Pageant Operator
Panel System
Instructions
Issue 3

CONTENTS

1. INTRODUCTION

The Pageant intrinsically safe Operator Panel is a PLC (programmable logic controller) comprising a BA3101 7 inch (177mm) backlit display. A plug-in CPU module (central processing unit) incorporating licensed CODESYS® industry standard PLC software and up to seven plug-in Input and Output Modules which are accommodated at the rear of the BA3101 display.

All the software is supplied with a lifetime licence and no renewals or additional payments are required. Optional external communication allows Pageant to be used as part of a network.

The BA3101 display and all of the plug-in modules have individual international Ex ia intrinsic safety apparatus certification, this permits any combination of modules to be used without the need for further third party assessment. This flexible certification simplifies system design and minimises cost as only the modules required for each application have to be purchased.

Pageant is totally intrinsically safe providing maximum safety in the most hazardous Zone 0 environments without the need for a heavy expensive enclosure. The BA3101 display and all of the plug-in modules are powered from a single BEKA Power Isolator located in a safe area or in Zone 2.

CODESYS runtime PLC software has become an industry standard and is now used in more than 1,500 different products worldwide. It is compliant with international standard IEC 61131 Programmable controllers and will already be familiar to many users.

The Operator Display has eight touch buttons each with a tricolour LED backlight for operator inputs and outputs, all of which are individually programmable. Two additional LEDs indicate status and diagnostics. Operator inputs can also be made via a plug-in DI module from external contacts such as large industrial push buttons.

Two alternative plug-in CPU modules are available. One has an intrinsically safe RS485-IS port which allow the Pageant Operator Panel to be integrated into a network, or to be configured as a Modbus master or slave.

2. DOCUMENTATION

The BA3101 Pageant display and each plug-in module are supplied with individual instructions which describe installation and certification. The intrinsic safety certificates for each Pageant device can be downloaded from the BEKA website www.beka.co.uk

This document describes the Pageant concept, how to design, assemble and operate a Pageant PLC system. It should be read in conjunction with the instructions for each module being used.

3. SYSTEM PARTS

There are four parts of the Pageant intrinsically safe Operator Panel system as shown in Fig 1.
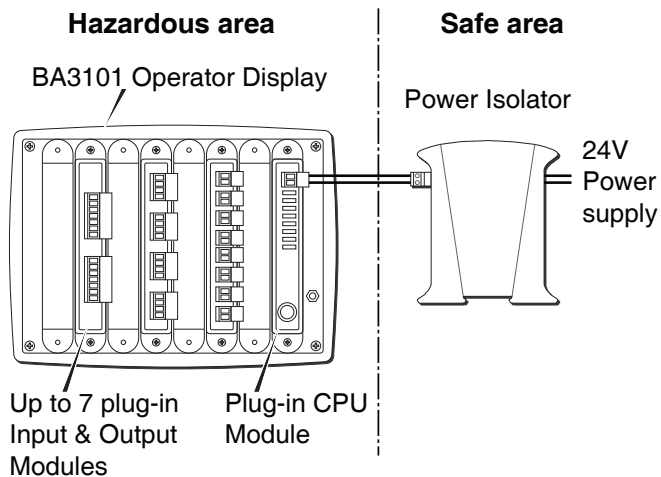

Fig 1 Pageant intrinsically safe Operator Panel system

3.1 BEKA Power Isolator

These galvanic isolators have associated apparatus intrinsic safety Ex ia and increased safety Ex ec component certification. The isolators provide power to the Pageant Operator Panel and may be mounted in a safe area, in Zone 2 or in a dust Zone 22 when provided with additional environmental protection.
Two models are available:

BA212 For powering an Operator Panel located in a IIA or IIB flammable gas, or in a combustible dust atmosphere. May also be used to power an Operator Panel in a IIC flammable gas atmosphere when the BA212 Power Isolator and the Operator Panel are located very close together.

BA243 Four channel supply for powering an Operator Panel located in a IIC flammable gas atmosphere.

3.2 BA3101 Display

The BA3101 is an IECEx, ATEX and UKEX certified intrinsically safe Display. It is the core of the Pageant Display Panel comprising a 7 inch (177mm) backlit screen with 8 touch buttons with independent tricolour backlights, plus 8 sockets which can accommodate a single plug-in CPU module and up to 7 plug-in Input and Output Modules. The CPU module also distributes power to the BA3101 display and to all of the plug-in I/O modules.

3.3 Plug-in CPU modules

Every Operator Display must be fitted with a plug-in CPU module in the right hand 'C' socket at the rear of the BA3101 Operator Display. All CPU modules contain a microprocessor and memory, together with a removable micro SD card on which is stored the CODESYS runtime software and the PLC application file.

The PLC application code can be updated by removing the micro SD card from the CPU module and transferring it to an SD card writer in the safe area. Alternatively, all CPU modules have a programming port which enables PLC application code to be downloaded to the module in a safe area via a BEKA BA3902 Pageant Programming Cable.

CAUTION

Make a backup copy of the original SD card before any changes are made.

All CPU modules have their own intrinsic safety apparatus Ex ia certification allowing them to be plugged into any BEKA Pageant Operator Display containing any mix of Input and Output modules.

A list of the CPU modules available at the time these instructions were published is contained in Appendix 1. Please see the BEKA website for details of any modules subsequently introduced.

3.4 Plug-in Input and Output Modules

The BA3101 Operator Display can accommodate up to seven plug-in Input and Output interface modules (I/O modules) in the sockets at the rear of the Display. These enable analogue and digital sensors and signals such as switch contacts, proximity detectors and 4/20mA process signals to be input to, and output from, the Pageant system.

Each module has its own intrinsic safety Ex ia apparatus certification and includes removable terminals for connecting field wiring.

A list of the interface I/O modules available at the time these instructions were published is contained in Appendix 1. Please see the BEKA website for details of any modules subsequently introduced.
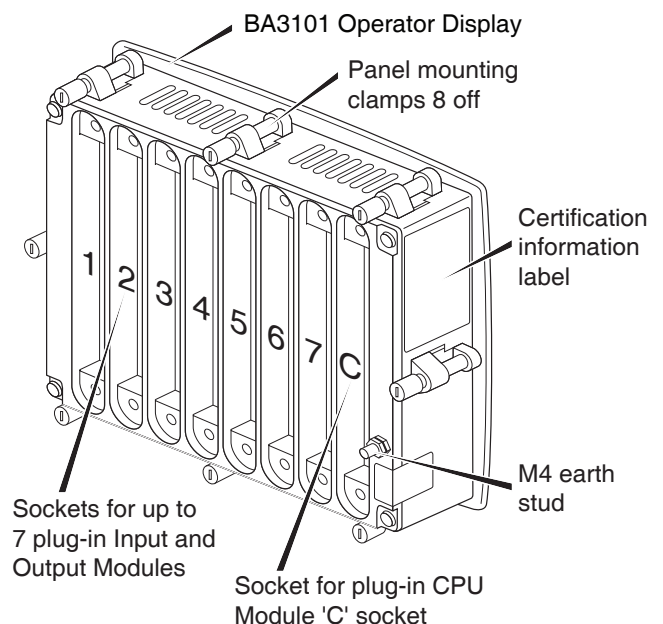

Fig 2 Rear of BA3101 display without plug-in modules

4. INTRINSIC SAFETY CERTIFICATION

EU Notified Body CML B.V. and UK Approved Body Eurofins CML have issued the Pageant Operator Display and each of the plug-in modules with individual IECEx, ATEX and UKEX Ex ia intrinsic safety apparatus certificates. The certificates for the BA3101 display and each module are described in the instructions which accompany each item and can also be downloaded from www.beka.co.uk

The ATEX certificates have been used to confirm compliance with the European ATEX Directive for Group II, Category 1G and 1D equipment, similarly the UKEX certificates have been used to confirm compliance with the UK Statutory Instrument UKSI 2016:1107 (as amended).

