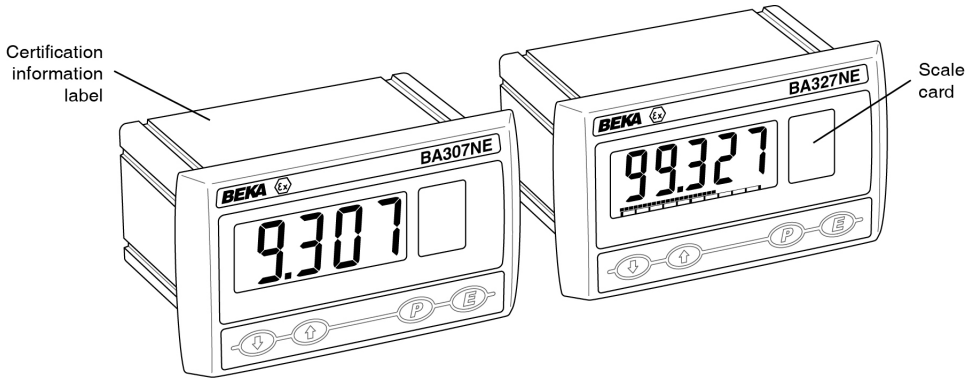
BA307NE & BA327NE
Ex nA & Ex tc
loop-powered
panel mounting indicators

Issue 5



Issue: 5
8th February 2023

CONTENTS

The BA307NE & BA327NE are CE marked to show compliance with the European Explosive Atmospheres Directive 2014/34/EU and the European EMC Directive 2014/30/EU

1. DESCRIPTION

These panel mounting, Ex nA certified non-sparking digital indicators display the current flowing in a 4/20mA loop in engineering units. They are loop powered but only introduce a 1.2V drop, which allows them to be installed into almost any 4/20mA current loop. No additional power supply or battery is required.

The two models are electrically similar, but have different displays.

Model	Display
BA307NE	4 digits 15mm high
BA327NE	5 digits 12.7mm high and 31 segment bargraph.

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

The main application of both models is to display a measured variable or control signal in a Zone 2 gas hazardous area or a Zone 22 dust hazardous process area. The zero and span of the display are independently adjustable so that the indicator can be calibrated to display any variable represented by the 4/20mA current, e.g. temperature, flow, pressure or level.

If required optional factory fitted dual alarms and a green display backlight which can be loop or separately powered, should be specified when the instrument is ordered.

Both models have been issued with a common Type Examination Certificate ITS14ATEX48028X. 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.

The certificate number has an 'X' suffix indicating that the two indicators are subject to special condition for safe use. For installations in Zone 2 the panel enclosure into which the indicators are mounted should comply with Ex n requirements which are defined in BS EN 60079-15. The indicators may also be installed in an Ex e or Ex p panel enclosure located in Zone 2 as described in Appendix 2.

Installation requirements for use in Zone 22 dust hazardous areas are described in Appendix 2..

The two indicators have also been issued with a common IECEx Ex nA and Ex tc Certificate of Conformity which is described in Appendix 3.

2. OPERATION

Fig 1 shows a simplified block diagram of both models. The 4/20mA input current flows through resistor R1 and forward biased diode D1. The voltage developed across D1, which is relatively constant, is multiplied by a switch mode power supply and used to power the instrument. The voltage developed across R1, which is proportional to the 4/20mA input current, provides the input signal for the analogue to digital converter.

Each time a 4/20mA current is applied to the instrument initialisation is performed during which all segments of the display are activated, after five seconds the instrument displays the input current using the calibration information stored in the instrument memory.

If the loop current is less than 1.2mA the indicator will display the error message ‘LPLo’, below this input current the instrument will not function correctly.

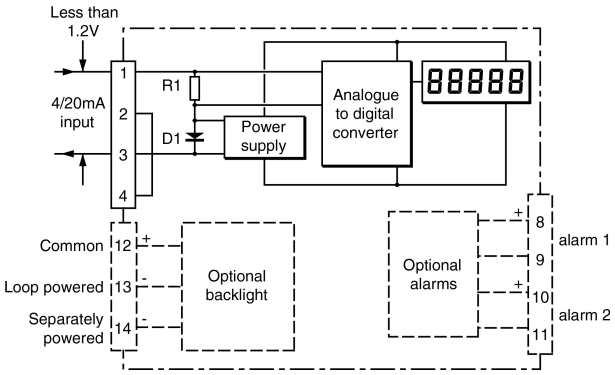


Fig 1 Indicator block diagram

2.1 Controls

The indicators are controlled and calibrated via the four front panel push button switches. In the display mode i.e. when the indicator is displaying a process variable, these push buttons have the following functions:

P	While this button is pushed the indicator will display the input current in mA, or as a percentage of the instrument span depending upon how the indicator has been configured. When the button is released the normal display in engineering units will return. The function of this push button is modified when optional alarms are fitted to the indicator.
▼	While this button is pushed the indicator will display the numerical value and analogue bargraph* the indicator has been calibrated to display with a 4mA$^{\Phi}$ input. When released the normal display in engineering units will return.
▲	While this button is pushed the indicator will display the numerical value and analogue bargraph* the indicator has been calibrated to display with a 20mA$^{\Phi}$ input. When released the normal display in engineering units will return.
E	No function in the display mode unless the tare function is being used.
P **+ ▼**	Indicator displays firmware number followed by version.
P **+ ▲**	Provides direct access to the alarm setpoints when optional alarms are fitted to the indicator and the 'ACSP' *access setpoints in display mode* function has been enabled.
P + E	Provides access to the configuration menu via optional security code.

Notes: * BA327NE only

$^{\Phi}$ If the indicator has been calibrated using the CAL function, calibration points may not be 4 and 20mA.

3. CERTIFICATION

Both models have ATEX and IECEx gas and dust certification. The main sections of this instruction manual describes ATEX gas certification. ATEX dust approval is described in Appendix 2 and IECEx gas and dust certification in Appendix 3.

3.1 ATEX Ex nA certification

Both instruments have been issued with a common EU Type Examination Certificate number ITS14ATEX48028X. This has been used to confirm compliance with the European ATEX Directive for Group II, Category 3GD equipment. The instruments, 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*. However, the local Code of Practice should always be consulted.

3.2 Zones, gas groups and T rating

The indicators have been certified as Group II Category 3G Ex nA ic IIC T5 Gc apparatus and may be used in an ambient temperature Ta between – 40°C to +70°C. This is non-sparking apparatus complying with BS 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.

Special conditions for safe use are specified by the Ex nA certificate indicated by the certificate number's 'X' suffix. These state that the indicators should be correctly mounted in a panel enclosure complying with the requirements specified in BS EN 60079-15 for Equipment protection by type of Protection 'n'. For 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.

BS 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.

The indicator's front panel push button contacts are non incendive and have been certified intrinsically Ex ic as shown on the Type Examination Certificate. This allows the indicators to be adjusted and configured live when installed in a panel enclosure located in Zones 2 or 22.

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 BA307NE or BA327NE 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 +70°C.

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

3.3 4/20mA input

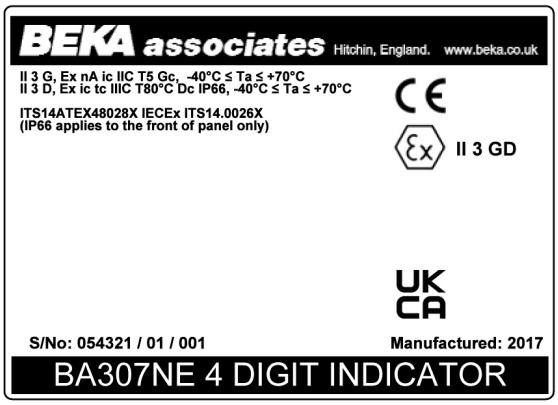
The input safety parameters for the 4/20mA input, terminals 1 and 3 are:

Ii = 200mA

The indicators are current input instruments incorporating an internal protection circuit that defines the voltage developed between the input terminals 1 and 3, therefore the ATEX certificate does not specify a maximum safety input voltage Ui.

3.4 Certification label information

The certification label is fitted in a recess on the top of the instrument. It shows the ATEX certification information, BEKA associates name and location, year of manufacture and the instrument serial number. IECEx certification information is also be shown.



BA307NE certification label

4. SYSTEM DESIGN FOR USE IN ZONE 2 GAS HAZARDOUS AREAS.

4.1 Transmitter loops

When correctly mounted in Zone 2 both indicators may be connected in series with almost any 4/20mA current loop with apparatus in the safe area, or with Ex n, Ex e, Ex p or Ex d protected apparatus located in Zones 1 or 2. The indicators are transparent to HART ® signals.

Because the BA307NE and BA327NE are not certified intrinsically safe they should not be connected to an intrinsically safe system.

There are four design requirements:

1. The indicator 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 certificate specifies that the indicator should be connected to a *limited energy* 4/20mA circuit having a maximum output current of 200mA. A low voltage supply, usually 24V, that is safe in normal operation and suitable for live connection i.e. CE marked, is usually considered acceptable.
3. Wiring must comply with Clause 9 of BS EN 60079-14.
4. The loop must be able to tolerate the additional 1.2V required to operate the indicator. This increases to 5.0V if the indicator is fitted with an optional backlight which is loop powered. See 9.5.1

Figs 2 illustrate a typical application in which a BA307NE or BA327NE located in Zone 2 is connected in series with a 2-wire Ex d transmitter located in Zone 1. BEKA Application Guide AG310, which can be downloaded from www.beka.co.uk, contains examples of other Ex n applications.

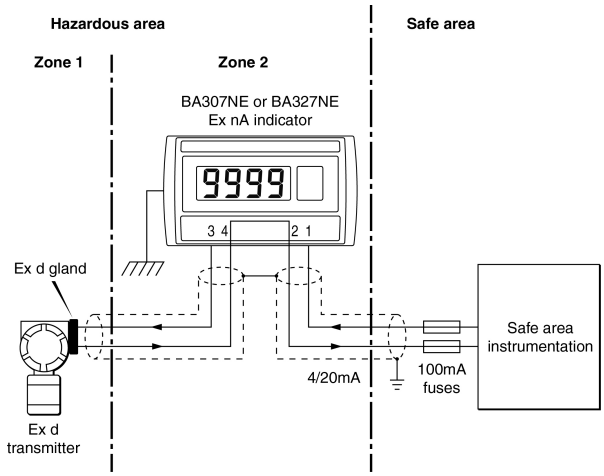


Fig 2 Typical Zone 2 transmitter loop

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 switch fuse holders with easily removable fuses which can be extracted to achieve isolation as shown in Fig 20. 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.

For some applications 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.

4.2 Remote indication

The BA307NE and the BA327NE may also be driven directly from a safe area instrument with a 4/20mA output to provide a remote display within a Zone 2 hazardous area.

