

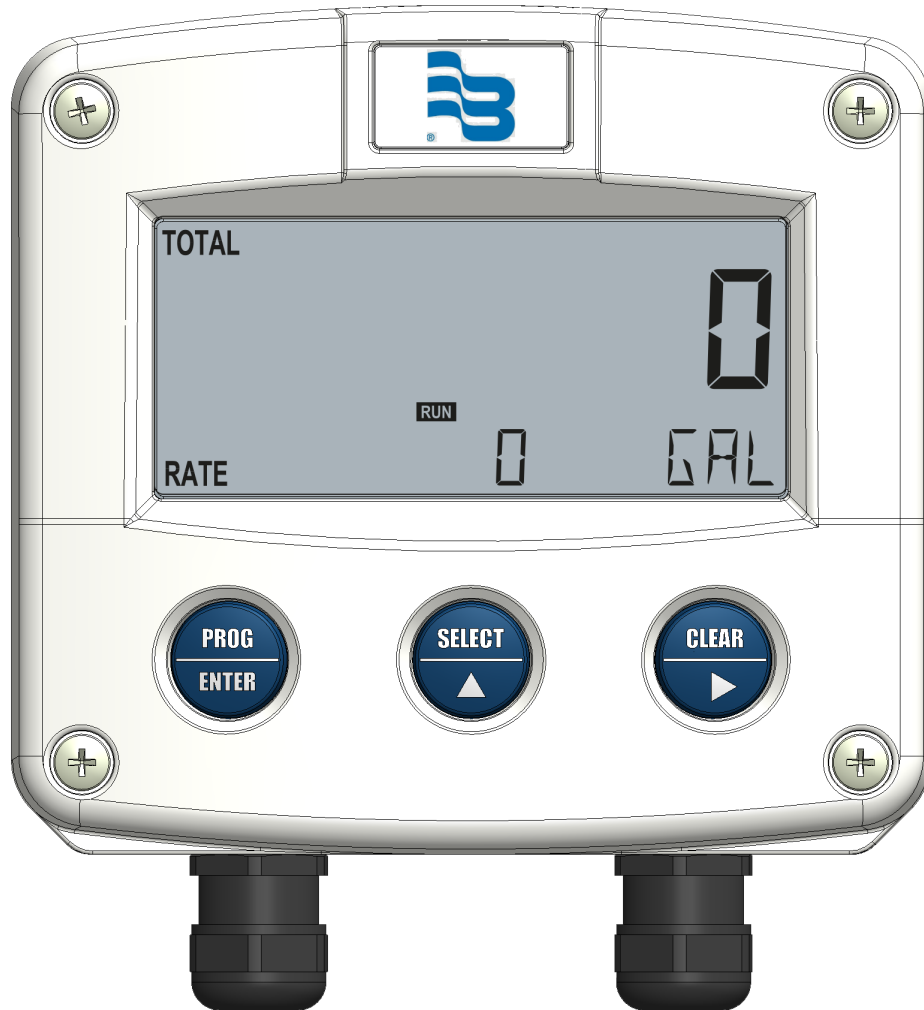


**Badger Meter**

## Industrial Registers

Models ER-420-AC, ER-420-DC & ER-420-LP

Totalizer and Rate of Flow Indicator with 4-20 mA Output Signal





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## ABOUT THIS MANUAL

This operation manual is divided into two main sections:

- The daily use of the unit is described in "Operation" on page 9. These instructions are meant for users.
- The remaining sections and appendices are exclusively meant for electricians and technicians. These provide a detailed description of all software settings and hardware installation guidance.

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

### Conventions Used in this Manual

A hazardous situation may occur if the ER-420 is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:

#### **⚠ WARNING**

**A WARNING INDICATES ACTIONS OR PROCEDURES THAT, IF NOT PERFORMED CORRECTLY, MAY LEAD TO PERSONAL INJURY, A SAFETY HAZARD OR DAMAGE OF THE ER-420 OR CONNECTED INSTRUMENTS.**

#### **⚠ CAUTION**

**A CAUTION INDICATES ACTIONS OR PROCEDURES THAT, IF NOT PERFORMED CORRECTLY, MAY LEAD TO PERSONAL INJURY OR INCORRECT FUNCTIONING OF THE ER-420 OR CONNECTED INSTRUMENTS.**

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

## SAFETY

### Warnings

#### **⚠ WARNING**

**ANY RESPONSIBILITY IS VOIDED IF THE INSTRUCTIONS AND PROCEDURES AS DESCRIBED IN THIS MANUAL ARE NOT FOLLOWED.**

#### **⚠ WARNING**

**LIFE SUPPORT APPLICATIONS: THE ER-420 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.**

#### **⚠ WARNING**

**ELECTROSTATIC DISCHARGE DOES INFLECT IRREPARABLE DAMAGE TO ELECTRONICS! BEFORE INSTALLING OR OPENING THE UNIT, THE INSTALLER HAS TO DISCHARGE HIMSELF BY TOUCHING A WELL-GROUNDED OBJECT.**

#### **⚠ WARNING**

**THIS UNIT MUST BE INSTALLED IN ACCORDANCE WITH THE EMC GUIDELINES (ELECTRO MAGNETIC COMPATIBILITY).**

## 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 ER-420 implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the ER-420 supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacturer's plate and "*Installation Considerations*" on page 22).
- 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.

## INTRODUCTION

### System Description of the ER-420

#### Firmware Version

The product label displays the firmware version for Rev. 03 and later. Earlier versions do not display the revision number.



Figure 1: Product label

### Functions and features

The flow rate/totalizer model ER-420 is a microprocessor driven instrument designed to display *Flow Rate*, *Total* and *Accumulated Total*.

This product has been designed with a focus on:

- Intrinsic safety for use in hazardous applications (option)
- Several mounting possibilities
- Ability to process all types of flowmeter inputs
- Transmitting possibilities with analog/pulse outputs

### Flowmeter input

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

One flowmeter with a passive or active pulse output can be connected to the ER-420.

To power the display and sensor, several options are available: ER-420-AC 115...230V AC, ER-420-DC 24V AC/DC, ER-420-LP (Loop Powered, 4-20 mA).

### Standard outputs

- 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 secs.
- Configurable linear 4-20 mA analog output with 10-bits resolution mirroring the actual flow rate. Flow Rate levels as well as the minimum and maximum signal output can be tuned.

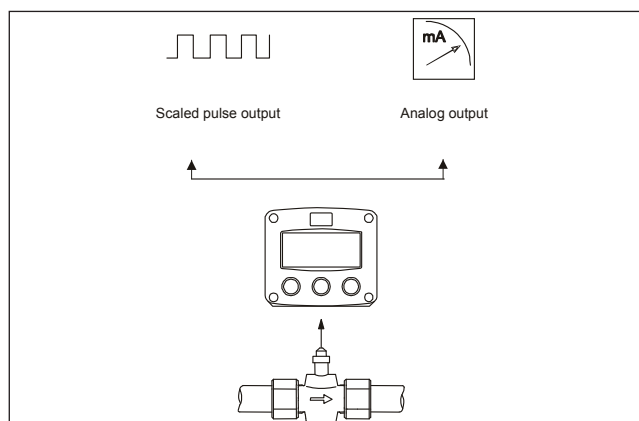


Figure 2: Typical application for the ER-420

### **Configuring the unit**

The ER-420 was designed to be implemented in many types of applications. For that reason, a *Setup* level is available to configure your ER-420 according to your specific requirements.

*Setup* includes several important features, such as K-factors, measurement units and signal selection. All settings are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery.

### **Displaying information**

The unit has a large transreflective LCD with symbols and digits to display measuring units, status information, trend-indication and keyword messages.

Flow Rate and *Totals* can be displayed either with the small 8 mm digits or with the 17 mm digits.

A backup of the *Total* and *Accumulated Total* in EEPROM memory is made every minute.



## OPERATION

### **⚠ WARNING**

**THE ER-420 MAY ONLY BE OPERATED BY PERSONNEL WHO ARE AUTHORIZED AND TRAINED BY THE OPERATOR OF THE FACILITY. OBSERVE ALL INSTRUCTIONS IN THIS MANUAL. TAKE CAREFUL NOTICE OF "SAFETY" ON PAGE 5.**

### Control Panel

The control panel contains the following keys:



Figure 3: Control panel

### Functions of the keys



This key is used to program and save new values or settings. It is also used to gain access to *Setup* level. See "*Programming Setup Level*" on page 11.



This key is used to select *Accumulated Total*. The arrow key is used to increase a value after PROG has been pressed or to configure the unit. See "*Configuration*" on page 11.



Press this key twice to clear the value for *Total*. The arrow key is used to select a digit after PROG has been pressed or to configure the unit. See "*Configuration*" on page 11.

### Operator Information and Functions

In general, the ER-420 will always act at *Operator* level. The information displayed is dependent upon the *SETUP* settings. All pulses generated by the connected flowmeter are measured by the ER-420 in the background, whichever screen refresh rate setting is chosen. After a key is pressed, the display updates very quickly for a 30 sec period, after which it will slow down again.



Figure 4: Example of display information during process

### Display flow rate / total or flow rate

This is the main display information of the ER-420. After selecting any other information, it will always return to this main display automatically.

*Total* is displayed on the upper line of the display and *Flow Rate* on the bottom line.

It is possible to display *Flow Rate* only with the large 0.67" digits; in this instance press, **SELECT** to read the *Total*.

When "-----" is shown, then the *Flow Rate* value is too high to be displayed. The arrows indicate the increase or decrease of the *Flow Rate* trend.