The Operator Display and all the plug-in modules carry both the CE and UKCA marks. Subject to local codes of practice, they may all be installed in any of the European Economic Area (EEA) member countries and in the UK. ATEX certificates are also acceptable for installations in some non EEA countries. The IECEx certification is acceptable worldwide, either directly or as an aid to obtaining local approval.

The Operator Display has no external connections apart from the seven sockets for the plug-in interface modules and the single 'C' socket for a plug-in CPU module. The intrinsic safety input and output safety parameters of the Operator Display sockets and all of the plug-in modules have been designed to allow any certified BEKA interface module to be safely plugged into any of the seven Operator Display sockets. Similarly, any certified BEKA CPU module may be safely plugged into the 'C' socket on the Operator Display. Each module certificate specifies that the module should only be used as part of a BEKA Pageant System.

When each plug-in module was assessed for intrinsic safety certification by a Notified and/or Approved Body, it was considered as being connected to (plugged into) a certified BA3101 Pageant Operator Display. To maximise flexibility the BA3101 certificates do not list all the modules that may be fitted, but for compliance with EN 60079-25 *Intrinsically safe electrical systems*, the BA3101 display and modules may be considered a certified intrinsically safe system only requiring a simplified Descriptive System Document.

These instructions describe IECEx, ATEX and UKEX installations which conform with IEC / EN 60079-14 *Electrical installations design, selection and erection*. When designing systems the local code of practice should be consulted.

4.1 Gas atmospheres - Zones, gas groups and T rating

Certificates for the Operator Display and all of the plug-in modules specify the same gas code:

Ex ia IIC T4 Ga $-40°C \leq Ta \leq 65°C$

When fitted with a certified BEKA plug-in CPU module and certified BEKA plug-in Input and Output Modules, the BA3101 may be installed in:

Zone 0   Explosive gas air mixture
continuously present.
Unlikely requirement

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

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

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

At an ambient temperature Ta between -40°C and +65°C.

4.2 Dust atmospheres
Zones, types & ignition temperature

Certificates for the Operator Display and all of the plug-in modules specify the same dust code, but have different maximum surface temperatures:

Ex ia IIIC T x°C Da -40°C ≤ Ta ≤ 65°C.

For applications in dust atmospheres, the certificates specify Special Conditions of Use (See section 4.3) which require the rear of the Operator Panel to have additional environmental protection. This requirement can be satisfied by mounting the BA3101 Operator Display and the plug-in modules, in a component certified Ex t enclosure with certified Ex t cable glands.

When fitted with a BEKA certified plug-in CPU and input & output modules, and mounted inside an Ex t enclosure with Ex t cable glands, the Pageant Operator Panel may be installed in:

Zone 20   explosive atmosphere in the form of a cloud of combustible dust in air is continuously present, 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 dust in subdivisions:
IIIA   combustible flyings
IIIB   non-conductive dust
IIIC   conductive dust

The apparatus certificates for the BA3101 Operator Display specifies that when installed in an enclosure the maximum surface temperature assigned to the BA3101, which is 135°C, shall take precedence to the surface temperature assigned to any plug-in module which may be installed in the BA3101 Operator Display.

When mounted in an enclosure the Operator Panel may therefore be used with dusts having a Minimum Ignition Temperature of:

Dust cloud   202°C

Dust layer on enclosure   210°C
up to 5mm thick

Dust layer on enclosure   Refer to EN 60079-14
over 5mm thick.

At an ambient temperature between -40 and +65°C

4.3 Special conditions for safe use

The IECEx, ATEX and UKEX certificate numbers for the BA3101 display and all of the plug-in modules have an 'X' suffix indicating that special conditions for safe use apply. Overall they are as follows, but please refer to certificates for details.

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 this equipment shall take precedence over the surface temperature assigned to any plug-in 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 enclosure shall be made via cable glands which provide a minimum degree of protection of IP5X.

4.4 Certification label information

The Operator Display and all of the plug-in modules are fitted with separate certification information labels. Each shows the model number, certification information and BEKA associates address and year of manufacture together with a serial number.

BEKA *associates* Hitchin, England. www.beka.co.uk

UK CA 0359   C E 2575   ⟨Ex⟩ II 1 GD

II 1 G, Ex ia IIC T4 Ga, -40°C ≤ Ta ≤ +65°C
II 1 D, Ex ia IIIC T135°C Da, -40°C ≤ Ta ≤ +65°C
CML 20ATEX2252X   CML 21UKEX2003X   IECEx CML 20.0150X

WARNING - POTENTIAL ELECTROSTATIC
CHARGING HAZARD - SEE INSTRUCTIONS

S/No: 043141 / 03 / 013   Manufactured: 2022
BA3101 DISPLAY UNIT

Typical certification information label

5. SYSTEM DESIGN

Fig 1 illustrates a basic Pageant Operator Panel System. Design of the system can be divided into a series of steps as follows.

5.1 Powering a Pageant Operator Panel

Pageant Operator Panels are powered by a BEKA Power Isolator located in a safe area or in Zone 2. Which isolator model is required depends upon the hazardous area gas group in which the Pageant Operator Panel is installed. Detailed Power Isolator installation instructions are supplied with each isolator and can be downloaded from www.beka.co.uk. Additional detailed information is contained in BEKA Power Isolator Application Guide AG210 which can also be downloaded from www.beka.co.uk.

5.1.1 Applications in IIA or IIB gas atmospheres

A BEKA BA212 Power Isolator should be used to power a Pageant Operator Panel installed in a hazardous area containing gases in groups IIA or IIB as shown in Fig 3.

Hazardous area
Gas groups IIA & IIB

Safe area

BA3101 Operator Display

7.5V min

BA212 Power Isolator

24V Power supply

Up to 7 plug-in Input & Output Modules
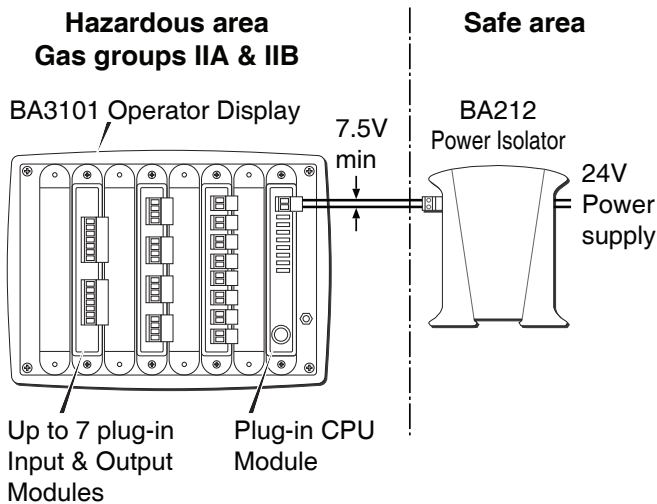
Plug-in CPU Module

Fig 3   Application in gas group IIA or IIB

The plug-in CPU module distributes power to the BA3101 display and all of the plug-in interface modules from the BA212 Power Isolator. The equivalent internal capacitance C_i and inductance L_i at the power supply terminals of all plug-in CPU modules are zero. Therefore the maximum permitted intrinsic safety parameters of the cable between the BA212 Power Isolator and the CPU module C_c, L_c and L_c/R_c are defined by, and are the same as, the output safety parameters of the isolator.

The C_o of the BA212 Power Isolator is 1.24µF in a IIC atmosphere, this is relatively large and unlikely to impose any practical cable length restrictions.

The inductive safety parameters of the cable between the BA212 Power Isolator output and the CPU plug-in module in the Operator Panel should comply with one of the following two alternatives:

Gas group	IIA	IIB
Lc inductance	$\leq 40µH$	$\leq 20µH$
OR		
Lc/Rc ratio	$\leq 34µH/\Omega$	$\leq 17µH/\Omega$

To comply with the total cable inductance requirement, the cable manufacturers specification should be consulted to determine the cables inductance per metre. Most twisted pair instrument cables have an inductance of less than 0.8µH/m. Depending upon the cable selected, lengths slightly longer than the following are achievable:

Gas group	IIB	IIA
Max cable length	25m	61m

Alternatively, complying with the Lc/Rc ratio requirement will allow a longer cable, limited by the cable's resistive voltage drop, to be used.

