BA329-GL & BA329-PC
intrinsically safe
8 input 4/20mA
panel mounting indicators

Issue 1

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The BA329 is CE marked to show compliance with the European Explosive Atmospheres Directive 2014/34/EU and the European EMC Directive 2014/30/EU.
It is 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).

CONTENTS

1. DESCRIPTION

The BA329 is an 8 channel, 4/20mA panel mounting, intrinsically safe digital indicator. It displays each input channel in engineering units together with individual tag information and units of measurement.

There are two electrically similar models:

Model	Application
BA329-GL	For intrinsic safety applications in, Zones 0, 1, 2, 20, 21 and 22. Has a toughened glass display window surrounded by a stainless steel front panel. Provides IP66 front of panel protection.
BA329-PC	For intrinsic safety applications when mounted in an Ex e or Ex t enclosure. Impact resistant front ensures that enclosure apparatus certification is not invalidated. Scratch resistant polycarbonate display window surrounded by a stainless steel front panel. Provides IP66 front of panel protection.

The main application of both models is to display up to eight 4/20mA measured variables or control signals in a hazardous process area. The zero and span of each display are independently adjustable via the Configuration Menu and the front panel touch buttons. Each display can be independently calibrated to show the variable represented by the 4/20mA input current, together with engineering units and tag information. Displays can be shown on a single screen, or in groups on multiple screens.

Both models have IECEx, ATEX and UKEX Ex ia intrinsic safety certification allowing installation in Zone 0, 1, 2, 20, 21 or 22.

All the inputs are galvanically isolated from each other and from the power supply. They have zero output safety parameters that comply with the requirements for *simple apparatus* specified in EN 60079-11. This, together with the low voltage drop introduced by each input in the 4/20mA loop, simplifies application and documentation.

The BA329 is powered by a BEKA power isolator located in a safe area, or in Zone 2 if mounted within an enclosure providing IP54 protection.
This instruction manual supplements the abbreviated instruction sheet supplied with each indicator.

2. CONSTRUCTION

The BA329 8 channel indicator comprises a panel mounting BA3101 or BA3102 Operator Display containing two BA3301 Analogue Input modules and a BA3201 CPU module. The Operator Display and each module have individual Ex ia intrinsic safety apparatus certificates allowing them to be safely interconnected in a hazardous area.

The CPU module is supplied pre-programmed. Only simple display configuration and calibration via the front panel touch buttons is required to produce the required engineering displays.

If configuration and calibration information is supplied when the BA329 indicator is ordered, the indicator can be supplied configured, ready to install for no additional charge.

2.1 Controls

When power is applied to a BA329 indicator, the power indicator shown in Fig 1, which is located below the four touch buttons on the right hand side of the display will initially be red. After 100 seconds the indicator will be green and the screen will show the operating display. The start up sequence is shown in Fig 7.

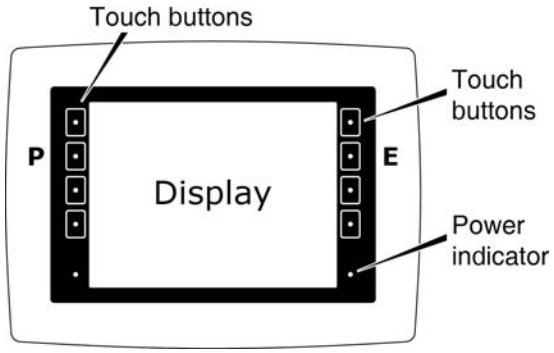


Fig 1 Controls

Access to the configuration menus is obtained by pressing the **P** and **E** touch buttons simultaneously at any time after completion of the start up sequence.

When a BA329 Indicator is operating, the function of each touch button is shown by the colour of the buttons backlight.

Green

The touch button controls how the adjacent input is displayed. For screen layouts where the display(s) are not adjacent to the touch buttons, the buttons are in the same vertical order as the displays.

When continuously touched, the button changes the associated digital display from units of measurement to the input current in milliamps, or to a percentage of full scale depending upon how the C--P function in the Process Variable menu has been set.

Button backlight will flash if associated display is under or overranged.

Amber

Pressing the button transfers the display to an associated screen, such as when 1, 2 or 4 inputs are displayed together on a common screen. If inputs 1, 2, 3 & 4 are displayed together on a common screen, pressing the button will change the display to the second screen showing inputs 5, 6. 7 and 8.

No backlight

The button has no function on this screen.

3. INTRINSIC SAFETY CERTIFICATION

Both BA329 models have IECEx, ATEX and UKEX gas and dust certification.

3.1 Construction

The BA329-GL and the BA329-PC Indicators are constructed from three different modules, each with individual intrinsic safety apparatus certificates which specify that they may be safely interconnected in a hazardous area.

BA3101 or BA3102 Operator Display
IECEx CML 20.0150X
CML 20ATEX2252X
CML 21UKEX2003X

Two BA3301 Analogue Input modules
IECEx CML 21.0101X
CML 21ATEX2830X
CML 21UKEX2831X

BA3201 CPU module
IECEx CML 20.0152X
CML 20ATEX2254X
CML 21UKEX2005X

The Operator Display and each module carry both the EU community CE mark and the UKCA mark. Subject to local codes of practice, BA329 Indicators may be installed in any of the European Economic Area (EEA) member countries and in the UK, plus areas which accept IECEx certification.

This section of the instruction manual describes IECEx, ATEX and UKEX installations conforming with EN 60079-14. When designing systems the local Code of Practice should always be consulted.

3.2 Gas Zones, groups and T rating

All the modules forming the BA329 Indicator have been certified:

Group II Category 1G (ATEX & UKEX only)
Ex ia IIC T4 Ga
-40ºC ≤ Ta ≤ +65ºC

The BA329 Indicator may be installed in, and connected to inputs 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	450ºC
T2	300ºC
T3	200ºC
T4	135ºC

At ambient temperatures between -40 and +65ºC.

Note: The operating temperature of the display is -20 to +65ºC.

This allows the BA329 to be installed in all gas Zones and to be used with most common industrial gases.

3.3 Dust Zones, groups and surface temperature

All the modules forming the BA329 indicator have been certified:

Group II Category 1D (ATEX & UKEX only)
Ex ia IIIC T135 Da
-40ºC ≤ Ta ≤ +65ºC

The BA329 indicator may be installed in, and connected to inputs in:

Zone 20	area in which an explosive atmosphere in the form of a cloud of dust in air is present continuously, or for long periods or frequently.
Zone 21	area in which an explosive atmosphere in the form of a cloud of dust in air is likely to occur, occasionally, in normal operation.
Zone 22	area in which an explosive atmosphere in the form of a cloud of dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Be used with dust in subdivisions:

IIIA	combustible flyings
IIIB	non-conductive dust
IIIC	conductive dust

Having a Minimum Ignition Temperature of:

Dust cloud	202°C
Dust layer on indicator up to 5mm thick	210°C
Dust layer on indicator over 5mm thick.	Refer to EN 60079-14

At an ambient temperature between -40 and +65°C See section 3.4 iii of these instructions.

Note: The operating temperature of the display is -20 to +65ºC.

