Pluto Safety PLC
With dynamic safety concept.

Pluto/Gateway/Encoder

HMI

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Descriptions and examples in this book show how the products work and can be used. This does not mean that they can meet the requirements for all types of machines and processes. The purchaser/user is responsible for ensuring that the product is installed and used in accordance with the applicable regulations and standards. We reserve the right to make changes in products and product sheets without previous notice. For the latest updates, refer to www.jokabsafety.com. 2011.
Why you should have Pluto safety PLC's.

– for simplifying the design of and changes to safety systems!

Pluto is an "All-Master" safety PLC concept, that simplifies the design of safety systems and achieves the highest safety level PL e according to EN ISO 13849-1 and SIL 3 according to EN 62061 and EN 61508. The key difference between Pluto and conventional safety PLC’s is that there is no "Master-Slave" relationship between the control units connected to the safety bus. Each Pluto is a 'Master' unit and can see the other Plutos' inputs and outputs, and can thereby make decisions about its own safety environment.

This concept enables simple communication, programming and changes to the safety system. With the use of a 'Gateway' device, a Pluto can communicate with other bus systems and thereby form part of a larger network. Gateway units are available for several different bus systems, such as Profibus, CanOpen, DeviceNet, Profinet, Ethernet/IP and Modbus TCP. With a Pluto AS-i, both safety slaves and standard slaves can be handled.

Pluto offers an economic solution for both single machines and for major machine systems.
Most safety devices on the market can be connected directly to Pluto units. By using dynamic signals with sensors from ABB Jokab Safety only one input is needed to achieve the highest level of safety, compared to two inputs for other manufacturers’ PLCs. It is also possible to connect up to 10 sensors in series to a single input on Pluto and still achieve the highest level of safety. For example non-contact Eden sensors, Spot light beams and Tina emergency stop buttons can all be connected in series to a single Pluto input. Even mechanical switches can be connected to the ‘dynamic’ safety circuit using ABB Jokab Safety’s various Tina adapt- ers. Pluto also has IO connections that can be used as both inputs and outputs.

### IO connections
Pluto has IO connections that can be used in three ways:
- input
- output
- both input and output at the same time (e.g. for a reset button with lamp indication)

### Dynamic signals
1–10 doors with one Eden per door

### Static inputs (mechanical switches)
2 for each door = PL e

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**Light beams**

**Light grids/curtains**

**3-position devices**

**Sensors/switches**

**Two-hand controls**

**Emergency stops**

**Strips**

**Mats**
Pluto safety PLC – an overview

Pluto with a safety bus

**Gateway** for two-way databus communication between Pluto and other control systems.

**HMI**. An HMI operator panel can communicate with Pluto in both directions. Connection can be made via the bus or direct to the front of the Pluto. The interface is RS232 and the protocol is Modbus ASCII 8 bit.

**Pluto bridge** With a Gateway set up as a Pluto bridge, it is possible to:
- increase the databus length
- use different databus speeds for each section
- filter information from one section to reduce the databus loading on other sections.

**Pluto** is an All-Master-System for dynamic and static safety circuits where the inputs and other information are shared on a databus. Several safety sensors can be connected to one input while still achieving the highest level of safety. Pluto has inputs for all safety devices on the market, and the Pluto Manager software selects how each input shall respond.

Pluto without a safety bus – Singel-Pluto

A single Pluto can be used as a fully programmable safety logic controller.

**Pluto S20**

**Pluto S46**

**Connector expansion**

Several expansion relays can be connected to a single Pluto safety output while retaining the safety level.

Pluto without a bus connection is available in two sizes, with 20 and 46 I/O, the S20 and S46 respectively. In other words, they are similar to the equivalent versions with bus connections, the B20 and B46.
Absolute encoder. 8 single turn or multi turn absolute encoders can be connected directly to the safety bus.

Pluto AS-i is an AS-i module which can be connected to an AS-i bus. It can either be AS-i master on the bus or work together with an AS-i master as monitor. It includes AS-i nodes, analogue and digital outputs, as well as safety outputs.

IDFIX - identifies Pluto

IDFIX is a identification circuit that is unique to each device on the Pluto bus. It includes an identification code and makes it possible to distribute a PLC program in the network. There are four different versions: R, RW, DATA and PROG. IDFIX PROG also has the current PLC program. If the Pluto PLC module needs to be replaced, all the information on this is held in memory at IDFIX.

**Overview Pluto Safety-PLC**

<table>
<thead>
<tr>
<th>Model</th>
<th>S2O</th>
<th>S60</th>
<th>AS20</th>
<th>BS20</th>
<th>BS46</th>
<th>AS20</th>
<th>AS46</th>
<th>AS2X</th>
<th>AS4X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of I/O</td>
<td>20</td>
<td>46</td>
<td>20</td>
<td>16</td>
<td>20</td>
<td>46</td>
<td>12</td>
<td>42</td>
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<tr>
<td>Failsafe inputs</td>
<td>8</td>
<td>24</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>24</td>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Failsafe inputs or non-failsafe outputs</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Analog inputs</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Failsafe relay outputs</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Failsafe transistor outputs</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pluto bus</td>
<td>-</td>
<td>-</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current monitoring</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions (b x h x d) mm</td>
<td>45 x 84 90 x 84 45 x 84 45 x 84 45 x 84 90 x 84 45 x 84 90 x 84</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>x 118  x 118 x 118 x 118 x 118 x 118 x 118 x 118</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>24VDC 24VDC 24VDC 24VDC 24VDC 24VDC 24VDC 24VDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pluto Safety PLC facilitates the design of your safety systems

Pluto is an All-Master system for dynamic and static safety circuits where inputs and other information are shared over the bus. Multiple safety sensors can be connected to a single input and still achieve the highest level of safety. Pluto has inputs suited for every safety product on the market, and each input function is configured in the accompanying software Pluto Manager.

Besides failsafe inputs (I) Pluto has a number of failsafe relay and transistor outputs (Q). On every Pluto unit there is also a possibility of using a number of terminals as failsafe inputs, non-failsafe outputs or both in and output simultaneously (IQ). The characteristics of the terminals are easily configured in Pluto Manager.

Safety in large and small systems

Pluto models without bus communication are stand alone units and are therefore perfectly suited for smaller systems that do not require communication with other Pluto units or gateways. Pluto models with bus communication can be connected to the Pluto bus where up to 32 Pluto units can interact and control large as well as small safety systems. The fact that Pluto is an All-Master system means that each Pluto unit controls their outputs locally, while it is as easy to read other Pluto units’ inputs as their own.

Specifically for Pluto A20 is that it is equipped with an analogue input for current measurement, which can be used for e.g. monitoring of muting lamps.

Pluto is primarily designed to satisfy the requirements of EU Machinery Directive (2006/42/EG) regarding safety in control systems, but the system can also be used in other areas as in the process industry, boiler plants etc which have similar requirements.
Technical info - Pluto

Dynamic signal

A dynamic signal makes it possible to achieve the highest level of safety with only one conductor. By transmitting a square wave and then evaluating the signal when it comes back to the controller you achieve the redundancy required. The signal is inverted once at each safety sensor (if the protection is OK) which makes it possible to detect short circuits across a sensor. When the signal switches between high (+24 V) and low (0V) it can be evaluated and tested about 200 times per second.

