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ABB AC Brushless Servodrives
MINIVECTOR 300 Converters

Installation and Commissioning Manual

ABB

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**Installation and
Commissioning Manual**

Safety Instructions

General This chapter states the safety instructions that must be followed when operating MINIVECTOR 300 Servodrives.

The material in this chapter and in the *Installation Manual* must be studied before attempting any work on, or with, the device.

Warnings and Notes This manual distinguishes two sorts of safety instructions. Warnings are used to inform of conditions which can, if proper steps are not taken, lead to a serious fault condition, physical injury and death. Notes are used when the reader is required to pay special attention or when there is additional information available on the subject. Notes are less crucial than Warnings, but should not be disregarded.

Warnings Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with the following symbols:

WARNING! Dangerous Voltage: warns of situations in which a high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.

WARNING! General Warning: warns of situations which can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.

Electrostatic Discharge Warning: warns of situations in which an electrostatic discharge can damage equipment. The text next to this symbol describes ways to avoid the danger.

Notes Readers are notified of the need for special attention or additional information available on the subject with the following symbol:

CAUTION! **Caution** aims to draw special attention to a particular issue.

Note. **Note** gives additional information or points out more information available on the subject.

General Safety Instructions

WARNING! All electrical installation and maintenance work on the drive should be carried out by qualified electricians.

The drive and adjoining equipment must be properly earthed.

WARNING! Do not attempt any work on a powered drive. After switching off the mains, always allow the intermediate circuit capacitors 5 minutes to discharge before working on the servo converter, the motor or the motor cable.

It is good practice to check (with a voltage indicating instrument) that the drive is in fact discharged before beginning work.

The motor cable terminals of the drive are at a dangerously high voltage when mains power is applied, regardless of motor operation.

There can be dangerous voltages inside the drive from external control circuits even when the drive mains power is shut off. Exercise appropriate care when working with the unit. Neglecting these instructions can cause physical injury and death.

WARNING! The installation must be executed according with the European Standards **CEE 89/336** and **CEE 72/23**.

WARNING! The machine manufacturer who commissions the converter, must install proper additional protection functions to avoid damages to health or equipment when the machine is operating.

More Warnings and Notes are printed at appropriate instances along the text.

Table of Contents

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Chapter 1 - General Information

Overview

This document is the *Installation and Commissioning Manual* for MINIVECTOR 300 Servodrives.

Before You Start

The reader is expected to have an appropriate knowledge of electrical fundamentals, electrical wiring practices, the drive, the use of the drive control panel.

What this Guide contains

The commissioning and operating of MINIVECTOR 300 Servodrives are introduced in this Guide.

Safety Instruction are featured in the first few pages of this Guide. Safety Instructions describe the formats for various warnings and notations used within this Guide. This chapter also states the safety instructions which apply to the operation of the MINIVECTOR 300 Converters.

Chapter 1 - General Information contains short description of this Guide and general information about MINIVECTOR 300 Servodrives.

Chapter 2 - Technical Specifications contains technical characteristics and ratings of MINIVECTOR 300 Converters.

Chapter 3 - Mechanical Installation contains instructions for mechanical installation of MINIVECTOR 300 Servodrives.

Chapter 4 - Electrical Installation contains instructions for electrical installation, wiring instructions and cooling requirements of MINIVECTOR 300 Servodrives.

Chapter 5 - Commissioning introduces the PC configuration tool for commissioning MINIVECTOR 300 Servodrives.

Chapter 6 - EMC Standards introduces EMC guidelines and requirements for MINIVECTOR 300 Servodrives.

General Information about MINIVECTOR 300

MINIVECTOR 300 is a simple yet versatile digital converter for brushless servomotors. Simple because it's easy to install, configure and, in a word, use. Versatile because it can be adapted quickly to the most widely varying drive applications in which current or speed control is required. What's more, the automation of many setting procedures makes the phase for putting it into service significantly shorter, while simultaneously ensuring uniform performance over time. The main features of the MINIVECTOR 300 include:

- Digital current control implemented using the space vector technique with a refresh rate of 20 kHz

- Digital speed loop with ± 10 V differential analogue input and proportional-integral compensator

- Resolver interface with encoder emulation up to 1024 pulses per revolution

- Automatic search for the number of motor poles and the angle between the motor magnetic axis and resolver.

MINIVECTOR 300 can be provided in two basic configurations,

1. with **single-phase** power supply

2. or with **three-phase** power supply

User Interface Application Software

MINIVECTOR 300 Converters are provided with a software tool, Miv32, for PC configuration. By this tool the drive can be configured and monitored in real time.

Product Identification

The identification label depicted below is applied on the side of the unit. When contacting the customer service, please report Part number and Serial number printed in the individual fields.

Complementary Equipment

There are two power sizes of MINIVECTOR 300, normally matched with ABB servomotors of the 8C and 8N SERIES, even if motors from other manufacturers are controllable as well. For additional info on the motor converter matching, the uses of other complementary and auxiliary equipment please consult Chapter.

Chapter 2 - Technical Specifications

Overview

The main features of the MINIVECTOR 300 servodrive are listed in the following sections.

Technical Characteristics

Control Board

The control unit is based on a multiprocessor architecture including:

- a powerful, 16 bit DSP which performs all the digital control tasks (current and position sensing, external reference conditioning, speed and/or current regulation and PWM generation) and manages faults and emergency conditions

- a 16 bit microcontroller dedicated to configuring and monitoring the servodrive as well as supervising the DSP functionality

Power Stage

The power stage is realized with discrete, fully-protected IGBT components and integrates a switching power supply for the control electronics.

Internal rectifier bridge, integrated fuse and inrush current limiter.

The power ground and the signal ground are electrically isolated.

Single-Phase Configuration

Main Supply

Direct mains connection, single-phase 110 Vac - 20% 230 Vac ± 10%, 50-60 Hz.

Inrush peak current: 130 symmetrical Arms (3,5 ms).

Auxiliary Supply

The auxiliary supply allows the status of the LED indicator and the encoder emulation output to be maintained active also after removing the main power supply. When the main supply is present, the internal switching power supply is fed directly from the DC bus and the auxiliary supply is no longer needed.

The auxiliary supply is necessary when the power-on sequence of the system where the servodrive is installed requires the main power supply to be applied only if the converter is active and does not signal fault conditions.

Output Currents The output currents depend on the size of the converter.

The peak current can be sourced for no more than 2 seconds. After this time the Ixt protection trips and the output current is automatically limited to the continuous rated current.

The following sizes are available ("continuous/peak" current in Arms):

- 3 / 6
- 5 / 10

Three-Phase Configuration

Main Supply Three-phase power supply 230 Vac +10 / -20 %, 50-60 Hz. Direct connection to the network is possible through an autotransformer.

Inrush peak current: 130 symmetrical Arms (3,5 ms).

Auxiliary Supply 24 Vdc auxiliary supply is necessary for operation of the servodrive control logic.

Output Currents The output currents depend on the size of the converter.

The peak current can be sourced for no more than 2 seconds. After this time the Ixt protection trips and the output current is automatically limited to the continuous rated current.

The following sizes are available ("continuous/peak" current in Arms):

- 3 / 6
- 5 / 10
- 7 / 14

Clamping Circuit The braking resistor is mounted internally for all sizes. However, when the power dissipated on the internal resistor exceeds the rated power, an external resistor is required (contact the Customer Service).

The internal resistor is short-circuit protected; an Ixt circuit limits the average power to the value shown in the table below.

Resistore Interno	Unità di Misura	Taglia 3/6	Taglia 5/10	Taglia 7/14
Resistenza	Ω	56	33	15
Potenza Nominale	W	110	110	220
Potenza di picco	W	2800	2800	2800
Tp (picco)	ms	400	400	400
Tp (o)	s	1,8	1,8	1,8

Electromagnetic Brake Optionally, an electromagnetic brake can be connected to terminal X3.

- Brake supply input: 24 Vdc, 2 A

- Internal brake supply: 24 Vdc, 0,8 Amax

- Brake release/lock automatically operated by the drive; supplying +24V to input BRK UNLOCK (pin 9 of connector X5) the brake is unlocked.

Dynamic Braking The drive is capable of braking the motor by shorting its windings and controlling the motor current at a pre-settable level.

The dynamic braking is automatically activated when a fault occurs or the drive is disabled; it can be disengaged by connecting to +24V the input BRK UNLOCK (pin 9 of connector X5).

Resolver Interface
- Reference / sine and cosine signals ratio: 2:1;

- Reference frequency: 10 kHz;

- Automatic amplitude adjustment of the sine and cosine signals;

- Automatic phase shift compensation between reference and sin/cos signals;

- Auto-phasing of resolver with respect to the motor magnetic axis.

Encoder Emulation Output
- Differential RS422 output.

- Programmable from 128 up to 1024 pulses per revolution.

- Maximum output frequency: 125 kHz.

Input/Output Signals
- Two 12-bit, ±10 V differential analog reference inputs.

- Two opto-isolated, 0-24 V digital inputs: drive enable and brake release.

- One digital fault output (potential free contact).

Ratings

Electrical and mechanical specifications, operating temperatures and servomotors matching are listed in the tables below.

Electrical Specifications

Single-Phase Configuration

Electrical Ratings	Units	Size 3/6	Size 5/10
Rated Supply Voltage	Vrms	110 ÷ 230 Vac +10 / -20%, 50/60 Hz	
Rated Auxiliary Voltage	Vrms	110 ÷ 230 Vac +10 / -20%, 50/60 Hz, 30 VA max	
Max Output Voltage	Vrms	220 Vac	
Rated Input Current	Arms	4,8	8,2
Rated Output Current	Arms	3	5
Max Output Current	Arms	6	10
Rated Output Power	kVA	1	1,7
PWM Switching Frequency	kHz	10	

Three-Phase Configuration

Electrical Ratings	Units	Size 3/6	Size 5/10	Size 7/14
Rated Supply Voltage	Vrms	110 ÷ 230 Vac +10 / -20%, 50/60 Hz		
Rated Auxiliary Voltage	Vrms	110 ÷ 230 Vac +10 / -20%, 50/60 Hz, 30 VA max		
Max Output Voltage	Vrms	220 Vac		
Rated Input Current	Arms	2,8	4,75	6,7
Rated Output Current	Arms	3	5	7
Max Output Current	Arms	6	10	14
Rated Output Power	kVA	1	1,7	2,4
PWM Switching Frequency	kHz	10		

Mechanical Specifications

Mechanical Ratings	Units	Size 3/6	Size 5/10	Size 7/14
Height	mm	206	206	226
Depth	mm	173	193	194
Width	mm	70	80	80
Weight	kg	1,7	2	2

Operating Temperature

During operation at rated current the permissible temperature range is 0 °C ÷ 40 °C.

A current derating of 2,5%/°C applies in the range 40 °C ÷ 60 °C.

Storage temperature is -10 °C ÷ 70 °C.

Motor Selection The following servomotor-servoconverter coupling are defined for general purpose. For special applications please contact the Customer Service.

