

Introduction



Pizzato Elettrica is pleased to present a new series of programmable safety modules, resulting from the decades-long experience of the company in the machine safety sector.

A CS MP series module is a programmable safety device, which allows several safety functions to be carried out simultaneously. This series of products has been specifically developed in order to meet the demands from manufacturers of machinery featuring a medium/low number of safety functions. As an indication, these modules are able to manage minimum applications comparable to the functions carried out by 3 - 4 traditional electromechanical safety modules and circuits having up to a few dozen inputs.

The Gemnis Studio program is a graphic development environment for the creation, simulation and debug of programs suitable to be entered in the modules belonging to the Gemnis line. **This software is licensed to the user who wishes to program the said modules, subject to prior registration in our web site: www.gemnis.com.**

General safety module characteristics

The Gemnis series modules are able to manage all the following types of safety devices:

- Mechanical safety switches
- Switches with solenoid for locking the guard
- Magnetic safety switches
- Optical safety barriers or optical safety sensors (in category 4)
- Safety sensors
- Mushroom pushbuttons for emergency stops
- Rope switches for emergency stops
- Safety mats or sensitive bumpers with 4-wire technology
- Bimanual controls in category IIIA or IIIC
- Safety selectors
- Enabling devices.

Moreover, these modules are provided with functions also allowing the following operations:

- Safety timing
- Detection of numerous types of faults in safety devices or their connections
- Checking of temperature limits inside the module
- Status communication by means of bus ports.

Finally, the Gemnis series modules can:

- Manage up to four different safety outputs, either electronic or with relay
- Manage various signalling outputs (not safe)
- Carry out status communications and data setting by means of the integrated USB communication port or appropriate communication boards.

The Gemnis project safety modules are able to create safety circuits classified up to SIL CL3 according to EN ISO 62061, up to PL e and category 4 according to EN ISO 13849-1.

TÜV approvals pending.



Web site

Support to this product line is provided on-line by our web site:

www.gemnis.com from where you can:

- Download the Gemnis Studio installation package (with prior registration)
- Download the support file
- Obtain the latest version of the instruction manual
- Obtain examples and other support information that will be added later.





Modules hardware structure

The Gemnis project modules have been designed with highly flexible properties, also in terms of hardware. These products are made up of various electronic boards, which are sold in different combination, but always contained in one single housing and with a unique product code.

The Gemnis line modules have a redundant-type self-monitored general structure, are controlled by a pair of processors which run the Application Program in parallel, while at the same time constantly monitoring their operation and system integrity.

Each module is provided with a single housing having the minimum width required to hold the boards making up the module. Housings from 45 up to 180 mm-wide are available. Therefore, the customers needs not worry about wiring the various parts.

The USB port integrated in the module is used to program and debug the module from the Gemnis Studio program. Once a given module has been programmed, the USB port can also be used to communicate with a PC installed on board the machine and to exchange information relating to the module status.



Code structure

CS MP301M0

Board combination		Supply voltage	
•••	board combination	0	24 Vdc -15% ... +15%
Connection			
M	connector with screw terminal		
X	connector with spring terminal		

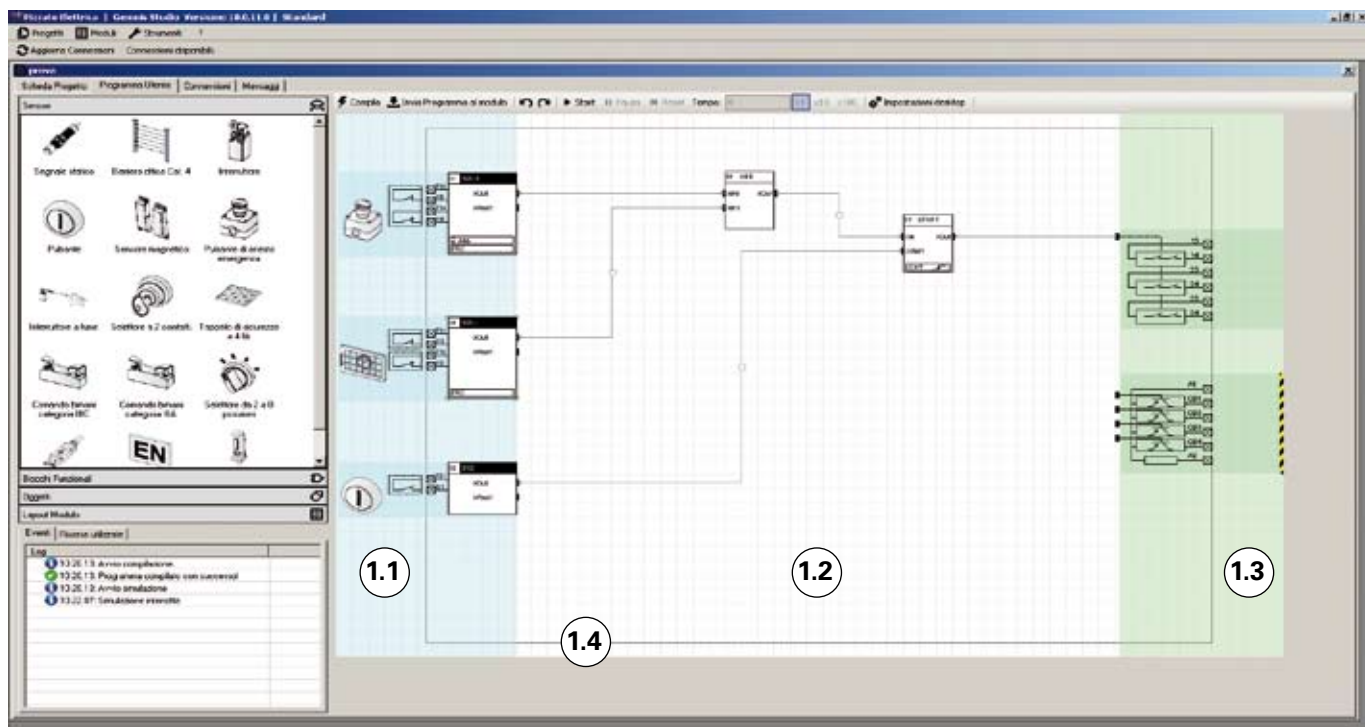
Gemis Studio

The Gemis Studio software has been designed to allow any user to program any module belonging to the Gemis line. This software is provided with a graphic interface used to display, in a natural intuitive way, the whole of the operations that the Application Program will carry out after being uploaded onto the module. Gemis Studio can complement the configuration information with useful support information and notes for the program to be fully understood. Furthermore, Gemis Studio can check that the Application Program operates correctly before it is sent to the module by means of simulation.

Finally, Gemis Studio can carry out monitoring or to detect and graphically represent the status of a real device when active and operating.



Desktop



The Gemis Studio software has been designed with the objective of making the operation of a Gemis series module as immediate and visible as possible. The choice was made to create a work environment – the Desktop – where, as far as possible, the user can get all the information necessary to actually “see” and not just “imagine” the behaviour of the project being developed. This is the reason for trying to make room for graphic representations of the objects, physical characteristics of the module used, and immediate interaction, by means of simulation, with the program created.

The Desktop is the main user work area, the zone where the flow and processing to be applied to the data detected by the module are defined by means of the graphic program interface.

The desktop is divided into three parts:

- 1.1) the sensor zone
- 1.2) the function block zone
- 1.3) the output zone

In the sensor zone (1.1) the user will indicate which types of external devices are connected to the module terminals and all the parameters needed to define them.

In the output zone (1.3) all the output devices present in the module selected (relays, transistors etc.) are immediately shown.

In the function block zone (1.2) the user will enter all the logic functions needed to process the flow of the data coming from the sensors, and will proceed to carry out the connections which transfer such data between the objects in the Desktop and finally onto the outputs.

The Desktop includes a dotted box (1.4) which represents the area “taken up by the module”, that is everything enclosed in the physical module, from terminals to codes. The area outside this box, instead, is taken up by the images of the physical devices on the outside of the module (switches, pushbuttons etc.), by their expected internal structure and possibly their description.

At the user’s request, the Desktop contents is compiled and, provided there are no mistakes, it is translated into the Application Program. If a module is connected to the computer, the Application Program can be immediately transferred into it, and therefore effective module operation can be checked on the field.

Otherwise it is possible to simulate Application Program operation directly on the desktop, by interacting with the sensors and evaluating the effects in graphic mode.

