CNC 8070

Remote modules.

(Ref: 1709)

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TRANSLATION OF THE ORIGINAL MANUAL

This manual is a translation of the original manual. This manual, as well as the documents derived from it, have been drafted in Spanish. In the event of any contradictions between the document in Spanish and its translations, the wording in the Spanish version shall prevail. The original manual will be labeled with the text "ORIGINAL MANUAL".

MACHINE SAFETY

It is up to the machine manufacturer to make sure that the safety of the machine is enabled in order to prevent personal injury and damage to the CNC or to the products connected to it. On start-up and while validating CNC parameters, it checks the status of the following safety elements. If any of them is disabled, the CNC shows the following warning message.

- Feedback alarm for analog axes.
- Software limits for analog and sercos linear axes.
- Following error monitoring for analog and sercos axes (except the spindle) both at the CNC and at the drives.
- Tendency test on analog axes.

FAGOR AUTOMATION shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC resulting from any of the safety elements being disabled.

HARDWARE EXPANSIONS

FAGOR AUTOMATION shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC resulting from any hardware manipulation by personnel unauthorized by Fagor Automation.

If the CNC hardware is modified by personnel unauthorized by Fagor Automation, it will no longer be under warranty.

COMPUTER VIRUSES

FAGOR AUTOMATION guarantees that the software installed contains no computer viruses. It is up to the user to keep the unit virus free in order to guarantee its proper operation. Computer viruses at the CNC may cause it to malfunction.

FAGOR AUTOMATION shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC due a computer virus in the system.

If a computer virus is found in the system, the unit will no longer be under warranty.

DUAL-USE PRODUCTS

Products manufactured by FAGOR AUTOMATION since April 1st 2014 will include "-MDU" in their identification if they are included on the list of dual-use products according to regulation UE 428/2009 and require an export license depending on destination.

It is possible that CNC can execute more functions than those described in its associated documentation; however, Fagor Automation does not guarantee the validity of those applications. Therefore, except under the express permission from Fagor Automation, any CNC application that is not described in the documentation must be considered as "impossible". In any case, Fagor Automation shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC if it is used in any way other than as explained in the related documentation.

The content of this manual and its validity for the product described here has been verified. Even so, involuntary errors are possible, hence no absolute match is guaranteed. However, the contents of this document are regularly checked and updated implementing the necessary corrections in a later edition. We appreciate your suggestions for improvement.

The examples described in this manual are for learning purposes. Before using them in industrial applications, they must be properly adapted making sure that the safety regulations are fully met.

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CHAPTER 5   **RIOW REMOTE MODULES. (CANOPEN PROTOCOL).**

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CNC 8070

(REF: 1709)

ABOUT THE PRODUCT - CNC 8070

BASIC CHARACTERISTICS.

Basic characteristics.	·BL·	·OL·	·L·
Number of axes.	3 to 7	3 to 31	3 to 31
Number of spindles.	1	1 to 6	1 to 6
Number of tool magazines.	1	1 to 4	1 to 4
Number of execution channels.	1	1 to 4	1 to 4
Number of interpolated axes (maximum).	4	3 to 31	3 to 31
Number of handwheels.	1 to 12		
Type of servo system.	Analog / Digital Sercos Digital Mechatrolink		Analog Sercos Digital
Communications.	RS485 / RS422 / RS232 Ethernet		
PCI expansion.	No	Option	No
Integrated PLC. PLC execution time. Digital inputs / Digital outputs. Marks / Registers. Timers / Counters. Symbols.	< 1ms/K 1024 / 1024 8192 / 1024 512 / 256 Unlimited		
Block processing time.	< 1 ms		< 1 ms

Remote modules.	RIOW	RIO5	RIO70		RIOR	RCS-S
Valid for CNC.	8070 8065 8060	8070 8065 8060	8070 8065 - - -	D I S C O N T I N U E D	8070 8065 8060	8070 8065 8060
Communication with the remote modules.	CANopen	CANopen	CANfagor		CANopen	Sercos
Digital inputs per module.	8	24 / 48	16		48	- - -
Digital outputs per module.	8	16 / 32	16		32	- - -
Analog inputs per module.	4	4	8		- - -	- - -
Analog outputs per module.	4	4	4		- - -	4
Inputs for PT100 temperature sensors.	2	2	- - -		- - -	- - -
Feedback inputs.	- - -	- - -	4 (*)		- - -	4 (**)

(*) Differential TTL / Sinusoidal 1 Vpp   (**) TTL / Differential TTL / Sinusoidal 1 Vpp / SSI protocol / FeeDat / EnDat

Customizing.
PC-based open system, fully customizable. INI configuration files. Tool for display configuration FGUIM. Visual Basic®, Visual C++®, etc. Internal databases in Microsoft® Access. OPC compatible interface

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SOFTWARE OPTIONS.

Some of the features described in this manual are dependent on the acquired software options. The active software options for the CNC can be consulted in the diagnostics mode (accessible from the task window by pressing [CTRL] [A]), under software options.

Consult the ordering handbook for information on the software options available for your model.

SOFT ADDIT AXES
Additional shaft.
Add axes to the default configuration.

SOFT ADDIT SPINDLES
Additional spindle.
Add spindles to the default configuration.

SOFT ADDIT TOOL MAGAZ
Additional tool magazine.
Add tool magazines to the default configuration.

SOFT ADDIT CHANNELS
Additional channel.
Add channels to the default configuration.

SOFT 4 AXES INTERPOLATION LIMIT
Limited to 4 interpolated axes.
It limits the number of axes to 4, where the CNC can also interpolate these at the same time.

SOFT OPEN SYSTEM
Open system.
The CNC is a closed system that offers all the features needed to machine parts. Nevertheless, at times there are some customers who use third-party applications to take measurements, perform statistics or other tasks apart from machining a part.
This feature must be active when installing this type of application, even if they are Office files. Once the application has been installed, it is recommended to close the CNC in order to prevent the operators from installing other kinds of applications that could slow the system down and affect the machining operations.

SOFT DIGITAL SERCOS
Sercos digital bus.
Sercos digital bus.

SOFT DIGIT NO FAGOR
Non-Fagor digital servo system.
Mechatrolink digital bus.

SOFT EDIT/SIMUL
EDISIMU mode (editing and simulation).
It allows for the editing, modification and simulation of a part-program.

SOFT IEC 61131 LANGUAGE
IEC 61131 language
IEC 61131 is a PLC programming language that is very popular in alternative markets, which is slowly entering into the machine-tool market. With this feature, the PLC may be programmed either in the usual Fagor language or in IEC 61131 format.

SOFT TOOL RADIUS COMP
Compensación de radio.
Tool compensation allows programming the contour to be machined based on part dimensions of the and without taking into account the dimensions of the tool that will be used later on. This avoids having to calculate and define the tool path based on the tool radius.

SOFT PROFILE EDITOR
Profile editor.
Allows for the part profiles to be edited graphically and to import dxf files.

SOFT RTCP
Dynamic RTCP (Rotating Tool Center Point).
The dynamic RTCP option is required for interpolation machining with 4, 5 or 6 axis.

SOFT C AXIS
C axis.
It activates the kinematics for working with the C axis and the associated canned cycles. The CNC can control several C axes. The parameters of each axis indicate if it will function as a C axis or not, where it will not be necessary to activate another axis for the machine parameters.

SOFT TANDEM AXES
Tandem axes.
A tandem axis consists in two motors mechanically coupled (slaved) and making up a single transmission system (axis or spindle). A tandem axis helps provide the necessary torque to move an axis when a single motor is not capable of supplying enough torque to do it.

When activating this feature, it should be kept in mind that for each tandem axis of the machine, another axis must be added to the entire configuration. For example, on a large 3-axis lathe (X Z and tailstock), if the tailstock is a tandem axis, the final purchase order for the machine must indicate 4 axes.

SOFT SYNCHRONISM
Synchronization of axes and spindles.
The axes and ballscrews may be synchronized in two ways: in terms of speed or position. The CNC configuration takes into consideration the synchronization of 2 axes or 2 spindles. Once synchronized, only the master displays and programs the element.

SOFT HSSA II MACHINING SYSTEM
HSSA-II machining system.
This is the new version of algorithms for high speed machining (HSC). This new HSSA algorithm allows for high speed machining optimization, where higher cutting speeds, smoother contours, a better surface finishing and greater precision are achieved.

SOFT TANGENTIAL CONTROL
Tangential control.
"Tangential Control" maintains a rotary axis always in the same orientation with respect to the programmed tool path. The machining path is defined on the axes of the active plane and the CNC maintains the orientation of the rotary axis along the entire tool path.

SOFT DRILL CYCL OL
Drilling ISO cycles for the OL model.
Drilling ISO cycles for the OL model (G80, G81, G82, G83).

SOFT PROBE
Probing canned cycles.
The CNC may have two probes; usually a tabletop probe to calibrate tools and a measuring probe to measure the part.
This option activates the functions G100, G103 and G104 (for probe movements); probe canned cycles are not included.

SOFT THIRD PARTY CANOPEN
Third-party CANopen.
Enables the use of non-Fagor CANopen modules.

SOFT FVC UP TO 10m3
SOFT FVC MORE TO 10m3
Medium and large volumetric compensation.
5-axis machines are generally used during the manufacturing of large parts. The accuracy of the parts is limited by the machine manufacturing tolerances and is effected by temperature variations during machining.

In sectors such as the aerospace industry, machining demands mean that classic compensation tools are becoming suboptimal. Volumetric compensation FVC comes in to complement the machine adjusting tools. When mapping the total work volume of the machine, the CNC knows the exact position of the tool at all times. After applying the required compensation, the resulting part is made with the desired precision and tolerance.

There are 2 choices, which depend on the size of the machine, being up to 10 m³ and over 10 m³.

SOFT 60 PWM CONTROL
Pulse-Width Modulation.
This function is only available for Sercos bus controlled systems. It is mostly oriented toward laser machines for the cutting of very thick sheets, where the CNC generates a series of PWM pulses to control the power of the laser when drilling the starting point.

This feature is essential for cutting very thick sheets and it requires two quick digital outputs located on the central unit. With this new feature, the OEM does not need to install or program any external device, which reduces machine costs and installation times. The end user also benefits, since the "Cutting with PWM " feature is much easier to use and program.

SOFT 60 GAP CONTROL
Gap control.
This is mostly oriented toward laser machines. Gap control makes it possible to maintain a set distance between the laser nozzle and the surface of the sheet. This distance is calculated by a sensor connected to the CNC, so that the CNC offsets the sensor variations on the distance programmed with additional movements in the axis programmed for the gap.

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DECLARATION OF CE CONFORMITY AND WARRANTY CONDITIONS

DECLARATION OF CONFORMITY

The declaration of conformity for the CNC is available in the downloads section of FAGOR'S corporate website. http://www.fagorautomation.com. (Type of file: Declaration of conformity).

WARRANTY TERMS

The warranty conditions for the CNC are available in the downloads section of FAGOR's corporate website. http://www.fagorautomation.com. (Type of file: General sales-warranty conditions).

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VERSION HISTORY - CNC 8070

Here is a list of the features added to each manual reference.

Ref. 1309

First version.

Ref. 1312

Remote module RCS-S. Connector ·H53·.

Ref. 1405

Corrected errors.

Ref. 1412

RIOW remote modules. Module RIOW-CANOPEN-ECO. - DISCONTINUED -.

Ref. 1505

Corrected errors.

Ref. 1512

RIOR remote module.
RIO70 remote modules. - DISCONTINUED -.

Ref. 1603

RIOR remote module (analog).

Ref. 1709

Remote module RCS-S. FeeDat/EnDat feedback.

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SAFETY CONDITIONS

Read the following safety measures in order to prevent harming people or damage to this product and those products connected to it. Fagor Automation shall not be held responsible of any physical or material damage originated from not complying with these basic safety rules.

Before start-up, verify that the machine that integrates this CNC meets the 2006/42/EC Directive.

PRECAUTIONS BEFORE CLEANING THE UNIT

Do not get into the inside of the unit.   Only personnel authorized by Fagor Automation may access the interior of this unit.

Do not handle the connectors with the unit connected to AC power.   Before handling these connectors (I/O, feedback, etc.), make sure that the unit is not powered.

PRECAUTIONS DURING REPAIRS

In case of a malfunction or failure, disconnect it and call the technical service.

Do not get into the inside of the unit.   Only personnel authorized by Fagor Automation may access the interior of this unit.

Do not handle the connectors with the unit connected to AC power.   Before handling these connectors (I/O, feedback, etc.), make sure that the unit is not powered.

PRECAUTIONS AGAINST PERSONAL HARM

Interconnection of modules.   Use the connection cables provided with the unit.

Use proper cables.   To prevent risks, only use cables and Sercos fiber recommended for this unit.

To prevent a risk of electrical shock at the central unit, use the proper connector (supplied by Fagor); use a three-prong power cable (one of them being ground).

Avoid electric shocks.   To prevent electrical shock and fire risk, do not apply electrical voltage out of the indicated range.

Ground connection.   In order to avoid electrical discharges, connect the ground terminals of all the modules to the main ground terminal. Also, before connecting the inputs and outputs of this product, make sure that the ground connection has been done.

In order to avoid electrical shock, before turning the unit on verify that the ground connection is properly made.

Do not work in humid environments.   In order to avoid electrical discharges, always work with a relative humidity (non-condensing).

Do not work in explosive environments.   In order to avoid risks, harm or damages, do not work in explosive environments.

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PRECAUTIONS AGAINST DAMAGE TO THE PRODUCT

Work environment.	This unit is ready to be used in industrial environments complying with the directives and regulations effective in the European Community.
	Fagor Automation shall not be held responsible for any damage suffered or caused by the CNC when installed in other environments (residential, homes, etc.).
Install this unit in the proper place.	It is recommended, whenever possible, to install the CNC away from coolants, chemical product, blows, etc. that could damage it.
	This unit meets the European directives on electromagnetic compatibility. Nevertheless, it is recommended to keep it away from sources of electromagnetic disturbance such as:
	Powerful loads connected to the same mains as the unit.
	Nearby portable transmitters (radio-telephones, Ham radio transmitters).
	Nearby radio / TC transmitters.
	Nearby arc welding machines.
	Nearby high voltage lines.
Enclosures.	It is up to the manufacturer to guarantee that the enclosure where the unit has been installed meets all the relevant directives of the European Union.
Avoid disturbances coming from the machine.	The machine must have all the interference generating elements (relay coils, contactors, motors, etc.) uncoupled.
Use the proper power supply.	Use an external regulated 24 Vdc power supply for the keyboard, operator panel and the remote modules.
Connecting the power supply to ground.	The zero Volt point of the external power supply must be connected to the main ground point of the machine.
Analog inputs and outputs connection.	Use shielded cables connecting all their meshes to the corresponding pin.
Ambient conditions.	Maintain the CNC within the recommended temperature range, both when running and not running. See the corresponding chapter in the hardware manual.
Central unit enclosure.	To maintain the right ambient conditions in the enclosure of the central unit, it must meet the requirements indicated by Fagor. See the corresponding chapter in the hardware manual.
Power switch.	This switch must be easy to access and at a distance between 0.7 and 1.7 m (2.3 and 5.6 ft) off the floor.

SAFETY SYMBOLS

Symbols that may appear in the manual.

Danger or prohibition symbol.
This symbol indicates actions or operations that may hurt people or damage products.

Warning or caution symbol.
This symbol indicates situations that certain operations could cause and the suggested actions to prevent them.

Obligation symbol.
This symbol indicates actions and operations that must be carried out.

Information symbol.
This symbol indicates notes, warnings and advises.

Symbol for additional documentation.
This symbol indicates that there is another document with more detailed and specific information.

Symbols that the product may carry.

Ground symbol.
This symbol indicates that that point must be under voltage.

ESD components.
This symbol identifies the cards as ESD components (sensitive to electrostatic discharges).

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RETURNING CONDITIONS

Pack it in its original package along with its original packaging material. If you do not have the original packaging material, pack it as follows:

1 Get a cardboard box whose 3 inside dimensions are at least 15 cm (6 inches) larger than those of the unit itself. The cardboard being used to make the box must have a resistance of 170 Kg (375 lb.).

2 Attach a label to the device indicating the owner of the device along with contact information (address, telephone number, email, name of the person to contact, type of device, serial number, etc.). In case of malfunction also indicate symptom and a brief description of the problem.

3 Protect the unit wrapping it up with a roll of polyethylene or with similar material. When sending a central unit with monitor, protect especially the screen.

4 Pad the unit inside the cardboard box with polyurethane foam on all sides.

5 Seal the cardboard box with packaging tape or with industrial staples.

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CNC MAINTENANCE

CLEANING

The accumulated dirt inside the unit may act as a screen preventing the proper dissipation of the heat generated by the internal circuitry which could result in a harmful overheating of the unit and, consequently, possible malfunctions. Accumulated dirt can sometimes act as an electrical conductor and short-circuit the internal circuitry, especially under high humidity conditions.

To clean the operator panel and the monitor, a smooth cloth should be used which has been dipped into de-ionized water and /or non abrasive dish-washer soap (liquid, never powder) or 75º alcohol. Never use air compressed at high pressure to clean the unit because it could cause the accumulation of electrostatic charges that could result in electrostatic shocks.

The plastics used on the front panel are resistant to grease and mineral oils, bases and bleach, dissolved detergents and alcohol. Avoid the action of solvents such as chlorine hydrocarbons, venzole, esters and ether which can damage the plastics used to make the unit's front panel.

PRECAUTIONS BEFORE CLEANING THE UNIT

Fagor Automation shall not be held responsible for any material or physical damage derived from the violation of these basic safety requirements.

- Do not handle the connectors with the unit supplied with power. Before handling these connectors (I/O, feedback, etc.), make sure that the unit is not powered.

- Do not get into the inside of the unit. Only personnel authorized by Fagor Automation may access the interior of this unit.

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1   PREVIOUS INFORMATION.

About this manual.

This manual describes the characteristics, technical data and connections of the remote modules. The characteristics, technical data and connections of the CNC hardware are described in its own manual. The installation manual describes the CNC configuration, machine adaptation and start-up. The installation CD that comes with the unit has the necessary documentation to install, set up and operate the unit.

Installation and startup.

The hardware described in this manual is ready to be used in industrial environments complying with the directives and regulations effective in the European Community. Before start-up, verify that the machine that integrates this CNC meets the 89/392/CEE directive.

Safety conditions.

In order to avoid personal injuries and damage to this product or to those connected to it, read carefully the section on safety conditions in the introduction to this manual. Fagor Automation shall not be held responsible of any physical damage or defective unit resulting from not complying with these basic safety regulations.

Do not handle the connectors with the unit connected to AC power. Before doing it, make sure that the unit is unplugged from the power outlet.

Do not get into the inside of the unit. This unit MUST NOT be opened by unauthorized personnel. Only personnel authorized by Fagor Automation may manipulate the inside of this unit.

1.

PREVIOUS INFORMATION.

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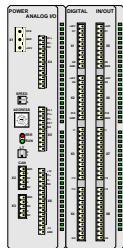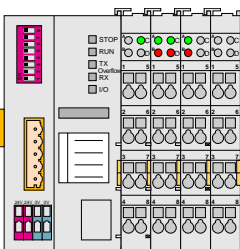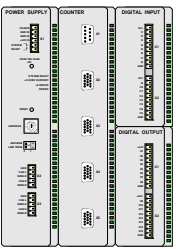
2 HARDWARE STRUCTURE.

Remote modules may be used to have an additional number of digital and analog inputs and outputs (remote I/O) that, distributed at different points of the machine or mounted in the cabinet, permit controlling various devices of the machine. The remote modules are distributed by groups (nodes) and are connected to the central unit through the CAN bus (RIO5, RIO70 or RIOW) or of the Sercos bus (RCS-S).

The CNC has remote modules for CANfagor bus (RIO70 series) and for CANopen bus (series RIO5 and RIOW) When the CNC works with CANopen bus, this bus lets combine in the bus groups (nodes) formed by RIO5 and RIOW series modules; modules of both series cannot be combined in the same group.

Identification.	Description.
	RIO5 modules (CANopen protocol). • Digital inputs and outputs. • General purpose analog inputs and outputs. • Analog inputs for PT100 temperature sensors.
	RIOW modules (CANopen protocol). • Digital inputs and outputs. • General purpose analog inputs and outputs. • Analog inputs for PT100 temperature sensors.
	RIO70 modules (CANfagor protocol). • Digital inputs and outputs. • General purpose analog inputs and outputs. • Feedback inputs.
	RIOR modules (CANopen protocol). • Digital inputs and outputs. • General purpose analog inputs and outputs. • Analog inputs for PT100 temperature sensors.
	RCS-S module (Sercos protocol). • Feedback inputs. • Analog outputs.

2.

HARDWARE STRUCTURE.

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3   RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).

▶ **D I S C O N T I N U E D** ◀

Remote modules may be used to have an additional number of digital and analog inputs and outputs (remote I/O) that, distributed at different points of the machine or mounted in the cabinet, permit controlling various devices of the machine. The remote modules are distributed by groups (nodes) and are connected to the central unit through the CAN bus that can have up to 32 nodes, including the central unit and the keyboards. The following elements may be available with RIO70 series modules.

Type of input/output	Amount.
Digital inputs.	1024
Digital outputs.	1024
General purpose analog inputs.	60
Analog outputs.	40
Feedback inputs.	40

Fagor remote modules, RIO70 series, available for CAN bus with CANfagor protocol.

There are full-size modules (those occupying the whole box) and half-size modules (occupying half the box). Two half-size modules may be mounted in a box. Each group may have up to 5 complete modules depending on consumption. See

3.

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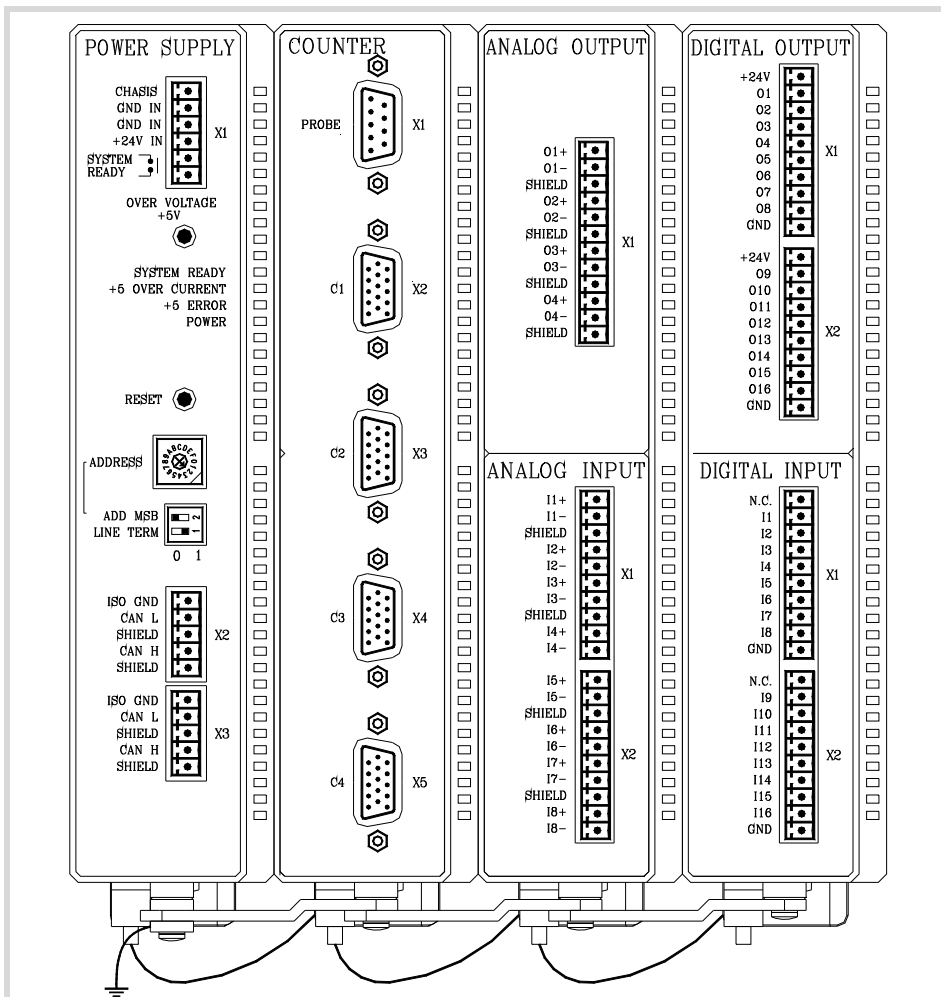
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Fagor supplies all types of possible combinations with half-size modules, even units with a single half-size module (the other half will be a cover). The available modules are the following.

- Power supply.

  The power supply module must be present in each group. This module must be powered at 24 V DC and connected to the system CAN bus.

- Feedback inputs.

  Each module has 4 feedback inputs.

- Digital inputs. Half size.

  Each module has 16 digital inputs.

- Digital outputs. Half size.

  Each module has 16 digital outputs.

- Analog inputs. Half size.

  Each module has 8 analog inputs.

- Analog outputs. Half size.

  Each module has 4 analog outputs.

Protection and power supply of the modules.

Class III safety protection unit, DCVA that must be powered with a SELV power supply.

Probe connection.

The digital inputs let you handle the signal of the two 24 V DC probes . Use machine parameters to define which digital input is associated with each probe and their type of pulse.

3.1   Dimensions and mounting of the modules.

Place the modules on 2 profiles, according to the UNE 50022 standard, with 2 securing ends, one at each end of the group; they help securing the modules besides maintaining the right gap between the profiles. The mounting order to be followed from left to right is:

- Power Supply.
- Counters.
- Analog outputs. Half size.
- Analog inputs. Half size.
- Digital outputs. Half size.
- Digital inputs. Half size.

Dimensions of the modules.

Always leave a 140 mm gap under the modules for ventilation and later handling.

Connection of the modules.

The modules of the group are connected as follows:

A For ground connection.

B Ribbon cable to interconnect the modules.

C Securing ends.

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Each group is connected to the system (CPU, Keyboard, etc.) through the CAN bus as described later on.

DO NOT make any connection or connect any module to the power supply while the latter is turned on. Before making any connection, ribbon cable included, turn the power supply off by unplugging the power cable.

3.
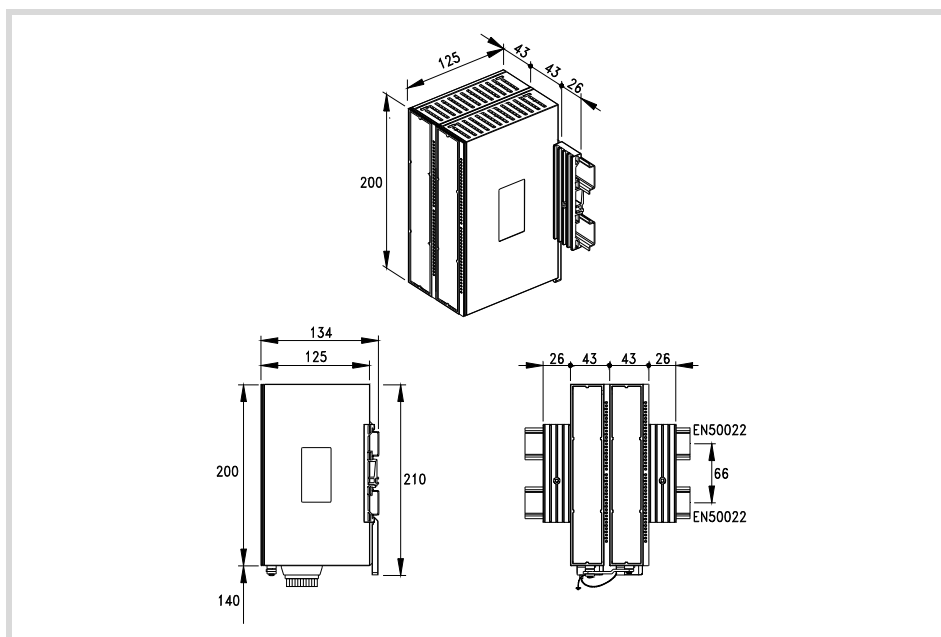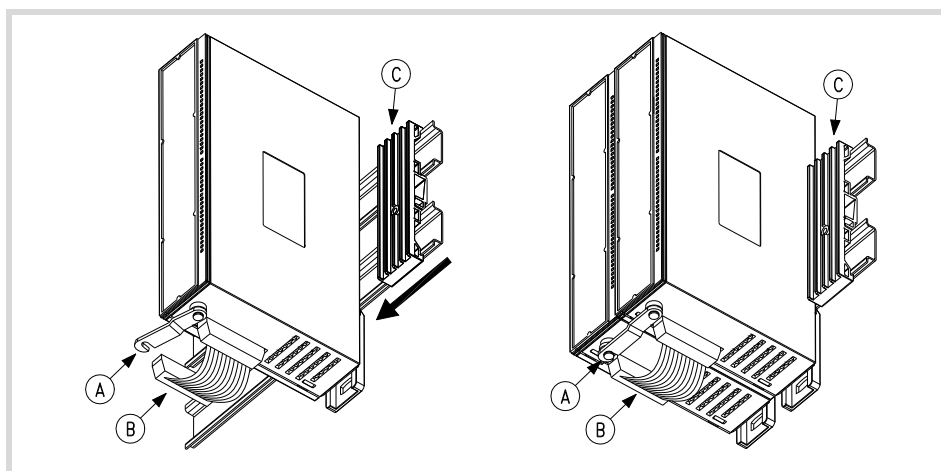
RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).

Dimensions and mounting of the modules.

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3.2 Consumption of the remote modules

The power supply is in charge of supplying to the rest of the modules through +5 V and ±18 V and managing the internal bus of the group. The total consumption of the group depends on the configuration of the modules.

	5 V	±18 V
(DI) Digital inputs.	0,40 watts	- - -
(DO) Digital outputs.	0,65 watts	- - -
(AI) Analog inputs.	0,3 watts	1,8 watts
(AO) Analog outputs.	0,35 watts	3,4 watts
(CT) Counters.	1,75 watts	- - -
(CPU) CPU-CAN.	0,6 watts	- - -

The consumption of the CPU-CAN is added to each module of the configuration. When mounting two half-size modules together (in the same box), the consumption of the CPU-CAN must only be added once.

The total consumption of the group must not exceed the following maximums. If any of them is exceeded, double the group. Use two power supplies and distribute the modules.

• For +5 V, a maximum consumption of 10 watts.

• For 18 V, a maximum consumption of 7.2 watts.

Example.
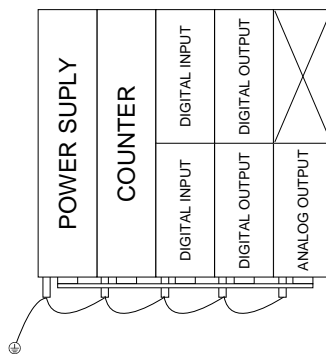
Modules.	5 V	±18 V
(CT) + (CPU)	1,75 + 0,6	- - -
(DI) + (DI) +(CPU)	0,4 + 0,4 + 0,6	- - -
(DO) + (DO) + (CPU)	0,65 + 0,65 + 0,6	- - -
(AO) + (CPU)	0,35 + 0,6	3,4
Total consumption	6,60 watts	3,4 watts

3.3   Power Supply.

The power supply must be present in all the configurations (1 per group), it must be powered at 24 Vdc and connected to the CAN bus of the system.

POWER SUPPLY

CHASIS
GND IN
GND IN
+24V IN   X1
SYSTEM
READY

Connector ·X1·.
Power and emergency relay.

OVER VOLTAGE
+5V

·OVER VOLTAGE· button
This button may be used to reset the module after an over-current.

SYSTEM READY
+5 OVER CURRENT
+5 ERROR
POWER

Leds.
Status indicator LED's.

RESET

·RESET· button.
This button may be used to reset the module.

ADDRESS

CAN bus. ·ADDRESS· selector.
Address (node) of the element within the CAN bus.

ADD MSB
LINE TERM
0   1

CAN bus. ·ADD MSB· selector
Address (node) of the element within the CAN bus.

CAN bus. ·Line Term· selector.
Line terminating resistor.

GND
CAN L
SHIELD   X2
CAN H
SHIELD

CAN bus. Connector ·X2·.
CAN bus connection.

GND
CAN L
SHIELD   X3
CAN H
SHIELD

CAN bus. ·X3· connector.
CAN bus connection.

3.3.1 Elements (connectors).

Connector ·X1·. Power and emergency relay.

6-pin male Phoenix minicombicon contact (3.5 mm pitch).
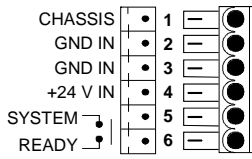
Signal.	Function.
Chassis	Shield.
GND IN	Power input.
GND IN	Power input.
+ 24 V	Power input.
System Ready	Relay for the emergency chain.

The relay may be used to connect the modules to the emergency chain of the electrical cabinet. The relay is an internal contact that closes when the group is ready; it opens again when an internal failure occurs.

·OVER VOLTAGE· button and status LED.

This button may be used to reactivate the power supply after an over-current. An over-current activates the safety device inside the power supply turns on the external red LED. The power supply will not be operative while the LED is on. There are two ways to reactivate the power supply after an over-current.

- Unplug the power supply from mains and wait for about 30 seconds until the red light turns off.
- Unplug the power supply and press the button. The red LED will turn off indicating that the power supply is ready.

If after reactivating the power supply, the LED turns back on, call the Technical Service Department.

·SYSTEM READY· LED. Module under power.

SYSTEM READY
+5 OVER CURRENT
+ 5 ERROR
POWER

The LED is green. This LED blinks when the module is under power.

·OVER CURRENT· LED. Over-current at the power supply.

SYSTEM READY
+5 OVER CURRENT
+ 5 ERROR
POWER

Red LED. This LED turns on when the +5 V power supply is outputting the maximum current.

·ERROR· LED. Error at the power supply.

SYSTEM READY
+5 OVER CURRENT
+ 5 ERROR
POWER

Red LED. This LED turns on when the power supply is not capable of supplying the 5 V DC due to a current overload

To eliminate the error, remove the load from the power supply or duplicate the group.

·POWER· LED. Status of the 5 V.

SYSTEM READY
+5 OVER CURRENT
+ 5 ERROR
POWER

The LED is green. This LED turns on when the +5 V power supply is working properly.

·RESET· button.

The ·RESET· button may be used to reset the module after changing the node address; however, it is recommended to change the address while the modules and the CNC are off.

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CAN bus. ·ADDRESS· selector. Address (node) of the element within the bus.

Each one of the elements integrated into the CAN bus is identified by the 16-position rotary switch (0-15) "Address" (also referred to as "Node_Select"). With the ADD MSB" switch, the positions or elements integrated in the CAN bus may be expanded up to 32.

The CNC must always occupy position "0" and the rest of the elements of the bus will occupy consecutive positions starting with 1. In order for any change at the "Address" switch to be assumed, the CNC must be restarted and the corresponding drive must be reset, however, we recommend to change the address while the modules and the CNC are off.

The "Address" switch also sets the priority of the group within the bus; the lower the number the higher the priority. We recommend the keyboard and jog panel to be the last node of the bus.

CAN bus. ·ADD MSB· selector Address (node) of the element within the bus.
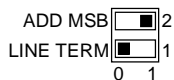
With the ·2· switch (ADD MSB), the positions or elements integrated in the CAN bus may be expanded up to 32. Positions 0-15 are selected with ADD MSB=0 and positions 16-31 with ADD MSB=1.

·ADD MSB·.	Address (node) of the element.
OFF	Positions 0-15 within the bus.
ON	Positions 16-31 within the bus.

CAN bus. ·Line Term· selector.
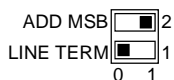
Line terminating resistor. The ·LT· switch identifies which are the elements that occupy the ends of the CAN bus; i.e. the first and last physical element in the connection.

The switch position of the terminating elements must be "1" and that of the rest of the elements "0".

CAN bus. ·CAN· connector. Connector ·X2· & ·X3·.
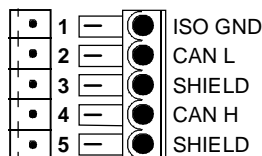
5-pin male Phoenix minicombicon contact (3.5 mm pitch).

Pin.	Signal.	Function.
1	ISO GND	Ground / 0 V.
2	CAN L	(LOW) bus signal.
3	SHIELD	CAN shield.
4	CAN H	(HIGH) bus signal.
5	SHIELD	CAN shield.