Instrumentation cables complying with the Lc/Rc ratio required for use in IIB gases are produced by a number of manufacturers. For example, the Draka Norsk Kabe FlexFlame RFOU(i) 150/250(300) cable has 0.75mm² conductors and is available with single and multi twisted pairs with and without screens and armour. Each single twisted pair has the following electrical parameters:

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

The minimum operating voltage at the plug-in CPU power supply terminals in the hazardous area is 7.5V The current consumption of the Operator Panel depends upon the number and type of plug-in I/O modules fitted as shown below:

Module total % power consumption	Operator Panel maximum current consumption
20%	300mA
100%	400mA

See section 5.2 and Appendix 1 for plug-in module loading information.

Using the recommended cable the maximum permitted cable lengths are:

Gas group IIB and IIA	20% total module power consumption	100% total module power consumption
Max cable length	137m	73m

Significantly longer cables can be used for IIA applications if a cable with a lower dc resistance having an L/R ratio of less than 34µH/Ω is used.

Additional detailed information about maximum permitted cable lengths is contained in the BEKA Power Isolator Application Guide AG210 which can be downloaded from www.beka.co.uk.

5.1.2 Applications in a IIC gas atmosphere

The BA212 Power Isolator is not suitable for most applications in group IIC gases. The maximum permitted external inductance Lo for a BA212 in a IIC hydrogen atmosphere is 5µH which only allows a cable length of a few metres. The isolator's IIC Lo/Ro ratio is 4.3µH/Ω, for which compliant cables are not generally available.

Hazardous area
Gas group IIC

BA3101
Operator Display

BA3901
Power
Combiner

8.6V
min

Safe area

BA243
Power Isolator

24V
Power
supply

Up to 7 plug-in
Input & Output
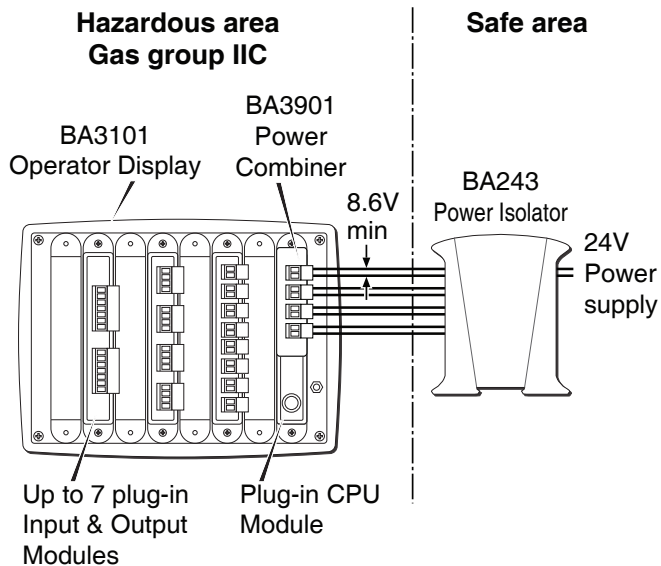Modules

Plug-in CPU
Module

Fig 4 Application in gas group IIC

The BA243 Power Isolator has four separately galvanically isolated outputs which are spark ignition safe in a IIC atmosphere when they are all connected in parallel. However, the large combined output current of the four parallel channels would reduce the inductance Lo that may be safely connected and hence the length of the cable between the Power isolator and the Pageant Operator Panel. This limitation can be overcome by treating each channel as a separate intrinsically safe circuit and remotely combining them at the Pageant Operator Panel as shown in Fig 4.

The BA3901 certified Power Combiner (4 Way Power Terminal Accessory) ensures that the four supplies remain isolated even under fault conditions. It mounts onto the rear of any plug-in CPU module and includes terminals for the four separate supplies. See section 10.2.

The Co of each BA243 Power Isolator output is 1.24µF in a IIC atmosphere, this is relatively large and is unlikely to impose any practical cable length restrictions.

The inductive safety parameters of each cable connecting the BA243 Power Isolator to the BA3901 Power Combiner at the Operator Panel should comply with one of the following two alternative safety parameters:

Gas group	IIC
Lc inductance	$\leq$ 79µH
OR	
Lc/Rc ratio	$\leq$ 17µH/Ω

To comply with the total cable inductance requirement, the cable manufacturers specification should be consulted to determine the cables inductance per metre.

Most twisted pair instrument cables have an inductance of less than 0.8µH/m. Using the Draka Norsk Kabe FlexFlame RFOU(i) 150/250(300) cable recommended in the previous section 5.1.1, in a IIC atmosphere allows lengths of up to:

Max cable length in IIC = 79µH/0.67µH/m = 117m

Alternatively, complying with the Lc/Rc ratio requirement will allow a longer cable, limited by the cable's resistive voltage drop, to be used.

The minimum operating voltage at the BA3901 Power Combiner terminals in the hazardous area is 8.6V. The current consumption of the Pageant Operator Panel depends upon the number and type of plug-in I/O modules fitted as shown below:

Module total % power consumption	Operator Panel maximum current consumption
20%	300mA
100%	400mA

See section 5.2 and Appendix 1 for loading information.

Using the recommended Draka Norsk Kabe FlexFlame RFOU(i) 150/250(300) cable the maximum permitted cable lengths are:

	Total % module power consumption	
	20%	100%
Max cable length in IIC	365m	177m

If the four outputs of the BA243 Power Isolator are connected to the remote BA3901 Power Combiner via a multicore cable, to maintain isolation between the four supplies the cable should be a Type A or a Type B multicore as defined in IEC 60079-14.

More detailed information about maximum permitted cable lengths is contained in BEKA Application Guide AG210 Power Isolators.

5.1.3 Applications in a IIIC dust atmosphere

For applications in a combustible dust atmosphere the Pageant Operator Panel should be powered in exactly the same way as for use in gas groups IIA and IIB described in section 5.1.1

The Operator Panel should be mounted in an enclosure providing IP5X protection for the rear of the Operator Panel. A metallic enclosure should comply with the requirements of EN60079-0 Clause 8.4 and/or EN60079-0 Clause 7.4.3 for a plastic enclosure.

All cable entries into the equipment enclosure should be made via cable glands which provide a minimum degree of protection of IP5X.

These requirements are satisfied by mounting the Operator Panel in an Ex t component certified enclosure fitted with Ex t cable glands.

5.2   Selecting plug-in Input and Output Modules

The BA3101 Operator Panel can accommodate up to seven plug-in Input and Output Modules which should be selected to satisfy the applications input and output requirements.   The intrinsic safety certification of all the modules and the BA3101 display permits any combination of modules to be fitted, but there are power limitations.

The datasheet and instructions for each plug-in Input and Output Module specify the percentage of the total available power from a BA3101 display that the module consumes.   Consumptions are also shown in Appendix 1 of this document.   The sum of the percentage power consumptions of all the plug-in modules must not exceed 100%.