Project

The whole of the information necessary to configure a module and describe its activities has been defined as “Project.” By means of Gemis Studio, the user can build up the text and graphic information needed to describe and comment the functions which will be carried out by the program after being installed on a Gemis line module.

Printing

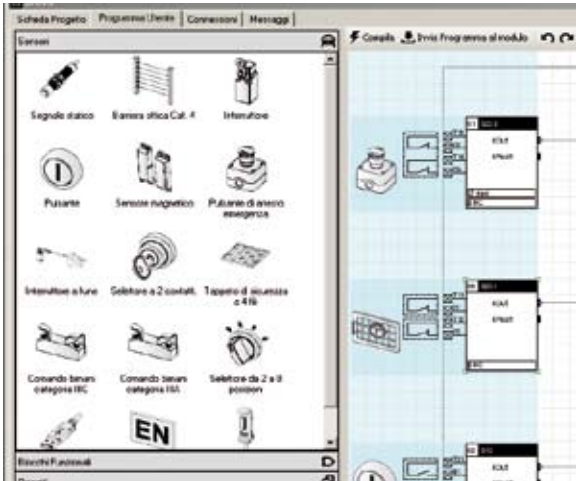
Gemis Studio can generate a Connection Report, including all connections to the module terminals, and a User Program Report, allowing the Application Program to be printed.

Password

The password offers the option of protecting the interaction capacity of a module and possibly modifying the project file.



Sensors



The sensor zone indicates the types of external devices which can be connected to the module terminals, and all the parameters needed to define them.

Each sensor created presents a view of the internal contact configuration and of how the contacts are connected to the module terminals, a box with the associated safety function and parameters selected for the function.

From the sensor panel, one sensor can be selected with the mouse and dragged into the dedicated desktop area.

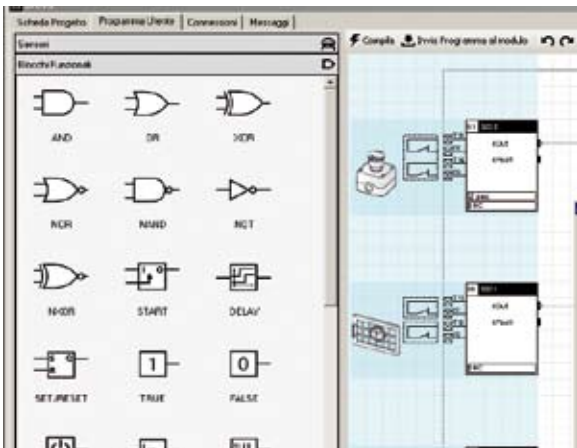
A full list of sensors available is shown on the side.

The list could be updated. For the latest products, see gemnis.com

List of sensors

Electrical types	Diagram	Examples
Sensor with 1 non-testable channel		
Sensor with 2 non-testable channels and interdependent signals		
Sensor with 1 tested channel		
Sensor with 2 independent tested channels		
Sensor with 2 dependent tested channels		
Sensor with 2 always-closed tested channels and short circuit admissible between the channels		
Sensor with 2 tested channels which can be crossed		
Sensor with 2 tested channels which cannot be crossed		
Sensor with 2 to 8 tested channels which cannot be crossed and must only be active one at a time		
Sensor with 2 tested channels which cannot be crossed and must follow a very precise activation/deactivation sequence made up of three statuses: rest, work, stop		

Function Blocks



The function blocks represent all the logic functions required to process the data flow between sensors and outputs.

From the function block panel, one block can be selected with the mouse and dragged into the dedicated desktop area.

A full list of the function blocks available is shown on the side.

The list could be updated. For the latest products, see gemnis.com

List of Function Blocks

	AND Basic boolean function
	OR Basic boolean function
	XOR Basic boolean function
	NOR Basic boolean function
	NAND Basic boolean function
	NOT Basic boolean function
	NXOR Basic boolean function
	START Control function
	DELAY Returns a Delay Off or Delay On-type signal
	SET/RESET Basic logical memory function
	TRUE / FALSE Basic boolean function
	POWER ON Signal active at the first execution cycle
	PULSE Returns a Delay Off-type signal on the selected input edge

List of Function Blocks

	CLOCK Generates impulses with fixed pre-established intervals
	ERROR Places the module in Error Status
	GEQ/EQU/LEQ Carries out a numerical comparison between two B or W-type values and indicates the result in boolean format (X)
	LKTBL Table for conversion between data of the same type
	MESSAGE Transmits a message on the USB and COM ports
	COUNTER Impulse counter
	TRIGGER Detects the edge, either rising or falling, of an incoming signal
	FILTER Filters a signal from interference lasting less than the time set
	LDC Function block preset for controlling a door-locking device



Expansion module with delayed contacts at de-energizing

Main functions

- For safety applications up to SIL 3 / PL e
- Possibility of control with 1 or 2 channels
- Supply voltages: 24 Vdc
- Visual programming and program simulation are made easier and intuitive thanks to Gemnis Studio
- Wide availability of logical blocks for the management of external devices and programs
- Customized versions available on customers' request

In conformity with standards:

IEC 60947-1, EN 60947-5-1, IEC 60204-1, EN 60204-1, EN ISO 13849-1, EN 999, EN 1037, EN ISO 12100-1, EN ISO 12100-2, EN ISO 13850, IEC 529, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 62326-1, EN 60664-1, EN 60947-5-1, EN 62061, EN 13849-1, UL 508, CSA C22.2 n° 14-95

Markings and quality marks:



Approval UL: E131787
Approval GOST: POCC IT.AB24.B04512

Complying with the requirements requested by:

Low Voltage Directive 2006/95/EC,
Machinery Directive 2006/42/EC,
Electromagnetic Compatibility 2004/108/EC

Data type approved by UL

Rated operating voltage (Un): 24 Vdc
Rated power consumption DC: < 3 W

Relay safety output:

- Max switching voltage: 230/240 Vac
- Max switching current per contact: 4 A
- Utilization category C300

Semiconductor output circuits:

- Max switching voltage: 24 Vdc
- Max switching current per contact: 500 mA

Notes:
- Use 60° or 75 °C copper (Cu) conductor and wire size No. 30-12 AWG.
- Terminal tightening torque of 5-7 Lb In.
- Only for 24 Vac/dc version, supply from remote class 2 source or limited voltage and limited energy.

Technical data

Housing

Housing: Made of polyamide PA 6.6 self-extinguishing, class V0 (UL94) IP40 (housing), IP20 (terminals)
Protection degree:
Dimensions, cross section of the conductors, terminal tightening torque:
Terminals layout:
Internal wiring diagram: see page 5/82, shape C / E
see page 5/84
see page 5/83

General data

SIL level (SIL CL): up to SIL 3 according to EN IEC 62061
Performance level (PL): up to PL e according to EN ISO 13849-1
Safety category: up to up to cat. 4 according to EN ISO 13849-1
Safety parameters: see page 7/34
System response time: < 30 ms
Working temperature: 0°C ... +55°C
Storage temperature: -20°C ... +70°C
Pollution degree: outside 3, inside 2
Rated impulse with stand voltage (Uimp): 4 KV
Rated insulation voltage (Ui): 500 V
Over-voltage category: II

Power supply

Rated voltage A1-A2 (Un): 24 Vdc
Maximum residual oscillation: 10%
Supply voltage tolerance: ±15% of Un
Rated consumption (loadless): < 3 W
General internal protection: PTC, I_h=1,5 A
PTC triggering time: triggering > 100 ms, reset > 3 s
Internal protection against short circuits on outputs (Tx, O_x): electronic
Maximum current to be supplied from the module as a summation of the Tx and O_x type outputs: 0,5 A
Self-test time at starting: < 2 s

Input circuits (Ix)

Voltage and current on input circuits: 24 V, 5 mA
Galvanic separation: No
Minimum input signal period: 10 ms
Input signal filtering: Yes, maximum interference period 0.4 ms
Maximum input resistance: 100 Ohm
Maximum input capacity: 1 µF towards earth and 470 nF between the two leads

Circuits with Test (Tx) signals

Type of signal: Pulsed 100 Hz 24V/0V, duty cycle 50%
Maximum summation of currents: see Power supply
Protected from short circuit: Yes

Signalling output circuits with semiconductor (Ox)

Type of output: PNP
Maximum current per output: 0,5 A
Maximum summation of currents: see Power supply
Protected from short circuit: Yes
Galvanic separation: No

Safety output circuits with semiconductor (OSx)

Rated voltage 24V-0V: 24 Vdc
Type of output: PNP
Maximum current per contact: 0,5 A
Maximum summation of currents: 2 A
Min. current: 10 mA
Protected from short circuit: Yes, PTC I_h=0,75 A
Galvanic separation: Yes
Survey of outputs short circuits: Yes
Duration of deactivation pulses on safety outputs: < 300 µs

Safety output circuits with relay

Rated voltage 24V-0V: 24 Vdc
Type of contact: Contacts guided according to EN 50205
Contact material: Silver alloy, gold plated
Maximum switching voltage: 230 Vac; 300 Vdc
Maximum current per contact: 6 A
Maximum summation of currents Σ I_{th}²: 36 A²
Min. current: 10 mA
Protection fuse: 4 A type gG
Maximum load: 1380 VA/W
Utilization category (EN 60947-5-1): AC15 (U_e=230V, I_e=3A); DC13 (U_e=24V, I_e=4A 6 cycles/minute)
C300
Category of use (UL 508):
Contact resistance: < 100 mOhm
Mechanical endurance: > 10 millions of operations
Electrical endurance: > 100.000 operations Galvanic
separation: Yes
The number and the load capacity of output contacts can be increased by using expansion modules or contactors See page 5/51 - 5/61.

