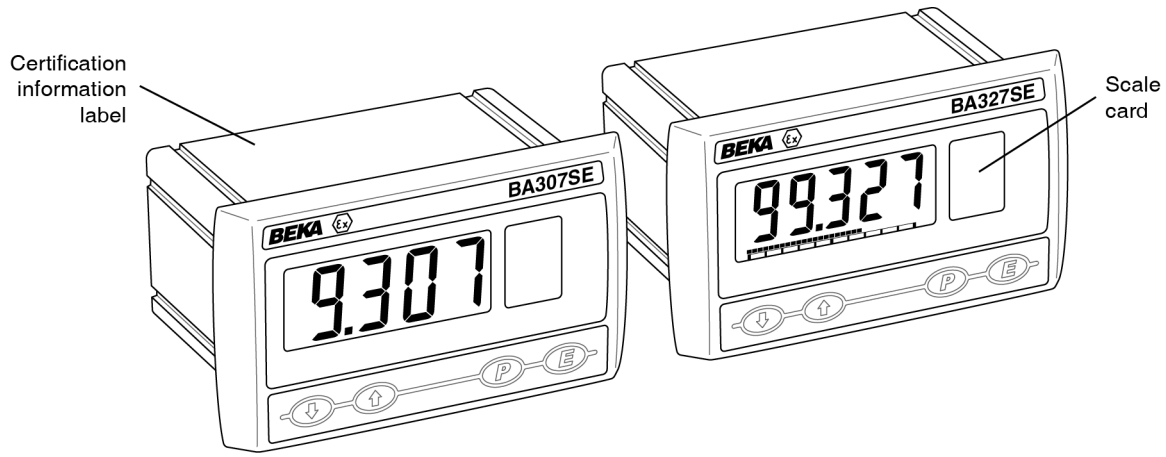
BA307SE & BA327SE
Ex ec & Ex tc
loop-powered
panel mounting indicators

Issue 6



Issue: 6
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Appendix 1 Use in an Ex p pressurised enclosure

Appendix 2 IECEx, ATEX and UKEX dust certification.

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

The BA307SE & BA327SE panel mounting indicators are CE marked to show compliance with the *European Explosive Atmospheres Directive 2014/34/EU* and the *European EMC Directive 2014/30/EU*.

The indicators are also UKCA marked to show compliance with UK statutory requirements *Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations UKSI 2016:1107 (as amended)* and with the *Electromagnetic Compatibility Regulations UKSI 2016:1091 (as amended).*

1. DESCRIPTION

These panel mounting, Ex ec increased safety 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
BA307SE	4 digits 15mm high
BA327SE	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.

Optional factory fitted dual alarm solid state outputs, 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 an IECEx Certificate of Conformity, and with ATEX and UKEX Type Examination Certificates. These confirm that both indicators comply with the requirements for increased safety Ex ec protection, and with those for dust ignition protection by enclosure Ex tc.

All the certificate numbers have 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 must comply with Ex e requirements which are defined in EN 60079-7.

The indicators may also be installed in an Ex p panel enclosure as described in Appendix 1.

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

Both indicators also have ETL and cETL certification allowing installation in the USA and Canada as 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.

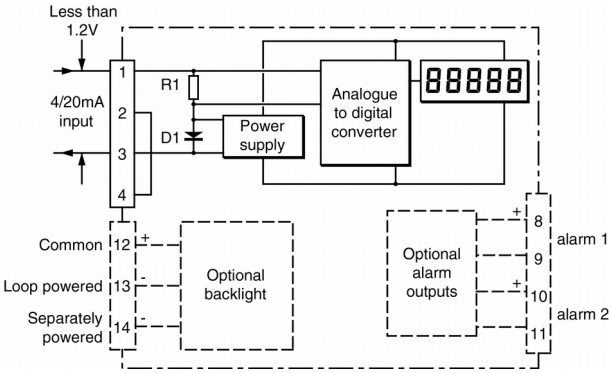


Fig 1 Indicator block diagram

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: * BA327SE 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 IECEx, ATEX, UKEX, ETL & cETL Ex ec increased safety gas certification and Ex tc protection by enclosure dust certification.

The main sections of this instruction manual describe IECEx, ATEX and UKEX gas certification. Dust approval is described in Appendix 2 and North American gas and dust certification in Appendix 3.

3.1 IECEx, ATEX and UKEX Ex ec gas certification

Testing and certification company Intertek Testing & Certification Ltd have issued both indicators with an IECEx Certificate of Conformity IECEx ITS 22.0023X, and a UKEX Type Examination Certificate ITS22UKEX0609X. Similarly, testing and certification company Intertek Italia S.p.A. have issued both indicators with an ATEX Type Examination Certificate ITS-1 22ATEX34494X.

Both indicators carry the Community and UKCA Marks, subject to local codes of practice, they may be installed in any of the EEA member countries and in the UK. The IECEx certificate allows worldwide installation, either directly or as a means to obtain local approval.

These instructions describe installations which conform to EN 60079:14 *Electrical installation design, selection and installation of equipment, including initial inspection.* When designing systems the local Code of Practice should always be consulted. Fig 2 shows the certification information label that is on the top of a BA307SE indicator.

3.2 Increased safety protection

Increased Safety Ex e protection applies additional measures to provide increased security against the possibility of excessive temperatures and against the occurrence of arcs and sparks. The fifth edition of international standard IEC 60079-7:2015 Equipment Protection by Increased Safety ‘e’ defines two levels of protection:

Ex eb EPL Gb
Equipment for installation in Zones 1 or 2.

Ex ec EPL Gc
Equipment for installation in Zone 2.

Note: Ex ec supersedes Ex nA protection following publication of the Ex n standard EN IEC 60079-15:2019 which no longer includes Ex nA protection.

3.3 Zones, gas groups and T rating

The BA307SE and BA327SE indicators have been certified as Group II Category 3G Ex ec ic IIC T5 Gc apparatus.

When connected to a suitable system and correctly mounted in a panel enclosure:

The indicators 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.

Note: When determining the maximum ambient temperature, heat generating equipment mounted in the same enclosure, or adjacent to the enclosure, should be considered.

This allows both indicators to be used with most common industrial gases except carbon disulphide and ethyl nitrite which have an ignition temperature of 95°C.

The Ex ic in the indicator's certification code refers to the front panel push button contacts which are non incendive and have been certified intrinsically safe without the need for an external Zener barrier or galvanic isolator. This allows the indicators to be adjusted when installed in Zone 2 or 22, but the indicators themselves are not intrinsically safe and should not be connected to an intrinsically safe circuit.

3.4 4/20mA input

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

U_{max} = 30V dc
I_{max} = 200mA

The indicators are current input instruments incorporating an internal protection circuit that defines the voltage developed between the input terminals 1 and 3.

3.5 Special conditions for safe use

All of the Ex ec certificates specify special conditions for safe use and therefore have certificate numbers with an 'X' suffix.

The certificates state that the BA307SE and BA327SE indicators should be mounted such that the rear of the indicator, including the terminals, have additional protection. This protection should comply with EN/IEC 60079-0 Clause 1 and provide at least IP54 ingress protection as required by IEC 60079-7.

Mounting the BA307SE or BA327SE in an Ex e component certified enclosure satisfies these requirements, but component certificates are only intended to be used as part of a certified assembly. Therefore the indicator certificate, the Ex e enclosure certificate and the installation should be be reviewed to ensure they are compatible.

3.6 Certification label information

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



Fig 2 BA307SE 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 e, Ex p or Ex d protected apparatus located in Zones 1 or 2. The indicators are transparent to HART ® signals.

CAUTION

The BA307SE and BA327SE are not certified intrinsically safe they should not be connected to an intrinsically safe system.

ATTENTION

Les BA307SE et BA327SE ne sont pas certifiés sécurité intrinsèque, ils ne doivent pas être connectés dans un système à sécurité intrinsèque.

There are four design requirements:

1. The indicator must be installed in a panel enclosure providing the additional rear protection outlined in section 3.5 of this manual. Installation in a certified Ex e enclosure satisfies these requirements.

2. The Ex ec certificates specify that the indicator should be powered from a *limited energy* circuit having a maximum output voltage of 30V dc. A low voltage instrument supply, usually 24V, that complies with the low voltage Directive and is CE/UKCA marked, is usually considered acceptable.

3. Wiring should comply with Clause 9 of 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 BA307SE or BA327SE located in Zone 2 is connected in series with a 2-wire Ex d transmitter located in Zone 1. BEKA Application Guide AG321, which can be downloaded from www.beka.co.uk, contains examples of other Ex ec indicator applications.

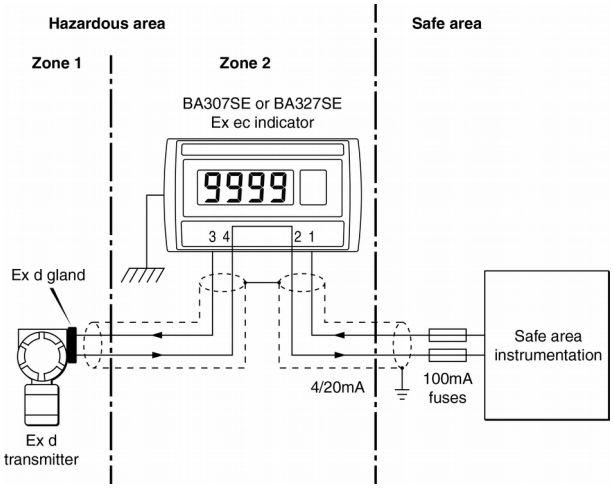


Fig 2 Typical Zone 2 transmitter loop

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 can be satisfied by using terminals containing a fuse holder with an easily removable fuse which can be extracted to achieve isolation as shown in Fig 3.

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 replacement of the fuses does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen.

For some applications Ex ec 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.

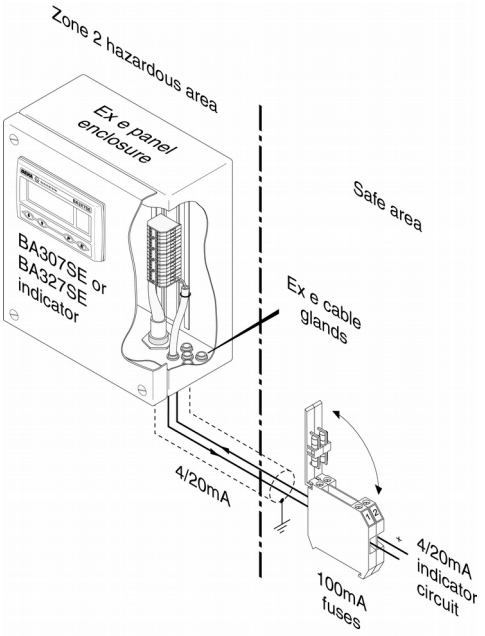


Fig 3 Indicator installation in Ex e enclosure with fuses in safe area terminals

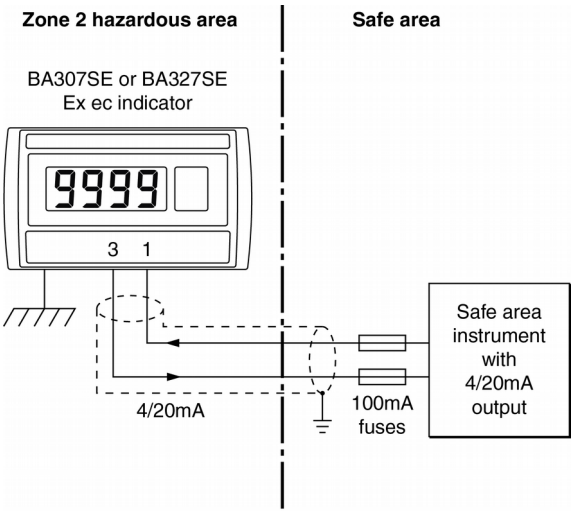


Fig 4 Remote indication in Zone 2 hazardous area

4.2 Remote indication

The BA307SE and the BA327SE 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 providing the additional rear protection outlined in section 3.5 of this manual. Installation in a certified Ex e enclosure satisfies these requirements.

2. The Ex ec certificates specify that the indicator should be powered from a *limited energy* circuit having a maximum output voltage of 30V dc. This requirement is satisfied if the 4/20mA indicator input current is derived from an instrument powered by a low voltage instrument supply, that complies with the EU/EC Low voltage Directive is usually acceptable..

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

4. The output from the safe area 4/20mA source 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 9.5.1

.

A typical applications is shown in Fig 4

To comply with the requirements of EN 60079:*14 Electrical installation design, selection and installation of equipment, including initial inspection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements can be satisfied by using terminals containing a fuse holder with an easily removable fuse which can be extracted 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 replacement of the fuse(s) does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen.

For some applications Ex ec 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 e protection as specified in section 3.5 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.

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

Both indicators have a stainless steel Ex e component certified housings which has 7J front of panel impact resistance incorporating a 10mm thick toughened glass window which can withstand a 4J impact. This component Ex e certification confirms that when a BA307SE or BA327SE indicator is installed in an Ex e enclosure the integrity of the enclosure and its Ex e component certification is not compromised. The captive silicone gasket provides an IP66 seal between the indicator and the enclosure.

Although the front of the indicators have IP66 protection, it is recommended they are shielded from continuous direct sunlight and severe weather conditions.

Fig 5 show the overall dimensions of the indicators together with the recommended panel enclosure cut-out dimensions.

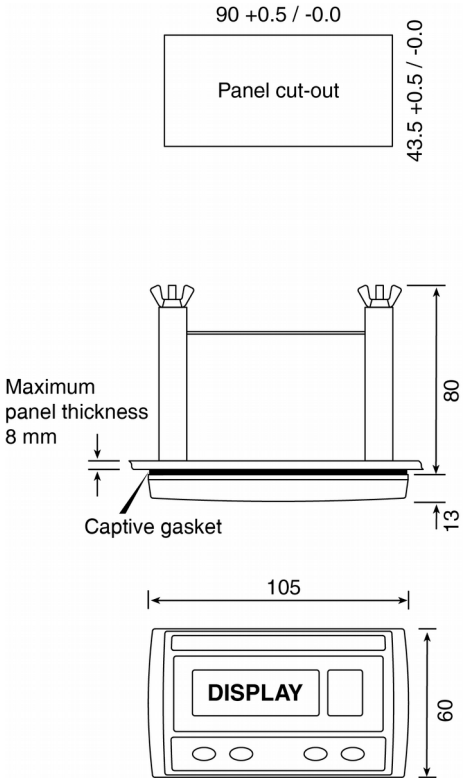


Fig 5 Dimensions

5.2 Installation Procedure

a. Cut the aperture specified in Fig 5 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 as shown in Fig 7.

c. 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.

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

e. Connect the panel enclosure wiring to the rear Ex e approved terminals. To fit a wire into a terminal, insert an instrument screwdriver into the slot at the side of the wire entry and gently push the screwdriver towards the entry as shown in Fig 6. This will open the gripping spring and allow a wire to be inserted into the terminal. When the screwdriver is withdrawn the wire will be secured. Only one wire should be inserted into each terminal.

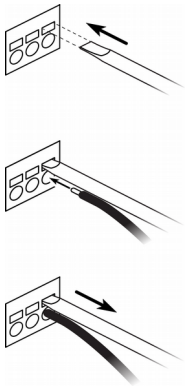


Fig 6 Inserting wire into rear terminals

Field wiring adjacent to the terminals should be supported to prevent damage resulting from vibration.

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

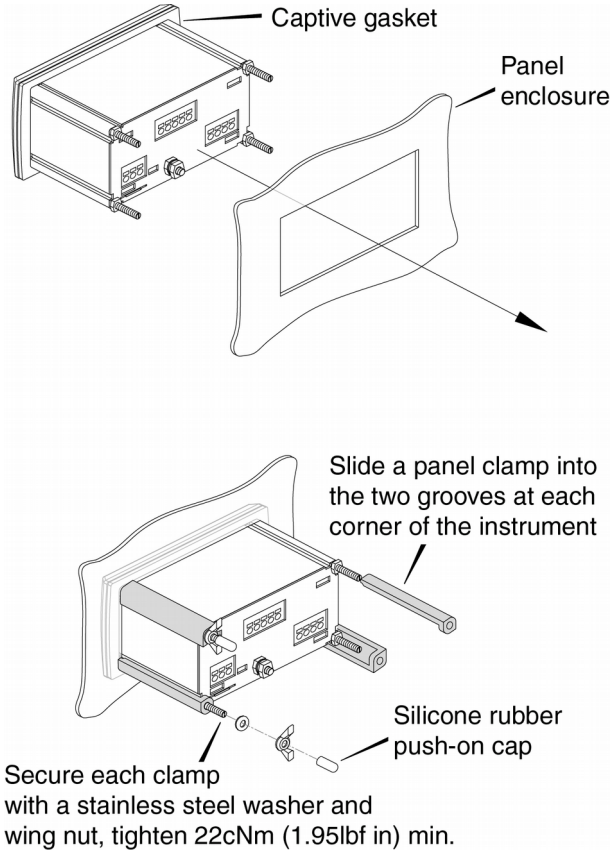


Fig 7 Installation procedure

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 and the UK Electromagnetic Compatibility Regulations UKSI 2016:1091 (as amended). For specified immunity all wiring should be in screened twisted pairs, with the screens earthed in the safe area.

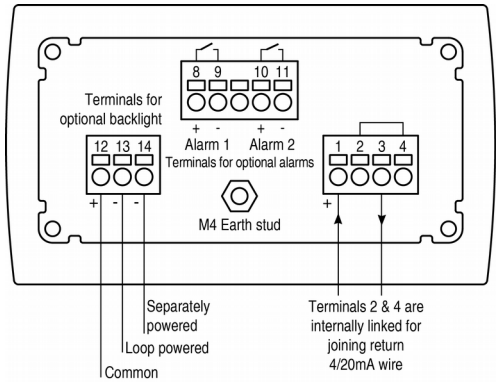


Fig 8 Rear terminals

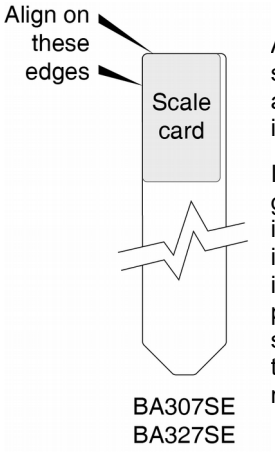
5.5 Scale card

The indicator's units of measurement can be 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 e panel or 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.



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

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.

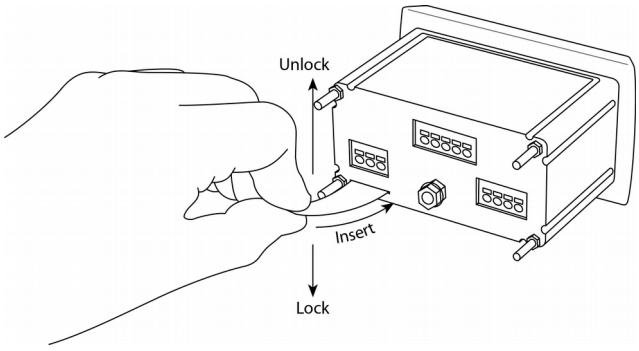


Fig 9 Inserting the flexible strip carrying the scale card into the slot at the rear of indicator.

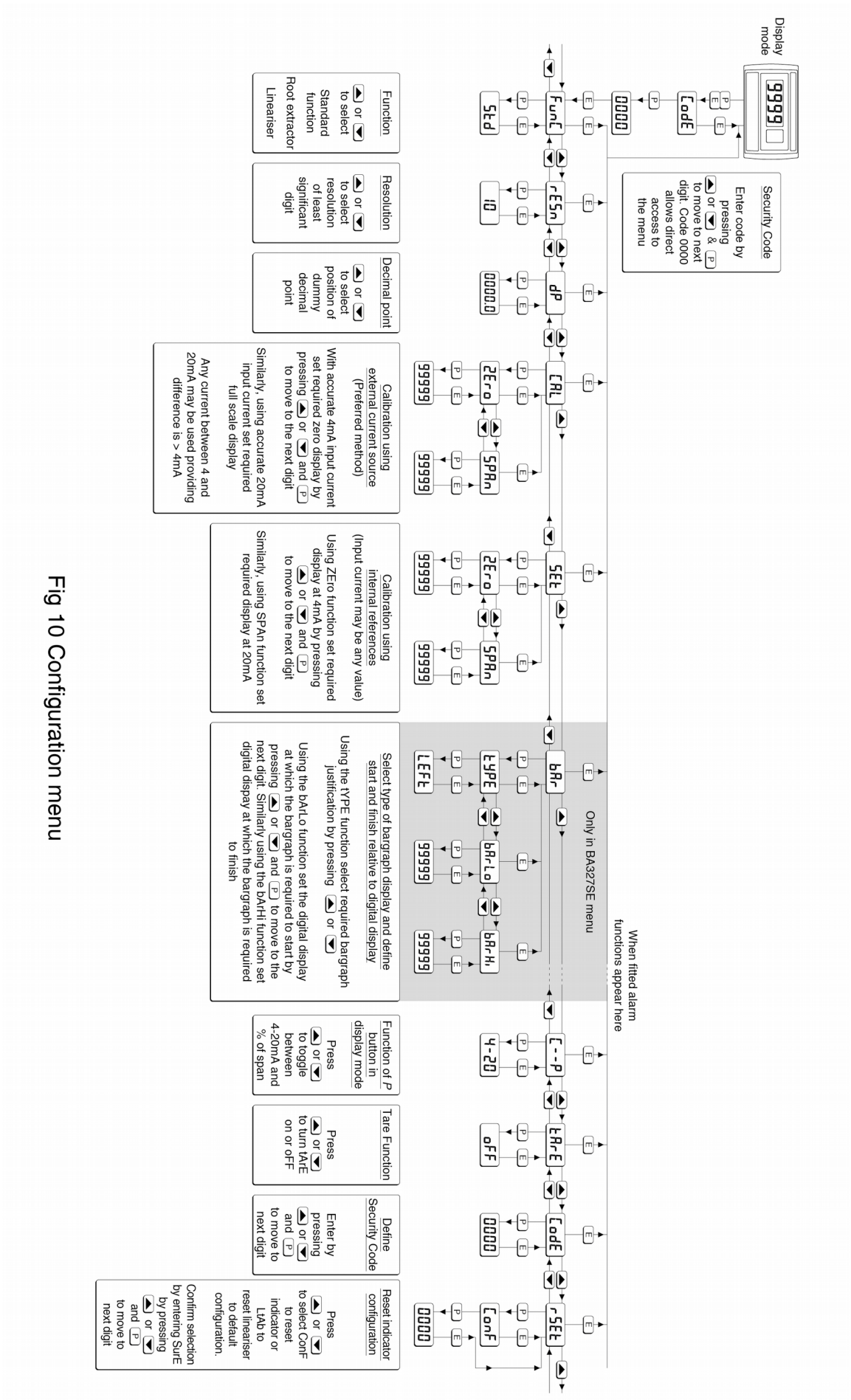


Fig 10 Configuration menu

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 10.

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 7 digit format as displayed by the indicators 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 10. 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

	BA307SE	BA327SE
Access code CodE	0000	0000
Function FunC	Linear	Linear
Display at 4mA 2Ero	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 9 illustrates the location of each function within the configuration menu. The linearisers and the optional factory fitted alarms are described separately in sections 7 and 9.4.3 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 calibration** ***Only the BA327SE 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 linearisers to the default conditions shown in section 7.5. To prevent accidental use both resets must be confirmed by entering **SurE** 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, within 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 BA327SE has a bargraph

In addition to a five digit numerical display the BA327SE 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 9.4.14.
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 7.5

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 **SurE**. 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 **SurE** 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:

	BA307SE	**BA327SE**
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 BA327SE 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 11 shows a typical linearised indicator characteristic.