### Clear total

The value for *Total* can be re-initialized by pressing **CLEAR** twice. After pressing **CLEAR** once, the flashing text "PUSH CLEAR" is displayed. To avoid re-initialization at this stage, press a key other than CLEAR or wait for 20 secs.

Re-initialization of the *Total* DOES NOT influence the *Accumulated Total*.

### Display accumulated total

When you press **SELECT**, the *Total* and *Accumulated Total* display. 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*.

### Display multiplication factor for total and accumulated total

When you press **SELECT** again, the actual multiplier factor is displayed for both totalizers. If, for example, the factor is "x100" and *Total* displays "54321 USGAL", then the true measured volume is 5432100 USGAL.

**NOTE:** This multiplier does NOT affect the displayed *Flow Rate*!

### Alarm 01-03

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

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

The alarm condition will almost certainly be handled internally and if all mentioned values still appear correct, no intervention by the operator is needed. If the alarm occurs more often or stays active for a longer time, please contact your supplier.

# CONFIGURATION

## Introduction

### ⚠ CAUTION

- **MOUNTING, ELECTRICAL INSTALLATION, START-UP AND MAINTENANCE OF THE INSTRUMENT MAY ONLY BE CARRIED OUT BY TRAINED PERSONNEL AUTHORIZED BY THE OPERATOR OF THE FACILITY. PERSONNEL MUST READ AND UNDERSTAND THIS MANUAL BEFORE CARRYING OUT ITS INSTRUCTIONS.**
- **THE ER-420 MAY ONLY BE OPERATED BY PERSONNEL WHO ARE AUTHORIZED AND TRAINED BY THE OPERATOR OF THE FACILITY. ALL INSTRUCTIONS IN THIS MANUAL ARE TO BE OBSERVED.**
- **ENSURE THAT THE MEASURING SYSTEM IS CORRECTLY WIRED UP ACCORDING TO THE WIRING DIAGRAMS. THE HOUSING MAY ONLY BE OPENED BY TRAINED PERSONNEL.**
- **TAKE CAREFUL NOTICE OF "Safety" on page 5.**

## Programming Setup Level

Configuration of the ER-420 is done at *Setup* level. To access the *Setup* level, press **PROG/ENTER** for 7 secs. Both arrows (^ and >) will be displayed. To return to the *Operator* level, press PROG for 3 secs. If no keys are pressed for 2 minutes, the unit will exit *Setup* automatically.

*Setup* can be reached at all times while the ER-420 remains fully operational.

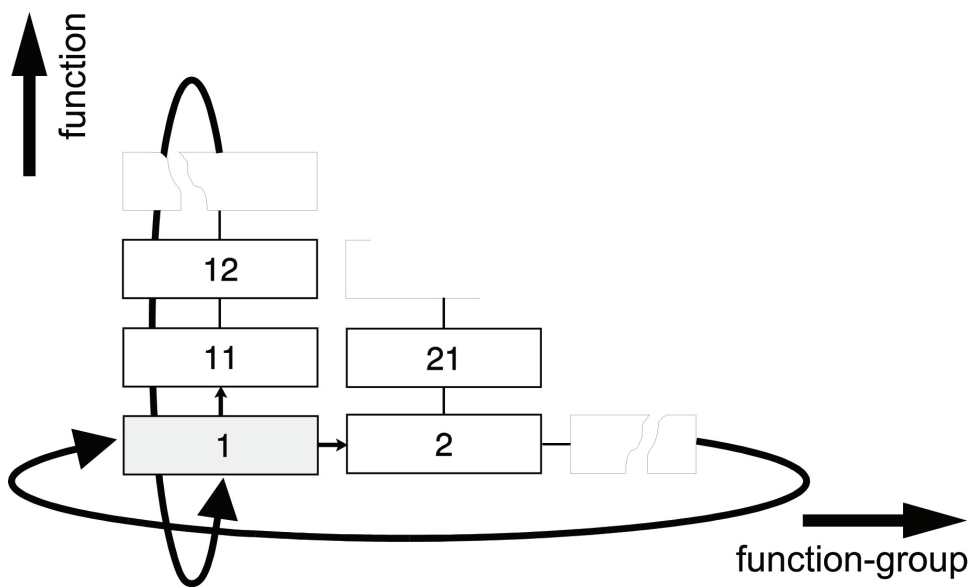
**NOTE:** A passcode may be required to enter *Setup*.

### Entering the setup level



Press the PROG/ENTER key for 7 seconds.

### Matrix structure of the setup level



## Scrolling through the setup level

### Selecting function groups and functions

Setup is divided into several function groups and functions.



Select the function group with the **CLEAR / ►** key.

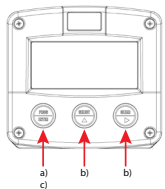


Select the function with the **SELECT / ▲** key.

Each function has a unique number, which displays below the word "SETUP" at the bottom of the screen. The number is a combination of two figures. The first figure indicates the function group and the second figure indicates 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 (for example, 1<sup>^</sup>, 11<sup>^</sup>, 12<sup>^</sup>, 13<sup>^</sup>, 14<sup>^</sup>, 1 > 2 >, 3<sup>^</sup>).

### Changing values



- Press the **PROG / ENTER** key briefly. The word **PROGRAM** will flash on the screen.
- Select or enter a value with the **SELECT / ▲** and/or the **CLEAR / ►** key.
- Press the **PROG / ENTER** key to confirm the value/selection.

- To change a value, use > to select the digits and ^ to increase that value.
- To select a setting, use both ^ and >.

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

When you change data but do not press **ENTER**, you can cancel the change by waiting for 20 secs or by pressing **ENTER** for three secs. The PROG procedure will be left automatically and the former value restored.

**NOTE:** Changes will only be set after you press **ENTER**.

### Returning to the operator level



Press the **PROG / ENTER** key for 3 seconds.

In order to return to the operator level, press **PROG** for three secs. If no keys are pressed for 2 minutes, Setup will be left automatically.

## Overview of Setup Functions

<b>Setup Functions and Variables</b>			
<b>1</b>	<b>Total</b>		
	11	UNIT	L, m <sup>3</sup> , kg, lb, GAL, USGAL, bbl, no unit
	12	DECIMALS	0, 1, 2, 3 (Ref: displayed value)
	13	K-FACTOR	0.000010...9,999,999 (see chart)
	14	DECIMALS K-FACTOR	0...6
	15	Multiplication factor	x1, x10, x100, x1000, x10000
<b>2</b>	<b>Flow Rate</b>		
	21	UNIT	mL, L, m <sup>3</sup> , mg, g, kg, ton, GAL, bbl, lb, cf, REV, no unit, scf, Nm <sup>3</sup> , NL, P, MGAL
	22	TIME UNIT	sec, min, hour, day
	23	DECIMALS	0, 1, 2, 3 (Ref: displayed value)
	24	K-FACTOR	0.000010...9,999,999
	25	DECIMALS K-FACTOR	0...6
	26	CALCULATION	per 1...255 pulses
	27	CUT-OFF	0.1...999.9 secs
<b>3</b>	<b>Display</b>		
	31	FUNCTION	total, flow rate
<b>4</b>	<b>Power Management (Does Not Apply to This Unit)</b>		
<b>5</b>	<b>Flowmeter</b>		
	51	SIGNAL	nnp, nnp_lp, reed, reed_lp, pnp, pnp_lp, act_8.1, act_12, act_24
<b>6</b>	<b>Analog</b>		
	61	OUTPUT	disable, enable
	62	4 mA	0000.000...9,999,999
	63	20 mA	0000.000...9,999,999
	64	CUT-OFF	0.0...9.9%
	65	TUNE MIN, 4 mA	0...9,999
	66	TUNE MAX, 20 mA	0...9,999
	67	FILTER	00...99
<b>7</b>	<b>Pulse for Versions Earlier than Rev. 03</b>		
	71	PULSE WIDTH	0...250
	72	PULSE PER	X,XXX,XXX quantity
	<b>Pulse for Versions Rev. 03 and Later</b>		
	71	PULSE WIDTH	0.000...9.999 sec (0=Off)
	72	DECIMALS	0, 1, 2, 3
	73	AMOUNT	X,XXX,XXX quantity
<b>8</b>	<b>Communication (Does Not Apply to This Unit)</b>		
<b>9</b>	<b>Others</b>		
	91	MODEL	F100-P
	92	TYPE	ER-420LP / ER-420DC / ER-420AC
	93	SOFTWARE VERSION	___-___-___
	94	SERIAL NO.	xxxxxxx
	95	PASS CODE	0000...9999
	96	TAGNUMBER	0000000...9999999

## Details of Setup Functions

<b>1 – TOTAL</b>	
MEASUREMENT UNIT 11	<p>SETUP 11 determines the measurement unit for total, accumulated total and pulse output. The options are: L, m<sup>3</sup>, 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 the number of digits following the decimal point for total, accumulated total and pulse output.</p> <p>The options are: 0000000, 111111.1, 22222.22, 3333.333</p> <p><b>NOTE:</b> Setup 15 offers a multiplication factor. If the volume measured is very high it is advised to use the multiplication factor and to select 0000000 decimals for SETUP 12.</p>
K-FACTOR 13	<p>With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be.</p> <p>Example 1: Calculating the K-factor Let us assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m<sup>3</sup>". A cubic meter consists of 1000 parts of one liter which implies 2481.3 pulses per m<sup>3</sup>. So, the K-factor is 2481.3. Enter for SETUP 13: "2481300" and for SETUP 14: decimals K-factor "3"</p> <p>Example 2: Calculating the K-factor Let us assume that the flowmeter generates 6.5231 pulses per US gallon and the selected measurement unit is US 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). You can select from 0 to 6 decimals:</p> <p>This setting indirectly influences the accuracy of the K-factor (that is, 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>
MULTIPLICATION FACTOR 15	<p>In applications where very large volumes are measured, it is desired to use a multiplication factor for the displayed totalizers. This to avoid a fast "turning to zero". The ER-420 will divide the real totalized volume with this factor and display the result. Following multiple factors can be selected and will be displayed for the Operator.</p> <p>The options are: x1, x10, x100, x1000, x10000</p> <p>For the Operator, the valid factor is displayed after pressing SELECT twice. This factor does not influence the flow rate.</p> <div style="background-color: orange; padding: 5px; display: inline-block;"><b>⚠ WARNING</b></div> <p><b>THIS MULTIPLICATION FACTOR APPLIES ALSO ON PULSE AND OUTPUT (SETUP 72).</b></p>

