Operating Instructions 12/2007

SITRANS F RA 110 ATEX

Intrinsically-safe flowrate indicator/totalizer

flow

SIEMENS

SIEMENS

SITRANS F Flowmeters
Intrinsically-safe flowrate indicator/totalizer SITRANS F RA 110 ATEX

Operating Instructions (Compact)

Introduction

Safety guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.

⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

A5E01576737-01, 12/2007

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

About the operation instructions

These operation instructions describe the standard unit as well as most of the options available. For additional information, please contact your supplier.

These operation instructions are divided into two main sections:

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

⚠ WARNING
A hazardous situation may occur if the SITRANS F RA110 is not used for the purpose it is designed for or is used incorrectly. Please carefully note the information in these operating instructions indicated by the pictograms which are explained at page 2.

Safety instructions

Note

Responsibility

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

⚠WARNING

Life support applications

The SITRANS F RA110 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.

CAUTION

Electromagnetic compatibility

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

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.

General

⚠DANGER

The housing may only be opened by trained personnel.

Protection against accidental contact is no longer assured when the housing cover is removed or the cabinet has been opened. This might lead to death or personal injuries due to an electric shock.

Prescribed usage

Note the following:

⚠WARNING

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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.

Note

Modifications of the F RA110 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 **only** by authorized technicians.

Before installing the unit check the mains voltage with the information provided on the manufacturer's plate

Check all connections, settings and technical specifications of the various peripheral devices with the F RA110 supplied.

Open the casing **only** if all leads are free of potential.

Never touch the electronic components (electronically sensitive devices).

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 the owner or principal responsible must be informed.

The local labor and safety laws and regulations must be adhered to.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and softwaredescribed. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Description

System Description

Functions and features

The flowrate / totalizer model SITRANS F RA 110 is a microprocessor-driven instrument designed to display flowrate, total and accumulated total.

This product has been designed with a focus on:

- harsh industrial surroundings,
- ability to process all types of flowmeter signals,
- transmitting possibilities with analog and / or pulse outputs.

Flowmeter input

These instructions describe the unit with a pulse type input from the flowmeter. Other versions are available to process (0)4 - 20 mA or 0 - 10 V flowmeter signals. One flowmeter with a Namur, NPN or PNP signal output can be connected to the SITRANS F RA 110.

Output options

Note

The basic version of this product does not have output options, although the software functions are available; enabling or changing these output functions does not have any influence.

Following output options are available:

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

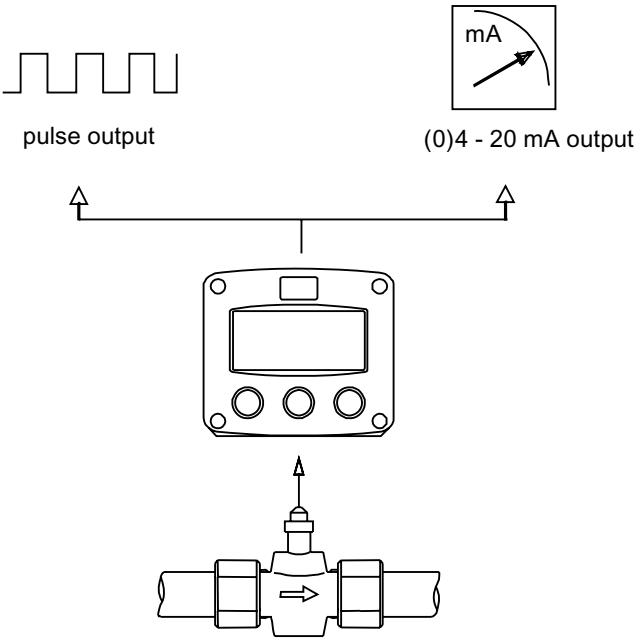


Figure 1 Typical application for the SITRANS F RA 110

Configuration of the unit

The SITRANS F RA 110 was designed to be implemented in many types of applications. For that reason, a SETUP level is available to configure the deivce according to your specific requirements. SETUP includes several important features, such as K factors, measurement units, signal selection etc. All settings are stored in an EEPROM memory and will not be lost in the event of power failure.

Display information

The unit has a large LCD display with all kinds of symbols and digits to display measuring units, status information, trend indication and keyword messages. Flowrate and totals can be displayed either with the small 8 mm digits or with the large 17 mm digits. A backup of the total and accumulated total in the EEPROM memory is made every minute.

Ordering scheme

Table 1 SITRANS F RA 110 ordering codes

SITRANS F RA 110 ordering codes									
Standard configuration Electronic counter in aluminium housing for the display of flow rate and total 7 digits LCD, IP 67 (NEMA4)	**7MV1070 -**					**-**			**A0**
Signal input									
NAMUR signal		**1**							
NPN		**2**							
PNP		**3**							
0 (4) - 20 mA		**5**							
Power supply, incl. sensor supply 8.2 V DC									
AC/DC 18 - 24 V			**A**						
AC 115 - 230 V			**B**						
DC 16 - 30 V (required for intrinsically safe version)			**C**						
Functions (output)									
Display of flow rate and total				**A0**					
- including active pulse output (safe area only)				**B1**					
- including passive pulse output				**B2**					
- including active pulse and 4-20 mA output (safe area only)				**C1**					
- including passive pulse and 4-20 mA output				**C2**					
- including passive pulse and floating 4-20 mA output				**D2**					
Mounting									
For wall, rack and pipe mounting					**0**				
EX - hazardous area									
no							**0**		
EEx ia IIB/IIC T4 T100 °C							**1**		
Backlit LED									
without								**A**	
with (safe area only)								**B**	

Installation

General instructions

⚠WARNING

Safety instructions

The installation of this intrinsically safe device must be in accordance with the ATEX directive 94/9/EC. This device has to be installed in accordance with the product certificate
KEMA 03ATEX1074 X.

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.

⚠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.

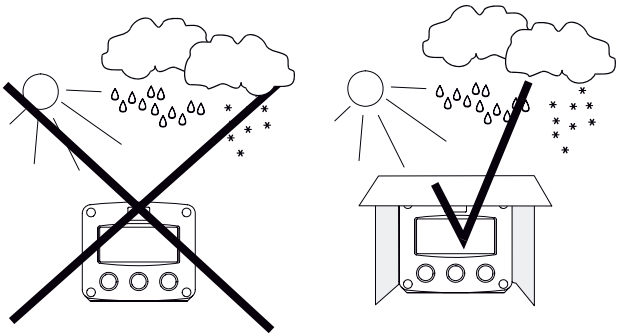
All instructions in this manual are to be observed.

Take careful notice of the "Safety rules, instructions and precautionary measures" at the front of this manual.