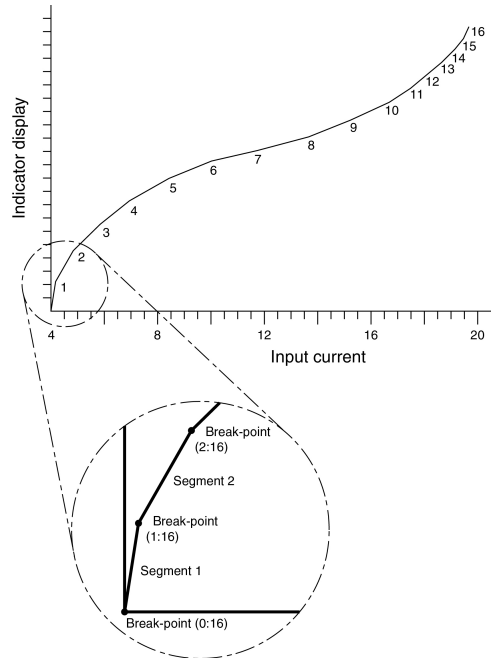


Fig 11 shows a typical linearising characteristic

Selecting **Lin** in the **FunC** section of the configuration menu activates the lineariser, this does not change the configuration menu shown in Fig 10, but the **CAL** and **SEt** functions are extended as shown in Fig 12. As with a linear indicator, calibration of the lineariser 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 using the **LEAb** 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.

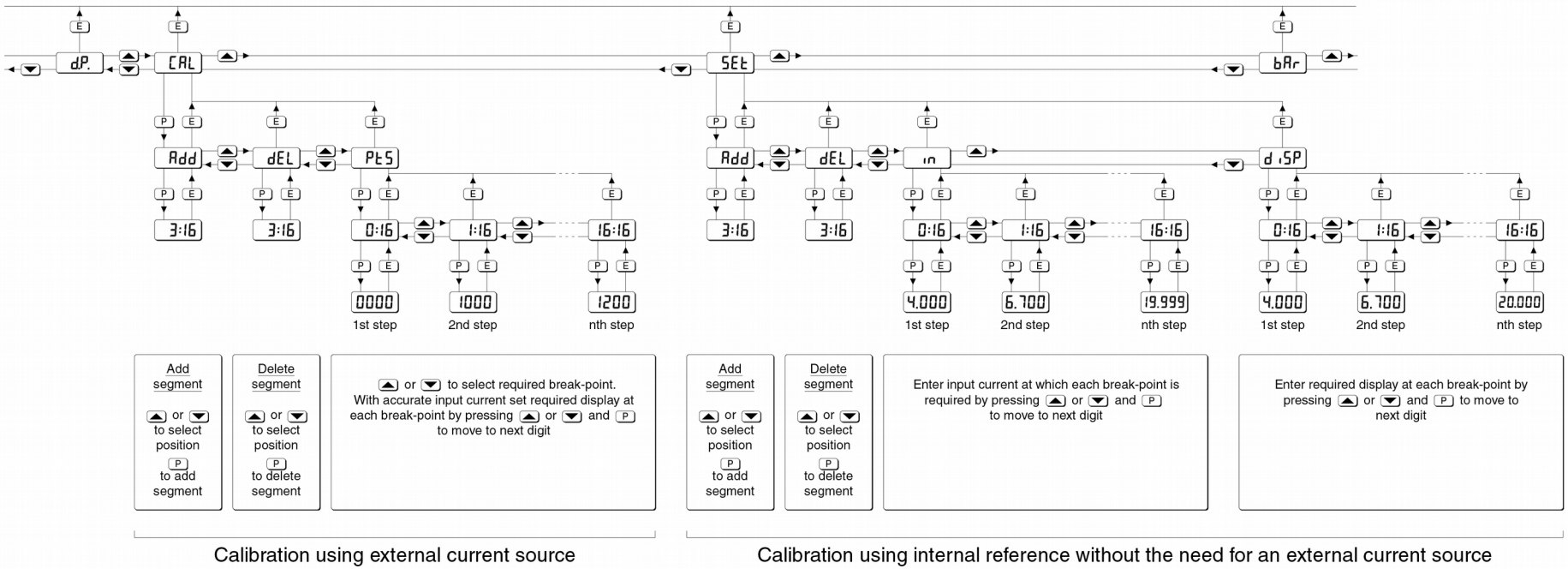
The number of break-point required should first be entered using the **Add** and **dEL** functions. In both these sub-functions the indicator initially displays the current break-point and the total number of break-points being used as shown below.



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 ▲ or ▼ push buttons. Each subsequent operation of the P push button will introduce an additional break-point up to the maximum of **n:16**.



Calibration using external current source

Calibration using internal reference without the need for an external current source

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 12 Extension of CAL and SEt functions for lineariser configuration

CAUTION

When adding break-points to a new indicator, or following resetting of the linearisers 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.

ATTENTION

Lors de l'ajout de points d'arrêt à un nouvel indicateur, ou après la réinitialisation du linéariseur aux valeurs d'usine à l'aide de la fonction LtAb ,décrite dans la section 6.11, de nouveaux points d'arrêt doivent être ajoutés entre les deux valeurs par défaut points d'arrêt 0:1 et 1:1. Si de nouveaux points d'arrêt sont ajoutés avant le point d'arrêt 0:1 dont le réglage par défaut est de 4mA, il en résultera un message d'erreur FAIL lorsque la valeur à afficher est entrée.

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 12. 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.
I n	**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.
d SP	**Defines indicator display at break-point.** Enables the indicator display at each break-point to be defined.



current breakpoint total number of breakpoints

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.

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 01 and 11. If new break-points are added before breakpoint 01 which has a default setting of 4mA, it will result in a FAIL error message when the indicator display is entered.

ATTENTION

Lors de l'ajout de points d'arrêt à un nouvel indicateur, ou après la réinitialisation du linéariseur aux valeurs d'usine à l'aide de la fonction LtAb ,décrite dans la section 6.11, de nouveaux points d'arrêt doivent être ajoutés entre les deux valeurs par défaut points d'arrêt 01 et 11. Si de nouveaux points d'arrêt sont ajoutés avant le point d'arrêt 01 dont le réglage par défaut est de 4mA, il en résultera un message d'erreur FAIL lorsque la valeur à afficher est entrée.

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 01 and 11.

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 11, can now be entered using the In and di SP 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 0n, 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 di SP sub-function Using the ▲ and ▼ buttons select the di SP sub-function and press P which will reveal the starting point for the first break-point 0n, 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 0n, 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 nn, 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	
			BA307SE	**BA327SE**
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 connected to be 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.	Under-range 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 opening of an Ex ec enclosure for maintenance purposes is not considered normal operation (opening an Ex e certified enclosure in which a BA307SE or BA327SE indicator is mounted). However, Clause 4.8.1c of *BS EN 60079-17 Electrical installations inspection and maintenance* permits live maintenance in Zone 2 or 22 if a risk analysis demonstrates that this does not introduce an unacceptable risk and can be performed 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 Zone 2 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.

S'ASSURER DE LA SECURITE DE L'INSTALLATION AVANT DE COMMENCER LA MAINTENANCE

La maintenance sous tension à l'intérieur de la zone 2 ne doit être effectuée que lorsqu'elle est autorisée par l'analyse des risques ou lorsqu'il n'y a pas de risque de présence d'une atmosphère inflammable.

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 BA307SE and BA327SE 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.

Tous les indicateurs BA307SE et BA327SE alimentés en boucle de courant sont interchangeables si les options d'alarmes et le rétroéclairage sont équipés. Un instrument de rechange peut être rapidement recalibré pour remplacer un instrument endommagé ou défaillant.Il ne faut pas essayer de réparer les instruments au niveau composant.

