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**CMZ hardware**

# **FCT241**

*Doc. TR300502  
Ed. 0 - English – 01 December 2005*

## **IMPORTANT**

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## **PURPOSE OF THE USER GUIDE**

This guide describes the hardware of the controller system **FCT241**.

It gives information of a general nature regarding the functions and the structure of the controller system. All the data and specifications necessary for connections and commissioning are also provided.

### **NOTE**

Prior to installing this hardware it is recommended that the user consult the guide “Electromagnetic disturbance”, which gives some suggestions on how to carry out the various connections between the FCT241 and other external systems in order to reduce interference to a minimum.

## Section 1. THE SYSTEM FCT241

The system FCT241 is a black box controller containing a *CANopen-oriented* PowerPC processor that may be programmed according to standard IEC61131.

It requires an alternating current supply at 18Vac or 24Vdc. The system allows communication with standard CANopen protocol (two ports) to decentralise CANopen peripherals, an Ethernet interface for debugging or communication with other intelligent units, a serial RS232 also for debugging or communication with other intelligent units and the option of an expansion on Profibus field bus. There is also a CompactFlash slot for updating firmware. The hardware features of the central processor and of the communication peripherals are listed below:

CPU
Motorola MC8241 Microprocessor (266MHz)
32 Mbyte at 64 Bit SDRAM Memory Bus (up to 128Mhz)
1MByte Flash EPROM
32 MByte serial Flash (program and user data)
128 Kbyte SRAM buffered (program and user data) with Real Time Clock and integrated WD timer
4 Kbyte I <sup>2</sup> C EEPROM (system parameters)
Temperature sensor with I <sup>2</sup> C communication

COMMUNICATION PERIPHERALS
1 optoisolated RS232C port - DSUB9F connector
2 optoisolated CAN ports - DSUB9M connector
1 Ethernet port - RJ45 connector
1 port for CompactFlash Type I 3.3Vdc with ATA 16 Bit driver
1 optoisolated Profibus port - DSUB9F connector

Figure 1.1 gives a 3-D view of the FCT241 system. For overall size and the mechanical details of the system, see the section MECHANICAL FEATURES.

Figure 1.2 shows a possible application of the system. The high capacity of CANopen network decentralisation should be noted in particular, with remote peripherals for I/O or brushless motor driver management. Communication with an operator panel is possible through the serial RS232.



