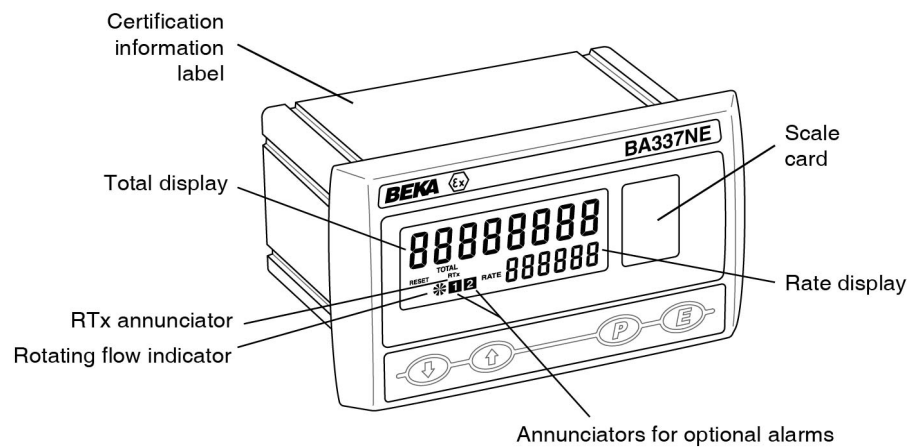


BA337NE
Rugged one input
Ex nA and Ex tc
Rate Totaliser
Issue 7



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1. DESCRIPTION

The BA337NE is an Ex nA and Ex tc certified, panel mounting, pulse input rate totaliser primarily intended for use with flowmeters in Zones 2 or 22. The instrument simultaneously displays the rate of flow and the total flow in the same or different engineering units. It is controlled and configured via the four front panel push buttons, a user defined four digit code may be entered to prevent accidental access to the instrument's configuration menu.

This instruction manual supplements the abbreviated instruction sheet supplied with each instrument.

The BA337NE has been issued with a Type Examination Certificate ITS16ATEX48409X by Notified Body Intertek Testing and Certification Ltd. This confirms compliance with the type of protection requirements for non-sparking Ex nA apparatus, and for dust ignition protection by enclosure Ex tc. This certificate has been used to confirm compliance with the European ATEX Directive 2014/34/EU.

For international applications the BA337NE also has IECEx certification which is described in Appendix 2.

For application in the USA or Canada the BA337NE has ETL and cETL certification, see Appendix 3.

Factory fitted accessories include an internally powered display backlight and one of three isolated output options, dual alarms, a pulse or a 4/20mA output.

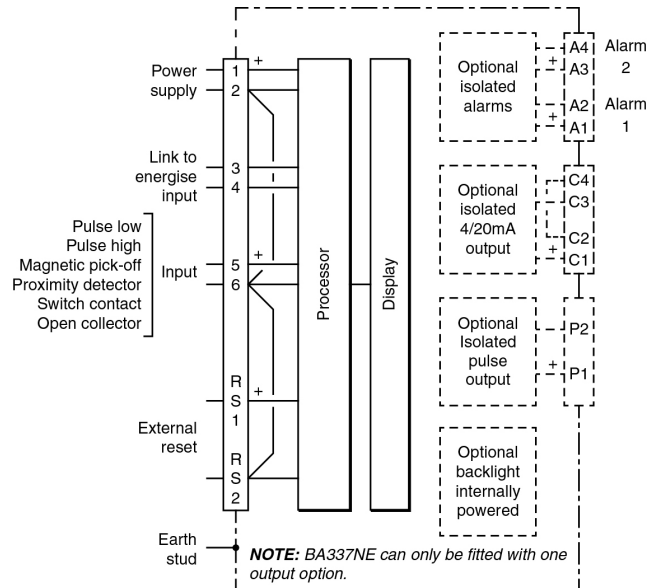


Fig 1 BA337NE block diagram

2. OPERATION

Fig 1 shows a simplified block diagram of the BA337NE Rate Totaliser. The instrument can accept pulses from most flowmeter transducers. When connected to a pulse output flowmeter the BA337NE will provide an accurate display of the rate of flow and the total flow in the same or different engineering units. The internal lineariser, which can have up to sixteen straight-line segments, may be calibrated to compensate for flowmeter non-linearity.

The BA337NE has a single pair of input terminals 5 & 6 for connection to all types of transducer. When counting pulses from a transducer requiring energising, such as a switch contact, open collector or a two wire proximity detector, an external link between terminals 3 and 4 supplies power to the transducer input terminals.

2.1 Initialisation

Each time power is applied to the Rate Totaliser initialisation is performed. After a short delay the following display sequence occurs:




















All segments of the display are activated

Instrument starts functioning using the configuration information stored in permanent memory. Unless total and grand total displays have been reset to zero, new flow will be added to the existing totals.

2.2 Controls

The BA337NE is controlled and configured via four front panel push buttons. In the totalisation mode i.e. when the instrument is displaying rate and total flow the push button functions are:

Push Button Functions

-  +  Grand total - shows L_0 followed by least significant 8 digits of the 16 digit grand total.
-  +  Grand total - shows H_1 followed by the most significant 8 digits of the 16 digit grand total.
If Local Grand Total Reset $ELR\ E_{tot}$ in the instrument configuration menu has been activated, operating the  +  buttons for ten seconds will result in ELR_{no} being displayed with the no flashing. Operating the  or  button will change the display to $ELR\ YES$, the  button will then reset the grand total to zero which will be confirmed by a brief display of $E_{t}\ ELRd$. See 6.20
-  +  If Local Total Reset $ELR\ E_{tot}$ in the instrument configuration menu has been activated, operating the  +  buttons simultaneously for three seconds will reset the total display to zero and clear any pulses stored in the optional pulse output.
The Grand Total is not reset.
See 6.19
-  +  Shows in succession, firmware version number, instrument function $E_{ot}RL\ SE$ and any output accessories that are fitted:
 - R Dual alarm outputs
 - P Pulse output
 - E 4/20mA output
-  +  Provides direct access to the alarm setpoints when the Rate Totaliser is fitted with optional alarms and the RES_P setpoints function has been enabled.
See 10.4.13 and 10.4.14
-  +  Access to configuration menu

2.3 Displays

The BA337NE has two digital displays and associated annunciators, plus a flow indicator as shown on the front cover of this manual.

Total display	Shows the total flow on the upper eight digit display. May be reset to zero via front panel push buttons or by a remote reset switch.
Rate Display	Shows the flow rate on the lower six digit display.
Flow indicator	This disc in the lower left hand corner of the display 'rotates' for two seconds each time an input pulse is received. Appears to rotate continuously when input frequency exceeds 0.5Hz.
Hold annunciator	Activated when input frequency is below the clip-off threshold.
Reset annunciator	Activated while instrument is being reset via the front panel push buttons, or the external reset terminals.
Rate annunciator	Identifies rate display
Total annunciator	Identifies total display
RTx annunciator	Retransmitted pulse annunciator. Depends upon the setting of $5_{out}EE$ in the pulse output configuration menu.
	SCALE# Annunciator activated each time pulse output open collector is <i>on</i> , i.e. R_{on} is less than $60\Omega + 3V$.
	drEEt: Annunciator continuously activated.

2.3.1 Display over-range

Over-range of the upper eight digit display or the lower six digit display is indicated by all the digits displaying 9 and all the decimal points flashing.

3. CERTIFICATION

The BA337NE has ATEX and IECEx Ex nA gas and Ex tc dust certification. The main sections of this instruction manual describes ATEX gas certification. ATEX dust certification is described in Appendix 1 and IECEx gas and dust certification in Appendix 2.

3.1 ATEX Ex nA certification

Notified Body Intertek Testing and Certification Ltd have issued the BA337NE with a Type Examination Certificate number ITS16ATEX48409X. This has been used to confirm compliance with the European ATEX Directive for Group II, Category 3G equipment. The instrument carries the Community Mark and, subject to local codes of practice, may be installed in any of the European Economic Area (EEA) member countries and in the EEA EFTA states, Iceland, Liechtenstein and Norway. ATEX certificates are also acceptable in Switzerland and Turkey. The European Commission's Blue Guide lists the member states, overseas countries and territories that have adopted harmonisation legislation.

This section of the instruction manual describes ATEX installations in explosive gas atmospheres conforming with EN 60079-14 *Electrical installations design, selection and erection*. When designing systems for installation outside the UK the local Code of Practice should be consulted.

3.2 Zones, gas groups and T rating

The Rate Totaliser has been certified as Group II Category 3G Ex ic nA IIC T5 Gc $-40^{\circ}\text{C} \geq T_a \geq +60^{\circ}\text{C}$ apparatus. This is non-sparking apparatus complying with EN 60079-15 *Equipment protection by type of protection 'n'* that minimises the risk of arcs or sparks capable of creating an ignition hazard occurring during conditions of normal operation.

The Rate Totaliser's front panel push button contacts are non incandive and have been certified intrinsically safe Ex ic without an external Zener barrier or galvanic isolator, as shown on the Type Examination Certificate. This allows the Rate Totaliser to be adjusted and configured live when installed in a Ex n panel enclosure located in Zones 2.

When connected to a suitable system and correctly mounted in a panel enclosure complying with the requirements for Type of protection 'n', the panel enclosure containing the BA337NE Rate Totaliser may be installed in:

Zone 2 explosive gas air mixture not likely to occur, and if it does will only exist for a short time.

Be used with gases in groups:

- Group A propane
- Group B ethylene
- Group C hydrogen

In gases that may safely be used with equipment having a temperature classification of:

T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C

At ambient temperatures between -40 and $+60^{\circ}\text{C}$.

This allows use with all commonly used industrial gases except carbon disulphide CS_2 .

3.3 Special conditions for safe use

Special conditions for safe use are specified by the Ex nA certificate indicated by the certificate number's 'X' suffix. These state that the BA337NE Rate Totaliser should be:

- a. Mounted such that the instrument terminals are protected by at least an IP54 enclosure certified to IEC 60079-0 or IEC 60079-15 as appropriate.
- b. Be supplied from limited energy circuits with output parameters in normal operation equal to, or less than the instruments input parameters.

These special conditions for safe use can be satisfied by mounting the BA337NE in an Ex n, Ex e or Ex p panel enclosure. For ATEX Category 3 installations in Zone 2, self or third party certified Ex n, Ex e or Ex p panel enclosures may be used. Additional requirement apply for non-metallic panel enclosures.

3.4 Power supply

The input safety parameters for the power supply terminals 1 and 2 are:

U_i	=	30dc
I_i	=	100mA

This allows the BA337NE to be powered from any dc supply which in normal operation has an output voltage of less than 30V. See section 4.1 for power supply recommendations.

3.5 Pulse input

The BA337NE Rate Totalisers has a single pair of pulse input terminals 5 and 6 that may be configured for use with different types of sensor.

For sensors that require energising to determine their state, such as switch contacts or a 2-wire proximity detector, an external link between terminals 3 & 4 of the BA337NE connects an internal 7V, 6mA supply to the input terminals.

Energising is not required when the Rate Totaliser input is connected to a voltage pulse source.

Fitting an external link between terminals 3 & 4 changes the Rate Totaliser's pulse input safety parameters in normal operation as shown below. This table also shows the types of sensor requiring energising (link fitting).

Type of input	Link 3 & 4	Safety parameters		
		Input Ui	Output Uo	Output Io
Switch contact	Yes	15V	10.5V	9.2mA
Proximity detector	Yes	15V	10.5V	9.2mA
Open collector	Yes	15V	10.5V	9.2mA
Magnetic pick-off	No	30V	1.1V	0.5mA
Voltage input (low)	No	30V	1.1V	0.5mA
Voltage input (high)	No	30V	1.1V	0.5mA

3.6 Remote reset terminals

The BA337NE total display may be reset to zero by connecting the external reset terminals RS1 and RS2 together for more than one second. The two reset terminals have the following safety parameters in normal operation:

Ui	=	30V
Uo	=	3.8V
Io	=	1mA

3.7 Certification label information

The Rate Totaliser certification information label is fitted in a recess on the top outer surface of the enclosure. It shows the ATEX and IECEx certification information plus BEKA associates name, location, year of manufacture and the instrument serial number.



BA337NE Certification information label

4. SYSTEM DESIGN FOR HAZARDOUS AREAS

When correctly installed in Zone 2 the BA337NE Rate Totaliser may be connected to almost any apparatus in the safe area and to Ex n, Ex e, Ex p and Ex d protected apparatus located in Zone 2. Because the BA337NE is not certified intrinsically safe it should not be connected to an intrinsically safe system.

BEKA Application Guide AG310, *Guide for Installation of [extra low voltage d.c.] Ex nA instrumentation*, which can be downloaded from www.beka.co.uk, contains explanations and recommendations for the installation of Ex nA equipment.

In addition to being able to be connected to other equipment in the safe area and in Zone 2, the BA337NE may also be connected to suitably protected and certified equipment located in Zone 1. This is illustrated in Fig 5 and explained in Application Guide AG310.

There are four design requirements:

1. The BA337NE must be installed in a panel enclosure complying with the requirements for Ex n protection as shown in section 5 of this manual.
2. The BA337NE should be powered from a circuit that has output safety parameters in normal operation equal to, or less than, the input safety parameters for terminals 1 and 2 specified by the BA337NE ATEX Type Examination Certificate.
3. Hazardous area apparatus to which the BA337NE is connected should be protected by a technique suitable for the Zone in which the equipment is located such as Ex n or Ex e if located in Zone 2. Equipment protected by intrinsic safety should not be connected to a BA337NE.
4. Wiring should comply with Clause 9 of EN 60079-14.

When designing a system it is important to remember that terminals 2, 6 and RS2 are interconnected within the BA337NE. See Fig 1.

4.1 Power supply

The BA337NE Rate Totaliser require a minimum of 10V between terminal 1 & 2 and consumes:

	10mA	without optional backlight
plus	6mA	when terminals 3 & 4 are linked

A 24V dc regulated supply with a current limit located in a safe area is suitable.

The power supply should meet the requirements for personnel safety so that 'live maintenance' can safely be performed. The implicit requirement for galvanic isolation from the mains supply ensures that the possible difficulties from circulating earth currents caused by mains faults is minimised. In European terms if the power supply is CE marked it is almost certainly acceptable.

To comply with the requirements of EN 60079:14 *Electrical installations design, selection and erection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements may be satisfied by using DIN rail mounted terminals incorporating a fuse with easily removable fuses which can be extracted to achieve isolation as shown in Fig 2. Clear identification of, and easy access to the means of isolation is essential for their effective use. It is also necessary to ensure that the maintenance procedure makes sure that unauthorised re-closure of the switches does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen.

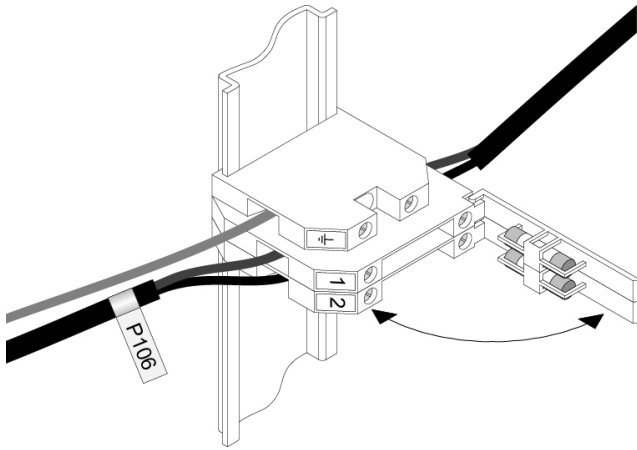


Fig 2 DIN rail mounting terminals incorporating a fuse

For some applications Ex nA instrumentation energised by a current limited power supply or instrument that can be switched off, is considered adequate and to comply with the requirements of the standard.

4.2 Pulse input

The BA337NE can display the rate and total flow from flowmeters with a wide variety of pulse outputs located in a Zone 2 hazardous areas or in a safe area. Fig 3 shows the connections when the flowmeter is located in Zone 2 and Fig 4 the connections required when the flowmeter is in a safe area.

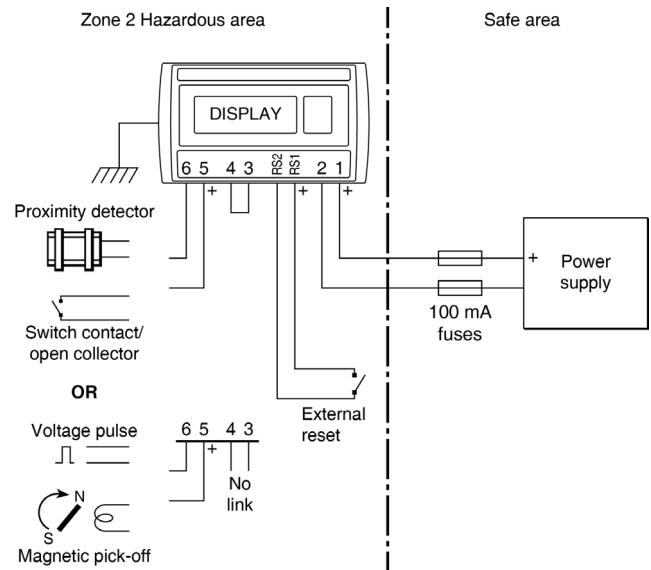


Fig 3 Connections for flowmeter sensor in Zone 2

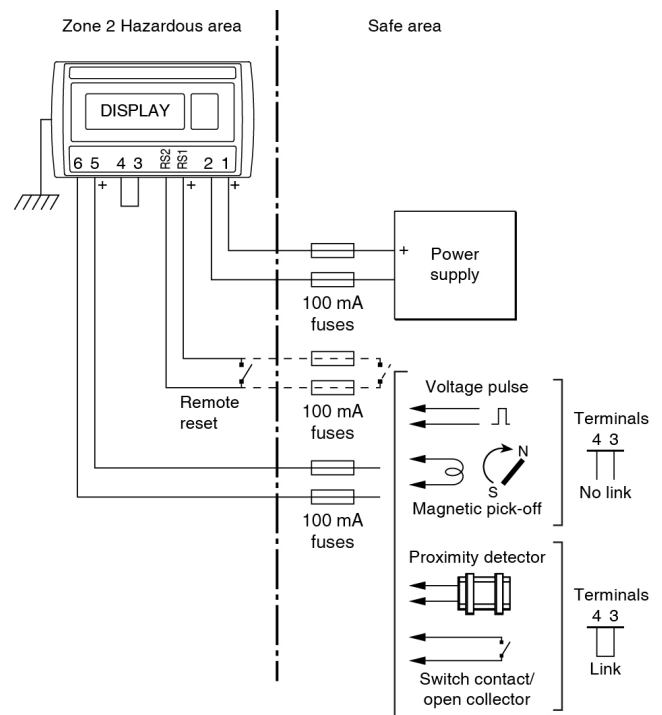


Fig 4 Connections for flowmeter sensor in safe area

Providing the BA337NE Rate Totaliser is correctly installed in an Ex n panel enclosure located in Zone 2, the input terminals may be connected to a certified flowmeter sensor located in Zone 1 as shown in Fig 5. The flowmeter sensor should have Ex e or Ex d certification permitting installation in Zone 1. Intrinsically safe Ex i certified flowmeter sensors should not be used.