Nous recommandons que les instruments défectueux soient renvoyés à BEKA associates ou l'agent local de BEKA pour réparation.

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.

Custom printed cards showing less common units of measurement are available from BEKA or can be hand printed onto the scale card using a variety of techniques.

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 Item removed

9.4 Alarm outputs

CAUTION

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

ATTENTION

Ces sorties d'alarme ne doivent pas être utilisées pour des applications de sécurité critique tel qu'un système d'arrêt d'urgence.

All BA307SE and BA327SE indicators contain dual alarms which may be configured as shown in Fig 16.

This optically isolated solid state outut accessory, enables each indicator alarm to control a low power load. 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 13 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 **ALr 1** 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.

ATTENTION

Les alarmes sont activées par l'affichage numérique de l'indicateur. L'utilisation de la fonction tArE modifie l'affichage numérique, les alarmes continueront à fonctionner à la valeur d'origine mais celle-ci correspondra à un courant d'entrée différent.

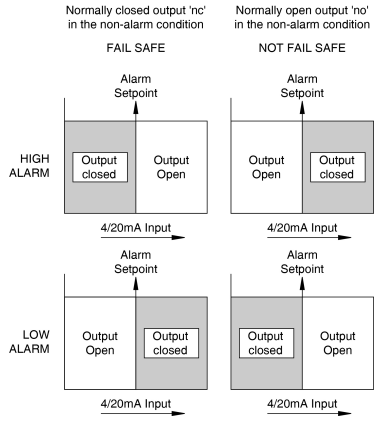


Fig 13 Alarm outputs

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 14. 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
Imax	=	200mA

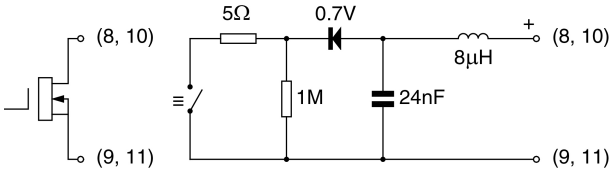


Fig 14 Equivalent circuit of each alarm output

9.4.2 Ex ec certification

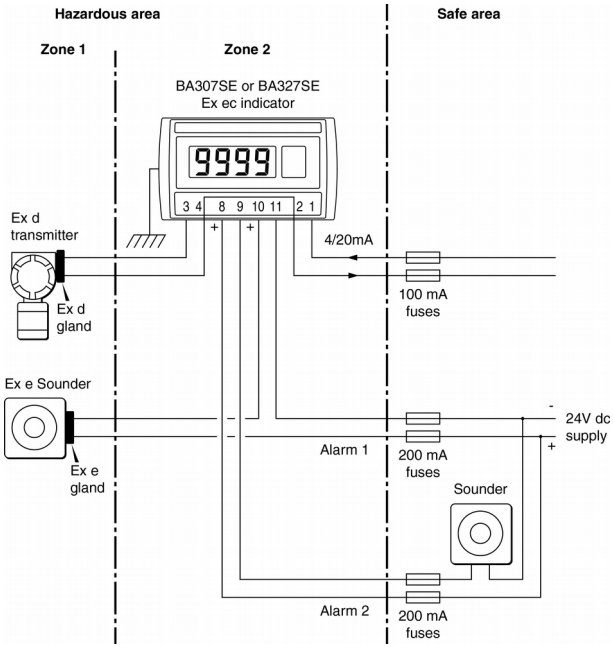
Each alarm output is a separate galvanically isolated Ex ec circuit with the following input safety parameters:

U_{max}	=	30V dc
I_{max}	=	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 BA307SE or BA327SE indicator is correctly installed in a panel enclosure located in Zone 2 complying with the requirements for Ex e 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 BA307SE or BA327SE indicator mounted in an Ex e panel enclosure located in Zone 2 is displaying the output from a 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.



(Shown without recommended screened cables)

Fig 15 Typical alarm application

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 can be satisfied by using a terminal containing an easily removable fuse 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 replacement of the fuses does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen. Figure 3 contains an illustration of this type of fused terminal block.

For some application Ex ec 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.

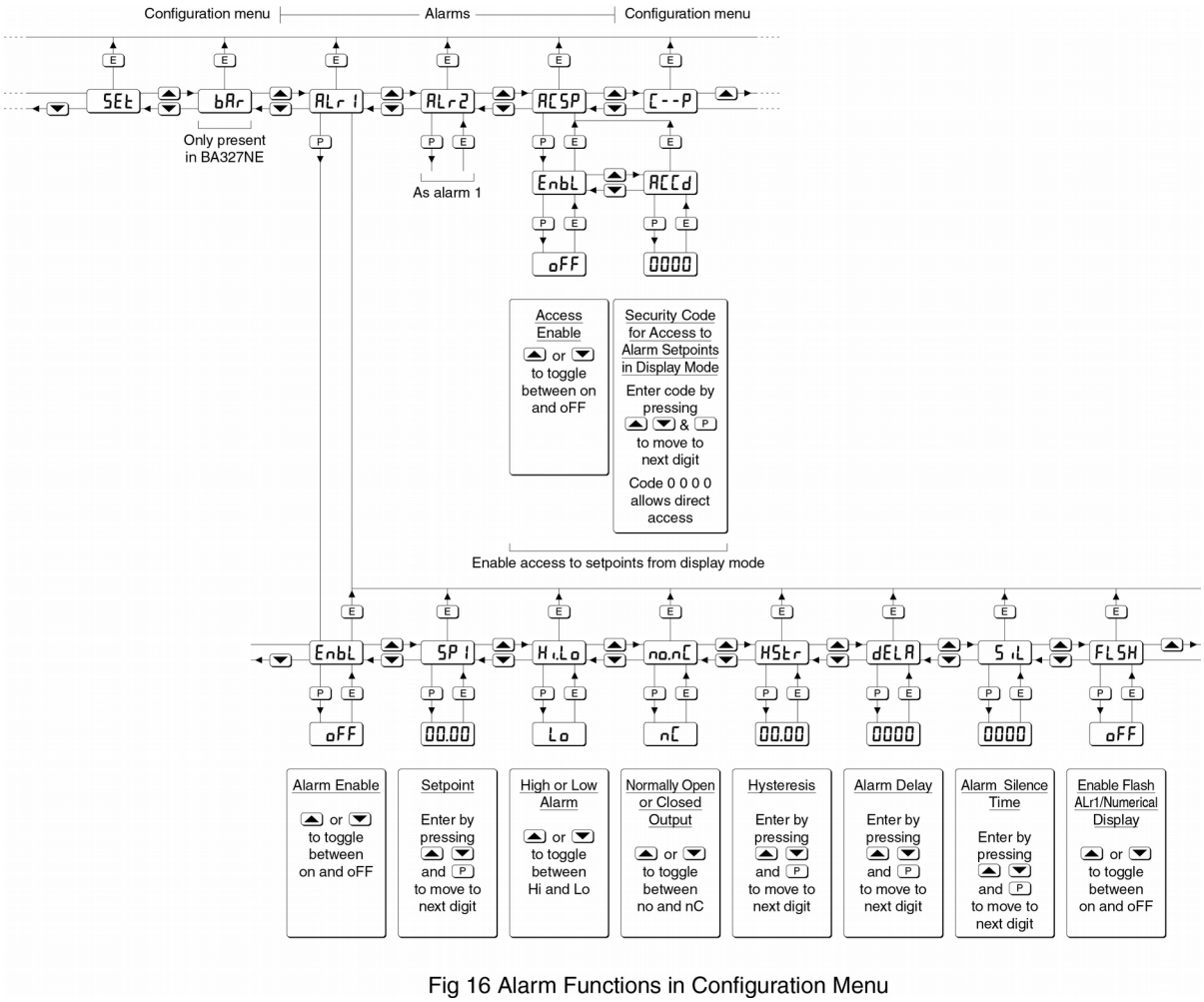


Fig 16 Alarm Functions in Configuration Menu

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 16. The additional functions appear between the **SEt** and the **C- - P** functions for the BA307SE and between **bAr** and **C- -P** for the BA327SE indicator. For simplicity, Fig 16 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.

