

MXL-INST_ERST
REV 1
03/20



FLOWRATE INDICATOR / TOTALIZER

Electronic Register (ERST)

REMOTE MOUNT



ERST-RMA (F127-P-AP-CX-EL-HA-OT-PD-TP-XX-ZB)

Signal input flowmeter: Reed and NPN

Signal input temperature: PT100

***Output: 4-20mA, corrected flow rate, scaled pulse ref.
accumulated total, Backlight***

To the Owner

Please read and retain this instruction manual to assist you in the operation of this product. This Instruction Manual provides instruction guide on the operation and programming of the Type ERST, 17 mm LCD Digital Register. Should you require further assistance please contact your local Macnaught representative. Macnaught offer a comprehensive set of web-based support materials to complement our product range. Access the instruction manual by scanning the QR code.



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SAFETY INSTRUCTIONS

- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- LIFE SUPPORT APPLICATIONS: The ERST 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 ERST, the installer has to discharge himself by touching a well-grounded object.
- The ERST must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).

DISPOSAL OF ELECTRONIC WASTE



- The WEEE Directive requires the recycling of disposed electrical and electronic equipment in the European Union. When the WEEE Directive does not apply to your region, we support its policy and ask you to be aware on how to dispose of this product.
- The crossed-out wheeled bin symbol as illustrated and found on our products tells that this product shall not be disposed of into the general waste system or into a landfill.
- At the end of its life, equipment shall be disposed of according to the local regulations regarding waste of the electrical and the electronic equipment.
- Please contact your local dealer, national distributor or the manufacturer's Technical helpdesk for information on the product disposal.

SAFETY RULES AND PRECAUTIONARY MEASURES



- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the ERST implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.
- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the ERST supplied.
- Open the enclosure only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according the classification of the enclosure (see Chapter 4).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

ABOUT THE MANUAL

This manual is divided into two main sections:

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

This manual describes the standard Macnaught unit (ERST – F127-P). For additional information, please contact your supplier.

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



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



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



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

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

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WARRANTY

For warranty terms & conditions, visit

<https://au.macnaught.com/warranty>

1 INTRODUCTION

1.1 SYSTEM DESCRIPTION (Functions and features)

The flow computer, model ERST is a microprocessor driven instrument for the calculation of differential flow measurement applications using flow equations for liquids. This product has been designed with a focus on:

- two multi-purpose pulse inputs;
- ability to process all types of flowmeter signals, NPN and Reed;
- PT100 temperature input
- ultra-low power consumption to allow long-life battery powered applications
- aluminum enclosure for mounting in harsh industrial surroundings;
- transmitting possibilities with analog / pulse outputs.

Flowmeter and temperature input

This manual describes the unit with a pulse input from the flowmeter. The ERST has also a PT100 temperature input. Two flowmeters with an NPN or Reed signal output can be connected to the ERST.

Standard output

- Pulse output to transmit a pulse that represents a totaled quantity as programmed.
- Passive 4-20mA analog output to represent the actual calculated differential flow rate as programmed. The 4-20mA signal limits can be tuned.

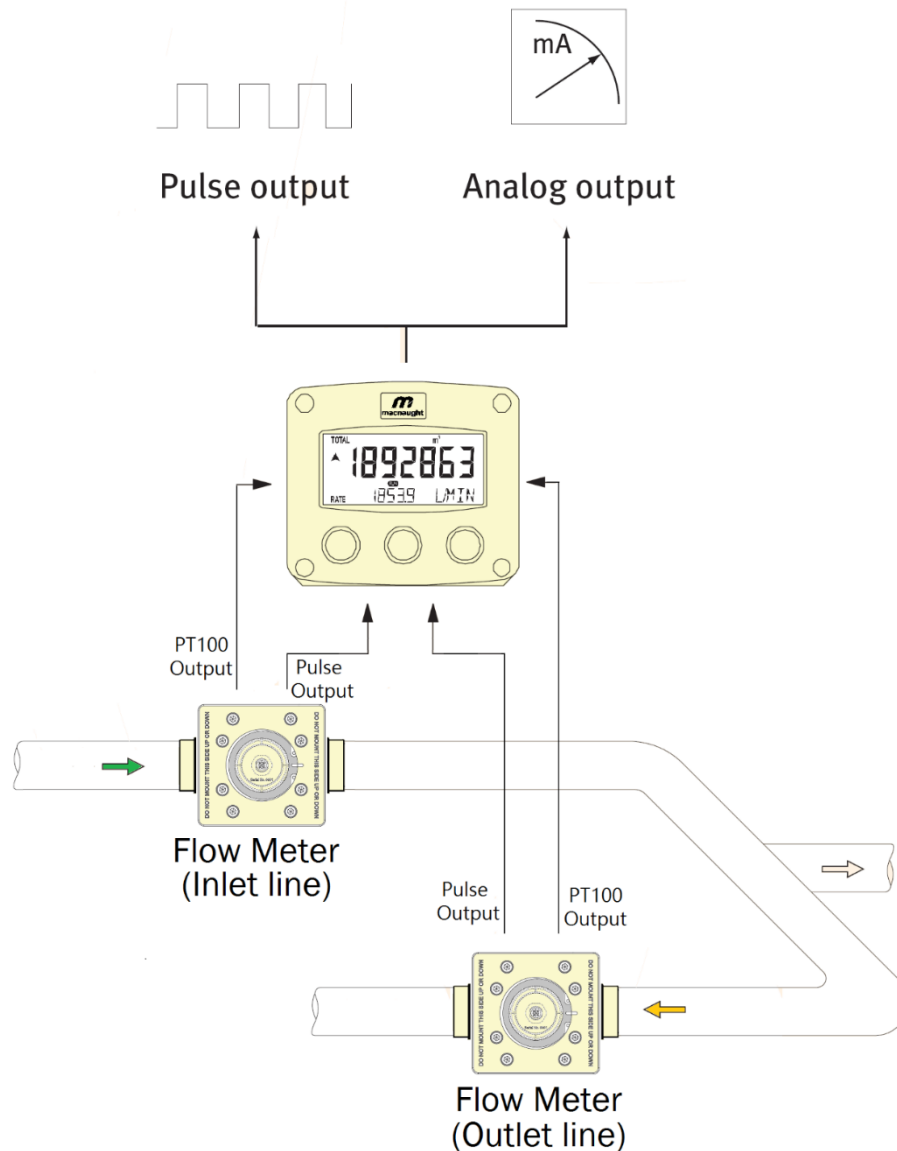


Fig. 1: Typical application for the ERST
MXL-INST_ERST

Configuration of the unit

The ERST is designed for use in many types of applications. For that reason, a setup menu is available to program the ERST according to your specific requirements. The setup includes several important features, such as K-Factors, engineering units, signal selection, power management (to extend battery life-time), etc. All settings are stored in a non-volatile EEPROM memory and therefore kept in the event of a power failure or an exhausted battery.

Display information

The unit has an LCD with a backlight to show the process information, status information, trend indication, key word and alarm messages. Differential or sum Flowrate and totals can be displayed either with the small 8mm digits or with the 17mm digits. The flowrate and accumulated total of flow A and flow B can be displayed as well. A backup of the total and accumulated total in EEPROM memory is made every minute.

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

Backlight

A backlight is available which requires a power supply. The brightness of backlight can be tuned as desired. For battery and loop powered applications the backlight will not function.

Options

The following options are available: passive 4-20mA analog output, Power and sensor supply options, extended measurement range for PT100, wall-mount and weather-proof enclosures, LED backlight.

2 OPERATIONAL



- This device may only be operated by persons who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.

This chapter describes the daily use of the ERST. This instruction is meant for users / operators.

2.1 CONTROL PANEL

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



Fig. 2: Control Panel

Functions of the keys



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



This key is used to select the accumulated total and temperature.
The **"SELECT"** ▲ key is also used to increase a value after the PROG/ENTER key has been pressed (read chapter 3).



This key is used to reset the total.

The "CLEAR" key is also used to select a digit or an option after the PROG/ENTER key has been pressed (read chapter 3).