3.

RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).
Power Supply.

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3.4   Digital inputs and outputs.

DIGITAL INPUT

N.C.
I1
I2
I3
I4
I5
I6
I7
I8
GND

X1

Connector ·X1·.
8 digital inputs.

N.C.
I9
I10
I11
I12
I13
I14
I15
I16
GND

X2

Connector ·X2·.
8 digital inputs.

DIGITAL OUTPUT

+24V
O1
O2
O3
O4
O5
O6
O7
O8
GND

X1

Connector ·X1·.
8 digital outputs.

Status indicator LED.

+24V.
O9
O10
O11
O12
O13
O14
O15
O16
GND

X2

Connector ·X2·.
8 digital outputs.

FAGOR

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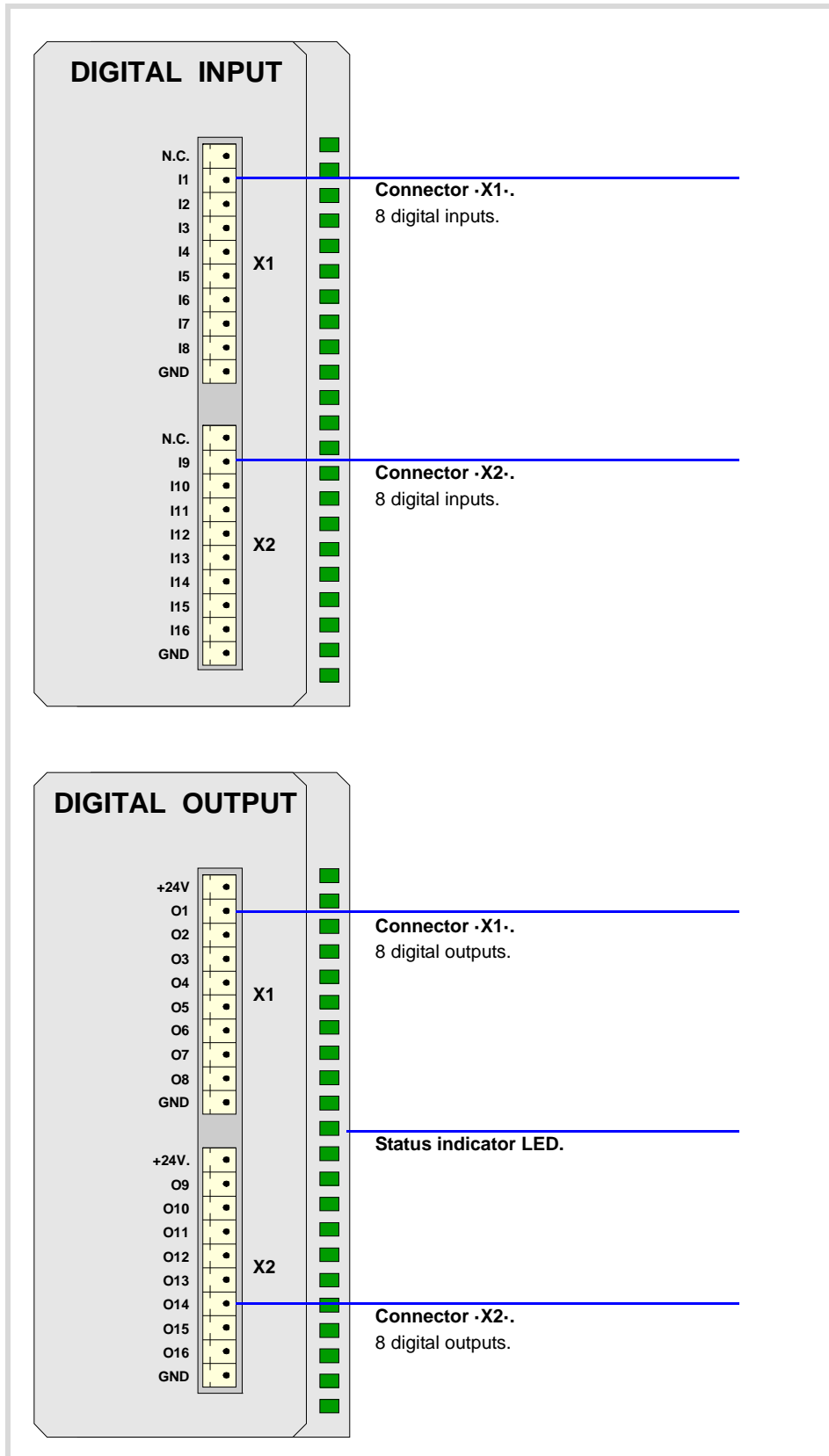
3.4.1 Elements (connectors).

Connector ·X1· & ·X2·. Digital inputs (8 inputs in each connector).

10-pin male Phoenix minicombicon contact (3.5 mm pitch).
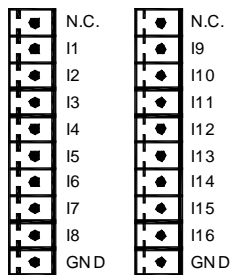
Signal.	Function.
N.C.	Not being used.
I1 - I8	Digital inputs.
I9 - I16	Digital inputs.
GND	0 V reference signal.

Connector ·X1· & ·X2·. Digital outputs (8 outputs in each connector).

10-pin male Phoenix minicombicon contact (3.5 mm pitch). Both connectors must be powered with 24 V DC and GND.
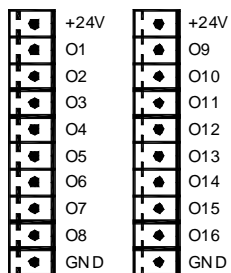
Signal.	Function.
+ 24 V	Power supply.
O1 - O8	Digital outputs.
O9 - O16	Digital outputs.
GND	0 V reference signal.

Status indicator LED.

The green LED located in the middle of the digital output module turns on when the module is powered with 24 Vdc and the inside fuse is OK.

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RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).

Digital inputs and outputs.

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3.5   Analog inputs and outputs

ANALOG INPUT

I1+
I1-
SHIELD
I2+
I2-
I3+   X1
I3-
SHIELD
I4+
I4-

I5+
I5-
SHIELD
I6+
I6-
I7+   X2
I7-
SHIELD
I8+
I8-

Connector ·X1·.
4 analog inputs.

Connector ·X2·.
4 analog inputs.

ANALOG OUTPUT

O1+
O1-
SHIELD
O2+
O2-
SHIELD   X1
O3+
O3-
SHIELD
O4+
O4-
SHIELD

Connector ·X1·.
4 analog inputs.

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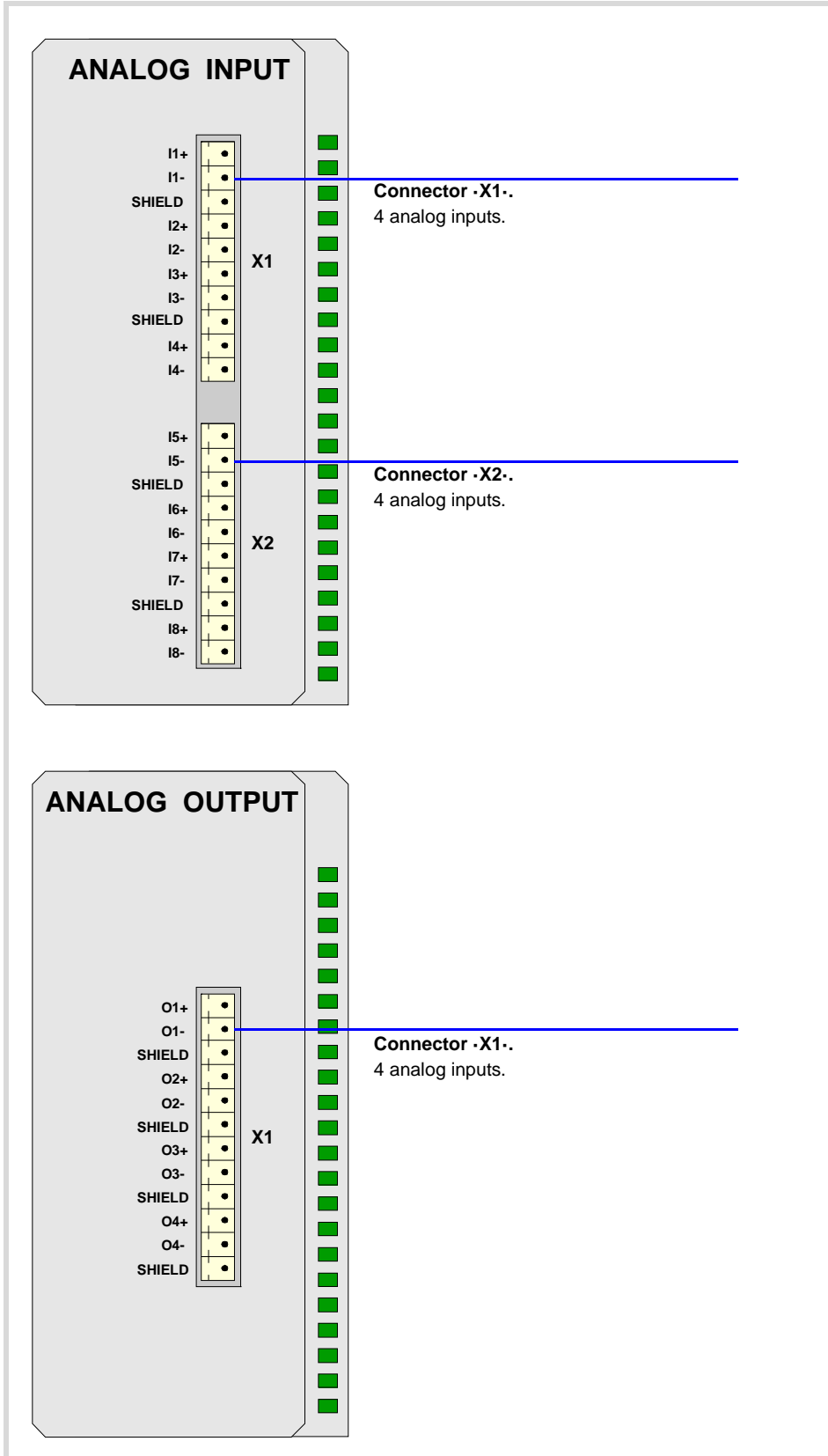
3.5.1 Elements (connectors).

Connector ·X1· & ·X2·. Analog inputs (4 inputs in each connector).

10-pin male Phoenix minicombicon contact (3.5 mm pitch).
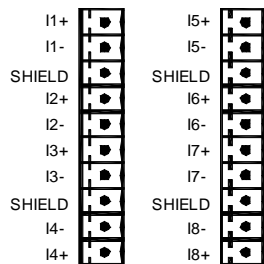
Signal.	Function.
I1+ I1-	Analog inputs.
SHIELD	Shield connection.

Each analog input has three pins (I+, I-, SH). Use shielded cables connecting their meshes to the corresponding shield pin.

Connector ·X1·. Analaog outputs (4 outputs in each connector).
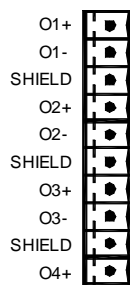
12-pin male Phoenix minicombicon contact (3.5 mm pitch).

Signal.	Function.
O1+ O1-	Analog outputs.
O2+ O2-	Analog outputs.
O3+ O3-	Analog outputs.
O4+ O4-	Analog outputs.
SHIELD	Shield connection.

Each analog output has three pins (O+, O-, SH). Use shielded cables connecting their meshes to the corresponding shield pin.

3.6   Feedback inputs (counter).

COUNTER

Connector ·X1·.
2 probe inputs.

Connector ·X2·.
Feedback input (differential TTL and sinusoidal 1 Vpp).

·X3· connector.
Feedback input (differential TTL and sinusoidal 1 Vpp).

Connector ·X4·.
Feedback input (differential TTL and sinusoidal 1 Vpp).
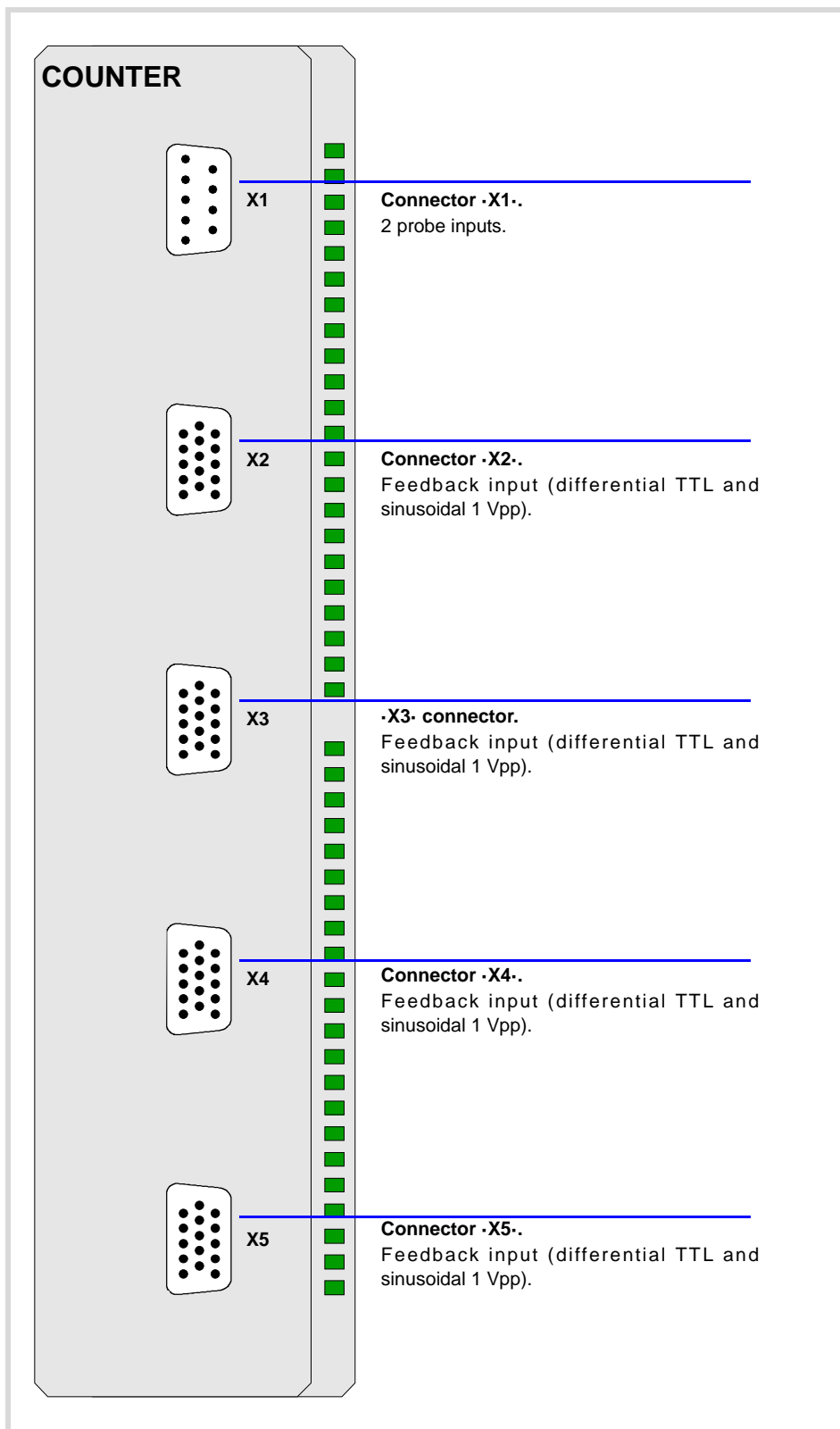
Connector ·X5·.
Feedback input (differential TTL and sinusoidal 1 Vpp).

3.6.1 Elements (connectors).

Connector ·X1·.

Not being used from software version V01.10 on. Previous versions allowed connecting 2 probes of 5 V DC or 24 V DC.

Connectors ·X2· & ·X3· & ·X4· & ·X5·. Feedback inputs (differential TTL and sinusoidal 1 Vpp).

4 15-pin female SUB-D HD type connectors.

Pin.	Signal.	Function.
1	A	Feedback signals.
2	/ A	
3	B	
4	/ B	
5	I0	Reference signals.
6	/ I0	
7	AL	Feedback alarm.
8	/ AL	
9	+5 Vdc	Voltage supply for the feedback system.
10	- - -	
11	GND	0 V reference signal.
12	- - -	
13	- - -	
14	- - -	
15	Chassis(*)	Shield.

(*) Pin ·15· is offered for compatibility. We recommed to connect the cable shield to the connector housing at both ends.

To connect feedback devices with differential TTL or 1 Vpp sinusoidal signals. See *"3.8 Feedback inputs. Technical characteristics and connection."* on page 38.

3.7 Electrical characteristics of the inputs and outputs.

Digital inputs.

All digital inputs, 16 per module, have a status indicating LED and are galvanically protected with opto-couplers. The electrical characteristics of the inputs are:

Nominal voltage.	+24 V DC (between +18 V DC and +30 V DC).
High threshold "1".	Over +18 V DC.
Low threshold "0".	Under +9 V DC.
Typical consumption of each input.	5 mA.
Maximum consumption of each input.	7 mA.

Digital outputs.

All digital outputs, 16 per module, have a status indicating LED and are galvanically protected with opto-couplers. The electrical characteristics of the outputs are:

Nominal voltage.	+24 V DC (between +18 V DC and +30 V DC).
Output voltage.	2 V less than the supply voltage.
Maximum output current.	500 mA per output.

The digital output modules have an 8A fuse inside for protection against over-voltage (over 33 Vdc) and against reverse connection.

Analog inputs.

Use shielded cables connecting their meshes to the corresponding shield pin. All the analog inputs, 8 per module, have the following characteristics:

Voltage within range.	± 10 V.
Resolution.	12 bits.
Input impedance.	20 kΩ.
Maximum cable length (unshielded).	75 mm.

Analog outputs.

Use shielded cables connecting their meshes to the corresponding shield pin. All the analog outputs, 4 per module, have the following characteristics:

Command voltage within range.	± 10 V.
Resolution.	16 bits.
Minimum impedance of the connected device.	10 kΩ.
Maximum cable length (unshielded).	75 mm.

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3.8 Feedback inputs. Technical characteristics and connection.

The module has 4 feedback inputs, valid for differential TTL and sinusoidal 1 Vpp signals.

Technical characteristics of the feedback inputs.

Power consumption: +5 V 1 A (250 mA per axis)

Work levels for differential TTL signal.
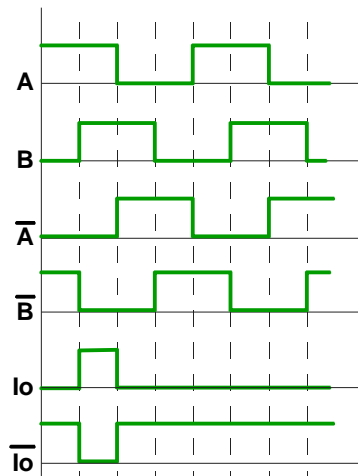
Maximum frequency:	1000 kHz.
Maximum gap between flanks:	460 ns.
Phase shift:	90º ± 20º.
Maximum voltage in common mode:	± 7 V.
Maximum voltage in differential mode:	± 6 V.
Hysteresis:	0.2 V.
Maximum differential input current:	3 mA.

Work levels for sinusoidal 1 Vpp signal.

Maximum frequency:	500 kHz.
A and B signals. Amplitude:	0.6 ÷ 1.2 Vpp
A and B signals. Centered:	$|V1-V2| / 2$ Vpp =< 6.5%
A and B signals. Ratio:	VApp / VBpp = 0.8 ÷ 1.25
A and B signals. Phase shift:	90º ± 10º
I0 signal. Amplitude:	0.2 ÷ 0.85 V
I0 signal. Width:	T-90º =< I0 =< T+180º

Feedback cable characteristics.

Fagor Automation offers a wide range of cables and extension cables to connect the feedback systems to the CNC. Refer to our catalog for further information.

The cable used must have overall shield; the rest of the characteristics of the cable, as well as its length, will depend on the type of feedback device used. Refer to our catalog.

The shield of the cable being used must be connected to the connector housing at both ends. The unshielded portion of the wires of an unshielded cable cannot be longer than 75 mm.

We recommend to run the feedback cables as far away as possible from the power cables of the machine.

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RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).

Feedback inputs. Technical characteristics and connection.

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3.9   Numbering of the digital inputs and outputs.

Use machine parameters to set the number of digital I/O modules connected to the same CAN bus. If these parameters are not set, the CNC numbers the modules automatically according to the order of the remote groups (·ADDRESS· selector of the power supply module).

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RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).
Numbering of the digital inputs and outputs.

Numbering according to the order of the remote groups.
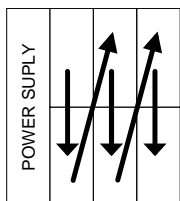
The CNC numbers the modules automatically according to the order of the remote groups (·ADDRESS· selector of the power supply module). Within each group, they are ordered from top to bottom and from left to right.

Example of configuration of the following remote modules.

Group ·1·	Group ·2·	Group ·3·
48 digital inputs.	16 digital inputs.	32 digital inputs.
32 digital outputs.	16 digital outputs.	16 digital outputs.

Example 1.

	Group ·1· (address = 1)	Group ·2· (address = 2)	Group ·3· (address = 3)
Digital inputs.	1 ·· 48	49 ·· 64	65 ·· 96
Digital outputs.	1 ·· 32	33 ·· 48	49 ·· 64
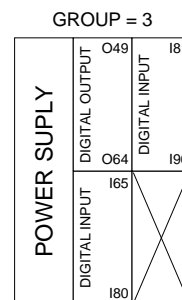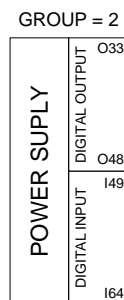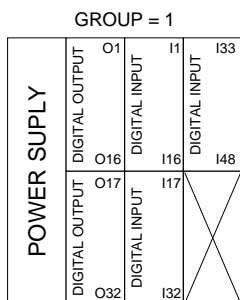
Example 2.

	Group ·1· (address = 1)	Group ·2· (address = 3)	Group ·3· (address = 2)
Digital inputs.	1 ·· 48	81 ·· 96	49 ·· 80
Digital outputs.	1 ·· 32	49 ·· 64	33 ·· 48

Numbering by machine parameters.

When the numbering is set by machine parameters, each module is assigned a base index and the inputs or outputs of that module are numbered after it. The values of the base index must be comply with the formula 16n+1 (i.e. 1, 17, 33, etc.). The rest of the inputs or outputs are numbered sequentially. The base indexes may follow any order, they do not have to be sequential.

When inserting a new module, the first modules will be assigned the numbering of the table and the last one will be assigned the next valid base index after the highest one assigned until then.

Examples for numbering the different modules.

Remote group (1).

	Digital inputs.		Digital outputs.	
	Base index.	Numbering.	Base index.	Numbering.
Module 1.	1	1 ·· 16	33	33 ·· 48
Module 2.	33	33 ·· 48	81	81 ·· 96
Module 3.	97	97 ·· 112		

Remote group (2).

	Digital inputs.		Digital outputs.	
	Base index.	Numbering.	Base index.	Numbering.
Module 1.	113	113 ·· 128	49	49 ·· 64

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RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).
Numbering of the digital inputs and outputs.

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3.10 Numbering of the analog inputs and outputs and of the feedback inputs.
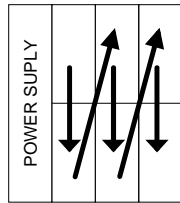
POWER SUPLY

The CNC numbers the modules automatically according to the order of the remote groups (·ADDRESS· selector of the power supply module). Within each group, they are ordered from top to bottom and from left to right.

Group ·1·	Group ·2·
8 analog inputs.	8 analog inputs.
4 analog inputs.	4 analog inputs.

Example.

	Group ·1· (address = 1)	Group ·2· (address = 2)
Analog inputs.	1 ·· 8	9 ·· 16
Analog outputs.	1 ·· 4	5 ·· 8

3.11   Probe connection.

The digital inputs let you handle the signal of the two 24 V DC probes . Use machine parameters to define which digital input is associated with each probe and their type of pulse.

Probe whose output has a normally open contact. Connection to +24 V.

The connection acts upon the up flank (positive pulse) of the probe signal.
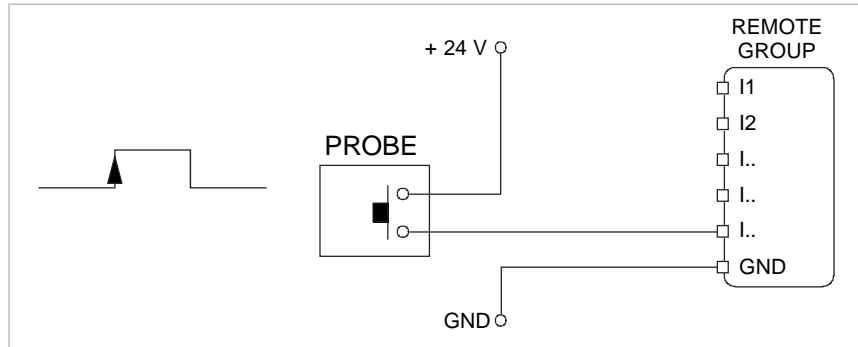
Probe whose output has a normally closed contact. Connection to +24 V.

The connection acts upon the up flank (positive pulse) of the probe signal.
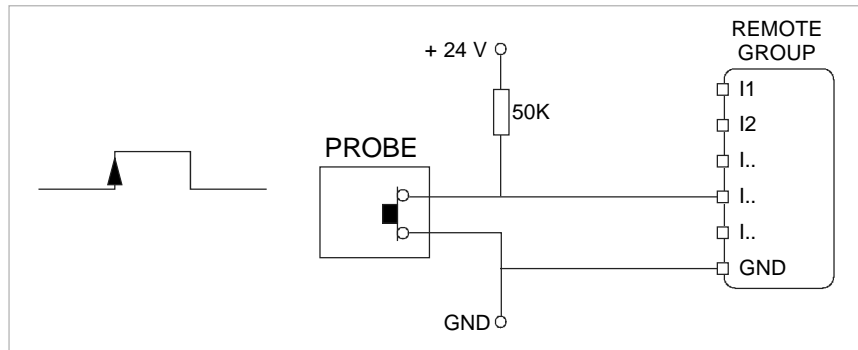
Interface with an open-collector output. Connection to +24 V.

The connection acts upon the down flank (negative pulse) of the probe signal.

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Interface with a PUSH-PULL output. Connection to +24 V.

Depending on the interface being used, the connection acts upon the up flank or down flank of the probe signal.

3.
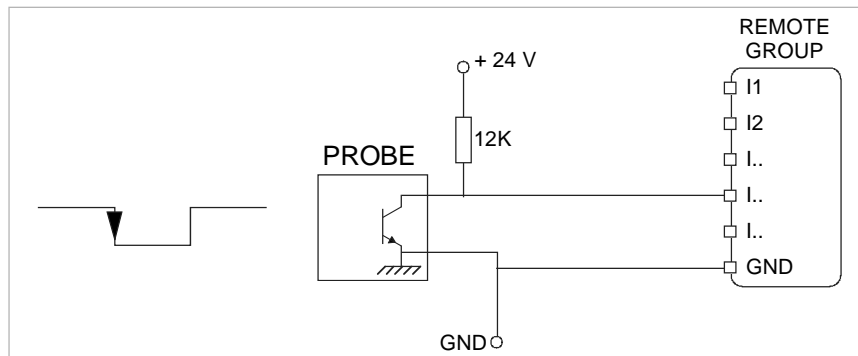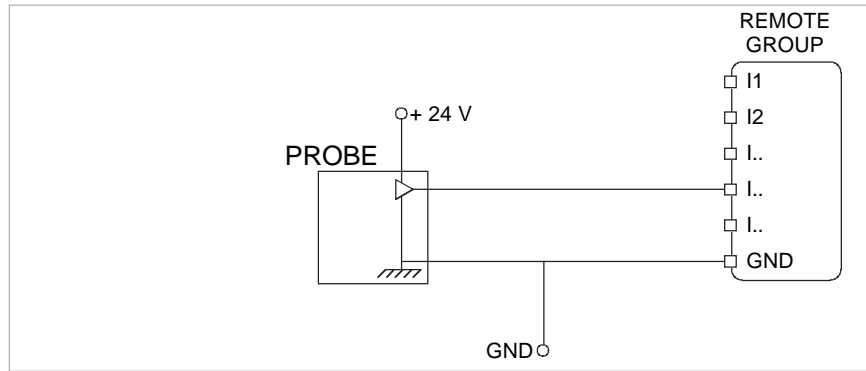
RIO70 REMOTE MODULES. (CANFAGOR PROTOCOL).

Probe connection.

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4   RIO5 REMOTE MODULES. (CANOPEN PROTOCOL).

Remote modules may be used to have an additional number of digital and analog inputs and outputs (remote I/O) that, distributed at different points of the machine or mounted in the cabinet, permit controlling various devices of the machine. The remote modules are distributed by groups (nodes) and are connected to the central unit through the CAN bus that can have up to 32 nodes, including the central unit and the keyboards. The following elements may be available with RIO5 series modules.

Type of input/output	Amount.
Digital inputs.	1024
Digital outputs.	1024
General purpose analog inputs.	40
Analog outputs.	40
Analog inputs for temperature sensors.	10

When the CNC works with CANopen bus, this bus lets combine in the bus groups (nodes) formed by RIO5 and RIOW series modules; modules of both series cannot be combined in the same group.

Fagor remote modules, RIO5 series, available for CAN bus with CANopen protocol.

Each group (node) may consist of up to two of these modules.
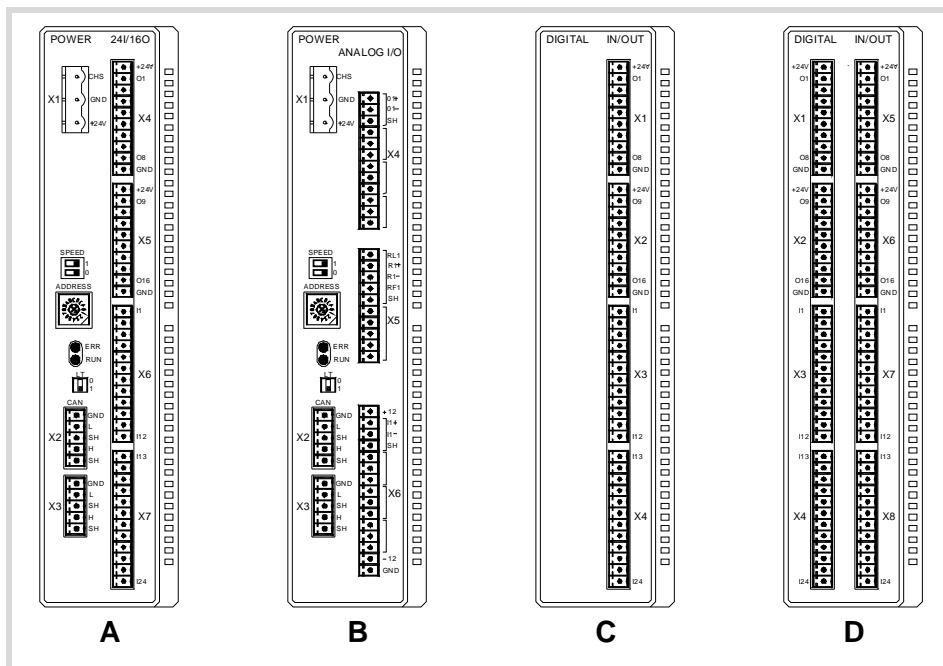
A   Power supply with 24 digital inputs and 16 digital outputs.

B   Power supply with 4 analog inputs, 4 analog outputs and 2 inputs for temperature sensors.

C   Digital Inputs / Outputs (single module). Each module has 24 digital inputs and 16 digital outputs.

D   Digital Inputs / Outputs (double module). Each module has 48 digital inputs and 32 digital outputs.

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General considerations on power supply modules.

When mounting the groups, bear in mind the following.

- One of the power supply modules must be present in each group. The power supply must be powered at 24 Vdc and connected to the CAN bus of the system.

- Two power supply modules cannot be in the same group.

- Power supplies of both models may be connected to the same CAN bus.

Fagor modules and third-party modules. Considerations about the number of analog inputs.

The CANopen bus can manage up to 60 analog inputs of any kind. The maximum number of analog inputs of each type that the bus can have depends on the type of modules installed.

CAN bus with Fagor modules.

A bus made up of only with Fagor modules can have 40 general purpose analog inputs and 10 inputs for temperature sensors. In Fagor modules, the analog inputs are pre-assigned as general-purpose inputs (four per module) or as inputs for temperature sensors (two inputs per module).

In Fagor modules of analog inputs, the CNC considers the inputs for the temperature sensor (connector X5) as analog inputs. Therefore, when numbering the inputs, the CNC considers that each module has 6 analog inputs; the four analog inputs plus the two temperature sensor inputs.

CAN bus with third-party modules.

A bus made up of only third-party modules can have 60 analog inputs of any kind. In third-party modules, it is up to the manufacturer to set the right configuration so the CNC treats these analog inputs as general purpose, for temperature sensors, etc.

CAN bus with Fagor modules and third-party modules.

A bus made up of Fagor modules and third-party modules, each Fagor modules counts as 6 analog inputs; 4 general purpose inputs and 2 inputs for temperature sensors. The inputs of third-party modules can be of any kind.

In third-party modules, it is up to the manufacturer to set the right configuration so the CNC treats these analog inputs as general purpose, for temperature sensors, etc.

Consumption of the remote modules.

Each group consumes 1.2 A without including the consumption of the digital and analog outputs.

4.1   Dimensions and mounting of the modules.

Place the modules on 2 profiles, according to the UNE 50022 standard, with 2 securing ends, one at each end of the group; they help securing the modules besides maintaining the right gap between the profiles.

Dimensions of the modules.

Always leave a 140 mm gap under the modules for ventilation and later handling.
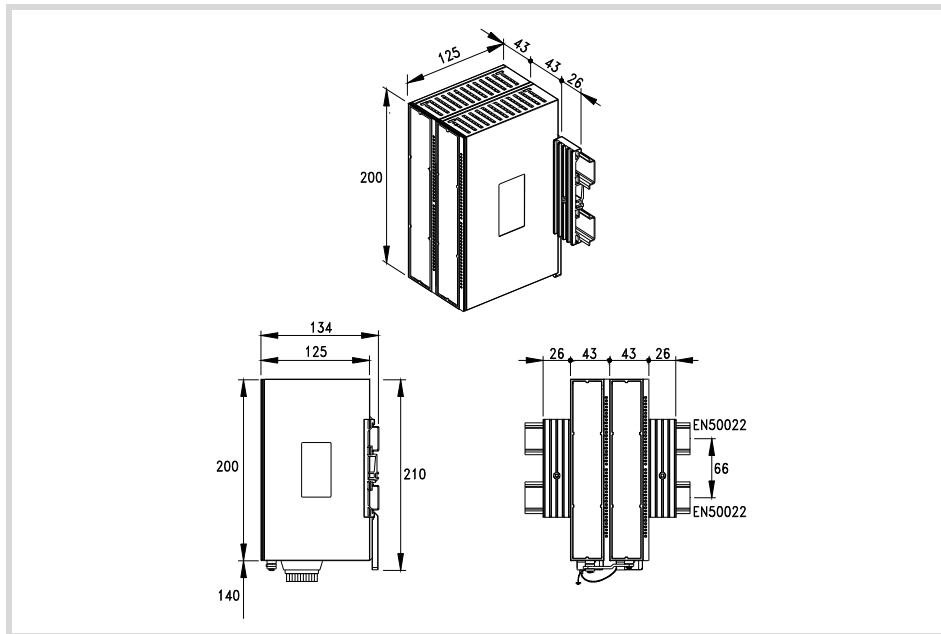
Connection of the modules.

