

**FCT640**
Short Guide

Doc. TR301901
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**DANGER: safety instructions**

Failure to follow the safety instructions included in this document may result in danger of death, injuries or material damages. For a safe operation, respect all the safety instructions here contained. The responsible of the safety must ensure that the entire personnel has read and understood the contents before the use of the product.

The FCT640 controller must be installed, used and uninstalled by technical personnel that is expert and informed about the risks of the application and the operative conditions; its use is not appropriate as safety component.

**DANGER: installation environment**

The FCT640 controller is designed for the use in the industrial environment inside a closed zone that can be accessible by an expert operator (e.g. electric panel).

The controller must not be used in explosive or corrosive environment, in presence of flammable gas, in places subject to water splash or near combustibles. There can be risk of fire, electric shock or injuries.

In case of malfunctions due to accidental causes or errors in the wirings, the supply part could cause electric arcs in extreme situations. Therefore the controller must be installed in an environment without flammable elements. This product is intended to be exclusively used in machines and systems in industrial environment, by respecting the described application, environmental and functioning conditions. It is recommended not to use the product for any further purpose than those specified.

**Note: purpose of the document**

The purpose of this guide is to provide basic information for the product installation and to allow the user to familiarize with the main characteristics. It is recommended to keep this document with the product. For further information about the FCT640 contact CMZ SISTEMI ELETTRONICI S.r.l..

Thank you for your preference on CMZ SISTEMI ELETTRONICI S.r.l. products.

The FCT640 is a device with high performances and high technological integration for the field-bus control for the EtherCAT, CANopen¹ peripheral management, with communication on

¹Only for products with cod. FCT640.2100.xxx.xxx

Ethernet network. Like other CMZ products, it includes functions as axis controller, PLC, local and distributed network master controller. For the programming of the device it can be used the CODESYS environment with IEC 61131-3 language.

The FCT640 has been designed for the industrial environment: for details about its characteristics see [Technical features](#).

The FCT640 can be used to realize a control system that includes analog and digital I/Os, and other TB20 peripherals: for informations see the manual *"TB20 – Digital, Analog, and System Modules"*: as regards to the FCT640, the present document gets the priority. In order to realize a TB20 control system with FCT640 it is necessary to install the controller as first element to which eventual local modules will be connected.



Tip: complementary information

Before the reading of this document it is recommended the comprehension of the manual *"TB20 – Digital, Analog, and System Modules"*, that can be requested to the supplier.

1. Packaging

The packaging is made by cardboard with an internal nylon film.

The package includes:

- the FCT640 controller;
- the removable connector for X1 (already installed);
- battery CR2032 (already inserted);
- protective cover for the lateral contacts, in the absence of modules (already installed).

Before beginning to work with the controller, verify that there are no visible damages. Be sure that the FCT640 controller found in the package is the correct model for the application, that corresponds to what has been ordered and that can be provided a proper voltage and a supply system according to the specifications written in this document.

2. Precautions for the product handling

Do not keep the product in the stock without the original package. Open the package just before the installation. Do not stack the packages and comply with the indication that are written in this document.

Pay attention to comply with the environmental condition that are required (see [Table 2](#), *"Generic features"*).

**WARNING: components damage**

The package content includes ESD-sensitive parts with high risk to be damaged (e.g. contacts on the right side and internal components). Avoid any contact with non ESD-safe material or use proper ESD-safe protections before touching the equipment and avoid to move close materials that may potentially be ESD-charged (such as insulating materials non-dissipating or conductive unearthed parts).

In case the FCT640 is installed without local modules it is recommended to always protect the lateral contacts through the protective cover accessory.

3. Dimensions and sizes

Lateral right and frontal views of the FCT640.