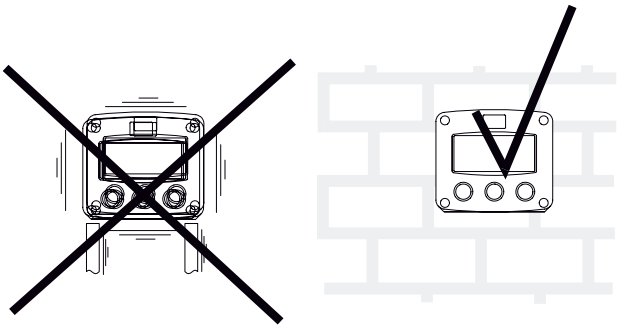
Ambient conditions

Take the relevant IP classification of the housing into account (see manufacturer's plate). Even an IP67 (NEMA 4X) housing should **never** be exposed to strongly varying (weather) conditions. When panel-mounted, the protection class of the unit is IP65 (NEMA 4)!

When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a drying agent (e. g. silica gel) inside the housing.



Always mount the SITRANS F RA 110 on a solid structure to avoid vibrations.



Connecting

Sensor supply voltage selection

Terminal 11 offers a 3.2 V or 8.1 V voltage to power the sensor. This voltage is selected with the switch(es) inside the enclosure. To gain access to the switches first remove the terminal strip then the internal plastic cover.

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

voltage selection

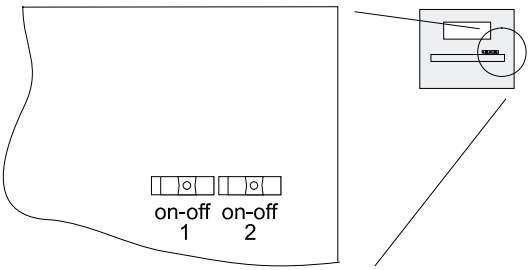


Figure 2 Voltage selection

Terminal connectors

The following terminal connectors are available:

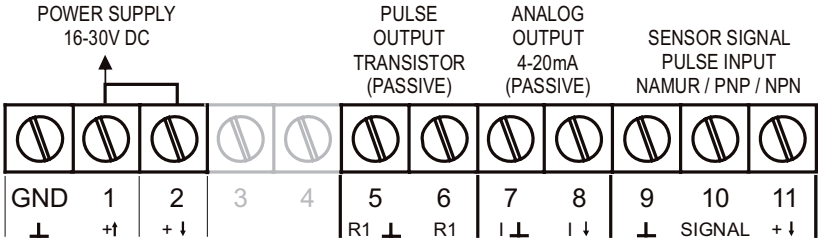


Figure 3 Overview terminal connectors - intrinsically safe applications

Note

For all safety values of the terminals as described in this section: follow the ATEX certificate!

Terminal GND 01 and 11 - intrinsically safe power supply

Type	Sensor supply	Terminal		
		GND	01	02
Input voltage: 8 ... 30 V DC	3.2 ... 8.1 V	L-	L+	Internally linked with terminal 01

Terminal 02 offers the same voltage as terminal 01

Scaled pulse output R1 - terminals 05 and 06

Function 51 describes the pulse output function. The maximum pulse frequency of this output is 60Hz. A passive transistor output is available with this option.

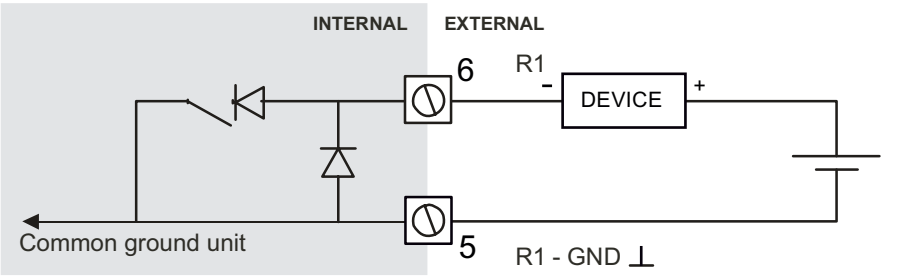


Figure 4 Passive pulse output R1

Analog output - terminals 07 and 08

An analog output signal proportional to the flowrate is available as standard. For analog output parameter settings see function group 4.

A passive 4 ... 20 mA signal proportional to the flowrate is available with this option. When a power supply is connected while the output is disabled, a 3.5 mA signal will be generated. The maximum driving capacity is 1000 Ohm. This output also supplies loop power to the unit.

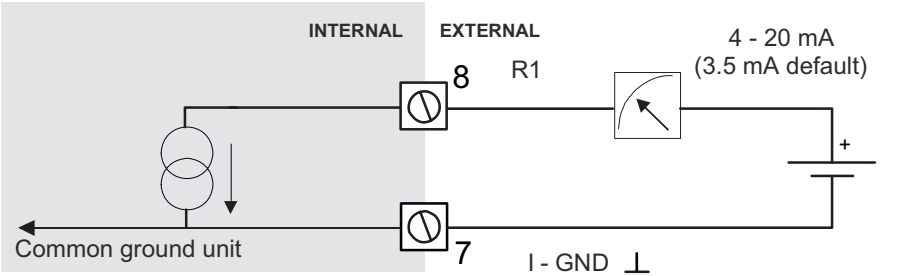


Figure 5 Passive 4-20 mA intirinsically safe analog output

Flowmeter input - terminals 09 through11

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 using the correct functions (see function groups 1 and 2)

Pulse signal NPN/NPN-LP

The SITRANS F RA110 is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2 V. Signal setting 'NPN-LP' employs a low-pass signal noise filter, which limits the maximum input frequency.

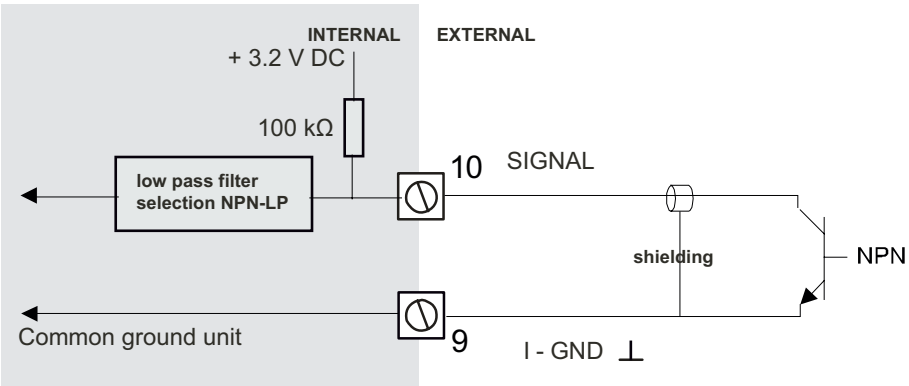


Figure 6 NPN signal input

Pulse signal PNP/PNP-LP

The SITRANS F RA110 is suitable for use with flowmeters which have a PNP output signal.
A 3.2 V voltage is provided at 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.
A sensor supply voltage of 8.1 V is provided at terminal 11. For a signal detection level of 50% of the supply voltage please refer to "Active signal input".