The modules of the group are connected as follows:
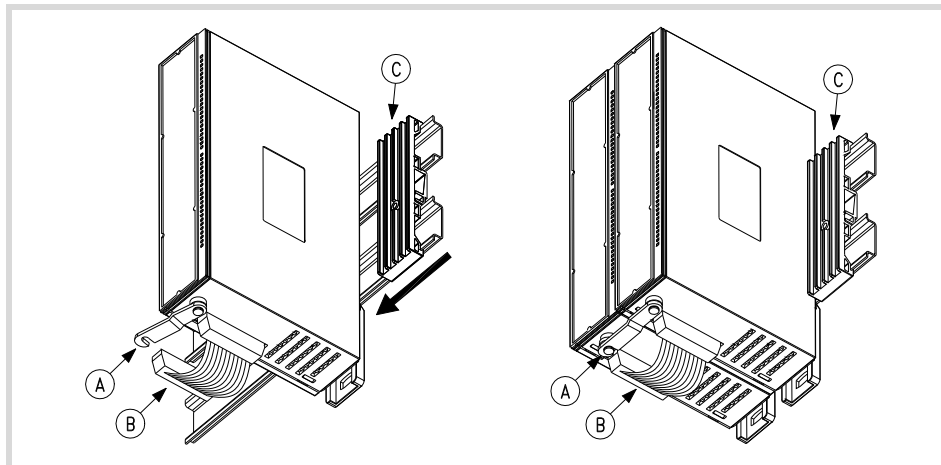
A For ground connection.

B Ribbon cable to interconnect the modules.

C Securing ends.

Each group is connected to the system (CPU, Keyboard, etc.) through the CAN bus as described later on.

DO NOT make any connection or connect any module to the power supply while the latter is turned on. Before making any connection, ribbon cable included, turn the power supply off by unplugging the power cable.

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4.2   Power supply.

The power supply must be powered at 24 Vdc and connected to the CAN bus of the system. There are two power supply models.

- Power supply with 24 digital inputs and 16 digital outputs.

- Power supply with 4 analog inputs, 4 analog outputs and 2 inputs for temperature sensors.

Power supply with digital inputs and digital outputs.

POWER   24I/16O

Connector ·X1·.
Power supply.

X1   CHS
      GND
      +24V

CAN bus. ·SPEED· selector.
CAN bus transmission speed.

CAN bus. ·ADDRESS· selector.
Address (node) of the element within the CAN bus.

SPEED
1
0

ADDRESS

CAN bus. Leds.
Status indicators.

ERR
RUN

CAN bus. ·ST· selector.
Line terminating resistor.

LT
0
1

CAN bus. Connector ·X2·.
CAN bus connection.

CAN

X2   GND
      L
      SH
      H
      SH

CAN bus. ·X3· connector.
CAN bus connection.

X3   GND
      L
      SH
      H
      SH

+24V
O1

X4

O8
GND

+24V
O9

X5

O16
GND

I1

X6

I12

I13

X7

I24

Connector ·X4·.
8 digital outputs.

Connector ·X5·.
8 digital outputs.

Connector ·X6·.
12 digital inputs.

Connector ·X7·.
12 digital inputs.

·48·

Power supply with analog inputs and outputs.

Connector ·X1·.
Power supply.

CAN bus. ·SPEED· selector.
CAN bus transmission speed.

CAN bus. ·ADDRESS· selector.
Address (node) of the element within the CAN bus.

CAN bus. Leds.
Status indicators.

CAN bus. ·ST· selector.
Line terminating resistor.

CAN bus. Connector ·X2·.
CAN bus connection.

CAN bus. ·X3· connector.
CAN bus connection.

POWER
ANALOG I/O

X1
CHS
GND
+24V

O1+
O1-
SH
X4

SPEED
1
0

ADDRESS

ERR
RUN

LT
0
1

CAN

X2
GND
L
SH
H
SH

X3
GND
L
SH
H
SH

RL1
R1+
R1-
RF1
SH
X5

+12
I1+
I1-
SH

X6

-12
GND

Connector ·X4·.
4 general purpose analog outputs.

Connector ·X5·.
2 PT100 inputs.

Connector ·X6·.
4 differential analog inputs.

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CNC 8070

4.2.1 Elements (connectors).

Connectors at the power supply.

Connector ·X1·. Power supply.

3-pin male Phoenix combicom contact (7.62 mm pitch).

Signal.	Function.
Chassis	Shield.
GND	Power supply.
+24 V	Power supply.

CAN bus. ·CAN· connector. Connector ·X2· & ·X3·.

5-pin male Phoenix minicombicon contact (3.5 mm pitch).

Pin.	Signal.	Function.
1	ISO GND	Ground / 0 V.
2	CAN L	(LOW) bus signal.
3	SHIELD	CAN shield.
4	CAN H	(HIGH) bus signal.
5	SHIELD	CAN shield.

CAN bus. ·SPEED· selector. Selecting the baudrate for the CANopen bus.

SPEED

The transmission speed depends on the total length of the cable. Use the following approximate values. Assigning other values may cause communication errors due to signal distortion.

·CO BR·	Speed	Length of the CAN bus.
SPEED	1000 kHz	Up to 20 meters.
SPEED	800 kHz	From 20 to 40 meters.
SPEED SPEED	500 kHz	From 40 to 100 meters. Unlike at the keyboards, the communication at 250 kHz is not available at the remote modules.

In order for any change of speed to be assumed, the corresponding module must be reset; however, we recommend to change the speed while the modules and the CNC are off.

CAN bus. ·ADDRESS· selector. Address (node) of the element within the bus.

Each one of the elements integrated into the CAN bus is identified by the 16-position rotary switch (0-15) "Address" (also referred to as "Node_Select").

The CNC must always occupy position "0" and the rest of the elements of the bus will occupy consecutive positions starting with 1. In order for any change at the "Address" switch to be assumed, the CNC must be restarted and the corresponding drive must be reset, however, we recommend to change the address while the modules and the CNC are off.

The "Address" switch also sets the priority of the group within the bus; the lower the number the higher the priority. We recommend the keyboard and jog panel to be the last node of the bus.

CAN bus. ·ST· selector.

LT
■ 0
☐ 1

Line terminating resistor. The ·LT· switch identifies which are the elements that occupy the ends of the CAN bus; i.e. the first and last physical element in the connection.

The switch position of the terminating elements must be "1" and that of the rest of the elements "0".

·ERROR· LED. Status indicator LED.

Red LED. Its meaning depends on the blinking speed.

Type of blinking.	Meaning.
LED off.	The module works properly.
Blinking fast.	Module configuration stage.
Single blinking.	Warning. Poor transmission.
Double blinking.	There is no communication with the cpu.
LED on.	Error. Too many errors.

CAN bus. Led ·RUN·.

The LED is green. Its meaning depends on the blinking speed.

Type of blinking.	Meaning.
LED on.	The module works properly.
Single blinking.	Module stopped.
Blinking fast.	Module configuration stage.
Continuous blinking.	Start-up stage or error.

Connectors for the digital inputs and outputs.

Connector ·X4· & ·X5·. Digital outputs (8 outputs in each connector).

10-pin male Phoenix minicombicon contact (3.5 mm pitch). Both connectors must be powered with 24 V DC and GND.

X4

+24V
O1
O2
O3
O4
O5
O6
O7
O8
GND

X5

+24V
O9
O10
O11
O12
O13
O14
O15
O16
GND
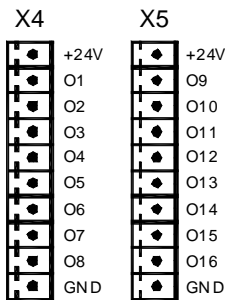
Signal.	Function.
+ 24 V	Power supply.
O1 - O8	Digital outputs.
O9 - O16	Digital outputs.
GND	Power supply.

Connector ·X6· & ·X7·. Digital inputs (12 inputs in each connector).

12-pin male Phoenix minicombicon contact (3.5 mm pitch).

X6

I1
I2
I3
I4
I5
I6
I7
I8
I9
I10
I11
I12

X7

I13
I14
I15
I16
I17
I18
I19
I20
I21
I22
I23
I24

Signal.	Function.
I1 - I12	Digital inputs.
I13 - I24	Digital inputs.

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CNC 8070

(REF: 1709)
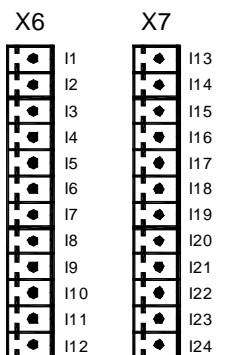
Connectors for the analog inputs and outputs.

Connector ·X4·. General purpose analog outputs (4 outputs).

12-pin male Phoenix minicombicon contact (3.5 mm pitch).
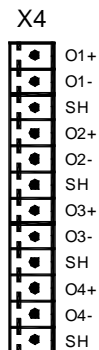
X4

O1+
O1-
SH
O2+
O2-
SH
O3+
O3-
SH
O4+
O4-
SH

Signal.		Function.
O1+	O1-	Analog outputs.
O2+	O2-	Analog outputs.
O3+	O3-	Analog outputs.
O4+	O4-	Analog outputs.
SH		Shield connection.

Each analog output has three pins (O+, O-, SH). Use shielded cables connecting their meshes to the corresponding shield pin.

Connector ·X6·. Differential analog inputs (4 inputs).

15-pin male Phoenix minicombicon contact (3.5 mm pitch).

X6

+12
I1+
I1-
SH
I2+
I2-
SH
I3+
I3-
SH
I4+
I4-
SH
-12
GND
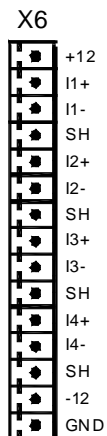
Signal.		Function.
I1+	I1-	Analog inputs.
I2+	I2-	Analog inputs.
I3+	I3-	Analog inputs.
I4+	I4-	Analog inputs.
SH		Shield connection.
+12	-12	12 V output.
GND		0 V reference signal.

Each analog input has three pins (I+, I-, SH). Use shielded cables connecting their meshes to the corresponding shield pin.

Connectors for the temperature sensors PT100.

Connector ·X5·. Inputs for temperature sensors PT100 (2 inputs).

10-pin male Phoenix minicombicon contact (3.5 mm pitch).

X5

RL1
R1+
R1-
RF1
SH
RL2
R2+
R2-
RF2
SH
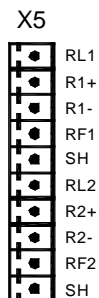
Signal.		Function.
R1+ RL1	R1- RF1	Signals of the PT100 sensor.
R2+ RL2	R2- RF2	Signals of the PT100 sensor.
SH		Shield connection.

Each input has 5 pins (RL, R+, R-, RF, SH). Use shielded cables connecting their meshes to the corresponding shield pin.

4 wires.   3 wires.   2 wires.

4.
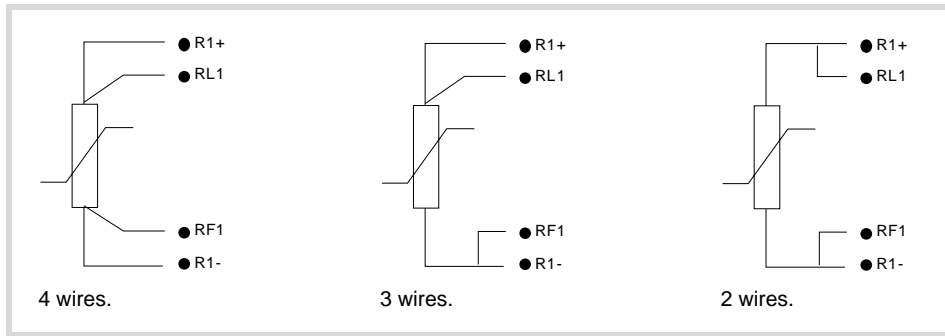
RIO5 REMOTE MODULES. (CANOPEN PROTOCOL).

Power supply.

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(REF: 1709)

·53·

4.3 Digital inputs and digital outputs (single module).

This module is used to expand the digital inputs and outputs (remote I/O). Each module has 24 digital inputs and 16 digital outputs.

Digital inputs and digital outputs (single module).

4.

RIO5 REMOTE MODULES. (CANOPEN PROTOCOL).
Digital inputs and digital outputs (single module).

DIGITAL   IN/OUT

+24V
O1

X1

O8
GND

Connector ·X1·.
8 digital outputs.

+24V
O9

X2

O16
GND

Connector ·X2·.
8 digital outputs.

I1

X3

I12

·X3· connector.
12 digital inputs.

I13

X4

I24

Connector ·X4·.
12 digital inputs.

4.3.1 Elements (connectors).

Connector ·X1· & ·X2·. Digital outputs (8 outputs in each connector).

10-pin male Phoenix minicombicon contact (3.5 mm pitch). Both connectors must be powered with 24 V DC and GND.

X1   X2

+24V	+24V
O1	O9
O2	O10
O3	O11
O4	O12
O5	O13
O6	O14
O7	O15
O8	O16
GND	GND
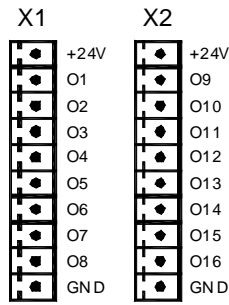
Signal.	Function.
+ 24 V	Power supply.
O1 - O8	Digital outputs.
O9 - O16	Digital outputs.
GND	Power supply.

Connector ·X3· & ·X4·. Digital inputs (12 inputs in each connector).

12-pin male Phoenix minicombicon contact (3.5 mm pitch).

X3   X4

I1	I13
I2	I14
I3	I15
I4	I16
I5	I17
I6	I18
I7	I19
I8	I20
I9	I21
I10	I22
I11	I23
I12	I24

Signal.	Function.
I1 - I12	Digital inputs.
I13 - I24	Digital inputs.

4.

RIO5 REMOTE MODULES. (CANOPEN PROTOCOL).
Digital inputs and digital outputs (single module).

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CNC 8070
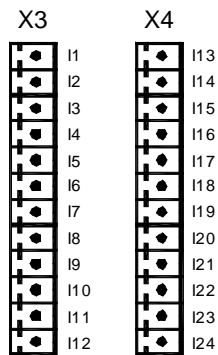
4.4 Digital inputs and digital outputs (double module).

This module is used to expand the digital inputs and outputs (remote I/O). Each module has 48 digital inputs and 32 digital outputs.
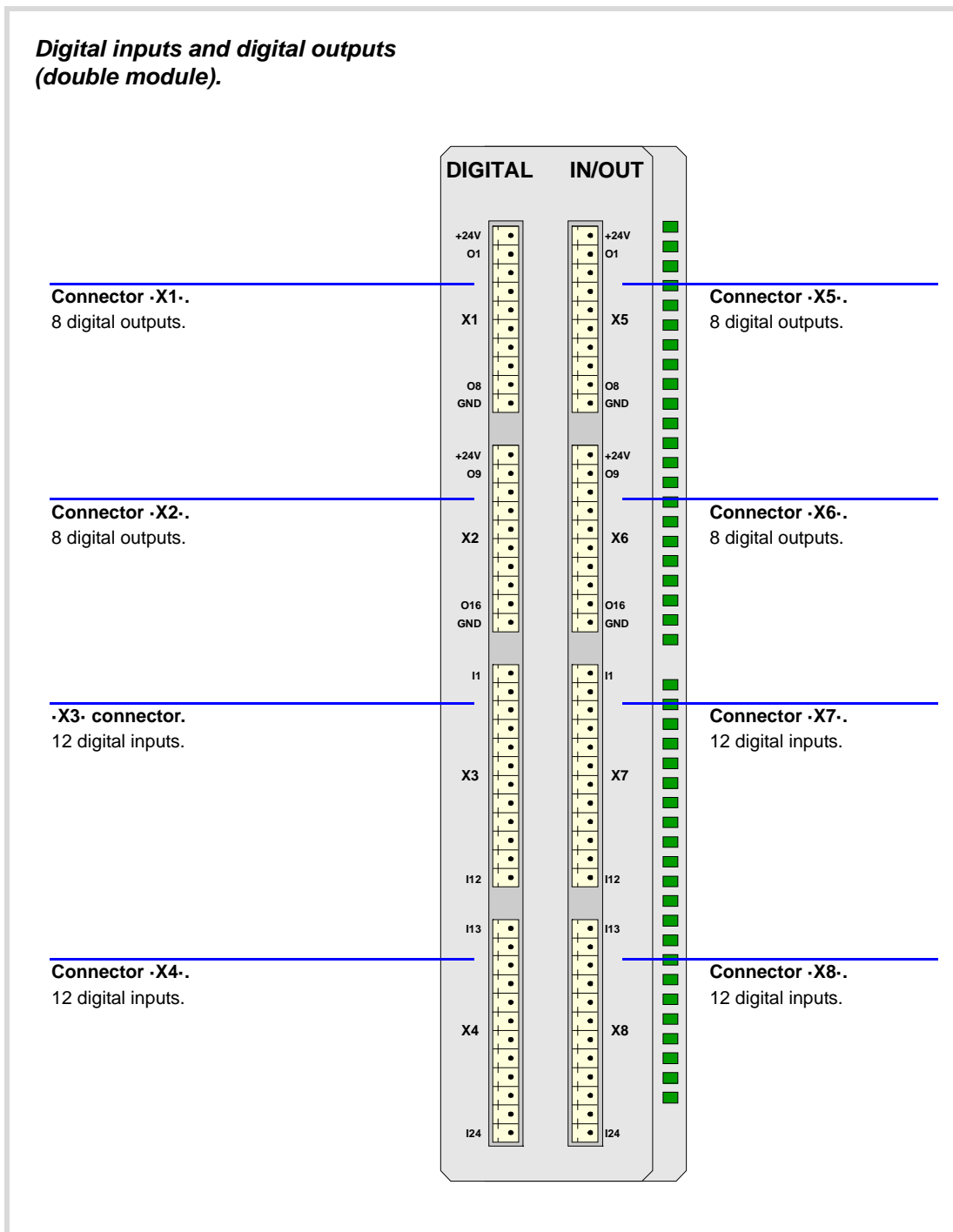
Digital inputs and digital outputs (double module).

DIGITAL   IN/OUT

Connector ·X1·.
8 digital outputs.

Connector ·X5·.
8 digital outputs.

Connector ·X2·.
8 digital outputs.

Connector ·X6·.
8 digital outputs.

·X3· connector.
12 digital inputs.

Connector ·X7·.
12 digital inputs.

Connector ·X4·.
12 digital inputs.

Connector ·X8·.
12 digital inputs.

4.4.1   Elements (connectors).

Connector ·X1· & ·X2· & ·X5· & ·X6·. Digital outputs (8 outputs in each connector).

10-pin male Phoenix minicombicon contact (3.5 mm pitch). Both connectors must be powered with 24 V DC and GND.

X1-X5   X2-X6
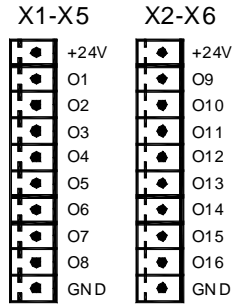
Signal.	Function.
+ 24 V	Power supply.
O1 - O8	Digital outputs.
O9 - O16	Digital outputs.
GND	Power supply.

Connector ·X3· & ·X4· & ·X7· & ·X8·. Digital inputs (12 inputs in each connector).

12-pin male Phoenix minicombicon contact (3.5 mm pitch).

X3-X7   X4-X8

Signal.	Function.
I1 - I12	Digital inputs.
I13 - I24	Digital inputs.

4.

RIO5 REMOTE MODULES. (CANOPEN PROTOCOL).
Digital inputs and digital outputs (double module).

FAGOR

FAGOR AUTOMATION

CNC 8070
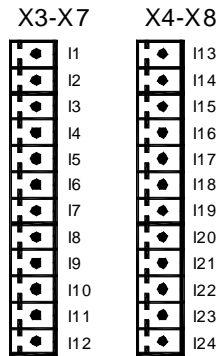
4.5 Electrical characteristics of the inputs and outputs.

Digital inputs.

All digital inputs are galvanically isolated through opto-couplers. All the digital inputs have the following characteristics:

Nominal voltage.	+24 V DC (between +18 V DC and +30 V DC).
High threshold "1".	Over +18 V DC.
Low threshold "0".	Under +9 V DC.
Typical consumption of each input.	5 mA.
Maximum consumption of each input.	7 mA.

Digital outputs.

All digital outputs are galvanically isolated through opto-couplers. All the digital outputs have the following characteristics:

Nominal voltage.	+24 V DC (between +18 V DC and +30 V DC).
Output voltage.	2 V less than the supply voltage.
Maximum output current.	500 mA per output.

The digital outputs have a fuse inside for protection against over-voltage (over 33 V DC) and against reverse connection of the power supply.

Analog inputs.

Use shielded cables connecting their meshes to the corresponding shield pin. All the analog inputs have the following characteristics:

Voltage within range.	± 10 V.
Resolution.	12 bits.
Input impedance.	20 kΩ.
Maximum cable length (unshielded).	75 mm.

Analog outputs.

Use shielded cables connecting their meshes to the corresponding shield pin. All the analog outputs have the following characteristics:

Command voltage within range.	± 10 V.
Resolution.	16 bits.
Minimum impedance of the connected device.	10 kΩ.
Maximum cable length (unshielded).	75 mm.

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Inputs for the temperature sensors PT100.

Use shielded cables connecting their meshes to the corresponding shield pin. The electrical characteristics of the inputs are:

Type of sensor.	PT100
Temperature range.	Between -200 ºC (-328 ºF) and +850 ºC (1562 ºF).
Resolution.	0.1 ºC
Typical consumption of each input.	2 mA.
Maximum cable length (unshielded).	75 mm.

4.6   Numbering of the digital inputs and outputs.

Use machine parameters to set the number of digital I/O modules connected to the same CAN bus. If these parameters are not set, the CNC numbers the modules automatically according to the order of the remote groups (·ADDRESS· selector of the power supply module).

Numbering according to the order of the remote groups.

The CNC numbers the modules automatically according to the order of the remote groups (·ADDRESS· selector of the power supply module). Within each group, they are ordered from left to right.

Group ·1·	Group ·2·	Group ·3·
24 digital inputs.	24 + 48 digital inputs.	24 + 24 digital inputs.
16 digital outputs.	16 + 32 digital outputs.	16 + 16 digital outputs.

Example 1.

	Group ·1· (address = 1)	Group ·2· (address = 2)	Group ·3· (address = 3)
Digital inputs.	1 ·· 24	25 ·· 48 49 ·· 96	97 ·· 120 121 ·· 144
Digital outputs.	1 ·· 16	17 ·· 32 33 ·· 64	65 ·· 80 81 ·· 96

Example 2.

	Group ·1· (address = 1)	Group ·2· (address = 3)	Group ·3· (address = 2)
Digital inputs.	1 ·· 24	73 ·· 96 97 ·· 144	25 ·· 48 49 ·· 72
Digital outputs.	1 ·· 16	49 ·· 64 65 ·· 96	17 ·· 32 33 ·· 48

Numbering by machine parameters.

When the numbering is set by machine parameters, each module is assigned a base index and the inputs or outputs of that module are numbered after it. The double input/output module must be assigned two base indexes for the inputs and two base indexes for the outputs; one for each board;

The values of the base index must be comply with the formula "8n + 1" (i.e. 1, 9, 17, 25, etc.). The rest of the inputs or outputs are numbered sequentially. The base indexes may follow any order, they do not have to be sequential.

When inserting a new module, the first modules will be assigned the numbering of the table and the last one will be assigned the next valid base index after the highest one assigned until then.

Examples for numbering the different modules.

(*) For each base index, indicate the connector and the input or output it corresponds to.
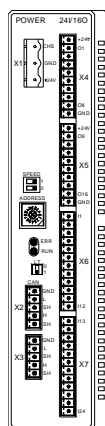
Power supply.

	Base index*	Numbering.
Digital inputs.	·1· (I1 of X6)	1 ·· 24
Digital outputs.	·1· (I1 of X4)	1 ·· 16
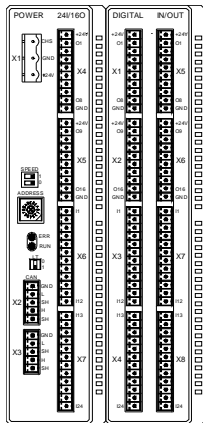
Power supply.

	Base index*	Numbering.
Digital inputs.	·1· (I1 of X6)	1 ·· 24
Digital outputs.	·1· (I1 of X4)	1 ·· 16

Module of digital inputs and outputs (double module).

	Base index*	Numbering.
Digital inputs.	·25· (I1 of X3) ·49· (I1 of X7)	25 ·· 48 49 ·· 64
Digital outputs.	·17· (I1 of X1) ·33· (I1 of X5)	17 ·· 32 33 ·· 48

4.7 Numbering of the analog inputs and outputs and of the temperature sensor inputs.

The CNC numbers the modules automatically according to the order of the remote groups (·ADDRESS· selector of the power supply module).

When numbering the analog inputs, the CNC considers the inputs for the temperature sensor (connector X5) as analog inputs. Therefore, when numbering the inputs, the CNC considers that each module has 6 analog inputs; the four analog inputs plus the two temperature sensor inputs.

Group ·1·	Group ·2·
4 analog inputs.	4 analog inputs.
4 analog inputs.	4 analog inputs.
2 PT100 inputs	2 PT100 inputs

Example.

	Group ·1· (address = 1)	Group ·2· (address = 2)
Analog inputs. PT100 inputs.	1 ·· 4 5 ·· 6	7 ·· 10 11 ·· 12
Analog outputs.	1 ·· 4	5 ·· 8

The CNC machine parameters must be set to indicate the number of PT100 inputs and to which analog inputs they are connected. A PT100 input is active if it has one of these temperature sensors connected to it. Refer to the installation manual for further detail.

4.

RIO5 REMOTE MODULES. (CANOPEN PROTOCOL).

Numbering of the analog inputs and outputs and of the temperature sensor inputs.

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CNC 8070

5   RIOW REMOTE MODULES. (CANOPEN PROTOCOL).

Remote modules may be used to have an additional number of digital and analog inputs and outputs (remote I/O) that, distributed at different points of the machine or mounted in the cabinet, permit controlling various devices of the machine. The remote modules are distributed by groups (nodes) and are connected to the central unit through the CAN bus that can have up to 32 nodes, including the central unit and the keyboards. The following elements may be available with RIOW series modules.

Type of input/output	Amount.
Digital inputs.	1024
Digital outputs.	1024
General purpose analog inputs.	40
Analog outputs.	40
Analog inputs for temperature sensors.	10

When the CNC works with CANopen bus, this bus lets combine in the bus groups (nodes) formed by RIO5 and RIOW series modules; modules of both series cannot be combined in the same group.

Fagor remote modules, RIOW series, available for CAN bus with CANopen protocol.

Each group (node) will consist of a leading (first) module (RIOW-CANOPEN-STAND), an end module (last) (RIOW-END) and a maximum of 64 intermediate modules for processing digital and analog inputs and outputs, etc.

RIOW-CANOPEN-STAND   1   2   3   4   5   7   8   9   . . .   63   64   RIOW-END
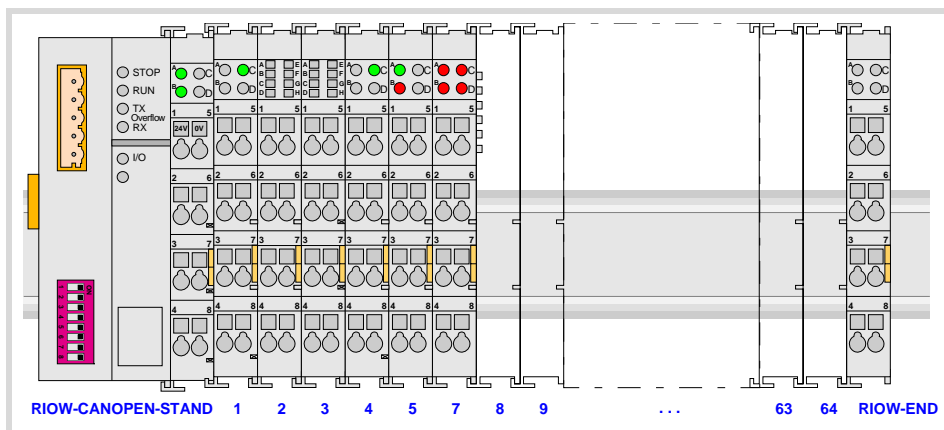
Module.	Description.
RIOW-CANOPEN-STAND.	This module must be the first module of each group and it is in charge of managing the internal bus of the group and connecting the group to the CAN bus of the system.
RIOW-END.	This module must be the last module of each group and it is used to end the internal bus of the group and ensure proper data flow.
RIOW-PS24.	Power supply module. This module is in charge of supplying power to the I/O modules through the side jumpers with 24 V 10A.
RIOW-8DI.	Expansion module with eight 24V DC digital inputs.
RIOW-8DO.	Expansion module with eight 24V DC 0.5 A digital outputs.
RIOW-4AI.	Expansion module with four ±10 V DC analog inputs.
RIOW-4AO.	Expansion module with four ±10 V DC analog outputs.
RIOW-2AI-PT100.	Expansion module with 2 analog inputs for PT100 temperature sensors.

5.

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(REF: 1709)

5.1 Dimensions of the modules.
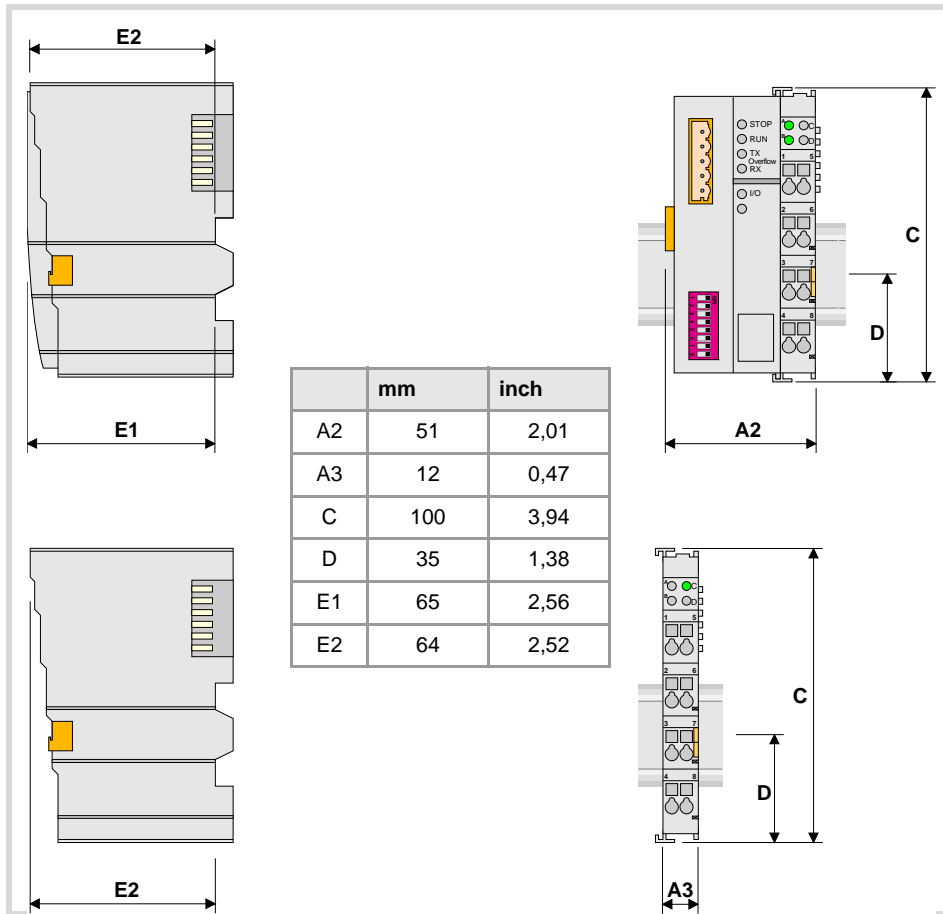
	mm	inch
A2	51	2,01
A3	12	0,47
C	100	3,94
D	35	1,38
E1	65	2,56
E2	64	2,52

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CNC 8070

(REF: 1709)

5.2 Technical and electrical characteristics.

5.2.1 Technical characteristics.

Mechanical characteristics.

Vibrations (module RIOW-CANOPEN-STAND).

- Meets the IEC60068-2-6 standard.
- Sweep sine trial with a frequency step of 1 octave/minute (±10%) and on each of the three axes.

5 Hz ≤ f < 9 Hz	1.750 mm amplitude (constant) or 3.5 mm (short periods).
9 Hz ≤ f < 150 Hz	0.5 mm (constant acceleration) or 1g (short periods).

Choques.

- Meets the IEC60068-2-27 standard.
- Semi-sinusoidal pulses with 15g peaks for 11 ms. 3 pulses in each direction (positive and negative) of each of the three vertical axes (18 pulses in all).

Free fall.

- Meets the IEC60068-2-32 standard.
- Up to 1 m with the unit in its original packaging.

Electromagnetic compatibility.

Regulations valid for all RIOW modules.

Immunity against disturbances (regulation EN 50082-2:1996).

- Meets the EN 61000-4-2 regulation.
- Meets the EN 61000-4-3 regulation.
- Meets the EN 61000-4-4 regulation.
- Meets the EN 61000-4-6 regulation.

Regulations valid for all RIOW modules except for RIOW-CANOPEN-STAND module.

Emission of disturbances (regulation EN 50081-1:1993).

- Meets the EN 55022 regulation.

Regulations only valid for RIOW-CANOPEN-STAND module.

Emission of disturbances (regulation EN 50081-2:1994).

- Meets the EN 55011 regulation.

Ambient conditions.

- Relative humidity: 5-95% without condensation.
- Work temperature: 0-55 ºC.
- Storage temperature: Between -20 ºC (77 ºF) and +85 ºC (158 ºF).
- Resistance to harmful substances: Meets standards IEC 60068-2-42 and IEC 60068-2-43.

Degree of protection.

- It meets the protection standard IP 20.

The machine manufacturer must comply with the EN 60204-1 (IEC-204-1) regulation regarding electrical shocks in case of defective input/output pins with external power supply when not plugging the connector before turning the power supply on.

Do not get into the inside of the unit. This unit MUST NOT be opened by unauthorized personnel. Only personnel authorized by Fagor Automation may manipulate the inside of this unit.

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FAGOR AUTOMATION

CNC 8070

5.2.2   Electrical characteristics of the inputs and outputs.

Digital outputs.

All digital outputs have a status indicating LED that turns on when the output is active. The outputs are protected with opto-couplers and protected against short-circuits.

Technical characteristics.	
Number of outputs.	8 outputs per module.
Nominal voltage.	+24 V DC (between -15 % and +20 %).
Typical consumption.	15 mA per module plus the consumption of the elements.
Output current.	500 mA per output.

Digital inputs.

All digital inputs have a status indicating LED that turns on when the input is active. The inputs are protected by opto-couplers.

Technical characteristics.	
Number of inputs.	8 inputs per module.
Nominal voltage.	+24 V DC (between -15 % and +20 %).
Low threshold "0".	Within -3 and 5 V DC.
High threshold "1".	Within 15 and 30 V DC.
Typical consumption.	2.8 mA.

Analog inputs.

All analog inputs have a status indicating LED that turns on when there is an over-voltage or an under-voltage.

Use shielded cables connecting their meshes to the corresponding shield pin. Maximum cable length (unshielded): 75 mm.

Technical characteristics.	
Number of inputs.	4 inputs per module.
Voltage range.	± 10 V.
Maximum input voltage.	± 40 V.
Typical input impedance.	> 100 kΩ
Measuring error (25 ºC).	<± 0.1 %
Resolution.	12 bits.
Typical consumption of each input.	0.5 mA.

Analog outputs.

Each input has 2 LED's; a green one that turns on when the bus transmission is OK and a red one that turns on when there is an overload or a short-circuit to ground at any of the outputs.

Use shielded cables connecting their meshes to the corresponding shield pin. Maximum cable length (unshielded): 75 mm.

Technical characteristics.	
Number of outputs.	4 outputs per module.
Voltage range.	± 10 V.
Impedance of the connected device.	> 5 kΩ
Output filter time (typical value).	100 ms.
Measuring error (25 ºC).	<± 0.1 %
Resolution.	12 bits.
Typical consumption of each input.	0.5 mA.

Analog inputs for PT100 temperature sensors.

Each input has 2 LED's; a green one that turns on when the bus transmission is OK and a red one that turns on when there is a reading error at the inputs.

The inputs are protected by opto-couplers. Use shielded cables connecting their meshes to the corresponding shield pin. Maximum cable length (unshielded): 75 mm.