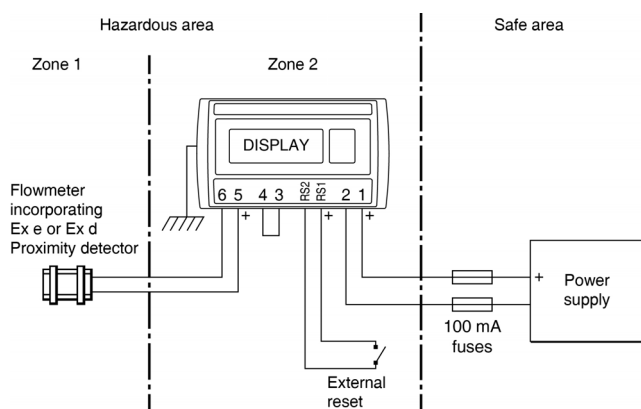


Fig 5 Connection to an Ex d or Ex e flowmeter in Zone 1

4.2.1 Input switching thresholds

For reliable totalisation the Rate Totaliser pulse input must fall below the lower threshold and rise above the upper thresholds shown in the following table.

Input transducer	Switching thresholds	
	Lower	Upper
Open collector	2k Ω	10k Ω
Voltage pulse low	1.0V	3.0V
Voltage pulse high	3.0V	10.0V
Magnetic pick-off	0mV	40mV peak
Proximity detector	1.2mA	2.1mA
Switch	100 Ω	1000 Ω

Flowmeters with a switch contact, proximity detector or an open collector output require energising which is achieved by linking Rate Totaliser terminals 3 & 4.

4.2.2 Switch contact input

Any flowmeter with a mechanically or magnetically activated switch contact located in Zone 2 or in the safe area may be directly connected to pulse input terminals 5 and 6 which are non incensive, providing the flowmeter and associated wiring can withstand a 500V rms insulation test to earth. Most magnetically activated reed relays used in turbine flowmeters comply with these requirements. The BA337NE contains a configurable debounce circuit to prevent contact bounce being counted. See section 6.7.

4.2.3 Open collector input

Flowmeters with an open collector output located in Zone 2 or in the safe area may be directly connected to input terminals 5 & 6 providing the flowmeter and associated wiring can withstand a 500V rms insulation test to earth.

The BA337NE contain a configurable debounce circuit to prevent false triggering. See section 6.7.

4.2.4 2-wire proximity detector input

Most Zone 2 certified flowmeters incorporating a NAMUR 2-wire proximity detector may be directly connected to a BA337NE input terminals 5 & 6 providing minimum operating voltage is greater than 7.5V. The flowmeter and the associated wiring should be able to withstand a 500V rms insulation test to earth.

The BA337NE contain a configurable debounce circuit to prevent false triggering. See section 6.7.

4.2.5 Magnetic pick-off input

Flowmeters incorporating a magnetic pick-off to sense flow will usually have a low level ac voltage output which a BA337NE Rate Totaliser can sense when configured for a Σ input. The Rate Totaliser input terminals 5 and 6 may be connected to any Zone 2 certified magnetic pick-off output flowmeter, providing the output in normal operation is equal to or less than 30V the Rate Totaliser's U_i . The flowmeter and associated wiring should be able to withstand a 500V rms insulation test to earth.

The BA337NE contain a configurable debounce circuit to prevent false triggering. See section 6.7.

4.2.6 Voltage pulse input



Two voltage pulse input ranges are selectable in the BA337NE Rate Totaliser configuration menu, $U_{0L}L5$ and $U_{0H}L5$. The Rate Totaliser input terminals 5 and 6 may be connected to any Zone 2 certified voltage pulse output flowmeter, providing the output in normal operation is equal to or less than 30V the Rate Totaliser's U_i . The flowmeter and associated wiring should be able to withstand a 500V rms insulation test to earth.

The BA337NE contain a configurable debounce circuit to prevent false triggering. See section 6.7.

4.3 Remote reset

The BA337NE Rate Totaliser's total display may be remotely reset to zero by connecting terminals RS1 and RS2 together. Permanent interconnection inhibits totalisation. Remote resetting may be accomplished by any mechanically operated switch located in Zone 2 as the Rate Totaliser's reset circuit is non incensive. The reset switch and the associated wiring should be able to withstand a 500V rms insulation test to earth.

A BA337NE may also be remotely reset from the safe area. Any switch may be used. Fig 4 illustrates how a BA337NE may be reset from both the safe and the hazardous area.

The BA337NE total display may also be reset when the  and  push buttons are operated simultaneously in the totalising mode i.e. when the instrument is displaying flow. See 6.19

5. INSTALLATION

5.1 Location

When installed in a panel enclosure complying with the requirements for Ex n protection as shown in section 3.2 of this manual, the BA337NE may be located in a Zone 2 hazardous area providing that the operating temperature is between -40°C and $+60^{\circ}\text{C}$ and the installation complies with the Rate Totalisers certification requirements. Certified Ex e panel enclosures are frequently used as Ex n panel enclosures.

The BA337NE Rate Totaliser has a stainless steel housings with a 7J front of panel impact resistance incorporating a 10mm thick toughened glass window which can withstand a 4J impact. This, together with a captive silicone gasket which seals the joint between the instrument and the panel, enclosure provides IP66 ingress protection. The BA337NE has IP20 rear protection.

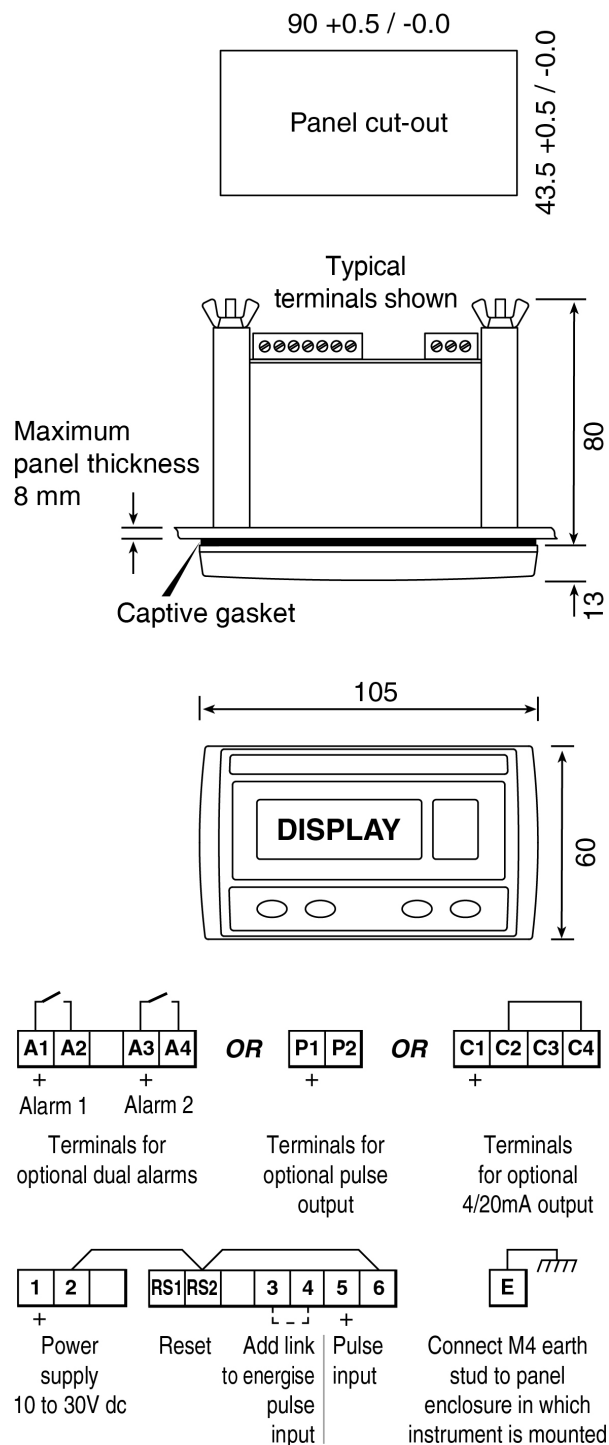
Although the front of the BA337NE Rate Totaliser has IP66 protection, it should be shielded from continuous direct sunlight and severe weather conditions.

Fig 6 shows the overall dimensions of the BA337NE together with the recommended panel enclosure cut-out dimensions.

5.2 Installation Procedure

- Cut the aperture specified in Fig 6 in the panel enclosure. Ensure that the edges of aperture are de-burred.
- Inspect the Rate Totaliser's captive gasket and ensure that it is not damaged before inserting it into the panel enclosure aperture.
- If the enclosure panel is less than 1.0mm thick, or is non-metallic, an optional BEKA stainless steel support plate should be slid over the rear of the indicator before the panel clamps are fitted to evenly distribute the clamping force and prevent the enclosure panel being distorted or creeping.
- Slide a panel clamp into the two grooves at each corner of the indicator housing with the M3 stud protruding through the hole at the rear of the clamp. Fit the stainless steel spring washer over the stud and secure with the stainless steel wing nut.
- Evenly tighten the four clamps to secure the instrument. The recommended minimum tightening torque for each wing nut is 22cNm (1.95 lbf in).
- Connect the panel enclosure wiring to the rear terminal blocks. To simplify installation, the terminals are removable so that wiring can be completed before the instrument is installed. Wiring should be supported to prevent damage resulting from vibration.

- Finally, fit a silicone rubber push-on cap to the end of each M3 threaded rod.



Support panel wiring to prevent vibration damage

Note: Optional backlight is internally powered

Fig 6 BA337NE dimensions and terminals

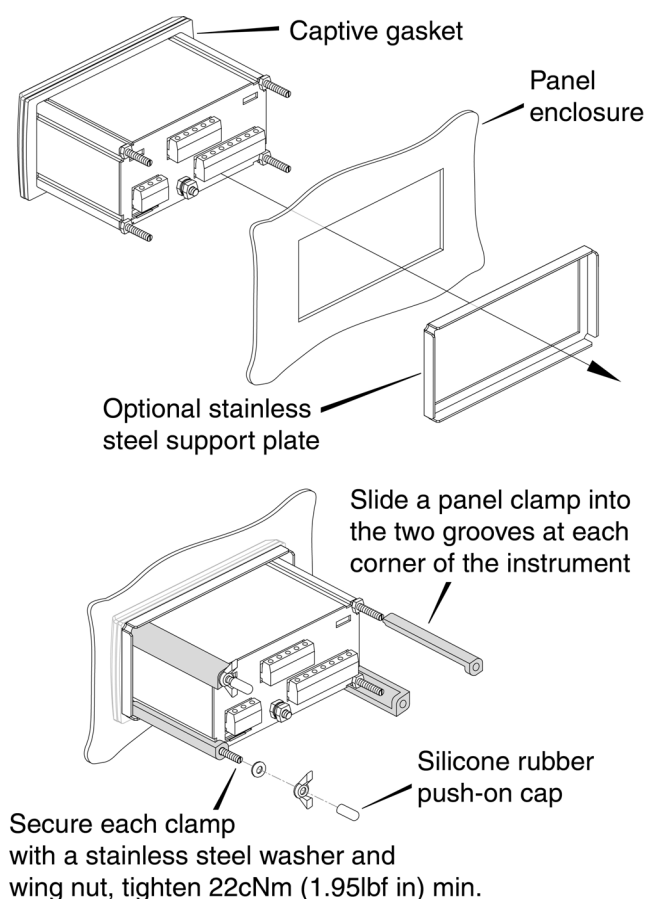


Fig 7 Installation procedure

5.3 Rate totaliser earthing

The BA337NE has an M4 earth stud on the rear panel which should be electrically connected to the panel enclosure in which the Rate Totaliser is mounted, or to the plant equipotential conductor.

5.4 EMC

The BA337NE complies with the requirements of the European EMC Directive 2014/30/EU. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed in the safe area.

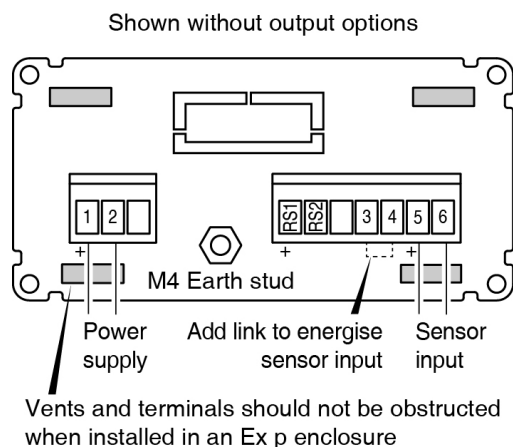


Fig 8 Rear terminals

5.5 Scale card

The Rate Totaliser's units of measurement are shown on a printed scale card in a window at the right hand side of the display. The scale card is mounted on a flexible strip that is inserted into a slot at the rear of the instrument as shown in Fig 9. Thus the scale card can easily be changed without dismantling the indicator or removing it from the Ex n enclosure in which it is mounted.

New Rate Totalisers are supplied with a printed scale card showing the requested units of measurement, if this information is not supplied when the instrument is ordered a blank card will be fitted.

A pack of self-adhesive scale cards printed with common units of measurement is available as an accessory from BEKA associates. Custom printed scale cards can also be supplied.

To change a scale card, unclip the protruding end of the flexible strip by gently pushing it upwards and pulling it out of the enclosure. Peel the existing scale card from the flexible strip and replace it with a new printed card, which should be aligned as shown below. Do not fit a new scale card on top of an existing card.

Install the new scale card by gently pushing the flexible strip into the slot at the rear of the Rate Totaliser, when it reaches the internal end-stop secure it by pushing the end of the flexible strip downwards so that the tapered section is held by the Rate Totaliser rear panel.

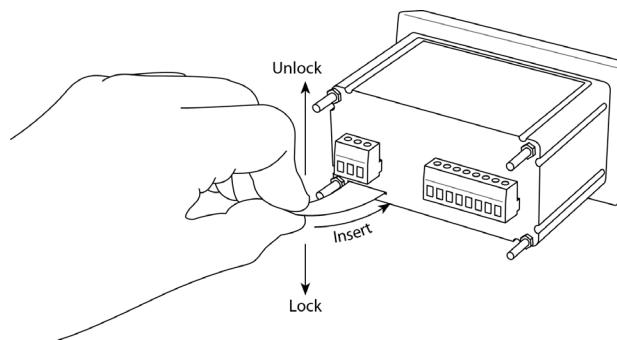
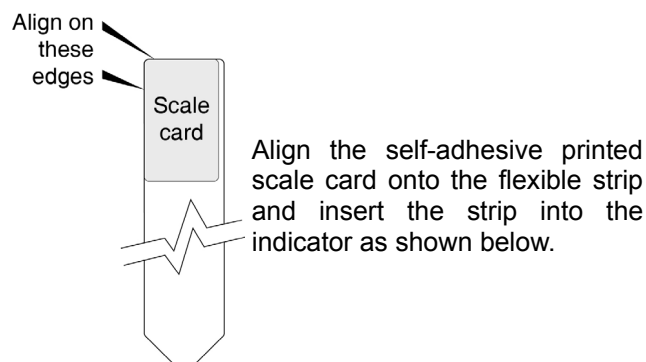


Fig 9 Inserting flexible strip carrying scale card into slot at the rear of indicator.

6.0 CONFIGURATION & CALIBRATION

The BA337NE Rate Totalisers is configured and calibrated via four front panel push buttons. All the configuration functions are contained in an easy to use intuitive menu that is shown diagrammatically in Fig 11.

Each menu function is summarised in section 6.3 of this manual and each summary includes a reference to more detailed information. The sixteen segment lineariser is described separately in section 7.

Configuration of the optional isolated pulse output, optional alarms and the optional 4/20mA output are described separately in section 10. When fitted they appear as additional functions within the configuration menu.

All new Rate Totalisers are supplied calibrated as requested at the time of ordering. If calibration is not requested, Rate Totalisers will have default configuration as shown in the following table, but can easily be re-configured on-site.