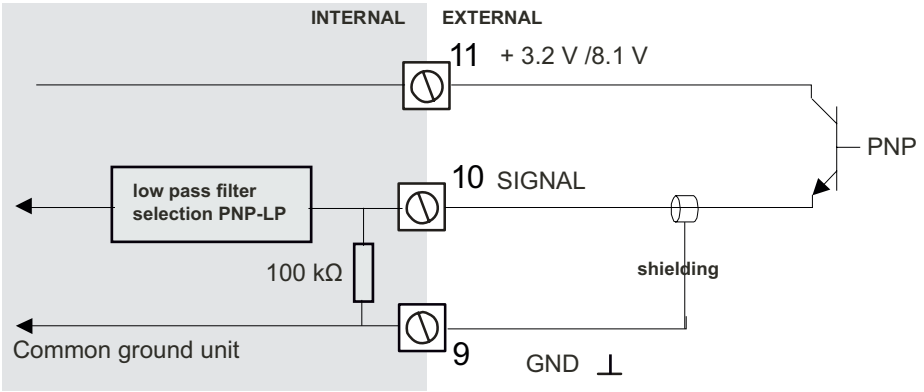


Figure 7 PNP signal input

Active signal input 8.1 V, 12 V and 24 V

If a sensor delivers an active signal, please read par. 'SETUP functions'. The detection levels are 50% of the selected supply voltage; approximately 4 V (ACT_8.1) , 6 V (ACT_12) or 12 V (ACT_24).

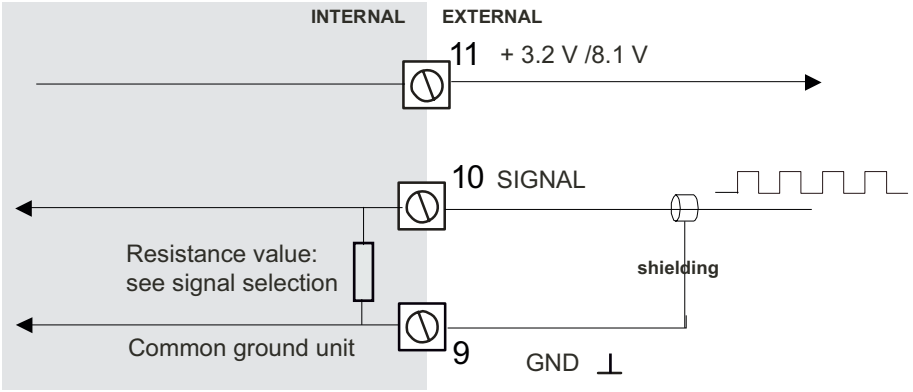


Figure 8 Active signal input

Reed switch

The SITRANS F RA110 is suitable for use with flowmeters which have a reed switch. To avoid pulse errors from the reed switch, we advise to select REED LP - low-pass filter.

NAMUR signal input

The SITRANS F RA110 is suitable for flowmeters with a NAMUR signal. A 8.2 V sensor supply voltage is provided at terminal 11.

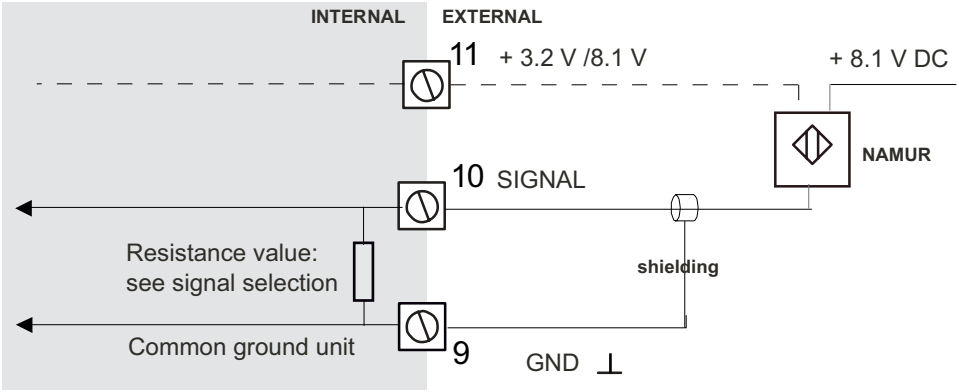


Figure 9 NAMUR signal input

Operation

Setup Level Functions

Table 2 Overview of setup level functions

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	11	UNIT	l - m^3 - kg - lb - GAL - USGAL- bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K FACTOR	0.00001 ... 9,999,999
	14	DECIMALS K FACTOR	0 ... 6
2	**FLOWRATE**		
	21	UNIT	ml - l - m^3 - mg -g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm^3 - NL - P
	22	TIME UNIT	Sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	K FACTOR	0.00001 ... 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	FUNCTIONS	Total - flowrate
	32	LCD UPDATE	fast - 1 second
	33	LANGUAGE	English - Deutsch
	34	BACKLIGHT BRIGHTNESS	0 ... 100 %
4	**ANALOG OUTPUT (OPTION)**		
	41	OUTPUT	Enable - disable
	42	FLOWRATE MINIMUM VALUE	0000.000 ... 9,999,999 unit/time unit
	43	FLOWRATE MAXIMUM VALUE	0000.000 ... 9,999,999 unit/time unit
	44	CUT-OFF	0.0 ... 9.9 %

SETUP FUNCTIONS AND VARIABLES			
	45	TUNE MINIMUM VALUE	0 ... 9,999
	46	TUNE MAXIMAUM VALUE	0 ... 9,999
	47	FILTER	00 .. 99
5	PULSE OUTPUT (OPTION)		
	51	PULSE WIDTH	0.001 ... 999.9 seconds
	52	DECIMALS	0 - 1 - 2 - 3
	53	PULSES	Per X quantity
6	OTHERS		
	61	MODEL	F RA 110 A / B / C
	62	SOFTWARE VERSION	02.11.xx
	63	SERIAL NO.	xxxxxxx
	64	PASSWORD	0000 9999
	65	TAG	0000000 ... 9999999

General

⚠DANGER

The housing may only be opened by trained personnel.

Protection against accidental contact is no longer assured when the housing cover is removed or the cabinet has been opened. This might lead to death or personal injuries due to an electric shock.

Personnel must read and understand this manual before carrying out its instructions. The SITRANS F RA110 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 and particular attention must be paid to the safety rules, instructions and precautionary measures in the first section of this manual.

Before you start working with the device make sure that the measuring system is correctly wired up according to the wiring diagrams.

Control panel

The control panel consists of three keys.