3.4 Special conditions for safe use

All the certificate numbers for the modules comprising the BA329 have an 'X' suffix indicating that special conditions for safe use apply.

i. Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

ii. The metal bezel of the equipment shall be connected to earth via the integral earth stud.

iii. In installations requiring EPLs Da, Db, or Dc, the surface temperature assigned to the BA3101 or BA3102 Operator Display (135ºC) shall take precedence over the surface temperature assigned to any module which may be installed within its enclosure.

iv. In installations requiring EPL Da, Db, or Dc, the equipment shall be mounted to an enclosure which provides a minimum degree of protection of IP5X and which meets the requirements of EN60079-0 Clause 8.4 (material composition requirements for metallic enclosures for Group III) and/or EN60079-0 Clause 7.4.3 (Avoidance of a build up of electrostatic charge for Group III) as appropriate. All cable entries into the equipment shall be made via cable glands which provided a minimum degree of protection of IP5X.

3.5 4/20mA inputs

The BA329 includes two BA3301 Analogue Input modules each having four galvanically isolated unpowered 4/20mA inputs. Each input has the following safety parameters:

Ui = 30V
Ii = 200mA
Pi = 0.84W
Uo = 0
Io = 0
Po = 0
Ci = 0
Li = 4µH

The output safety parameter of each input are zero. These inputs comply with the requirement for *simple apparatus* allowing connection with almost any intrinsically safe 4/20mA loop in any gas or dust hazardous area in Zone 0, 1, 2, 20, 21 or 22, having output parameters equal to or less than:

Uo ≤ 30V
Io ≤ 200mA
Po ≤ 0.84W

3.6 Power input

The BA329 indicator is powered via a BA212 single channel Power Isolator, or from a BA243 Power Isolator and a BA3901 Power Combiner.

CAUTION
Do not power a BA329 indicator from a 24V dc supply without a BA212 or BA243 Power Isolator.

The BA329 intrinsic safety input parameters for the power input terminals TB1 are:

Ui ≤ 12.4V
Ii ≤ 2.68A
Pi ≤ 5.44W
Ci = 0
Li = 0

4. SYSTEM DESIGN FOR GAS HAZARDOUS AREAS

4.1 Powering a BA329 indicator

CAUTION
Do not power a BA329 indicator from a 24V dc supply without a BA212 or BA243 Power Isolator.

For applications in gas groups IIA, IIB and in dust hazardous atmospheres, the BA329 indicator is powered by a BEKA BA212 Power Isolator. A BA212 Power Isolator may also be used for IIC applications when the cable length between the isolator and the indicator is less than a few metres long.

For most applications in a IIC gas hazardous atmosphere a BEKA BA243 Power Isolator should be used. This has four galvanically isolated intrinsically safe outputs which are remotely combined by a certified BA3901 4 way Power Combiner mounted on the BA329 indicator allowing longer field cables to be used.

CAUTION
Parameters for the actual cable being installed should be used when calculating the maximum safe length.

4.2 Applications in Group IIB and IIA gases

Fig 2 shows a BA212 Power Isolator powering a BA329 indicator. The cable between the BA212 and the BA329 should be selected to have a total inductance of less than Lo of the BA212 isolator, **or** an L/R ratio of less than Lo/Ro of the BA212 isolator as shown below.

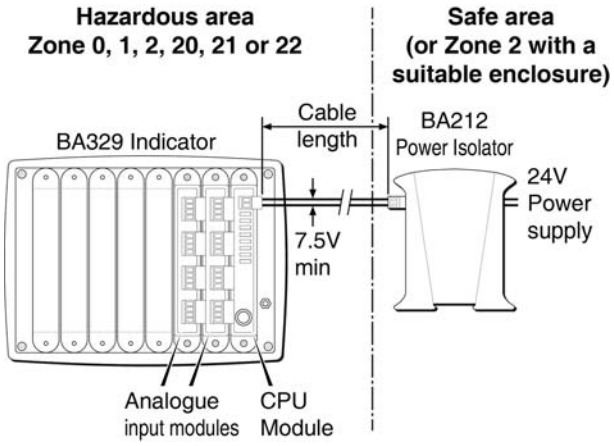


Fig 2 BA329 powered by BA212 Power Isolator

4.2.1 Maximum cable length determined by total cable inductance.

	Gas group		
	IIC	**IIB**	**IIA**
Lo of BA212 isolator	5μH	20μH	40μH

Most twisted pair instrument cables have an inductance of less than 0.8μH per metre. The addition of a screen or armour makes little difference. Twisted pairs within multicore cables also have a similar inductance. With a 0.8μH per metre cable, the maximum permissible cable length between a BA212 Power Isolator and a BA329 Indicator is:

Gas group		
IIC	**IIB**	**IIA**
6m	25m	50m

For dust applications, the IIB figures should be used.

4.2.2 Maximum cable length determined by cable L/R ratio.

Any cable with an L/R ratio equal to, or less than, the BA212 isolator's Lo/Ro ratio may be used. The practical maximum cable length depends upon the voltage drop caused by the cable, which must not reduce the voltage at the BA329 Indicator below 7.5V.

	Gas group		
	IIC	**IIB**	**IIA**
Lo/Ro of BA212	4.3μH/Ω	17μH/Ω	34μH/Ω

Instrumentation cables with an L/R ratio equal to, or less than 4.3μH/Ω, required for IIC gas application are not generally available, but those for use in IIB and IIA gases are produced by multiple manufacturers.

Cable parameters for a typical twisted pair instrument cable (*Draka Norsk Kabe FlexFlame RFOU(i) 150/250(300)*) are shown below:

Inductance	**Resistance**	**L/R ratio**
0.67μH/m	26.3mΩ/m	12.7μH/Ω

Using this cable, the maximum cable length between the BA212 Isolator and the BA329 Indicator will be:

	Gas group		
	IIC	**IIB**	**IIA**
Cable length	-	155m	155m

The cable length is limited by the voltage drop caused by the cable as explained in Appendix 1 of these instructions. Further information is contained in the BEKA Application Guide AG210.

4.3 Applications in Group IIC gases

For most applications in a group IIC gas, the BEKA BA243 Power Isolator should be used as shown in Fig 3. This has four galvanically isolated outputs which are remotely combined by a BA3901 Power Combiner at the BA329 Indicator allowing a much longer cable length for applications in gas group IIC.

Each of the four cables between the BA243 Power Isolator and the BA3901 Power Combiner should be selected to have a total inductance of less than, Lo of each BA243 isolator output, **or** an L/R ratio of less than Lo/Ro of each BA243 isolator as shown below.