Function	Display	Default
Access code	Code	0000
Function	Function	Std
Input	Input type	oP.CoL
Debounce	deBounCE	dEFRAULt
Update	uPdARE	0.5
Upper display	diSP-1	Rate
Lower display	diSP-2	Total
Decimal point	dP	00
K Factor	FRctOr	1.0
Total scale factor	SCALE-t	1.0
Rate scale factor	SCALE-r	1.0
Timebase	t-bRSE	SEC
Filter	FLtEr	24
Clip-off	CLP-oFF	0
Local total reset	t-rESEt	oFF
Local grand total reset	Gt-rESEt	oFF
Security code	Code	0000

Note: While the instrument is being configured totalisation continues so that any flow occurring during this time is recorded.

6.1 Calibration structure

Fig 10 shows the BA337NE calibration structure. The rate and total display calibrations are independent which allows the displays to have different engineering units.

The rate totaliser pulse input is divided by $FRctOr$ which is usually set to the K-factor of the flowmeter, thus converting the flowmeter output into engineering units. When the 16 segment lineariser Lin is selected in the Function sub-menu, up to 16 values for $FRctOr$ may be entered each at a specified input pulse frequency to compensate for flowmeter nonlinearity. See section 7.

$SCALE-r$ is a dividing factor that converts the output from $FRctOr$ into the required rate display in engineering units. e.g. if the output from $FRctOr$ is one pulse per litre and the rate display is required in gallons, $SCALE-r$ should be set to 4.546 l which is the number of litres in an imperial gallon.

The timebase $t-bRSE$ is a multiplying factor that determines if the instrument displays flow per second, per minute or per hour.

The total flow display is independent of the rate display. $SCALE-t$ is a dividing factor that converts the output from $FRctOr$ into the required total display engineering units. e.g. if the output from $FRctOr$ is one pulse per litre and the total display is required in thousands of gallons, $SCALE-t$ should be set to 4 546 l which is the number of litres in 1,000 imperial gallons.

The BA337NE uses 'real' decimal points. Moving the position of a decimal point in a scale factor will affect the instrument calibration.

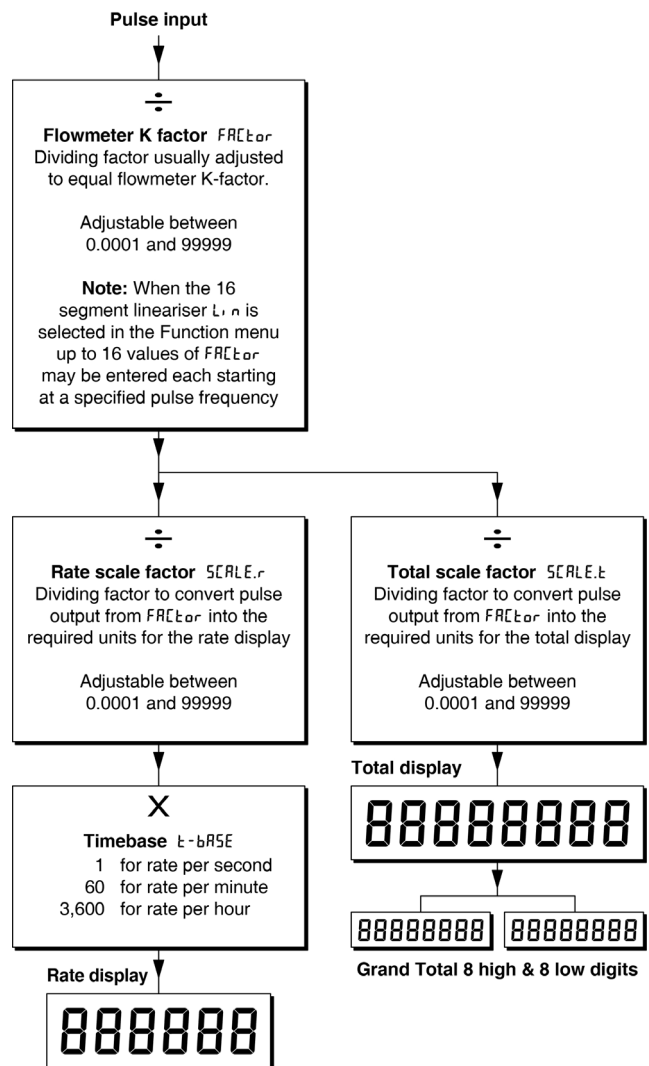





















Fig 10 Calibration structure



6.2 Accessing configuration functions

Throughout this manual push buttons are shown as , ,  and  and legends displayed by the instrument are shown in a seven segment font exactly as they appear on the instrument display e.g.  and .

Access to the configuration menu is obtained by operating the  and  push buttons simultaneously. If the instrument is not protected by a security code the first parameter  will be displayed. If a security code other than the default code  has already been entered, the instrument will display . Press  to clear this prompt and enter the security code for the instrument using the  or  push button to adjust each digit, and the  push button to transfer control to the next digit. If the correct code has been entered pressing  will cause the first parameter  to be displayed. If an incorrect code is entered, or a push button is not operated within ten seconds, the instrument will automatically return to the totalisation mode.



















All configuration functions and prompts are shown on the upper eight digit display.

Once within the main configuration menu the required parameter can be selected by scrolling through the menu using the  or  push button. The configuration menu is shown diagrammatically in Fig 11.

When returning to the totalisation mode following reconfiguration, the Rate Totaliser will display  followed by  while the new information is stored in permanent memory.

6.3 Summary of configuration functions

This section summarises all the configuration functions. When read in conjunction with Fig 11 it provides a quick aid for configuring the Rate Totaliser. If more detail is required, each section contains a reference to a full description of the function.

Display	Summary of function
	Rate Totaliser function Defines the relationship between the pulse input and the Rate Totaliser display. May be set to:  Standard linear relationship  16 segment adjustable lineariser - see section 7. See section 6.4
	Input Contains sub-menu with two functions  Select Input type  Set debounce See section 6.5
	 Configures the Rate Totaliser to accept one of six types of input:  Open collector *  Voltage pulse <1 >3V  Voltage pulse <3 >10V  Magnetic pick-off  Proximity detector *  Switch contact * * Link terminals 3 & 4 See section 6.6
	 Defines level of input debounce applied to the pulse input to prevent false counting:    See section 6.7
	Display update interval Define the interval between display updates between 0.5 and 5 seconds. See section 6.8

Display	Summary of function	Display	Summary of function
d, SP-1	Upper display Defines whether <i>rate</i> or <i>total</i> is shown on the upper display. The other variable will be shown on the lower display, providing the lower display is on in function <i>d, SP-2</i> . See section 6.9	SCALE-r	Rate scale factor SCALE-r is a dividing factor that converts the pulse output from FRCtor into the required rate display in engineering units. e.g. if the output from FRCtor is one pulse per litre and the rate display is required in gallons, SCALE-r should be set to 4.546 l which is the number of litres in an imperial gallon. SCALE-r may be adjusted between 0.0001 and 99999. The flow rate display is independent of the total flow display. See section 6.14
d, SP-2	Lower display Turns the lower display, which normally shows rate, on or off. See section 6.10		
dP	Decimal points Defines the position of the decimal point in both the rate and total displays. See section 6.11	tb-BASE	Timebase Selectable multiplier allowing flow rate to be displayed in units per second, per minute or per hour. Select: tb-01 for flow / second tb-60 for flow / minute tb-3600 for flow / hour See section 6.15
FRCtor	Flowmeter K-factor The rate totaliser pulse input is divided by FRCtor, which is usually set to the K-factor of the flowmeter, thus converting the flowmeter output into engineering units. FRCtor may be adjusted between 0.0001 and 99999. When the 16 segment lineariser Lin is selected in the Function sub-menu, up to 16 values for FRCtor may be entered, each at a specified input pulse frequency to compensate for flowmeter non-linearity. See section 6.12		
SCALE-t	Total Scale Factor SCALE-t is a dividing factor that converts the pulse output from FRCtor into the required total display in engineering units. e.g. if the output from FRCtor is one pulse per litre and the total display is required in thousands of gallons, SCALE-t should be set to 4546.1 which is the number of litres in 1,000 imperial gallons. SCALE-t may be adjusted between 0.0001 and 99999. The total flow display is independent of the rate display. See section 6.13	FLTER	Display filter An adjustable digital filter to reduce noise on the rate display is controlled by two parameters each adjustable between 0 and 9. The first digit defines the amount of filtering applied to the display, the second deviation from the displayed rate at which the filter will be overridden and the rate display will move rapidly to the new value. See section 6.16
		CLP-off	Clip-off To prevent totalisation of very low flow rates, clip-off enables the user to select a flow rate display below which totalisation is inhibited. See section 6.17

Display	Summary of function	Display	Summary of function
LoL Lr	<p>Local reset Contains sub-menu with two functions enabling total and grand total to be reset to zero via the front panel push buttons when the Rate Totaliser is in the totalisation mode. See section 6.18</p> <p>Local total reset Lr tot When on is selected total display is reset when ▼ and ▲ buttons are operated simultaneously for more than 3 seconds in the operating mode. See section 6.19</p> <p>Local grand total reset Lr Gtot When on is selected the grand total is reset when E + ▲ buttons are operated simultaneously for more than 10 seconds in the operating mode. Note: Once reset, the grand total can not be restored. See section 6.20</p>	<p>Lr-Gtot</p>	<p>Reset grand total from configuration menu. This function resets the grand total to zero from within the configuration menu when Lr GE5 is selected, and SurE is entered to confirm the instruction. Note: Once reset, the grand total can not be recovered. See section 6.21</p>
		LodE	<p>Security code Defines a four digit alphanumeric code which must be entered to gain access to the configuration menu. Default code 0000 disables the security function and allows unrestricted access to all configuration functions. See section 6.22</p>
		rSEt dEF	<p>Reset to factory defaults Returns the Rate Totaliser configuration functions to the factory default shown in section 6. To prevent accidental use the request must be confirmed by entering SurE before the reset will be executed. See section 6.23</p>

6.4 Rate Totaliser function: **Funct, on**

The Rate Totaliser contains an adjustable sixteen segment lineariser which may be used to compensate for flowmeter non-linearity. This function turns the lineariser on or off.

Std	Lineariser not activated
Lin	Lineariser activated

To reveal the existing Rate Totaliser function select **Funct, on** from the configuration menu and press **[P]**. If the function is set as required, press **[E]** to return to the configuration menu, or press the **[V]** or **[A]** button to change the setting, followed by the **[E]** button to return to the **Funct, on** prompt in the configuration menu.

Std Linear

Provides a linear relationship between the pulse input and the Rate Totaliser displays.

Lin 16 segment adjustable lineariser

Enables a sixteen segment adjustable lineariser. When **Lin** is selected the **Func, on** function is expanded to allow up to 16 values to be entered for different input pulse frequencies. Detailed information about the lineariser including configuration is contained in section 7 of this instruction manual.

6.5 Input: **Input**

The Input function contains two sub-functions **Input Type** and **Debounce** which configure the Rate Totaliser input and input noise rejection.

6.6 Input type: **Input Type**

Input Type is a sub-menu in the **Input** function which defines the type of flowmeter or input pulse that the Rate Totaliser will count. To check or change the type of input, select **Input** in the main configuration menu and press **[P]** which will reveal the **Input Type** prompt, pressing **[P]** again will show the Rate Totaliser input. If set as required press **[E]** twice to return to the configuration menu, or repeatedly press the **[V]** or **[A]** button until the required type of input is displayed, then press **[E]** twice to return to the configuration menu.

One of following six types of input may be selected:

		Switching thresholds	
		Low	High
Open Col	Open collector ²	2	10kΩ
Voltage pulse low	Voltage pulse low ¹	1	3V
Voltage pulse high	Voltage pulse high ¹	3	10V
Magnetic pick-off	Magnetic pick-off ¹	0	40mV
Proximity detector	Proximity detector ²	1.2	2.1mA
Switch contact	Switch contact ²	100	1000Ω

Notes:

1. Maximum voltage input +30V.
2. For flowmeter transducers that require energising i.e. proximity detectors, switch contacts or open collectors, terminals 3 & 4 of the Rate Totaliser should be linked together.
3. To count correctly, the input pulse must fall below the lower switching threshold and rise above the higher switching threshold.
4. See section 6.7 for maximum counting frequency.

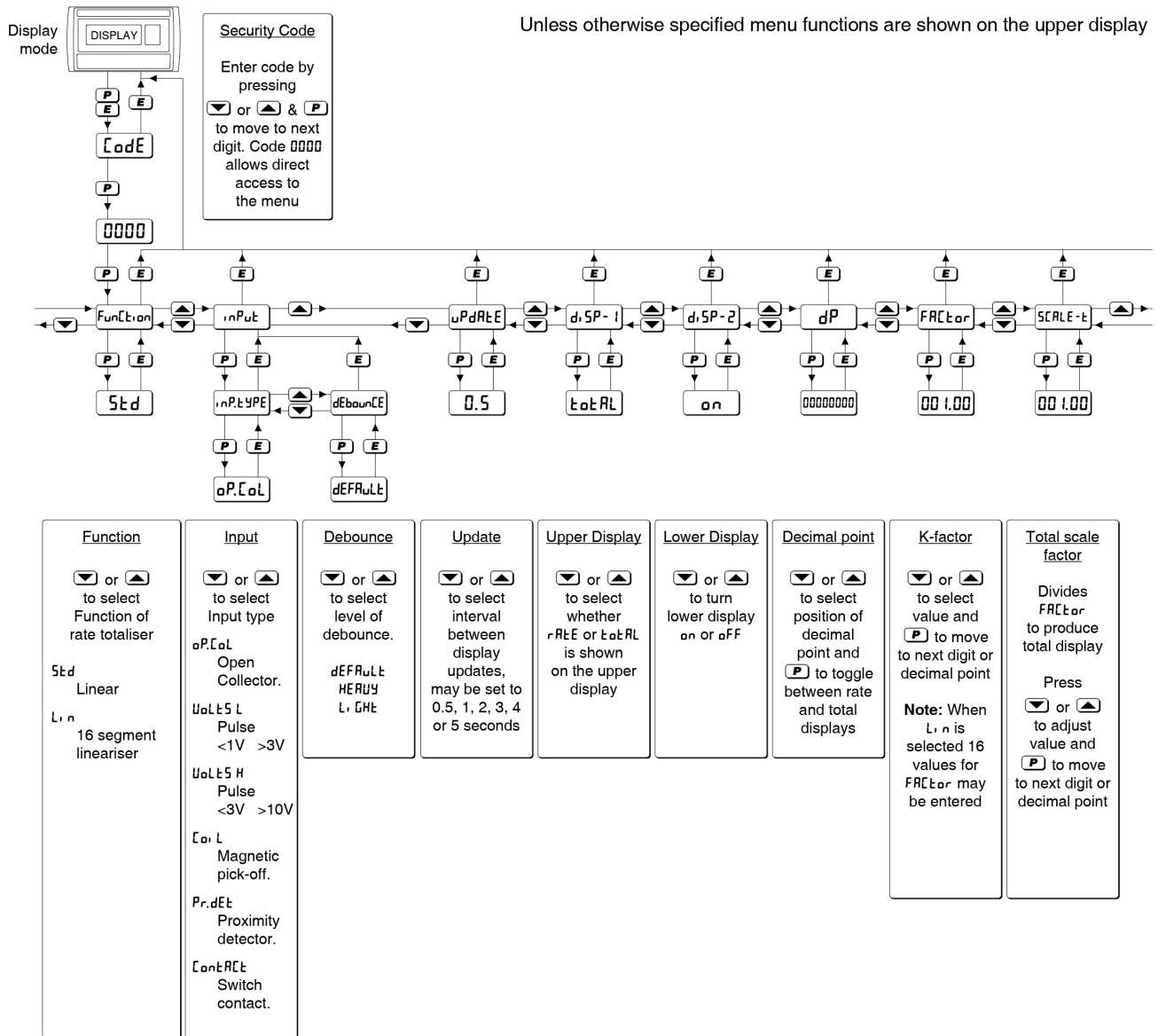
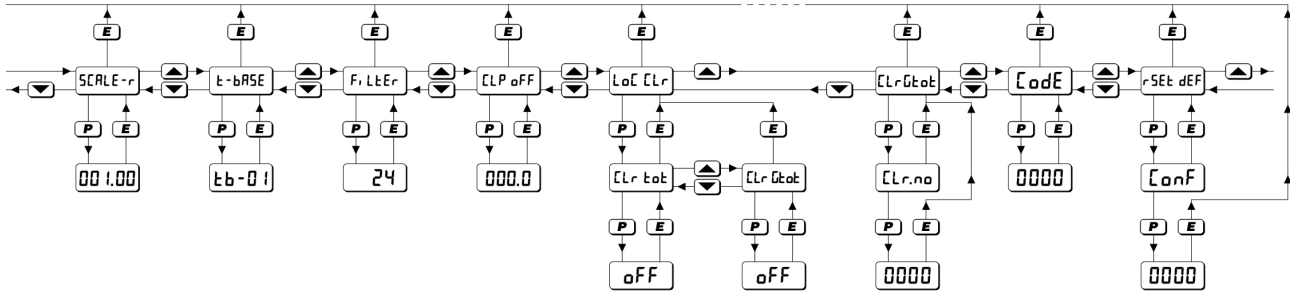


Fig 11 Configuration menu

When fitted optional alarms,
pulse output and 4/20mA
output functions appear here.