Display	Summary 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
nonC	**Normally open or normally closed output** Sets the alarm output open or closed in the non-alarm condition. See section 9.4.7
HSEr	**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
Si L	**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: nonC

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 13.

- 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.

ATTENTION

Lorsque l'alimentation 4/20mA de l'indicateur alimenté en boucle de courant est coupée , les deux sorties d'alarme s'ouvrieront indépendamment du conditionnement.

Par conséquent, pour un fonctionnement sécurisé, les deux sorties d'alarme doivent être conditionnées pour être ouvertes sous la condition d'alarme nC.

To check or change the alarm output status, select noAC 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: HSEr

Hysteresis is shown in the units that the indicator has been calibrated to display.
To adjust the hysteresis select HSEr 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 hysteresis 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 16. 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 17. 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.

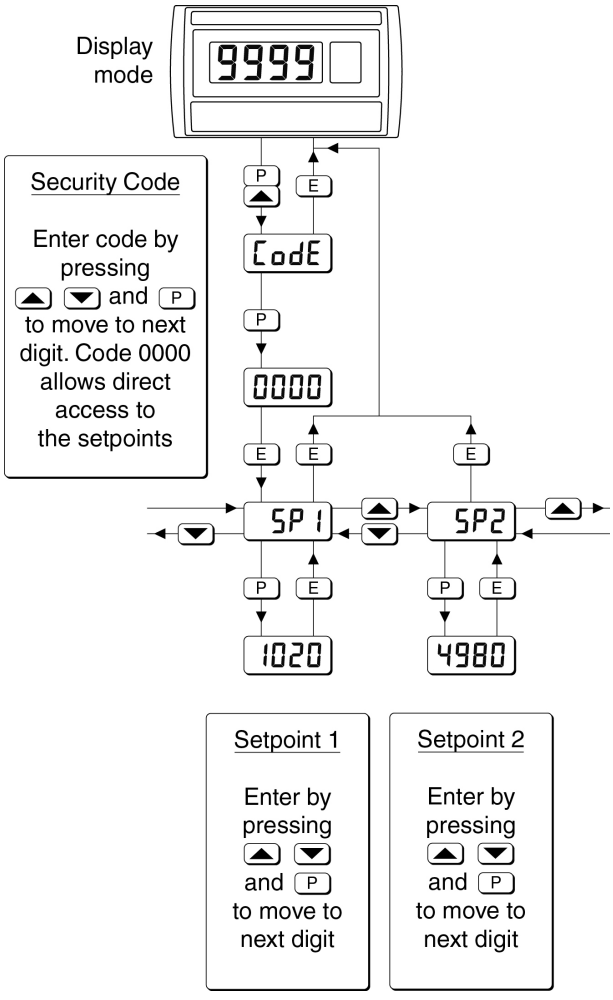


Fig 17 Setpoint adjustment from the display mode

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 BA327SE 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 18.

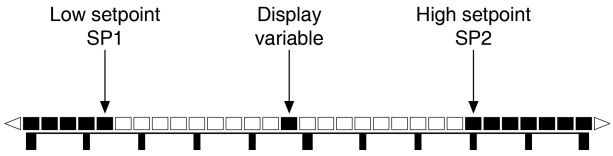


Fig 18 Displayed value and setpoints on bargraph

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 BA307SE and BA327SE 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 slightly brighter, the brilliance can be adjusted, but additional field wiring is required.

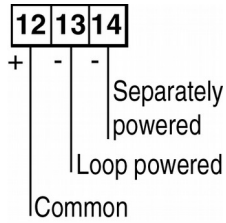


Fig 19 Terminals for optional backlight

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 20, which increases the maximum indicator voltage drop from 1.2 to 5V.

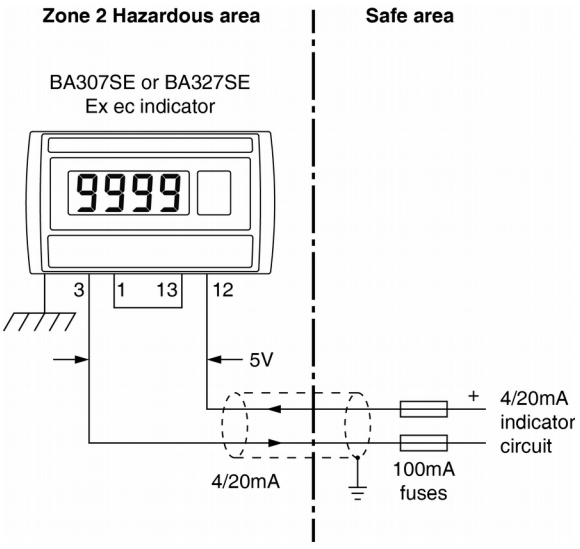


Fig 20 Loop powered backlight

The input safety parameters for the indicator and backlight connected in series remain the same as for the indicator alone:

U_{max} = 30V dc
I_{max} = 200mA

9.5.2 Separately powering the backlight

The optional backlight may also be powered from a separate power supply as shown in Fig 21.

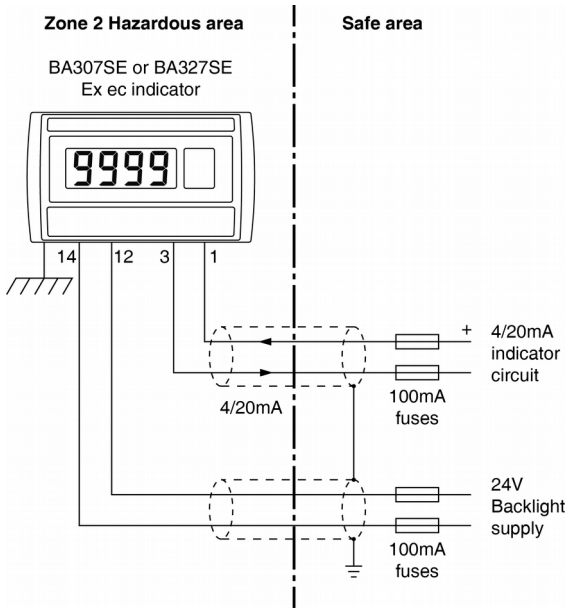


Fig 21 Separately powered backlight

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 Ex ec certificate specify the following input safety parameters for terminals 12 and 14:

U_{max} = 30V
I_{max} = 200mA

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 can be satisfied by using a terminal containing an easily removable fuse 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 replacement of the fuses does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen. Figure 3 shows an illustration of this type of fused terminal block.

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

APPENDIX 1
Use in an Ex p panel enclosure

The BA307SE and BA327SE indicator Ex ec certificates permit the indicators to be installed in an Ex p pressurised panel enclosure located in a Zone 2 hazardous area.

A1.2 Installation in a Zone 2 Ex p enclosure

Installation of a BA307SE or BA327SE 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 BA307SE and BA327SE remain increased safety Group II Category 3G Ex ec ic IIC T5 Gc apparatus, and the front panel push button contacts remain intrinsically safe Ex ic.

CAUTION

BA307SE and BA327SE indicators should not be installed in an Ex p panel enclosure located in Zone 1.

ATTENTION

Les indicateurs BA307SE et BA327SE ne doivent pas être installés dans une armoire Ex p située dans la Zone 1.

The BA307SE and the BA327SE 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.

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

3. The Ex ec certificates specify that the indicator should be powered from a *limited energy* circuit having a maximum output voltage of 30V dc. This requirement is satisfied if the 4/20mA indicator input current is derived from an instrument powered by a low voltage instrument supply, that complies with the EU/EC Low voltage Directive is usually acceptable.