Pluto can generate three unique dynamic signals; A pulse, B pulse or C pulse. Short circuits between two different dynamic signals are detected whenever the signal that is created is different from the expected signal in Pluto. The kind of signal Pluto expects at the input terminal is determined in Pluto Manager (A, B or C pulse and if the signal should be inverted or not).

Static signal

Static signals (+24 V or 0 V) can be connected to all inputs on Pluto. The kind of signal Pluto expects at the input terminal is determined in Pluto Manager. To achieve a two-channel structure according to EN ISO 13849-1 you need two inputs.

OSSD-signal

There are safety products with internal monitoring of dual OSSD signals (the device detects its own faults rather than Pluto doing this). From these devices, at least one of the two signals is connected to an I-input in Pluto, i.e. both signals must not be connected to the IQ-terminals. The terminal blocks are then configured in Pluto Manager to expect static inputs (OSSD signals are filtered internally in Pluto).

IQ - individual failsafe inputs and non-failsafe outputs

The IQ terminals can be used either as individual failsafe input or non-failsafe output (e.g. for indicator light or status signal). The terminal blocks can also be used as both input and output simultaneously, which is useful for example for push buttons (input) with indicator light (output). This function is designed primarily for reset buttons to reduce the number of used terminal blocks on the controller.

I - individual failsafe inputs

All inputs are individually failsafe as each input is connected separately to both processors in Pluto. In order to maintain the redundancy required for two-channel structure and the highest level of safety, the dynamic signal must be used. When using static signals, two inputs must be used to achieve two-channel structure. The expected signal to the terminals blocks is determined in Pluto Manager (static or dynamic signal).

Q - individual failsafe outputs

All Q outputs are individually safe and are independently programmable. There are both relay outputs and transistor outputs.

Transistor outputs (-24 VDC)

The transistor outputs are just like the relay outputs, that is individually safe and independently programmable. However, the transistor outputs are different from the relay outputs as the internal connection provides the nominal input voltage -24 VDC, which is primarily intended for controlling electromechanical components such as contactors and valves. As -24 VDC is a unique signal in the majority of electrical cabinets and the fact that the output is monitored by Pluto, short circuits with other potentials can be detected right away.

Pluto-bus

The Pluto-bus is a CAN-bus with its own safety protocol. The bus cable can be up to 600 m long at the minimum bus speed, and up to 150 m at 400 kb/s. The bus can be both extended and connected to other types of buses through gateways.

Pluto Manager and IDFIX

Pluto manager

The Pluto Manager is a freeware for fast, easy and safe programming of the PLC program for Pluto. The programming language used is ladder, which is supplemented with TÜV-approved function blocks for many common features. The software can also be used to configure Pluto's terminal blocks, e.g. to specify the IQ terminals that serve as inputs or outputs, and if the controller should expect a static or dynamic signal. Pluto Manager can be downloaded from Jokab Safety's website.

IDFIX

IDFIX is an identification circuit that is unique to each device on the Pluto bus. It includes an identification code and makes it possible to distribute a PLC program in the network. There are four different versions: R, RW, DATA and PROG. In addition to the identification code, DATA may also include safety codes from the AS-i nodes in an AS-i system. PROG includes the current PLC program and is used with single-Pluto for program distribution. IDFIX is connected between the input terminals ID and 0V.

www.jokabsafety.com
Pluto without a safety bus

Single Pluto controls and monitors safety for local systems - large as well as small systems

Pluto S20
Patented solution

Pluto S46
Patented solution

BT51
Connector expansion
Several expansion relays can be connected to a single Pluto safety output while retaining the safety level.

HMI
A HMI-terminal is easy to connect to one or more Plutos through the Modbus contact.

Pluto Manager
A free of charge software is available on our website.

The Pluto S20 and Pluto S46 versions are safety PLC’s that are designed for safety and protection products installed locally on a machine. With a wide range of connectivity options, a lot of protection is integrated into a PLC which in turn controls, for example, one or more safe outputs in a qualified manner without risking a dangerous situation.

Using an expansion relay, such as BT50, the number of safe outputs in Pluto can be expanded. The connection will then be made as shown in the figure. If IDFIX PROG is used for single-Pluto, there is the option of copying a PLC program via the identification circuit over to Pluto without having to connect a computer.
### Technical data - general

<table>
<thead>
<tr>
<th>Manufacturer:</th>
<th>ABB AB/Jokab Safety, Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour:</td>
<td>Black and beige</td>
</tr>
<tr>
<td>Operating voltage:</td>
<td>24V DC ±15%</td>
</tr>
<tr>
<td>Installation:</td>
<td>35 mm DIN rail</td>
</tr>
<tr>
<td>Electrical insulation:</td>
<td>Category II in accordance with IEC 61010-1</td>
</tr>
<tr>
<td>Level of safety:</td>
<td>EN 954-1 Kat. 4 EN ISO 13849-1 PL e/kat. 4 EN 61508 SIL 3 EN 62061 SIL 3</td>
</tr>
<tr>
<td>PFHₗ₉ Relay output</td>
<td>2,00×10⁻⁹</td>
</tr>
<tr>
<td>Transistor output</td>
<td>1,50×10⁻⁹</td>
</tr>
<tr>
<td>Type:</td>
<td>+24 V (for PNP sensors), IQ also configurable as non-failsafe outputs</td>
</tr>
<tr>
<td>Current at 24 V</td>
<td>5.1 mA</td>
</tr>
<tr>
<td>Max. overvoltage</td>
<td>27 V continuous</td>
</tr>
<tr>
<td>Safe outputs Q</td>
<td>Transistor, −24VDC, 800 mA</td>
</tr>
<tr>
<td>Q2–Q3:</td>
<td>Supply voltage - 1.5 V at 800 mA</td>
</tr>
<tr>
<td>Output voltage tolerance</td>
<td>Relay outputs</td>
</tr>
<tr>
<td>Q0, Q1, (Q4, 5):</td>
<td>AC-1: 250 V/1.5 A</td>
</tr>
<tr>
<td></td>
<td>AC-15: 250 V/1.5 A</td>
</tr>
<tr>
<td></td>
<td>DC-1: 50 V/1.5 A</td>
</tr>
<tr>
<td></td>
<td>DC-13: 24 V/1.5 A</td>
</tr>
<tr>
<td>Non-failsafe outputs Q Type:</td>
<td>Transistor +24V, PNP &quot;open collector&quot; also configurable as failsafe inputs 800 mA</td>
</tr>
<tr>
<td>Max. current/output:</td>
<td></td>
</tr>
</tbody>
</table>