Selection table



Article	CS MP201M0	CS MP202M0	CS MP203M0	CS MP204M0
Dimensions (H x W x D)	111,5 x 45 x 99 mm	111,5 x 45 x 99 mm	111,5 x 45 x 99 mm	111,5 x 45 x 99 mm
Safety inputs (Ix)	8	16	12	12
Test outputs (Tx)	8	4	4	4
Semiconductor signaling output circuits (Ox)	4	4	4	4
Semiconductor safety output circuits (OSx)	/	4PNP	/	/
Relay safety output circuits	3NO	/	3NO+1NO	3NO
Weight	300 g	250 gr	300 g	300 g



Article	CS MP301M0	CS MP302M0	CS MP303M0	CS MP304M0
Dimensions (H x W x D)	111,5 x 67,5 x 99 mm	111,5 x 67,5 x 99 mm	111,5 x 67,5 x 99 mm	111,5 x 67,5 x 99 mm
Safety inputs (Ix)	24	24	32	28
Test outputs (Tx)	8	12	4	4
Semiconductor signaling output circuits (Ox)	4	4	4	4
Semiconductor safety output circuits (OSx)	/	4PNP	4PNP	/
Relay safety output circuits	3NO	/	/	3NO+1NO
Weight	400 g	350 g	350 g	400 g



Article	CS MP305M0	CS MP306M0
Dimensions (H x W x D)	111,5 x 67,5 x 99 mm	111,5 x 67,5 x 99 mm
Safety inputs (Ix)	24	20
Test outputs (Tx)	4	4
Semiconductor signaling output circuits (Ox)	12	12
Semiconductor safety output circuits (OSx)	4PNP	/
Relay safety output circuits	/	3NO+1NO
Weight	350 g	400 g

The list could be updated. For the latest products, see gemnis.com

Introduction



GEMNIS

An increasing number of users requires products to carry out several safety functions without needing the complex management of a safety PLC or the complex wiring of many traditional safety modules. Such problems mainly arise when the safety functions are usually greater than 3 or 4, and/or when managing a safety PLC software (software purchase, training courses, programming of all modules, software management and filing, updates etc.) turns out to be difficult in relation to problem complexity.

Pizzato Elettrica introduces Gemnis, a series of electronic modules which are pre-programmed for specific customers' applications or for generic safety macro-functions commonly used in industrial contexts. The following pages list some of the products pre-programmed for generic macro-functions commonly addressed to the industrial sector. Such products can be freely purchased even individually. Any customer requiring a product pre-programmed on particular specifications can contact the Pizzato Elettrica technical department (minimum volumes are requested).

The resulting advantages for customers typically include simple product management (purchase of finished components) and reduced general costs (no software to be installed and

managed, products immediately operative).

All the Gemnis series products are able to provide circuit solutions at SIL3 (EN 62061), PLe (EN 13849) or category 4 (EN 954-1) levels.

TÜV approval pending.

Markings and quality marks:



Approval UL:

E131787

Approval GOST:

POCC IT.AB24.B04512

Code structure

CS MF201M0-P●●

Hardware code

●● hardware code

Program code

P●● program code

Connection

M connector with screw terminal

Supply voltage

0 24 Vdc -15% ... +15%



List of products

Product code	Functions provided	Safe outputs	Signalling outputs	Page
CS MF201M0-P1	Monitoring of 2 guards in AND and 1 emergency stop with automatic or manual monitored start.	3 NO	4 PNP	5/71
CS MF202M0-P2	Monitoring of 4 guards in AND, 1 bypass selector, 1 emergency stop, automatic or manual monitored start, general enabling signal.	4 PNP	4 PNP	5/72
CS MF202M0-P3	Monitoring of 6 guards in AND (2NC contacts), 1 emergency stop, automatic or manual monitored start.	4 PNP	4 PNP	5/73
CS MF202M0-P4	Monitoring of 6 guards in AND (1NC+1NO contacts), 1 emergency stop, automatic or manual monitored start.	4 PNP	4 PNP	5/74
CS MF202M0-P5	Monitoring of 4 guards with independent outputs, 1 bypass selector, 1 emergency stop, automatic or manual monitored start, general enabling signal.	4 PNP	4 PNP	5/75
CS MF202M0-P6	Monitoring of 2 guards and 1 bypass, 1 emergency stop, automatic or manual monitored start, general enabling signal. Three instantaneous outputs and one output timed with a 4-setting selector. Selectable On/Off delay.	4 PNP	4 PNP	5/76
CS MF202M0-P7	Monitoring of 4 guards in AND with switches provided with door lock, "D" principle, 1 emergency stop, monitored start. Two instantaneous outputs and two outputs timed by means of a 4-setting selector.	4 PNP	4 PNP	5/77
CS MF202M0-P8	Monitoring of 4 guards in AND with switches provided with door lock, "E" principle, 1 emergency stop, monitored start. Two instantaneous outputs and two outputs timed by means of a 4-setting selector.	4 PNP	4 PNP	5/78

Legend



Monitoring of gate



Start function



Time selector



Monitoring of gate with lock



Bypass selector



Enabling input



Emergency stop



Product code
CS MF201M0-P1



Functions provided

- Monitoring of 2 guards
- Monitoring of 1 emergency stop
- Automatic or manual monitored start