There are four design requirements:

1. The indicator 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 certificates specify that the indicator should be connected to a *limited energy* 4/20mA circuit having a maximum output current of 200mA. An instrument located in the safe area that is safe in normal operation and has a 4/20mA output suitable for live connection i.e. CE marked, is usually considered acceptable.
3. Wiring must comply with Clause 9 of EN 60079-14.
4. The output from the safe area 4/20mA instrument must be able to supply the 1.2V required to operate the indicator. This increases to 5.0V if the indicator includes an optional backlight which is loop powered. See 9.4.1

Fig 3 shows a typical application.

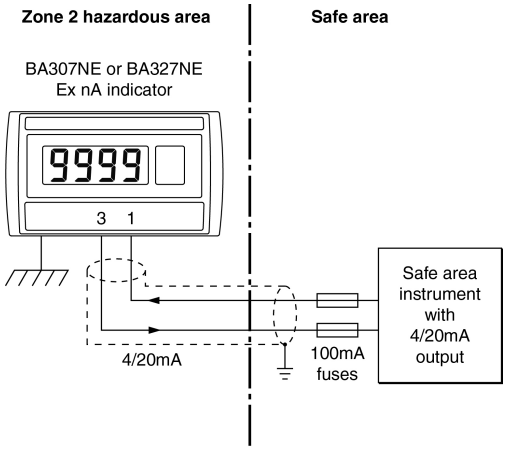


Fig 3 Remote indication in Zone 2 hazardous area

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 are frequently satisfied by using switch fuse holders with easily removable fuses which can be extracted to achieve isolation as shown in Fig 20. 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.

For some applications 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.

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, both indicators may be located in a Zone 2 hazardous area providing that the operating temperature is between –40°C and +70°C and the installation complies with the indicator's certification requirements. Certified Ex e panel enclosures are frequently used as Ex n panel enclosures.

The indicators may also be installed in an Ex e or Ex p panel enclosure located in Zone 2 as described in Appendix 1.

Both indicators have 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. Both indicators have IP20 rear protection.

Although the front of the indicators have IP66 protection, they should be shielded from continuous direct sunlight and severe weather conditions.

Fig 4 show the overall dimensions of the indicators together with the recommended panel enclosure cut-out dimensions.

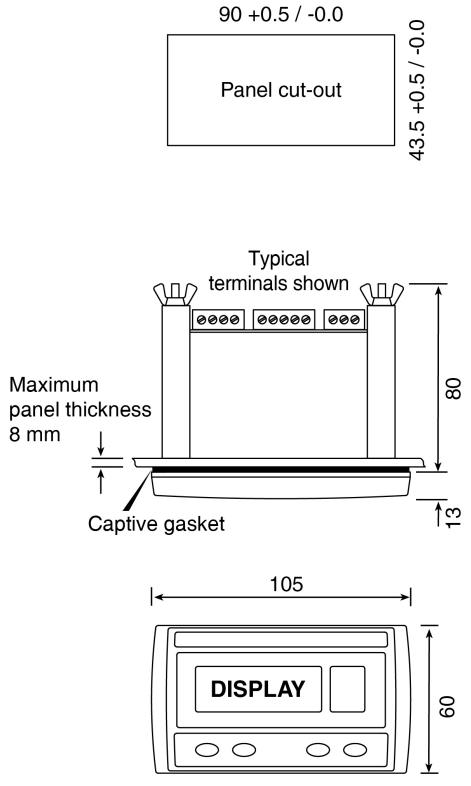


Fig 4 Dimensions

5.2 Installation Procedure

a. Cut the aperture specified in Fig 4 in the panel enclosure. Ensure that the edges of aperture are de-burred.

b. Inspect the indicator's captive gasket and ensure that it is not damaged before inserting the indicator into the panel enclosure aperture.

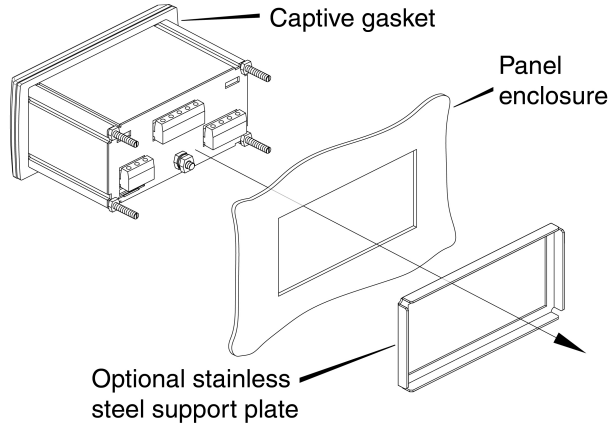
c. If the enclosure panel is less than 1.0mm thick, or is non-metallic, an optional BEKA stainless steel support plate should be slid over the rear of the indicator before the panel clamps are fitted to evenly distribute the clamping force and prevent the enclosure panel being distorted or creeping.

d. 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.

e. Evenly tighten the four clamps to secure the instrument. The recommended minimum tightening torque for each wing nut is 22cNm (1.95 lbf in).

f. 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.

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



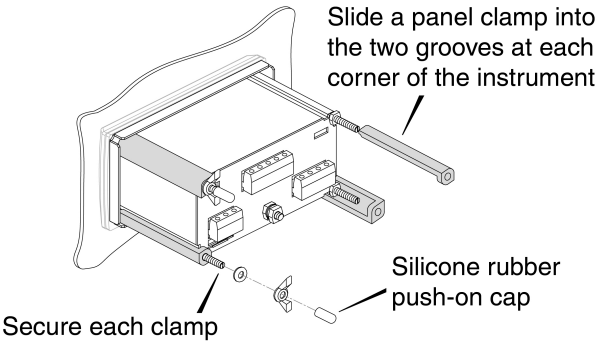


Fig 5 Installation procedure

5.3 Indicator earthing

Both indicators have an M4 earth stud on the rear panel which should be electrically connected to the panel enclosure in which the indicator is mounted, or to the plant equipotential conductor.

5.4 EMC

Both instruments comply 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.

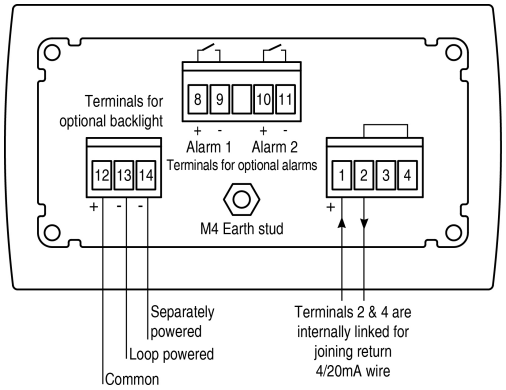


Fig 6 Rear terminals

5.5 Scale card

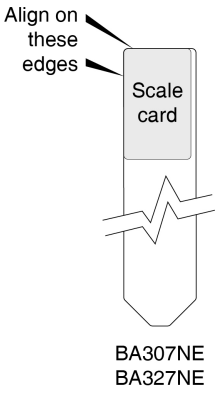
The indicator's units of measurement are shown on a printed scale card in a window at the right hand side of the display. The scale card is mounted on a flexible strip that is inserted into a slot at the rear of the instrument as shown in Fig 7. Thus the scale card can easily be changed without dismantling the indicator or removing it from the Ex n enclosure in which it is mounted.

New indicators are supplied with a printed scale card showing the requested units of measurement, if this information is not supplied when the indicator 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 indicator, 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 rear panel of the indicator.



Align the self-adhesive printed scale card onto the flexible strip and insert the strip into the indicator as shown below.

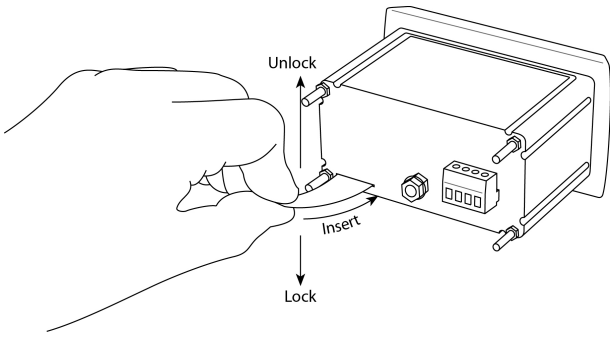


Fig 7 Inserting flexible strip carrying scale card into slot at the rear of indicator.

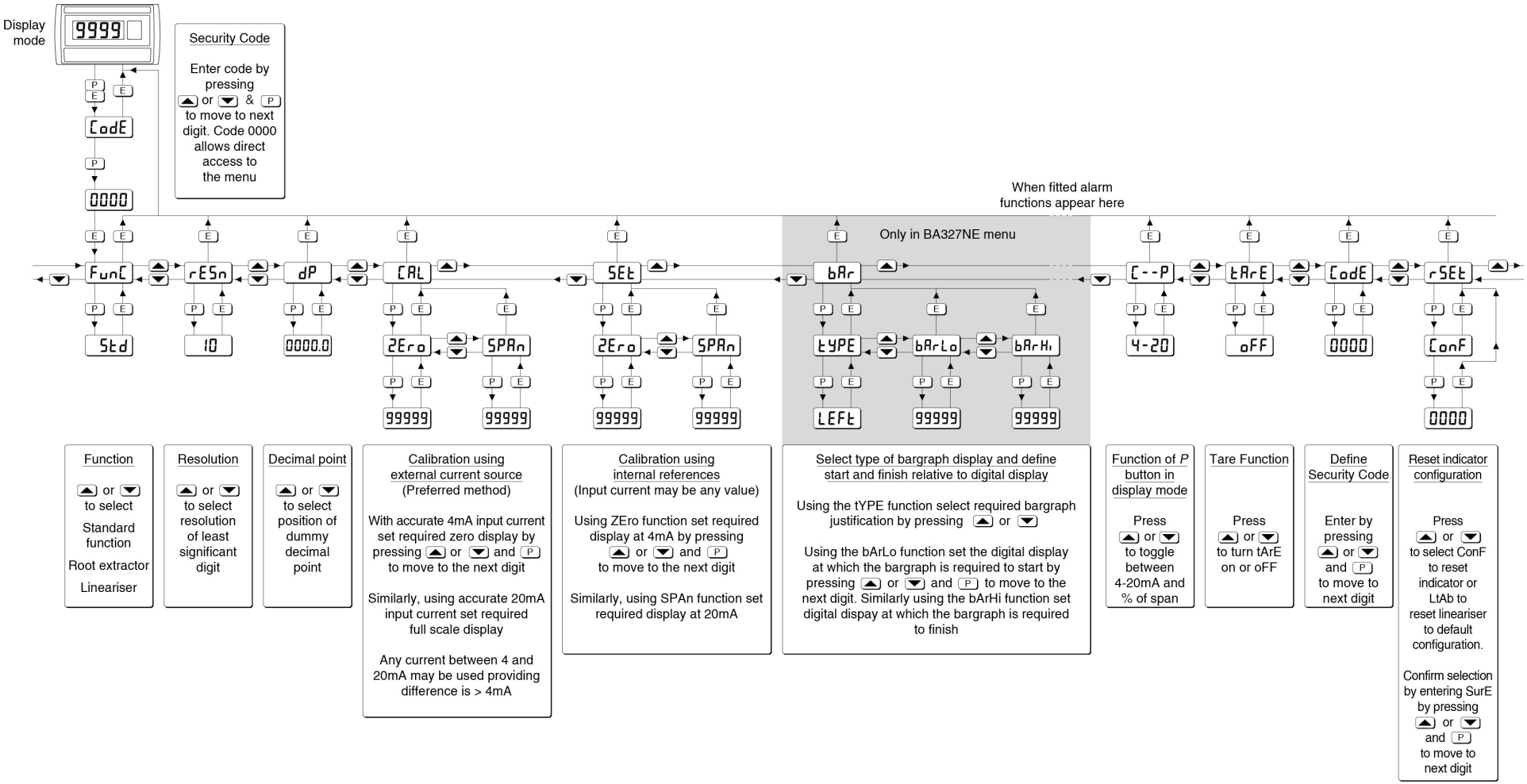


Fig 8 Configuration menu

6. CONFIGURATION AND CALIBRATION

Indicators are configured and calibrated via the four front panel push buttons. All the configuration functions are contained in an easy to use intuitive menu that is shown diagrammatically in Fig 8.