Servomotor Type	MINIVECTOR 300 Size	Stall torque	Peak stall torque	Nominal torque to the nominal speed	Nominal speed
		M_0 [Nm]	M_{max} [Nm]	M_n [Nm]	n_N [Rpm]
SDM SERIES					
SDM 251…0N3-55	03/06	0.34	1.3	0.32	6000
SDM 251…0N5-55	03/06	0.5	1,7	0.48	6000
SDM 251…1N0-55	03/06	0,94 *	1,8	0.71	6000
SERIE 8N					
8NB.2.40… ..E	03/06	0,36	1	0,34	4000
8N0.1.40… ..E	03/06	0,53	1,5	0,47	4000
8N0.2.40… ..E	03/06	0,95	2,7	0,84	4000
8C SERIES					
8C1.1.30... ..E	03/06	1,3	3,4	4,3	3000
8C1.1.60... ..E	03/06	1,2	2,2	3,6	6000
8C1.2.30... ..E	03/06	2,5	4,4	7,4	3000
8C1.2.60... ..E	05/10	2,5	4,5	5,0	6000
8C1.3.30... ..E	05/10	3,6	8,2	8,2	3000
8C1.4.30... ..E	05/10	4,5	8,2	9,1	3000
8C4.0.15... ..E	03/06	3,9	7,2	12,0	1500
8C4.0.30... ..E	05/10	3,9	7,4	8,2	3000
8C4.1.15... ..E	05/10	7,3	15,1	16,8	1500
8C4.2.15... ..E	05/10	9,6	18,2	17,5	1500

* The motor nominal (1 Nm) is limited from the nominal drive current.

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Chapter 3 - Mechanical Installation

Overview

This Chapter provides instructions for mechanical installation, cabling and cooling requirements of MINIVECTOR 300 Converters.

Mechanical Installation

Use brackets and screws supplied with the converter for mounting MINIVECTOR 300

- Fix the bottom bracket to the mounting panel with two screws
- Place the converter on the bottom bracket
- Place and fix with a screw the top bracket.
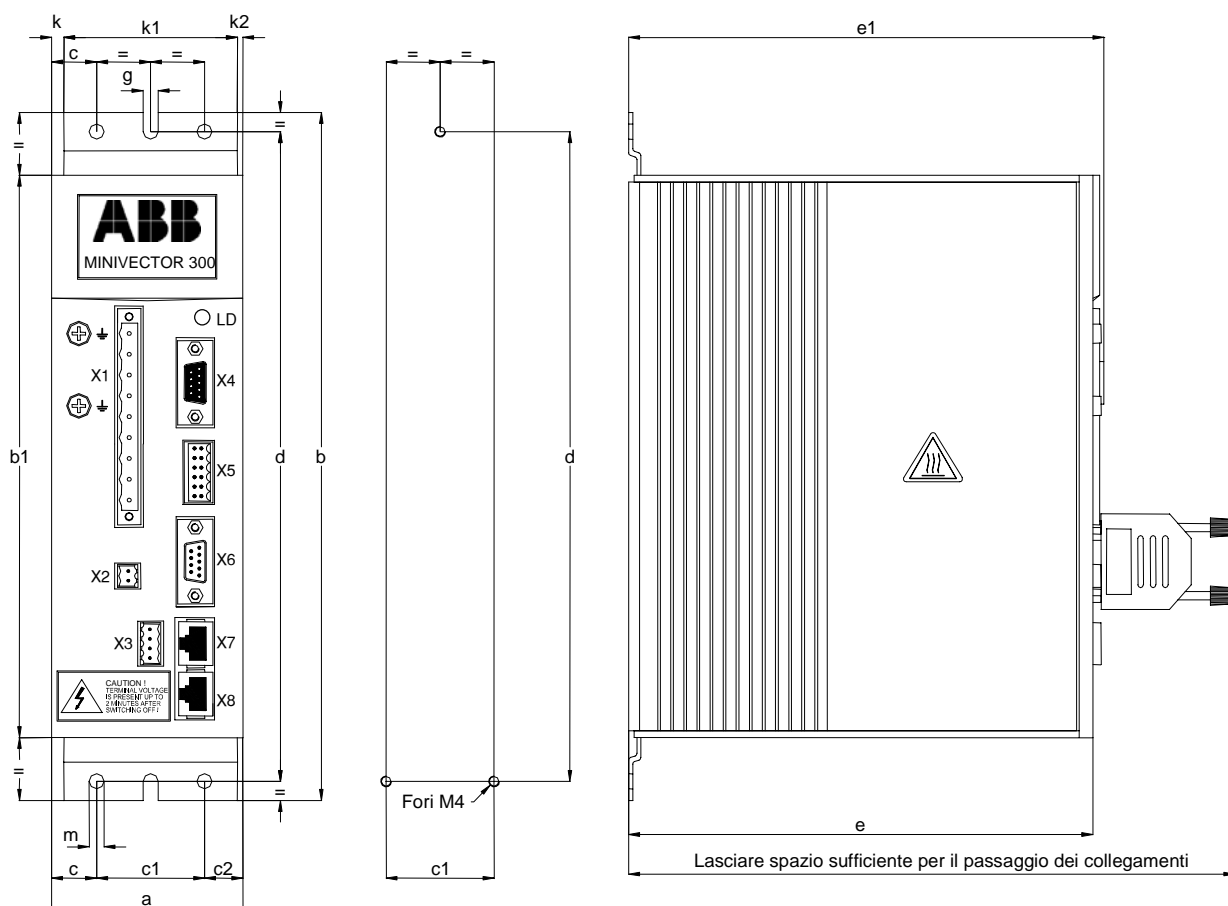
MINIVECTOR 300	unità	a	b	b1	c	c1	c2	d	e	e1	g	k	k1	k2	m
Size 3/6	[mm]	70	252	206	16,5	39,5	14	238^{+1}_{-0}	170	174	5,5	4,5	63,5	2	$\varnothing 5,5$
Size 5/10	[mm]	70	252	206	16,5	39,5	14	238^{+1}_{-0}	170	174	5,5	4,5	63,5	2	$\varnothing 5,5$

Fori M4

Lasciare spazio sufficiente per il passaggio dei collegamenti
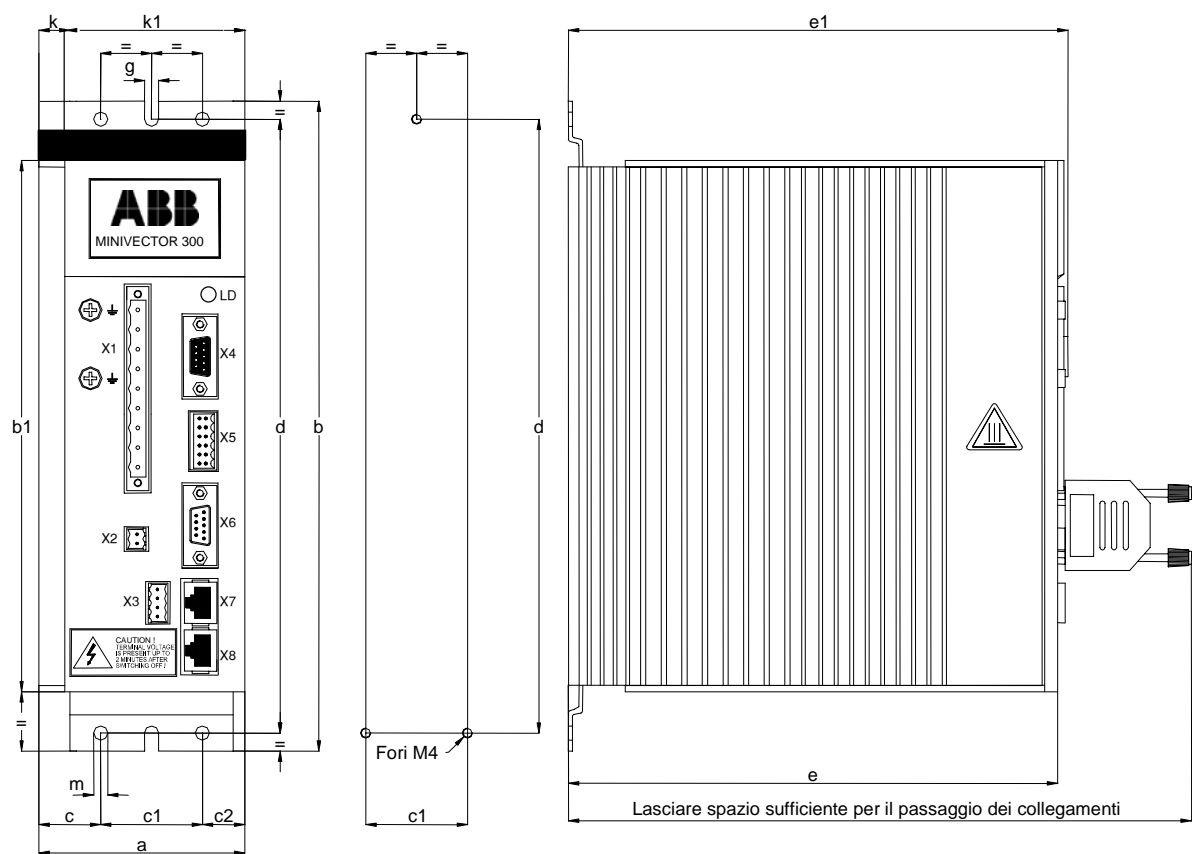
MINIVECTOR 300	unità	a	b	b1	c	c1	c2	d	e	e1	g	k	k1	m
Size 7/14	[mm]	80	268	206	24	39,5	14	254^{+1}_{-0}	190	194	5,5	12	63,5	∅5,5

In multi-axis systems, the mounting distances shown in figure below should be respected in order to allow an adequate air circulation. No additional forced ventilation systems are required.
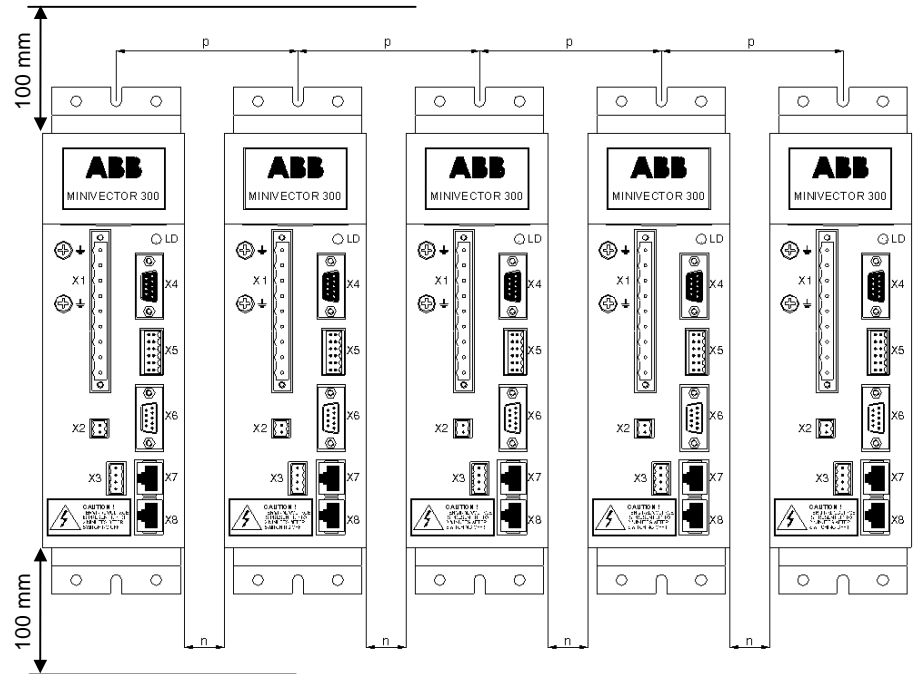
n = min. 20 mm

p = min. 90 mm

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Chapter 4 - Electrical Installation

Overview

This Chapter provides terminals of MINIVECTOR 300 and wiring instructions

The single- and three-phase configurations of MINIVECTOR 300 have different main supply terminal (X1) and auxiliary supply terminal (X2).

