
ABB
PLUTO B20
PLUTO B20 v2
PLUTO D45

Pluto Safety PLC
With dynamic safety concept

Why should you have Pluto safety PLC?

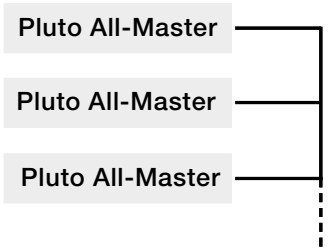
– for simplifying the design of and changes to safety systems!

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 PLCs 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.

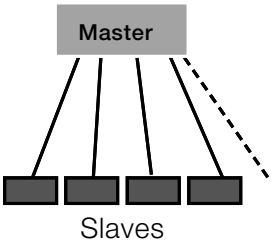
This concept enables simple communication, programming and changes to the safety system. With the use of a ”Gateway” device, a Pluto can communicate with other bus systems and thereby form part of a larger network. Gateway units are available for several different bus systems, such as Profibus, CanOpen,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

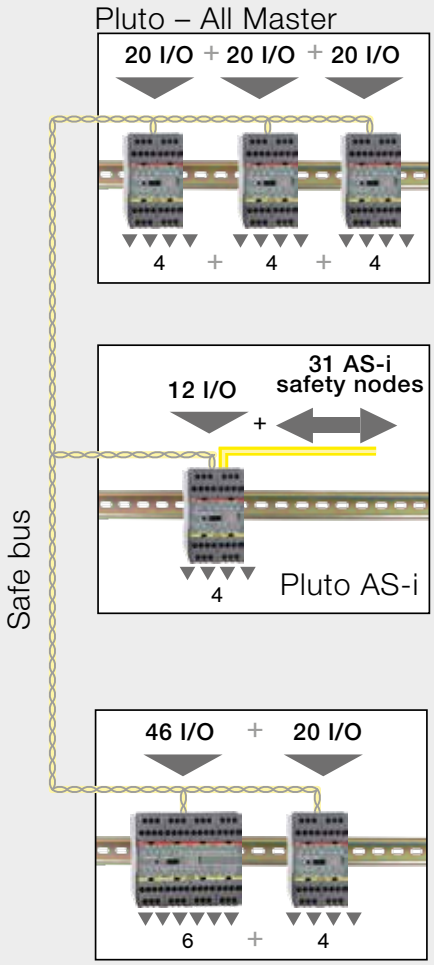
Pluto offers an economic solution for both single machines and for major machine systems.

Our solution with All-Master



Traditional safety PLC





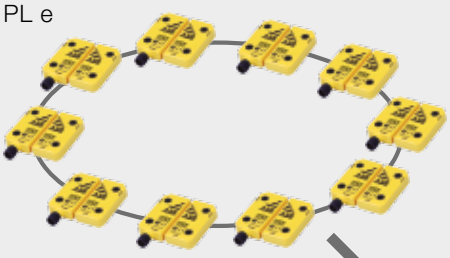
– to supervise safety devices!

Light beams | Light grids/curtains | 3-position devices | Sensors/ switches | Two-hand controls | Emergency stops | Strips | Mats

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 adapters. Pluto also has IO connections that can be used as both inputs and outputs.

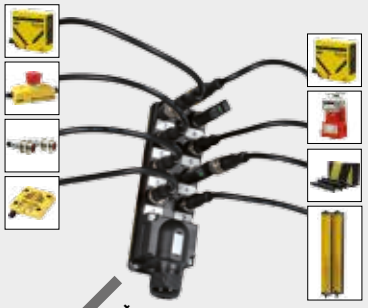
– to save on inputs!

Dynamic signals
– 1–10 doors with one Eden per door
PL e



One input

Dynamic signals
1-10 sensors
PL e



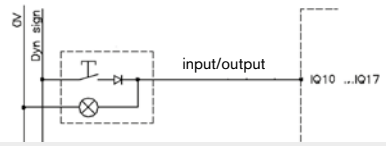
One input

Pluto has inputs for static and dynamic sensors. Several sensors can be connected to one dynamic input in accordance with PL e.

One connection

Two inputs

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)



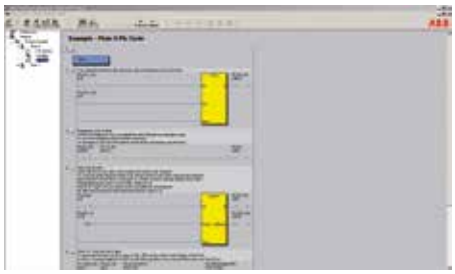
Static inputs (mechanical switches)
2 for each door = PL e

Connection examples for Pluto with safety bus

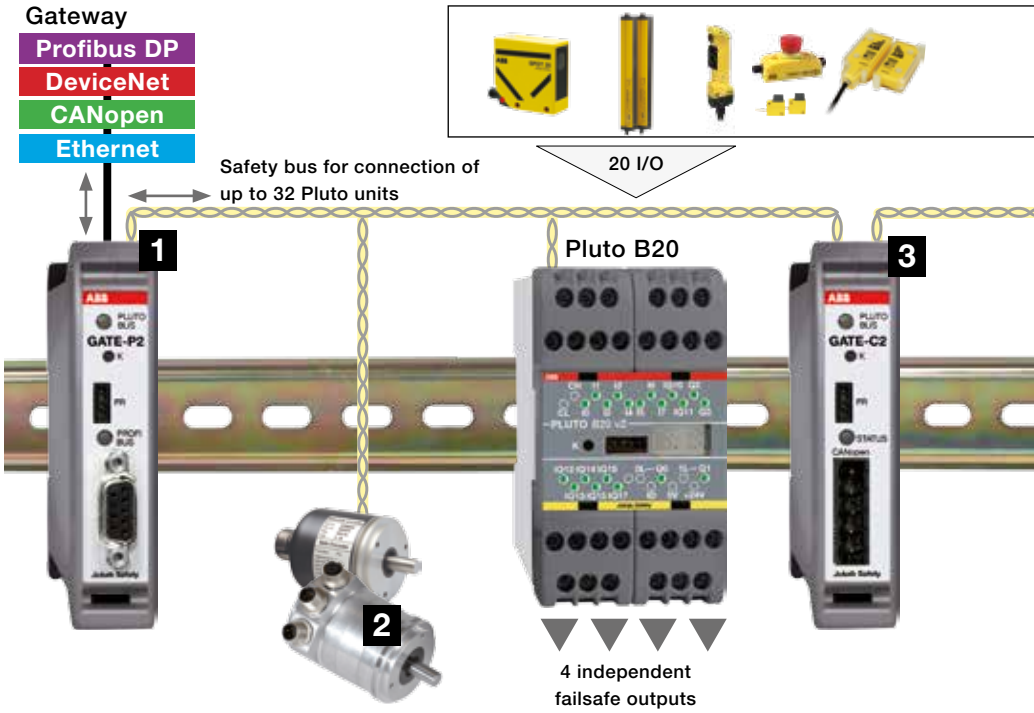
1. Gateway – For two-way safe bus communication between Pluto and other control systems.

2. Absolute encoder – 8 single turn or multi turn absolute encoders can be connected directly to the safety bus.

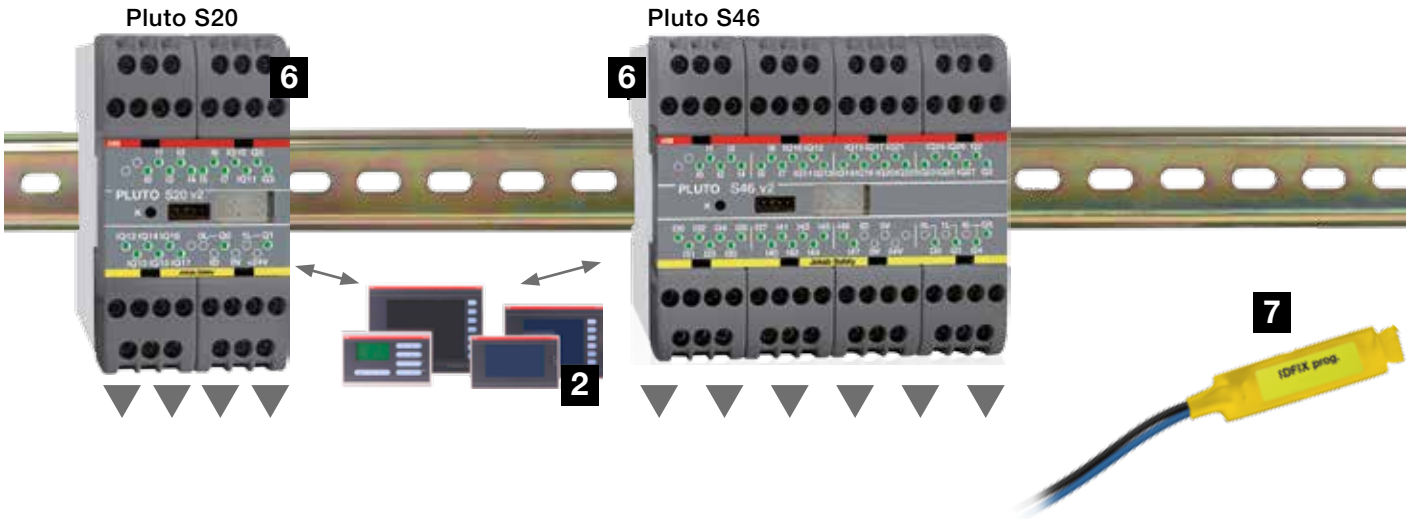
Pluto Manager



Free software at www.abb.com/jokabsafety, Ladder with TÜV-approved function blocks.



Connection examples for Pluto without a safety bus



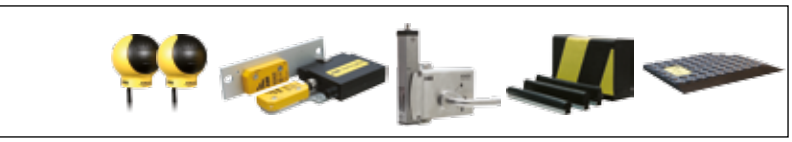
6. Stand alone Pluto
Same functionality as other Plutos, but without safety bus connections.

