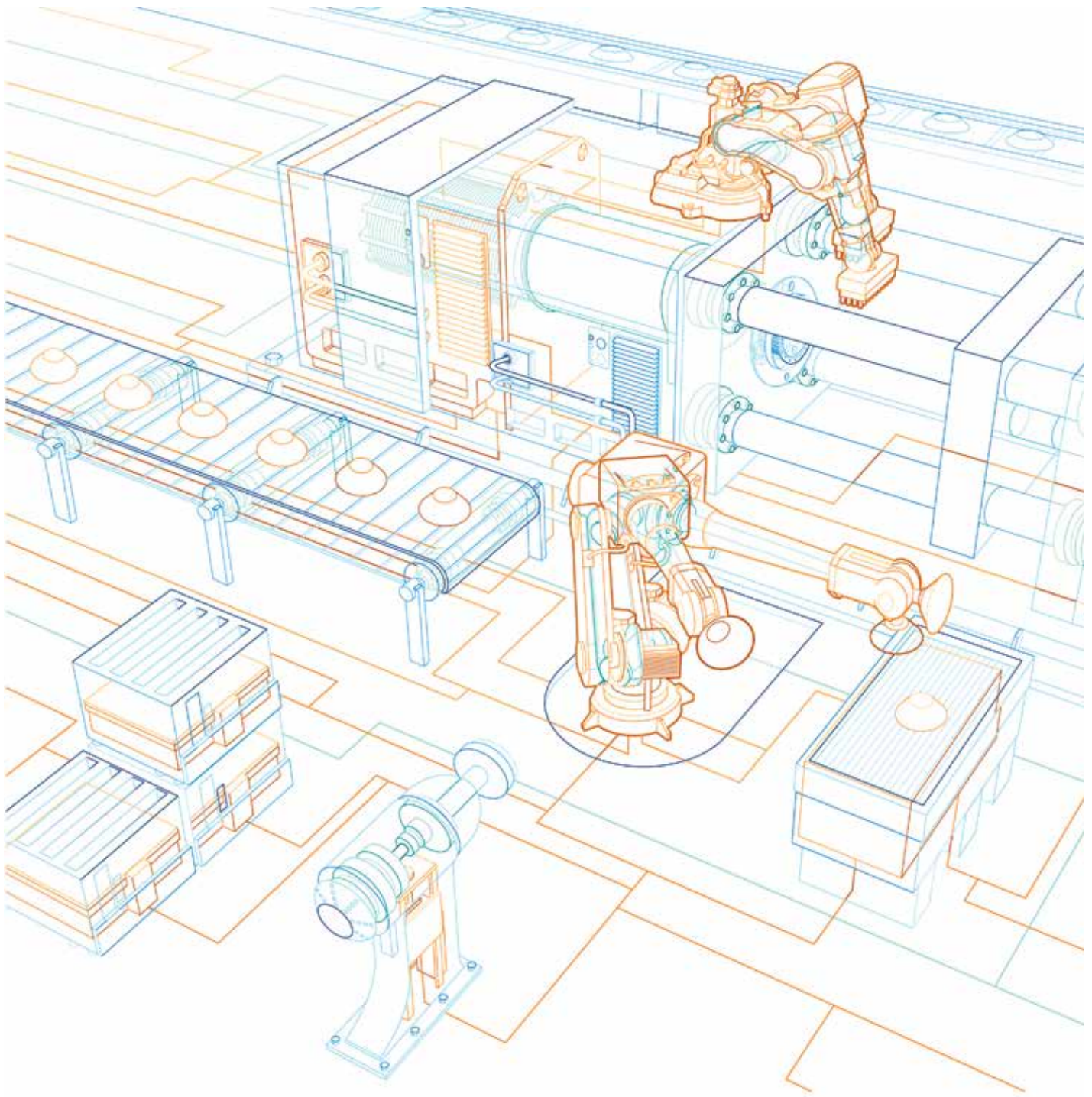


ABB JOKAB SAFETY Products

# Pluto Safety PLCs Product overview

Power and productivity  
for a better world™





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# Pluto Safety PLC

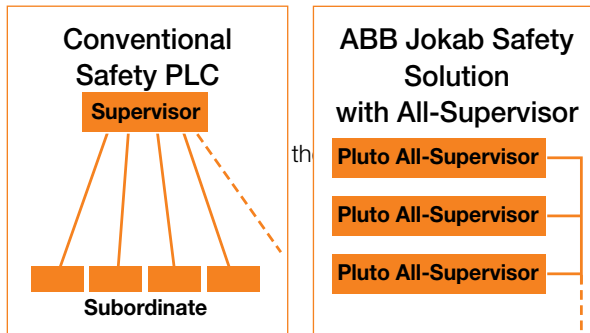
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# Why should I use the Pluto Safety PLC?

## ...for simplifying the design!

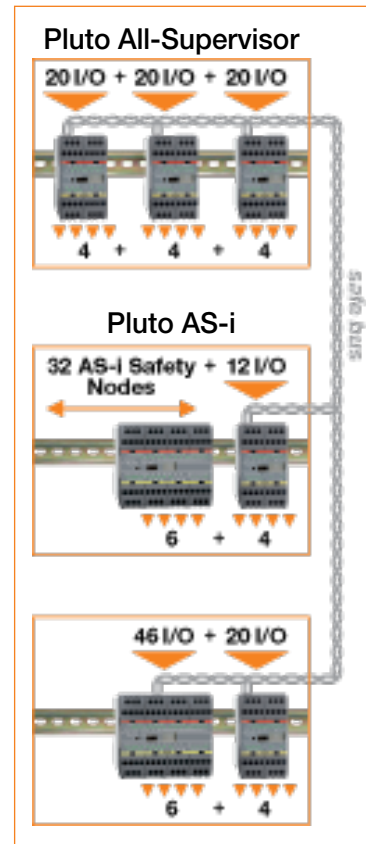
Pluto is an “All-Supervisor” Safety PLC concept that simplifies design of safety systems and achieves the highest safety (Category 4) according to EN 954-1/EN ISO 13849-1 and SIL 3 according to IEC/EN 61508.



The key difference between Pluto and conventional Safety PLCs is that there is no “supervisor-subordinate” relationship between the control units connected to the Safe Bus. All Plutos are “supervisor” units and can see each others’ inputs and outputs. Using this concept, each Pluto can make decisions about its own immediate safety environment.

This concept enables simple communication and easy alterations of the safety system. With the use of a “Gateway” device, information from a Pluto network can be transferred to other bus systems thereby creating even larger systems. Gateway units are readily available for a number of different bus-systems—i.e. Profibus DP, DeviceNet, CANopen, Profinet, Ethernet/IP and Modbus TCP.

Pluto offers an economic solution for both a single machine and for large integrated machine systems. Of Pluto B20’s I/O, 8 are dedicated as safety inputs, 8 can be configured as both safety inputs or outputs (sometimes even as inputs and outputs at the same time) and 4 are failsafe outputs independent of each other. 32 Plutos can be connected to a twisted pair safe bus system. This enables the amount of physical I/O connections to be expanded from 20 to 150 for the B20 family and 46 to 390 for the B46 family.



## ...to supervise safety devices!

Most safety devices on the market can be connected directly to the Pluto unit. When using dynamic sensors from ABB JOKAB SAFETY, the number of I/O points can be significantly reduced. These sensors enable Category 4 in a dynamic pulse system. Up to 10 sensors can be connected in series to one Input compared to two inputs for other manufacturers. For example, Eden non-

contact sensors, SPOT light beams and Tina adapters (interfacing to emergency stop push buttons, safety switches, etc.) can be connected in series to one input on the Pluto. Up to 150 safety devices can be connected to one Pluto B20 or 390 to one Pluto B46 and maintain Category 4 per EN 954-1 and ISO 13849-1 PL e.



Light Beams



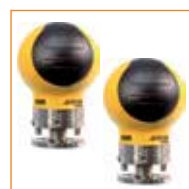
Light Curtains and Grids



3-Position Devices



Gate Switches and Sensors



Two-Hand Controls



Strips, Mats and Bumpers



Emergency Stop Buttons



## ...to save on inputs!

Pluto has inputs for static and/or dynamic sensors.  
Several sensors can be connected to one dynamic input in accordance with Category 4, PL e, SIL 3.

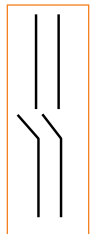
### One input...

Dynamic signals: 1 to 10 sensors while maintaining Category 4, PL e, SIL 3.



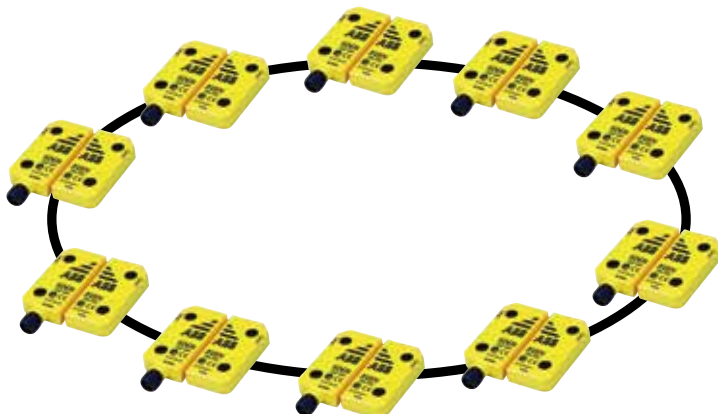
### Two inputs...

Static inputs: two mechanical switches per door while still maintaining Category 4, PL e, SIL 3.



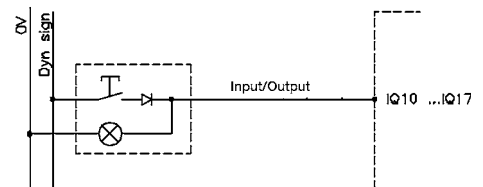
### One input...

Dynamic signals: 1 to 10 doors with one Eden per door while maintaining Category 4, PL e, SIL 3.



### One input...

I/O connections: can be used in three ways—inputs, outputs or both input and output at the same time (e.g. for a reset button with lamp indication).



# Pluto Safety PLC facilitates the design of your safety systems

Pluto is an All-Supervisor 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-Supervisor system means that each Pluto unit controls their outputs locally, while it is as easy to read other Pluto units' inputs as it is to read their own.

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. You can also connect speed and position sensors via the Pluto bus.

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.

## Regulations and Standards

The Pluto PLC is designed and approved in accordance with appropriate directives and standards. Examples of such are: EN 954-1/EN ISO 13849-1 Category 4, PL e, EN 61496-1 Type 4, EN 61508 SIL 3.



## Control of

- Safety products in dynamic and static circuits
- Electrically controlled actuators such as contactors, valves, motors
- Indicators and buttons

## Applications

- Emergency stops
- 3-Position devices
- Interlocked gates/hatches
- Safety mats
- Light curtains
- Light beams
- Two-hand devices
- Contact strips
- Foot-operated switches
- Timing functions
- Logic functions
- Math functions
- Speed monitoring functions
- Muting (bypassing)

## Features

- A Safety PLC for each part of a system
- Modular machine design
- Great flexibility
- Up to 10 sensors in series connected to one input
- Software Pluto Manager included with purchase
- Custom made safety bus

## Approvals

TÜV Rheinland



## Current monitoring (Pluto A20 only)

Pluto A20 differs from the other models in that it can monitor the current through the IQ16 and IQ17 I/O. 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.

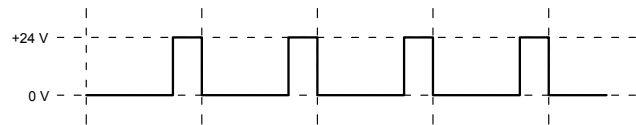
## Pluto D20 and D45 - with analog inputs

Pluto D20 is equipped with 4, and Pluto D45 with 8, safe 4-20mA/0-10V analog inputs. These can be configured as either "ordinary" failsafe inputs, as analog inputs 0-10V or as analog inputs 4-20mA. For an application to reach SIL 3/PL e, it is required that two sensors in parallel with one input each are being used.

## Counter inputs Pluto D45

For Pluto D45 four of the analog inputs can be configured as counter inputs (pulse counting) which work for frequencies up to 14000 Hz. As counter inputs IA0 – IA3 can be used in two ways, Up counting or Up/Down counting.

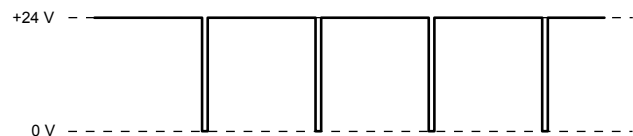
## Technical info - Dynamic signal



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).

## Technical info - 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.

## Technical info - 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.

## Technical info - 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).

## Technical info - Q - individual failsafe outputs

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

## Technical info - 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.

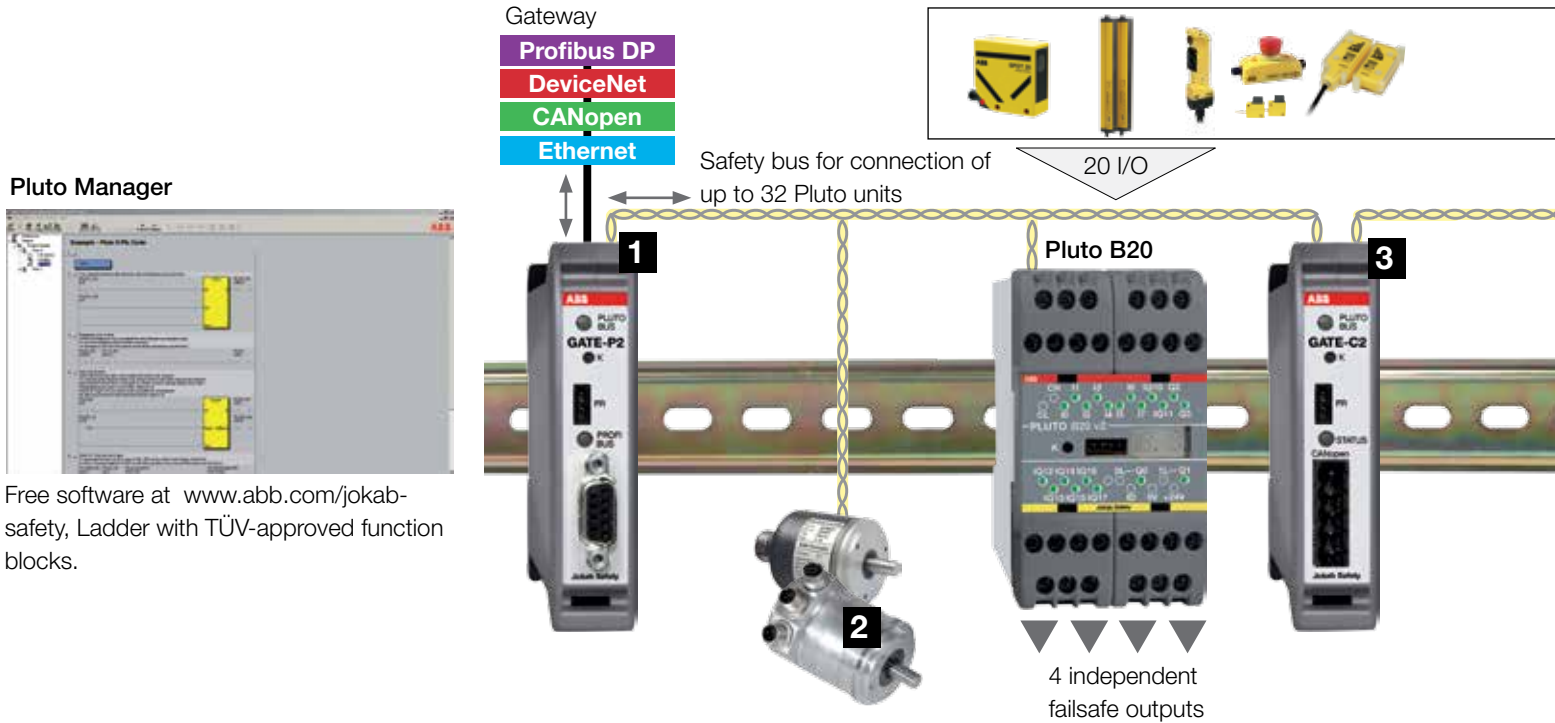
## Technical info - Pluto-bus

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.

