	uint32	1...9999999 Representation: 0.000010...9999999 depending on variable 54: decimals K-factor.
[d] 1049 [h] 0x419	41050	K-factor decimals	1	R/W	uint16	0...6

Linearization						
The linearization table is an INDEXED variable. Reading and writing the entries of the linearization table is done by first selecting the entry through the index. Valid values for the index are 0...14, which correspond with the linearization table entries 1 through 15. Indexes outside this range will result in an error being sent back. (See the communication-section of this appendix for setting the index and its extended functionality through variable 150 and 149).						
PDU ADDRESS	REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 1024 [h] 0x400	41025	linearization table entry	3 INDEXED variable	R/W	struct  2x uint24	The 3 registers represent a structure containing 2 variables of each 3 bytes. The three least significant bytes (PDU address 1024 and LSB of PDU address 1025) contain the frequency part, the three most significant bytes (MSB of PDU address 1025 and PDU address 1026) contain the M-factor part.  Valid range for the frequency is 0.000 to 9999Hz. Decimal point dependent on variable 1039. A value of 0 for frequency means that entry is disabled.  Valid range for the M-factor 0.000000 to 9.999999.
[d] 1038 [h] 0x40E	41039	linearization on/off	1	R/W	uint16	0=disable 1=enable
[d] 1039 [h] 0x40F	41040	decimals	1	R/W	uint16	0...3 This variable selects the number of decimals used for the frequencies entered in the linearization table.

Analog output						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	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 output	1	R/W	uint16	0...9999
[d] 122 [h] 0x07A	40123	tune maximum output	1	R/W	uint16	0...9999
[d] 127 [h] 0x07F	40128	filter	1	R/W	uint16	1...99

Pulse output						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 128 [h] 0x080	40129	pulse time width	1	R/W	uint16	0...9999 Representation: 0.001 – 9.999 sec
[d] 2152 [h] 0x868	402153	solid state output	1	R/W	uint16	0=disable 1=enable
[d] 130 [h] 0x082	40131	pulse per X quantity	2	R/W	uint32	1...9999999 Representation: 0.000001...9999999 depending on variables 133
[d] 133 [h] 0x085	40134	pulse quantity decimals	1	R/W	uint16	0...3

Modbus communication						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 144 [h] 0x090	40145	speed (baudrate)	1	R/W	uint16	0=1200    2=4800    4=9600HP    6=38400 1=2400    3=9600    5=19200    7=57600
[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
[d] 1271 [h] 0x4F7	41272	data bits	1	R/W	uint16	0=7 bits    1=8 bit
[d] 1272 [h] 0x4F8	41273	parity	1	R/W	uint16	0=none    1=even    2=odd
[d] 147 [h] 0x093	40148	delay	1	R/W	uint8	delay between receiving a (valid) modbus command and sending the response 0...255 ms
[d] 150 [h] 0x096	40151	index	1	R/W	uint16	used for indexed values 0...255
[d] 149 [h] 0x095	40150	index use	1	R/W	uint16	0=static    1=auto    2=auto increment    decrement
[d] 25 [h] 0x019	40026	reboot	1	R/W	uint16	Returns 0 on read. Write 0xA50F for unit restart Write 0x5AF0 for factory settings

Data logging (type -ZL only)						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 576 [h] 0x240	40577	log interval	1	R/W	uint16	0=off    3=10 min    6=1 hour    9= 6 hours 1=1 min    4=15 min    7=2 hours    10=8 hours 2=5 min    5=30 min    8= 4 hours
[d] 577 [h] 0x241	40578	daily log	1	R/W	uint16	0=off    1=Single    2=Dual
[d] 578 [h] 0x242	40579	daily1	1	R/W	uint16	00:00 – 23:59 Representation: hh:mm Stored decimal: 23:59 = 2359d = 0x0937
[d] 580 [h] 0x244	40581	daily2	1	R/W	uint16	00:00 – 23:59 Representation: hh:mm Stored decimal: 23:59 = 2359d = 0x0937
[d] 176 [h] 0x0B0	40177	local time	2	R/W	uint32	00:00:00 – 23:59:59 Representation: hh:mm:ss Stored decimal: 23:59:59 = 235959d = 0x0003.99B7
[d] 179 [h] 0x0B3	40180	date	2	R/W	uint32	2000-01-01 – 2099-12-31 Representation: yy-mm-dd Stored decimal: 99-12-31 = 991231d = 0x000F.1FFF

