

1. Introduction

This application guide describes the use of BA300 series 3½ and 4½ digit intrinsically safe loop powered digital indicators, including the BA326C combined analogue and digital instrument.

For applications in Zone 2 hazardous areas the field mounting models are available with Type nL certification. The BA500 series duplicates the complete range for safe area applications.

For explosion proof applications, the BR323 which is available with an aluminium or stainless steel enclosure has ATEX flameproof and FM explosion proof certification.

2. Description

The BA300 series indicators are loop powered by the 4/20mA current they are measuring and do not require an additional power supply. All the models can be calibrated to display the 4/20mA input current in engineering units and the BA326C also includes a vertical analogue bargraph.

Fig 1 shows a simplified block diagram of a BA300 series indicator. 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 and used to power the analogue to digital converter and the liquid crystal display. The voltage

developed across R1, which is proportional to the 4/20mA input current, provides the input signal for the analogue to digital converter. This technique allows all models to drop less than 1.1V in the 4/20mA loop, and enables the two input terminals to comply with the requirements for simple apparatus.

The features of all the models are summarised in Table 1. Detailed specifications for each model are shown on individual datasheets available from BEKA associates sales department or they may be downloaded from the BEKA web site at www.beka.co.uk.

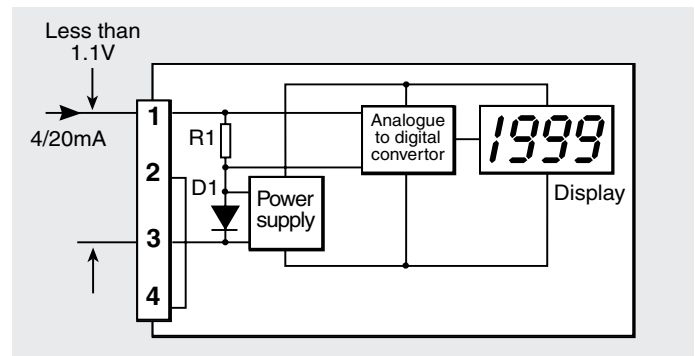


Fig 1 Simplified block drawing of BA300 series indicator

Model	BA304D	BA307C	BA308C	BA324D	BA326C	BA327C	BA328C
Mounting & enclosure	Field GRP	Panel 96 x 48	Panel 144 x 72	Field GRP	Panel 48 x 144	Panel 96 x 48	Panel 144 x 72
Protection	IP66 & NEMA 4X	Front IP65 rear IP20		IP66 & NEMA 4X	Front IP65 rear IP20		
Separate terminal compartment	Yes	No	No	Yes	No	No	No
Display	Digital				Analogue & digital	Digital	
Number of digits	3½	3½	3½	4½	4½ + dummy 0 & two 100 segment bargraphs	4½	4½
Height of display	25mm	12.7mm	25mm	20mm	Digits 5.5mm Bargraph 95mm	10mm	20mm
Certification Europe	ATEX Group II, Category 1G EEx ia IIC T5						
Certification USA	FM 3610 Entity & 3611 Nonconductive						
International IECEx	Ex ia IIC T5				No	Ex ia IIC T5	
Options							
ATEX & IECEx dust certification	Yes	No	No	Yes	No	No	No
Backlight							
Loop powered	Yes	Yes	Yes	Yes	No	Yes	Yes
Separately powered	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Root extractor	Yes	Yes	Yes	Standard	Standard	Standard	Standard
Internal calibrator	Yes	Yes	Yes	Standard	Standard	Standard	Standard
Alarms	No	No	No	Yes	Yes	Yes	Yes
Lineariser	No	No	No	Yes	Yes	Yes	Yes
Tare function	No	No	No	Yes	No	Yes	Yes
External keypad	No	No	No	Yes	Standard	Standard	Standard

Table 1

3. Intrinsic Safety Certifications

3.1 ATEX certification

Notified Body Intertek Testing Services have issued all models with EC-Type Examination Certificates confirming compliance with the European ATEX Directive 94/9/EC for Group II, Category 1G equipment, EEx ia IIC T5. The instruments bear the Community Mark and, subject to local codes of practice, may be installed in any of the European Economic Area (EEA) member countries. ATEX certificates are also acceptable for installations in Switzerland.

This guide describes ATEX installations which conform with BS EN60079:Part14:1997 Electrical Installation in Hazardous Areas. When designing systems for installation outside the UK, the local Code of Practice should be consulted.

3.2 FM certification

All models have class 3610 Entity Concept intrinsic safety approval for use in Divisions 1 and 2 plus class 3611 Nonincendive approval for use in Division 2 without Zener barriers or galvanic isolators. The field mounting models have Class I, II & III approval and may be used with all hazards, the panel mounting instruments are only approved for use with Class I hazards i.e. gases and vapours. See BEKA datasheets and the FM Approval listing for full certification details. The approval is similar to the ATEX certification except the temperature rating is T4.

3.3 IECEx certification

All models, except the BA326C combined analogue and digital indicator, have IECEx certification with the same safety parameters as the ATEX approvals. This new international approval scheme already permits installation in Australia, New Zealand and Singapore without national certification and enables 'fast-track' approval in IECEx member countries still requiring national certification.

4. Explanation of ATEX certification

4.1 4/20mA input

In Europe, sources of energy which do not generate more than 1.5V, 100mA and 25mW are, for intrinsic safety purposes, considered to be simple apparatus (Clause 5.4 of IEC60079-11).

Although the BA300 series indicators do not themselves comply with the requirements for simple apparatus, the EC-Type Examination Certificates specify that under fault conditions the voltage, current and power at the 4/20mA input terminals 1 and 3 will not exceed those specified for simple apparatus. This allows terminals 1 and 3 to be connected in series with any certified intrinsically safe circuit protected by a Zener barrier or galvanic isolator, providing the output parameters of the circuit do not exceed:

U _o	≤	30V dc
I _o	≤	200mA
P _o	≤	0.85W

The EC-Type Examination Certificates specify that the maximum equivalent capacitance and inductance between the two 4/20mA input terminals 1 and 3 is:

C _i	=	20nF
L _i	=	10mH

To determine the maximum permissible usable cable parameters these figures should be subtracted from the maximum cable capacitance and inductance permitted by the ATEX certificate for the interface powering the loop i.e. the Zener barrier or galvanic isolator.

4.2 Zones, gas groups and T rating

All the BA300 series instruments and accessories have been certified as Group II Category 1G, EEx ia IIC T5 (T_{amb} -40 to 60°C).

When connected to a suitable system the indicators and accessories may be installed in:

Zone 0	explosive gas air mixture continuously present.
Zone 1	explosive gas air mixture likely to occur in normal operation.
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

Having a temperature classification of:

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

In an ambient temperature between -40 and +60°C.

Note: Although certified safe at -40°C, the indicators are only guaranteed to function between -20°C and +60°C

This allows the BA300 series indicators to be installed in all Zones and to be used with most common industrial gases.

4.3 Optional combustible dust certification

The BA304D and BA324D field mounting models are available with optional ATEX Group II Category 1GD EEx ia IIC T5 approval, permitting use in the presence of combustible dusts. The permitted ambient temperature range is -20 to +60°C which is slightly less than for flammable gas certification, and the maximum indicator surface temperature is 80°C.

When installed as specified by EN 50281 Part 1-2, 'Selection, installation and maintenance of electrical apparatus protected by enclosures' the indicators may be used in:

Zone 20	Explosive atmosphere in the form of a cloud of combustible dust in air is continuously present, or for long periods or frequently.
Zone 21	Explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur occasionally in normal operation.
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 EN500281 Part 1-2

At ambient temperatures between -20 and +60°C

Indicators supplied with optional ATEX dust certification also have IECEx dust certification.

4.4 Optional alarms

The BA324D, BA326C, BA327C and the BA328C indicators can be supplied with two single pole solid state alarm outputs. Each

output is galvanically isolated and has been certified as a separate intrinsically safe circuit which complies with the requirements for simple apparatus. This allows each alarm output to switch any intrinsically safe circuit protected by a Zener barrier or galvanic isolator with output parameters not exceeding:

$$\begin{aligned} U_o &\leq 28V \text{ dc} \\ I_o &\leq 159mA \\ P_o &\leq 0.8W \end{aligned}$$

The EC-Type Examination Certificates specifies that the maximum equivalent capacitance and inductance between the terminals of each alarm output is:

$$\begin{aligned} C_i &= 40nF \\ L_i &= 20\mu H \end{aligned}$$

To calculate the maximum permissible usable cable parameters these figures should be subtracted from the maximum cable capacitance and inductance permitted by the certificate for the barrier or isolator powering the circuit being switched.

4.5 Optional display backlighting

Two alternative backlight options are available. The loop powered backlight produces green background illumination enabling the display to be read at night and in poor lighting conditions. It does not require an additional power supply, IS interface or field wiring, but the indicator voltage drop is increased. The separately powered backlight provides a bright orange output to enhance daylight viewing, but it requires an additional IS interface and field wiring.

4.5.1 Optional loop powered backlight

All the models except the BA326C combined indicator can be supplied with a loop powered backlight which provides green background illumination. The backlight terminals 12 & 13 are connected in series with the 4/20mA indicator terminals - see Fig 7 Terminals 1 & 13 comply with the requirements for simple apparatus and may be connected in series with any certified intrinsically safe circuit protected by a certified Zener barrier or galvanic isolator, providing the output parameters of the circuit do not exceed:

$$\begin{aligned} U_o &\leq 30V \text{ dc} \\ I_o &\leq 200mA \\ P_o &\leq 0.85W \end{aligned}$$

The EC-Type Examination Certificates specify that the maximum equivalent capacitance and inductance between the two 4/20mA input terminals 1 and 13 is:

$$\begin{aligned} C_i &= 40nF \\ L_i &= 30mH \end{aligned}$$

To determine the maximum permissible usable cable parameters these figures should be subtracted from the maximum cable capacitance and inductance permitted by the certificate for the barrier or isolator powering the loop into which the BA300 series indicator is connected.

4.5.2 Optional separately powered backlight

All models can be supplied with an optional separately powered backlight to enhance daylight viewing. The backlight is segregated from the measuring circuit and has been certified as a separate intrinsically safe circuit.

The backlight must be powered from the safe area via a certified Zener barrier or galvanic isolator having output parameters equal to or less than:

$$\begin{aligned} U &\leq 30V \text{ dc} \\ I_o &\leq 159mA \\ P_o &\leq 0.8W \end{aligned}$$

The EC-Type Examination Certificates specify that the maximum equivalent capacitance and inductance between the separately powered backlight terminals 12 and 13 is:

$$\begin{aligned} C_i &= 45nF \\ L_i &= 20mH \end{aligned}$$

To determine the maximum permissible usable cable parameters these figures should be subtracted from the maximum cable capacitance and inductance specified by the Zener barrier or isolator certificate.

5. Explanation of FM certification

The BA300 series indicators and accessories have been approved intrinsically safe and nonincendive by Factory Mutual. Users should refer to the FM approval report and Control Drawing for classes and permitted gas groups for each instrument.

All FM installations must comply with the appropriate BEKA associates Control Drawing, ANSI/ISA RP12.6 and the National Electrical Code ANSI/NFPA70.

All the intrinsically safe circuits shown in this Application Guide may be used for installations in the USA, providing the Zener barriers and galvanic isolators are FM approved and comply with the FM specified entity parameters.

5.1 4/20mA input

The BA300 series indicators have been evaluated under the entity concept and may be connected in series with any intrinsically safe circuit having output parameters equal to or less than:

$$\begin{aligned} V_{oc}, V_t &\leq 32V \\ I_{sc}, I_t &\leq 200mA \\ P_o &\leq 1.2W \end{aligned}$$

The 4/20mA input terminals have a maximum equivalent capacitance and inductance of:

$$\begin{aligned} C_i &= 0.02\mu F \\ L_i &= 0.01mH \end{aligned}$$

To determine the maximum permissible usable cable parameters, these figures must be subtracted from the maximum permissible cable capacitance and inductance specified by the FM report for the Zener barrier or galvanic isolator powering the loop into which the indicator is installed.

5.2 Classes, Divisions, Gas Groups and T Rating

The two field mounting indicators may be used with Class I, II & III hazards, but the panel mounting models may only be used with Class I hazards i.e. gases and vapours.

Field Mounting Indicators BA304D and BA324D

Intrinsic Safety	Nonincendive
Division 1 and 2	Division 2
Class I Group A, B, C & D	Class I Group A, B, C & D
Class II Group E, F & G	Class II Group E, F & G
Class III	Class III

Intrinsic Safety	Nonincendive
Division 1 and 2	Division 2
Class I Group A, B, C & D	Class I Group A, B, C & D

Before installation reference should be made to the FM Approval listing, the BEKA Control Drawing and the instrument FM Certificate of Compliance.

5.3 Optional Alarms

The BA324D, BA326C, BA327C and the BA328C indicators can be supplied with two single pole alarm outputs. Each output is a galvanically isolated single pole solid state switch which may be connected to any intrinsically safe circuit having entity output parameters equal to or less than:

$$\begin{aligned} V_{oc}, V_t &\leq 32V \\ I_{sc}, I_t &\leq 159mA \\ P_o &\leq 1.2W \end{aligned}$$

Each of the alarm outputs has a maximum equivalent capacitance and inductance of:

$$\begin{aligned} C_i &= 0.04\mu F \\ L_i &= 0.02mH \end{aligned}$$

These figures should be subtracted from the maximum permissible cable capacitance and inductance allowed for the Factory Mutual approval Zener barrier or galvanic isolator connected to the alarm output.

5.4 Optional loop powered backlight

All the models except the BA326C can be supplied with a loop powered backlight which provides green background illumination. The backlight terminals 12 & 13 are connected in series with the 4/20mA indicator terminals - see Fig 7 Terminals 1 & 13 may be connected in series with any intrinsically safe circuit having output parameters equal to or less than:

$$\begin{aligned} V_{oc}, V_t &\leq 32V \\ I_{sc}, I_t &\leq 200mA \\ P_o &\leq 1.2W \end{aligned}$$

The terminals have a maximum equivalent capacitance and inductance of:

$$\begin{aligned} C_i &= 0.04\mu F \\ L_i &= 0.03mH \end{aligned}$$

To determine the maximum permissible usable cable parameters, these figures should be subtracted from the maximum permissible cable capacitance and inductance specified by the FM report for the Zener barrier or galvanic isolator powering the loop into which the indicator is installed.

5.5 Optional separately powered backlight

All models can be supplied with an optional separately powered backlight to enhance daylight viewing. The backlight has been approved as a separate intrinsically safe circuit under the entity concept. The backlight may be powered from any certified associated apparatus such as a Zener barrier or galvanic isolator having output parameters equal to or less than:

$$\begin{aligned} V_{oc}, V_t &\leq 32V \\ I_{sc}, I_t &\leq 159mA \\ P_o &\leq 1.2W \end{aligned}$$

The terminals have a maximum equivalent capacitance and inductance of:

$$\begin{aligned} C_i &= 0.04\mu F \\ L_i &= 0.02mH \end{aligned}$$

To determine the maximum permissible usable cable parameters, these figures should be subtracted from the maximum permissible cable capacitance and inductance specified by the FM report for the Zener barrier or galvanic isolator powering the loop into which the indicator is installed.

6. Explanation of IECEx certification

All the BA300 series indicators have IECEx certification apart from the BA326C combined analogue and digital indicator. The standards are similar or identical to those used for the ATEX approvals, safety parameters are therefore the same.

7. Location

7.1 Field mounting indicators

The BA304D and BA324D field mounting indicators are housed in a glass reinforced polyester enclosure (GRP) with silicone gaskets and a separate terminal compartment. This enclosure has been independently tested in the UK and the USA and reports are available confirming that it provides IP66 and NEMA 4X protection. Copies may be downloaded from the BEKA web site at www.beka.co.uk. The enclosure has a toughened glass window and stainless steel fitting making it suitable for use in marine and corrosive environments. Sealing will not be degraded by a 3.5 Joule impact (1kg dropped through 35cm) even after the enclosure has been operated at 90°C for 14 days. Enclosures with optional combustible dust approval will withstand a 7 Joule impact after 28 days at 90°C.

The field mounting indicators are very robust and provided they are correctly installed will provide satisfactory performance in most industrial environments.

The field mounting indicators have been assessed and certified to remain intrinsically safe between -40 and +60°C, but their display performance is only guaranteed between -20 and +60°C, although most instruments will continue to function below -20°C.

Three entries are provided in the base of the enclosure. ATEX and IECEx models have M20 x 1.5 tapped holes to accept glands or treaded conduit. FM approved field mounting instruments have plain 22.25 diameter holes. Unused entries should be fitted with an appropriate sealing plug.

7.2 Panel mounting indicators

All the panel mounting indicators have IP65 sealed fronts and are supplied with a gasket to seal the joint between the instrument and the panel into which it is mounted. The rear of all the panel mounting instruments have IP20 protection so they should be located where liquids and condensates are not present.

When correctly installed in an instrument panel, cubicle or box, the front of the instrument will have IP65 protection and may be cleaned with a low pressure hose. It is not recommended that the indicator front panel is permanently exposed to severe exterior environments unless additional protection is provided.

8. System Design for Hazardous Areas

The design of measurement loops incorporating BA300 series indicators is the same irrespective of the certification being used. However, certification parameters vary slightly between authorities so care must be taken to ensure that the correct ones are used.

8.1 Transmitter loops

A BA300 series indicator may be connected in series with almost any intrinsically safe 4/20mA current loop and calibrated to display the measured variable or control signal in engineering units. There are three design steps:

- From table 1 select the model with the required display, mounting and accessories.

3½ digit models can display: -1999 to 1999

4½ digit models can display: -19999 to 19999

- Check that the output parameters of the 4/20mA loop, which are defined by the Zener barrier of galvanic isolator, are equal to or less than the maximum input parameters specified by the indicator certification. For ATEX installations:

$U_o \leq 30V$ dc
 $I_o \leq 200mA$ dc
 $P_o \leq 0.8W$

- Ensure that the loop can support the additional 1.1V required to operate the indicator. If an optional loop powered backlight is used the total voltage drop increases to 5V

Fig 2 illustrates how a BA300 series indicator may be connected in series with a 2-wire intrinsically safe transmitter protected by Zener barriers. Considering the voltage drop around the loop.

Total voltage drop around the loop shown in Figure 2

2-wire transmitter	10.0
Maximum voltage drop caused by BA300 series digital indicator	1.1
Maximum voltage drop caused by 28V 300Ω barrier (340Ω end to end resistance x 20mA)	6.8
Maximum voltage drop caused by diode return barrier (21Ω + 0.9V)	1.4
Maximum voltage drop caused by 250V load (250Ω x 20mA)	5.0
Maximum voltage drop caused by cable resistance (10Ω x 20mA)	0.2
Total maximum voltage drop around loop	24.5V

The instrument power supply voltage must therefore be above 24.5V, but below 25.5V which is the maximum working voltage of the 28V 300Ω Zener barrier.

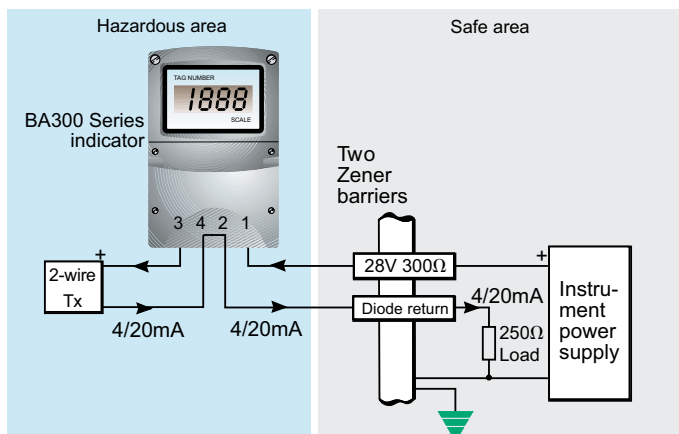


Fig 2 BA300 series indicator displaying output from a 2-wire transmitter within hazardous area

Terminals 2 and 4 are internally linked and may be used for joining the return 4/20mA wire as shown in Fig 2. Field mounting instruments have an additional pair of internally linked terminals for joining the screens of the incoming and outgoing cables.

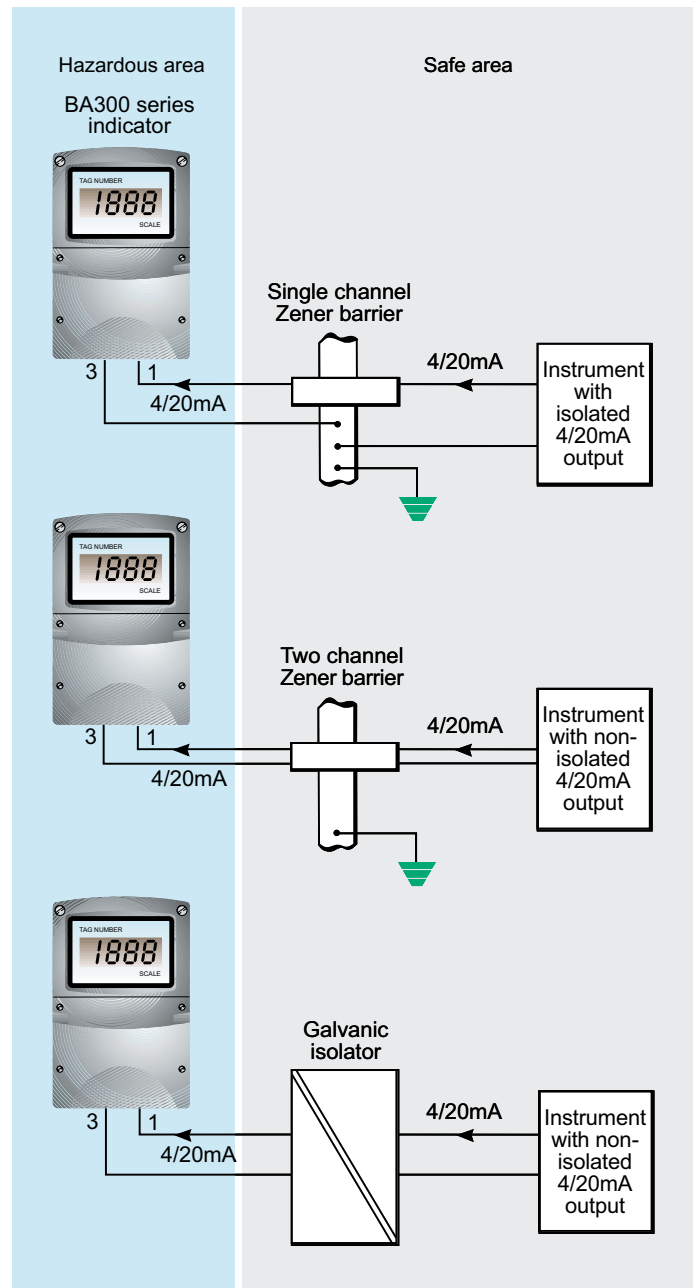


Fig 3 Alternative circuits for remote indication in a hazardous area

8.2 Remote indication

BA300 series indicators may also be driven via an intrinsically safe interface from a 4/20mA safe area signal to provide a remote indication within a hazardous area. The type of interface is not critical; either a Zener barrier or a galvanic isolator may be used, but again output parameters of the interface must not exceed the indicator's maximum input parameters.

If one side of the 4/20mA current loop may be earthed, a single channel Zener barrier provides the lowest cost protection. If the 4/20mA signal is not isolated, two Zener barriers, a two channel Zener barrier or a galvanic isolator must be used. Again it is necessary to ensure that the voltage capability of the 4/20mA signal is sufficient to drive the indicator plus the voltage drop introduced by the intrinsically safe interface. Fig 3 shows the alternative circuits which may be used.

8.3 Alarms

The BA324D, BA326C, BA327C and the BA328C can be supplied with two single pole solid state alarm outputs. Each output may be programmed as a high or a low alarm with a normally open or a normally closed 'contact'. Fig 4 illustrates the conditions available and shows which are fail safe. i.e. output is in alarm condition ('contact' open) when the 4/20mA input current is zero.

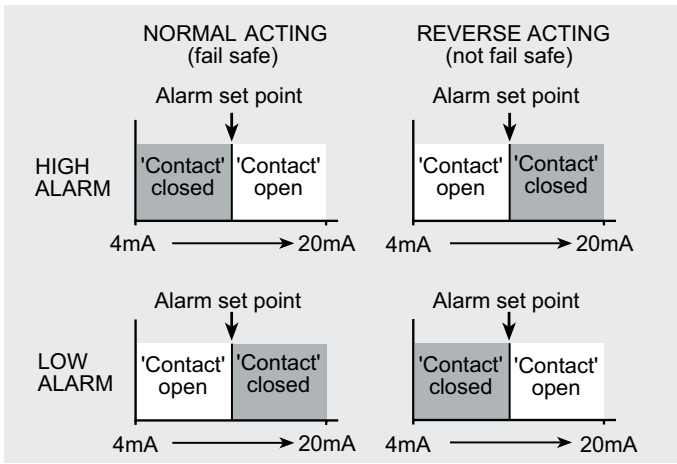


Fig 4 Alarm outputs - operational status

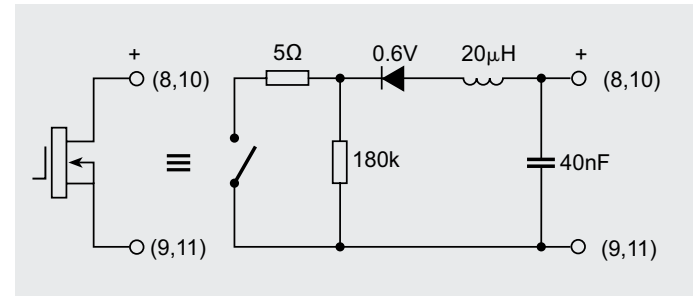


Fig 5 Equivalent circuit of each alarm output

These alarm outputs should not be used for critical safety applica-

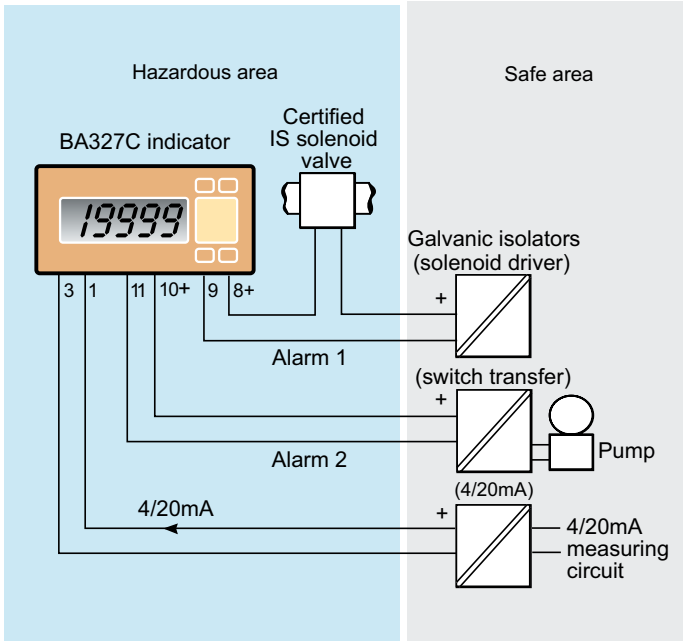


Fig 6 Typical application of BA327C with alarm outputs

tions such as a shutdown system.

Each alarm output is galvanically isolated and may be used to switch any certified dc circuit which complies with the intrinsically safety requirements specified in sections 4.4 and 5.3 for ATEX and FM installations. The equivalent electrical circuit of each alarm output is shown in Fig 5. Both outputs are polarised and will only pass current in one direction.

The alarm outputs may be used to switch loads within the hazardous area or to switch safe area loads via a Zener barrier or a galvanic isolator. Fig 6 shows a BA327C indicator switching a certified intrinsically safe solenoid valve located in the hazardous area and a pump in the safe area via a galvanic isolator. When the alarm outputs are used to activate an annunciator such

as a flashing beacon or sounder one of the indicator push-buttons may be programmed to operate as an alarm 'accept' button. This allows the operator to silence the alarm for a programmable time.

8.4 Display backlights

Two backlight options are available. The loop powered backlight produces green background illumination enabling the display to be read at night and in poor lighting conditions. No additional power supply or field wiring are required, but the indicator voltage drop is increased from 1 to 5V. Alternatively, the separately powered backlight has a bright orange output which enhances daylight viewing, but an additional intrinsically safe interface and field wiring are required.

8.4.1 Loop powered backlight

An optional loop powered backlight is available on all models except the BA326C combined analogue and digital indicator. The backlight is powered by the 4/20mA loop current so the backlight terminal 12 & 13 are connected in series with the indicator 4/20mA input terminals as shown in Fig 7.

Any of the circuits shown in Figs 2 and 3 may be used providing

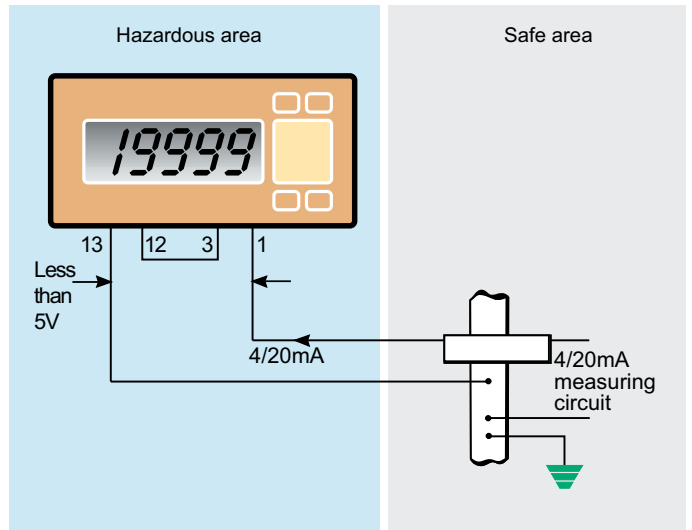


Fig 7 Connection of loop powered backlight

that 5V is available to power the indicator plus the backlight See 8.1 step 3.

8.4.2 Separately powered backlight

All the models can be supplied with a separately powered backlight to enhance daylight viewing. The backlight has been certified as a separate intrinsically safe circuit and should be powered from the safe area via a Zener barrier or a galvanic isolator as shown in Fig 8. The display brilliance depends upon the current flowing through the backlight which is determined by the supply voltage and the end-to-end resistance of the Zener barrier or output resistance of the galvanic isolator. Brilliance is not significantly reduced until the current falls below 20mA.

For a BA307C or BA327C

$$\text{Backlight current} = \frac{V_{\text{supply}} - 14}{\text{End-to-end resistance of Barrier}^*}$$

For a BA304D, BA308C, BA324D, BA326C or BA328C

$$\text{Backlight current} = \frac{V_{\text{supply}} - 18}{\text{End-to-end resistance of Barrier}^*}$$

*or output resistance of galvanic isolator

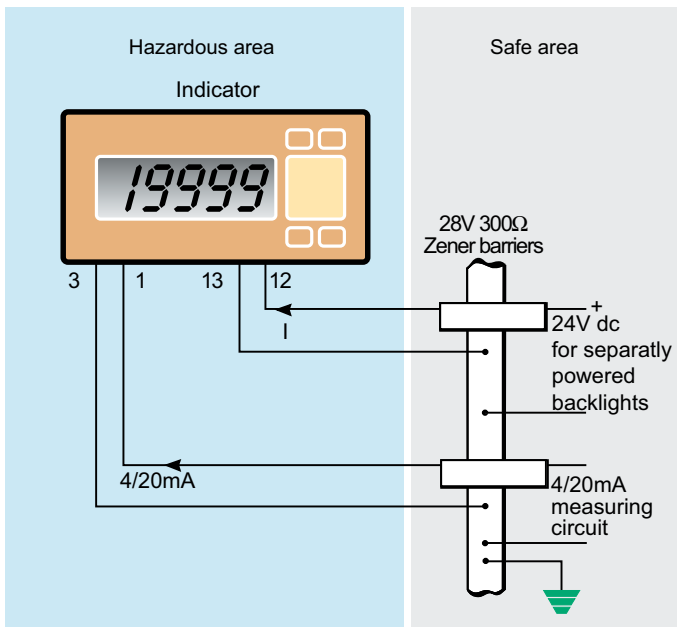


Fig 8 Backlight power supply

9. Additional functions on 4½ digit models

The BA324D, BA326C, BA327C and BA328C are firmware controlled and provide display functions that are not available on the 3½ digit models. Operating the front panel push-buttons temporarily changes the display to:

- ▲ Reading instrument has been calibrated to display with 4mA input
- ▼ Reading instrument has been calibrated to display with 20mA input.
- P Display as a percentage of span or Display of input current in mA.

9.1 Optional special functions

The 4½ digit models can also be supplied with accessory firmware which provides additional or alternative functions for specialised applications.

9.1.1 Lineariser

This special function enables a BA300 series 4½ digit indicator to display non-linear variables in linear engineering units. The function provides a sixteen point fully adjustable straight line lineariser which may be conditioned on-site to compensate for most non-linearities.

For example, the contents of a horizontal cylindrical tank can be displayed in linear volumetric units from the 4/20mA output of a level transmitter. The BA326C is particularly effective for this application as it provides both an analogue representation of contents and an accurate digital display.

9.2 Tare

Primarily intended for use with weighing systems, the tare function replaces the standard percentage function. When the tare push-button is operated the indicator display is set to zero, thus subtracting the current reading from subsequent readings. When used with a weighing system, this function enables the displayed weight of an empty container to be subtracted from the weight of the container plus contents, so that the net weight of the contents is displayed.

An annunciator shows when net weight is being displayed. Total gross weight can be redisplayed by pressing and holding the tare button for more than three seconds

10. Calibration

10.1 3½ digit models

The 3½ digit models are calibrated by plug-in links and two multi-turn potentiometers. For maximum accuracy these indicators should be periodically calibrated using a traceable current source with a resolution of at least 4uA. If traceability is not required, these models can be supplied with an internal calibrator which simulates an input current of 4 and 20mA. This allows recalibration without the need for external instruments and the field models do not need to be disconnected from the 4/20mA loop.

10.2 4½ digit models

The 4½ digit models and the BA326C combined analogue and digital indicator are programmed and calibrated via four front panel push-buttons.

The push-buttons on the BA324D field mounting model are located behind a removable protective front cover. When frequent adjustments are required duplicate membrane push-buttons can be fitted on the outside of the instrument.

All programme and calibration functions are contained in easy to understand menus which may be protected by a four digit user selectable security code. For maximum accuracy these instruments should be periodically calibrated using a traceable current source with a resolution of at least 0.4uA. When traceability is not required, the instrument span and zero may be reset using the internal calibrator which is a standard feature in all 4½ digit instruments. This allows rapid calibration without the need for external instruments or disconnection from the 4/20mA loop.

11. Loop powered 4/20mA rate totalisers

To compliment to this range of loop powered indicators, BEKA also manufacture loop powered intrinsically safe rate totalisers. These instruments display the 4/20mA output from a flow transmitter in linear units of flow, they also calculate the total flow and show it on a separate display. See Application Guide AG354