### Temperature

- Ambient temperature: −10°C to +50°C
- Storage and transport: −25°C to +55°C

### Response times

- Dyn. A or static input to relay output:
  - <20.5 ms + program exec. time
  - <16.5 ms + program exec. time
- Dyn. B or Dyn. C input to relay output:
  - <23 ms + program exec. time
  - <19 ms + program exec. time
- 5 ms shorter response time on I & IQ inputs

### Additional Response times

- Databus between Pluto units on error:
  - 10 ms
  - 10–40 ms

### Enclosure classification

- Enclosure: IP 40, IEC 60 529
- Connection terminals: IP 20, IEC 60 529

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### Technical data - type-specific

#### Pluto S20

- 20 I/O
- Non-Pluto safety bus
- Article number/ordering data: 2TL020070R0500
- Failsafe inputs: 8 (I0..I7)
- Failsafe inputs or non-failsafe outputs: 8 (I0..I7, I30..37, I40..I47)
- Analogue inputs: 1 (I5) 0..27V
- Failsafe relay outputs: 2 (Q0..Q1)
- Failsafe transistor outputs: 2 (Q2..Q3)
- Current monitoring: –
- Pluto safety bus: –
- Own current consumption: 100...300 mA
- Recommended external fuse: 6 A
- Dimensions (w x h x d): 45 x 84 x 118 mm

#### Pluto S46

- 46 I/O
- Non-Pluto safety bus
- Article number/ordering data: 2TL020070R1800
- Failsafe inputs: 24 (I0..I7, I30..37, I40..I47)
- Failsafe inputs or non-failsafe outputs: 16 (I0..I7, I30..37, I40..I47)
- Analogue inputs: 3 (I6) 0..27 V
- Failsafe relay outputs: 4 (Q0..Q1 & Q4..Q5)
- Failsafe transistor outputs: 2 (Q2..Q3)
- Current monitoring: –
- Pluto safety bus: –
- Own current consumption: 100...500 mA
- Recommended external fuse: 10 A
- Dimensions (w x h x d): 90 x 84 x 118 mm

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The terminal blocks are detachable without needing to disconnect the wiring. The units are assembled with a gap of at least 5 mm.
ID: Connection for identifier, which has a unique ID number that can be read by the system.

I.. Safety inputs (24 VDC) that are individually secure. This means that the highest level of safety can be achieved with only one input if ABB Jokab Safety dynamic safety components are used. Otherwise two inputs are required for each safety function.

IQ.. I/O that can be used for safety inputs or signal outputs, e.g. to indicate or control functions that are not safety-related. For IQ.. as safety inputs, refer to I..

Q0, Q1: Failsafe relay outputs that are individually failsafe and individually programmable.

Q2, Q3: Failsafe transistor outputs (-24 VDC) that are individually failsafe and individually programmable. Intended for electro-mechanical components such as contactors and valves.

Q4, Q5: Failsafe relay outputs with common potential that are individually failsafe and individually programmable.
**Input connection**

The system offers solutions for both single and two-channel safety devices. In order to monitor wiring short-circuits it is possible to use up to three different dynamic signals and static voltage (+24 V) to supply the inputs. The inputs are then programmed to only accept one of the signal types.

In a two-channel system both channels will be measured, using two different signals. The system will thereby be able to detect a short-circuit between the channels.

In a single channel system the dynamic signal is modified at each sensor. A short-circuit between the input and the output of the sensor will be detected at the Pluto input. PL e according to EN ISO 13849-1 can thus be achieved by using only one channel and one input.

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**Reset button that uses the combined input and output facility**

Both a lamp and a pushbutton can be connected to the same terminal. This function is for resetting safety devices and to reduce the number of I/Os used.
Pluto with a safety bus

Pluto models with a safety bus controls and monitors safety for dispersed systems – large as well as small systems.

Gateway
for two-way bus communication between Pluto and other control systems.

HMI
A HMI-terminal is easy to connect to one or more Plutos through the Modbus contact.

Absolutgivare
8 single- or multiturn absolute encoders can be connected.

Pluto Manager
A free of charge software is available on our website.

Pluto versions with bus have the same properties as single-Pluto unlike bus communication. With the help of the Pluto-bus networks can be created with multiple Plutos in interaction. Gateways can be connected to the Pluto bus for communication with other systems. The gateway models GATE D2 and C2 can also be used as an extension of the bus cable to extend the Pluto network. The fact that Pluto is an All-master system means that each Pluto device controls its outputs locally, while it is just as easy to read the inputs of other Pluto-units as it is to read its own. It is also easy to both read and write to global memory locations available across the Pluto bus. The PLC program is created using the Pluto Manager freeware and is distributed to all Pluto units. You can also connect speed and position sensors via the Pluto bus.

Current monitoring (Pluto A20 only)
Pluto A20 can monitor the current through the IQ16 and IQ17 outputs. The function is designed for, but not limited to, ensuring that the muting lamps are working. The hardware for current monitoring is not designed with individual redundancy, which means that the function must be used dynamically if it is to be used in a safety function. This means that the current must be read and evaluated both when the output is enabled and disabled.
Technical data - general

Manufacturer: ABB AB/Jokab Safety, Sweden

Colour: Black and beige

Operating voltage: 24V DC ±15%

Installation: 35 mm DIN rail

Electrical insulation: Category II in accordance with IEC 61010-1

Safety level
EN 954-1 Kat. 4
EN ISO 13849-1 SIL 3
EN 62061 SIL 3

PFHₘ
Relay output: 2,00×10⁻⁹
Transistor output: 1,50×10⁻⁹

Failsafe inputs I & IQ
Type: +24 V (for PNP sensors), IQ also configurable as non-failsafe outputs
Current at 24 V: 5.1 mA
Max. overvoltage: 27 V continuous

Safe outputs Q
Q2–Q3: Transistor, –24VDC, 800 mA
Supply voltage - 1.5 V at 800 mA
Relay outputs
AC-1: 250 V/1,5 A
AC-15: 250 V/1,5 A
DC-1: 50 V/1,5 A
DC-13: 24 V/1,5 A

Non-failsafe outputs Q
Type: Transistor +24V, PNP "open collector" also configurable as failsafe inputs
Max. current/output: 800 mA

Pluto safety bus
Max number of Pluto units on the databus:
32 CAN
100, 125, 200, 250, 400, 500, 800, 1000 kb/s
Up to 600 m, 150 m at 400 kb/s

Temperature
Ambient temperature: –10°C to +50°C
Storage and transport: –25°C to +55°C

Response times
Dyn. A or static input to relay output:
<20.5 ms + program exec. time
Dyn. A or static input to transistor output:
<16.5 ms + program exec. time
Dyn. B or Dyn. C input to relay output:
<23 ms + program exec. time
Dyn. B or Dyn. C input to transistor output:
<19 ms + program exec. time
Software setting "NoFilt": 5 ms shorter response time on I & IQ inputs

Additional Response times
Databus between Pluto units on error
10–40 ms

Enclosure classification
Enclosure: IP 40, IEC 60 529
Connection terminals: IP 20, IEC 60 529