Technical characteristics.	
Number of inputs.	2 inputs per module.
Type of sensor.	PT100
Type of connection.	2-wire or 3-wire interface.
Temperature range.	Between -200 ºC (-328 ºF) and +850 ºC (1562 ºF).
Resolution.	0.1 ºC
Measuring error (25 ºC).	<± 0.2 %
Response time, from when the sensor is connected until the first correct measure is obtained.	4 s.
Typical consumption of each input.	0.5 mA.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
Technical and electrical characteristics.

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5.3   Sizing of the remote groups.

Maximum number of modules in a group.

Each group (node) will consist of a leading (first) module, an end module (last) and a maximum of 64 intermediate modules; power supply modules, input modules, output modules, etc. In any case, a group without leading (first) module and with last module cannot be wider than 780 mm.

Module.	Width.	Maximum quantity.
Leading (first) module. • RIOW-CANOPEN-STAND.	51 mm	1
Intermediate modules. • RIOW-PS24. Power supply module. • RIOW-8DI. Module of 8 digital inputs. • RIOW-8DO. Module of 8 digital outputs. • RIOW-4AI. Module of 4 analog inputs. • RIOW-4AO. Module of 4 analog outputs. • RIOW-2AI-PT100. Module of 2 inputs for PT100 sensors.	12 mm	64
Last Module. • RIOW-END.	12 mm	1

Sizing of the group depending on the consumption at the bus.

The leading module is in charge of managing and feeding the internal bus of the group. The RIOW-CANOPEN-STAND module supplies a voltage of 5 V DC 2 A. This module consumes 350 mA at 5 V; therefore, it can supply a maximum of 1650 mA to the rest of the modules.

If when configuring the remote group, the consumption at the bus exceeds the maximum value that the leading module can supply, duplicate the group.

Module.	Internal consumption of the module.
RIOW-CANOPEN-STAND.	350 mA.
RIOW-END.	0 mA.
RIOW-PS24.	0 mA.
RIOW-8DI.	17 mA.
RIOW-8DO.	25 mA.
RIOW-4AI.	65 mA.
RIOW-4AO.	125 mA.
RIOW-2AI-PT100.	80 mA.

Example: In a group made up of 1 RIOW-CANOPEN-STAND module, 5 RIOW-8DI modules and 10 RIOW-8DO modules, the total consumption will be 685 mA.

RIOW-CANOPEN-STAND. 350 mA.

RIOW-PS24.   0 mA.

RIOW-8DI.   5 x 17 mA

RIOW-8DO.   10 x 25 mA

RIOW-END.   0 mA.

5.4   Installation of the modules.

⚠️ *DO NOT make any connection or connect any module or cable if the group is under power. Before making any connection, disconnect the power supply cable of the leading (first) module (RIOW-CANOPEN) and, if necessary, that of the power supply module (RIOW-PS24).*

Place the modules on 1 profile, according to the European regulation EN50022 (DIN 35), with 2 securing ends, one at each end of the group to help secure the modules. RIOW series modules may be mounted horizontally or vertically; when mounting them vertically, use additional mounting blocks at the bottom to secure the modules.

Ground connection.

The profiles on which the modules are mounted must be connected to the system ground because some modules make contact with the profile to connect to ground. To connect the profiles to ground, use a cable with a minimum section of 4 mm². To ensure contact between the profile and the modules, the material of the profile must not be corrosive.
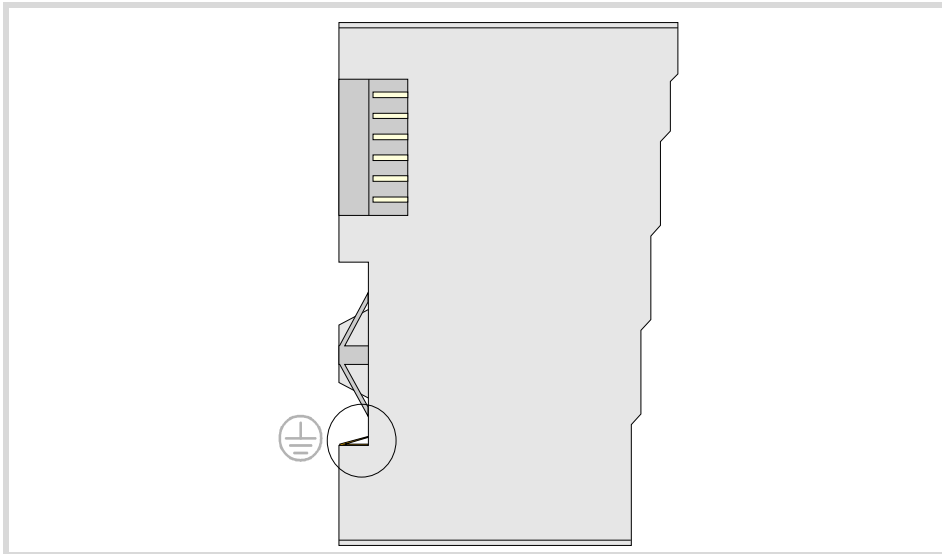
At the RIOW-PS24 module, the ground connection is done through the bottom pins of the module. The ground connection is extended to the adjacent modules through the side jumpers of the module.

Shield connection.

Proper shielding of the signal and data cables reduces interference and improves signal quality while preventing measuring and data transmission errors. The cables must be continuously shielded to ensure compliance with the technical specifications related to measuring accuracy.

Ambient characteristics of the enclosure.

The temperature of the cabinet (enclosure) where the modules are mounted must not exceed 55 ºC (131ºF) when the modules are working. The heat dissipated by all the modules must not exceed the heating capability of the cabinet where they are installed.

Element	Dissipated power
Leading (first) module.	2.0 watts.
Rest of modules.	0.8 W per module.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
Installation of the modules.

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Clearance recommended around a group.

It is recommended to leave a gap between the group and the adjacent elements (other groups, cable carrying channels, enclosure walls, etc.) for better ventilation and easier handling of the unit later on.

	mm	inch
A	20	0,787
B	35	1,378
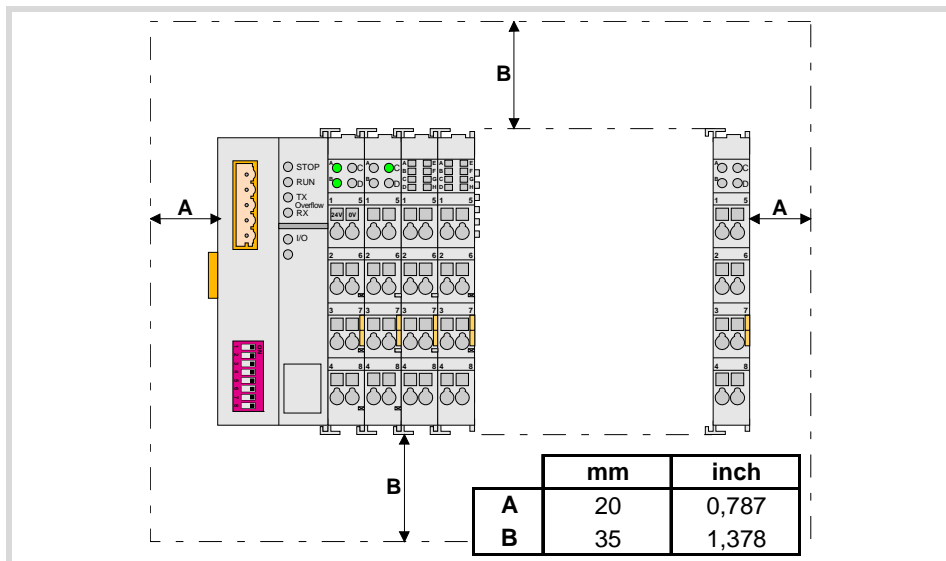
How to mount and dismount the modules.

Since the communication between the modules is done through the six-pin connector on the side of the modules, they must be latched to each other.

Do not touch the side pins of the bus to avoid soiling them, damaging them and any possible electrostatic discharges that could damage the module.
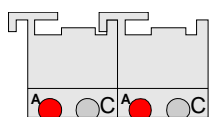
To ensure that the modules are joined together, they have some tabs on top and at the bottom. To join the modules together, slide each module onto the previous one, from top to bottom, making sure that the tabs latch onto each other.

Always mount the modules from left to right beginning with the leading module and always ending the group with the end module (last). To fix the leading module, once mounted on the rail, push onto the top groove of the locking disk located on the left side of the module. To free the module and be able to remove it from the rail, push on the bottom groove of the locking disk. To help remove a module from the rail, pull the unlocking tab located on the right side of the module.
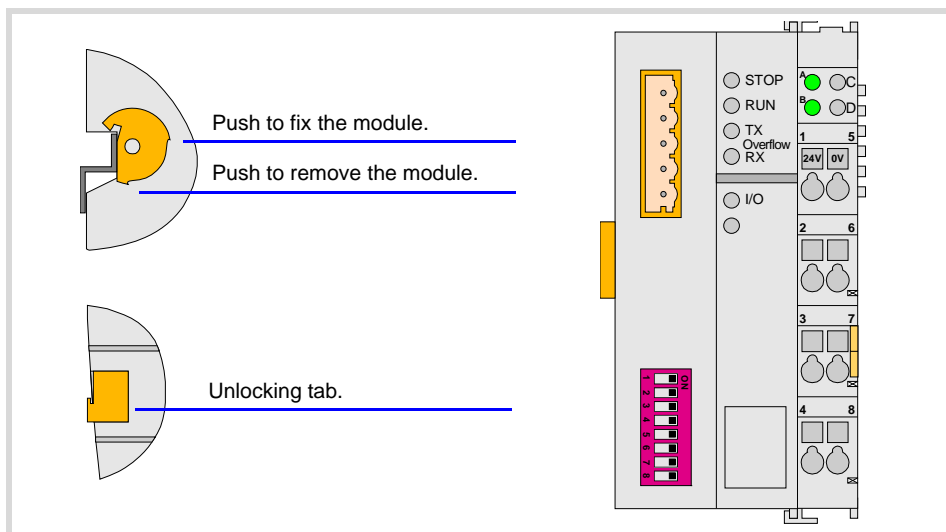
Push to fix the module.

Push to remove the module.

Unlocking tab.

Side voltage jumpers.

Some modules, e.g. the digital inputs module, have some jumpers on the left side for receiving and sending a current of 10 A needed to supply the module.

The jumpers of a module must latch into the grooves of the previous module. It must be borne in mind that not all the modules have the same number of jumpers and grooves. Before mounting a module with jumpers, make sure that the previous module has enough grooves to receive the jumpers.

The voltage jumpers are sharp. Handle the modules carefully to prevent getting hurt.

Cable connection.

DO NOT make any connection or connect any module or cable if the group is under power. Before making any connection, disconnect the power supply cable of the leading (first) module (RIOW-CANOPEN) and, if necessary, that of the power supply module (RIOW-PS24).

Each connector only admits one cable. To insert several cables into one connector, join the cables at a terminal and insert the terminal into the connector.

The cables are secured into the connectors by pressure. Insert a tool into the square hole located on top of the connector, this opens the connector. Insert the cable into the connector and remove the tool. After removing the tool, the cable stays fixed.

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RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
Installation of the modules.

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5.5   RIOW-CANOPEN-STAND module. Leading (first) module.

The RIOW-CANOPEN-STAND module must be present in all the groups and must be the first module of the group. This module is in charge of managing the internal bus of the group, connecting the group to the system CAN bus and supplying power to the I/O modules through the side jumpers with 24 V 10A. If when configuring the remote group, the consumption of the I/O modules is higher, additional RIOW-PS24 modules must be added.

Power the module with an external 24V DC (between -15% and +20%) regulated power supply. Using the wrong voltage may cause severe damage to the components.
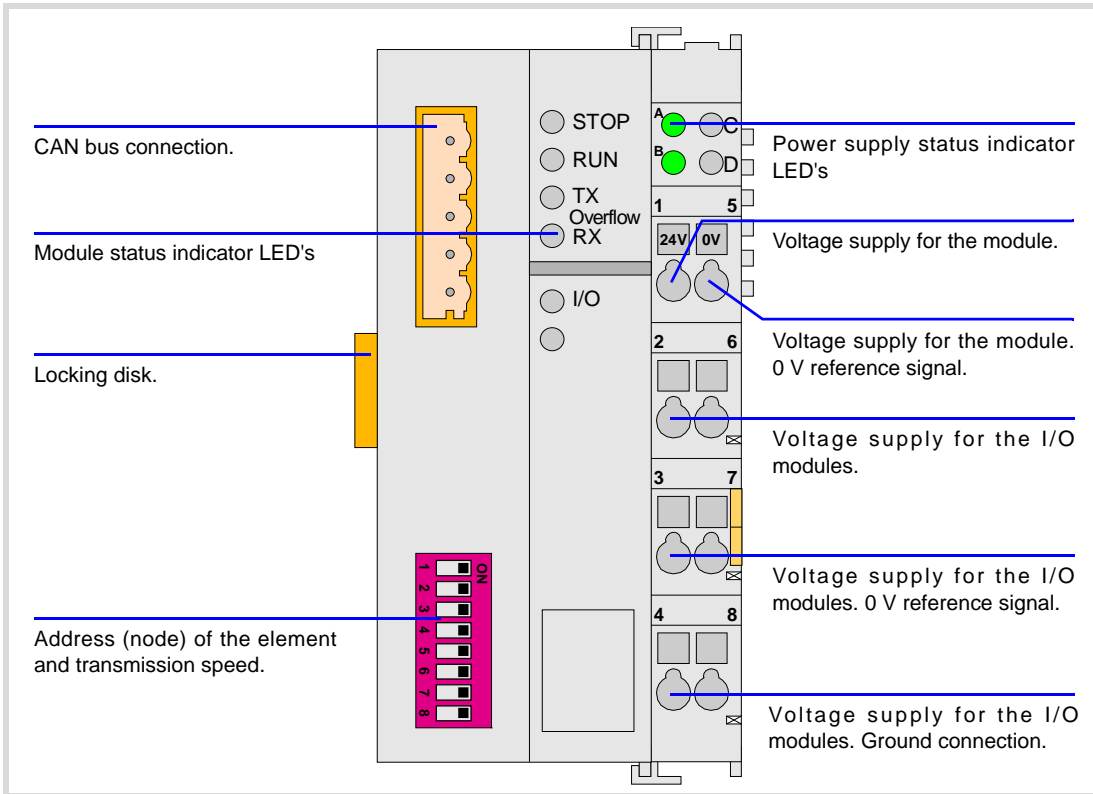
CAN bus connection.

Module status indicator LED's

Locking disk.

Address (node) of the element and transmission speed.

STOP
RUN
TX
Overflow
RX
I/O

Power supply status indicator LED's

Voltage supply for the module.

Voltage supply for the module. 0 V reference signal.

Voltage supply for the I/O modules.

Voltage supply for the I/O modules. 0 V reference signal.

Voltage supply for the I/O modules. Ground connection.

5.5.1 Elements (connectors).

CAN bus connection.
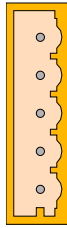
Pin	Signal	Function
5	N.C.	Not being used.
4	CAN H	(HIGH) bus signal.
3	SHIELD	CAN shield.
2	CAN L	(LOW) bus signal.
1	GND	Ground / 0 V.

N.C.
CAN H
SHIELD
CAN L
GND

Address (node) of the element and transmission speed.

ON

The dipswitch may be used to select the address of the node and the transmission speed. See *"5.5.3 Node configuration."* on page 76.

When using the CANopen protocol, the transmission speed at the bus is defined in each node. All the nodes must work at the same speed.

Status indicator LED's.

The module has the following LED's on top. These LED's indicate the status of the node and of the communication through the CAN bus. See *"5.5.4 Meaning of the LED's."* on page 78.

LED.	Color.	Meaning.
STOP	Red.	The node is stopped.
RUN	Green.	The node works properly.
TX overflow	Red.	Data sending error.
RX overflow	Red.	Data reception error.

LED.	Color.	Meaning.
I/O	Green.	Status of the communication with the I/O modules.
I/O	Red.	Status of the communication with the I/O modules.

Power supply.
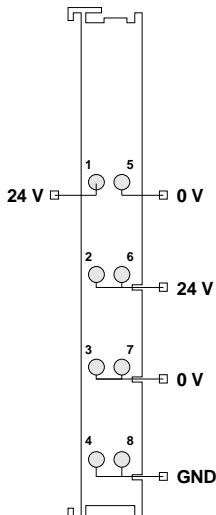
Pin	Function
1	Voltage supply for the module. 24V power input.
5	Voltage supply for the module. 0 V reference signal.
2 - 6	Voltage supply for the I/O modules. 24V power input.
3 - 7	Voltage supply for the I/O modules. 0 V reference signal.
4 - 8	Voltage supply for the I/O modules. Ground connection.

24 V   1   5   0 V
2   6   24 V
3   7   0 V
4   8   GND

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-CANOPEN-STAND module. Leading (first) module.

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Power supply status indicator LED's
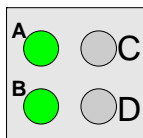
Led	Color	Function
A	Green	The LED turns on when the module is under power.
B	Green	The LED turns on if the side jumpers have 24 V.

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RIOW REMOTE MODULES. (CANOPEN PROTOCOL).

RIOW-CANOPEN-STAND module. Leading (first) module.

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5.5.2 Voltage supply for the module.

Power for the module and for the rest of the modules must be separated in order to ensure the operations in the bus in case of a short-circuit on the side of the actuator.

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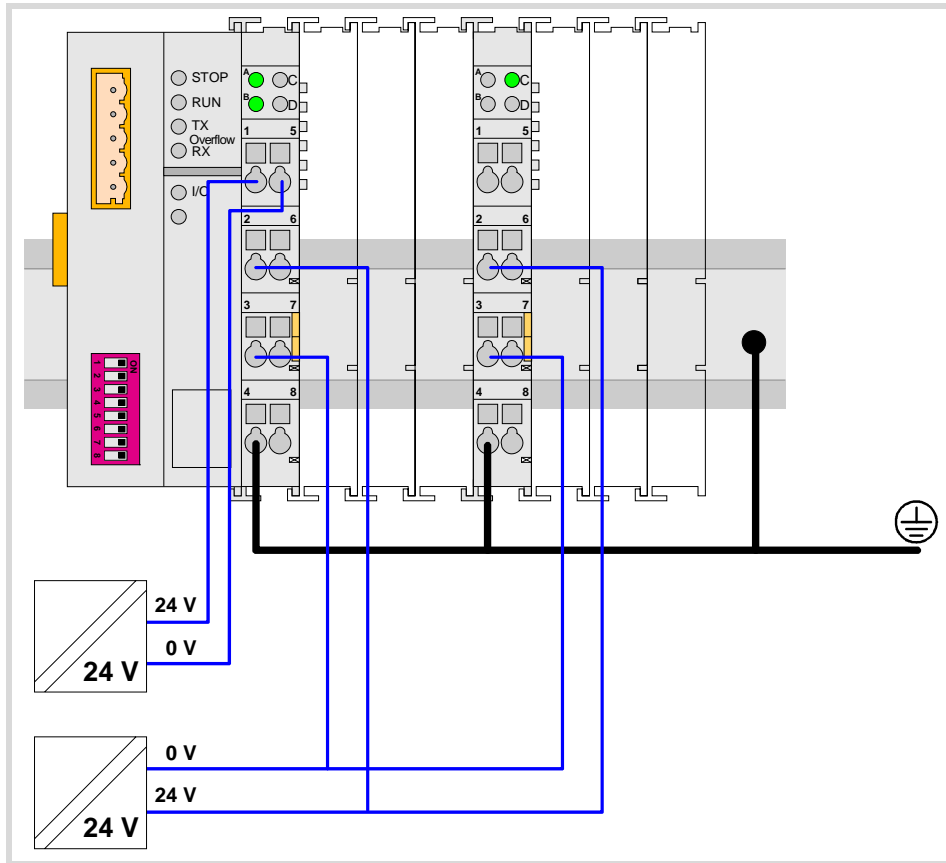
RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-CANOPEN-STAND module. Leading (first) module.

5.5.3 Node configuration.

The node is configured using the dipswitches to select the node address and the transmission speed.

Configuring the node speed.

To select the speed of the node, the module must be in configuration mode (all the dipswitches in the ·off· position). After turning the module on in configuration mode, the top 4 LED's of the module blink indicating the speed selected at the module. The STOP LED corresponds to dipswitch ·1·, the RUN to dipswitch ·2·, the TX to dipswitch ·3· and the RX to dipswitch ·4·. The first time the module is configured, the TX LED blinks indicating that no valid speed has been selected.

> **i** *If when turning the module on, all the dipswitches are not in the ·off· position, the position of the dipswitches will be the new address (node number) of the group.*

The first 4 dipswitches are used to select the speed; the rest must be in the ·off· position. To select the speed, put the corresponding dipswitches in the ·on· position. The transmission speed depends on the total length of the cable. Use the following approximate values. Assigning other values may cause communication errors due to signal distortion.

Dipswitch	Speed	Length of the CAN bus.
1 2 3 4 ON	1000 kHz	Up to 20 meters.
1 2 3 4 ON	800 kHz	From 20 to 40 meters.
1 2 3 4 ON	500 kHz	From 40 to 100 meters.
1 2 3 4 ON	250 kHz	From 100 to 500 meters.

To save the selected speed, put dipswitch ·8· in the ·on· position. After saving the configuration, the corresponding LED's turn on to indicate the module speed. For 1 MHz, all four LED's turn on.

Once the speed has been selected, turn the module off by removing power and set dip-switch ·8· in the ·off· position. Bear in mind that the next time the module is turned on, the position of the dipswitches will indicate the address (node number) of the group.

Configuring the address (node number) of the group.

Each one of the elements integrated into the CAN bus is identified by its address or node number. The CNC must always occupy position "0" and the rest of the elements of the bus will occupy consecutive positions starting with 1.

The address (node number) of the group is selected while the module is off. Select the speed by putting the corresponding dipswitches in the ·on· position. The binary meaning of each dipswitch increases according to its number; dipswitch ·1· for address 1, dipswitch ·3· for address 4 and so on.

1 2 3 4 ON	1 2 3 4 ON	1 2 3 4 ON
Address ·1·.	Address ·3·.	Address ·9·.

Line terminating resistor.

In the CAN bus, it is necessary to use a line terminating resistor to identify which are the elements that occupy the ends of the bus; i.e. the first and last physical element in the connection. For the central unit, the terminating resistor is factory installed because the CNC is always at one end of the bus.

The RIOW series modules do not have a factory-installed line terminating resistor. The leading module (RIOW-CANOPEN-STAN) mounted at the end of the bus must have a 120 Ω line terminating resistor between pins CAN_H and CAN_L to avoid signal deflections (rebounds).

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5.5.4 Meaning of the LED's.

While staring the module up, the LED's indicate the stage the node is in and its status.

Node status.	Meaning.
Initializing stage	After starting up or after a reset, the module goes into the initializing stage to run an autotest. During the initializing stage, the I/O LED blinks orange until it changes to red. • If the module is properly initialized, it changes to the pre-operative stage, the I/O LED changes to green and the RUN LED blinks. • If the module detects any problem in the initializing stage, it changes to the stop stage, the I/O LED blinks red and the STOP LED turns on. The blinking rate of the I/O LED indicates the detected error.
Pre-operative stage.	In this stage, the module configures the bus. During the pre-operative stage, the I/O LED turns green and the RUN LED blinks.
Operative stage.	In this stage, the module is ready to work. In the operative stage, the I/O and RUN LED's turn green.
Stop stage.	This stage indicates an error at the node. The STOP LED turns on in the stop stage.

When a module is in configuration mode (dipswitch value equal to ·0·), the LED's indicate the speed selected at the module. See

LED's STOP, RUN, TX overflow and RX overflow.

The top four LED's of the module (STOP, RUN, TX overflow and RX overflow) indicate the status of the node and of the communication through the CAN bus.

STOP	RUN	Meaning.
OFF	OFF	Module turned off or in initializing stage.
OFF	Blinking slow	Module in pre-operative stage.
OFF	ON	Module in operative stage.
ON	OFF	Module in stop stage. Node configuration error or bus error.
OFF	Blinking fast	Module in pre-operative stage. Module error.
Blinking fast	Blinking fast	Module in pre-operative stage. Module error.
Blinking fast	OFF	Module in pre-operative stage. Module error.

TX overflow	RX overflow	Meaning.
OFF	OFF	Module turned off or in initializing stage.
- - -	ON	Data reception error.
ON	- - -	Data sending error.
Blinking fast	Blinking fast	Too many errors at the node.

Led I/O.

Three-colored LED (orange/red/green) that indicates the bus status and the errors found.

Led I/O.	Meaning.
off	There's no data at the data bus
Green.	The module is transmitting data.
Red.	Hardware error.
Blinking orange.	The module is in the initializing stage.
Blinking red.	Data bus error.
Cyclic red blinking.	Error code.

Start the module up, the LED blinks orange until it changes to red. If the module is successfully initialized, the LED changes to green. If the module detects a problem the LED keeps blinking red. The module shows the error code, cyclically, by three blinking sequences.

- The first blinking sequence (10 Hz) indicates that there are errors at the node.
- After a pause, the module offers the second blinking sequence (1 Hz). The number of blinks indicates the error code.
- After a longer pause, the module offers the third blinking sequence (1 Hz). The number of blinks indicates the type of error.

Error 1: Hardware and configuration error at the node.

Type.	Description.	Solution.
- - -	Checksum error in the data.	Remove power from the node, reduce the number of I/O modules and apply power to the node again.
1	Overflow at the internal data memory of the module.	Remove power from the node, reduce the number of I/O modules and apply power to the node again. If the error persists, replace the leading (first) module.
2	Wrong I/O module at the node.	Replace wrong module. If the error persists, update the firmware of the leading (first) module. To locate the wrong module, repeat the following sequence as often as necessary. • Remove power from the node, place the end module in the middle of the node and apply power to the node again. • If the error persists, remove power from the node again, place the end module in the middle of the first half of the node and apply power to the node again. • If there are no errors, remove power from the node again, place the end module in the middle of the second half of the node and apply power to the node again. If there is only one I/O module left in the node, that module will be the wrong one.
3	The type of module stored in the flash cannot be identified or is wrong.	Remove power from the node, replace the leading module and apply power to the node again.
4	Error while writing in Flash memory.	Remove power from the node, replace the leading module and apply power to the node again.
5	Error while deleting the Flash memory.	Remove power from the node, replace the leading module and apply power to the node again.
6	The configuration of the I/O modules has changed after a reset.	Initialize the module by removing power and applying it again.
7	Error when writing EEPROM data.	Remove power from the node, replace the leading module and apply power to the node again.
8	Wrong hardware and firmware combination.	Remove power from the node, replace the leading module and apply power to the node again.
9	Checksum error in the EEPROM.	Remove power from the node, replace the leading module and apply power to the node again.

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Type.	Description.	Solution.
10	Error when initializing the EEPROM.	Remove power from the node, replace the leading module and apply power to the node again.
11	Timeout error when reading EEPROM data.	Remove power from the node, replace the leading module and apply power to the node again.
12	Timeout error when writing EEPROM data.	Remove power from the node, replace the leading module and apply power to the node again.
13	Reserved.	
14	Reserved.	

Error 2: Not being used.

Type.	Description.	Solution.
- - -	Not being used	- - -

Error 3: Error in the protocol of the internal bus of the node.

Type.	Description.	Solution.
- - -	Communication error at the bus. Wrong module not found.	Replace wrong module. To locate the wrong module, repeat the following sequence as often as necessary. • Remove power from the node, place the end module in the middle of the node and apply power to the node again. • If the error persists, remove power from the node again, place the end module in the middle of the first half of the node and apply power to the node again. • If there are no errors, remove power from the node again, place the end module in the middle of the second half of the node and apply power to the node again. If there is only one I/O module left in the node, that module or the leading module will be the wrong one.

Error 4: Physical error in the internal bus of the node.

Type.	Description.	Solution.
- - -	Communication error at the bus or the bus is interrupted.	Replace wrong module. Place an I/O module after the leading module and check if it causes an error. If there are no errors, replace the leading (first) module. If the leading module is correct, replace the wrong I/O module. To locate the wrong module, repeat the following sequence as often as necessary. • Remove power from the node, place the end module in the middle of the node and apply power to the node again. • If the error persists, remove power from the node again, place the end module in the middle of the first half of the node and apply power to the node again. • If there are no errors, remove power from the node again, place the end module in the middle of the second half of the node and apply power to the node again. If there is only one I/O module left in the node, that module or the leading module will be the wrong one.
n	The bus is interrupted after the n-th module. The number of blinks indicates the n position of the I/O module.	Remove power from the node, replace the (n+1)th module and apply power to the node again.

Error 5: Internal-bus initializing error.

Type.	Description.	Solution.
n	Communication error while initializing the module. The number of blinks indicates the n position of the I/O module.	Remove power from the node, replace the n-th module and apply power to the node again.

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RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-CANOPEN-STAND module. Leading (first) module.

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5.6   RIOW-PS24 module.

This module is in charge of supplying power to the I/O modules through the side jumpers with 24 V 10A. If when configuring the remote group, the consumption of the I/O modules is higher, additional RIOW-PS24 modules must be added.

Power the module with an external 24V DC regulated power supply.
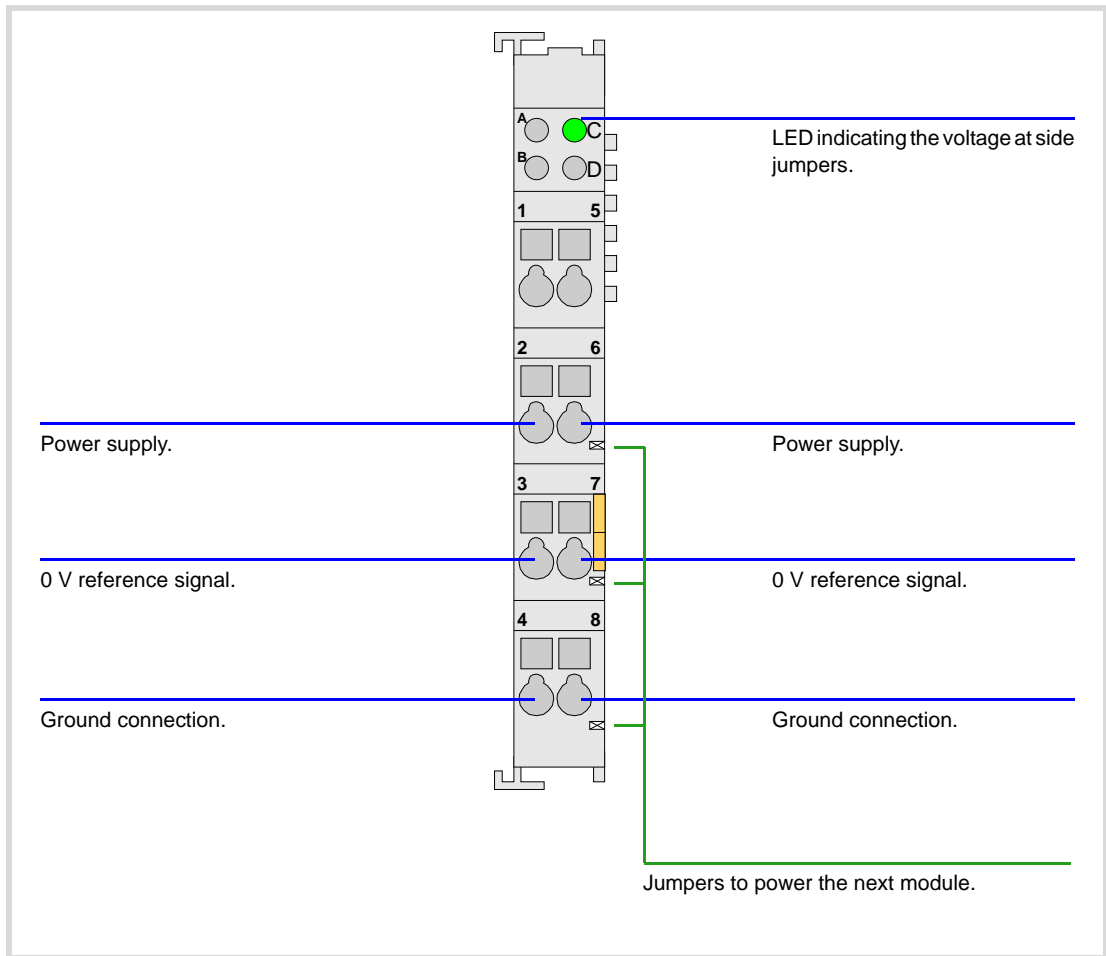
LED indicating the voltage at side jumpers.

Power supply.

Power supply.

0 V reference signal.

0 V reference signal.

Ground connection.

Ground connection.

Jumpers to power the next module.

5.6.1   Elements (connectors).

Power supply.
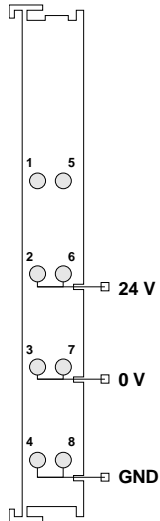
Signal	Function
24 V	Power supply.
0 V	0 V reference signal.
GND	Ground connection.

24 V

0 V

GND

Status indicator LED's.

24 V
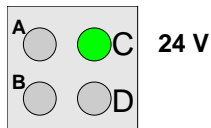
The LED is green. The LED turns on if the side jumpers have 24 V.

5.

RIOW-PS24 module.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).

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5.7   RIOW-8DI module. Module of 8 digital inputs.

Expansion module with eight 24V DC digital inputs. The module has an LED indicating the status for each input.

The 24 V DC needed to power the module comes from the previous module (inputs, outputs module or power supply module) through the side power supplying jumpers). Likewise, this module can also power the next module through the same jumpers. This module, by itself, does not generate any voltage; it just receives the voltage generated by the previous RIOW-PS24 module and passes it on to the next module.

LED's indicating the activity of the digital inputs.

Digital input ·1·.   Digital input ·2·.

Digital input ·3·.   Digital input ·4·.

Digital input ·5·.   Digital input ·6·.

Digital input ·7·.   Digital input ·8·.

Jumpers to power the module.   Jumpers to power the next module.

5.7.1 Elements (connectors).

Digital inputs (8 inputs).

Signal	Function
24 V	Power supply.
0 V	Power supply.
DI1 - DI8	Digital inputs.

Status indicator LED's.

Green LED's. All digital inputs have a status indicating LED that turns on when the input is active.

5.8   RIOW-8DO module. Module of 8 digital outputs.

Expansion module with eight 24V DC 0,5 A digital outputs. The module has an LED indicating the status for each output.

The 24 V DC needed to power the module comes from the previous module (inputs, outputs module or power supply module) through the side power supplying jumpers). Likewise, this module can also power the next module through the same jumpers. This module, by itself, does not generate any voltage; it just receives the voltage generated by the previous RIOW-PS24 module and passes it on to the next module.

LED's indicating the activity of the digital outputs.

Digital output ·1·.

Digital output ·2·.

Digital output ·3·.

Digital output ·4·.

Digital output ·5·.

Digital output ·6·.

Digital output ·7·.

Digital output ·8·.

Jumpers to power the module.

Jumpers to power the next module.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-8DO module. Module of 8 digital outputs.

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(REF: 1709)

·86·

5.8.1 Elements (connectors).

Digital outputs (8 outputs).
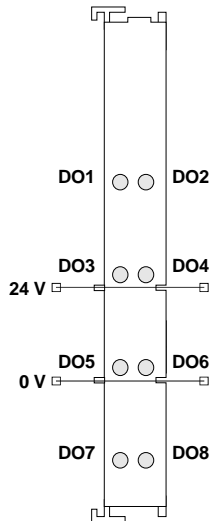
Signal	Function
24 V	Power supply.
0 V	Power supply.
DO1 - DO8	Digital outputs.

DO1   DO2

DO3   DO4
24 V

DO5   DO6
0 V

DO7   DO8

Status indicator LED's.

DO1   A   E   DO2
DO3   B   F   DO4
DO5   C   G   DO6
DO7   D   H   DO8
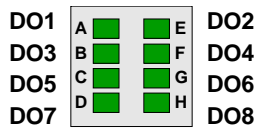
Green LED's. All digital outputs have a status indicating LED that turns on when the output is active.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-8DO module. Module of 8 digital outputs.

