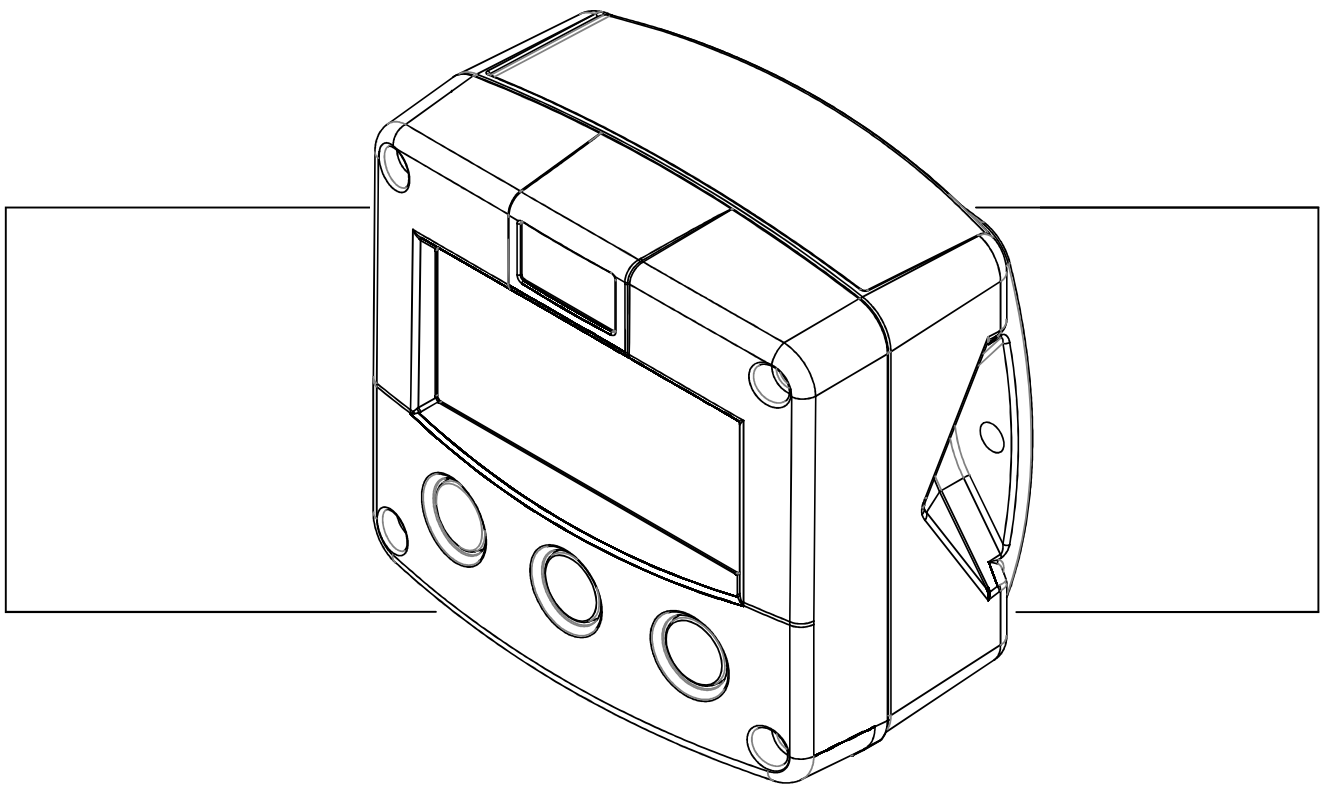


101A(i)

**FLOWRATE INDICATOR / TOTALIZER
WITH LINEARISATION**



Signal input flowmeter: coil.

Signal outputs: (0)4-20mA ref. flowrate and pulse ref. total.

Options: Intrinsically Safe, Modbus communication, external reset.



SAFETY INSTRUCTIONS



- **Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.**



- **LIFE SUPPORT APPLICATIONS: The 101A(i) is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.**



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



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



- **Do connect a proper grounding to the aluminum casing as indicated if the 101A(i) has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.**



- **Intrinsically Safe applications: follow the instructions as mentioned in Chapter 5 and consult "Fluidwell F1...-XI - Documentation for Intrinsic Safety".**

DISPOSAL



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

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the 101A(i) implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the 101A(i) supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

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

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

A hazardous situation may occur if the 101A(i) 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 101A(i) or connected instruments.



Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the 101A(i) or connected instruments.



Note !

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

Hardware version:	02.01.xx
Software version:	02.05.xx
Model base	: F112-P
Manual :	HF101Ai_v0404_03
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1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE 101A(i)

Functions and features

The flowrate / totalizer model 101A(i) is a microprocessor driven instrument designed to linearise the flowmeters flow curve and to display flowrate, total and accumulated total.

This product has been designed with a focus on:

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

Flowmeter input

This manual describes the unit with a pulse type input from the flowmeter "-P version".

One flowmeter with a sine wave (coil) signal output can be connected to the 101A(i). To power the sensor, several options are available.

Standard outputs

- Configurable pulse output: a scaled pulse mirroring a certain linearized total quantity. Maximum frequency 60Hz.; the pulse length can be set from 7,8msec up to 2 seconds.
- Configurable linear (0)4-20mA analog output with 10-bits resolution mirroring the actual linearized flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.

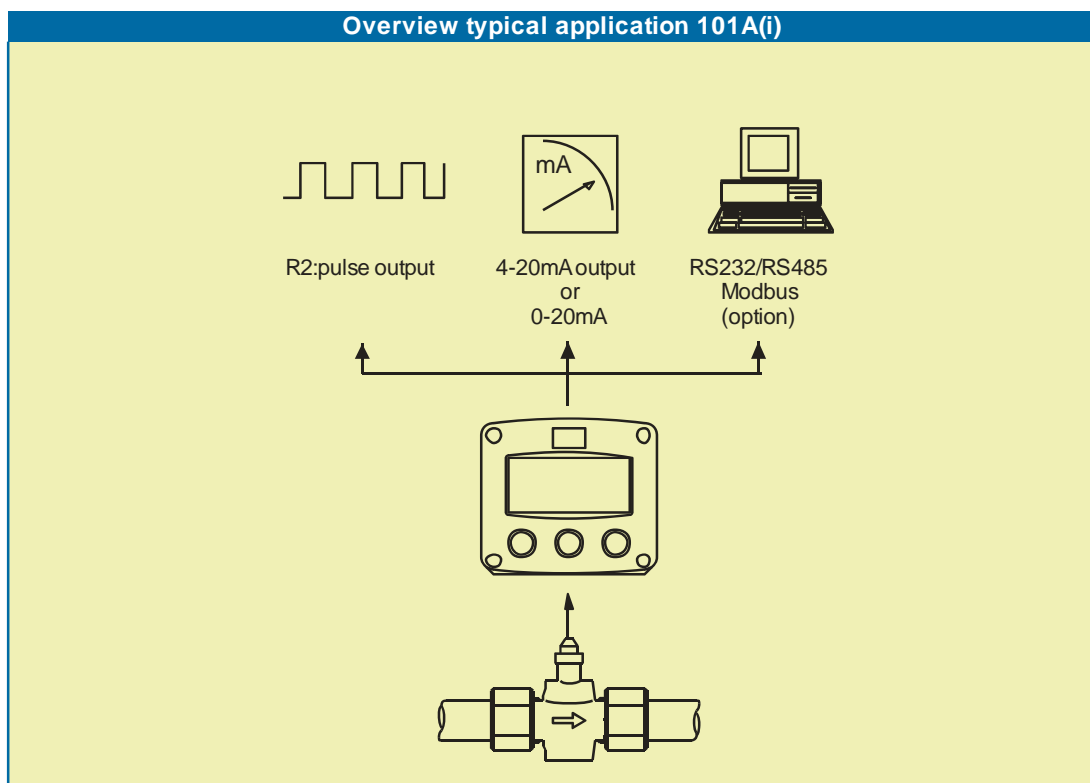


Fig. 1: Typical application for the 101A(i).