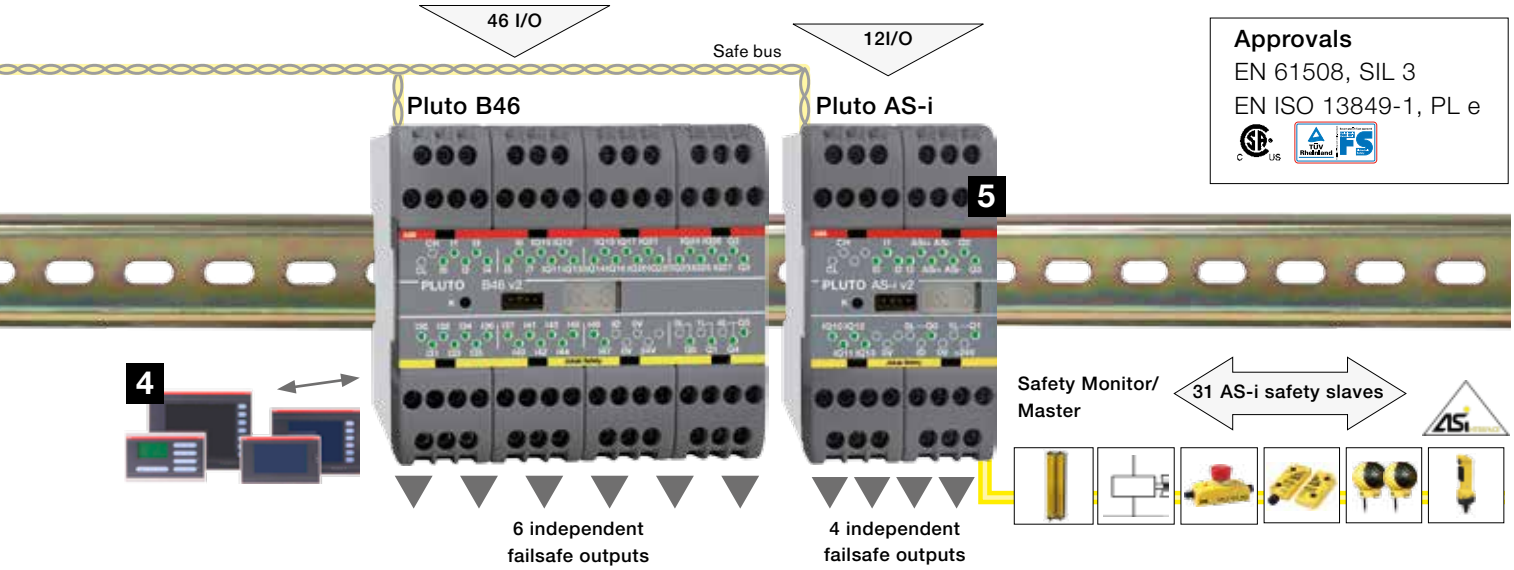
7. IDFIX – Identifies Pluto
If IDFIX PROG is used for single-Pluto, there is the option of copying a PLC program via the identification circuit over to Pluto without having to connect a computer.

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, analogue 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
Analogue inputs 0-10V/4-20mA	-	-	-	-	4	8*	-	-	-	-
Counter inputs	-	-	-	-	-	4*	-	-	-	-
Analogue 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 analogue inputs can be configured as counter inputs. The total number of analogue inputs + counter inputs = 8.

Safety PLC
Pluto

Approvals:

CE cULus TÜV Rheinland

Control of:

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

Features:

- A Safety-PLC for each system part
- Dispersed constructions of machines
- Great flexibility
- Up to 10 sensors in series connected to one input
- Software Pluto Manager free of charge
- Handles conventional circuit breakers as well as dynamical sensors
- Custom made safety bus

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 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. It is also easy to both read and write to global memory locations available across the Pluto bus.

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.

Single Pluto - Pluto without safety bus

The Pluto models S20 and S46 without bus communication are stand alone units which are perfectly suited for smaller systems that do not require communication with other Pluto units or gateways. In all other ways the S20 has the same functionality as the B20 model, and the S46 as the B46 model – but without a safety bus connection.

Current monitoring (Pluto A20 only)

Pluto A20 differs from the other models in that it 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.

Pluto for the AS-i system

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, analogue 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.

Pluto D20 and D45 - with analogue inputs

Pluto D20 is equipped with 4, and Pluto D45 with 8, safe 4-20mA/0-10V analogue inputs. These can be configured as either “ordinary” failsafe inputs, as analogue inputs 0-10V or as analogue 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.

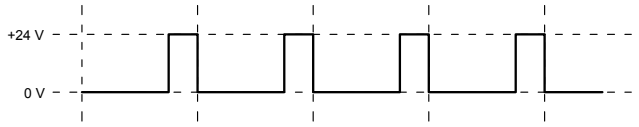
Counter inputs Pluto D45

For Pluto D45 four of the analogue 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.

Pluto B22 - expansion module with increased number of inputs

Pluto B22 is an expansion module without safety outputs. It is equipped with 14 safe inputs and 8 safe inputs or non-safe outputs.

Technical info - Dynamic signal



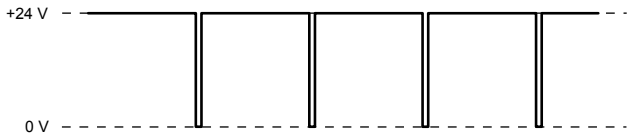
A dynamic signal makes it possible to achieve the highest level of safety with only one conductor. By transmitting a square wave and then evaluating the signal when it comes back to the controller you achieve the redundancy required. The signal is inverted once at each safety sensor (if the protection 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.

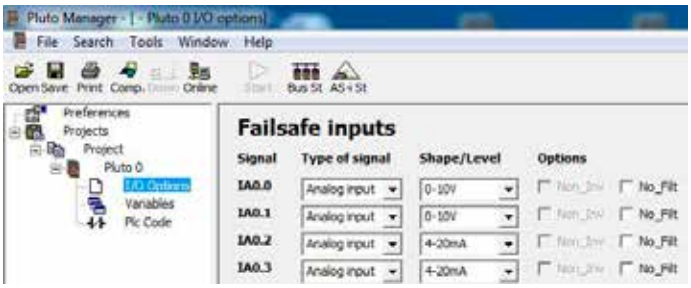
Technical info - Pluto-bus

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.

Function Blocks for Analogue inputs Pluto D20 and D45

Configuration in Pluto Manager

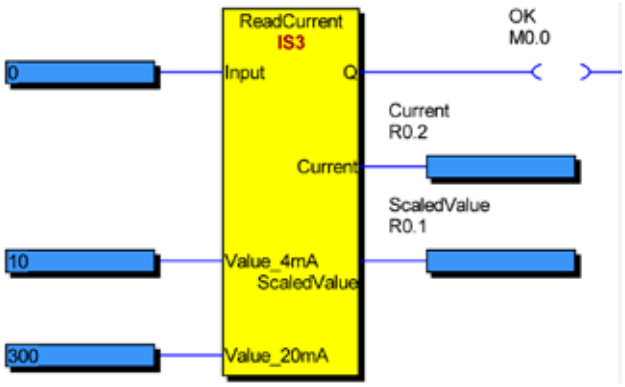
The inputs can be configured under “I/O Options” in Pluto Manager. As analogue inputs they can be configured either as 0-10V inputs, or as 4-20mA inputs. For Pluto D45 they can also be configured as Counter inputs.



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

ReadVoltage and ReadCurrent function blocks

For analogue input 0-10V the function block “ReadVoltage” is needed, and for analogue 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. As output from the blocks there is one output with the absolute value in V or mA, and one output which can be scaled as desired. The picture and table below shows the “ReadCurrent” function block only, but “ReadVoltage” works in the same way.



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 µA.
Scaled Value	Output with scaled value.

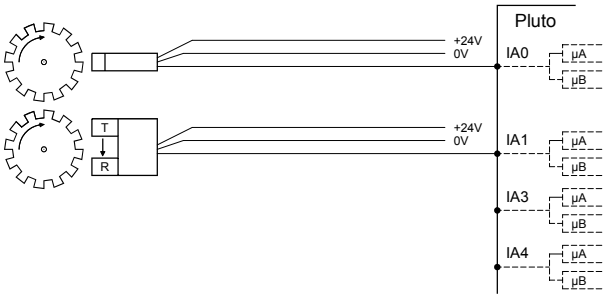
Counter inputs Pluto D45

For Pluto D45 the inputs IA0 – IA3 can be configured as counter inputs (pulse counting). As counter inputs IA0 – IA3 can be used in two ways, Up counting or Up/Down counting.

Configuration of counter input

Up count

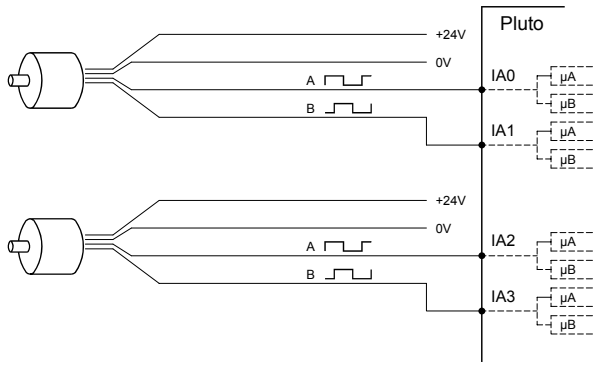
When the input is configured for Up count Pluto counts the pulses on the input. Via a function block the user gets the pulse rate which for example can represent a speed. The sensor can be anything, like an inductive sensor, photocell or incremental encoder (HTL, 24V).



Example of speed monitoring. The sensors can for example be proximity switches or photocells. Any of the inputs IA0..IA3 can be used.

Up/Down count

With the function Up/Down count it is possible to detect the direction of the movement. A pair of inputs, IA0/IA1 and/or IA2/IA3 can be configured as Up/Down counters. 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. The sensor is typically an incremental encoder with HTL (24V) interface.



Example of speed monitoring with incremental encoders leaving A and B pulses to two inputs, IA0-IA1 or IA2-IA3. The direction is then possible to measure.

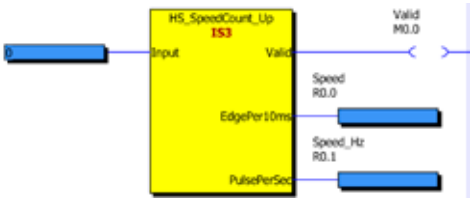
Sensor types

The upper frequency limit is dependent on the type of senor. For incremental encoders with HTL output (“push – pull”) the counter inputs work for frequencies up to 14 kHz.

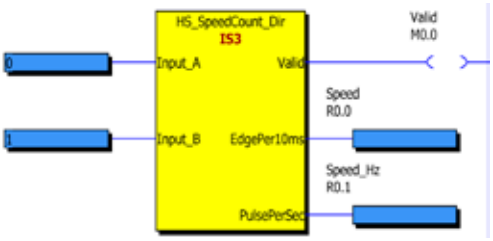
For photocells, proximity switches, inductive sensors etc. which normally do not have a “push – pull” output the maximum frequency might typically be 1 – 4 kHz, but the limit is also dependent on the output resistance, the cable length etc.

Function blocks for speed monitoring

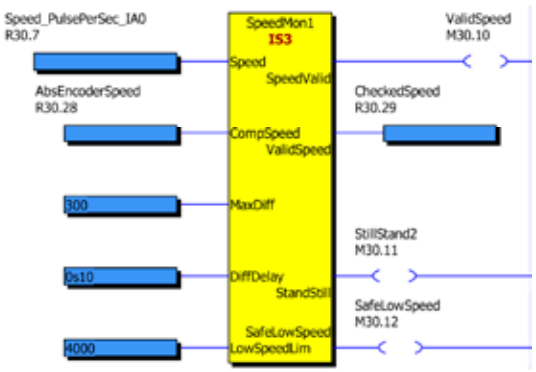
For inputs configured as Up count the function block “HS_SpeedCount_Up” shall be used.



For inputs configured as Up/Down count the function block “HS_SpeedCount_Dir” shall be used.



The function block “SpeedMon1” is intended to be used for redundant speed monitoring, but has also functions for stand still monitoring and safe low speed. It has two inputs for speed values. These input registers can take their values from different sources such as the function blocks for incremental encoders, absolute encoders, analogue inputs etc. The input “Speed” is a primary input for a speed value and “CompSpeed” is a secondary channel for monitoring the correctness of the primary speed value.

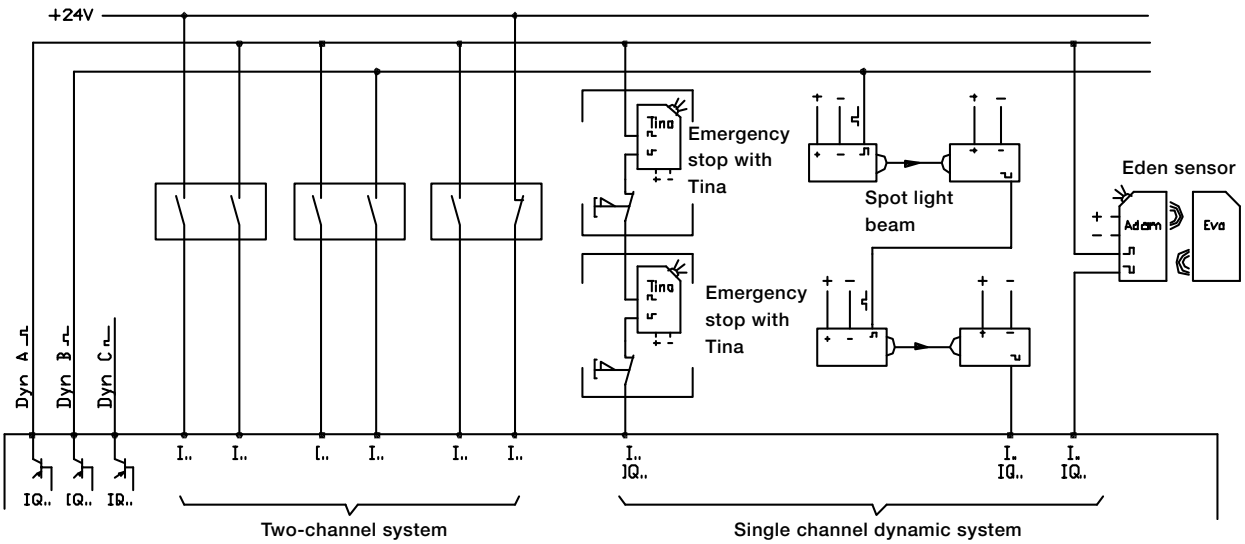


Input connection

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.

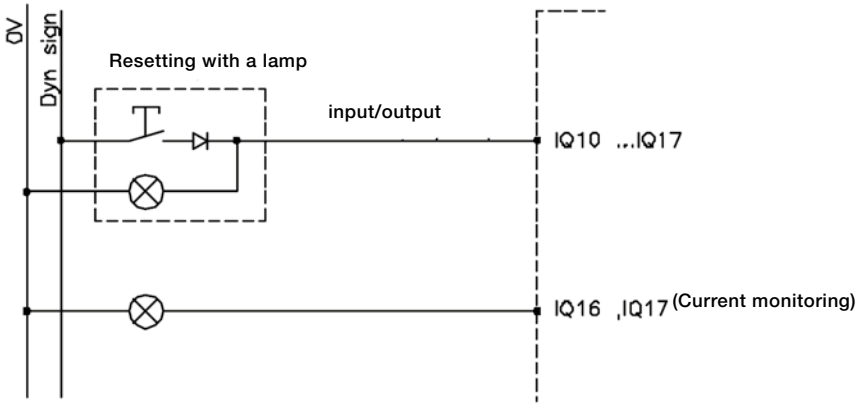
In a two-channel system both channels will be measured, using two different signals. The system will thereby be able to detect a short-circuit between the channels.

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.



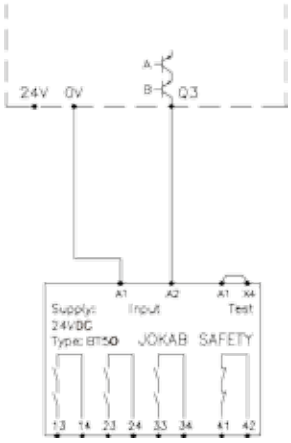
Input connection alternative in accordance with PL e EN ISO 13849-1.

Reset button that uses the combined input and output facility



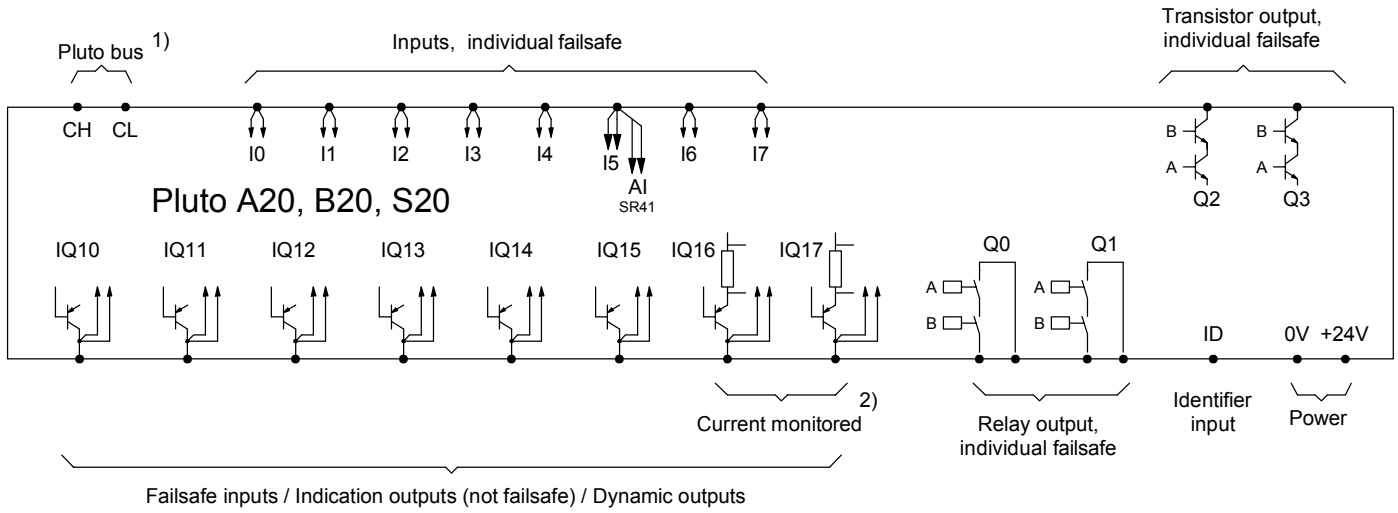
Both a lamp and a pushbutton can be connected to the same terminal. This function is for resetting safety devices and to reduce the number of I/Os used.

Output connector expansion

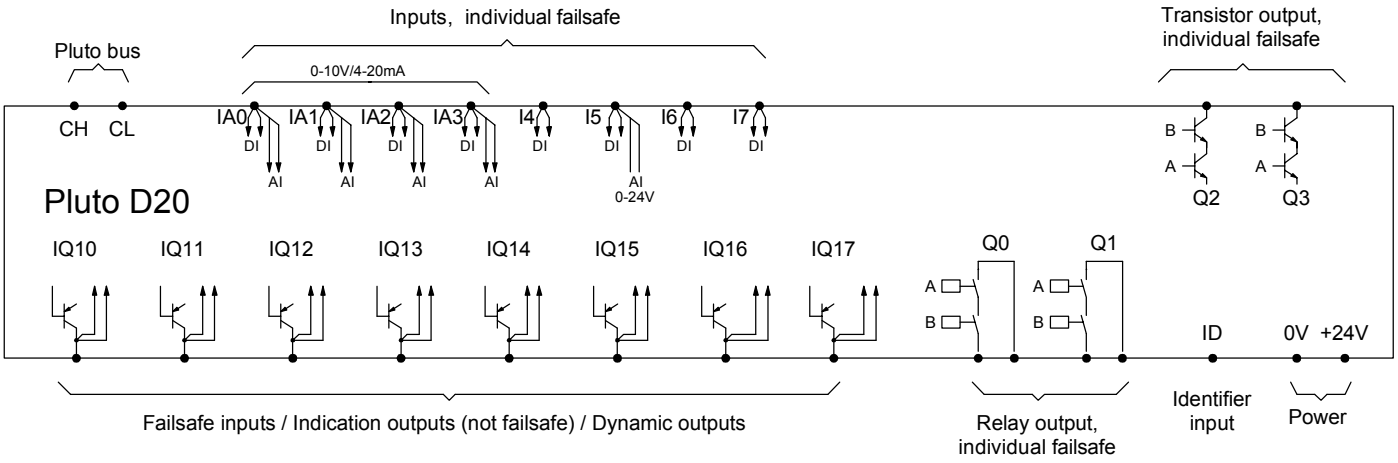


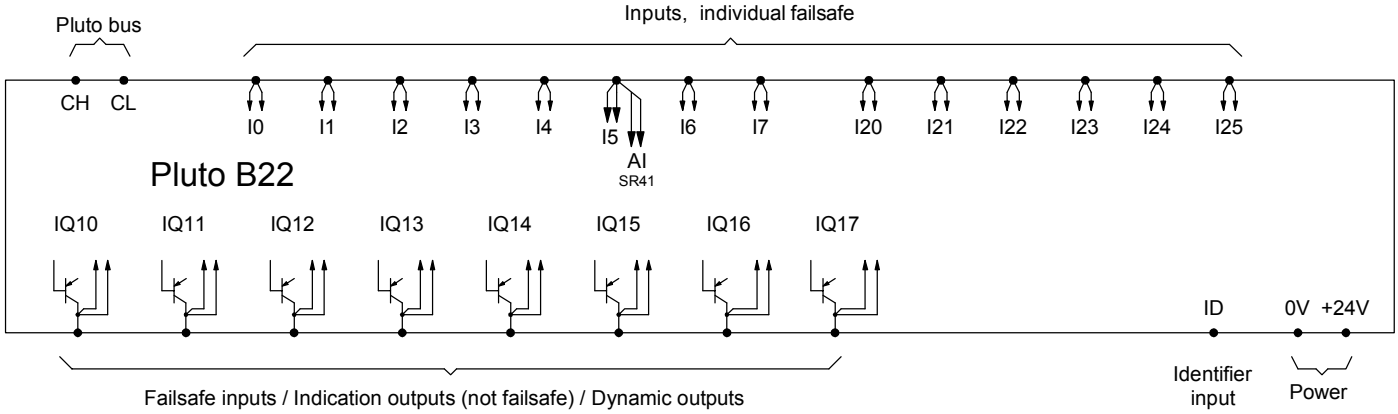
Using an expansion relay, such as BT50, the number of safe outputs in Pluto can be expanded. The connection shall be made as shown in the figure. Several expansion relays can be connected to a single Pluto safety output while retaining the safety level.