2.2 OPERATOR INFORMATION AND FUNCTIONS

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



For the Operator, the following functions are available:

Display calculated differential flow rate and calculated differential total

This is the main display information of the ERST. After the selection of any other information, it will always return to this main display automatically. Total is shown on the upper line of the display and flow rate on the bottom line. When selected in the setup menu, the display shows the flow rate only. When you press the select key, the total shows momentarily.

When "-----" is shown, then the flow rate value is too high to be shown. The arrows \blacktriangleleft \blacktriangleright indicate the increase/decrease of the flow rate trend. If the consumption is very low, it might be that a stable low flow rate and total is shown; this is due to the settings of the ERST.

Clear total

The value for total can be reset. To do so, press the "CLEAR" key twice. When the key is pressed once, the text "PUSH CLEAR" is shown. To avoid a reset at this stage, press another key other than the "CLEAR" key or wait for 20 seconds. A reset of the total does not influence the accumulated total.

Display calculated differential accumulated total

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

Display line temperature and calculated flow rate INLET / OUTLET

When the "SELECT" key is pressed twice, the actual INLET / OUTLET temperature is shown at the top line of the display. At the bottom line, the calculated INLET / OUTLET flow rate is shown together with the engineering units for flow rate and temperature.

Range error

As soon as the input value is out of the calibrated PT100 measurement range, the alarm indicator shows. When the "SELECT" key is pressed a few times, the alarm code is shown in the alarm display. This alarm is also activated at a wire break or faulty sensor. (standard range -100 °C - +200 °C).

Low-battery alarm

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



Fig. 3: Low-battery alarm (typical)

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

Alarm

When the alarm indicator is shown, refer to 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.

3.2 PROGRAMMING SETUP-LEVEL

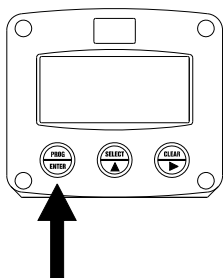
Configuration of the ERST is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows \blacktriangleleft \blacktriangleright will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively,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



Note !

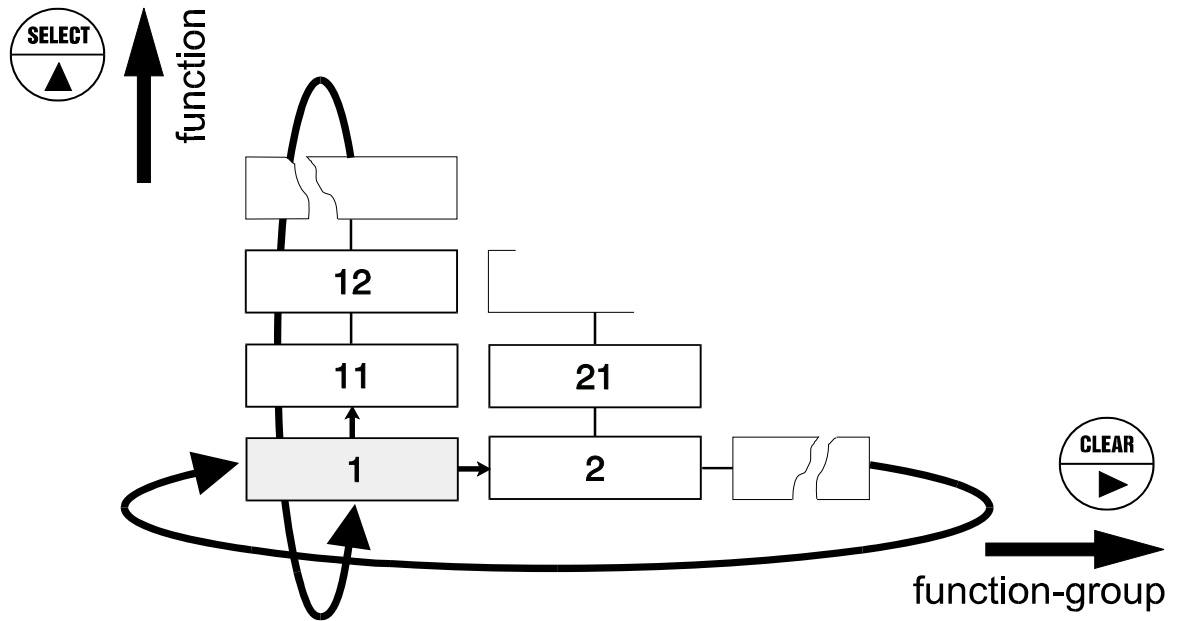
Note: A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.

To enter SETUP-level:



Press for 7 seconds

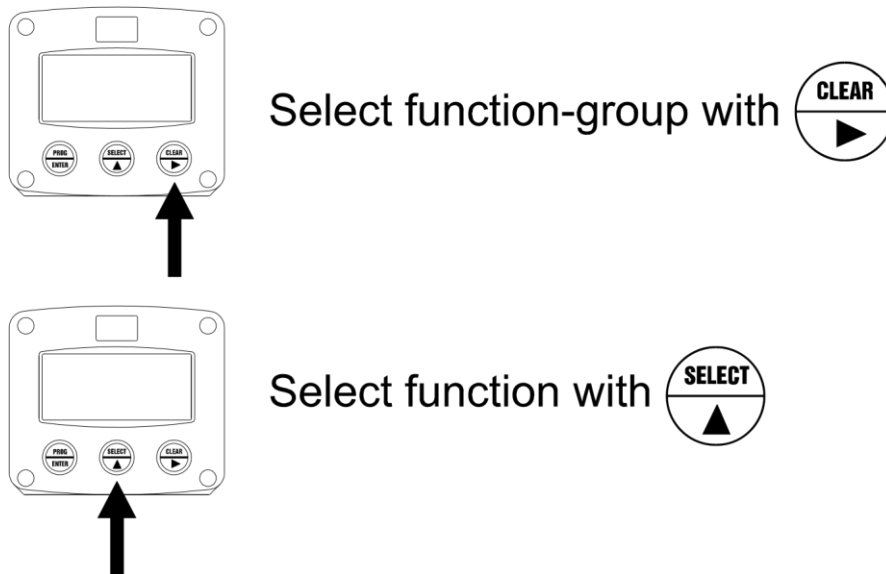
Matrix structure SETUP-level:



SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:

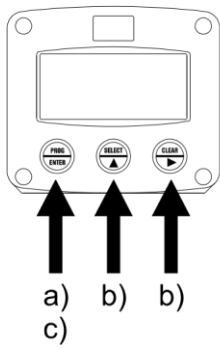
SETUP is divided into several function groups and functions.









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.). The "CLEAR" button can be used to jump a step back if you missed the desired function.

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.

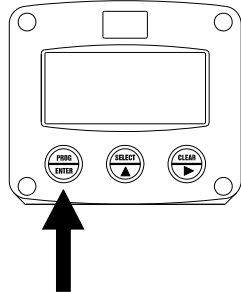
To select a setting,  is used to select in one direction and  can be used to select in the other direction. If the new value is invalid, the increase sign  or decrease-sign  will be displayed while you are programming.


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.