Each menu function is summarised in section 6.1 and includes a reference to more detailed information. When the indicator is fitted with alarms additional functions are added to the menu which are described in section 9.3. Throughout this manual push buttons are shown as ***P***, ***E***, ▼ or ▲, and legends displayed by the indicator are shown within inverted commas e.g. 'CAL' and ' ALr2'.

Access to the configuration menu is obtained by operating the ***P*** and ***E*** push buttons simultaneously. If the indicator security code is set to the default 0000 the first parameter 'FunC' will be displayed. If a security code other than the default code 0000 has already been entered, the indicator will display 'CodE'. Pressing the ***P*** button will clear this prompt allowing each digit of the code to be entered using the ▲ and ▼ push buttons and the ***P*** button to move control to the next digit. When the correct four digit code has been entered pressing ***E*** will cause the first parameter 'FunC' to be displayed. If the code is incorrect, or a button is not pressed within twenty seconds, the indicator will automatically return to the display mode.

Once within the configuration menu the required parameter can be reached by scrolling through the menu using the ▲ and ▼ push buttons as shown in Fig 8. When returning to the display mode following recalibration or a change to any function, the indicator will display ‘dAtA’ followed by ‘SAVE’ while the new information is stored in non-volatile memory.

All new indicators are supplied calibrated as requested at the time of ordering. If calibration is not requested, indicators will be supplied with the following default configuration:

Default Configuration

	BA307NE	BA327NE
Access code ‘CodE’	0000	0000
Function ‘FunC’	Linear	Linear
Display at 4mA ‘Zero’	0.0	0.00
Display at 20mA ‘SPAn’	100.0	100.00
Resolution ‘rESn’	1 digit	1 digit
Bargraph start ‘BarLo’	-----	0.00
Bargraph finish ‘BarHi’	-----	100.00
P button in display mode ‘C-P’	%	%
Tare ‘tArE’	Off	Off

6.1 Summary of configuration functions

This section summarises each of the main configuration functions and includes a cross reference to a more detailed description. Fig 6 illustrates the location of each function within the configuration menu. The lineariser and the optional factory fitted alarms are described separately in sections 7 and 9.3 of this manual.

Display — **Summary of function**

'FunC' **Indicator function**
Defines the relationship between the 4/20mA input current and the indicator display. May be set to:
‘Std’ Standard linear relationship
‘root’ Square root extraction
‘Lin’ 16 segment adjustable lineariser – see section 7.
See section 6.2

'rESn' **Display resolution**
Defines the resolution of the least significant display digit. May be set to ‘1’, ‘2’, ‘5’ or ‘10’ digits.
See section 6.3

'dP' **Decimal point**
Positions a dummy decimal point between any of the digits or turns it off.
See section 6.4

'CAL' **Calibration of the digital display using an external current source.**
Enables the zero and span of the indicator to be adjusted using an external current source such as a calibrator. When used with an accurate traceable current source this is the preferred method of calibration.
See section 6.5

'SEt' **Calibration of display using internal references.**
Enables the zero and span of the indicator to be adjusted without the need for an accurate input current or disconnection from the 4/20mA loop.
See section 6.6

'bAr' **Bargraph format and claibration**
Only the BA327NE has a bargraph the bargraph may be conditioned to start from left, right or centre of the display, or it may be disabled. When optional alarms are fitted it can also display both alarm setpoints and the measured value. The bargraph may be calibrated to start and finish at any value within the indicator’s calibrated digital display.See section 6.7

Display **Summary of function**

'C - - P' **Function of *P* push button**
The indicator may be configured to display the input current in milliamps, or the input current as a percentage of the 4/20mA input when the ***P*** push button is operated in the display mode.
See section 6.8

'tArE' **Tare function**
When enabled the tare function sets the indicator display to zero when the ***E*** push button is operated in the display mode.
See section 6.9

'CodE' **Security code**
Defines a four digit numeric code that must be entered to gain access to the configuration menu. Default code 0000 disables this security function and allows unrestricted access to all conditioning functions.
See section 6.10

'rSEt' **Reset**
Contains two sub-functions, ‘ConF’ which returns the indicator to the default conditions shown in section 6.0 and ‘LtAb’ which returns the lineariser to the default conditions shown in section 7.3. To prevent accidental use both resets must be confirmed by entering ‘5urE’ before they will be executed.
See section 6.11

6.2 Indicator function: ‘FunC’

This configuration function defines the relationship between the indicator’s 4/20mA input current and the indicator’s display. Three alternatives are available:

‘Std’	Standard linear relationship
‘root’	Square root extraction
‘Lin’	16 segment adjustable lineariser

To reveal the existing indicator function select 'FunC' from the configuration menu and press ***P***. If the function is set as required, press ***E*** to return to the menu, or press the ▲ or ▼ button to change the setting, followed by the ***E*** button to return to the configuration menu.

‘Std’ **Linear**
Provides a linear relationship between the 4/20mA indicator input current and the indicator display.

‘root’ **Square root extraction**
Primarily intended to linearise the square law 4/20mA output from differential flowmeters.

For reference, the following table shows the output current from a non-linearised differential flowmeter.

% of full flow	Current output mA
2.5	4.01
10.0	4.16
25.0	5.00
50.0	8.00
75.0	13.00
100.0	20.00

When the root function is selected the indicator will display flow in linear units.

‘Lin’ **16 segment adjustable lineariser**
Enables non linear variables to be displayed by the indicator in linear engineering units. Use of the lineariser is described in section 7 of this instruction manual.

6.3 Resolution: rESn

This function defines the resolution of the least significant display digit. Decreasing the display resolution can improve the readability of a noisy signal. Select "rESn' from the menu and press ***P*** which will reveal the current display resolution. To change the resolution press the ▲ or ▼ button to select 1, 2, 5 or 10 digits, followed by the ***E*** button to enter the selection and return to the configuration menu.

6.4 Position of the decimal point: 'dP'

A dummy decimal point can be positioned between any of the digits or it may be absent. To position the decimal point select 'dP' from the menu and press ***P***. The decimal point can be moved by pressing the ▲ or ▼ push button. If a decimal point is not required it should be positioned beyond the most or least significant digit. When positioned as required press the ***E*** button to enter the selection and return to the configuration menu.

6.5 Calibration using an external current source: 'CAL'

This function enables the zero and span of the indicator to be adjusted using an external calibrated current source. When used with an accurate traceable current source this is the preferred method of calibration.

Zero is the indicator display with 4mA input
Span is the indicator display with 20mA input

To calibrate the indicator select 'CAL' from the configuration menu and press ***P***. The indicator will display 'ZEro' which is a request for a 4mA input current. Adjust the external current calibrator to 4.000mA and again press ***P*** which will reveal the current zero display. The flashing digit of the indicator display can be changed by pressing the ▲ or ▼ buttons, when set as required pressing ***P*** will transfer control to the next digit. When all the digits have been adjusted, press ***E*** to enter the new zero and return to the 'ZEro' prompt .

Pressing the ▲ button will cause the indicator to display 'SPAn' which is a request for a 20mA input current. Adjust the external current calibrator to 20.000mA and again press ***P*** which will reveal the existing span display. The flashing digit of the indicator display can be changed by pressing the ▲ or ▼ buttons, when set s required pressing ***P*** will transfer control to the next digit. When all the digits have been adjusted press ***E*** *t*o enter the new span and return to the 'SPAn' prompt. Finally press ***E*** again to return to the configuration menu.

Notes:

a. The indicator input current must be adjusted to the required value before the zero and span functions are entered by pressing the ***P*** button.

b. Indicators may be calibrated at currents other than 4 and 20mA, withiin the range 3.8 to 21.0mA providing the difference between the two currents is greater than 4mA. If these conditions are not complied with, the indicator displays 'FaiL' and aborts the calibration.

c. If the zero current is greater than the span current the instrument will be reverse acting i.e. an increasing input current will cause the display to decrease.

6.6 Calibration using internal reference: 'SEt'

Using the 'SEt' function the indicator can be calibrated without the need to know the value of the 4/20mA input current, or to disconnect the indicator from the 4/20mA loop.

When using the 'Set' function the indicator's internal reference is used to simulate a 4mA and 20mA input current.

Zero is the display with a simulated 4mA input
Span is the display with a simulated 20mA input

To calibrate the indicator display select 'SEt' from the configuration menu and press ***P***. The indicator will display 'ZEro', pressing ***P*** again will reveal the current display at 4mA. The flashing digit can be adjusted by pressing the ▲ or ▼ buttons, when the flashing digit is correct pressing ***P*** will transfer control to the next digit. When all the digits have been adjusted, press ***E*** to return to the 'ZEro' prompt.

To adjust the display at 20mA, press the ▲ button which will cause the indicator to display 'SPAn', pressing ***P*** will then reveal the indicator's existing display at 20mA. The flashing digit can be adjusted by pressing the ▲ or ▼ buttons, when the flashing digit is correct pressing ***P*** will transfer control to the next digit. When all the digits have been adjusted press ***E*** *t*o return to the 'SPAn' prompt followed by ***E*** to return to the 'SEt' prompt in the configuration menu.

6.7 Bargraph format and calibration: 'bAr'

Only the BA327NE has a bargraph

In addition to a five digit numerical display the BA327NE has a 31 segment analogue bargraph which may be configured to start and finish anywhere within the indicator's numerical display range.

To configure the bargraph select 'bAr' from the configuration menu and press ***P***. The indicator will display 'tYPE', pressing ***P*** again will reveal the existing bargraph justification which can be changed to one of the following four or five options using the ▲ or ▼ button:

	Bargraph justification starts from
'LEFt'	Left end of display
'CEntr'	Centre of display
'riGHT'	Right end of display
'AlrSP'	Only with alarms – see section 9.3
'oFF'	Bargraph disabled

When set as required press ***E*** to return to the 'tYPE' sub-function prompt.