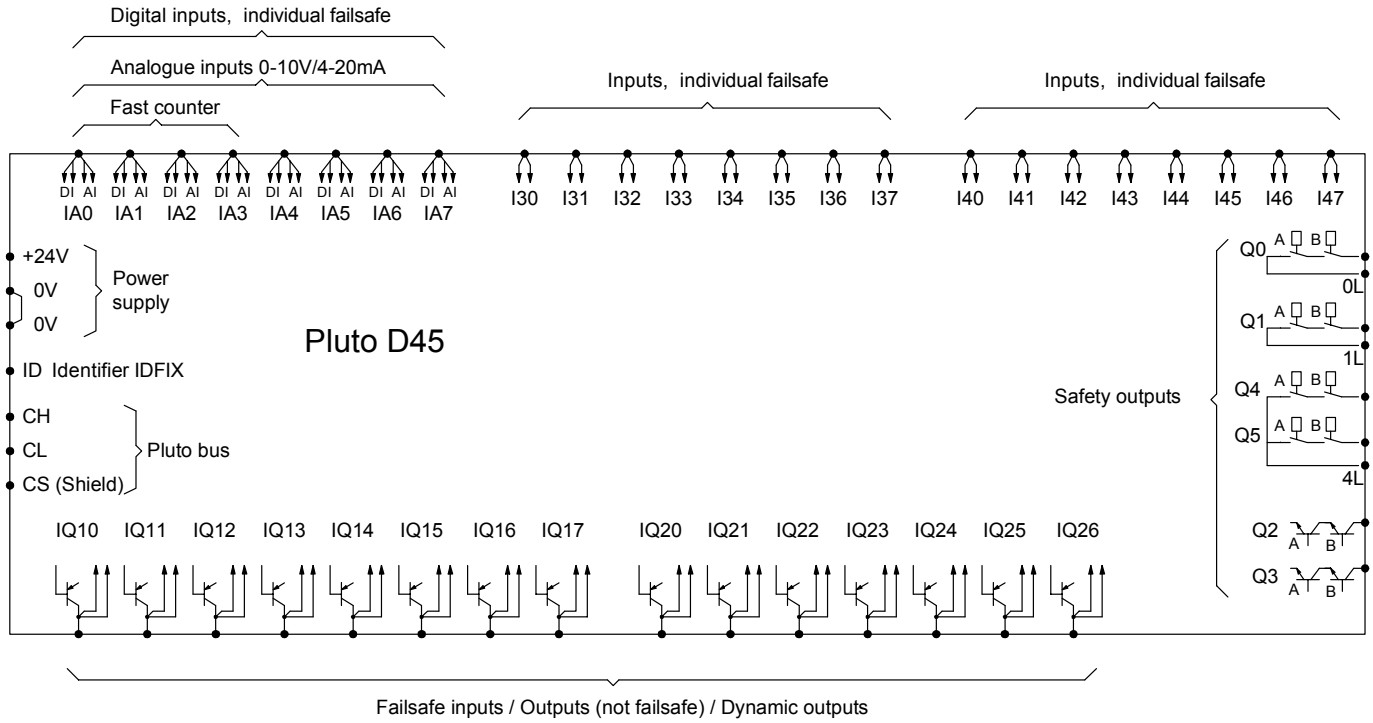
I/O Overview

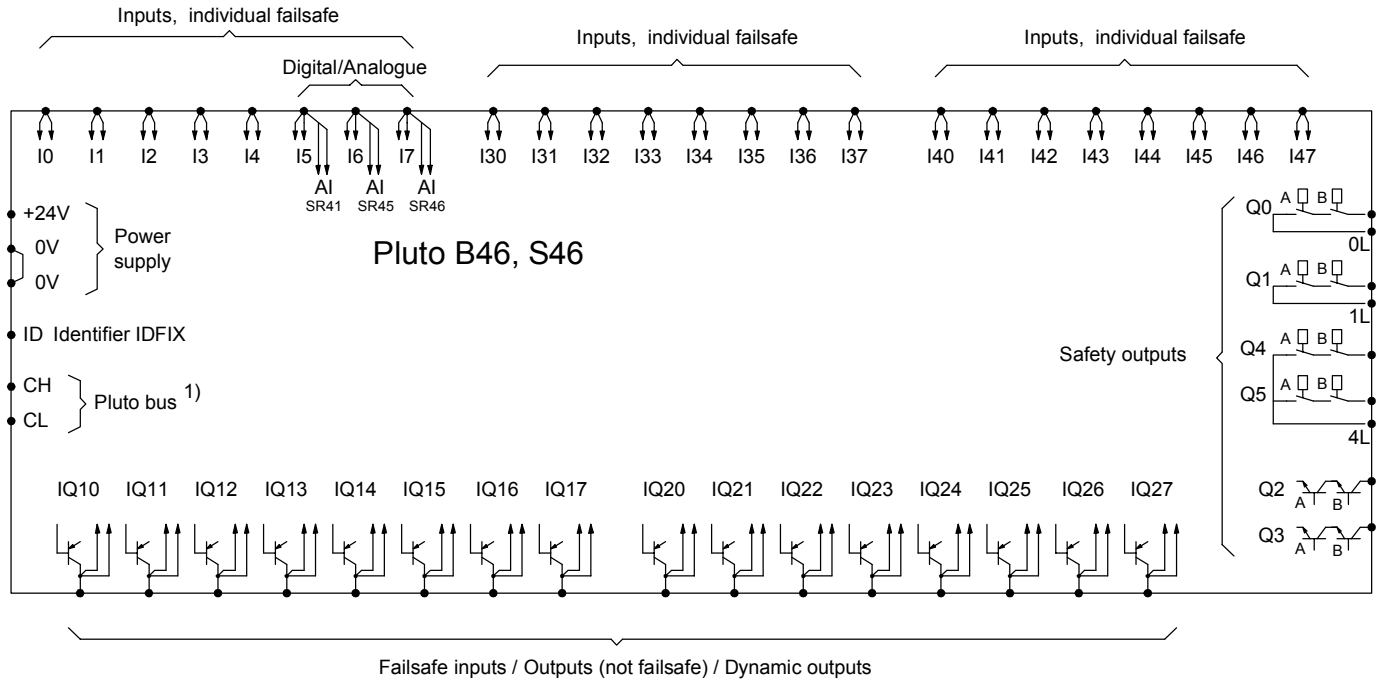


1) Not S-models, S20,...
2) Current monitored only on A20

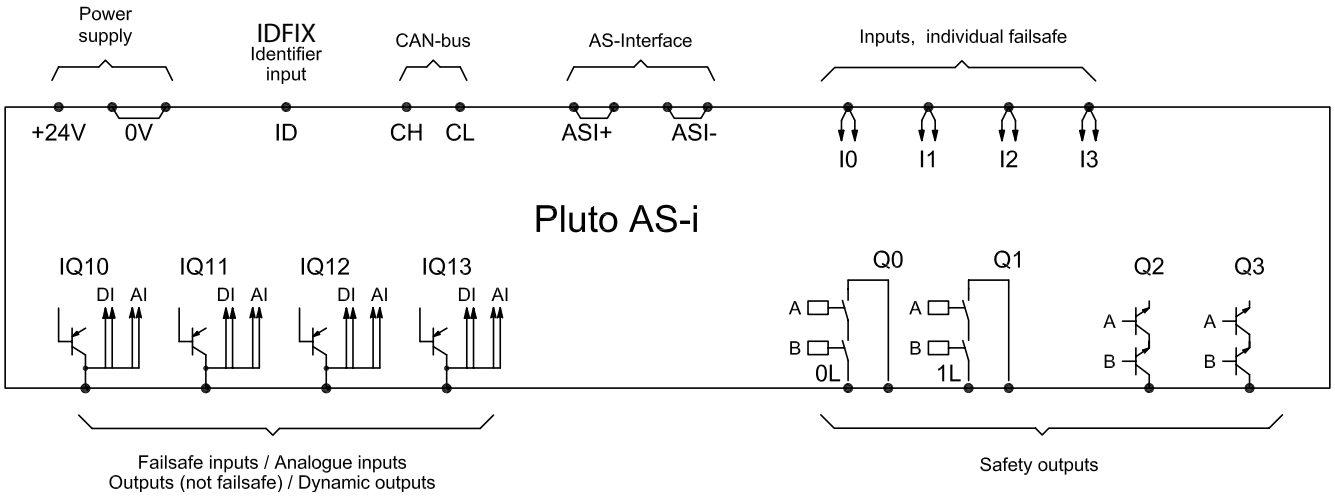


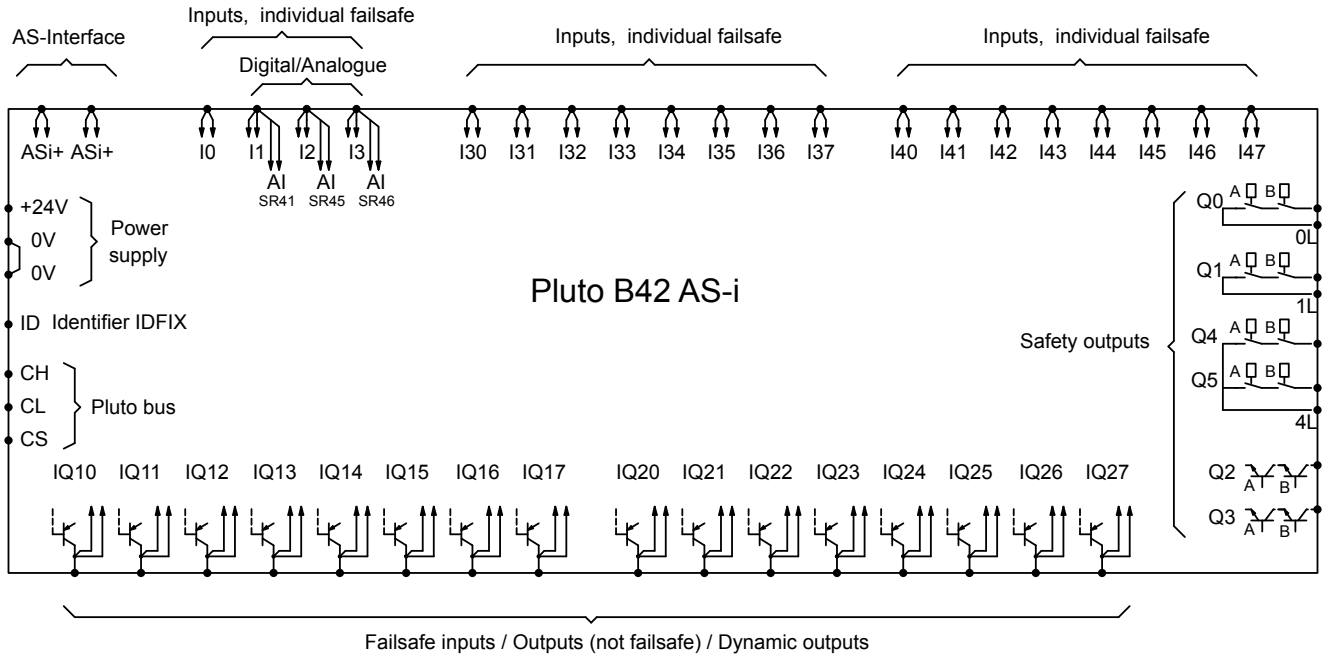

Pluto bus
Inputs, individual failsafe
CH CL
I0 I1 I2 I3 I4 I5 I6 I7 I20 I21 I22 I23 I24 I25
AI SR41
Pluto B22
IQ10 IQ11 IQ12 IQ13 IQ14 IQ15 IQ16 IQ17
ID 0V +24V
Failsafe inputs / Indication outputs (not failsafe) / Dynamic outputs
Identifier input
Power


Digital inputs, individual failsafe
Analogue inputs 0-10V/4-20mA
Fast counter
Inputs, individual failsafe
Inputs, individual failsafe
DI AI IA0 IA1 IA2 IA3 IA4 IA5 IA6 IA7
I30 I31 I32 I33 I34 I35 I36 I37
I40 I41 I42 I43 I44 I45 I46 I47
+24V 0V 0V
Power supply
Pluto D45
ID Identifier IDFIX
CH CL CS (Shield)
Pluto bus
Safety outputs
Q0 Q1 Q4 Q5 Q2 Q3
A B
0L 1L 4L
IQ10 IQ11 IQ12 IQ13 IQ14 IQ15 IQ16 IQ17 IQ20 IQ21 IQ22 IQ23 IQ24 IQ25 IQ26
Failsafe inputs / Outputs (not failsafe) / Dynamic outputs


Inputs, individual failsafe
Digital/Analogue
Inputs, individual failsafe
Inputs, individual failsafe
I0 I1 I2 I3 I4 I5 I6 I7
AI SR41 AI SR45 AI SR46
I30 I31 I32 I33 I34 I35 I36 I37
I40 I41 I42 I43 I44 I45 I46 I47
+24V 0V 0V
Power supply
Pluto B46, S46
ID Identifier IDFIX
CH CL
Pluto bus 1)
Safety outputs
Q0 Q1 Q4 Q5 Q2 Q3
A B
0L 1L 4L
IQ10 IQ11 IQ12 IQ13 IQ14 IQ15 IQ16 IQ17 IQ20 IQ21 IQ22 IQ23 IQ24 IQ25 IQ26 IQ27
Failsafe inputs / Outputs (not failsafe) / Dynamic outputs

1) Not S46





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.

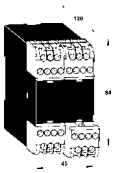
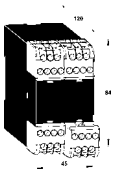
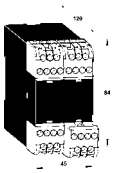
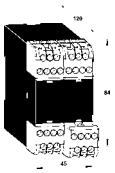
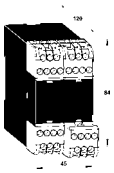
IQ.. I/O that can be used for safety inputs or signal outputs, e.g. to indicate or control functions that are not safety-related. For IQ.. as safety inputs, refer to I..

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 electromechanical 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

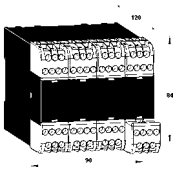
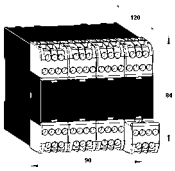
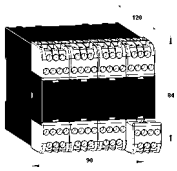
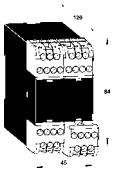
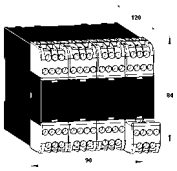






	Pluto A20	Pluto B20	Pluto B22	D20	S20
	20 I/O Current monitoring	20 I/O	22 I/O	20 I/O Analogue inputs	20 I/O Without safety bus
Article number	2TLA020070R4500	2TLA020070R4600	2TLA020070R4800	2TLA020070R6400	2TLA020070R4700
Failsafe inputs	8 (I0..I7)	8 (I0..I7)	14 (I0..I7, I20..I25)	8 (I0..I7)	8 (I0...I7)
Failsafe inputs or non-failsafe outputs	8 (IQ10..IQ17) Max total load 2.5 A	8 (IQ10..IQ17) Max total load 2.5 A	8 (IQ10..IQ17) Max total load 2.5 A	8 (IQ10..IQ17) Max total load 2.5 A	8 (IQ10...IQ17) Max total load 2.5 A
Analogue inputs (0-10V/4-20 mA)	–	–	–	4	–
Counter inputs	–	–	–	–	–
Analogue 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

Colour	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_D	
Relay output	2.00×10^{-9}
Transistor output:0	1.50×10^{-9}
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	Transistor, –24VDC, 800 mA
Output voltage tolerance	Supply voltage - 1.5 V at 800 mA
Q0, Q1, (Q4, Q5)	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.
Max. current/output	800 mA
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	Pluto D45	Pluto S46	Pluto AS-i	Pluto B42 AS-i
46 I/O	45 I/O Analogue/counter inputs	46 I/O Without safety bus	AS-i bus	AS-i 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) Max total load 2A	15 (IQ10..IQ17, IQ20..IQ26) Max total load 2A	16 (IQ10..IQ17, IQ20..IQ27) Max total load 2A	4 (IQ10..IQ13) Max total load 2A	16 (IQ10..IQ27) Max total load 2A
–	4*	–	–	–
–	8*	–	–	–
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

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

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.
Bus cable length:	Up to 500 m 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.

Robot cell with Pluto

Description

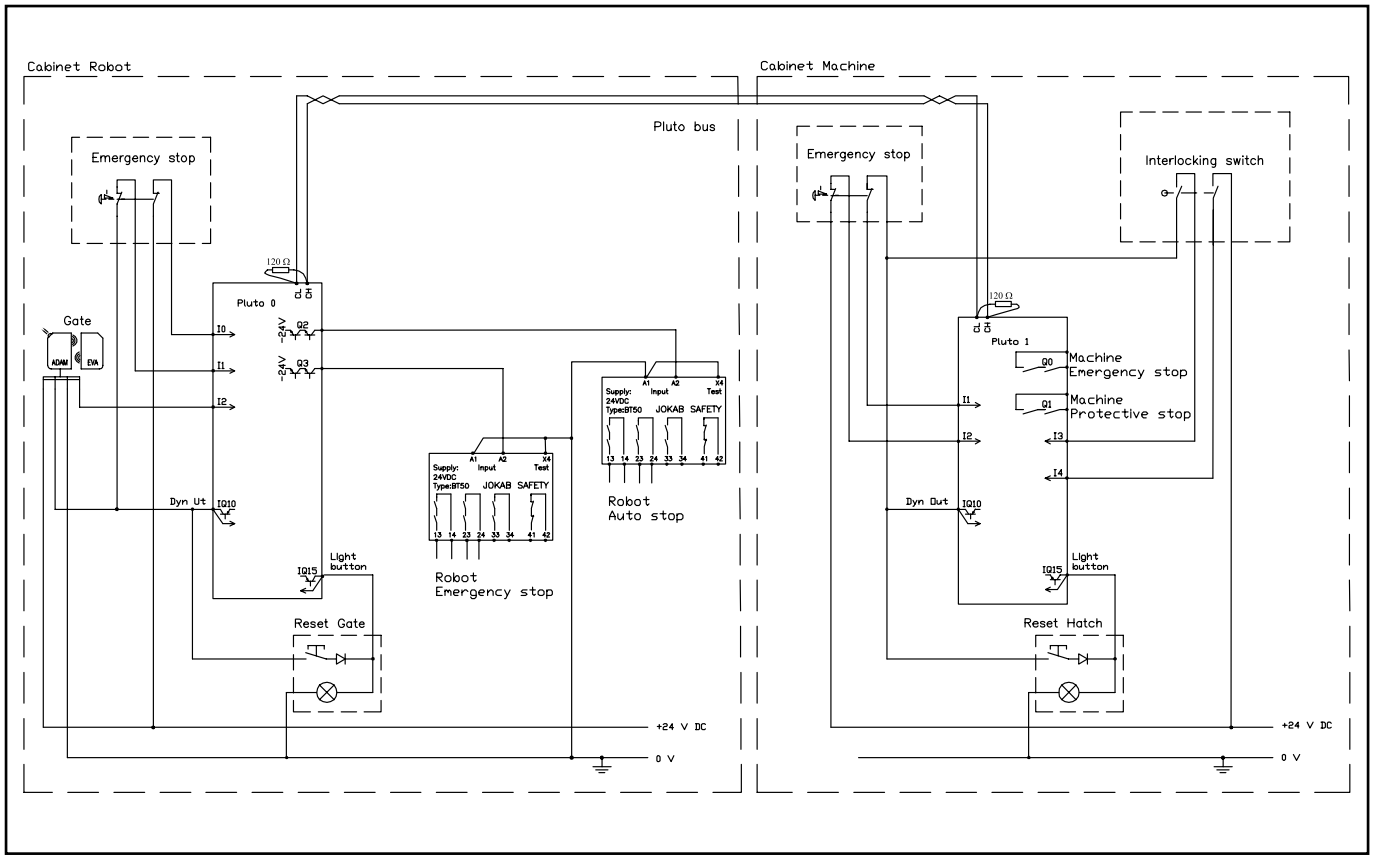
The example describes a processing machine served by a robot. The machine safety system consists of one (Pluto 1) to which all protection has been connected. The robot has been equipped with a (Pluto 0) to which the cell protection has been connected. The Pluto for the machine has been connected via a databus cable to the robot's Pluto so that common functions, such as emergency stop, can be used by the whole cell.

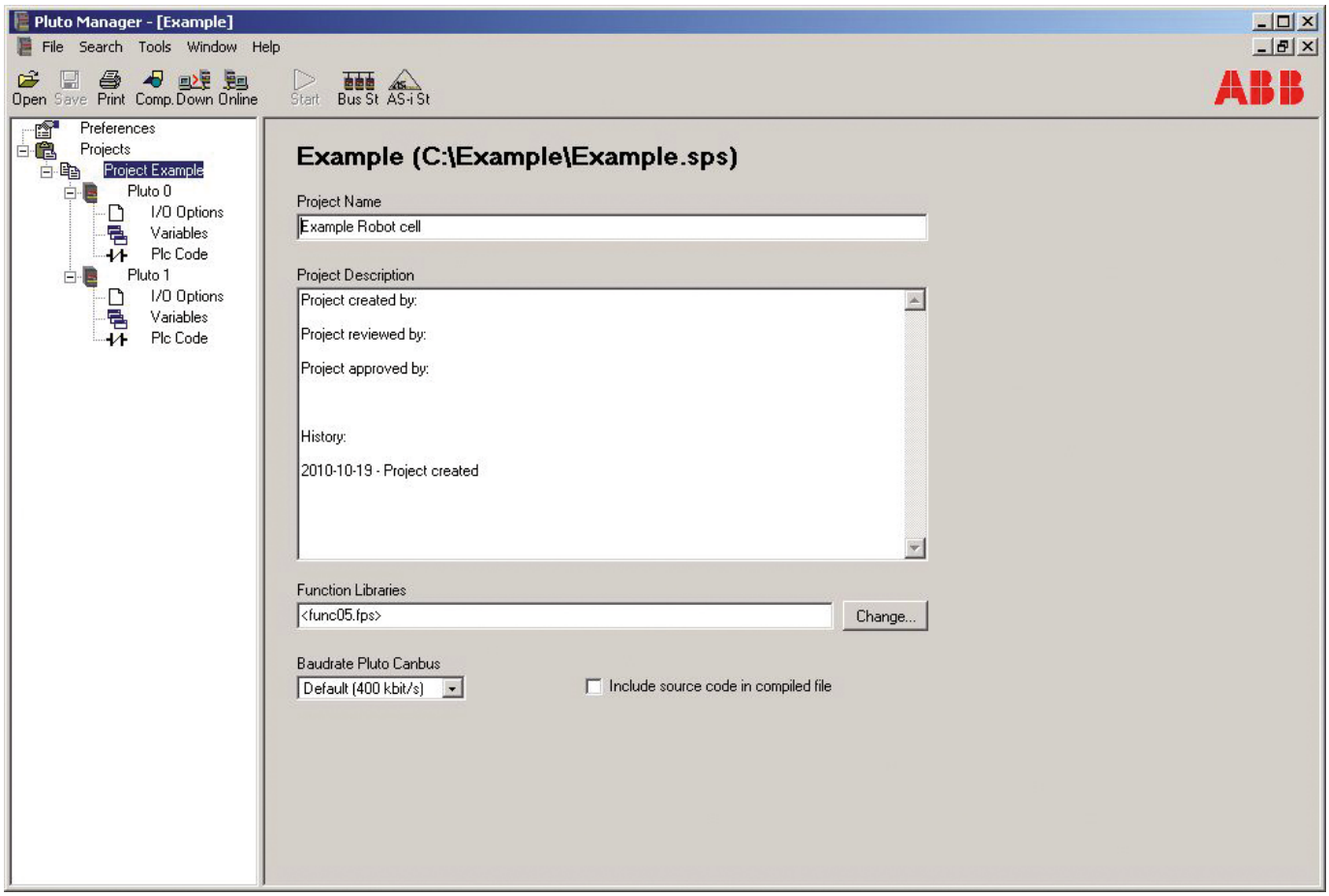
Function

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. 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





PLC code Pluto 0 – Robot cabinet

1

Start

2 Two channel monitoring with automatic reset of emergency stop at the door.

GM0.0=P0_ES_OK	*Emergency stop OK in 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*

3 Emergency stop of robot.

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.

GM0.0=P0_ES_OK	*Emergency stop OK in Pluto 0*
GM1.0=P1_ES_OK	*Emergency stop OK in Pluto 1*
Q0.3=P0_ES	*Robot emergency stop - Expansion BT50 relay*

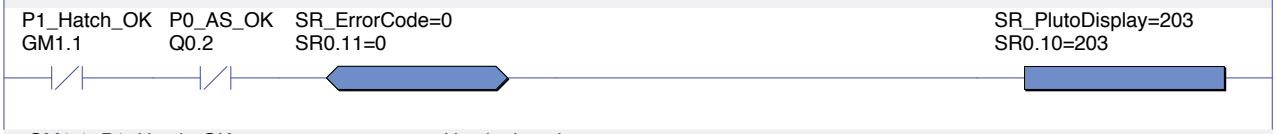
4 Auto stop of robot.

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 diffirent 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.

I0.15=P0_LB1_In	*Reset Door - Light button input - Dynamic A*
I0.2=P0_Eden1	*Door Eden sensor - Dynamic A*
Q0.15=P0_LB1_Out	*Reset Door - Light button output - Static*
Q0.2=P0_AS_OK	*Robot auto stop - Expansion BT50 relay*

5 Alarm 03 - Machine hatch open.

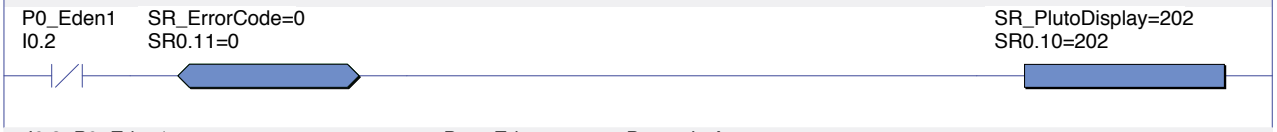
To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.



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

6 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*
SR0.10=SR_PlutoDisplay	*Pluto display figure. For user error: 200+no*
SR0.11=SR_ErrorCode	*Error code*

7 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.

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

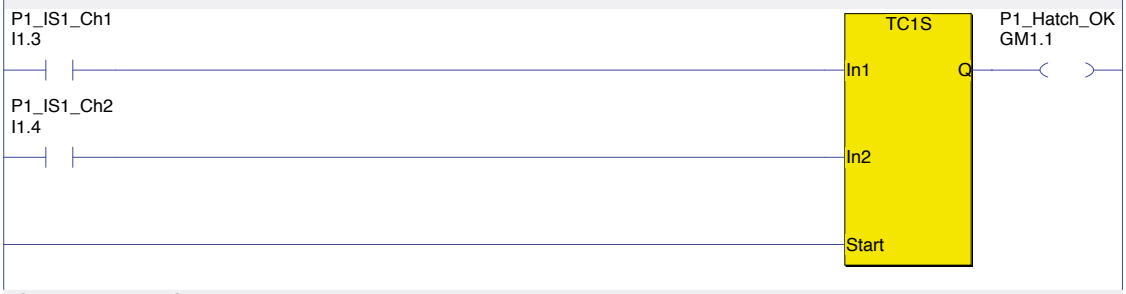
1

Start

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

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*

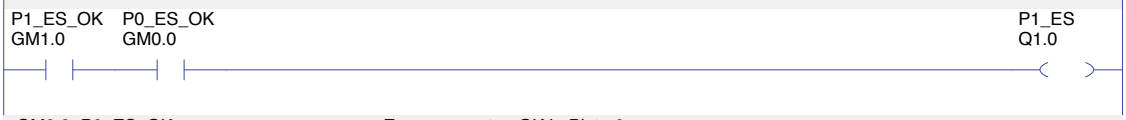
3 Two channel monitoring with automatic reset of interlocking switch of the machine hatch.



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*

4 Emergency stop of machine.

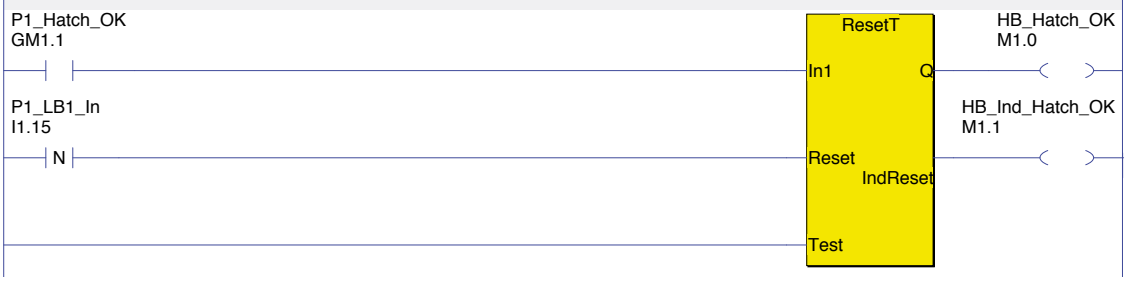
When the emergency stop is actuated the machine will make an emergency stop.
In order to restore safety requires the emergency stop button needs to be reset.
An emergency stop from the robot will also emergency stop the machine.