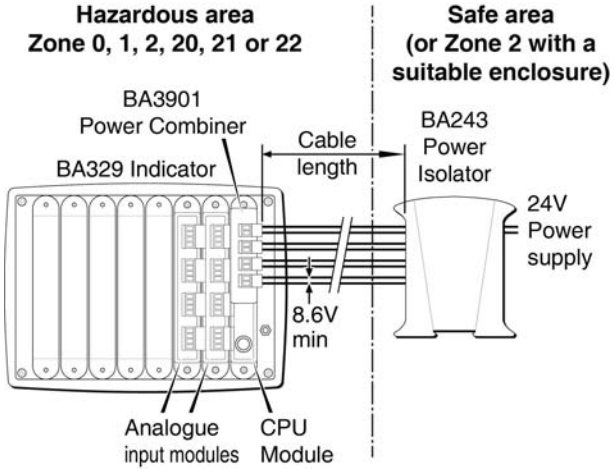


Fig 3 BA329 powered by a BA243 Power Isolator

4.3.1 Maximum cable length determined by total cable inductance.

	Gas group		
	IIC	**IIB**	**IIA**
Lo of each BA243 output	79µH	317µH	637µH

Most twisted pair instrument cables have an inductance of less than 0.8µH per metre. The addition of a screen or armour makes little difference. Twisted pairs within multicore cables also have a similar inductance. With a 0.8µH per metre cable, the maximum permissible cable length between a BA243 Power Isolator and a BA329 Indicator is:

	Gas group		
	IIC	**IIB**	**IIA**
Maximum cable length	97m	396m	796m

However, for distance greater than approximately 300m in IIB and IIA gases the cable resistance voltage drop will become the limiting factor.

If the four isolator outputs are connected to the BA329 Indicator via a multicore cable, the cable should be a Type A or a Type B multicore as defined in IEC 60079-14.

4.3.2 Maximum cable length determined by cable L/R ratio.

Any cable with an L/R ratio equal to, or less than, the Lo/Ro ratio of each BA243 output may be used. The practical maximum cable length depends upon the voltage drop caused by the cable, which must not reduce the voltage at the BA3901 Power Combiner mounted to the BA329 Indicator terminals to less than 8.6V.

	Gas group		
	IIC	**IIB**	**IIA**
Lo/Ro of each BA243 output	17µH/Ω	68µH/Ω	137µH/Ω

Cable parameters for a typical twisted pair instrument cable (*Draka Norsk Kabe FlexFlame RFOU(i) 150/250(300)*) are shown below:

Inductance	**Resistance**	**L/R ratio**
0.67µH/m	26.3mΩ/m	12.7µH/Ω

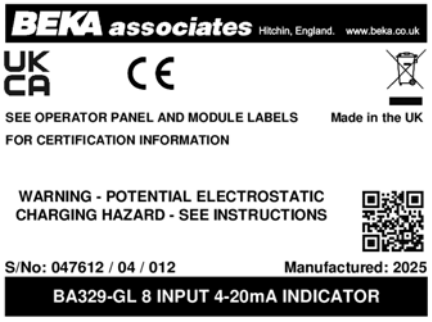
Using this cable, the maximum cable length between the BA243 isolator and the BA3901 Power Combiner at the BA329 Indicator terminals will be:

	Gas group		
	IIC	**IIB**	**IIA**
Cable length	800m	800m	800m

Additional information about calculating maximum cable lengths is contained in Appendix 2 of these instructions, and in the BEKA Application Guide AG210.

4.4 Documentation and certification labels

Each of the apparatus certified modules forming the BA329 indicator has its own certification label showing certification information, the module serial number, year of manufacture plus the name and location of BEKA associates. The complete BA329 Indicator assembly also carries a label showing the product name, serial number and BEKA associates name and location.



All intrinsically safe system installations should have a Descriptive Systems Drawing defining why the system is safe, as specified in EN 60079-25 I*ntrinsically safe electrical systems.* As the BA329 consists of a number of interconnected modules each with apparatus certification, it is an intrinsically safe system and requires a Descriptive Systems Drawing.

To assist users prepare a Descriptive Systems Drawing for their installation, Appendix 3 contains examples of Descriptive System Drawings for a BA329 indicator powered by a BA212 and by a BA243 Power Isolator.

All the intrinsic safety certificates can be downloaded from the BEKA website.

5. INSTALLATION

The BA329-GL and BA329-PC intrinsically safe panel mounting indicators feature a 316 stainless steel front panel surrounding the display, with a silicone moulded gasket to seal the joint between the indicator and the instrument panel. The fronts of both models, including the seal between the indicator and the instrument panel, have third party certified IP66 protection. The rear of both models have IP20 protection.

The BA329-GL Indicator has a toughened glass display window. It may be installed in all gas and dust hazardous environments permitted by the instruments intrinsic safety certification.

The BA329-PC Indicator has a scratch resistant polycarbonate display window. The front of the indicator has been certified compliant with Ex e and Ex t impact and ingress requirements. For intrinsic safety applications, this allows the BA329-PC to be installed in an Ex e or Ex t enclosure without invalidating the certification of the enclosure.

Although the front of all BA329 Indicators have IP66 protection, if possible they should be shielded from continuous direct sunlight and severe weather conditions.

CAUTION

The front panel touch buttons should not be exposed to salt water.

5.1 EMC

The BA329 indicator complies with the requirements of the European EMC Directive and the UK EMC statutory requirements. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed at one point within the safe area.

5.2 Installation Procedure

1. Cut the aperture specified in Fig 4 in the instrument panel and ensure that all edges are de-burred.

2. First ensure that all eight panel mounting clamps are closed by turning the knurled screws fully anticlockwise until the two pips in the clamp foot align with holes in the clamp body as shown in Fig 5.

3. Ensure that the panel sealing gasket is correctly positioned before inserting the BA329 Indicator into the panel aperture.

4. Place a clamp in the recess on each side of the BA329 Indicator, pulling gently to slide it onto the dovetail as shown in Fig 5. Push the knurled screw slightly forward to engage the thread and tighten by turning clockwise until it is just finger tight. When both clamps are fitted ensure that the gasket behind the front panel bezel remains correctly positioned before fitting the remaining six panel mounting clamps. Finally, fully tighten all the panel clamps to secure the instrument. The maximum recommended clamp tightening torque is 25cNm (2.2lbf in) which is approximately equivalent to finger-tight plus one half turn. Do not over tighten.

5. Connect the power supply and 4/20mA input wiring as shown in Figs 2, 3 and 6.

6. Connect the BA329 indicator earth stud shown in Fig 6 to earth. If metallic, the instrument panel in which the indicator is mounted should also be earthed.

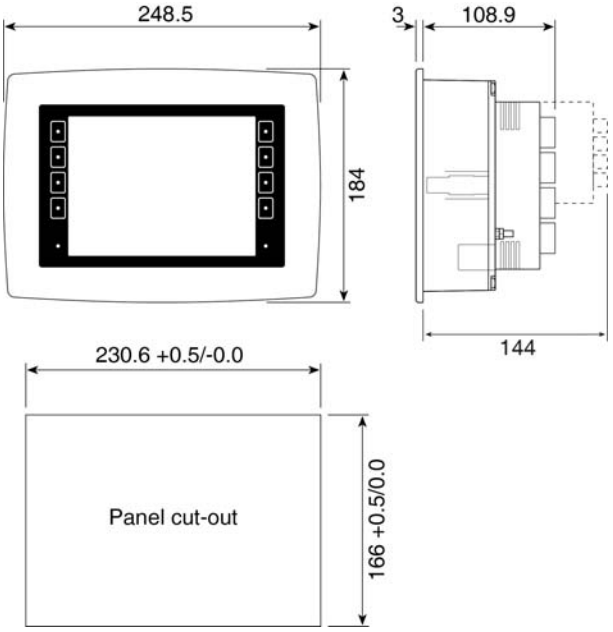
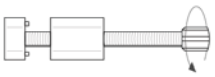