Others						
PDU ADDRESS	HOLDING REGISTER	VARIABLE	NO. REGISTERS	R/W	TYPE	VALUE / REMARKS
[d] 160 [h] 0x0A0	40161	model number	1	R	uint16	0...9999
[d] 173 [h] 0x0AD	40174	model suffix	1	R	char	Representation: ASCII character
[d] 162 [h] 0x0A2	40163	firmware version	2	R	uint32	0...999999 Representation: xx.xx.xx
[d] 165 [h] 0x0A5	40166	serial no	2	R	uint32	0...9999999 Representation: xxxxxxx
[d] 176 [h] 0x0B0	40177	local time	2	R/W	uint32	00:00:00 – 23:59:59 Representation: hh:mm:ss Stored decimal: 23:59:59 = 235959d = 0x0003.99B7
[d] 168 [h] 0x0A8	40169	password	1	R	uint16	0...9999
[d] 81 [h] 0x051	40082	battery mode	1	R/W	uint16	0=operate    1=shelf
[d] 2148 [h] 0x864	402149	quick, setup menu	1	R/W	uint16	0=disable    1=enable
[d] 170 [h] 0x0AA	40171	tag no	2	R/W	uint32	0...9999999 Representation: xxxxxxx

# APPENDIX D. CONTROL DRAWING F1XX-XN

Terminals	Function	Isolated	0, 1	3, 4	5, 6	7, 8	9, 10, 11	12, 13, 14	15, 16	17, 18	19, 20	C1, C2, C3, C4
	Power Supply	-										Communication
Input:	V <sub>in-max</sub>	30V dc	30V dc	30V dc	30V dc	30V dc	10V dc or peak	10V dc or peak	30V dc	30V dc	30V dc	-7 dc to 12V dc
	I <sub>in-max</sub>	0.5A (fused)	300mA	300mA	300mA	-	-	-	60mA	-	-	-
Output:	V <sub>oc</sub>						5.1V dc	5.1V dc				
	I <sub>sc</sub>						1.9mA	1.9mA				
	P <sub>o</sub>						2.4mW	2.4mW				
	Ca						1000µF	1000µF				
	La						3H	3H				

Note 1: Greyed-out terminal mean 'no connection' and should not be connected to any circuit.  
 Note 2: Isolated means isolated from internal circuitry and circuits connected to GND.  
 Note 3: All circuits can have optional hazardous location apparatus installed. Verify suitability with above I/O parameters and I/O parameters of the circuits and optional apparatuses.  
 Note 4: In case this instrument is connected to a supply by means of a permanent connection a switch or circuit-breaker shall be included in the installation.  
 This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.  
 Furthermore, a protective over-current device with a maximum rating of 0.5A (e.g. fuse or circuit breaker) must be inserted in the positive supply line in safe area.  
 The external power supply must be an approved ELV source, insulated from AC mains by double / reinforced insulation per CSA C22.2 No. 61010-1-12 / UL61010-1.  
 Note 5: The installation must comply with (inter)national requirements and local ordinances.  
 Within the United States all field wiring (for Class I, Div. 2) must conform to Article 501.10(B) of the National Electric Code, NFPA 70.  
 Within Canada all field wiring must conform to Section J18-064 (for non-incendive field wiring) or J18-152 (for Class I, Div. 2 wiring), of the Canadian Electrical Code for installations within Canada.