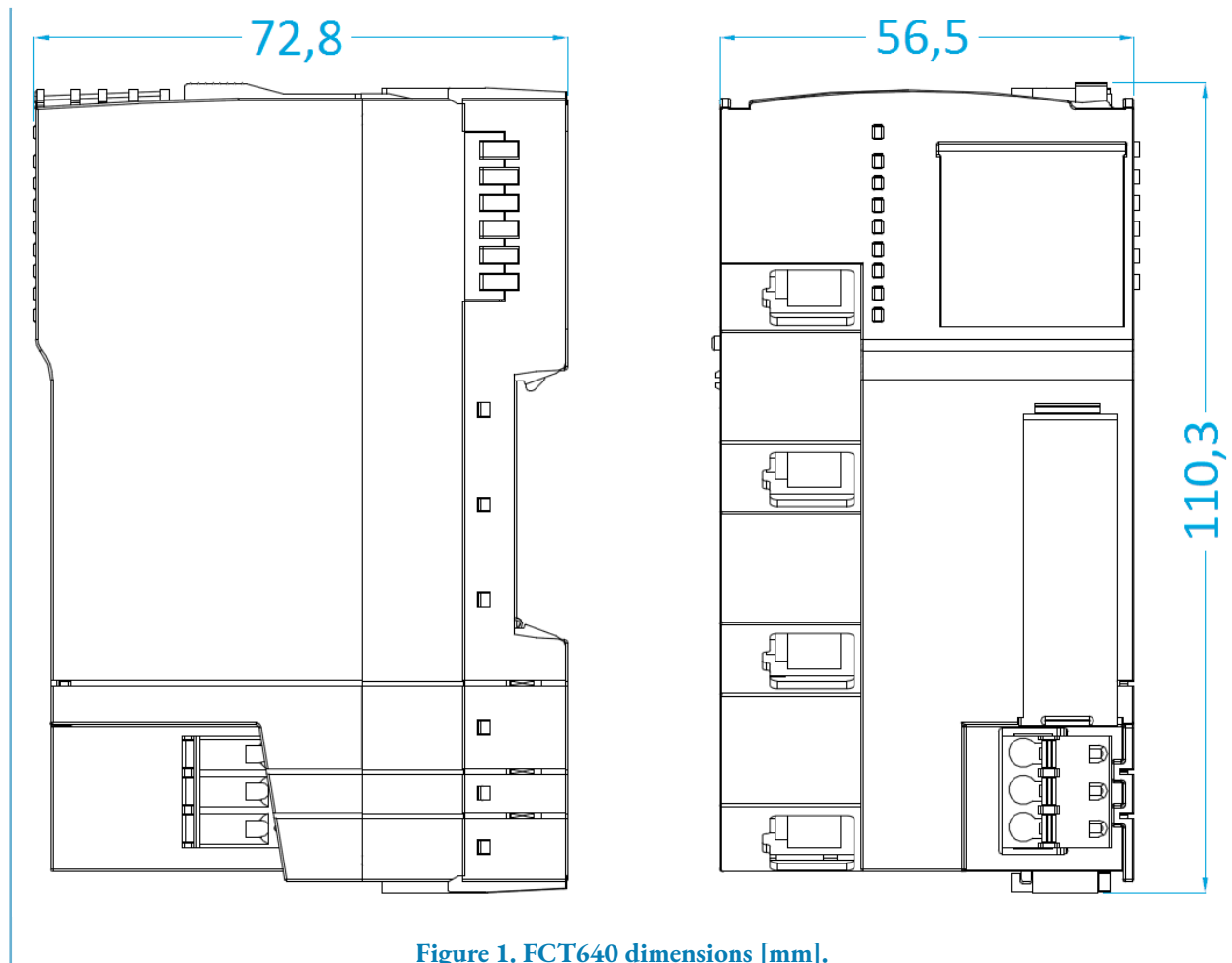


Figure 1. FCT640 dimensions [mm].

- The DIN rail must be "top hat" type according to the EN 60715, with height 35 mm, thickness 1 mm, not subject to corrosion and with clean and conductive surface;
- Indicative weight: about 230 g.

**WARNING: functional earth**

The DIN rail connects to the system functional earth: connect it to the panel ground.

4. Installation and disassembling

In order to optimize the thermal dissipation the controller must be installed in vertical position (with X1 as lower connector), with DIN rail horizontal. The DIN rail must be firmly fixed to the internal back of the electrical panel.

The FCT640 system installation must provide the dissipation of the heat that is generated by the system itself through the upper/lower air vents, by guaranteeing a sufficient free volume inside the panel in which it is installed. In fact the system produces heat that must be dissipated inside the panel and for this reason it is absolutely necessary to guarantee a minimum air convection from the other devices.

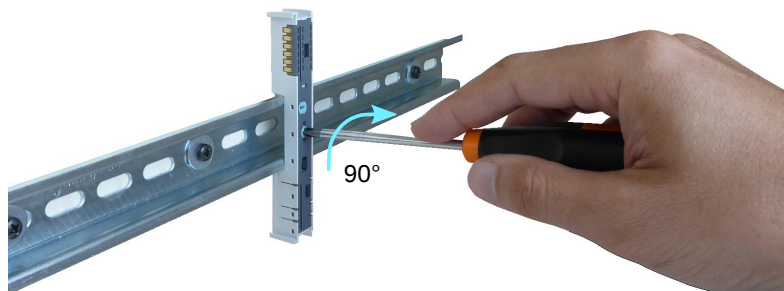
The FCT640 and eventual additional modules must be installed leaving free at least 10 cm on the top and bottom sides and 5 cm on the lateral sides, and avoiding hot zones in the panel as drives or motor braking resistors and the zones with EMC interferences.