Example of 6 module combination:

Qty.	Model	Function	% of available power module consumes
2	BA3701	Totaliser / Counter Module	2 x 24% = 48
1	BA3402	Digital NAMUR Input Module	1 x 40% = 40
3	BA3301	Analogue Input Module	3 x 4% = 12
		Total power consumption	**100%**

(Total equals 100% therefore acceptable)

Example of 7 module combination:

Qty.	Model	Function	% of available power module consumes
5	BA3401	Digital Input Module	5 x 4% = 20
2	BA3601	Digital Output Module	2 x 4% = 8
		Total power consumption	**28%**

(Total less than 100% therefore acceptable)

Example of 6 module combination:

Qty.	Model	Function	% of available power module consumes
2	BA3701	Totaliser / Counter Module	2 x 24% = 48
2	BA3402	Digital NAMUR Input Module	2 x 40% = 80
3	BA3301	Analogue Input Module	3 x 4% = 12
		Total power consumption	**140%**

(Total exceeds 100% therefore unacceptable)

6.   USING THE PAGEANT OPERATOR PANEL

When power is applied to a BEKA Operator Panel from a Power Isolator the panel will immediately start to boot up from the SD-card in the CPU module.   After a short delay the start-up sequence provides access to the configuration menu for approximately ten seconds before automatically loading the CODESYS runtime software and starting the PLC application code.

The configuration menu enables the operating conditions of the Pageant panel, such as display brilliance and access code to be adjusted and defined.   If the configuration menu is not accessed during the start-up sequence the PLC application code will automatically start.
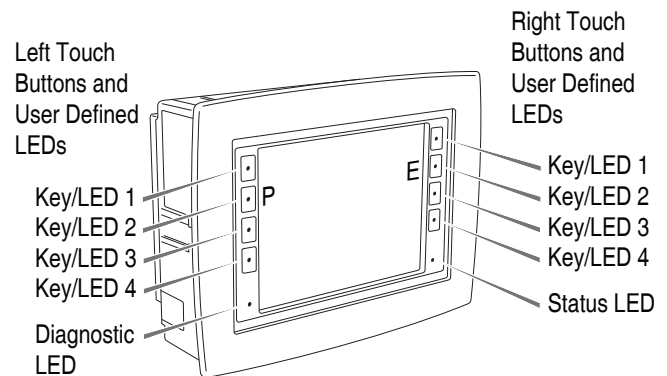

Fig 5 Controls and annunciators

The start-up sequence is as follows:

Approximate elapsed time after power applied	Action	Status LED
0	Blank screen	Red
35s	BEKA logo on screen	Red
45s	**P** and **E** buttons identified by amber backlights, operating both simultaneously accesses the configuration menu.	Flashing red
55s	**P** and **E** buttons backlight extinguished, configuration menu can no longer be accessed.	Red
65s	User PLC programme is loading or is in a stopped state.	Amber
	User PLC programme is running.	Green

While the status lamp is flashing red the configuration menu can be accessed by simultaneously operating the touch buttons identified by amber backlights which are the **P** (Left hand key 2) and **E** (Right hand key 2) buttons. The configuration menu is protected by a four digit alphanumeric security code, if the security code is set to the default '0000' the first screen 'Menu' will be displayed. If a security code other than the default code '0000' has already been entered, 'Access Code Entry' will be displayed which is a request for the access code to be entered.

6.1 Configuration menu

The configuration menu structure is shown in Fig 8. Touch buttons which are active for each selected sub-menu have a green backlight and their function is shown on the screen adjacent to the button.

Button functions are:

P & E	Enter configuration menu
P	Enter into a sub-menu or trigger an action
E	Exit from a sub-menu, save settings or answer a question.
▲	Move the cursor up the screen
▼	Move the cursor down the screen
►	Move the cursor to the right
◄	Move the cursor to the left

All menu functions will time-out if the delay between operating an active touch button exceeds sixty seconds. After time-out has occurred the Pageant panel will automatically continue the start-up sequence.

6.2 Diagnostic

The diagnostic LED on the Pageant front panel provides basic information about system health. When not illuminated the system is operating correctly.

Diagnostic LED	Fault	Corrective action required
Flashing red	Corrupt memory	Return BA3101 Operator Display to BEKA
Red	Plug-in module failed in CODESYS application	Ensure that the correct Device Description file(s) has been used in the CODESYS IDE
Flashing amber	Device description error	Ensure that the correct Device Description file(s) has been used in the CODESYS IDE
Amber	Operator panel over temperature	Determine cause of Operator Panel overheating
Flashing green	Incorrect plug-in module	Ensure that the plug-in I/O module slots specified in the CODESYS IDE match where the plug-in I/O modules have been fitted

7. Developing CODESYS application PLC code

PLC application code for Pageant should be developed within a CODESYS Integrated Development Environment (IDE). This may be downloaded free of charge from the CODESYS website to a PC having a Windows 8.1, 10 or 11, 64 bit operating system. Recommended minimum system requirements are:

- 2.5 GHz Processor
- 8 GB RAM
- 12 GB available HD space

No software licence is required to download and use this IDE which complies with IEC 61131 and will be familiar to many users.

7.1 CODESYS Package

Before starting a project in the CODESYS IDE, the latest CODESYS Control for Pageant package should be installed via the Package Manager. This file is available for free from the BEKA website at https://www.beka.co.uk/files.

The package contains:
- The Device Description Files for the Pageant CPU Module, Pageant Display and plug-in I/O modules.

- A BEKA project template with the devices and visualization inserted in the Project device tree.

- A Visualization style which will constrain the colour palette in the visualization elements to grey scale.

7.2 Transferring a PLC application file to Pageant

After a new or modified PLC application file has been developed within a CODESYS Integrated Development Environment (IDE) it can be transferred to the Pageant Operator Panel in a number of ways.

CAUTION

Make a backup copy of the original SD card before any changes are made.

a. The easiest and fastest technique is to unplug the CPU module from the Hazardous area Pageant Operator Panel and remove the micro SD card as shown in Fig 6.

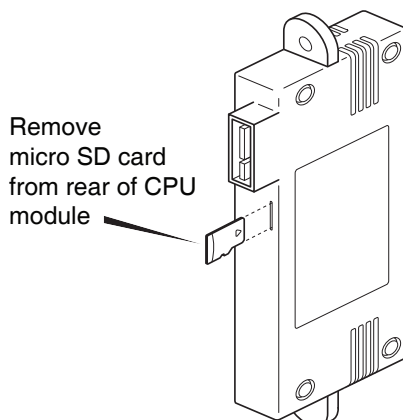Remove micro SD card from rear of CPU module

Fig 6   Removing micro SD card from plug-in CPU module

Using an SD card writer the revised compiled PLC application code can be copied to the micro SD card in a safe area. A Windows based system will show 4 removable drives on the Pageant SD card:

- Kernel
- Unknown Format
- Unknown Format
- BEKA

    |-----Logs
        Contains files that may assist BEKA in the event of a problem.

    |-----Runtime Update
        For storing a CODESYS Runtime program update which may be accepted using the Runtime update screen in the configuration menu.

    |----User Data
        For user PLC application data

    |----User Program Update
        For compiled user PLC program application file which may be accepted using the User Program Update screen in the configuration menu.

The CODESYS generated boot application files and subfolders should be copied to the User Program Update area in the BEKA drive.

The card should then replaced in the CPU module which should be reinstalled in the Pageant Operator Panel.

Once the product has booted up, go in the BEKA Configuration Menu and update the application via the User Program Menu.

Exiting the Configuration Menu will cause the revised PLC application to automatically start.

b. Alternatively, but not so fast as method 'a'. If a duplicate Pageant Operator Panel is available in a safe area, the hazardous area Operator Panel CPU module should be transferred to the safe area Pageant Operator Panel.

Using a BA3902 Programming Cable to connect a USB port on the PC hosting the CODESYS IDE to the programming port on the CPU module, the compiled updated PLC application file can be copied to the CPU module. Finally, the CPU module should be transferred back in the hazardous area Pageant Operator Panel.

The BA3902 Programming Cable shown in Fig 8 ensures that the intrinsic safety components within the CPU module are not damaged if a fault develops in the PC.