The indicator's digital display at which the bargraph starts is defined by the 'bArLo' sub-function which is selected by pressing the ▲ button followed by the ***P*** button which will reveal the current indicator display at which the bargraph starts. The flashing digit can be adjusted by pressing the ▲ or ▼ buttons, when set as required pressing ***P*** will transfer control to the next digit. When all the digits have been adjusted, press ***E*** to return to the 'bArLo' prompt from which 'bArHi' which defines the finishing point of the bargraph can be selected by pressing the ▲ button. 'bArHi' is adjusted in the same way as 'bArLo'. When set as required, pressing ***E*** twice will return the display to the 'bAr' prompt in the configuration menu.

Note: 'bArLo' must be set lower than 'bArHi', incorrect setting is indicated by the bargraph scale flashing with a single bargraph segment activated.

6.8 Function of the *P* push button: 'C - - P'

When the indicator is in the display mode, operating the ***P*** push button will display the input current in milliamps, or the displayed value as a percentage of the difference between the displayed values at 4mA and 20mA inputs.

To check or change the function of the ***P*** push button select 'C - -P' from the configuration menu and press ***P*** to reveal the current setting. Pressing the ▲ or ▼ button will toggle the setting between '4-20' the current display in milliamps and 'PC' the percentage display. When set as required press ***E*** to return to the 'C - - P' prompt in the configuration menu.

6.9 Tare function: 'tArE'

The tare function is primarily intended for use with weighing system. When the indicator is in the display mode and the tare function is activated, pressing the ***E*** button for more than three seconds will zero the indicator display and activate the tare annunciator. Subsequent operation of the ***E*** push button for less than 3 seconds will return the indicator to the gross display and deactivate the tare annunciator.

To check or change the tare function select 'tARE' from the configuration menu and press ***P*** to reveal the current setting. Pressing the ▲ or ▼ button will toggle the setting between 'on' and 'oFF'. When set as required press ***E*** to return to the 'tARE' prompt in the configuration menu.

6.10 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 indicator to display the existing security code with one digit flashing. The flashing digit can be adjusted using the ▲ and ▼ 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 in the configuration menu. The revised security code will be activated when the indicator is returned to the display mode.

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

6.11 Reset to factory defaults: 'rSEt'

This function enables the indicator and the lineariser to be quickly returned to the factory default configurations shown in sections 6.0 and 7.3

To reset the indicator or lineariser select 'rSEt' from the configuration menu and press ***P***, the indicator will display one of the reset options 'ConF' or 'LtAb'.

'ConF'	Resets the indicator only to defaults
'LtAb'	Resets the lineariser only to defaults

Using the ▲ or ▼ push button select the required sub-function and press ***P.*** To prevent accidental resetting the request must be confirmed by entering '5urE'. Using the ▲ button set the first 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 selected configuration menus and return the display to the 'rSEt' function in the configuration menu.

6.12 Under and over-range

If the numerical display range of the indicator is exceeded, all the decimal points will flash as shown below:

	BA307NE	**BA327NE**
Underrange	-9.9.9.9	-9.9.9.9.9
Overrange	9.9.9.9	9.9.9.9.9

Although not guaranteed, most indicators will continue to function normally with an input current between 1.8mA and 4mA, at lower currents the instrument will display 'LPLo' before it stops functioning.

Under or overrange of the BA327NE bargraph is indicated by an activated arrow at the appropriate end of the bargraph and a flashing bargraph scale.

7. LINEARISER

A sixteen segment, seventeen breakpoint (0 to 16) lineariser may be selected in the ‘FunC’ section of the configuration menu. The starting point and slope of each straight line segment are fully adjustable allowing the indicator to display most non-linear process variables in linear engineering units. Each break-point must occur at a current greater than the preceding break-point and less than the following break-point, in the range 3.8 to 21.0mA. If this requirement is not observed when configuring the lineariser the indicator will display 'FaiL' and the configuration adjusted which produced the error message will be ignored. Fig 9 shows a typical linearised indicator characteristic.

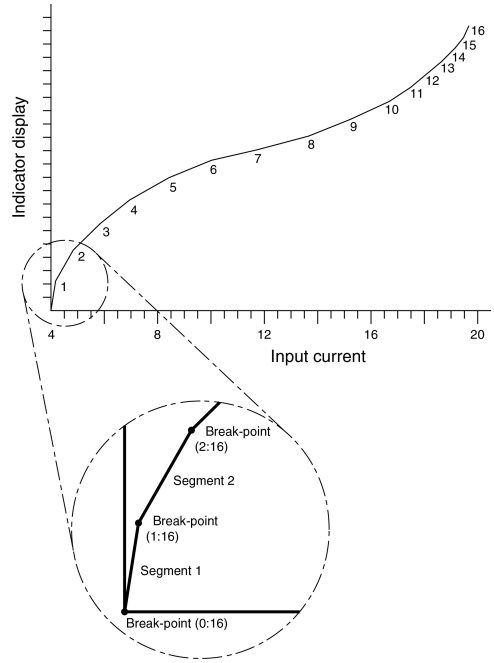


Fig 9 shows a typical linearising characteristic

Selecting ‘Lin’ in the ‘FunC’ section of the configuration menu activates the lineariser, this does not change the configuration menu shown in Fig 8, but the 'CAL' and 'SEt' functions are extended as shown in Fig 10. As with a linear indicator, calibration of the lieariser may be performed with an external current source using the 'CAL' function, or with the internal reference using the 'SEt' function.

The lineariser calibration is retained irrespective of how the indicator function ‘FunC’ is subsequently changed. It is therefore possible to select and deselect the lineariser without having to reconfigure it each time.

The lineariser calibration may be reset to the factory default settings without changing the indicator configure uing the 'LtAb' function described in section 6.11.

7.1 Lineariser calibration using an external current source.

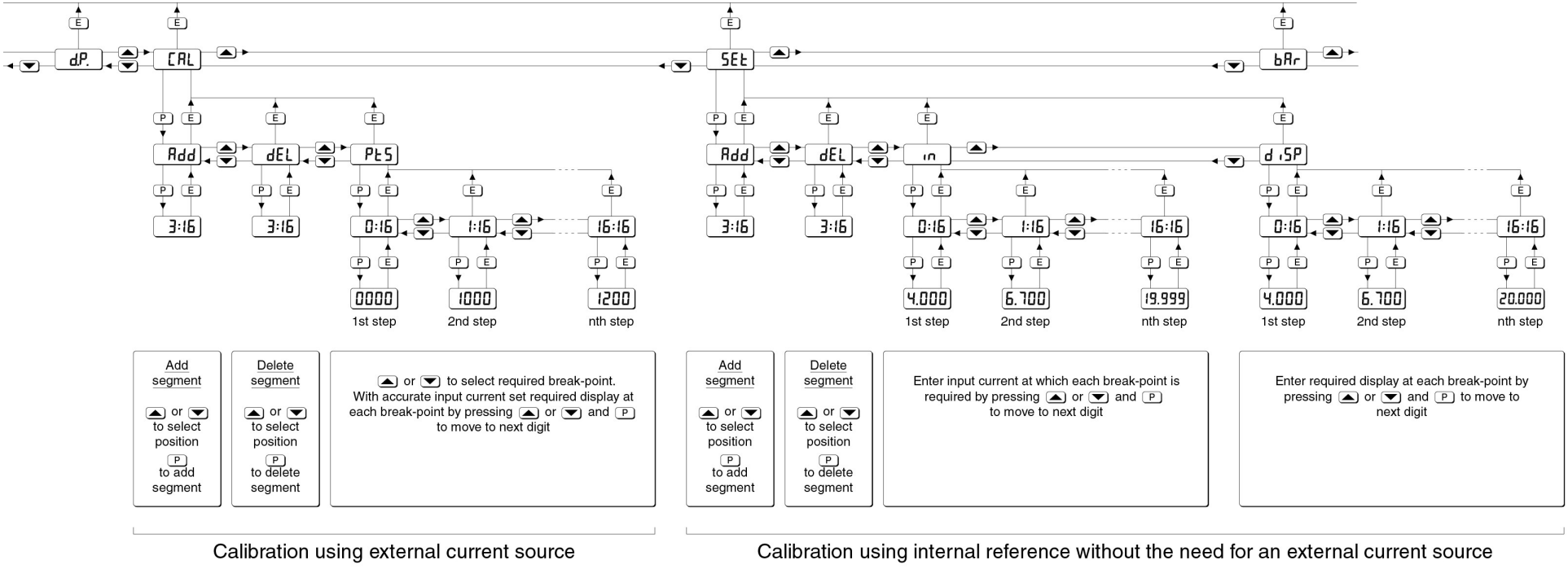
This method allows direct calibration of the lineariser with an external current source and is the preferred method when traceability is required. If the exact system non-linearity is unknown, this method also allows direct calibration from the variable to be displayed. e.g. the output from a level sensor in an irregular tank may be displayed in linear volumetric units by filling the tank with known incremental volumes and calibrating the indicator to display the sum of the increments at each break-point.

The number of break-point required should first be entered using the 'Add' and 'dEL' functions. In both these sub-functions the indicator initially displays the current break-point and the total number of break-points being used as shown below.

current breakpoint — total number of breakpoints

Display	Description of function
'Add'	**Add a break-point** Adds a new break-point before the displayed break-point. The calibration of existing break-points is not changed, but the identification number of all subsequent break-points is increased by one.
'dEL'	**Remove a break-point** Removes the displayed break-point and joins the preceding break-point to the following break-point with a straight line. The identification number of all subsequent break-points is decreased by one.

To add a break-point use the ▲ or ▼ button to select 'CAL' from the configuration menu and press ***P*** which will result in the 'Add' sub-function prompt being displayed. To enter the sub-function press ***P*** which will reveal the current break-point and the total number of break-points which have already been entered. When adding a break-point to a calibrated indicator, the insertion position for the new segment can be selected using the ▲ and ▼ push buttons. Each subsequent operation of the ***P*** push button will introduce an additional break-point up to the maximum of 'n:16'.



Each break-point must occur at an input current greater than the proceeding break-point and less than the following break-point, in the range 3.8 to 21.0 mA

Fig 10 Extension of CAL and SEt functions for lineariser configuration

CAUTION

When adding break-points to a new indicator, or following resetting of the lineariser to the factory defaults using the 'LtAb' function described in section 6.11, new break-points should be added between the two default break-points '0:1' and '1:1'. If new break-points are added before breakpoint '0:1' which has a default setting of 4mA, it will result in a 'FaiL' error message when the indicator display is entered.

The delete break-point sub-function 'dEL' operates in exactly the same way as the 'Add' sub-function described above. Once within the 'dEL' sub-function each time the ***P*** button is pressed a break-point is removed. When deleting a break-point from a calibrated indicator, the break-point to be deleted can be selected using the ▲ and ▼ push buttons. The minimum number of break-point is 2, break-points '0:1' and '1:1'.