Configuration of the unit

The 101A(i) was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your 101A(i) according to your specific requirements. SETUP includes several important features, such as K-factors, measurement units, signal selection etc. All settings are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery.

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

Display information

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

Flowrate and totals can be displayed either with the small 8mm digits or with the 17mm digits.

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

Options

The following options are available: full Modbus communication RS232/485/TTL (also battery powered), intrinsic safety, external reset, panel-mount, wall-mount and weather-proof enclosures.

2. OPERATIONAL

2.1. GENERAL



- ***The 101A(i) may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.***
- ***Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.***

This chapter describes the daily use of the 101A(i). This instruction is meant for users / operators.

2.2. CONTROL PANEL

The following keys are available:

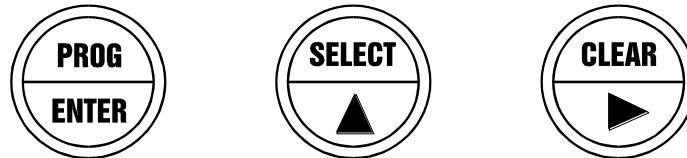


Fig. 2: Control Panel.

Functions of the keys



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



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



Press this key twice to CLEAR the value for total. The arrow-key ► is used to select a digit after PROG has been pressed or to configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the 101A(i) will always act at Operator level. The information displayed is dependant upon the SETUP-settings. All pulses generated by the connected flowmeter are measured by the 101A(i) in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again. All information displayed is corrected by using the linearization table as stored in the 101A(i).



Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

- **Display flowrate / total or flowrate**
This is the main display information of the 101A(i). After selecting any other information, it will always return to this main display automatically.
Total is displayed on the upper-line of the display and flowrate on the bottom line.
It is possible to display flowrate only with the large 17mm digits; in this instance press the SELECT-key to read the total.
When "-----" is shown, then the flowrate value is too high to be displayed. The arrows \blacktriangleleft \blacktriangleright indicate the increase/decrease of the flowrate trend.
- **Clear total**
The value for total can be re-initialized. To do so, press CLEAR twice. After pressing CLEAR once, the flashing text "PUSH CLEAR" is displayed. To avoid re-initialization at this stage, press another key than CLEAR or wait for 20 seconds.
Re-initialization of total DOES NOT influence the accumulated total.
With 'option IB – external reset' the Total can be reset to zero with an external switch. The Total resets only when the switch *opens*. When closed Total still counts but the "Clear Total" function is disabled. See also 'Terminal 12-13' on page 24.
- **Display accumulated total**
When the SELECT-key is pressed, total and accumulated total are displayed. The accumulated total cannot be re-initialized. The value will count up to 99,999,999,999. The unit and number of decimals are displayed according to the configuration settings for total.
- **Low-battery alarm**
When the battery voltage drops, it must be replaced. At first "low-battery" will flash, but as soon as it is displayed continuously, the battery MUST be replaced shortly after!
Only original batteries supplied by the manufacturer may be used, else the guarantee and liability will be terminated. The remaining lifetime after the first moment of indication is generally several days up to some weeks.



Fig. 4: Example of low-battery alarm.

- **Alarm 01-03**
When "alarm" is displayed, please consult Appendix B: problem solving.

3. CONFIGURATION

3.1. INTRODUCTION

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



- **Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.**
- **The 101A(i) may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.**
- **Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.**
- **Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.**

3.2. PROGRAMMING SETUP-LEVEL

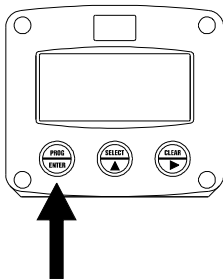
3.2.1. GENERAL


Configuration of the 101A(i) is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows ⇄ will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically. SETUP can be reached at all times while the 101A(i) remains fully operational.



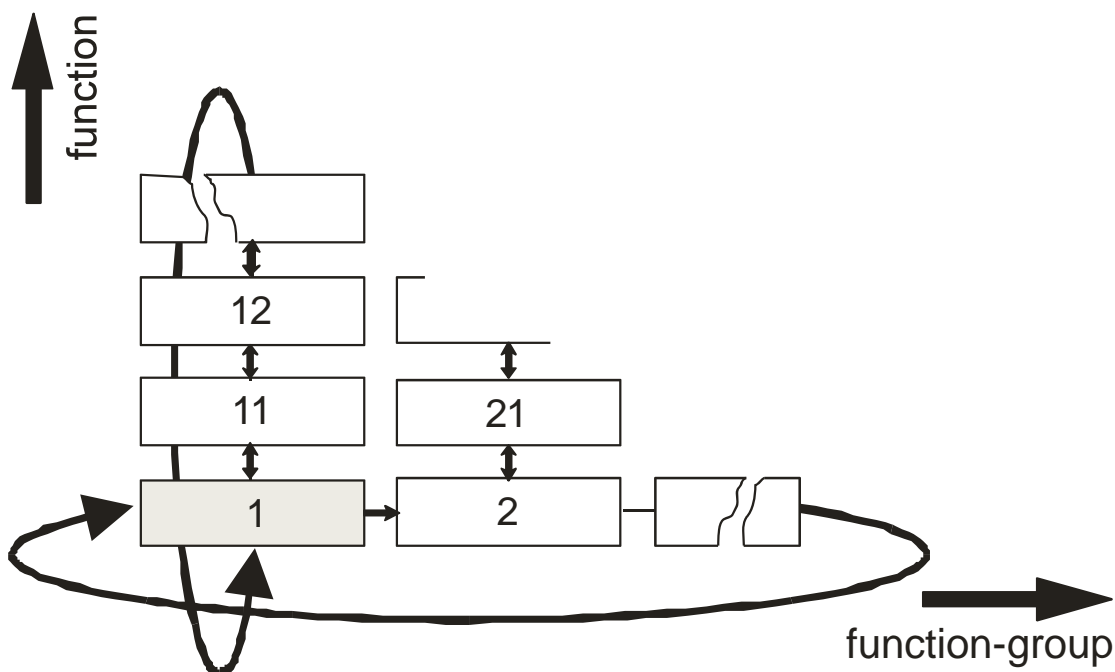
Note: A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.

To enter SETUP-level:



Press  for 7 seconds

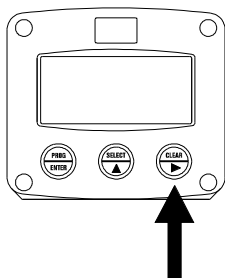
Matrix structure SETUP-level:



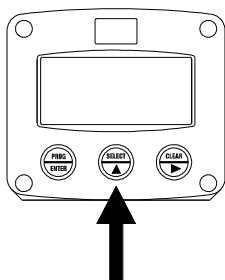
SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:

SETUP is divided into several function groups and functions.



Select function-group with



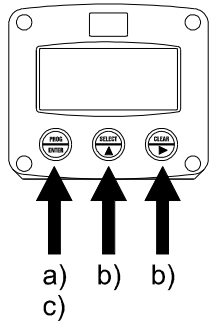
Select function with









Each function has a unique number, which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function-group and the second figure the sub-function. Additionally, each function is expressed with a keyword.



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



To change or select a value:



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

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

To select a setting, both  and  can be used.

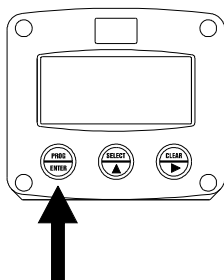
If the new value is invalid, the increase sign  or decrease-sign  will be displayed while you are programming.