Technical data - type-specific

Pluto A20
20 I/O
Current monitoring

Pluto B16
16 I/O
Non-failsafe outputs

Pluto B20
20 I/O

Pluto B46
46 I/O

Article number/ordering data:
2TLJ020070R0300
2TLJ020070R0700
2TLJ020070R0600
2TLJ020070R1700

Failsafe inputs
8 (I0..I7)
8 (I0..I7)
8 (I0..I7)
24 (I0..I7, I30..I37, I40..I47)

Failsafe inputs or non-failsafe outputs
8 (I01..I07)
8 (I01..I07)
8 (I01..I07)
16 (I01..I07, I10..I17)

Analogue inputs
1 (I5) 0..27V
1 (I5) 0..27V
1 (I5) 0..27V
3 (I5) 0..27 V

Failsafe relay outputs
2 (Q0..Q1)
–
2 (Q0..Q1)
4 (Q0..Q1 & Q4..Q5)

Failsafe transistor outputs
2 (Q2..Q3)
–
2 (Q2..Q3)
2 (Q2..Q3)

Current monitoring
2(I016,I017)0-1.0A ±10%
–
–
–

Pluto safety bus
•
•
•

Own current consumption
100...300 mA
100...300 mA
100...300 mA
100...500 mA

Recommended external fuse:
6 A
6 A
6 A
10A

Dimensions (w x h x d)
45 x 84 x 118 mm
45 x 84 x 118 mm
45 x 84 x 118 mm
90 x 84 x 118 mm

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I/O Overview - Pluto with a safety bus

ID: Connection for identifier, which has a unique ID number that can be read by the system.

I.: Safety inputs (24 VDC) that are individually secure. This means that the highest level of safety can be achieved with only one input if ABB Jokab Safety dynamic safety components are used. Otherwise two inputs are required for each safety function.

IQ.: I/O that can be used for safety inputs or signal outputs, e.g. to indicate or control functions that are not safety-related. For IQ.. as safety inputs, refer to I..

Q0, Q1: Failsafe relay outputs that are individually failsafe and individually programmable.

Q2, Q3: Failsafe transistor outputs (-24 VDC) that are individually failsafe and individually programmable. Intended for electro-mechanical components such as contactors and valves.

Q4, Q5 Failsafe relay outputs with common potential that are individually failsafe and individually programmable.
Internet support - Pluto

Our web site has a section dedicated to Pluto customers, offering continuously updated product support. The Pluto customer site offers:

- E-mail support directly linked to our Pluto specialists
- Hardware manuals
- The Safety Manual, with the most important safety requirements
- Programming manual
- Gateway manual
- Function block descriptions
- Common questions and answers
- Pluto Manager installation file, programming tools
- Pluto OS, files to update system software
- Confirmation of compliance
**Description:**
The example describes a processing machine served by a robot. The machine safety system consists of one (Pluto 1) to which all protection has been connected. The robot has been equipped with a (Pluto 0) to which the cell protection has been connected. The Pluto for the machine has been connected via a databus cable to the robot’s Pluto so that common functions, such as emergency stop, can be used by the whole cell.

**Function:**
Emergency stop takes priority and will stop both the machine and the robot. The machine hatch acts as the zone divider, when the hatch is closed the machine forms one zone and the robot another zone. When the machine hatch is open, both the machine and the robot belong to the same zone. If the door is opened when the machine hatch is open, the machine and the robot will both stop, but if the machine hatch is closed, only the robot will be stopped. After the door has been opened, the system must be reset by means of the reset button on the outside of the door. Emergency stop is reset when the pressed-in button is pulled out. NOTE. The cell operating cycle must not however start immediately on resetting the emergency stop or the door.
Electrical connections

Example (C:\Program Files\PlutoManager\Example.sps)

Project Name
Example Robot cell

Project Description

Project created by:

Project reviewed by:

Project approved by:

History:
2010-10-19 - Project created

Function Libraries

Baudrate Pluto Canbus
Default (480 kbps)
**Pluto 0 settings – Robot cabinet**

Pluto 0

I0.0=P0_ES1_Ch1 ;Emergency stop 1 channel 1 - Static
I0.1=P0_ES1_Ch2 ;Emergency stop 1 channel 2 - Dynamic A non-inverted
I0.2=P0_Eden1 ;Door Eden sensor - Dynamic A
I0.15=P0_LB1_In ;Reset Door - Light button input - Dynamic A
Q0.2=P0_AS_OK ;Robot auto stop - Expansion BT50 relay
Q0.3=P0_ES ;Robot emergency stop - Expansion BT50 relay
GM0.0=P0_ES_OK ;Emergency stop OK in Pluto 0
Pluto 1 settings – Machine cabinet

Pluto 1
I1.1 = P1_ES1_Ch1
I1.2 = P1_ES1_Ch2
I1.3 = P1_IS1_Ch1
I1.4 = P1_IS1_Ch2
I1.15 = P1_LB1_In
Q1.0 = P1_ES
Q1.1 = P1_PS
GM1.0 = P1_ES_OK
GM1.1 = P1_Hatch_OK

;Emergency stop 1 channel 1 - Dynamic A non-inverted
;Emergency stop 1 channel 2 - Static
;Interlocking switch channel 1 - Dynamic A non-inverted
;Interlocking switch channel 2 - Static
;Reset Hatch - Light button input - Dynamic A
;Machine Emergency stop
;Machine protective stop
;Emergency stop OK in Pluto 1
;Hatch closed
PLC code Pluto 0 – Robot cabinet

1. Start

2. Two channel monitoring with automatic reset of emergency stop at the door.
   - P0_ES1_Ch1
     - I0.0
   - P0_ES1_Ch2
     - I0.1

   \[
   \begin{align*}
   GM0.0 &= P0_ES_OK \quad \text{Emergency stop OK in Pluto 0} \\
   I0.0 &= P0_ES1_Ch1 \quad \text{Emergency stop 1 channel 1 - Static} \\
   I0.1 &= P0_ES1_Ch2 \quad \text{Emergency stop 1 channel 2 - Dynamic A non-inverted}
   \end{align*}
   \]

   - When the emergency stop is actuated the robot will make an emergency stop.
   - In order to restore safety requires the emergency stop button needs to be reset.
   - An emergency stop from the machine panel will also emergency stop the robot.

   \[
   \begin{align*}
   GM0.0 &= P0_ES_OK \quad \text{Emergency stop OK in Pluto 0} \\
   GM1.0 &= P1_ES_OK \\
   Q0.3 &= P0_ES \quad \text{Robot emergency stop - Expansion BT50 relay}
   \end{align*}
   \]

   - When the door to the robot cell is opened the robot is auto stopped.
   - To reset the safety the door needs to be closed and the reset button pressed and released.
   - Note that IQ15 of the Pluto is used both as a button in and to indicate different reset states.
   - Constant light means reset is not possible, safety not ok.
   - Flash 0.4 s high, 0.6 s low means reset is possible but not performed.
   - No light means reset has been performed and the safety is ok.

   \[
   \begin{align*}
   I0.15 &= P0\_LB1\_In \quad \text{Reset Door - Light button input - Dynamic A} \\
   I0.2 &= P0\_Eden1 \quad \text{Door Eden sensor - Dynamic A} \\
   Q0.15 &= P0\_LB1\_Out \quad \text{Reset Door - Light button output - Static} \\
   Q0.2 &= P0\_AS\_OK \quad \text{Robot auto stop - Expansion BT50 relay}
   \end{align*}
   \]
Alarm 03 - Machine hatch open.

To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.

<table>
<thead>
<tr>
<th>P1_Hatch_OK</th>
<th>P0_AS_OK</th>
<th>SR_ErrorCode=0</th>
<th>SR_PlutoDisplay=203</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM1.1</td>
<td>Q0.2</td>
<td>SR0.11=0</td>
<td></td>
</tr>
</tbody>
</table>

GM1.1=P1_Hatch_OK  Hatch closed
Q0.2=P0_AS_OK  Robot auto stop - Expansion BT50 relay
SR0.10=SR_PlutoDisplay  Pluto display figure. For user error: 200+no
SR0.11=SR_ErrorCode  Error code

Alarm 02 - Door open.

To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.

<table>
<thead>
<tr>
<th>P0_Eden1</th>
<th>SR_ErrorCode=0</th>
<th>SR_PlutoDisplay=202</th>
</tr>
</thead>
<tbody>
<tr>
<td>I0.2</td>
<td>SR0.11=0</td>
<td></td>
</tr>
</tbody>
</table>

I0.2=P0_Eden1  Door Eden sensor - Dynamic A
SR0.10=SR_PlutoDisplay  Pluto display figure. For user error: 200+no
SR0.11=SR_ErrorCode  Error code

Alarm 01 - Emergency stop actuated.

To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.

<table>
<thead>
<tr>
<th>P0_ES_OK</th>
<th>SR_ErrorCode=0</th>
<th>SR_PlutoDisplay=201</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM0.0</td>
<td>SR0.11=0</td>
<td></td>
</tr>
</tbody>
</table>

GM0.0=P0_ES_OK  Emergency stop OK in Pluto 0
SR0.10=SR_PlutoDisplay  Pluto display figure. For user error: 200+no
SR0.11=SR_ErrorCode  Error code
**PLC code Pluto 1 – Machine cabinet**

1. Two channel monitoring with automatic reset of emergency stop at the machine hatch.

   - P1_ES1_Ch1
   - P1_ES1_Ch2

   - Start

   **GM1.0=P1_ES_OK** Emergency stop OK in Pluto 1
   **I1.1=P1_ES1_Ch1** Emergency stop 1 channel 1 - Dynamic A non-inverted
   **I1.2=P1_ES1_Ch2** Emergency stop 1 channel 2 - Static

2. Two channel monitoring with automatic reset of interlocking switch of the machine hatch.

   - P1_IS1_Ch1
   - P1_IS1_Ch2

   - Start

   **GM1.1=P1_Hatch_OK** Hatch closed
   **I1.3=P1_IS1_Ch1** Interlocking switch channel 1 - Dynamic A non-inverted
   **I1.4=P1_IS1_Ch2** Interlocking switch channel 2 - Static

3. Emergency stop of machine.

   When the emergency stop is actuated the machine will make an emergency stop.
   In order to restore safety requires the emergency stop button needs to be reset.
   An emergency stop from the robot will also emergency stop the machine.

   - P1_ES_OK
   - P0_ES_OK
   - P1_ES
   - GM1.0
   - GM0.0
   - Q1.0

   **GM0.0=P0_ES_OK** Emergency stop OK in Pluto 0
   **GM1.0=P1_ES_OK** Emergency stop OK in Pluto 1
   **Q1.0=P1_ES** Machine Emergency Stop

4. Monitoring of the hatch.

   When the hatch is opened the monitoring of the hatch is inactive.
   To reset the safety the hatch needs to be closed and the reset button pressed and released.
   Note that IQ15 of the Pluto is used both as a button in and to indicate different reset states.
   Constant light means reset is not possible, safety not ok.
   Flash 0.4 s high, 0.6 s low means reset is possible but not performed.
   No light means reset has been performed and the safety is ok.

   - P1_Hatch_OK
   - P1_LB1_In
   - Reset

   **GM1.1=HB_Hatch_OK** Help Bit - Hatch closed
   **Q0.2=P0_AS_OK** Robot auto stop - Expansion BT50 relay
   **Q1.1=P1_PS** Machine Protective Stop

5. Protective stop of the machine.

   Either the hatch is closed and reset or the door to the robot cell is closed and reset.
   This means the cell can work with the hatch both open or closed as long as the cell's door is closed and reset.

   - GM1.0
   - Q1.0

   **GM1.0=HB_Hatch_OK** Help Bit - Hatch closed
   **Q0.2=P0_AS_OK** Robot auto stop - Expansion BT50 relay
   **Q1.1=P1_PS** Machine Protective Stop


   To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
   A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.

   **GM1.1=P1_Hatch_OK** Hatch closed
   **Q0.2=P0_AS_OK** Robot auto stop - Expansion BT50 relay
   **SR1.10=SR_PlutoDisplay** Pluto display figure. For user error: 200+no application example
Light button indication of the reset of the hatch.

If the robot cell's door is closed and reset no light indication is needed inside the cell.

Protective stop of the machine.

Either the hatch is closed and reset or the door to the robot cell is closed and reset. This means the cell can work with the hatch both open or closed as long as the cell's door is closed and reset.

Alarm 03 - Machine hatch open.

To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto. A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.

Alarm 02 - Door open.

To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto. A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.

Alarm 01 - Emergency stop actuated.

To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto. A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.
Pluto gateway is a unit providing two-way communication between a Pluto safety PLC and other field buses.

The Pluto gateway is a compact unit mounted on a DIN rail, and can be connected anywhere in a Pluto safety bus. The unit has a common interface with Pluto, i.e. the same cabling, and the Pluto Manager PC program can be used for servicing and where necessary programming. Normally, however, all the settings are made via a DIP switches, which means that programming tools are not required to put the gateway itself into operation.

For programming Pluto there are ready-made function blocks which, via a Pluto gateway, send and receive data from the supervisory system.

**Data from Pluto**
Via PROFIBUS a supervisory PLC system can have access to the I/O and other variables in a Pluto safety PLC. Global I/O in a Pluto safety PLC are accessible via PROFIBUS modules in the gateway, one module for each Pluto unit. Local data in Pluto units can be read by a "local data" module together with the PLC codes in the supervisory system.

**Data to Pluto**
Via PROFIBUS a supervisory PLC system can transmit non-safety-related information to a Pluto safety PLC. A total of 64 Boolean values and 8 different 16-bit registers can be transmitted. Function blocks for these functions are available in Pluto Manager.

**PLC function blocks**
To simplify the integration of a Pluto gateway PROFIBUS into the supervisory PLC system, ABB Jokab Safety provides ready-made function blocks for several popular brands of PLC. The function blocks make it easier to receive and send information to the Pluto system. The function blocks are supplied as open units with full access for the customer to change and add functions. These function blocks can be obtained via the Jokab Safety web site.

**Use:**
- Bi-directional status information from the Pluto safety PLC
- For Profibus

**Features:**
- Two-way communication
- Built-in filter function, shared network
- Only 22.5 mm wide
- Can be located anywhere in the databus
- Common interface with Pluto
- Ready-made function blocks
## Technical data - GATE-P2

<table>
<thead>
<tr>
<th><strong>Manufacturer:</strong></th>
<th>ABB AB/Jokab Safety, Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Article number/ordering data:</strong></td>
<td>2TLA020071R7800 GATE-P2</td>
</tr>
</tbody>
</table>
| **Databases:** | - Pluto safety bus CAN (isolated)  
- PROFIBUS RS485 (isolated) |
| **Pluto safety bus speeds:** | 100, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection) |
| **PROFIBUS speed:** | Up to 12 Mbit/s (automatic speed detection) |
| **PROFIBUS address:** | Setting via DIP switches (0-99) |
| **PROFIBUS version:** | DP slave, DP-V0 |
| **Connections:** | Top, 3-pole terminal for Pluto safety bus (included)  
Front, standard 9-pole PROFIBUS connection.  
Bottom, 2-pole terminal for 24 V DC (included) |
| **Status indication:** | Pluto safety bus status indication via LED  
PROFIBUS status indication via LED |
| **Operating voltage:** | 24 V DC, -15% till +20% |
| **Current at 24 V:** | < 100 mA (recommended fuse ≤6 A) |
| **Dimensions (w x h x d):** | 22.5 x 101 x 119 mm |
| **Installation:** | 35 mm DIN rail |
| **Operating temperature (ambient):** | -10°C to + 55°C |
| **Temperature, transport and storage:** | -25°C to + 55°C |
| **Humidity:** | EN 60 204-1 50% at 40°C  
(ambient 90% at 20°C) |
| **Enclosure classification:** | Enclosure IP 20 - IEC 60 529  
Terminals IP 20 - IEC 60 529 |

### Gateway block schematic diagram - Pluto Profibus

![Gateway block schematic diagram - Pluto Profibus](image-url)
Pluto gateway is a unit providing two-way communication between a Pluto safety PLC and other field buses.

The Pluto gateway is a compact unit mounted on a DIN rail, and can be connected anywhere in a Pluto safety bus. The unit has a common interface with Pluto, i.e. the same cabling, and the Pluto Manager PC program can be used for servicing and where necessary programming. Normally, however, all the settings are made via a DIP switches, which means that programming tools are not required to put the gateway itself into operation.

For programming Pluto there are ready-made function blocks which, via a Pluto gateway, send and receive data from the supervisory system.

**Data from Pluto**

Via DeviceNet a supervisory PLC system can have access to the I/O and other variables in a Pluto safety PLC. Global I/Os in a Pluto safety PLC are accessible via DeviceNet "implicit" messages. Local data in Pluto units can be read via DeviceNet "explicit" messages.

**Data to Pluto**

Via DeviceNet a supervisory PLC system can transmit non-safety-related information to a Pluto safety PLC. A total of 64 Boolean values and 8 different 16-bit registers can be transmitted (via DeviceNet "implicit" or "explicit" messages). Function blocks for these commands are available in Pluto Manager.

**Pluto bridge**

A GATE-D2 can also be used to advantage as a CAN bridge when it is required to divide a Pluto safety bus into several sections. This is particularly useful when long data-bus cables are needed.

There is also a built-in filter function which makes it possible to block any data that is not required for use on the other side of the bridge, which reduces the databus loading in the other sections and thereby permits longer data-bus cables.

**ABB Robotics IRC5**

PLUTO GATE-D2 has support for integration into an ABB Robotics IRC5-system. The documentation that describes this integration can be obtained via the Jokab Safety web site.
Technical data - GATE-D2

**Manufacturer:** ABB AB/Jokab Safety, Sweden

**Article number/ordering data:** 2TLA020071R8200 GATE-D2

**Databases:**
- Pluto safety bus CAN (isolated)
- DeviceNet CAN (isolated)

**Pluto safety bus speeds:** 100, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection)

**DeviceNet speeds:** 125, 250 and 500 kbit/s (set via DIP switch)

**DeviceNet address:** Setting via DIP switches (1-63)

**DeviceNet Version:** ODVA version 2.0

**Connections:**
- Top, 3-pole terminal for Pluto safety bus (included)
- Front, 5-pole terminal for DeviceNet (included)
- Bottom, 2-pole terminal for 24 V DC (included)

**Status indications:**
- Pluto safety bus status indication via LED
- DeviceNet MNS status indication via LED

**Operating voltage:** 24 V DC, -15% till +20%

**Current at 24 V:** < 100 mA (recommended fuse ≤6 A)

**Dimensions (w x h x d):** 22.5 x 101 x 119 mm

**Installation:** 35 mm DIN rail

**Operating temperature (ambient):** -10°C to + 55°C

**Temperature, transport and storage:** -25°C to + 55°C

**Humidity:** EN 60 204-1 50% at 40°C (ambient 90% at 20°C)

**Enclosure classification:** Enclosure IP 20 - IEC 60 529
- Terminals IP 20 - IEC 60 529

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Gateway block schematic diagram - Pluto DeviceNet

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Pluto gateway is a unit providing two-way communication between a Pluto safety PLC and other field buses.

The Pluto gateway is a compact unit mounted on a DIN rail, and can be connected anywhere in a Pluto safety bus. The unit has a common interface with Pluto, i.e. the same cabling, and the Pluto Manager PC program can be used for servicing and where necessary programming. Normally, however, all the settings are made via a DIP switches, which means that programming tools are not required to put the gateway itself into operation.

For programming Pluto there are ready-made function blocks which, via a Pluto gateway, send and receive data from the supervisory system.

**Data from Pluto**

Via CANopen a supervisory PLC system can have access to the I/O and other variables in a Pluto safety PLC. Global I/Os in a Pluto safety PLC are accessible via CANopen PDO messages. Local data in Pluto units can be read via CANopen SDO messages together with the PLC codes in the supervisory system.

**Data to Pluto**

Via CANopen a supervisory PLC system can send non-safety-related information to a Pluto safety PLC. A total of 64 Boolean values and 8 different 16-bit registers can be transmitted (CANopen PDO or SDO messages). Function blocks for these commands are available in Pluto Manager.

**Pluto bridge**

A GATE-C2 can also be used to advantage as a CAN bridge when it is required to divide a Pluto safety bus into several sections. This is particularly useful when long data-cable cables are needed.

There is also a built-in filter function which makes it possible to block any data that is not required for use on the other side of the bridge, which reduces the data-cable loading in the other sections and thereby permits longer data-cable cables.