They have then the same terminals

- X3 optional board for electromagnetic brake,
- X4 for motor signals,
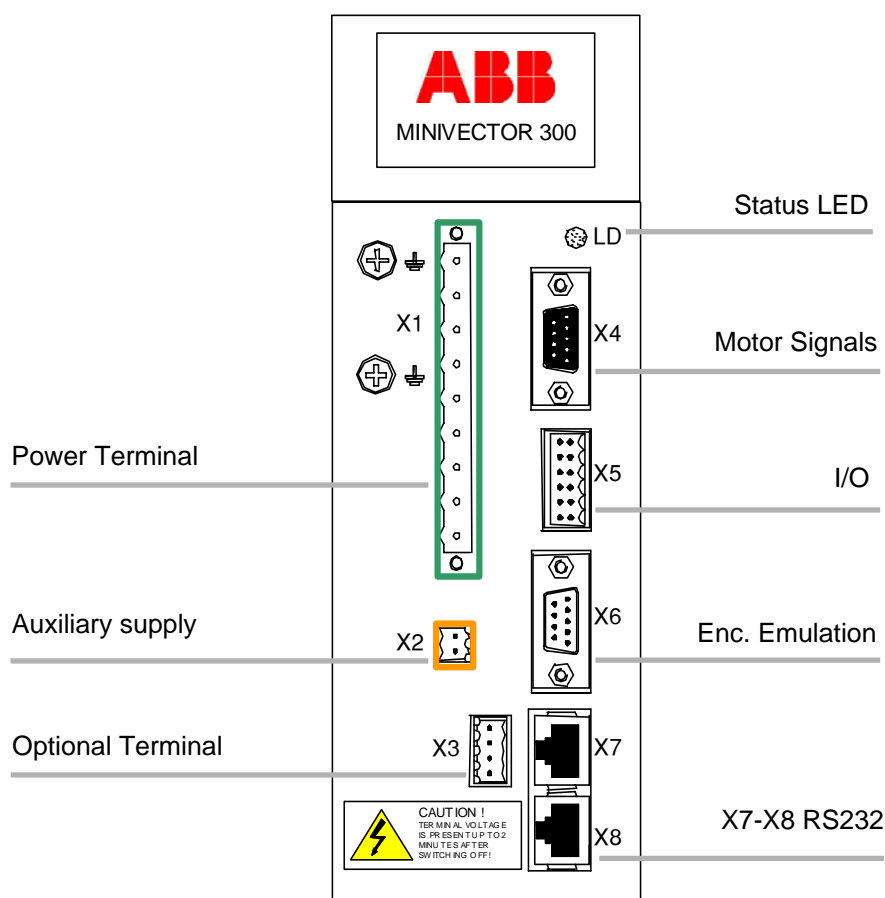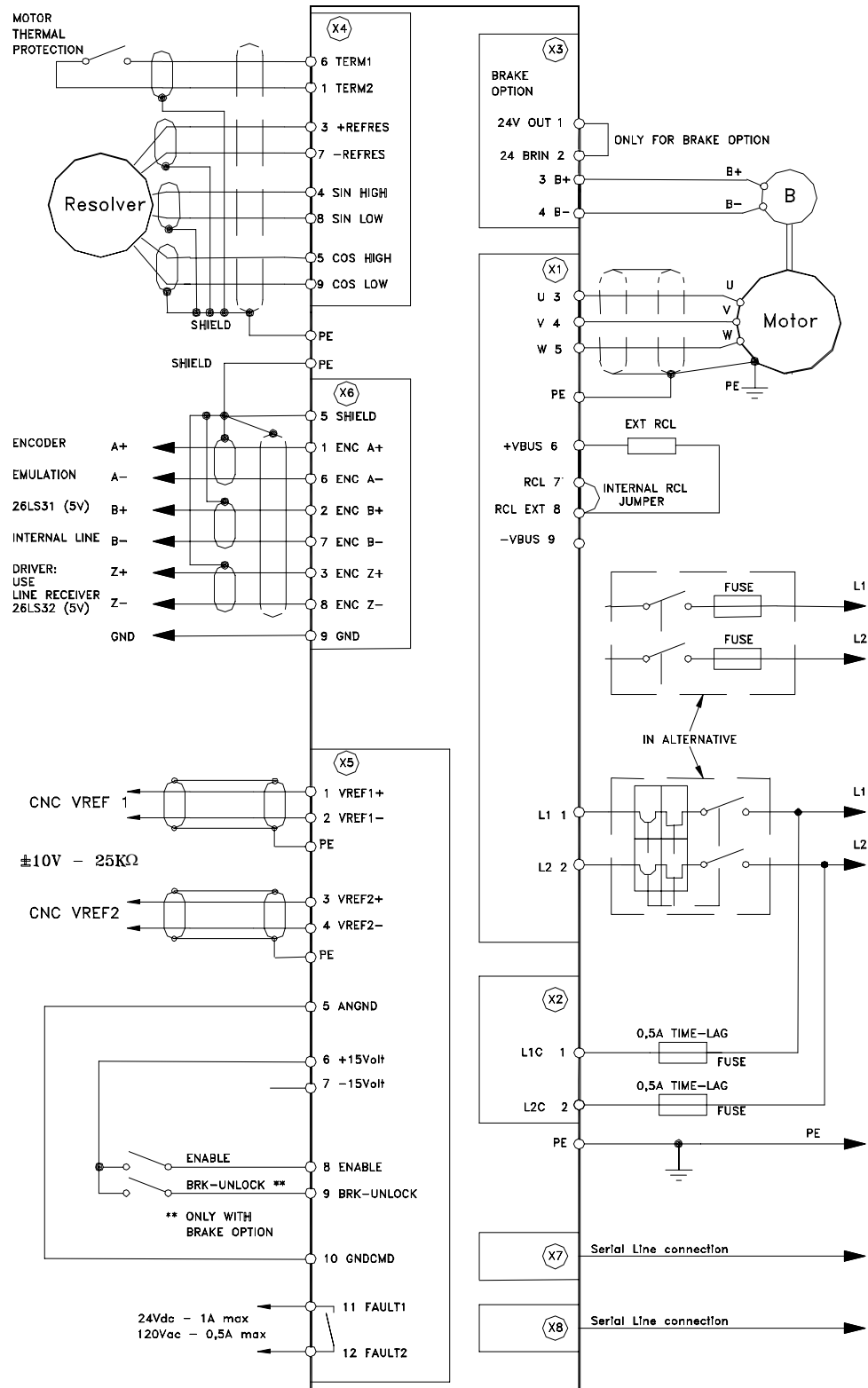- X5 for digital I/O
- X6 for encoder emulation interface
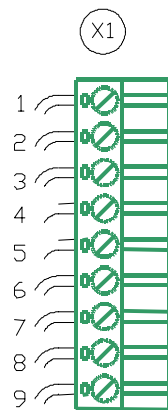- X7 and X8 for serial connection RS232.

Single-Phase Configuration

Description of Terminals

Wiring Scheme

Power Connections Terminal X1 is dedicated to connections of power supply, motor and clamp resistor.

Pin	Reference	Description
1	VR	Single-phase power supply (230VAC)
2	VN	Single-phase power supply (neutral)
3	U	Motor phase 1
4	V	Motor phase 2
5	W	Motor phase 3
6	+VBUS	DC bus positive terminal
7	RCL	Internal Resistor Clamp
8	RCL EXT	Int/external Resistor Clamp
9	-VBUS	DC bus negative terminal

Main Supply Connections Connect terminals L1 and L2 according the electrical diagrams specific for each network type.

It is possible to connect to TN and TT network type.

The connection to the IT network it is possible only if the voltage between the phase and the ground cannot exceed 253 Vac (230 Vac ± 10%).

> **Considering that it is very difficult to check the voltage limit during the voltage transient, this connection type is unsuitable.**

Therefore with IT network we suggest you to introduce a transformer.

Connect the PE cable to one of the two PE screw terminals on the front panel.

Clamp Resistor Connection

- When using the internal resistor connect terminals 7 and 8.

- When using an external resistor, connect the resistor between terminals 6 and 8.