When the required number of linearising break-points has been entered, return to the linearisation sub-menu by pressing ***E***. The indicator will display the 'Add' or 'dEL' prompt depending upon the last function used. Using the 'Pts' sub-function the input current at which each break-point occurs and the corresponding indicator display may now be defined.

Using the ▲ or ▼ button select the 'PtS' function in the sub-menu and press ***P*** to enter the function which will display the first break-point '0 : n', where n is the total number of linearising break-points entered – see Fig 9. The selected linearising break-point can be changed using the ▲ and ▼ buttons. When the required linearising break-point has been selected set the indicator input current to the exact value at which the break-point is required and press ***P****. Using the ▲ and ▼ buttons and the ***P*** button to move between digits, enter the required indicator display at this break-point.

When set as required, press the ***E*** push button to enter the required indicator display and return to the sub-menu from which the next beak-point can be selected.

*** Note:** The indicator input current must be adjusted to the required value before the ***P*** button is operated to enter the required indicator display.

Error message

If during calibration the indicator displays a 'FAiL' error message the current at which the selected break-point is being set is not above the proceeding break-point or is not below the following break-point.

When all the break-points have been calibrated pressing ***E*** twice will return the indicator to the 'CAL' function in the configuration menu.

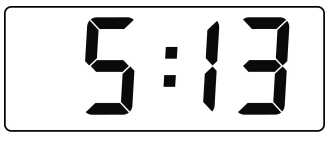
7.2 Lineariser calibration using the internal reference.

The 'SEt' function enables the lineariser to be calibrated without the need for an accurate external current source. Throughout the calibration the indicator input current may be any value between 4 and 20mA.

The 'SEt' functions contains four sub-functions.

Display	Description of function
'Add'	**Add a break-point** Adds a new break-point before the displayed break-point. The calibration of existing break-points is not changed, but the identification number of all subsequent break-point is increased by one.
'dEL'	**Remove a break-point** Removes the displayed break-point and joins the preceding segment to the following segment with a straight line. The identification number of all subsequent break-points is decreased by one.
'in'	**Defines the current at which break-point occurs.** Enables the required current at each break-point to be defined without having to input an accurate input current to the indicator.
'diSP'	**Defines indicator display at break-point.** Enables the indicator display at each break-point to be defined.

The number of break-point required should first be entered using the 'Add' and 'dEL' sub-functions. In both these sub-functions the indicator initially displays the current break-point and the total number of break-point being used as shown below.



current breakpoint — total number of breakpoints

To add a break-point using the ▲ or ▼ button select 'SEt' from the configuration menu and press ***P*** which will result in the 'Add' sub-function prompt being displayed. To enter the sub-function press ***P*** which will reveal the current break-point and the total number of break-point which have already been entered. Each subsequent operation of the ***P*** push button will introduce an additional break-

point up to the maximum of 'n:16'. When adding a break-point to a calibrated indicator, the insertion position for the new segment can be selected using the ▲ and ▼ push buttons.

CAUTION

When adding break-points to a new indicator, or following resetting of the lineariser to the factory defaults using the 'LtAb' function described in section 6.11, new break-points should be added between the two default break-points '0:1' and '1:1'. If new break-points are added before breakpoint '0:1' which has a default setting of 4mA, it will result in a 'FaiL' error message when the indicator display is entered.

The delete break-point, sub-function 'dEL' operates in exactly the same way as the 'Add' sub-function described above. Once within the 'dEL' function each time the ***P*** button is pressed a break-point is removed. When deleting a break-point from a calibrated indicator, the break-point to be deleted can be selected using the ▲ and ▼ push buttons. The minimum number of break-point is 2, break-points '0:1' and '1:1'.

When the required number of linearising break-point has been entered, return to the linearisation sub-menu by pressing ***E***. The indicator will display the 'Add' or 'dEL' prompt depending upon the last sub-function used. The indicator input current and corresponding indicator display at each break-point, which is the segment finishing point as shown in Fig 8, can now be entered using the 'in' and 'diSP' sub-functions.

Using the ▲ or ▼ button select 'in' from the sub-menu and press ***P*** which will reveal the starting point for the first segment '0:n', where n is the total number of break-point entered. Press ***P*** and use the ▲ and ▼ buttons and the ***P*** button to move between digits, to enter the input current in milliamps at which the first break-point is required, usually 4.000mA. When set as required, press ***E*** to return to the '0 : n' prompt from which the next break-point can be selected using the ▲ and ▼ buttons. When the required break-point has been selected press ***P*** and set the indicator input current at this break-point. Repeat this procedure until the indicator input current at all the break-points has been defined and then return to the 'in' sub-function by pressing the ***E*** button.

The corresponding indicator display at each of the break-points can now be defined using the 'diSP' sub-function Using the ▲ and ▼ buttons select the 'diSP' sub-function and press ***P*** which will reveal the starting point for the first break-point '0:n', where n is the total number of break-points entered. Press ***P*** and use the ▲ and ▼ buttons and the ***P*** button to move between digits, to enter the required indicator display at the first break-point. When set as required, press ***E*** to return to the '0 : n' prompt from which the next break-point can be selected using the ▲ or ▼ buttons. When the required break-point has been selected press ***P*** and set the required indicator display at this break-point.

Repeat this procedure until the indicator display at all the break-points has been defined and then return to the 'SEt' function in the configuration menu by pressing the ***E*** button twice.

7.3 Lineariser error message

If an attempt is made to position a break-point at a current which is not greater than the current of the preceding break-point, or at a current which is not less than the current of the following break-point, the error message 'FAiL' will be displayed. This error message will also be displayed if an attempt is made to position a break-point outside the current range 3.8 to 21.0mA.

7.4 Under and over-range

The lineariser does not change the under and over-range indication described in section 6.12. At input currents below that specified for the first break-point '0:n', the indicator will continue to use the specified slope of the first segment. Although not guaranteed, most indicators will continue to function normally with an input current between 1.8mA and 4mA, at lower currents the instrument will display 'LPLo' before it stops functioning.

At input currents above that specified for the last break-point 'n:n', the indicator will continue to use the slope specified for the last lineariser segment.

7.5 Lineariser default configuration

When the lineariser is reset to the factory defaults using the 'LtAb' function described in section 6.11, the defaults conditions are:

			Indicator display	
			BA307NE	**BA327NE**
First break-point	'0:1'	4mA	0.0	0.00
Second break-point	'1:1'	20mA	100.0	100.00

8. MAINTENANCE

8.1 Fault finding during commissioning

If an indicator fails to function during commissioning the following procedure should be followed:

Symptom	Cause	Solution
No display	Incorrect wiring	Check wiring There should be 0.6 to 1.2V between terminals 1 & 3 with terminal 1 positive. With an optional backlight which is loop powered, there should be 3.4 to 5V between terminals 3 & 12 with terminal 12 positive.
No display, 0V between terminals 1 & 3.	Incorrect wiring or no power supply.	Check supply voltage and voltage drop caused by all the instruments in the loop.
All decimal points flashing.	Underrange if –ve sign displayed or overrange.	Recalibrate the indicator to reduce the maximum display.
Unstable display	4/20mA input is noisy.	Reduce noise on 4/20mA input and/ or decrease indicator resolution.
Unable to enter configuration menu.	Incorrect security code entered.	Enter correct security code, or contact BEKA if the code has been lost.

8.2 Fault finding after commissioning

The IEC guidance on maintenance procedures *EN 60079-17:2014 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 panel enclosure in which the indicator is mounted] 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 an indicator fails after it has been functioning correctly, follow the procedure shown in section 8.1. If this does not reveal the cause of the fault, it is recommended that the instrument is replaced.

8.3 Servicing

All BA307NE and BA327NE loop powered indicators are interchangeable if the required optional backlight and alarms are fitted. A single spare instrument may quickly be recalibrated to replace any instrument that is damaged or fails. No attempt should be made to repair instruments at component level.

We recommend that faulty instruments are returned to BEKA associates or to your local BEKA agent for repair.

8.4 Routine maintenance

The mechanical condition of the instrument and electrical calibration should be regularly checked. Inspection frequency should be chosen to suit the environmental conditions.

8.5 Guarantee

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

8.6 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.

9. ACCESSORIES

9.1 Scale card

Both models have a window on the right hand side of the display through which to view a scale card showing the units of measurement such as °C, mBar or RPM. New indicators are fitted with a scale card showing the units of measurement specified when the indicator 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 to the indicator on-site without opening the indicator enclosure or removing it from the panel enclosure. See section 5.5 of this instruction manual.

Less common units of measrement can be hand printed onto the scale card using a variety of techniques, or custom printed cards are available from BEKA.

9.2 Tag information

New indicators can be supplied with tag or application information laser etched onto the rear of the instrument. This tag information is not visible from the front of the instrument after installation.

9.3 Stainless steel support plate

When a BA307NE or BA327NE indicator is installed into an enclosure panel less than 1mm thick or in a non-metallic enclosure panel, a support plate may be required as explained in section 5.2c of this manual. This plate prevents the enclosure panel being distorted or creeping when the indicator panel clamps are tightened and ensures that the joint between the indicator and the panel enclosure in which it is mounted remains sealed.

9.4 Alarms

CAUTION

These alarms outputs should not be used for critical safety applications such as an emergency shut down system.

Both models can be supplied with factory fitted dual solid state, single pole alarm outputs. Each alarm output may be independently conditioned as a high or low alarm with a normally open or normally closed output in the non-alarm condition.

When the 4/20mA current powering the indicator is removed both alarm outputs will open irrespective of configuration. The open circuit condition should therefore be chosen as the alarm condition when designing an alarm system. Fig 11 illustrates the conditions available and shows which are fail safe.

When an alarm occurs an alarm annunciator on the indicator's front panel is activated and if required the numerical display can alternate between the measured value and the alarm channel identification ‘ALr1’ or ‘ALr2’.

CAUTION

The alarms are activated by the indicator’s numerical display. Use of the Tare Function ‘tArE’ will change the numerical display, the alarms will continue to function at the original displayed value, but this will correspond to a different input current.

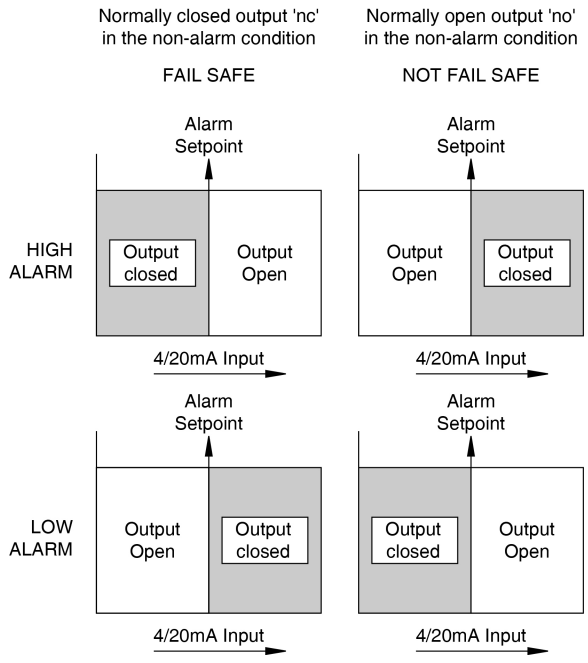


Fig 11 Alarm outputs

Configurable functions for each alarm include adjustable setpoint, hysteresis, alarm delay and alarm accept.