Assembling

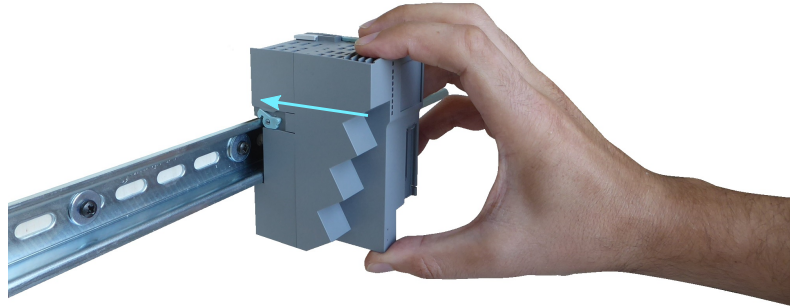
1. In case the backplane connector is separated, fix the base for the modules on the DIN rail by making a quarter of clockwise revolution (90°) on the star-shaped insert on the module center.

**Important: modules installation**

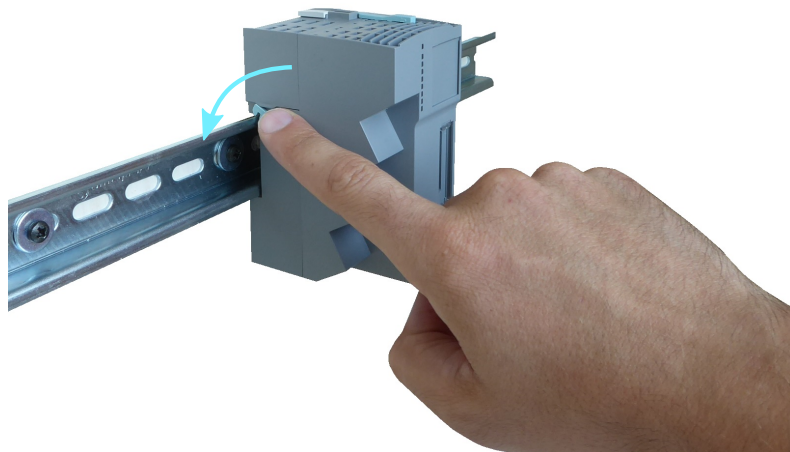
Do not force the modules insertion on the backplane connector: previously check that the orientation of the coding insert is compatible with the orientation of the insert on the FCT640 back.



2. Insert the device in the backplane connector, by sliding it perpendicularly to the DIN rail. Push it towards the backplane connector until the blocking device springs (until a slight "click" can be heard).

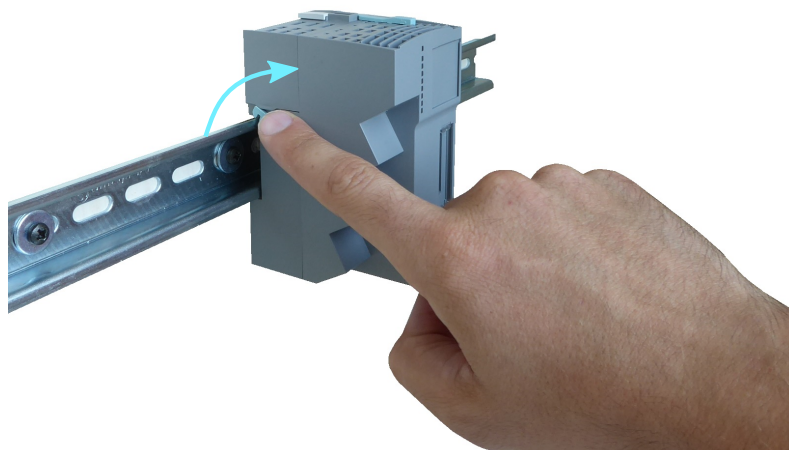


3. Rotate counterclockwise the blocking lever on the left of the device in order to fix its position on the DIN rail.

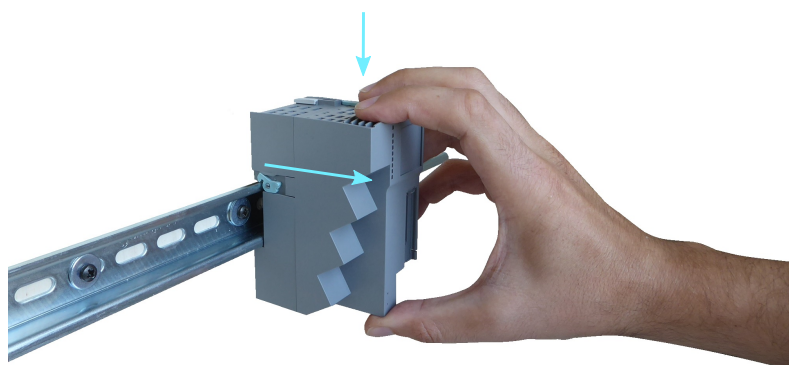


Disassembling

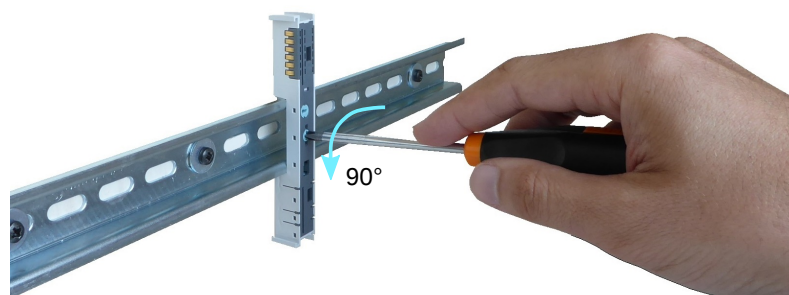
1. Rotate clockwise the blocking lever on the left of the device in order to free its position on the DIN rail.