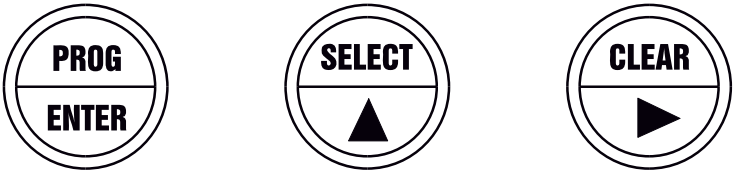


Figure 10 Control panel

Functions of the keys

Key	Function
PROG ENTER	This key is used to - program and/or save new values or settings - access SETUP level
SELECT	This key is used to - SELECT accumulated total - increase a value after PROG has been pressed - configure the unit
CLEAR	Press this key twice to CLEAR the value for total. The arrow key is used to - select a digit after PROG has been pressed - configure the unit

Operator information

After switching on the SITRANS F RA110 will always act at operator level. The information displayed is dependant on the SETUP settings. All pulses generated by the connected flowmeter are measured by the F RA110 in the background and are displayed at the set screen refresh rate. Having pressed a key, the display will be updated very quickly during a 30 second period, after which it will slow down again.

Figure 11 Example of display information during measurements

Operator functions

To an Operator, the following functions are available:

Display flowrate / total or flow rate

This is the main display information of the SITRANS F RA110. After selection of another information, the device will always return automatically to this main display. Total is displayed on the upper-line of the display and flow rate on the bottom line. It is possible to display flow rate only using the large 17mm digits; if so you have to press the SELECT-key to read the total.
If "-------" appears instead of the flow rate, then the flow rate value is too high to be displayed. The arrows ⇕ indicate the increase/decrease of the flow rate trend.

Clear total

The value for total can be re-initialized. To do so, press CLEAR twice. After pressing CLEAR once, the message "PUSH CLEAR" flashes. To avoid re-initialization at this stage, press any other key than CLEAR or wait for 20 seconds. Re-initialization of total DOES NOT influence the accumulated total.

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.

Alarm

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

Configuration

General

This chapter is exclusively addressed to programmers and configurators. It contains an extensive description of all software settings provided.

Setup level

Configuration of the F RA110 is done at SETUP level. You will enter SETUP level 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, you will have to press PROG for 3 seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP level automatically. You can enter SETUP level at any time while the F RA110 is fully operational.

SETUP level

Note

Code

To enter SETUP level you can set a code password. In this case access to SETUP level is denied if no or an incorrect code is entered.

Enter SETUP level

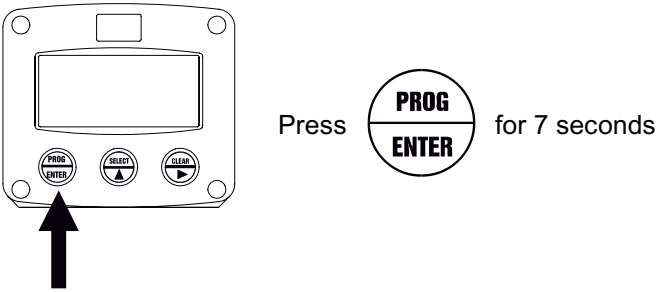


Figure 12 How to enter SETUP level

SETUP level structure

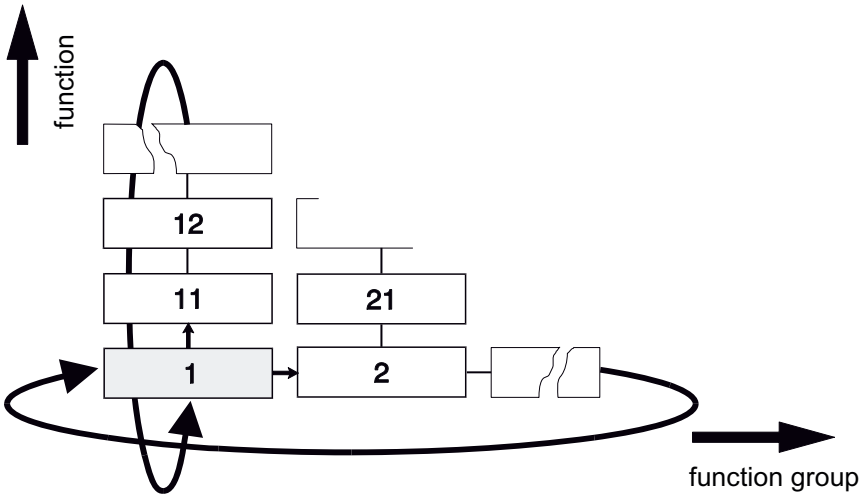


Figure 13 Matrix structure of SETUP level

The SETUP level consists of function groups (first level) and functions (second level).

Scrolling through SETUP level

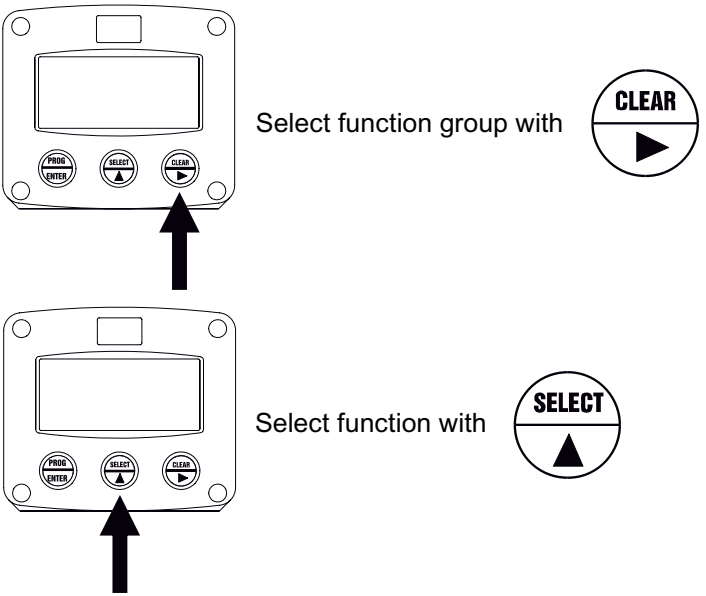


Figure 14 Scrolling through SETUP level

Each function has a specific number which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function group and the second figure the function. Additionally, each function is expressed with a keyword. After selecting a function, the next function group is selected after having scrolled through all "active" functions (e.g. 1▲, 11▲t, 12▲, 13▲, 14▲, 1▶, 2▶, 3▲, 31 etc.).

Change or select a value

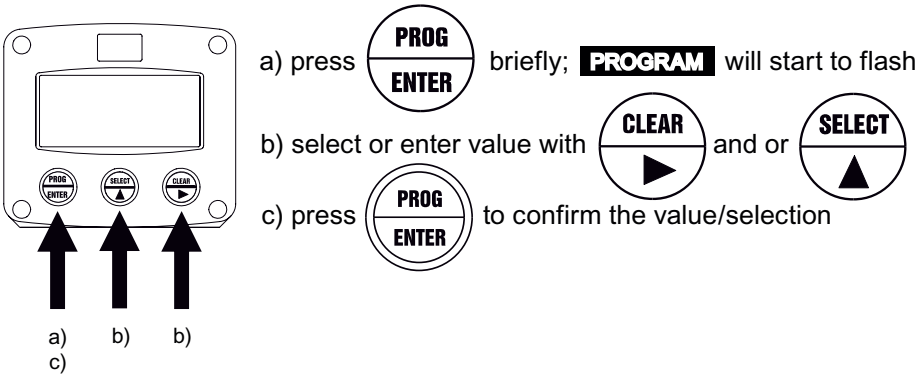


Figure 15 Selecting / changing values

To change a value, use ▸ to select the digit and ▲ to increase that value.

To select a setting, both keys ▲ and ▸ can be used. If the new value is invalid, the increase sign ▲ or decrease-sign ▼ will be displayed while you are programming. Changes are only effective after they have been confirmed by pressing PROG/ENTER. During the programming process any changes can still be cancelled either by waiting 20 seconds or by keeping the PROG/ENTER button pressed for at least 3 seconds. In that case the programming procedure will be abandoned and the former value reinstated.

Note

Changes are only effective after they been confirmed by pressing ENTER.

Return to operator level

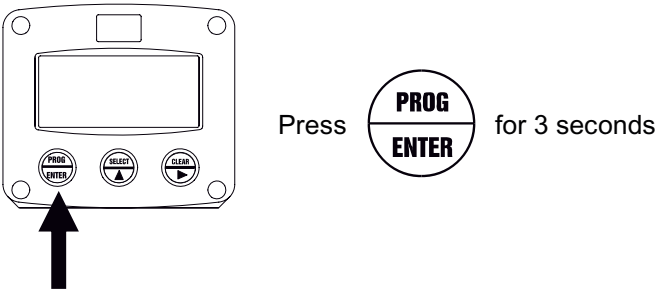


Figure 16 Leave SETUP level

To return to the operator level press PROG/ENTER for at least three seconds. The device will automatically return to the operator level when no keys are pressed for two minutes.

Function

Function group 1 TOTAL

The variables of SETUP function group 1 - TOTAL as described as follows:

Measurement unit (11)

This function determines the measurement unit for total, accumulated total and pulse output (optional). As units can be selected: l - m^3 - kg - lb. - GAL - USGAL - bbl - _ (no unit). Changing the measurement unit will consequently lead to changes in operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.

Decimals (12)

The decimal point determines the number of digits following the decimal point for total, accumulated total and pulse output.

The following settings can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333

K factor (13)

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 is set, the more accurate the device will work.

Example: Calculating the K factor.

Let us assume the flowmeter is a DN 25, the chamber volume of this flowmeter is 0.179 liters and the pulse output is 10 pulses per revolution. Furthermore, the display is set to a total in cubic meters (m^3), one of which corresponds to 1,000 liters.

Now calculate the number of revolutions per m^3as follows:
Cubic meter = 1,000 liters divided by chamber volume of 0.179 = 5,586.5921 revolutions. As the pulse output generates 10 pulses per revolution, the number of pulses generated per m^3 is:
10 x 5,586.5921 = 55,865.921. Since there is space only for 7 digits, round this figure and enter as settings for function 13 (K factor) 5586592 and for function 14 (number of decimals for K factor): 2.

The following table shows the relation between diameter size and K factor.

DN	Chamber volume	Number of revolutions per liter	K factor for 1 liter based on 10 pulses per revolution	K factor for 1 liter based on 100 pulses per rev.
DN 15	0.033 l	1 / 0.033 = 30.30303	303.0303	3030.303
DN 25	0.179 l	1 / 0.179 = 5.586592	55.86592	558.6592
DN 50	1.500 l	1 / 1.500 = 0.666667	6.666667	66.66667
DN 80	4.320 l	1 / 4.320 = 0.231481	2.314810	23.14810

The table values were determined using a SITRANS F R rotary piston meter.

Decimals K factor (14)

This setting represents the digits behind the decimal point of a K factor. Any number between 0 and 6 can used.

Note

This setting influences indirectly the accuracy of the K factor , i.e. the position of the decimal point and thus the resulting value.

This setting does **not** influence the displayed number of decimals for totals (function 12)!

Function group 2 FLOWRATE

The settings for total and flow rate are completely separate. In this way different measurement units can be used (e.g. cubic meters for total and liters for flow rate. The display refresh rate for this parameter can be set to one second or more.

Note

These settings also influence the optional analog output signal.

Measurement unit (21)

This parameter determines the flow rate measurement unit.
The following units can be selected:
ml - l - m^3 - mg - g - kg - ton - GAL - bbl - lb. - cf - REV - _no unit - scf - Nm^3 - Nl - P.

Changing the measurement unit will consequently lead to changes in operator and SETUP level values. Please note that the K factor has to be adapted as well; the calculation is not done automatically.

Time unit (22)

The flow rate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).

Decimals (23)

The decimal point determines the number of digits following the decimal point.

The following settings can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333

K factor (24)

With the K-factor, the flowmeter pulse signals are converted to a flow rate. 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 is set, the more accurate the device will work.

An example of a K factor calculation is given with function 13.

Decimals K factor (25)

This setting represents the digits behind the decimal point of a K factor. Any number between 0 and 6 can used.

Note

This setting influences indirectly the accuracy of the K factor , i.e. the position of the decimal point and thus the resulting value.

This setting does **not** influence the displayed number of decimals for totals (function 23)!

Calculation (26)

The flow rate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses per time period a set the more accurate is the flow rate. The maximum value is 255 pulses.

Note

Refresh rate

This setting influences the refresh rate for the analog output directly (maximum refresh rate is 10 times per second). If the output response is too slow, decrease the number of pulses.

For low frequency applications (<10 Hz): do not set more than 10 pulses else the refresh rate will be very slow.

For high frequency applications (>1 kHz) you can set a value of 50 or more pulses.

Cut-off time (27)

This parameter determines a switching point for low flow cut-off, which prevents too low flows from being measured. If flow falls below this point , i.e. if the number of pulses set using function 26 is less within the cut-off time set the flow rate will be displayed as zero. The cut-off time has to be entered in seconds, any value between 0.1 and 999.9 seconds (about 15 minutes) is permitted.

Function group 3 DISPLAY

Display functions (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 the flowrate will be displayed with the set measuring unit. In this case total will only be displayed after having pressed SELECT.

LCD update (32)

The update frequency of the displayed information can be selected as follows:

FAST: the totalizer will be updated 8 times per second - the flowrate once per second

1 SECOND: both totalizer and flowrate will be updated once per second

Please understand that NO information will be lost at whatever update frequency is selected; every pulse will be counted and the output signals will be generated as usual.