Direct Connection to 400Vac TN-Network
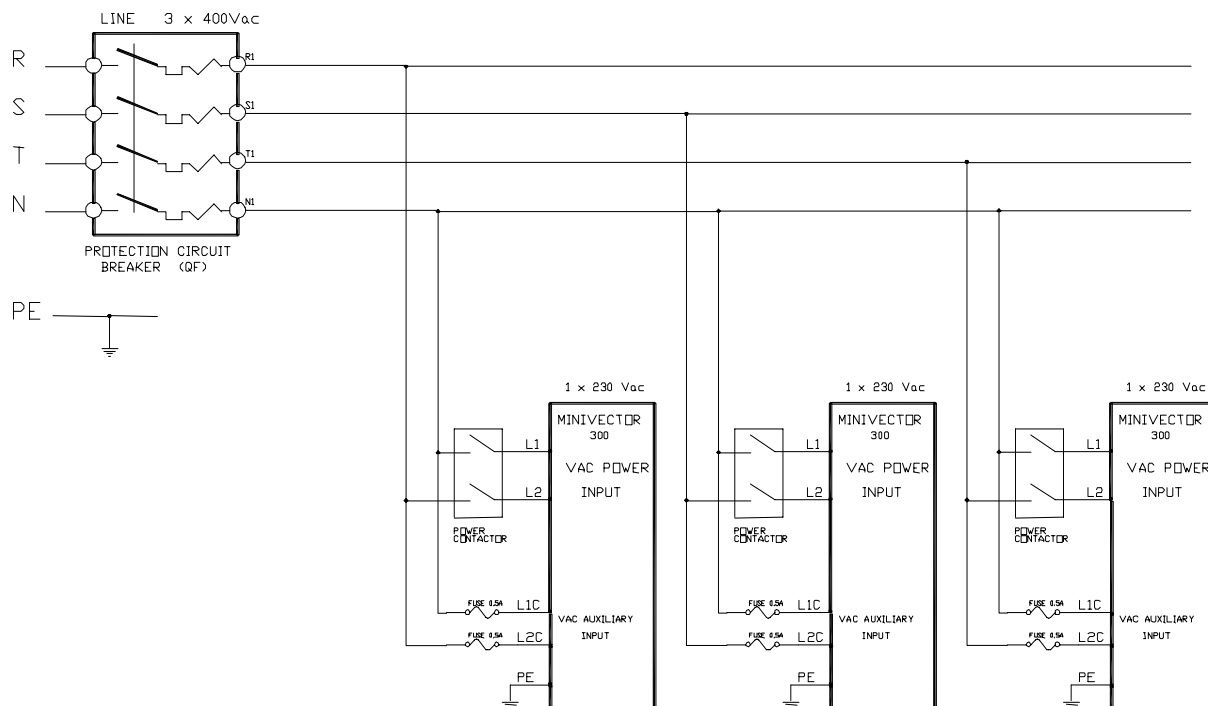
Connection to 400Vac TT-Network with Autotransformer
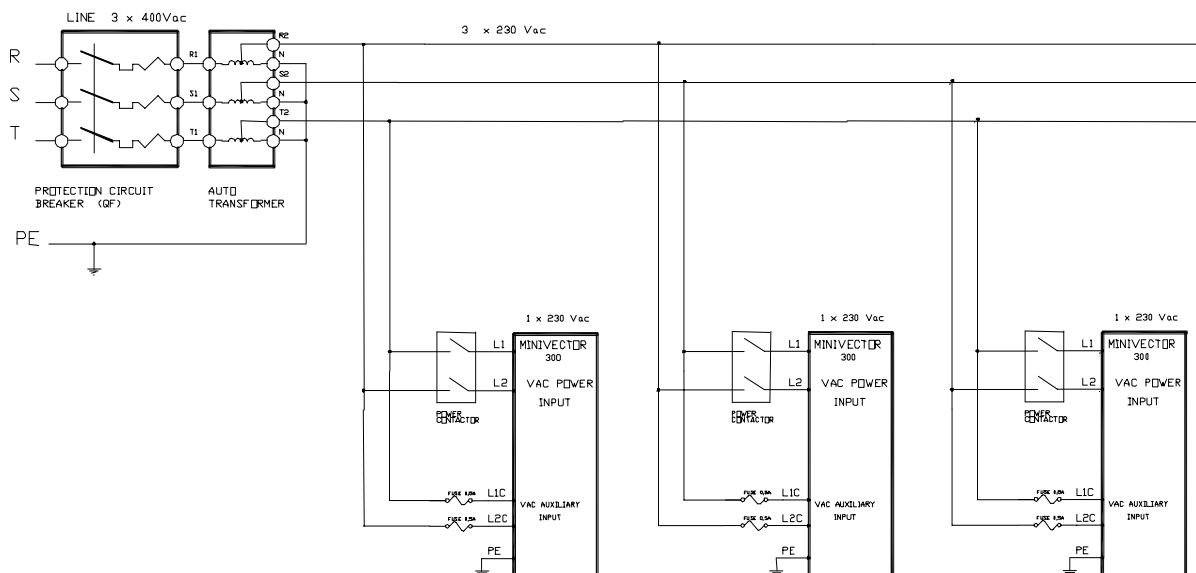
Direct Connection to 230Vac TT-Network
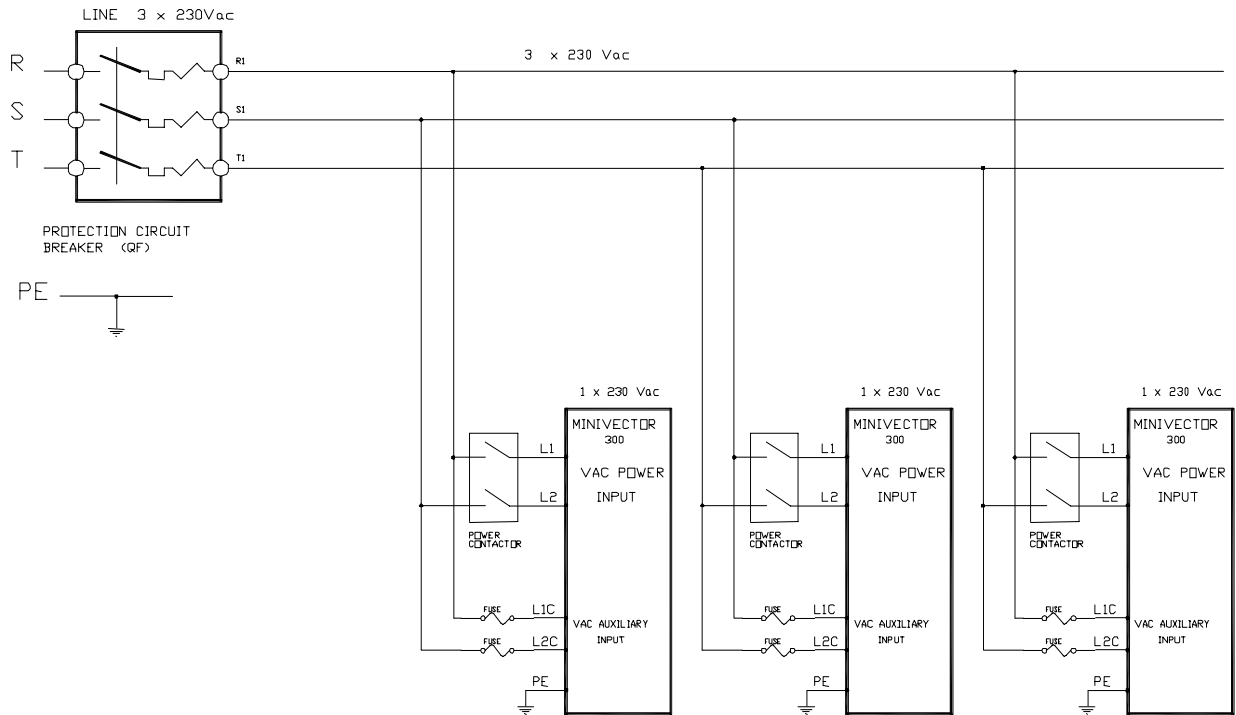
Connection to 400Vac IT-Network with Transformer
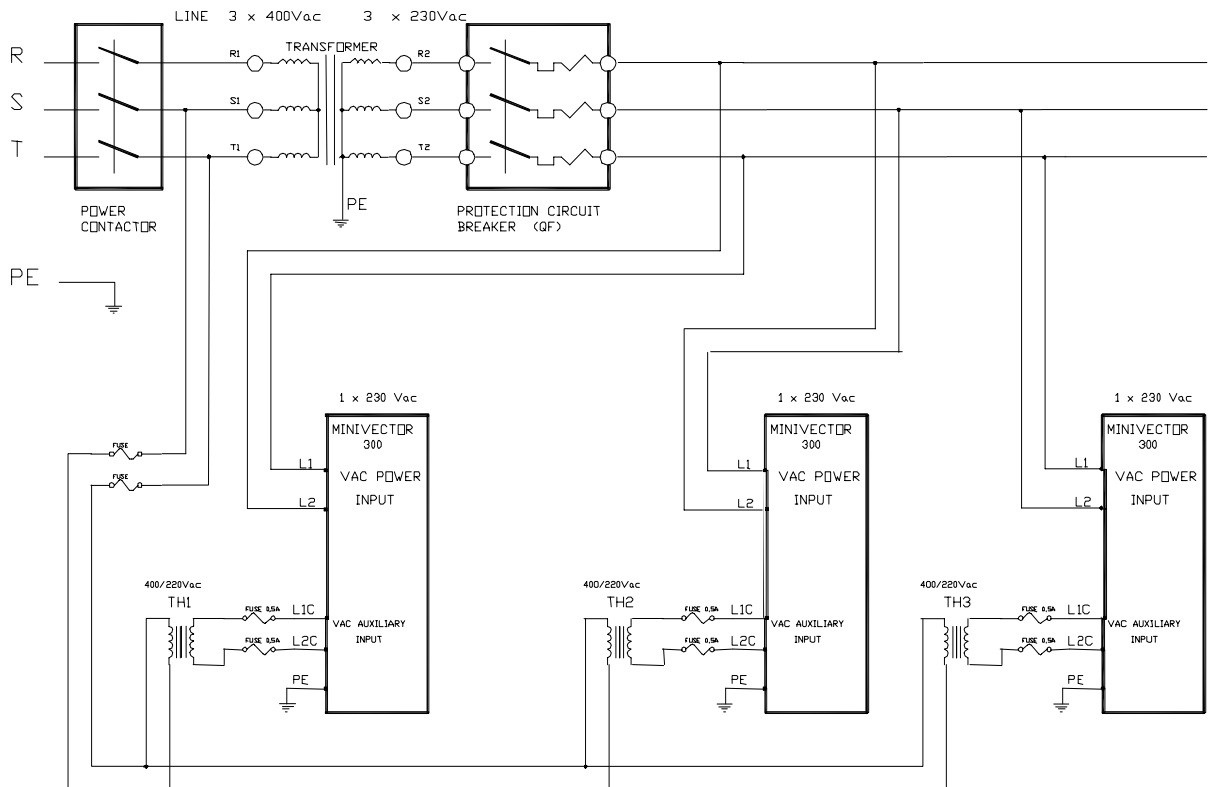
Auxiliary Supply Connections   The auxiliary supply L1C - L2C (Terminal X2) is necessary when you need to save the status data or the encoder emulation without the main supply L1- L2.
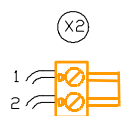
LC1 - LC2 auxiliary power input 110/230Vac ± 10% - 10VA max

Three-Phase Configuration
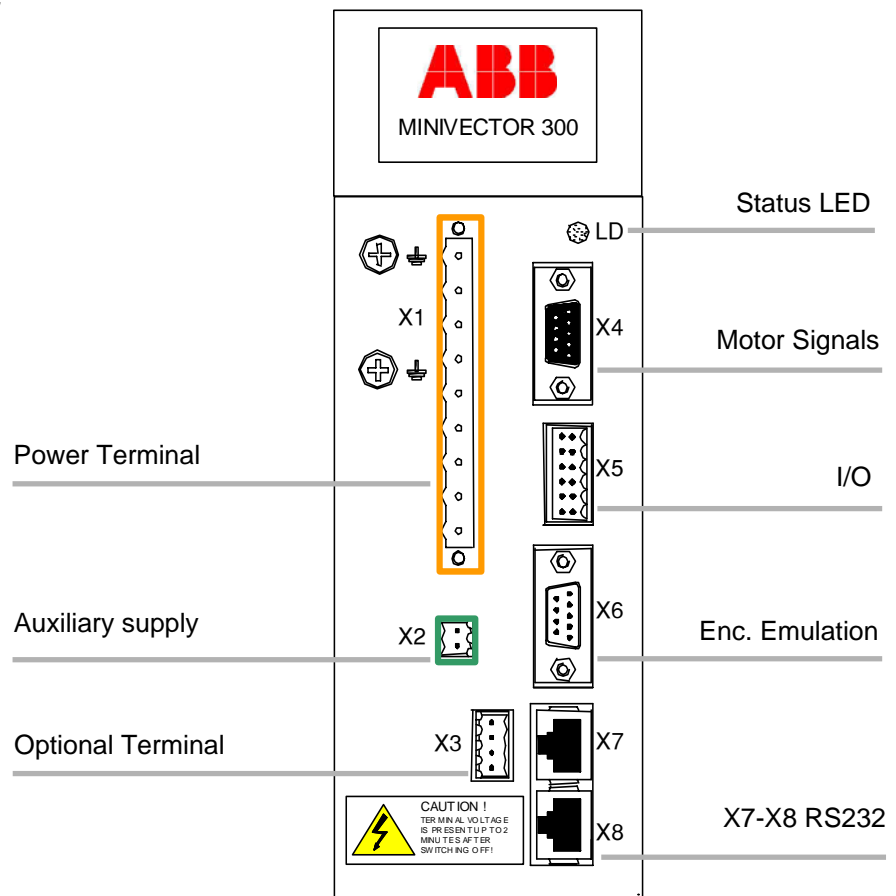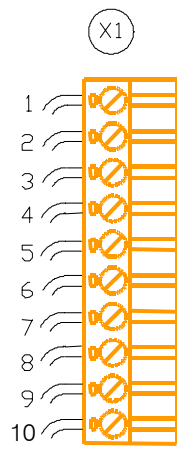
Description of Terminals

MINIVECTOR 300

Status LED

X1

X4 Motor Signals

Power Terminal

X5 I/O

Auxiliary supply

X2

X6 Enc. Emulation

Optional Terminal

X3

X7

CAUTION !
TERMINAL VOLTAGE
IS PRESENT UP TO 2
MINUTES AFTER
SWITCHING OFF!