<b>2 – FLOW RATE</b>	
<p>The settings for <i>Total</i> and <i>Flow Rate</i> are entirely separate. In this way, different units of measurement can be used, for example, USGAL for <i>Total</i> and barrels for <i>Flow Rate</i>. The display update time for <i>Flow Rate</i> is one sec or more.</p> <p><b>NOTE:</b> These settings also influence the analog output.</p>	
MEASUREMENT UNIT 21	<p>SETUP 21 determines the measurement unit for flow rate.</p> <p>The options are: mL, L, m<sup>3</sup>, mg, g, kg, ton, GAL, bbl, lb, cf, REV, no unit, scf, Nm<sup>3</sup>, NL, P, MGAL.</p> <p>Alteration of the measurement unit will have consequences for operator and Setup level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.</p>
TIME UNIT 22	The flow rate can be calculated per sec (SEC), minute (MIN), hour (HR) or day (DAY).
DECIMALS 23	<p>This setting determines for flow rate the number of digits following the decimal point.</p> <p>The options are: 00000, 1111.1, 2222.22, 3333.333</p>
K-FACTOR 24	<p>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, the more accurate the functioning of the system will be. For examples read SETUP 13.</p>
DECIMALS K-FACTOR 25	<p>This setting determines the number of decimals for the K-factor (SETUP 24). The options are: 0, 1, 2, 3, 4, 5, 6</p> <p>This SETUP indirectly influences the accuracy of the K-factor. This setting has NO influence on the displayed number of digits for flow rate (SETUP 23)!</p>
CALCULATION 26	<p>The flow rate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flow rate will be. The maximum value is 255 pulses.</p> <p><b>NOTES:</b></p> <ul style="list-style-type: none"> <li>• This setting does influence the update time for the analog output directly (maximum update 10 times a sec). If the output response is too slow, decrease the number of pulses.</li> <li>• For low frequency applications (below 10 Hz): do not program more than 10 pulses else the update time will be very slow.</li> <li>• For high frequency application (above 1 kHz) do program a value of 50 or more pulses.</li> </ul>
CUT-OFF TIME 27	<p>With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 26) are generated, the flow rate will be displayed as zero.</p> <p>The cut-off time has to be entered in secs.</p> <p>The maximum time is 999 secs (about 15 minutes).</p>
<b>3 – DISPLAY</b>	
FUNCTION 31	<p>The large 17 mm digits can be set to display total or flow rate.</p> <p>When you select <b>Total</b>, both the total and the flow rate display simultaneously.</p> <p>When you select <b>Flow Rate</b>, only flow rate and its measuring unit display. Press <b>Select</b> to display the total.</p>
<b>4 – POWER MANAGEMENT (DOES NOT APPLY TO THIS UNIT)</b>	

<b>5 – FLOWMETER</b>				
SIGNAL 51	The ER-420 is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 51. <b>NOTE:</b> The selections "active pulse" offer a detection level of 50% of the supply voltage. Read also par. 4.4.2.2. and 4.4.3.2. Flowmeter input terminal 09-11.			
Type of Signal	Explanation	Resistance	Freq. / MV	Remark
NPN	NPN input	100 K pull-up	6 kHz	(open collector)
NPN - LP	NPN input with low pass filter	100 K pull-up	2.2 kHz	(open collector) less sensitive
REED	Reed switch input	1 M pull-up	1.2 kHz	—
REED - LP	Reed switch input with low pass filter	1 M pull-up	120 Hz	Less sensitive
PNP	PNP input	100 K pull-down	6 kHz	—
PNP - LP	PNP input with low pass filter	100 K pull-down	700 kHz	Less sensitive
ACT_8.1	Active pulse input 8.1V DC	3 K $\Omega$	10 kHz	External power required
ACT_12	Active pulse input 12V DC	4 K	10 KHz	External power required
ACT_24	Active pulse input 24V DC	3 K	10 KHz	External power required



<b>6 – ANALOG OUTPUT</b>					
A linear analog 4-20 mA signal is generated according to the <i>Flow Rate</i> with a 10 bits resolution. The settings for <i>Flow Rate</i> (SETUP 2) influence the analog output directly. The relationship between rate and analog output is set with the following functions:					
DISABLE / ENABLE 61	The analog output can be disabled. When disabled, a 3.5 mA will be generated if a power supply is available.				
MINIMUM FLOW RATE 62	Enter here the flow rate at which the output should generate the minimum signal (4 mA)—in most applications, at flow rate "zero". The number of decimals displayed depends upon SETUP 23. The time and measuring units (L/min for example) are dependant upon SETUP 21 and 22 but are not displayed.				
MAXIMUM FLOW RATE 63	Enter here the flow rate at which the output should generate the maximum signal (20 mA)—in most applications at maximum flow. The number of decimals displayed depends upon SETUP 23. The time and measuring units (L/min for example) are dependant upon SETUP 21 and 22 but cannot be displayed.				
CUT-OFF 64	To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16 mA. When the flow is less than the required rate, the current will be the minimum signal (4 mA). Examples:				
	<b>4 mA (SETUP 62)</b>	<b>20 mA (SETUP 63)</b>	<b>CUTOFF (SETUP 64)</b>	<b>REQUIRED RATE</b>	<b>OUTPUT</b>
	0 gpm	100 gpm	2%	$(100-0)*2\% = 2.0 \text{ gpm}$	$4+(16*2\%) = 4.32 \text{ mA}$
	20 gpm	800 gpm	3.5%	$(800-20)*3.5\% = 27.3 \text{ gpm}$	$4+(16*3.5\%) = 4.56 \text{ mA}$
TUNE MIN / 4 mA 65	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 can be tuned precisely with this setting.  <b>⚠ WARNING</b>  <b>BEFORE TUNING THE SIGNAL, BE SURE THAT THE ANALOG SIGNAL IS NOT BEING USED FOR ANY APPLICATION!</b>  After pressing <b>PROG</b> , the current will be about 4 mA. The current can be increased / decreased with the arrow-keys and is directly active. Press <b>ENTER</b> to store the new value.  The analog output value can be programmed "upside-down" if desired, so 20 mA at minimum flow rate for example!				
TUNE MAX / 20 mA 66	The initial maximum analog output value is 20 mA. However, this value might differ slightly due to external influences such as temperature for example. The 20 mA value can be tuned precisely with this setting.  <b>⚠ WARNING</b>  <b>BEFORE TUNING THE SIGNAL, BE SURE THAT THE ANALOG SIGNAL IS NOT BEING USED FOR ANY APPLICATION!</b>  After pressing <b>PROG</b> , the current will be about 20 mA. The current can be increased or decreased with the arrow keys and is directly active. Press <b>ENTER</b> to store the new value.  The analog output value can be programmed "upside-down" if desired, so 4 mA at maximum flow rate for example!				

**6 – ANALOG OUTPUT**

FILTER  
67

This function is used to stabilize the analog output signal. The output value is updated every 0.1 sec. 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:

**RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SecS**

<b>FILTER VALUE</b>	<b>50% INFLUENCE</b>	<b>75% INFLUENCE</b>	<b>90% INFLUENCE</b>	<b>99% INFLUENCE</b>
01	filter disabled	filter disabled	filter disabled	filter disabled
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 sec	7 sec	14 sec
50	3.5 sec	7 sec	11 sec	23 sec
75	5.2 sec	10 sec	17 sec	34 sec
99	6.9 sec	14 sec	23 sec	45 sec

### 7 – PULSE OUTPUT for Versions Earlier than Rev. 03

One transistor or mechanical pulse output is available as scaled pulse output according to the *Accumulated Total*.