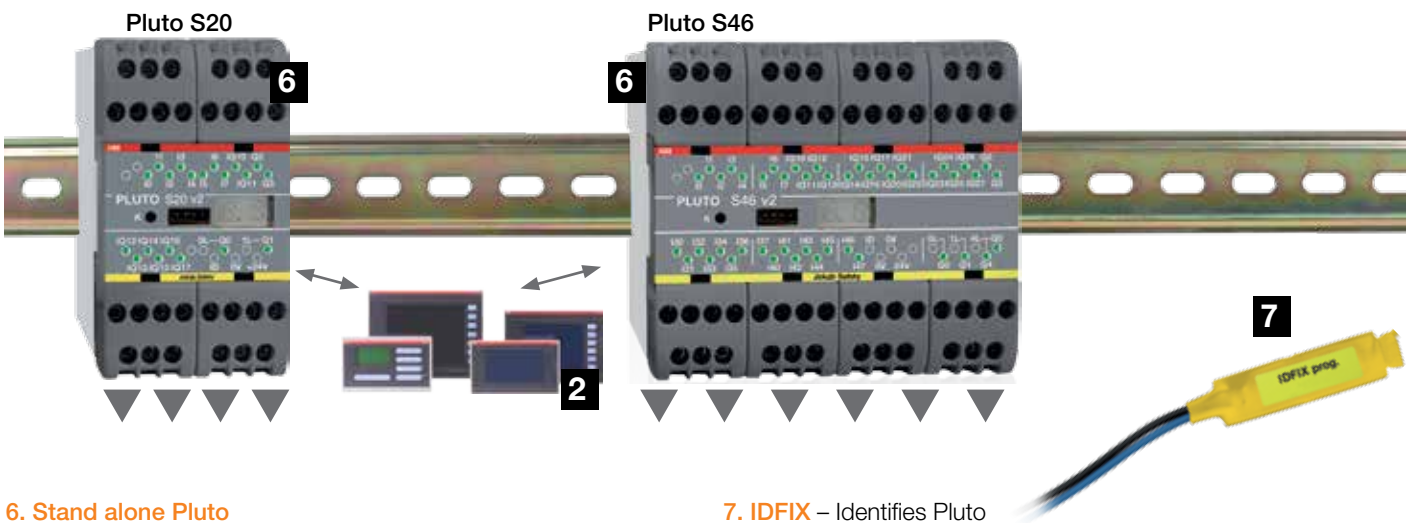
# Connection examples for Pluto with Safety Bus

**1. Gateway** – For two-way bus communication between Pluto and other control systems.

**2. Absolute Encoder** – 8 single turn or multi turn absolute encoders can be connected directly to the Safety Bus.



# Connection examples for Pluto without a Safety Bus



**6. Stand alone Pluto**

Same functionality as other Plutos, but without Safety Bus connections.

**7. IDFIX** – Identifies Pluto

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.

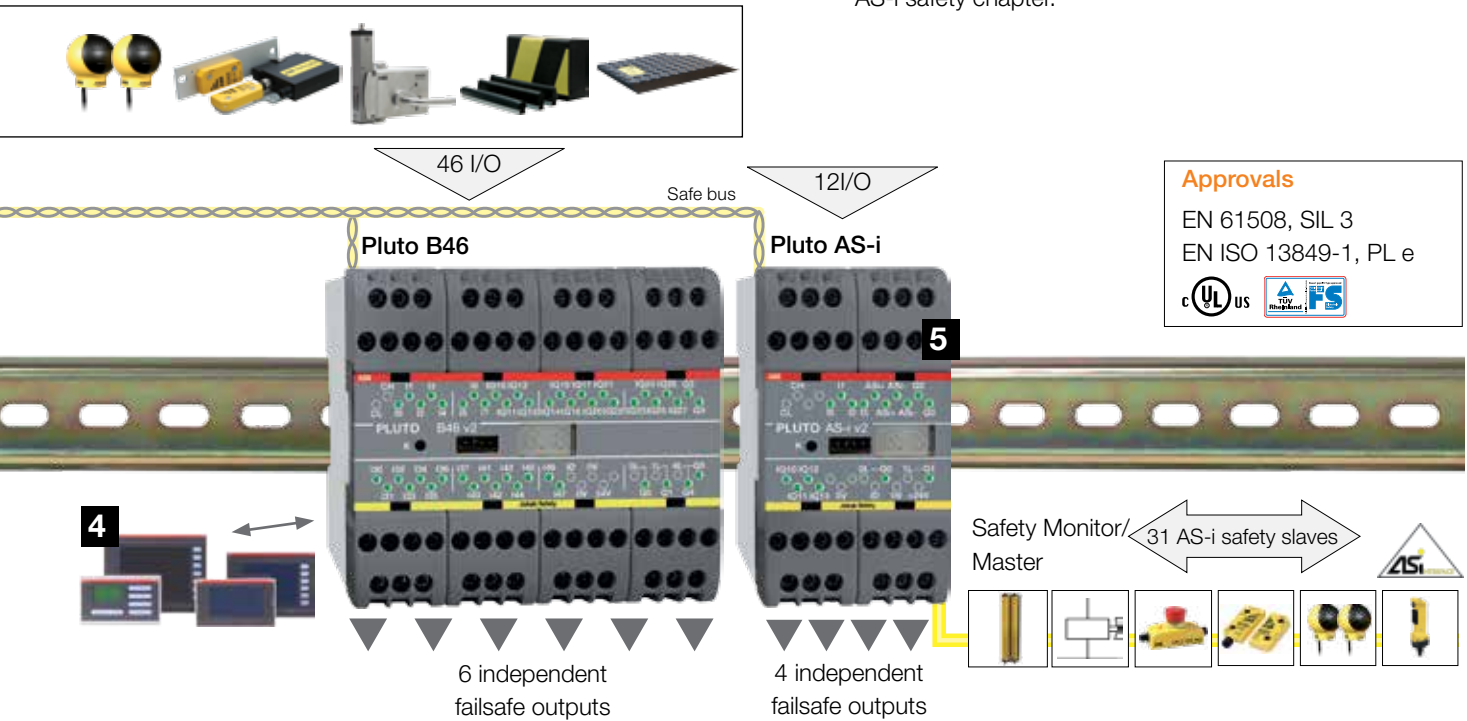


**3. Pluto bridge** – With a Gateway it is possible to:

- Increase the Safety Bus length
- Use different bus speeds for each section
- Filter information from one section to reduce the load on the Safety Bus.

**4. HMI** – An HMI operator panel can communicate with Pluto in both directions. Connection can be made direct to the front of the Pluto.

**5. Pluto AS-i** – Can either be AS-i master on the AS-i bus or work together with an AS-i master as a monitor. It includes AS-i nodes, analog and digital outputs, as well as safety outputs. Also available as Pluto B42 AS-i for more I/O. For more information see the AS-i safety chapter.



**Overview Pluto Safety-PLC**

Model	S20	S46	A20	B22	D20	D45	B20	B46	AS-i	B42 AS-i
Number of I/O	20	46	20	22	20	45	20	46	12	42
Failsafe inputs	8	24	8	14	8	24	8	24	4	20
Failsafe inputs or non-failsafe outputs	8	16	8	8	8	15	8	16	4	16
Analog inputs 0-10V/4-20mA	-	-	-	-	4	8*	-	-	-	-
Counter inputs	-	-	-	-	-	4*	-	-	-	-
Analog inputs (0-27V)	1	3	1	1	1	3	1	3	4	3
Failsafe relay outputs	2	4	2	-	2	4	2	4	2	4
Failsafe transistor outputs	2	2	2	-	2	2	2	2	2	2
Pluto bus	-	-	●	●	●	●	●	●	●	●
Pluto AS-i bus	-	-	-	-	-	-	-	-	●	●
Current monitoring	-	-	2	-	-	-	-	-	-	-
Dimensions (b x h x d) mm	45 x 84 x 118	90 x 84 x 118	45 x 84 x 118	45 x 84 x 118	45 x 84 x 118	90 x 84 x 118	45 x 84 x 118	90 x 84 x 118	45 x 84 x 118	90 x 84 x 118
Supply voltage	24VDC	24VDC	24VDC	24VDC	24VDC	24VDC	24VDC	24VDC	24VDC	24VDC

\*4 of the analog inputs can be configured as counter inputs. The total number of analog inputs + counter inputs = 8.

# Pluto D20 and Pluto D45

## New safety PLC module with Analog Inputs



### ABB JOKAB SAFETY has expanded the range of Pluto Safety PLC modules.

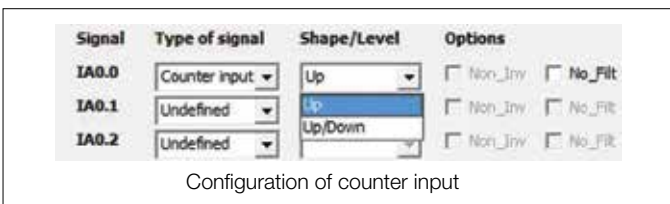
The new unit, Pluto D20, is a 45 mm wide module with 4 safe analog inputs. The I/O configuration is the same as for Pluto B20, but with the added feature that 4 of the inputs can be used as either ordinary safe inputs or as safe analog inputs.

### Analog inputs Pluto D20 and D45

Pluto D20 is equipped with 4, and Pluto D45 with 8, safe 4-20mA/0-10V analog inputs. These (D20: IA0 – IA3, D45: IA0 – IA7) can be configured as either “ordinary” failsafe inputs, as analog inputs 0-10V or as analog inputs 4-20mA. (For D45 IA0 – IA3 can also be configured as counter inputs, see below.) For an application to reach SIL 3/PL e it is required that two sensors in parallel with one input each must be used. See Pluto Programming Manual.

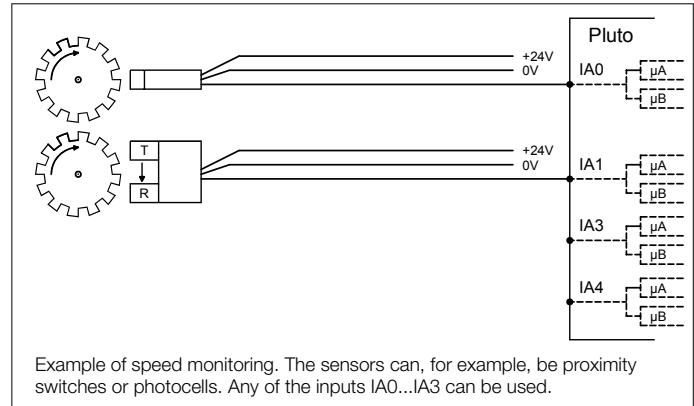
### Counter inputs Pluto D45

For Pluto D45 the inputs IA0 – IA3 can be configured as counter inputs (pulse counting) which work for frequencies up to 14000 Hz. As counter inputs IA0 – IA3 can be used in two ways, Up counting or Up/Down counting.



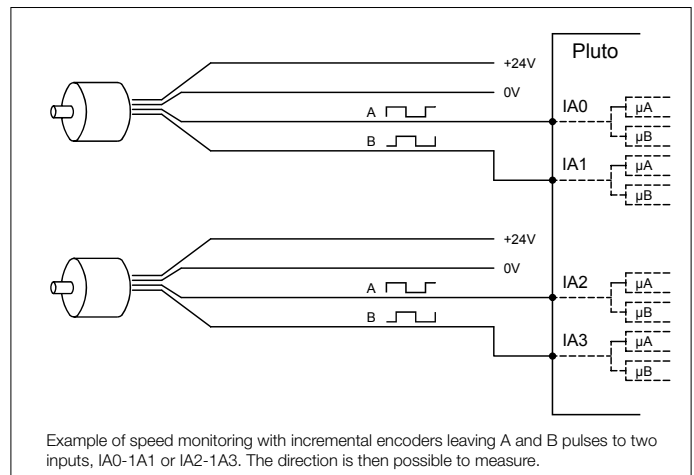
### Up count

When the input is configured for Up count Pluto counts the pulses on the input. Via a function block the user gets the pulse rate which for example can represent a speed. The sensor is typically an inductive sensor, photocell or incremental encoder (HTL, 24V). For description of the use of Function blocks see Pluto Programming Manual.



### Up/Down count

Input IA0 and IA2 can be configured as Up/Down counters. When this is done the next input (IA1 or IA3) is automatically reserved for Up/Down counting. This means that for Up/Down counting IA0-IA1 are a pair and IA2-IA3 are another pair. In order to make up/down counting it requires that the sensors can produce A/B-pulses. A/B-pulses are two square wave signals that are 90° phase shifted to each other. For description of the use of Function blocks see Pluto Programming Manual.



### Disabling of test pulses

For Pluto A20 v2, B20 v2, S20 v2 and Pluto D20, the test pulses can be disabled via Pluto Manager. See Pluto Programming Manual.

# Pluto D20 and Pluto D45

## Function blocks for Analog Inputs

### Configuration in Pluto Manager

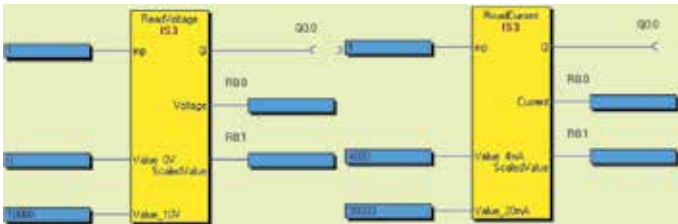
The inputs can be configured under “I/O Options” in Pluto Manager. If the inputs are configured as Analog inputs, the function blocks “ReadVoltage” or “ReadCurrent” shall be used. If, for a D45, the inputs are configured as Counter inputs, the function blocks “HS\_SpeedCount” shall be used. All these function blocks are included in the “Analog01.fps” library.



IA0.0 and IA0.1 are configured as Analog input 0-10V, and IA0.2 and IA0.3 are configured as Analog input 4-20mA.

### ReadVoltage and ReadCurrent function blocks

For analog input 0-10V the function block “ReadVoltage” is needed, and for analog input 4-20mA the function block “ReadCurrent” is needed. There are also 32-bit versions of these function blocks (“ReadVoltage\_32” and “ReadCurrent\_32”) for use with Double Registers.



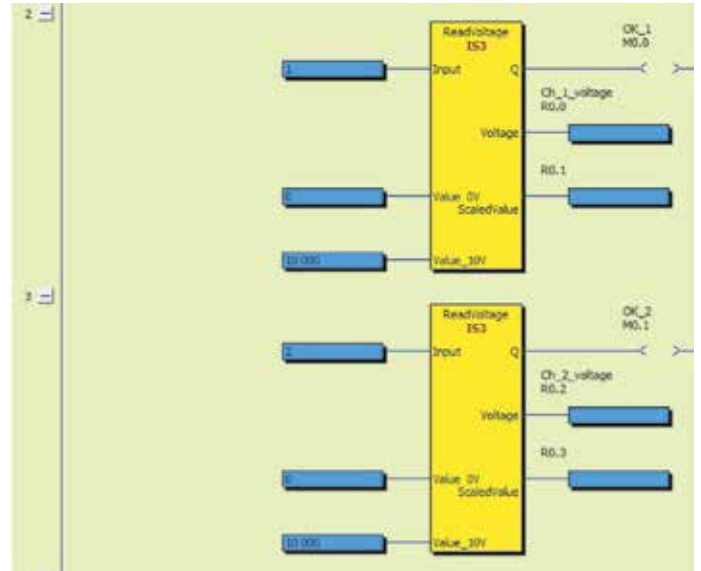
#### ReadVoltage function block. Description of inputs and outputs:

inp	Input connected to the block.
Value 0V	Input value for scaling. At 0V the output “Scaled value” will show this value.
Value 10V	Input value for scaling. At 10V the output “Scaled value” will show this value.
Q	OK output. Value is within range.
Voltage	Output with calibrated absolute value in mV.
Scaled Value	Output with scaled value.

#### ReadCurrent function block. Description of inputs and outputs:

inp	Input connected to the block.
Value 4mA	Input value for scaling. At 4mA the output “Scaled value” will show this value.
Value 20mA	Input value for scaling. At 20mA the output “Scaled value” will show this value.
Q	OK output. Value is within range.
Current	Output with calibrated absolute value in $\mu$ A.
Scaled Value	Output with scaled value.