<p>Rate scale factor</p> <p>Divides FRAc to produce rate display</p> <p>Press <input type="button" value="▼"/> or <input type="button" value="▲"/> to adjust value and <input type="button" value="P"/> to move to next digit or decimal point</p>	<p>Timebase</p> <p><input type="button" value="▼"/> or <input type="button" value="▲"/> to select rate display timebase</p> <p>t-b-01 for flow/sec</p> <p>t-b-60 for flow/min</p> <p>t-b-3600 for flow/hour</p>	<p>Filter</p> <p><input type="button" value="▼"/> or <input type="button" value="▲"/> to adjust value of each digit and <input type="button" value="P"/> to transfer control to other digit</p> <p>First digit: filter magnitude</p> <p>second digit: step response</p> <p>Note: While making adjustments the filtered rate display is shown on lower display so stability can be assessed</p>	<p>Clip off</p> <p>Rate display below which totalisation is inhibited</p> <p>Press <input type="button" value="▼"/> or <input type="button" value="▲"/> to adjust value of each digit and <input type="button" value="P"/> to move to next digit</p>	<p>Local total reset</p> <p><input type="button" value="▼"/> or <input type="button" value="▲"/> to turn the local total reset function on or aFF. When on, total display is reset to zero when <input type="button" value="▼"/> and <input type="button" value="▲"/> are operated simultaneously in display mode for more than 3 seconds</p>	<p>Local grand total reset</p> <p><input type="button" value="▼"/> or <input type="button" value="▲"/> to turn the local grand total reset function on or aFF. When on, grand total display may be reset to zero when <input type="button" value="E"/> and <input type="button" value="▲"/> are operated simultaneously in display mode for more than 10 seconds</p>	<p>Clear grand total</p> <p>Press <input type="button" value="▼"/> or <input type="button" value="▲"/> to select YES to reset grand total to zero</p> <p>Confirm instruction by entering SurE. Press <input type="button" value="▼"/> or <input type="button" value="▲"/> to adjust each digit and <input type="button" value="P"/> to move to next digit</p>	<p>Define Security Code</p> <p>Enter by pressing <input type="button" value="▼"/> or <input type="button" value="▲"/> and <input type="button" value="P"/> to move to next digit</p>	<p>Reset configuration to factory defaults</p> <p>Confirm instruction by entering SurE. Press <input type="button" value="▼"/> or <input type="button" value="▲"/> to adjust each digit and <input type="button" value="P"/> to move to next digit</p>
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6.7 Debounce: dE_{bounCE}

dE_{bounCE} is an adjustable sub-menu in the Rate function which prevents the Rate Totaliser miscounting when the input pulse has noisy edges, such as those resulting from a mechanical contact closing and bouncing. Three levels of protection may be selected and the amount of debounce applied depends upon the type of Rate Totaliser input that has been selected in the RateType function.

The following table shows the minimum time that the input pulse must be continuously above the upper input switching threshold and continuously below the lower switching threshold to ensure that the Rate Totaliser processes the input pulse. Input switching thresholds are shown in section 4.2.1.

De-bounce level	Min input pulse width	
	Type of Input	
	Contact	All others
Default	1600 μ s	40 μ s
Heavy	3200 μ s	350 μ s
Light	400 μ s	5 μ s

The Rate Totaliser's maximum counting frequency depends upon the debounce level selected, the shape of the input pulse and its amplitude. The following table assumes a square wave input and is only for guidance. The maximum counting frequency will be lower if the input pulses have sloping edges and the pulse amplitude only slightly exceeds the input switching thresholds.

ONLY FOR GUIDANCE		
De-bounce level	Max counting frequency	
	Type of input	
	Contact	All others
Default	250Hz	12kHz
Heavy	120Hz	2kHz
Light	1000Hz	100kHz

The minimum input frequency is 0.01Hz. Below this frequency the rate display will be forced to zero.

The dE_{bounCE} function is a sub-menu located in the Rate function. Select Rate in the configuration menu and press P which will reveal the RateType prompt, press the \downarrow or \uparrow button to select dE_{bounCE} followed by P to reveal the existing setting. Pressing the \downarrow or \uparrow button will scroll through the three levels. When the required level has been selected, pressing E twice will enter the selection and return the display to the Rate prompt in the configuration menu.

6.8 Display update interval: Rate

If either the rate or the total display is likely to change rapidly, a longer interval between display updates may simplify reading the Rate Totaliser display. This function allows one of six different display intervals between 0.5 and 5 seconds to be selected. The selected display update interval does not affect the update time of any other instrument function.

To adjust the update interval select Rate from the configuration menu and press P to reveal the existing time. Pressing the \downarrow or \uparrow button will scroll through the six times. When the required interval has been selected press E to enter the selection and return to the configuration menu.

6.9 Upper display: d_{5P-1}

Usually total flow is shown on the larger upper eight digit display, but this function allows rate to be shown on the upper display and total on the smaller lower display which can show six positive digits.

To check the status of the upper display, select d_{5P-1} from the configuration menu and press P which will reveal if the display is showing Rate or Total . The setting can be changed by pressing the \downarrow or \uparrow button followed by the E button to enter the selection and return to the configuration menu.

6.10 Lower display: d_{5P-2}

This function turns the lower display *on* or *off*. When turned *off* the BA337NE will only have one eight digit display which may be configured in the d_{5P-1} function to show total flow or rate of flow.

To check the status of the lower display, select d_{5P-2} from the configuration menu and press P to reveal if the lower display is *on* or *off*. The setting may be changed by pressing the \downarrow or \uparrow button followed by the E button to enter the selection and return to the configuration menu.

6.11 Position of the decimal points: dP

The upper and lower displays have eight and six digits respectively. This function enables the position of the decimal point on both displays to be independently positioned.

To adjust the position of the decimal points select dP from the configuration menu and press $[P]$. The upper display defined as the rate or total display by function $d, SP-1$ (section 6.9) will be activated and identified by the display annunciator as Rate or Total. The decimal point is positioned by operating the \blacktriangledown or \blacktriangle push button.

In the total display the \blacktriangledown button moves the position of the decimal point to the left and the \blacktriangle button moves it to the right. It may be positioned between any of the 8 hand digits or absent by moving it to the right of the least significant digit.

When the decimal point in the upper display has been positioned pressing the $[P]$ button will transfer control to the lower display variable, but it will be shown and annunciated on the larger upper display. The position of the decimal point may be positioned in the same way between any of the five right hand digits or absent by operating the \blacktriangledown or \blacktriangle push buttons. When set as required enter the settings and return to the configuration menu by operating the $[E]$ button.

6.12 Flowmeter K-factor: $FACtor$

The rate totaliser pulse input is divided by $FACtor$, which is adjustable between 0.0001 and 99999, for flow applications $FACtor$ should be set to the K-factor of the flowmeter. K-factor is the number of pulses that the flowmeter produces per unit volume of flow e.g. 20 pulses per litre, $FACtor$ therefore converts the flowmeter output into engineering units ready for further scaling to produce the required rate and total flow displays. See Fig 10.

When the 16 segment lineariser L, n is selected in $Funct, on$ up to 16 values of $FACtor$ may be entered, each at a specified input pulse frequency to compensate for flowmeter non-linearity. See section 7 of this manual.

To check or change the value select $FACtor$ from the configuration menu and press $[P]$ which will reveal the existing value with one digit flashing.

The flashing digit may be adjusted by pressing the \blacktriangledown or \blacktriangle button. When this digit has been adjusted pressing $[P]$ will transfer control to the next digit. When all the digits have been adjusted pressing $[P]$ will transfer control to the decimal point that may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When set as required, press $[E]$ to return to the $FACtor$ prompt in the configuration menu.

6.13 Total scale factor: $SCALE.t$

$SCALE.t$ is a dividing factor adjustable between 0.0001 and 99999 that enables total flow to be displayed in the required engineering units. e.g. if the output from $FACtor$ is one pulse per litre and the total display is required in thousands of gallons, $SCALE.t$ should be set to 4546.1 which is the number of litres in 1,000 imperial gallons. The total flow display is independent of the rate display.

To check or change the total scale factor select $SCALE.t$ from the configuration menu and press $[P]$ which will reveal the existing value with one digit flashing. The value of the flashing digit may be changed by pressing the \blacktriangledown or \blacktriangle button. When this digit has been adjusted as required, pressing $[P]$ will transfer control to the next digit. When all the digits have been adjusted pressing $[P]$ will transfer control to the decimal point that may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When the required total scale factor has been entered, press $[E]$ to return to the $SCALE.t$ prompt in the configuration menu.

6.14 Rate scale factor: $SCALE.r$

$SCALE.r$ is a dividing factor adjustable between 0.0001 and 99999 that enables the flow rate to be displayed in the required engineering units. e.g. if the output from $FACtor$ is one pulse per litre and the rate display is required in gallons, $SCALE.r$ should be set to 4.5461 which is the number of litres in an imperial gallon.

The units of the rate display are volume per unit of time. The unit of time is the timebase of the instrument which is determined by $t-base$ described in section 6.15.

To check or change the rate scale factor select $SCALE.r$ from the configuration menu and press $[P]$ which will reveal the existing value with one digit flashing. The value of the flashing digit may be changed by pressing the \blacktriangledown or \blacktriangle button. When this digit has been adjusted as required, pressing $[P]$ will transfer control to the next digit. When all the digits have been adjusted pressing $[P]$ will transfer control to the decimal point which may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When the required rate scale factor has been entered, press $[E]$ to return to the $SCALE.r$ prompt in the configuration menu.

6.15 Timebase: t-bR5E

The timebase multiplies the rate display by 1, 60 or 3,600 depending upon whether the Rate Totaliser is required to display rate per second, per minute or per hour. See Fig 10.

To check or change the timebase, select t-bR5E from the configuration menu and press P which will reveal the existing setting. Pressing the V or A button will scroll through the three options:

t-b-1	for flow / second
t-b-60	for flow / minute
t-b-3600	for flow / hour

When the required multiplier is displayed press E to return to the t-bR5E prompt in the configuration menu.

6.16 Display filter: F, LLEr

The digital display filter has two independent adjustable parameters enabling the rate display response to be tailored for optimum performance. The filter parameters are controlled by a two digit number. The first digit defines the amount of filtering applied to the display as shown below.

First digit	Filter time constant seconds
0X	0
1X	1.3
2X	4.3
3X	6.5
4X	8.7
5X	11.3
6X	15.7
7X	20.9
8X	25.2
9X	31.5

The second digit defines the deviation from the displayed rate at which the filter will be overridden and the rate display will move rapidly to the new value.

Second digit	Magnitude of step change which will produce a rapid response
X0	off
X1	1%
X2	2%
X3	4%
X4	8%
X5	12%
X6	16%
X7	24%
X8	32%
X9	64%

By careful adjustment of the two parameters a stable display with an acceptable input step response can be obtained for most applications.

During commissioning it is recommended that initially the second digit is set to 0 (off) and the first digit is adjusted to provide acceptable rate display stability. The second digit should then be increased until the selected step size is greater than the noise on the display signal, at which setting the rate display will become stable. These will be the optimum filter parameters for acceptable rate display stability and a fast response to a large rate signal change.

To check or change the filter select F, LLEr in the configuration menu and press P which will reveal the existing settings with the first digit flashing. Pressing the V or A button will change the flashing digit and P will transfer control to the second digit. While making adjustments the filtered rate display is shown on the lower display so that stability can be assessed while adjustments are being made. When set as required, press the E button to enter the revised parameters and return to the F, LLEr prompt in the configuration menu.

6.17 Clip-off: CLP oFF

To prevent totalisation of very low flow rates that over long periods may result in significant totalisation errors, the BA337NE may be configured to stop totalising when the flow rate falls below an adjustable threshold.

To check or change the clip-off threshold select CLP oFF from the configuration menu and press P which will reveal the current setting. The threshold is shown in the units already selected for the flow rate display. One digit will be flashing. The value of the flashing digit may be changed by pressing the V or A button. When this digit is correct pressing P will transfer control to the next digit. When clip-off is set as required, press the E button to enter the revised figure and return to the CLP oFF prompt in the configuration menu.

When the flow rate falls below the clip-off threshold, the rate display will show zero flow, totalisation will stop and the HOLD annunciator will be activated. The flow indicator will continue to rotate for 2 seconds each time an input pulse is received i.e. at input pulse frequencies above 0.5Hz it will appear to rotate continuously.

Note:

To avoid confusion, when the K-factor FRLEor , rate scale factor SCrLE.r , timebase t-bR5E , or the position of the rate display decimal point are changed, clip-off will automatically be reset to zero. A new clip-off threshold must therefore be entered after any of these functions have been adjusted.

6.18 Local reset: LoC CLR

The Local reset function contains two sub-functions CLR tot and CLR Gtot which when enabled allow the total display and grand total to be reset to zero via the instrument push buttons while the Rate Totaliser is in the totalisation mode.

6.19 Local total reset: CLR tot

CLR tot is a sub-menu in the LoC CLR function which when activated allows an operator to reset the total display to zero while in the totalisation mode by operating the \blacktriangledown and \blacktriangle push buttons simultaneously for more than three seconds.

Select LoC CLR in the configuration menu and press P which will reveal the CLR tot prompt, press P again which will show if the local total reset is on or off . If set as required operate the E button twice to return to the configuration menu, or the \blacktriangledown or \blacktriangle button to change the setting followed by the E button twice to enter the change and return to the LoC CLR prompt in the configuration menu.

Note:

The total display may also be reset to zero remotely by connecting terminals RS1 and RS2 together for more than one second. See sections 3.6 and 4.3 of this manual.

6.20 Local grand total reset: CLR Gtot

The grand total is a separate sixteen digit counter which is incremented in parallel with the total display, but is not zeroed when the total display is reset to zero. The grand total may be viewed in the totalisation mode in two eight digit sections as described in section 2.2 of this manual.

CLR Gtot is a sub-menu in the LoC CLR function which when activated allows the operator to reset the grand total display to zero in the totalisation mode by operating the E and \blacktriangle push buttons simultaneously for more than ten seconds.

Select LoC CLR in the configuration menu and press P which will reveal CLR tot . Using the \blacktriangledown or \blacktriangle button to select CLR Gtot and press P which will show if local grand total reset is on or off . If set as required operate the E button twice to return to the configuration menu, or the \blacktriangledown or \blacktriangle button to change the setting followed by the E button twice to enter the change and return to the LoC CLR prompt in the configuration menu.

6.21 Grand total reset from configuration menu: CLR Gtot

The grand total is a separate sixteen digit counter which is incremented in parallel with the total display, but is not zeroed when the total display is reset to zero. The grand total may be viewed in the totalisation mode in two eight digit sections as described in section 2.2 of this manual.

The grand total can be reset to zero from within the configuration menu using this CLR Gtot function, or from the totalisation mode if sub-function CLR Gtot in the LoC CLR function is activated - see 6.20.

To zero the grand total from within the configuration menu select CLR Gtot and press P which will cause the instrument to display CLR . no with no flashing. Press the \blacktriangledown or \blacktriangle push button until CLR.9E5 is displayed and then press P which will result in a 0000 prompt being displayed with the first digit flashing. This is a request for the instruction to be confirmed by entering SurE using the \blacktriangledown or \blacktriangle buttons and the P button to move control to the next digit. Pressing E will then reset the grand total to zero and return the Rate Totaliser to the configuration menu.

Note:

Once reset, the grand total can not be recovered.

6.22 Security code: CodE

Access to the instrument configuration menu may be protected by a four digit security code which must be entered to gain access. New instruments are configured with the default security code 0000 which allows unrestricted access to all configuration functions.

To enter a new security code select CodE from the configuration menu and press P which will cause the Rate Totaliser to display 0000 with one digit flashing. The flashing digit may be adjusted using the \blacktriangledown or \blacktriangle push buttons, when set as required operating the P button will transfer control to the next digit. When all the digits have been adjusted press E to return to the CodE prompt. The revised security code will be activated when the Rate Totaliser is returned to the totalisation mode.

Please contact BEKA associates sales department if the security code is lost.

6.23 Reset configuration to factory defaults

r5Et dEF

This function resets the Rate Totaliser including the lineariser, to the factory default configurations which are shown in section 6.0

To reset the Rate Totaliser to the factory default configurations select **r5Et dEF** from the configuration menu and press **[P]** which will result in a **0000** display with the first digit flashing. This is a request to confirm the reset to factory default instruction by entering **5urE**. Using the **[▼]** or **[▲]** button set the flashing digit to 5 and press **[P]** to transfer control to the second digit which should be set to **u**. When **5urE** has been entered, pressing the **[E]** button will reset the BA337NE to the factory defaults and return the instrument to the totalising mode.

7. LINEARISER

The BA337NE Rate Totalisers can produce accurate results when used with a flowmeter having a K-factor that varies with the flow rate, such as a turbine meter used over a wide range of flows. The BA337NE includes a sixteen segment straight-line lineariser that may be adjusted to compensate for flowmeter non-linearity.

The lineariser is enabled by selecting **LIN** in the **FUNCTION** section of the configuration menu. The configuration menu shown in Fig 11 remains basically unchanged, except that up to 16 values of the flowmeter K-factor can be entered as **L-FRECTOR**, together with **PULSE Freq** the corresponding input frequency at which each starts.

Fig 13 shows how the Rate Totaliser configuration function **FRECTOR** is extended when the lineariser is activated by selecting **LIN** in the **FUNCTION** menu.