When installing or removing a plug-in CPU module in a Pageant Operator Display, the CPU module should not be powered.
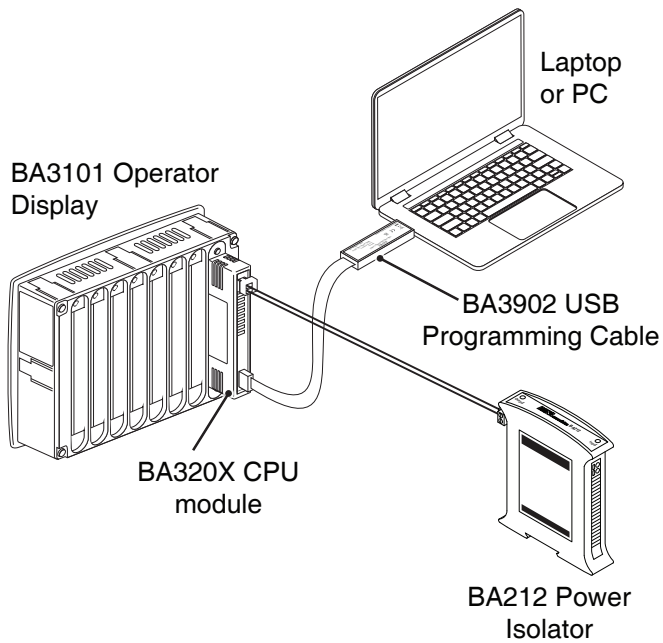
Laptop
or PC

BA3101 Operator
Display

BA3902 USB
Programming Cable

BA320X CPU
module

BA212 Power
Isolator

Fig 7 Transferring PLC application file to
Pageant in a safe area

c. If a gas clearance certificate is available for the hazardous area in which the Pageant Operator Panel is installed, method 'b' can be used to transfer the compiled PLC user application file directly to the CPU module in the hazardous area. When the status LED flashes red during the Pageant start-up sequence, the (and) buttons should be operated simultaneously to access the configuration menu. The menu enables the new user program to be accepted using the 'User Progam Update' screen.

CAUTIONS

Unless a gas clearance certificate is available, BA3200 series CPU modules should only be reprogrammed in a safe area.

A BEKA BA3902 CPU Module Programming Lead should be used to connect the programming port to the programming computer.
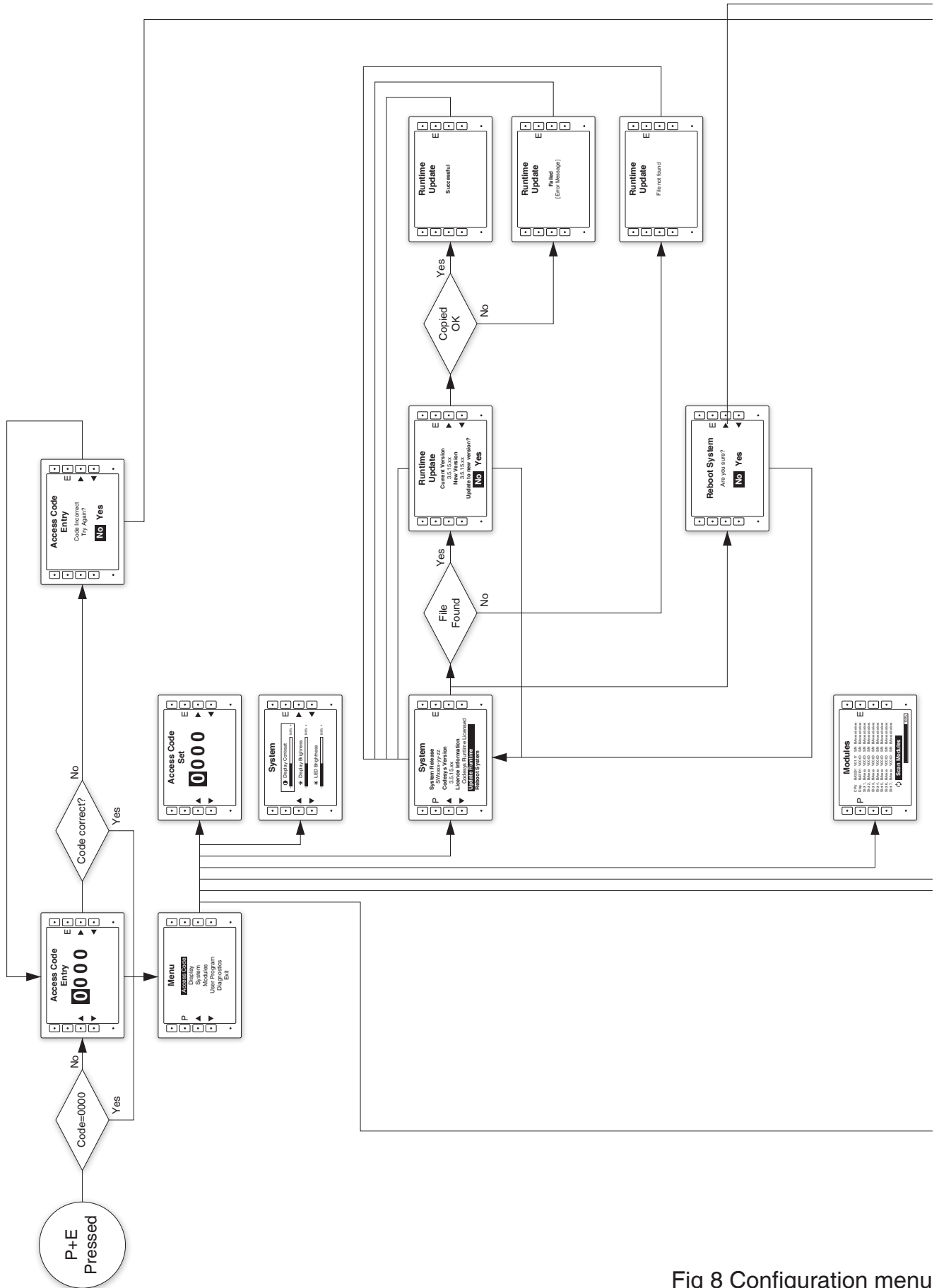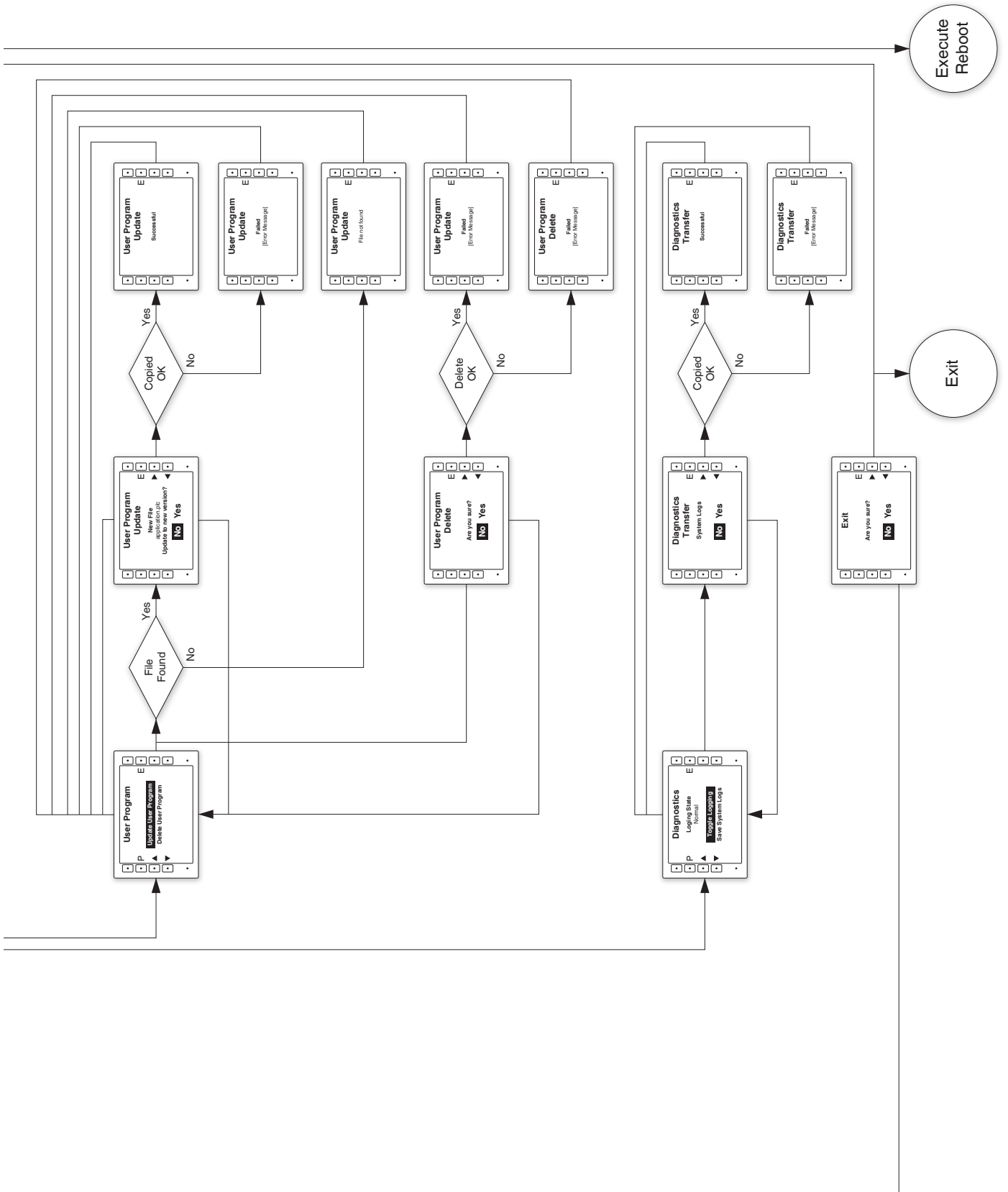
P+E
Pressed