Control drawing: D\_F1xx

Revision: 1.0      Control drawing number: D\_F1xx\_1.0      Date: July 14th, 2020

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LIST OF CONFIGURATION SETTINGS				
SETTING		DEFAULT	DATE:	DATE:
<b>1</b>	<b>TOTAL</b>	Enter your settings here		
1.1	UNIT	L		
1.2	DECIMALS	0		
1.3	K-FACTOR	AUTO		
1.4	FACTOR-X	x1		
1.5	CLEAR PASSWORD	000		
1.6	CONTRACT HOUR	00:00		
1.7	CURRENT DAY TOTAL	----		
1.8	PREVIOUS DAY TOTAL	----		
<b>2</b>	<b>FLOWRATE</b>			
2.1	UNIT	L		
2.2	TIME	/min		
2.3	DECIMALS	0		
2.4	K-FACTOR	AUTO		
2.5	CALCULATION	PLS 10		
2.6	CUT-OFF	30.0		
<b>3</b>	<b>DISPLAY</b>			
3.1	FUNCTION	total		
3.2	DAY TOTALS	off		
3.3	BACKLIGHT	100%		
<b>4</b>	<b>DISPLAY</b>			
4.1	LCD NEW	1 sec		
4.2	POWER MANAGEMENT	operate		
<b>5</b>	<b>FLOWMETER</b>			
5.1	SIGNAL	coil lo		
5.2	UNITS	auto-vol		
5.3	UNIT	L		
5.4	K-FACTOR	1		
<b>6</b>	<b>LINEARIZE</b>			
6.1	FREQUENCY 1	0.0Hz		
	M-FACTOR 1	1.000000		
6.2	FREQUENCY 2	0.0Hz		
	M-FACTOR 2	1.000000		
6.3	FREQUENCY 3	0.0Hz		
	M-FACTOR 3	1.000000		
6.4	FREQUENCY 4	0.0Hz		
	M-FACTOR 4	1.000000		
6.5	FREQUENCY 5	0.0Hz		
	M-FACTOR 5	1.000000		
6.6	FREQUENCY 6	0.0Hz		
	M-FACTOR 6	1.000000		
6.7	FREQUENCY 7	0.0Hz		
	M-FACTOR 7	1.000000		
6.8	FREQUENCY 8	0.0Hz		
	M-FACTOR 8	1.000000		
6.9	FREQUENCY 9	0.0Hz		
	M-FACTOR 9	1.000000		
6.A	FREQUENCY 10	0.0Hz		
	M-FACTOR 10	1.000000		
6.B	FREQUENCY 11	0.0Hz		
	M-FACTOR 11	1.000000		

6	LINEARIZE (continued)			
6.C	FREQUENCY 12	0.0Hz		
	M-FACTOR 12	1.000000		
6.D	FREQUENCY 13	0.0Hz		
	M-FACTOR 13	1.000000		
6.E	FREQUENCY 14	0.0Hz		
	M-FACTOR 14	1.000000		
6.F	FREQUENCY 15	0.0Hz		
	M-FACTOR 15	1.000000		
6.G	LINEARIZATION	disable		
6.H	DECIMALS FREQUENCY	0.1		
7	ANALOG			
7.1	OUTPUT	disable		
7.2	RATE-MIN (4mA)	0		
7.3	RATE-MAX (20mA)	99999		
7.4	CUT-OFF	0.0%		
7.5	TUNE-MIN (4mA)	1438		
7.6	TUNE-MAX (20mA)	5778		
7.7	FILTER	1		
8	PULSE			
8.1	WIDTH	0.000 sec		
8.2	SOLID STATE OUTPUT	disable		
8.3	AMOUNT	1000		
9	COM MODB			
9.1	SPEED	9600		
9.2	ADDRESS	1		
9.3	MODE	bus-rtu		
9.4	DATABITS	8 bits		
9.5	PARITY	none		

**For F103-P without data logging (without type ZL)**

10	OTHERS			
10.1	MODEL	F103-P		
10.2	SOFTWARE VERSION	03:__:__		
10.3	SERIAL NO	-----		
10.4	TIME	00:00:00		
10.5	PASSWORD	0000		
10.6	QUICK SETUP	enable		
10.7	TAG-NO	0000000		

**For F103-P with data logging (with type ZL)**

10	DATALOG			
10.1	LOG INT	Off		
10.2	DAILY LOG	Off		
10.3	DAILY 1	00:00		
10.4	DAILY 2	00:00		
10.5	TIME	00:00:00		
10.6	DATE	00.01.01		
11	OTHERS			
11.1	MODEL	F103-P		
11.2	SOFTWARE VERSION	03:__:__		
11.3	SERIAL NO	-----		
11.4	PASSWORD	0000		
11.5	QUICK SETUP	enable		
11.6	TAG-NO	0000000		



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