ER420	Flowrate/Totalizer with 4-20mA Output Signal ER420-AC – 115-230V AC Powered ER420-DC – 24V AC/DC Powered ER420-LP – Loop Powered	Installation & Operation Manual

ABOUT THE OPERATION MANUAL

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

A hazardous situation may occur if the ER420 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 ER420 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 ER420 or connected instruments.

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 INSTRUCTIONS

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

⚠ WARNING
- *LIFE SUPPORT APPLICATIONS: The ER420 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
- *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).*

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 ER420 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 ER420 supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE ER420

Functions and features

The flowrate / totalizer model ER420 is a microprocessor driven instrument designed to display flowrate, 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 <u>pulse type</u> input from the flowmeter.

One flowmeter with a passive or active pulse output can be connected to the ER420.

To power the display and sensor, several options are available: ER420-AC 115-230V AC, ER420-DC 24V AC/DC, ER420-LP – Loop Powered.

Standard outputs

- Configurable pulse output: a scaled pulse mirroring a certain totalized quantity. Maximum frequency 60Hz.; the pulse length can be set from 7.8msec up to 2 seconds.
- Configurable linear 4-20mA analog output with 10-bits resolution mirroring the actual flowrate. Flowrate levels as well as the minimum and maximum signal output can be tuned.
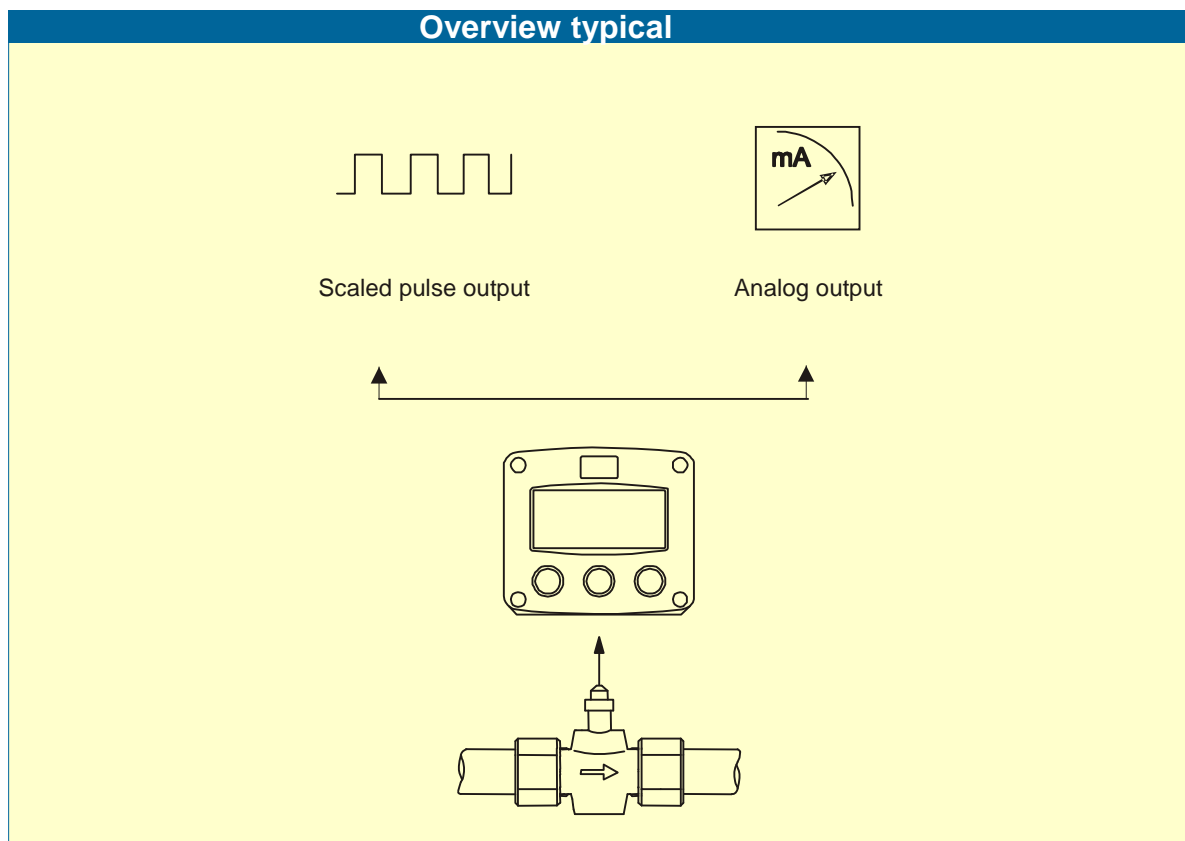
Fig. 1: Typical application for the ER420.

Configuration of the unit
The ER420 was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your ER420 according to your specific requirements.
SETUP includes several important features, such as K-factors, measurement units, signal selection etc.
All setting are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery.

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

2.   OPERATIONAL

2.1.   GENERAL

⚠ **WARNING**

- *The ER420 may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

2.2.   CONTROL PANEL

The following keys are available:
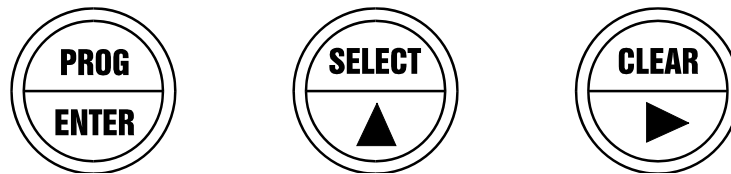
Fig. 2: Control Panel.

Functions of the keys

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

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

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

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the ER420 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 ER420 in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.

Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

▪ **Display flowrate / total or flowrate**
  This is the main display information of the ER420. After selecting any other information, it will always return to this main display automatically.
  Total is displayed on the upper-line of the display and flowrate on the bottom line.
  It is possible to display flowrate only with the large 0.67" digits; in this instance press the SELECT-key to read the total.
  When "-------" is shown, then the flowrate value is too high to be displayed. The arrows ⬍ indicate the increase/decrease of the flowrate trend.

▪ **Clear total**
  The value for total can be re-initialized. To do so, press CLEAR twice. After pressing CLEAR once, the flashing text "PUSH CLEAR" is displayed. To avoid re-initialization at this stage, press another key than CLEAR or wait for 20 seconds.
  Re-initialization of total DOES NOT influence the accumulated total.

▪ **Display accumulated total**
  When the SELECT-key is pressed, total and accumulated total are displayed. The accumulated total cannot be re-initialized. The value will count up to 99,999,999,999. The unit and number of decimals are displayed according to the configuration settings for total.

▪ **Display multiply factor for total and accumulated total**
  When the SELECT-key is pressed 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 flowrate!

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

3.   CONFIGURATION

3.1.   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 Operating Manual before carrying out its instructions.*
- *The ER420 may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

3.2.   PROGRAMMING SETUP-LEVEL

3.2.1.   GENERAL

Configuration of the ER420 is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows ↕ will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically.
SETUP can be reached at all times while the ER420 remains fully operational.