Language (33)

The following display languages can be selected:
English - Deutsch (German)

Brightness (option) (34)

The brightness of the optional backlight can be set in steps of 10%.

0% results in a switched-off backlight
100% results in a maximum brightness

Function group 4 ANALOG OUTPUT

This is an optional parameter which depends on the configuration of the flowmeter.

A linear (0) 4 ... 20 mA signal output signal is generated according to the flowrate with a 12 bit resolution. The settings for flowrate (SETUP - 2) directly influence the analog output settings. When the output is disabled, about 0 mA will be generated. The relationship between flowrate and analog output is set using the following functions:

Disable/enable (41)

If the analog output is not being used, select "disable" to switch-off the converter.

Minimum flowrate (42)

The flowrate value at which the output should generate a (0) 4 mA signal - in most applications this will be flowrate "zero". The number of decimals displayed depends on the value set with function 23. The calculation time and measuring unit (l/min for example) are dependant on the settings of functions 21 and 22 but both are not displayed.

Note

Note that this minimum flowrate signal (0)4 mA is determined using function 45. It can be any value in the range 0 ... 20 mA.

Maximum flowrate (43)

The flowrate value at which the output should generate a 20 mA signal - in most applications this will be at maximum flow. The number of decimals displayed depends on the value set with function 23. The calculation time and measuring unit (l/min for example) are dependant on the settings of functions 21 and 22 but both are not displayed.

Note

Note that this maximum flowrate signal 20 mA is determined using function 46. It can be any value in the range 0 ... 20 mA.

Cut-off (44)

To ignore leakage of the flow for example, a switching point for low flow cut-off can be set as a percentage of the full range of 16mA (or 20mA). When the flow falls below that switching point, the output current will be set to (0) 4 mA.

Table 3 Examples:

0 (4) mA (f. 42)	20 mA (f. 43)	Cut-off (f. 44)	Switching point (flow falls below...)	Output at switching point (when set to 4 mA)
0 l/min	100 l/min	2 %	(100-0) * 2 % = 2.0 l/min	4 + (16 * 2 %) = 4.32 mA
20 l/min	800 l/min	3.5 %	(800-20) * 3.5 % = 27.3 l/min	4 + (16 * 3.5 %) = 4.56 mA

Set minimum value 0 (4) mA (45)

The initial minimum analog output value is 4 mA. However, this value might differ slightly due to external influences such as temperature. The 4 mA value or any other value in the range 0 ... 21 mA can be tuned precisely with this setting.

CAUTION
Before setting the signal, be sure that the analog signal is not being used in any application!

Start the function by pressing PROG. The current can be increased / decreased with the arrow-keys and is **directly active**. Press ENTER to store the new value.

Set maximum value 20 mA (46)

The initial maximum analog output value is 20 mA. However, this value might differ slightly due to external influences such as temperature. The 20 mA value or any other value in the range 0 ... 21 mA can be tuned precisely with this setting.

CAUTION
Before setting the signal, be sure that the analog signal is not being used in any application!

Note

Before setting the maximum value, first set the minimum value (function 45) as it influences the maximum value.

Start the function by pressing PROG. The current can be increased / decreased with the arrow-keys and is **directly active.** Press ENTER to store the new value.

Filter (47)

This function is used to stabilize the analog output signal. Normally the output value is updated every 0.1 second. With the help of this digital filter a more stable but less actual reading can be obtained. The filter principal is based on three input values: the filter level (01-99), the last analog output value and the last average value. The higher the filter level, the longer will be the response time after a value change.

The following table shows several filter levels with their corresponding response times.

Filter value	Response time in seconds on step-by-step change of analog value			
	50 % influence	75 % influence	90 % influence	99 % influence
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.1 seconds	0.2 seconds	04. seconds	0.7 seconds
03	0.2 seconds	0.4 seconds	0.6 seconds	1.2 seconds
05	0.4 seconds	0.7 seconds	1.1 seconds	2.1 seconds
10	0.7 seconds	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	4.0 seconds	7.0 seconds	14 seconds
50	3.5 seconds	7.0 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

Function group 5 RELAY OUTPUT

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

Pulse width (51)

This function 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 pulse width, i.e. the pulse/pause ratio is 1:1. One pulse period lasts 7.8 msec. The minimum value is 0, the maximum value is 255 periods. If the pulse width value is set to "zero", the pulse output is disabled.

Note

If the frequency should go out of range - e.g. when the flowrate increases - an internal buffer will be used to "store the missed pulses": As soon as the flowrate reduces again, this buffer will be "emptied".

To avoid missing pulses due to a buffer overflow, set this parameter such that it always remains within its target area.

If a mechanic relay is used for the pulse output, we recommend to reduce the maximum output frequency to 0.5 Hz, else the lifetime will be reduced significantly.

The following table shows the ratio between the pulse parameters:

Number of periods	Pulse width	Frequemcy
0	disabled	disabled
1	0.0078 sec.	64 Hz
2	0.0156 sec.	32 Hz
3	0.0234 sec.	21 Hz
64	0.5000 sec	1 Hz
255	1.9922 sec.	0.25 Hz

Pulse rate (52)

According to the settings for total, a pulse will be generated every X-quantity. Enter this quantity here. Doing so you have must also take the displayed decimal position and measuring unit into account.

Function group 6 OTHERS

Type (61)

For support and maintenance it is important to have information about the characteristics of the SITRANS F RA110: A, B or C. This letter indicates the type of functionality according the ordering code:

- A: no outputs
- B: pulse output
- C: pulse and analog output

Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrades.

Software version (62)

For support and maintenance reasons it is important to have information about the software version of the SITRANS F RA110. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrades.

Serial number (63)

For support and maintenance it is important to have information about the characteristics of the SITRANS F RA110. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrades.

Password (64)