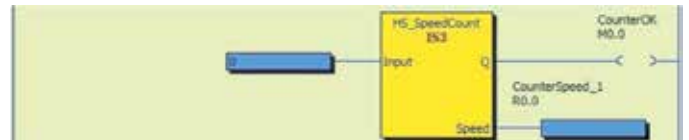
Note: For an application to reach SIL 3/PL e two sensors in parallel, with one analog input and one function block each, must be used.



Example: Both channel 1 and channel 2 need to be at least 5V in order to set “Voltage\_OK”.

### HS\_SpeedCount function block

For D45 with inputs configured as “Counter input” the function block “HS\_SpeedCount” shall be used.



#### HS\_SpeedCount function block. Description of inputs and outputs:

inp	Input connected to the block.
Q	OK output. Value is within range.
Speed	Output for speed value in pulses/10ms. Shall be connected to a register (R).

### Description

The function block reads a high speed counter input configured as “Counter input” (I/O options). When an input is configured to “Counter input” the choice “Up” or “Up/Down” is given.

#### Up count:

If the input is configured for Up count the output Speed always shows a positive value. The function block simply counts the amount of pulses coming on the input during 10 ms (1 program cycle).

#### Up/Down count:

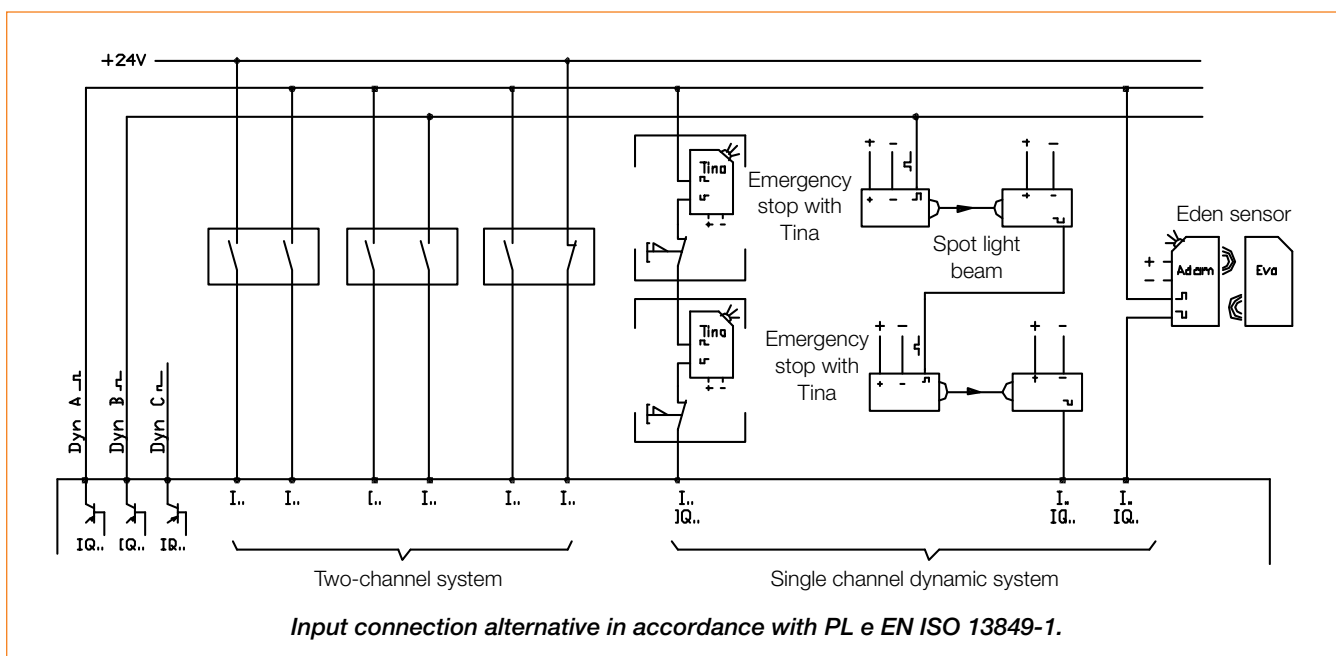
A pair of inputs e.g. IA0 and IA1, can be configured for “Up/Down” count. The direction of a motion can then be determined which is shown by a positive or negative value on the output Speed. The requirement for determination of direction is that the sensor connected to the input pair gives pulses that are 90° phase shifted to each other, A/B pulses. This is a common standard for incremental encoders.

# 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.

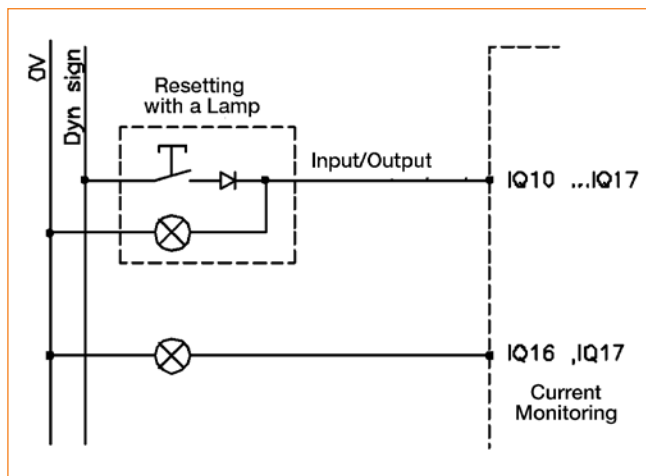
In a two-channel system both channels will be measured, using two different signals. The system will therefore be able to detect a short-circuit between the channels.

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.



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

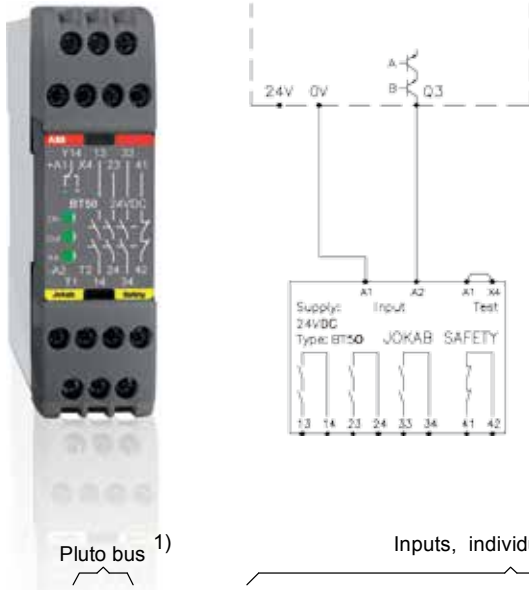
Both a lamp and a pushbutton can be connected to the same terminal. This function is for resetting safety devices and to reduce the number of I/Os used.



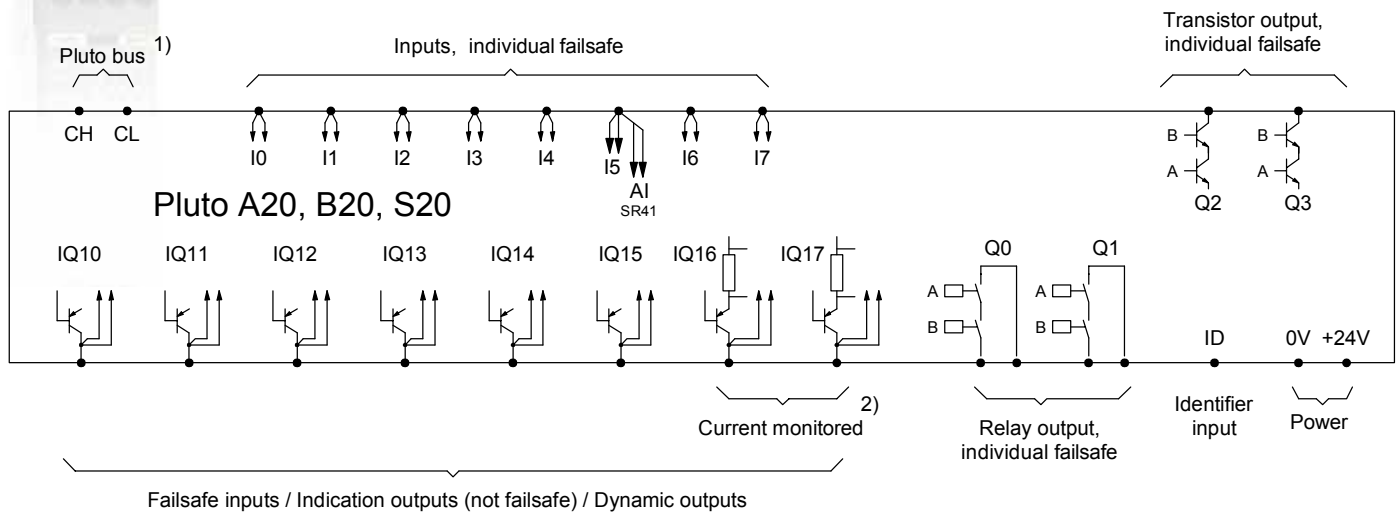


# I/O Overview

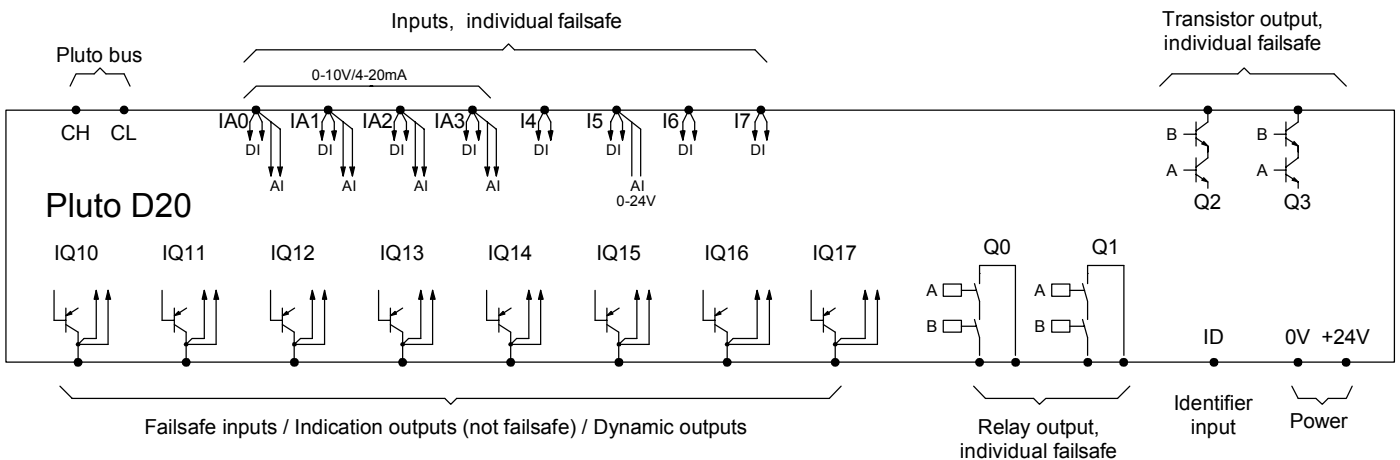
## Output connector expansion



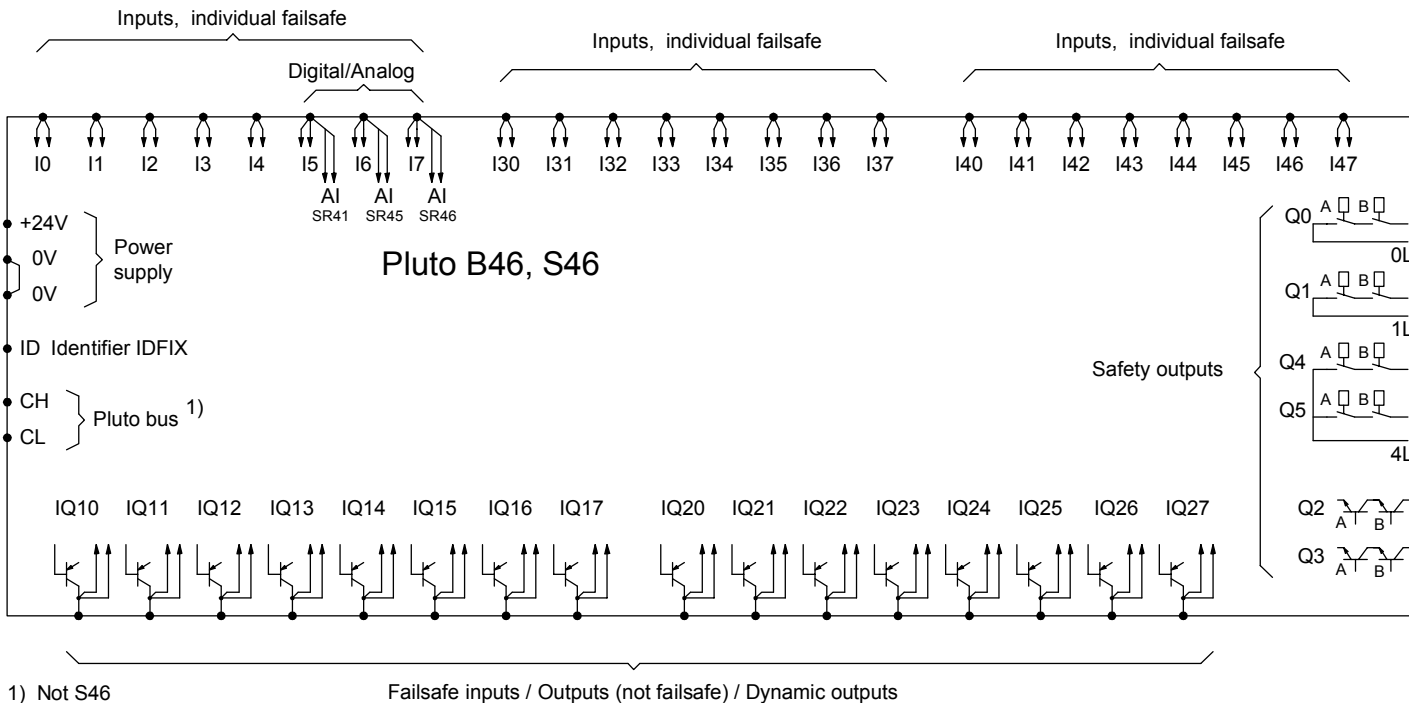
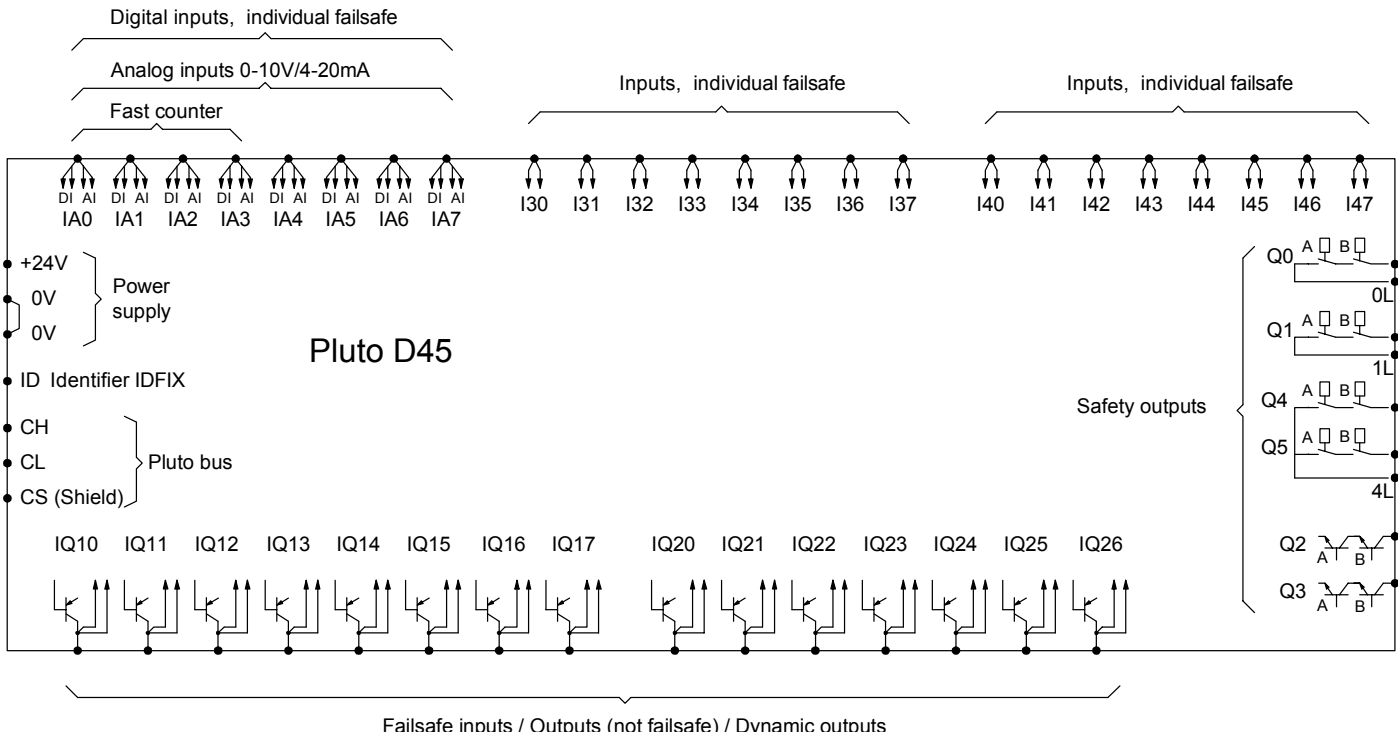
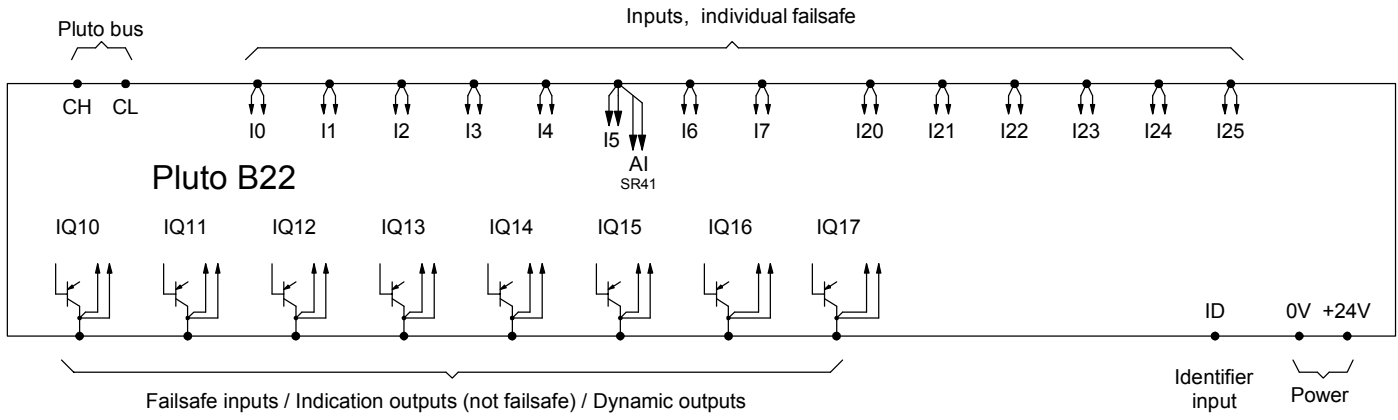
Using an expansion relay, such as BT50, the number of safe outputs in Pluto can be expanded. The connection shall be made as shown in the figure. Several expansion relays can be connected to a single Pluto safety output while retaining the safety level.