Fig. 1.1 System FCT241

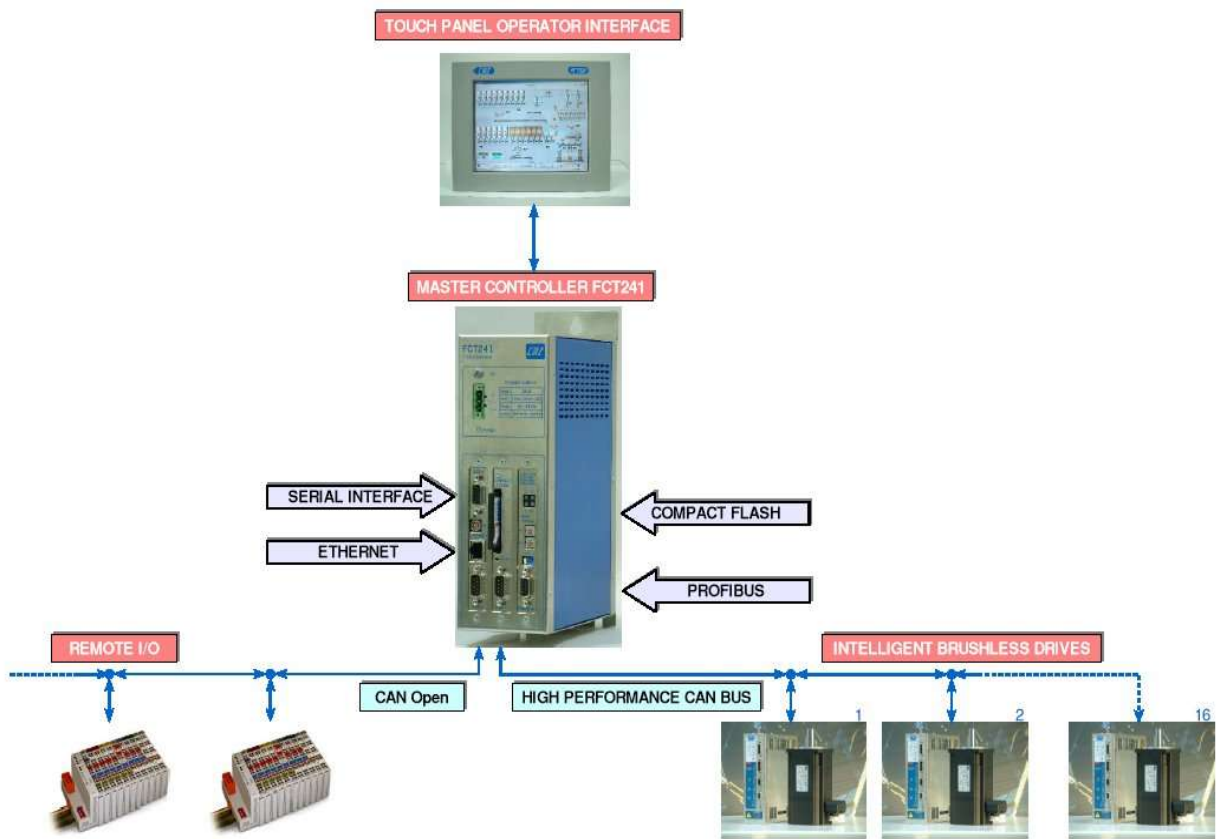


Fig. 1.2 Block diagram of application with FCT241 system

## Section 2. CONNECTIONS

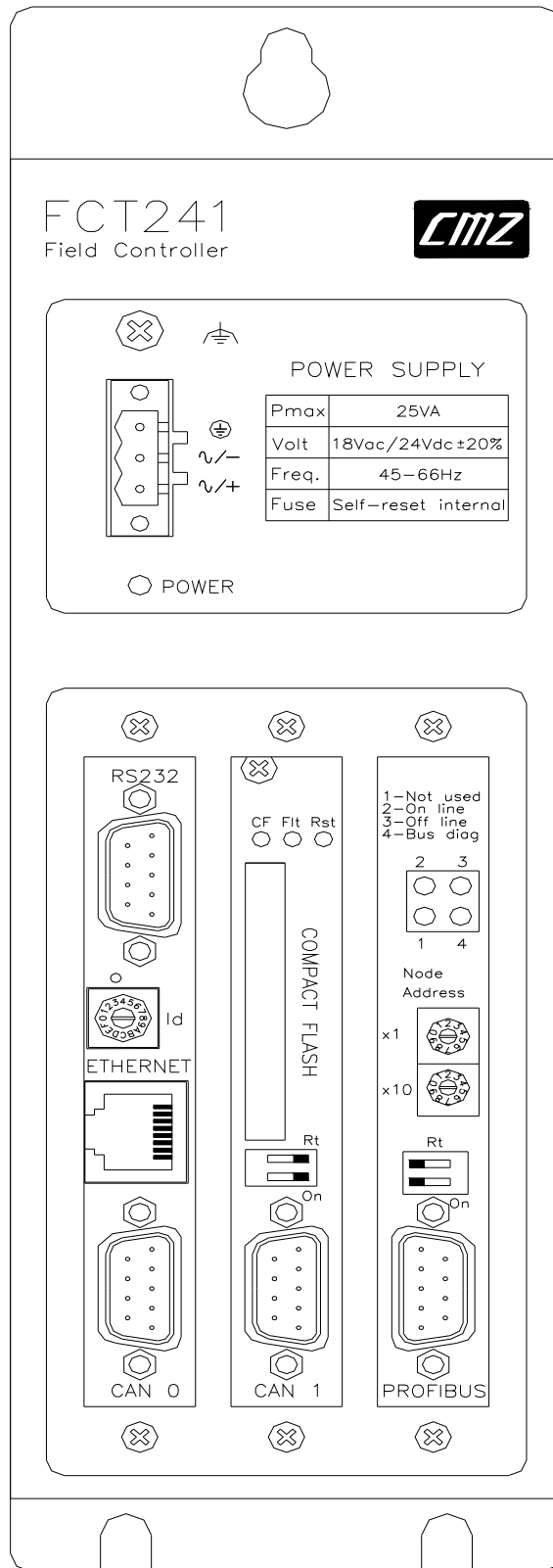
### 2.1 INTRODUCTION

The power supply sections and the FCT241 system communication interfaces are described in this section.

Figure 2.1 gives a front view of the system showing the power supply section, the slots with the communication interfaces/ports, the LEDs and the dipswitches. There are three slots for the following peripherals:

- communication port RS232 (first slot)
- communication port CAN0 (first slot)
- communication port CAN1 (second slot)
- Ethernet communication port (first slot)
- CompactFlash card interface (second slot)
- Profibus communication port (third slot)

All these communication peripherals will be described in more detail in the following paragraphs.