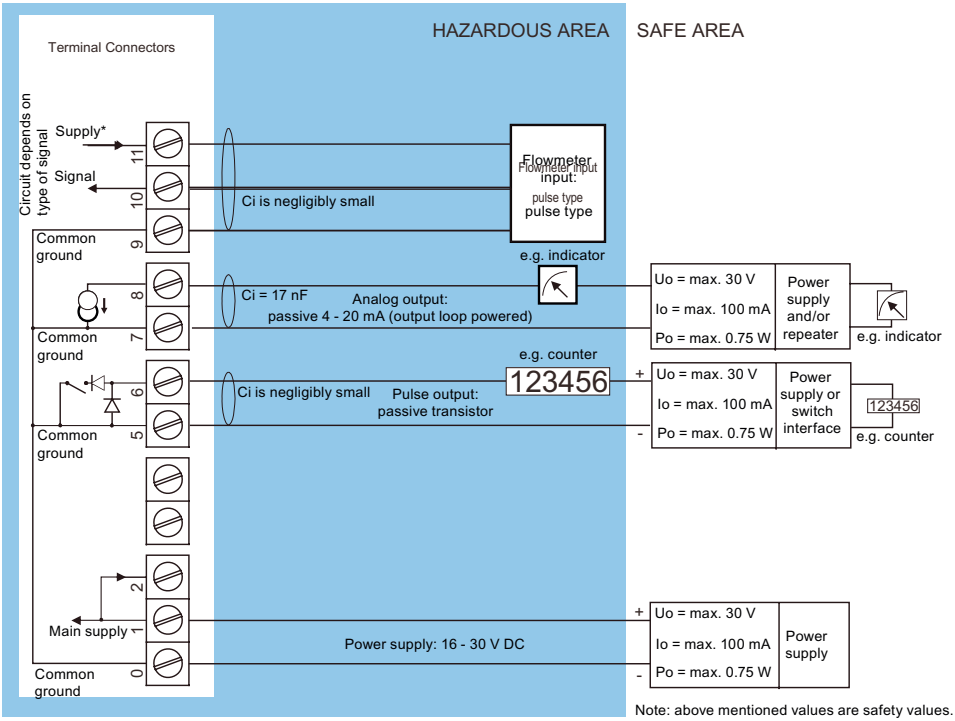
A password can be used to protect the SETUP values against maloperations This protection is disabled with the value 0000 (zero). Up to 4 digits can be programmed, e. g. 1234.

Tag (65)

To clearly identify the unit, a tag can be assigned. This tag consists of a number of maximum 7 digits, e.g. 1234567.

Configuration example

The following figure shows an configuration example of an intrinsically safe circuit.



* Note: power supply type PD: the supply voltage to the sensor is maximum 8.7 V
(Uo = 8.7 V, Io = 25 mA, Po = 150 mW)
Terminal 2 offers the same voltage as terminal 1 (internally linked)

Figure 17 Configuration example

Service and maintenance

Type label information

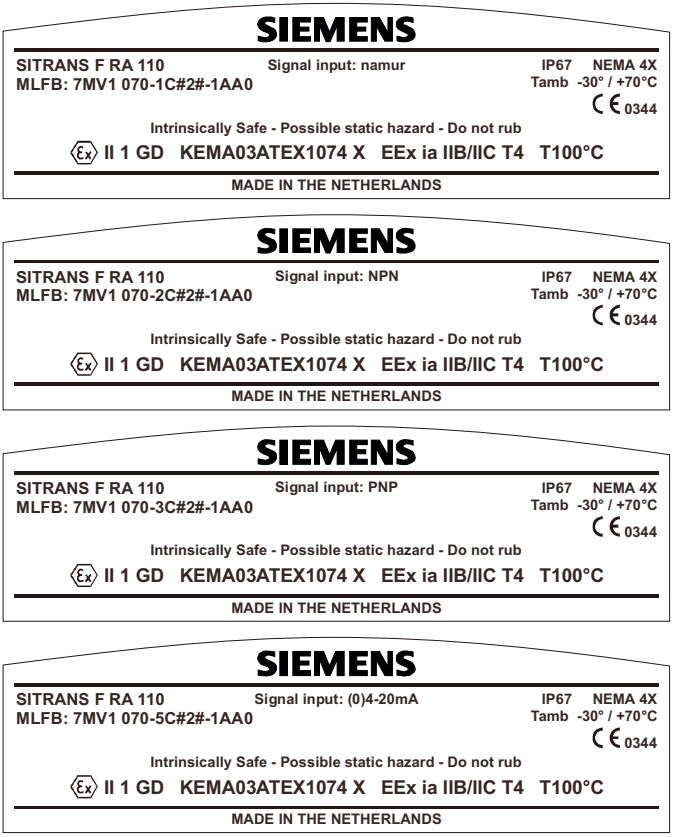


Figure 18 Labels inside housing

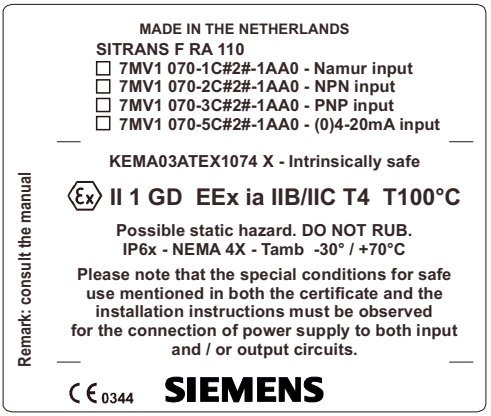


Figure 19 Label outside

Serial number

This information appears on the display after activation of function 63.

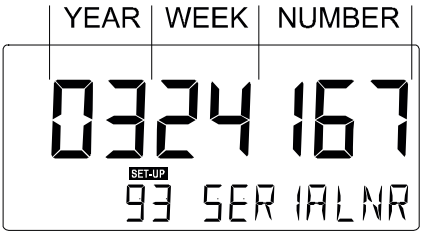


Figure 20 Serial number

Maintenance

⚠ 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 F RA110 does not require special maintenance unless it is used in low temperature applications or surroundings with high humidity (above 90% annual mean). Any user is responsible to take all precautions to dehumidify the internal atmosphere of the F RA110 such that no condensation will occur, e. g. by placing dry silica-gel sachet in the housing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

Periodically must be checked:

- condition of the housing, cable glands and front panel.
- input / output wiring for reliability and aging symptoms.
- process accuracy. As a result of wear and tear, re-calibration of the flowmeter might be necessary. If applicable any subsequent K-factor alterations must be entered.

If necessary clean the housing using only water to which a small amount of a mild detergent might be added. Do not use any aggressive solvents as these might damage the polyester coating.

Troubleshooting

Flowmeter does not generate pulses

Check the following:

- Type of signal flowmeter with the supplied type of input signal
- Wiring and connection of terminals

Flowmeter generates "too many pulses"

Check the following:

- Settings for total and flowrate: SETUP functions 11-14 and 21-27
- Proper grounding of the SITRANS F RA110

Analog output does not function properly

Check the following settings:

- Function 41 - is the function enabled?
- Functions 42 / 43: are the flow levels programmed correctly?

Pulse output does not function

Check the following settings:

- Function 53 - pulses per "x" quantity; is the value programmed reasonably?
- Function 52 - pulse width; is the external device able to recognize the selected pulse width and frequency?

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

Check the following settings:

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

Unknown code

If the factory-set code is not 1234, please contact your supplier.

Alarms

When the alarm flag starts flashing an internal alarm condition has occurred. Press the "select button" several times to display the 5-digit error code. These 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: errors 1 and 2 occurred simultaneously
- 0004: DAC communication
- 0008: DATA error

Technical data

Technical data

Table 4 TeTechnical data - General

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Digits	Seven 17 mm (0.67") or eleven 8 mm (0.31") digits. Various symbols and measuring units
Refresh rate	User definable: 0.125 ... 30 secs.