---

**GATE-C2**

**Use:**

- Bi-directional status information from the Pluto safety PLC
- For CANopen and Pluto-bridge

**Features:**

- Two-way communication
- Built-in filter function, shared network
- Only 22.5 mm wide
- Can be located anywhere in the databus
- Common interface with Pluto
- Ready-made function blocks
## Technical data - GATE-C2

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>ABB AB/Jokab Safety, Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article number/ordering data:</td>
<td>2TLA020071R8100 GATE-C2</td>
</tr>
</tbody>
</table>
| Databases:            | - Pluto safety bus CAN (isolated)  
                        | - CANopen CAN (isolated) |
| Pluto safety bus speeds: | 100, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection) |
| CANopen speeds:       | 125, 250 and 500 kbit/s (set via DIP switch)  
                        | 10, 20, 50, 100, 125, 250, 500, 800 and 1000 kbit/s (via software) |
| CANopen address:      | Setting via DIP switches or software (1-63) |
| CANopen version:      | "Version 4.02 of the CiA Draft Standard 301" |
| Connections:          | Top, 3-pole terminal for Pluto safety bus (included)  
                        | Front, 5-pole terminal for CANopen (included)  
                        | Bottom, 2-pole terminal for 24 V DC (included) |
| Status indications:   | Pluto safety bus status indication via LED  
                        | CANopen status indication via LED |
| Operating voltage:    | 24 V DC, -15% till +20% |
| Current at 24 V:      | < 100 mA (recommended fuse ≤ 6 A) |
| Dimensions (w x h x d): | 22.5 x 101 x 119 mm |

### Gateway block schematic diagram - Pluto CANopen

![Gateway block schematic diagram](image)

- **Installation:** 35 mm DIN rail
- **Operating temperature (ambient):** -10°C to + 55°C
- **Temperature, transport and storage:** -25°C to + 55°C
- **Humidity:** EN 60 204-1 50% at 40°C  
  (ambient 90% at 20°C)
- **Enclosure classification:**  
  - Enclosure IP 20 - IEC 60 529  
  - Terminals IP 20 - IEC 60 529
Pluto gateway GATE-E2

Pluto gateway is a unit providing two-way communication between a Pluto safety PLC and other field buses.

The Pluto gateway is a compact unit mounted on a DIN rail, and can be connected anywhere in a Pluto safety bus. The unit has a common interface with Pluto, i.e. the same cabling, and the Pluto Manager PC program can be used for servicing and where necessary programming. Normally, however, all the settings are made via a DIP switches, which means that programming tools are not required to put the gateway itself into operation.

For programming Pluto there are ready-made function blocks which, via a Pluto gateway, send and receive data from the supervisory system.

Protocol
PLUTO Gateway GATE-E2 handles the status from and to Pluto safety PLCs via Ethernet protocols EtherNet/IP, PROFINET, Modbus TCP and a simple binary protocol that uses TCP/IP.

For IP-address configuration, etc. there is a simple web server and a terminal server.

Data from Pluto
Via one of the Ethernet protocols a supervisory PLC system can have access to the I/O and other variables in a Pluto safety PLC. Global I/Os in a Pluto safety PLC are accessible via the usual I/O transfer in the respective protocol. Local data in Pluto units can be read by special commands together with the PLC codes in the supervisory system.

Data to Pluto
Via the Ethernet protocol a supervisory PLC system can transmit non-safety-related information to a Pluto safety PLC. A total of 64 Boolean values and 8 different 16-bit registers can be transmitted. Function blocks for these functions are available in Pluto Manager.

Features:
- Two-way communication
- Built-in filter function, shared network
- Can be located anywhere in the databus
- Common interface with Pluto
- Ready-made function blocks

Use:
- Bi-directional status information from the Pluto safety PLC
- Profinet, Ethernet/IP, Modbus TCP
## Technical data - GATE-E2

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>ABB AB/Jokab Safety, Sweden</th>
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<tr>
<td>Article number/ordering data:</td>
<td>2TLA020071R8300 GATE-E2</td>
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<tr>
<td>Buses:</td>
<td>Pluto-bus CAN (isolated)</td>
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<tr>
<td></td>
<td>Profinet (isolated)</td>
</tr>
<tr>
<td></td>
<td>Ethernet/IP (isolated)</td>
</tr>
<tr>
<td></td>
<td>Modbus TCP (isolated)</td>
</tr>
<tr>
<td>Pluto safety bus speeds</td>
<td>100, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection)</td>
</tr>
<tr>
<td>Ethernet</td>
<td>Status from and to Pluto safety PLC</td>
</tr>
<tr>
<td></td>
<td>- EtherNet/IP</td>
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<tr>
<td></td>
<td>- PROFINET (in development)</td>
</tr>
<tr>
<td></td>
<td>- Modbus TCP</td>
</tr>
<tr>
<td></td>
<td>- Binary server (TCP/IP)</td>
</tr>
<tr>
<td>Ethernet protocol</td>
<td>Status from and to Pluto safety PLC</td>
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<td>- EtherNet/IP</td>
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<td></td>
<td>- PROFINET (in development)</td>
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<tr>
<td></td>
<td>- Modbus TCP</td>
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<td></td>
<td>- Binary server (TCP/IP)</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>According to ODVA “CIP Edition 3.2” and “EtherNet/IP Adaption of CIP Edition 1.3”. Minimum RPI of 50 ms</td>
</tr>
<tr>
<td>PROFINET</td>
<td>PROFINET</td>
</tr>
<tr>
<td>Modbus TCP</td>
<td>According to the Modbus organisation, version 1.0b (approx. 20 messages per second).</td>
</tr>
<tr>
<td>Binary server (TCP/IP)</td>
<td>Simple TCP/IP protocol to send status from/to the Pluto system.</td>
</tr>
</tbody>
</table>

### Connections

- **Top, 3-pole terminal for Pluto safety bus (included)**
- **Front, Ethernet connection via RJ-45 (screened cable cat. 5e FTP)**
- **Bottom, 2-pole terminal for 24 V DC (included)**

### Status indications

- **Pluto safety bus status indication via LED (Pluto safety bus)**
- **Ethernet module status indication via LED (Mod Status)**
- **Ethernet network status indication via LED (Net Status)**

### Operating voltage

- 24 V DC, -15 % till +20 %

### Current at 24 V

- < 150 mA (recommended fuse ≤6 A)

### Dimensions (w x h x d):

- 35 x 101 x 120 mm

### Installation

- 35 mm DIN rail

### Operating temperature (ambient)

- -10°C to + 55°C

### Temperature, transport and storage

- -25°C to + 55°C

### Humidity

- EN 60 204-1 50 % at 40°C (ambient 90 % at 20°C)

### Enclosure classification

- Enclosure IP 20 - IEC 60 529
- Terminals IP 20 - IEC 60 529

---

### Gateway block schematic diagram - Pluto Ethernet

**Web server**

- For simple sharing of IP addresses.

**Terminal server (TCP/IP)**

- Simple server with the same commands as via the serial programming port in the unit.

**IP address**

- Static sharing via web server or via programming port.

**Gateway configuration**

- Takes place via EtherNet/IP, PROFINET, Modbus TCP or via the binary TCP/IP server.