2. While pushing the lever, pull the device perpendicularly to the DIN rail. In this way the backplane connector will remain anchored to the DIN rail: this allows a faster substitution of the controller.



3. Remove the base for the modules from the DIN rail by making a quarter of revolution (90°) counterclockwise, on the appropriate star-shaped insert on the module center.



5. Electrical connections

Required instruments, materials and equipment

For the correct functioning of the controller, protection included, the installation of the following components is required:

- **Fuse** (slow-blow fuse, max. 8A) to be installed in series to the following pins of X1: L+ and AUX (only if used). It must protect the internal electronics of the FCT640 in case of short-circuit or overload.
- **24 V_{DC} power supply** to be connected to the L+ (+) and GND (-) signals of X1. The power supply must have a stabilized output voltage and output current adequate to the absorption of the FCT640 and of the connected modules (in case the AUX signal is used, it is necessary that a compatible source is connected to the AUX (+), GND (-) signals of X1).



CAUTION: protective fuses

The FCT640 is not internally protected against the overload or short-circuit on the supply section. Protect the product with fuses that complies with the technical data and the local regulations.

5.1. Precautions during the wiring

Before supplying the FCT640, the DIN rail must be wired to the panel earth for EMC compatibility: through it the spring contacts connect the controller to the earth.



CAUTION: current on the connector

Do not exceed the 8A limit on each pin of the connector X1. In case of higher absorption use the proper supply modules TB20.



Important: grounding contact

The correct functioning of the FCT640 needs the earthing of the DIN rail is made through a reliable contact of the DIN rail posterior springs. Avoid any mechanical strain on the controller in order to not risk to interrupt the electrical connection.

The wiring of the connector X1 must respect the SELV/PELV requirements and the SELV/PELV circuits segregation and insulation requirements in relation to the different kind of cir-

cuits. Furthermore the wiring must be made with wires that are appropriate to the application, according to the temperature and insulation voltage of the other circuits with higher voltage.

- Do not use power suppliers with characteristics that are different from the indicated ones.
- Do not connect more power suppliers in series and/or parallel in order to avoid to exceed the limitations of the certified voltage/current rating.
- Do not reverse the supply polarity.
- Do not connect the power supply to the FCT640 without the protection of the fuses that are indicated in *Required instruments, materials and equipment*.

6. Expansion modules connection

For the connection of the modules to the controller, refer to the *"TB20 – Digital, Analog, and System Modules"* manual, that can be downloaded from the CMZ website: cmz.it.

The maximum number of modules that can be connected to and managed by the FCT640 is 64. This number may not be reached due to the different current absorption of each module (the total current that can be provided by the FCT640 is reported in the *Technical features*). In case it is necessary, it is possible to insert some power modules that compensate for the supply decrease. The power modules has not to be added to the counting of the 64 modules that can be managed by the FCT640.



CAUTION: final module cover

Always install the protective panel on the last module, so that it is protected against accidental contacts with conductive materials.
(The order code of the protective panel is 640-920-9AA01).

7. CE compliance

The FCT640 controller respects the following European directives:

- 2014/30/UE relating to electromagnetic compatibility;
- 2006/66/EC on batteries and accumulators and waste batteries and accumulators.

in conditions in which the instructions in the user documentation are respected and there are not particular work environment or installation needs.

CMZ SISTEMI ELETTRONICI S.r.l. guarantees the conformity of the controller to the following harmonized standards:

EN 61131-2:2007

Programmable controllers - Part 2: Equipment requirements and tests

The system integrator has the responsibility to guarantee that the product or the final system comply to the pertinent regulations that are in force in the country in which the product (or the entire system) is used.



DANGER: risk analysis

The machine user that uses the FCT640 controller must execute a risk analysis of the machine and must implement proper actions in order to ensure that any unexpected event may cause damage to any person or to the machine.

8. Technical features

Main supply section	
Rated voltage	24 V _{DC} (-15% / +20%)
Internal protections	Polarity reversal
Absorbed current @ 24 V _{DC}	350 mA (continuous, no modules connected) 550 mA (peak, no modules connected)
Maximum output current (for the modules supply)	2,5 A

Table 1. FCT640 electrical features.