3.3 SETUP MENU – SETTINGS

SETUP FUNCTIONS AND VARIABLES			
1	TOTAL-A		
	11	unit	L - m ³ - kg - lb - GAL - USGAL - bbl - no unit
	12	decimals	0 - 1 - 2 - 3 (Ref: displayed value)
	13	k-factor	0.000010 – 9,999,999
	14	decimals k-factor	0 – 6
2	FLOW RATE-A		
	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	0.000010 - 9,999,999
	25	decimals k-factor	0 - 6
	26	filter	0 - 99
	27	period	0.1 - 99.9 seconds
3	TOTAL-B		
	31	K-factor:	0.000010 - 9999999
	32	decimals K-factor	0 - 6
4	FLOWRATE-B		
	41	K-factor	0.000010 - 9999999
	42	decimals K-FACTOR	0 - 6
5	DISPLAY		
	51	function	total; rate
	52	light	0% (off); 20%; 40%; 60%; - 80%; 100% (full brightness)
	53	measurement	bi-direct; not negative; threshold; stationary
	54	stationary flow rate	0000.000 - 9999999
	55	stationary total	0000.000 - 9999.999
6	POWER MANAGEMENT		
	61	LCD UPDATE	Fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	62	BATTERY MODE	Operational - Shelf
7	FLOWMETER		
	71	signal A	npn; npn_lp; reed; reed_lp; 8.1 DC; 12 DC; 24 DC
	72	signal B	npn; npn_lp; reed; reed_lp; 8.1 DC; 12 DC; 24 DC
8	TEMPERATURE A/B		
	81	display	°C; °F; K
	82	no. of wires	2; 3
	83	filter	01 - 99
9	FORMULA		
	91	equations type	EL (fixed)
	92	Thermal expansion coefficient	0.000000 - 9.999999 (*10-3/K)
	93	normal temperature	0.00 - 99,999.99 K
A	ANALOG		
	A1	output	disable - enable
	A2	minimum signal	0000.000 - 9,999,999 unit/time unit
	A3	maximum signal	0000.000 - 9,999,999 unit/time unit
	A4	cut-off	0.0 - 9.9%
	A5	tune min – (0)4ma	0 - 9,999
	A6	tune max- 20ma	0 - 9,999
	A7	filter	00 - 99
B	IMPULSE		
	B1	mode	signed; not negative; separated
	B2	width	0.001 – 9
	B3	decimals	0000000; 111111.1; 22222.22; 3333.333
	B4	amount	0.001 – 9999999
C	OTHERS		
	C1	type / model	ERST
	C2	software version	MCN0121
	C3	serial no.	N/A
	C4	pass code	0000 – 9999
	C5	tag number	00 - 9999999


3.4 EXPLANATION OF SETUP-FUNCTIONS


1 – TOTAL-A	
MEASUREMENT UNIT 11	<p>SETUP - 11 determines the measurement unit for total and accumulated total. The following units can be selected:</p> <p>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 and accumulated total the number of digits following the decimal point. The following can be selected:</p> <p>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><u>Example 1: Calculating the K-factor</u> Let us assume that the flowmeter generates 2.4813 pulses per litre and the selected unit is "m³". A cubic meter consists of 1000 parts of one litre 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".</p> <p><u>Example 2: Calculating the K-factor</u> 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".</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>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-A	
<p>The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meter for total and litres for flowrate. The display update time for flowrate is one second or more. NOTE: These settings also influence the analog output.</p>	
MEASUREMENT UNIT 21	<p>SETUP - 21 determines the measurement unit for flowrate. The following units can be selected:</p> <p>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	<p>The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).</p>
DECIMALS 23	<p>This setting determines for flowrate the number of digits following the decimal point. The following can be selected:</p>

	00000 - 1111.1 - 2222.22 - 3333.333																																																							
K-FACTOR 24	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 litre. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.																																																							
DECIMALS K-FACTOR 25	This setting determines the number of decimals for the K-factor (SETUP 24). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 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).																																																							
FILTER 26	This setting is used to stabilize the output signal. With the help of this digital filter a more stable but less actual representation of the flow rate can be obtained. The filter principal is based on three input values: the filter level (01-99), the last calculated flow rate and the last average value. The higher the filter level, the longer the response time on a value change will be.																																																							
Filter Value	Response time on step change of analog value. Time in seconds																																																							
	<table border="1"> <thead> <tr> <th>Influence</th> <th>50%</th> <th>75%</th> <th>90%</th> <th>99%</th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Filter disables</td> <td>Filter disables</td> <td>Filter disables</td> <td>Filter disables</td> </tr> <tr> <td>02</td> <td>0.1 sec</td> <td>0.2 sec</td> <td>0.4 sec</td> <td>0.7 sec</td> </tr> <tr> <td>03</td> <td>0.2 sec</td> <td>0.4 sec</td> <td>0.6 sec</td> <td>1.2 sec</td> </tr> <tr> <td>05</td> <td>0.4 sec</td> <td>0.7 sec</td> <td>1.1 sec</td> <td>2.1 sec</td> </tr> <tr> <td>10</td> <td>0.7 sec</td> <td>1.4 sec</td> <td>2.2 sec</td> <td>4.4 sec</td> </tr> <tr> <td>20</td> <td>1.4 sec</td> <td>2.8 sec</td> <td>4.5 sec</td> <td>9.0 sec</td> </tr> <tr> <td>30</td> <td>2.1 sec</td> <td>4.0 sec</td> <td>7.0 sec</td> <td>14 sec</td> </tr> <tr> <td>50</td> <td>3.5 sec</td> <td>7.0 sec</td> <td>11 sec</td> <td>23 sec</td> </tr> <tr> <td>75</td> <td>5.2 sec</td> <td>10 sec</td> <td>17 sec</td> <td>34 sec</td> </tr> <tr> <td>99</td> <td>6.9 sec</td> <td>14 sec</td> <td>23 sec</td> <td>45 sec</td> </tr> </tbody> </table>	Influence	50%	75%	90%	99%	01	Filter disables	Filter disables	Filter disables	Filter disables	02	0.1 sec	0.2 sec	0.4 sec	0.7 sec	03	0.2 sec	0.4 sec	0.6 sec	1.2 sec	05	0.4 sec	0.7 sec	1.1 sec	2.1 sec	10	0.7 sec	1.4 sec	2.2 sec	4.4 sec	20	1.4 sec	2.8 sec	4.5 sec	9.0 sec	30	2.1 sec	4.0 sec	7.0 sec	14 sec	50	3.5 sec	7.0 sec	11 sec	23 sec	75	5.2 sec	10 sec	17 sec	34 sec	99	6.9 sec	14 sec	23 sec	45 sec
Influence	50%	75%	90%	99%																																																				
01	Filter disables	Filter disables	Filter disables	Filter disables																																																				
02	0.1 sec	0.2 sec	0.4 sec	0.7 sec																																																				
03	0.2 sec	0.4 sec	0.6 sec	1.2 sec																																																				
05	0.4 sec	0.7 sec	1.1 sec	2.1 sec																																																				
10	0.7 sec	1.4 sec	2.2 sec	4.4 sec																																																				
20	1.4 sec	2.8 sec	4.5 sec	9.0 sec																																																				
30	2.1 sec	4.0 sec	7.0 sec	14 sec																																																				
50	3.5 sec	7.0 sec	11 sec	23 sec																																																				
75	5.2 sec	10 sec	17 sec	34 sec																																																				
99	6.9 sec	14 sec	23 sec	45 sec																																																				
PERIOD 27	This setting is used to calculate the flow rate by counting the number of pulses within a certain time, for example 1 second. The longer the time the more accurate the flow rate will be. <i>This setting does influence the update time for the analog output directly. If the output response is too slow, decrease the number of pulses.</i> <i>The shorter the update time, the higher the power consumption of the unit will be (important for battery powered applications).</i>																																																							
	 Note !																																																							
3 – TOTAL-B																																																								
The engineering units are the same as used in SETUP-menu 1 - Total-A																																																								
K-FACTOR 31	This setting is used to set the K-Factor for the total (B). With the K-Factor, the flowmeter pulse signals are converted to a quantity. The K-Factor is based on the number of pulses generated by the flowmeter per selected engineering unit, for example per m ³ . A more accurate K-Factor (more decimals, as set in decimals K-Factor) allows for a more accurate operation of the system.																																																							
DECIMALS K-FACTOR 32	This setting is used to set the number of digits behind the decimal point for the (accumulated) total indication (B).																																																							
4 – FLOWRATE-B																																																								
K-FACTOR 41	This setting is used to set the K-Factor for the flow rate (B). With the K-Factor, the flowmeter pulse signals are converted to a quantity. The K-Factor is based on the number of pulses generated by the flowmeter per selected engineering unit, for example per m ³ . A more accurate K-Factor (more decimals, as set in decimals K-Factor) allows for a more accurate operation of the system.																																																							