**Fig. 2.1 Front view of system FCT241**

## 2.2 POWER SUPPLY

### 2.2.1 General information

The power supply section consists of a power supply unit that receives an input of 18Vac  $\pm$ 20% or 24Vdc  $\pm$ 20% and supplies the necessary voltages to the motherboard for operation of its logic sections and communication interfaces; it also supplies the power-fail and reset signals to the motherboard.

All the voltages related to the logic section and to the communication sections are isolated from the external 18Vac or 24Vdc supply voltage.

There is a green LED on the panel where the power supply connector is located, which indicates the presence of voltage at the power supply unit input.

### 2.2.2 Technical data

#### *Power supply section technical data*

<b>Input voltage</b> rating rating	18 Vac / 24 Vdc $\pm$ 20 %
<b>Network frequency</b> rating range	50 Hz / 60 Hz $\pm$ 2 %
<b>Input current</b> typical working value typical value during initial peak typical duration of initial peak typical value during initial transient typical duration of initial transient	1,25Arms 20Arms 5ms 3Arms 100ms
<b>Total input power</b> maximum value	35VA
<b>Short-circuit protection</b>	Electronic
<b>Primary circuit protection</b>	Self-reset fuse
<b>Galvanic separation from earth/ground</b>	Yes
<b>Voltage present LED</b>	Green

#### **N.B. CAUTION**

Being a capacitive type stage, the FCT241 system start-up features considerable current absorption (see table). A transformer (or stabiliser) must therefore be used that can supply the required current.

### 2.2.3 Notes for installation

#### 2.2.3.1 Description of the connector

The external power supply is connected in the printed circuit through a 3 pin male connector, which requires a plug that is provided together with the system to which the power supply cables are connected, preferably terminated with lugs

*Power supply connector*

PIN	SIGNAL	DESCRIPTION
1	PE	Protective earth
2	-VIN	18 Vac / 0 Vdc
3	+VIN	18 Vac / 24 Vdc

### 2.2.3.2 Notes for connection

The earth/ground connection must be made both through the power supply connector and the functional earthing screw (located on top of the actual connector) to ensure better behaviour of the system in respect of disturbance or noise (cf. appendix A on SAFETY). This connection also ensures that the whole metal housing of FCT241 is equipotential with the protective earth of the system.

## 2.3 RS232 SERIAL COMMUNICATION PORTS

### 2.3.1 General information

The system FCT241 has 1 optoisolated *RS232 serial communication port* to act as communication interface with other intelligent units. As can be seen, it is on the first of the three available slots (see fig. 2.1).

### 2.3.2 Notes for installation

#### 2.3.2.1 Description of connectors

*RS232 connector (DSUB 9 pin female)*

PIN	SIGNAL	DESCRIPTION
1	DCD (on PORT 0 only)	Data carrier detect (on PORT 0 only)
2	TXD	Transmit data
3	RXD	Receive data
4	-	-
5	SGND	Signal ground
6	VCC	Power supply +5 Vdc
7	CTS	Clear to send
8	RTS	Request to send
9	-	-

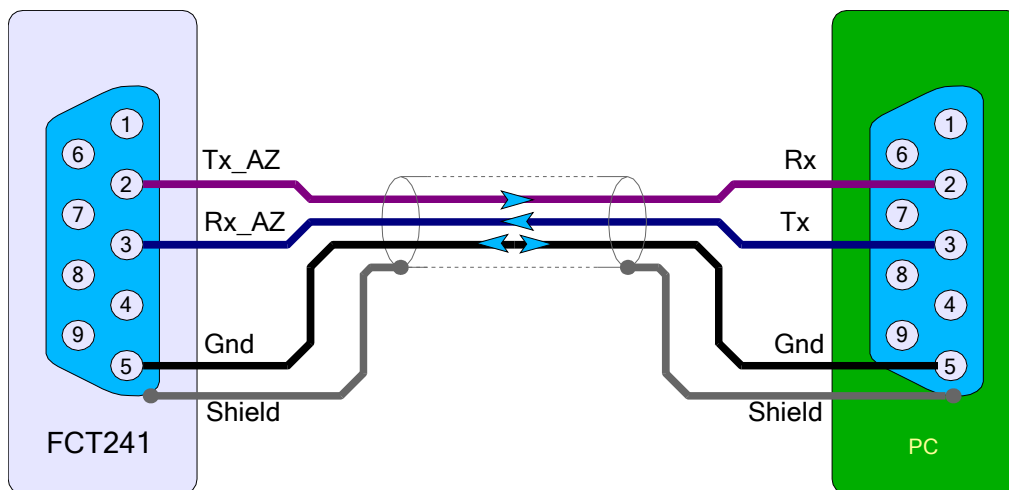
#### 2.3.2.2 Notes for connection

Figure 2.2 shows the serial connecting cables in minimum configuration towards a PC host. The maximum data rate is 115200 baud, for an allowed cable length of 10 m.