9.4.1 Solid state output

Each alarm output is a galvanically isolated single pole solid state switch as shown in Fig 12. The output is polarised and current will only flow in one direction, terminals 8 and 10 should therefore be connected to the positive side of the circuit being switched.

Ron = less than 5Ω + 0.7V
Roff = greater than 1MΩ

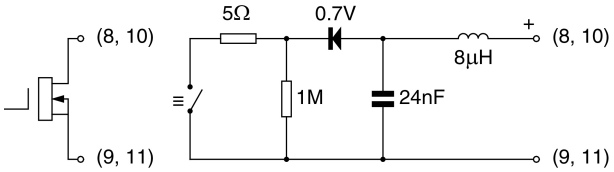


Fig 12 Equivalent circuit of each alarm output

9.4.2 Type nA certification

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

Ui = 30V dc
Ii = 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 BA307NE or BA327NE indicator 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 13 shows a typical application in which a BA307NE or BA327NE indicator mounted in an Ex n panel enclosure located in Zone 2 is displaying the output from an Flameproof Ex d 2-wire transmitter 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.

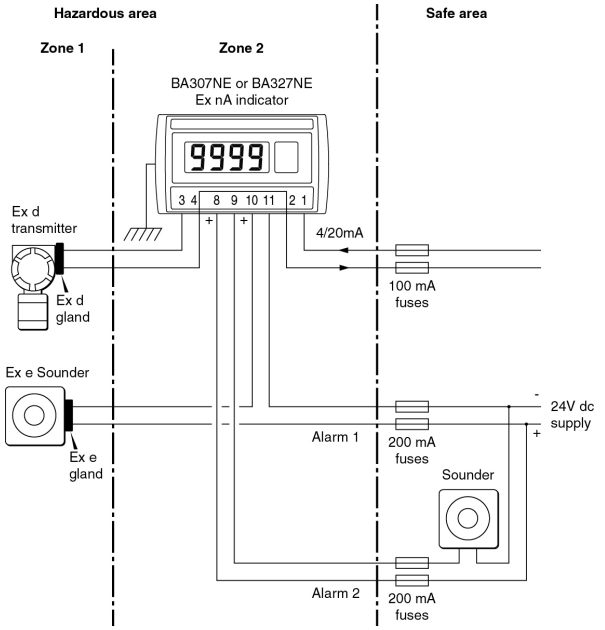


Fig 13 Typical alarm application
(Shown without recommended screened cables)

To comply with the requirements of BS 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 20 illustrates an example of this type of switch fuse 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.

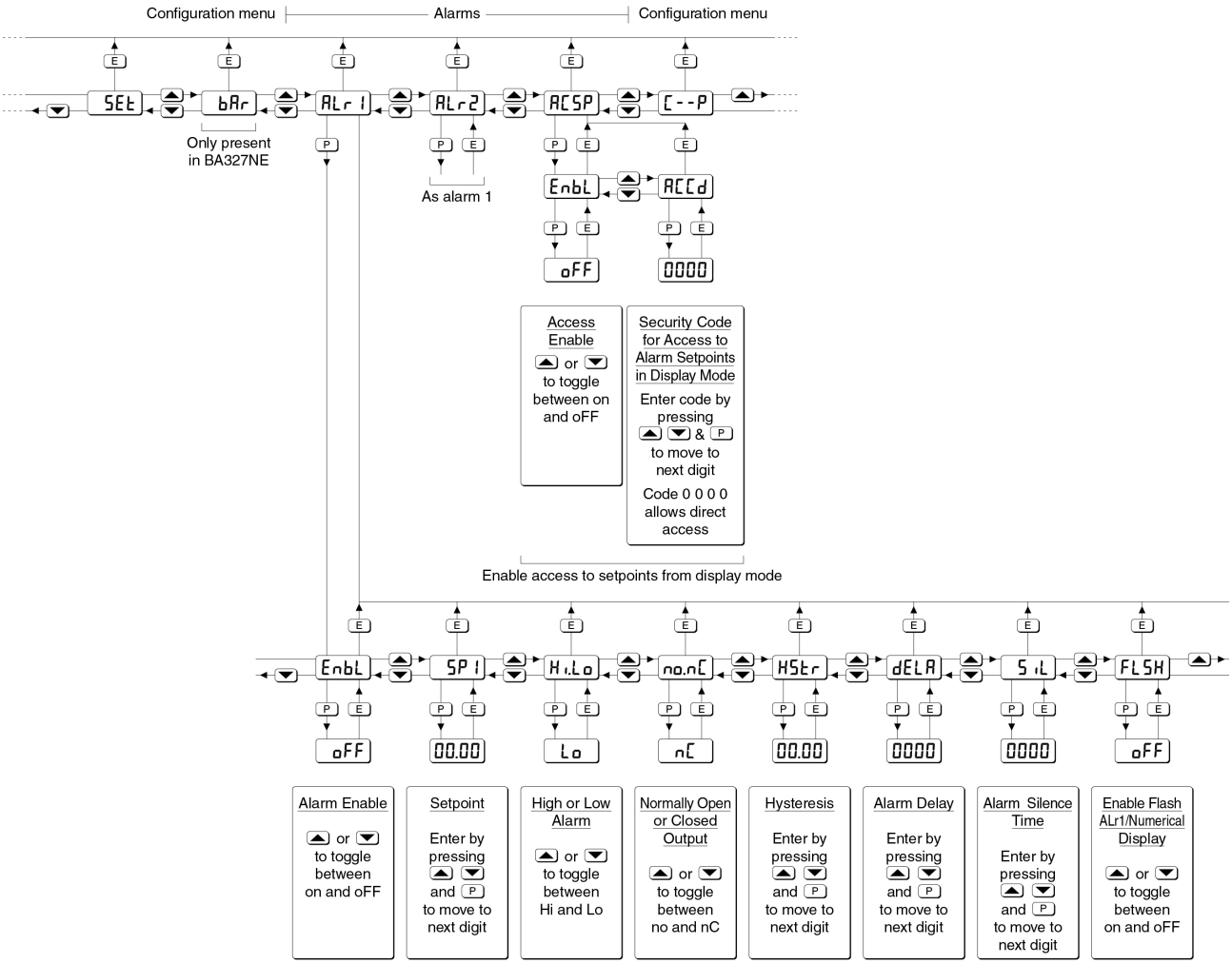


Fig 14 Alarm Functions in Configuration Menu

9.4.3 Configuration and adjustment

When optional alarms are fitted to a loop powered indicator the configuration menu is extended as shown in Fig 12. The additional functions appear between the ‘SEt’ and the ‘C- - P’ functions for the BA307NE and between ‘bAr’ and ‘C- -P’ for the BA327NE indicator. For simplicity, Fig 12 only shows the additional functions for alarm 1, but alarm 2 has identical functions.

The following table summaries each of the alarm configuration functions and includes a cross reference to more detailed information.

Summary of alarm configuration functions

Display	Description of function
'EnbL’	**Alarm enable** Enables or disables the alarm without changing the alarm parameters. See section 9.4.4
'SP1'	**Alarm setpoint 1** Adjusts the alarm setpoint. The alarm is activated when the indicator display equals the setpoint. See section 9.4.5
'Hi.Lo'	**Alarm function** Defines the alarm function as High or Low. See section 9.4.6
'no.nC'	**Normally open or normally closed output** Sets the alarm output open or closed in the non-alarm condition. See section 9.4.7
'HStr'	**Hysteresis** Adjusts the alarm hysteresis. See section 9.4.8
'dELA'	**Alarm delay time** Introduces adjustable delay between the display equalling the setpoint and the alarm output being activated. See section 9.4.9
'SiL'	**Alarm silence time** Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 9.4.10
‘FLSH’	**Flash display when alarm occurs** When enabled, alternates the numerical display between process value and alarm reference, ‘ALr1’ or ‘ALr2’, when an alarm output is activated. See section 9.4.11
'ACSP'	**Access setpoint** Sub-menu which enables direct access to the alarm setpoints from the indicator display mode, and defines a separate security code. See section 9.4.12

9.4.4 Alarm enable: 'EnbL'
This function allows each alarm to be enabled or disabled without altering any of the alarm parameters. To enable or disable the alarm select 'EnbL' from the alarm menu and press ***P*** which will reveal the current setting 'on' or 'oFF'. The function can be changed by pressing the ▲ or ▼ button followed by the ***E*** button to return to the alarm menu.

9.4.5 Setpoint adjustment: 'SP1' and 'SP2'
The setpoint of each alarm may be positioned anywhere in the numerical display of the indicator providing that this corresponds to an input current between 3.8 and 20.2mA. e.g. If the indicator has been calibrated to display 0 with 4mA input and 10000 with 20mA input, the two alarm setpoints may be positioned anywhere between -125 and 10125.
To adjust the setpoint select 'SP1' or 'SP2' from the alarm configuration menu and press ***P*** which will reveal the existing alarm setpoint. The flashing digit of the setpoint can be adjusted using the ▲ and ▼ push buttons, and the ***P*** button to move control to the next digit. When the required setpoint has been entered press ***E*** to return to the alarm configuration menu.
The alarm setpoints may also be adjusted when the indicator is in the display mode, see section 9.4.12.

9.4.6 Alarm function: 'Hi.Lo'
Each alarm can be independently conditioned as a high alarm or as a low alarm. To check or change the alarm function select 'Hi.Lo' from the alarm menu and press ***P*** to reveal the current setting. The function can be changed by pressing the ▲ or ▼ button followed by the ***E*** button to return to the alarm menu.

9.4.7 Alarm output status: 'no.nC'
Configures the solid state alarm output to be open 'no' or to be closed 'nC' in the non-alarm condition. When deciding which is required, care should be taken to ensure that the alarm output is fail safe as illustrated in Fig 9.

'no' Alarm output open in non-alarm condition

'nC' Alarm output closed in non-alarm condition

CAUTION
When the 4/20mA supply is removed from the loop powered indicator, both alarm outputs will open irrespective of conditioning. Therefore for fail safe operation both alarm outputs should be conditioned to be open in the alarm condition 'nC'.

To check or change the alarm output status, select 'no.nC' from the alarm configuration menu and press ***P*** to reveal the setting. The function may be changed by pressing the ▲ or ▼ button followed by the ***E*** button to return to the alarm configuration menu.