Other data		
Supply protection	Undervoltage	< 17 V _{DC}
Surrounding air temperature	0 ÷ +40 °C	
Storage ambient temperature	-20 ÷ +50 °C (for long storage time) -20 ÷ +70 °C (for short storage time)	
Relative humidity of storage and operation (without condensation)	+5 ÷ +95 %	
Weight	About 230 g	
Maximum altitude	4000 m [s.l.m.]	
Ventilation	Natural convection	
Pollution degree	2	
Protection degree	IP20	
EMC zone	B (general industrial environment)	
Communication ports	3xRJ45	Ethernet 10/100 Mb/s (X2, X3, X4 with X2 default for Debug/PC/CODESYS/HMI)

Other data		
	1xRJ45 ^a	CAN bus (X5)
Fieldbus	EtherCAT Master (X2, X3, X4), CANopen Master (X5) ^a	
Processor	RISC, dual-core 1.0 GHz 64 bit, 3 level cache	
Volatile memory	DRAM 512 MB DDR3L-1600	
Retentive memory for application	MRAM 32 KB	
Mass storage	Flash NAND 1GB	
Retentive memory extension	SD Card	
Clock	Internal RTC with backup through battery CR2032 (included)	
Operative system	real-time	
Programmability	CODESYS, CMZ libraries	
Language	IEC 61131-3	
Modularity	extensible up to 64 local modules	
Status report	9 leds	
Buttons	reset, recovery	

^aOnly for products with cod. FCT640.2100.xxx.xxx

Table 2. Generic features

9. Connectors

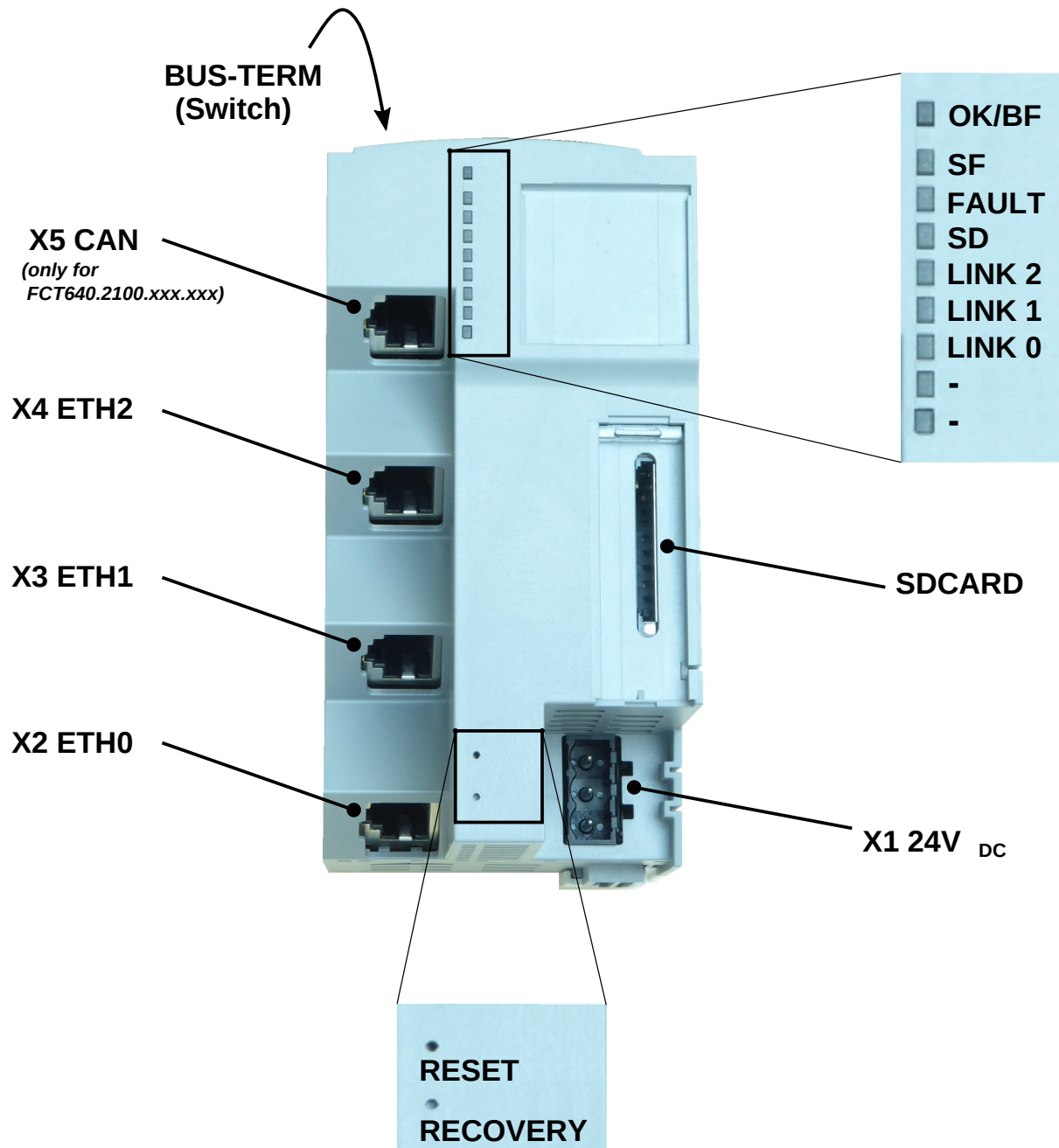
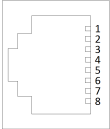
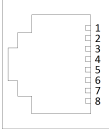


Figure 2. Connectors arrangement.