The use of shielded cable is recommended (mod. 8104 BELDEN ELECTRONICS) with the shielding connected to the DSUB connector shell at both ends of the cable.

**IMPORTANT**

If there is other than nil difference between the potential reference (protective earth PE) of FCT241 and the potential reference of the connected system (e.g. a PC), the serial cable shielding must be connected only to the FCT241 connector.



**Fig. 2.2 Connecting cable RS232 between FCT241 and PC**

**2.3.2.3 Technical data**

*Communication parameters*

PARAMETER	VALUES
Baudrate	1200 to 115200 bps
DataBits	5 to 8 bits
StopBits	1 or 2
Parity	None, Odd, Even, Space, Mark

**2.3.2.4 Adapters ADP422 and ADP485**

These adapters are an economic and compact solution for converting the serial channel signals from RS232 to RS422/485, thereby expanding the system capacity. The power supply is provided by the same RS232 port of the system and is protected against short circuit. A more detailed description of these adapters and their size can be found in the manual “Accessories and interface or adapter cards”.

## 2.4 CAN SERIAL COMMUNICATION PORTS

### 2.4.1 General information

The FCT241 system has 2 CAN (Controller Area Network) *serial communication interfaces*. More precisely, port CAN0 is present on the first slot and the second port is on the second slot (see fig. 2.1). The peripherals of a system may be expanded through this field network with easy decentralisation, reduced wiring costs, considerable performance in terms of speed (up to 1 Mbit/s) and communication correctness. The system FCT241 is designed to act as CANopen master for this network, provided there are no obstacles to it becoming (alternately or simultaneously) also SDO server of a network supervisor (e.g. a PC). The system can communicate with the other nodes both with CANopen protocol and other proprietary protocols, provided that the latter are implemented with suitable SW libraries. In the case of CANopen, in particular, the network can be set up either with CMZ CANopen nodes or with CANopen nodes available on the market. The position of the connectors interfacing the communication ports is on two different slots, as shown in fig. 2.1

### 2.4.2 Technical data

*The table below gives the main characteristics of the serial connection.*

For the general characteristics of the serial connection, the topology, the maximum number of nodes that may be connected, the baud rate/length ratio and the specifications of the transmission medium, refer to the specific manual “CANopen network peripherals” for the CANopen protocol or to the relevant manual for the protocol being used.

*Characteristics of the serial connection*

Protocol	CAN (ISO-11898 Ver. 2.0 Part B)
Galvanic isolation	No
Termination resistor	Can be connected through RT dip switch

### 2.4.3 Notes for installation

#### 2.4.3.1 Description of connectors

*CAN connector (DSUB 9 pin male)*

PIN	SEGNAL	DESCRIPTION
1	-	-
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	-
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	-
9	-	-

**N.B. The pin configuration is valid for both ports CAN0 and CAN1.**

### 2.4.3.2 Notes for connection

The specifications for setting up this type of network are also given in the aforementioned specific manual.

#### **IMPORTANT: Termination resistor**

No dipswitch is provided for the port CAN0 for setting the termination resistor, which is always connected with internal connections to the card. There is instead a dipswitch for the port CAN1, which allows connection or otherwise of the termination resistor.

This means that the position of FCT241 with regard to the port CAN0 must be at the start or the end of the network and that there can be two FCT241 at the most on one network (see CANopen network manual).

## 2.5 PROFIBUS-DP SERIAL COMMUNICATION PORT

### 2.5.1 General information

The system FCT241 can house an expansion board so that a Profibus-DP serial communication port is available. The position of this board is on the third slot of the system; the module is optional (but cannot be connected by the end customer).

A module is used that guarantees compatibility with the Profibus-DP standard EN 50170 (DIN 19245). This way communication between FCT241 and other non-CMZ systems that use this standard protocol (in particular PLC) is allowed. The Profibus interface panel is shown in figure 1.1.

### 2.5.2 Technical data

The baud rate is self-selecting on the Profibus-DP network (via software) among 9 different values, from a minimum of 9.6 Kbaud to a maximum of 12 Mbaud locking on to the network rate.