X8 X7-X8 RS232

Wiring Scheme

Power Connections   Terminal X1 is dedicated to connections of power supply, motor and clamp resistor.

Pin	Signal	Description
1	R	Three-phase power supply (230 VAC)
2	S	Three-phase power supply (230 VAC)
3	T	Three-phase power supply (230 VAC)
4	U	Motore Phase 1
5	V	Motore Phase 2
6	W	Motore Phase 3
7	+VBUS	DC bus positive terminal
8	RCL	Internal clamp resistor
9	RCL EXT	Internal/external clamp resistor
10	-VBUS	DC bus negative terminal

Main Supply Connections   Connect terminals R, S and T according the electrical diagrams specific for each network type.

Connection to TT-network type is allowed.

Direct connection to the IT network is possible only if the voltage between the phase and the ground cannot exceed 253 Vac (230 Vac + 10%).

Considering that it is very difficult to check the voltage limit during the voltage transient, this connection type is unsuitable.

Therefore with IT network we suggest you to introduce a transformer, connected as illustrated in *Connection to 400 Vac IT-Network with Transformer*.

Connect the PE cable to one of the two PE screw terminals on the front panel.

Clamp Resistor Connection
- When using the internal resistor connect terminals 8 and 9.
- When using an external resistor, connect the resistor between terminals 7 and 9.

*Connection to 400 Vac
TT-Network with
Autotransformer*
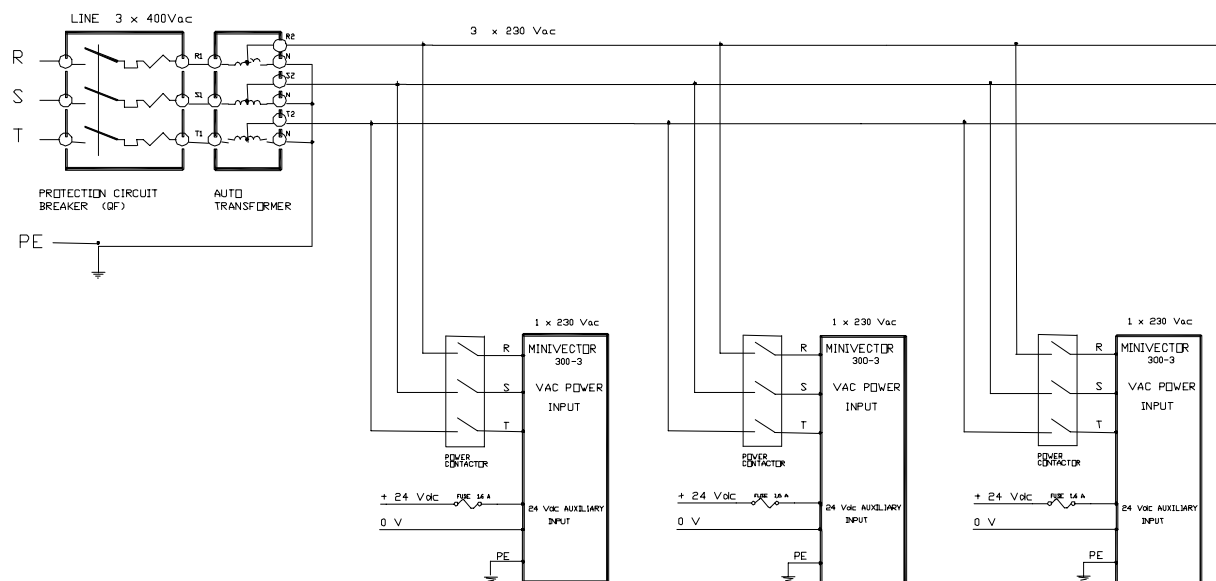
*Connection to 400 Vac
IT-Network with
Transformer*
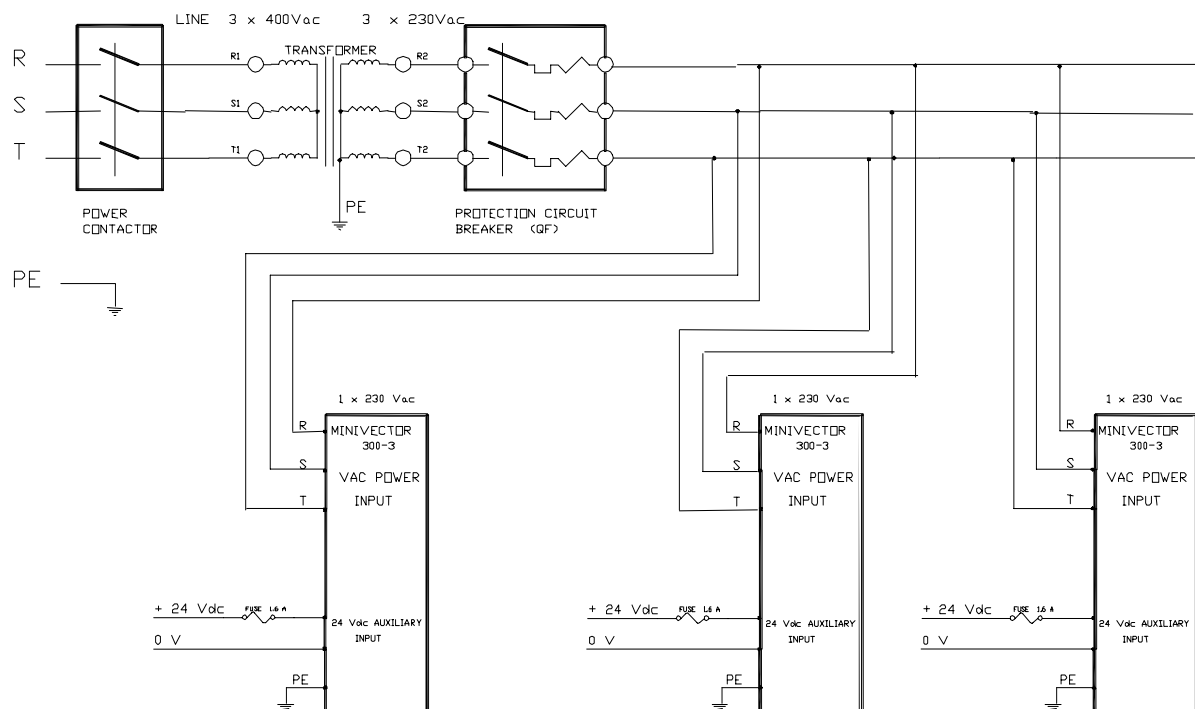
Auxiliary Supply Connections   Auxiliary supply must be 24 Vdc $\pm$ 15%, 1,5 A max, derived from a DC power supply.

24 Vdc $\pm$ 15%, 30 VA max.
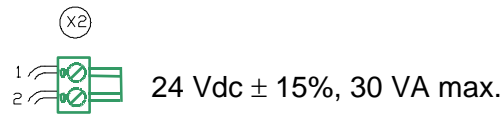
Motor Connections   Connect the motor wires to U, V, W, PE terminal observing the correct pole connection.

Connect the PE cable to one of the two PE screw terminals on the front panel.

Power Connections
SDM motor side

Power Connections
8C and 8N motor side
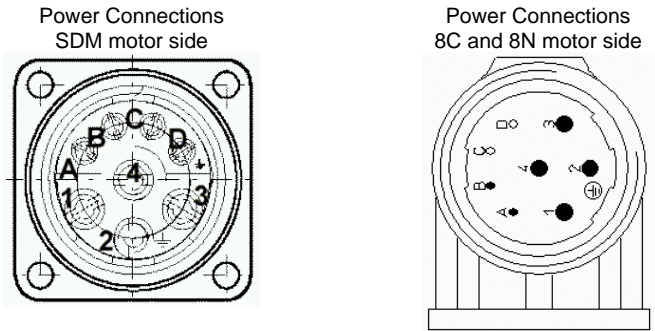
Pin	SDM Connections	8C1 Connections	8N Connections
1	U	V	U
2	Ground	Ground	Ground
3	W	U	W
4	V	W	V
A	+ Brake (optional)	+ Brake (optional)	+ Brake (optional)
B	- Brake (optional)	- Brake (optional)	- Brake (optional)

Power Connection box of 8C4 servomotors:

Ground wire connected on the pin 3 of signal connector
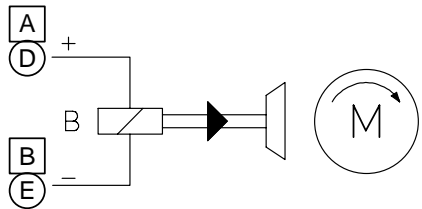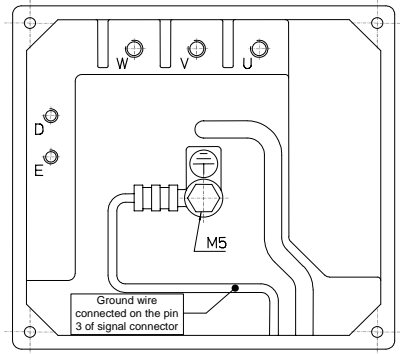
8C motors brake connections

Brake Connections

Connecting Terminal X3 is optional. It may be used with motors including an electromagnetic brake.

X3
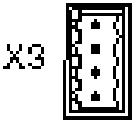
Pin	Reference	Description
1	24VOUT	Brake Output 24V (24Vdc, 0.8A max)
2	24BRIN	Brake Input 24V (24Vdc, 2A max)
3	B+	Positive brake supply
4	B-	Negative brake supply

The drive automatically cuts off power and releases the electro mechanic brake when connection between pins 1 and 2 is open.

Connect a potential free contact emergency switch between pins 1 and 2, or jumper them.

If the brake current is over 0,8 A, it is necessary supply the brake with an external voltage (24V dc with a maximum current of 2A) connected on pin B- (4) and 24BRIN (2).