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5.9   RIOW-4AI module. Module of 4 analog inputs.

Expansion module with four ±10 V DC analog inputs. The module has an LED indicating the status for each input.

The 24 V DC needed to power the module comes from the previous module (inputs, outputs module or power supply module) through the side power supplying jumpers). Likewise, this module can also power the next module through the same jumpers. This module, by itself, does not generate any voltage; it just receives the voltage generated by the previous RIOW-PS24 module and passes it on to the next module.

LED's indicating an error at the analog inputs.

Analog input ·1·.

Analog input ·2·.

Ground connection.

Ground connection.

Analog input ·3·.

Analog input ·4·.

Ground connection.

Ground connection.

Jumpers to power the module.

Jumpers to power the next module.

5.9.1   Elements (connectors).

Analog inputs (4 inputs).

Signal	Function
AI1 - AI4	Analog inputs.
GND	Ground connection.
0 V	Power supply.
24 V	Power supply.

Connectors ·2· and ·6· are joined together internally.
Connectors ·4· and ·8· are joined together internally.

Status indicator LED's.
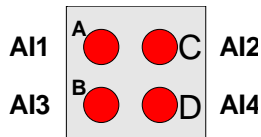
Red LED's. All analog inputs have a status indicating LED that turns on when there is an over-voltage or an under-voltage.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-4AI module. Module of 4 analog inputs.

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5.10   RIOW-4AO module. Module of 4 analog outputs.

Expansion module with four ±10 V DC analog outputs. The module has an LED indicating the status of the bus an LED indicating an error at any of the outputs.

The 24 V DC needed to power the module comes from the previous module (inputs, outputs module or power supply module) through the side power supplying jumpers). Likewise, this module can also power the next module through the same jumpers. This module, by itself, does not generate any voltage; it just receives the voltage generated by the previous RIOW-PS24 module and passes it on to the next module.
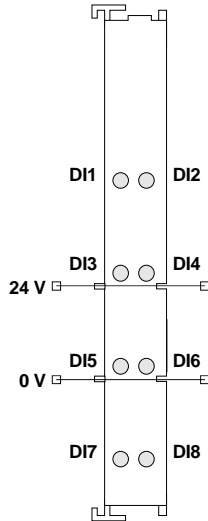

Bus status indicator LED.

LED indicating an error at any analog output.

Analog output ·1·.   Analog output ·2·.

Ground connection.   Ground connection.

Analog output ·3·.   Analog output ·4·.

Ground connection.   Ground connection.

Jumpers to power the module.   Jumpers to power the next module.

5.10.1 Elements (connectors).

Analog outputs (4 outputs).
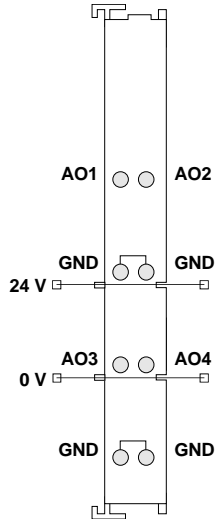
Signal	Function
AO1 - AO4	Analog outputs.
GND	Ground connection.
0 V	Power supply.
24 V	Power supply.

All ·GND· connectors are joined together internally.

Led ·BUS·. Data bus status.
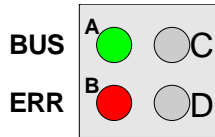
Green LED's. The LED turns on when transmission at the bus is OK.

Led ·ERR·. Error at the outputs.
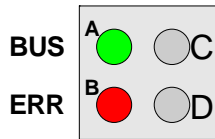
Red LED's. The LED turns on if there is an overload or a short-circuit to ground at any of the outputs.

5.

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5.11 RIOW-2AI-PT100 module. Module of 2 inputs for PT100 temperature sensors.

Expansion module with 2 analog inputs for PT100 temperature sensors. Each input has an LED indicating the status of the bus an LED indicating a measuring error of the sensor.

Bus status indicator LED for sensor ·1·.

Bus status indicator LED for sensor ·2·.

LED indicating an error at sensor ·1·; reading error or broken cable.

LED indicating an error at sensor ·2·; reading error or broken cable.

R+ signal of the sensor ·1·

R+ signal of the sensor ·2·

RL signal of the sensor ·1·

RL signal of the sensor ·2·

R- signal of the sensor ·1·

R- signal of the sensor ·2·

Shield connection.

Shield connection.

5.11.1 Elements (connectors).

Analog inputs for PT100 temperature sensors (2 inputs).
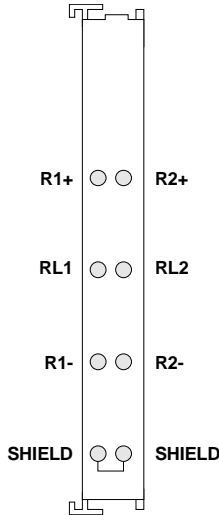
Signal	Function
R1+ RL1 R1-	Signals of the PT100 sensor.
R2+ RL2 R2-	Signals of the PT100 sensor.
SHIELD	Grid.

R1+ ○ ○ R2+

RL1 ○ ○ RL2

R1- ○ ○ R2-

SHIELD ○ ○ SHIELD

The shield connectors are internally joined together and are connected to the profile where the module is mounted

The module allows connecting sensors with a 2-wire or 3-wire interface.

3 wires.   2 wires.

Led ·BUS·. Data bus status.

BUS **A**● ●**C** BUS

ERR **B**● ●**D** ERR
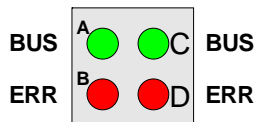
Green LED's. Both inputs have an LED that turns on when transmission at the bus is OK.

Led ·ERR·. Error at the outputs.

BUS **A**● ●**C** BUS

ERR **B**● ●**D** ERR
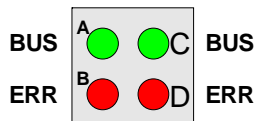
Red LED's. Both inputs have an LED that turns on when there is an input reading error; reading out of range or broken cable.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).

RIOW-2AI-PT100 module. Module of 2 inputs for PT100 temperature sensors.

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(REF: 1709)

5.12   RIOW-END module. Last module of the group.

The RIOW-END module must be present in all the groups and must be the last module of the group. This module is used to end the internal bus of the group and ensure proper data flow.

5.

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).
RIOW-END module. Last module of the group.

Not being used.

Not being used.

Unlocking tab.

Not being used.

Not being used.
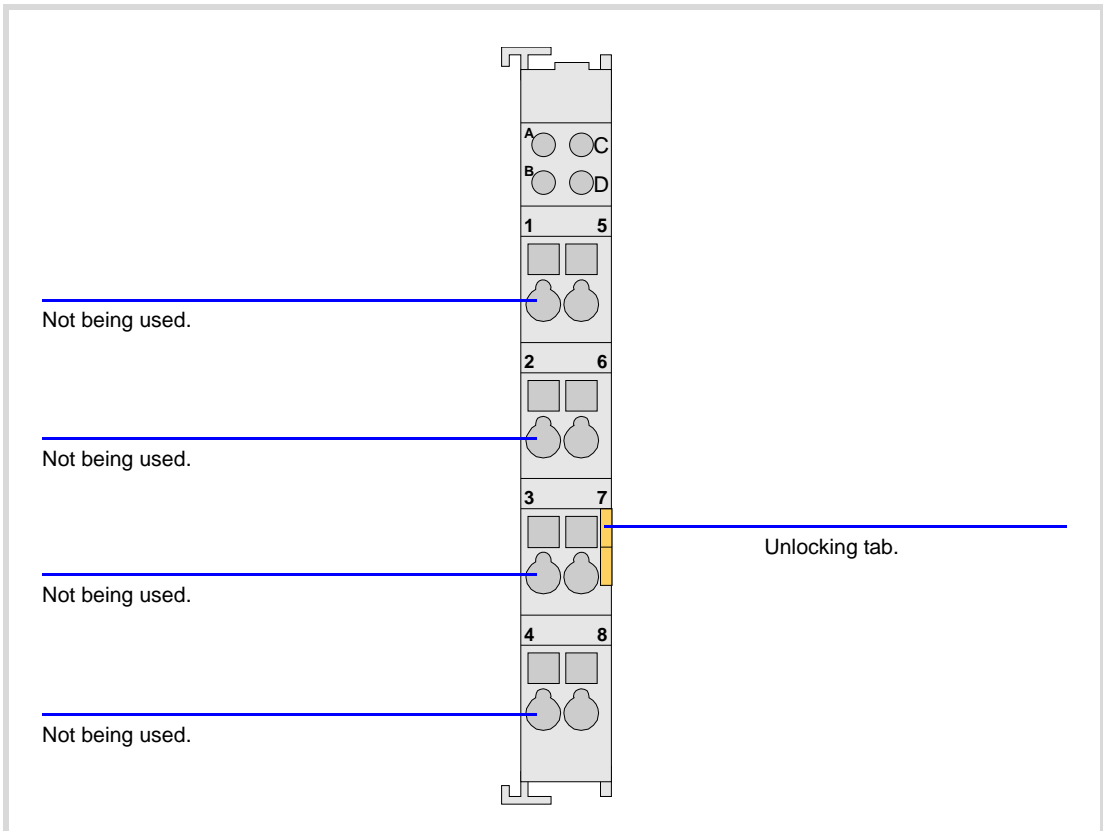
5.13   Numbering of the digital inputs and outputs.

Use machine parameters to set the number of digital I/O modules connected to the CAN bus. If these parameters are not defined, the CNC numbers the modules automatically according to the logic order of the remote groups.

Numbering according to the order of the remote groups.

The CNC numbers the modules automatically according to the logic order of the remote groups. Within each group, they are ordered from left to right.

8DI   8DI   8DO   **8DI   8DO**

Group ·1·	Group ·2·
8 + 8 digital inputs.	8 digital inputs.
8 digital outputs.	8 digital outputs.

Example 1.

	Group ·1· (address = 1)	Group ·2· (address = 2)
Digital inputs.	1 ·· 8 9 ·· 16	17 ·· 24
Digital outputs.	1 ·· 8	9 ·· 16

Example 2.

	Group ·1· (address = 2)	Group ·2· (address = 1)
Digital inputs.	9 ·· 16 17 ·· 24	1 ·· 8
Digital outputs.	9 ·· 16	1 ·· 8

Numbering by machine parameters.

When the numbering is set by machine parameters, each module is assigned a base index and the inputs or outputs of that module are numbered after it.

The values of the base index must be comply with the formula "8n + 1" (i.e. 1, 9, 17, 25, etc.). The rest of the inputs or outputs are numbered sequentially. The base indexes may follow any order, they do not have to be sequential.

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When inserting a new module, the first modules will be assigned the numbering of the table and the last one will be assigned the next valid base index after the highest one assigned until then.

5.

Examples for numbering the different modules.

GROUP = 1

GROUP = 2

8DI   8DI   8DO

8DI   8DO

Remote group (1).

	Digital inputs		Digital inputs	
	Base index	Numbering	Base index	Numbering
module 1	1	1 ·· 8	81	81 ·· 88
module 2	33	33 ·· 40		

Remote group (2).

	Digital inputs		Digital inputs	
	Base index	Numbering	Base index	Numbering
module 1	113	113 ·· 120	49	49 ·· 56

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5.14   Numbering of the analog inputs and outputs and of the temperature sensor inputs.

The CNC numbers the modules automatically according to the logic order of the remote groups. Within each group, they are ordered from left to right.

When numbering the analog inputs, the CNC considers the inputs for the temperature sensor as analog inputs. The CNC machine parameters must be set to indicate the number of PT100 inputs and to which analog inputs they are connected. A PT100 input is active if it has one of these temperature sensors connected to it. Refer to the installation manual for further detail.

Group ·1·	Group ·2·
4 + 4 analog inputs.	4 analog inputs.
4 analog inputs.	2 PT100 inputs.
2 PT100 inputs.	

Example.

	Group ·1· (address = 1)	Group ·2· (address = 2)
Analog inputs.	1 ·· 4	11 ·· 12
PT100 inputs.	5 ·· 6	
Analog inputs.	7 ·· 10	
Analog outputs.	1 ·· 4	5 ·· 8

RIOW REMOTE MODULES. (CANOPEN PROTOCOL).

Numbering of the analog inputs and outputs and of the temperature sensor inputs.

5.

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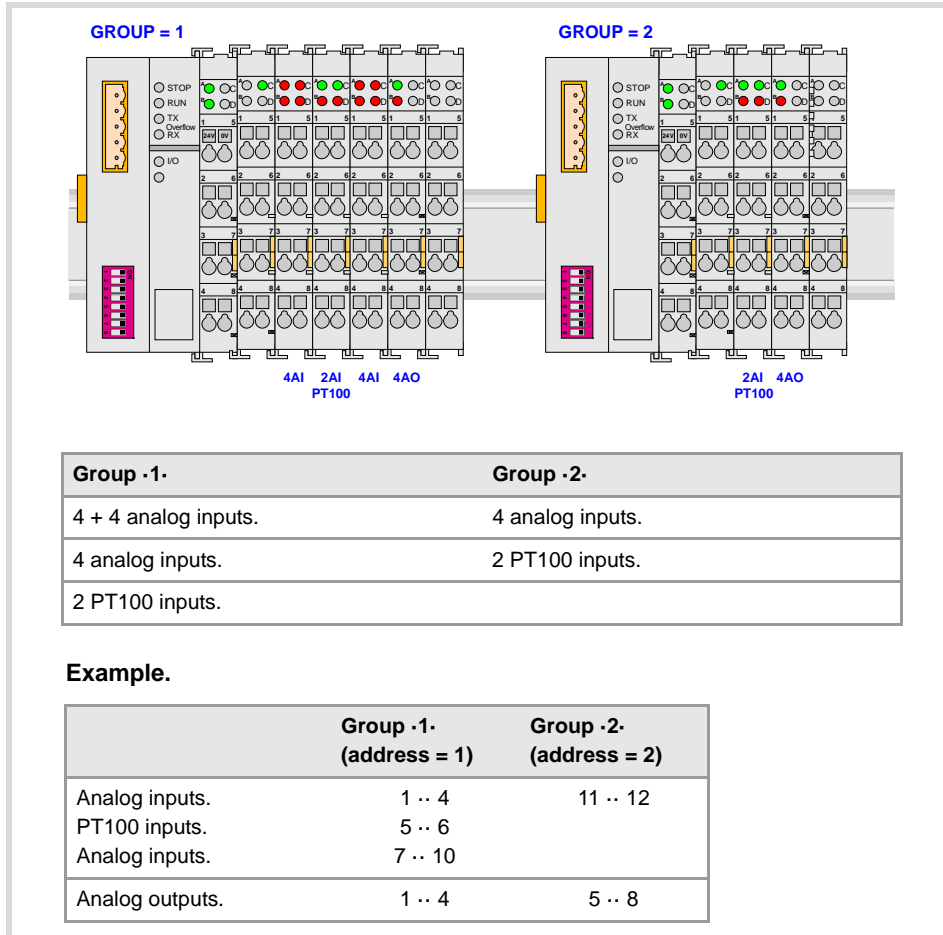
6 REMOTE MODULE RIOR. (CANOPEN PROTOCOL).

Remote modules may be used to have an additional number of digital and analog inputs and outputs (remote I/O) that placed in the cabinet, permit controlling various devices of the machine.

RIOR remote modules, for CANopen bus.

Each RIOR module constitutes a node inside the CAN bus, which may have up to 32 nodes, including the central unit and the keyboards. RIOR modules can communicate at 1 MHz up to 20 meters. The following RIOR modules are available.

Module	Description.
RIOR-48I32O	48 digital inputs. 32 digital outputs.
RIOR-48I32O-ANALOG	48 digital inputs. 32 digital outputs. 2 Analog inputs (12 bits that may be configured in voltage or current). 4 Analog outputs (16 bits in voltage). 2 PT100 inputs.

RIOR-48I32O
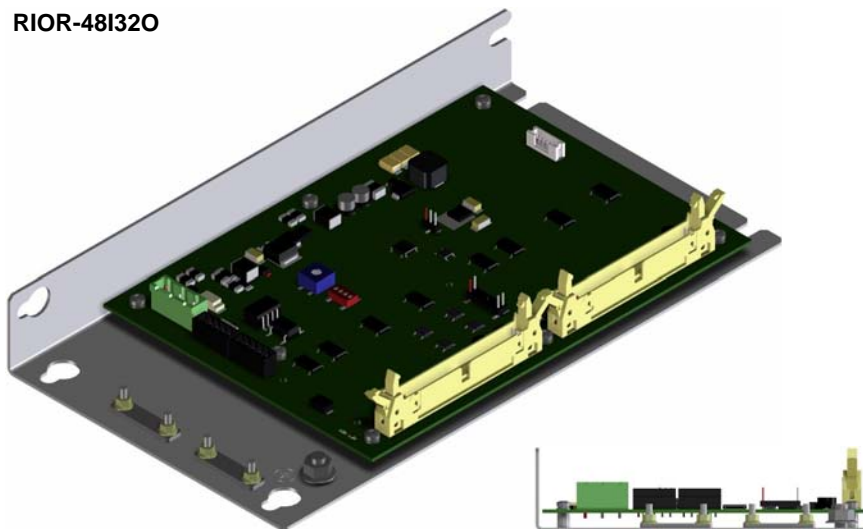
RIOR-48I32O-ANALOG
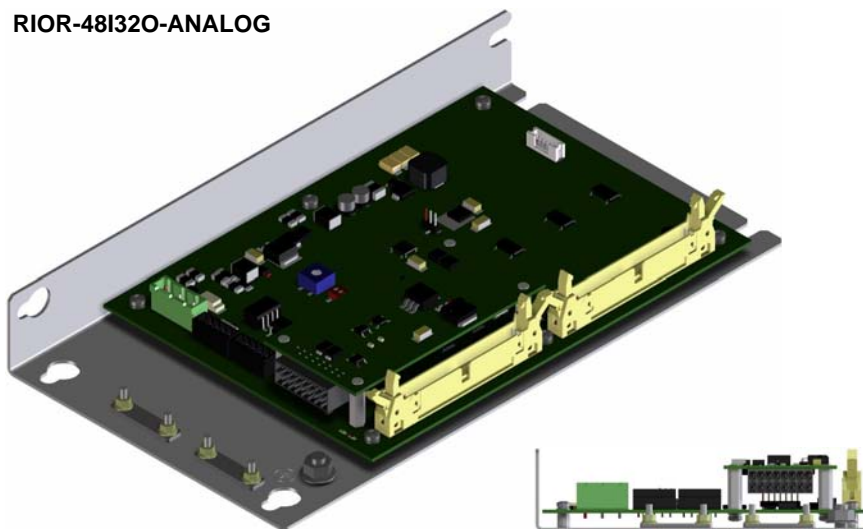
CANopen bus characteristics.

When the CNC works with CANopen bus, this bus lets combine in the bus groups (nodes) formed by the RIO5, RIOW and RIOR series modules; modules of different series cannot be combined in the same group. The maximum number of inputs and outputs available at the CANopen bus is the following.

Type of input/output	Amount.
Digital inputs.	1024
Digital outputs.	1024
General purpose analog inputs.	40
Analog outputs.	40
Analog inputs for temperature sensors.	10

6.

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6.1   Dimensions and mounting of the module.

⚠️ *DO NOT make any connection or connect any module to the power supply while the latter is turned on. Before making any connection, turn the power supply off by unplugging the power cable.*

⚠️ *The RIOR module, meeting the standard EN 60529, corresponds to the IP00 classification, so it must be mounted inside an electrical cabinet that provides at least IP54 protection.*

Module dimensions.

	mm	inch
a	150	5.90
b	272	10.70
c	36.50	1.44

	mm	inch
Da	120	4.72
Db	256	10.08

	mm	inch
Ra	R 3.50	R 0.14
Rb	R 6.50	R 0.26
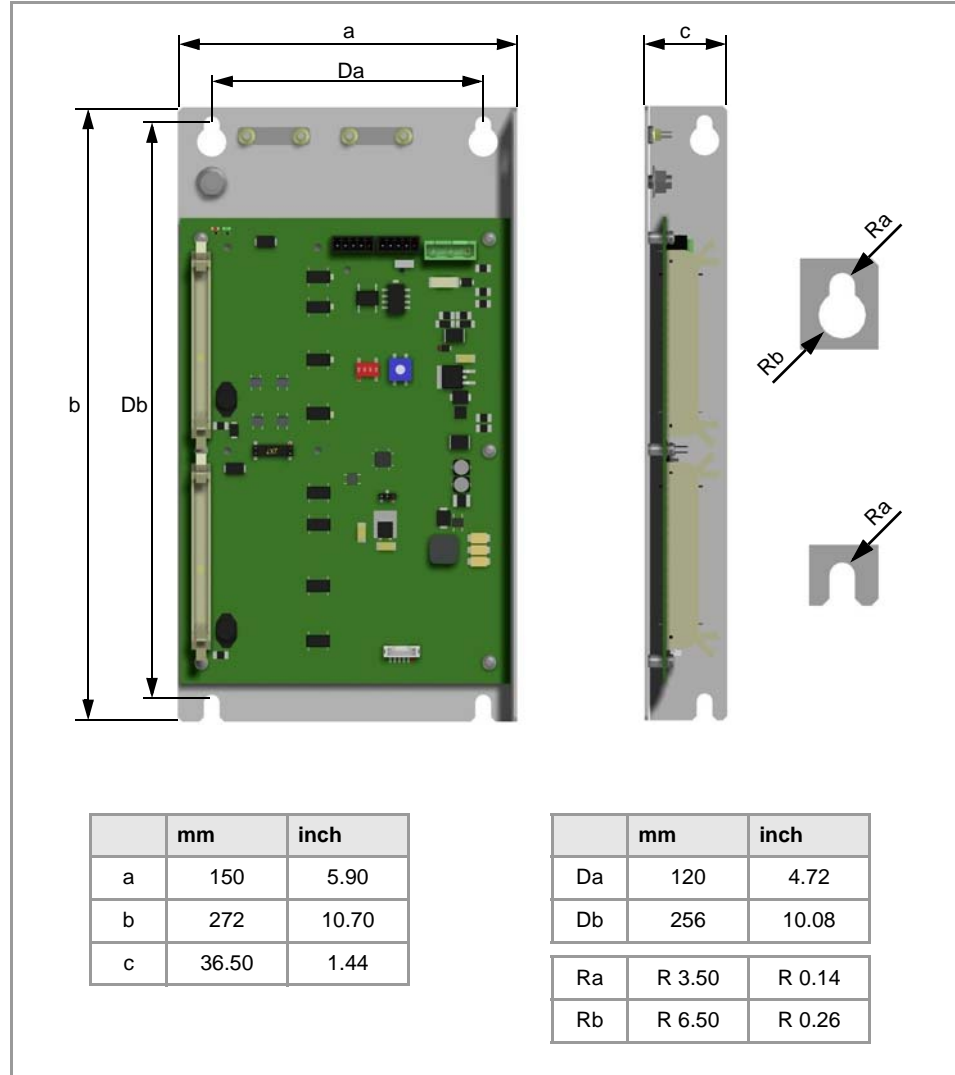
Mounting the module.

The RIOR module may be mounted onto the electrical cabinet in two positions; parallel to the cabinet with 4 mounting points or perpendicular to it with two mounting points. Use M6 bolts to secure the modules.

Mounting parallel to the cabinet.   Mounting perpendicular to the cabinet.
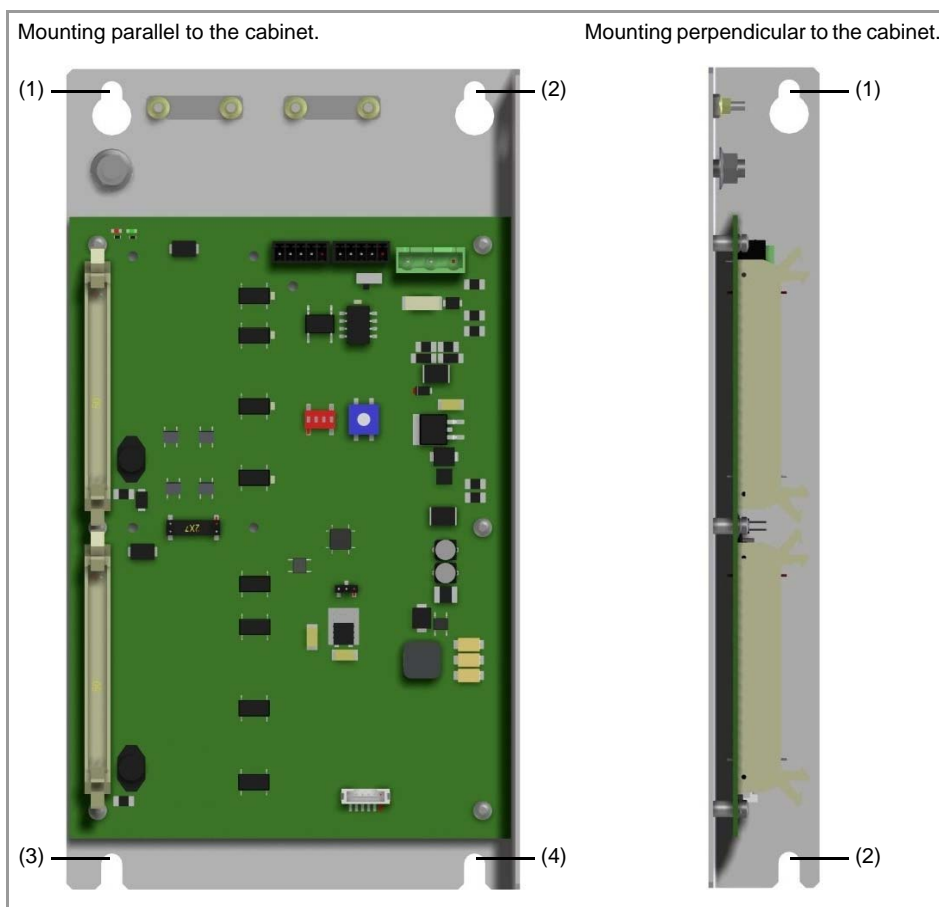
Connection of the modules.

Join the ground terminal of the module to the cabinet chassis. Each module is connected to the system (central unit, keyboard, etc.) through the CAN bus as described later on.

6.2   Powering the modules.

Power the RIOR modules with a 24 V DC class III power supply that does not exceed the limits for SELV/PELV.

Power supply requirements.

⚠️

If the supply cable is longer than 10 meters, some protection element must be installed at the input of the device to protect it against voltage peaks.

The power supply must be connected to the ground/shield of the module for functionality or electromagnetic compatibility; for electromagnetic compatibility, this connection must only be done at one point.

Nominal voltage.	
Meets EN 61131-2	24 V DC
Voltage range (mean value).	Within 20.4 V DC and 28.8 V DC.
Voltage range (dynamic).	Within 18.5 and 30.2 V DC.
Voltage ripple peak-to-peak.	5% (unfiltered 6-pulse rectification).
Startup time after power-up.	Any.

Non-periodic over-voltages.	
Over-voltage.	≤ 35 V
Duration of the over-voltage.	≤ 500 ms
Recovery time.	≥ 50 s
Events per hour.	≤ 10

Transient voltage interruptions.	
Idle time.	≤ 3 ms
Recovery time.	≥ 10 s
Events per hour.	≤ 10

Power supply cable characteristics.

Use generic cable 12 AWG to 24 AWG.

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6.3   Electrical characteristics of the inputs and outputs.

Digital inputs.

The digital inputs have no galvanic isolation. Each connector has an auxiliary 24 V output protected against short-circuits, to feed the digital inputs. The digital inputs have the following characteristics.

Nominal voltage.	+24 V DC (between +20 V DC and +28 V DC).
High threshold "1".	Over +20 V DC.
Low threshold "0".	Under +5 V DC.
Typical consumption of each input.	3.5 mA.
Maximum consumption of each input.	4 mA.

Digital outputs.

The digital outputs have no galvanic isolation. The digital outputs have the following characteristics.

Nominal voltage.	+24 V DC (between +20 V DC and +28 V DC).
Maximum supply voltage.	+36 V DC.
Output voltage.	1 V less than the supply voltage.
Maximum output current.	300 mA per output.
Maximum output inductance.	1 H.

Analog inputs.

Use shielded cables connecting the shields to the ground plate of the module itself. All the analog inputs have the following characteristics:

Voltage within range.	±10 V.
Current within the range.	±20 mA.
Resolution.	12 bits.
Input impedance.	1 MΩ in voltage mode. 500 Ω in current mode.
Maximum cable length (unshielded).	75 mm.

Analog outputs.

Use shielded cables connecting the shields to the ground plate of the module itself. All the analog outputs have the following characteristics:

Command voltage within range.	±10 V.
Resolution.	16 bits.
Minimum impedance of the connected device.	1 kΩ.
Maximum cable length (unshielded).	75 mm.

6.

REMOTE MODULE RIOR. (CANOPEN PROTOCOL).
Electrical characteristics of the inputs and outputs.

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Inputs for the temperature sensors PT100.

Use shielded cables connecting the shields to the ground plate of the module itself. The electrical characteristics of the inputs are:

Type of sensor.	PT100
Temperature range.	Between -200 ºC (-328 ºF) and +850 ºC (1562 ºF).
Resolution.	0.1 ºC
Typical consumption of each input.	1 mA.
Maximum cable length (unshielded).	75 mm.

6.4   Description of connectors.

Ground plate

I48		B28B
D46		B28A
D45		A22
		S43
		S42
I44A		S41
I44B		
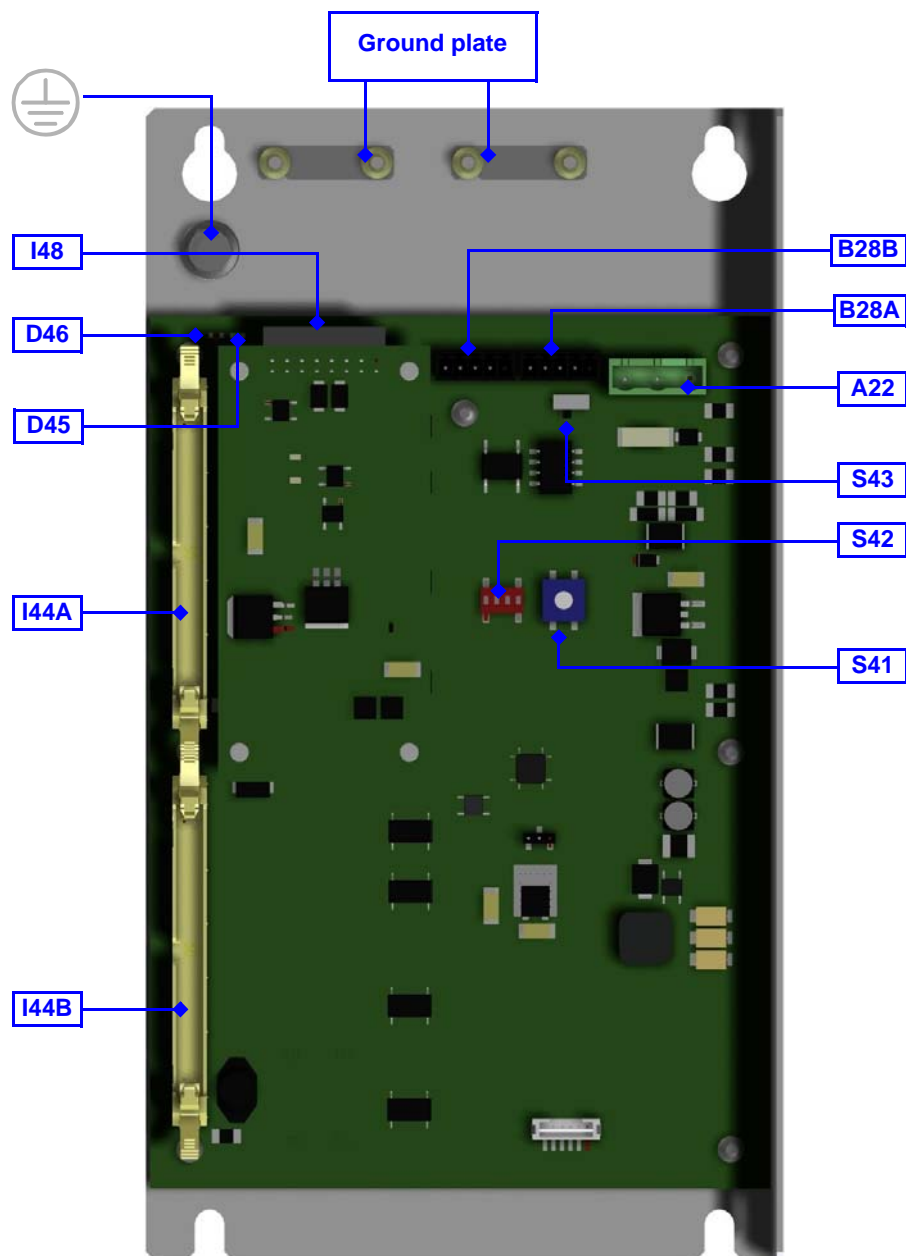
Connector.	
·A22·	24 V DC supply input.
·B28A· ·B28B·	CAN bus.
·D45·	RUN led, module status indicator.
·D46·	ERR led, transmission status indicator.
·I44A· ·I44B·	Digital inputs and outputs.
·I48·	Analog inputs and outputs (only in RIOR-48I32O-ANALOG). Analog inputs for temperature sensors (only in RIOR-48I32O-ANALOG).
·S41·	CAN bus. Address (node) of the element within the bus.
·S42·	CAN bus. Address (node) of the element within the bus. CAN bus. Selecting the speed for the CANopen bus.
·S43·	CAN bus. Line terminating resistor.

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·A22·   24 V DC supply input.

Plug-in part 3-pole Phoenix combicom contact (7.62 mm pitch). Rated current; 12 A.

Pin	Signal.	Function.
1	⏚	- - -.
2	GND	0 V reference signal.
3	+24 V	Power supply.

Connector data.	
Number of poles.	3.
Pitch.	7.62 mm.
Connection technique.	Screw connection.
Minimum/maximum tightening torque.	0.5 / 0.6 Nm.
Minimum/maximum section.	0.2 / 2.5 mm².
Rated current In.	12 A.

Cable data.	
Length to be stripped.	7 mm.

·B28A·/·B28B·   CAN bus.

Plug-in part 5-pole Phoenix contact minicombicon connector (3.5 mm pitch). Rated current; 8 A.

Pin.	Signal.	Function.
1	GND	Ground / 0 V.
2	CL	(LOW) bus signal.
3	SH	CAN shield.
4	CH	(HIGH) bus signal.
5	SH	CAN shield.

Connector data.	
Number of poles.	5.
Pitch.	3.5 mm.
Connection technique.	Screw connection.
Minimum/maximum tightening torque.	0.22 / 0.25 Nm.
Minimum/maximum section.	0.14 / 1.5 mm².
Rated current In.	8 A.

Cable data.	
Length to be stripped.	7 mm.

·D45·   RUN led, module status indicator.
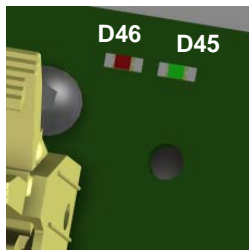
The LED is green. Its meaning depends on the blinking speed.

Blinking rate.	Description.
Intermittent.	Module in PRE-OPERATIONAL state.
Single blinking.	Module in STOPPED state.
On.	Module in OPERATIONAL state.

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·D46· ERR led, transmission status indicator.

Red LED. Its meaning depends on the blinking speed.

Blinking rate.	Description.
Off.	The module is ready to run.
Intermittent.	Module configuration stage.
Single blinking.	Poor transmission. At least one of the error counters of the CAN controller has reached the alarm level.
Double blinking.	There is no communication with the cpu.
On	Error. The CAN controller is in "Bus Off" state.

·I44A·/·I44B· Digital inputs and outputs.

50-pin male IDC connector with a latch. Use a female connector for ribbon cable. Maximum height of the connector, 14.5 mm.

- Connector ·I44A·.

Pin.	Signal.	Description.
1	GND	0 V reference signal.
2	24V_OUT	24 V output for digital inputs.
3···26	I1 - I24	Digital inputs.
27···30	- - -	
31···46	O1 - O16	Digital outputs.
47···50	24V	24 V supply for digital outputs.

- Connector ·I44B·.