4. Wiring should comply with EN 60079-14.

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

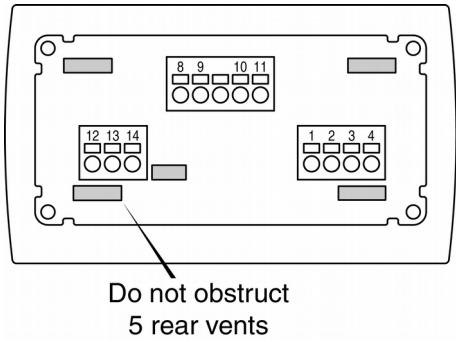


Fig 22 Position of rear vents

APPENDIX 2
IECEx, ATEX and UKEX dust certification

In addition to Ex ec certification permitting installation in Zone 2 gas atmospheres which is described in the main section of this instruction manual, the BA307SE and the BA327SE also have Ex tc certification. This allows installation in Zone 22 combustible dust atmospheres when the indicator is mounted in a panel enclosure meeting the construction requirements of IEC 60079-0 and providing the specified ingress protection for the appropriate dust group as shown below:

Dust Group	IIIA Atmospheres containing combustible flyings.	IIIB Atmospheres containing non-conductive dust.	IIIC Atmospheres containing conductive dust.
Ingress protection	IP5X	IP5X	IP6X

Ingress protection shall be determined in accordance with degree of protection (IP) of enclosures as specified in IEC 60079-0. IP5X enclosures shall satisfy the test and acceptance requirements of IP5X, as specified in IEC 60529.

Using an Ex t or Ex e component certified enclosure satisfies these requirements.

A2.1 Zones and Maximum Surface Temperature

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

The Ex ic in the indicator's certification code refers to the front panel push button contacts which are non incendive and have been certified intrinsically safe. This allows the indicators to be adjusted when installed in Zone 22, but the indicators themselves are not intrinsically safe and should not be connected to an intrinsically safe loop.

When mounted in a panel enclosure as described in section 5 of this manual, and complying with this dust appendix, and the installation requirements of 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 60079-14

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

Note: When determining the maximum ambient temperature, heat generating equipment mounted in the same enclosure, or adjacent to the enclosure, should be considered.

* Unlikely occurrence in Zone 22

A2.2 Installation

All the circuits shown in section 5 of this instruction 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 or Ex e panel enclosure located within Zone 22. The panel enclosure containing the indicator should be located where the minimum amount of dust will accumulate on it.

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 BA307SE and BA327SE 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 the certified 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 t or Ex e enclosure ensure that the sealing gaskets are undamaged and free from dirt and foreign bodies.

S'ASSURER DE LA SÉCURITÉ DE L'INSTALLATION AVANT DE COMMENCER LA MAINTENANCE

L'entretien sous tension dans la zone dangereuse ne doit être effectué que lorsqu'il est autorisé par l'analyse des risques ou lorsqu'il n'y a pas de risque de présence d'une atmosphère inflammable.

Avant de fermer le boîtier Ex t ou Ex e, assurez-vous que les joints d'étanchéité sont intacts et exempts de saletés et de corps étrangers.

Inspection of the indicator's mechanical condition and removal of accumulated dust from the front of the indicator and the outside of the Ex t or Ex e 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

ETL & cETL certification for installations in USA and Canada.

A3.0 cETL Mark

For installations in the USA and Canada, the BA307SE and BA327SE indicators have ETL and cETL Ex ec and Ex tc approval. Copies of the Authorisation to Mark may be downloaded from the BEKA associates website www.beka.co.uk or requested from the BEKA associates sales office.

A3.1 ETL and cETL certification

The US and Canadian standards used for assessment and certification of the BA307SE and BA327SE are listed on the cETL Authorisation to Mark.

ETL codes for USA

Class I Zone 2 AEx ec ic IIC T5 Gc
Zone 22 AEx ic tc IIIC T80ºC Dc

Class I Division 2 Groups A, B, C, D
Class II Division 2 Groups F, G
Class III Division 2
-40ºC ≤ Ta ≤ +70ºC

cETL codes for Canada

Ex ec ic IIC T5 Gc
Ex ic tc IIIC T80ºC Dc

Class I Division 2 Groups A, B, C, D
Class II Division 2 Groups F, G
Class III Division 2
-40ºC ≤ Ta ≤ +70ºC

Installations in the USA and Canada must comply with BEKA associates Control Drawing CI300-86, which follows this appendix.

The ETL safety parameters are the same as the IECEx, ATEX & UKEX parameters, the systems shown in sections 4 of this manual may therefore also be used for US and Canadian installations subject to compliance with the local codes of practice and the BEKA Control Drawing CI300-86.

The Indicator's front panel push button contacts are non incendive and have been certified intrinsically safe AEx ic, without the need for an external Zener barrier or galvanic isolator. This is the 'ic' code shown on the instrument's certification label and on the ETL Authorisation to Mark. This allows the loop powered indicator to be adjusted and configured live when installed in a Zone 2 or 22 hazardous areas.

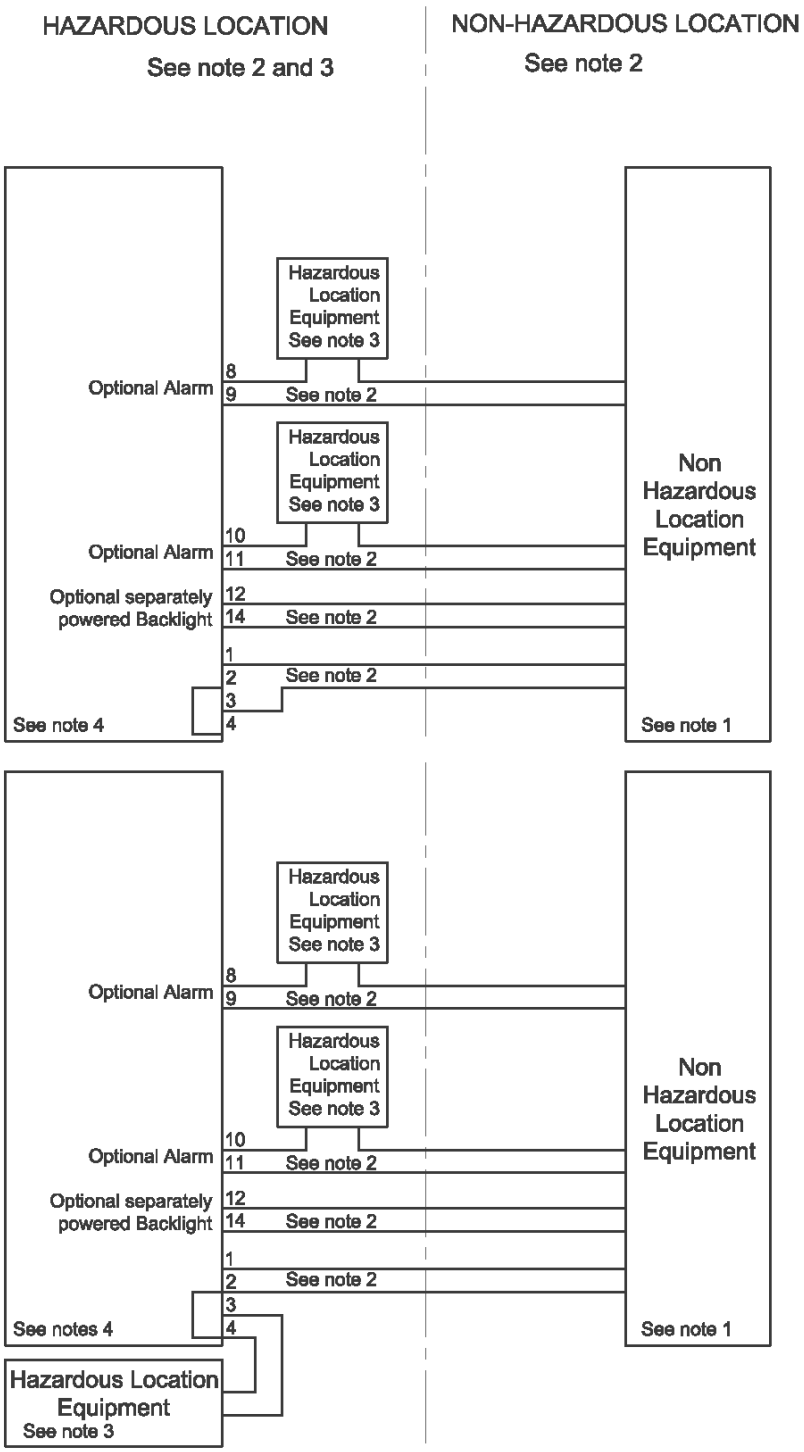
These loop powered indicators are not intrinsically safe and therefore they should not be connected to an intrinsically safe loop.

Iss.	Date	Modification	Appd.	Ckd.
1	30.06.2023	New drawing.		

BEKA associates Hitchin England

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LOOP POWERED INDICATORS WITH SEPARATELY POWERED BACKLIGHT



Title

ETL Control Drawing for
BA307SE and BA327SE LOOP POWERED INDICATORS

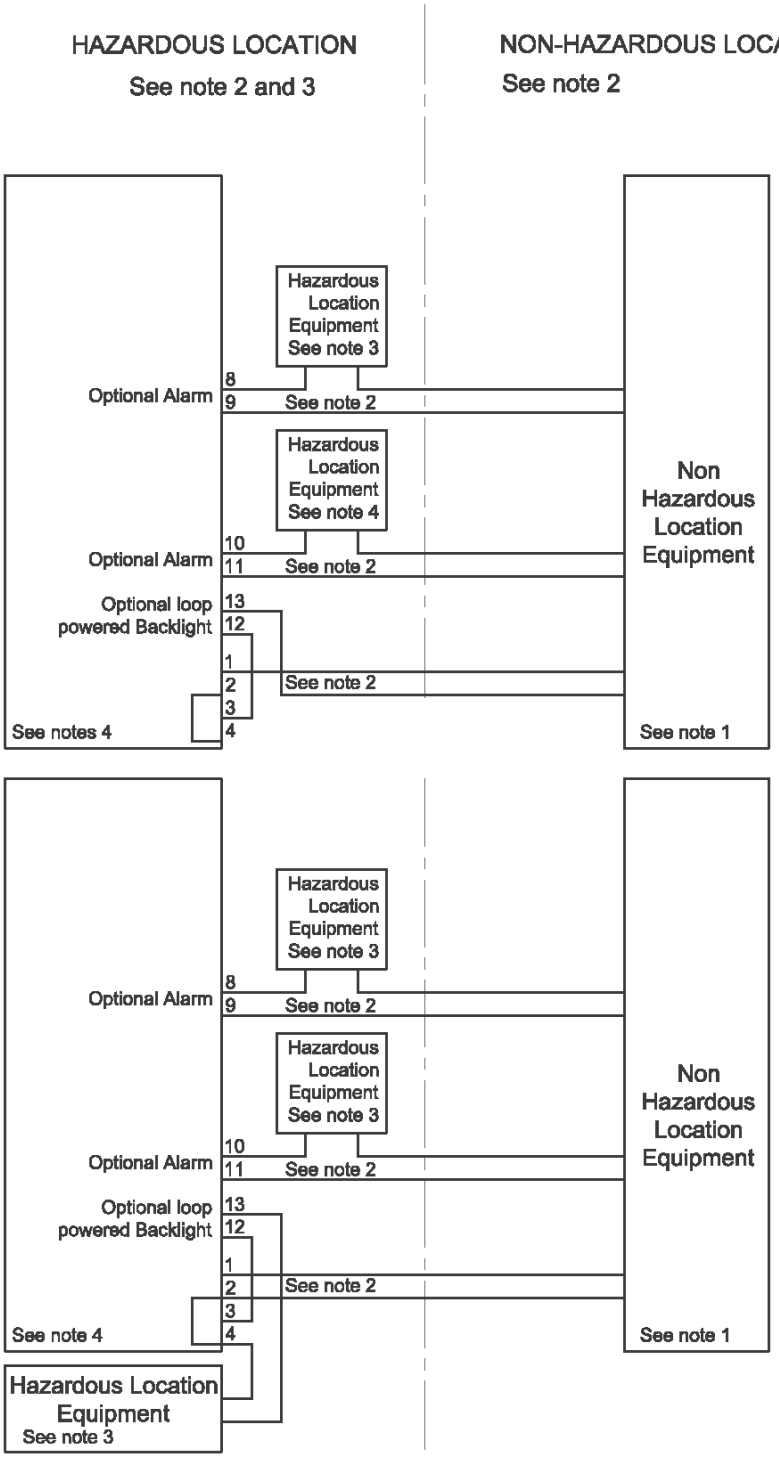
Drawn	Checked	Scale
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Drawing No. CI300–86

Sheet 1 of 3

File No 300–86s01.dwg 30.06.23

LOOP POWERED INDICATORS WITH LOOP POWERED BACKLIGHT



Iss.	Date	Modification	Ckd.	Appd.
1	30.06.2023	New drawing.		

BEKA associates Hitchin England

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Title

ETL Control Drawing for
BA307SE and BA327SE LOOP POWERED INDICATORS

Drawn	Checked	Scale
KB		–

Drawing No. CI300–86
Sheet 2

File No 300–86s02.dwg 30.06.23

Notes

1. The non-hazardous location equipment shall not use or generate more than 250V rms or 250V dc.

2. Field wiring installations shall be in accordance with the National Electrical Code ANSI/NFPA 70. Installations in Canada shall be in accordance with the Canadian Electrical Code C22.2.

3. Hazardous location equipment shall be NRTL Approved Ex e or Ex d Apparatus. For Canadian installations hazardous location equipment shall be NRTL or CSA Approved Apparatus.

4. Loop powered indicators with model numbers and coding as shown in the table below.

Models	Zones	Divisions	Ambient Temperature
BA307SE BA327SE	Class I Zone 2 AEx ec ic IIC T5 Gc Zone 22 AEx ic tc IIIC T85°C Dc Ex ec ic IIC T5 Gc Ex ic tc IIIC T85°C Dc	Class I Div 2 Groups A–D Class II Div 2 Groups E–G Class III Div 2	−40°C ≤ Ta ≤ +70°C

5. Ratings

TB1 4/20mA Loop Input – Terminals 1 & 3
Umax = 30V
Imax = 200mA

TB2 Backlight – Terminals 12 & 13 (4/20mA loop powered)
Umax = 30V
Imax = 200mA
(connected in series with TB1 terminals 1 & 3)

TB2 Backlight – Terminals 12 & 14 (separately powered)
Umax = 30V
Imax = 200mA

TB4 Alarms – each channel – Terminals 8 & 9; 10 & 11
Umax = 30V
Imax = 200mA

6. For Ex ec, the instrument must be installed within an Ex e or Ex pzc panel enclosure.

For Ex tc, the instrument must be installed in Ex tc panel enclosure.

For all installations, the instrument must be powered from a limited energy circuit and the vents located on the back of the instrument must not be obstructed.

For instruments designated for type of protection pressurized equipment the supply circuit shall be rated for a prospective short circuit current of not more than 10kA.·

The equipment must be installed in a panel that maintains at least one of the following types of protection:
Ex e IIC Gc -40°C ≤ Ta ≤ +70°C·
Ex pzc IIC Gc -40°C ≤ Ta ≤ +70°C·
Ex tc IIIC Dc -40°C ≤ Ta ≤ +70°C with an enclosure meeting the requirements of either:
IP5X for Groups IIIB & IIIA
or IP6X for Group IIIC applications

Iss.	Date	Modification	Appd.	Ckd.
1	30.06 2023	New drawing.		

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Title
ETL Control Drawing for
BA307SE and BA327SE LOOP POWERED INDICATORS

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Drawing No. CI300–86
Sheet 3

File No 300–86s03.dwg 30.06.23