9.4.8 Hysteresis: HStr
Hysteresis is shown in the units that the indicator has been calibrated to display.
To adjust the hysteresis select 'HStr' from the alarm menu and press ***P*** which will reveal the existing figure. The flashing digit can be adjusted using the ▲ and ▼ push buttons, and the ***P*** button will move control to the next digit. When the required hystersis has been entered press ***E*** to return to the alarm configuration menu.

e.g. An indicator calibrated to display 0 to 10000, with a high alarm set at 9000 and hysteresis of 200 will perform as follows:

The high alarm will be activated when increasing indicator display equals 9000, but will not reset until the indicator display falls below 8800.

9.4.9 Alarm delay: dELA
This function delays activation of the alarm output for an adjustable time following the alarm condition occurring. The delay can be set in 1 second increments between 0 and 3600 seconds. If a delay is not required zero should be entered. To adjust the delay select 'dELA' from the alarm configuration menu and press ***P*** which will reveal the existing delay. The flashing digit of the delay can be adjusted using the ▲ and ▼ push buttons, and the ***P*** button to move control to the other digits. When the required delay has been entered press ***E*** to return to the alarm menu.

e.g. An indicator with a high alarm set at 9000 and an alarm delay of 30 seconds will perform as follows:

The alarm annunciator will start to flash when an increasing indicator display equals 9000, but the alarm output will not be activated until the alarm condition has existed continuously for 30 seconds. When the alarm output is activated, the alarm annunciator will stop flashing and become permanently activated.

If the 'FLSH' function, which flashes the indicator display when an alarm occurs, has been enabled, it will not start to function until the alarm output is activated.
See section 9.4.11

9.4.10 Alarm silence time: SiL

This function is primarily intended for use in small installations where the alarm output directly operates an alarm annunciator such as a sounder or beacon. When the alarm silence time, which is adjustable between 0 and 3600 seconds in 1 second increments, 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. If the alarm condition still exists at the end of the silence time, the alarm output will be reactivated. During the silence time the indicator alarm annunciator will flash until the silence time expires or the alarm is cleared.

If the ‘FLSH’ function, which flashes the indicator display when an alarm occurs has been enabled, it will only function when the alarm output is activated, not during the silence time. See section 9.4.11

To adjust the alarm silence time select 'SiL' from the alarm configuration menu and press ***P*** which will reveal the existing silence time. The flashing digit of the silence time can be adjusted using the ▲ and ▼ push buttons, and the ***P*** button to move control to the other digits. When the required silence time has been entered press ***E*** to return to the alarm menu.

9.4.11 Flash display when alarm occurs ‘FLSH’

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

When enabled, the function alternates the indicator display between the numerical value and the alarm reference, ‘ALr1’ or ‘ALr2’, when the alarm output is activated. If both alarm outputs are activated, the alarm references are displayed in sequence.

To enable or disable the function select 'FLSH' from the alarm menu and press ***P*** which will reveal the current setting ‘on’ or ‘oFF’. The function can changed by pressing the ▲ or ▼ button followed by the ***E*** button to return to the alarm menu.

9.4.12 Access setpoint in display mode: ACSP

This function enables a separate menu providing access to the alarm setpoints from the display mode by simultaneously operating the ***P*** and ▲ push buttons. An operator can therefore adjust the alarm setpoints without having access to the indicator configuration menu. Protection against accidental adjustment of the setpoints when the indicator is in the display mode is provided by a separate security code.

This direct setpoint access menu is enabled and the separate security code entered from the 'ACSP' function in the alarm configuration menu as shown in Fig 12. To change the menu parameters select 'ACSP' from the configuration menu and press ***P*** which will display the enable prompt 'EnbL'. Press ***P*** again to reveal if the direct access menu is 'on' or 'oFF'. The ▲ or ▼ button will toggle the display between the two conditions.

If 'oFF' is selected, the operator will not have access to the setpoints from the display mode. Return to the 'ACSP' prompt in the main menu by pressing ***E*** twice.

If 'on' is selected, the operator will have direct access to the alarm setpoints from the display mode via a separate optional security code. To define this four digit security code press ***P*** to return to the 'Enbl' prompt followed by the ▲ or ▼ button to select the access code prompt 'ACCd'. Pressing ***P*** will reveal the current security code. Each digit of the code may be changed by operating the ▲ and ▼ push buttons, and the ***P*** button to move control to the next digit. When the required code has been entered, press ***E*** twice to return to the 'ACSP' prompt in the configuration menu.

Default code 0000 will disable the security code allowing direct access to the setpoints in the display mode by pressing the ***P*** and ▲ buttons simultaneously. Unless otherwise requested new instruments with alarms are supplied with this function disabled and the security code set to 0000.

9.4.13 Adjusting alarm setpoints from the display mode

Access to the alarm setpoints from the indicator display mode is obtained by operating the ***P*** and ▲ push buttons simultaneously as shown in Fig 15. If the setpoints are not protected by a security code the alarm setpoint prompt 'SP1' will be displayed. If the setpoints are protected by a security code, 'Code' will be displayed first. Pressing ***P*** again will enable the alarm security code to be entered digit by digit using the ▲ and ▼ buttons to change the flashing digit, and the ***P*** push button to move control to the next digit. If the correct code is entered pressing ***E*** will cause alarm setpoint prompt 'SP1' to be displayed. Pressing the ▲ or ▼ button will toggle the display between the two alarm setpoint prompts 'SP1' and 'SP2'.

If an incorrect security code is entered, or a button is not pressed within twenty seconds, the indicator will automatically return to the display mode.

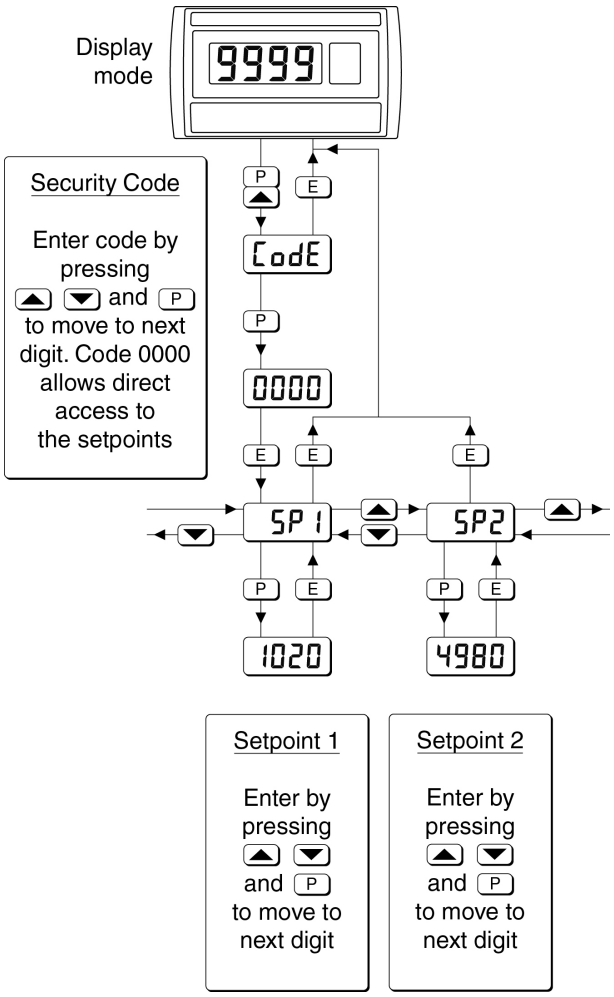


Fig 15 Setpoint adjustment from the display mode

To adjust an alarm setpoint select 'SP1' or 'SP2' and press ***P*** which will reveal the current setting. Each digit of the setpoint may be adjusted using the ▲ and ▼ push buttons, and the ***P*** button to move control to the next digit. When the required setpoint has been entered, pressing ***E*** will return the display to the 'SP1' or 'SP2' prompt from which the other setpoint may be selected, or the indicator may be returned to the display mode by pressing ***E*** again.

Note: With the indicator in the display mode, direct access to the alarm setpoints is only available when the ACSP menu is enabled - see section 9.4.12

9.4.14 Displaying setpoints on BA327NE bargraph

One of the selectable bargraph formats 'AlrSP' allows a low or a high setpoint plus the displayed value to be represented, or a low and a high setpoint plus the displayed value to be represented by the bargraph as shown in Fig 16.

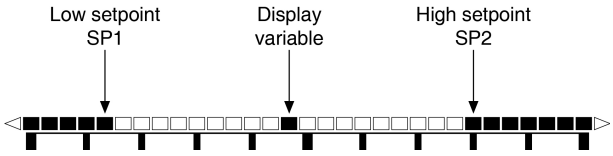


Fig 16 Displayed value and setpoints on bargraph

The bargraph area below the low alarm setpoint and the area above the high alarm setpoint are activated. The displayed variable is represented by an activated bar which moves between these low and high alarm setpoints.

When the activated bar representing the displayed variable is adjacent to the area representing the low or high alarm setpoints, the bar flashes. When a displayed variable equals the low or high alarm the complete bargraph representing the activated alarm flashes irrespective of whether the alarm output has been delayed or cleared.

For this function to operate SP1 must be conditioned as a low alarm and SP2 as a high alarm; SP1 must always be less than SP2. Incorrect configuration is shown by a flashing bargraph scale with no activated bars.

9.5 Display backlight

The BA307NE and BA327NE loop powered indicators can be supplied with a factory fitted backlight that may be loop or separately powered.

When loop powered the backlight produces green background illumination enabling the display to be read at night or in poor lighting conditions. No additional power supply or field wiring are required, but the indicator voltage drop is increased. When separately powered the backlight is brighter, but additional field wiring is required.

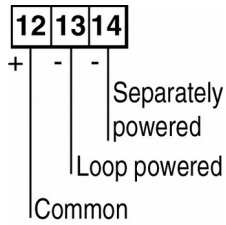


Fig 17 Terminals for optional backlight

9.5.1 Loop powering the backlight

The backlight is loop powered by connecting it in series with the indicator's 4/20mA input as shown in Fig 18, which increases the maximum indicator voltage drop from 1.2 to 5V.

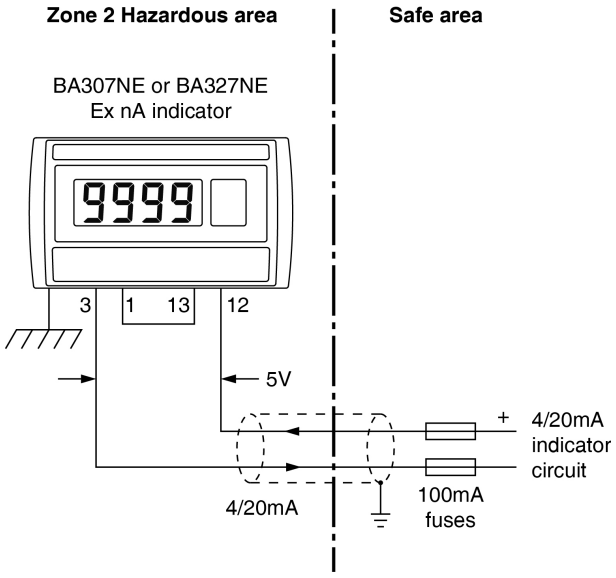


Fig 18 Loop powered backlight

9.5.2 Separately powering the backlight

The optional backlight may also be powered from a separate power supply as shown in Fig 19.