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*

5 Monitoring of the hatch.

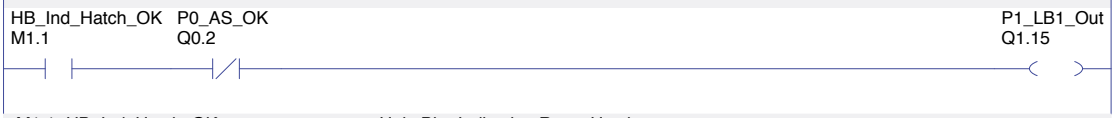
When the hatch is opened the monitoring of the hatch is inactive.
To reset the safety the hatch needs to be closed and the reset button pressed and released.
Note that IQ15 of the Pluto is used both as a button in and to indicate different reset states.
Constant light means reset is not possible, safety 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.



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.

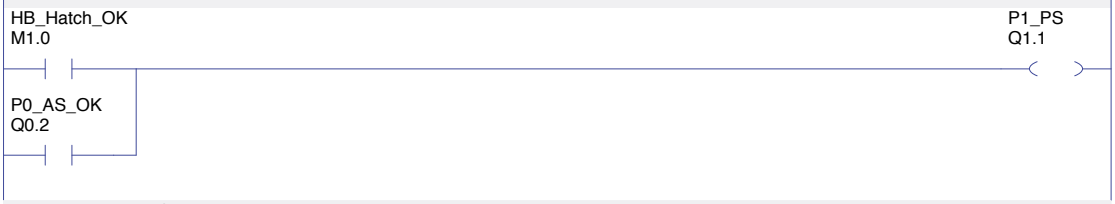
If the robot cell's door is closed and reset no light indication is needed inside the cell.



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.

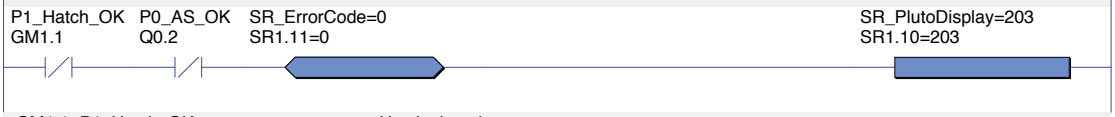
Either the hatch is closed and reset or the door to the robot cell is closed and reset.
This means the cell can work with the hatch both open or closed as long as the cell's door is closed and reset.



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.

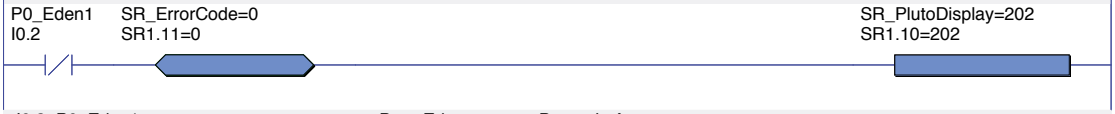
To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.



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.

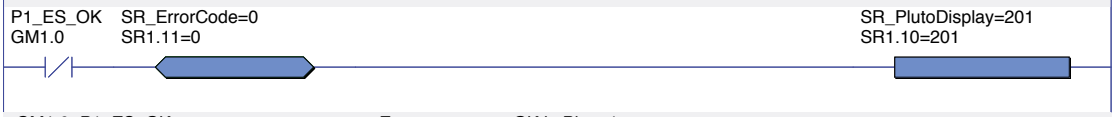
To generate User Errors (UE) a value of 200 - 299 can be written to the display of the Pluto.
A check of System Register 11 (SR11) in the Pluto prioritises errors from the Pluto itself over User Errors.



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

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

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.

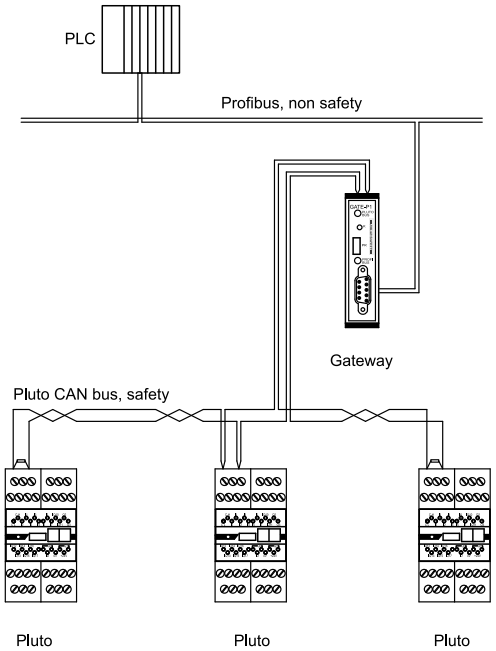
PLC function blocks

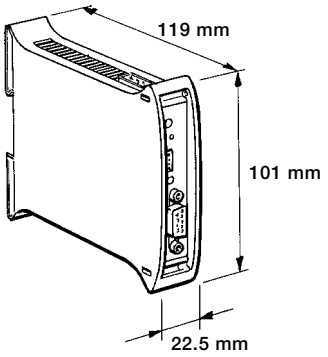
To simplify the integration of a Pluto gateway PROFIBUS into the supervisory PLC system, ABB Jokab Safety provides ready-made function blocks for several popular brands of PLC. The function blocks make it easier to receive and send information to the Pluto system. The function blocks are supplied as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

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 + 55ºC
Temperature, transport and storage	-25°C to + 55ºC
Humidity	EN 60 204-1 50% at 40ºC (ambient 90% at 20ºC)
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.

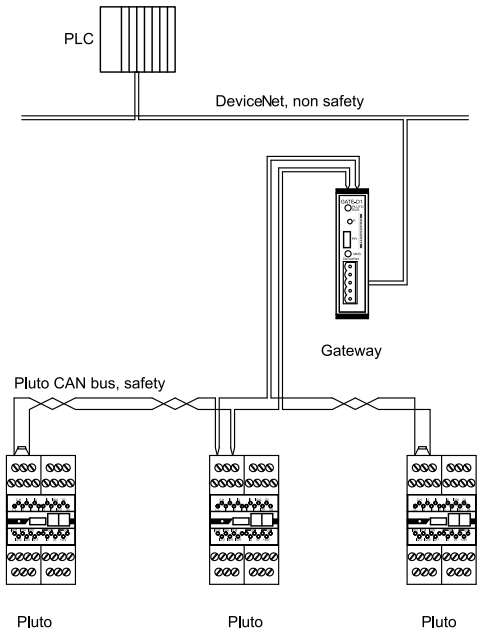
ABB Robotics IRC5

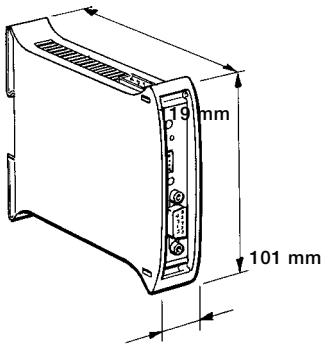
PLUTO GATE-D2 has support for integration into an ABB Robotics IRC5-system. The documentation that describes this integration can be obtained via www.abb.com/jokabsafety.

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

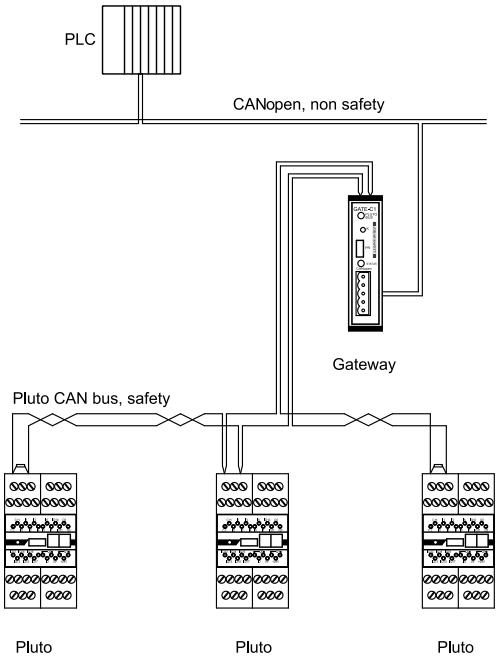
A GATE-C2 can also be used to advantage as a CAN bridge when it is required to divide a Pluto safety bus into several sections. This is particularly useful when long databus cables are needed.

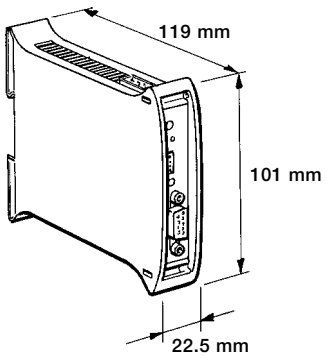
There is also a built-in filter function which makes it possible to block any data that is not required for use on the other side of the bridge, which reduces the databus loading in the other sections and thereby permits longer databus cables.

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.

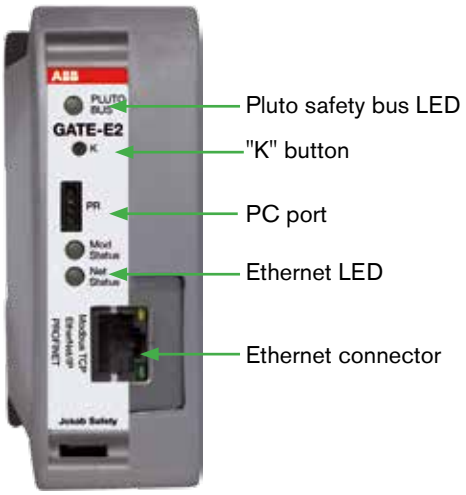
For IP-address configuration, etc. there is a simple web server and a terminal server.

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

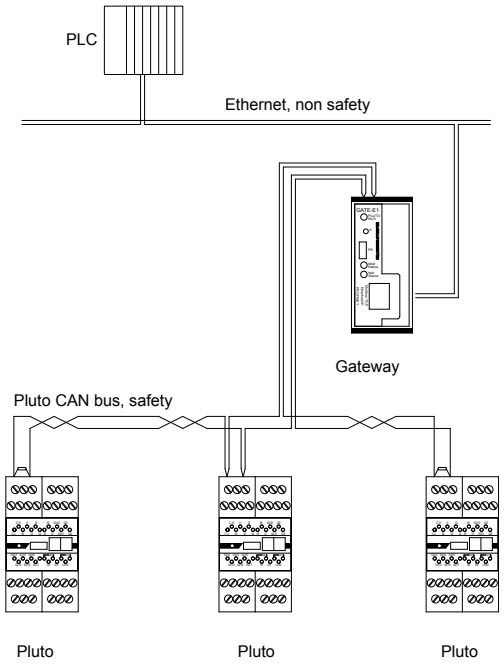
Via the Ethernet protocol a supervisory PLC system can transmit non-safety-related information to a Pluto safety PLC. A total of 64 Boolean values and 8 different 16-bit registers can be transmitted. Function blocks for these functions are available in Pluto Manager.