Resolver Connections

Terminal X4 is used to interface the resolver transducer

X4
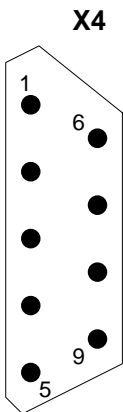
Pin	Reference	Description
1	THERMAL2	Motor thermal protection (2)*
2	N.C.	Not connected
3	+REFRES	+ resolver reference
4	SIN HIGH	+ resolver sinus signal
5	COS HIGH	+ resolver cosinus signal
6	THERMAL1	Motor thermal protection (1)*
7	-REFRES	- resolver reference
8	SIN LOW	- resolver sinus signal
9	COS LOW	- resolver cosinus signal

* Connect the thermostatic potential free contact (normally closed) or the PTC resistor between these pins

Front view of signal connector for motors 8C and SDM SERIES, on the left, and motors type 8C4, on the right.
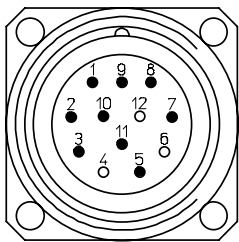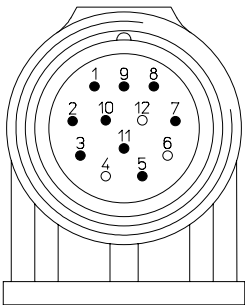
Resolver Cable

8CX SERIES RESOLVER CABLE
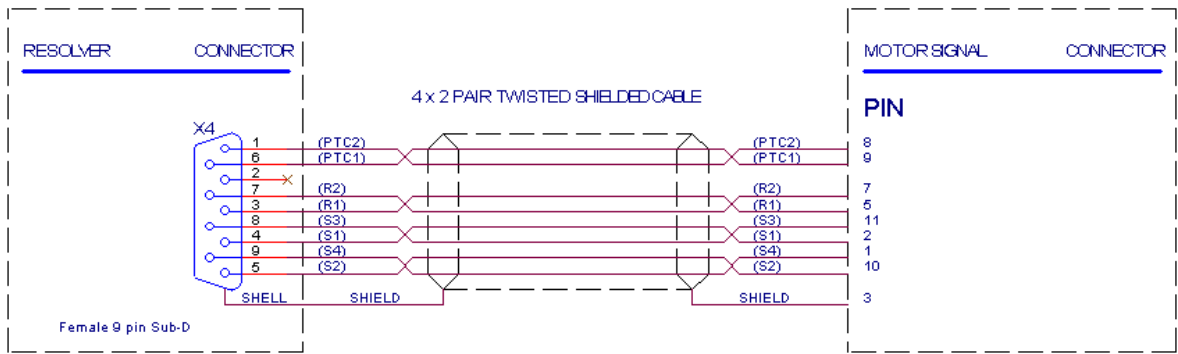
SDM251 SERIES RESOLVER CABLE
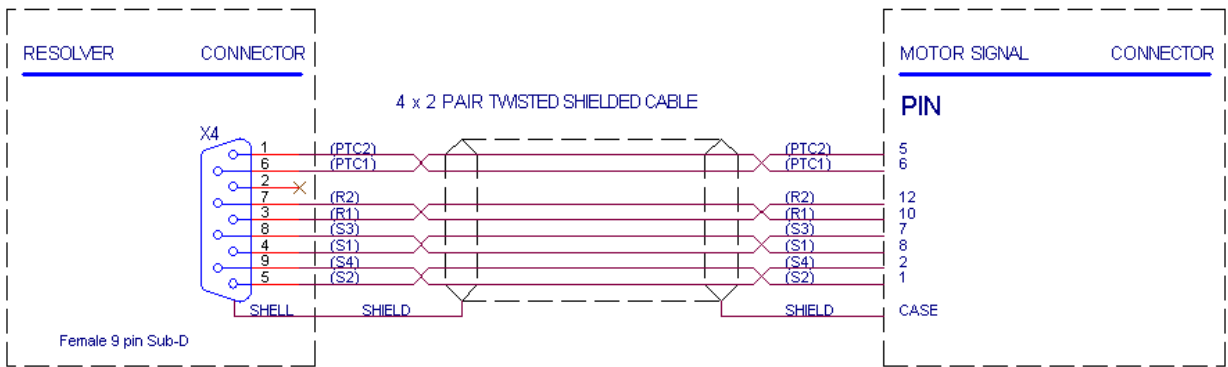
Control Connections   VREF1+/VREF1   analog reference input (+/-10 V - 25 Ω differential): is used for controlling the motor speed when the converter is configured in Speed Mode or the motor current when the converter is configured in Current Mode.

VREF2+/VREF2   analog reference input (+/-10 V - 25 Ω differential); may be used for limiting the maximum motor torque. Reference 0V = 100% current, 10V = 0% current.

ENABLE   digital input (15÷24V, 20 mA) to enable the power stage of the converter.

BRK UNLOCK   digital input (15÷24V, 20 mA) to unlock the motor magnetic brake and disable the dynamic braking.

FAULT1/FAULT2   relay contact normally closed when the converter status is Running status. The contact is open when the converter is in Stop status and some fault conditions are present.
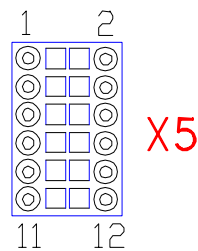
Pin	Reference	Description
1	VREF1+	Speed (or current) reference input +
2	VREF1-	Speed (or current) reference input -
3	VREF2+	Torque reference input + (option)
4	VREF2-	Torque reference input – (option)
5	ANGND	Analog ground
6	+15VOUT	Auxiliary voltage output (50mA max.)
7	-15VOUT	Auxiliary voltage output (50mA max.)
8	ENABLE	Power enable Input
9	BRK UNLOCK	Brake unlock Input
10	GNDCMD	ENABLE and BRK UNLOCK ground
11	FAULT1	Fault error signal input (relay contact)
12	FAULT2	Fault error signal output (relay contact)

Encoder Emulation

Terminal X6 has to be connected when the controller uses an encoder input as feedback of motor position

X6

Pin	Reference	Description
1	ENCA+	RS422 encoder signal
2	ENCB+	RS422 encoder signal
3	ENCZ+	RS422 encoder signal
4	N.C.	not connected
5	SHIELD	Shield
6	ENCA-	RS422 encoder signal
7	ENCB-	RS422 encoder signal
8	ENCZ-	RS422 encoder signal
9	GND	ground

Encoder Emulation Cable
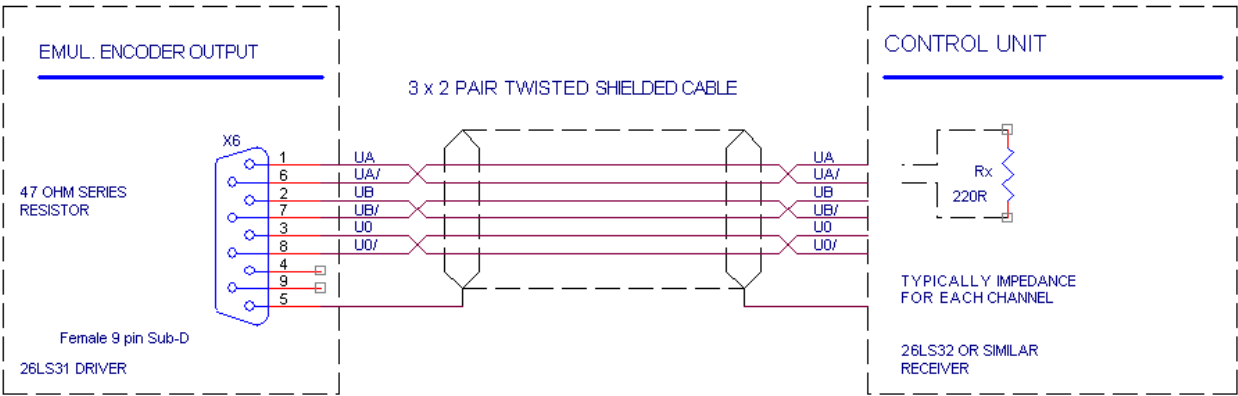
CABLE MAXIMUM LENGTH = 10M.

RX MIN	RX MAX	CABLE CAPACITANCE	MAX FREQUENCY
200 OHM'	4 KOHM	200 pF/m	200 KHz

Serial Connections   Terminals X7 and X8 are used to connect a PC serial line. The two connectors merge exactly the same electrical signals, so in RS485 bus you can use X7 as input connector and X8 as output connector (or vice versa).
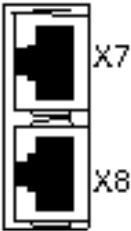
Pin	Reference	Description
1	RS232-RX	Rs232 receive
2	RS232-TX	Rs232 transmit
3	N.C.	Not connected
4	RS485 D-	Rs485 tx/rx -
5	RS485 D+	Rs485 tx/rx +
6	RS232 GND	Rs232 ground
7	RS485 GND	Rs485 ground
8	N.C.	Not connected