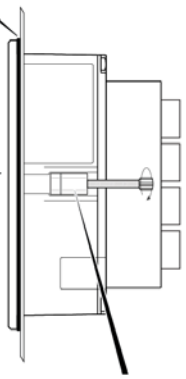
Fig 4 Dimensions including cut-out

a. Align foot and body of panel mounting clamp by turning screw anticlockwise



b. Position gasket behind instrument bezel

c. Insert BA329 Indicator into the panel from the front



d. Place a clamp in the recess on each side of the BA329 Indicator, pulling gently to slide them onto the dovetails. Push the knurled screws slightly forward to engage the threads and tighten by turning clockwise until both are just finger tight. When both clamps are fitted, ensure that the gasket behind the front panel bezel remains correctly positioned before fitting the remaining six panel mounting clamps. Finally, fully tighten all the panel clamps to secure the instrument. The maximum recommended clamp tightening torque is 25cNm (2.2lbf in) which is approximately equivalent to finger-tight plus one half turn.

DO NOT OVERTIGHTEN.

Fig 5 Installation of BA329 Indicator and mounting clamps.

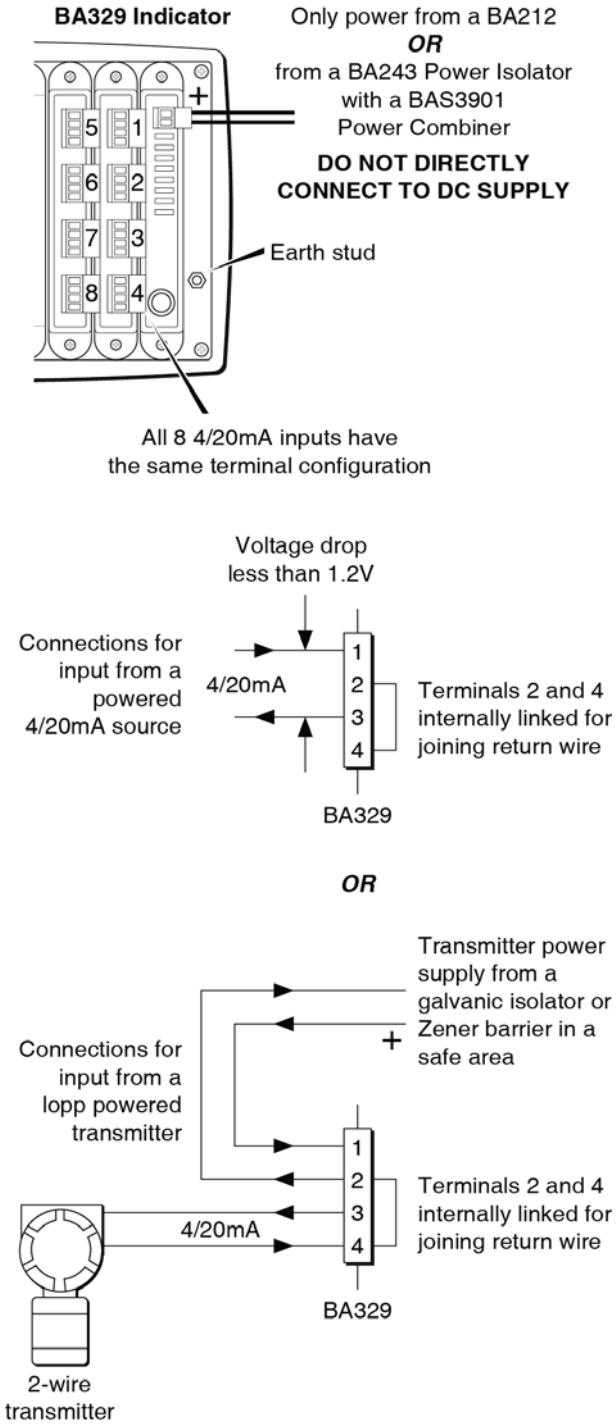


Fig 6 BA329 input terminal connections and wiring for 4/20mA source and for a loop powered transmitter.

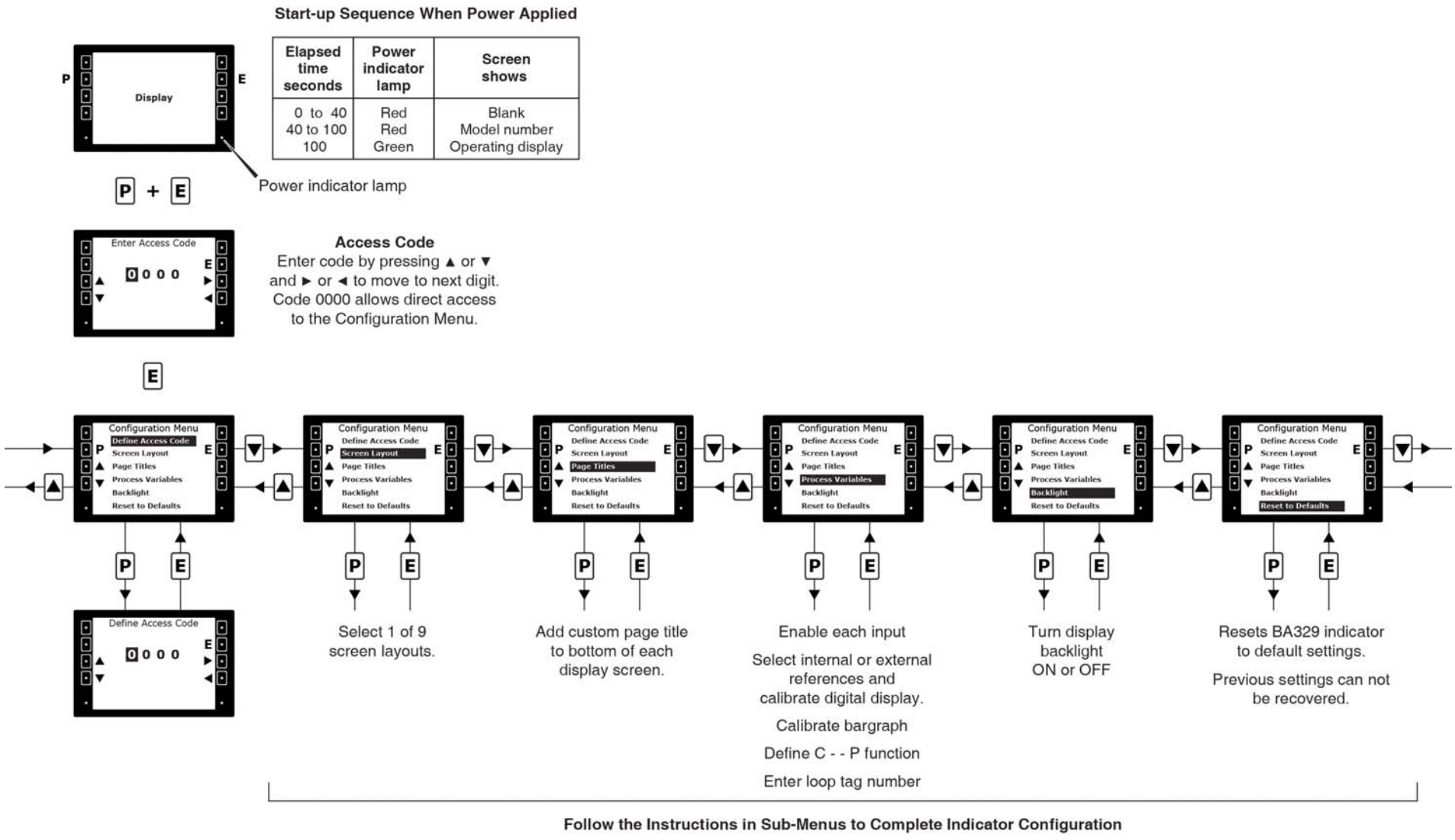


Fig 7 Configuration Menu

6. CONFIGURATION AND CALIBRATION

The BA329 indicator is configured and calibrated via the eight front panel touch buttons using a series of intuitive sub menus accessed via the Configuration Menu.