DECIMALS K-FACTOR 42	This setting is used to set the number of digits behind the decimal point for the K-Factor (B).
5 - DISPLAY	
FUNCTION 51	This setting can be set to display total or rate. <ul style="list-style-type: none"> When 'total' is selected, simultaneously, total is shown with the large digits and flow rate with the smaller digits. When SELECT is pressed, the accumulated total is shown temporarily. When 'rate' is selected, only flow rate will be shown with the large digits together with its measuring unit. When SELECT is pressed, the total and the accumulated total are shown temporarily.
LIGHT 52	The backlight brightness can be adjusted from 0% (off) to 100% (full brightness) in steps of 20%. When the ERST is only loop powered, the backlight is disabled. An external power supply is required to supply the backlight.
FLOW MEASUREMENT 53	To solve undesired display readings during low or even negative consumption situations, four different measurement methods have been implemented. Be aware that the selection does influence the analog output value (ref. flowrate) as well. bi-directional <u>Displayed flowrate:</u> positive and negative <u>Displayed total:</u> positive and negative not negative <u>Displayed flowrate:</u> only positive or zero <u>Displayed total:</u> positive and negative threshold <u>Displayed flowrate:</u> as soon as the flowrate is lower as setting 54 or negative, flowrate zero will be displayed. <u>Displayed total:</u> as soon as the flowrate is lower as setting 54 or negative, totalization will stop. stationary <u>Displayed flowrate:</u> as soon as the flowrate is lower as setting 54 or negative, the stationary flowrate (setting 54) will be displayed. <u>Displayed total:</u> as soon as the flowrate is lower as setting 54 or negative, stationary totalization (setting 55) will be activated. However, if the value of setting 55 is zero, totalization will be positive and negative.
STATIONARY FLOWRATE 54	Enter here the flowrate according setting 53 - threshold or stationary. The time and measuring units are according to FLOWRATE - setting 21 and 22. <u>In case of selection "threshold":</u> flowrate zero will be displayed as soon as the flowrate will be lower as this setting. <u>In case of selection "stationary":</u> as soon as the flowrate is lower as this setting, this flowrate will be displayed. However, if the flowmeters do not generate pulses, the displayed flowrate will be zero
STATIONARY TOTAL 55	Enter here a flowrate per hour according setting 53 - stationary. The measuring unit is according to TOTAL - setting 11. This flowrate is converted to a total which will be used as long as the flowrate is lower as setting 54. However, if the flowmeters do not generate pulses, the totalization will stop. This function is disabled if value zero has been entered.
6 - POWER MANAGEMENT	
When used with the internal battery option, the user can expect reliable measurement over a long period of time. The ER has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:	

LCD NEW 61  Note !	<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 signal will be generated in the normal way. The following can be selected:</p> <p>Fast - 1 sec - 3 sec - 15 sec - 30 sec - off.</p> <p>Note: after a button has been pressed by the operator - the display refresh rate will always switch to FAST for 30 seconds. When "OFF" is selected, the display will be switched off after 30 seconds and will be switched on as soon as a button has been pressed.</p>			
BATTERY-MODE 62	<p>The unit has two modes: operational or shelf</p> <p>After "shelf" has been selected, the unit can be stored for several years; it will not process the sensor signal; the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low.</p> <p>To wake up the unit again, press the SELECT-key twice.</p>			
7 - FLOWMETER				
SIGNAL 71	<p>The ER is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 51. Read also par. 4.4.2. or 4.4.3 - flowmeter input terminals.</p>			
TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / MV	REMARK
NPN	NPN input	100 k-Ohm pull-up	6 kHz.	(open collector)
NPN - LP	NPN input with low pass filter	100 k-Ohm pull-up	1.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1 m-Ohm pull-up	600 Hz.	-
REED - LP	Reed-switch input with low pass filter	1 m-Ohm pull-up	120 Hz.	Less sensitive
8 – TEMPRATURE A/B				
DISPLAY 81	<p>This setting is used to program the temperature unit which is shown to the operator. This setting does not influence the actual calculations.</p>			
NO. OF WIRES 82	<p>This setting is used to program the number of wires for the PT100 sensors.</p>			
FILTER 83	<p>The analog output signal of a sensor represents the actual temperature. This signal is measured several times a second. The value measured is a "snap-shot" of the real temperature as it will be fluctuating.</p> <p>With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value.</p> <p>The filter principal is based on three input values: the filter level (01-99), the last measured analog value and the last average value. The higher the filter level, the longer the response time on a value change will be.</p>			
Filter Value	Response time on step change of analog value. (Time in seconds).			
Influence	50%	75%	90%	99%
10	1.8 sec	3.5 sec	5.6 sec	11 sec
20	3.5 sec	7.0 sec	11 sec	23 sec
30	5.3 sec	10 sec	17 sec	34 sec
50	8.8 sec	17 sec	29 sec	57 sec
75	13 sec	26 sec	43 sec	86 sec
99	17 sec	34 sec	57 sec	114 sec
9 - FORMULA				
EQUATION TYPE 91	<p>This setting shows the formula. The type EL stands for Equations Liquid - flow computer for corrected liquid volume</p> <p>The formula used: $Q\text{-normal} = Q \times (1 + \alpha (T\text{-normal} - T))$ where:</p> <p>Q-normal: calculated volume at reference conditions</p>			

	Q: measured volume α: thermal expansion coefficient T-normal: reference temperature T: measured temperature			
THERMAL EXPANSION COEFFICIENT 92	Enter here the thermal expansion coefficient (α) for the liquid used. The value to be entered has to be multiplied with 1000. The decimal position is fixed but cannot be shown. With the default value of 0.000000 the volume correction is disabled . Examples: Calculation of the thermal expansion coefficient for water is 0.00031 per K. Enter: 0310000. for petrol is 0.00110 per K. Enter: 1100000.			
NORMAL TEMPERATURE	Enter here the reference temperature T-normal in degrees Kelvin (K). In most applications, the volume has to be calculated at 15°C which is 288.15 K.			
A - ANALOG				
A passive linear analog 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 A1	The analog output can be disabled. 3.5mA will be generated if a power supply is available but the output is disabled.			
MINIMUM FLOWRATE A2	Enter here the flowrate at which the output should generate the minimum signal (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) are dependent upon SETUP 21 and 22 but are not displayed.			
MAXIMUM FLOWRATE A3	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) are dependent upon SETUP 21 and 22 but cannot be displayed.			
CUT-OFF A4	To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16mA, (20mA). When the flow is less than the required rate, the current will be the minimum signal (4mA). Examples:			
4MA (SETUP A2)	20MA (SETUP A3)	CUT-OFF (SETUP A4)	REQUIRED RATE	OUTPUT
0 L/min	100 L/min	2%	$(100-0) \times 2\% = 2.0$ L/min	$4+(16 \times 2\%) = 4.32\text{mA}$
20 L/min	800 L/min	3.5%	$(800-20) \times 3.5\% =$ 27.3 L/min	$4+(16 \times 3.5\%) = 4.56\text{mA}$
TUNE MIN / 4MA 65	The initial minimum analog output value is 4mA. However, this value might differ slightly due to external influences such as temperature for example. The 4mA value can be tuned precisely with this setting.  Before tuning the signal, be sure that the analog signal is not being used for any application! After pressing PROG, the current will be about 4mA. The current can be increased / decreased with the arrow-keys and is directly active. Press ENTER to store the new value. Remark: the analog output value can be programmed "up-side-down" if desired, so 20mA at minimum flowrate for example!			