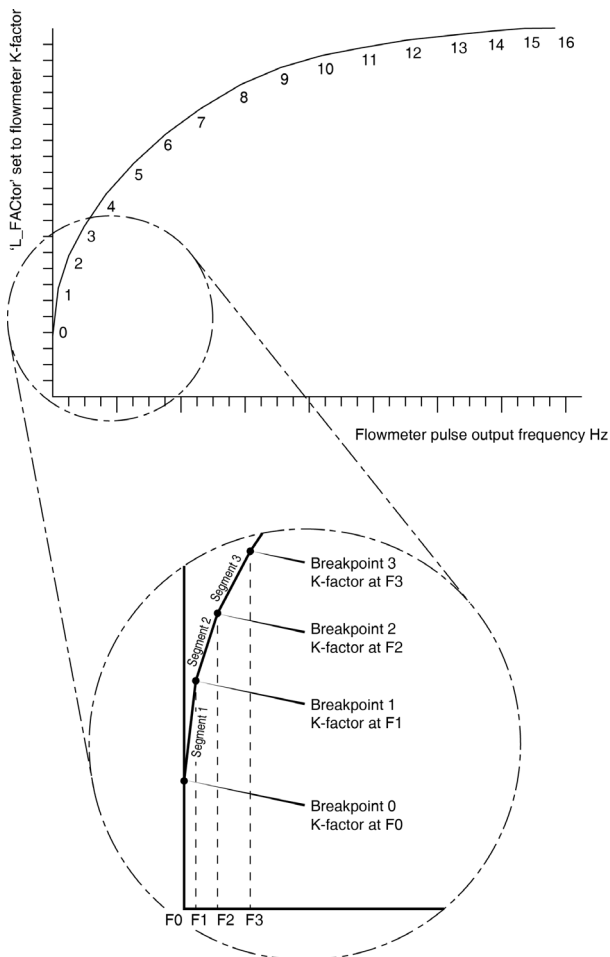


Fig 12 Typical linearising characteristic

The lineariser configuration is retained irrespective of how **FUNCTION** in the Rate Totaliser configuration menu is subsequently changed. It is therefore possible to select and deselect the lineariser without having to reconfigure it.

7.1 Flowmeter specification

Flowmeters are usually supplied with a calibration certificate specifying the average K-factor and the flow range over which it applies. For use over extended flow ranges and for non-linear devices, multiple K-factors will be specified, often in a table similar to the one shown below.

Flow Rate Litres/min	K-factor Pulses/litre
5	200
10	230
15	239
20	242

From this calibration certificate information the output frequency of the flowmeter, which is required for conditioning the Rate Totaliser lineariser, can be calculated.

$$\text{Output frequency Hz} = \frac{(\text{Flow rate per min}) \times (\text{K-factor})}{60}$$

Flow Rate Litres/min	K-factor Pulses/litre	Output frequency Hz
0	0	0
5	200	16.666
10	230	38.333
15	239	59.750
20	242	80.666

7.2 Summary of lineariser configuration Functions.

This section summarises the lineariser configuration functions. When read in conjunction with Fig 13 it provides a quick aid for configuring the lineariser. If more detail is required, each section contains a reference to a full description of the function.

The number of straight-line lineariser segments required should first be entered using the **ADD** and **DEL** functions. In both of these sub-functions the Rate Totaliser displays the current segment and the total number of segments being used as shown below.

5:13

current total number
breakpoint of breakpoints

Increasing the number of segments will provide a more accurate approximation of the flowmeter characteristic and increase totalisation accuracy.

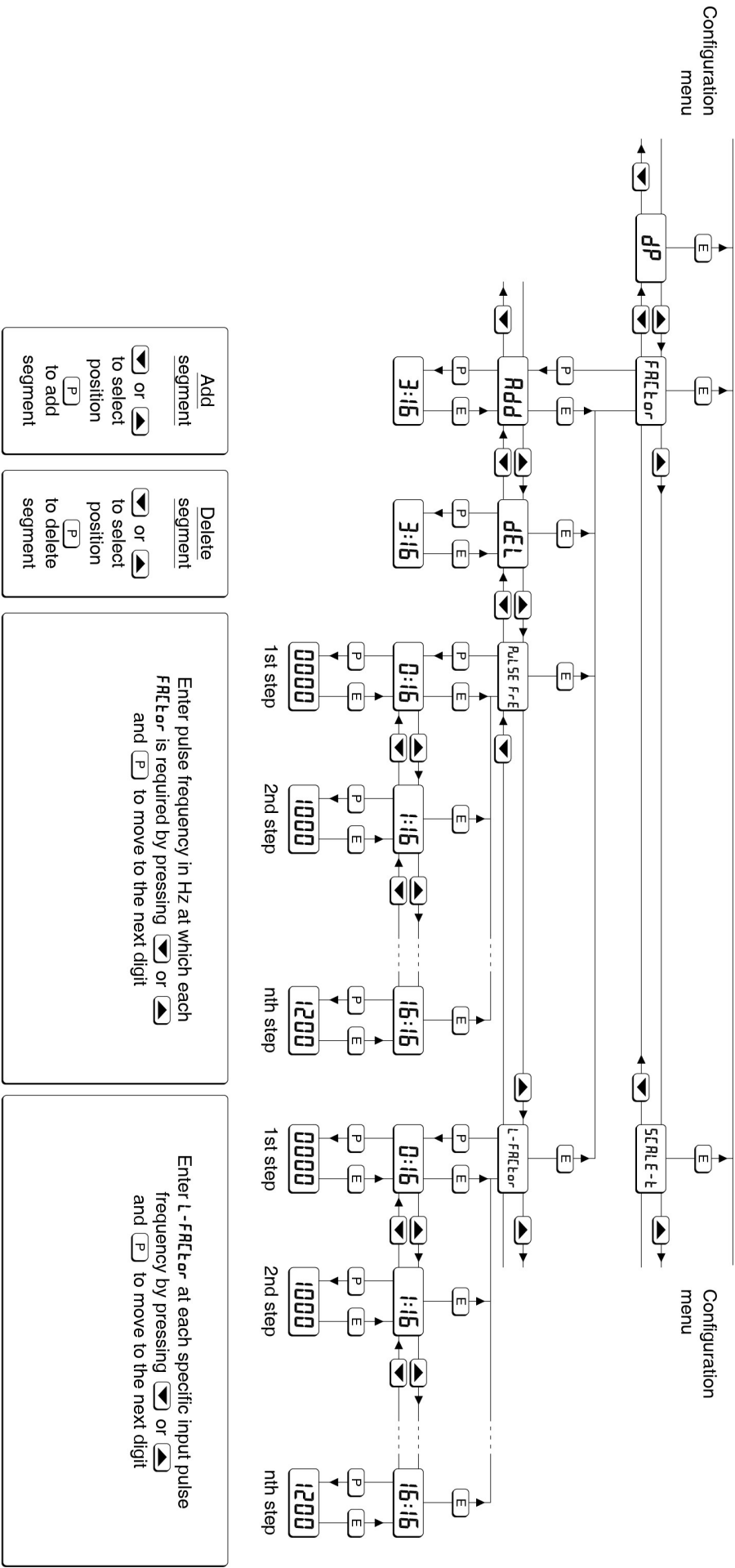


Fig 13 Lineariser configuration menu

For each segment an input pulse frequency in Hz *PuLSE Fr* and a corresponding flowmeter K-factor *L-FRActor* are required. See section 7.1

Lineariser factory defaults are shown below:

Break point	<i>PuLSEFrE</i>	<i>L-FRActor</i>
0.1	0Hz	1.00
1.1	5000Hz	1.00

Display Summary of function

Rdd

Add a segment

Adds a new segment before the displayed segment. The calibration of existing segments is not changed, but the identification number of all subsequent segments is increased by one.

See section 7.3

dEL

Remove a segment

Removes the displayed segment, the identification number of all subsequent segments is decreased by one.

See section 7.4

PuLSE Fr

Pulse input frequency

Defines the input frequency in Hz at which the selected lineariser segments starts.

See section 7.5

L-FRActor

Flowmeter K-factor

The rate totaliser pulse input is divided by *L-FRActor*, which is usually set to the K-factor of the flowmeter, thus converting the flowmeter output into engineering units. *L-FRActor* may be adjusted between 0.0001 and 99999.

Up to 16 values for *L-FRActor* may be entered, each starting at a specified input pulse frequency *PuLSE Fr*.

See section 7.6

7.3 Add a segment: *Rdd*

Rdd is a sub-menu in the *FRActor* function that enables a straight-line segment to be added to the lineariser at any point. Select *FRActor* in the configuration menu and press **[P]**, which will reveal one of four sub-functions. If *Rdd* is not displayed repeatedly press the **[V]** or **[A]** button to select *Rdd* followed by **[P]** which will cause the current segment and the total number of lineariser segments to be displayed as shown below:



current total number
breakpoint of breakpoints

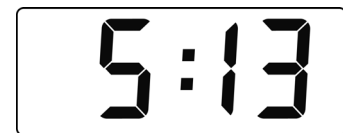
Each time the **[P]** push button is operated a segment will be added to the lineariser. If configuring the lineariser for the first time, repeatedly press **[P]** until the required total number of segments is shown on the right hand side of the display. Any number between 1 and 16 may be selected.

If adding an additional segment to an already configured lineariser, the insertion position, which is shown on the left hand side of the display, can be selected using the **[V]** or **[A]** push button. When inserting an additional segment, the identification numbers of all segments equal to and above the insertion point are increased by one.

Press **[E]** to return to the *Rdd* prompt in the *FRActor* sub-menu.



7.4 Remove a segment: *dEL*


dEL is a sub-menu in the *FRActor* function that enables any segment to be removed from the lineariser configuration. Select *FRActor* in the configuration menu and press **[P]**, which will reveal one of four sub-functions. If *dEL* is not displayed repeatedly press the **[V]** or **[A]** button to select *dEL* followed by **[P]** which will cause the current segment with the total number of segments to be displayed as shown below:



current total number
breakpoint of breakpoints





Each time the **[P]** push button is operated the current segment will be deleted from the lineariser. If configuring the lineariser for the first time, repeatedly press **[P]** until the total number of segments is reduced to the required number.

If removing a segment from a configured lineariser, the segment to be deleted, which is shown on the left hand side of the display, can be selected using the  or  push button. When a segment is deleted, the identification numbers of all segments above the deleted segment are decreased by one.

Press  to return to the *dEL* prompt in the lineariser sub-menu.










7.5 Input frequency: *PULSE Fr*


PULSE Fr is a sub-menu in the *FRCEtor* function for entering the pulse input frequency at which each of the lineariser segments starts, see Fig 12.

To enter the input pulse frequency at which one or more lineariser segments start, select *FRCEtor* in the configuration menu and press  which will reveal one of four sub-functions. If *PULSE Fr* is not displayed repeatedly press the  or  button to select *PULSE Fr* followed by  to display the current segment for which the start frequency will be entered and the total number of segments that have already been defined using the *Add* and *dEL* functions, see below.



current total number
breakpoint of breakpoints

The required segment, which is shown on the left hand side of the display, can be selected using the  or  push button. When selected press  which will reveal the current input frequency with one digit flashing. The value of the flashing digit may be changed by pressing the  or  button. When this digit is correct pressing  will transfer control to the next digit. When the input frequency for this lineariser segment is set as required, press the  button to return to the segment identification display from which the next segment may be selected using  or  push button.





When the input frequency for all of the segments has been entered, return to the *FRCEtor* prompt in the configuration menu by operating the  push button.



7.6 Flowmeter K-factors *L-FRCEtor*

L-FRCEtor is a sub-menu in the *FRCEtor* function for entering the flowmeter K-factor for each of the lineariser segments, see Fig 13.

The rate totaliser pulse input is divided by *L-FRCEtor*, which is adjustable between 0.0001 and 99999; for flow applications it should be set to the K-factor of the flowmeter.






K-factor is the number of pulses that the flowmeter produces per unit volume of flow e.g. 20 pulses per litre, *L-FRCEtor* therefore converts the flowmeter output into engineering units ready for further scaling to produce the required rate and total flow displays.





To enter the flowmeter K-factor for one or more segments, select *FRCEtor* in the configuration menu and press , which will reveal one of four sub-functions. If *L-FRCEtor* is not displayed in the sub-menu repeatedly press the  or  button to select *L-FRCEtor* followed by  to display the current segment for which *L-FRCEtor* will be entered and the total number of segments that have already been defined using the *Add* and *dEL* functions.

The required segment, which is shown on the left hand side of the display, can be selected using the  or  push button, see below.



current total number
breakpoint of breakpoints

When selected, press  which will reveal the current *L-FRCEtor* for the selected segment with one digit flashing. The value of the flashing digit may be changed by pressing the  or  button. When this digit has been adjusted as required, pressing  will transfer control to the next digit. When all the digits have been adjusted pressing  will transfer control to the decimal point that may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit.

When *L-FRCEtor* for this lineariser segment is set as required, press the  button to return to the segment identification display from which the next segment may be selected using  or  push button. When *L-FRCEtor* for all of the segments has been entered, return to the *FRCEtor* prompt in the configuration menu by operating the  push button twice.

7.7 Lineariser error message

If an attempt is made to position a segment at an input frequency which is not greater than the frequency of the preceding segment, or at an input frequency which is not less than the frequency of the following segment, the error message *VALUEErr* will be displayed.

8. CONFIGURATION EXAMPLE

In this example a BA337NE Rate Totaliser is connected to a turbine flowmeter having a K-factor of 105 pulses per litre with a magnetic pick-off.

The BA337NE is required to display rate of flow in imperial gallons per hour with a resolution of one gallon and total flow in cubic metres with a maximum total of 100000 and a resolution of 0.01 cubic metres. Linearisation is not required. Totalisation is to stop when the flow rate falls below 10 gallons per hour. The display is to be updated twice per second.

For this application the operator needs to reset the total display to zero from the totalisation mode, but should not be able to reset the grand total. To prevent tampering the instrument configuration menu is to be protected by security code of 1209

8.1 Configuration procedure

The BA337NE Rate Totaliser may be configured on-site without disconnection.

Step 1 Enter the configuration menu

Enter the configuration menu by simultaneously pressing **[P]** and **[E]**. Assuming a security code has not already been entered the instrument will respond by displaying *Funct, on* which is the first function in the configuration menu. See Fig 11.

Step 2 Select a linear function

With *Funct, on* displayed press **[P]** to reveal the function of the Rate Totaliser. Using the **[▼]** or **[▲]** button select *Std* to switch off the lineariser and provide a linear function. Press **[E]** to enter the selection. See 6.4

Step 3 Select the type of input & debounce

Using the **[▼]** or **[▲]** button select *Input* in the configuration menu and press **[P]** which will reveal the sub-menu. Again using the **[▼]** or **[▲]** button select *Input Type* and press **[P]** to reveal the existing input. The Rate Totaliser is required to work with a magnetic pick-off so using the **[▼]** or **[▲]** button select *Mag* followed by **[E]** to return to the *Input Type* prompt in the sub-menu.

Using the **[▼]** or **[▲]** button select *Debounce* from the sub-menu and press **[P]**. Using the **[▼]** or **[▲]** button select *Edge* which will provide moderate pulse edge noise protection. If the Rate Totaliser is subsequently found to miscount the noise rejection can be increased. Enter the selection and return to the *Input* prompt in the configuration menu by pressing the **[E]** button twice. See 6.6 and 6.7

Step 4 Select the interval between display updates

Using the **[▼]** or **[▲]** button select *Update* in the configuration menu and press **[P]** to reveal how frequently the Rate Totaliser display is updated. Using the **[▼]** or **[▲]** push button select *0.5* (0.5 seconds i.e. 2 display updates per second). Enter the selection and return to the *Update* prompt in the configuration menu by pressing the **[E]** button.

See 6.8

Step 5 Upper display

Using the **[▼]** or **[▲]** button select *UP-1* in the configuration menu and press **[P]** to select whether flow rate or total flow is shown on the upper 8 digit display. The required maximum total of 100000 with 0.01 resolution can only be accommodated on the top display. Therefore using the **[▼]** or **[▲]** button select *Total* and press **[E]** to enter the selection and return to the *UP-1* prompt in the configuration menu.

See 6.9

Step 6 Lower display

Using the **[▼]** or **[▲]** button select *UP-2* in the configuration menu and press **[P]** which will show if the lower display is *on* or *off*. The Rate Totaliser is required to display both total flow and the rate of flow so the lower display is required. Using the **[▼]** or **[▲]** button select *on* and press **[E]** to enter the selection and return to the *UP-2* prompt in the configuration menu. See 6.10

Step 7 Position rate & total decimal points

Select *DP* from the configuration menu and press **[P]**. The upper display already defined as the total display by function *UP-1* will be activated and identified by the Total annunciator. Using the **[▼]** or **[▲]** push button position the decimal point in front of the second least significant digit to give a total display resolution of *0.00*.

Pressing the **[P]** button will show the rate display, but in the upper display position with the Rate annunciator activated. Using the **[▼]** or **[▲]** push button position the decimal point to the right of the least significant digit so that it is not visible to give a total display resolution of *1*. Finally press the **[E]** button to enter the selections and return to the *DP* prompt in the configuration menu.

See 6.11

Step 8 Enter the flowmeter K-factor

K-factor is the number of pulses that a flowmeter produces per unit volume of flow. The Rate Totaliser pulse input is divided by $FRCLE.r$, which is adjustable between 0.0001 and 99999. When set to the K-factor of the flowmeter $FRCLE.r$ converts the flowmeter output into engineering units ready for further scaling to produce the required rate and total flow displays.

Using the \blacktriangledown or \blacktriangle push button select $FRCLE.r$ from the configuration menu and press P to show the existing value with one digit flashing. Enter 105 using the \blacktriangledown or \blacktriangle push button to adjust the flashing digit and the P button to transfer control to the next digit and to position the decimal point. Finally return to the $FRCLE.r$ prompt in the configuration menu by pressing E . The output from $FRCLE.r$ will now be in litres which may be scaled to produce required rate and total displays. See 6.12

Step 9 Enter the total scale factor

The Total Scale Factor $SCALE.t$ is a dividing factor adjustable between 0.0001 and 99999 that enables total flow to be displayed in the required engineering units. In this example the total flow display is required in cubic metres. There are 1,000 litres in a cubic metre so $SCALE.t$ should be set to 1000.