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

To enter SETUP-level:
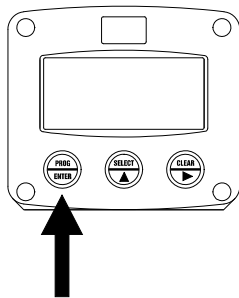
Press (PROG ENTER) for 7 seconds

Matrix structure SETUP-level:

function

12

11		21

1	→	2
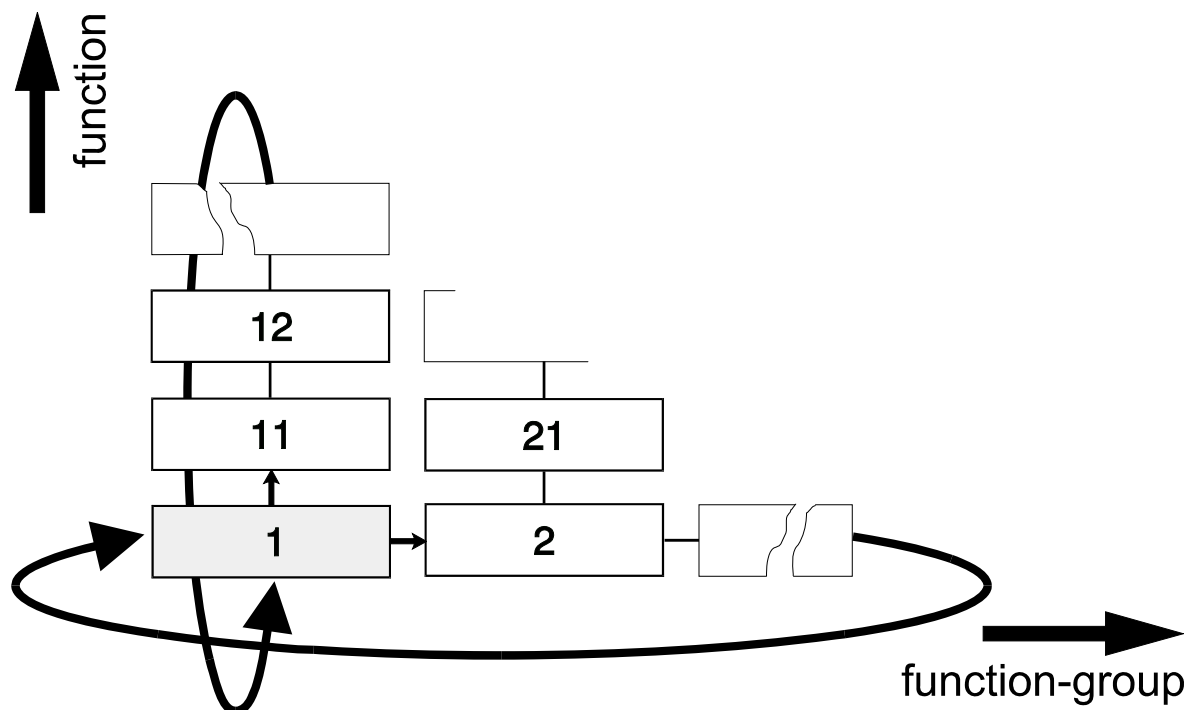
function-group

SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:
SETUP is divided into several function groups and functions.
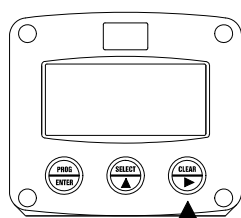
Select function-group with (CLEAR ▶)
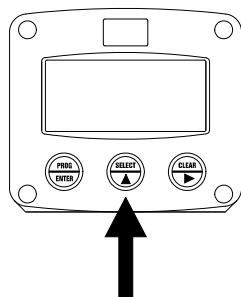
Select function with (SELECT ▲)

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

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

To change or select a value:
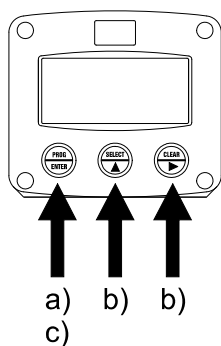
a) press (PROG ENTER) briefly; **PROGRAM** will start flash

b) select or enter value with (SELECT ▲) and / or (CLEAR ▸)

c) press (PROG ENTER) to confirm the value / selection.

To change a value, use ▸ to select the digits and ▲ to increase that value.
To select a setting, both ▲ and ▸ can be used.
If the new value is invalid, the increase sign▲ or decrease-sign▼ will be displayed while you are programming.

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

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

To return to OPERATOR-level:
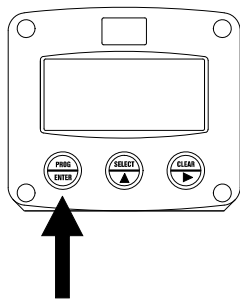
Press (PROG ENTER) for 3 seconds

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

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K-FACTOR:	0.000010 - 9,999,999 (see chart)
	14	DECIMALS K-FACTOR	0 - 6
	15	MULTIPLY FACTOR	x1 – x10 – x100 – x1000 – x10000
2	**FLOWRATE**		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - 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 seconds
3	**DISPLAY**		
	31	FUNCTION	total - flowrate
4	**POWER MANAGEMENT (DOES NOT APPLY TO THIS UNIT)**		
5	**FLOWMETER**		
	51	SIGNAL	npn - npn_lp - reed - reed_lp - pnp - pnp_lp - act_8.1 - act_12 - act_24
6	**ANALOG**		
	61	OUTPUT	disable - enable
	62	4mA	0000.000 - 9,999,999
	63	20mA	0000.000 - 9,999,999
	64	CUT-OFF	0.0 - 9.9%
	65	TUNE MIN - 4mA	0 - 9,999
	66	TUNE MAX- 20mA	0 - 9,999
	67	FILTER	00 - 99
7	**PULSE**		
	71	PULSE WIDTH	0 - 250
	72	PULSE PER	X,XXX,XXX quantity
8	**COMMUNICATION (DOES NOT APPLY TO THIS UNIT)**		
9	**OTHERS**		
	91	MODEL	F100-P
	92	TYPE	ER420LP / ER420DC / ER420AC
	93	SOFTWARE VERSION	__.__.__
	94	SERIAL NO.	xxxxxxx
	95	PASS CODE	0000 - 9999
	96	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL	
MEASUREMENT UNIT **11**	SETUP - 11 determines the measurement unit for total, accumulated total and pulse output. The following units can be selected: L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit). 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.
DECIMALS **12**	The decimal point determines for total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333 *NOTE: setup 15 offers a multiply factor. If the volume measured is very high it is advised to use the multiply factor and to select 0000000 decimals for setup 12.*
K-FACTOR **13**	With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be. **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 / m3". A cubic meter consists of 1000 parts of one liter which implies 2,481.3 pulses per m3. So, the K-factor is 2,481.3. Enter for SETUP - 13: "2481300" and for SETUP - 14 - decimals K-factor "3".* **Example 2:** **Calculating the K-factor.** *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".*
DECIMALS K-FACTOR **14**	This setting determines the number of decimals for the K-factor entered. (SETUP 13). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 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)!
MULTIPLY FACTOR **15**	In applications where very large volumes are measured, it is desired to use a multiply factor for the displayed totalisers. This to avoid a fast "turning to zero". The ER420 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. x1 – x10 – x100 – x1000– x10000 For the Operator, the valid factor is displayed after pressing SELECT twice. This factor does *not* influence the flowrate. **⚠ WARNING** This multiply factor applies also on pulse and output (SETUP 72).

2 - FLOWRATE

The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used, e.g. USGAL for total and barrels for flowrate. The display update time for flowrate is one second or more. **Note:** *these settings also influence the analog output.*

MEASUREMENT UNIT **21**	SETUP - 21 determines the measurement unit for flowrate. The following units can be selected: mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P - MGAL. 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.
TIME UNIT **22**	The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).
DECIMALS **23**	This setting determines for flowrate the number of digits following the decimal point. The following can be selected: 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 liter. 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)!
CALCULATION **26**	The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 255 pulses. *Note: this setting does influence the update time for the analog output directly (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses.* *Note: for low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.* *Note: for high frequency application (above 1kHz) do program a value of 50 or more pulses.*
CUT-OFF TIME **27**	With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 26) are generated, the flowrate will be displayed as zero. The cut-off time has to be entered in seconds - maximum time is 999 seconds (about 15 minutes).