Code=0000 — No / Yes

Access Code Entry
0 0 0 0

Code correct? — No / Yes

Access Code Entry
Code Incorrect
Try Again?
No Yes

Menu
Access Code
Display
System
Modules
User Program
Diagnostics
Exit

Access Code Set
0 0 0 0

System
Display Contrast
Display Brightness
LED Brightness

System
System Release
SWxxx-yy.zz
Codesys Version
3.5.15.xx
License Information
Codesys Runtime Licensed
Update Runtime
Reboot System

File Found — Yes / No

Runtime Update
Current Version
3.5.15.xx
New Version
3.5.15.xx
Update to new version?
No Yes

Copied OK — Yes / No

Runtime Update
Successful

Runtime Update
Failed
(Error Message)

Runtime Update
File not found

Reboot System
Are you sure?
No Yes

Modules
Scan Modules

Fig 8 Configuration menu

Execute Reboot

Exit

User Program Update — Successful

User Program Update — Failed [Error Message]

User Program Update — File not found

User Program Update — Failed [Error Message]

User Program Delete — Failed [Error Message]

Diagnostics Transfer — Successful

Diagnostics Transfer — Failed [Error Message]

User Program Update
New File
application.pb
Update to new version?
No Yes

User Program Delete
Are you sure?
No Yes

Diagnostics Transfer
System Logs
No Yes

Exit
Are you sure?
No Yes

User Program
Update User Program
Normal
Delete User Program

Diagnostics
Logging State
Normal
Toggle Logging
Save System Logs

Copied OK — Yes / No

Delete OK — Yes / No

Copied OK — Yes / No

File Found — Yes / No

8. INSTALLATION

8.1 Location

The BA3101 display has a 316 stainless steel front surrounding the backlit screen which is protected by a 4mm thick toughened glass window. The front has IP66 protection and a silicone moulded gasket provides an IP66 seal to the instrument panel in which it is mounted. The rear and the plug-in modules have IP20 protection.

The BA3101 and plug-in modules may be installed in any Instrument panel or enclosure providing the environmental and safety limits shown in the specification are not exceeded.

CAUTION

The front panel touch buttons can be operated with a gloved finger, but if they are likely to be exposed to salt water, it is recommended that operator inputs in the CODESYS PLC application be made using external sealed mechanical switch contacts via a BA3401 digital input module.

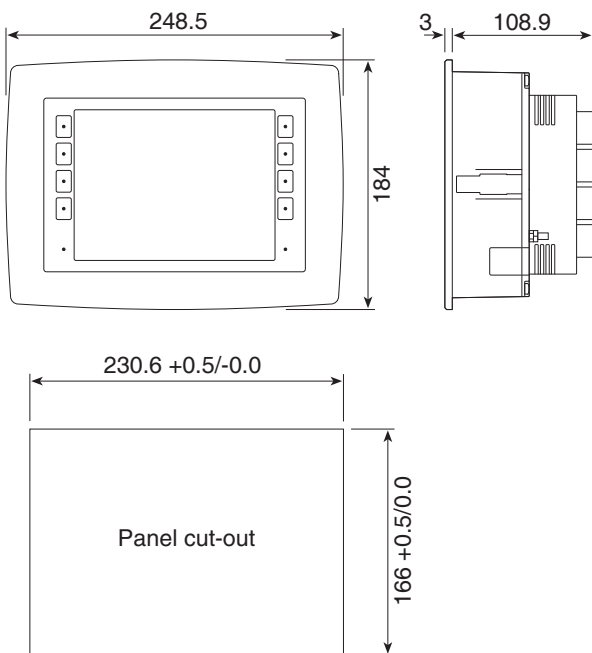Fig 9 shows the overall dimensions including the plug-in modules and the recommended panel cut-out dimensions.

Fig 9 Pageant Operator Panel dimensions
        including plug-in modules and panel cut-out.

8.2 Operator Panel Installation Procedure

1. Cut the aperture specified in Fig 9 in the instrument panel or enclosure 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 10.

3. Ensure that the panel sealing gasket is correctly positioned before inserting the Operator Panel into the aperture.

4. Place a clamp in the recess on each side of the Operator Panel, pulling gently to slide it onto the dovetail as shown in Fig 10. 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 panel mounting clamps. Finally, fully tighten all 8 panel clamps to secure the instrument. The maximum recommended clamp tightening torque is 22cNm (1.95 lbf in) which is approximately equivalent to finger-tight plus one half turn. Do not over tighten.
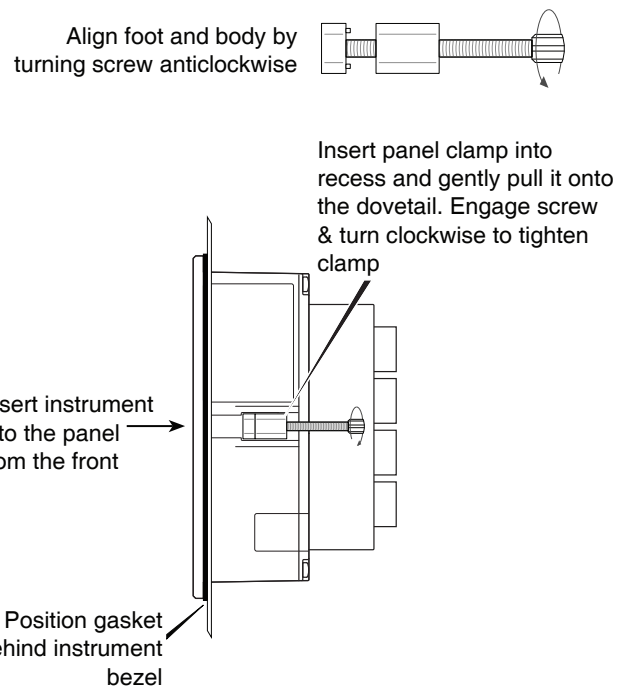
Align foot and body by turning screw anticlockwise

Insert panel clamp into recess and gently pull it onto the dovetail. Engage screw & turn clockwise to tighten clamp

Insert instrument into the panel from the front

Position gasket behind instrument bezel

Fig 10 Installation of panel mounting clamps

8.3. Plug-in modules

The BA3101 Operator Display can accommodate one plug-in CPU module in the right hand socket, marked 'C' and up to seven plug-in input or output modules in the remaining sockets marked 1 to 7 as shown in Fig 2. Modules have keyed plugs to ensure that CPU and Input and Output Modules can not be interchanged.