During configuration, if a button is not touched for 1 minute, the indicator will time-out and return to the operating mode.

Configuration entries in sub menus are transferred to permanent memory when the **E** touch button is pressed to leave the configuration menu. If the indicator times-out before the **E** button is pressed, configuration information already entered will not be saved and must be entered again.

6.1 Configuration Menu

Access to the Configuration Menu is obtained by simultaneously pressing the **P** and **E** touch buttons as shown in Fig 7. To prevent unauthorised adjustments, access may be protected by a four digit alphanumeric user definable access code. New BA329 indicators are configured with default code 0000 which provides direct access to the Configuration Menu.

To gain access to the Configuration Menu of a BA329 indicator with an access code other than 0000, press the **P** and **E** buttons simultaneously which will cause the Enter Access Code screen to be displayed as shown in Fig 8. Enter the access code character by character, if the correct code has been entered, pressing **E** will cause the Configuration Menu to be displayed.

Please contact BEKA associates if the indicator's access code is lost.

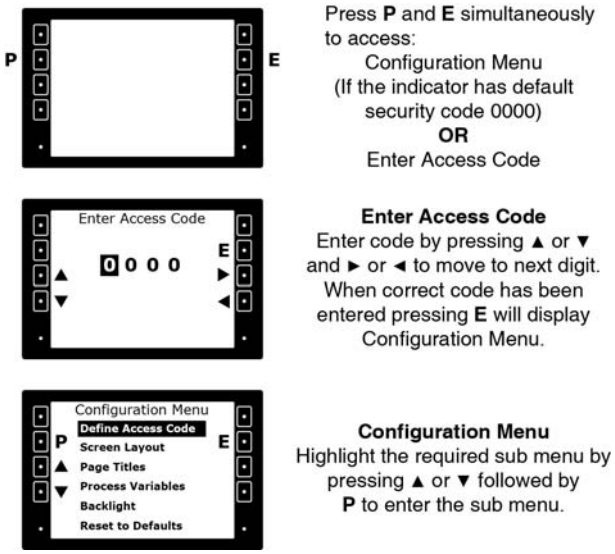


Fig 8 Access to the Configuration Menu

6.2 Define Access Code

Unless otherwise requested, new BA329 indicators are supplied with the default access code 0000 which allows unrestricted access to all configuration functions.

To enter a new access code select Define Access Code from the Configuration Menu shown in Fig 7.

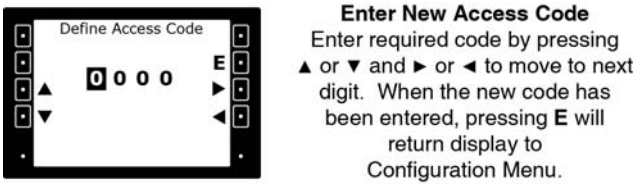
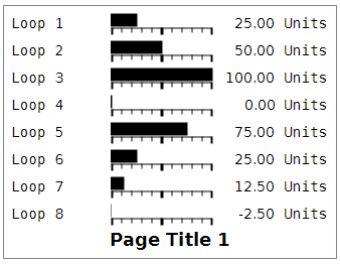


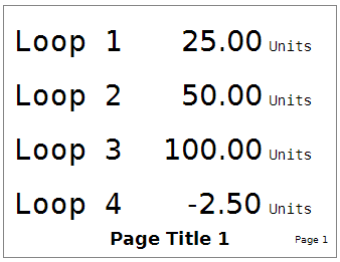
Fig 9 Entering a new Access Code

6.3 Screen layout

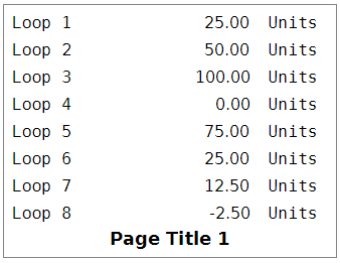
This sub menu allows one of the following nine screen formats to be selected.



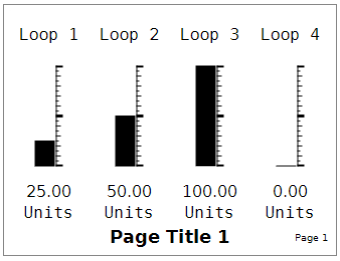
Rows: 8 variables + bargraphs



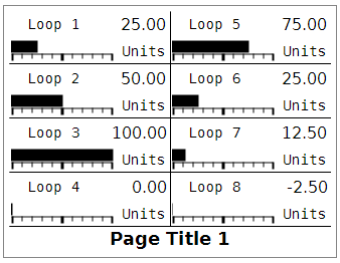
Rows: 4 variables



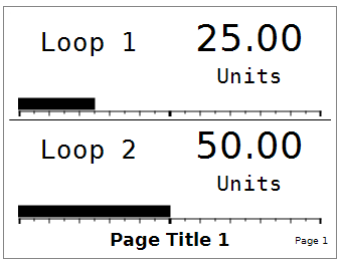
Rows: 8 variables



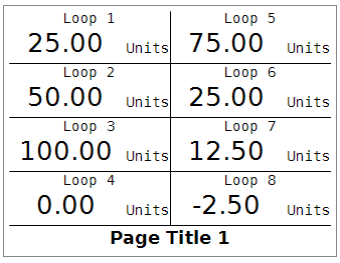
Columns: 4 variables + bargraphs



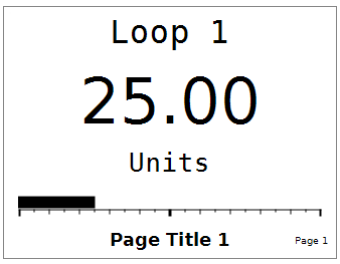
Grid: 8 variables + bargraphs



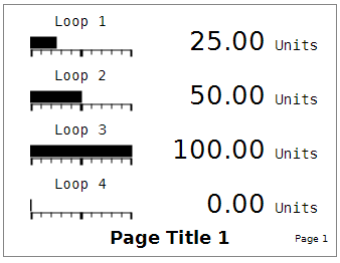
Rows: 2 variables + bargraphs



Grid: 8 variables

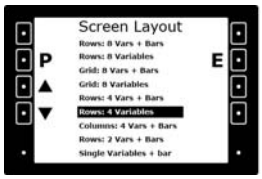


- Single variable + bargraph



Rows 4 variables + bargraphs

To select a screen format, first select Screen Layout from Configuration Menu shown in Fig 7 and press **P.**