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



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

To return to OPERATOR-level:



Press  for 3 seconds

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

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	TOTAL		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K-FACTOR:	0.000010 - 9,999,999
	14	DECIMALS K-FACTOR	0 - 6
2	FLOWRATE		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	K-FACTOR	0.000010 - 9,999,999
	25	DECIMALS K-FACTOR	0 - 6
	26	CALCULATION	per 1 - 255 pulses
	27	CUT-OFF	0.1 - 999.9 seconds
3	DISPLAY		
	31	FUNCTION	total - flowrate
4	POWER MANAGEMENT		
	41	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	42	BATTERY MODE	operational - shelf
5	FLOWMETER		
	51	SIGNAL	coil_hi - coil_lo
6	LINEARISATION		
	61	FREQ. / M-FACTOR 1	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	62	FREQ. / M-FACTOR 2	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	63	FREQ. / M-FACTOR 3	0.1 – 9,999.9 Hz / 0.000001 – 9.999999

	6F	FREQ. / M-FACTOR 15	0.1 – 9,999.9 Hz / 0.000001 – 9.999999
	6G	LINEARISATION	enable / disable
	6H	DECIMALS FREQUENCY	00000 - 1111.1 - 222.22 - 33.333
7	ANALOG		
	71	OUTPUT	disable - enable
	72	4mA / 0V	0000.000 - 9,999,999
	73	20mA / 10V	0000.000 - 9,999,999
	74	CUT-OFF	0.0 - 9.9%
	75	CALIBRATE LOW	default - calibrate - calibrate set
	76	CALIBRATE HIGH	default - calibrate - calibrate set
	77	FILTER	00 - 99
8	IMPULSE		
	81	PERIOD TIME	0 - 250
	82	IMPULSE PER	X,XXX,XXX quantity
9	COMMUNICATION		
	91	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	92	ADDRESS	1 - 255
	93	MODE	rtu - off
A	OTHERS		
	A1	MODEL	F100-P
	A2	TYPE	101A(i)
	A3	SOFTWARE VERSION	-
	A4	SERIAL NO.	-
	A5	PASS CODE	0000 - 9999
	A6	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL	
MEASUREMENT UNIT 11	<p>SETUP - 11 determines the measurement unit for total, accumulated total and pulse output. The following units can be selected:</p> <p style="text-align: center;">L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit).</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.</p>
DECIMALS 12	<p>The decimal point determines for total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">0000000 - 111111.1 - 22222.22 - 3333.333</p>
K-FACTOR 13	<p>With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be.</p> <p>Example 1: Calculating the K-factor. <i>Let us assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m3". A cubic meter consists of 1000 parts of one liter which implies 2,481.3 pulses per m3. So, the K-factor is 2,481.3. Enter for SETUP - 13: "2481300" and for SETUP - 14 - decimals K-factor "3".</i></p> <p>Example 2: Calculating the K-factor. <i>Let us assume that the flowmeter generates 6.5231 pulses per gallon and the selected measurement unit is gallons. So, the K-Factor is 6.5231. Enter for SETUP - 13: "6523100" and for SETUP - 14 decimals K-factor "6".</i></p>
DECIMALS K-FACTOR 14	<p>This setting determines the number of decimals for the K-factor entered. (SETUP 13). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this setting influences the accuracy of the K-factor indirectly. (i.e. the position of the decimal point and thus the value given) This setting has NO influence on the displayed number of digits for total (SETUP 12)!</p>

2 - FLOWRATE

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

The display update time for flowrate is one second or more.

Note: these settings also influence the analog output.

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



Note !

3 - DISPLAY	
FUNCTION 31	The large 17mm digits can be set to display total or flowrate. When "total" is selected, both total and flowrate are displayed simultaneously. When "flowrate" is selected, only flowrate will be displayed with it's measuring unit while total will be displayed after pressing SELECT.

4 - POWER MANAGEMENT	
When used with the internal battery option, the user can expect reliable measurement over a long period of time. The 101A(i) has several smart power management functions to extend the (optional) battery life time significantly. Two of these functions can be set:	
LCD NEW 41	<p>The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is strongly advised to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signals will be generated in the normal way. The following can be selected:</p> <p style="text-align: center;">Fast - 1 sec - 3 sec - 15 sec - 30 sec - off.</p> <p>Example 3: Battery life-time <i>battery life-time with a coil pick-up, 1KHz. pulses and FAST update: about 2 years.</i> <i>battery life-time with a coil pick-up, 1KHz. pulses and 1 sec update: about 5 years.</i></p> <p>Note: <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 be switched off after 30 seconds and will be switched on as soon as a button has been pressed.</i></p>
BATTERY-MODE 42	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not count pulses, the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the unit again, press the SELECT-key twice.



Note !

5 - FLOWMETER				
SIGNAL 51	The 101A(i) is able to handle one type of input signal with two levels. The level of flowmeter pickup / signal is selected with SETUP 51. Read also par. 4.4.3. Flowmeter input terminal 09-11.			
TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mV	REMARK
COIL HI	High sensitive sine-wave (coil) input	-	20mVp-p.	Sensitive for disturbance!
COIL LO	Low sensitive sine-wave (coil) input	-	90mVp-p.	Normal sensitivity

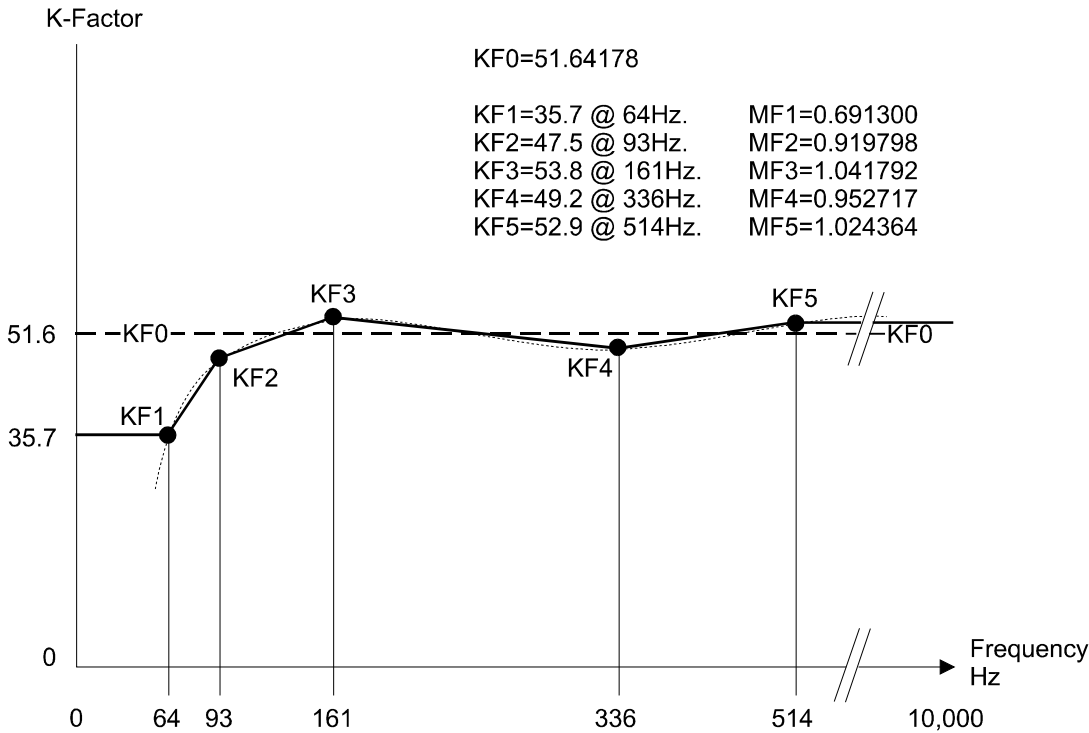
6 - LINEARISATION

The linearization function is available to approach the real flow curve better as with the general K-factor (KF0) entered with setup 14 and 24. This to obtain a more accurate flowrate, total and accumulated total as well as the analog and pulse output at any flowmeter frequency.
 A maximum of 15 linearization-positions can be entered while the interpolation will calculate any other position in-between.