<p>TUNE MAX / 20MA 66</p> 	<p>The initial maximum analog output value is 20mA. However, this value might differ slightly due to external influences such as temperature for example. The 20mA value can be tuned precisely with this setting.</p> <p>Before tuning the signal, be sure that the analog signal is not being used for any application!</p> <p>After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is directly active. Press ENTER to store the new value.</p> <p>Remark: the analog output value can be programmed “up-side-down” if desired, so 4mA at maximum flowrate for example!</p>			
<p>FILTER 67</p>	<p>This function is used to stabilize the analog output signal. The output value is updated every 0.1 second. With the help of this digital filter a more stable but less precise reading can be obtained. The filter principal is based on three input values: the filter level (01 -99), the last analog output value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with their response times are indicated:</p>			
<p>FILTER VALUE</p>	<p>RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE.</p> <p>TIME IN SECONDS</p>			
	<p>50% INFLUENCE</p>	<p>75% INFLUENCE</p>	<p>90% INFLUENCE</p>	<p>99% INFLUENCE</p>
<p>01</p>	<p>filter disabled</p>	<p>filter disabled</p>	<p>filter disabled</p>	<p>filter disabled</p>
<p>02</p>	<p>0.1 second</p>	<p>0.2 second</p>	<p>0.4 second</p>	<p>0.7 second</p>
<p>03</p>	<p>0.2 second</p>	<p>0.4 second</p>	<p>0.6 second</p>	<p>1.2 seconds</p>
<p>05</p>	<p>0.4 second</p>	<p>0.7 second</p>	<p>1.1 seconds</p>	<p>2.1 seconds</p>
<p>10</p>	<p>0.7 second</p>	<p>1.4 seconds</p>	<p>2.2 seconds</p>	<p>4.4 seconds</p>
<p>20</p>	<p>1.4 seconds</p>	<p>2.8 seconds</p>	<p>4.5 seconds</p>	<p>9.0 seconds</p>
<p>30</p>	<p>2.1 seconds</p>	<p>4 seconds</p>	<p>7 seconds</p>	<p>14 seconds</p>
<p>50</p>	<p>3.5 seconds</p>	<p>7 seconds</p>	<p>11 seconds</p>	<p>23 seconds</p>
<p>75</p>	<p>5.2 seconds</p>	<p>10 seconds</p>	<p>17 seconds</p>	<p>34 seconds</p>
<p>99</p>	<p>6.9 seconds</p>	<p>14 seconds</p>	<p>23 seconds</p>	<p>45 seconds</p>
<p>B - IMPULSE</p>				
<p>One transistor output is available as scaled pulse output according to the accumulated total.</p>				
<p>Mode B1</p> <p>Signed</p> <p>Not Negative</p> <p>Separated</p>	<p>The unit has three scaled pulse output modes. This functionality drives two pulse outputs which, depending on the mode, can be used as follows:</p> <p>On pulse output R1 a pulse will be sent when the total has increased or decreased with the set quantity (SETUP B4). Pulse output R2 will send a 0 for increase or 1 for decrease.</p> <p>On pulse output R1 a pulse will be sent when the total has increased with the set quantity (SETUP B4). On pulse output R2 the sign of the flow rate will be sent (positive=0, negative=1).</p> <p>On pulse output R1 a pulse will be sent when the total has increased with the set quantity (SETUP B4). On pulse output R2 a pulse will be sent when the total has decreased with the set quantity (SETUP B4).</p>			
<p>Width B2</p>	<p>The pulse width determines the time that the output will be active; in other words, the pulse duration. Value “zero” will disable the pulse output.</p> <p>The pulse signal always has a 50% duty cycle, hence the minimum time between the pulses is equal to the pulse width setting. If the frequency should go out of range – when the flow rate increases for example – an internal buffer will be used to “store the missed pulses”: As soon as the flow rate slows down, the buffer will be “emptied”.</p>			

	It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within its range!
Decimals B3	This setting is used to set the number of digits behind the decimal point for the amount.
Amount B4	A pulse will be generated every time a certain quantity is added to the total. Enter this quantity here while taking the decimals for pulse into account.
C - OTHERS	
TYPE OF MODEL C1	This setting shows the model name.
VERSION SOFTWARE C2	This setting shows the version number of the firmware (software).
SERIAL NUMBER C3	This setting shows the serial number.
PASS CODE C4	This setting is used to set a password (pin code) to limit the access for the setup menu. Only persons who know the pin code can access the setup menu. The pin code 0000 disables the pin code to allow for access by any person.
TAGNUMBER C5	This setting is used to set a tag number for the ERST.

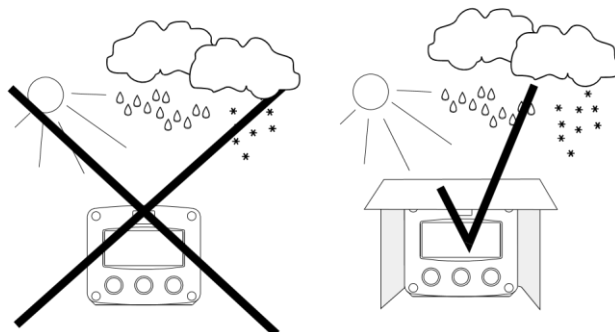
4. INSTALLATION

4.1 GENERAL DIRECTIONS

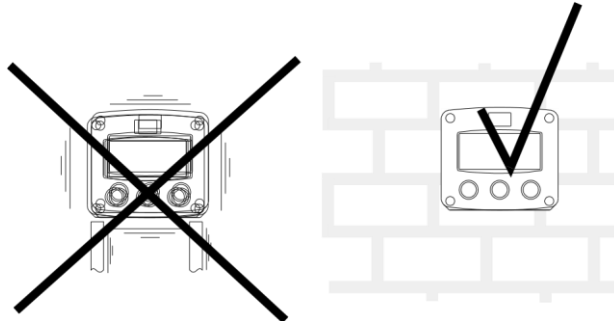


- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The ERST may only be operated by personnel 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 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 ERST on a solid structure to avoid vibrations.

4.3 DIMENSIONS- ENCLOSURE

Aluminium enclosures ERST-RMA:

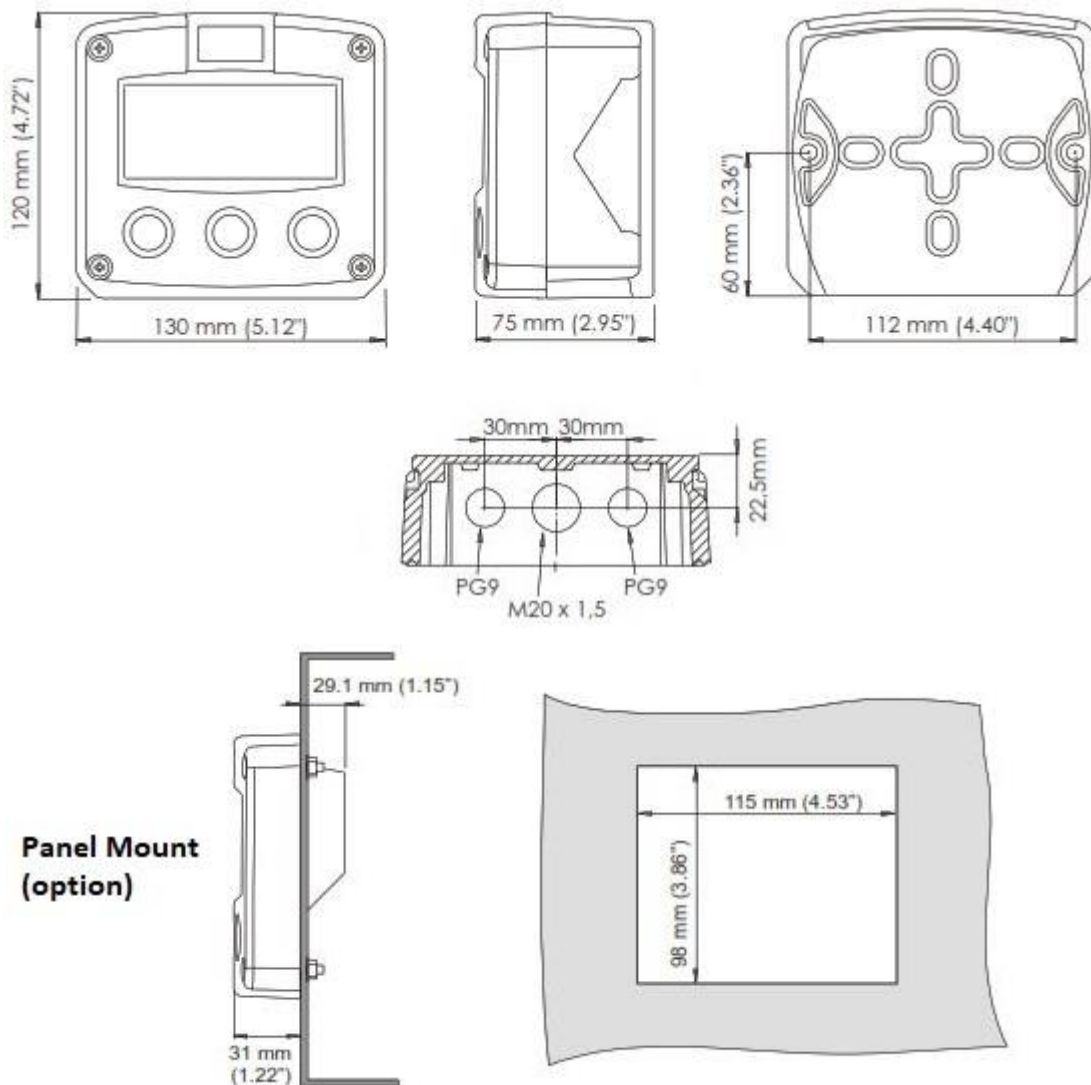


Fig. 4: Dimensions Aluminium enclosures

4.4 INSTALLING THE HARDWARE



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

Aluminum enclosures



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

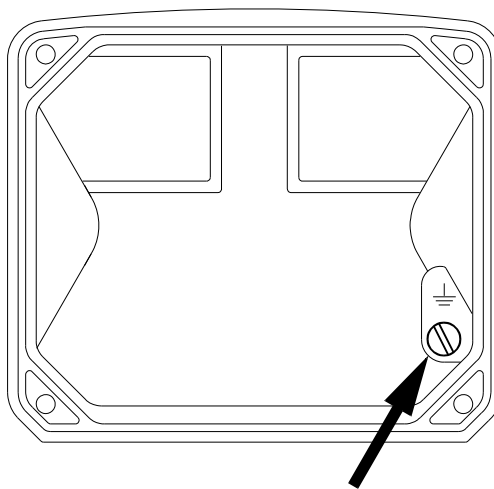


Fig. 5: Grounding aluminum enclosure

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.

4.5 VOLTAGE SELECTION SENSOR SUPPLY

Battery powered and output loop-powered applications:

Terminal 11 & 14 provides a signal input voltage of 3.2V / 8.2V / 12V or 24 V DC. The voltage can be selected with the four switches inside the enclosure. Total power consumption: max. 50mA@24V



Note !

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 reed-switch when operating without external power. It is possible to use some low power NPN output signals, but the battery life time will be significantly reduced (consult Macnaught).

Warning: be sure that all the leads to the terminals are disconnected from the unit when the internal 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 as indicated:

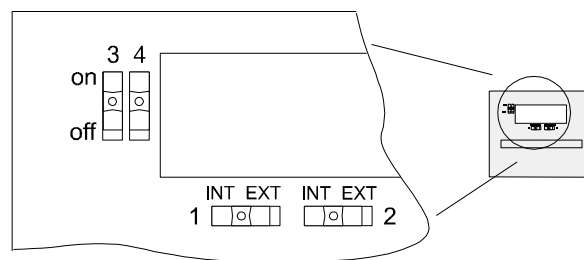


Fig. 6: Switch setting sensor supply voltage.

Switch positions:

Sensor A		Sensor B		Voltage Selection		
Switch 1	Voltage	Switch 2	Voltage	Switch 3	Switch 4	Voltage
Internal	3.2 V DC	Internal	3.2 V DC	On	On	8.2 V DC
External	Switch 3 + 4	External	Switch 3 + 4	On	Off	12 V DC
				Off	Off	24 V DC
Function Switch 1		Voltage selection sensor A - terminal 11				
Function Switch 1		Voltage selection sensor A - terminal 14				
Function Switch 1		The combination of these switches determines the voltage as indicated. If switch 1 and 2 are both set to position OFF than the selected voltage with switch 3+4 is valid for both sensors.				

4.6 TERMINAL CONNECTORS

The following terminal connectors are available:

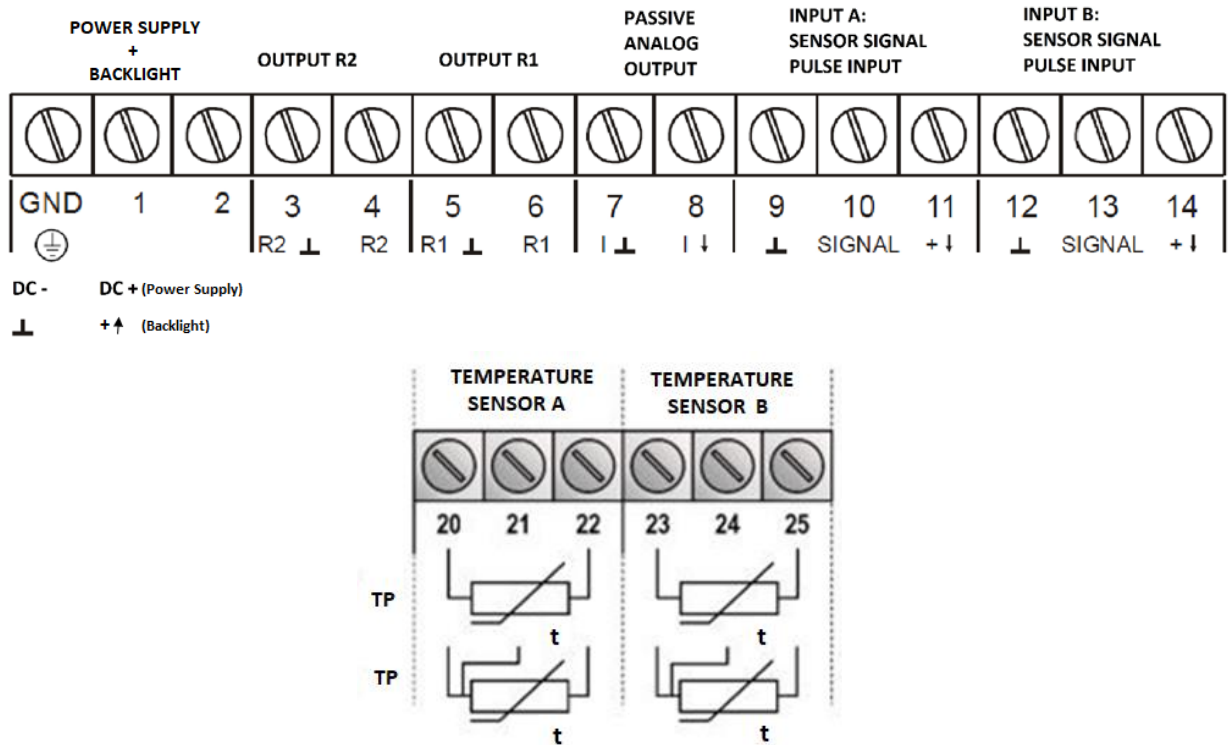


Fig. 7: Overview of terminal connectors standard configuration ERST and options.

Terminal GND- 01- 02: Power Supply and Backlight:

Type	Sensor Supply	Terminal			Backlight
		GND	01	02	
8 - 30 V DC	3.2 / 8.2 / 12 / 24V max. 50mA	DC -	DC +	-	◇

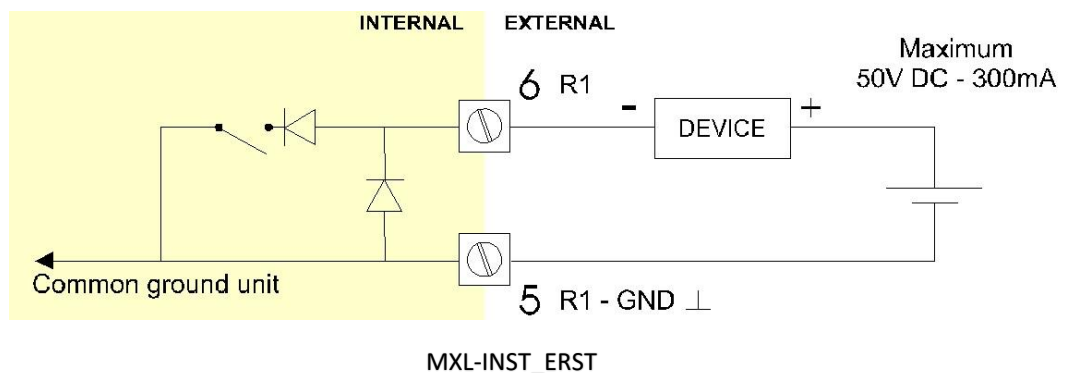
Note: The backlight supply is integrated into power supply terminals.