Housing	
General	Die-cast aluminium enclosure with polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material. Aluminum enclosure only: UV-resistant 2-component industrial painting.
Control keys	Three industrial micro-switch keys. UV-stabilized silicone keypad.
Painting	Aluminium surface: UV-resistant 2-component industrial painting.
Dimensions	L x H x D: 130 x 120 x 75 mm (5.10" x 4.72" x 2.95")
Classification	IP67 - NEMA 4X
Drilling	3 x M20 x 1.5

Operating temperature	At intrinsically safe operation: - 30 °C to + 70 °C (-22 °F to +158 °F)
Power supply	16 ... 30 V DC, power cosumption 0.75 Watt. For intrinsically safe applications, consult the safety values in the certificate
Sensor excitation for intrinsically safe operation	
Pulse signals	3.2 - 8.2 - max. 7 mA at 8.2 V DC.

Operating temperature	At intrinsically safe operation: - 30 °C to + 70 °C (-22 °F to +158 °F)
Analog signals	The sensor supply voltage is according to the power supply voltage connected to terminal 1.Terminal 2 offers the same voltage.
Terminal connections	Removable plug-in terminal strip. Wire diameter max. 1.5 mm^2 and 2.5 mm^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	Intrinsically safe: ATEX approval ref: <EX> II 1 GD EEx ia IIB/IIC T4 – T100°C.
Electromagnetic compatibility	Compliant ref: EN 61326 (1997), EN 61010-1 (1993).

Table 5 Technical data - Input

P type flowmeter	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.
K factor	0.000010 - 9,999,999 with variable decimal position
Low-pass filter	Available for all pulse signals
A type flowmeter	(0)4-20mA - with signal calibration feature at any current within the range.
Accuracy	Resolution 14 bit, error < 0.025 mA / ±0.125 % FS. Low level cut-off programmable
Span	0.000010 - 9,999,999 with variable decimal position
Update time	Four times a second
Voltage drop	2.5 Volt
Load impedance	3 kOhm
Relationship	Linear and square root calculation

Table 6 Technical data - Outputs

Analog output	
Function	Transmitting 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
Transistor output	
Pulse output	Max. frequency 60 Hz. Pulse length user definable between 7,8 msec and 2 seconds.
Function	One pulse output - transmitting accumulated total
Type OT	Passive transistor output - not isolated. Load max. 30 V DC - 100 mA

Table 7 Technical data - Operation

Operator functions	
Displayed functions	Total and/or flowrate Total and accumulated total Total can be reset to zero by pressing the CLEAR key twice
Total	
Digits	7 digits
Units	l, m^3, GAL, USGAL, kg, lb, bbl, no unit
Decimals	0 ... 3
Note	Total can be reset to zero
Accumulated total	
Digits	11 digits
Units/decimals	According to selection for total
Flowrate	
Digits	7 digits

Operator functions	
Units	ml, l, m^3, GAL, kg, ton, lb, bbl, cf, RND, ft^3, scf, Nm^3, Nl, USGAL, no unit
Decimals	0 ... 3
Time units	/sec, /min, /hr, /day

Drawings

Aluminuim housing

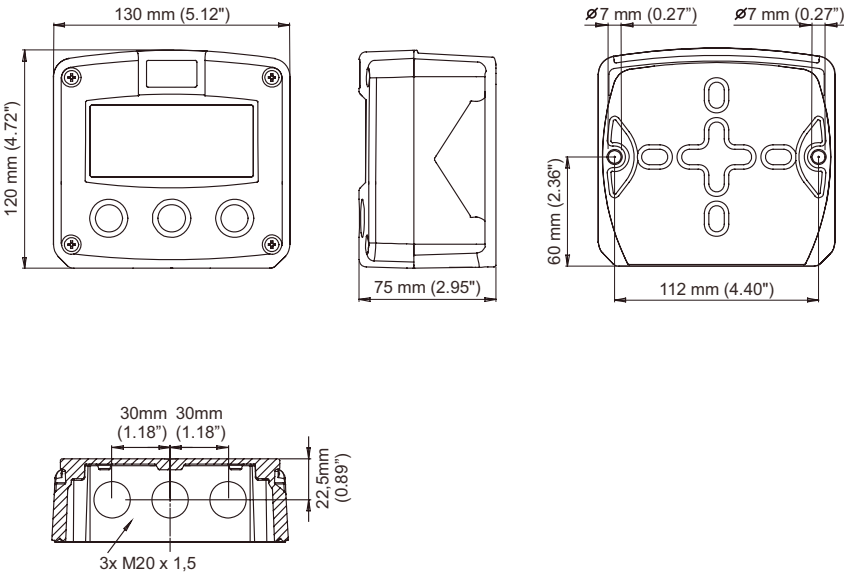


Figure 21 Housing dimensions

Appendix

Certificates

List of abbreviations

Abbreviations

Abbreviation/symbol	Explanation
"	Inch, equals 25.4 millimeters
°C	Degree Celsius, equals 1.8 degrees Fahrenheit
°F	Degree Fahrenheit, equals 0.5556 degrees Celsius
AC	Alternate current
ATEX	Atmosphère explosible, French for explosive atmosphere
bbl	Barrel, equals 5.6146 cubic feet or 158,9873 liters
cf	Cubic foot, equals 28.317 liters
DC	Direct current
EC	European community
E Ex	Explosion protection class
EEPROM	Electrically erasable programmable read-only memory
EN	European standard
ft^3	Cubic foot, equals 28.317 liters
g	Gram
GAL	(imperial) gallon, equals 1.201 US liquid gallons or 4.546 liters
GND	Ground
Hz	Hertz
IP	Ingress protection
kg	Kilogram, equals 2.2046 pounds
l	Liter, equals 0.0353 cubic feet
lb	Pound, equals 0.4536 kilograms

Abbreviation/symbol	Explanation
LCD	Liquid crystal display
LP	Low-pass filter
M	Metric
m^3	Cubic meters
mA	Milliamperes
mg	Milligram
ml	Milliliter
MLFB	German for 'Machine-readable fabrication number'
mm	Millimeter, equals 0.03937 inches
mm^2	Square millimeter
mW	Milliwatts
NEMA	National Electrical Manufacturers Association
Nl	Normal liter (liter at 0 °C temperature and 1 bar pressure)
Nm^3	Normal cubic meter (m^3 at 0 °C temperature and 1 bar pressure)
NPN	Negative - positive - negative (polarity of a transistor)
PNP	Positive - negative - positive (polarity of a transistor)
scf	Standard cubic foot (cf at 47 °F temperature and 14.7 psi pressure)
Tamb	Ambient temperature
USGAL	US (liquid) gallon, corresponding to 0.8327 imperial gallons or 3.7854 liters
V	volts
W	watts

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