PERIOD TIME PULSE OUTPUT 71	<p>The period time determines the time that the transistor or relay will be switched—the pulse length. The minimum time between the pulses is as long as the selected period time.</p> <p>One period is approximately 7.8 msec. If the value selected is “zero”, the pulse output is disabled. The maximum value is 255 periods.</p> <p><b>NOTE:</b> If the frequency goes out of range—when the flow rate increases, for example—an internal buffer stores the missed pulses. As soon as the flow rate reduces again, the buffer empties.</p> <p>Pulses may be missed due to a buffer overflow. Make sure to program this setting within its range.</p> <p>For the ER-420-DC and ER-420-AC, reduce the maximum output frequency to 0.5 Hz to prolong the life of the product.</p> <table border="1"> <thead> <tr> <th>Number of Periods</th> <th>Period Time</th> <th>Max. Frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Disabled</td> <td>Disabled</td> </tr> <tr> <td>1</td> <td>0.0078 secs</td> <td>64 Hz.</td> </tr> <tr> <td>2</td> <td>0.0156 secs</td> <td>32 Hz.</td> </tr> <tr> <td>3</td> <td>0.0234 secs</td> <td>21 Hz.</td> </tr> <tr> <td>64</td> <td>0.5000 secs</td> <td>1 Hz.</td> </tr> <tr> <td>255</td> <td>1.9922 secs</td> <td>0.25 Hz.</td> </tr> </tbody> </table>	Number of Periods	Period Time	Max. Frequency	0	Disabled	Disabled	1	0.0078 secs	64 Hz.	2	0.0156 secs	32 Hz.	3	0.0234 secs	21 Hz.	64	0.5000 secs	1 Hz.	255	1.9922 secs	0.25 Hz.
Number of Periods	Period Time	Max. Frequency																				
0	Disabled	Disabled																				
1	0.0078 secs	64 Hz.																				
2	0.0156 secs	32 Hz.																				
3	0.0234 secs	21 Hz.																				
64	0.5000 secs	1 Hz.																				
255	1.9922 secs	0.25 Hz.																				
PULSE PER 72	<p>According to the measurement unit settings for <i>Total</i>, a pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account.</p> <p><b>⚠ WARNING</b></p> <p><b>THE MULTIPLICATION FACTOR (SETUP 15) APPLIES ALSO ON THE DISPLAYED VALUE “PULSE PER”. IF THE FACTOR IS 100X AND THE DISPLAYED VALUE IS 10 GAL, IT MUST BE READ AS ONE PULSE PER 1000 GAL.</b></p>																					

### 7 – PULSE OUTPUT for Versions Rev. 03 and Later

One transistor or mechanical pulse output is available as scaled pulse output according to the *Accumulated Total*.

PULSE WIDTH 71	<p>The pulse width determines the time that the output will be switched on (the pulse length). The time between two pulses (when the output is switched off) is at least as long as the pulse width time (50/50 duty cycle).</p> <p>The pulse width is set in milliseconds in the range 0.001...9.999 sec.</p> <p>A value of zero disables the pulse output.</p> <p><b>NOTE:</b> If the frequency should go out of range—when flowrate increases, for example—an internal buffer will be used to store the missed pulses. As soon as the flowrate shows down, the buffer will be emptied. Pulses may be missed due to a buffer overflow, so program this setting within its range.</p>
DECIMALS 72	<p>This setting determines the decimal position for setting 73.</p> <p><b>NOTE:</b> The measuring unit is according to setting 11 (for total).</p>
AMOUNT 73	<p>According to the measurement unit settings for total, a pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account.</p>

### 8 – COMMUNICATION (DOES NOT APPLY TO THIS UNIT)

<b>9 – OTHERS</b>	
MODEL 91	For support and maintenance, it is important to have information about the characteristics of the ER-420. The main platform of this product is the F100-series with a pulse input signal type P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
TYPE 92	For support and maintenance, it is important to have information about the characteristics of the ER-420. This window displays the product specific information: ER-420-LP, ER-420-DC or ER-420-AC. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
VERSION SOFTWARE 93	For support and maintenance it is important to have information about the characteristics of the ER-420. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
SERIAL NUMBER 94	
PASS CODE 95	All SETUP values can be passcode-protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER 96	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

## Transmitter Pulses Per Unit

Use with the following transmitters: FT1, FT2XP, PFT2, PFT3, RST, RST-6P

Size	Meter Model	US Gallons	Liters	Ft <sup>3</sup>
1/2"	OP	222.960	58.899	1687.857
1/2"	OP (FT1 only)	111.500	29.455	834.078
1"	OP	76.640	20.246	573.307
2"	OP	20.600	5.442	154.099
2"	Industrial Turbo	17.360	4.586	129.862
3"	Industrial Turbo	12.400	3.276	92.758
4"	Industrial Turbo	2.560	0.676	19.150
6"	Industrial Turbo	1.080	0.285	8.079
5/8"	LP RCDL	229.554	60.641	1717.186
5/8"	25 RCDL	198.340	52.396	1484.689
3/4"	35 RCDL	126.671	33.463	947.566
1"	40 RCDL	89.781	23.717	671.610
1"	55 RCDL	58.064	15.339	434.351
1"	70 RCDL	46.752	12.350	349.726
1-1/2"	120 RCDL	23.867	6.305	178.539
2"	170 RCDL	14.565	3.848	108.955
1-1/2"	160 Turbo Series	1.537	0.406	11.495
2"	200 Turbo Series	1.537	0.406	11.495
3"	450 Turbo Series	1.598	0.422	11.955
4"	1000 Turbo Series	1.665	0.440	12.455
6"	2000 Turbo Series	0.150	0.040	1.122
8"	3500 Turbo Series	0.151	0.040	1.133
10"	5500 Turbo Series	0.198	0.052	1.481
12"	6200 Turbo Series	0.129	0.034	0.963
16"	6600 Turbo Series	0.016	0.004	0.116
20"	10000 Turbo Series	0.009	0.002	0.067
1/2"	Industrial OG	378.5 *	100 *	2831 *
3/4"	Industrial OG	249.8 *	66 *	1868 *
1"	Industrial OG	249.8 *	66 *	1868 *
1" HF	Industrial OG	162.8 *	43 *	1217 *
1-1/2"	Industrial OG	64.4 *	17 *	481 *
2"	Industrial OG	34.1 *	9 *	255 *
3"	Industrial OG	11.4 *	3 *	85 *

\* Approximate values. Exact pulses/liter for water is listed on each meter.

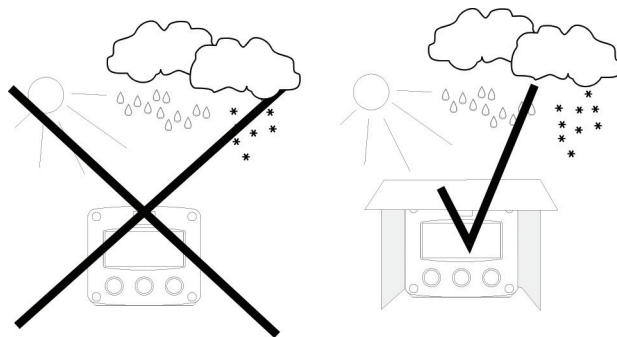
# INSTALLATION

## General Directions

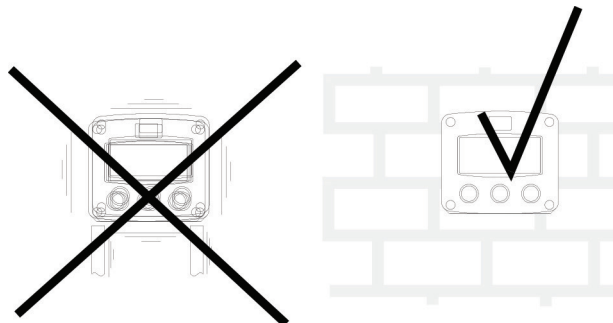
### **⚠ WARNING**

- **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 MANUAL BEFORE CARRYING OUT ITS INSTRUCTIONS.**
- **THE ER-420 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 "Safety" on page 5.**

## Installation Considerations



- Take the relevant IP classification of the casing into account (see manufacturer's plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying weather conditions.
- When panel-mounted, 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 dry sachet of silica gel, for example, inside the instrument case.



Mount the ER-420 on a solid structure to avoid vibrations.

## GRP (Glassfiber-Reinforced Polyamide) Enclosure Dimensions

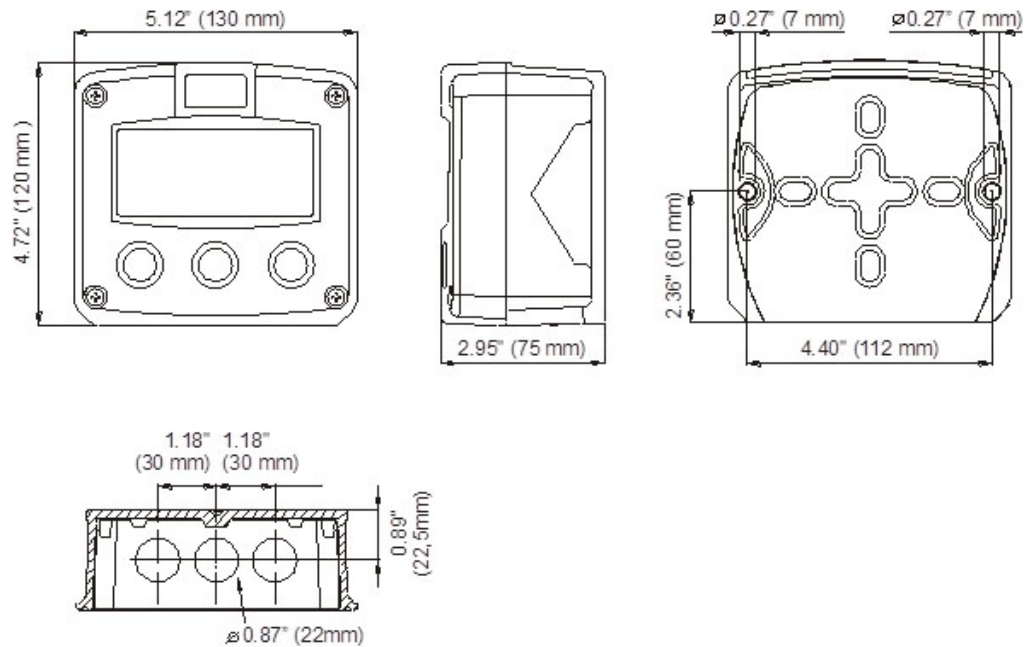


Figure 5: Enclosure dimensions

## Installing the Hardware

### Introduction

#### **⚠ WARNING**

**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.**

#### **⚠ WARNING**

**THIS UNIT MUST BE INSTALLED IN ACCORDANCE WITH THE EMC GUIDELINES (ELECTRO MAGNETIC COMPATIBILITY).**

For installation, pay special 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 the sensor.
- 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.

## ER-420-LP

The following terminal connectors are available:

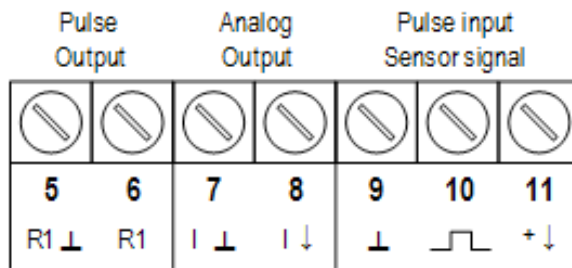


Figure 6: Overview terminal connectors loop powered ER-420-LP

### Voltage selection sensor supply

Terminal 11 provides a limited supply voltage of 3.2V DC for the signal output of the flowmeter.

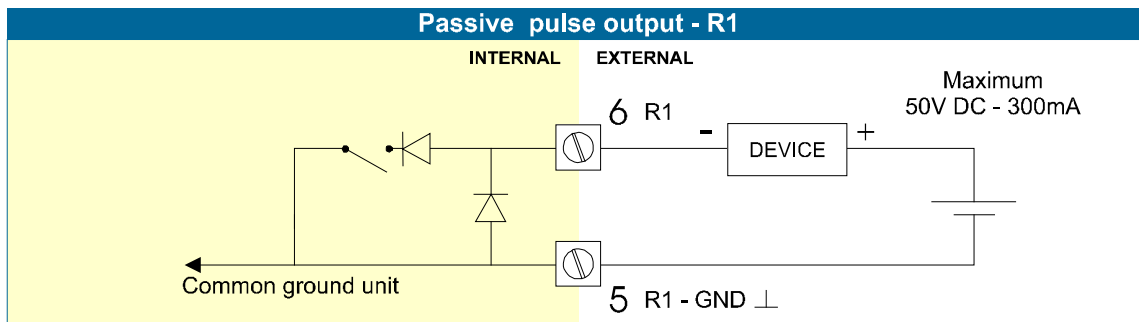
**NOTE:** This voltage MAY NOT be used to power the flowmeter's electronics, converters, or other components as it will not provide adequate sustained power! It is possible to use some low power reed switch, NPN or PNP output signals (consult your distributor).

### Terminal connections ER-420-LP

#### Terminal 05-06; scaled pulse output R1:

SETUP 7 determines the pulse output function. The maximum pulse frequency of this output is 60 Hz.

A passive transistor output is available for the ER-420-LP. Maximum driving capacity is 300 mA@50V DC.



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

Connect an external power supply of 8...30V DC to these terminals.

Do connect the "-" to terminal 7 and the "+" to terminal 8.

**CAUTION**

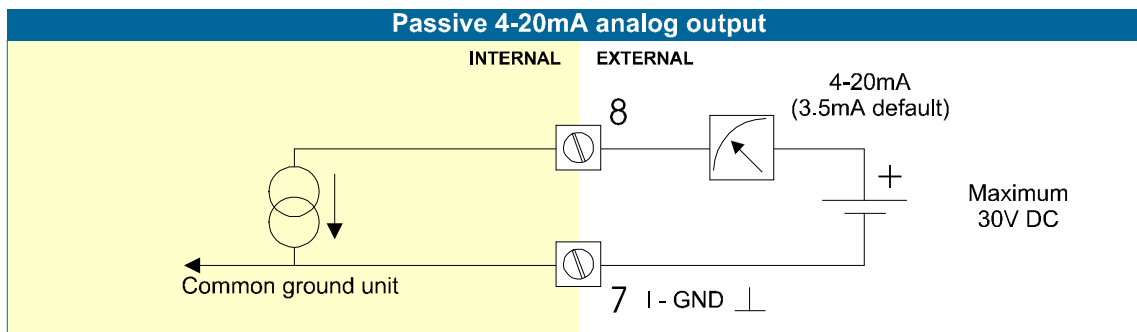
**ONLY VALID FOR THE ER-420-LP.**



**Terminal 07-08 analog output (SETUP 7):**

A passive 4-20 mA signal proportional to the flow rate is available. When a power supply is connected but the output is disabled, a 3.5 mA signal will be generated.

Maximum driving capacity is 1000 Ohm. This output does loop power the unit as well.

**Terminal 09-11; Flowmeter input:**

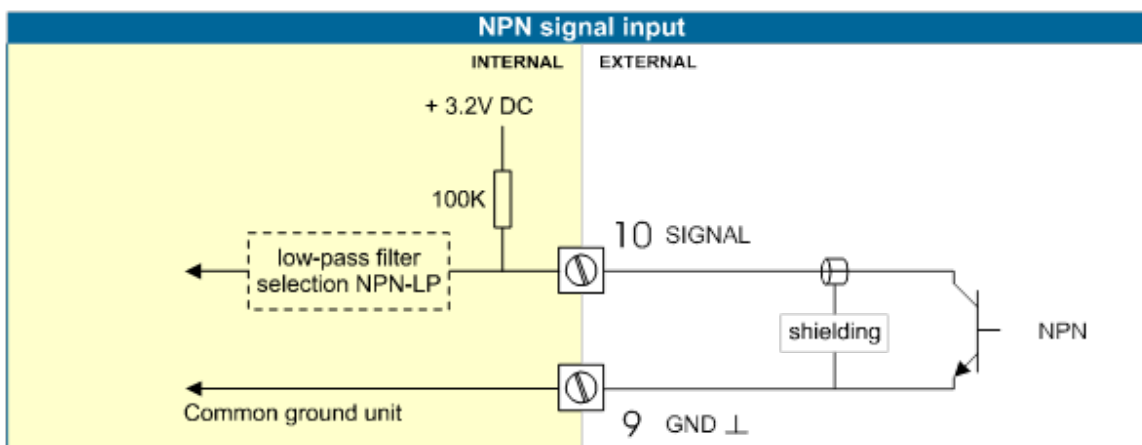
Two basic types of flowmeter signals can be connected to the unit: passive or active pulse.

The screen of the signal wire must be connected to the common ground terminal 9 (unless earthed at the sensor itself).

The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected with the correct SETUP function (see "Details of Setup Functions" on page 14).

**Pulse-signal NPN / NPN-LP:**

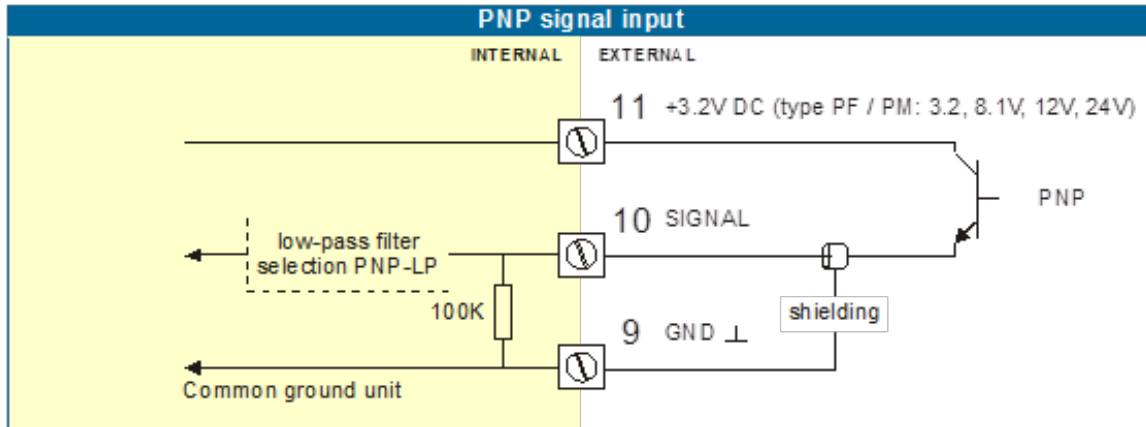
The ER-420 is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency (see "Details of Setup Functions" on page 14).



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

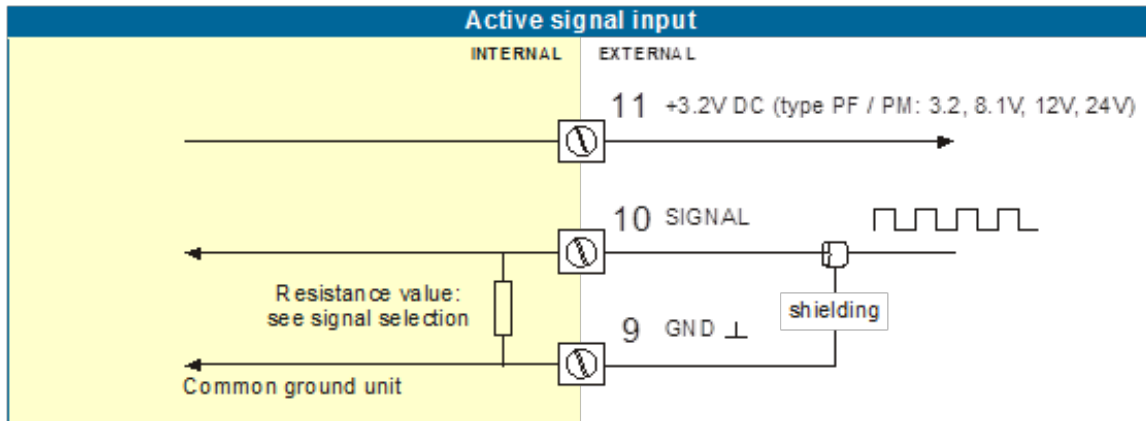
The ER-420 is suitable for use with flowmeters which have a PNP output signal. 3.2V is offered on terminal 11 which has to be switched by the sensor to terminal 10 (SIGNAL). For a reliable pulse detection, the pulse amplitude has to go above 1.2V. Signal setting PNP-LP employs a low-pass signal noise filter, which limits the maximum input frequency (see "Details of Setup Functions" on page 14).