Terminal 05-06 (R1) / 03-04 (R2); scaled pulse output

SETUP 8 (read chapter 3) 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.

Passive Transistor Output

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



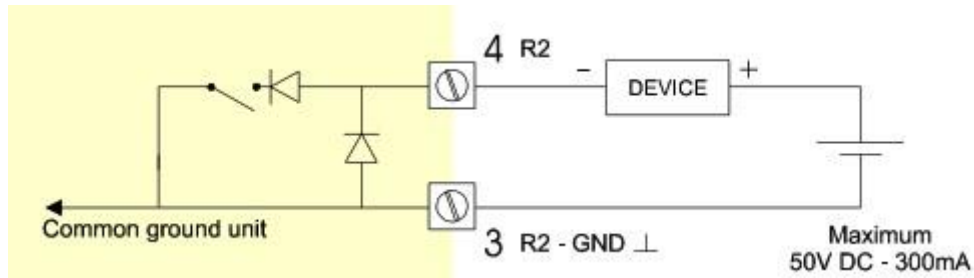


Fig. 8: Terminal connections - Pulse output (typical)

Terminal 07-08; Analog Output - output loop powered

Connect an external power supply of 8 – 30 VDC to these terminals for passive 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.

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

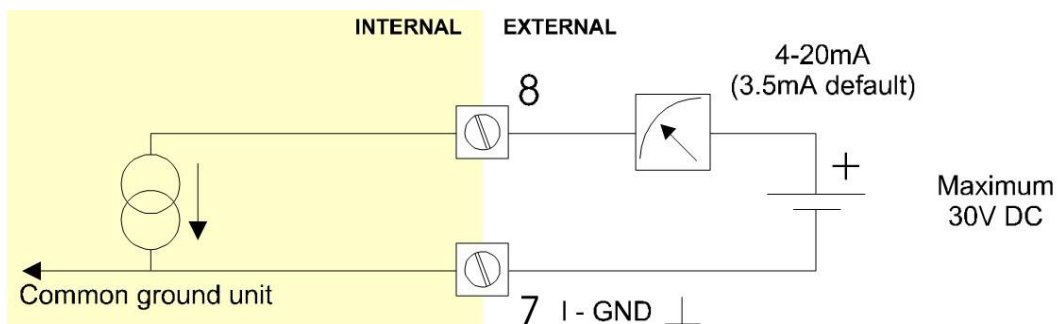


Fig. 9: Terminal connections - Passive 4-20mA analog output (typical)

Terminal 09-11; Terminal 12-14; Flowmeter input A and B:

Two basic types of flowmeter signals can be connected to the unit: NPN and Reed Switch. The connections for flowmeter A (Terminal 09-11) and B (Terminal 12-14) are the same. The screen of the signal wire must be connected to the related common ground terminal (unless earthed at the sensor itself) The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected in the flowmeter setup (read chapter 3).

Pulse-signal NPN / NPN-LP:

The ERST is suitable for use with flowmeters which have an NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency (read chapter 3).

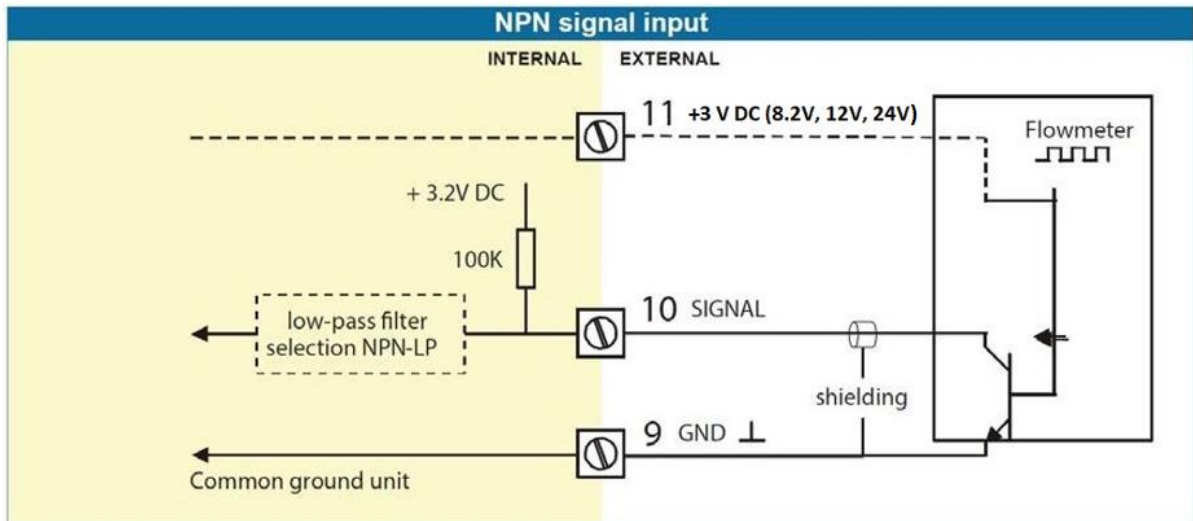


Fig. 10: Terminal connections - NPN signal input (typical)

Reed-switch:

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

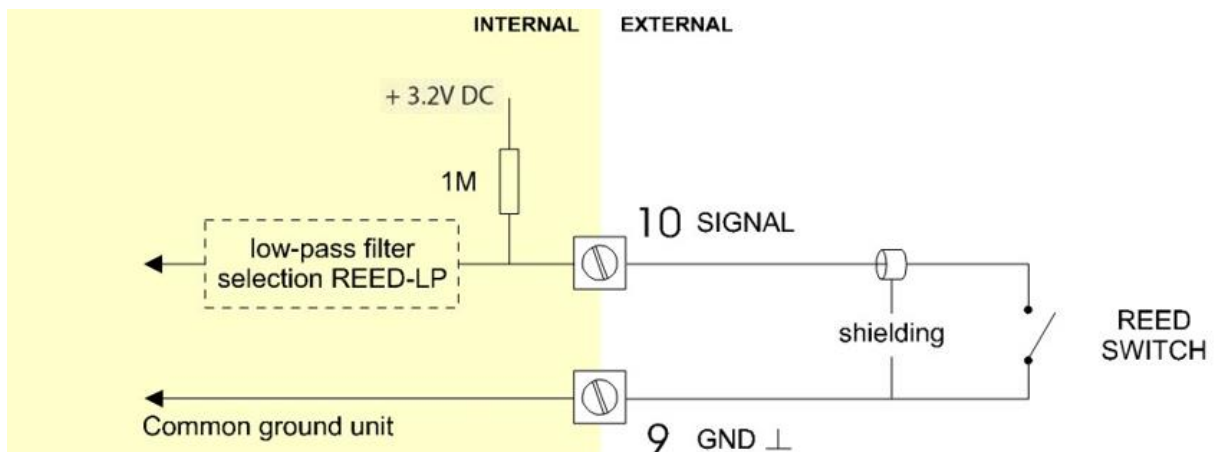


Fig. 11: Terminal connections - Reed-switch signal input (typical)

Terminal 20-22 and 23-25; Temperature inputs TP - PT100

Two types of PT100 elements can be connected: 2 or 3-wire. The temp coefficient for the RTD is 0.00385 ohms/ohms/°C. The R_0 is 100 ohms at 0.0°C. The temperature of the inlet flow will be measured with sensor A - terminal 20-22. The temperature of the outlet flow will be measured with sensor B - terminal 23-25.

5 MAINTENANCE

5.1 GENERAL DIRECTIONS

The ERST 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 user's responsibility to take all precautions to dehumidify the internal atmosphere of the ERST in such a way that no condensation will

occur, e.g. to put a dose of desiccant (drying agent) inside the enclosure just before closing it. Furthermore, it is required to replace the desiccant periodically as advised by its supplier.