RS232 Serial Cable
- Maximum cable length: 10 meters
- Maximum capacitance: 2500 pF
- Shielded cable
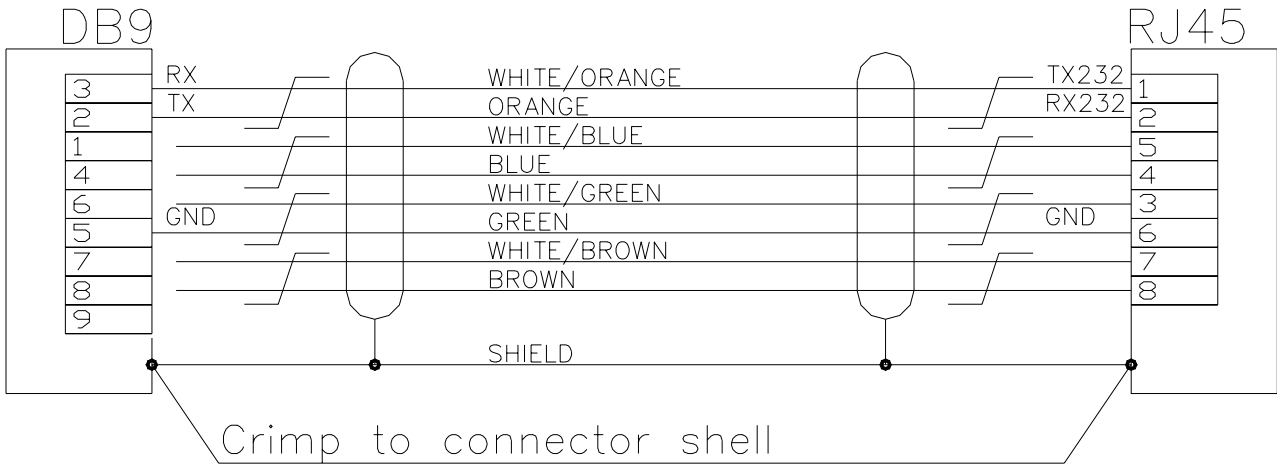
RS485 Serial Cable
- Maximum cable length: 100 meters
- Maximum capacitance: 100 pF/m
- Impedance: 120 ohm typ.
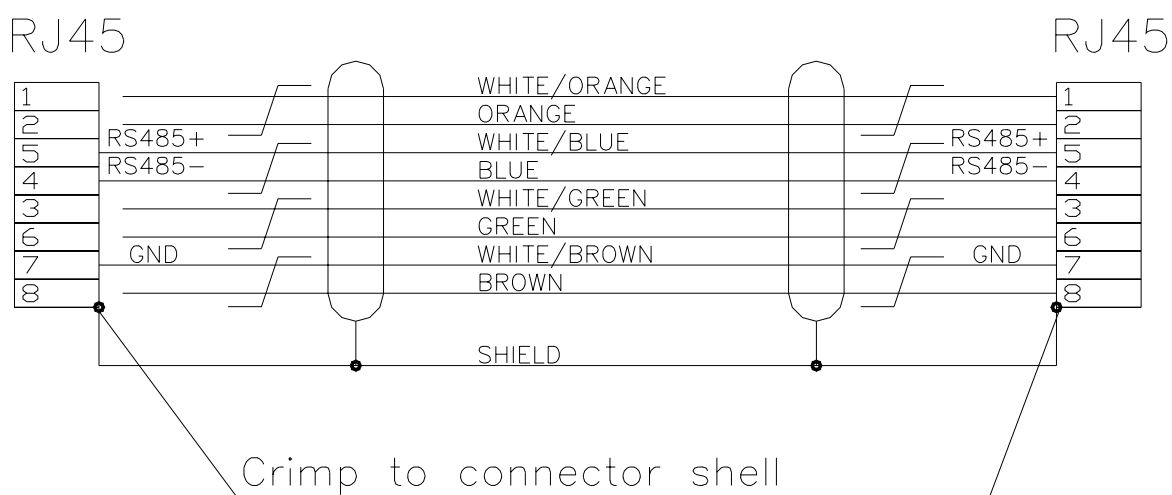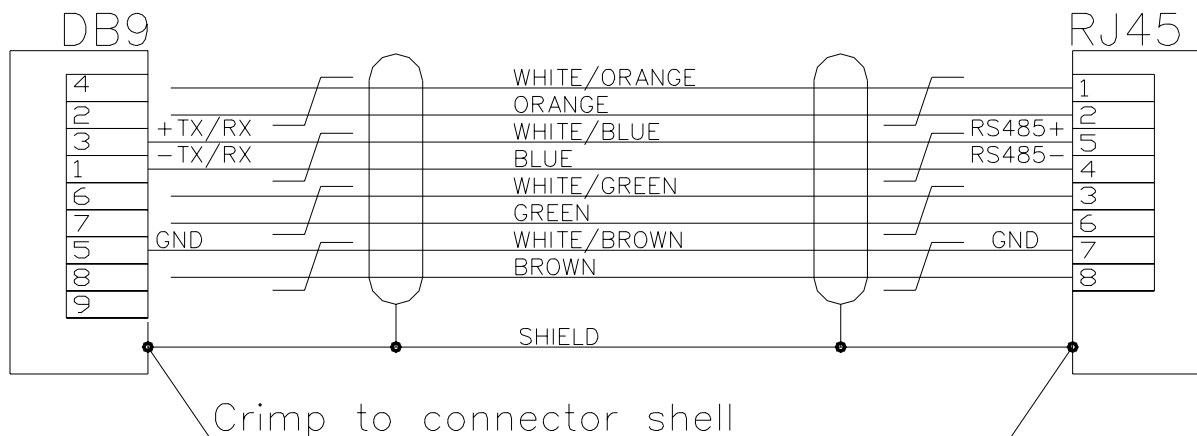
Cross Sections

Function	Terminal	Size 3/6	Size 5/10	Size 7/14
Clamp resistor cable	X1	1.5 mm^2		
Motor cable	X1	1.5 mm^2	2.5 mm^2	
Power supply cable	X1	1.5 mm^2	2.5 mm^2	
Brake cable, brake and auxiliary supply	X2, X3	0.5 ÷ 1 mm^2		
Resolver cable	X4	0.14 ÷ 0.22 mm^2		
Control unit signal cable	X5	0.14 mm^2		

Chapter 5 - Commissioning

Overview   This Chapter describes the PC configuration tool for commissioning MINIVECTOR 300 Servodrives.

Getting Started   You can't configure and parameterise the MINIVECTOR 300 without the "MINIVECTOR Interface" interface software that guides the user through the procedure for setting up the converter, displays the electrical and mechanical variables and enables any alarms to be identified.

The hardware and software requirements for installing "MINIVECTOR Interface" are as follows: PC with Windows 95/98/NT, 2000, XP, an RS-232 or RS-485 serial line, at least 2 MB of free hard disk space and a mouse.

To install "MINIVECTOR Interface" insert in the CD-ROM drive the installation CD delivered with the converter, run setup.exe and follow the instructions.

The "MINIVECTOR Interface" browser allows you to do the following:

- Identify the model and size of the converter along with the firmware versions currently resident on it;

- Read and write drive parameters, and load and save sets of parameters and basic information in files, download and update of the firmware version;

- Save the current configuration in the converter's EEPROM memory;

- Real-time control and monitoring of the drive's physical variables, status and any alarms.

MINIVECTOR Interface Browser

When you start "MINIVECTOR Interface" it displays a window with which it is possible to choose the working mode: off-line and on-line.
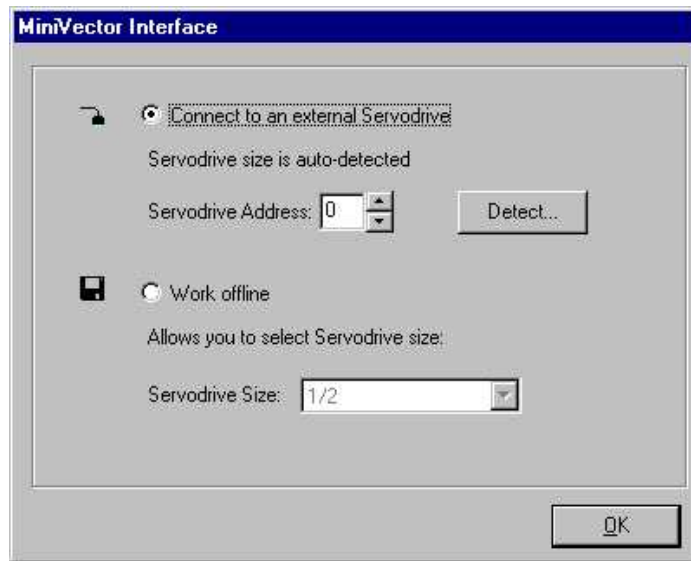
Browser Offline

The off-line mode allows you to pre-set the drive parameters in function of the application and to save in a file without to be connected to the drive. The file saved is available to be loaded in drive.

- Select the off-line mode and the drive size that you want to use.

- Select in the "Commands" menu the command "Select motor", and than choose the motor type.

- Set the parameters in function of the application.

- Save the parameters in a file by the command "Save as" of the "File" menu.

Browser Online

The on-line mode allows you to set the drive parameters connected to the drive.

- Select the on-line mode and the serial address (normally the serial address is 0).

- Select in the "Commands" menu the command "Select motor", and than choose the motor type.

- Set the parameters in function of the application.

- Save the parameters in the EEPROM by the command "Freeze configuration" in the "Commands" menu.

- Save the parameters in a file by the command "Save as" of the "File" menu.

In case you have already the parameters file of a previous application, you have to:

- Select in the "File" menu the command "Open" and choose the right file of the application.

- Save the new settings in the EEPROM by the command "Freeze configuration" in the "Commands" menu.

Note. To be online connected, select the serial communication port of your PC from menu *Commands – Change COM Port …*

Startup Assistant Once realized the previous operation, the Start Up page shows the Drive Model, Size, Serial Number, Boot version, Firmware Version, Config Version, and Motor poles. This information can't be changed by the user with the exception of the fields Application Description and Motor poles. Use the Application Description field to save the name of the data archive currently being used.
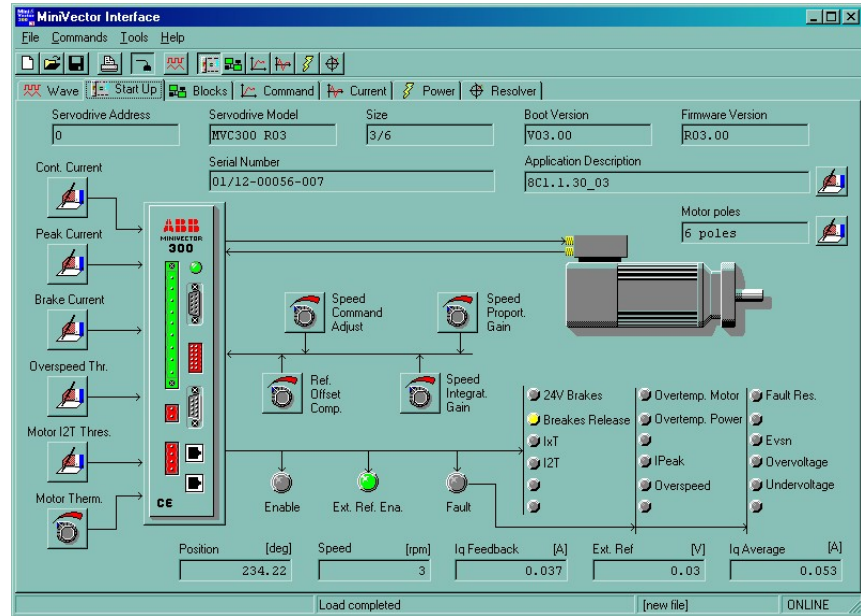
The Size is expressed in the format In/Ip, in which In stands for the converter's rated current and Ip stands for its peak current. Both values should be considered as expressed in rms amperes.

Three indicator lights indicate the current status: Enable, Ext. Ref. Enable and Fault. Twelve small indicator lights show any active safety functions.

Use the following icons to display, set and change parameters:

Selector allows you to switch between different operating modes (e.g. current/speed mode) or make simple selections (e.g. setting the encoder emulation resolution).

Trimmer allows you to carry out fine adjustment of those parameters that require calibration to optimise performance of the drive (e.g. the speed loop gains).

Parameter used to set a given drive parameter (e.g. the peak current).

Five display fields provide further information on the axis (position, speed, current, external reference and rms current). Their values are refreshed every 0.5 seconds when the serial communication is active.