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

4 - POWER MANAGEMENT (DOES NOT APPLY TO THIS UNIT)

5 - FLOWMETER

SIGNAL 51	The ER420 is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 51. *Note: 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	100K pull-up	6 kHz.	(open collector)
NPN - LP	NPN input with low pass filter	100K pull-up	2.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1M pull-up	1.2 kHz.	
REED - LP	Reed-switch input with low pass filter	1M pull-up	120 Hz.	Less sensitive
PNP	PNP input	100K pull-down	6 kHz.	
PNP - LP	PNP input with low pass filter	100K pull-down	700 Hz.	Less sensitive
ACT_8.1	Active pulse input 8.1 VDC	3K9	10KHz.	External power required
ACT_12	Active pulse input 12 VDC	4K	10KHz.	External power required
ACT_24	Active pulse input 24 VDC	3K	10KHz.	External power required

6 - ANALOG OUTPUT

A 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 **61**	The analog output can be disabled. When disabled, a 3.5mA will be generated if a power supply is available.
MINIMUM FLOWRATE **62**	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 dependant upon SETUP 21 and 22 but are not displayed.
MAXIMUM FLOWRATE **63**	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 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 16mA. When the flow is less than the required rate, the current will be the minimum signal (4mA). **Examples:**

4mA (SETUP 62)	20mA (SETUP 63)	CUT-OFF (SETUP 64)	REQUIRED RATE	OUTPUT
0 GPM	100 GPM	2%	(100-0)*2% = 2.0 GPM	4+(16*2%) = 4.32mA
20 GPM	800 GPM	3.5%	(800-20)*3.5%= 27.3 GPM	4+(16*3.5%)=4.56mA

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. **⚠ WARNING** ▪ *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 <u>directly active</u>. 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!
TUNE MAX / 20MA **66**	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. **⚠ WARNING** ▪ *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 20mA. The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed "up-side-down" if desired, so 4mA at maximum flowrate for example!

6 - ANALOG OUTPUT (CONTINUED)

FILTER 67	This function is used to stabilize the analog output signal. The output value is updated every 0.1 second. With the help of this digital filter a more stable but less precise reading can be obtained. The filter principal is based on three input values: the filter level (01-99), the last analog output value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with their response times are indicated:

FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.1 second	0.2 second	0.4 second	0.7 second
03	0.2 second	0.4 second	0.6 second	1.2 seconds
05	0.4 second	0.7 second	1.1 seconds	2.1 seconds
10	0.7 second	1.4 seconds	2.2 seconds	4.4 seconds
20	1.4 seconds	2.8 seconds	4.5 seconds	9.0 seconds
30	2.1 seconds	4 seconds	7 seconds	14 seconds
50	3.5 seconds	7 seconds	11 seconds	23 seconds
75	5.2 seconds	10 seconds	17 seconds	34 seconds
99	6.9 seconds	14 seconds	23 seconds	45 seconds

7 - PULSE OUTPUT

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

PERIOD TIME PULSE OUTPUT 71	The period time determines the time that the transistor or relay will be switched; in other words the pulse length. The minimum time between the pulses is as long as the selected period time. One period is approx. 7.8 msec. If the value selected is "zero", the pulse output is disabled. The maximum value is 255 periods. *Note: If the frequency should go out of range - when the flowrate increases for example - an internal buffer will be used to "store the missed pulses": As soon as the flowrate reduces again, the buffer will be "emptied". It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within it's range. For the ER420-DC and ER420-AC, it is recommended to reduce the max. output frequency to 0.5Hz, this will prolong the life of the product.*

NUMBER OF PERIODS	PERIOD TIME	MAX. FREQUENCY
0	disabled	Disabled
1	0.0078 seconds	64 Hz.
2	0.0156 seconds	32 Hz.
3	0.0234 seconds	21 Hz.
64	0.5000 seconds	1 Hz.
255	1.9922 seconds	0.25 Hz.

PULSE PER 72	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. **⚠ WARNING** The multiply factor (SETUP 15) applies also on the displayed value "pulse per". In other words, if the factor is 100x and the displayed value is 10 GAL, it must be read as one pulse per 1000 GAL.

8 - COMMUNICATION (DOES NOT APPLY TO THIS UNIT)

9 - OTHERS

MODEL **91**	For support and maintenance it is important to have information about the characteristics of the ER420. 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 ER420. This window offers you the product specific information: **ER420-LP, ER420-DC or ER420-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 ER420. 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**	For support and maintenance it is important to have information about the characteristics of the ER420. 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.
PASS CODE **95**	All SETUP-values can be pass code protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER **96**	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

3.2.4. TRANSMITTER PULSES PER UNIT CHART

Size	Meter Model	Gallons	Liters
Use with the following Transmitters: FTI, FT2XP, PFT2, PFT3		
1/2"	OP	223.0000	58.9000
1/2"	OP (FT1 only)	111.5000	29.4000
1" OP	OP	76.6000	20.2000
2"	OP	20.6000	5.4000
2"	Industrial Turbo	17.3600	4.6000
3"	Industrial Turbo	12.4000	3.2000
4"	Industrial Turbo	2.5600	0.6000
6"	Industrial Turbo	1.0800	0.2000
5/8"	25 Industrial RCDL	198.4000	52.4000
3/4"	35 Industrial RCDL	126.7000	33.5000
1"	40 Industrial RCDL	89.8000	23.7000
1"	70 Industrial RCDL	46.8000	12.4000
1-1/2"	120 Industrial RCDL	23.8000	6.3000
2"	170 Industrial RCDL	14.6000	3.9000
1-1/2"	160 Turbo Series	1.5366	0.4059
2"	200 Turbo Series	1.5366	0.4059
3"	450 Turbo Series	1.5982	0.4222
4"	1000 Turbo Series	1.6650	0.4399
6"	2000 Turbo Series	0.1501	0.0396
8"	3500 Turbo Series	0.1514	0.0400
10"	5500 Turbo Series	0.1980	0.0523
12"	6200 Turbo Series	0.1287	0.0340
16"	6600 Turbo Series	0.0155	0.0040
20"	10000 Turbo Series	0.0090	0.0023
1/2"	Industrial OG	378.5*	100*
3/4"	Industrial OG	249.8*	66*
1"	Industrial OG	249.8*	66*

*Approximate values

Exact pulses/liter for water can be found on each meter.

4. Installation

4.1. 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 Operating Manual before carrying out its instructions.*
- *The ER420 may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " at the front of this manual.*

4.2. INSTALLATION / SURROUNDING CONDITIONS
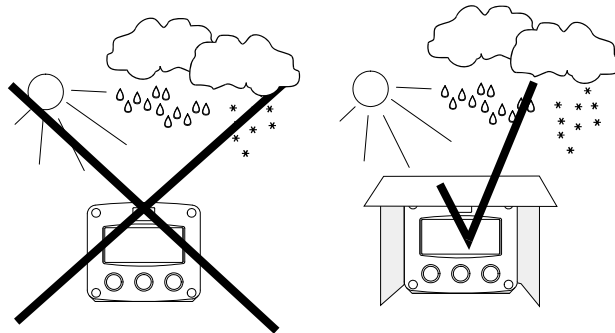
Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions.
When panel-mounted, the unit is IP65 (NEMA 4)!
When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.
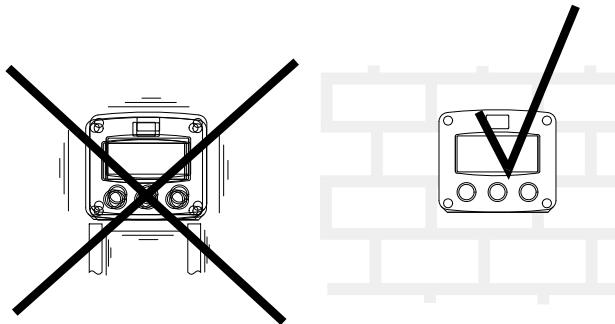
Mount the ER420 on a solid structure to avoid vibrations.
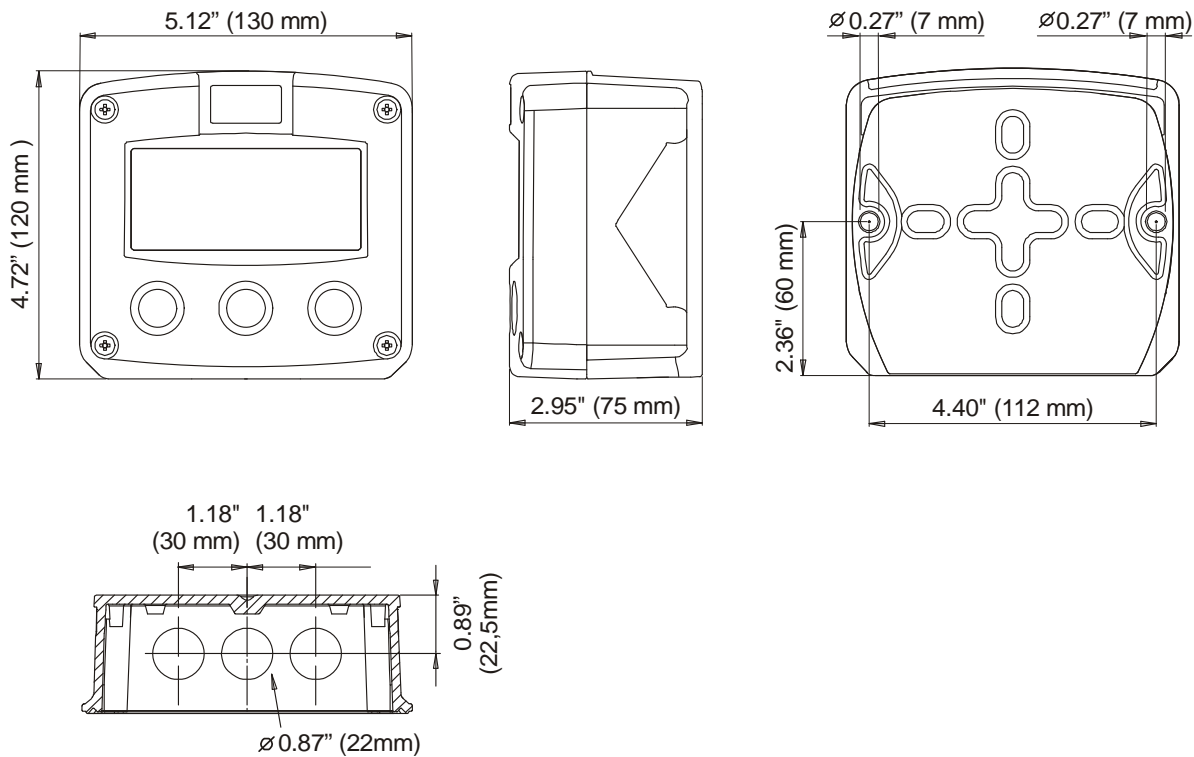
4.3.   DIMENSIONS- ENCLOSURE