For each linearization position, the frequency and a Meter Factor (MF) must be entered. The Meter Factor for each frequency is calculated with following formula:

$$\text{Meter-Factor} = \frac{\text{K-Factor at flowrate X}}{\text{KF0}}$$

The lowest frequency and MF you enter will be valid from 0Hz. The highest frequency and MF will be valid till 10KHz. It is advised to enter the frequencies in increasing order, however it is not necessary. Please have a look at following example to understand the method of linearization:



FREQUENCY / M-FACTOR 61 TO 6F
DISABLE / ENABLE 6G
DECIMALS FREQUENCY 6H

The frequency is displayed at the bottom line of the display. The maximum frequency is 9,999.9 Hz. With value 0.0Hz, the M-Factor is disabled. (Please read Setup function 6H - decimals frequency)

The M-Factor is displayed at the top-line of the display. The minimum value to be entered is 0.000001 and the maximum value is 9.999999.

Note: Please note that this value has always six decimals while the "dot" is not displayed.

Most M-factors will be around 1.000000 like 0.945354 or 1.132573.

With this setup function, you can easily enable / disable the linearization function.

For the frequency, following decimal positions can be selected:
 00000 - 1111.1 - 222.22 - 33.333



7 - ANALOG OUTPUT

A linear analog (0)4-20mA signal is generated according to the flowrate with a 10 bits resolution. The settings for flowrate (SETUP - 2) influence the analog output directly. The relationship between rate and analog output is set with the following functions:



DISABLE / ENABLE 71	The analog output can be disabled. In case of a passive analog output type AP, 3.5mA will be generated if a power supply is available but the output is disabled.
MINIMUM FLOWRATE 72	Enter here the flowrate at which the output should generate the minimum signal (0/4mA) - in most applications at flowrate "zero". The number of decimals displayed depend upon SETUP 23. The time and measuring units (L/min for example) depend upon SETUP 21 and 22 but are not displayed.
MAXIMUM FLOWRATE 73	Enter here the flowrate at which the output should generate the maximum signal (20mA) - in most applications at maximum flow. The number of decimals displayed depend upon SETUP 23. The time and measuring units (L/min for example) depend upon SETUP 21 and 22 but cannot be displayed.
CUT-OFF 74	To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16mA, (or 20mA). When the flow is less than the required rate, the current will be the minimum signal (0/4mA). Examples:

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

TUNE MIN / 4MA 75	<p>Tune Min / 4 mA allows you to tune the analog output value to represent minimum flowrate. Tuning is recommended when you:</p> <ul style="list-style-type: none"> ▪ First install or replace the unit ▪ Before tuning the signal, be sure that the analog signal is not being used for any application! <p>For instructions as how to tune see "Tuning an analog output" on page 33.</p>
------------------------------------	--



TUNE MAX / 20MA 76	<p>Tune Max / 20 mA allows you to tune the analog output value to represent maximum flowrate. Tuning is recommended when you:</p> <ul style="list-style-type: none"> ▪ First install or replace the unit ▪ Before tuning the signal, be sure that the analog signal is not being used for any application! <p>For instructions as how to tune see "Tuning an analog output" on page 33.</p>
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Continued next page >>>

7 - ANALOG OUTPUT (CONTINUED)

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

8 - RELAY OUTPUT

One transistor or mechanic relay output is available as scaled pulse output according to the accumulated total.

PERIOD TIME PULSE OUTPUT 81	<p>The period time determines the time that the transistor or relay will be switched; in other words the pulse length. The minimum time between the pulses is as long as the selected period time. One period is approx. 7.8 msec. If the value selected is "zero", the pulse output is disabled. The maximum value is 255 periods.</p> <p>Note: <i>If the frequency should go out of range - when the flowrate increases for example - an internal buffer will be used to "store the missed pulses": As soon as the flowrate reduces again, the buffer will be "emptied".</i></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 it's range.</i></p> <p><i>If a mechanic relay is used for the pulse output, it is recommended to reduce the max. output frequency to 0.5Hz, else the life time will be reduced significantly.</i></p>		
	NUMBER OF PERIODS	PERIOD TIME	MAX. FREQUENCY
	0	disabled	disabled
	1	0,0078 seconds	64 Hz.
	2	0,0156 seconds	32 Hz.
	3	0,0234 seconds	21 Hz.
	64	0,5000 seconds	1 Hz.
	255	1,9922 seconds	0.25 Hz.
PULSE PER 82	According to the measurement unit settings for total, a pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account.		



Note !

9 - COMMUNICATION (OPTIONAL)

The functions described below deal with hardware that is not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.	
BAUDRATE 91	For external control, the following communication speeds can be selected: 1200 - 2400 - 4800 - 9600 baud
BUS ADDRESS 92	For communication purposes, a unique identity can be attributed to every 101A(i). This address can vary from 1-255.
MODE 93	The communication protocol is Modbus RTU mode. Select OFF, to disable this communication function.

A - OTHERS

For support and maintenance it is important to have information about the characteristics of the 101A(i). Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.	
MODEL A1	This window shows the main hardware platform of this product: F100P (F100-series with a pulse input signal - type P) Certificates refer to this information.
TYPE A2	This window shows the product specific information: 101A(i)
VERSION SOFTWARE A3	This window shows the firmware version.
SERIAL NUMBER A4	This window shows the serial number of this product.
Below several miscellaneous functions:	
PASS CODE A5	All SETUP-values can be pass code protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER A6	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

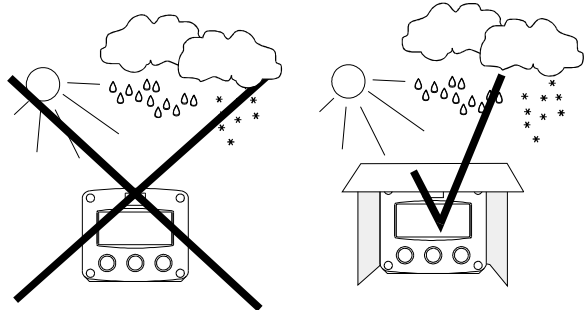
4. INSTALLATION



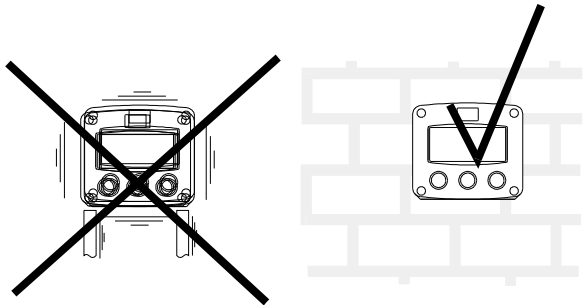
4.1. GENERAL DIRECTIONS

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The 101A(i) may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the " Safety rules, instructions and precautionary measures " at the front of this manual.

4.2. INSTALLATION / SURROUNDING CONDITIONS



Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions. When panel-mounted, the unit is IP65 (NEMA 4X)! When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.



Mount the 101A(i) on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE

GRP enclosures:

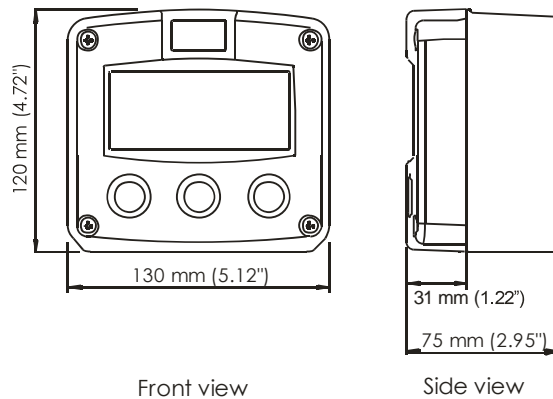


Fig. 5: Dimensions GRP enclosures.

4.4. INSTALLING THE HARDWARE



4.4.1. INTRODUCTION

- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.
- This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).

FOR INSTALLATION, PAY EMPHATIC ATTENTION TO:

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

4.4.2. VOLTAGE SELECTION SENSOR SUPPLY

For Intrinsically Safe applications: read chapter 5.

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

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

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



Type PD / PF / PM: Sensor supply: 1.2 - 3.2V - 8.2V - 12V or 24 V DC:

With this option, a real power supply for the sensor is available. The flowmeter can be powered with 8.2 - 12 or 24 V DC.

Total power consumption PD: max. 50mA@24V and PF / PM: max. 400mA@24V.