All BA3101 Operator Displays must be fitted with a CPU module, but the number of plug-in Input and Output Modules that may be fitted depends upon the application and may vary between zero and seven. Input and Output Modules may be fitted in any of the seven sockets most convenient for field wiring. Their location is defined in the PLC programme when the application is designed in the CODESYS IDE prior to being transferred to the CPU module.

8.3.1 Plug-in module installation procedure

All Pageant plug-in modules are installed in the same way and may be fitted before or after the BA3101 Operator Display is installed in the instrument panel. Ensure that the Operator Display is not powered while a plug-in module is being added or removed.

For an installation in a hazardous area, all the plug-in modules must be manufactured by BEKA and have certification that specifies that the module should be used as part of a BEKA Pageant System.

Each module should be inserted into the selected socket and secured by tightening the two module captive screws, as shown in Fig 11.
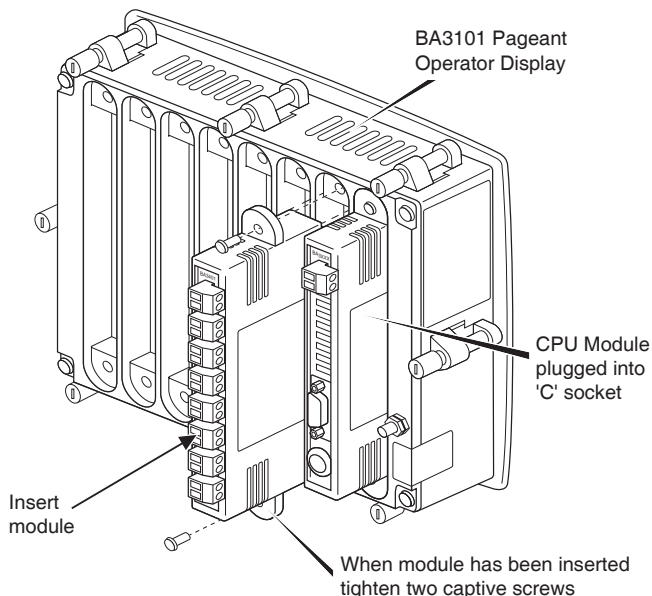

Fig 11 Installing plug-in modules

9. FIELD WIRING

All field connections to the Operator Panel are made via the terminals on the plug-in modules which are described in the instructions supplied with each module. Apart from the earth stud, there are no direct field connections to the BA3101 Pageant Operator Display.

The M4 earth stud is located on the right hand side at the rear of the Operator Panel as shown in Fig 2. It should be connected to the metallic structure of the panel or enclosure in which the Pageant Operator Panel is mounted which should also be earthed.

To simplify installation all module field wiring terminals are removable by gently pulling. Wiring should be supported to prevent damage to the connectors, particularly in installations subject to vibration.

10. ACCESSORIES

10.1 Tag number

The Pageant Operator Panel can be supplied with a customer defined tag number and application information thermally printed on a self adhesive label fitted to the side of the panel.

10.2 BA3901 Power Combiner
(4 Way Power Terminal Accessory)

The BA3901 is a certified 4 Way Power Terminal Accessory which remotely combines the output of four separate intrinsically safe power supplies. When used with a BEKA BA243 Power Isolator, it allows longer cables to be used between the isolator and the Operator Panel installed in a IIC hazardous gas atmosphere.

The 4 way Power Combiner may be fitted to any certified Pageant BA3200 series CPU module as shown in Fig 12. It includes four pairs of removable screw connectors for terminating field wiring.
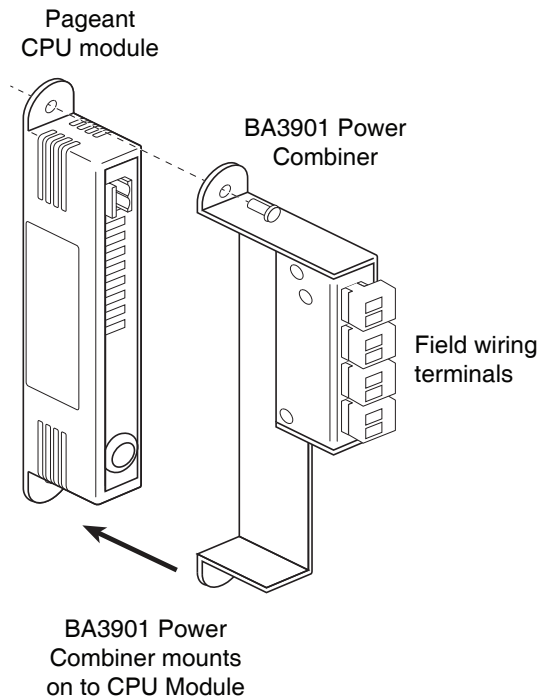

Fig 12 BA3901 Power Combiner mounts onto a CPU module

10.3 BA3902 USB programming cable

The BA3902 cable connects the programming port on a plug-in CPU module to a USB port on a personal computer, enabling CODESYS application code to be downloaded to the CPU module. The cable incorporates isolation and power limitation to prevent the CPU module's intrinsic safety components being damaged if the personal computer develops a fault. The CPU module requires powering during downloading which may only be performed in a non hazardous safe area, or when a gas clearance certificate is available.
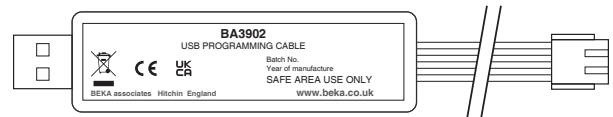

Fig 13 BA3902 USB programming cable

10.4 BA3903 RS485-IS SUB D 9 Connector

RS485-IS is a 2-wire intrinsically safe communications standard where field wiring can be looped through up to 32 devices on a single segment. The BA3903 mates with the standard female connector on an RS485-IS device, such as a Pageant plug-in CPU module. The connector contains duplicate input and output screw terminals enabling twisted pair field wiring to be easily connected. It also contains a switchable terminating resistor for use at the end of the RS485-IS line.
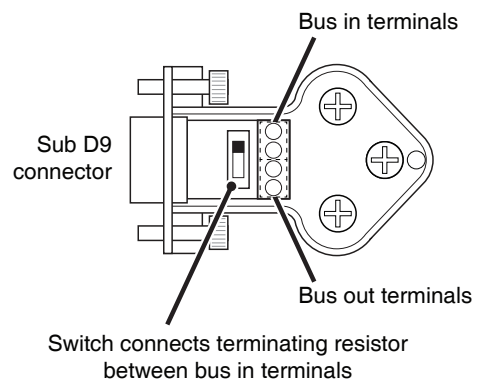

Fig 14 BA3903 RS485-IS SUB D 9 Connector

11. MAINTENANCE

The Pageant Operator Panel and plug-in modules should be regularly inspected to ensure that they have not been damaged. The frequency of inspection depends upon environmental conditions.

No attempt should be made to repair a faulty Pageant Operator Panel or plug-in module. Suspect Operator Panels or modules should be returned to BEKA associates or your local BEKA agent.

12. GUARANTEE

Operator Panels and plug-in modules 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 symptom(s) is provided.

13. CUSTOMER COMMENTS

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

APPENDIX 1 List of plug-in CPU and Input & Output modules.

This appendix lists the plug-in modules available when these instructions were published. Please see BEKA website www.beka.co.uk for any additional modules that may have subsequently been introduced.

CPU Modules

BA3201   Plug-in CPU module without external communication.