Pin.	Signal.	Description.
1	GND	0 V reference signal.
2	24V_OUT	24 V output for digital inputs.
3···26	I25 - I48	Digital inputs.
27···30	- - -	
31···46	O17 - O32	Digital outputs.
47···50	24V	24 V supply for digital outputs.

14.5 mm

6.

REMOTE MODULE RIOR. (CANOPEN PROTOCOL).
Description of connectors.

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(REF: 1709)

·107·

·I48·   Analog inputs and outputs. Analog inputs for temperature sensors.

Plug-in part 8x2 pin two-level male Phoenix Contact minicombicon (3.5 mm pitch). Rated current; 8 A.

Pin.	Signal.	Function.
1	GND_AO1	Reference signal. Analog output 1.
2	GND_AO2	Reference signal. Analog output 2.
3	AO1+	Analog output 1.
4	AO2+	Analog output 2.
5	GND_AO3	Reference signal. Analog output 3.
6	GND_AO4	Reference signal. Analog output 4.
7	AO3+	Analog output 3.
8	AO4+	Analog output 4.
9	GND_AI1	Reference signal. Analog input 1.
10	GND_AI2	Reference signal. Analog input 2.
11	AI1+	Analog input 1.
12	AI2+	Analog input 2.
13	GND_PT100_1	Reference signal. Input PT100 1.
14	GND_PT100_2	Reference signal. Input PT100 2.
15	PT100_1+	Input PT100 1.
16	PT100_2+	Input PT100 2.

Connector data.	
Number of poles.	2x8.
Pitch.	3.5 mm.
Connection technique.	Spring connection.
Minimum/maximum section.	0.2 / 1.5 mm².
Rated current In.	8 A.

Cable data.	
Length to be stripped.	7 mm.

·S41·   CAN bus. Address (node) of the element.

Each one of the elements integrated into the CAN bus is identified by the 16-position rotary switch (0-15) "Address" (also referred to as "Node_Select"). With the ADD MSB" switch, the positions or elements integrated in the CAN bus may be expanded up to 32.

The CNC must always occupy position "0" and the rest of the elements of the bus will occupy consecutive positions starting with 1. In order for any change at the "Address" switch to be assumed, the CNC must be restarted and the corresponding drive must be reset, however, we recommend to change the address while the modules and the CNC are off.

The "Address" switch also sets the priority of the group within the bus; the lower the number the higher the priority. We recommend the keyboard and jog panel to be the last node of the bus.

·S42·   CAN bus. Address (node) of the element.

With the ·4· switch (ADD MSB), the positions or elements integrated in the CAN bus may be expanded up to 32. Positions 0-15 are selected with ADD MSB=0 and positions 16-31 with ADD MSB=1.

DS ·4·	Address (node) of the element.
off	Positions 0-15 within the bus.
on	Positions 16-31 within the bus.

·S42· CAN bus. Communication speed selection.

The transmission speed at the bus is defined in each node and they all must run at the same speed. The speed is selected with switches ·2· and ·3· (CO BR).

The transmission speed depends on the total length of the bus. Using the following illustrative values; assigning other values may cause communication errors due to signal distortion.

DS ·2·	DS·3·	Speed	Length of the CAN bus.
on	on	1000 kHz	Up to 20 meters.
off	on	800 kHz	From 20 to 40 meters.
on	off	500 kHz	From 40 to 100 meters.
off	off	250 kHz	From 100 to 500 meters.

In order for any change of speed to be assumed, the corresponding module must be reset; however, we recommend to change the speed while the modules and the CNC are off.

·S43· CAN bus. Line terminating resistor.
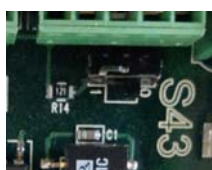
The line terminating resistor identifies which are the elements that occupy the ends of the CAN bus; i.e. the first and last physical element in the connection.

The terminating elements must have the resistor activated (position 1) but not the rest of the elements (position 0).

6.

REMOTE MODULE RIOR. (CANOPEN PROTOCOL).
Description of connectors.

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6.5   CAN bus connection.

·B28A·/·B28B connector pinout.

Plug-in part 5-pole Phoenix contact minicombicon connector (3.5 mm pitch). Rated current; 8 A.

Pin.	Signal.	Function.
1	GND	Ground / 0 V.
2	CL	(LOW) bus signal.
3	SH	CAN shield.
4	CH	(HIGH) bus signal.
5	SH	CAN shield.

Cable characteristics.

Use a specific CAN cable. The ends of all the wires and the shield must be protected by the corresponding terminal (pin). Also use the terminals (pins) to secure the cable to the connector.

General characteristics.	
Type.	Shielded. Twisted pair (1 x 2 x 0.22 mm²) with a characteristic impedance of 120 Ω. AWG 24 gage.
Flexibility.	Extremely flexible. Minimum bending radius, static = 50 mm and dynamic = 95 mm.
Cover.	PUR
Impedance.	Cat.5 (100 Ω - 120 Ω)
Capacity.	50 ns/Ω

⚠️ *Always connect the shield of the cable to the ground plate of the module itself.*

Shield.

Ground plate.
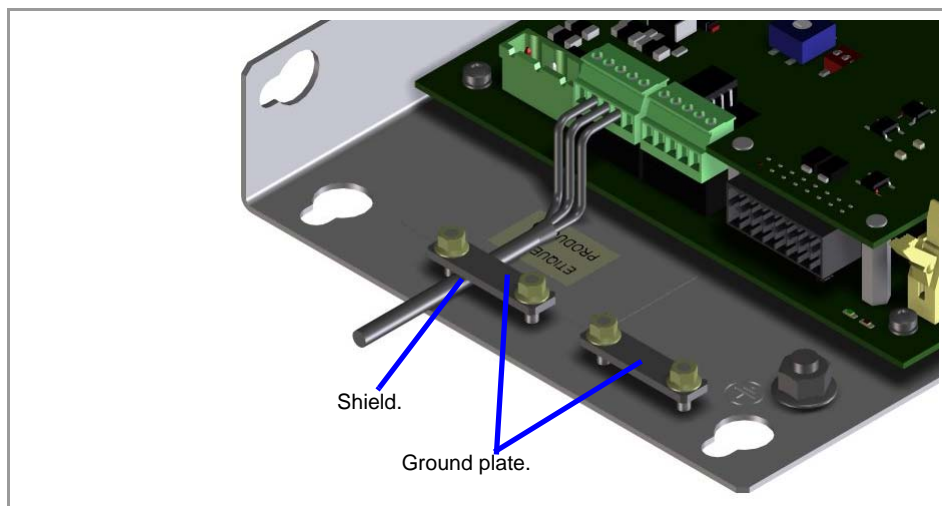
6.6 Connection of the digital inputs and outputs.

·I44A·/·I44B· connector pinout.

50-pin male IDC connector with a latch. Use a female connector for ribbon cable. Maximum height of the connector, 14.5 mm.

- Connector ·I44A·.

Pin.	Signal.	Description.
1	GND	0 V reference signal.
2	24V_OUT	24 V output for digital inputs.
3···26	I1 - I24	Digital inputs.
27···30	- - -	
31···46	O1 - O16	Digital outputs.
47···50	24V	24 V supply for digital outputs.

- Connector ·I44B·.

Pin.	Signal.	Description.
1	GND	0 V reference signal.
2	24V_OUT	24 V output for digital inputs.
3···26	I25 - I48	Digital inputs.
27···30	- - -	
31···46	O17 - O32	Digital outputs.
47···50	24V	24 V supply for digital outputs.

6.

REMOTE MODULE RIOR. (CANOPEN PROTOCOL).
Connection of the digital inputs and outputs.

6.7 Connection of the analog inputs/outputs and the PT100 inputs.

·I48· connector pinout.

Plug-in part 8x2 pin two-level male Phoenix Contact minicombicon (3.5 mm pitch). Rated current; 8 A.

Pin.	Signal.	Function.
1	GND_AO1	Reference signal. Analog output 1.
2	GND_AO2	Reference signal. Analog output 2.
3	AO1+	Analog output 1.
4	AO2+	Analog output 2.
5	GND_AO3	Reference signal. Analog output 3.
6	GND_AO4	Reference signal. Analog output 4.
7	AO3+	Analog output 3.
8	AO4+	Analog output 4.
9	GND_AI1	Reference signal. Analog input 1.
10	GND_AI2	Reference signal. Analog input 2.
11	AI1+	Analog input 1.
12	AI2+	Analog input 2.
13	GND_PT100_1	Reference signal. Input PT100 1.
14	GND_PT100_2	Reference signal. Input PT100 2.
15	PT100_1+	Input PT100 1.
16	PT100_2+	Input PT100 2.

Cable characteristics.

Use shielded twisted cable, AWG 16 to AWG 24 gage. The unshielded portion of the wires of an unshielded cable cannot be longer than 75 mm.

⚠️ *Always connect the shield of the cable to the ground plate of the module itself.*

Ground plate.

Shield.
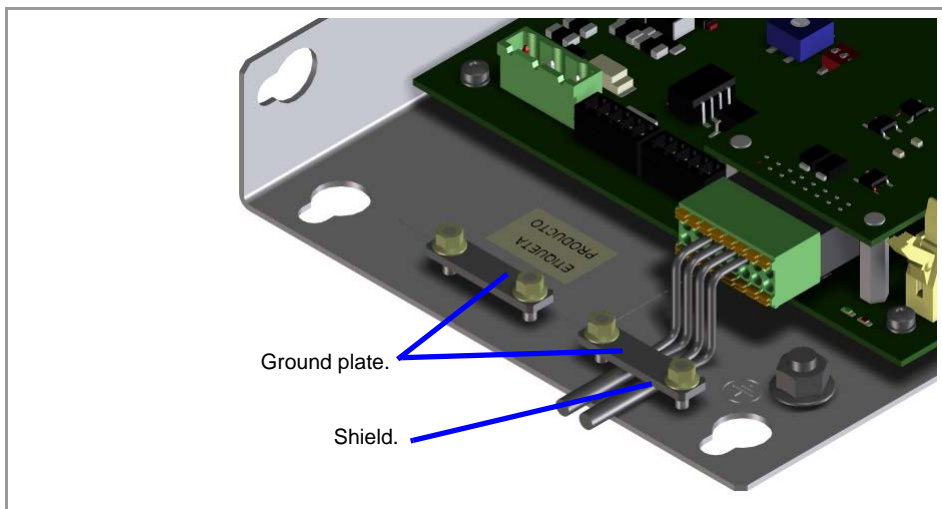
PT100 sensor connection.

The module allows connecting sensors with a 2-wire interface.

● PT100_1+

● GND_PT100_1

Connection of 2 wires.

7   RCS-S-4F4AO

The "RCS-S" counter may be used to get extra feedback (counter) inputs and analog outputs (remote I/O). These modules are connected to the central unit via Sercos-II bus and they are just another bus within the bus.

Module	Description.
RCS-S-4F4AO	4 Feedback inputs. - Incremental TTL, differential TTL and Vpp signal. - SSI, FeeDat, EnDat 2.1 and EnDat 2.2 protocols. 4 general purpose ±10 V analog outputs (16 bits).

Bottom view.
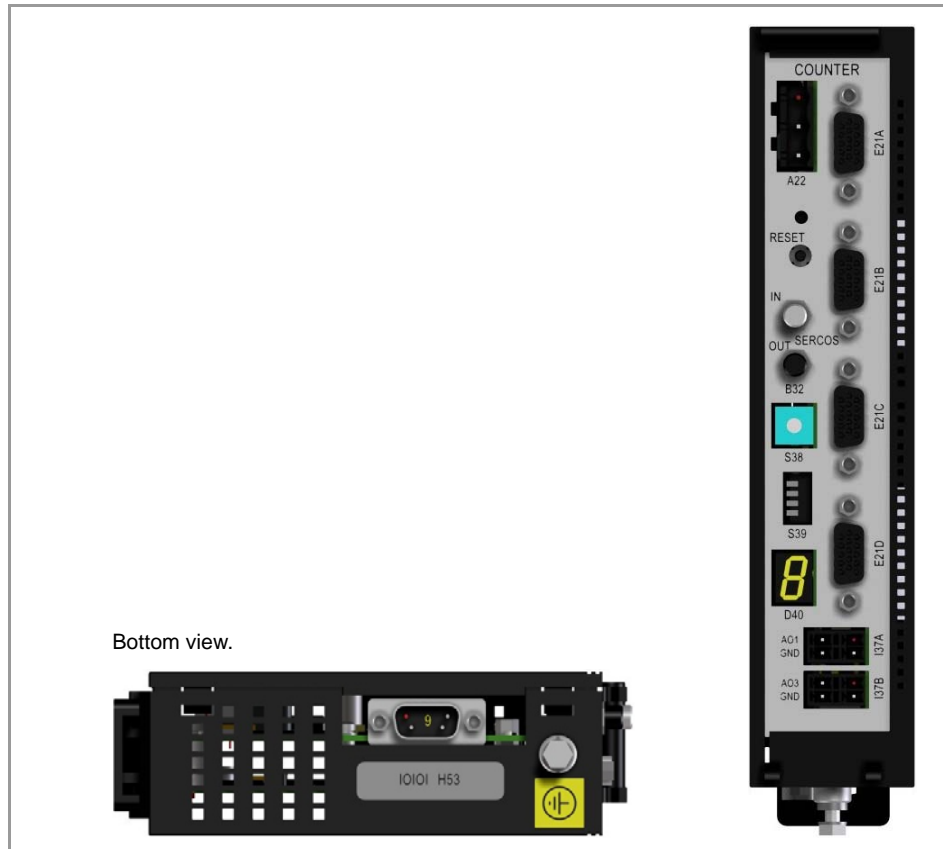
The FeeDat / EnDat support for the RCS-S module is available from the software version v2.01 and hardware version v2.01.

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7.1   Specifications.

Type.	Description.
General.	Remote module with feedback inputs and analog outputs. • Dimensions (width x height x depth) - 43 × 200 × 125 mm. - 1.69" × 7.87" × 4.92". • Weight: 1.2 kg (2.65 lb)
Regulation.	• CE.
Ambient.	• Storage temperature: Between -40 and 70 °C (-40 and 158 °F). • Working temperature: Between 0 and 55 °C (32 and 131 °F). • Relative humidity: 90 % RH (non-condensing). • Vibrations: Vibration test according to IEC 60068-2-6 with a frequency step of 1 octave/minute (±10%) and a duration of 10 sweeps. Frequency of 5 Hz at 8.4 Hz (3.5 mm constant movement) and 8.4 Hz at 150 Hz (1 g of constant acceleration). • Degree of protection: IP2X.
Power supply.	• Supply voltage: 24 V DC ±10 %, 0.4 A. • Consumption: 10 W (maximum). • The module is protected against reverse voltage at the 24V input.
Connectivity.	• Sercos-II bus (16 Mbps up to 40 meters). • 1 simple RS232 serial line (only RX and TX) for updating the module.
Inputs/Outputs.	• 4 feedback inputs, 5 V 250 mA. - Incremental TTL signal (100 kHz). - Incremental differential TTL signal (1000 kHz). - Incremental Vpp signal (500 kHz). - SSI protocol, synchronous serial transfer via RS-485, 100 ~ 500 kHz. - EnDat 2.1, EnDat 2.2 and FeeDat protocols • 4 general purpose differential analog inputs (±10 V, 16-bit).

7.2   General diagram. Connecting to the CNC
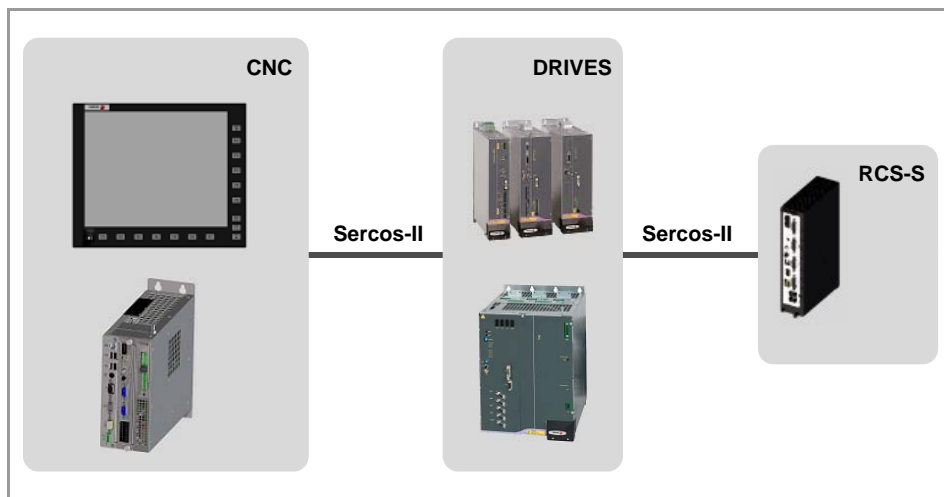
Connection.	Description.
Sercos-II	Connecting the RCS-S module to the Sercos ring. Maximum length: 15m (49.21 ft) with SFO cable; 40m (131.23 ft) with SFO-FLEX cable; more than 40m (131.23 ft) with SFO-V-FLEX cable.

7.3   Dimensions.

	mm	inch
a	43	1.69
b	200	7.87
c	125	4.92

	mm	inch
d	134	5.27
e	210	8.26
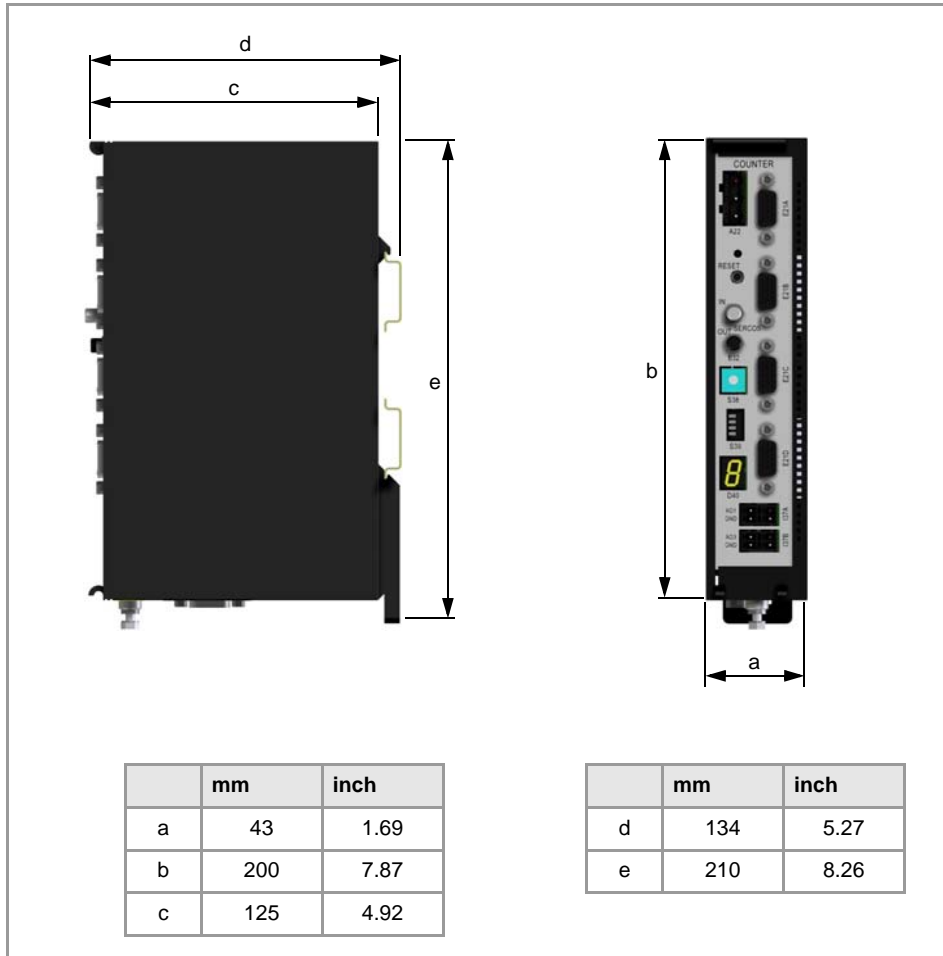
7.4 Securing the module.

7.4.1 Ambient characteristics.

The RCS-S modules must be installed inside an electrical cabinet with a protection rating of IP54 or higher. The ventilation for the electrical cabinet must be enough to dissipate the heat generated by all the devices and components working inside. The interior temperature of the cabinet must not exceed 55ºC (113ºF) while the unit is running.

7.4.2 Securing the module.

When attaching the modules, the following requirements must be met.

- Place the modules in a vertical position.

- Place the modules on 2 profiles, in accordance with EN 50022 (DIN 46277-3) (TS 35), 66mm (2.60") apart. Attach the modules using two fastening caps (one on each side of the module) to maintain a proper clearance between the profiles and lock the modules in place.

- Always leave a 140 mm (5.51") gap under the modules for ventilation and later handling.

	mm	inch
a	43	1.69
b	> 25 (*)	> 0.98 (*)
c	66	2.60
d	140	5.51

(*) There must be enough "b" distance between modules to respect the minimum bend radius if the fiber optic cable.

Cable.	R (minimum bend radius)
SFO	Minimum bending radius of 30 mm.
SFO-FLEX	Minimum static bending radius of 50 mm and a dynamic radius of 70 mm.
SFO-V-FLEX	Minimum static bending radius of 45 mm and a dynamic radius of 60 mm.

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7.5 Voltage supply for the module.

⚠️ *DO NOT make any connection or connect any module to the power supply while the latter is turned on. Before making any connection, turn the power supply off by unplugging the power cable.*

⚠️ *DO NOT make any connection or connect any module or cable if the group is under power. Before connecting anything, unplug the cable from the power supply module.*
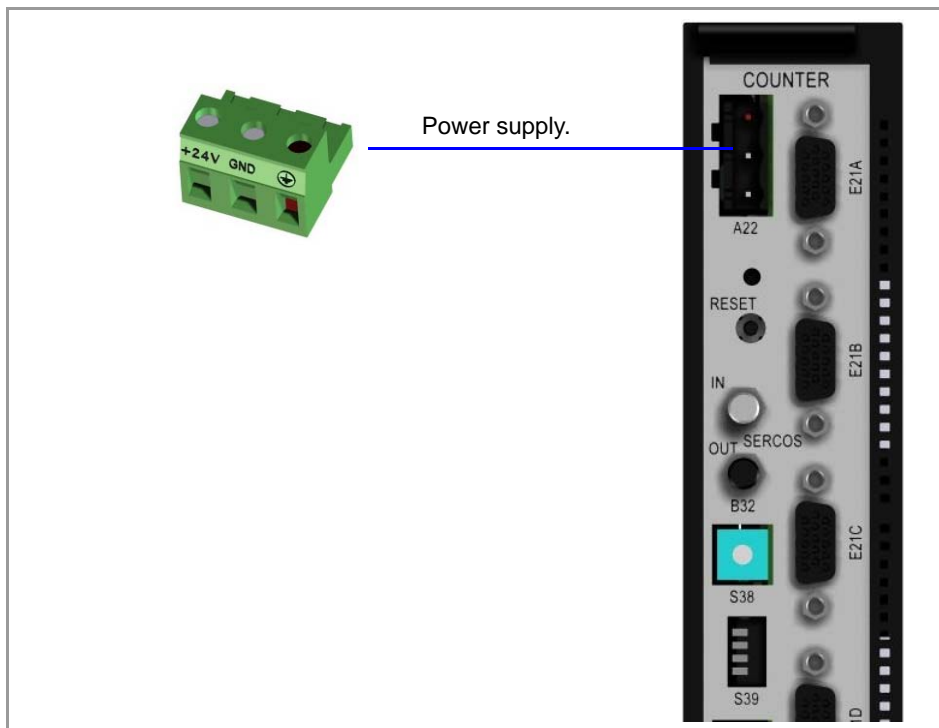
Power supply.

7.5.1 Voltage supply at 24 V DC.

Power the module with a 24 V DC ±10% 0.4 A power supply.

Connector pinout.

A22

Plug-in part 3-pole Phoenix-contact combicon connector (7.62 mm pitch). Rated current; 12 A.

Pin	Signal.	Function.
1	⏚	- - -.
2	11	0 V reference signal.
3	+24 V	Power supply.

Power supply cable characteristics.

Use generic cable 12 AWG to 24 AWG.

Consumption.

Consumption: 10 W (maximum).

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CNC 8070

7.5.2   Module protections.

Protection against reverse voltage.

The module is protected against reverse voltage at the 24V input.

7.5.3   Ground connection.

Bottom view.

IOIOI H53
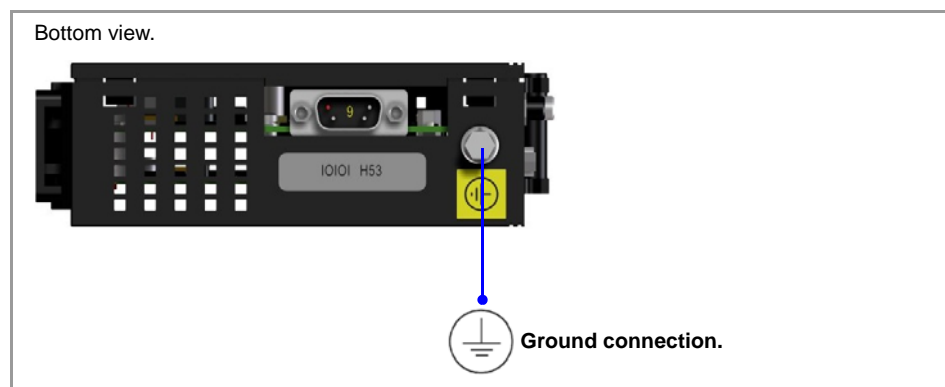
Ground connection.

Join the ground terminal of the module to the cabinet chassis. The ground terminals of all the elements making up the system must be connected to a single ground point.

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7.6 Hardware functionality. Connectors.

Front view.

Connector ·A22·.
24 V supply input.

·Boot· button.

·Reset· button.

Connector ·B32·.
Sercos bus connection.

Selector ·S38·.
Address (node) of the element within the Sercos bus.

Switch ·S39·.
Switch for Sercos setting.

Display ·D40·.
Error display.

Connector ·E21A·.
Feedback input.

Connector ·E21B·.
Feedback input.

Connector ·E21C·.
Feedback input.

Connector ·E21D·.
Feedback input.

Connector ·I37A·.
2 general purpose analog outputs.

Connector ·I37B·.
2 general purpose analog outputs.

Bottom view.

H53·connector.
RS232 serial line.

Ground connection.

7.

RCS-S-4F4AO
Hardware functionality. Connectors.

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7.6.1   Pinout and connector characteristics (front).

·A22   24 V DC supply input.

Plug-in part 3-pole Phoenix-contact combicon connector (7.62 mm pitch). Rated current; 12 A.

Pin	Signal.	Function.
1	⏚	- - -.
2	11	0 V reference signal.
3	+24 V	Power supply.

Connector data.	
Number of poles.	3.
Pitch.	7.62 mm.
Connection technique.	Screw connection.
Minimum/maximum tightening torque.	0.5 / 0.6 Nm.
Minimum/maximum section.	0.2 / 2.5 mm².
Rated current In.	12 A.

Cable data.	
Length to be stripped.	7 mm.

·Boot·   Button to update the software.
·Reset·   Reset button.

·Boot·

Button to update the software. This button is for the exclusively use by personnel authorized by Fagor Automation.

·Reset·

Magazine reset.

·B32·   Sercos-II bus connection.

·IN· & ·OUT· connectors Honeywell emitter and receiver.

Signal.	Function.
IN	Sercos signal receiver.
OUT	Sercos signal emitter.

·S38·   Address (node) of the element within the bus.

Each one of the elements integrated into the Sercos bus is identified by the 16-position rotary switch (0-15).

The CNC must always occupy position "0" and the rest of the elements of the bus will occupy consecutive positions starting with 1. In order for any change at this switch to be assumed, the module must be reset and the CNC powered off and back on.

7.

RCS-S-4F4AO

Hardware functionality. Connectors.

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·S39· Sercos-II bus setting (transmission speed and optical power).

Switches ·1· and ·2· indicate the Sercos transmission speed (baudrate). Switches ·3· and ·4· set the Sercos power or the intensity of the light going through the optic fiber. The optical power value depends on the total length of the cable being used. Set these values with the same values used by the CNC and the drives. Assigning other optical power values, e.g. a value of 6 for a length of 3 m, can cause communication errors due to fiber optic signal distortion.

Switch.		Transmission speed.
·1·	·2·	
Off	Off	2 Mbps.
ON	Off	4 Mbps.
Off	ON	8 Mbps.
ON	ON	16 Mbps.

Switch.		Optical power depending on cable length.	
·3·	·4·		
Off	Off	1 to 4	Cable shorter than 15 meters. Recommended cable: SFO / SFO-FLEX
ON	Off	5 to 6	Cable between 15 and 30 meters. Recommended cable: SFO-FLEX
Off	ON	7	Cable between 30 and 40 meters. Recommended cable: SFO-FLEX
ON	ON	8	Cable longer than 40 meters. Recommended cable: SFO-V-FLEX

·D40· Status and error display.

7-segment display for module status and error codes.

·E21A· / ·E21B· / ·E21C· / ·E21D· Feedback inputs.

1 feedback input per connector. The feedback signals may be incremental (TTL, differential TTL, Vpp) or communication protocols (SSI, FeeDat, EnDat).

Plug-in part 4 identical connectors 15-pin male SUB-D HD connector.

1 ... 5
6 ... 10
11 ... 15
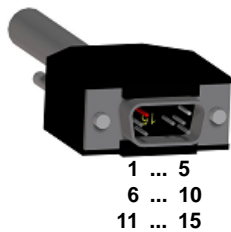
• Feedback signals (TTL, differential TTL, Vpp).

Pin.	Signal.	Function.
1	A	Feedback signals.
2	/A	
3	B	
4	/B	
5	I0	Reference signals.
6	/I0	
7	AL	Feedback alarm.
8	/AL	
9	+5 V DC	Voltage supply for the feedback system.
10	+5 V DC	
11	11	0 V reference signal.
12	11	
13	- - -	- - -
14	- - -	- - -
15	Chassis	Shield.

The input has an overcurrent warning alarm (300 mA). If the input is configured as differential TTL, it will provide cable-breakage detection alarm.

- Communication protocols (SSI, EnDat).

Pin.	Signal.	Function.
1	A	Feedback signals.
2	/A	
3	B	
4	/B	
5	DATA	Data line.
6	/DATA	
7	CLOCK	Clock line.
8	/CLOCK	
9	+5 V	Voltage supply for the feedback system.
10	+5_SENSE	
11	11	Reference signal.
12	GND_SENSE	
13	- - -	- - -
14	- - -	- - -
15	- - -	- - -
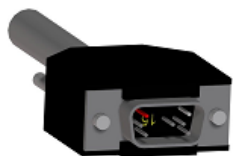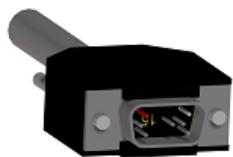
1 ... 5
6 ... 10
11 ... 15

- Communication protocols (FeeDat):

Pin.	Signal.	Function.
1	- - -	- - -
2	- - -	- - -
3	- - -	- - -
4	- - -	- - -
5	DATA	Data line.
6	/DATA	
7	REQ	Data request line.
8	/REQ	
9	+5 V	Voltage supply for the feedback system.
10	+5_SENSE	
11	11	Reference signal.
12	GND_SENSE	
13	- - -	- - -
14	- - -	- - -
15	- - -	- - -

1 ... 5
6 ... 10
11 ... 15

·I37A· General purpose ±10 V analog outputs (16 bits).
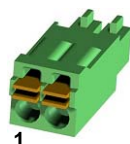
Plug-in part 2 identical connectors 2-pole Phoenix-contact minicombicon connector (3.5 mm pitch). Rated current; 8A.

- Left connector.

Pin.	Signal.	Function.
1	11	0 V reference signal.
2	AO1	Analog output.

- Right connector.

Pin.	Signal.	Function.
1	11	0 V reference signal.
2	AO2	Analog output.

- Both connectors.

Connector data.	
Number of poles.	2.
Pitch.	3.5 mm.
Connection technique.	Spring connection.
Minimum/maximum section.	0.2 / 1.5 mm².
Rated current In.	8 A.

Cable data.	
Length to be stripped.	10 mm.

7.

RCS-S-4F4AO
Hardware functionality. Connectors.

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·122·

·I37B·   general purpose ±10 V analog outputs (16 bits).
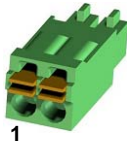
Plug-in part 2 identical connectors 2-pole Phoenix-contact minicombicon connector (3.5 mm pitch). Rated current; 8A.

- Left connector.

Pin.	Signal.	Function.
1	11	0 V reference signal.
2	AO3	Analog output.

- Right connector.

Pin.	Signal.	Function.
1	11	0 V reference signal.
2	AO4	Analog output.

- Both connectors.

Connector data.	
Number of poles.	2.
Pitch.	3.5 mm.
Connection technique.	Spring connection.
Minimum/maximum section.	0.2 / 1.5 mm².
Rated current In.	8 A.

Cable data.	
Length to be stripped.	10 mm.

7.6.2   Pinout and connector characteristics (lower end).

·H53·   RS232 serial line.

Simple RS232 communication (only RX and TX) for updating the module.

Plug-in part 9-pin female SUB-D HD connector.

1 ... 5
6 ... 9

Pin.	RS232 signal.
1	DCD
2	RxD
3	TxD
4	DTR
5	11
6	DSR
7	RTS
8	CTS
9	RI

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7.6.3 Technical/electrical characteristics of the feedback inputs.

Use shielded cables connecting the shields to the ground plate inside the electrical cabinet.
The unshielded portion of the wires of an unshielded cable cannot be longer than 75 mm.

Characteristic.	Value.
+5 V power consumption.	1 A (250 mA per connector).

Work levels for TTL signals.
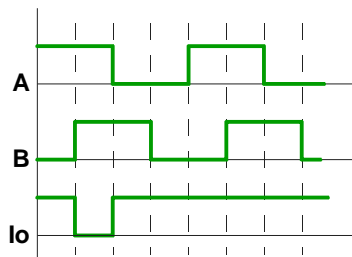
Characteristic.	Value.
Maximum frequency:	100 kHz.
Phase difference:	90º ± 20º.
High threshold (logic level "1") VIH:	2,2 V < VIH < 5 V.
Low threshold (logic level "0") VIL:	-1 V < VIL < 0,6 V.
Maximum voltage:	-1 V ÷ 7 V
Hysteresis:	1.2 V.

Work levels for differential TTL signals.
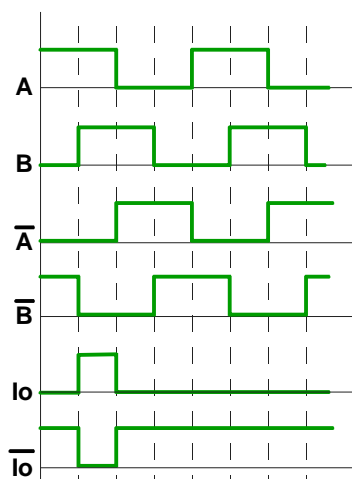
Characteristic.	Value.
Maximum frequency:	1000 kHz.
Phase difference:	90º ± 20º.
Maximum voltage in common mode:	-1 V ÷ 7 V
Maximum voltage in differential mode:	± 6 V.
Hysteresis:	0.2 V.
Maximum differential input current:	50 mA.

Work levels for sinusoidal 1 Vpp signals.

Characteristic.	Value.
Maximum frequency:	500 kHz.
A and B signals. Amplitude:	0.6 ÷ 1.2 Vpp
A and B signals. Centered:	$|V1-V2|$ / 2 Vpp =< 6,5%
A and B signals. Ratio:	VApp / VBpp = 0.8 ÷ 1.25
A and B signals. Phase shift:	90º ± 10º
I0 signal. Amplitude:	0.2 ÷ 0.85 V
I0 signal. Width:	T-90º =< I0 =< T+180º

Work levels for SSI protocol signals.