GRP enclosures:

Fig. 4: Dimensions enclosure.

4.4.   INSTALLING THE HARDWARE

4.4.1.   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 it's screen to terminal 9 (GND) or at the sensor itself, whichever is appropriate to the application.

4.4.2.   ER420-LP
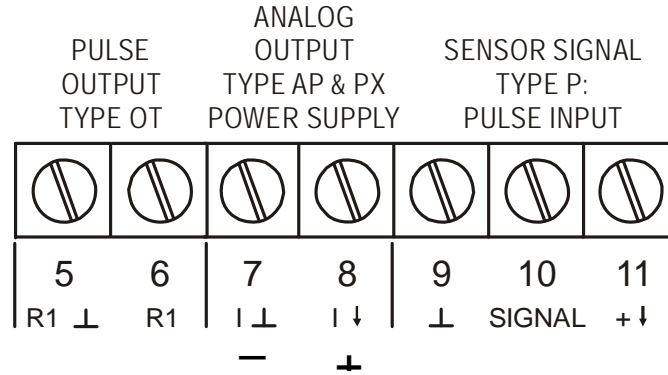
The following terminal connectors are available:

| | ANALOG | SENSOR SIGNAL |
| PULSE OUTPUT TYPE OT | OUTPUT TYPE AP & PX POWER SUPPLY | TYPE P: PULSE INPUT |

5	6	7	8	9	10	11
R1 ⊥	R1	I ⊥	I ↓	⊥	SIGNAL	+ ↓
		—	+			

Fig. 5: Overview terminal connectors loop powered ER420-LP.

4.4.2.1.   VOLTAGE SELECTION SENSOR SUPPLY

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

Note: This voltage MAY NOT be used to power the flowmeters electronics, converters etc, as it will not provide adequate sustained power ! It is possible to use some low power reed-switch, NPN or PNP output signals (consult your distributor).

4.4.2.2   TERMINAL CONNECTIONS ER420-LP

Terminal 05-06; scaled pulse output R1:
Setup 7 (par. 3.4.4.) determines the pulse output function. The maximum pulse frequency of this output is 60Hz.

A <u>passive</u> transistor output is available for the ER420-LP. Max. driving capacity 300mA@50V DC.
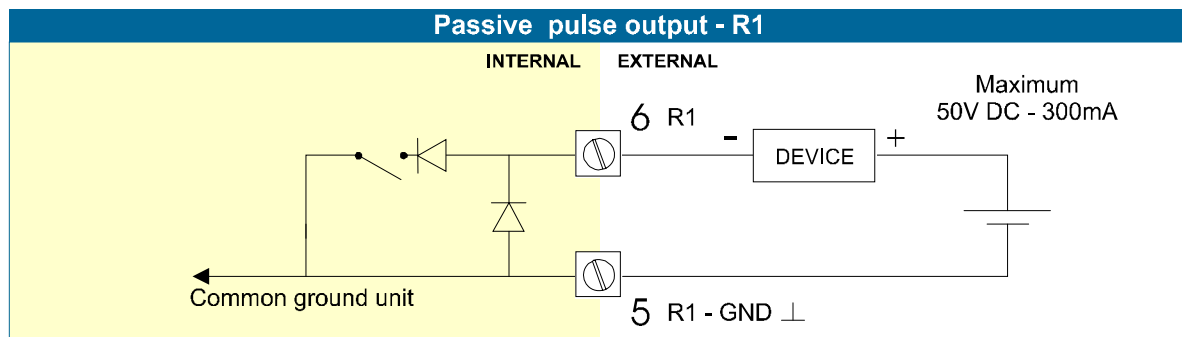
Terminal 07-08; basic <u>POWER SUPPLY</u> - output loop powered:
Connect an external power supply of 8-30VDC to these terminals.
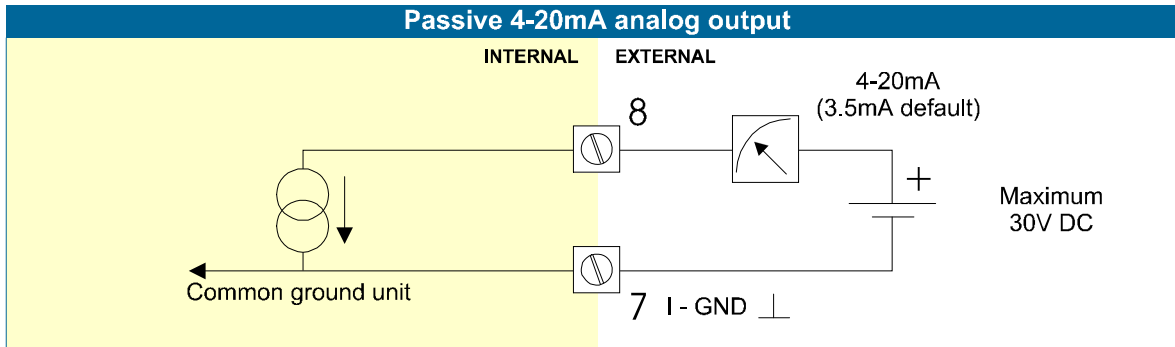Do connect the "-" to terminal 7 and the "+" to terminal 8.

⚠CAUTION
Only valid for the ER420-LP !