*Main characteristics of the transmission medium and the connection*

Connection	RS485
Galvanic isolation	With optocouplers
Medium	Shielded twisted pair cable
Shield	Combined: film and braiding
Number of pairs	1
Characteristic impedance $Z_0$	150 $\Omega$
Network termination	220 $\Omega$ on board
Recommended models	3079A BELDEN ELECTRONICS

### 2.5.3 Notes for installation

#### 2.5.3.1 Description of connector

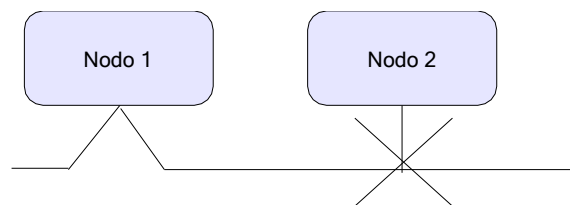
*Profibus-DP connector (DSUB 9 pin female)*

PIN	SIGNAL	DESCRIPTION
Guscio	SHLD	Connesso a PE
1	-	-
2	-	-
3	BUS_H	Signal high
4	RTS	Request to send
5	SGND	Signal ground
6	+VCC	+5 Vdc
7	-	-
8	BUS_L	Signal low
9	-	-

#### 2.5.3.2 Notes for connection

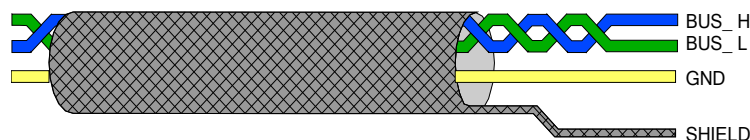
To implement this type of network, the following specifications must be observed:

- Cascade connections must be used for the network units; under no circumstances must shunts (stubs) or star connections be used. If the system is in an intermediate position within the network, the shunt must be wired externally to the connector otherwise the transmission is not reliable (see fig. 2.3).



**Fig. 2.3 Detail of correct connection between systems with Profibus-DP**

- Use the same type of cable for the whole installation.
- The BUS\_H and BUS\_L pins must be connected to the same twisted pair (see fig. 2.4); the cable shield is connected to the connector shell.



**Fig. 2.4 Connecting cable for Profibus-DP**

- For systems that are in a terminal position, that is, start or end of the line, connect the on-board termination resistor to the setter accessible from outside

*Termination resistor*

IMPOSTATORE	SEGNALE
ON	Connected resistor
OFF	Unconnected resistor

N.B. At the time of delivery the setters are in the positions indicated in **bold print**.

Also connect a 390Ω 1/4W pull-up resistor between BUS-H (pin 3) and +5Vdc (pin 6), and a 390Ω 1/4W pull-down resistor between BUS-L (pin 8) and SGND (pin 5).

- Each network node is assigned a distinct number to allow its addressing. In system FCT241 this number is assigned by using 2 rotary switches, which allow a number to be set in decimal form anywhere between 1 and 99 (0 is reserved to allow numbering via software). The switch marked “x1” is used to set the units and the one marked “x10” to set the tenths. **The address cannot be changed during operation.**

### 2.5.3.3 Description of the LEDs

There are 4 LEDs, which indicate the status of the Profibus-DP expansion module; their positions are shown in the figure to the right (in which the position of the LED block in relation to the printed circuit is shown), while their functions are described in the table below:

LED	NOME	COLOUR	DESCRIPTION
1	Not used	-	Not used
2	On-line	Green	<b>On-</b> indicates that the module is on-line in the Fieldbus <b>Off-</b> indicates that the module is not on-line
3	Off-line	Red	<b>On-</b> indicates that the module is off-line in the Fieldbus <b>Off-</b> indicates that the module is not off-line
4	Fieldbus diagnostics	Red	Indicates various states of the Fieldbus: <b>Blinking 1 Hz-</b> Configuration error: the length of the INs or OUTs set during initialization of the module is not the same as that set during network configuration <b>Blinking 2 Hz-</b> User Parameter data error: the length/contents of the User Parameter data set during initialization of the module is not the same as that set during network configuration. <b>Blinking 4 Hz-</b> Profibus communications ASIC initialization error. <b>No blinking-</b> No diagnostics

## 2.6 ETHERNET SERIAL COMMUNICATION PORT

### 2.6.1 General information

The system FCT241 is designed for an ETHERNET communication interface through an RJ45 connector (fig. 1.1) for programming purposes and for use as a communication interface with other intelligent units. Ethernet is used to connect to the PC where the user develops his application, in order to debug and monitor his program.