Bidirectional 485 data line and unidirectional clock line.
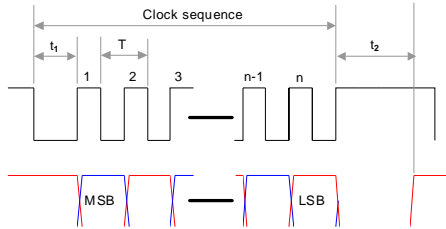
Characteristic.	Value.
Transmission:	SSI synchronous serial transfer via RS 485.
Levels:	EIA RS 485
Clock frequency:	100 kHz - 500 kHz
Maximum number of bits (n):	32 (configurable).
T:	1 µs to 10 µs
t1:	> 1 µs
t2:	20 µs to 35 µs
SSI:	Binary code.
Parity:	Fully configurable.

Work levels for FeeDat protocol signals.

Consult Fagor Automation regarding the work levels for FeeDat protocol signals.

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7.6.4 Technical/electrical characteristics of the analog outputs:

Use shielded cables connecting their meshes to the ground screw of the module. All the analog outputs have the following characteristics:

Characteristics.	Value.
Command voltage within range.	±10 V.
Resolution.	16 bits.
Minimum impedance of the connected device.	10 kΩ.
Maximum cable length (unshielded).	75 mm.

7.7 Connection.

⚠️ *Do not make any connections while the module is powered. Before connecting anything, unplug the cable from the power supply module.*

7.7.1 Connecting the feedback system.

The module has four feedback inputs (one per connector). The feedback signals may be incremental (TTL, differential TTL, Vpp) or communication protocols (SSI, FeeDat, EnDat).

Connector pinout.
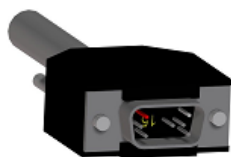
Plug-in part 4 identical connectors 15-pin male SUB-D HD connector.

1 ... 5
6 ... 10
11 ... 15

Pin.	Incremental signal. TTL. Differential TTL. 1 Vpp sinusoidal.	Protocol. SSI EnDat.	FeeDat.
1	A	A	- - -
2	/A	/A	- - -
3	B	B	- - -
4	/B	/B	- - -
5	I0	DATA	DATA
6	/I0	/DATA	/DATA
7	AL	CLOCK	REQ
8	/AL	/CLOCK	/REQ
9	+5 V DC	+5 V	+5 V
10	+5 V DC	+5_SENSE	+5_SENSE
11	11	11	11
12	11	GND_SENSE	GND_SENSE
13	- - -	- - -	- - -
14	- - -	- - -	- - -
15	Chassis	- - -	- - -

If the input is configured as TTL, differential TTL or 1 Vpp, it will provide over-current feedback alarm (300 mA). If the input is configured as differential TTL, it will provide cable-breakage detection alarm.

Technical characteristics of the feedback inputs.

Characteristic.	Description.
+5 V power consumption.	1 A (250 mA per connector).
Incremental signal. TTL.	See *"Work levels for TTL signals."* on page 124.
Incremental signal. Differential TTL.	See *"Work levels for differential TTL signals."* on page 124.
Incremental signal. 1 Vpp.	See *"Work levels for sinusoidal 1 Vpp signals."* on page 125.
SSI protocol.	See *"Work levels for SSI protocol signals."* on page 125.
FeeDat protocol.	Consult Fagor Automation regarding the work levels for FeeDat protocol signals.

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Feedback cable characteristics.

Fagor Automation offers a wide range of cables and extension cables to connect the feedback systems to the CNC. The cable characteristics , as well as its length, depend on the type of feedback being used. Refer to our catalog for further information.

Connection.

Always connect the shield of the feedback cable to the ground plate of the electrical cabinet using a metallic clamp.

Use shielded cables connecting the shields to the ground plate inside the electrical cabinet. The unshielded portion of the wires of an unshielded cable cannot be longer than 75 mm.

We recommend to run the feedback cables as far away as possible from the power cables of the machine.

Feedback cable.

Cable shield.

Ground plate.
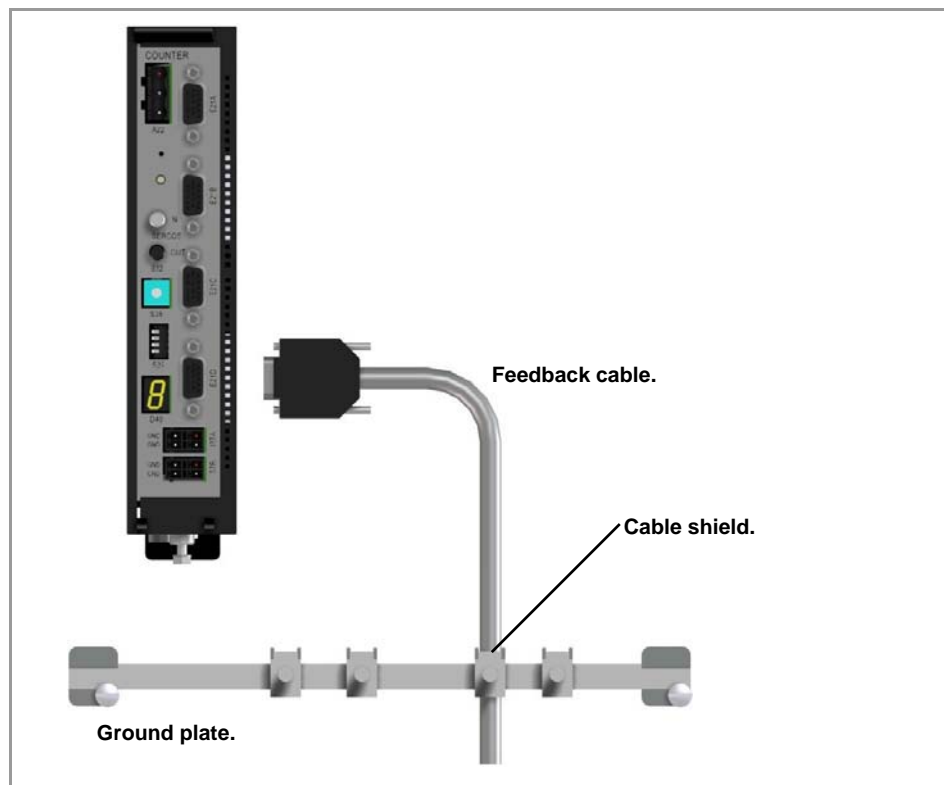
7.

RCS-S-4F4AO
Connection.

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7.7.2   Sercos-II connection.

Connector.

·IN· & ·OUT· connectors Honeywell emitter and receiver.

Signal.	Function.
IN	Sercos signal receiver.
OUT	Sercos signal emitter.

Characteristics of the Sercos-II cable.

Fagor Automation provides the fiber optic cables needed for Sercos communication. There are different types of cables depending on length and dynamic and static installation characteristics. Refer to our catalog for further information.

Remove the protective cap from the cable.

Fagor supplies the cable with the terminals protected by a cap. Remove the protection cap before connecting the cable.
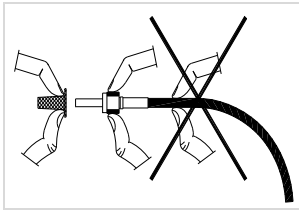
To remove the terminal protecting cap or to connect or disconnect the cable, hold the cable by its terminal; never pull the cable by holding its plastic part because it could render it useless.

Connection of the modules.

The Sercos connection is carried out in a ring using fiber optic cable by joining an OUT terminal with an IN terminal.

CNC	RCS-S	RCS-S	RCS-S	RCS-S
Node = 0	Node = 1	Node = 2	Node = n-1	Node = n
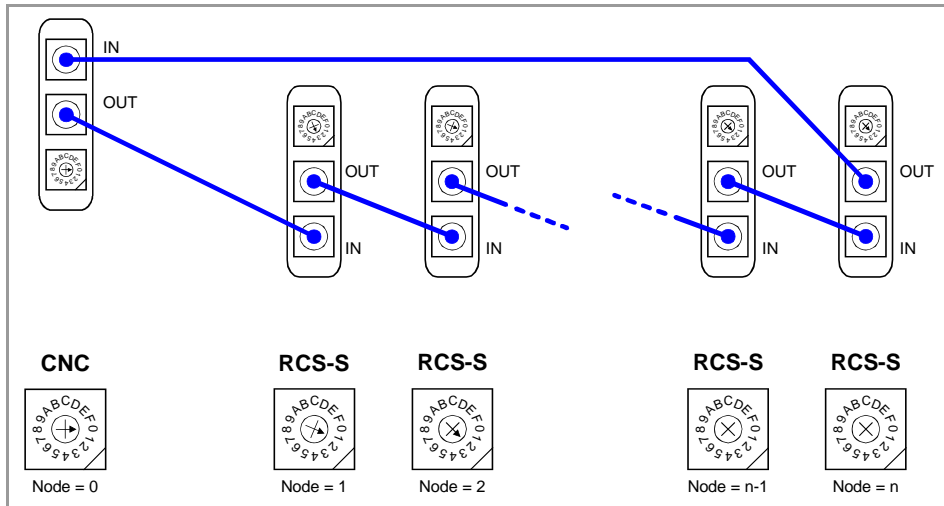
Module identification.

Address (node) of the element within the bus.

Nodes are identified with the 16-position rotary switch (thumbwheel) "Address" (also called "Node_Select") and for the RCS-S modules also with parameter SERCOUUNTID. This switch selects the address occupied by each of the elements integrated into the Sercos connection. The CNC does not have the switch; it is pre-configured to always occupy position ·0· at the bus. The nodes must occupy consecutive positions starting at ·1·. In order for any change at the "Address" switch to be assumed, the corresponding node must be reset and the CNC powered off and back on.

Sercos-II bus setting (transmission speed and optical power).

Switches ·1· and ·2· indicate the Sercos transmission speed (baudrate).

Switches ·3· and ·4· set the Sercos power or the intensity of the light going through the optic fiber. The optical power value depends on the total length of the cable being used. Set these values with the same values used by the CNC and the drives. Assigning other optical power values, e.g. a value of 6 for a length of 3 m, can cause communication errors due to fiber optic signal distortion.

Switch.		Transmission speed.
·1·	·2·	
Off	Off	2 Mbps.
ON	Off	4 Mbps.
Off	ON	8 Mbps.
ON	ON	16 Mbps.

Switch.		Optical power depending on cable length.	
·3·	·4·		
Off	Off	1 to 4	Cable shorter than 15 meters. Recommended cable: SFO / SFO-FLEX
ON	Off	5 to 6	Cable between 15 and 30 meters. Recommended cable: SFO-FLEX
Off	ON	7	Cable between 30 and 40 meters. Recommended cable: SFO-FLEX
ON	ON	8	Cable longer than 40 meters. Recommended cable: SFO-V-FLEX

7.7.3   RS232 serial line connection.

Connector pinout.

Plug-in part 9-pin female SUB-D type connector.

Pin.	Signal.	Description.
1	DCD	Carrier detect.
2	RxD	Receive data.
3	TxD	Send data.
4	DTR	Data terminal ready.
5	11	Reference signal.
6	DSR	Data set ready.
7	RTS	Request to send.
8	CTS	Clear to send.
9	RI	Ring indicator.

1 ... 5
6 ... 9

Cable characteristics.

Twisted-pair shielded cable should be used to minimize interference between cables, thus preventing poor communication in long lengths.

Characteristic.	Description.
Type.	Shielded. Twisted-pair, with a minimum wire section of 0.14 mm².
Capacitance.	164 pF/m (50 pF/ft).
Maximum length.	At a baudrate of 19200 Bd, 15 m (50 ft) or a length equivalent to a capacitance of 2500 pF.

Node connection.

The cable shield must be connected to the connector at both ends. It is recommended to reference all the control and data signals to the same point (pin 5 GND), thus avoiding reference points with different voltages because there could be voltage differences in long lengths between the two ends of the cable.

• Simplified connection
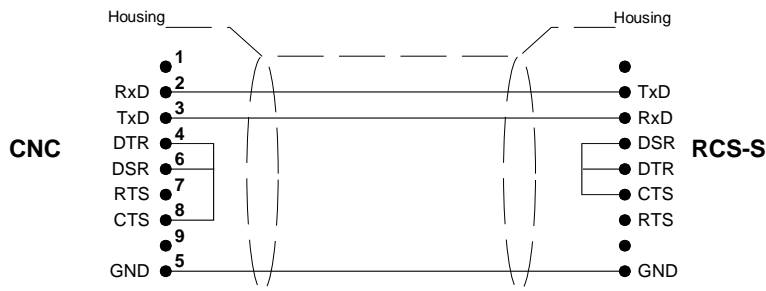
• Full connection
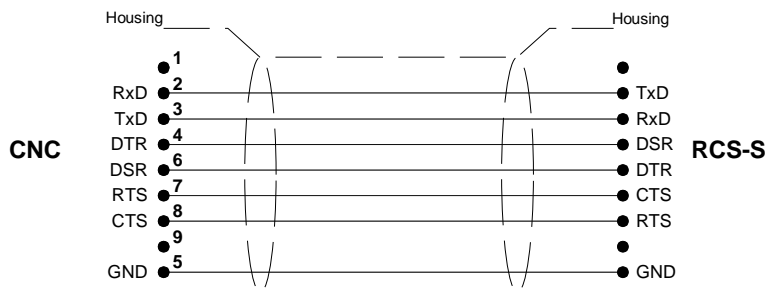
7.8   Module configuration on the CNC.

7.8.1   Module identification at the bus

The SCR-S module is, like the drives, a node type of the Sercos ring. In terms of parameter setting, these modules have dual identification, physical and logic, as described next.

Physical module identification.

Each counter must be identified by a number (Sercos ID) using the thumbwheel located on its front plate. That identifier must be unique in the ring, the number is sequential from 1 to n and without skipping any and "n" being the total number of Sercos nodes (including drives and counters).

Logic module identification.

The SERCOUNTID table of the general machine parameters allows linking the logic number of the Sercos counters (1..8) to the physical number set by the thumbwheel of each node (enter in each position of the Sercos ID table associated with that logic position of the counter).

Identifying the feedback inputs and analog outputs on the modules.

Remote Sercos type feedback inputs (COUNTERID) and analog outputs (ANAOUTID) that may be used when setting the parameters of axes or handwheels follow the allocation criteria based on the logic numbering of the Sercos counters. The physical numbering set by the Sercos ID is irrelevant.

- SERCOUNTID1   COUNTERID (1..4)   ANAOUTID (1..4)
- SERCOUNTID2   COUNTERID (5..8)   ANAOUTID (5..8)
-     ...   .
- SERCOUNTID8   COUNTERID (29..32)   ANAOUTID (29..32)

7.8.2   Parameter setting example.

The system has 2 Sercos counters (nodes 3, 5) and 3 Sercos AXD drives (nodes 1, 2, 4). Plus, the system has the following axes.

- 3 analog axes X Y Z.
- 1 Sercos U axis (with external feedback on an RCS-S module).
- 1 Sercos V axis (without external feedback).
- 1 handwheel.
- 1 Sercos spindle S.

The connection is as follows:

Node.		Input/Output.	Shaft/Handwheel.
1	AXD drive.	- - -	V Sercos axis.
2	AXD drive.	- - -	U Sercos axis.
3	RCS-S module.	E21A feedback input. Analog output ANAOUT2. E21B feedback input. Analog output ANAOUT1.	X analog axis. X analog axis. Handwheel. Y analog axis.
4	AXD drive.	- - -	Sercos spindle S.
5	RCS-S module.	E21B feedback input. E21C feedback input. E21A feedback input. Analog output ANAOUT4.	Sercos U axis (external feedback). Y analog axis. Z analog axis. Z analog axis.
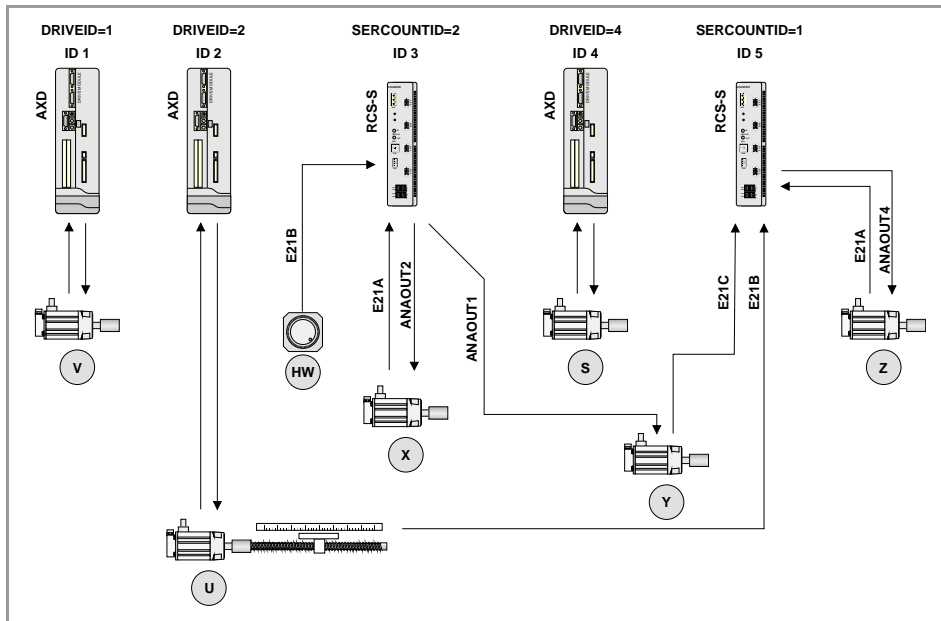
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The parameter could be set as follows.

NSERCOUNT   2   Number of Sercos axes in the system.

SERCOUNTID1   5   (No common, but valid).

SERCOUNTID2   3

Parameters SERCOUNTID1 through SERCOUNTID8 set the order (sequence) of the feedback inputs. Since SERCOUNTID1=5 and SERCOUNTID2=3, the first feedback input will be the first one of node 5.

Axis.	Parameter.	Value.
X axis.	DRIVETYPE COUNTERTYPE COUNTERID ANAOUTTYPE ANAOUTID	Analog. Sercos counter. 5. Sercos counter. 6.
Y axis.	DRIVETYPE COUNTERTYPE COUNTERID ANAOUTTYPE ANAOUTID	Analog. Sercos counter. 3. Sercos counter. 5.
Z axis.	DRIVETYPE COUNTERTYPE COUNTERID ANAOUTTYPE ANAOUTID	Analog. Sercos counter. 1. Sercos counter. 4.
U axis.	DRIVETYPE DRIVEID OPMODEP FBACKSRC COUNTERTYPE COUNTERID	Sercos. 2. Speed. External. Sercos counter. 2.
V axis.	DRIVETYPE OPMODEP DRIVEID	Sercos. Position. 1.
Handwheel.	MANPG COUNTERTYPE COUNTERID	1. Sercos counter. 6.
Spindle S.	DRIVETYPE OPMODEP DRIVEID	Sercos. Position. 4.

7.8.3   Automatic detection of a FeeDat/EnDat encoder.

The FeeDat and EnDat protocols enable the necessary parameters to be read from the feedback device itself, so they can be used by the CNC without any additional parameter settings. The CNC will request the encoder parameters through Sercos at the end of each Sercos ring initialization (system start-up, reset and machine parameter validation), immediately after passing all the nodes to phase 4. The module reads all the feedback inputs that are set in the parameters on any axis set as being FeeDat/EnDat-type inputs.

For each feedback input set in the parameters as FeeDat/EnDat, the CNC has two copies of encoder parameters: that which has been detected, and that saved in the tables.

Automatically validating a FeeDat/EnDat feedback the first time an encoder is connected.

When a feedback is defined as FeeDat/EnDat and its encoder is connected for the first time (the module reads the valid data for the first time), the CNC automatically saves the data in the machine parameter table and validates them. If a FeeDat/EnDat feedback is eliminated from the axis parameter settings, the CNC deletes the encoder information from the table.

This automatic validation only works the first time an encoder is connected. If the encoder is replaced, even if by another functionally equivalent model, the CNC displays the error E4026 and it will be necessary to add the data of the new encoder. See *"7.8.4 Identifying the encoder. Consistency check (error 4026)."* on page 136.

Validating a FeeDat/EnDat feedback during setup.

It is possible to change the configuration of the encoder parameters from the machine parameters. If the data read from the encoder do not match those saved in the parameter table, the CNC will display a new table with both groups of values. At the same time, it will display a softkey to save the new data in the table. The CNC will only display this softkey if the data read from the encoder are valid (the encoder is connected and correctly identified) and they do not match those already saved.

In order to be able to add the data from a FeeDat/EnDat feedback, it is necessary for the counter to have read the encoder correctly during its initialization phase. The CNC will not allow data from a feedback to be added if there is not an encoder connected or if the parameter reading process is erroneous (erroneous CRC).

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Module configuration on the CNC.

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7.8.4   Identifying the encoder. Consistency check (error 4026).

At the end of the Sercos initialization process (system start-up, machine value reset or validation), a consistency check is performed on the encoder data. If the data detected and saved do not match all the FeeDat and EnDat feedbacks, the CNC will display error 4026 (encoder FeeDat/EnDat data mismatch), indicating the ID of the feedback in which the mismatched data has been detected. Error 4026 will continue until the mismatch causing it has been corrected.

Correcting error E4026.

When an error 4026 occurs, the person responsible for the position in operation must check the configuration of the feedback producing the error, and ensure that the detected data and the validated data match, using one of the following methods:

• Changing the encoder, replacing it with the previously validated one. Substituting the encoder, even it is with another with equivalent functions, will continue to show error E4026.

• Expressly adding the new encoder, validating the new data. This option must be implemented in Setup mode so that the changes are made permanent.

⚠ *The User mode can also be used to modify the parameter settings of the feedbacks and add the new encoder data (either from the machine parameters or from the diagnosis mode), but this change will be temporary. When the CNC is shut down, the data are lost.*

Exceptions to error E4026.

The CNC only displays error E4026 when the FeeDat/EnDat feedback has valid data and is active.

• If a FeeDat/EnDat feedback does not have an encoder connected, or the parameter reading process is erroneous (incorrect CRC), the error will not appear, even if there are validated data. The CNC displays the feedback errors reported by the module itself.

• If all the axes that use a FeeDat/EnDat feedback are parked, the CNC thinks that the feedback is not being used. The CNC disables the counter alarms and therefore will not report the error E4026.

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7.9   Error codes and messages on the Sercos counter.

The module display shows the active error code. The CNC screen displays this same error code. The CNC can display both the errors listed in this chapter and the error codes and texts of the Sercos communication itself.

CNC response following an error.

Activating any of the errors listed in this chapter causes the following effects at the CNC.

- The CNC interrupts program execution.
- The CNC stops the movement of the axes and spindles.
- The CNC sets the mark /ALARM to zero. This signal is present in the PLC program, which will manage that emergency without having to know which error was activated. The PLC will normally use the signal /ALARM to activate the corresponding emergency output.

The system cannot be started without having eliminated all the errors detected by the Sercos counter. When using the Sercos communication interface, the errors are reset the same way as any other CNC error.

Activating any of the "resettable" or "non-resettable" errors causes a category 1 stop.

Type of error.

Resettable errors.

| Definition. | Errors that can be eliminated with a "reset" after eliminating their cause. |

Non-resettable errors.

| Definition. | Errors that cannot be eliminated with a "reset" after eliminating their cause; in other words, the previous procedure cannot be followed to eliminate them. |
| Procedure. | Eliminate the cause of the error and when it disappears, turn the unit off and back on. |

The following errors are non-resettable:

| E034 | E038 | E039 | E040 | E041 | E044 | E045 | E046 | E047 | E048 | E083 |

Errors that cancel the analog outputs.

| Definition. | Errors that set the analog outputs to 0 V. |
| Procedure. | Eliminate the cause of the error and when it disappears, turn the unit off and back on. |

The following errors disable the analog outputs:

| E034 | E038 | E039 | E040 | E041 | E044 | E045 | E046 | E047 | E048 | E083 |
| E084 | E403 | E404 | E405 | E406 | E407 | E410 | E411 | E412 | E413 | |

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7.9.1   Alarm codes. Meaning and solution.

A201   Fagor digital feedback. Analog signal < 0.4 Vpp. E21A feedback.
A301   Fagor digital feedback. Analog signal < 0.4 Vpp. E21B feedback.
A401   Fagor digital feedback. Analog signal < 0.4 Vpp. E21C feedback.
A501   Fagor digital feedback. Analog signal < 0.4 Vpp. E21D feedback.
Level of signal 1 Vpp too low. Check the cable and the connection between the encoder and the RCS-S module. If the error persists, try replacing the encoder module and/or the cable associated with the feedback. If the problem persists, contact Fagor Automation.

A202   Fagor digital feedback. Encoder power outside desired values. E21A.
A302   Fagor digital feedback. Encoder power outside desired values. E21B.
A402   Fagor digital feedback. Encoder power outside desired values. E21C.
A502   Fagor digital feedback. Encoder power outside desired values. E21D.
Check that the power supply cable of the encoder is not damaged. Also check that the cable length is the right one and that the wiring connection is the right one. If the problem persists, contact Fagor Automation.

A203   Fagor digital feedback. Excessive axis speed. E21A feedback.
A303   Fagor digital feedback. Excessive axis speed. E21B feedback.
A403   Fagor digital feedback. Excessive axis speed. E21C feedback.
A503   Fagor digital feedback. Excessive axis speed. E21D feedback.
The axis moving speed exceeds the sampling capability of the Sercos counter hardware for this type of encoder signal. Decrease the maximum axis moving speed. If the problem persists, contact Fagor Automation.

A204   Fagor digital feedback. Internal temperature is out of range. E21A feedback.
A304   Fagor digital feedback. Internal temperature is out of range. E21B feedback.
A404   Fagor digital feedback. Internal temperature is out of range. E21C feedback.
A504   Fagor digital feedback. Internal temperature is out of range. E21D feedback.
The wiring, the feedback device or the feedback of the Sercos counter may have some problem. Check the condition (shape) of the cable, of the connection or of the feedback device. If the problem persists, contact Fagor Automation.

A205   Fagor digital feedback. Loss of SOL synchronization. E21A feedback.
A305   Fagor digital feedback. Loss of SOL synchronization. E21B feedback.
A405   Fagor digital feedback. Loss of SOL synchronization. E21C feedback.
A505   Fagor digital feedback. Loss of SOL synchronization. E21D feedback.
The FeeDat protocol has a SOL (Sign of Life) counter that increases its value every time the master reads the coordinate. With each interruption in the reading, the counter increases its own software count, which must be kept so that it matches the SOL of the protocol. This warning occurs when the two counts do not match.

7.9.2 Error codes. Meaning and solution.

E034   Error identifying the CPU board.
Contact Fagor Automation. Error that cannot be reset.

E038   Code checksum error.
The loaded checksum of the program code is not correct. Load the software again. If the problem persists, the RAM, FLASH memories or the loaded code may be defective. Contact Fagor Automation. Error that cannot be reset.

E039   Error on the Sercos board .
Contact Fagor Automation. Error that cannot be reset.

E040   Failure of the clock of the SerCon® board.
Contact Fagor Automation. Error that cannot be reset.

E041   SerCon® memory corrupted.
Contact Fagor Automation. Error that cannot be reset.

E044   Corrupted file system in flash.
Contact Fagor Automation. Error that cannot be reset.

E045   Error reading analog offsets.
Contact Fagor Automation. Error that cannot be reset.

E046   Error identifying the axis board.
Contact Fagor Automation. Error that cannot be reset.

E047   Unknown axis board identification.
Contact Fagor Automation. Error that cannot be reset.

E04   Error in FPGA code.
The FPGA code seems to be corrupted or is missing. Try reloading the software version. If the problem persists, the RAM, FLASH memories or the loaded code may be defective. Contact Fagor Automation. Error that cannot be reset.

E083   The FPGA could not be loaded.
Restart the counter. If the problem persists, contact Fagor Automation. Error that cannot be reset.

E084   Reset due to watchdog.
The system has restarted because watchdog kicked in. If the problem is repetitive and/or persists, contact Fagor Automation.

E085   Error in power supply for the analog outputs.
Contact Fagor Automation.

E133   Broken wire, A signal of E21A feedback.
E233   Broken wire, A signal of E21B feedback.
E333   Broken wire, A signal of E21C feedback.
E433   Broken wire, A signal of E21D feedback.
For differential TTL feedback. The A and/or /A signal wire may be broken or disconnected.
Check the connection. Check the level of the signals provided by the feedback device.

E134   Broken wire, B signal of E21A feedback.
E234   Broken wire, B signal of E21B feedback.
E334   Broken wire, B signal of E21C feedback.
E434   Broken wire, B signal of E21D feedback.
For differential TTL feedback. The B and/or /B signal wire may be broken or disconnected.
Check the connection. Check the level of the signals provided by the feedback device.

E135   Broken wire, I0 signal of E21A feedback.
E235   Broken wire, I0 signal of E21B feedback.
E335   Broken wire, I0 signal of E21C feedback.
E435   Broken wire, I0 signal of E21D feedback.
For differential TTL feedback. The I0 and/or /I0 signal wire may be broken or disconnected. Check the connection. Check the level of the signals provided by the feedback device.

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E136   Broken wire, AL signal of E21A feedback.
E236   Broken wire, AL signal of E21B feedback.
E336   Broken wire, AL signal of E21C feedback.
E436   Broken wire, AL signal of E21D feedback.

For differential TTL feedback. The AL and/or /AL signal wire may be broken or disconnected. Check the connection. Check the level of the signals provided by the feedback device.

E137   Received alarm signal at E21A feedback.
E237   Received alarm signal at E21B feedback.
E337   Received alarm signal at E21C feedback.
E437   Received alarm signal at E21D feedback.

The encoder has generated a signal alarm due to its poor performance. Check the encoder documentation to determine the source of (reason for) the alarm. It could also be a false positive due to poor connection.

E138   Amplitude alarm at E21A feedback.
E238   Amplitude alarm at E21B feedback.
E338   Amplitude alarm at E21C feedback.
E438   Amplitude alarm at E21D feedback.

Excessive weakening or saturation of the A and/or B signals. There may be a problem with the wiring, the feedback device or the feedback of the Sercos counter. Check the condition (shape) of the cable, of the connection or of the feedback device. If the problem persists, contact Fagor Automation.

E140   Feedback frequency too high at E21A feedback.
E240   Feedback frequency too high at E21B feedback.
E340   Feedback frequency too high at E21C feedback.
E440   Feedback frequency too high at E21D feedback.

The axis moving speed exceeds the sampling capability of the Sercos counter hardware for this type of encoder signal. Decrease the maximum axis moving speed.

E141   Wrong distance between I0s, E21A feedback.
E241   Wrong distance between I0s, E21B feedback.
E341   Wrong distance between I0s, E21C feedback.
E441   Wrong distance between I0s, E21D feedback.

Resettable error. Error indicating the lack of repeatability of the reference mark signal at each revolution of the feedback device. Some pulses are being lost and/or the measurement provided by the feedback device is wrong. Check that the connection and the wiring are correct. Check that the number of pulses allowed as error margin is not too low. Check that the value of CNC parameter REFPULSE is correct. If the error continues to repeat, the feedback device may be damaged; contact Fagor Automation.

E142   Over-current or short-circuit at E21Afeedback.
E242   Over-current or short-circuit at E21B feedback.
E342   Over-current or short-circuit at E21C feedback.
E442   Over-current or short-circuit at E21D feedback.

Either a short-circuit has occurred or the feedback device is over-supplied.

Check cables and connections.

E143   Communication error at E21A feedback. Wrong CRC.
E243   Communication error at E21B feedback. Wrong CRC.
E343   Communication error at E21C feedback. Wrong CRC.
E443   Communication error at E21D feedback. Wrong CRC.

Error reading absolute position value; wrong CRC.

Check the cable and connection with the encoder. Check that the parameters of the feedback device have been set correctly. If the problem persists, contact Fagor Automation.

E144   Communication error at E21A feedback. Acknowledge not received.
E244   Communication error at E21B feedback. Acknowledge not received.
E344   Communication error at E21C feedback. Acknowledge not received.
E443   Communication error at E21D feedback. Acknowledge not received.

Error reading absolute position value; acknowledge not received.

Check the cable and connection of the feedback device. The error could be due to a problem at the feedback device. If the problem persists, contact Fagor Automation.

E145   ABSIND: Synchronism error at E21A feedback.
E245   ABSIND: Synchronism error at E21B feedback.
E345   ABSIND: Synchronism error at E21C feedback.
E445   ABSIND: Synchronism error at E21D feedback.
Synchronism lost between the Sercos counter and the ABSIND module which may have caused a wrong position reading. The error is likely due to a malfunction of the ABSIND module or a connection problem between the ABSIND module and the Sercos counter associated with that feedback. If the problem persists, contact Fagor Automation.

E146   ABSIND: Error reading information at E21A feedback.
E246   ABSIND: Error reading information at E21B feedback.
E346   ABSIND: Error reading information at E21C feedback.
E446   ABSIND: Error reading information at E21D feedback.
It could not read the ABSIND module identification info during system startup. The error is likely due to a malfunction of the ABSIND module or a connection problem between the ABSIND module and the Sercos counter associated with that feedback.
If the problem persists, contact Fagor Automation.

E0147   Digital feedback. Error reading the encoder parameters. E21A feedback.
E0247   Digital feedback. Error reading the encoder parameters. E21B feedback.
E0347   Digital feedback. Error reading the encoder parameters. E21C feedback.
E0447   Digital feedback. Error reading the encoder parameters. E21D feedback.
Error during the initialization phase of the EnDat or FeeDat feedback device, during the feedback parameter reading. The error may be due to a malfunction of the encoder or a connection problem. If the problem persists, contact Fagor Automation.

E0148   Digital feedback. Error initializing feedback E21A.
E0248   Digital feedback. Error initializing feedback E21B.
E0348   Digital feedback. Error initializing feedback E21C.
E0448   Digital feedback. Error initializing feedback E21D.
Error in the initialization phase of the EnDat or FeeDat feedback device during the synchronous reading of the absolute coordinate of the feedback device. The error may be due to a malfunction of the encoder or a connection problem. If the problem persists, contact Fagor Automation.

E183   INDUCTOSYN: INC signal too low at E21A feedback.
E283   INDUCTOSYN: INC signal too low at E21B feedback.
E383   INDUCTOSYN: INC signal too low at E21C feedback.
E483   INDUCTOSYN: INC signal too low at E21D feedback.
Incremental signal level of the inductosyn/resolver feedback device too low. Check the gain and phase values of the ABSIND module with the adjustment software. Check the cable and the connection between the ABSIND module and the inductosyn/resolver feedback device. If the error persists and cannot be changed with the previous actions, try replacing the ABSIND module and/or the cable associated with that feedback. If the error persists, contact Fagor Automation.

E184   INDUCTOSYN: INC signal too high at E21A feedback.
E284   INDUCTOSYN: INC signal too high at E21B feedback.
E384   INDUCTOSYN: INC signal too high at E21C feedback.
E484   INDUCTOSYN: INC signal too high at E21D feedback.
Incremental signal level of the inductosyn/resolver feedback device too high. Check the gain and phase values of the ABSIND module with the adjustment software. Check the cable and the connection between the ABSIND module and the inductosyn/resolver feedback device. If the error persists and cannot be changed with the previous actions, try replacing the ABSIND module and/or the cable associated with that feedback. If the error persists, contact Fagor Automation.

E185   INDUCTOSYN: GRAY signal missing at E21A feedback.
E285   INDUCTOSYN: GRAY signal missing at E21B feedback.
E385   INDUCTOSYN: GRAY signal missing at E21C feedback.
E485   INDUCTOSYN: GRAY signal missing at E21D feedback.
GRAY signal level of the inductosyn/resolver feedback device missing. Check the gain and phase values of the ABSIND module with the adjustment software. Check the cable and the connection between the ABSIND module and the inductosyn/resolver feedback device. If the error persists and cannot be changed with the previous actions, try replacing the ABSIND module and/or the cable associated with that feedback. If the error persists, contact Fagor Automation.

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Error codes and messages on the Sercos counter.

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E186 INDUCTOSYN: Linear encoder unstable on Power-ON, E21A feedback.
E286 INDUCTOSYN: Linear encoder unstable on Power-ON, E21B feedback.
E386 INDUCTOSYN: Linear encoder unstable on Power-ON, E21C feedback.
E486 INDUCTOSYN: Linear encoder unstable on Power-ON, E21D feedback.
The position read when initializing the ABSIND module is unstable. Check that the axis is not moving while starting up or initializing. Check the cable and the connection between the ABSIND module and the inductosyn/resolver feedback device. Check the ground connections in the electrical cabinet (electrical noise on the signals). If the error persists and cannot be changed with the previous actions, try replacing the ABSIND module and/or the cable associated with that feedback. If the error persists, contact Fagor Automation.