The voltage is selected with the three switches inside the enclosure.



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

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

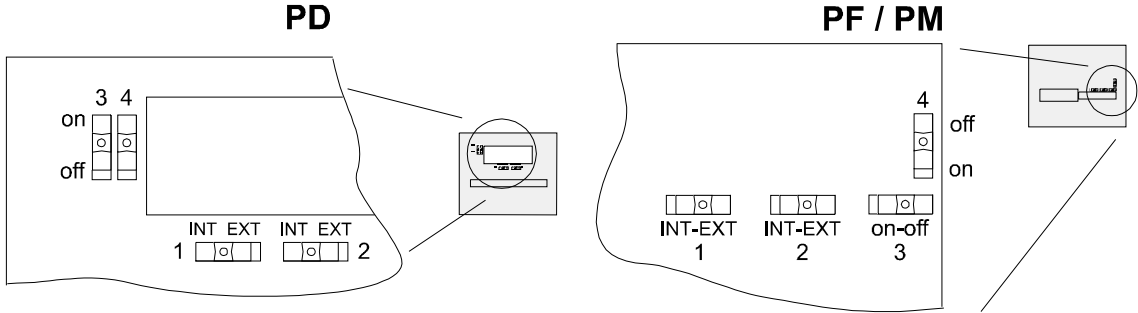


Fig. 6: Switch setting sensor supply voltage.

Switch positions

SENSOR A		SENSOR B		VOLTAGE SELECTION		
SWITCH 1	VOLTAGE	SWITCH 2	VOLTAGE	SWITCH 3	SWITCH 4	VOLTAGE
internal	3.2 V DC			on	on	8.2 V DC
external	switch 3+4			on	off	12 V DC
				off	off	23 V DC

- Function switch 1:** voltage selection sensor A - terminal 11.
- Function switch 2:** not available for this Model.
- Function switch 3+4:** the combination of these switches determine the voltage as indicated. Do move switch 1 and / or switch 2 to the OFF position to enable the selected voltage with switch 3+4.

4.4.3. TERMINAL CONNECTORS

For Intrinsically Safe applications: read chapter 5.

The following terminal connectors are available:

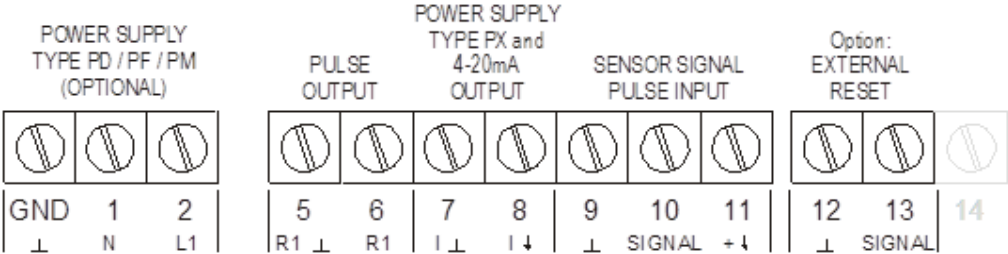


Fig. 7: Overview of terminal connectors standard configuration 101A(i) and options.

REMARKS: TERMINAL CONNECTORS:

Terminal GND- 01- 02: Power Supply - only available with type PD / PF or PM:

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

◇=option

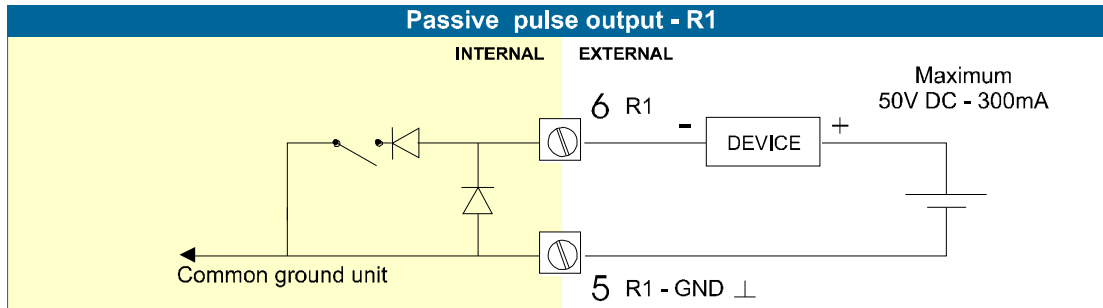


Note: for power supply type PX: please read Terminal 07-08 !

Terminal 05-06; scaled pulse output R1:

Setup 7 (par. 3.4.4.) determines the pulse output function. The maximum pulse frequency of this output is 60Hz. If a relay output option has been supplied, be sure that the output frequency does not exceed 5Hz or else the life-time of the relay will be reduced significantly.

Type OT:



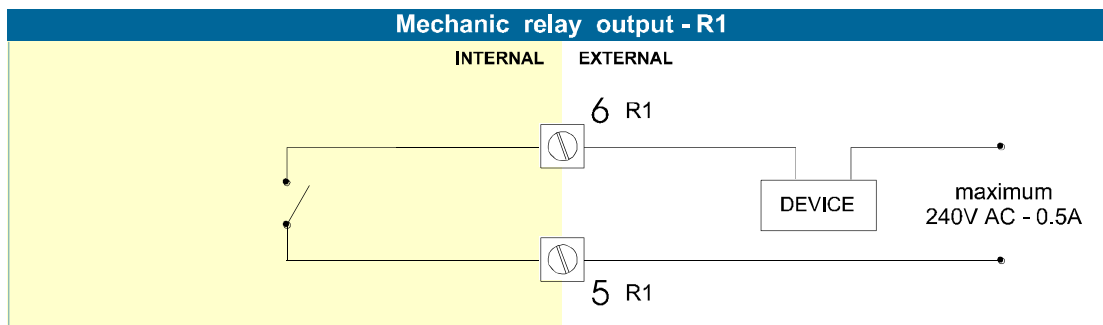
A passive transistor output is available with this option. Max. driving capacity 300mA@50V DC.

Type OR:

A mechanical relay output is available with this option.

Max. switch power 240V 0,5A per output. (Requires power supply type PF / PM).

Be sure that the output frequency does not exceed 5Hz, else the relay life time will be reduced significantly.



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

Connect an external power supply of 8-30VDC to these terminals or a 4-20mA loop. Do not connect the "-" to terminal 7 and the "+" to terminal 8. When power is applied to these terminals, the (optional) internal battery will be disabled / enabled automatically to extend the battery life time.



Only valid for standard passive output type AP!

Terminal 07-08 analog output (SETUP 7) :

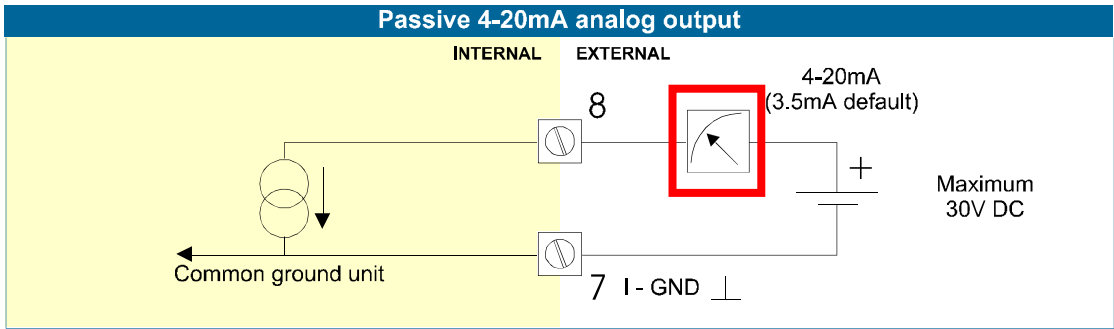
An analog output signal proportional to the flowrate is available as standard.

Type AF:

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

Type AP:

A passive 4-20mA signal proportional to the flowrate is available with this option. When a power supply is connected but the output is disabled, a 3.5mA signal will be generated. Max. driving capacity 1000 Ohm. This output does loop power the unit as well (type PX).