X1 Control supply (removable connector) 	Metz SP06603VBNC		
	Connector type	-	female extractable
	Poles number	-	3
	Stranded copper conductor section	[mm ²]	0,8 ÷ 2,5
	Rated voltage	[V _{DC}]	24
	Rated current	[A]	8

	<table><tr><th>PIN</th><th>Signal</th><th>Description</th></tr><tr><td>1</td><td>AUX</td><td>Terminal for the additional voltage potential 0 ÷ 24 V_{D.C}(ref. to GND)</td></tr><tr><td>2</td><td>GND</td><td>Ground Control Supply</td></tr><tr><td>3</td><td>+24 V_{DC}</td><td>+24 V_{DC} Control Supply</td></tr></table>	PIN	Signal	Description	1	AUX	Terminal for the additional voltage potential 0 ÷ 24 V _{D.C} (ref. to GND)	2	GND	Ground Control Supply	3	+24 V _{DC}	+24 V _{DC} Control Supply
PIN	Signal	Description											
1	AUX	Terminal for the additional voltage potential 0 ÷ 24 V _{D.C} (ref. to GND)											
2	GND	Ground Control Supply											
3	+24 V _{DC}	+24 V _{DC} Control Supply											
X2, X3, X4 Eth-  ernet	ELITALIA MJ99-88AB												
	Connector type		- RJ45 female ^a										
	Poles number		- 8										
	Network interface		- 10/100 BASE-T										
	Bit rate		- 10/100 Mb/s										
	Autonegotiation		- Yes, with HP Au-to-MDIX technology										
	Cable		- CAT-5 S/FTP ^b (or better)										
	Characteristic impedance Z ₀		[Ω] 100										
	Maximum cable length		[m] 100										
	PIN	Signal	Description										
	1	TD+	Transmit data +										
	2	TD-	Transmit data -										
	3	RD+	Receive data +										
	4	-	Not connected										
	5	-	Not connected										
	6	RD-	Receive data -										
	7	-	Not connected										
	8	-	Not connected										
	X5 CANopen^c 	ELITALIA MJ99-88AB											
Connector type		- RJ45 female ^a											
Poles number		- 8											
Network interface		- CAN (ISO-11898 v2.0 Part B)											
Communication protocol		- CANopen DS301											
Baud rate		kbaud/s 50/125/250/500/800/1000											
Termination resistor		[Ω] 120 (see <i>Switch for the CANopen termination resistor (BUS-TERM)</i>)											
Cable		- CAT-5 S/FTP ^b (o better)											
Characteristic impedance Z ₀		[Ω] 120 (100 Ω ≤ Z ₀ ≤ 150 Ω)											
PIN		Signal	Description										
1		CAN_H	CAN high										
2		CAN_L	CAN low										
3		CAN_GND	CAN ground										

	PIN	Signal	Description
	4 ÷ 9	-	Not connected

^aTo guarantee a higher reliability of the connection, it is suggested to use a connector with a shield-clamping collar.

^bThe S/FTP cable is provided with shielding of the single twisted pairs in aluminium foil and copper clad braid screen.

^cOnly for products with cod. FCT640.2100.xxx.xxx

9.1. SD Card slot

The FCT640 system includes an external interface for SD Card memory boards accessible by lifting up the frontal transparent window. The SD Card port allows different functionalities including the mass data storage and the automatic update of the system software.

The port is protected against overload and short-circuit of the SD card through the electronic current limit with signal report on the fault led.

In the *Table 3, "SD Card characteristics."* the main characteristics of the SD card, that can be used with the system, are reported.

Insert the card up to the 'click'.

To remove the card it is sufficient to push and release it (push-pull slot).



Important: precautions with the SD Card

After the use of the SD card it is recommended to remove it and close the frontal transparent window: that is useful to avoid the entrance of humidity, dust, and extraneous particles inside the device. Always close the SD card slot when it is not inserted.

Supply voltage	[V _{DC}]	3,3
Overload protection threshold	[mA]	400
Standard	-	SD Card Specification Ver.2.0

Table 3. SD Card characteristics.



Important: SD Card type

CMZ recommends to use the S-250 series of Swissbit SD cards, after having tested their compatibility with the controller and by recognizing a performance that is suitable with industry about temperature range and data retention reliability (SLC technology). The available sizes are 512 MB, 1 GB and 2 GB and it is possible to purchase the 1 GB version directly from CMZ.