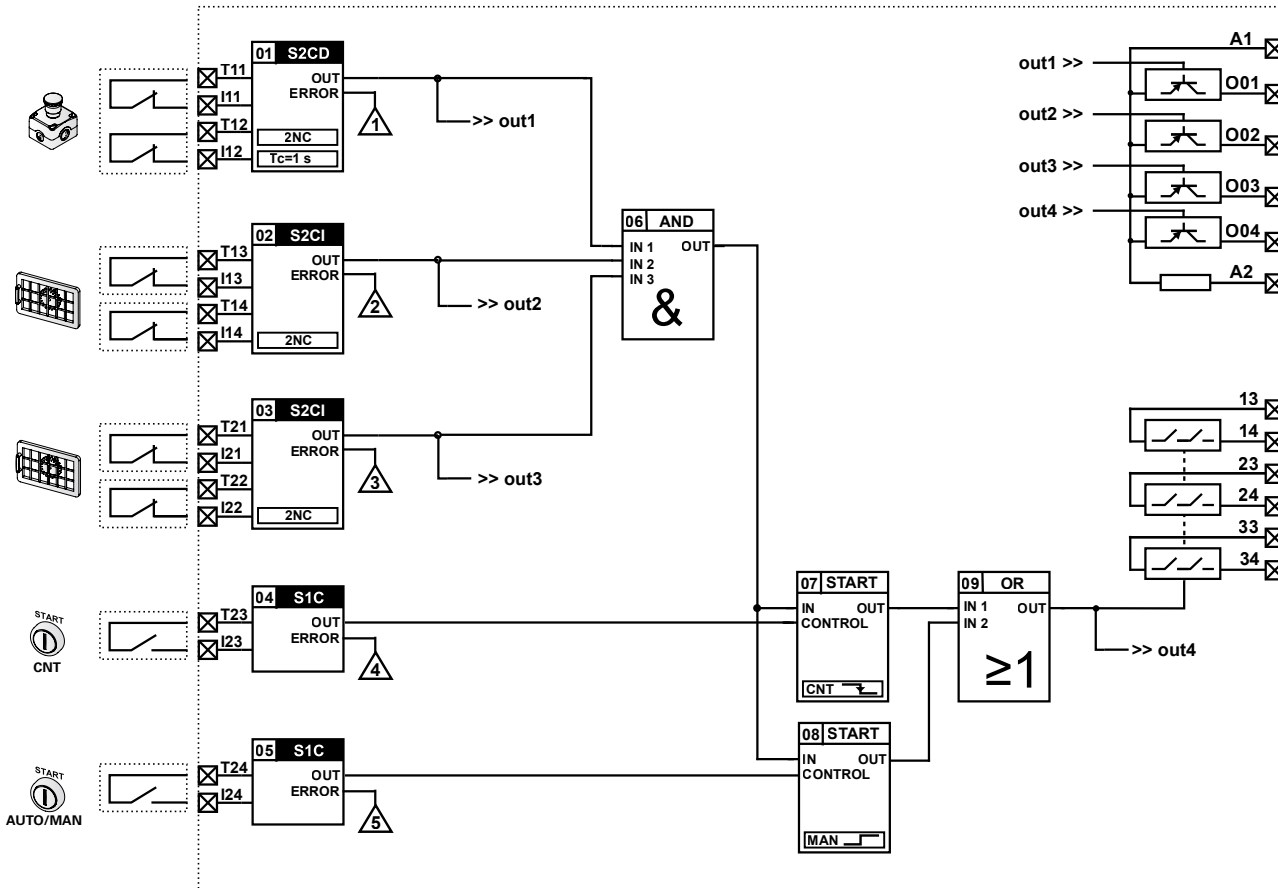
Outputs

- 3 NO safety outputs
- 4 PNP signalling outputs

Technical data see CS MP201M0: see pages 5/67-5/68
 Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
 Terminals layout: see page 5/84
 Internal wiring diagram: see page 5/83

Application program: P1

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Product code
CS MF202M0-P2



Functions provided

- Monitoring of 4 guards
- 1 bypass selector
- 1 emergency stop
- Automatic or manual monitored start
- General enabling signal

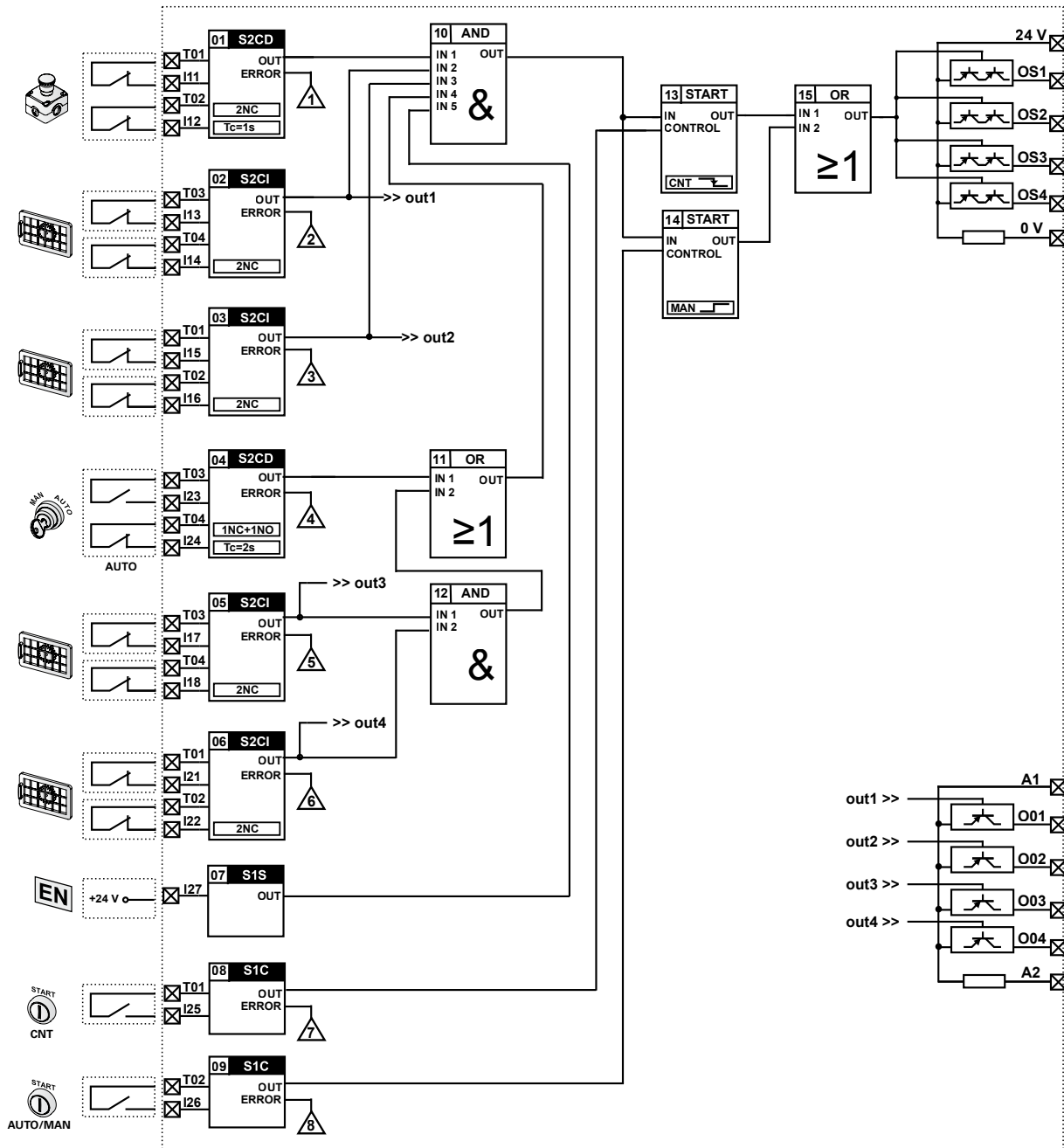
Outputs

- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data see CS MP202M0: see pages 5/67-5/68
Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
Terminals layout: see page 5/84
Internal wiring diagram: see page 5/83

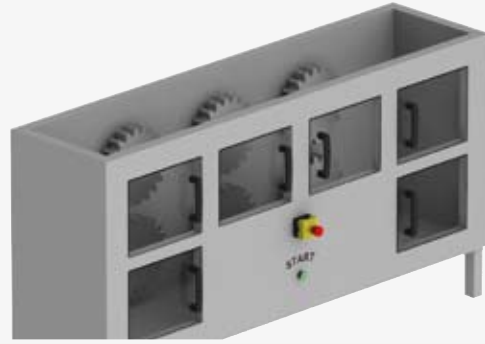
Application program: P2

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Product code
CS MF202M0-P3



Functions provided

- Monitoring of 6 guards (2NC contacts)
- 1 emergency stop
- Automatic or manual monitored start

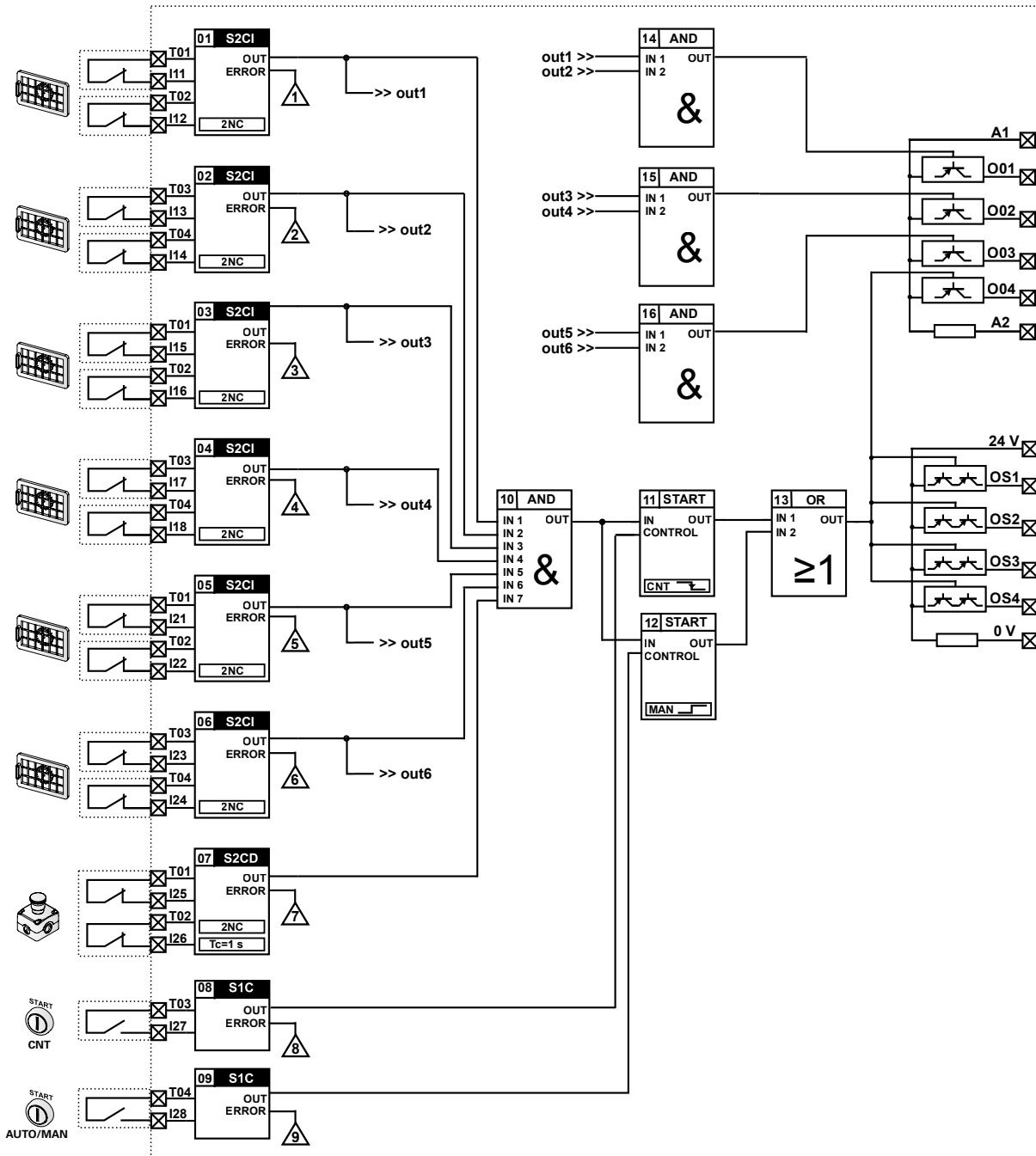
Outputs

- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data see CS MP202M0: see pages 5/67-5/68
 Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
 Terminals layout: see page 5/84
 Internal wiring diagram: see page 5/83

Application program: P3

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Product code
CS MF202M0-P4



Functions provided

- Monitoring of 6 guards (1NC+1NO contacts)
- 1 emergency stop
- Automatic or manual monitored start

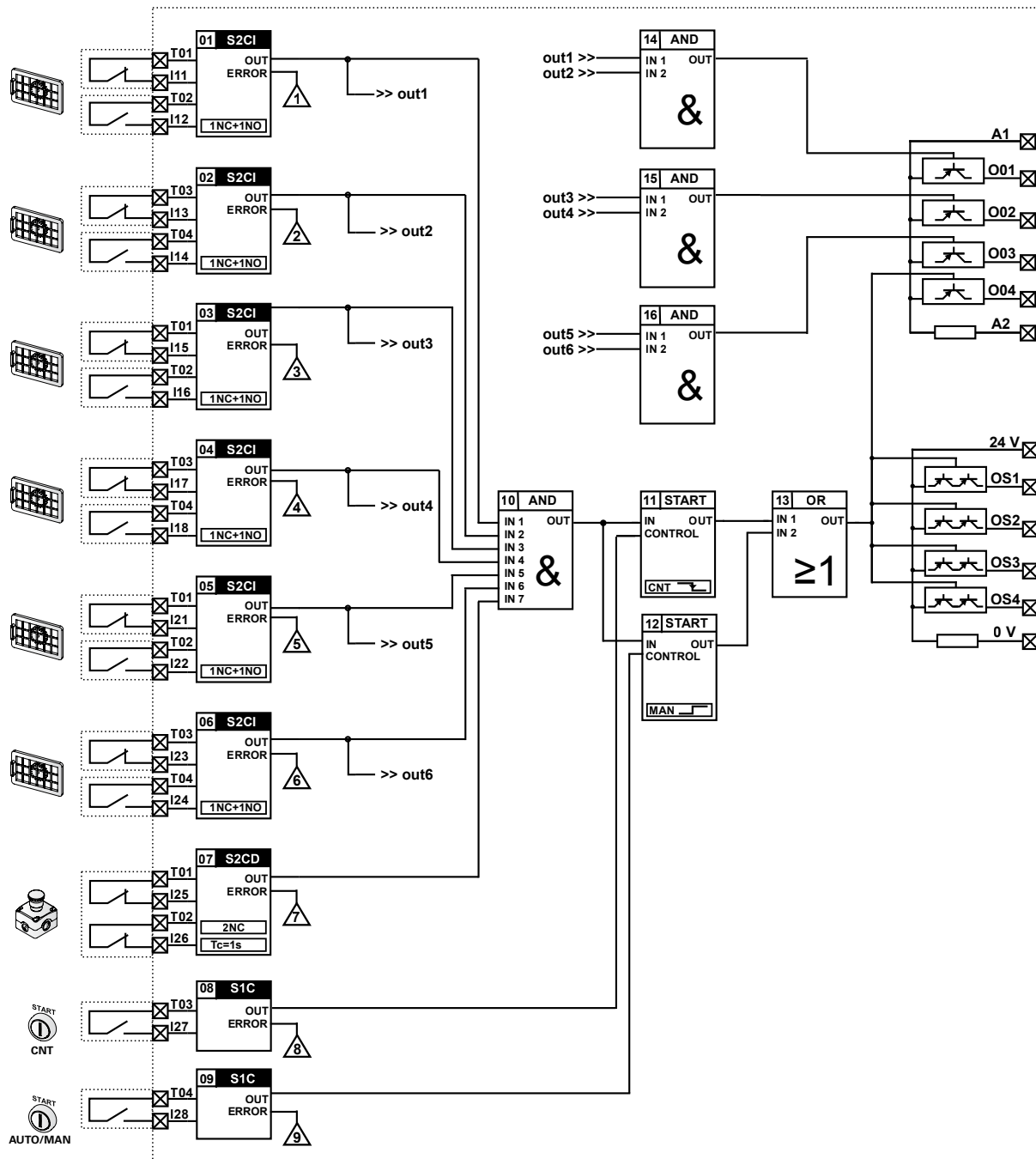
Outputs

- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data see CS MP202M0: see pages 5/67-5/68
Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
Terminals layout: see page 5/84
Internal wiring diagram: see page 5/83

Application program: P4

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Product code
CS MF202M0-P5



Functions provided

- Monitoring of 4 guards with independent outputs
- 1 bypass selector
- 1 emergency stop
- Automatic or manual monitored start
- General enabling signal

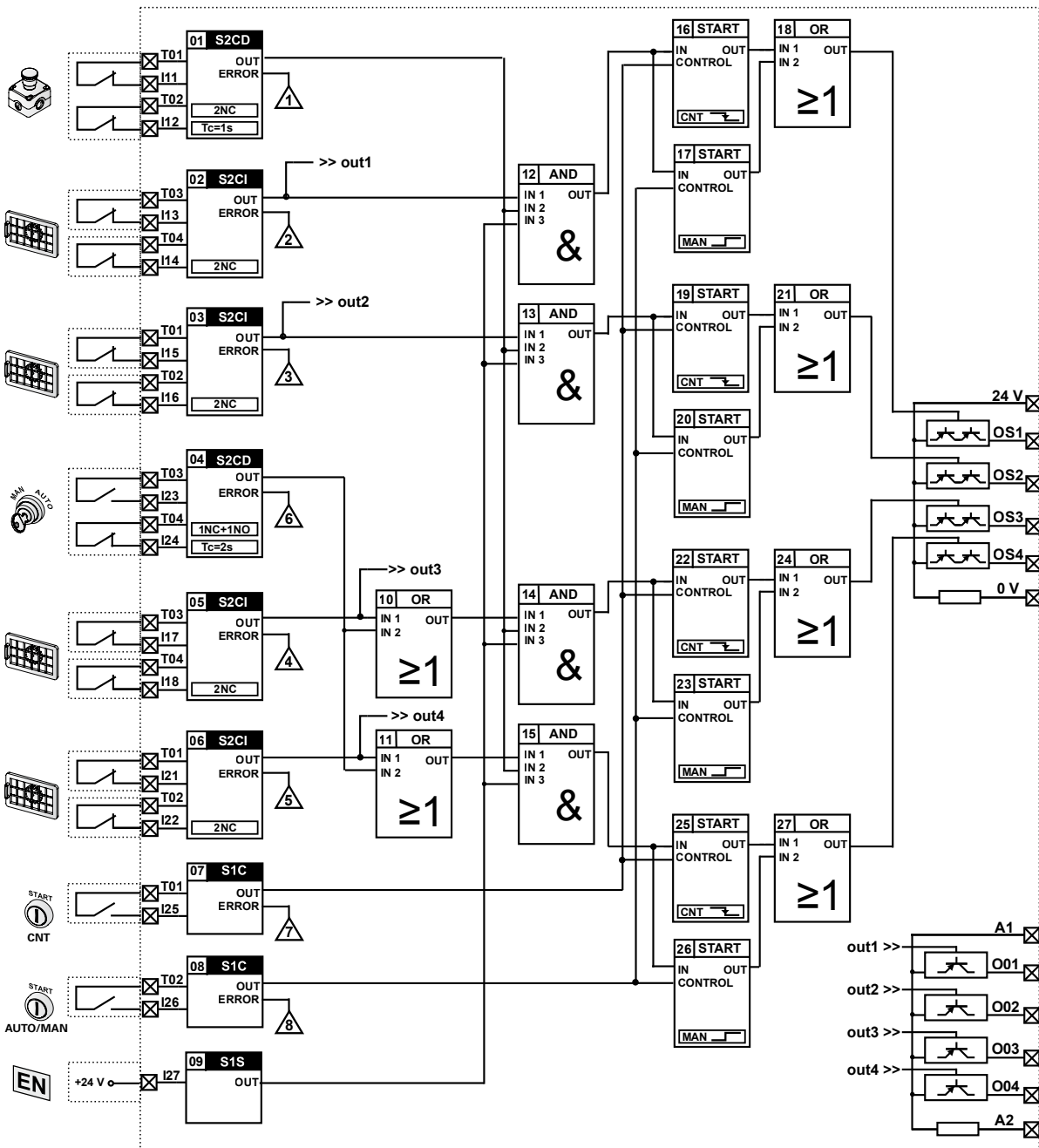
Outputs

- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data see CS MP202M0: see pages 5/67-5/68
Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
Terminals layout: see page 5/84
Internal wiring diagram: see page 5/83

Application program: P5

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Product code
CS MF202M0-P6



Functions provided

- Monitoring of 2 guards
- 1 bypass
- 1 emergency stop
- Automatic or manual monitored start
- General enabling signal
- Selectable On/Off delay
- 4-setting selector

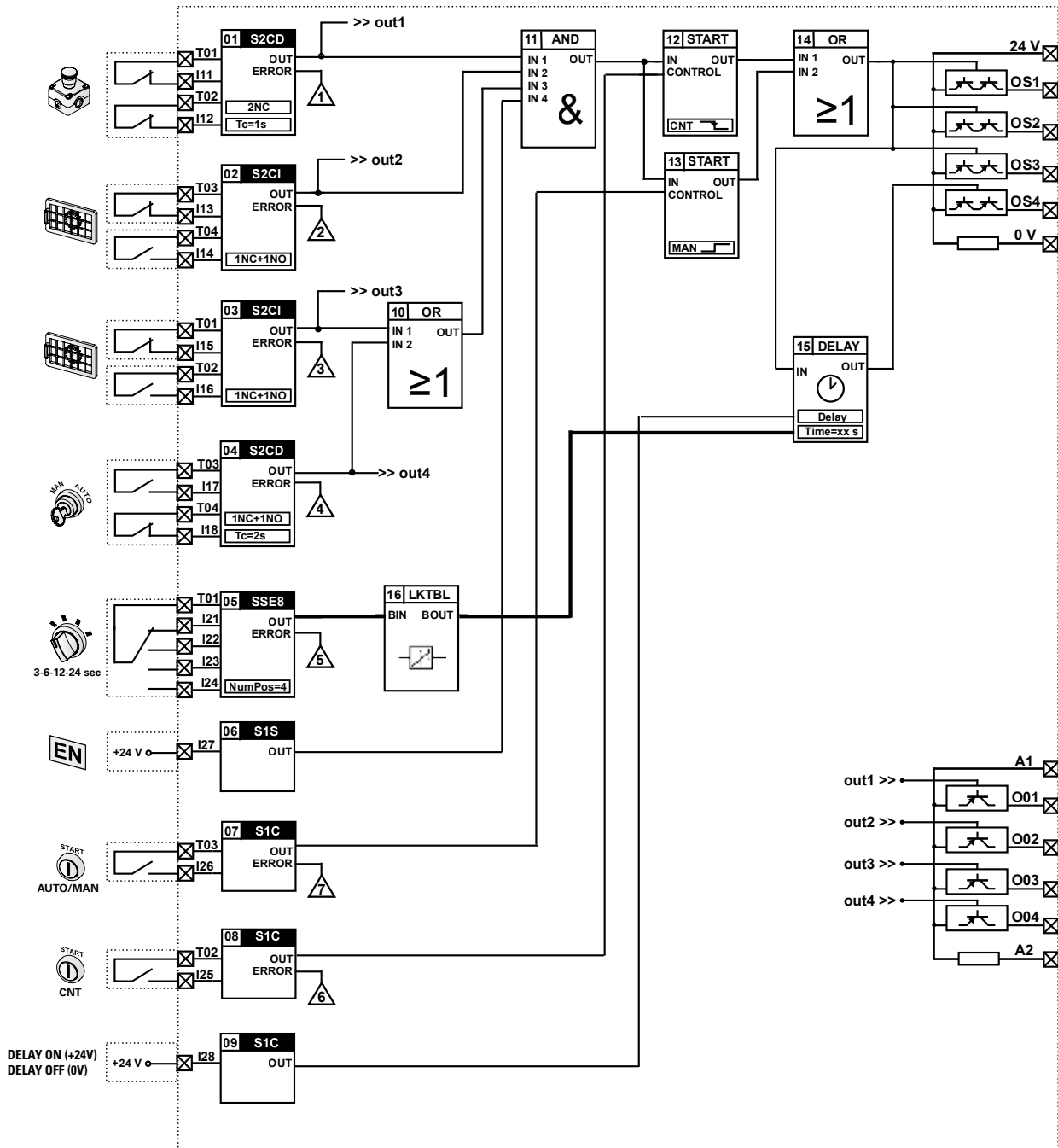
Outputs

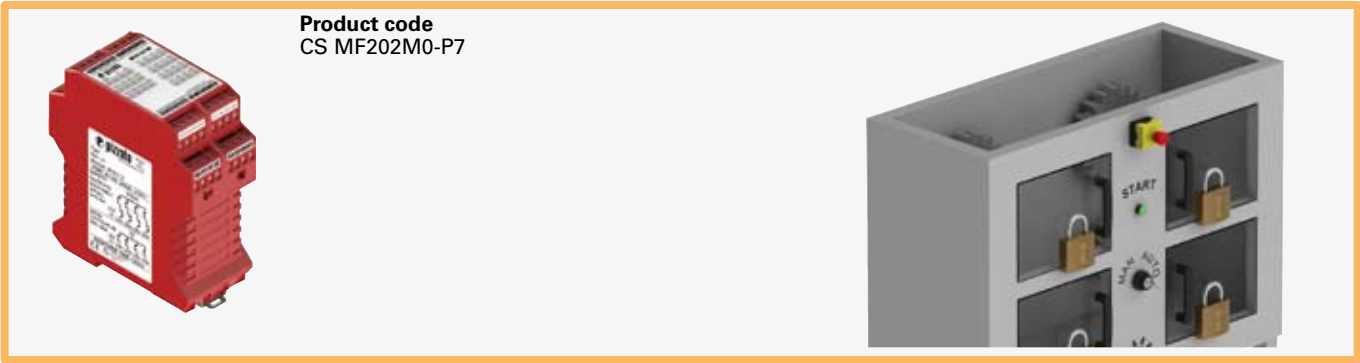
- Three instantaneous outputs and one output timed
- 4 PNP signalling outputs

Technical data see CS MP202M0: see pages 5/67-5/68
 Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
 Terminals layout: see page 5/84
 Internal wiring diagram: see page 5/83

Application program: P6

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Functions provided

- Monitoring of 4 guards with switches provided with door lock, "D" principle (locked switches with de-energized solenoid)
- 1 emergency stop
- Monitored start

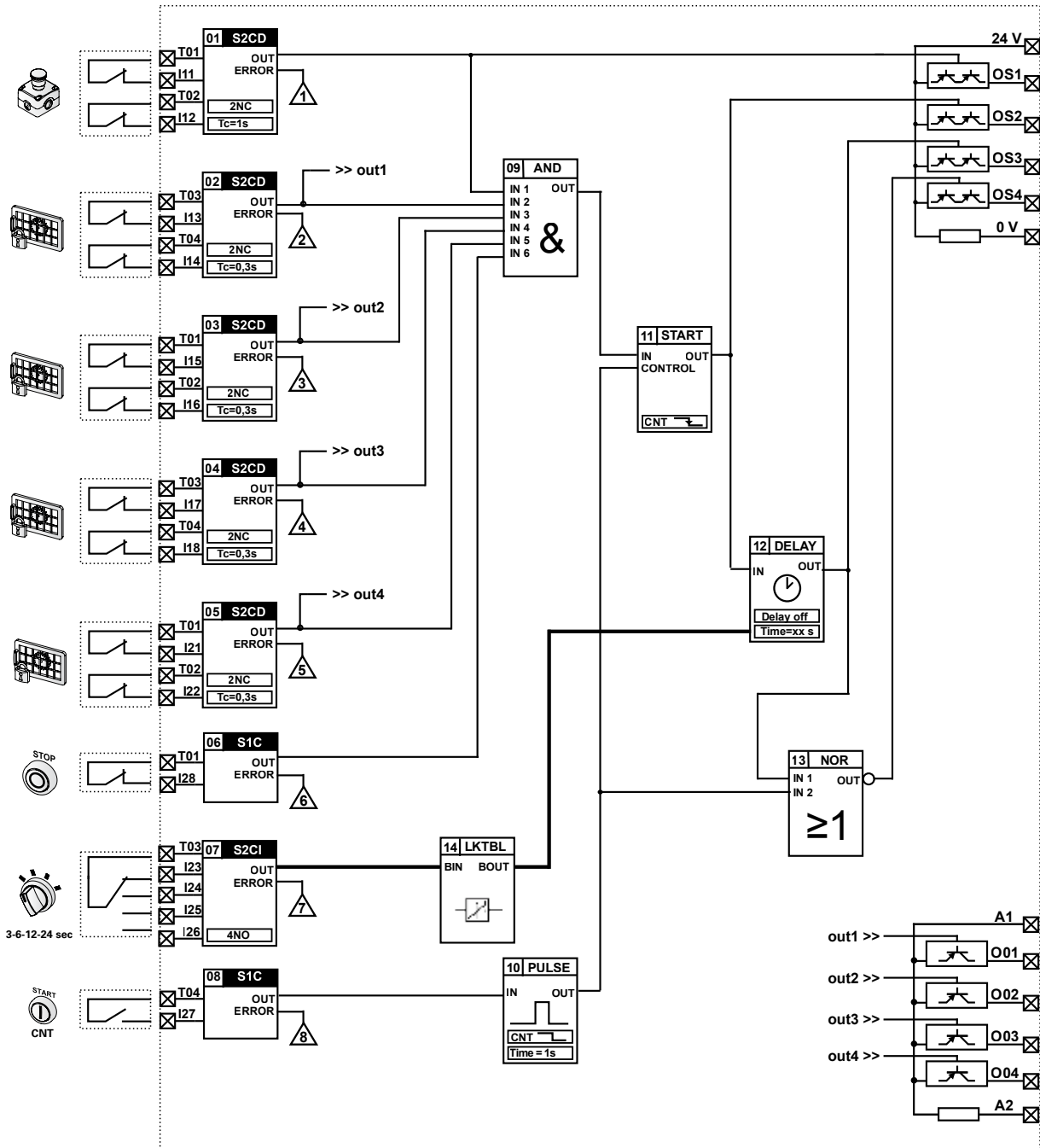
Outputs

- Two instantaneous outputs and two outputs timed with a 4-setting selector
- 4 PNP signalling outputs
- OS4 output for door locking control

Technical data see CS MP202M0: see pages 5/67-5/68
 Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
 Terminals layout: see page 5/84
 Internal wiring diagram: see page 5/83

Application program: P7

The application program memorised in the module runs one or more safety function, as shown in the following block diagram:





Functions provided

- Monitoring of 4 guards with switches provided with door lock, "E" principle (locked switches with energized solenoid)
- 1 emergency stop
- Monitored start

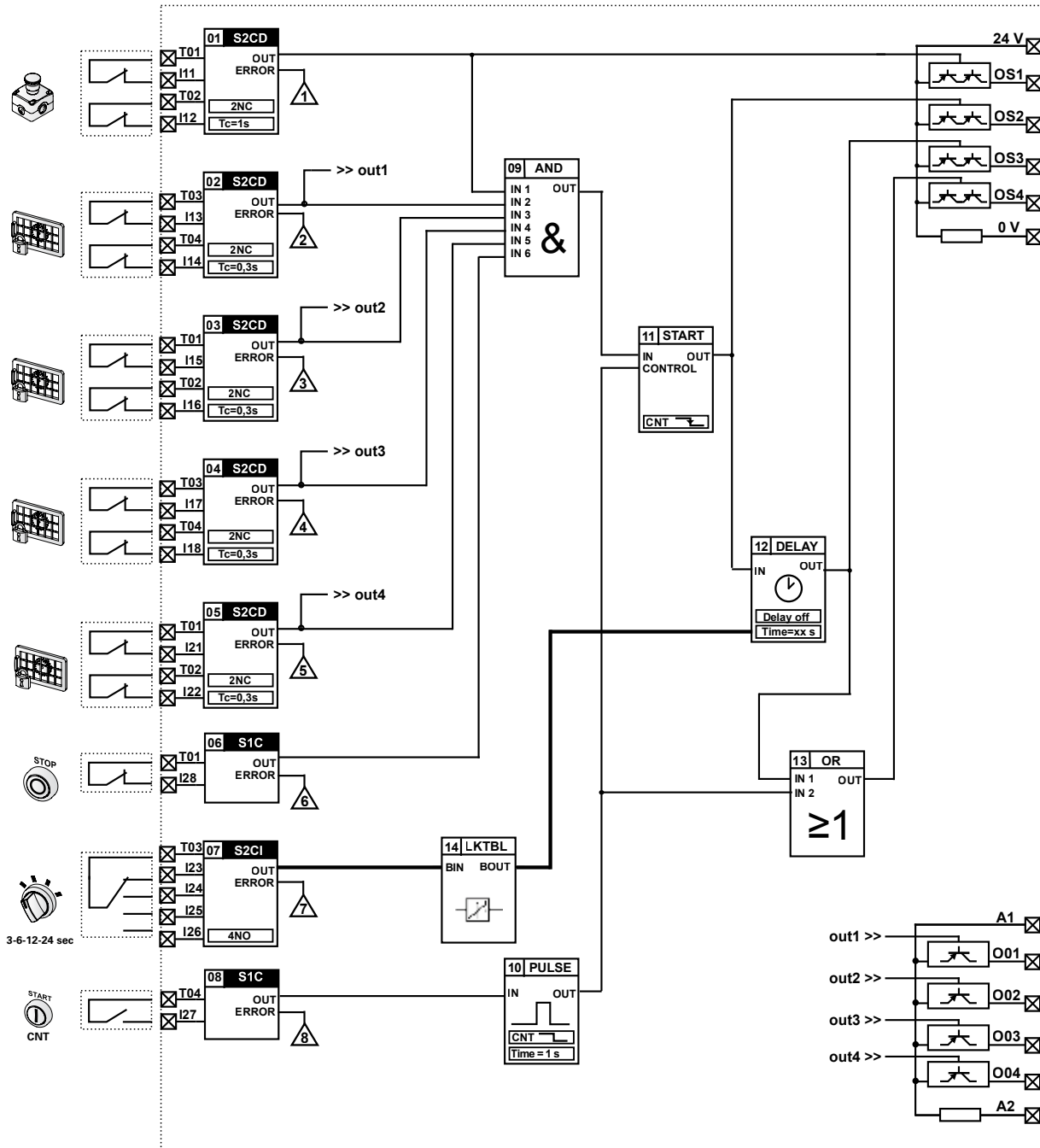
Outputs

- Two instantaneous outputs and two outputs timed with a 4-setting selector
- 4 PNP signalling outputs
- OS4 output for door locking control

Technical data see CS MP202M0: see pages 5/67-5/68
 Dimensions, conductors cross section, terminal tightening torque: see page 5/82, shape C
 Terminals layout: see page 5/84
 Internal wiring diagram: see page 5/83

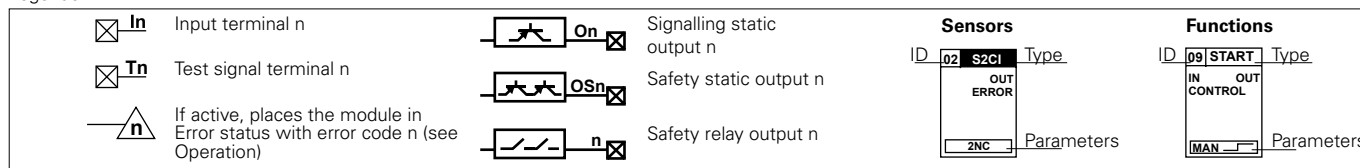
Application program: P8

The application program memorized in the module runs one or more safety function, as shown in the following block diagram:



Notes: The positions of the contacts shown in the diagram are only given as examples, and they refer to expected working conditions, with machinery in operation, guards closed and safety devices not activated. For any further explanations, see documentation relating to each specific safety function (page 5/80).