Terminal 09-11; Flowmeter input:

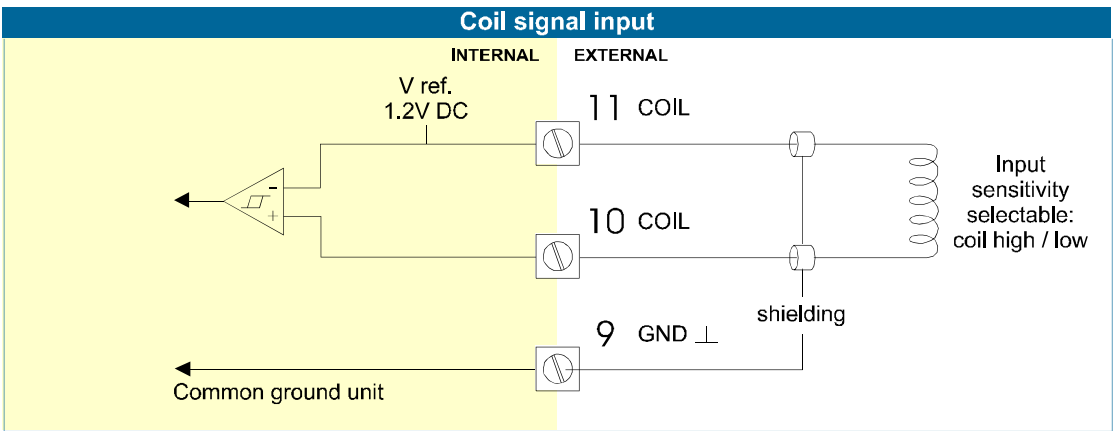
One type of flowmeter signal can be connected to the unit: sine-wave (coil). The screen of the signal wire must be connected to the common ground terminal 09 (unless earthed at the sensor itself). The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal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

Sine-wave signal (Coil):

Two sensitivity levels can be selected with the SETUP-function:

COIL LO: sensitivity from about 120mVp-p.

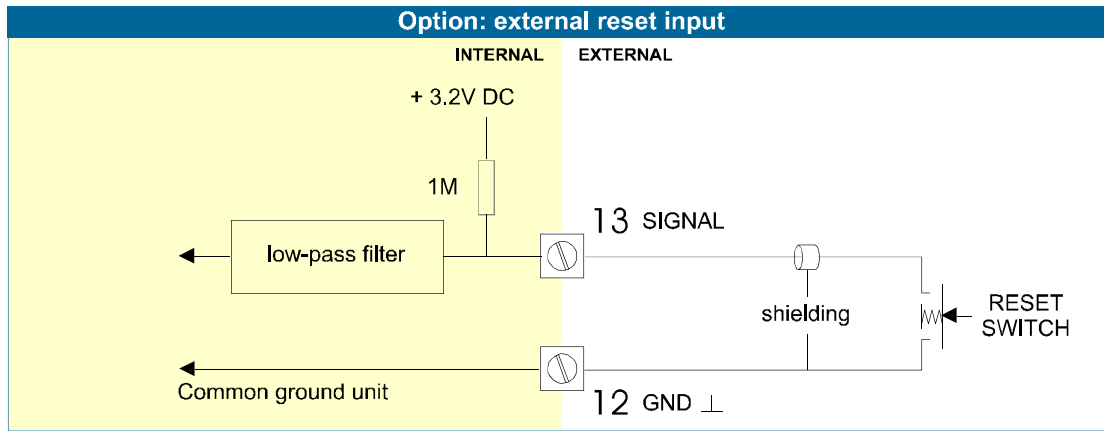
COIL HI: sensitivity from about 20mVp-p.



Terminal 12-13: Type IB – external reset (option):

With this function the total can be reset to zero with an external switch. The Total resets only when the switch *opens*. When closed Total still counts but the "Clear Total" function is disabled (see chapter 2).

The input must be switched with a potential free contact to the GND-terminal number 12.



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

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

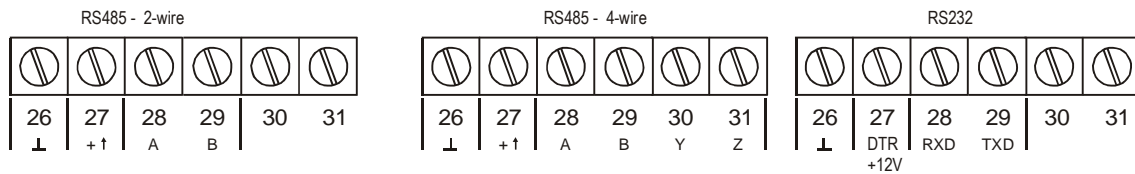


Fig. 8: Overview terminal connectors communication option.

When using the RS232 communication option, terminal 27 is used for supplying the interface. Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (+12V). If no active signal is available it is possible to connect a separate supply between terminals 26 and 27 with a voltage between 8V and 24V.

5. INTRINSICALLY SAFE APPLICATIONS

5.1. GENERAL INFORMATION AND INSTRUCTIONS



Caution !

Cautions

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



Safety Instructions

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



Note !

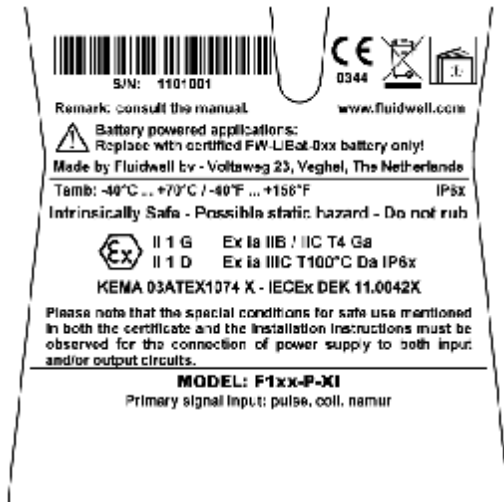
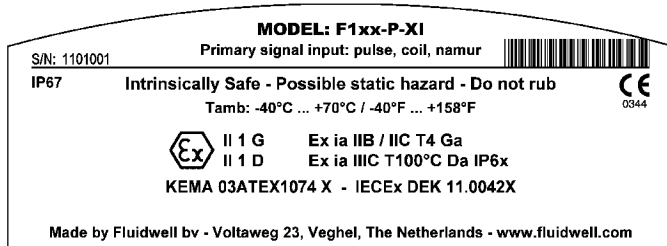
Please Note

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

Label information (inside and outside the enclosure)

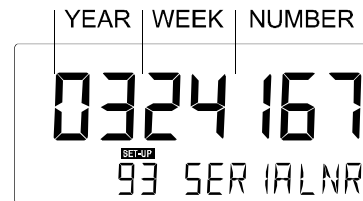
Indicated labels on the back cover (below) and on the inside cover (right) show the type labels for intrinsically safe certified units.

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



Serial number and year of production

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



5.2. TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS



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

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

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

Terminal connectors 101A(i):

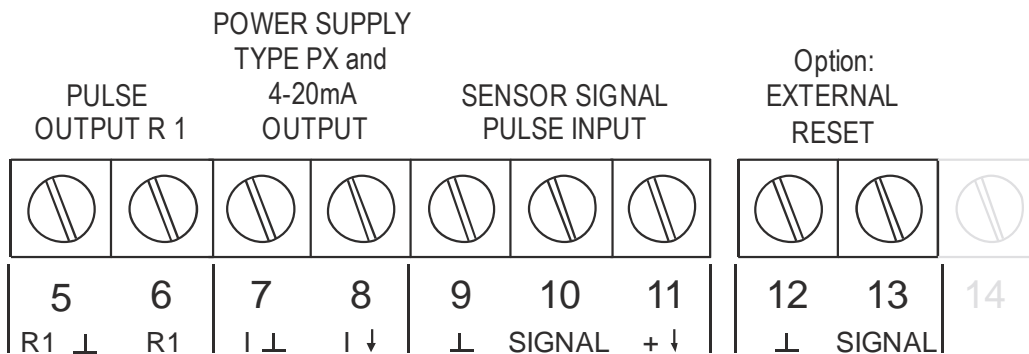


Fig. 9: Overview terminal connectors XI - Intrinsically Safe applications.