Using the \blacktriangledown or \blacktriangle push button select $SCALE.t$ from the configuration menu and press P to reveal the existing value with one digit flashing. Enter 1000 using the \blacktriangledown or \blacktriangle push button to adjust the flashing digit and the P button to transfer control to the next digit and to position the decimal point. Finally, return to the $SCALE.t$ prompt in the configuration menu by pressing E . The total flow display is independent of the rate display. See 6.13

Step 10 Enter the rate scale factor

$SCALE.r$ is a dividing factor adjustable between 0.0001 and 99999 that enables the flow rate to be displayed in the required engineering units. The rate display timebase is determined by $t-bRSE$ that is adjusted in Step 11.

In this example the rate of flow display is required in imperial gallons. $FRCLE.r$, which was adjusted in Step 8 of this example produces an output in Litres that must be converted to imperial gallons. There are 4.5461 Litres in an imperial gallon so $SCALE.r$ should be adjusted to 4.5461

Using the \blacktriangledown or \blacktriangle push button select $SCALE.r$ from the configuration menu and press P to reveal the existing value with one digit flashing. Enter 4.5461 using the \blacktriangledown or \blacktriangle push button to adjust the flashing digit and the P button to transfer control to the next digit and to position the decimal point. Finally return to the $SCALE.r$ prompt in the configuration menu by pressing E . The flow rate display is independent of the total flow display. See 6.14

Step 11 Enter the rate timebase

The rate timebase determines whether flow rate is displayed per second, per minute or per hour. In this example gallons per hour are required.

Using the \blacktriangledown or \blacktriangle push button select $t-bRSE$ from the configuration menu and press P . Again using the \blacktriangledown or \blacktriangle push button select $t-b-3600$ from the three options which will multiply the rate display by 3600. Return to the $t-bRSE$ prompt in the configuration menu by pressing E . See 6.15

Step 12 Adjust the display filter

The digital display filter has two independent adjustable parameters enabling the rate display response to be tailored for optimum performance. The filter parameters are controlled by a two digit number. The first digit defines the amount of filtering applied to the display, for initial configuration it is recommended it is set to 2 which is a time constant of 4.3 seconds. The second digit controls jump-out following a step input change and it is recommended that this is initially set to 0.

After configuration during commissioning both parameters should be adjusted experimentally to provide a stable display with an acceptable step response. To allow the effect of filter changes to be seen immediately, the live rate display is shown on the lower display while the filter parameters are shown and may be adjusted on the upper display. Using the \blacktriangledown or \blacktriangle push button select $FILTER$ from the configuration menu and press P .

The first digit, which controls the filter time constant, will be flashing and should be set to 2 using the ▼ or ▲ push button. The **P** button will transfer control to the second digit, which controls the step response and should be set to 0 in the same way. When entered return to the **Filter** prompt in the configuration menu by pressing **E**.

See 6.16

Step 13 Define clip-off

To prevent totalisation of low flow rates clip-off defines a flow rate threshold below which totalisation is inhibited. In this example it is required that totalisation does not occur at flow rates below 10 gallons per hour.

Using the ▼ or ▲ push button select **CLP OFF** from the configuration menu. Press **P** which will reveal the current clip-off threshold in gallons per hour i.e. the same units already selected for the rate display. Enter 10 using the ▼ or ▲ push button to adjust the flashing digit and the **P** button to transfer control to the next digit. Finally, store the new clip-off threshold and return to the **CLP OFF** prompt in the configuration menu by pressing **E**.

See 6.17

Step 14 Local reset of total and grand total

Two separate functions in the **Loc Lr** sub-menu may be individually activated to enable the operator to reset the total and grand total displays from the totalisation mode without entering the configuration menu.

In this example the operator is required to be able to reset the total display but not the grand total display when the BA337NE Rate Totaliser is in the totalisation mode.

Using the ▼ or ▲ button select **Loc Lr** in the configuration menu and press **P** which will reveal the sub-menu. Again using the ▼ or ▲ button select the local total reset function **Lr Tot** and press **P**. This function is required so using the ▼ or ▲ button select **on** followed by **E** to return to the **Lr Tot** prompt in the sub-menu.

Using the ▼ or ▲ button select the local grand total reset function **Lr Gtot** and press **P**. This function is not required so using the ▼ or ▲ button select **off**. Finally return to the **Loc Lr** prompt in the configuration menu by pressing the **E** button twice.

See 6.18, 6.19 and 6.20.

Step 15 Reset the grand total to zero

Before completing configuration the Rate Totaliser's grand total should be reset to zero. Using the ▼ or ▲ button select **Lr Gtot** in the configuration menu and press **P** which will cause **Lr.no** to be displayed with **no** flashing. Again using the ▼ or ▲ button select **Lr.YE5** with **YE5** flashing. Press **P** which will result in **0000** being displayed with one digit flashing. This is a request for the instruction to be confirmed by entering **SurE** using the ▼ or ▲ button to set each digit and the **P** button to move control to the next digit.

Pressing **E** will then reset the grand total to zero and return the instrument to the **Lr Gtot** prompt in the configuration menu.

See 6.21.

Step 16 Define the security code

Defining a security code prevents unauthorised access to the configuration menu. Using the ▼ or ▲ buttons select **SecE** from the configuration menu and press **P** which will result in **0000** being displayed with the first digit flashing. This example requires the security code to be 1209, using the ▼ or ▲ buttons set the flashing digit to 1 and press **P** to transfer control to the second digit. When all the digits of the new code have been entered press **E** to store the code and return to the main configuration menu.

See 6.22.

Step 17 Return to the totalisation mode

Configuration of the BA337NE is now complete. Pressing the **E** button will save the new configuration and return the Rate Totaliser to the totalisation mode. The BA337NE will display **RateR** followed by **SRUE** while the new information is being stored in permanent memory.

9. MAINTENANCE

9.1 Fault finding during commissioning

If a BA337NE fails to function during commissioning the following procedure should be followed:

Symptom	Cause	Check:
No display	No power supply, or incorrect wiring. Note: Terminals 2, 6 & RS2 are interconnected within the instrument.	That there is between 10 and 30V on terminals 1 & 2 with terminal 1 positive.
Rate Totaliser is receiving power but flow indicator not rotating	No input pulses, incorrect input configuration, incorrect linking of terminals 3 & 4	Input configuration. Linking of terminals 3 & 4. That input signal polarity is correct.
Flow indicator rotating but incorrect rate display	Incorrect rate display calibration	FRt or SCALr t-bRSE
Flow indicator rotating but incorrect total display	Incorrect total display calibration. Remote reset switch contacts closed	FRt or SCALt That RESET annunciator is not activated. If it is, check reset wiring and switch.
Flow indicator rotating, but zero rate display, no totalisation and HOLD annunciator activated.	ELP oFF is activated	ELP oFF and if necessary adjust threshold.
Unstable rate display	Noisy pulse input signal	Eliminate source of electrical noise. Increase debounce and/or display filter.
Unable to enter configuration menu.	Incorrect security code	That the correct security code is being used. Contact BEKA if code is lost.
Clip-off does not function	Clip-off has automatically reset to zero following change of rate display calibration.	Reconfigure ELP oFF
Alarms do not function	Alarms have been disabled following calibration change	Re-enable both alarms.

9.2 Fault finding after commissioning

EN 60079-17 *Electrical installations inspection and maintenance* permits live maintenance in Zone 2 if a risk analysis demonstrates that this does not introduce an unacceptable risk. The removal of covers [opening of Ex n enclosure] is permitted if this can be done without contaminating the interior of the instrument with dust or moisture. Some end-users may prefer not to permit live maintenance to minimise risk.

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

Live maintenance within the hazardous area should only be performed when it is permitted by risk analysis, or when there is no risk of a flammable atmosphere being present.

If a BA337NE fails after it has been functioning correctly, the following table may help to identify the cause of the failure.

Symptom	Cause	Check:
No display	No power supply.	That there is between 10 and 30V on terminals 1 & 2
Flow indicator not rotating	No input pulses	Output from flowmeter. Wiring between flowmeter and Rate Totaliser.
Flow indicator rotating, rate display is zero and totalisation. HOLD annunciator is not activated.	Input below clip-off threshold.	ELP oFF threshold and if necessary adjust.
Unstable rate display	Noisy pulse input signal	Locate source of electrical noise, or increase debounce and rate display filter.

If this procedure does not reveal the cause of the fault, it is recommended that the instrument is replaced.

9.3 Servicing

We recommend that faulty BA337NE rate totalisers are returned to BEKA associates or to our local agent for repair.

9.4 Routine maintenance

The mechanical and electrical condition of the instrument should be regularly checked. Initially annual inspections are recommended, but the inspection frequency should be adjusted to suit the environmental conditions.

9.5 Guarantee

Instruments which fail within the guarantee period should be returned to BEKA associates or our local agent. It is helpful if a brief description of the fault symptoms is provided.

9.6 Customer comments

BEKA associates is always pleased to receive comments from customers about our products and services. All communications are acknowledged and whenever possible, suggestions are implemented.

10. ACCESSORIES

Only one of the three factory fitted optional outputs may be installed in a BA337NE Rate Totaliser. If required, dual alarms, an isolated 4/20mA current sink or an isolated pulse output should be specified when the instrument is ordered.

10.1 Scale card

The BA337NE has a window on the right hand side of the display through which to view a scale card showing the units of measurement such as Gals/hour or Litres. New Rate Totalisers are fitted with a scale card showing the units of measurement specified when the instrument was ordered, if the units are not specified a blank scale card will be fitted. A pack of scale cards pre-printed with common units of measurement is available as an accessory. These can easily be fitted on-site to the Rate Totaliser without opening the instrument enclosure or removing it from the panel, See section 5.5 of this instruction manual.

Custom scale cards for applications requiring less common units of measurement are also available.

10.2 Tag information

A custom specified tag number or application information can be laser etched onto the instrument rear panel adjacent to the terminals. This information is not visible from the front of the instrument after installation.

10.3 Backlight

The BA337NE Rate Totaliser can be supplied with a factory fitted backlight that produce green illumination enhancing display contrast and enabling it to be read at night or in poor lighting conditions. The backlight is internally powered from the instrument power supply so that no additional wiring is required, but the instrument supply current increases.

Current consumption	
Without backlight	10.0mA
Addition for backlight	22.5mA
Addition with terminals 3 & 4 linked	6.0mA
Total current	38.5mA

10.4 Alarms

The BA337NE can be supplied with factory fitted dual solid, state single pole alarm outputs that may be independently configured as high or low, rate or total alarms with normally open or normally closed outputs.

Note: Only one of the three output options can be fitted.

Configurable functions for each alarm include adjustable setpoint, alarm delay time and alarm silence time. Hysteresis may be applied to rate alarms.

CAUTION

Alarm outputs should not be used for critical safety applications such as a shut down system.

When the BA337NE Rate Totaliser power supply is turned off or disconnected, the alarm outputs will open irrespective of whether normally open or normally closed outputs have been selected. When designing a system an open output should therefore be chosen for the alarm condition.

Alarm annunciators on the instrument display indicate the status of each alarm. If an alarm delay or silence time has been selected the annunciator will flash during the delay or silence period.

The BA337NE internal counters are up-dated and compared with the alarm setpoint twice per second, irrespective of the display update time selected. This may result in an alarm being delayed for up to half a second after the rate or total has exceeded the setpoint.

10.4.1 Solid state output

Each alarm has a galvanically isolated single pole solid state switch output as shown in Fig 14. The outputs are polarised and current will only flow in one direction. Terminals A1 and A3 should be connected to the positive side of the supply.

$$R_{on} = \text{less than } 5\Omega + 0.7V$$

$$R_{off} = \text{greater than } 1M\Omega$$

Note: Because of the series protection diode some test meters may not detect a closed alarm output.

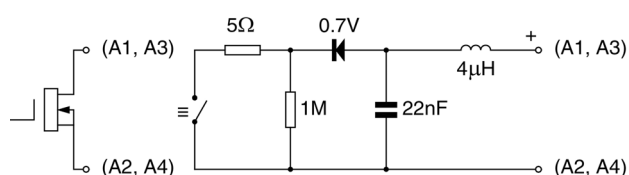


Fig 14 Equivalent circuit of each alarm output

9.4.2 Type nA certification

Each alarm output is a separate galvanically isolated Ex nA circuit with the following input parameters:

$$U_i = 30V \text{ dc}$$

$$I_i = 200mA$$

This allows each alarm output to switch any dc circuit providing that in normal operation the maximum supply voltage is not greater than 30V dc and the switched current is not greater than 200mA.

Providing that the BA337NE Rate Totaliser is correctly installed in a panel enclosure located in Zone 2 complying with the requirements for Ex n protection, the two alarm outputs may be used to switch suitably protected equipment located in any Zone of a hazardous area, or equipment located in a safe area.

Fig 15 shows a typical application in which a BA337NE Rate Totaliser is mounted in an Ex n panel enclosure located in Zone 2 is displaying the output from an Flameproof Ex d 2-wire flowmeter located in Zone 1. Alarm 1 is switching an Ex e sounder in Zone 1 and alarm 2 is switching a sounder located in the safe area.

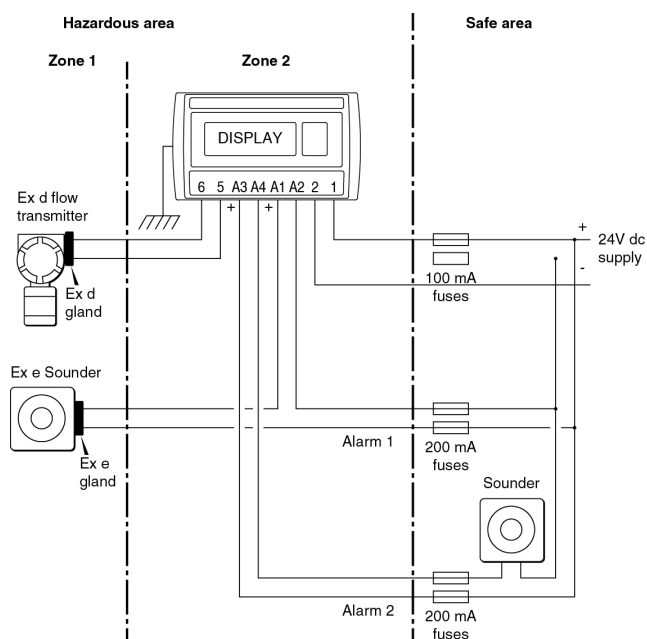


Fig 15 Typical alarm application
(Shown without recommended screened cables)

To comply with the requirements of EN 60079-14 *Electrical installations design, selection and erection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements are frequently satisfied by using fuse holders with easily removable fuses and removing the fuses to achieve isolation. This is a satisfactory method at the low voltages and currents common in instrumentation systems. Clear identification of, and easy access to the means of isolation is essential for their effective use. It is also necessary to ensure that the maintenance procedure makes sure that unauthorised re-closure of the switches does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen. Figure 2 illustrates an example of this type of fused terminal block.










For some application Ex nA instrumentation energised by a current limited power supply or instrument that can be switched off, is often considered adequate and to comply with the requirements of the standard.

10.4.3 Configuration and adjustment

When a BA337NE is supplied with alarms the configuration menu is extended as shown in Fig 16. For simplicity Fig 16 only shows the configurable functions on the rate option of alarm AL1, the total options is identical except that total alarms do not have hysteresis. Alarm AL2 is identical to alarm AL1. The following table summarises each of the alarm configuration functions and includes a cross reference to more detailed information. Again only the functions on alarm AL1 are listed.







Display	Summary of function
EnbL	Alarm enable Enables or disables the alarm without changing the alarm parameters. See section 10.4.4
tYPE	Type of alarm Defines whether the alarm operates on the rate or total display. See section 10.4.5
SP Ir or SP It	Alarm setpoint 1 Adjusts the alarm setpoint. The alarm is activated when the rate or total display equals the setpoint. Note: SP Ir is displayed for a rate alarm and SP It for a total alarm. See section 10.4.6
Hi.Lo	Alarm function Defines whether the alarm has a high or low function. See section 10.4.7
no.nC	Normally open or normally closed output. Determines whether the single pole alarm output is open or closed in the non-alarm condition. See section 10.4.8
HSt r	Hysteresis Adjusts the alarm hysteresis. Only available on a rate alarm. See section 10.4.9
dEL R	Alarm delay time Adjusts the delay between the display equaling the setpoint and the alarm output being activated. See section 10.4.10
S. L	Alarm silence time Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 10.4.11
FLSH	Flash display when alarm occurs When enabled, alternates the rate or total display between process value and alarm reference RL1 or RL2 when an alarm output is activated. See section 10.4.12
RCSP	Access setpoint Sub-menu that enables direct access to the alarm setpoints from the totalisation mode and defines a separate security code. See section 10.4.13

10.4.4 Alarm enable: **EnbL**

This function allows the alarm to be enabled or disabled without altering any of the alarm parameters. Using the  or  push button select **RL 1** or **RL 2** from the configuration menu and press  to access the alarm sub-menu. Press the  or  button until **EnbL** is displayed followed by  which will reveal if the function is **on** or **off**. The setting can be changed by pressing the  or  push button followed by the  button to return to the alarm sub-menu.

10.4.5 Type of alarm: **TYPE**








Alarm 1 and Alarm 2 are totally independent, both may be rate or total alarms, or one may be conditioned for rate and the other for total.

Using the  or  push button select **TYPE** from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the selection between **rate** and **total**, when set as required press the  button to return to the alarm sub-menu.

Note: When **TYPE** is changed, the alarm configuration is automatically reset to the default values and the alarm is disabled. It must therefore be reconfigured before use.







10.4.6 Setpoint adjustment: **SP1r & SP2r**

The rate alarm setpoints **SP1r** and **SP2r** may be positioned anywhere between 000000 and 999999 and the total alarm setpoint **SP1t** and **SP2t** anywhere between 00000000 and 99999999.