- 1) Not S-models, S20,...
- 2) Current monitored only on A20

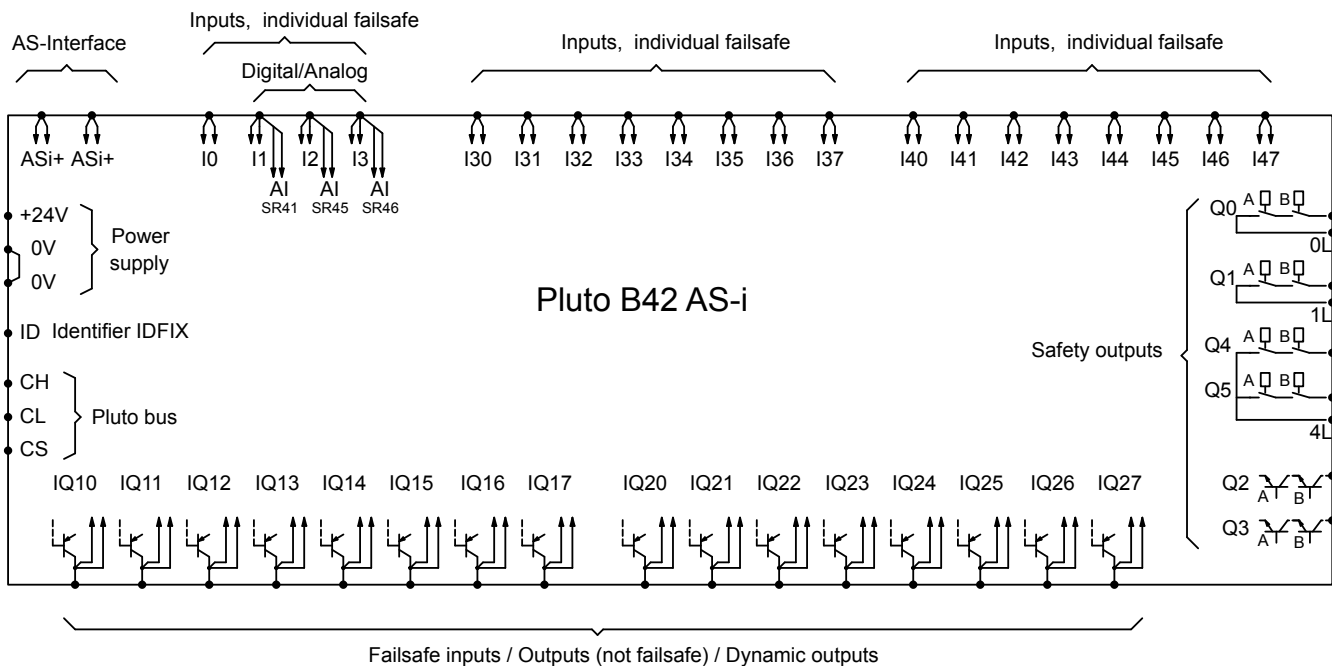
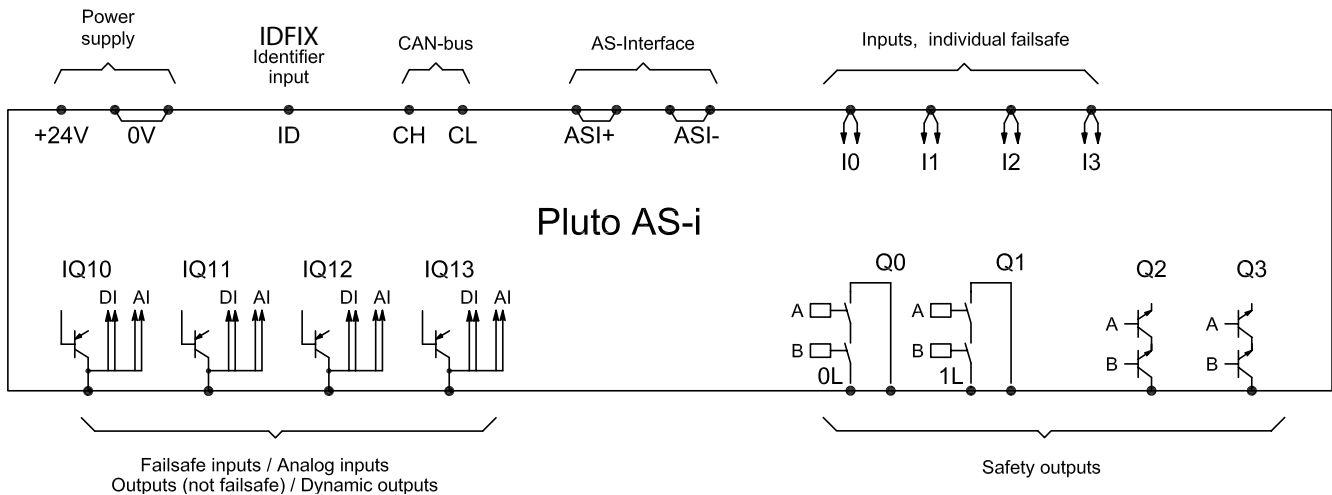


# I/O Overview



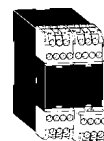
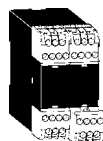
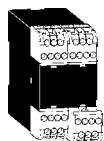
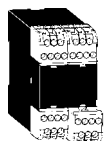
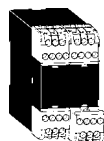
1) Not S46

# I/O Overview



- 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 failsafe. 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.

## Technical data Type-specific



	Pluto A20 v2	Pluto B20 v2	Pluto B22	D20	Pluto S20 v2
	20 I/O	20 I/O	22 I/O	20 I/O	20 I/O
	Current monitoring			Analog inputs	Without safety bus
Article number	2TLA020070R4500	2TLA020070R4600	2TLA020070R4800	2TLA020070R6400	2TLA020070R4700
Failsafe inputs	8 (I0..I7)	8 (I0..I7)	14 (I0..I7, I20..I25)	8 (I0..I7)	8 (I0..I7)
Failsafe inputs or non-failsafe outputs	8 (IQ10..IQ17)	8 (IQ10..IQ17)	8 (IQ10..IQ17)	8 (IQ10..IQ17)	8 (IQ10..IQ17)
Max total load	Max total load 2.5 A	Max total load 2.5 A	Max total load 2.5 A	Max total load 2.5 A	Max total load 2.5 A
Analog inputs (0-10V/4-20 mA)	-	-	-	4	-
Counter inputs	-	-	-	-	-
Analog inputs (0-27V)	1 (I5)	1 (I5)	1 (I5)	1 (I5)	1 (I5)
Failsafe relay outputs	2 (Q0..Q1)	2 (Q0..Q1)	-	2 (Q0..Q1)	2 (Q0..Q1)
Failsafe transistor outputs	2 (Q2..Q3)	2 (Q2..Q3)	-	2 (Q2..Q3)	2 (Q2..Q3)
Current monitoring	2 (IQ16, IQ17)	-	-	-	-
	0-1.0 A ±10%				
Pluto safety bus	•	•	•	•	-
Pluto AS-i bus	-	-	-	-	-
Own current consumption	100...300 mA	100...300 mA	100...300 mA	100...300 mA	100...300 mA
Recommended external fuse	6A	6A	6A	6A	6A
Dimensions (w x h x d)	45 x 84 x 118 mm	45 x 84 x 118 mm	45 x 84 x 118 mm	45 x 84 x 118 mm	45 x 84 x 118 mm

## Technical data General

Color	Grey
Operating voltage	24 VDC ±15%
Installation	35 mm DIN rail
Electrical insulation	Category II in accordance with IEC 61010-1
Safety level	
EN 954-1	Cat. 4
EN ISO 13849-1	PL e/Cat. 4
EN 61508	SIL 3
EN 62061	SIL 3
PFH <sub>b</sub>	
Relay output	2.00×10 <sup>-9</sup>
Transistor output:0	1.50×10 <sup>-9</sup>
Failsafe inputs I & IQ	
I0..7 (I30..37, I40..47)	+24 V (for PNP sensors)
IQ10..17 (IQ20..27)	+24 V (for PNP sensors) IQ also configurable as non-failsafe outputs.
Current at 24 V	5.1 mA
Max. overvoltage	27 V continuous

### Failsafe outputs Q

Q2, Q3  
Output voltage tolerance  
Q0, Q1, (Q4, Q5)

Transistor, -24VDC, 800 mA  
Supply voltage - 1.5 V at 800 mA  
Relay outputs  
VAC-12: 250 V/1.5 A  
VAC-15: 250 V/1.5 A  
VDC-12: 50 V/1.5 A  
VDC-13: 24 V/1.5 A

### Non-failsafe outputs Q

IQ10..17 (IQ20..27)

Transistor +24V, PNP "open collector" also configurable as failsafe inputs.  
800 mA

Max. current/output

### Indicator

Input/output LED

1 per I/O (green)

Display

7-segments, two characters

### Pluto safety bus

Max number of Pluto units on the databus

32

Databus type

CAN

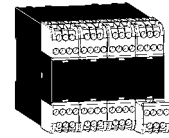
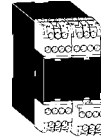
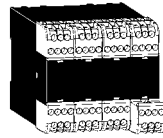
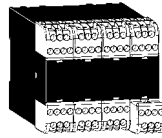
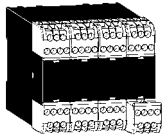
Databus speeds

100, 125, 200, 250, 400, 500, 800, 1000 kb/s

Databus cable length

Up to 600 m, 150 m at 400 kb/s





Pluto B46 v2	Pluto D45	Pluto S46 v2	Pluto AS-i v2	Pluto B42 AS-i
46 I/O	45 I/O	46 I/O	AS-i bus	AS-i bus
	Analog/counter inputs	Without safety bus		
2TLA020070R1700	2TLA020070R6600	2TLA020070R1800	2TLA020070R1100	2TLA020070R1400
24 (I0..I7, I30..I37, I40..I47)	24 (I0..I7, I30..I37, I40..I47)	24 (I0..I7, I30..I37, I40..I47)	4 (I0..I3)	20 (I0..I3, I30..I47)
16 (IQ10..IQ17, IQ20..IQ27)	15 (IQ10..IQ17, IQ20..IQ26)	16 (IQ10..IQ17, IQ20..IQ27)	4 (IQ10..IQ13)	16 (IQ10..IQ27)
Max total load 2A	Max total load 2A	Max total load 2A	Max total load 2A	Max total load 2A
–	8*	–	–	–
–	4*	–	–	–
3 (I5..I7)	3 (IQ10..IQ12)	3 (I5..I7)	4 (IQ10..IQ13)	3 (I1..I3)
4 (Q0..Q1 & Q4..Q5)	4 (Q0..Q1 & Q4..Q5)	4 (Q0..Q1 & Q4..Q5)	2 (Q0..Q1)	4 (Q0..Q1 & Q4..Q5)
2 (Q2..Q3)	2 (Q2..Q3)	2 (Q2..Q3)	2 (Q2..Q3)	2 (Q2..Q3)
–	–	–	–	–
•	•	–	•	•
–	–	–	•	•
100...500 mA	100...500 mA	100...500 mA	100 mA	150 mA
10A	10A	10A	6A	10A
90 x 84 x 118 mm	90 x 84 x 118 mm	90 x 84 x 118 mm	45 x 84 x 118 mm	90 x 84 x 118 mm

#### Pluto AS-i bus

Master profile	M2
Number of slave units	31/62*
Bus operation mode	Master
	Safety monitor
	Safety monitor, slave and safe I/O module.
	Up to 500 m
Bus cable length:	100 m between each repeater

#### 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
AS-i bus to relay output	<33 ms + prog. execution time
AS-i bus to transistor output	<29 ms + prog. execution time

#### Additional response times

Databus between Pluto units	10 ms
Databus between Pluto units at fault condition	10–40 ms

#### Enclosure classification

Enclosure	IP40, IEC 60 529
Connection terminals	IP20, IEC 60 529

The terminal blocks are detachable without needing to disconnect the wiring. The units shall be assembled with a gap of at least 5 mm.

# Application example

## Robot cell with Pluto



### 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

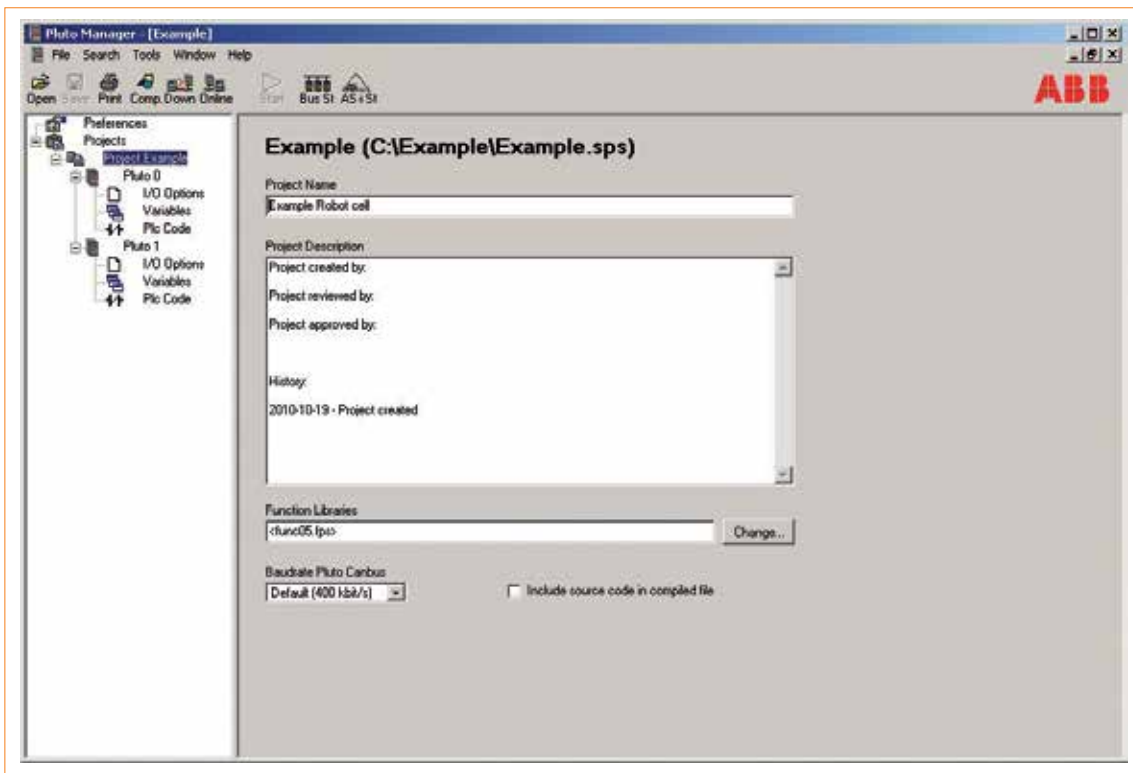
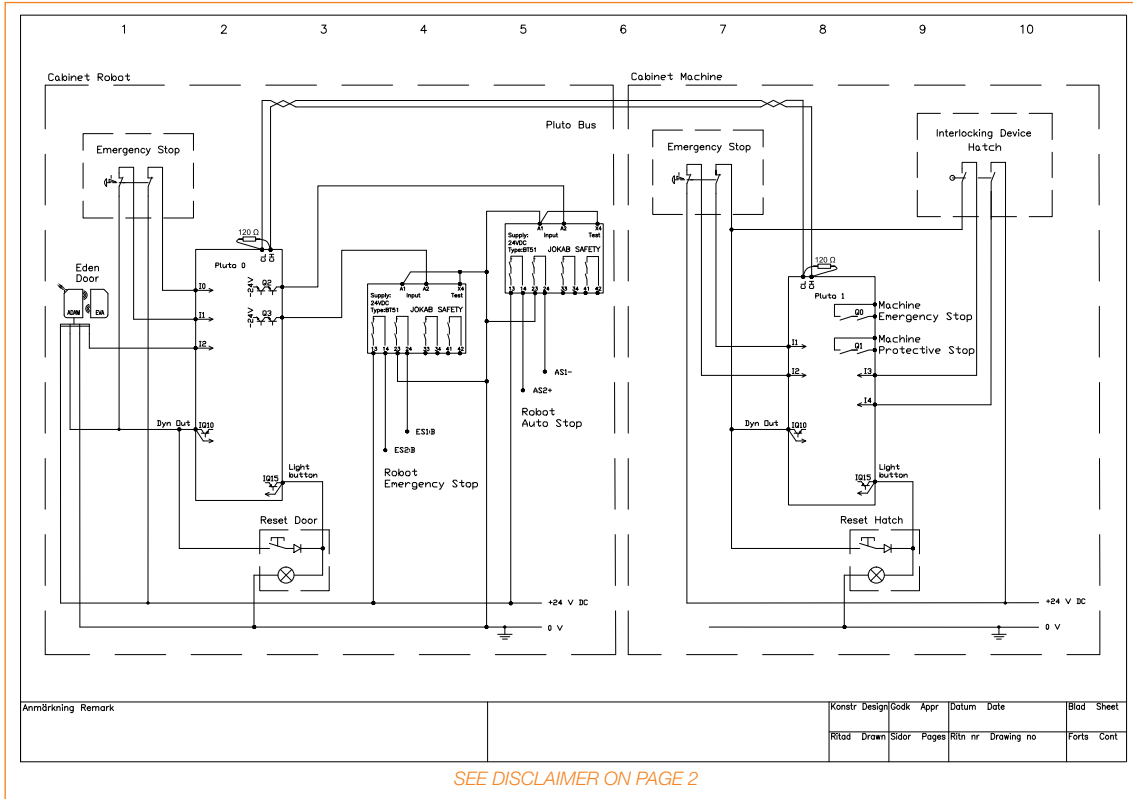
Emergency stop takes priority and will stop both the machine and the robot. The machine hatch acts as the zone divider, when the hatch is closed the machine forms one zone and the robot another zone. When the machine hatch is open, both the machine and the robot belong to the same zone. If the door is 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.

*Note: The cell operating cycle must not start immediately on resetting the emergency stop or the door.*

# Application example

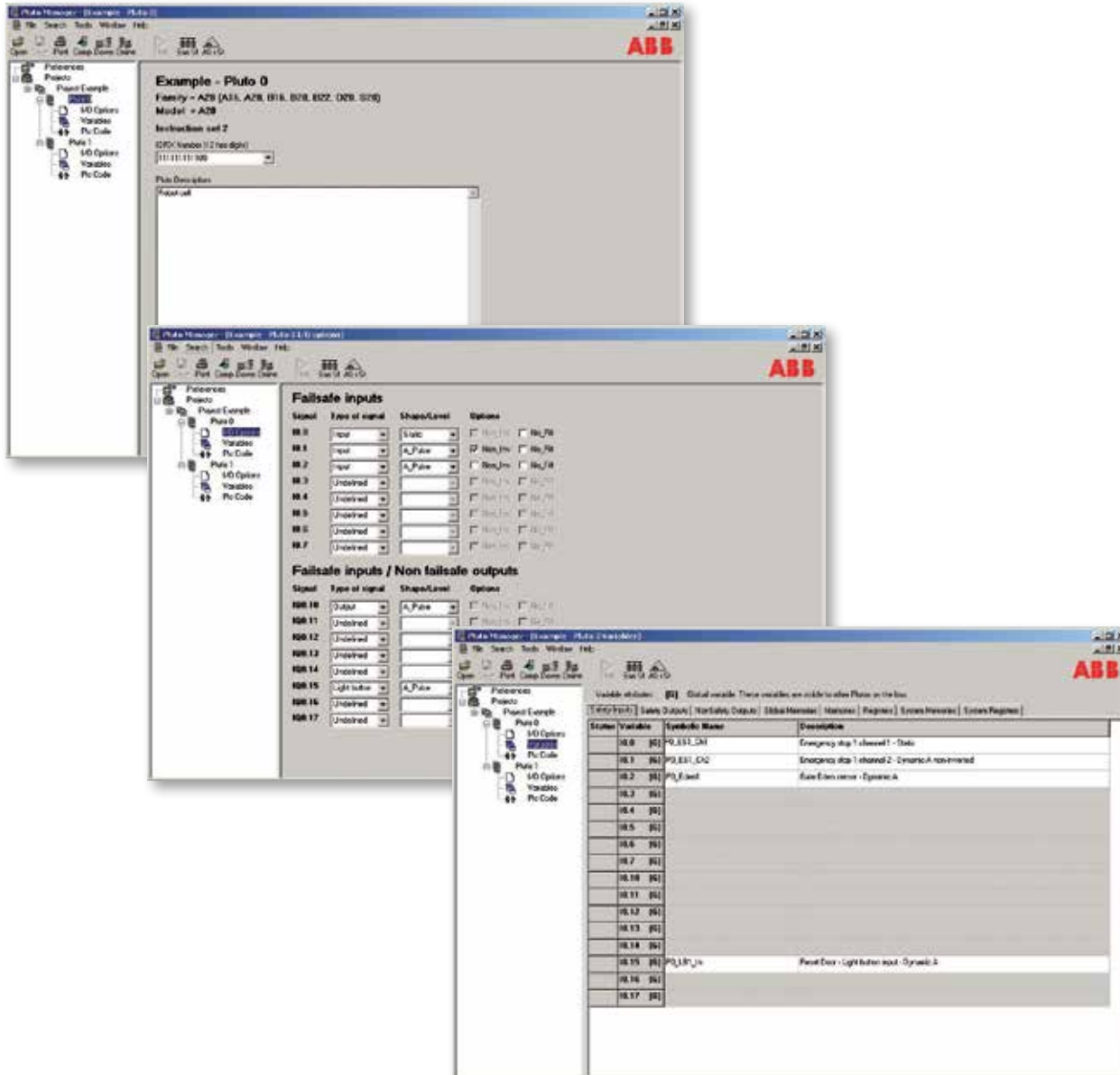
## Electrical connections



# Application example

## Pluto 0 settings

### Robot cabinet



### Pluto 0

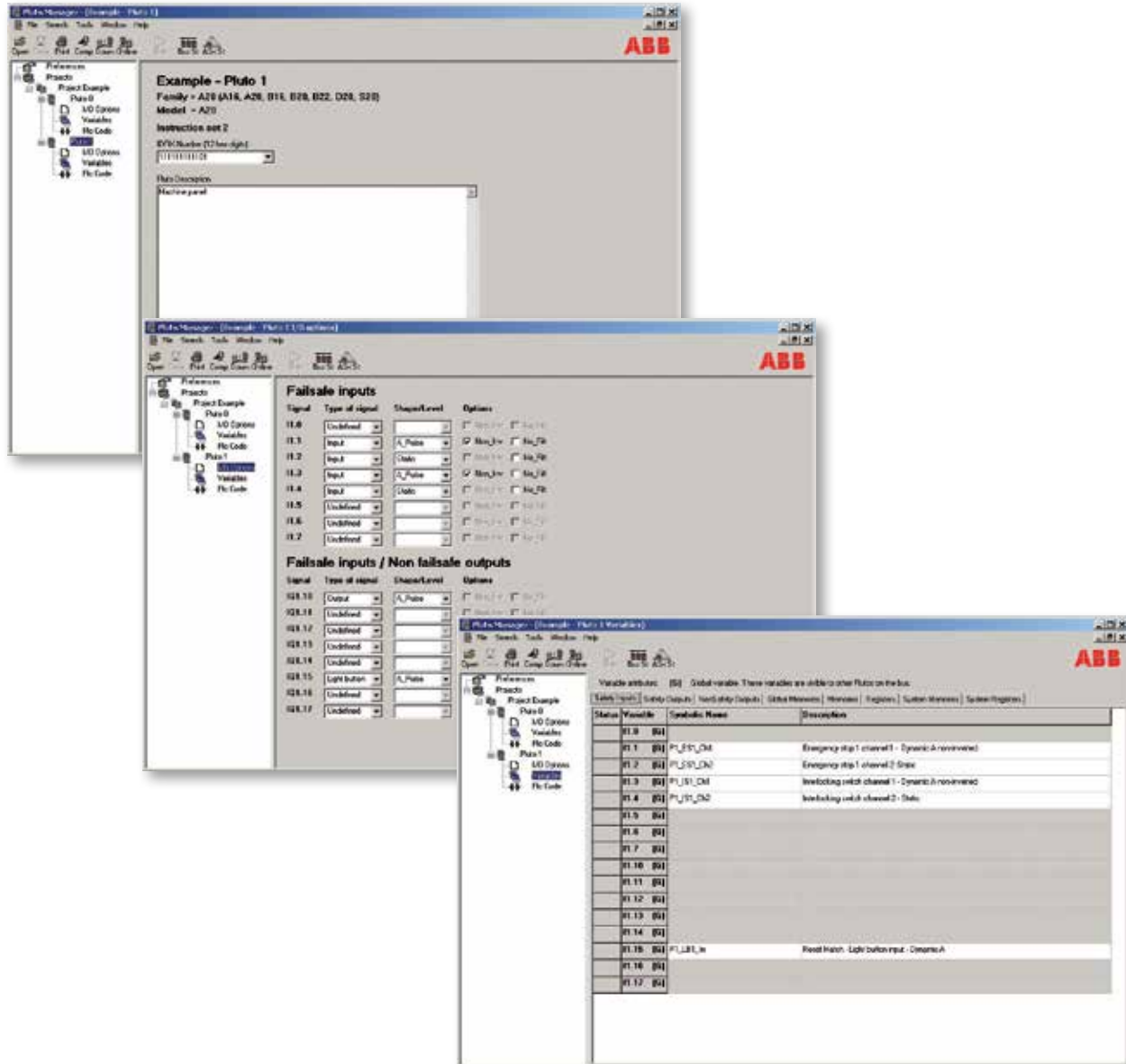
- IO.0=P0\_ES1\_Ch1: Emergency stop 1 channel 1 - Static
- IO.1=P0\_ES1\_Ch2: Emergency stop 1 channel 2 - Dynamic A non-inverted
- IO.2=P0\_Eden1: Door Eden sensor - Dynamic A
- IO.15=P0\_LB1\_In: Reset Door - Light button input - Dynamic A
- Q0.2=P0\_AS\_OK: Robot auto stop - Expansion BT50 relay
- Q0.3=P0\_ES: Robot emergency stop - Expansion BT50 relay
- GM0.0=P0\_ES\_OK: Emergency stop OK in Pluto 0



# Application example

## Pluto 1 settings

### Machine cabinet



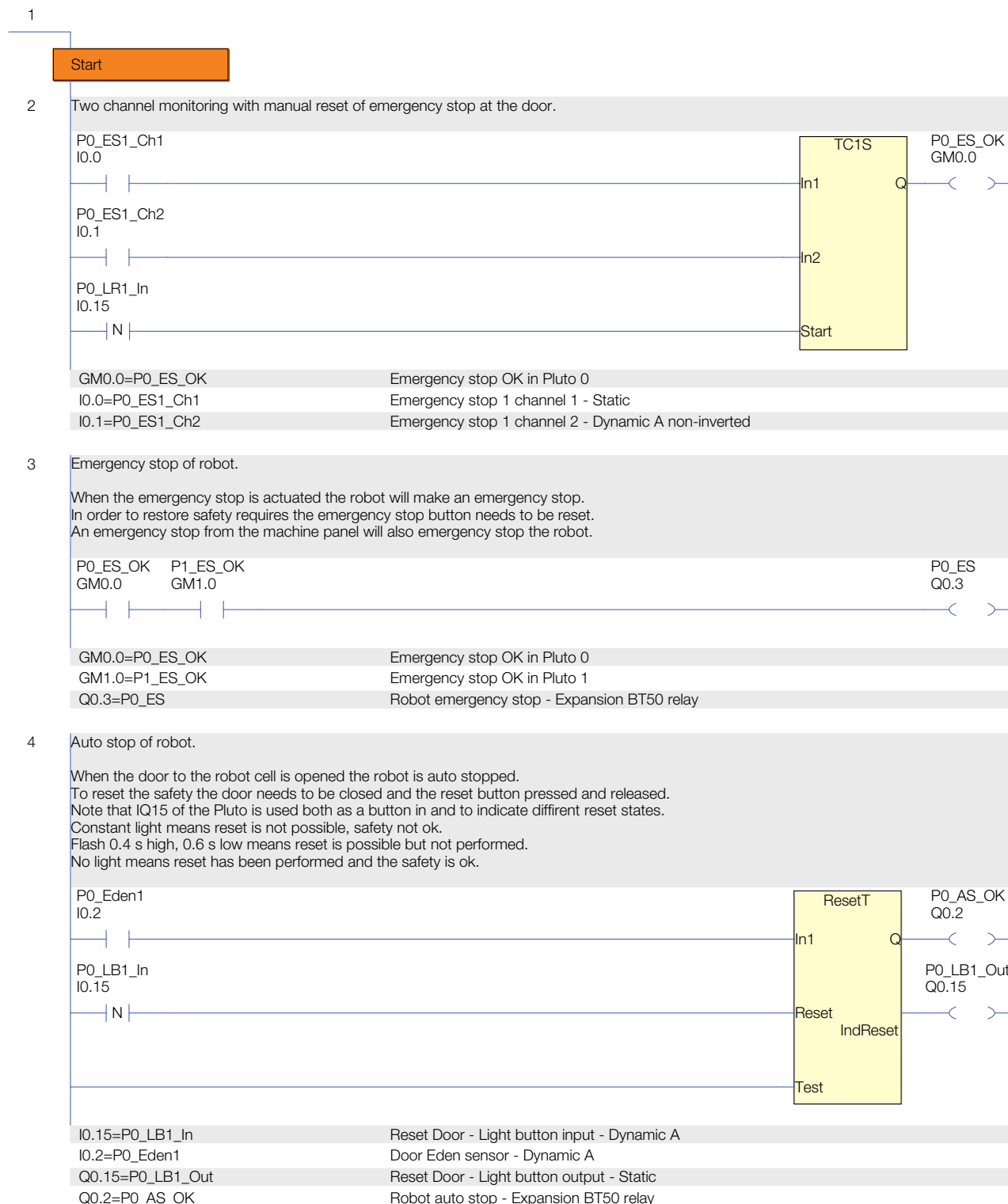
### Pluto 1

- I1.1=P2\_ES1\_Ch1: Emergency stop 1 channel 1 - Dynamic A non-inverted
- I1.2=P2\_ES1\_Ch2: Emergency stop 1 channel 2 -Static
- I1.3=P2\_IS1\_Ch1: Interlocking switch channel 1 - Dynamic A non-inverted
- I1.4=P2\_IS1\_Ch2: Interlocking switch channel 2 - Static
- I1.15=P2\_LB1\_In: Reset Hatch - Light button input - Dynamic A
- Q1.0=P2\_ES: Machine Emergency stop
- Q1.1=P2\_PS: Machine protective stop
- GM1.0=P2\_ES\_OK: Emergency stop OK in Pluto 1
- GM1.1=P2\_Hatch\_OK: Hatch closed

# Application example

## PLC Code Pluto 0 settings

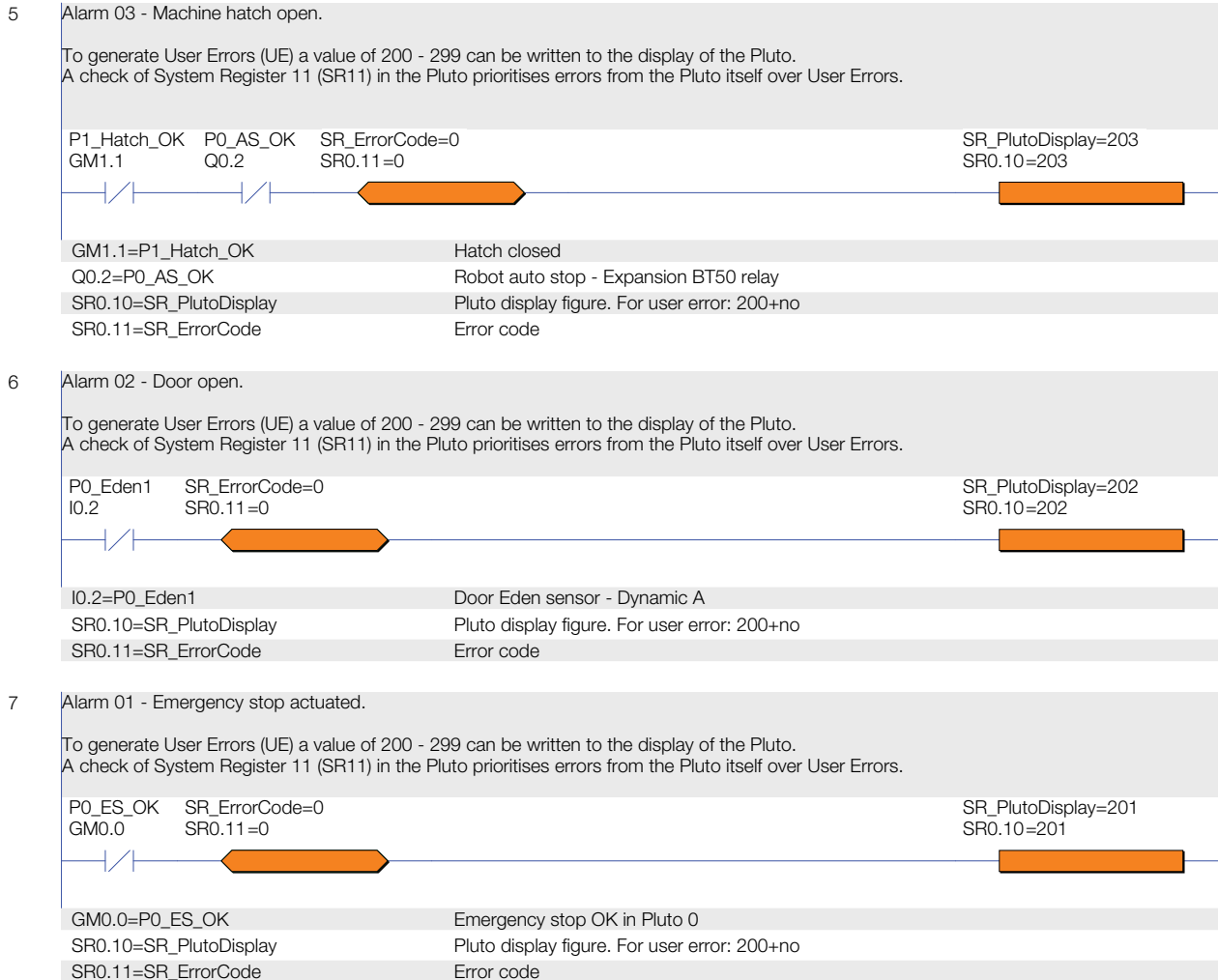
### Robot cabinet



# Application example

## PLC Code Pluto 0 settings

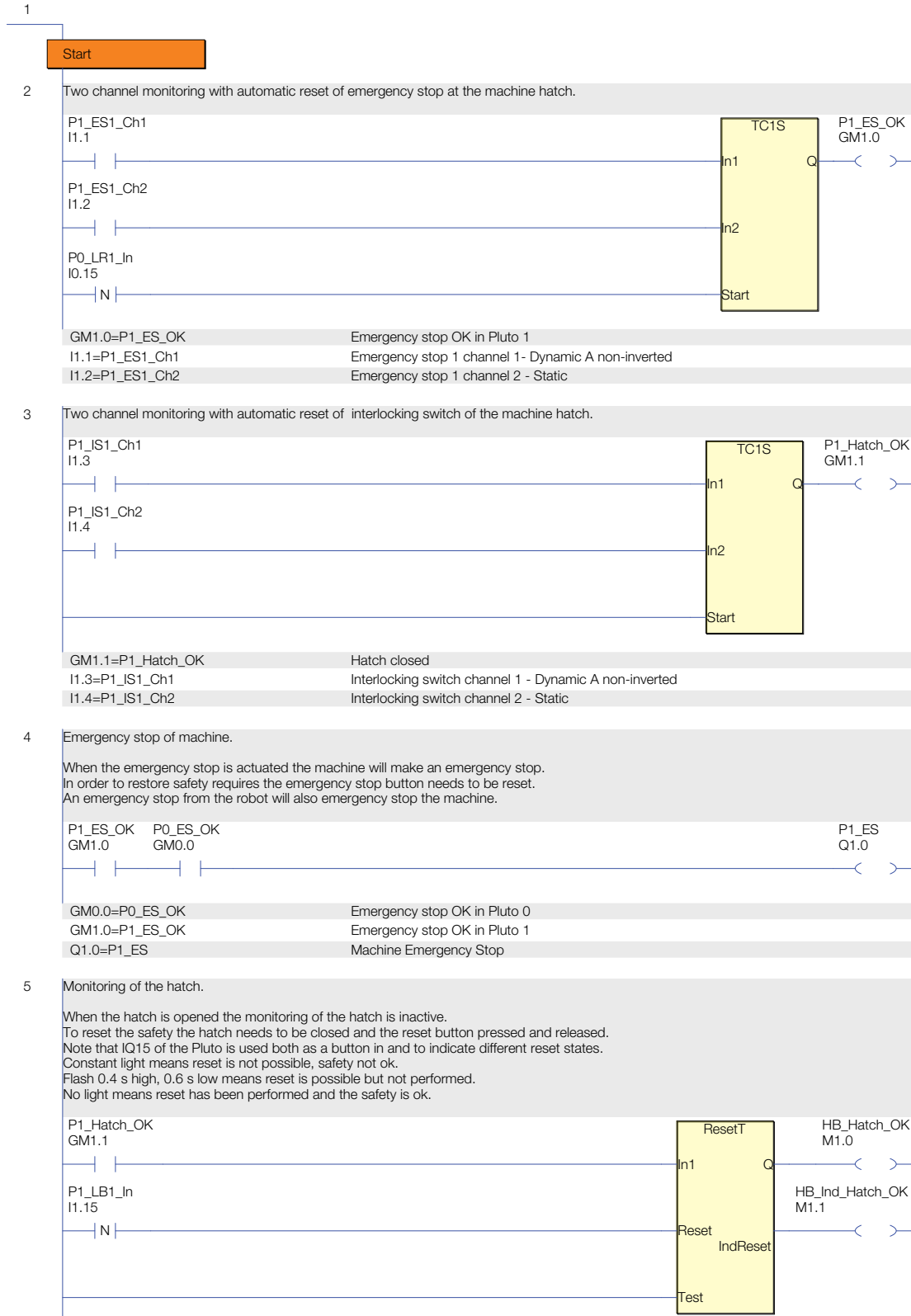
### Robot cabinet (continued)



# Application example

## PLC Code Pluto 1 settings

### Machine cabinet



# Application example

## PLC Code Pluto 1 settings

### Machine cabinet (continued)

	GM1.1=P1_Hatch_OK	Hatch closed	
	I1.15=P1_LB1_In	Reset Hatch - Light button input - Dynamic A	
	M1.0=HB_Hatch_OK	Help Bit - Hatch closed	
	M1.1=HB_Ind_Hatch_OK	Help Bit - Indication Reset Hatch	

6 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.

	M1.1=HB_Ind_Hatch_OK	Help Bit - Indication Reset Hatch	
	Q0.2=P0_AS_OK	Robot auto stop - Expansion BT50 relay	
	Q1.15=P1_LB1_Out	Reset Hatch - Light button output - Static	

7 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.

	M1.0=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	

8 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.

	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	
	SR1.11=SR_ErrorCode	Error code	

9 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.

	I0.2=P0_Eden1	Door Eden sensor - Dynamic A	
	SR1.10=SR_PlutoDisplay	Pluto display figure. For user error: 200+no	
	SR1.11=SR_ErrorCode	Error code	

10 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.

	GM1.0=P1_ES_OK	Emergency stop OK in Pluto 1	
	SR1.10=SR_PlutoDisplay	Pluto display figure. For user error: 200+no	
	SR1.11=SR_ErrorCode	Error code	



# Pluto Gateway

## GATE-P2



Profibus DP

DeviceNet

CANopen

Profinet

Ethernet/IP

Modbus TCP

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 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.

### 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

### PLC function blocks

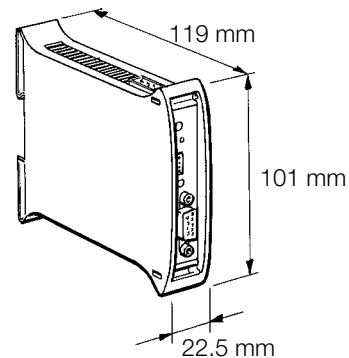
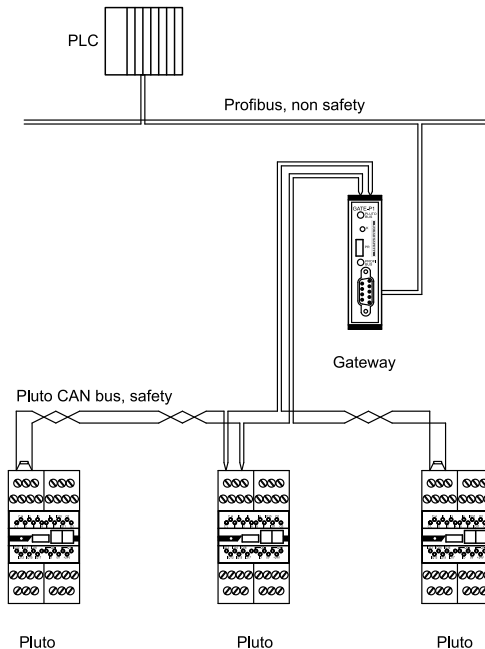
To simplify the integration of a Pluto Gateway PROFIBUS into the supervisory PLC system, ABB JOKAB SAFETY provides ready-made function blocks for several popular brands of PLC. The function blocks make it easier to receive and send information to the Pluto system. The function blocks are supplied as open units with full access for the customer to change and add functions.



## Technical data - GATE-P2

Article number	2TLA020071R8000
Databuses	-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 VDC (included)
Status indication	Pluto Safety Bus status indication via LED PROFIBUS status indication via LED
Operating voltage	24 VDC, -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 IP20 - IEC 60 529 Terminals IP20 - IEC 60 529

## Gateway block schematic diagram - Pluto Profibus



# Pluto Gateway

## GATE-D2



Profibus DP

DeviceNet

CANopen

Profinet  
Ethernet/IP  
Modbus TCP

### Use:

- Bi-directional status information from the Pluto Safety PLC
- For DeviceNet 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

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 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 databus 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 databus cables.

### ABB Robotics IRC5

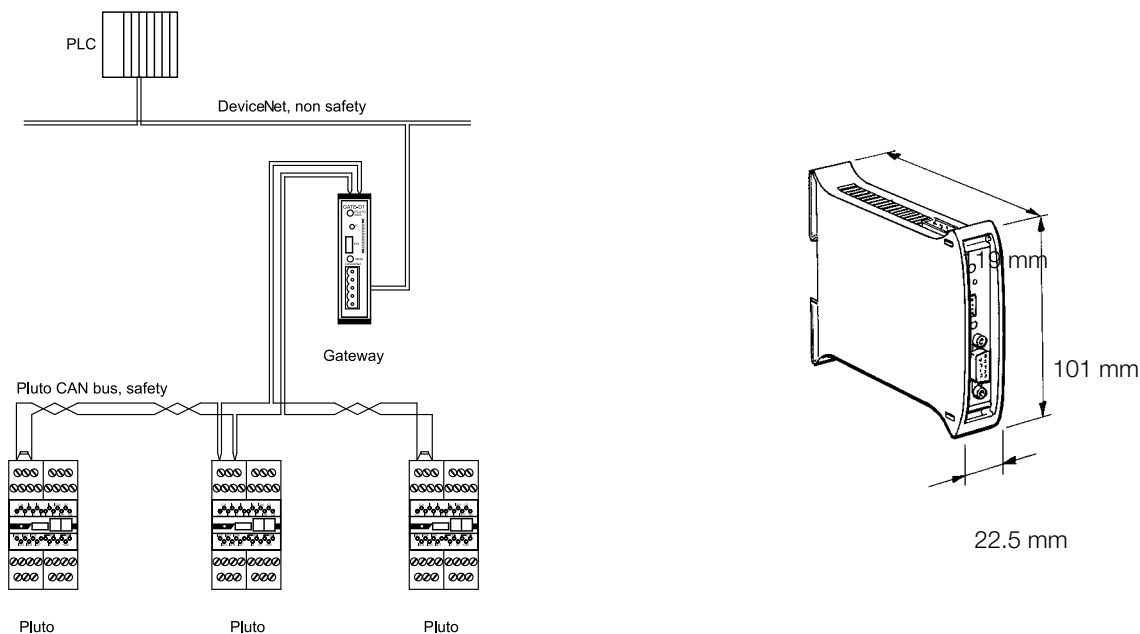
PLUTO GATE-D2 has support for integration into an ABB Robotics IRC5-system. The documentation that describes this integration can be obtained via [www.abb.com/jokabsafety](http://www.abb.com/jokabsafety).



## Technical data - GATE-D2

Article number	2TLA020071R8200
Databuses	-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 speed	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 VDC (included)
Status indications	Pluto Safety Bus status indication via LED DeviceNet MNS status indication via LED
Operating voltage	24 VDC, -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 IP20 - IEC 60 529 Terminals IP20 - IEC 60 529

## Gateway block schematic diagram - Pluto DeviceNet



# Pluto Gateway

## GATE-C2



- Profibus DP
- DeviceNet
- CANopen
- Profinet
- Ethernet/IP
- Modbus TCP

### 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

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 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 databus 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 databus cables.

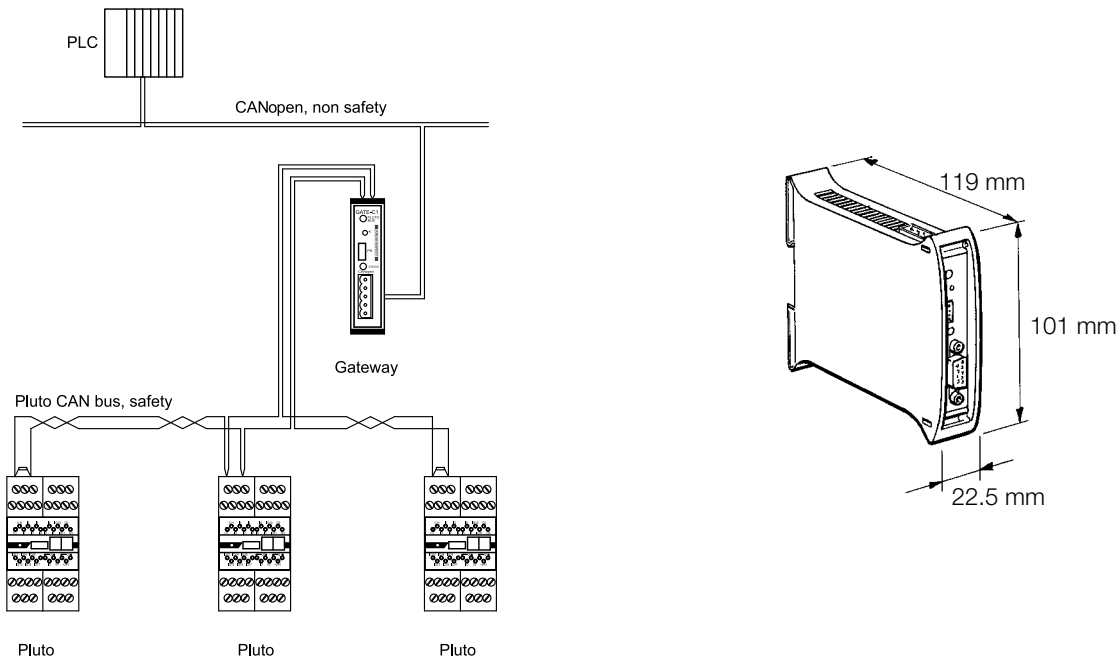




## Technical data - GATE-C2

Article number	2TLA020071R8100
Databuses	-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 VDC (included)
Status indications	Pluto Safety Bus status indication via LED CANopen status indication via LED
Operating voltage	24 VDC, -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 IP20 - IEC 60 529 Terminals IP20 - IEC 60 529

## Gateway block schematic diagram - Pluto CANopen



# Pluto Gateway

## GATE-E2



- Profibus DP
- DeviceNet
- CANopen
- Profinet
- Ethernet/IP
- Modbus TCP

### Use:

- Bi-directional status information from the Pluto Safety PLC
- Profinet, Ethernet/IP, Modbus TCP

### 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

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 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

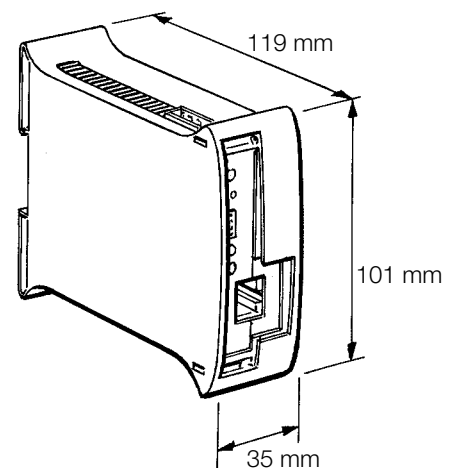
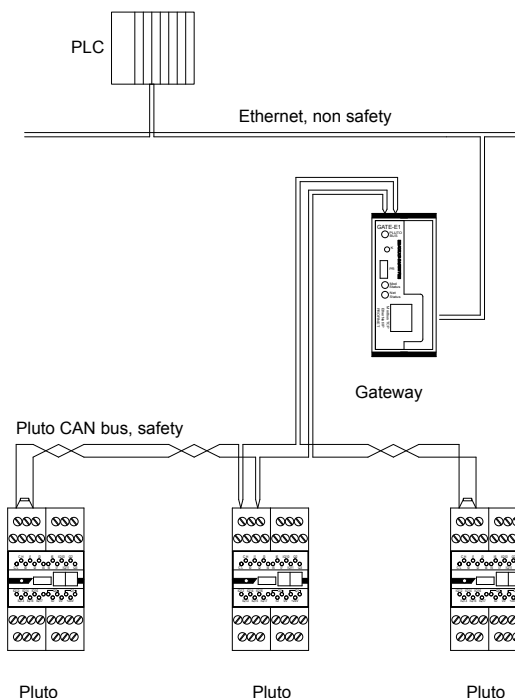
Via the Ethernet protocol a supervisory PLC system can transmit non-safety-related information to a Pluto Safety PLC. A total of 64 Boolean values and 8 different 16-bit registers can be transmitted. Function blocks for these functions are available in Pluto Manager.



## Technical data - GATE-E2

Article number	2TLA020071R8300	Web server	For simple sharing of IP addresses.
Buses	Pluto-bus CAN (isolated) Profinet (isolated) Ethernet/IP (isolated) Modbus TCP (isolated)	Terminal server (TCP/IP)	Simple server with the same commands as via the serial programming port in the unit.
Pluto safety bus speeds	100, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection)	IP address	Static sharing via web server or via programming port.
Ethernet	10/100 Mbit/s Half and full duplex	Gateway configuration	Takes place via EtherNet/IP, PROFINET, Modbus TCP or via the binary TCP/IP server.
Ethernet protocol	Status from and to Pluto Safety PLC - EtherNet/IP - PROFINET - Modbus TCP - Binary server (TCP/IP) Note that certain combinations of server protocols cannot be used simultaneously. Gateway status and IP address configuration - Web server - Terminal server (TCP/IP)	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 VDC (included)
EtherNet/IP	According to ODVA "CIP Edition 3.2" and "EtherNet/IP Adaption of CIP Edition 1.3". Minimum RPI of 50 ms	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)
PROFINET	PROFINET	Operating voltage	24 VDC, -15 % till +20 %
Modbus TCP	According to the Modbus organization, version 1.0b (approx. 20 messages per second).	Current at 24 V	< 150 mA (recommended fuse ≤6 A)
Binary server (TCP/IP)	Simple TCP/IP protocol to send status from/to the Pluto system.	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 IP20 - IEC 60 529 Terminals IP20 - IEC 60 529

## Gateway block schematic diagram - Pluto Ethernet



# Pluto Safety Encoders

## Rotational absolute value sensor for safe positioning

This rotational absolute encoder, together with a Pluto Safety PLC, 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 configurable for single and multi-turn applications.

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.



**Safety Encoders  
RSA 698**

### 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.*

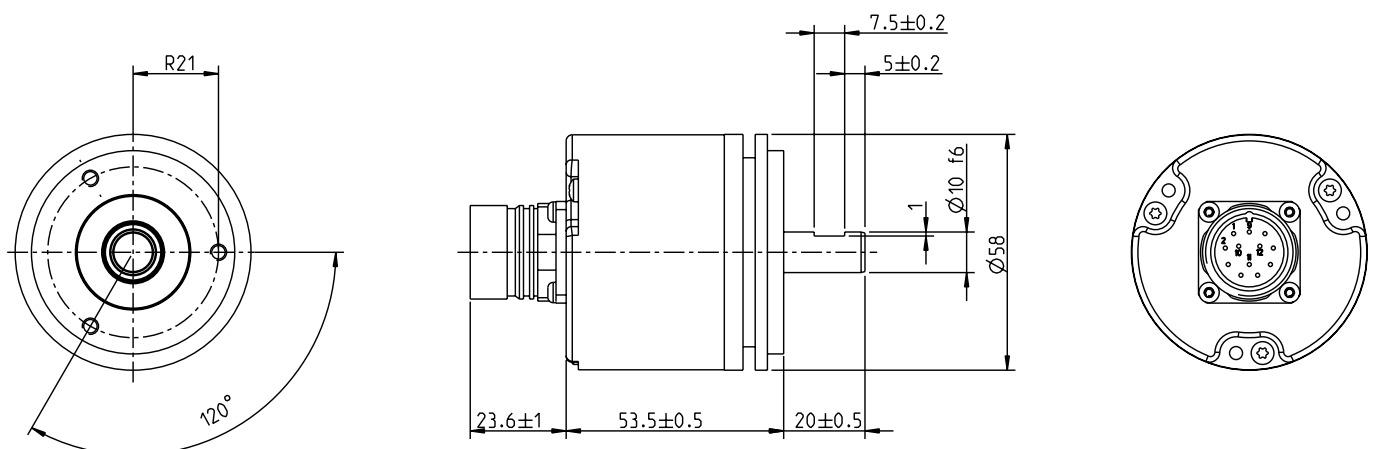
## Technical data – Safe Encoder RSA 597/RHA 597

Article number	2TLA020070R3600 2TLA020070R3300 2TLA020070R3400 2TLA020070R5900
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)	< 300 m/s <sup>2</sup> in accordance with IEC 60068-2-6
Shock (6ms)	< 2000 m/s <sup>2</sup> in accordance with IEC 60068-2-27
Material, enclosure	Aluminium
Surface treatment	Painted and chromed or anodized
Weight	Approx. 300 g
Accuracy and resolution	
Resolution	13 bits, 8192 positions per rotation
Accuracy	± ½ LSB (Least Significant Bit)
Operating voltage	9-36 VDC
Polarity-protected	Yes
Short-circuit protected	Yes
Databus speed	5 kbit/s - 1 Mbit/s, preset at 500kbit/s
Address input	Active low
Code type	Binary
Programmable functions	Resolution, 0 position Direction, Databus speed
Current consumption	50 mA at 24 VDC
Max current consumption	100 mA

## Ordering details

Shaft	Connection	Type	Order code
Ø 10 mm with face	12-pole connector	RSA 597	2TLA020070R3600
Ø 6 mm with face	1.5 m cable	RSA 579	2TLA020070R3300*
		RSA 597	
Hollow shaft Ø 12 mm	2 m cable	RHA 597	2TLA020070R3400*
Hollow shaft Ø 12 mm	10 m cable	RHA 597	2TLA020070R5900*

\*Ordering product





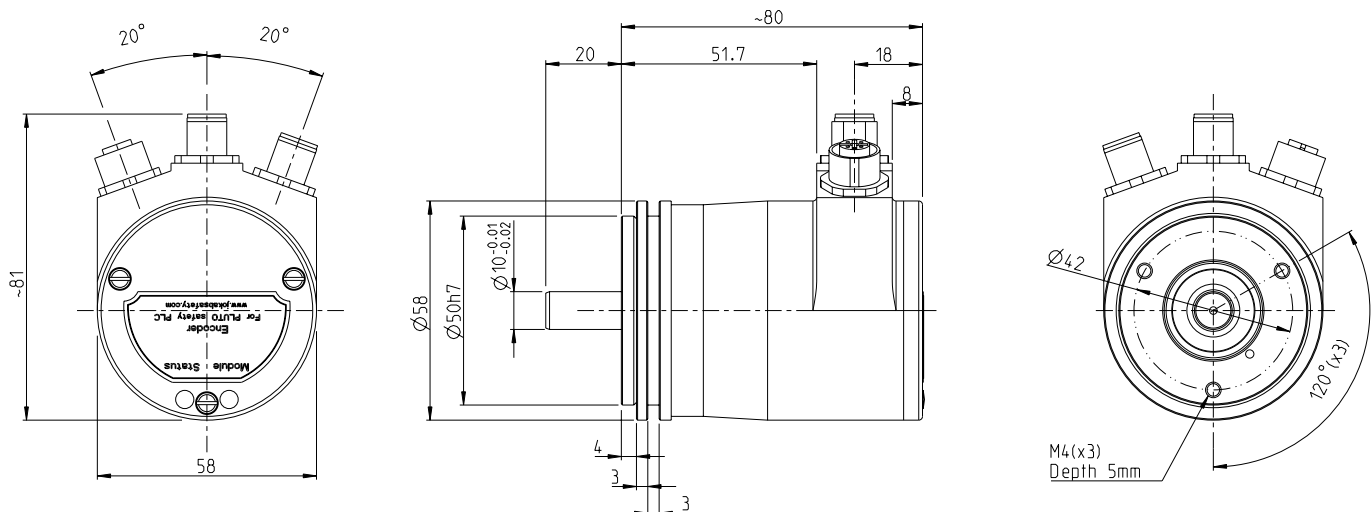
## Technical data – Safe Encoder RSA 698/RHA 698

Article number	2TLA020070R3700 2TLA020070R7800 2TLA020070R7900
Ambient temperature	-40°C .. +70°C
Temperature, transport and storage	-30°C .. +70°C
Ingress protection class	IP67 in accordance with IEC 60529
At shaft inlet	IP66 in accordance with IEC 60529
Vibration (55 to 2000 Hz)	< 100 m/s <sup>2</sup> in accordance with IEC 60068-2-6
Shock (6ms)	< 2000 m/s <sup>2</sup> in accordance with IEC 60068-2-27
Material, enclosure	Aluminium
Surface treatment	Anodized
Weight	Approx. 400g
Accuracy and resolution	
Resolution, total	25 bit 13 bits, 8192 positions per rotation 12 bits, 4096 rotations
Accuracy	± 1 LSB (Least Significant Bit)
Operating voltage	9-36 VDC
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 24 VDC
Max current consumption	100 mA

## Ordering details

Shaft	Connection	Type	Order code
Ø 10 mm round	M12 5-pole connector	RSA 698	2TLA020070R3700
Ø 6 mm round	M12 5-pole connector	RSA 698	2TLA020071R7800*
Hollow shaft Ø 12 mm	M12 5-pole connector	RHA 698	2TLA020071R7900*

\*Ordering product



## Safe Encoder

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

### Function

The block reads and evaluates two absolute encoders. 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.



#### Descriptions of inputs and outputs

- AdrEncoderA: Encoder A node address
- AdrEncoderB: Encoder B node address
- MaxDiff: Max allowed deviation between the encoders (max 2% of Range)
- Range: Number of increments per revolution
- OK: Set when encoders are working OK and the position values are within the margin set by 'MaxDiff'
- Position: Position value
- Speed: Speed value as increments/10ms
- A: Encoder A position. Must not be used in PLC program!
- B: Encoder B position. Must not be used in PLC program!

NOTE! Position values from single encoders are only available for adjustment purposes and must NOT be used for safety.

NOTE! When error occurs 'Position' = -1, 'Speed' = -32768 and the OK output will be reset.

## Safe Encoder Multiturn

Function block for two multi-turn encoders that generates safe position and speed values.

### 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.



#### Descriptions of inputs and outputs

- AdrEncoderA: Encoder A node address
- AdrEncoderB: Encoder B node address
- MaxDiff: Max allowed deviation between the encoders (max 2% of IncrPerRev)
- IncrPerRev: Number of increments per revolution
- OK: Set when encoders are working OK and the position values are within the margin set by 'MaxDiff'
- Position: Position value
- Speed: Speed value as increments/10ms
- A: Encoder A position. Must not be used in PLC program!
- B: Encoder B position. Must not be used in PLC program!

NOTE! Position values from single encoders are only available for adjustment purposes and must NOT be used for safety.

NOTE! When error occurs 'Position' = -1, 'Speed' = -32768 and the OK output will be reset.

## Encoder Cam

Function block for electronic cam gear.

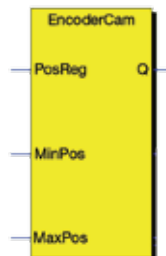
### Function

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.



#### Descriptions of inputs and outputs

- PosReg: Input for the position value
- MinPos: Minimum limit value
- MaxPos: Maximum limit value

# Pluto identifier

## IDFIX



### Use:

- Gives each Pluto unit an identity on the bus
- For storage of the PLC program
- For storage of the AS-i safety codes

IDFIX is an identifier circuit which gives each Pluto an address on the bus. It contains an identification code which can be read by the system. The identification code is declared in the PLC program so that the correct part of the PLC program is executed by each specific Pluto. The use of IDFIX is mandatory in a multi-Pluto project, but voluntary if a unit works alone. If one Pluto in a multi-Pluto project needs to be replaced it is possible to let the new Pluto self load the PLC program from another Pluto on the bus. The IDFIX will ensure that the new Pluto has the correct address on the bus.

### Five different versions of IDFIX

R is pre-programmed.

RW is programmable.

DATA is programmable and can also store the AS-i safety codes.

PROG 2k5 is for single-Pluto projects only, and has a 2.3 kbyte memory for storage of the PLC program. It can also store the AS-i safety codes in the same way as IDFIX-DATA.

PROG 10k works in the same way as PROG 2k5, but it has a larger memory (10 kbyte).

IDFIX is connected between the input terminals ID and 0V.

### IDFIX-DATA

IDFIX-DATA is for Pluto AS-i and B42 AS-i, and contains a memory for storage of the AS-i safety codes.

### IDFIX-PROG

IDFIX-PROG contains a memory for storage of the PLC program for single-Pluto projects. When a program is downloaded to Pluto the IDFIX-PROG will automatically be updated. If the Pluto unit needs to be replaced, the new Pluto can self load the PLC program from IDFIX-PROG by pressing the K button (in the same way as a Pluto can self load the program over the CAN bus). Only one Pluto is allowed in the project and the IDFIX code is always EEEEEEEEEEE0. IDFIX-PROG can also store the AS-i safety codes in the same way as IDFIX-DATA.

NOTE! "Single-Pluto project" means that the PLC program only contains one Pluto. It is still possible to connect several "Single-Pluto projects", each with its own program and IDFIX-PROG, together via the Pluto bus.

# Pluto Manager

## A programming tool for your safety functions

Pluto Manager is a software tailored for the Pluto Safety PLC. Programming is done in ladder, and together with the function block, creates the structure of your safety functions. The software comes with predefined function blocks approved by TÜV to facilitate the work on designing the safety functions. Pluto Manager gives you a structured overview of Plutos, gateways and peripheral components in large and small projects. It gives you an overview and control of the sensors and actuators, and the reactions between them. Pluto Manager also contains manuals for the software and hardware that are connected and need to be handled through the program.

The interface gives the option to get the status directly from Pluto's two bus options, AS-i and Pluto bus. There are also diagnostic functions and the option to export data.

## Systematic working method through project management

### Step 1 - Configuration of I/O

In every started project, each Pluto is defined individually. Its inputs and outputs are configured as desired and depending on what they connect to. Pluto's IQ ports are also configured here as inputs or outputs, dynamic or static signals.

### Step 2 - Naming of Variables

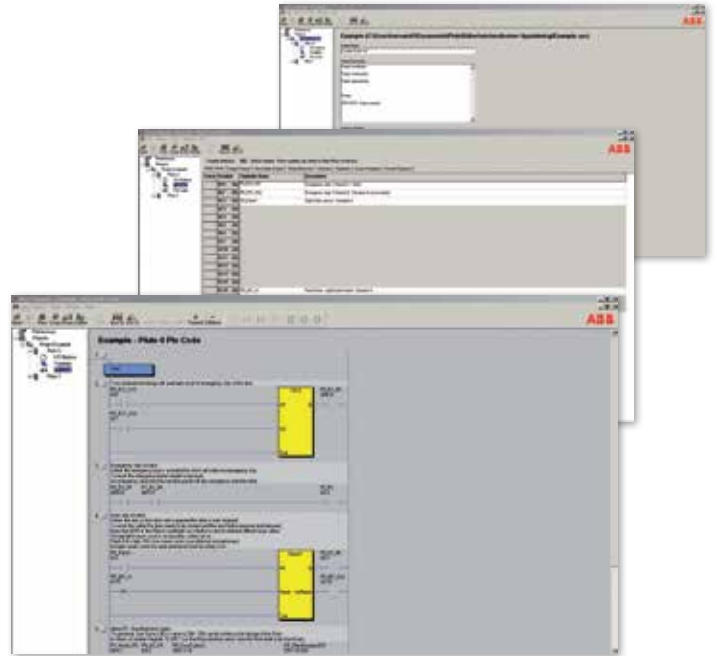
After configuration the system's variables are determined. Inputs (I), outputs (Q), remanent memories (M), global auxiliary memories for bus communication (GM) and registers (R) are given names that can be used in place of the actual variable designation in the PLC program.

### Step 3 - Ladder Programming

The program is built using the named variables connected to inputs and outputs. The programming language has a full range of instructions, similar to standard PLCs on the market—with timers, arithmetic, sequence programming etc.

The project is then downloaded to Pluto via a programming cable. This program is distributed simultaneously through bus communication to the other Plutos in the project. In this way, you need only access a single Pluto where each Pluto gets the right information specified in your project.

Pluto Manager is included when purchasing the Pluto Safety PLC. The software is Windows based and can be downloaded free from [www.abb.com/lowvoltage](http://www.abb.com/lowvoltage).



## Applications

- Software for the Pluto Safety PLC
- A tool to structure the safety functions

## Features

- Software included with purchase
- Downloaded from [www.abb.com/lowvoltage](http://www.abb.com/lowvoltage)
- Ready to use function blocks for your safety components
- Contains TÜV-approved function blocks
- Provides an overview of the current projects and your Plutos
- Easy programming through ladder language

# Pluto manager standards and special function blocks

The safety designer has complete freedom to program the safety functions or to use TÜV-approved pre-defined safety function blocks.

## Blocks in the Standard Library (func05):

1. Two-channel function with input for start
2. Two-channel function with test input
3. Two-channel function with test and reset inputs, and reset indication. See example.
4. Two-channel function with simultaneous requirement.
5. Single channel function with input for start.
6. Single channel function with start and test inputs.
7. Single channel function with reset and test inputs.
8. Two-channel function with max. time limitation (equivalent to JSHT2). Time begins to count down when both inputs are activated.
9. Two-channel function with max. time limitation (equivalent to JSHT2). Time begins to count down when one of the inputs is activated.
10. Single channel pulse function, e.g. for timed reset.
11. Two-channel pulse function, e.g. for timed reset.
12. Two single channel bypass connection functions with max. time limiting.
13. Single channel bypass connection function with max. time limiting.
14. Two-channel bypass connection function with max. time limiting and simultaneous requirement.
15. Two-channel safety function with max. time limited bypass connection.
16. Two-hand control. See example.
17. Counter which counts up to preset value.
18. Counter which counts down from preset value to 0.
19. Off delay.
20. Muting lamp\_Q16.
21. Muting lamp\_Q17.
22. Muting lamp W\_Q16. With possibility to set the power level in Watts.
23. Muting lamp W\_Q17. With possibility to set the power level in Watts.
24. Light curtain with single cycle operation.
25. Light curtain with single cycle operation and reset selection.
26. Multiplication.
27. Division.

## Other function blocks

1. Safety absolute encoder.
2. Electronic cam.
3. External communication.

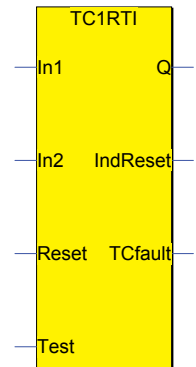
## Special function blocks

1. Program library with program block for eccentric shaft presses.
2. Custom special function blocks can be made available.

### TC1RTI Block 3 Example

#### Two-channel function with test and reset inputs, and reset indication

- In1 and In2 are safety inputs, to which the safety device outputs are connected.
- Test is a condition that must be true at the moment of switching on, and can be used for monitoring external components. Test must be true before the Reset input closes, i.e. the function block cannot be initiated by Test.
- Reset is a supervised reset input and must be activated (positive flank) after the other inputs have activated for the function output to be activated.
- The IndReset output is activated when the function block is 0 and flashes when the function block is ready for resetting.
- The TCfault output is activated in the case of a two-channel fault, i.e. if the function block is activated and only one of In1 and In2 opens and closes.



#### Description

The function block acts as a conventional two-channel safety relay with dual and supervised inputs (In1, In2).

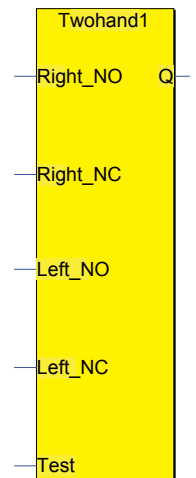
### Block 16 Example

#### Two-hand control for devices with NO/NC + NO/NC

- Right\_NO is right handed NO contact
- Right\_NC is right handed NC contact, etc.
- The test is a condition that must be met before any of the other inputs are actuated and can be used for monitoring external components.

#### Function

In stand-by, Right\_NO must be 0, Right\_NC 1, Left\_NO 0 and Left\_NC 1. In order to start, these four inputs switch the condition within 0.5 seconds and then retain their conditions. After shut-down, all inputs must return to stand-by before any restart can be made.

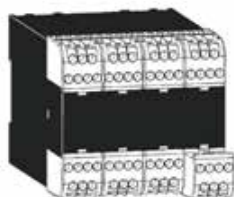




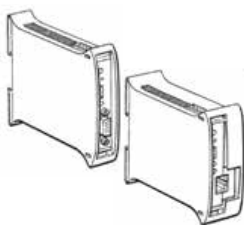
# Component list - Pluto Safety PLC



Product	Ordering number	Description
PLUTO A20 v2	2TLA020070R4500	Safety PLC with 8 failsafe inputs + 8 non-failsafe outputs/failsafe inputs + 2 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus. Current monitoring on Q16 + Q17.
PLUTO B20 v2	2TLA020070R4600	Safety PLC with 8 failsafe inputs + 8 non-failsafe outputs/failsafe inputs + 2 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus.
PLUTO B22	2TLA020070R4800	Safety PLC with 14 failsafe inputs + 8 non-failsafe outputs/failsafe inputs. For use with Pluto safe bus and/or a Pluto Safety databus.
PLUTO D20	2TLA020070R6400	Safety PLC with 8 failsafe inputs + 8 non-failsafe outputs/failsafe inputs + 2 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus. 4 0-10V/2-20mA analog inputs.
PLUTO S20 v2	2TLA020070R4700	Safety PLC with 8 failsafe inputs + 8 non-failsafe outputs/failsafe inputs + 2 individual failsafe relay outputs + 2 individually failsafe transistor outputs.
PLUTO AS-i v2	2TLA020070R1100	Safety PLC with 4 failsafe inputs + 4 non-failsafe outputs/failsafe inputs + 2 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus and/or ASi Safe bus.



PLUTO B46 v2	2TLA020070R1700	Safety PLC with 24 failsafe inputs + 16 non-failsafe outputs/failsafe inputs + 4 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus.
PLUTO D45	2TLA020070R6600	Safety PLC with 24 failsafe inputs + 15 non-failsafe outputs/failsafe inputs + 4 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus. 8 0-10V/2-20mA analog inputs, 4 high speed counter inputs.
PLUTO S46 v2	2TLA020070R1800	Safety PLC with 24 failsafe inputs + 16 non-failsafe outputs/failsafe inputs + 4 individual failsafe relay outputs + 2 individually failsafe transistor outputs.
PLUTO B42 AS-i	2TLA020070R1400	Safety PLC with 20 failsafe inputs + 16 non-failsafe outputs/failsafe inputs + 4 individual failsafe relay outputs + 2 individually failsafe transistor outputs. For use with Pluto safe bus and/or a Pluto Safety databus and/or ASi Safe bus.

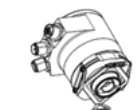


GATE-P2	2TLA020071R8000	Gateway for 2-way communication between the Pluto bus and Profibus.
GATE-C2	2TLA020071R8100	Gateway for 2-way communication between the Pluto bus and CANopen.
GATE-D2	2TLA020071R8200	Gateway for 2-way communication between the Pluto bus and DeviceNet.
GATE-E2	2TLA020071R8300	Gateway for 2-way communication between Pluto databus and Profinet, Gateway Pluto Ethernet/IP, Modbus TCP.



IDFIX-R	2TLA020070R2000	Identifier, read only. For assigning Pluto an address on the Pluto bus. The IDFIX number is fixed by delivery.
IDFIX-RW	2TLA020070R2100	Identifier, read/write. For assigning Pluto an address on the Pluto bus. The IDFIX number is programmable.
IDFIX DATA	2TLA020070R2300	Identifier, read/write and AS-i safety codes. For assigning Pluto an address on the Pluto bus and storage of AS-i safety codes. The IDFIX number is programmable. Intended for Pluto AS-i and B42 AS-i but can be used for all Pluto types.
IDFIX-PROG 2k5	2TLA020070R2400	External program memory, 2.5 kbyte. For projects with only one Pluto the memory can store the PLC program. Can also be used to give Pluto AS-i a specific address.
IDFIX-PROG 10k	2TLA020070R2600	External program memory, 10 kbyte. For projects with only one Pluto the memory can store the PLC program. Can also be used to give Pluto AS-i a specific address.
R-120	2TLA020070R2200	Terminating resistor for Pluto bus.

# Component list - Pluto Safety PLC



Product	Ordering number	Description
PROG CABLE	2TLA020070R5600	Cable for connecting PC serial port to Pluto for programming and on-line monitoring. 9-pole D-sub connector to straight modbus contact.
PROG CABLE	2TLA020070R5700	Cable for connecting HMI-panel to Pluto programming port. Connector at HMI-side: 15-pole D-sub, Pluto side: 90 degrees angled modbus contact.
PROG CABLE	2TLA020070R5800	For connecting PC, USB port to Pluto for programming and on-line monitoring.
BUS CABLE	2TLA020070R3000	CAN-Bus cable, yellow, 1 2 x 0.50 mm2.
BUS CABLE	2TLA020070R6800	CAN-Bus cable, yellow, 1 x 2 x 0.75 mm2. UL & CSA approved.
ABSOLUTE ENCDR RSA 597	2TLA020070R3600	Absolute encoder RSA 597, single turn, connector, 10mm shaft.
ABSOLUTE ENCDR RSA 698	2TLA020070R3700	Absolute encoder RSA 698, multi-turn, M12 connector, 10 mm shaft.
ABSOLUTE ENCDR RSA 597	2TLA020070R3300	Absolute encoder RSA 597, single turn, 1.5 m cable, 10 mm shaft.
ABSOLUTE ENCDR RHA 597	2TLA020070R3400	Absolute encoder RHA 597, single turn, 2 m cable, hollow shaft, 12 mm hole.
ABSOLUTE ENCDR RHA 597	2TLA020070R5900	Absolute encoder RHA 597, single turn, 10 m cable, hollow shaft, 12 mm hole.
ABSOLUTE ENCDR RSA 698	2TLA020071R7800	Absolute encoder RSA 698, multi-turn, M12 connector, 6 mm shaft.
ABSOLUTE ENCDR RHA 698	2TLA020071R7900	Absolute encoder RHA 698, multi-turn, M12 connector, hollow shaft, 12 mm hole
CONNECTOR ABSO- LUTE ENCDR	2TLA020070R3900	Connector for absolute encoder RSA 597 with connector.
HMI DISPLAY	2TLA850015R1100	3.5" TFT-LCD touch screen display, 320x240pixels and 64k colors. RS422/RS485, RS232, Ethernet and USB communication.
HMI DISPLAY	2TLA850015R1300	5.7" TFT-LCD touch screen display, 320x240pixels and 64k colors. RS422/RS485, RS232, Ethernet and USB communication.
HMI DISPLAY	2TLA850015R1500	3.5" TFT-LCD touch screen display, 320x240pixels and 16 grayscales. RS422/RS485, RS232, Ethernet and USB communication.
HMI DISPLAY	2TLA850015R1600	5.7" TFT-LCD touch screen display, 320x240pixels and 16 grayscales. RS422/RS485, RS232, Ethernet and USB communication.
HMI DISPLAY	2TLA850015R1700	6.5" TFT-LCD touch screen display, 640x480 pixels. 64k colors. RS422/RS485, RS232, Ethernet and USB communication. Compact Flash Slot.
HMI SOFTWARE	2TLA850015R2300	For Exter and Cimrex terminals For use with Windows XP/Vista.

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1SXU172023B0201 June 2013

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