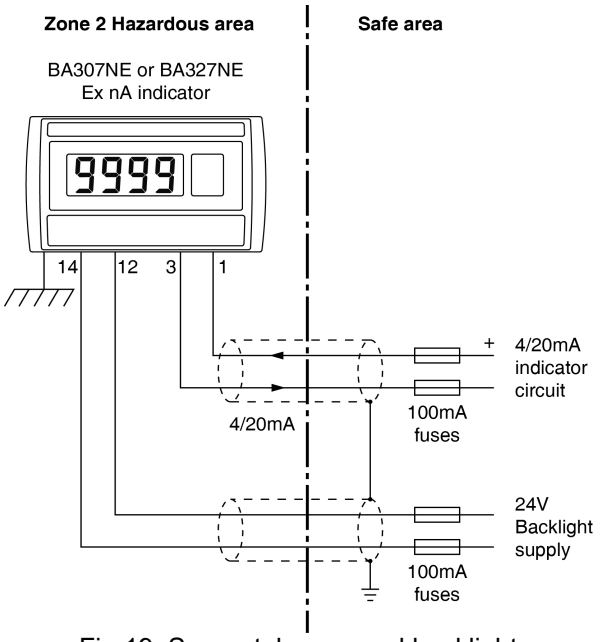


Fig 19 Separately powered backlight

The separately powered backlight is a current sink which will draw a constant 22.5mA when the supply voltage is equal to or greater than 9V. At lower supply voltages the backlight will continue to function but with reduced brilliance and will draw less current.

The ATEX certificate therefore only specifies the maximum safety input voltage Ui for terminals 12 and 14.

Ui = 30V

To comply with the requirements of BS 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 20 illustrates an example of this type of switch fuse terminal block.

For some application Ex nA instrumentation energised by a current limited power supply that can be switched off, is often considered adequate.

APPENDIX 1
Use in an Ex e or Ex p panel enclosure located in Zone 2.
The ATEX and IECEx certificates for the BA307NE and BA327NE indicators permit the instruments to be installed in an Ex e increased safety panel enclosure located in Zone 2, or in an Ex p pressurised panel enclosure located in a Zone 2 hazardous area.

A1.1 Installation in Ex e panel enclosure within Zone 2
Installation of a BA307NE or BA327NE indicator in an Ex e increased safety panel enclosure does not invalidate the Ex e panel's ingress and impact protection as the front of both indicators comply with Ex e ingress and impact requirements. Although mounted in an Ex e panel enclosure, the BA307NE or BA327NE remain protected by Group II Category 3G Ex nA ic IIC T5 Gc certification described in the main section of this manual and the front panel push button contacts remain intrinsically safe Ex ic.

In normal operation i.e. without faults, the maximum power dissipation within the indicator is less than 150mW which is very unlikely to modify the internal temperature of the Ex e panel enclosure.

CAUTION
BA307NE and BA327NE indicators should not be installed in an Ex e panel enclosure located in Zone 1.

There are four design requirements:

1. The indicator should be installed generally as shown in section 5 and Fig 20.

2. The certificate specifies that the indicator should be connected to a *limited energy* 4/20mA circuit having a maximum output current of 200mA. A low voltage supply, usually 24V, that is safe in normal operation and suitable for live connection i.e. CE marked, is usually considered acceptable.

3. Wiring should comply with Clause 9 of BS EN 60079-14.

4. The 4/20mA input must be able to supply the 1.2V required to operate the indicator. This increases to 5.0V if the indicator includes an optional loop powered backlight. See 9.5.1.

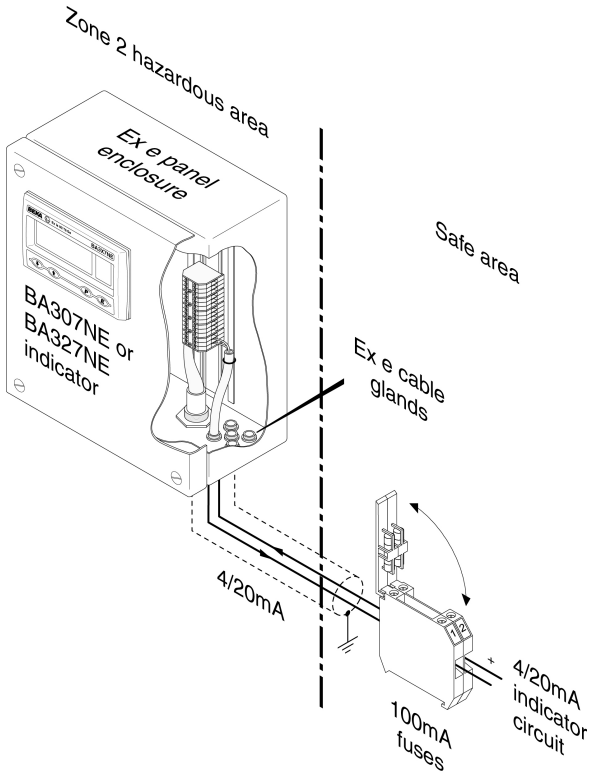


Fig 20 Typical installation in Ex e panel enclosure

A1.2 Zone 2 installation in Ex p enclosure
Installation of a BA307NE or BA327NE indicator in an Ex p pressurised panel enclosure does not invalidate the pressurised panel's ingress and impact protection as the front of the indicator complies with Ex p ingress and impact requirements. Although mounted in an Ex p panel, enclosure the BA307NE or BA327NE remain protected by Group II Category 3G Ex nA ic IIC T5 Gc certification described in the main section of this manual and the front panel push button contacts remain intrinsically safe Ex ic.

CAUTION
BA307NE and BA327NE indicators should not be installed in an Ex p panel enclosure located in Zone 1.

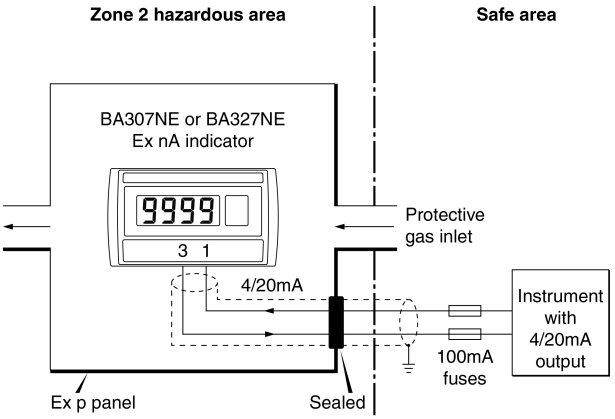


Fig 21 Typical installation in Ex p panel enclosure

A1.3 Installation in an Ex p panel enclosure within Zone 2.

Fig 21 shows a typical installation within an Ex p pressurised enclosure located in Zone 2.

The BA307NE and the BA327NE may be driven directly from any instrument with a 4/20mA output located in the safe area or from apparatus located within the Ex p panel enclosure.

There are five design requirements:

1. The indicator must be installed in the panel of an Ex p enclosure generally as shown in section 5 of this manual and in Fig 21.

2. The four vents at the rear of the indicator enclosure shown in Fig 22 must not be obstructed.

3. The certificate specifies that the indicator should be connected to a *limited energy* 4/20mA circuit having a maximum output current of 200mA. An instrument located in the safe area that is safe in normal operation and has a 4/20mA output suitable for live connection i.e. CE marked, is usually considered acceptable.

4. Wiring should comply with Clause 9 of BS EN 60079-14:2008.

5. The 4/20mA input must be able to supply the 1.2V required to operate the indicator. This increases to 5.0V if the indicator includes an optional loop powered backlight. See 9.5.1

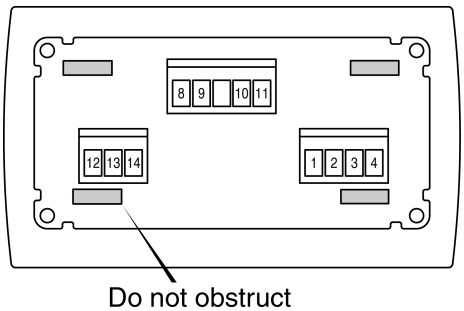


Fig 22 Position of rear vents

APPENDIX 2
ATEX dust certification

In addition to ATEX certification permitting installation in Zone 2 gas atmospheres which is described in the main section of this instruction manual, the BA307NE and the BA327NE also have ATEX Ex tc certification, allowing installation in Zone 22 combustible dust atmospheres when mounted in an Ex t panel enclosure.

A2.1 Zones and Maximum Surface Temperature

Both indicators have been certified as Group II Category 3D Ex tc IIIC T80°C Dc IP20 apparatus with a Ta of –40°C to +70C. This is dust ignition protection by enclosure complying with BS EN 60079-31 *Equipment dust ignition protection by enclosure "t".*

When mounted in an Ex t panel enclosure as specified in section 5 of this instruction manual and complying with the installation requirements of BS EN 60079-14 the indicators 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 dusts 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 BS EN 60079-14

At an ambient temperature between -40 and +70°C

* Unlikely occurrence in Zone 22

A2.2 Installation

All the circuits shown in the main section of this manual for indicator installations in Zone 2 flammable gas atmospheres, may also be used for Zone 22 combustible dust applications. The indicator should be installed in an Ex t panel enclosure located within Zone 22. The panel enclosure containing the indicator should be located where the minimum amount of dust will accumulate on them and the installation should be as specified in section 5 of this instruction manual and comply with the requirements of EN 60079-14.

BS EN 60079-14 requires that each of the wires entering the hazardous area should be individually fused and contain a means of isolation. However, in practice instrumentation energised by a current limited power supply that can be switched off is often considered adequate.

A2.3 Maintenance

The BA307NE and BA327NE front panel keypads are intrinsic safe Ex ic which allows them to be operated in Zone 22.

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 indicator's mechanical condition and removal of accumulated dust from the front of the indicator and the outside of the Ex tc enclosure should be performed regularly. The interval between inspections depends upon environmental conditions. Removal of flammable dust should be performed with care to avoid creating a dust cloud.

APPENDIX 3
IECEx gas and dust certification

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

A3.1 IECEx Certificate of Conformity

The BA307NE and the BA327NE loop powered indicators and the optional accessories have been issued with an IECEx Certificate of Conformity number IECEx ITS 14.0026X that specifies the following certification codes:

Ex nA ic IIC T5 Gc
Ex tc IIIC T80°C Dc IP66
Ta = -40°C to 70°C

The specified gas and dust safety parameters are identical to the ATEX safety parameters described in the main section and Appendix 1 and 2 of this manual.

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

A3.2 Installation

The IECEx and ATEX certificates specify identical safety parameters and installation requirements for both indicators. The ATEX installation requirements specified in the main section of this manual and in Appendix 1 & 2 may therefore be used for IECEx installations which should comply with IEC 60079-14 *Electrical installations design, selection and erection*. The local code of practice should also be consulted.