BA3202   Plug-in CPU module with Modbus RTU external communication.
The module has an isolated intrinsically safe RS485-IS port and contains software that enables the Operator Panel to operate as a Modbus RTU master or slave.

Input and Output Modules

Model	Function	% of available power module consumes
BA3301	Analogue Input Module 4 x 4/20mA individually isolated unpowered inputs.	4%
BA3401	Digital Input Module 8 x contacts or open collector inputs. 2 combined channels can decode a quadrature input.	4%
BA3402	Digital NAMUR Input Module 8 x NAMUR inputs 2 combined channels can decode a quadrature input.	40%
BA3501	Analogue Output Module 4 x 4/20mA individually isolated unpowered outputs.	4%
BA3601	Digital Output Module 4 x solid state contacts individually isolated.	4%
BA3701	Totaliser / Counter Module 2 x NAMUR inputs each with a synchronous isolated output for retransmission. With both inputs energised	24%

APPENDIX 2   RS485-IS port and network

The BA3202 plug-in CPU module has an isolated RS485-IS port which complies with the requirements of *Profibus RS485-IS User and Installation Guideline Version 1.1/June 2003.*

This guide defines the intrinsic safety parameters for an RS485-IS port as:

U_i	$\leq$	$\pm 4.2V$
I_i	$\leq$	4.8A
U_o	$\leq$	$\pm 4.2V$
I_o	$\leq$	149mA
L_i		0
C_i		Not specified for safety, insignificant at 4.2V.
L_o/R_o	$\leq$	$15\mu H/\Omega$

The standard permits up to 32 devices complying with these safety parameters to be connected to a common 2 wire network located in Zone 1 or 2 with a IIC gas without further system safety analysis.

To prevent reflections both ends of the RS485-IS network should be fitted with terminating resistors if not included in the first and last device.   See section A2.2

The RS485-IS port on the BA3202 enables the Pageant Operator Panel to be directly connected to an RS485-IS hazardous area network as shown in Fig. A2.1 and to communicate as a Modbus RTU master or slave.

Each device connected to the network must be certified by a Notified or Approved Body, confirming that the RS485-IS intrinsically safe port complies with the safety parameters specified in the *Profibus RS485-IS User and Installation Guideline.*

Providing not more than 32 devices are connected to the RS485-IS network and the L/R ratio of the network cable is equal to, or less than, $15\mu H/\Omega$, no further safety assessment is required.   The network cable length does not effect the network intrinsic safety but may effect its performance.
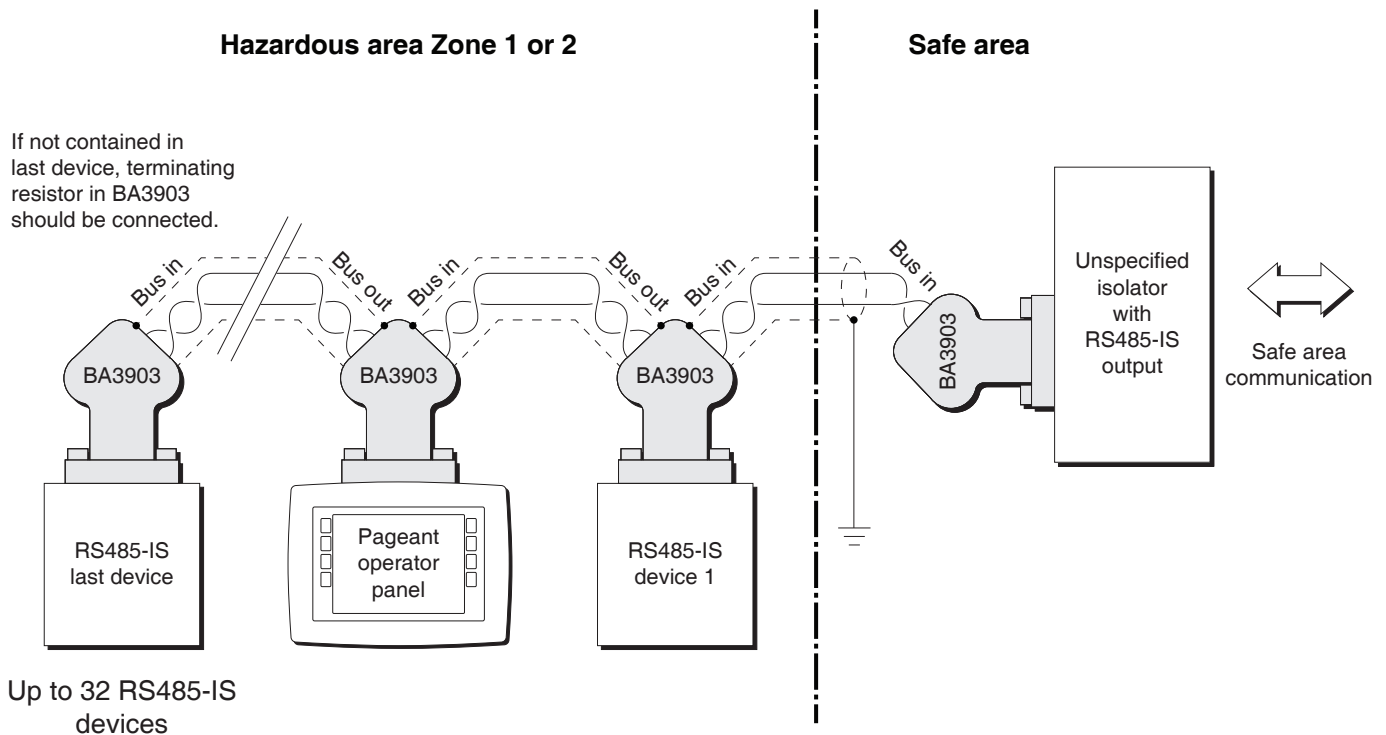
Fig A2.1 Hazardous and safe are network

A2.1 RS485-IS galvanic Isolators

If the hazardous area RS485-IS network is required to communicate with equipment in a safe area, as shown in Fig A2.1, a galvanic isolator with an RS485-IS output port is required to protect the hazardous area network. BEKA associates can provide a list of devices which are known to operate with the Pageant Operator Panel and have a variety of safe area network connections.

A2.2 BA3903 connector

The *Profibus RS485-IS User and Installation Guideline* suggests the utilisation of a 9-pole D-Sub female connector for RS485-IS port connections when only IP20 protection is required.   Terminating a cable to a D connector is not easy on a process site, therefore BEKA has developed the BA3903 connector.
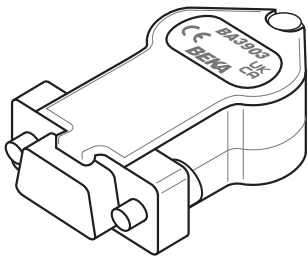
Fig A2.2   BA3903 RS485-IS connector

The BA3903 incorporates a sub D9 male connector that mates with the standard female connector on an RS485-IS field mounting device such as a Pageant plug-in CPU module. The connector can also be used to simplify connection to an RS485-IS galvanic isolator.

Duplicate input and output screw terminals in the BA3903 enable twisted pair field wiring to be easily connected to, and looped-through, the RS485-IS device.

The BA3903 connector also contains a switchable terminating resistor for use at the end of an RS485-IS network.
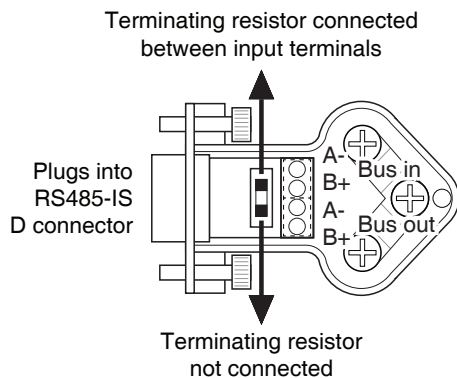
Fig A2.3   Inside BA3903 showing duplicate terminals and switch positions for terminating resistor.