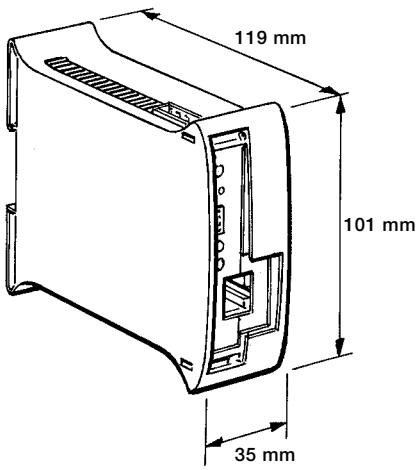


Technical data - GATE-E2

Article number	2TLA020071R8300
Buses	Pluto-bus CAN (isolated) Profinet (isolated) Ethernet/IP (isolated) Modbus TCP (isolated)
Pluto safety bus speeds	100, 200, 250, 400, 500, 800 and 1000 kbit/s (automatic speed detection)
Ethernet	10/100 Mbit/s Half and full duplex
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)
EtherNet/IP	According to ODVA “CIP Edition 3.2” and “EtherNet/IP Adaption of CIP Edition 1.3”. Minimum RPI of 50 ms
PROFINET	PROFINET
Modbus TCP	According to the Modbus organisation, version 1.0b (approx. 20 messages per second).
Binary server (TCP/IP)	Simple TCP/IP protocol to send status from/to the Pluto system.
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.
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)
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 VDC, -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 IP20 - IEC 60 529 Terminals IP20 - IEC 60 529

Gateway block schematic diagram - Pluto Ethernet





Pluto
Safe Encoder

Use:

- Safe position and speed determination of machine movements.

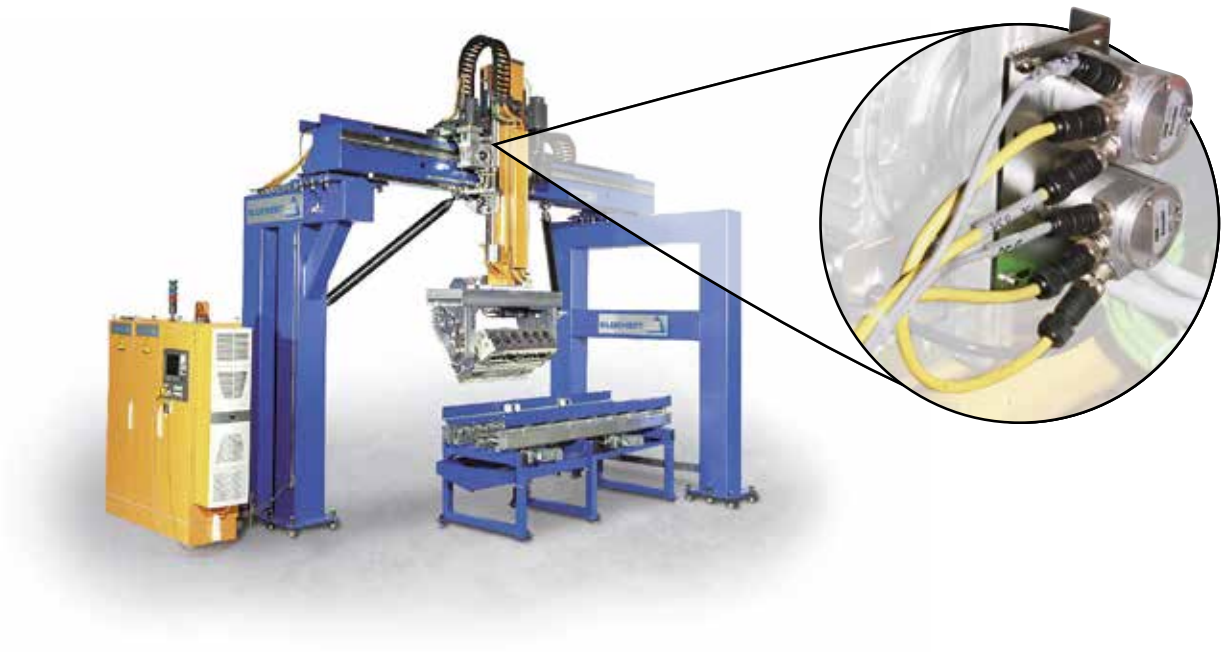
Features:

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

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 with equipment such 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.



Example of an application where 2 sensors provide safe position determination in a gantry robot.

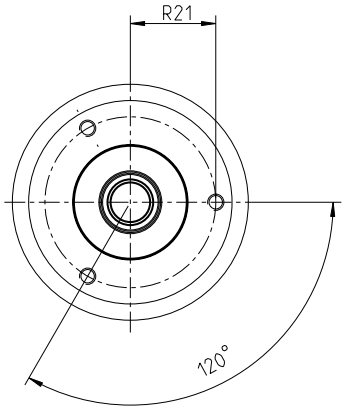
Technical data – Safe Encoder RSA 597/RHA 597

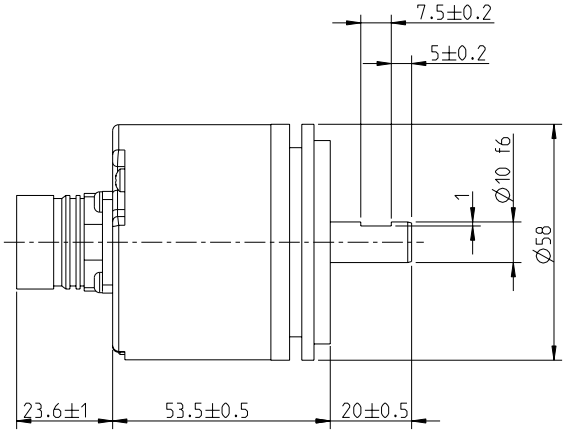
Article number	2TLA020070R3600 2TLA020070R3300 2TLA020070R3400 2TLA020070R5900
Ambient temperature	-40°C .. +70°C
Temperature, transport and storage	-30°C .. +70°C
Ingress protection class	IP-67 in accordance with IEC 60529
At shaft inlet	IP-66 in accordance with IEC 60529
Vibration (55 to 2000 Hz)	< 300 m/s² in accordance with IEC 60068-2-6
Shock (6ms)	< 2000 m/s² in accordance with IEC 60068-2-27
Material, enclosure	Aluminium
Surface treatment	Painted and chromed or anodised
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

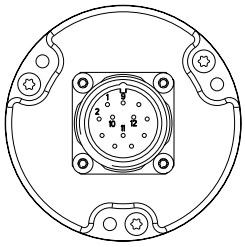
Ordering details

Shaft	Conncection	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 RSA 597	2TLA020070R3300*
Hollow shaft Ø 12 mm	2 m cable	RHA 597	2TLA020070R3400*
Hollow shaft Ø 12 mm	10 m cable	RHA 597	2TLA020070R5900*

***Ordering product**







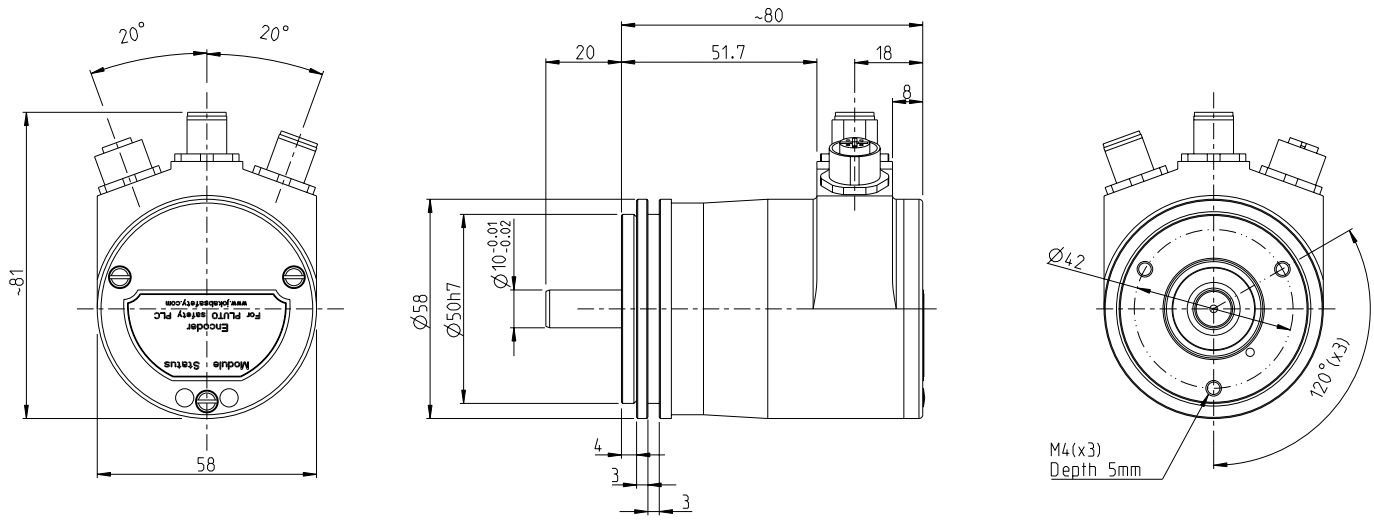
Technical data – Safe Encoder RSA 698/RHA 698

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/s² in accordance with IEC 60068-2-6
Shock (6ms)	< 2000 m/s² in accordance with IEC 60068-2-27
Material, enclosure	Aluminium
Surface treatment	Anodised
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	Conncection	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**

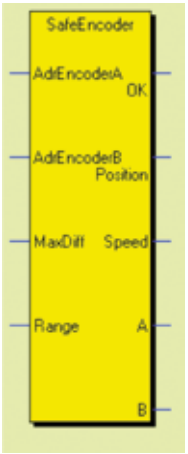


Safe Encoder

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.

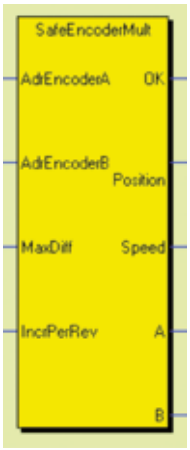
NOTE! When error occurs 'Position' = -1, 'Speed' = -32768 and the OK output will be reset.

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.

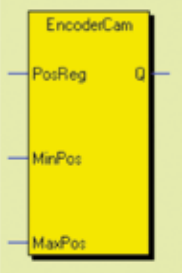
NOTE! When error occurs 'Position' = -1, 'Speed' = -32768 and the OK output will be reset.

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 preprogrammed.
- 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.