Battery life-time:

It is influenced by several issues:

- Type of sensor (read chapter 3): NPN inputs consume more energy than coil inputs;
- Input frequency: the higher the frequency, the shorter the battery life-time;
- Analog output signal: be sure that an external power supply is connected or that the function is disabled if not in use; or else it will have a major influence on the battery life-time;
- Display update: fast display update uses significantly more power;
- Pulse output and communications:
- Low temperatures: the available power will be less due to battery chemistry.



It is strongly advised to disable the unused functions

Check periodically:

The condition of the enclosure, 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 window and enclosure only with a lint-free cleaning cloth made damp with a mild soap solution. Do not use any aggressive solvents as these might damage the coating.

5.2 INSTRUCTIONS FOR REPAIR

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

5.3 BATTERY REPLACEMENT

5.3.1 SAFETY INSTRUCTIONS

Handle the battery with care. A mistreated battery can become unsafe. Unsafe batteries can cause (serious) injury to persons.

Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained persons authorized by the operator of the facility. Persons must read and understand this manual before carrying out its instructions.

APPENDIX A: TECHNICAL SPECIFICATIONS

GENERAL	
Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Dimensions	90 x 40mm (3.5"x 1.6")
Digits	Seven 17 mm (0.67") and eleven 8 mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Backlight	LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications.
Enclosure	
General	Die-cast aluminum enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame-retardant material.
Control Keys Painting	Three industrial micro-switch keys. UV-stabilized silicone keypad. 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") – L x H x D.
Classification Panel cut-out Type ERST-RMA	IP65 / NEMA 4X 115 x 98mm (4.53" x 3.86") L x H. Aluminum panel-mount enclosure
Wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95") – L x H x D.
Classification Type ERST-RMA	IP67 / NEMA4X Drilling: 2 x 16mm (0.63") – 1 x 20mm (0.78") – (Aluminum enclosure)
Operating Temperature	
Operational	- 40 °C to +80 °C (- 40°F to +176 °F)
Relative Humidity	no condensation allowed.
Power Requirements	
Passive Analog Output	8-30V DC; Power consumption max. 0.5 Watt.
Battery Supply backlight	Lithium battery - life-time depends upon settings - up to 5 years. 8-30V DC; Power consumption max. 5 Watt. 12-30V DC; Power consumption max. 5 Watt.
Sensor Excitation	
	Sensor supply voltage: 3.2 / 8.2 / 12 / 24V DC - max. 50mA@24V DC
Terminal Connections	
	Removable plug-in terminal strip. Wire max. 1.5mm ² and 2.5mm ²
Data Protection	
Backup Data Retention Password	EEPROM backup of all setting. Backup of running totals every minute. For at least 10 years. Configuration settings can be password protected.
INPUTS	
Flowmeter	
Type Frequency K-factor Low-pass filter	NPN and Reed-switch 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. 0.000010 - 9,999,999 with variable decimal position. Available for all pulse signals.
Temperature	
Type	2 or 3 wire PT100

Temperature range Update time	-100°C to +200°C (-148°F to 392°F) four times a second NOTE: The linearity is internally compensated.
OUTPUTS	
Analog Output	
Function Accuracy Load Type	Transmitting calculated differential or sum flowrate. 10 bits. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up. max. 1 k-Ohm Passive 4 - 20 mA output - output loop powered
Scalable pulse (Passive Transistor Output) – Switch Outputs	
Pulse output Function Type	Max. frequency 500Hz. Pulse length user definable between 0.001 up to 9.999 seconds. Two outputs: scaled pulse output transmitting accumulated total and flow direction indication. Passive transistor output - not isolated. Load max. 50V DC - 300mA.
OPERATIONAL	
Operator Functions	
Displayed functions	<ul style="list-style-type: none"> - Compensated differential total and/or compensated differential flow rate. - Compensated differential total and compensated differential accumulated total. - Inlet temperature and compensated flow rate. - Outlet temperature and compensated flow rate. - Compensated differential total can be reset to zero by pressing the CLEAR-key twice.
Total	
Digits Units Decimals Note	7 digits L, m3, GAL, USGAL, KG, lb, bbl, no unit 0 - 1 - 2 or 3 total can be reset to zero.
Accumulated total	
Digits Units / decimals	11 digits. according to selection for total.
Flowrate	
Digits Units Decimals Time Units	7 digits mL, L, m3, mg, g, kg, ton, GAL, bbl, lb, cf, rev, no unit 0 - 1 - 2 or 3 /sec - /min - /hr - /day.
Line Temperature	
Digits Units Decimals Normal Temperature	'6 Digits °C; °F; K 1 default: 273.15 K - any temperature can be set.
Flow Equation	
Type EL Formula	Equations Liquid - flow computer for corrected liquid volume $Q\text{-normal} = Q \times (1 + \alpha (T\text{-normal} - T))$ where α = thermal expansion coefficient

APPENDIX B: PROBLEM SOLVING

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

Flowmeter does not generate pulses:

Check:

- Signal selection
- Pulse amplitude
- Flowmeter, wiring and connection of terminal connectors
- Power supply of flowmeter

Flowmeter generates "too many pulses":

Check:

- Settings for total and Flowrate
- Type of signal selected with actual signal generated
- Sensitivity of coil input
- Proper grounding of the ERST
- Use screened wire for flowmeter signals and connect screen to terminal 9 or 12. (unless connected at sensor)

Analog output does not function properly:

Check:

- SETUP 81 - is the function enabled?
- SETUP 82 / 83: are the flow-levels programmed correctly?
- connection of the external power-supply according to the specification.

Pulse output does not function:

Check:

- AMOUNT - pulse per "x" quantity; is the value programmed reasonable and will the maximum output be under 60Hz.
- WIDTH - 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:

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

The pass code is unknown:

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

ALARM

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

Not recoverable by the end user:

- [d] 0 = No error;
- [d] 1 = Display error;
- [d] 2 = Data-storage error;
- [d] 3 = Error 1 + error 2 simultaneously;
- [d] 4 = Initialization error.
- [d] 8 = Analog input error;
- [d] 16 = PT100 ADC error.

Recoverable by the end user:

- [d] 32 = Correction calculation factor (A) error;
- [d] 64 = Correction calculation factor (B) error;
- [d] 128 = Temperature Pressure Compensation (TPC A) calculation error;
- [d] 256 = Temperature Pressure Compensation (TPC B) calculation error;
- [d] 512 = PT100 sensor 1 out of range error;
- [d] 1024 = PT100 sensor 2 out of range error.

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

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LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE:	DATE:
1 - TOTAL A	Enter your settings here		
11 unit	L		
12 decimals	0		
13 K-factor	0000001		
14 decimals K-factor	0		
2 - FLOWRATE A			
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 K-factor	0000001		
25 decimals K-factor	0		
26 filter	01		
27 period time	1.0 sec.		
3 - TOTAL B			
31 K-factor	0000001		
32 decimals K-factor	0		
4 - FLOWRATE B			
41 K-factor	0000001		
42 decimals K-factor	0		
5 - DISPLAY			
51 function	total		
52 calculate	differential		
53 measurement	bi-directional		
54 stationary flow rate	0 L/ min		
55 stationary total	0 L/hr	/hr	/hr
6 - POWER MANAGEMENT			
61 LCD-new	1 sec.		
62 mode	operational		
7 - FLOWMETER			
71 signal A	Npn_lp		
72 signal B	Npn_lp		
8 - TEMPERATURE A/B			
81 Display Unit	°C		
82 No. of wires	3		
83 Filter	0		
9 - FORMULA			
91 Type	EL		
92 Thermal Exp. Coefficient	0.000000		
93 Normal Temperature	288.15 K		
A - ANALOG OUTPUT			
A1 output	disabled		
A2 min. flowrate	0000000		
A3 max. flowrate	9999999		
A4 cut off percentage	0.0%		
A5 tune min - 4mA	0208		

A6 tune max - 20mA	6656		
A7 filter	01 (off)		
B - PULSE OUTPUT			
B1 mode	signed		
B2 width	0.000		
B3 decimals	0000000		
B4 amount	1000		
C - OTHERS			
C1 model	ERST		
C2 Software Version	-		
C3 Serial number	-		
C4 pass code	0000		
C5 tagnumber	0000000		



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