The connector is available on the motherboard and therefore in the first slot in the central position, as can be seen in figure 2.1.

*ETHERNET section characteristics*

Baud Rate	10 Mbit/s
Communication protocol	IEEE 802.3 CSMA/CD
Network interface	10 BASE-T Twisted Pair
Network connector	RJ-45
Network connector	Through Pulse Transformer

### 2.6.2 Diagnostic function of the LEDs

The RJ45 connector of the ETHERNET section has 2 integrated LEDs with the following diagnostic function:

- LED yellow: active if there is a link with a hub
- LED green: indicates network traffic

The two LEDs blink slowly and alternately if there is no firmware Ethernet, whereas they blink quickly during updating of the same.

### 2.6.3 Description of dipswitches

In the Ethernet section there is a 16-setting rotary dipswitch to set the node Ethernet IP address. The "F" combination is reserved. The combination "0" gives access to the DHCP service of a network server. After having set the first 28 bits via software, all the other combinations allow the last 4 bits of the IP address to be changed (the IP address is a 32-bit numeric address) so as to configure 14-node networks fast. With the selector in position "F" the software IP settings are ignored and an IP configuration is used that was previously set on-line through a special PC utility. With the selector on "0" the software IP settings are ignored and a configuration is requested from a network DHCP server. Timeout for the search is 90 seconds. At timeout the controller takes on a pre-selected IP address. The same result is obtained in circumstances where the Ethernet cable is already disconnected or is disconnected before the DHCP server answers.

## 2.6.4 Description of connectors

*Ethernet connector (RJ45)*

PIN	SIGNAL	DESCRIPTION
1	TD+	Transmit data +
2	TD-	Transmit data -
3	RD+	Receive data +
4	-	-
5	-	-
6	RD-	Receive data -
7	-	-
8	-	-

## 2.7 COMPACT FLASH

The system FCT241 includes an interface to a CompactFlash Storage Card visible in the controller file system. The Card is used to store user data at will and also to allow cloning of user programs between two controllers or for the automatic reprogramming of firmware.

The table below gives the main characteristics of the CompactFlash that may be used in the system; it should be noted that the useable CompactFlash must be in conformity with the specifications indicated by the CompactFlash Association.

### Technical data

Model	Compact Flash Type I con driver ATA a 16Bit
Size (mm)	42.8 x 36.4 x 3.3
Supply voltage	3,3 Vdc
Type of storage	non volatile
Standard	Compact Flash specification
Red warning LED	On during access in CF

The CompactFlash fits in the second slot in relation to the first, which houses the motherboard. The second slot (see fig.2.1) can also have a CANopen communication port with relative termination dipswitch as well as two-colour LEDs, the meaning of which is described in the paragraph below. Never switch off the system during access to CompactFlash

### 2.7.1 Meaning of the status LEDs

The 3 status LEDs on the second slot located beside the COMPACTFLASH card housing, provide some useful indications for the user regarding the system status. The table below gives their meaning.

#### Status LED

LED NAME	COLOUR	DESCRIZIONE
CF	Red	<b>CF LED:</b> indicates that a reading/writing operation is in progress in the CompactFlash card present in the slot.
FLT	Orange/Red	<b>FAULT LED:</b> the meaning is described below this table.
RST	Orange/Green	

The **FAULT LED** may have various meanings; when it is **orange**:

- if the LED is constantly lit, the system is debugging;
- if the LED is off, the system is correctly started up and the Firmware has been loaded;
- if the LED blinks, the system is warning of an anomaly or malfunction and sends an alarm code, indicated by the number of blinks emitted at the frequency of 1 blink/sec at intervals of 3 sec; these codes are given in the table below:

When the LED is **red** this means that it is carrying out an update of the system boot.