E187 INDUCTOSYN: Wrong EEPROM checksum, E21A feedback.
E287 INDUCTOSYN: Wrong EEPROM checksum, E21B feedback.
E387 INDUCTOSYN: Wrong EEPROM checksum, E21C feedback.
E487 INDUCTOSYN: Wrong EEPROM checksum, E21D feedback.
Check the gain and phase values of the ABSIND module with the adjustment software. If the error persists and cannot be changed with the previous actions, try replacing the ABSIND module associated with that feedback. If the error persists, contact Fagor Automation.

E188 INDUCTOSYN: Unknown error at E21A feedback.
E288 INDUCTOSYN: Unknown error at E21B feedback.
E388 INDUCTOSYN: Unknown error at E21C feedback.
E488 INDUCTOSYN: Unknown error at E21D feedback.
The ABSIND module has generated an unknown error. The error is likely due to bad performance. It the error is repetitive and persistent, try replacing the ABSIND module associated with that feedback. If the error persists, contact Fagor Automation.

E189 INDUCTOSYN: Incoherent SSITYPE parameter with feedback device type connected to E21A feedback.
E289 INDUCTOSYN: Incoherent SSITYPE parameter with feedback device type connected to E21B feedback.
E389 INDUCTOSYN: Incoherent SSITYPE parameter with feedback device type connected to E21C feedback.
E489 INDUCTOSYN: Incoherent SSITYPE parameter with feedback device type connected to E21D feedback.
Check the dipswitch S50 of the ABSIND module. The selected value must be coherent with CNC machine parameter SSITYPE and with the feedback type (inductosyn/resolver) connected to the ABSIND module.

E192 wrong REFPULSE parameter at E21A feedback.
E292 wrong REFPULSE parameter at E21B feedback.
E392 wrong REFPULSE parameter at E21C feedback.
E492 wrong REFPULSE parameter at E21D feedback.
The value of machine parameter REFPULSE is inconsistent with the type of feedback connected.
Try changing its value. If the problem persists, contact Fagor Automation.

E193 Fagor digital feedback. Error on the absolute track. E21A feedback.
E293 Fagor digital feedback. Error on the absolute track. E21B feedback.
E393 Fagor digital feedback. Error on the absolute track. E21C feedback.
E493 Fagor digital feedback. Error on the absolute track. E21D feedback.
It cannot calculate the absolute position. Feedback pulses lost. The analog signal < 0.20 Vpp.
Check that the encoder is working at proper speed. Check mounting tolerances. Clean the glass or the steel tape of the linear encoder. If none of the previous solutions solves the error, replace the encoder or encoder head.

E194 Fagor digital feedback. CPU error. E21A feedback.
E294 Fagor digital feedback. CPU error. E21B feedback.
E394 Fagor digital feedback. CPU error. E21C feedback.
E494 Fagor digital feedback. CPU error. E21D feedback.
Damaged encoder or encoder head. Replace the encoder or the encoder head.

E195 Fagor digital feedback. Error at the adjustment potentiometers. E21A feedback.
E295 Fagor digital feedback. Error at the adjustment potentiometers. E21B feedback.
E395 Fagor digital feedback. Error at the adjustment potentiometers. E21C feedback.
E495 Fagor digital feedback. Error at the adjustment potentiometers. E21D feedback.
Damaged encoder or encoder head. Replace the encoder or the encoder head.

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E196   Fagor digital feedback. Image capturing sensor (CCD) error E21A feedback.
E296   Fagor digital feedback. Image capturing sensor (CCD) error E21B feedback.
E396   Fagor digital feedback. Image capturing sensor (CCD) error E21C feedback.
E496   Fagor digital feedback. Image capturing sensor (CCD) error E21D feedback.
Check mounting tolerances. Clean the glass or the steel tape of the linear encoder.
Damaged encoder or encoder head; the CCD (Charge-Coupled Device) or the LED (Light-Emitting Diode). Replace the encoder or the encoder head.

E197   Fagor digital feedback. Supply voltage out of range. E21A feedback.
E297   Fagor digital feedback. Supply voltage out of range. E21B feedback.
E397   Fagor digital feedback. Supply voltage out of range. E21C feedback.
E497   Fagor digital feedback. Supply voltage out of range. E21D feedback.
The power voltage must be between 5.3 V and 4.1 V. Check that the power supply cable of the encoder is not damaged. Also check that the cable length is the right one and that the wiring connection is the right one.

E198   Fagor digital feedback. Parameter error. E21A feedback.
E298   Fagor digital feedback. Parameter error. E21B feedback.
E398   Fagor digital feedback. Parameter error. E21C feedback.
E498   Fagor digital feedback. Parameter error. E21D feedback.
The encoder or encoder head configuration has been lost. Replace the encoder or the encoder head.

E403   MST failure.
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E404   MDT failure.
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E405   Invalid phase(>4).
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E406   Phase up-shift error.
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E407   Phase down-shift error.
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E410   Noise resets Sercon®.
Noise gets in through the connection of the internal bus resetting the SerCon® but not with the VeCon2.

E411   Error when receiving telegrams.
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E412   Delayed synchronism message.
Communication problems through fiber optic ring. Check the ring connections and the identification of each module.

E413   Handshake error in Sercos counter.
The master element (CNC) sends a synchronism message in every cycle (usually 4ms) that synchronizes the drives. This error appears when they can't synchronize or lose synchronism.
Maybe the CNC has not sent this message or if it has, it wasn't in the precise moment. Check the transmission cable or check that there is no noise in the transmission.

7.

RCS-S-4F4AO

Error codes and messages on the Sercos counter.

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7.10 Diagnosis of the Sercos counter.

7.10.1 General diagnosis.

The following information is available in diagnosis mode by selecting a Sercos bus module.

General information about the RCS-S module.

General information about the RCS-S module.

Field.	Meaning.
SERCOUNTID	ID of the thumbwheel associated with the counter.
Soft Version	Software version of the counter.
Checksum	Checksum of the counter code.
CPU.IDENT	Hardware ID of the CPU board.
IOB.IDENT	Hardware ID of the axes board.
IOB.FPGAVERS	FPGA version of the axes board.
T1	Time from the MST until the counter begins to send the telegram (AT). (*)
Control Word	Contents of the counter's control word. (*)
Status Word	Contents of the counter's status word. (*)

(*) Consult the Sercos protocol.

Information about the resources (inputs/outputs) of the module.

The connectors are displayed in expanded form for each of the counters. Each feedback input indicates the type of feedback connected: TTL, differential TTL, 1 Vpp, SSI, EnDat or FeeDat.

Resources	Information.
C1	E21A feedback input for axes, spindles and handwheels.
C2	E21B feedback input for axes, spindles and handwheels.
C3	E21C feedback input for axes, spindles and handwheels.
C4	E21D feedback input for axes, spindles and handwheels.
AO1	ANAOUT1 analog output for axes and spindles.
AO2	ANAOUT2 analog output for axes and spindles.
AO3	ANAOUT3 analog output for axes and spindles.
AO4	ANAOUT4 analog output for axes and spindles.

Information about FeeDat or EnDat feedback.

When the type of feedback on a connector is FeeDat or EnDat, the CNC displays the following information. The CNC obtains this information from the encoder itself. If the data read from the encoder do not match those saved in the parameter table, the CNC will offer the option to save the new data in the table. See on page 146.

Resources	Information.
FBACKCONFIG	Type of feedback.
Serial number.	Encoder serial number.
Name.	If it is a Fagor encoder, the name of the encoder. If it is an EnDat encoder, the "EnDat" text.

Resources	Information.
Type.	Encoder type (multi-turn absolute rotary, absolute rotary, absolute linear, etc).
Resolution.	Encoder resolution. • If the encoder is linear, nanometer resolution. • If the encoder is angular, the number of pulses per turn.
Datalength.	Number of bits.
Version.	Protocol version of FeeDat or EnDat.
Temperature.	Temperature. The module does not update this value in real time; it only reads them at start-up or in the event of an error in the FeeDat feedback.
VCC.	Voltage supply for the encoder. The module does not update this value in real time; it only reads them at start-up or in the event of an error in the FeeDat feedback.

Error information.

Field.	Meaning.
Reset Hard counter.	Number of times the counter has been reset.
Distortion errors.	Distortion error counter on the counter. (*)
AT errors.	AT reception error counter on the counter. (*)

(*) Consult the Sercos protocol.

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7.10.2   Updating the FeeDat and EnDat information.

If the data read on any FeeDat or EnDat encoder feedback do not match those saved in its parameter table, the CNC displays a softkey to save the new data in the table. The softkey is available when selecting the level of the Sercos bus. The CNC will only display this softkey if the data read from the encoder are valid (the encoder is connected and correctly identified) and they do not match those already saved.

This softkey validates and saves the information read in all the FeeDat/EnDat feedbacks whose parameters have been set in the CNC.

When the CNC is in User mode, any change in the parameter settings or the FeeDat/EnDat configuration (for example, replacing an encoder, even with a functionally equivalent model) requires first changing to Setup mode if you wish the changes to be permanent.
The User mode can also be used to modify the parameter settings of the feedbacks and add the new encoder data (either from the machine parameters or from the diagnosis mode), but this change will be temporary. When the CNC is shut down, the data are lost.

7.

RCS-S-4F4AO
Diagnosis of the Sercos counter.

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7.11   Software installation/update.

### Requirements for updating the software.

The software for the RCS-S (Sercos counter) module can only be installed or updated through Fagor's WinDDSSetup application for PCs (version 08.06 or later). In addition to having this application installed on the PC, the RCS-S module must be connected to the PC by a RS-232 series line cable.
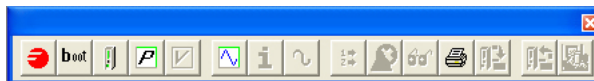
Process to install or update the software.
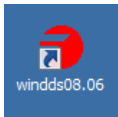
Proceed as follows:

1   Run the WinDDSSetup application at the PC.

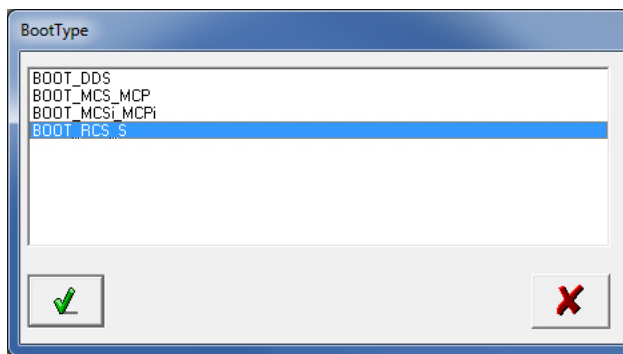2   Display the top menu "Work mode" and mark the option "Boot".
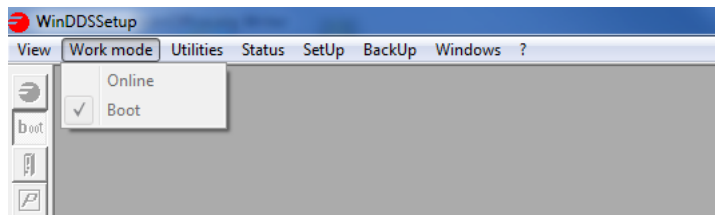
3   If the "Online" option is shown, uncheck it to enable the "Boot" option. Its associated icon will also be enabled on the tool bar.
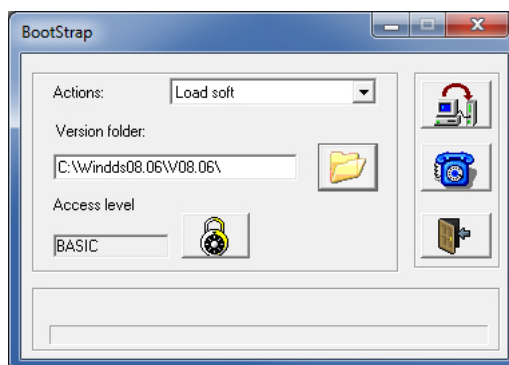

BOOT.

4   Click on the "Boot" icon of the tool bar to access the "BootType" window.

5   Select "BOOT_RCS_S" from the list and click on "Validate". That will display the "BootStrap" window.

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Search the directory with the version to install.

6 Click on this icon to go to the "Version folder" window where the version to be installed has been decompressed (expanded). Locate and select the file "cser2.cfg" in the corresponding folder and click on the "Open" button.
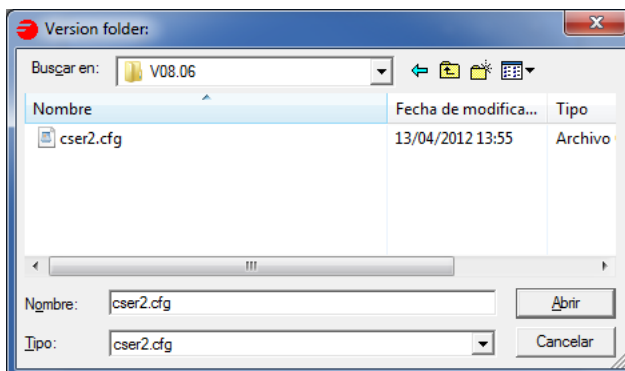
Loading software (from the PC to the remote module "RCS-S").

7 Click on this icon to go to the "instructions" text window. Follow the instructions in the order indicated.

Note. The "Boot" and "Reset" buttons referred to in the text are located on the front of the module.
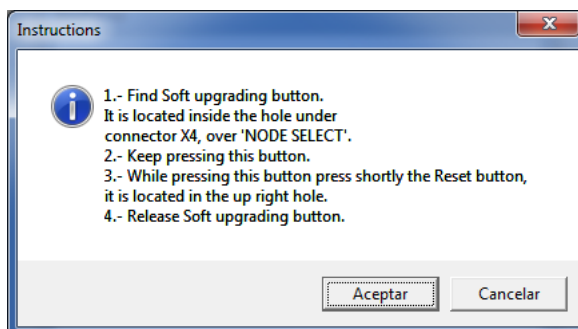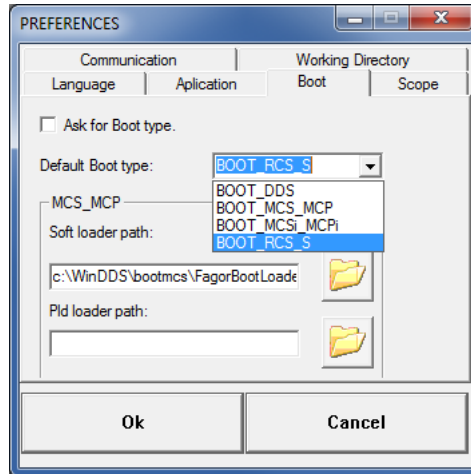
8 Once all the steps have been completed, click on the "OK" button to start the software loading process from the PC to the remote module "RCS-S".

7.11.1 Set the default Boot.

Display the top menu "SetUp" > "Preferences" > "Boot". Use this menu sequence to set the "Default Boot Type" and also uncheck the option "Ask for boot type".

After clicking on "OK", the next time the "Boot" icon of the tool bar is pressed on the home screen of WinDDSSetup, it will no longer display the "BootType" window. The application will execute the options selected in the drop down list "Default type of Boot" directly, which in this case is "BOOT_RCS_S".

7.11.2 Communication parameters.

Display the top menu "SetUp" > "Preferences" > "Communication". Use this menu to set the main parameters involved in the communication between the PC and the remote module "RCS-S". These parameters are applied by default when starting a new session with WinDDSSetup. Any changes made in this dialog box has an immediate effect.
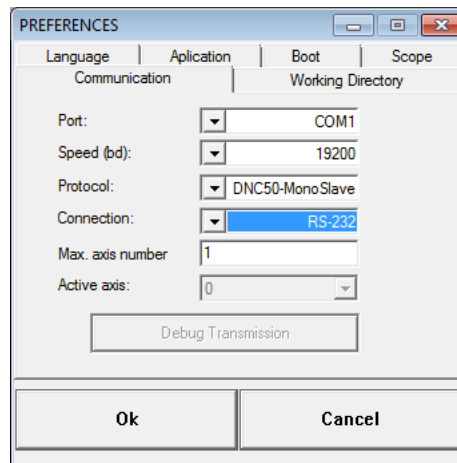
| Parameter.	Meaning.
Port.	Select the communication port. Options: COM1 or COM2.
Speed (bd).	Select communication speed. Options: 9600 or 19200.
Protocol.	Select communication protocol. Options: DNC50 - Monoslave, DNC50 - Multislave, MODBUS-RTU or MODBUS-ASCII.
Connection.	Select connection through RS-232 or RS-422 serial line after selecting MODBUS RTU or ASCII protocol.

8   CAN BUS (CANFAGOR/CANOPEN PROTOCOLS).

CANfagor and CANopen are two network communication protocols based on the CAN bus system for connecting the CNC with remote modules and keyboards. The CAN connection supports up to 32 devices (nodes), including the central unit; more one than keyboard and several groups of remote modules are possible.
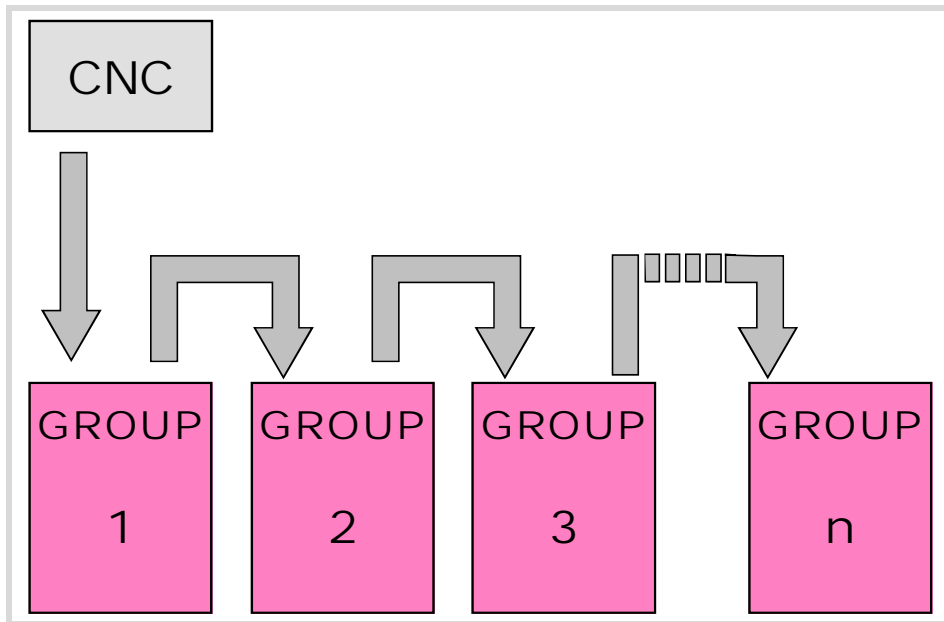
CAN connector.

5-pin male Phoenix minicombicon contact (3.5 mm pitch).
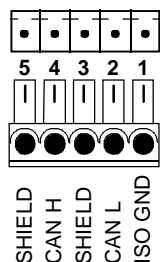
Pin.	Signal.	Function.
1	ISO GND	Ground / 0 V.
2	CAN L	(LOW) bus signal.
3	SHIELD	CAN shield.
4	CAN H	(HIGH) bus signal.
5	SHIELD	CAN shield.

The cable shield must be connected to the connector at both ends. The connector has two shield pins. Both pins are equivalent and the CAN shield may be connected to either one.

CAN cable characteristics.

Use a specific CAN cable. The ends of all the wires and the shield must be protected by the corresponding terminal (pin). Also use the terminals (pins) to secure the cable to the connector.

General characteristics.	
Type.	Shielded. Twisted pair (1 x 2 x 0.22 mm²).
Flexibility.	Extremely flexible. Minimum bending radius, static = 50 mm and dynamic = 95 mm.
Cover.	PUR
Impedance.	Cat.5 (100 Ω - 120 Ω)

Module interconnection.

Respect the cable's minimum bending radius when connecting it. They must be connected in series; on elements having two CAN connectors, either one may be used. Once the elements have been connected, define their logic order in the bus and the transmission speed.

Remote modules of the RIO5, RIOR and RIO70 series.

The drawing shows the CAN connection between the CPU (central unit), the operator panel and 2 groups of RIO5, RIOR or RIO70 series remote modules.

RIOW series remote modules.

The drawing shows the CAN connection between the CPU (central unit), the operator panel and 2 groups of RIOW series remote modules.

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CAN BUS (CANFAGOR/CANOPEN PROTOCOLS).

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8.1 Identification of the modules at the bus.

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CAN BUS (CANFAGOR/CANOPEN PROTOCOLS).
Identification of the modules at the bus.

Each one of the elements integrated into the CAN bus is identified by its address or node number. The CNC must always occupy position "0" and the rest of the elements of the bus will occupy consecutive positions starting with 1.

The node address or number also sets the priority of the group within the bus; the lower the number the higher the priority. We recommend to set the priority of the groups as follows (from highest to lowest).

- The groups that have the feedback inputs.
- The groups that have analog inputs and outputs.
- The groups that have digital inputs and outputs.
- The keyboard and jog panel

Configuring the address (node number). RIO5, RIOR and RIO70 series remote modules.

·ADDRESS· selector. Address (node) of the element within the bus.

Each one of the elements integrated into the CAN bus is identified by the 16-position rotary switch (0-15) "Address" (also referred to as "Node_Select"). With the "ADD MSB" switch, the positions or elements integrated in the CAN bus may be expanded up to 32.

In order for any change at the "Address" switch to be assumed, the CNC must be restarted and the corresponding drive must be reset, however, we recommend to change the address while the modules and the CNC are off.

The "Address" switch also sets the priority of the group within the bus; the lower the number the higher the priority. We recommend the keyboard and jog panel to be the last node of the bus.

·ADD MSB· selector Address (node) of the element within the bus.

At RIOR and RIO70 series modules, with the "ADD MSB" switch, the positions or elements integrated in the CAN bus may be expanded up to 32. Positions 0-15 are selected with ADD MSB=0 and positions 16-31 with ADD MSB=1.

ADDRESS	0	1	2	3	···	13	14	15
ADD MSB =0	0	1	2	3	···	13	14	15
ADD MSB =1	16	17	18	19	···	29	30	31

Configuring the address (node number). RIOW series remote modules.

ON

The dipswitch may be used to select the address of the node and the transmission speed.

The address (node number) of the group is selected while the module is off. Select the speed by putting the corresponding dipswitches in the ·on· position. The binary meaning of each dipswitch increases according to its number; dipswitch ·1· for address 1, dipswitch ·3· for address 4 and so on.

| Address ·1·. | Address ·3·. | Address ·9·. |

Identification of the first and last elements of the bus. Line terminating resistor.

In the CAN bus, it is necessary to use a line terminating resistor to identify which are the elements that occupy the ends of the bus; i.e. the first and last physical element in the connection. For the central unit, the terminating resistor is factory installed because the CNC is always at one end of the bus.

RIO5, RIOR and RIO70 series remote modules. ·ST· selector.

0   1

The ·LT· switch identifies which are the elements that occupy the ends of the CAN bus; i.e. the first and last physical element in the connection.

The switch position of the terminating elements must be "1" and that of the rest of the elements "0". The central unit must always be at one end of the line even when not having this switch. The other end of the line will be the last physical device of the bus.

RIOW series remote modules.

The RIOW series modules do not have a factory-installed line terminating resistor. The RIOW module mounted at the end of the bus must have a 120 Ω line terminating resistor between pins CAN_H and CAN_L to avoid signal deflections (rebounds).

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CAN BUS (CANFAGOR/CANOPEN PROTOCOLS).

Identification of the modules at the bus.

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8.2 Type of CAN bus and baudrate.

Bus type selector: CANfagor / CANopen.

The CNC has two types CAN bus: CANfagor and CANopen. There are specific remote modules for each type of bus; at the CNC and at the operator panels, the type of active CAN bus must be selected.

Bus type selection at the CNC.

At the CNC, the type of CAN bus is selected by means of the machine parameters (parameter CANMODE),

8.3   Selecting the baudrate for the CANopen bus.

When using the CANopen protocol, the transmission speed at the bus is defined in each node and they all must run at the same speed. The transmission speed depends on the total length of the bus. Using the following illustrative values; assigning other values may cause communication errors due to signal distortion.

Speed	Length of the CAN bus.
1000 kHz	Up to 20 meters.
800 kHz	From 20 to 40 meters.
500 kHz	From 40 to 100 meters.
250 kHz	From 100 to 500 meters. The speed of 250 kHz is only available to communicate with the keyboards and RIOW series remote modules; this speed is not available at the RIO5 series remote modules.

Selecting the speed at the CNC.

The CNC detects the transmission speed (baudrate) automatically by asking the rest of the nodes connected to it.

Speed selection at RIO5 remote modules.

SPEED
■ 1
■ 0

The speed is selected with the ·SPEED· switches.

In order for any change of speed to be assumed, the corresponding module must be reset; however, we recommend to change the speed while the modules and the CNC are off.

SPEED ■ 1 ■ 0	SPEED ■ 1 ■ 0	SPEED ■ 1 ■ 0	SPEED ■ 1 ■ 0
1000 kHz	800 kHz	500 kHz	500 kHz

The communication at 250 kHz is not available at the RIO5 series remote modules.

Speed selection at RIOR remote modules.

The speed is selected with the ·CO BR· switches.

In order for any change of speed to be assumed, the corresponding module must be reset; however, we recommend to change the speed while the modules and the CNC are off.

	DS ·2·	DS·3·	Speed	Length of the CAN bus.
	on	on	1000 kHz	Up to 20 meters.
	off	on	800 kHz	From 20 to 40 meters.
	on	off	500 kHz	From 40 to 100 meters.
	off	off	250 kHz	From 100 to 500 meters.

Speed selection at RIOW remote modules.

ON

The dipswitch may be used to select the address of the node and the transmission speed.

To select the speed of the node, the module must be in configuration mode (all the dipswitches in the ·off· position). After turning the module on in configuration mode, the top 4 LED's of the module blink indicating the speed selected at the module. The STOP LED corresponds to dipswitch ·1·, the RUN to dipswitch ·2·, the TX to dipswitch ·3· and the RX

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CAN BUS (CANFAGOR/CANOPEN PROTOCOLS).
Selecting the baudrate for the CANopen bus.

to dipswitch ·4·. The first time the module is configured, the TX LED blinks indicating that no valid speed has been selected.

> ℹ️ *If when turning the module on, all the dipswitches are not in the ·off· position, the position of the dipswitches will be the new address (node number) of the group.*

The first 4 dipswitches are used to select the speed; the rest must be in the ·off· position. To select the speed, put the corresponding dipswitches in the ·on· position.

Dipswitch ·1·	Dipswitch ·2·	Dipswitch ·3·	Dipswitch ·4·	Speed
Off	Off	Off	Off	1000 kHz
ON	Off	Off	Off	800 kHz
Off	ON	Off	Off	500 kHz
ON	ON	Off	Off	250 kHz

To save the selected speed, put dipswitch ·8· in the ·on· position. After saving the configuration, the corresponding LED's turn on to indicate the module speed. For 1 MHz, all four LED's turn on.

Once the speed has been selected, turn the module off by removing power and set dip-switch ·8· in the ·off· position. Bear in mind that the next time the module is turned on, the position of the dipswitches will indicate the address (node number) of the group.

8.4 Selecting the speed for the CANfagor bus.

When using the CANfagor protocol, the transmission speed at the bus is defined at the CNC (parameter CANLENGTH). The transmission speed depends on the total length of the cable. Use the following approximate values. Assigning other values may cause communication errors due to signal distortion.

Length (m)	Speed (KHz)	Length (m)	Speed (KHz)
20	1000	90	533
30	888	100	500
40	800	110	480
50	727	120	430
60	666	130	400
70	615	> 130	250
80	571		

8.

FAGOR

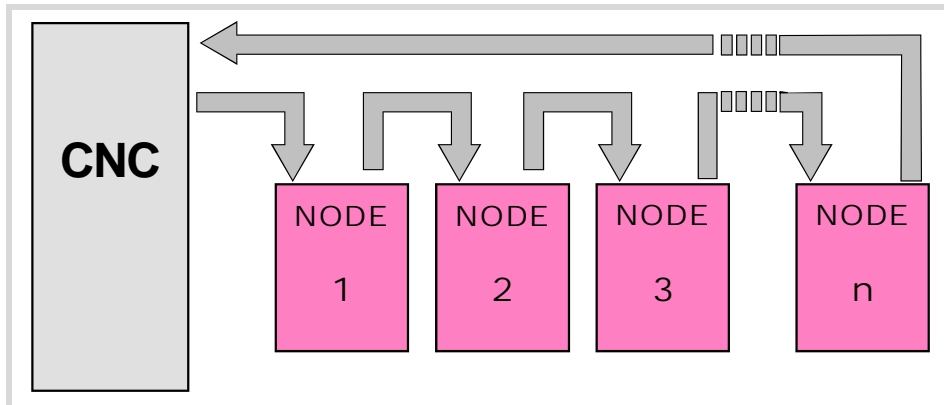**FAGOR AUTOMATION**

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9   SERCOS BUS.

The Sercos interface is a communications standard designed especially for the machine-tool world and that allows a simple interconnection between the CNC, drives and RCS-S modules. All the data and commands are transmitted in digital format through fiber optic lines that make up a ring (the Sercos ring) that connects all the elements of the bus to each other. Using the Sercos interface considerably minimizes the necessary hardware, makes cabling simpler and grants greater reliability to the system making it immune to electrical interference (noise).

Sercos cable characteristics.

Fagor Automation supplies the fiber optic cables needed for Sercos communication. There are several types of cable depending on their length and their dynamic and static installation characteristics.

- Fiber optic cable with polymer core (SFO, SFO-FLEX) for up to 40 meters. If the fiber optic cable is going to withstand dynamic conditions (moving), always use the SFO-FLEX cable If the fiber optic cable is going to withstand static conditions (not moving), always use the SFO cable

- Fiber optic cable with glass core (SFO-V-FLEX) for over 40 meters.

Mechanical cable characteristics.

SFO cable.	
Flexibility.	Normal. Minimum bending radius of 30 mm. Only to be used in static systems (not moving).
Cover.	PUR. Polyurethane resistant to chemicals used in machines.
Temperature.	Working: -20 ºC / 80 ºC (-4 ºF / 176 ºF). Storage: -35 ºC / 85 ºC (-31 ºF / 158 ºF).

| SFO-FLEX cable.	
Flexibility.	High. Minimum bending radius, static = 50 mm and dynamic = 70 mm. Special cable to be used in cable chains.
Cover.	PUR. Polyurethane resistant to chemicals used in machines.
Temperature.	Working: -20 ºC / 70 ºC (-4 ºF / 158 ºF). Storage: -40 ºC / 80 ºC (-40 ºF / 176 ºF).

SFO-V-FLEX cable.	
Flexibility.	Minimum bending radius, static = 45 mm and dynamic = 60 mm.
Cover.	PUR. Polyurethane resistant to chemicals used in machines.
Temperature.	Working: -40 ºC / 80 ºC (-40 ºF / 176 ºF). Storage: -40 ºC / 80 ºC (-40 ºF / 176 ºF).

9.
SERCOS BUS.

FAGOR AUTOMATION
CNC 8070
(REF: 1709)

Cable handling.

The cable provided by Fagor has its pins protected with a hood. Before connecting the cable, remove the protecting hood.
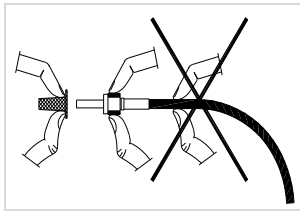
Both for removing the pins protecting hood for the pins and for plugging and unplugging the cable, hold the cable by its pin, never pull at the cable while holding it by its plastic part because it could make it useless.

9.

SERCOS BUS.

FAGOR

FAGOR AUTOMATION

CNC 8070

(REF: 1709)

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9.1   Module identification and connection

Node identification.

Nodes are identified with the 16-position rotary switch (thumbwheel) "Address" (also called "Node_Select") and for the RCS-S modules also with parameter SERCOUUNTID. This switch selects the address (node) occupied by each of the elements integrated into the Sercos connection. The CNC does not have the switch; this CNC is pre-configured to always occupy position ·0· at the bus.

The CNC must always occupy position 0 and the nodes will occupy consecutive positions starting with 1. In order for any change at the "Address" switch to be assumed, the corresponding node must be reset and the CNC powered off and back on.

Whether the drive identified with number 1 (for example) corresponds to the X axis, to the Y axis or to another one is irrelevant. However, it is a good idea, for clarity sake, that the machine axes X, Y, Z, U, V, W, A, B and C be assigned consecutive numbers in that order.

> ℹ️ *Then set certain CNC machine parameters to configure the connection.*

Module interconnection.

The Sercos connection is carried out in a ring using fiber optic cable by joining an OUT terminal with an IN terminal. The drawing shows the Sercos connection of the CNC with Fagor spindle drives and the X, Y axes.

CNC	SPINDLE	X AXIS	Y AXIS
Node = 0	Node = 3	Node = 1	Node = 2
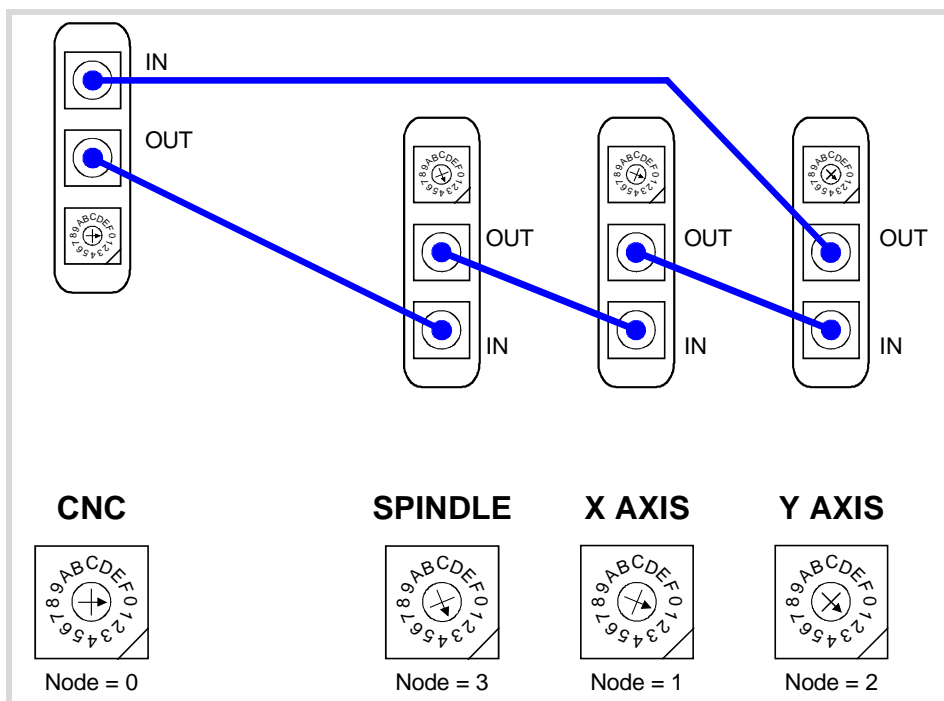
9.

SERCOS BUS.

Module identification and connection

FAGOR

FAGOR AUTOMATION

CNC 8070

9.2   Data exchange via Sercos.

The data exchange between the CNC and the drives takes place in each position loop. The more data is exchanged, the more overloaded the Sercos transmission will be. These registers should be limited leaving only the ones absolutely necessary after the setup.

There is data that must necessarily be transmitted in every position loop (velocity commands, feedback, etc.) and other data that may be transmitted in several loops (monitoring, etc.). Since the CNC must know the priority of those transmissions, there must be two separate transmission channels.

Cyclic channel (fast).

The data is transmitted in every position loop. It contains velocity commands, feedback, etc. Each variable that is read or written at the drive is included in this data pack. In order not to overload the interface, you must limit the number of drive variables involved to the minimum necessary.

Indicate the type of data to be transmitted. The data to be sent to the drives must be placed in certain particular registers of the PLC and the data to be read from the drives is received in other registers of the PLC.

Service channel (slow).

The data is transmitted in several position loops. It contains monitoring data, etc.

This channel can only be accessed through high-level blocks in the part-program or from the PLC channel.

User notes:

User notes: