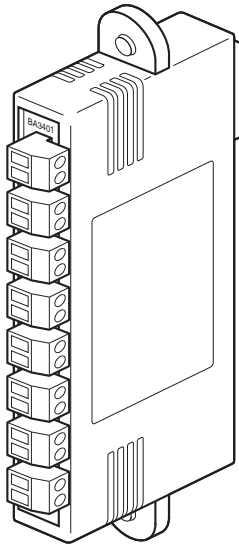


Instructions for BA3400 series Pageant plug-in Digital Input modules



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1. INTRODUCTION

The BA3400 series plug-in DI (Digital Input) modules are part of the BEKA Pageant Display system. Two models are available:

- BA3401 8 contact inputs
- BA3402 8 NAMUR 2-wire inputs

Both models have IECEx, ATEX and UKEX intrinsic safety apparatus certification.

The DI modules plug into any of the seven module sockets at the rear of the BA3101 Pageant Operator Display. Power for the module is provided by the BA3101 Operator Display which determines the modules response speed. If required multiple DI modules may be plugged into an Operator Display.

Fig 1 shows a BA3400 DI plug-in module with its features identified.

Each of the eight inputs is a separate intrinsically safe circuit but they are not isolated from each other. Inputs should therefore only be connected to isolated sensors and wiring such as reed relays, switch contacts and proximity detectors. The BA3402 can power and monitor the status of 2-wire NAMUR compliant sensors, such as proximity detectors. It may also be used to monitor switch status in noisy environments.

In addition to their normal function, inputs 7 and 8 may be used for the decoding a quadrature signal from a plant position sensor or a BEKA BA490 rotary encoder.

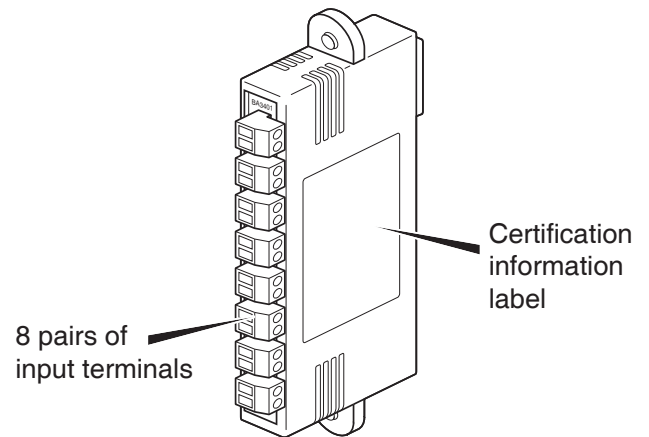


Fig 1 BA3400 series plug-in DI module

2. INTRINSIC SAFETY CERTIFICATION

Notified Body CML B.V. and UK Approved Body Eurofins CML have issued the BA3400 series plug-in DI modules with the following apparatus certificates:

IECEX	IECEX CML 21.0004X
ATEX	CML 21ATEX2110X
UKEX	CML 21UKEX2111X

The ATEX certificate has been used to confirm compliance with the European ATEXr Directive for Group II, Category 1GD equipment, similarly the UKEX certificate has been used to confirm compliance with UK statutory requirements. All BA3400 series DI modules carry both the CE and UKCA marks, subject to local codes of practice, they may 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 EU countries.

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.

Plug-in BA3400 series Pageant DI Modules are CE marked to show compliance with the European Explosive Atmospheres Directive 2014/34/EU and the European EMC Directive 2014/30/EU.

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

2.1 Zones, gas groups and T rating

All of the BA3400 series DI certificates specify the same certification codes:

BA3401

Ex ia IIC T4 Ga
Ex ia IIIC T135°C Da*
-40°C ≤ Ta ≤ 65°C

BA3402

Ex ia IIC T4 Ga
Ex ia IIIC T195°C Da*
-40°C ≤ Ta ≤ 65°C

* Dust certification requires the Pageant Operator Panel and the BA3400 series DI module to have a minimum additional IP54 rear protection.

2.2 Special conditions for safe use

- 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. 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.
- iii. The BA3400 series shall only be used as part of a BEKA Pageant System.

2.3 Certification label information

The certification information label is fitted to the side of the BA3400 series plug-in DI module. It shows the model number, certification information, BEKA associates address and year of manufacture together with the serial number.



BA3401 certification Information Label

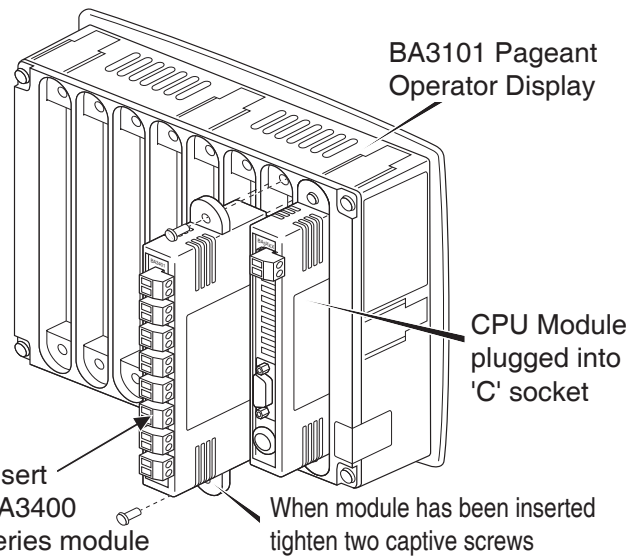


Fig 2 Inserting BA3400 series DI module into one of the seven sockets

3. INSTALLATION

The BA3400 series plug-in DI module should be fitted into one of the seven sockets at the rear of a BA3101 Pageant Operator Panel as shown in Fig 2.

For a hazardous area installation the plug-in DI module must be manufactured by BEKA and have certification that specifies that it shall be used as part of a BEKA Pageant system.

3.1 Power consumption

The intrinsic safety certification of the BA3400 series plug-in modules permits any combination to be installed in a Pageant BA3101 display but there are power limitations.

The percentage of the total available power that these modules consumes is:

BA3401	8 contact inputs	4%
BA3402	8 NAMUR 2-wire inputs	40%

The sum of the percentage power consumption's of all the plug-in modules installed in a BA3101 display must not exceed 100%.

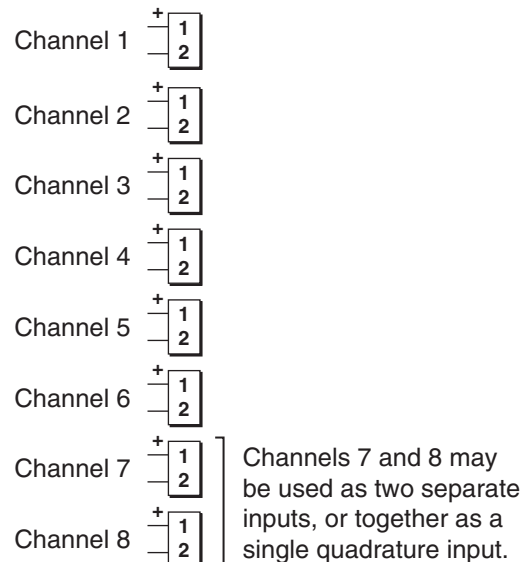


Fig 3 Input terminals

3.2 BA3400 series plug-in DI module Installation

1. The BA3400 series DI module may be fitted before or after the Operator Panel is installed. The Operator Panel should not be powered when the module is fitted.
2. Carefully insert the DI module into the selected slot at the rear of the BA3101 Pageant Operator Panel. When correctly positioned secure the module by tightening the two captive module fixing screws.
3. Connect field wiring to each of the eight pairs of removable input terminals shown in Fig 3. Each input is a separate intrinsically safe circuit and field wiring should comply with segregation requirements specified in IEC/EN 60079-14. If a multicore cable is used for the inputs, it should have Type A or B construction as specified in Clause 16.2.2.7 of IEC/EN 60079-14. Wiring should be supported to avoid damaging the module's terminals.

4. INPUTS

Both models have eight inputs which are not isolated from each other and should therefore only be connected to isolated sensors. The BA3401 should be used for contact and open collector inputs and the BA3402 for NAMUR compliant 2-wire sensors and for contact and open collector inputs in noisy environments.

4.1 BA3401 inputs

Each of the eight inputs has the following electrical specification allowing it to sense the status of a wide range of switch contacts and sensors with open collector outputs.

Sensing voltage	3.3V
Sensing Current	33µA
Switching threshold	
Closed	< 25kΩ
Open	>35kΩ
Frequency	Inputs polled 10 times per second by BA3101 Operator Panel.

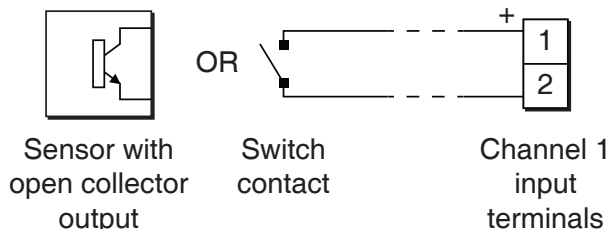


Fig 4 BA3401 switch contact or open collector connected to channel one input

The intrinsic safety parameters for each input are not restrictive as for intrinsic safety purposes the output current I_o is considered to be zero.

Therefore the maximum inductance that may be connected L_o is not specified, the cable length between the BA3401 input terminals and the sensor is only limited by the permitted capacitance C_o which is extremely large.

$$\begin{aligned}
 U_i &= 0 \\
 U_o &= 4.94V \\
 I_o &= 0 \\
 P_o &= 0 \\
 C_o &= 100\mu F \text{ for IIC}
 \end{aligned}$$

Any mechanically or magnetically activated switch contact located in the same hazardous area as the BA3401 may be directly connected to any of the eight input channels providing the switch and associated wiring can withstand a 500V insulation test to earth. Most magnetically activated reed relays comply with these requirements. Most certified intrinsically safe sensors with an open collector output can also be connected to any of the eight input channels, providing the sensor output is compatible with the sensing voltage and current.

4.1.1 BA3401 quadrature input

Input channels 7 and 8 may be used together for decoding a quadrature signal from a plant position sensor or a BEKA BA490 rotary encoder. Fig 5 shows the required connections.

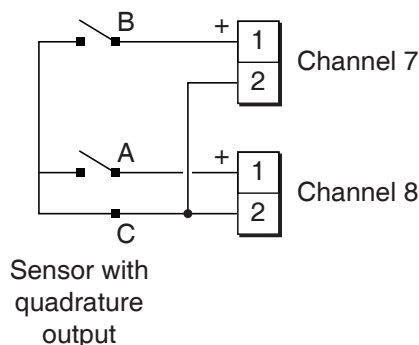


Fig 5 Connections for sensor with a quadrature output

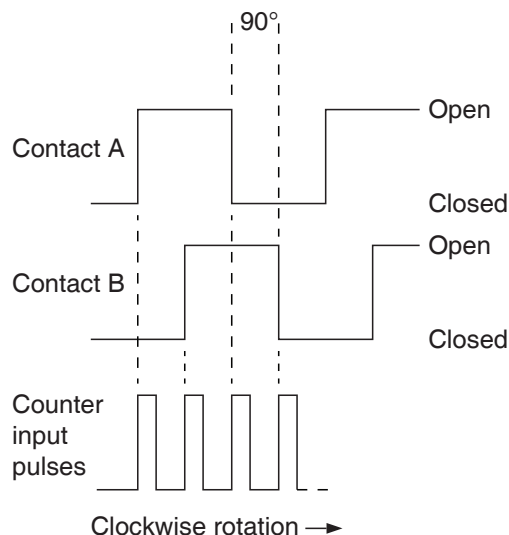


Fig 6 Quadrature sensor waveforms

Unlike most quadrature inputs which produce one incrementing or decrementing input pulse for each A + B cycle, the BA3401 produces four as shown in Fig 6 which results in increased resolution.

Sensing voltage	3.3V
Sensing Current	33µA
Switching threshold	
Closed	<25kΩ
Open	>35kΩ
Frequency	1kHz max Counter polled 10 times per second by BA3101 Operator Panel.

The intrinsic safety parameters for the quadrature input are the same as those for a single input shown in 4.1 and are again not restrictive.

The quadrature sensor and associated wiring should be able to withstand a 500V rms insulation test to earth.

4.2 BA3402 inputs

Each of the eight inputs has the following electrical specification allowing it to sense the status of a wide range of 2-wire NAMUR compliant sensors such as proximity detectors. The BA3402 may also be used for monitoring the status of switch contacts and sensors with open collector outputs in high noise environments.

Sensing voltage	8.2V
Switching threshold	Lower Upper
Proximity detector	1.2mA 2.1mA
Contact	2.6kΩ 5.5kΩ
Frequency	Inputs polled 10 times per second by BA3101 Operator Panel.

The intrinsic safety parameters for each input are shown below.

U_i	=	0
U_o	=	8.8V
I_o	=	7.4mA
P_o	=	16mW
C_o	=	5.5µF for IIC
L_o	=	556mH for IIC

Almost any certified intrinsically safe 2-wire NAMUR compliant sensor located in the same hazardous area as the BA3402 may be directly connected to any of the eight input channels. The Ci and Li of the sensor, plus the cable capacitance and inductance, should be less than Co and Lo of the BA3402 input .

The sensor and wiring should be able to withstand a 500V rms insulation test to earth.

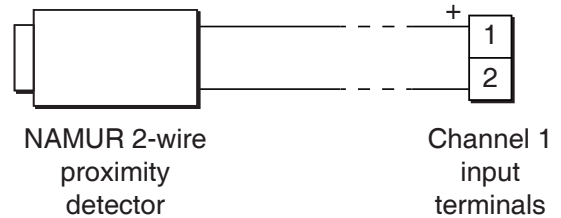


Fig 7 BA3402 2-wire NAMUR proximity detector connected to channel one input

Because the BA3402 has higher noise immunity than the BA3401, it should be used in preference to the BA3401 for switch contact monitoring in noisy environments. A switch contact located in the same hazardous area as the BA3402 may be connected to any of the eight input channels providing the switch and associated wiring can withstand a 500V insulation test to earth.

Most certified intrinsically safe sensors with an open collector output can also be connected to any of the inputs, providing the sensor output is compatible with the BA3402 sensing voltage and 500V isolation is maintained.

4.2.1 BA3402 quadrature input

Input channels 7 and 8 may be used together for decoding a quadrature signal generated by a certified sensor with a quadrature output, or from two separate sensors having a 90° phase difference. Connections and waveforms are as shown in Figs 8 and 9.

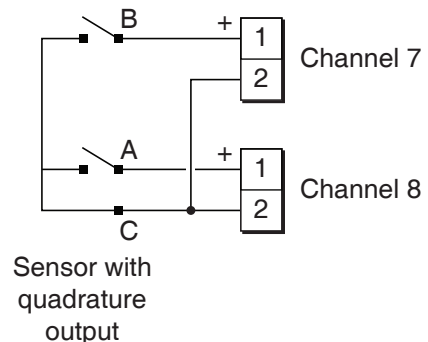


Fig 8 Connections for sensor with a quadrature output

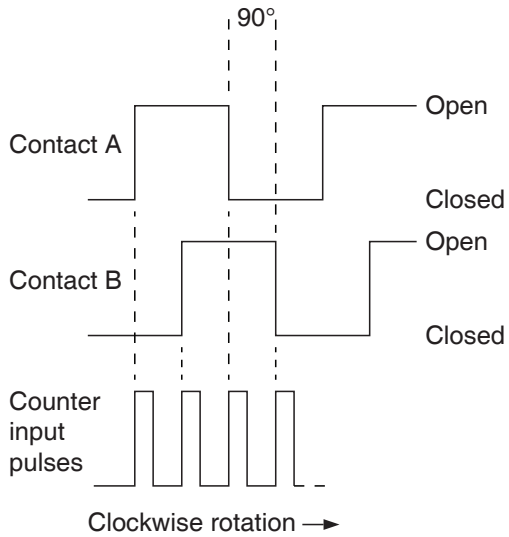


Fig 9 Quadrature sensor waveforms

Unlike most quadrature inputs which produce one incrementing or decrementing input pulse for each A + B cycle, the BA3402 produces four as shown in Fig 9 which results in increased resolution.