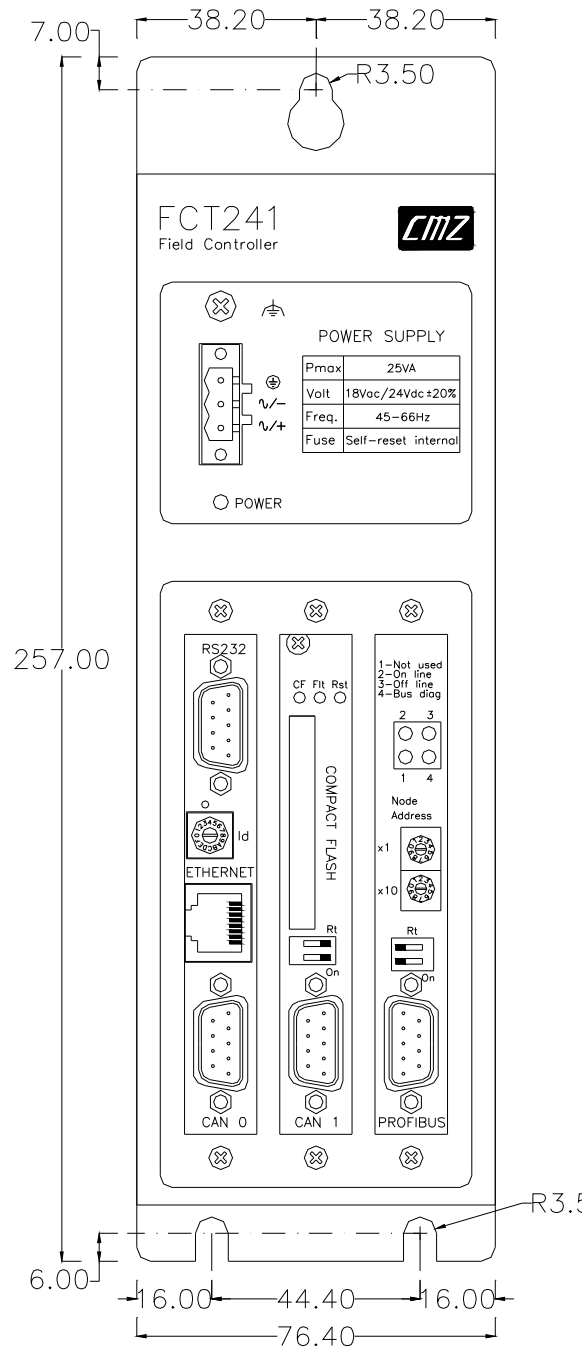
*Alarm codes*

<b>CODE</b>	<b>DESCRIPTION</b>
1	Failure of a self-loading SoftPLC stored in the File system upon start-up of the system.
2	Run-down buffer storage battery.
3	HW initialization error (Ethernet and other)
4	Reading of the internal system temperature > 60 degrees
5	Card option error
6	Slot error (Profibus and other)
> 6	Reserved

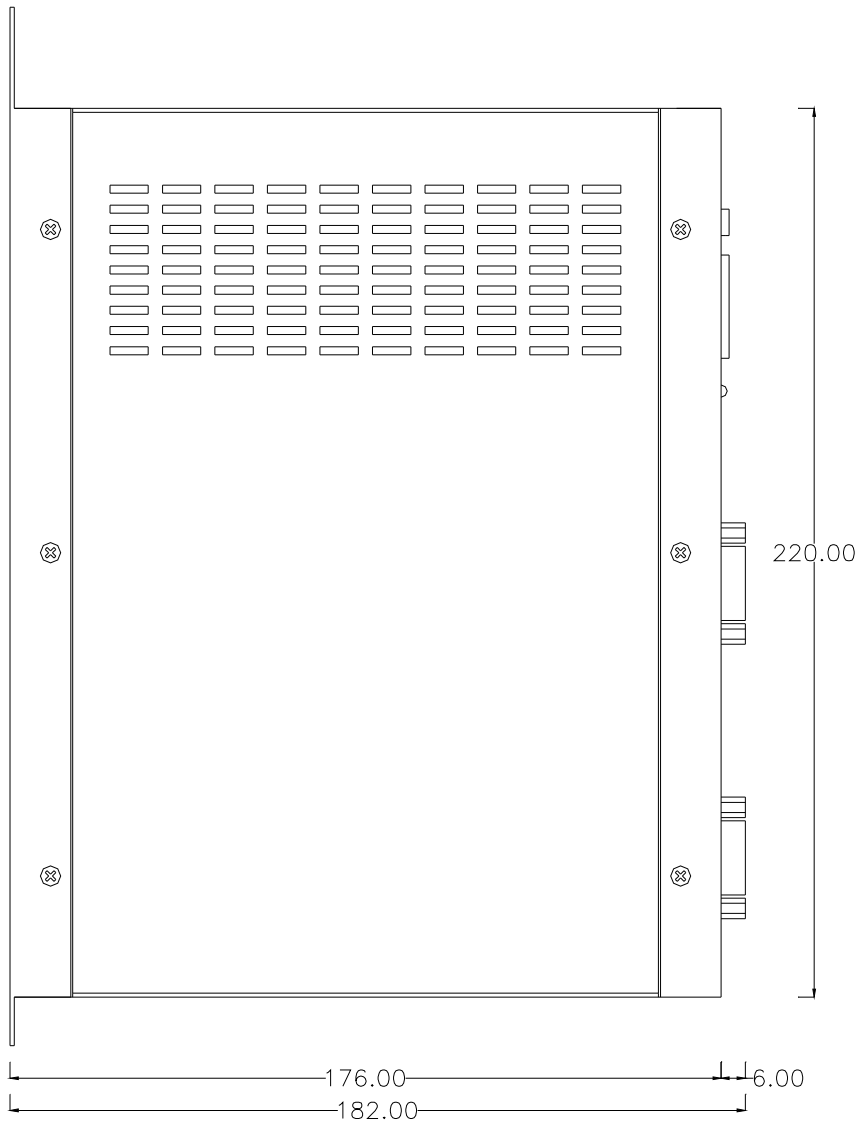
N.B. In the event of several alarms simultaneously, their code is issued in sequence.