Configuration example (standard configuration)

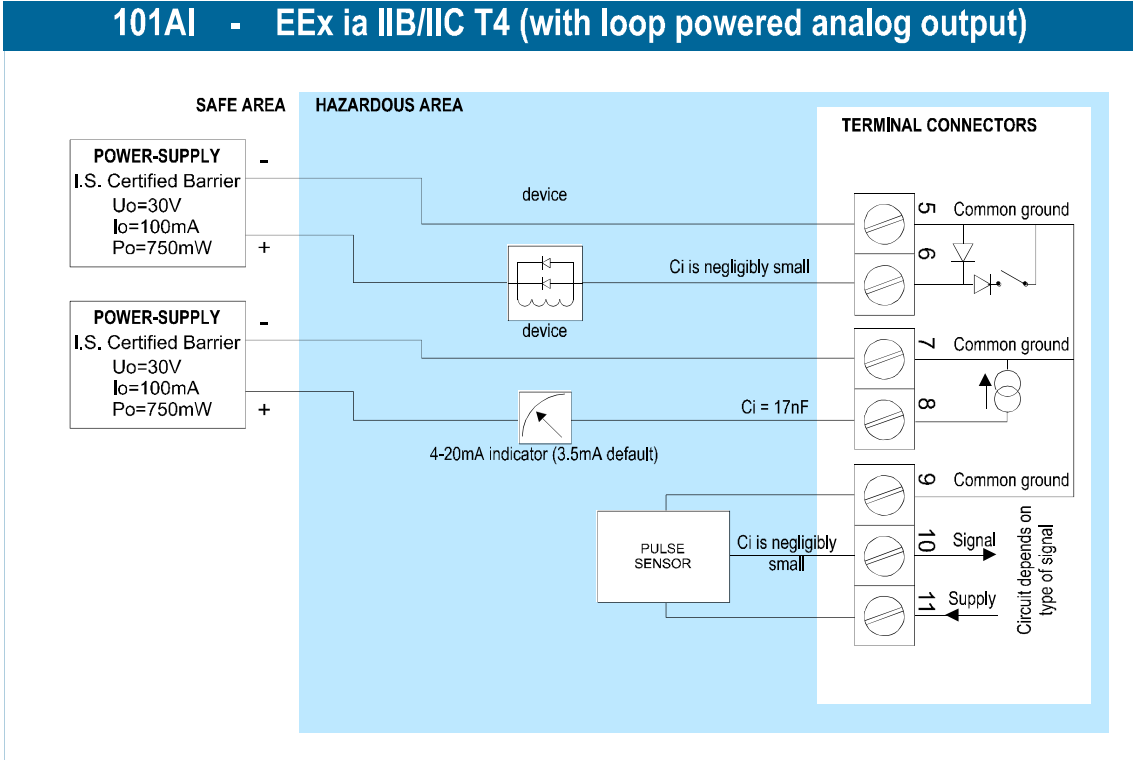


Fig. 10: Configuration example Intrinsically Safe.

5.4 BATTERY REPLACEMENT INSTRUCTIONS



Safety Instructions

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



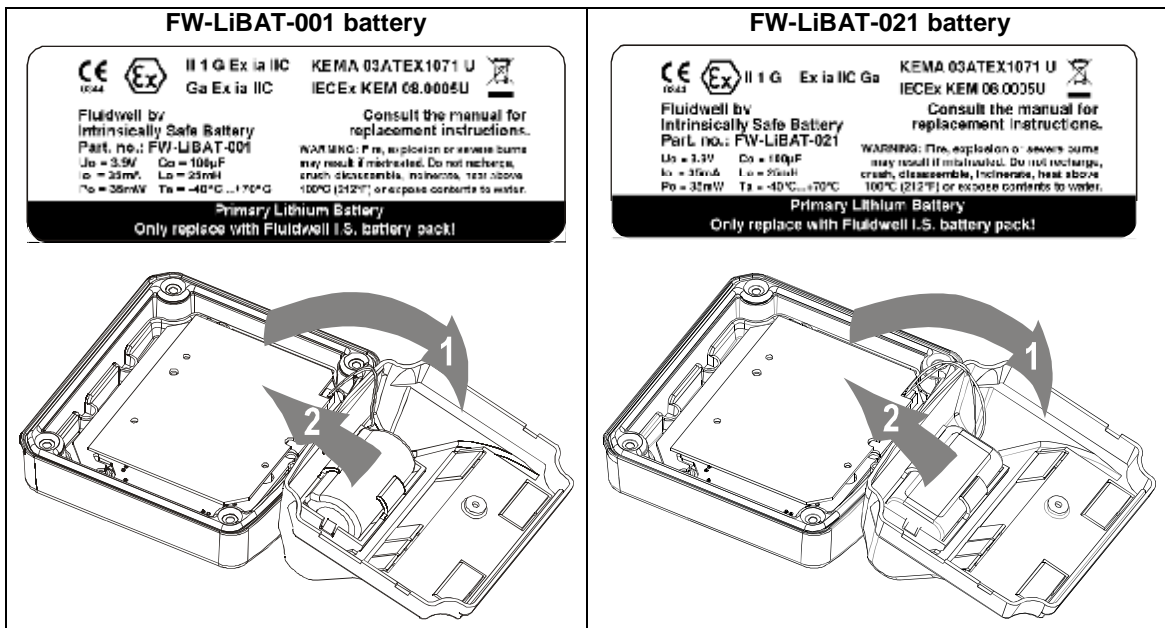
Safety instructions for hazardous areas

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

Battery replacement procedure



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



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

6. MAINTENANCE

6.1. GENERAL DIRECTIONS



- ***Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.***
- ***The 101A(i) may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.***
- ***Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.***
- ***Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.***

The 101A(i) 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 101A(i) in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

Battery life-time:

It is influenced by several issues :

- Type of sensor: read chapter 3.2.3. NPN and PNP inputs consume more energy than coil inputs.
- Input frequency: the higher the frequency, the shorter the battery life-time.
- Flowrate calculation: the lower number of pulses (SETUP 26) the shorter the battery life-time.
- Analog output signal; be sure that an external power supply is connected or that the function is disabled if not in use; or else it will have a influence on the battery life-time (SETUP 71).
- Display update: fast display update uses significantly more power; SETUP 41.
- Pulse output and communications .
- Low temperatures; the available power will be less due to battery chemistry.



Note !

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

Check periodically:

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

6.2. REPAIR

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

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.

Enclosures	
General	GRP (Glassfibre Reinforced Polyamide) enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material.
Control Keys	Three industrial micro-switch keys. UV-stabilized silicone keypad.
Painting	Aluminum enclosure only: UV-resistant 2-component industrial painting.
Panel-mount enclosures	Dimensions: 130 x 120 x 60mm (5.10" x 4.72" x 2.38") – LxHxD.
Classification	IP65 / NEMA4X
Panel cut-out	115 x 98mm (4.53" x 3.86") LxH.
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95") – LxHxD.
Classification	IP67 / NEMA4X


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

Power supply	
Type PB	Lithium battery - life-time depends upon settings - up to 5 years.
Type PC	Intrinsically Safe lithium battery - life-time depends upon settings - up to 5 years.
Type PM	115-230V AC + 10%. Power consumption max. 15 Watt.
Type PX	Output loop powered: 8-30V DC. Power consumption max. 0.5 Watt.
Note PM	The total consumption of the sensors', backlight and outputs may not exceed 400mA@24V.
Note I.S. applications	For intrinsically safe applications, consult the safety values in the certificate.

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

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

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

Hazardous area (option)	
Intrinsically safe Type XI	ATEX approval:  II 1 G Ex ia IIB/IIC T4 Ga II 1 D Ex ia IIIC T100°C Da IP6x IECEx approval: Ex ia IIB/IIC T4 Ga Ex ia IIIC T100°C Da IP6x

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

INPUTS

Flowmeter	
Type P	Coil/sine wave (minimum 20mVp-p or 80mVp-p - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8 - 12 and 24V.
Frequency	Minimum 0 Hz - maximum 7 kHz for total and flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.
Linearisation	15 positions with interpolation function; Meter-Factor 0.000001 - 9.999999 versus Frequency 0.001 Hz - 9,999 Hz.

Reset (option)	
Type IB	Make contact - external reset totalizer. Additional functionality to lock the RESET button of the keyboard (as long as this contact is being made).
Duration	Minimum 100mSec. to reset Total.

OUTPUTS

Analog output	
Function	transmitting linearised flowrate.
Accuracy	10 bit. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm
Type AP	Passive 4-20mA output - output loop powered (type PX).

Transistor output(s)	
Pulse output	Max. frequency 60Hz. Pulse length user definable between 7,8msec up to 2 seconds.
Function	One pulse output - transmitting linearised accumulated total.
Type OR	Isolated mechanic relay output; max. switch power 230V AC - 0,5A (requires type PF or PM).
Type OT	Passive transistor output - not isolated. Load max. 50V DC - 300mA.

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

OPERATIONAL

Operator functions	
Displayed functions	<ul style="list-style-type: none"> • linearised total and/or flowrate. • linearised total and linearised accumulated total. • total can be reset to zero by pressing the CLEAR-key twice.

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

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

Flowrate	
Digits	7 digits.
Units	mL, L, m3, Gallons, KG, Ton, lb, bl, cf, RND, ft3, scf, Nm3, NI, igal - no units.
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the 101A(i) is going to be installed or while it is in operation.

Flowmeter does not generate pulses:

Check:

- Signal selection SETUP - 51,
- Pulse amplitude (par. 4.4.3.),
- Flowmeter, wiring and connection of terminal connectors (par. 4.4.3.),
- Power supply of flowmeter (par. 4.4.2.).

Flowmeter generates "too many pulses":

Check:

- Settings for total and Flowrate: SETUP 11-14 and 21-27,
- Type of signal selected with actual signal generated - SETUP - 51,
- Sensitivity of coil input - SETUP - 51 and par. 4.4.3.
- Proper grounding of the 101A(i) - par. 4.4.1.
- Use screened wire for flowmeter signals and connect screen to terminal 9. (unless connected at sensor)

Analog output does not function properly:

Check:

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

Pulse output does not function:

Check:

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

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

Check:

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

Linearization does not work:

Check:

- SETUP 6G: is the function enabled?
- SETUP 6A-6F: are all M-Factors and the frequency entered correctly?

The pass code is unknown:

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

Tuning an analog output

To tune the analog output do the following:

1. Connect a calibrated mA Voltmeter to the analog output.
2. Select 75 " Tune Min 4 mA " or 76 " Tune Max 20 mA " to tune either the minimum flowrate or the maximum flowrate.
 - a. The display shows the value that represents the current output value. (4 mA equals approximately 350, 20 mA equals approximately 5300)
3. Press PROG to calibrate.
4. Use Select ▲ (up arrow) and Clear ► (arrow to right) to change the display value up or down. You see the change directly on your meter!
5. Press ENTER to store the new setting.

ALARM

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

- 0001: irrecoverable display-data error: data on the display might be corrupted.
- 0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.
- 0003: error 1 and error 2 occurred simultaneously

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

APPENDIX C: COMMUNICATION VARIABLES

Remarks:

- Below, an overview of the 101A(i) specific variables; other common variables are described in the standard table.
- All numbers are decimal numbers, unless otherwise noted.
- The following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

CONFIGURATION VARIABLES 101A(i) - SETUP-LEVEL:				
VAR	DESCRIPTION	BYTES	VALUE	REMARKS
TOTAL				
32 (20h)	unit	1	0=L 1=m3 2=kg 3=lb 4=gal 5=usgal 6=bb1 7=none	
33 (21h)	decimals	1	0...3	
34 (22h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR37)
37 (25h)	decimals K-factor	1	0...6	
FLOWRATE				
48 (30h)	unit	1	0=mL 1=L 2=m3 3=mg 4=g 5=kg 6=ton 7=gal 8=bb1 9=lb 10=cf 11=rev (revolutions for RPM) 12=none 13=scf 14=NM3 15=NL 16=p	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0...3	
51 (33h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals K-factor	1	0...6	
55 (37h)	number of pulses	1	1..255	
56 (38h)	cut-off time	2	1 .. 9999	steps of 100ms

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
DISPLAY				
64 (40h)	display function	1	0=total 1=flowrate	
68 (44h)	set flowrate monitor	1	0=operator level 1=SETUP level	
POWERMANAGEMENT				
80 (50h)	LCD update time	1	0=fast 1=1sec 2=3sec 3=15sec 4=30sec 5=off	
81 (51h)	power-mode battery	1	0=operational 1=shelf	
FLOWMETER				
96 (60h)	flowmeter signal	1	7=coil hi 8=coil lo	
LINEARISATION				
1024 (400h)	linearization table entry	6	m=0..9999999 / f=0..99999	INDEXED 3 bytes m-factor MS-part 3 bytes freq. LS-part. m m m f f f MSB.....LSB
1038 (40Eh)	linearization on/off	1	0=disable 1=enable	
1039 (40Fh)	Decimals	1	0, 1, 2, 3	Number of decimals
ANALOG OUTPUT				
112 (70h)	analog output	1	0=disable 1=enable	
113 (71h)	minimum rate	3	0..9999999	unit, time, decimals acc. var48-50
116 (74h)	maximum rate	3	0..9999999	unit, time, decimals acc. var48-50
119 (77h)	cut off percentage	1	0..99	steps of 0.1%
120 (78h)	tune minimum rate	2	0..9999	
122 (7Ah)	tune maximum rate	2	0..9999	
99 (63h)	filter	1	0....99	
PULSE OUTPUT				
128 (80h)	impulse width	1	0=off 1=short 2=long	
129 (81h)	pulse per X quantity	3	1..9999999	unit, decimals acc. var32 -33
OTHERS				
168 (A8h)	pass code	2	xxxx	read only!
VAR	DESCRIPTION	BYTES	VALUE	REMARKS
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER 101A(i) VARIABLES FOR COMMUNICATION**TOTAL** - variable number 566 (236h) – 6 bytes

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

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

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

Read acc. total: A difference between the read value and the display value, as explained for “Read total”, might appear here too.

Write acc. total: Not possible.

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

Example: read var. 566 for total:

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

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

Read flowrate: The value difference as mentioned with total/acc. total might appear here too.

Write flowrate: Not possible.

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LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL	Enter your settings here		
11 unit			
12 decimals			
13 K-factor			
14 decimals K-factor			
2 - FLOWRATE			
21 unit			
22 time unit			
23 decimals			
24 K-factor			
25 decimals K-factor			
26 calculation / pulses			
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M-Factor			
62 frequency			
M-Factor			
63 frequency			
M-Factor			
64 frequency			
M-Factor			
65 frequency			
M-Factor			
66 frequency			
M-Factor			
67 frequency			
M-Factor			
68 frequency			
M-Factor			
69 frequency			
M-Factor			



SETTING	DEFAULT	DATE :	DATE :
6A frequency			
M-Factor			
6B frequency			
M-Factor			
6C frequency			
M-Factor			
6D frequency			
M-Factor			
6E frequency			
M-Factor			
6F frequency			
M-Factor			
6G linearization			
6H decimals frequency			
7 - ANALOG OUTPUT			
71 output			
72 min. flowrate 4-mA			
73 max. flowrate 20mA			
74 cut off percentage			
75 tune min - 4mA			
76 tune max - 20mA			
77 filter			
8 - PULSE OUTPUT			
81 impulse width			
82 pulse per			
9 - COMMUNICATION			
91 baud-rate			
92 address			
93 mode			
A - OTHERS			
A1 model			
A2 Type			
A3 software version			
A4 serial number			
A5 pass code			
A6 tagnumber			