Sensing voltage	8.2V	
Switching threshold	Lower	Upper
Proximity detector	1.2mA	2.1mA
Contact	2.6k Ω	5.5k Ω
Frequency	1kHz max Counter polled 10 times per second by BA3101 Operator Panel.	

The intrinsic safety parameters for the quadrature input are the same as those for a single input shown in 4.2.

The quadrature sensor and associated wiring should be able to withstand a 500V rms insulation test to earth.

5. MAINTENANCE

BA3400 series DI input module should be regularly inspected to ensure that it has not been damaged. The frequency of inspection depends upon environmental conditions.

No attempt should be made to repair a faulty BA3400 series plug-in DI module. Suspect modules should be returned to BEKA associates or your local BEKA agent.

6. GUARANTEE

BA3400 series DI 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 symptoms is provided.

7. 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

BA3400 Series Pageant Digital Input Modules Codesys Mapping and Parameters

The Pageant Codesys Quick Start Guide which can be downloaded from the BEKA website https://www.beka.co.uk/manuals/pageant_codesys_quick_start_guide.pdf explains how to setup the CODESYS v3 environment to work with a BEKA Pageant Operator Panel and to start developing PLC applications.

The BEKA Quick Start Guide is not a programming manual, for detailed documentation about the CODESYS v3 development system please refer to <https://www.codesys.com> and to the on-line help.

The following table lists the BA3400 series Pageant Digital Input Modules Codesys parameters that can be set and mapped during the initialisation of the PLC application which is described in the BEKA Quick Start Guide. If the values are not set in the Codesys project, the default values will be used.

The bidirectional channels are both read and write, the value written by the application is cleared once processed by the module.

BA3400 Series Digital Input Modules Codesys Mapping and Parameters

BA3401 – DI MODULE

Channel or Parameter Name	Type	Default	Variable Type	Range	Description
Quadrature Control	Parameter ⁽¹⁾	Disabled	Enumeration Of BYTE	Enabled Disabled	Enable Quadrature on Inputs 7 and 8
Clear	Bidirectional ⁽²⁾	N/A	BYTE	0..255	Any value > 0 will clear the Quadrature Count
Quadrature Count	Input	N/A	INT	-32768..32767	Current Quadrature Count, Always 0 if Disabled This counter will roll-over if it reaches 32767 in the forward direction or -32768 in the backward direction
Input Values	Input	N/A	BYTE	0...255	Bit Field: Bit7...Bit0 represent the value for Input 8 to 1 0: Input Low 1: Input High

Notes

- (1) Parameters are only set during the initialisation of the PLC application, if the value is not set in the CODESYS project, the default value will be used.
- (2) These bidirectional channels are both write and read, the value written by the application is cleared once processed by the module.

BA3402 – DI MODULE NAMUR

Channel or Parameter Name	Type	Default	Variable Type	Range	Description
Quadrature Control	Parameter ⁽¹⁾	Disabled	Enumeration Of BYTE	Enabled Disabled	Enable Quadrature on Inputs 7 and 8
Input 1 Fault Detection Control	Parameter ⁽¹⁾	1	BOOL	0..1	0: Fault Detection Disabled, 1: Fault Detection Enabled
Input 2 Fault Detection Control					
Input 3 Fault Detection Control					
Input 4 Fault Detection Control					
Input 5 Fault Detection Control					
Input 6 Fault Detection Control					
Input 7 Fault Detection Control					
Input 8 Fault Detection Control					
Clear	Bidirectional ⁽²⁾	N/A	BYTE	0..255	Any value > 0 will clear the Quadrature Count
Quadrature Count	Input	N/A	INT	-32768..32767	This counter will roll-over if it reaches 32767 in the forward direction or -32768 in the backward direction
Input Values	Input	N/A	BYTE	0...255	Bit Field: Bit7...Bit0 represent the value for Input 8 to 1 0: Input Low 1: Input High

Notes

- (1) Parameters are only set during the initialisation of the PLC application, if the value is not set in the CODESYS project, the default value will be used.
- (2) These bidirectional channels are both write and read, the value written by the application is cleared once processed by the module.



All associated manuals, certificates, and
datasheets can be downloaded from
<https://www.beka.co.uk/qr-ba3100>

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