Terminal 07-08 analog output (SETUP 7) :
A passive 4-20mA signal proportional to the flowrate is available with this option. When a power supply is connected but the output is disabled, a 3.5mA signal will be generated.
Max. driving capacity 1000 Ohm. This output does loop power the unit as well.
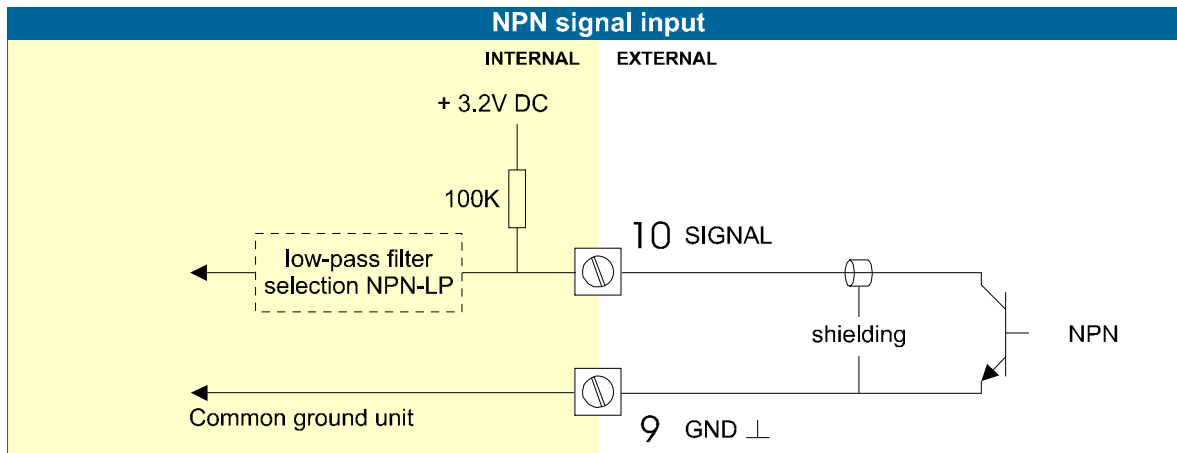

Terminal 09-11; Flowmeter input:
Two basic types of flowmeter signals can be connected to the unit: passive or active pulse.
The screen of the signal wire must be connected to the common ground terminal 9 (unless earthed at the sensor itself).
The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected with the correct SETUP-function (read par. 3.2.3.)

Pulse-signal NPN / NPN-LP:
The ER420 is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency (read par. 3.2.3.)
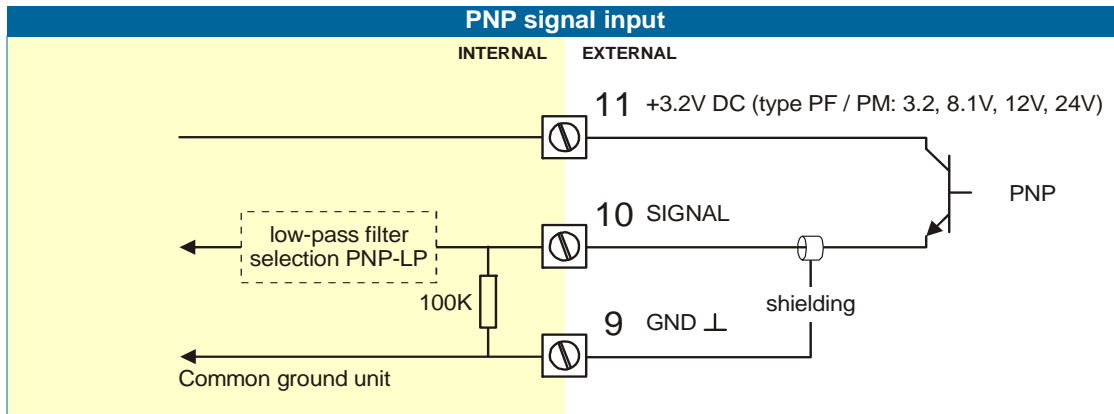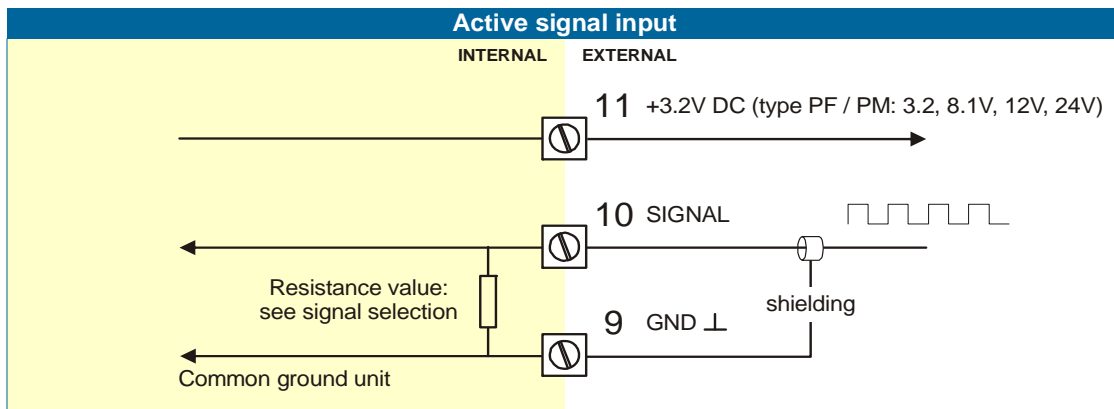

24

Pulse-signal PNP / PNP-LP:

The ER420 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 (read par. 3.2.3.)
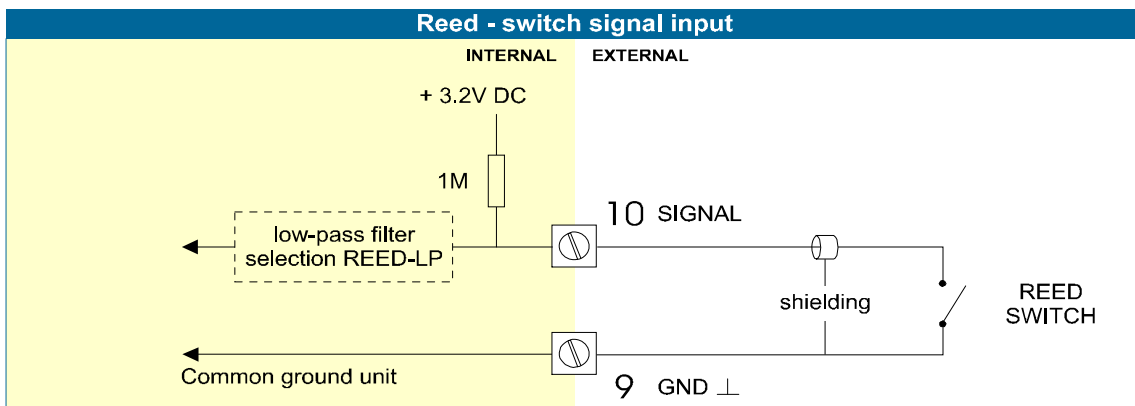For a signal detection level of 50% of the supply voltage: please refer to "active signals."

PNP signal input

INTERNAL   EXTERNAL

11 +3.2V DC (type PF / PM: 3.2, 8.1V, 12V, 24V)

10 SIGNAL

low-pass filter
selection PNP-LP

PNP

100K

shielding

9 GND ⊥

Common ground unit

Active signals 8.1V - 12V and 24V:

If a sensor gives an active signal, please read par. 3.2.3. The detection levels are 50% of the selected supply voltage; approximately 4V (ACT_8.1) or 6V (ACT_12) or 12V (ACT_24).

Active signal input

INTERNAL   EXTERNAL

11 +3.2V DC (type PF / PM: 3.2, 8.1V, 12V, 24V)

10 SIGNAL

Resistance value:
see signal selection

shielding

9 GND ⊥

Common ground unit

Reed-switch:

The ER420 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 par. 3.2.3.). Transmitter wire pairs to terminals are either green and white – or – black and blue.

Reed - switch signal input

INTERNAL   EXTERNAL

+ 3.2V DC

1M

low-pass filter
selection REED-LP

10 SIGNAL

shielding

REED
SWITCH

Common ground unit

9 GND ⊥

4.4.3   ER420-DC AND ER420-AC

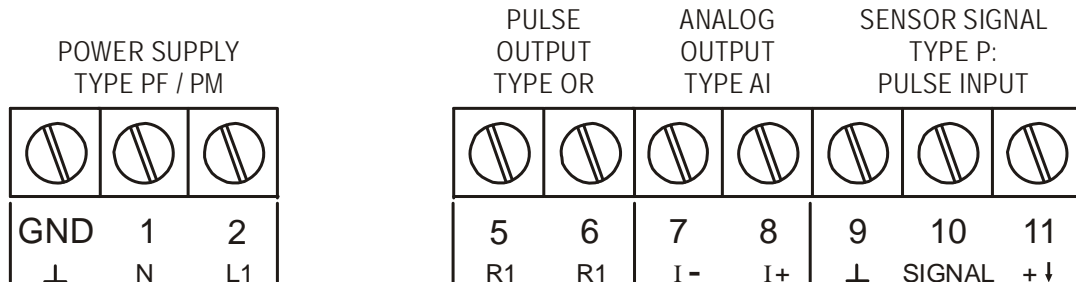The following terminal connectors are available:

Fig. 6: Overview terminal connectors AC or DC powered ER420.