10. Leds

For the leds disposal see *Figure 2, "Connectors arrangement."*

The leds, placed on the upper-front side of the FCT640, may assume the following states:

- *OFF*: led switched off;
- *ON*: led switched on;
- *BLK* (blinking): led 500 ms on, 500 ms off;

The notifications meaning of the leds (in top-down order) can be found in the following table:

Leds	Colour	Status	Meaning
OK/BF	-	OFF	Not supplied system
	BLU	ON	System ready, configuration complete
		BLK	System in start-up or unable to pass to the operative cycle due to a wrong configuration of the modules (missing, wrong, ...)
	RED	ON	At least one module is in error and provides a diagnostic report message (for example "wire break")
SF	-	OFF	No system error (or backplane bus error)
	YELLOW	ON	The installed plug-in module model is wrong or it is not CMZ SISTEMI ELETTRONICI S.r.l.
		BLK	Module missing (at the start-up) / module removed (during the operation)
FAULT	-	OFF	System correctly started without alarms
	ORANGE	ON	System in Debugger mode
	RED	ON	System software update in progress
		2 BLK	Internal RTC Clock not set or its backup battery has ran out
		3 BLK	HW initialization error (Ethernet or other resources)
		4 BLK	Overtemperature reached
SD	-	OFF	SDCard not inserted
	RED	BLK	The system is accessing the memory card in reading or writing
	ORANGE	BLK	Current overload of the memory card. Remove the device.
LINK 2	-	OFF	Communication not active on ETH2 port
	GREEN	BLK	Communication active on ETH2 port
LINK 1	-	OFF	Communication not active on ETH1 port
	GREEN	BLK	Communication active on ETH1 port
LINK 0	-	OFF	Communication not active on ETH0 port
	GREEN	BLK	Communication active on ETH0 port
-	-	OFF	Not used
-	-	OFF	Not used

Table 4. Description of the leds for FCT640 controller.

11. Buttons and switch

For the arrangement of the buttons and the switch refer to *Figure 2, "Connectors arrangement."*

Button 1 (RESET)

This button, that can be pushed through a pointed tool (diameter < 0,8 mm), allows to put the system in a predefined status stopping the application, that is the Boot status. For further details refer to the software manual.

Push the button and release it. Wait until the third led "FAULT" remains steady ON.



CAUTION: precautions for the reboot

If it is pushed during the functioning it interrupts every procedure/activity of the FCT640 and of the local modules connected to it. Be sure that the reset request does not imply a risk for the safety of any person or for the damage of the machine or for the loss of data.

Button 2 (RECOVERY)

This button is used to delete the application (File System format: application, parameters, user files, ...), while the firmware and the licenses are not deleted.

The "RECOVERY" sequence, which is reported here below, is intentionally laborious in order to avoid that the application is deleted by mistake or without intention.

1. execute a reset through the *Button 1 (RESET)* waiting that the third led "FAULT" remains steady ON;
2. hold the *Button 2 (RECOVERY)* pushed until all the leds turn on, then release the button;
3. push the *Button 2 (RECOVERY)* three times, at a distance of 2 seconds from each other (in this phase the lowest led corresponds to the button status: it turns-on when the button is pushed. Wait its turn-on before releasing the button);
4. Push the *Button 2 (RECOVERY)* the fourth time and hold it until all the leds are on, then release the button;
5. after about 10 seconds the application is deleted. The leds blink more and more faster, to indicate the approaching of the deletion. The procedure can be interrupted before the time elapses, by cutting out the system supply (turning it off);

Switch for the CANopen termination resistor (BUS-TERM)

This controller contains a termination resistor for the CANopen network that can be inserted or not, according to the need. Its configuration (reported by the written "ON" and "OFF" on the left side of the controller, in correspondence with the switch itself) is described in the *Table 5, "Setting of the switch (BUS-TERM)."*

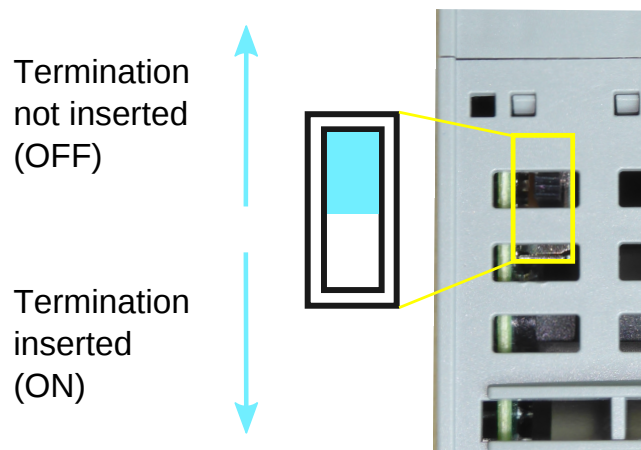


Figure 3. CANopen termination resistor switch

Position	Resistor status
OFF	Termination resistor not inserted
ON	Termination resistor inserted (DEFAULT)

Table 5. Setting of the switch (BUS-TERM).