All the setpoints are adjusted in the same way, for example to adjust the setpoint of Alarm 1 which has been configured to operate on the rate display. Using the  or  push button select **SP1r** in the **RL 1** sub-menu and press  which will reveal the existing setpoint with one digit flashing. The required setpoint can be entered using the  or  push button to adjust the flashing digit and the  button to transfer control to the next digit. When set as required press  to enter the value and return to the **SP1r** prompt in the alarm 1 sub-menu.







10.4.7 Alarm function: **Ht.Lo**

Alarm 1 and Alarm 2 are totally independent, both may be **Ht** or **Lo**, or one may be conditioned as a **Ht** alarm and the other as a **Lo** alarm.

Using the  or  push button select **Ht.Lo** from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the alarm function between **Ht** and **Lo**, when set as required, press the  button to return to the **Ht.Lo** prompt in the alarm sub-menu.








10.4.8 Alarm output status: **no.nL**

Each single pole alarm output may be open or closed in the non-alarm condition. When the BA337NE power supply is turned off or disconnected, the alarm output(s) will open irrespective of whether normally open or normally closed outputs have been selected. Therefore when designing an alarm system normally closed **nL** should be selected so that the output opens when an alarm occurs or if the power supply fails.

Using the  or  push button select **no.nL** from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the contact status between **no** and **nL**, when set as required, press the  button to return to the **no.nL** prompt in the alarm sub-menu.

10.4.9 Hysteresis: **H5tr**

Hysteresis is only available on rate alarms so the **H5tr** function only appears in the configuration sub-menu when alarm **TYPE** has been set to **rate**. During configuration hysteresis is shown in the units of rate previously configured for the rate display.








Using the  or  push button select **H5tr** in the selected alarm sub-menu and press  which will reveal the existing hysteresis with one digit flashing. The required hysteresis can be entered using the  or  push button to adjust the flashing digit and the  button to transfer control to the next digit. When set as required press  to enter the value and return to the **H5tr** prompt in the alarm sub-menu.

e.g. A Rate Totaliser configured to display a flow of 0 to 5000, with a high alarm set at 4000 and hysteresis of 100 will perform as follows:

High alarm will be activated when flow equals or exceeds 4000, but will not reset until the flow falls below 3900.

10.4.10 Alarm delay: **dELR**

This function enables activation of the alarm output to be delayed for a fixed time following the alarm condition occurring. The delay can be set in 1 second increments up to 3600 seconds. If a delay is not required zero should be entered.

To adjust the delay select **dELR** using the  or  push button in the selected alarm sub-menu and press  which will reveal the existing delay time in seconds with one digit flashing. The required delay time can be entered using the  or  push button to adjust the flashing digit and the  button to transfer control to the next digit. When set as required press  to enter the value and return to the **dELR** prompt in the alarm sub-menu.

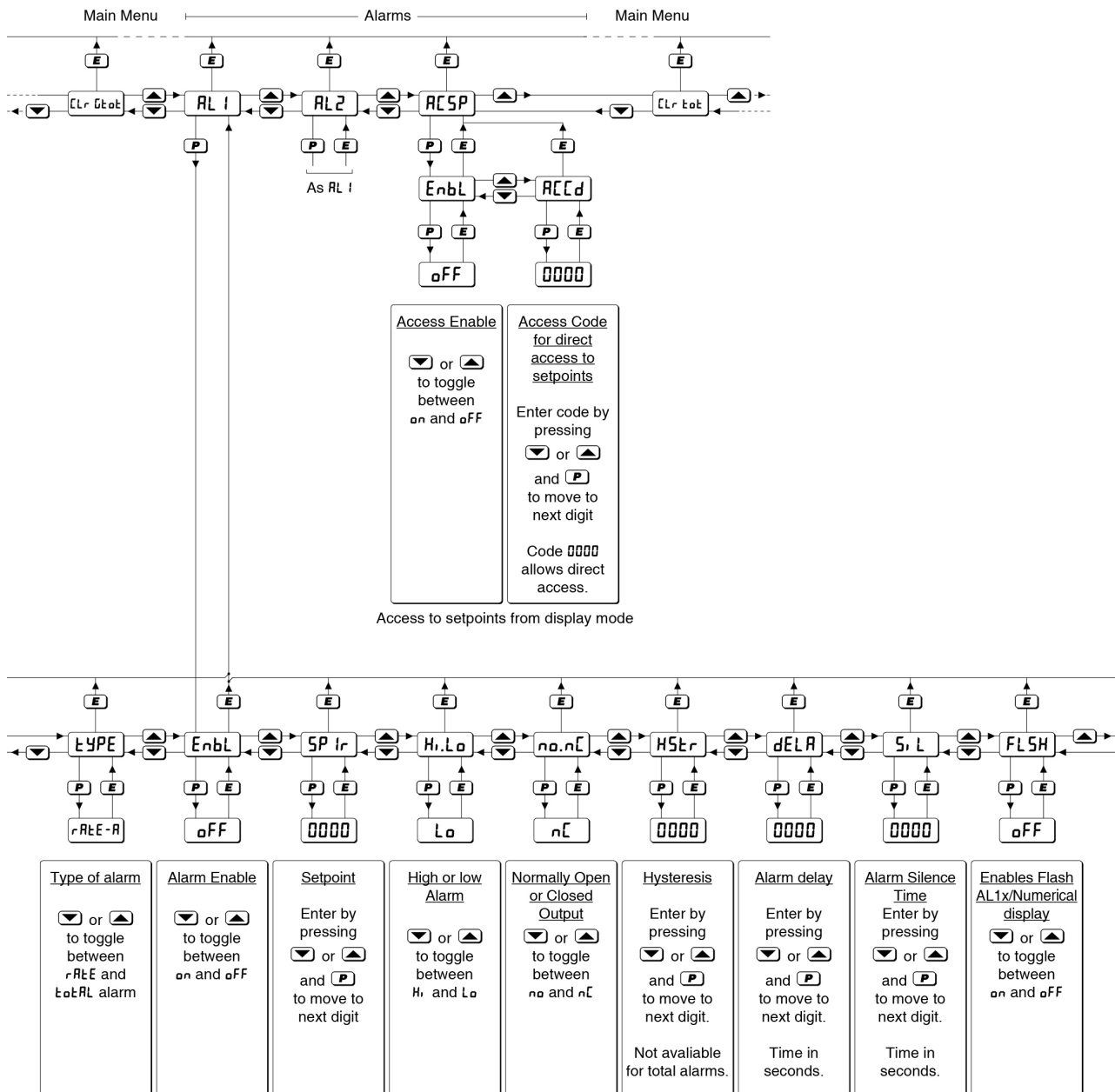


Fig 16 Alarm menu structure

The Rate Totaliser's alarm annunciator will start flashing immediately an alarm condition occurs and will continue for the delay time, after which the alarm output will be activated and the alarm annunciator will be permanently activated.

10.4.11 Alarm silence time: 5, L

The alarm silence function is primarily intended for use in small installations where the alarm output directly operates an annunciator such as a sounder. When the alarm silence time is set to any figure other than zero, the P push button becomes an alarm accept button.

After an alarm has occurred, operating the P button







will cause the alarm output to revert to the non-alarm condition for the programmed alarm silence time. When an alarm is silenced by operating the P push button, the Rate Totaliser's alarm annunciator will flash until the silence time expires.

To adjust the alarm silence time select 5, L using the ▼ or ▲ push button in the selected alarm sub-menu and press P which will reveal the existing alarm silence time in seconds with one digit flashing. The required delay time can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the 5, L prompt in the alarm sub-menu.



10.4.12 Flash display when alarm occurs: FL5H










In addition to the two alarm annunciators on the left hand side of the Rate Totaliser display which show the status of both alarms, this function provides an even more conspicuous indication that an alarm condition has occurred.








When enabled, this function alternates the rate or total display between the numerical value and the alarm identification RL1 or RL2 when an alarm occurs.

Using the  or  push button select FL5H from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the function between OFF and ON, when set as required, press the  button to return to the FL5H prompt in the alarm sub-menu.

10.4.13 Access Setpoint: RCL5P








This function activates a separate menu that provides direct access to the alarm setpoints from the totalisation mode by simultaneously operating the  and  buttons. An operator can therefore adjust the alarm setpoints without having access to the configuration and alarm sub-menus. Protection against unauthorised or accidental adjustment is provided by a separate security access code.



Using the  or  push button select RCL5P from the configuration menu and press  to reach the enable function ENBL. Pressing  will reveal the existing setting which can be toggled between ON and OFF by pressing the  or  push button. When set as required, press the  button to return to the ENBL prompt from which a separate security access code can be entered using the RCL5P function which can be selected using the  or  push button.

To enter a new security code select RCL5P from the RCL5P sub-menu and press  which will cause the Rate Totaliser to display 0000 with one digit flashing. The flashing digit may be adjusted using the  or  push button, when set as required operating the  button will transfer control to the next digit. When all the digits have been adjusted press  twice to return to the RCL5P prompt in the configuration menu. The revised security code will be activated when the Rate Totaliser is returned to the totalisation mode. Default security access code 0000 will disable the security code allowing direct access to the setpoints from the totalisation mode by pressing the  and  buttons simultaneously.

Please contact BEKA associates sales department if the security code is lost.

10.4.14 Adjusting alarm setpoints from the totalisation mode

Access to the two alarm setpoints from the Rate Totaliser totalisation mode is obtained by operating the  and  push buttons simultaneously as shown in Fig 17. If the setpoints are not protected by a security code the alarm setpoint prompt SP1x or SP2x will be displayed depending upon whether a rate or total alarm has been conditioned. If access to the setpoints is protected by a security code, CODE will be displayed first. Pressing  again will allow the alarm setpoint security code to be entered digit by digit using the  or  button to change the flashing digit and the  push button to move control to the next digit. If the correct code is entered pressing  will result in the alarm setpoint prompt SP1x to be displayed. If an incorrect security code is entered, or a button is not pressed within ten seconds, the instrument will automatically return to the totalisation mode.

Once within the menu pressing the  or  buttons will toggle the display between the two alarm setpoint prompts SP1x and SP2x.

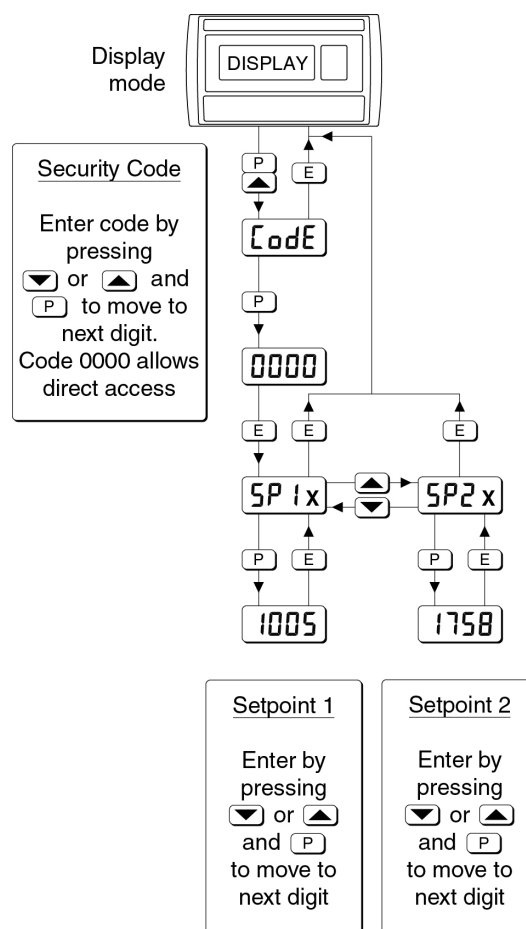


Fig 17 Setpoint adjustment from the totalisation mode

To adjust an alarm setpoint select $5P1x$ or $5P2x$ and press \boxed{P} which will reveal the existing value. The flashing digit of the setpoint may be adjusted using the $\boxed{\nabla}$ or $\boxed{\blacktriangle}$ push button and the \boxed{P} button to move control to the next digit. When the required setpoint has been entered, pressing \boxed{E} will return the display to the $5P1x$ or $5P2x$ prompt from which the other setpoint may be selected, or the instrument may be returned to the totalisation mode by pressing \boxed{E} again.

Note: Direct access to the alarm setpoints is only available when the menu is enabled - see section 10.4.13

10.5 Pulse output

The BA337NE can be supplied with a factory fitted isolated pulse output for retransmitting pulses to other instruments.

Note: Only one of the three output options can be fitted to a BA337NE Rate Totaliser.

The pulse output is an open collector with the following parameters:

Ron	=	$60\Omega + 3V$
Roff	=	1M
I max	=	10mA

To retransmit a pulse to another BA337NE Rate Totaliser or to a BEKA counter, the pulse output terminals may be directly connected to the input terminals of the second instrument as shown in Fig 18, alternatively the second instrument may be located in the safe area. The second Rate Totaliser should be configured for an open collector input.

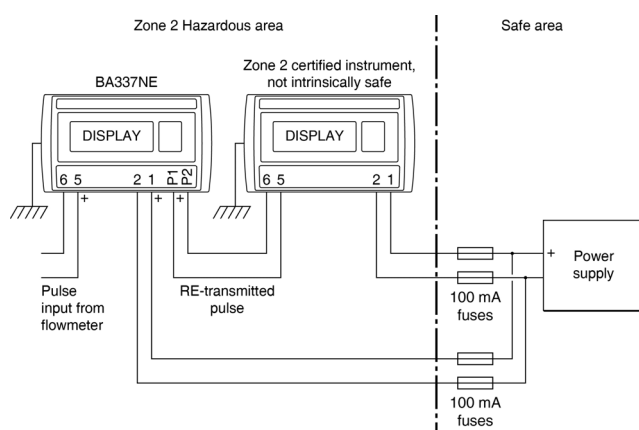


Fig 18 Pulse retransmission to another BEKA 'E' Ex nA instrument.

A voltage output pulse can be generated as shown in Fig 19. The current flowing in the pulse output circuit, which is defined by resistor R1, should be less than 10mA. With a 24V supply R1 should therefore be 2,200 Ω or greater.

The output pulse may be a synchronous duplicate of the input pulse for re-transmission applications, or the

frequency may be divided and the pulse width defined.

The retransmitted RTx annunciator on the instrument display shows the status of the retransmitted pulse output. Annunciator activation depends upon the setting of $5aurEE$ in the pulse output configuration menu.

SCALE#

Annunciator activated each time pulse output open collector is *on*, i.e. Ron is less than $60\Omega + 3V$.

drRECT:

Annunciator continuously activated

9.5.1 Ex nA certification

The optional pulse output is a separate opto-isolated Ex nA circuit with the following input parameters:

$$\begin{aligned} U_i &= 30\text{V dc} \\ I_i &= 100\text{mA} \end{aligned}$$

This allows the pulse output to be connected to any dc circuit providing that in normal operation the maximum supply voltage is not greater than 30V dc.

Providing that the BA337NE Rate Totaliser is correctly installed in a panel enclosure located in Zone 2 complying with the requirements for Ex n protection, the pulse output may be used to transmit a pulse to any suitably protected equipment, except intrinsically safe, located in Zone 1 or 2 of a hazardous area, or to equipment located in a safe area.

Fig 19 shows a BA337NE Rate Totaliser mounted in an Ex n panel enclosure located in Zone 2 retransmitting a pulse to the safe area. The current pulse flows through R1 resulting in a voltage pulse output with an amplitude of about 20V.

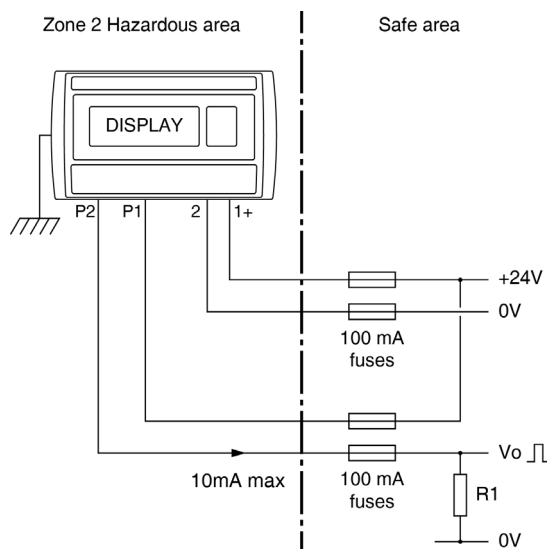


Fig 19 Generating voltage pulse in safe area

To comply with the requirements of EN 60079-14 *Electrical installations design, selection and erection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements may be satisfied by installing DIN rail mounted terminals incorporating a fuse which can easily be removed as shown in Fig 2 to provide isolation. Clear identification of, and easy access to the means of isolation is essential for their effective use. It is also necessary to ensure that the maintenance procedure makes sure that unauthorised re-closure of the switches does not occur. It is not considered necessary to have a means of isolation or electrical protection for cable screens.

For some application Ex nA instrumentation energised by a current limited power supply or instrument that can be switched off, is often considered adequate and to comply with the requirements of the standard.

10.5.2 Pulse output configuration: **PuLSE oP**

When a BA337NE is supplied with a factory fitted pulse output the instrument configuration menu is extended as shown in Fig 20. Using the \blacktriangledown or \blacktriangle push button scroll through the configuration menu until **PuLSE oP** is displayed, pressing **P** will then access the pulse output sub-menu.