4.4.3.1.   VOLTAGE SELECTION SENSOR SUPPLY

With the ER420-DC and ER420-AC, a real power supply for the sensor is available. The flowmeter can be powered with 8.2 - 12 or 24 V DC. Total power consumption: max. 400mA@24V.
The voltage is selected with the three switches inside the enclosure.

⚠ WARNING

- *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 (type PF / PM) as indicated:
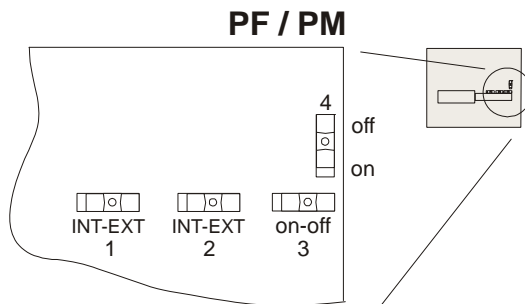

Fig. 7: Switch setting sensor supply voltage ER420-DC / ER420-AC.

Switch positions

SENSOR A	
SWITCH 1	VOLTAGE
internal	3.2 V DC
external	switch 3+4

SENSOR B	
SWITCH 2	VOLTAGE

VOLTAGE SELECTION		
SWITCH 3	SWITCH 4	VOLTAGE
on	on	8.2 V DC
on	off	12 V DC
off	off	23 V DC

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

4.4.3.2. TERMINAL CONNECTIONS ER420-DC AND ER420-AC

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

TYPE		SENSOR SUPPLY	Terminal		
			GND	01	02
ER420-DC	24V AC ± 15%	8.2, 12, 24V max. 400mA		AC	AC
ER420-DC	24V DC ± 15%	8.2, 12, 24V max. 400mA	L-	L+	
ER420-AC	115-230V AC ± 15%	8.2, 12, 24V max. 400mA	EARTH	AC	AC
Note PF / PM		The total consumption of the sensors and outputs may not exceed 400mA@24V			

Terminal 05-06; scaled pulse output R1:
Setup 7 (par. 3.4.4.) determines the pulse output function. The maximum pulse frequency of this output is 60Hz, however, with the mechanic output option supplied, be sure that the output frequency does not exceed 5Hz or else the life-time of the relay will be reduced significantly.

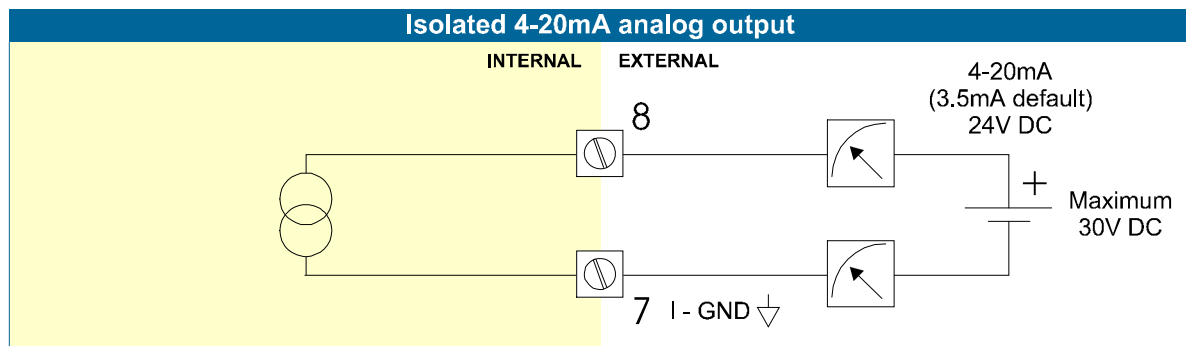An isolated mechanic relay output is available for the ER420-DC and ER420-AC.
Max. switch power 240V 0.5A per output.
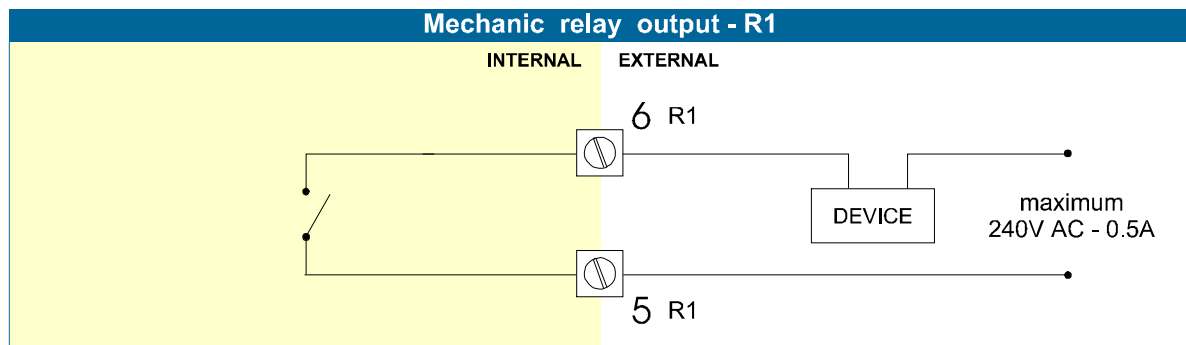
Terminal 07-08 analog output (SETUP 7) :
An isolated 4-20mA signal proportional to the flowrate is available for the ER420-DC and ER420-AC.
When the output is disabled, a 3.5mA signal will be generated on these terminals.
Max. driving capacity 1000 Ohm @ 30VDC.
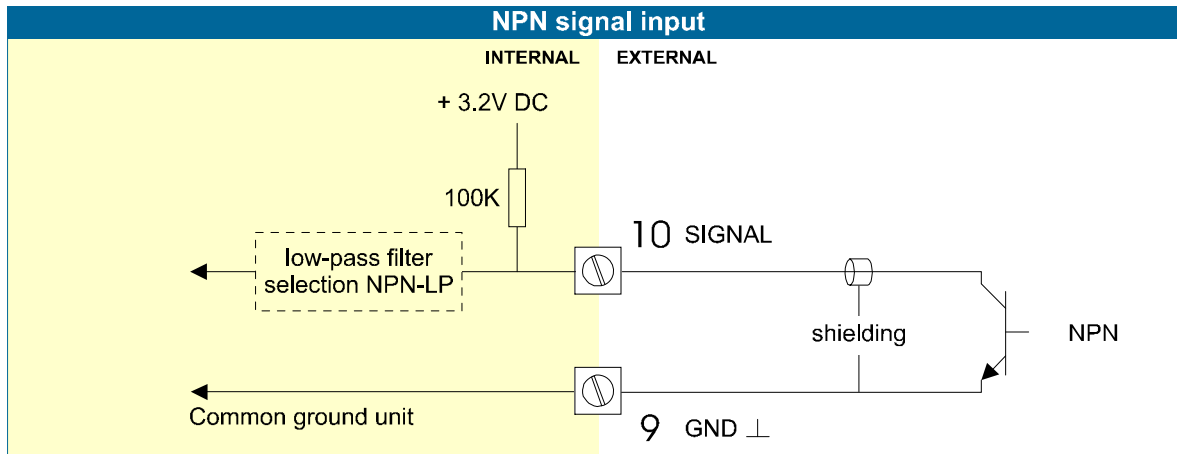
Terminal 09-11; Flowmeter input:
Two basic types of flowmeter signals can be connected to the unit: passive or active pulse.
The screen of the signal wire must be connected to the common ground terminal 9 (unless earthed at the sensor itself).
The maximum input frequency is approximately 10 kHz (depending on the type of signal). The input signal type has to be selected with the correct SETUP-function (read par. 3.2.3.)

Pulse-signal NPN / NPN-LP:
The ER420 is suitable for use with flowmeters which have a NPN output signal. For reliable pulse detection, the pulse amplitude has to go below 1.2V. Signal setting NPN-LP employs a low-pass signal noise filter, which limits the maximum input frequency (read par. 3.2.3.)

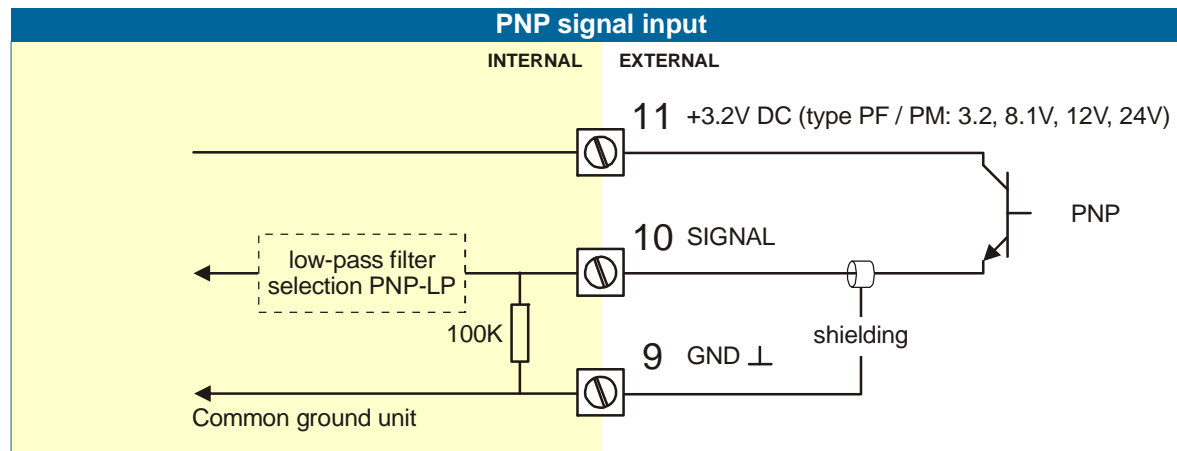**Pulse-signal PNP / PNP-LP:**
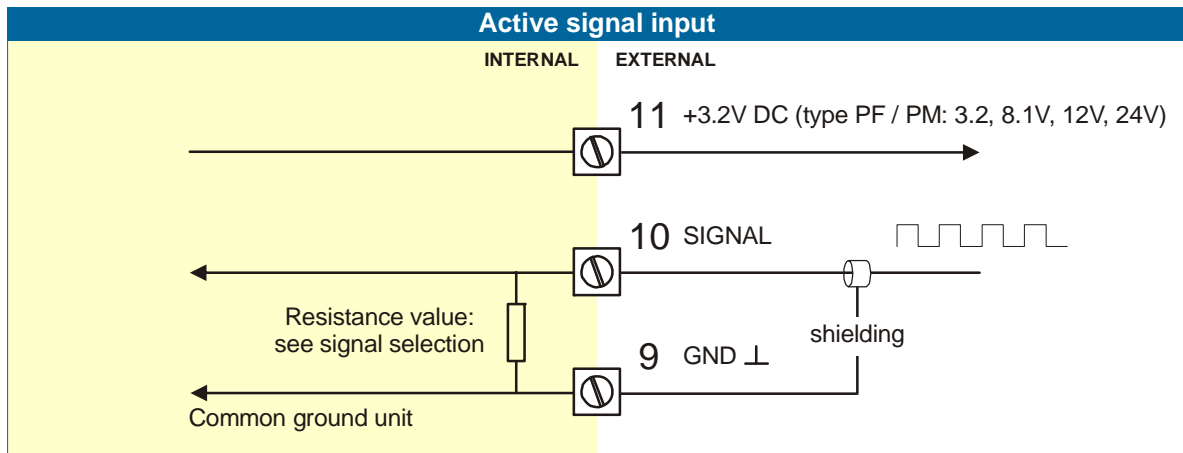The ER420 is suitable for use with flowmeters which have a PNP output signal.
For a reliable pulse detection, the pulse amplitude has to go above 1.2V. Signal setting PNP-LP employs a low-pass signal noise filter, which limits the maximum input frequency (read par. 3.2.3.)

For a signal detection level of 50% of the supply voltage: please refer to "active signals".

Active signals 8.1V - 12V and 24V:

If a sensor gives an active signal, please read par. 3.2.3. The detection levels are 50% of the selected supply voltage; approximately 4V (ACT_8.1) or 6V (ACT_12) or 12V (ACT_24).

Active signal input
INTERNAL   EXTERNAL

11   +3.2V DC (type PF / PM: 3.2, 8.1V, 12V, 24V)

10   SIGNAL

Resistance value:
see signal selection

shielding

9   GND ⊥

Common ground unit

Reed-switch:

The ER420 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 par. 3.2.3.)

Reed - switch signal input
INTERNAL   EXTERNAL

+ 3.2V DC

1M

low-pass filter
selection REED-LP

10   SIGNAL

shielding

REED
SWITCH

Common ground unit

9   GND ⊥
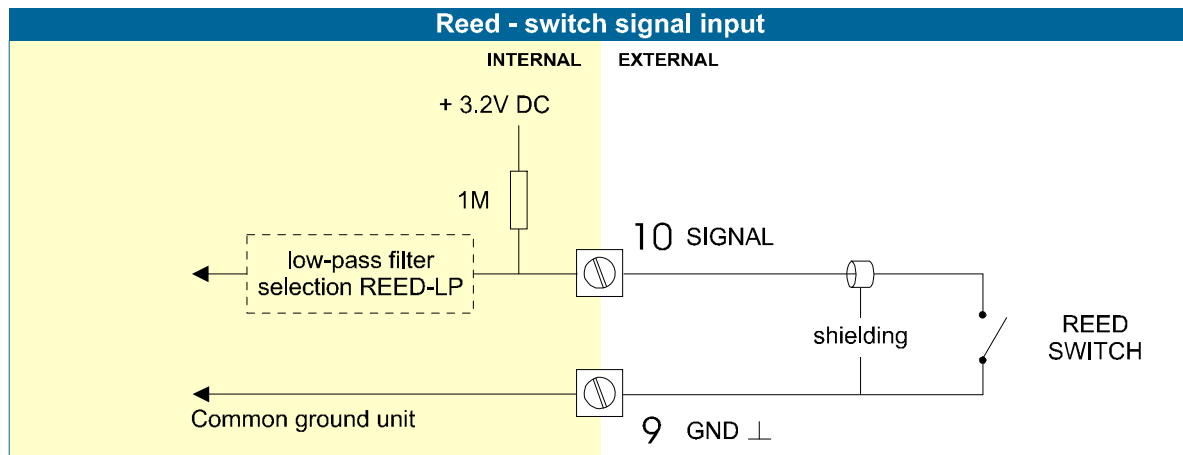
4.4.5   INDUSTRIAL OVAL GEAR ADAPTER WIRING
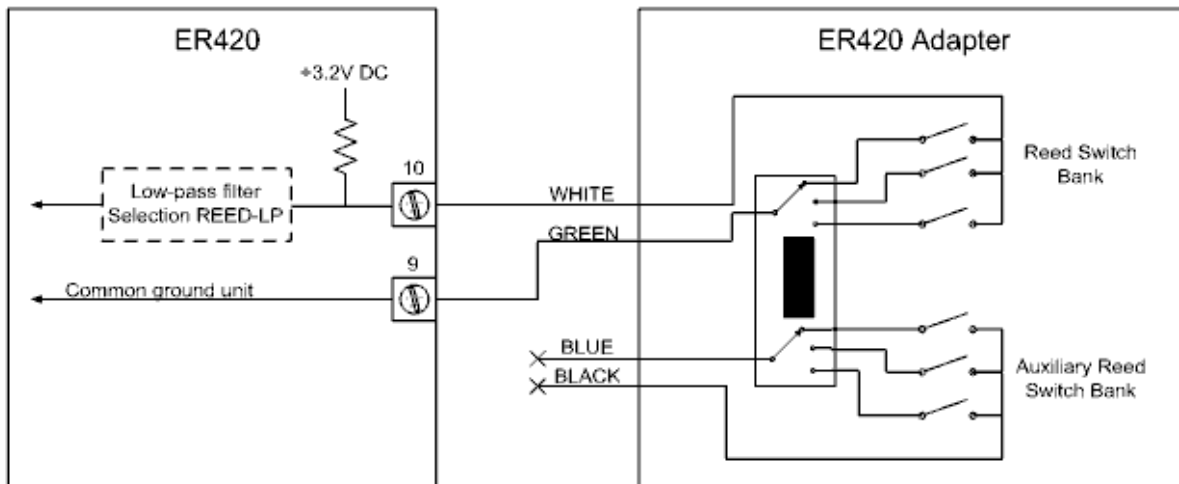
ER420 Wiring

Refer to the section 3.2.4. Transmitter Pulses Per Unit Chart on page 20.