For a signal detection level of 50% of the supply voltage, see "Terminal 05-06; scaled pulse output R1:" on page 24.



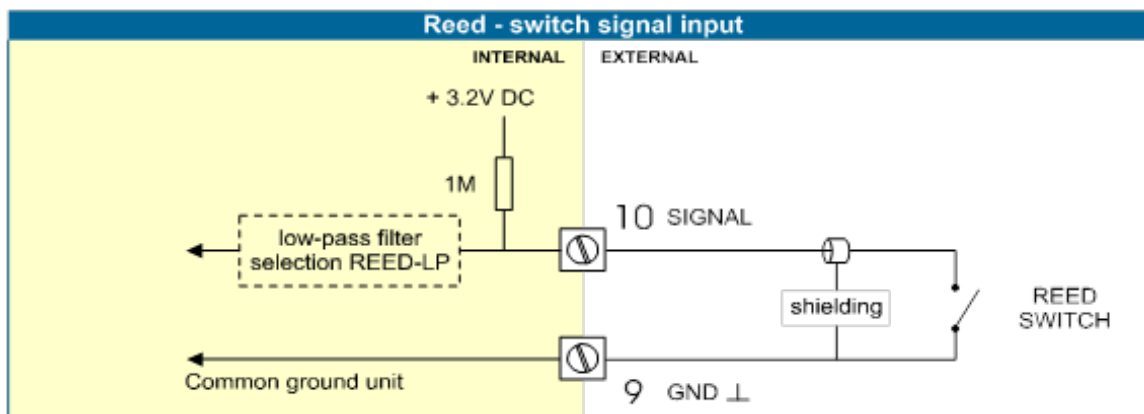
**Active signals 8.1V to 12V and 24V**

If a sensor gives an active signal, see "Details of Setup Functions" on page 14. The detection levels are 50% of the selected supply voltage; approximately 4V (ACT\_8.1) or 6V (ACT\_12) or 12V (ACT\_24).



Reed switch

The ER-420 is suitable for use with flowmeters which have a reed switch. To avoid pulse bounce from the reed switch, select REED LP – low-pass filter (see "Details of Setup Functions" on page 14). Transmitter wire pairs to terminals are either green and white or black and blue.



ER-420-DC and ER-420-AC

The following terminal connectors are available:

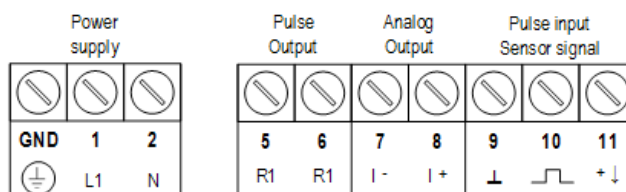


Figure 7: Overview terminal connectors AC or DC powered ER-420

Voltage selection sensor supply

With the ER-420-DC and ER-420-AC, a real power supply for the sensor is available. The flowmeter can be powered with 8.2 to 12 or 24 V DC. Total power consumption: max. 400 mA@24V. The voltage is selected with the three switches inside the enclosure.

**WARNING**

- **BE SURE THAT ALL THE LEADS TO THE TERMINALS ARE DISCONNECTED FROM THE UNIT WHEN THE INTERNAL PLASTIC PROTECTION COVER HAS BEEN REMOVED.**
- **HIGH VOLTAGE 400V !! NEVER CONNECT THE MAIN POWER SUPPLY TO THE UNIT WHEN THE PLASTIC PROTECTION COVER HAS BEEN REMOVED.**

**FIRST, REMOVE THE TERMINAL STRIP(S) AFTER WHICH THE INTERNAL PLASTIC COVER CAN BE REMOVED. THE SWITCHES ARE LOCATED ON THE RIGHT HAND (MODEL AC/DC) AS INDICATED:**

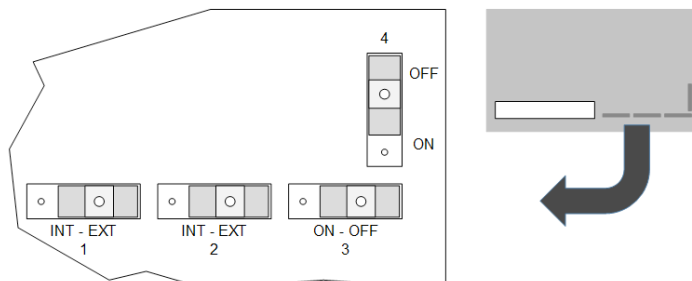


Figure 8: Switch setting sensor supply voltage ER-420-DC / ER-420-AC

Switch positions

Sensor A		Sensor B		Voltage Selection		
Switch 1	Voltage	Switch 2	Voltage	Switch 3	Switch 4	Voltage
internal	3.2V DC	—	—	on	on	8.2V DC
external	switch 3+4	—	—	on	off	12V DC
—	—	—	—	off	off	2 V DC

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

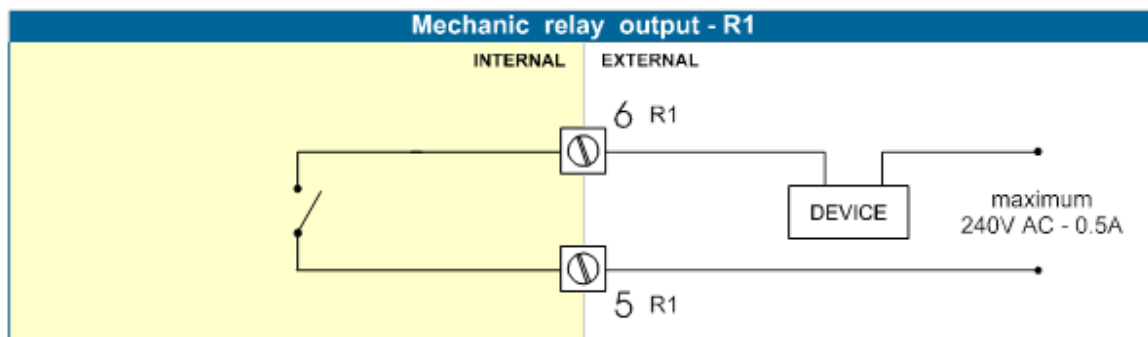
Terminal connections ER-420-DC and ER-420-AC

Terminal GND 01 - 02: Power Supply available only with model AC or DC:

Type	Sensor Supply	Terminal		
		GND	01	02
ER-420-DC 24V AC ±15%	8.2, 12, 24V max. 400 mA	—	AC	AC
ER-420-DC 24V DC ±15%	8.2, 12, 24V max. 400 mA	DC-	DC+	—
ER-420-AC 115-230V AC ±15%	8.2, 12, 24V max. 400 mA	EARTH	AC	AC
Note AC/DC:		The total consumption of the sensors and outputs may not exceed 400 mA@24V		

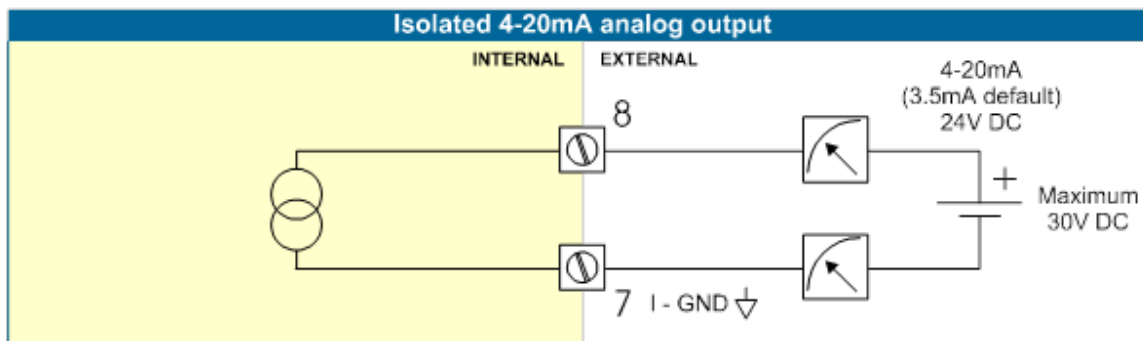
Terminal 05-06 scaled pulse output R1

SETUP 7 determines the pulse output function. The maximum pulse frequency of this output is 500 Hz for units with Rev. 03 and newer (60 Hz for units earlier than Rev. 03). However, with the mechanic output option supplied, be sure that the output frequency does not exceed 5 Hz or else the lifetime of the relay will be reduced significantly. An isolated mechanical relay output is available for the ER-420-DC and ER-420-AC. Maximum switch power is 240V 0.5A per output.



Terminal 07-08 analog output (SETUP 7)

- An isolated 4...20 mA signal proportional to the flow rate is available for the ER-420-DC and ER-420-AC.
- When the output is disabled, a 3.5mA signal will be generated on these terminals.
- Maximum driving capacity is 1000 Ohm @ 30V DC.

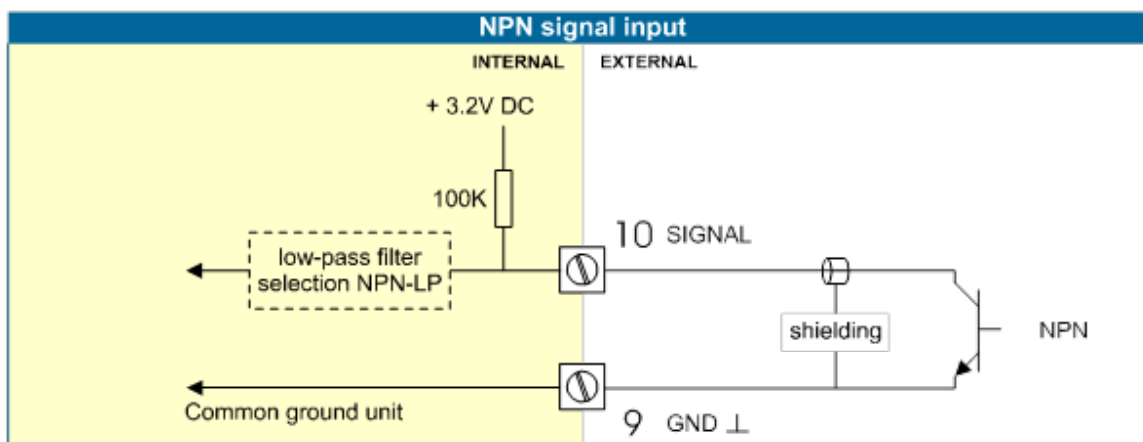


#### Terminal 09-11 flowmeter input

- Two basic types of flowmeter signals can be connected to the unit: passive or active pulse.
- The screen of the signal wire must be connected to the common ground terminal 9 (unless earthed at the sensor itself).
- The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected with the correct SETUP-function (see "Details of Setup Functions" on page 14).

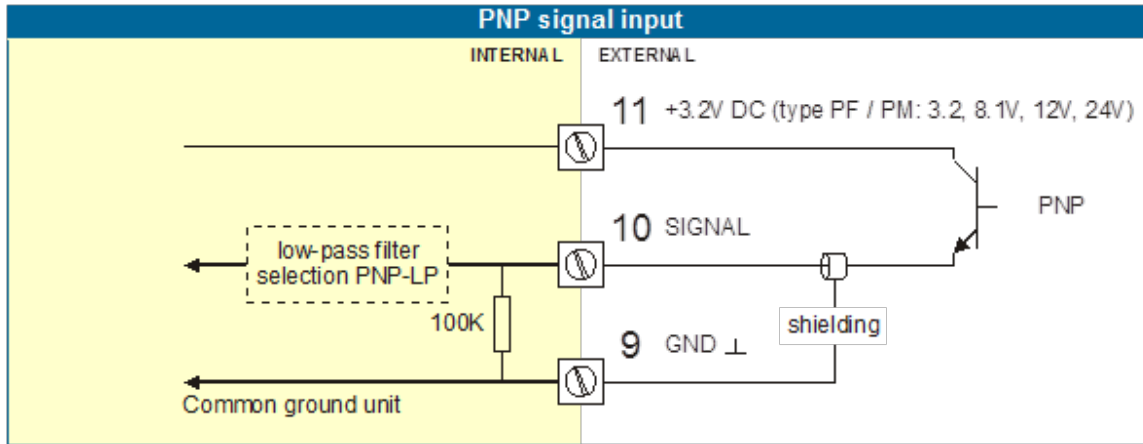
#### Pulse-signal NPN / NPN-LP

The ER-420 is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency (see "Details of Setup Functions" on page 14).



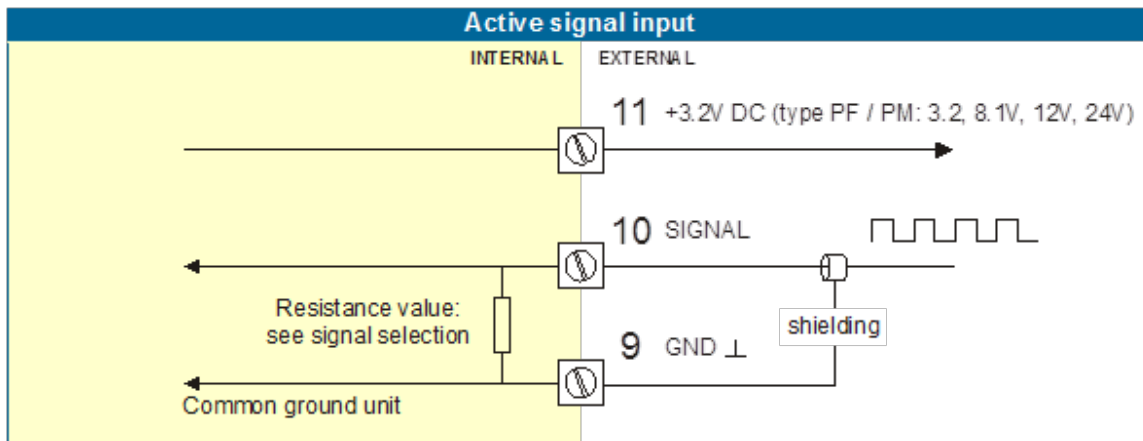
**Pulse-signal PNP / PNP-LP**

The ER-420 is suitable for use with flowmeters which have a PNP output 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 (see "Details of Setup Functions" on page 14). For a signal detection level of 50% of the supply voltage, see "Active signals 8.1V to 12V and 24V" on page 30.



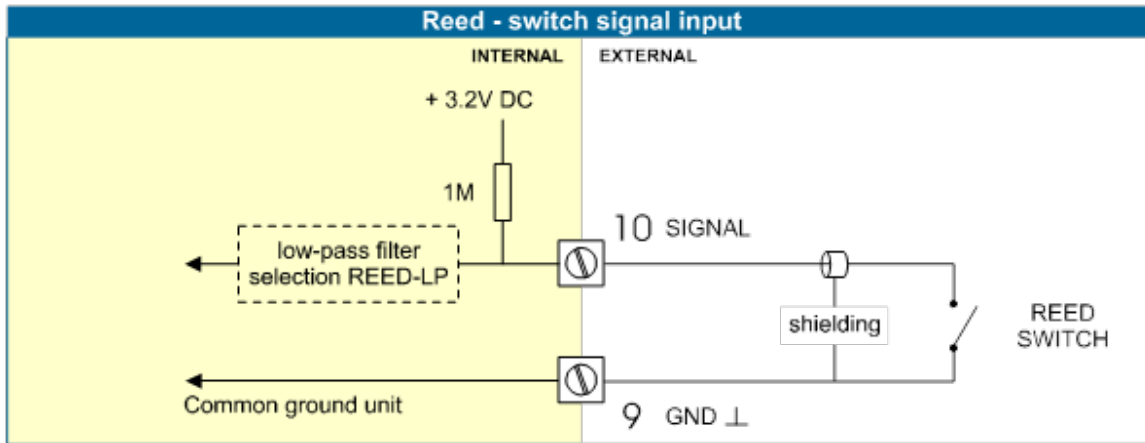
**Active signals 8.1V to 12V and 24V**

If a sensor gives an active signal, see "Details of Setup Functions" on page 14. The detection levels are 50% of the selected supply voltage; approximately 4V (ACT\_8.1) or 6V (ACT\_12) or 12V (ACT\_24).



Reed switch

The ER-420 is suitable for use with flowmeters which have a reed switch. To avoid pulse bounce from the reed switch, select REED LP low-pass filter (see "Details of Setup Functions" on page 14).



## Industrial Oval Gear Adapter Wiring

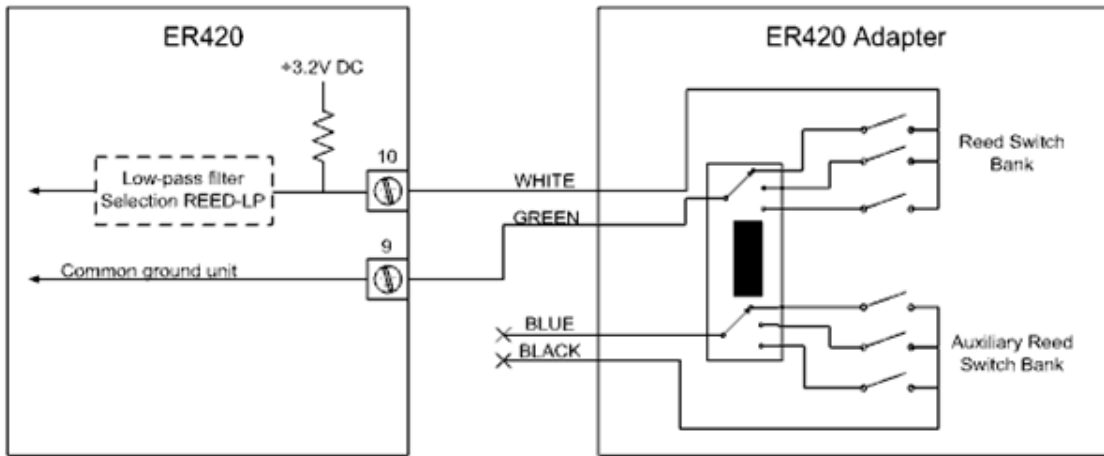


Figure 9: ER-420 Wiring

See "Transmitter Pulses Per Unit" on page 21.

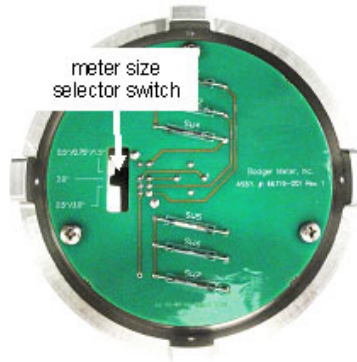


Figure 10: ER-420 Transmitter Adapter Switch Positions

**NOTE:** The meter size selector switch must be set to correspond to the size of the meter to properly detect fluid flow.  
 Position 1 (top): 1/2", 3/4", 1"  
 Position 2 (center): 1-1/2"  
 Position 3 (bottom): 2", 3"



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# MAINTENANCE

## General Directions

### **⚠ WARNING**

- **MOUNTING, ELECTRICAL INSTALLATION, START-UP AND MAINTENANCE OF THE INSTRUMENT MAY ONLY BE CARRIED OUT BY TRAINED PERSONNEL AUTHORIZED BY THE OPERATOR OF THE FACILITY. PERSONNEL MUST READ AND UNDERSTAND THIS OPERATING MANUAL BEFORE CARRYING OUT ITS INSTRUCTIONS.**
- **THE ER-420 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 "Safety" on page 5.**

The ER-420 does not require special maintenance unless it is used in low-temperature applications or surroundings with high humidity (above 90% annual mean). It is the users responsibility to take all precautions to dehumidify the internal atmosphere of the ER-420 in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

Check periodically:

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

## Repair

Please contact customer service at Badger Meter.

## TECHNICAL SPECIFICATIONS

### General

#### Display

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

#### Enclosures

General Control Keys	GRP (glassfiber-reinforced polyamide) enclosure with polycarbonate window, silicone and EPDM gaskets. UV-stabilized and flame retardant material. Three industrial micro-switch keys. UV-stabilized silicone keypad.
Field/wall-mount enclosures Classification Drilling	Dimensions: 130 x 120 x 75 mm (5.10" x 4.72" x 2.95") LxHxD. IP67 / NEMA4X Three 3/4" holes.

#### Operating Temperature

Operational	-30...80° C (-22...178° F).
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#### Power Supply

ER-420-DC	24V AC / DC + 10%. Power consumption maximum is 0.5 Watt.
ER-420-AC	115...230V AC + 10%. Power consumption maximum is 0.5 Watt.
ER-420-LP	Output loop powered: 8...30V DC. Power consumption maximum is 0.5 Watt.
Models DC/AC	The total consumption of the sensors, backlight and outputs may not exceed 400 mA @ 24V.

#### Sensor Excitation

ER-420-LP	3.2V DC for pulse signals. <b>NOTE:</b> This is not a real sensor supply. It is suitable only for pulse sensors—like reed switches—with a very low power consumption.
ER-420 AC/DC	3.2, 8.2, 12 and 24V DC. Maximum is 400 mA @ 2 4V DC.

#### Terminal Connections

Type	Removable plug-in terminal strip. Wire maximum is 1.5 mm <sup>2</sup> and 2.5 mm <sup>2</sup>
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#### Data Protection

Type	EEPROM backup of all setting. Backup of running totals every minute. Data retention is at least 10 years.
Passcode	Configuration settings can be passcode protected.

#### Directives and Standards

EMC	EN 61326-1; FCC 47 CFR part 15
LVD	EN/IEC 61010-1
ATEX / IECEx	EN/IEC 60079-0; EN/IEC 60079-11; EN/IEC 60079-26
RoHS	EN 50581
IP & NEMA	EN 60529; NEMA 250

## Inputs

### Flowmeter

Type P	NPN/PNP, open collector, reed switch, active pulse signals 8...12 and 24V.
Frequency	Minimum 0 Hz, maximum 7 kHz for total and flow rate. Maximum frequency depends on signal type and internal low-pass filter. Example: Reed switch with low-pass filter: maximum frequency is 120 Hz.
K-Factor	0.000010...9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.

## Outputs

### Analog Output

Function	Transmitting flow rate.
Accuracy	10 bit. Error < 0.05%. Updates 10 times a sec. Software function is to calibrate the 4.00 mA and 20.00 mA levels precisely within setup.
Load	1 kOhm max.
Type ER-420-AC and ER-420-DC	Passive galvanically isolated output.
Type AP	Passive 4...20 mA output; output loop powered.

### Transistor Output

Pulse output	Maximum frequency is 500 Hz for units with Rev. 03 and newer (60 Hz for units earlier than Rev. 03). Pulse length is user-definable between 7.8 msec up to 2 secs.
Function	One pulse output, transmitting accumulated total.
Type ER-420-AC and ER-420-DC	Isolated mechanical relay output; maximum switch power is 230V AC to 0.5A.
ER-420-LP	Passive transistor output, not isolated. Load maximum is 50V DC to 300 mA.

## Operational

### Operator Functions

Displayed functions	<ul style="list-style-type: none"> <li>• <i>Total</i> and/or <i>Flow Rate</i>.</li> <li>• <i>Total</i> and <i>Accumulated Total</i>.</li> <li>• <i>Total</i> can be reset to zero by pressing the <b>CLEAR</b> key twice.</li> <li>• Multiplication factor: x1, x10, x100, x1000, x10000.</li> </ul>
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### Total

Digits	7 digits.
Units	L, m <sup>3</sup> , GAL, USGAL, kg, lb, bbl, __ (no unit)
Decimals	0, 1, 2, or 3
Note	<i>Total</i> can be reset to zero.

### Accumulated Total

Digits	11 digits.
Units / decimals	According to selection for <i>Total</i> .

### Flow Rate

Digits	7 digits
Units	mL, L, m <sup>3</sup> , mg, g, kg, ton, GAL, bbl. lb, cf, REV, __ (no unit), scf, Nm <sup>3</sup> , NL, P
Decimals	0, 1, 2, or 3
Time units	sec, minute, hour, day

## TROUBLESHOOTING

Issue	What to Check	Refer to
Flow meter does not generate pulses.	Signal selection	SETUP 51
	Pulse amplitude	"ER-420-DC and ER-420-AC" on page 27
	Flowmeter, wiring and connection of terminal connectors	"ER-420-DC and ER-420-AC" on page 27
	Power supply of flowmeter	par. 4.4.2
Flow meter generates too many pulses.	Settings for <i>Total</i> and Flow Rate	SETUP 11-14 and 21-27
	Type of signal selected with actual signal generated	SETUP 51
	Sensitivity of coil input	SETUP 51 and "ER-420-DC and ER-420-AC" on page 27
	Proper grounding of the ER-420	—
	Use shielded wire for flowmeter signals and connect screen to terminal 9 (unless connected at sensor).	—
Analog output does not function properly.	Is the function enabled?	SETUP 61
	Are the flow levels programmed correctly?	SETUP 62 / 63
	Is the external power supply connected according to the specification?	—
Pulse output does not function.	Impulse width—is the external device able to recognize the selected pulse width and frequency?	SETUP 72
	Pulse per "x" quantity—is the value programmed reasonable and will the maximum output be under 20 Hz?	SETUP 71
Flow rate displays "0 / zero" while there is flow (total is counting).	Are the K-factor and time unit correct?	SETUP 22 / 25
	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 secs for example: the result is that the unit has at least 10 secs time to measure the number of pulses according to SETUP 26.	SETUP 26 / 27
The passcode is unknown.	Try passcode 1234.	If 1234 does not work, call your supplier.

### Alarm

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

0001: irrecoverable display-data error: data on the display might be corrupted.

0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.

0003: error 1 and error 2 occurred simultaneously.

The alarm condition will almost certainly be handled internally and if all mentioned values still appear correct, no intervention by the operator is needed. If the alarm occurs more often or stays active for a longer time, please contact your supplier.

## Your Configuration Settings

**NOTE:** Some settings are not applicable.

Setting	Default	Date:	Date:
<b>1 – Total</b>		<i>Enter your settings here.</i>	
11 unit	GAL		
12 decimals	0000000		
13 K-factor	0000001		
14 decimals K-factor	0		
15 multiplication factor	x1		
<b>2 – Flow Rate</b>			
21 unit	GAL		
22 time unit	/min		
23 decimals	0000000		
24 K-factor	0000001		
25 decimals K-factor	0		
26 calculation / pulses	010		
27 cut-off time	30.0 sec.		
<b>3 – Display</b>			
31 function	total		
<b>4 – Power Management</b>			
41 LCD-new	1 sec.		
42 mode	operational		
<b>5 – Flowmeter</b>			
51 signal	Reed switch		
<b>6 – Analog Output</b>			
61 output	disabled		
62 min. flow rate 4-mA	0000000		
63 max. flow rate 20mA	9999999		
64 cutoff percentage	0.0%		
65 tune min. 4mA	0208		
66 tune max. 20mA	6656		
67 filter	01 (off)		
<b>7 – Pulse Output (for units earlier than Rev. 03)</b>			
71 pulse width	000 periods		
72 pulse per	0001000		
<b>7 – Pulse Output (for units Rev. 03 or later)</b>			
71 pulse width	000 periods		
72 decimals	0		
73 pulse per	0001000		
<b>8 – Communication</b>			
81 baud-rate	2400		
82 address	1		
83 mode	BUS-ASC		
<b>9 – Others</b>			
91 model	F-Series	F-Series	F-Series
92 type	ER-420	ER-420	ER-420
93 software version			
94 serial number			
95 pass code	0000		
96 tagnumber	0000000		

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