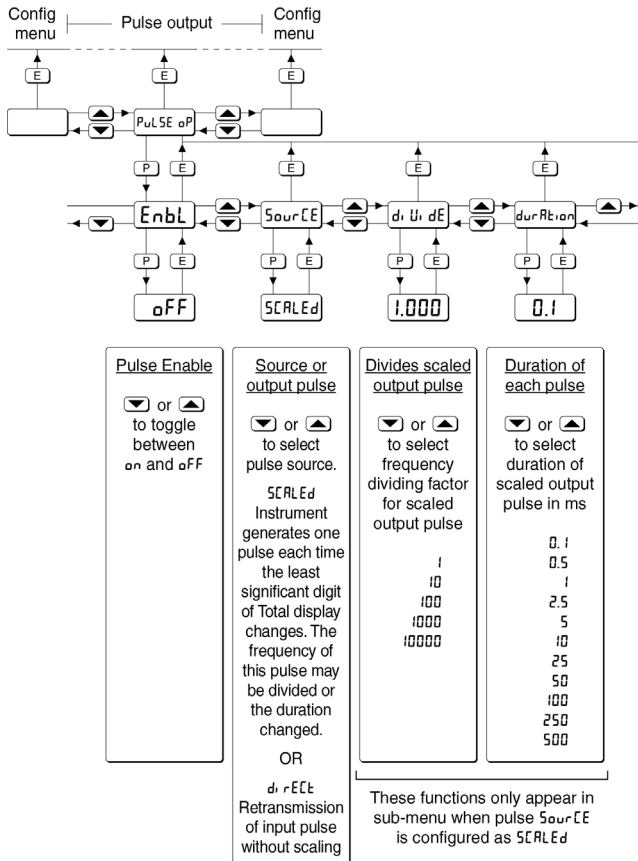


Fig 20 Pulse output configuration sub-menu

10.5.3 Enable pulse output: **EnbL**

This function allows the pulse output to be enabled or disabled without altering any of the pulse output parameters. Using the \blacktriangledown or \blacktriangle push button select **EnbL** in the pulse output sub-menu and press **P** which will reveal the existing setting **on** or **off**. The function can be changed by pressing the \blacktriangledown or \blacktriangle push button followed by the **E** button to return to **EnbL** prompt in the sub-menu.

10.5.4 Source of pulse output: **5aurEE**

The output pulse may be derived from:

5CRLed Incrementation of least significant digit of the total display. May be divided and width defined by the **d, U, dE** and **durAtion** functions to generate the required output pulse.

d, rEEt Output is synchronous duplicate of the Rate Totaliser input pulse.

Using the \blacktriangledown or \blacktriangle push button select **5aurEE** in the pulse output sub-menu and press **P** to reveal the existing pulse source. The function can be changed by pressing the \blacktriangledown or \blacktriangle push button followed by the **E** button to return to **5aurEE** prompt in the sub-menu.

10.5.5 Divide output pulse frequency: **d, U, dE**

When **5CRLed** is selected in the **5aurEE** sub-function (10.5.4) the output pulse is derived from incrementation of the least significant digit of the total display divided by one of the following five factors to produce the output pulse:

1
10
100
1000
10000

Using the \blacktriangledown or \blacktriangle push button select **d, U, dE** in the pulse output sub-menu and press **P** which will reveal the existing divisor. The selected divisor can be changed by pressing the \blacktriangledown or \blacktriangle push button followed by the **E** button to return to **d, U, dE** prompt in the sub-menu.

Note: This function only appears in the pulse output sub-menu when **5CRLed** is selected in the **5aurEE** sub-function. See 10.5.4.

10.5.6 Output pulse width: **durAtion**

When **5CRLed** is selected in the **5aurEE** sub-function (10.5.4) the output pulse width is defined by this function. One of following millisecond pulse widths may be selected:

0.1
0.5
1
2.5
5
10
25
50
100
250
500

Using the \blacktriangledown or \blacktriangle push button select *durRateOn* in the pulse output sub-menu and press P which will reveal the existing pulse duration. The value can be changed by pressing the \blacktriangledown or \blacktriangle push button to select the required value followed by the E button to return to *durRateOn* prompt in the sub-menu.

Note: This function only appears in the pulse output sub-menu when *5ELEd* is selected in the *5outEE* sub-function. See 10.5.4.

10.5.7 Pulse storage

If the *dUdE* and *durRateOn* functions are configured such that the output pulse frequency with the specified pulse width can not be output in real time, the number of pulses will be stored and transmitted at the maximum possible speed.

When the total display is reset to zero or the power supply to the Rate Totaliser is disconnected or turned off, any stored pulses will not be retained.

10.6 4/20mA output

The BA337NE Rate Totalisers can be supplied with a factory fitted isolated 4/20mA output which may be configured to represent the rate or total display.

Note: Only one of the three output options can be fitted.

10.6.1 Type nA certification

The optional 4/20mA output is a separate galvanically isolated Ex nA circuit with the following input parameters:

$$U_i = 30V \text{ dc}$$

This allows the 4/20mA output to be connected to any dc circuit providing that in normal operation the maximum supply voltage is not greater than 30V dc..

Providing that the BA337NE Rate Totaliser is correctly installed in a panel enclosure located in Zone 2 complying with the requirements for Ex n protection, the 4/20mA current output may be used to transmit to suitably protected equipment located in Zone 1 or 2 of a hazardous area, or to equipment located in a safe area.

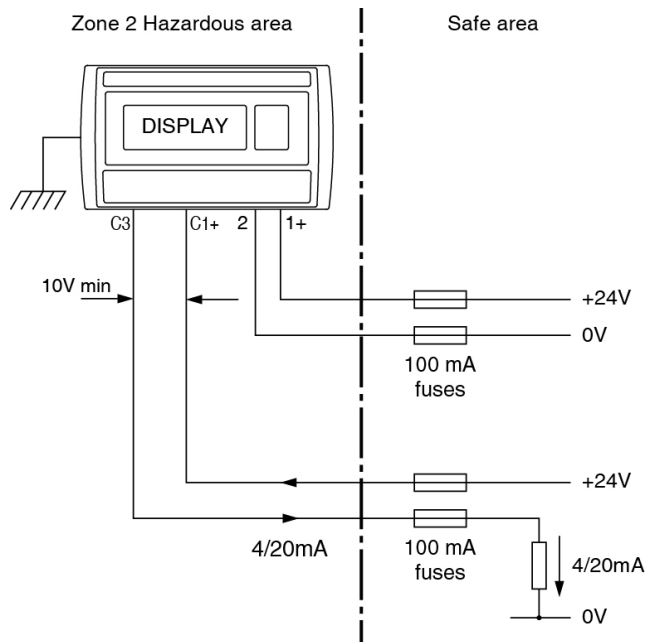


Fig 21 Application of 4/20mA output
(Shown without recommended screened cables)

Fig 21 shows a typical application in which a BA337NE Rate Totaliser is mounted in an Ex n panel enclosure located in Zone 2 is retransmitting the 4/20mA current to the safe area.

To comply with the requirements of EN 60079-14 *Electrical installations design, selection and erection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements may be satisfied by installing DIN rail mounted terminals incorporating a fuse which can easily be opened as shown in Fig 2 to provide isolation. Clear identification of, and easy access to the means of isolation is essential for their effective use. It is also necessary to ensure that the maintenance procedure makes sure that unauthorised re-closure of the switches does not occur. It is not considered necessary to have a means of isolation or electrical protection for cable screens.

For some application Ex nA instrumentation energised by a current limited power supply or instrument that can be switched off, is often considered adequate and to comply with the requirements of the standard.

10.6.2 Configuration

When a BA337NE Rate Totaliser is supplied with an optional 4/20mA output the configuration menu is extended as shown in Fig 22. The 4/20mA output sub-menu is accessed via the 4-20 mA function.

The 4/20mA output sub-menu allows the 4/20mA output to be controlled by the rate or the total display and to be scaled.

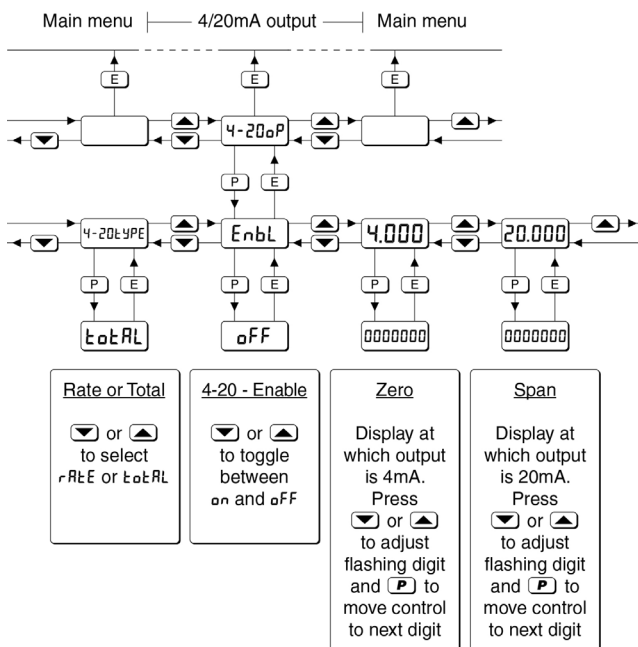


Fig 22 4/20mA output configuration sub-menu

10.6.3 4/20mA output: 4-20 mA

Access the Rate Totaliser's configuration menu as described in section 6.2. Using the ∇ or \blacktriangle push buttons scroll through the menu until 4-20 mA is displayed, pressing P will then access the 4/20mA output sub-menu which is shown in Fig 22.

10.6.4 Enable 4/20mA output: EnbL

This function allows the 4/20mA output to be disabled or enabled without altering any of the 4/20mA output parameters. Using the ∇ or \blacktriangle push button select EnbL in the 4-20 mA sub-menu and press P to reveal the existing setting on or off. The function can be changed by pressing the ∇ or \blacktriangle push button followed by the E button to return to EnbL prompt.

Note: When the 4/20mA output is disabled by selecting off, the output is a constant 3.5mA irrespective of the instrument display.

10.6.5 Select rate or total source: 4-20TYPE








The 4/20mA output current can represent the Rate Totaliser's rate or total display, this should be defined before any other current output functions are adjusted.

Using the ∇ or \blacktriangle push button select 4-20TYPE in the 4/20mA output sub-menu and press P to reveal the existing setting total or rate. The function can be changed by pressing the ∇ or \blacktriangle push button followed by the E button to return to the 4-20TYPE prompt in the sub-menu.

10.6.6 Display which corresponds to 4mA output: 4.000

The Rate Totaliser display which corresponds to a 4.000mA output current is defined by this function. Using the ∇ or \blacktriangle push button select 4.000 in the 4/20mA output sub-menu and press P which will reveal the existing rate or total display with one digit flashing. The required display can be entered using the ∇ or \blacktriangle push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the 4.000 prompt in the 4/20mA output sub-menu.

10.6.7 Display which corresponds to 20mA output: 20.000

The Rate Totaliser display which corresponds to a 20.000mA output current is defined by this function. Using the  or  push button select 20.000 in the 4/20mA output sub-menu and press  which will reveal the existing rate or total display with one digit flashing. The required display can be entered using the  or  push button to adjust the flashing digit and the  button to transfer control to the next digit. When set as required press  to enter the value and return to the 20.000 prompt in the 4/20mA output sub-menu.

Notes:

1. If the calibration of the rate or total display defined as the source for the 4/20mA output is changed, the 4/20mA output will automatically be set to give a constant 3.5mA output irrespective of the display. The 4/20mA output should always be reconfigured following reconfiguration of the source display.
2. If the Rate Totaliser and the 4/20mA current sink output are powered from separate supplies, the 4/20mA output current will continue to flow when the Rate Totaliser supply fails or is turned off. Powering both from a common supply eliminates this effect.

Appendix 1

Dust certification

A1.0 ATEX dust certification

In addition to ATEX Ex nA certification permitting installation in explosive gas atmospheres which is described in the main section of this instruction manual, all BA337NE Rate Totalisers have ATEX dust ignition protection by enclosure certification Ex tc permitting installation in combustible dust atmospheres. The front panel push button switches are non incendive and have been certified intrinsically safe Ex ic without the need for Zener barriers or galvanic isolators.

This appendix describes ATEX installations in explosive dust atmospheres conforming with EN 60079-14 *Electrical installations design, selection and erection*. When designing systems for installation outside the UK the local Code of Practice should be consulted.

The Rate Totaliser's Ex tc dust input and output safety parameters are identical to the Ex nA gas parameters, therefore all the electrical circuits shown in the main section of this manual may also be used for dust applications.

A1.1 Zones, and Maximum Surface Temperature

The BA337NE has been ATEX dust certified

Group II, Category 3D
Ex ic tc IIIC T80°C Dc $-40 \leq T_a \leq 60^\circ\text{C}$

When connected to a suitable system the Rate Totaliser may be installed in:

Zone 22 explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation, but if it does occur, will only persist for a short period.

Be used with dust in subdivisions:

IIIA	combustible flyings
IIIB	non-conductive dust
IIIC	conductive dust

Having a Minimum Ignition Temperature of:

Dust cloud	120°C
Dust layer on indicator up to 5mm thick	155°C
Dust layer on indicator over 5mm thick.	Refer to EN 60079-14

At an ambient temperature between -40 and $+60^\circ\text{C}$

A1.2 Special conditions for safe use in dust atmospheres.

The BA337NE ATEX Type Examination Certificate has an 'X' suffix to show that special conditions for safe use are specified by the BA337NE Ex ic tc certificate indicated by the certificate number's 'X' suffix. These state that the BA337NE Rate Totaliser should be:

- Mounted such that the instrument terminals are protected by at least an IP54 enclosure certified to IEC 60079-15 or IEC 60079-0 as appropriate.

Note: *An Ex t, Ex n, Ex e or Ex p certified enclosure satisfies this requirement.*

- Instrument terminals must be supplied from limited energy circuits.

Note: *This means that the BA337NE should only be connected to circuits with output parameters in normal operation equal to, or less than the instruments input parameters which are the same as the Ex nA input parameters specified in section 3 of this manual.*

A1.3 Maintenance

The IEC guidance on maintenance procedures EN 60079-17 permits live maintenance in Zone 22 if a risk analysis demonstrates that this does not introduce an unacceptable risk. The removal of covers [opening of Ex tc enclosure] is permitted if this can be done without contaminating the interior of the enclosure and instrument with dust or moisture. Some end-users may prefer not to permit live maintenance to minimise risk.

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

Live maintenance within the hazardous area should only be performed when it is permitted by risk analysis or when there is no risk of a flammable atmosphere being present.

Before closing the Ex tc enclosure ensure that the sealing gaskets are undamaged and free from dirt and foreign bodies.

Inspection of the Rate Totalisers mechanical condition and removal of accumulated dust from the front of the instrument and the outside of the enclosure should be regularly performed. The interval between inspections depends upon environmental conditions. Removal of flammable dust should be performed with care to avoid creating a dust cloud.

Appendix 2 IECEx certification

Appendix 2 IECEx certification

A2.0 The IECEx Certification Scheme

IECEx is a global certification scheme for explosion protected products which aims to harmonise international certification standards. For additional information about the IECEx certification scheme and to view the BEKA associate certificates, please visit www.iecex.com

A2.1 IECEx Certificate of Conformity

The BA337NE Rate Totaliser has been issued with an IECEx Certificate of Conformity number IECEx ITS 16.0005X which specifies the following certification code:

Ex nA ic IIC T5 Gc
Ex ic tc IIIC T80°C Dc IP66
-40°C ≤ Ta ≤ +60°C

The IECEx certificate may be downloaded from www.beka.co.uk, www.iecex.com or requested from the BEKA sales office.

A2.2 Installation

The IECEx safety parameters are identical to the ATEX safety parameters described in the main section of this manual and both refer to equivalent standards. Therefore the ATEX installation requirements specified in the main sections and in Appendix 1 of this manual, also apply for IECEx installations, but the local code of practice should also be consulted.

The Rate Totaliser's front panel push button contacts are non incendive and have been certified intrinsically safe Ex ic, without the need for an external Zener barrier or galvanic isolator, as shown on the IECEx certificate. This allows the Rate Totaliser to be adjusted and configured live when installed in a Ex n panel enclosure located in Zone 2.

For ATEX installations self certified Category 3GD equipment, such as enclosures, may be installed in Zone 2 or 22, but self certified equipment is not permitted for IECEx installations.

A2.3 Special conditions for safe use

The IECEx certificate number has an 'X' suffix indicating that special conditions apply for safe use. These conditions are identical to the ATEX special conditions for safe use specified in the main sections and in Appendix 1 of this manual.

Appendix 3 ETL & cETL certification for installations in USA and Canada

A3.0 cETL Mark

For installations in the USA and Canada, the BA317NE Tachometer has ETL and cETL Ex nA and Ex tc approval, Control Number 4008610. Copies of the Authorisation to Mark are available from the BEKA associates sales office and www.beka.co.uk

A3.1 ETL and cETL certification

The US and Canadian standards used for assessment and certification of the BA317NE are listed on the cETL Authorisation to Mark.

Installations must comply with BEKA associates Control Drawing CI330-53, which is attached to this appendix.

The ETL and cETL safety parameters are the same as the ATEX and IECEx parameters, the systems shown in sections 3 and 4 of this manual may therefore also be used for US and Canadian installations subject to complying with codes of practice.

ETL and cETL codes

CL I Zone 2 AEx nA ic IIC T5 Gc (US gas, Zone cert)

Zone 22 AEx ic tc IIIC T80°C Dc (US dust, Zone cert)

Ex nA ic IIC T5 Gc (Canadian gas, Zone cert)

Ex ic tc IIIC T80°C Dc (Canadian dust, Zone cert)

-40°C ≤ Ta ≤ 60°C

The Tachometer's front panel push button contacts are non incendive and have been certified intrinsically safe Ex ic, without the need for an external Zener barrier or galvanic isolator, as shown on the ETL Authorisation to Mark. This allows the Tachometer to be adjusted and configured live when installed in a Ex n panel enclosure located in Zone 2.