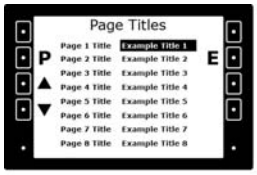
Screen Layout
Highlight the required screen by pressing ▲ or ▼ followed by **E** to confirm selection and return to the configuration Menu

Fig 10 Selecting the required Screen Layout

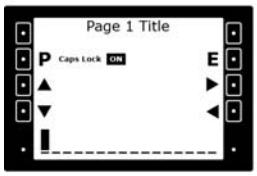
6.4 Page Titles

Using this function a custom page title can be added to the bottom of each display screen. The number of Page Titles that may be entered will depend upon the screen layout selected. If a screen displaying eight variables has been selected, only one page title will be required, if each variable is displayed on a separate screen, up to eight different page titles may be entered.

To add one or more page titles select Page Titles from the Configuration Menu shown in Fig 7 and press **P**.



Page Titles
Highlight the required page by by pressing ▲ or ▼ followed by **P** to enter the selected screen



Enter Page Title
Enter each character of the page title by pressing ▲ or ▼ and ► or ◄ to move to the next character.

When complete press **E** to enter another page title.

Finally press **E** again to return to the Configuration Menu.

P turns caps. lock **ON** or **OFF**

Fig 11 Entering Page Titles

6.5 Process Variables

This sub-menu allows:

Each 4/20mA input to be enabled

Calibration of each digital display and bargraph

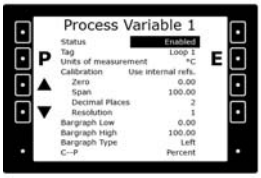
Entry of Units of Measurement for each display

Entry of Tag information for each display

Configuration of C--P function

6.5.1 Input enable

To enable an input, select Process Variables from the Configuration Menu shown in Fig 7 and press **P**. Disabled inputs are not displayed, but their calibration and configuration are retained.



Select the required input by pressing ► or ◄

To enable or disable the input, press **P** and select required option by pressing ► or ◄ followed by **E** to return to this menu.

Another adjustment can be selected by pressing ▲ or ▼

Fig 12 Selecting and enabling an input

6.5.2 Digital display calibration

Each BA329 digital display may be calibrated using an external calibrated current source, or the indicator's internal references to simulate 4mA and 20mA inputs.

Zero is the digital display with a 4mA input

Span is the digital display with a 20mA input.

An accurate traceable external current source is the preferred method of calibration. The Zero and Span calibration currents should be more than 3.7mA apart and between 3.7mA and 21mA. The use of external references enables a complete 4/20mA loop, including other instruments in the loop such as transmitters, to be calibrated.

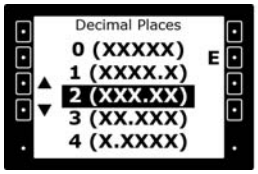
Each digital display has a dummy decimal point which can be positioned between any of the digits, or it may be absent.

Display underrange is indicated by a display of -9.9.9.9 and display overrange by 9.9.9.9, the green backlight of the associated touch button also flashes.

If the input current falls below 3.5mA or rises above 22.5mA the digital display is reversed i.e. white digits on a black background.

6.5.2.1 Dummy decimal point

To position the dummy decimal point in a digital display select Decimal Places on the Process Variable screen and press **P**.

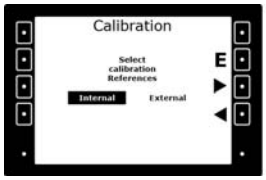


Position Decimal Place
Select the required decimal place position by pressing ▲ or ▼, followed by **E** to return to the Process Variable menu.

Fig 13 Position display dummy decimal point

6.5.2.2 External or internal references

To define if the internal references or an external 4/20mA source such as a calibrator is to be used to calibrate the digital display, select Calibration on the Process Variable screen and press **P**.



Select the required calibration reference by pressing ► or ◄ followed by **E** to return to the Process Variable screen from which another adjustment can be made by pressing ▲ or ▼

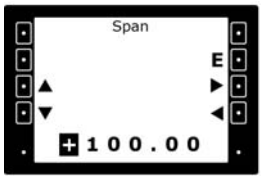
Fig 14 Calibration reference

6.5.2.3 Zero and span

Calibration of the span and zero of each digital display differs depending on whether an external calibrator or the indicator's internal references are being used.

To use an external calibrator, select Zero on the Process Variable screen and press **P**. Adjust the indicators input current to 4.000mA and enter the required digital display as shown in Fig 15.

Similarly, select Span on the Process Variable screen in exactly the same way, but with an input current of 20.000mA.



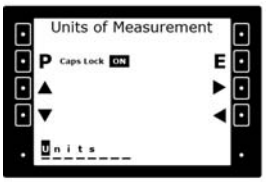
Enter Zero or Span
Enter the required Zero or Span calibration digit by pressing ▲ or ▼ and ► or ◄ to move to the next digit, followed by **E** to return to the process Variable menu.

Fig 15 Zero and Span Calibration

To use the indicators internal references, follow the same procedure described above, but the indicators input current can be any value.

6.5.2.4 Units of measurement and tag information

Units of measurement with up to 8 characters may be added to each display. To add units to a digital display, select Units of measurement on the Process Variable screen and press **P**.



Add units of measurement
Enter units of measurement character by character by pressing ▲ or ▼ and ► or ◄ to move to the next character.
Press **E** to return to the Process Variable menu.

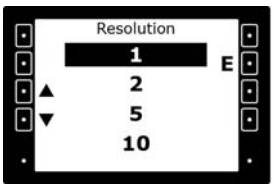
Fig 16 Units of measurement

Similarly, up to 15 characters of tag information can be added to each display by selecting Tag from the Process Variable screen and following the same procedure.

6.5.2.5 Digital display resolution

The resolution of the least significant display digit can be reduced to improve display readability of a noisy 4/20mA input.

To define the display resolution select Resolution on the Process Variable screen and press **P**.



Select display resolution
by pressing ▲ or ▼
followed by **E** to return
to the Process Variable menu.

Fig 17 Display resolution

6.5.2.6 Bargraph calibration

When a Screen Layout which includes a bargraph has been selected, the bargraph calibration can be the same or different from the digital display.

The Bargraph Type sub menu allows the bargraph starting position to be selected, including a centre position. The bargraph can also be turned off.

Off
Left, or bottom for vertical bargraphs
Centre
Right, or top for vertical bargraphs

Each bargraph may be calibrated by selecting Bargraph Low and Bargraph High from the Process Variable sub menu, and entering the digital display value corresponding with the required bargraph start and finish.

6.6 C--P function

When the indicator is in the operating mode, continuously touching the button with a green backlight adjacent to a display will change that display to the input current in milliamps, or to the displayed value as a percentage of the difference between the calibrated values at 4mA and 20mA inputs.

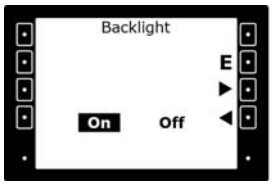
To configure which is displayed, select C--P from the Process Variable screen and press **P**.

Select C - - P fuction
Select the required function by pressing ► or ◄ followed by E to return to the Process Variable menu.

Fig 18 C--P function selection

6.7 Backlight

From the Configuration Menu shown in Fig 7 select Backlight and press **P**.



Backlight
Press ► or ◄ to toggle backlight on and off. When set press **E** to return to the Configuration menu.

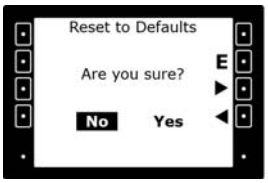
Fig 19 Backlight control

6.8 Reset to defaults

The BA329 indicator configuration can be reset to the following defaults using this function. After resetting to defaults, the previous configuration can not be recovered, therefore the instruction has to be confirmed before execution.

Access code	0000
Screen layout	8 variables on 2 screens with bargraphs.
Digital display calibration	0.00 to 100.00
Bargraph calibration	As digital display
Display backlight	On
C--P function	mA

From the Configuration Menu shown in Fig 7 select Reset to Defaults and press **P**.

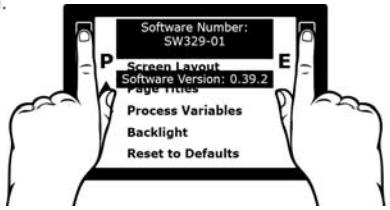


Reset to Default Confirmation
Press ► or ◄ to confirm or cancel instruction, followed by **E** to reset to defaults or return to the Configuration menu.

Fig 20 Reset to default calibration

6.9 System

The software issue number of the BA329 indicator is displayed from the Configuration Menu as below.



System information
To view the software version number press the two upper buttons in the Configuration menu.

Fig 21 System screen

7. MAINTENANCE

7.1 Fault finding during commissioning

If a BA329 indicator fails to function correctly during commissioning, the following procedure should be followed:

Symptom	Cause	Solution
BA329 power indicator not illuminated.	Incorrect wiring, or no power supply.	Check wiring Using a BA212 Power Isolator there should be 7.5V min at BA329 indicator power supply terminals. Using a BA243 Power Isolator there should be 8,6V min between each of the four inputs of the BA3901 Power Combiner. Power Isolators should have a green LED at their input and output terminals,
	BA329 takes up to 100 seconds to start working.	Wait more than 100 seconds after applying power to the BA329.
4/20mA input not correctly displayed	Incorrect input wiring.	Check input wiring. There should be 0.6V to 1.2V between terminals 1 & 3 with terminal 1 positive. Check supply voltage and voltage caused by all instruments in the 4/20mA loop.
	Incorrect BA329 indicator calibration.	Check calibration and that correct input is being displayed.
-9.9.9.9 or 9.9.9.9 display and associated touch button flashing.	Over or underrange.	Check calibration
Flashing bargraph scale.	Over or underange	Check calibration
Reversed digital displayed i.e. white digits on black background.	Input current is below 3.5mA or above 22.5mA	Check 4/20mA loop
Error message		Contact BEKA or your local agent.

7.2 Fault finding after commissioning

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

Live maintenance is permitted on intrinsically safe equipment installed in a hazardous area, but only certified test equipment should be used unless a gas clearance certificate is available.

If a BA329 indicator fails after it has been functioning correctly, follow the procedure shown in section 7.1. If this does not reveal the cause of the fault, it is recommended that the instrument is replaced. This can be done without disconnecting power, but while the indicator is disconnected the 4/20mA loops will be open circuit.

7.3 Servicing

No attempt should be made to repair BA329 indicators at component level. We recommend that faulty instruments are returned to BEKA associates or to your local BEKA agent for repair.

7.4 Routine maintenance

The mechanical condition of the instrument and electrical calibration should be regularly checked. The interval between inspections depends upon environmental conditions. We recommend that initially inspection should be performed annually.

7.5 Guarantee

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

7.6 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.

APPENDIX 1
Using a BA212 Power Isolator

The BA212 isolator is primarily intended to power a BA329 indicator in gas group IIB (ethylene) or IIA (propane). The BA212 does have IIC (hydrogen) certification, but the output inductive parameters Lo limit applications in IIC to where the BA212 isolator and the BA329 indicator are located close together. The maximum capacitance Co that may be be safely connected to the BA212 output is relatively large, and is unlikely to limit the cable length.

CAUTION
Parameters for the cable being installed should be used when calculating the maximum safe length.

The cable between the BA212 Power Isolator output and the BA329 Indicator should be selected to have inductance of less than Lo of the isolator, or an L/R ratio of less than Lo/Ro of the isolator.

Cable length limitation imposed by Lo or BA212:
Most twisted pair instrument cables have an inductance of less than 0.8µH per metre. The addition of a screen or armour makes little difference. Twisted pairs within multicore cables also have a similar inductance.

The equivalent inductance at the BA329 indicator power input terminals Li is zero. All of the allowable inductance that may be connected to the BA212 isolator output may therefore be allocated to the cable inductance.

$$\text{Max cable length} = \frac{\text{BA212 Lo for required gas group}}{\text{Cable inductance per metre}}$$

Using cable having inductance of 0.8µH per metre.

	Gas group		
	IIC	**IIB**	**IIA**
BA212 Lo µH	5	20	40
Max cable length m	6	25	50

Cable length limitation imposed by BA212 Lo/Ro:
Alternatively, any length of cable with an L/R ratio equal to, or less than, the BA212 isolators Lo/Ro may be used. The maximum length being defined by the acceptable resistive voltage drop of the cable.

	Gas group		
	IIC	**IIB**	**IIA**
BA212 Lo/Ro	4.3µH/Ω	17µH/Ω	34µH/Ω

Instrumentation cables complying with the L/R ratio required for use in IIC gases are not generally available, but those complying with requirements for use in IIB and IIA gases are common.

The maximum allowable cable length can be calculated as follows:

$$\text{Max cable length} = \left[\frac{(\text{Vo min} - \text{VL min})}{\text{IL max}} - \text{Ro max}\right]\left[\frac{1}{2 \times \text{R cab}}\right]$$

Where:

Vo min = Minimum BA212 isolator output voltage with no load which is 11.53V

VL min = Minimum operating voltage of BA329 indicator which is 7.5V.

IL max = Maximum current consumption of BA329 indicator which is 0.28A.

Ro max = Maximum BA212 isolator output resistance which is 6.22Ω

R cab = Cable conductor resistance Ω/m

Using a typical instrument cable with a resistance of 0.0263Ω per metre.

$$\text{Max cable length} = \left[\frac{(11.53 - 7.5)}{0.28} - 6.22\right]\left[\frac{1}{2 \times 0.0263}\right]$$

Max cable length = 155m

For applications in gas groups IIB and IIA the maximum permissible cable length is 155m.

This calculation should be repeated for the instrument cable being used.

APPENDIX 2
Using a BA243 Power Isolator

The BA243 Power Isolator has four galvanically isolated outputs which have been certified intrinsically safe in IIC atmospheres when remotely interconnected by a BA3901 Power Combiner. The BA3901 Power Combiner mounts onto the rear of the BA329 indicator and contains separate terminals for each of the four circuits. For applications in gas group IIC (hydrogen), this technique allows much longer cable lengths between the BA243 isolator and the BA329 indicator.

If the four isolator outputs are connected to the indicator via a multicore cable, the cable should be a Type A or a Type B multicore as defined in IEC 60079-14.

The maximum capacitance that may be be safely connected to each BA243 output Co, is relatively large, and is unlikely to limit the cable length.

CAUTION

Parameters for the cable being installed should be used when calculating the maximum safe length.

The cable between each BA243 Power Isolator output and the BA329 indicator should be selected to have inductance of less than Lo of each BA243 Power Isolator output, or an L/R ratio of less than Lo/Ro of each isolator output.

The minimum operating voltage of a BA329 indicator is 7.5V, and the BA3901 Power Combiner introduces an additional 1.1V voltage drop. The minimum permissible voltage at the BA3901 is therefore 8.6V. Each power input supplies 70mA which is one quarter of the BA329s maximum current consumption.

Cable length limitation imposed by BA243 Lo:

Most twisted pair instrument cables have an inductance of less than 0.8µH per metre. The addition of a screen or armour makes little difference. Twisted pairs within multicore cables also have a similar inductance.

The equivalent inductance at each of the BA3901 Power Combiner input terminals Li is zero. All of the allowable inductance that may be connected to each BA243 isolator output may therefore be allocated to the cable inductance.

$$\text{Max cable length} = \frac{\text{BA243 Lo for each output}}{\text{Cable inductance per metre}}$$

As an example, using a cable having inductance of 0.8µH per metre.

	Gas group		
	IIC	**IIB**	**IIA**
BA243 Lo µH	79	317	634
Max cable length m	98	396	792

If resistance of each cable exceeds 22Ω, the cable length will be limited by the voltage drop caused by the cable.

Cable length limitation imposed by BA243 Lo/Ro:

Alternatively, any length of cable with an L/R ratio equal to, or less than the BA243 isolators Lo/Ro ratio for each output may be used. The maximum cable length being defined by the resistive voltage drop of the cable.

	Gas group		
	IIC	**IIB**	**IIA**
BA243 Lo/Ro of each output	17µH/Ω	68µH/Ω	137µH/Ω

$$\text{Max cable length} = \left[\frac{\text{Vo min - VL min}}{\text{IL max}} - \text{Ro max}\right]\left[\frac{1}{2 \times \text{R cab}}\right]$$

Where:

Vo min = Minimum BA243 isolator output voltage with no load which is 11.5V

VL min = Minimum operating voltage of BA329 indicator including BA3901 Power Combiner which is 8.6V.

IL max = One quarter of BA329 indicator maximum current consumption which is 0.07A.

Ro max = Maximum BA243 isolator output resistance which is 20.36Ω

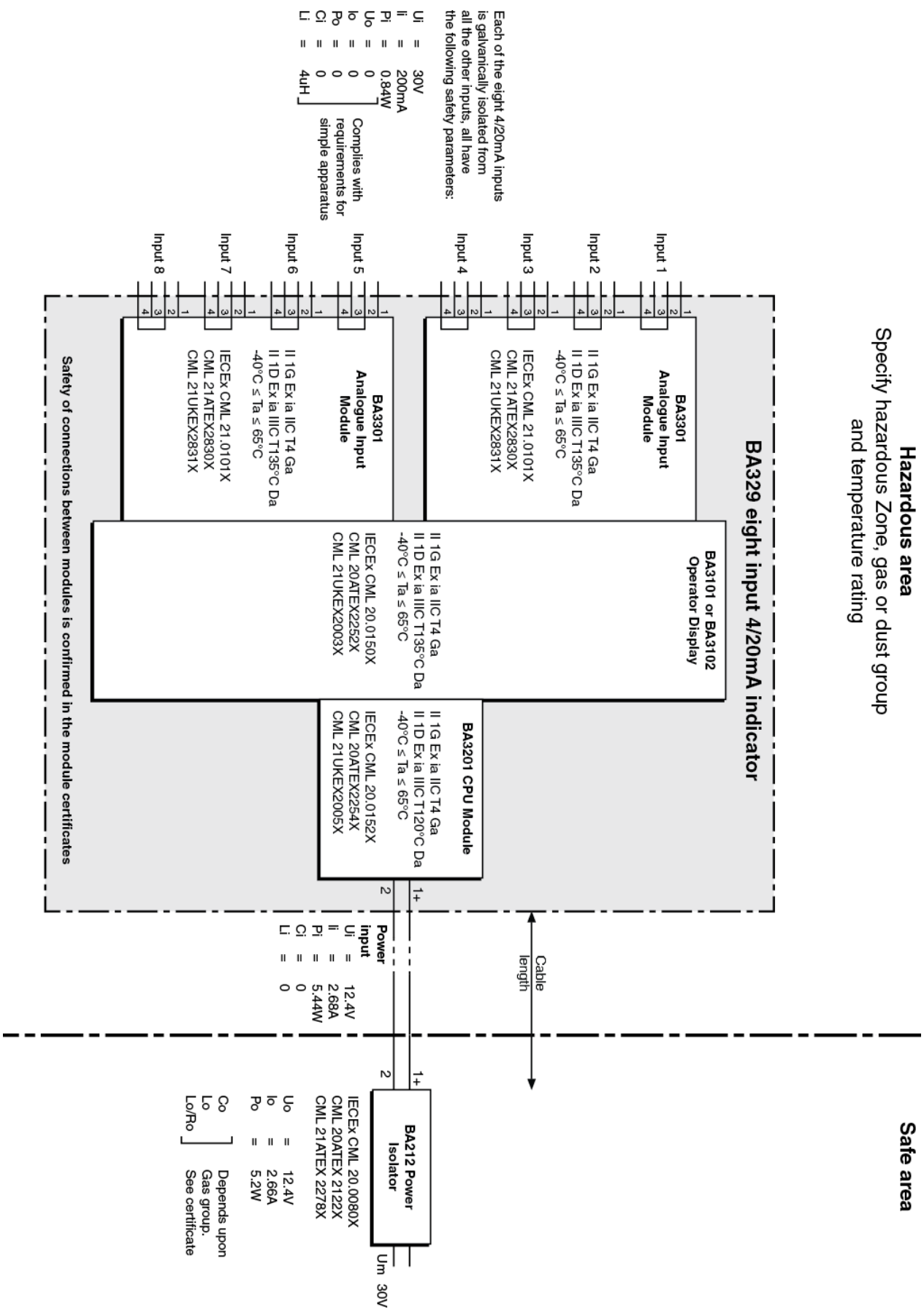
R cab = Cable conductor resistance Ω/m

For example using a typical instrument cable with a resistance of 0.0263Ω per metre.

$$\text{Max cable length} = \left[\frac{11.5 - 8.6}{0.07} - 20.36\right]\left[\frac{1}{2 \times 0.0263}\right]$$

Max cable length = 400m

APPENDIX 3 Descriptive Systems Drawings
Using BA212 Power Isolator



APPENDIX 4 Descriptive Systems Drawings
Using BA243 Power Isolator