Legende



Disclaimer:
Subject to modifications without prior notice and errors excepted. The data quoted on this sheet are accurately checked and they refer to the typical mass production values. The description and application of this device, the fields of use, the details on external controls, as well as information on installation and operation are supplied to the best of our knowledge. At any event, this does not mean that the characteristics described may entail legal liabilities extending beyond the "General Terms of Sale", as stated in the Pizzato Elettrica general catalogue. Customers/users are not relieved from the obligation to read and understand our information and recommendations, as well as the pertaining technical standards, before using the products for their own purposes.

Definitions

Application Program: The section of the internal software of this module which is directed to the customer's application.
"Power On" Status: The status of this device, which lasts from the time it is switched on until the end of internal controls.
"Run" Status: The status of this device after the end of the "Power-On" phase (if no errors have been detected) in which the Application program is run.
"Error" Status: The status of this device when a fault is detected. In this status the module is placed in a safe condition, that is with all the safety outputs open.
Fault: A fault may be internal or external to the safety module. Internal faults are autonomously detected by the module thanks to its redundant self-monitored structure. An external fault can be detected by the Application program. It follows that the definition of external fault is strictly dependent on the application (see note A).

Operation

When supplied with power, the module enters the Power-On status and runs an internal self-diagnosis. In this phase, the two processor LEDs (P1, P2) remain switched on with a red light for about 1 second. If the internal tests are completed without malfunctions, the two LEDs are switched off, the module enters the Run status and runs the Application Program. If the starting tests are not passed, the module enters the Error status and the malfunction is indicated by the processor LEDs remaining on with a red light. The green LEDs relating to the power supply and the module inputs are not controlled by processors, and they immediately start to indicate the status of the respective inputs/outputs. When the module is in the RUN status, and no faults are detected, the two LEDs (P1, P2) remain switched off. In the Run status, the module can detect faults external to the module, for example caused by short circuits, or invalid input status (see note A). Depending on the type of fault detected, the Application Program may impose on the module to be placed in Error status to highlight the malfunction. In this case, the Application Program can communicate an error code by making the LEDs (P1, P2) blink in sequence. During the Run status, at the same time as executing the Application program, the module constantly runs a series of internal tests to check for correct hardware operation. If a malfunction is detected, the module status is changed to Error. When in Error status, the module is placed in a safe condition, that is with all the safety outputs open; the Application program is no longer evaluated and the same happens with the system inputs. Furthermore, the signalling static outputs are left unaltered (changes in inputs do not affect them) at the value imposed by the Application Program before entering the Error status. To reset the module, just switch it off for the time necessary (see technical data) and then switch it on again.

Note A: A short circuit is not always a fault. For example, in the case of an ordinary push button for emergency stops provided with two NC contacts, contact opening is the signal to be evaluated and a short circuit between the two contacts is a fault. On the contrary, in the case of a safety mat with 4-wire technology, the opposite is true, i.e. a short circuit between the wires is the signal to be evaluated whereas wire interruption is a fault.

Fault signaling

LED PWR	LED P1 and P2	Possible cause of fault
Off	Off	No power supply, incorrect connections, power wires cut, external fuses broken. Module fault.
Green	Off	Normal operation.
Green	Red	Fault not restorable. Suggested action: Send the module to be repaired.
Green	Red x 1 Blue x 1	Fault restorable: Overcurrent on Tx or Ox outputs. Suggested action: Disconnect the signalling static outputs (Ox) and the test outputs (Tx) to check if an external short circuit is present.
Green	Red x 1 Blue x 2	Fault restorable. Problem detected on OSx (short circuit towards earth or positive, or else short circuit between two OSx). Suggested action: Disconnect the safety outputs to check if there are any problems on the external connections of OSx outputs.
Green	Red x 1 Blue x 3	Fault restorable. Module temperature outside the limits. Suggested action: Return the module temperature within the limits permissible.
Green	Blue x N	Error status entered by module at the request of the application program. Error code N. Typically due to incorrect conditions on the inputs (external short circuits, status not permitted). Suggested action: Disconnect the inputs to find any short circuits. Check the documentation enclosed with the Application program for further details.



Quick description of the main safety functions (CS MF•••••)

SENSORS

Sensor	S1C	Control of one contact
Outputs	OUT	The OUT output is active when the input is closed and there is no error.
	ERROR	The ERROR output is active in the case where an electrical malfunction is detected in the input signal
Parameters	None	
Examples		Start push button; Stop push button; Simple contact

Sensor	S1S	Control of a static signal
Outputs	OUT	The OUT output is active when a 24Vdc signal is present in input
Parameters	None	
Examples		Generic sensors with PNP output; Enabling signals

Sensor	S2CD	Control of two dependent contacts
Outputs	OUT	The OUT output is active when both inputs are in normal or safety status and there is no error
	ERROR	The ERROR output is active in the case where simultaneity times are not respected, or in the case where an electrical malfunction is detected in the input signals
Parameters	2NC / 1NO+1NC	Contact position in normal or safety status
	Tc	Maximum simultaneity time expressed in seconds
Examples		Emergency stop button; Rope switch; Switch with two connected contacts; Modal selectors with two changeover positions; Two distinct switches with time interdependence

Sensor	S2CI	Control of two independent contacts
Outputs	OUT	The OUT output is active when both inputs are in normal or safety status and there is no error
	ERROR	The ERROR output is active in the case where an electrical malfunction is detected in the input signal
Parameters	2NC / 1NO+1NC	Contact position in normal or safety status
Examples		Two switches; Magnetic sensor

Sensor	SSE8	Modal selector with 2 to 8 positions
Outputs	OUT	The output gives a numerical value of 1 to 8 in correspondence of the same active input, 0 in case of error
	ERROR	The ERROR output is active in the case where several inputs or no input are active, or in the case where an electric malfunction is detected in the input signals
Parameters	NumPos	Number of contacts in input (2 to 8)
Examples		Modal selectors with a common contact and a number of outputs ranging from 2 to 8

FUNCTIONS

Functions	AND	AND logical function
Outputs	OUT	The OUT output is only activated in the presence of all the IN input signals

Functions	DELAY	Delayed activation/deactivation of a process
Outputs	OUT	The OUT output is activated in the presence of the IN input signal with a Td delay (Don type parameter) The OUT output is deactivated in the absence of the IN input signal with a Td delay (Doff type parameter)
	Don / Doff	Type of delay, at Don (delay-on) activation or at Doff (delay-off) deactivation
Parameters	Td	Delay period activation or deactivation

Functions	NOR	NOR logical function
Outputs	OUT	The OUT output is only activated in the absence of all the IN input signals

Functions	OR	OR logical function
Outputs	OUT	The OUT output is only activated in the presence of at least one IN input signal

Functions	PULSE	Activation of a process for a short time
Outputs	OUT	The OUT output is activated on the IN signal falling edge and remains active for the time set by Tp
Parameters	Tp	Impulse period

Functions	START	Activation of a process
Outputs	OUT	The OUT output is activated, if the signal at the IN input is present, on the edge (see parameter) of the CONTROL signal. Therefore it remains active as long as IN is present
Parameters	MAN / CNT	MAN = activation on the rising edge, CNT = activation of the falling edge

Function	LKTBL	Lookup table; conversion table between data of the same type
Outputs	BOUT	Output converted data. It is 0 at starting.
Parameters	Number of data	Number of data in the chart