ER420 Transmitter Adapter Switch Positions

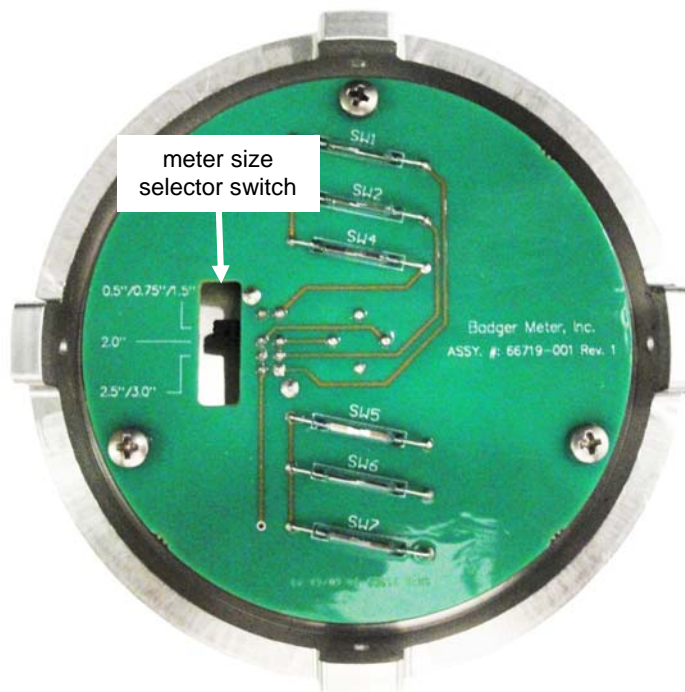NOTE: The meter size selector switch must be set to correspond to the size of the meter to properly detect fluid flow.

Position 1 (top): 1/2", 3/4", 1"

Position 2 (center): 1-1/2"

POSITION 3 (BOTTOM): 2", 3"

5. MAINTENANCE

5.1. 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 ER420 may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

The ER420 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 ER420 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. Do not forget to re-enter any subsequent K-factor alterations.
- The indication for low-battery.
- Clean the casing with soapy-water. Do not use any aggressive solvents as these might damage the polyester coating.

5.2. REPAIR

Please contact customer service at Badger Meter.

APPENDIX A: TECHNICAL SPECIFICATION

GENERAL

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Digits	Seven 17mm (0.67") and eleven 8mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Type ZB (option)	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications.

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

Operating temperature	
Operational	-30°C to +80°C (-22°F to +178°F).

Power supply	
ER420-DC	24V AC / DC + 10%. Power consumption max. 15 Watt.
ER420-AC	115-230V AC + 10%. Power consumption max. 15 Watt.
ER420-LP	Output loop powered: 8-30V DC. Power consumption max. 0.5 Watt.
Models DC/AC	The total consumption of the sensors, backlight and outputs may not exceed 400mA@24V.

Sensor excitation	
ER420-LP	3.2V DC for pulse signals. Note: This is not a real sensor supply. Only suitable for pulse sensors with a very low power consumption like reed-switches.
ER420 AC/DC	3.2 - 8.2 - 12 and 24V DC - max. 400mA@24V DC.

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm2 and 2.5mm2

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

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

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 flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.

Analog output	
Function	transmitting flowrate.
Accuracy	10 bit. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm
Type ER420-AC and ER420-DC	Passive galvanically isolated output.
Type AP	Passive 4-20mA output - output loop powered.

Transistor output(s)	
Pulse output	Max. frequency 60Hz. Pulse length user definable between 7.8msec up to 2 seconds.
Function	One pulse output - transmitting accumulated total.
Type ER420-AC and ER420-DC	Isolated mechanic relay output; max. switch power 230V AC – 0.5A.
ER420-LP	Passive transistor output - not isolated. Load max. 50V DC - 300mA.

OPERATIONAL

Operator functions	
Displayed functions	• total and/or flowrate. • total and accumulated total. • total can be reset to zero by pressing the CLEAR-key twice. • Multiply factor x1 - x10 - x100 - x1000 - x10000

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

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

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

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the ER420 is going to be installed or while it is in operation.

Flow meter does not generate pulses:
Check:
- Signal selection SETUP - 51,
- Pulse amplitude (par. 4.4.3.),
- Flowmeter, wiring and connection of terminal connectors (par. 4.4.3.),
- Power supply of flowmeter (par. 4.4.2.).

Flow meter generates "too many pulses":
Check:
- Settings for total and Flowrate: SETUP 11-14 and 21-27,
- Type of signal selected with actual signal generated - SETUP - 51,
- Sensitivity of coil input - SETUP - 51 and par. 4.4.3.
- Proper grounding of the ER420 - par. 4.4.1.
- Use shielded wire for flowmeter signals and connect screen to terminal 9. (unless connected at sensor)

Analog output does not function properly:
Check:
- SETUP 61 - is the function enabled?
- SETUP 62 / 63: are the flow-levels programmed correctly?
- connection of the external power-supply according to the specification.

Pulse output does not function:
Check:
- SETUP 71 - pulse per "x" quantity; is the value programmed reasonable and will the maximum output be under 20Hz?
- SETUP 72 - impulse width; is the external device able to recognize the selected pulse width and frequency?

Flowrate displays "0 / zero" while there is flow (total is counting):
Check:
- SETUP 22 / 25: are the K-factor and time unit correct?
- SETUP 26 / 27: The unit has to count the number of pulses according to SETUP 26 within the time according to SETUP 27. Make sure that 27 is set to 10.0 seconds for example: the result is that the unit has at least 10 seconds time to measure the number of pulses according to SETUP 26.

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 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.

LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL	Enter your settings here		
11 unit	GAL		
12 decimals	0000000		
13 K-factor	0000001		
14 decimals K-factor	0		
15 multiply factor	x1		
2 - FLOWRATE			
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.		
3 - DISPLAY			
31 function	total		
4 - POWER MANAGEMENT			
41 LCD-new	1 sec.		
42 mode	operational		
5 - FLOWMETER			
51 signal	Reed-switch		
6 - ANALOG OUTPUT			
61 output	disabled		
62 min. flowrate 4-mA	0000000		
63 max. flowrate 20mA	9999999		
64 cut off percentage	0.0%		
65 tune min - 4mA	0208		
66 tune max - 20mA	6656		
67 filter	01 (off)		
7 - PULSE OUTPUT			
71 pulse width	000 periods		
72 pulse per	0001000		
8 - COMMUNICATION			
81 baud-rate	2400		
82 address	1		
83 mode	BUS-ASC		
9 - OTHERS			
91 model	F-series	F-series	F-series
92 type	ER420	ER420	ER420
93 software version			
94 serial number			
95 pass code	0000		
96 tagnumber	0000000		

CE

Please see our website at
www.badgermeter.com
or specific contacts.

Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists.

Badger Meter
P.O. Box 245036, Milwaukee, WI 53224-9536
Telephone: (800) 456-5023 / (877) 243-1010
Fax: (414) 355-7499 / (866) 613-9305
www.badgermeter.com