The modification of the BUS-TERM switch position is necessary only if the FCT640 is not the final node of the CAN network: the operation must be carefully executed by an expert operator after the controller has been disconnected from any other device, power supply and additional modules included; then it is necessary to move the switch by inserting a flat-blade screwdriver 0.5 x 3 mm in the air vent indicated in *Figure 3, “CANopen termination resistor switch”*.



CAUTION: BUS-TERM switching

Modify the BUS-TERM switch position only after the FCT640 complete disconnection from any power source and the turning off of all the leds. Exclusively use the indicated object through the dedicated air vent. In all the other cases DO NOT introduce any object in order to avoid internal damages!

12. Battery

The FCT640 is provided with a system clock supplied by a backup battery that allows the maintenance of the related data in case of 24 V_{DC} supply missing. The battery is already installed and working inside the system. In case of internal clock setting loss after the turn-off of the system, and in any case after 10 years, it will be necessary to replace the internal battery.

For its substitution exclusively use a battery which characteristics are below reported: after it, the setting of the system date/hour will be necessary.



CAUTION: battery substitution

The FCT640 controller chassis can be opened only in order to substitute the internal battery: this operation is delicate and must be executed by an expert operator according to precise instructions that can be requested to the system supplier. Pay attention to the substitution operations and to the correct polarity of the battery during its substitution since the system contains components that are sensitive to ESD disturbance and it is not protected against the polarity reverse of the battery.

The battery characteristics are the following:

Characteristic	Value
Type	CR 2032 (e.g. VARTA mod. 6032 101 501) ^a
Material	Lithium, not rechargeable, (LiMn204, Lithium content 0,07 g)
Rated voltage	3,0 V
Capacity	200 mAh min.
Absorption	1µA max.
Service life	10 years
Absorption	1 µA max.

^aPay attention to the compatibility with the application temperature range.

Table 6. Backup battery features.

13. First system switch-on

The following components must be available in order to execute the first switch-on of the system:

- FCT640 and material indicated in *Required instruments, materials and equipment*;
 - PC with Ethernet port; required applications: FCTTool (from CMZ website) and CODESYS 3.5 or higher;
 - Ethernet cable RJ45-RJ45 cat. 5 S/FTP.
1. Install the FCT640 according to the requirements indicated in *Installation and disassembling* and *Electrical connections*;
 2. Connect point-to-point the Ethernet cable between the PC and the connector X2 of the FCT640; take note of the MAC address related to the connector, as reported on the FCT640;
 3. Supply the FCT640;
 4. Identify the MAC address previously obtained through FCTTool: then configure the identification parameters of the network in which the FCT640 has to be used; if this step is not fulfilled at the FCT640 network settings, default values are assigned;
 5. Connect the FCT640 to the configured network and reboot it.

**Important: lacking information**

This section is dedicated to the first installation and is not complete with all the operations that are necessary for the product use. For specific details refer to the FCT640 complete manual.

14. Methods of product disposal at the end of life

The device must be disposed as electrical or electronic waste. The packaging of the product is of good quality and can be re-used. For the recycling or the disposal of a product or of a packaging, CMZ exhort to respect the current regulations and the more appropriate procedures.

**CAUTION: battery damage**

In order to avoid explosions and damages to things or people, it is recommended to not recharge or short-circuit the battery, not expose it to heat source, not put it under mechanical strain.

**Important: battery disposal**

Before disposing the product it is recommended to remove the internal battery and dispose it separately according to the local regulations.

15. Safety precautions

**WARNING: preventive supply cut-off**

Before any operation on the product, cut-off the power supply and verify the risk absence for all the devices that are connected and which functioning depends on the FCT640.



CAUTION: contents and responsibility

CMZ SISTEMI ELETTRONICI S.r.l. reserves the right to make modifications to the products that are described in this document at any time and without notice.

This document was written by CMZ SISTEMI ELETTRONICI S.r.l. only to be used by its customers, providing the most updated version related to the products at the date of publishing.

It's intended that the documentation use by the user is under its own responsibility and that the use of certain functions that are described in this document must be made with the due care, so that to avoid danger for the personnel and damages to the machines.

No other warranty is provided by CMZ SISTEMI ELETTRONICI S.r.l., in particular for possible imperfections, incompleteness, and/or any other difficulties.

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Important: long-term storage

Avoid long periods of storage that may imply the damage of the system due to the possible leak of corrosive substances from the battery and its discharge. In order to avoid it, in case the product remains unused for a of long period, it is recommended to physically remove the internal battery: for the instructions about this operative procedure contact the supplier of the system.



Important: tampering and warranty

The FCT640 controller must not be opened or disassembled by the user. The opening of the plastic cover of the FCT640 is allowed only in case of the substitution of the battery and must be made by an expert operator according to precise instructions that can be requested to the supplier support. For all the other maintenance operations contact the CMZ Technical Support (references at the end of the present document). In case of alteration of the controller the warranty is void.



For support please contact:

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