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![Gateway block schematic diagram - Pluto Ethernet](image-url)
Rotational absolute value sensor for safe positioning

Together with a Pluto safety PLC, this rotational absolute encoder can be used for safe position determination. This is particularly useful in the case of such equipment as gantry robots, industrial robots, etc. Also in eccentric shaft presses, existing cam mechanisms can be replaced by absolute value position sensors for safe positioning. The sensors are available in single and multi-turn versions.

Up to 16 absolute encoders can be connected to a Pluto CAN databus. A Pluto on the databus reads the sensor values, which are evaluated. With a special function block in the PLC code, it is possible to design two-channel solutions with the sensors. The user can obtain safe values for position and speed from these values. This enables supervision of stationary and overspeed conditions.

The absolute value sensors are standard sensors with modified software to meet the safety requirements.

Use:
Safe position and speed determination of machine movements.

Features:
- High resolution
- Selectable resolution
- Connected directly to the Pluto safety bus
- Ready-made function blocks

Example of an application where 2 sensors provide safe position determination in a gantry robot.
## Technical data – Safe Encoder RSA 597

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manufacturer</strong></td>
<td>ABB AB/Jokab Safety, Sweden</td>
</tr>
<tr>
<td><strong>Article number/ordering data:</strong></td>
<td>2TLJ020070R3600 RSA 597</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-40°C .. +70°C</td>
</tr>
<tr>
<td><strong>Temperature, transport and storage</strong></td>
<td>-30°C .. +70°C</td>
</tr>
<tr>
<td><strong>Ingress protection class</strong></td>
<td>IP-67 in accordance with IEC 60529</td>
</tr>
<tr>
<td><strong>At shaft inlet</strong></td>
<td>IP-66 in accordance with IEC 60529</td>
</tr>
<tr>
<td><strong>Vibration (55 to 2000 Hz)</strong></td>
<td>&lt; 300 m/s² in accordance with IEC 60068-2-6</td>
</tr>
<tr>
<td><strong>Shock (6ms)</strong></td>
<td>&lt; 2,000 m/s² in accordance with IEC 60068-2-27</td>
</tr>
<tr>
<td><strong>Material, enclosure</strong></td>
<td>Aluminium</td>
</tr>
<tr>
<td><strong>Surface treatment</strong></td>
<td>Painted and chromed or anodised</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 300 g</td>
</tr>
<tr>
<td><strong>Accuracy and resolution</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>13 bits, 8192 positions per rotation</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± ½ LSB (Least Significant Bit)</td>
</tr>
<tr>
<td><strong>Operating voltage</strong></td>
<td>9-36 V dc</td>
</tr>
<tr>
<td><strong>Polarity-protected</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Short-circuit protected</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Databus speed</strong></td>
<td>5 kbit/s - 1 Mbit/s, preset at 500kbit/s</td>
</tr>
<tr>
<td><strong>Address input</strong></td>
<td>Active low</td>
</tr>
<tr>
<td><strong>Code type</strong></td>
<td>Binary</td>
</tr>
<tr>
<td><strong>Programmable functions</strong></td>
<td>Resolution, 0 position, Direction, Databus speed</td>
</tr>
<tr>
<td><strong>Current consumption</strong></td>
<td>50 mA at 24V dc</td>
</tr>
<tr>
<td><strong>Max current consumption</strong></td>
<td>100 mA</td>
</tr>
</tbody>
</table>
Technical data – Safe Encoder RSA 698

**Manufacturer**
ABB AB/Jokab Safety, Sweden

**Article number/ordering data:**
2TLJ020070R3700 RSA 698

**Ambient temperature**
-40°C .. +70°C

**Temperature, transport and storage**
-30°C .. +70°C

**Ingress protection class**
IP-67 in accordance with IEC 60529

**At shaft inlet**
IP-66 in accordance with IEC 60529

**Vibration (55 to 2000 Hz)**
< 100 m/s² in accordance with IEC 60068-2-6

**Shock (6ms)**
< 2,000 m/s² in accordance with IEC 60068-2-27

**Material, enclosure**
Aluminium

**Surface treatment**
Anodised

**Weight**
Approx. 400g

**Resolution and resolution**
25 bit
13 bits, 8192 positions per rotation
12 bits, 4096 rotations

**Accuracy**
± 1 LSB (Least Significant Bit)

**Operating voltage**
9-36 V dc

**Polarity-protected**
Yes

**Short-circuit protected**
Yes

**Databus speed**
10 kbit/s - 1 Mbit/s

**Code type**
Binary

**Programmable functions**
Resolution, 0 position

**Current consumption**
50 mA at 24V dc

**Max current consumption**
100 mA

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**Safe Encoder RSA 698 – multi turn**

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**Dimensions:**

- Diameter: 58 mm
- Height: 18 mm
- Width: 51.7 mm

**Marking:**
M3x(3) Depth 5mm

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**Product features:**
- Safe encoder for multi-turn applications
- High resolution and accuracy
- Polarity-protected and short-circuit protected
- Databus speed up to 1 Mbit/s
- Binary code type

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**Technical specifications:**
- Ambient temperature: -40°C .. +70°C
- Temperature, transport and storage: -30°C .. +70°C
- Ingress protection class: IP-67
- Vibration: < 100 m/s²
- Shock: < 2,000 m/s²
- Material: Aluminium
- Surface treatment: Anodised
- Weight: Approx. 400g
- Resolution: 25 bit
- Accuracy: ± 1 LSB
- Operating voltage: 9-36 V dc
- Polarity-protected: Yes
- Short-circuit protected: Yes
- Databus speed: 10 kbit/s - 1 Mbit/s
- Code type: Binary
- Programmable functions: Resolution, 0 position
- Current consumption: 50 mA at 24V dc
- Max current consumption: 100 mA
Safe Encoder

Function block for a single-turn encoder that generates safe position and speed values from two absolute encoders.

Function
The block reads and evaluates one absolute encoder. The position value is sent to the 'Position' output. The 'Speed' output is the average value for the speed, at the rate of pulses/10 ms. If an error occurs, the 'OK' output is set to zero. In certain applications, the values of 'Position' and 'Speed' are used in conjunction with the 'OK' output.

Safe Encoder
Multiturn

Function block for a multi-turn encoder that generates safe position and speed values from two absolute encoders. Operative system 2.4.4 or higher is required.

Function
The block reads and evaluates two absolute encoders. The average value for the two sensors is calculated and sent to the 'Position' output. The 'Speed' output is the average value for the speed, at the rate of pulses/10 ms. The block monitors that the encoder position values do not differ by more than the input value set by 'MaxDiff'. If an error occurs, the 'OK' output is set to zero. In certain applications, the values of 'Position' and 'Speed' are used in conjunction with the 'OK' output.

Encoder Cam

Function block for electronic cam gear.

Function
Output Q is activated if the value of the input register 'PosReg' is within the limits for 'MinPos' and 'MaxPos'.

NOTE! It is possible to specify a value that defines the sensor's zero position. Position <0 is not permitted.
Example: If MinPos = 3000 and MaxPos = 200, Q is activated when the position is greater than 2999 or less than 201.