**Section 3. MECHANICAL FEATURES**

Figures 3.1 and 3.2 show the dimensions of system FCT241. All the values are given in mm. The weight of the configured system, also including the Profibus module, is approx. 1940g.



**Fig. 5.1 Front view**



**Fig. 5.2 Side view**

## appendix A. SAFETY

### A.1 INTRODUCTION

The system FCT241 is in conformity with the following European standards:

European standards

<b>CEI EN 61131-2</b>	<b>Programmable controllers Part 2: Equipment requirements and tests</b>
<b>CEI EN 61131-2</b>	<b>Programmable controllers Part 2: Equipment requirements and tests</b>
<b>CEI EN 60204-1</b>	<b>Safety of machinery – Electrical equipment of machines Part 1: General information</b>

The system FCT241 is a *CLASS III* device and the protection against the risk of electrical discharge is therefore ensured by the presence of low-voltage circuits

### A.2 CONDITIONS OF SERVICE AND REQUIREMENTS RELATED TO THE PHYSICAL ENVIRONMENT

The system FCT241 has been designed to be safe in the following conditions:

Conditions of use

<b>Ambient temperature (inside the switchboard)</b>	5 °C ÷ 45 °C
<b>Relative humidity</b>	Rh2 (5 % 1 95 %) or less than 85% for T>40°C
<b>Degree of pollution</b>	II
<b>Altitude</b>	2000 m above sea level

### A.3 ELECTRICAL REQUIREMENTS

#### ATTENTION

The electrical requirements, the fields of use and the methods of installation and maintenance of the sections making up the FCT241 are described in detail in the specific paragraphs. With a view to safety, also comply with the following instructions:

- Connect the power supply cable socket correctly to the relative connector, complying with the indications given on the actual panel. To improve the behaviour of the system with regard to disturbance/noise, the functional earth/ground must be connected using the screw terminal to be found beside the power supply connector
- Before powering the device, make sure that the actual power supply system corresponds to the specifications given in par. 2.2 (18 Vac / +24 Vdc).

## **appendix B. ELECTROMAGNETIC COMPATIBILITY**

### **B.1 INTRODUCTION**

The system FCT241 is in conformity with the specifications of the EEC electromagnetic compatibility directive 89/336, which in the industrial sphere entails application of the following European standards:

Standards

<b>EN 61131-2</b>	<b>product standard</b>
<b>EN 61000 – 6 – 4</b>	<b>emission standard</b>
<b>EN 61000 – 6 - 2</b>	<b>immunity standard</b>

**In observance of the above standards, the tests passed by the system in question are indicated below:**

- **Electrostatic discharge immunity test (EN 61000-4-2)**
- **Radiated, radio frequency, electromagnetic field immunity test (EN 61000 – 4 – 3)**
- **Immunity to conducted disturbances, induced by radio-frequency fields (EN 61000 – 4 – 6)**
- **Electrical fast transient/burst immunity test (EN 61000-4-4)**
- **Conducted emission test within the frequency range 0.15 - 30 MHz (EN-55011)**
- **Radiated emission test within the frequency range 30 - 1000 MHz (EN 55011)**

<b>ORDER CODE</b>
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SYSTEM FCT241.0

*THE EXPANSIONS ENVISAGED FOR THE SYSTEM ARE INDICATED BELOW:*

Order code:

-FCT241.a

with this meaning:

a = 0                      system without Profibus interface

a = 1                      system with Profibus interface

N.B.: all the required options must be specified at the time of placing the order.