Block Analyzer   Clicking the mouse on the image of the converter or the menu *Tools –*
Block Analyzer takes you on to the next window. This window
provides an overview of the set of blocks forming the converter, as
well as monitoring certain variables. Subsequently clicking on any of
the blocks takes you on to the related windows.
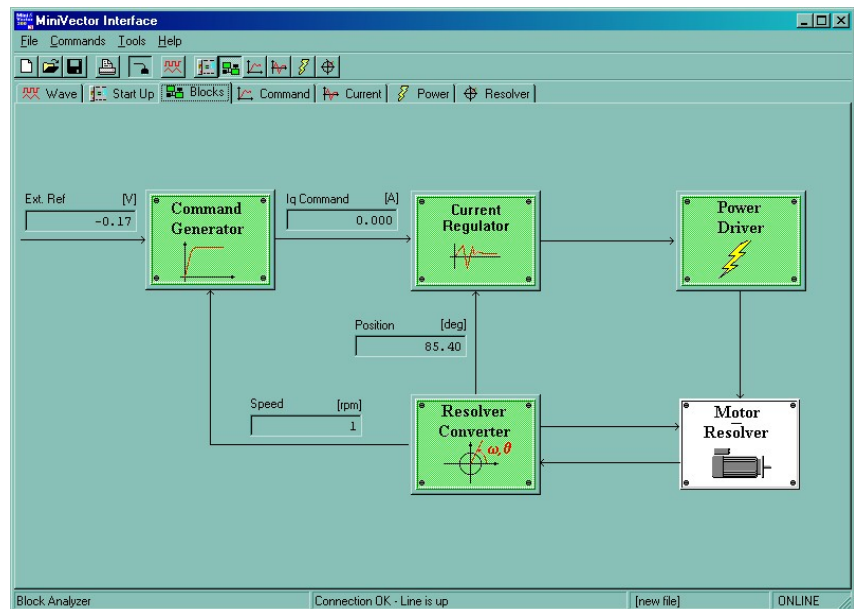
Command Generator   The Command Generator window contains the reference input setting
and conditioning section and allows you to set the speed loop
parameters
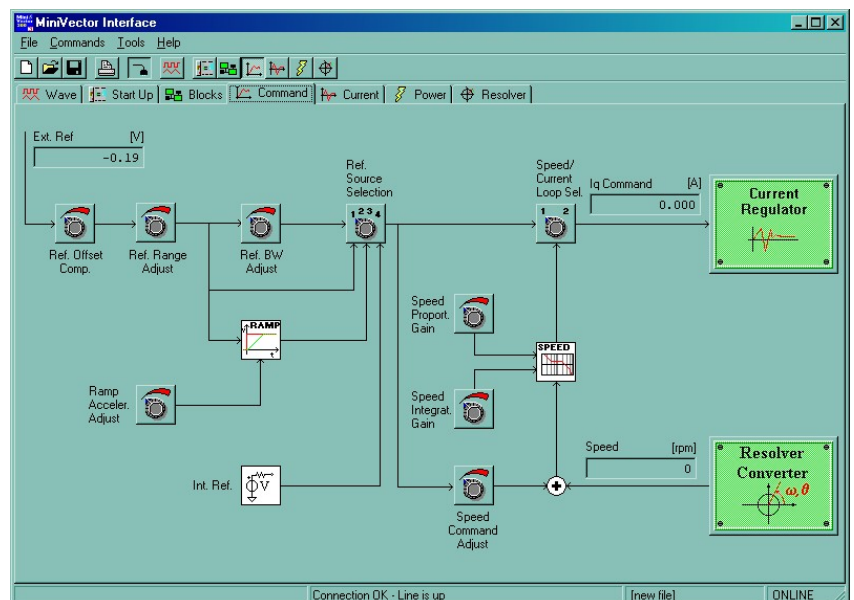
Current Regulator   The *Current Regulator* window contains the parameters for setting the current loop. These parameters are subject to access restrictions (a password).
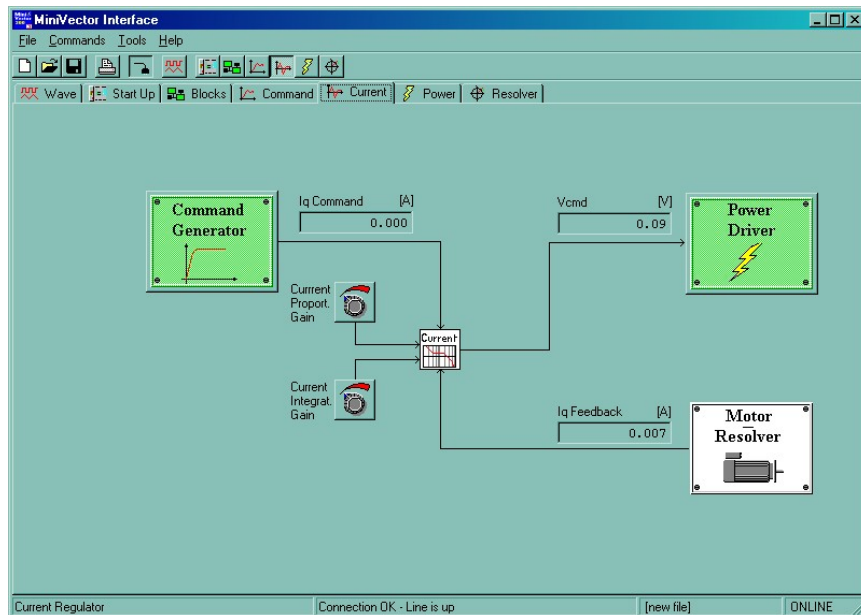
Resolver Converter   The *Resolver Converter* window concerns the position feedback from the resolver and allows you to set the encoder output resolution and the phase angle between the motor and resolver. No other settings are required since the return signal levels and phase relationship with the carrier are set automatically each time the converter is switched on.
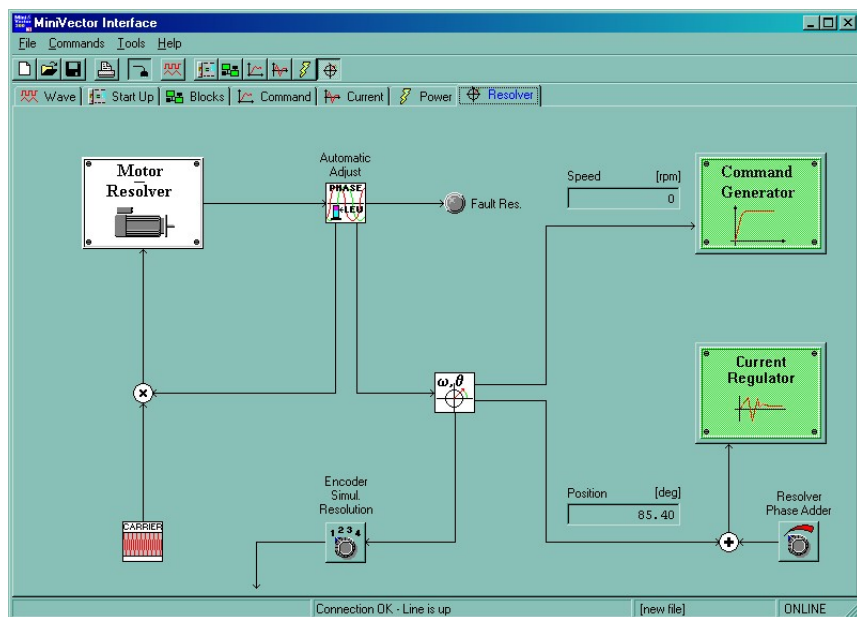
Power Drive   The *Power Drive* window shows the status of the converter's power stage. You can also enable/disable the external reference (*Ext. Ref. enable* button) and the converter itself (*General enable* button) in this window.

The *General Enable* button must always be ON to enable power to the drive.

The *External Reference Enable* button must be ON during normal operation.
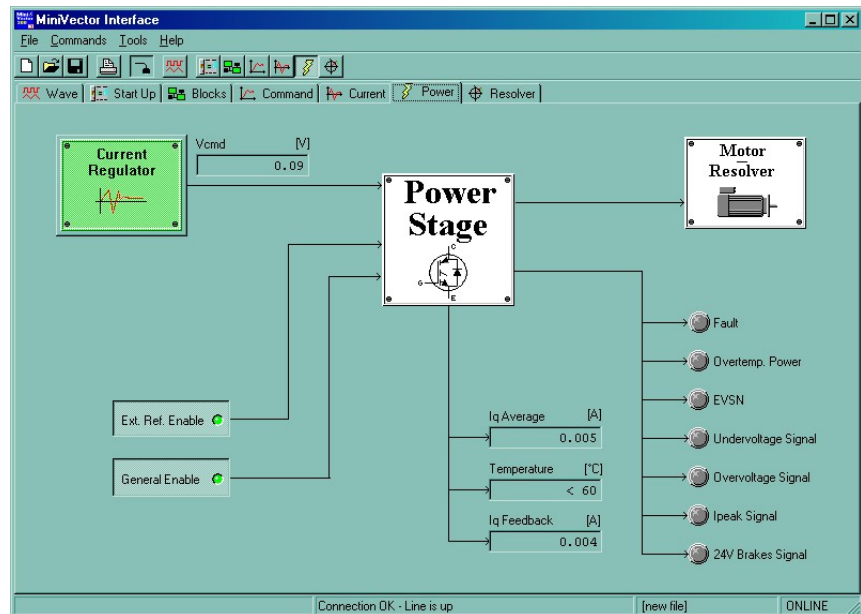
Waveform Generator These utility functions can be accessed using the command *Tools –
Waveform Generator*.
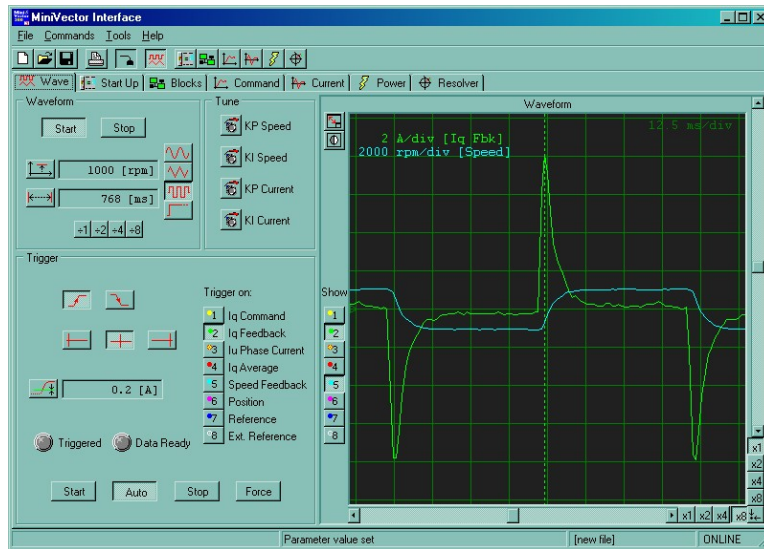
The oscilloscope function works and is displayed in exactly the same
way as on the front panel of a normal digital oscilloscope. Buttons are
provided for selecting the level, front, position and trigger channel.

Press the *Start* button to start acquisition of the signals. The
Triggered indicator light comes on when the trigger condition
occurs. The *Data Ready* indicator light comes on when the acquired
data buffer is complete. The Trigger condition can be forced at any
time using the *Force* button. In this case acquisition starts
immediately. An automatic trigger function is also available (*Auto*
button).

The MiniVector 300 drive saves the samples of the two channels
selected (the data buffer comprises 1024 samplings with an interval
of 1 msec). The data can only be transferred to the oscilloscope
display if serial communication has been enabled and is active (the
Connect command has already been activated and the serial line
status message is ON LINE).

To select the channels to be acquired and displayed, select the
trigger parameter in the first column (*Trigger*) next to the
oscilloscope screen and select the second parameter in the other
column (*Show*).

The Waveform Generation function allows you to control the drive
with a digital waveform generator in accordance with the control
mode (current/speed) selected. You can program the amplitude,
form and period of the waveform. The drive is disabled with the *Stop*
command for safety reasons. Click on the *Enable* button in the
Power Driver window to enable it again.

In addition, you have direct access to proportional and integrative
gains of current and speed controllers so that you can easily tune
the drive while observing its response on the oscilloscope window.

Parameter Settings   All the parameters that can be set using the "MiniVector Interface" program are listed below: Clicking the mouse on the icon for the parameter desired opens the window for displaying the current value and any change. Depending on the type of parameter concerned, the system will either provide a window for setting it using the keyboard, a window for making your selection using the mouse, or a window for making changes using the sliders for increasing or decreasing the value. When you have modified the value, activate the change by clicking the mouse on the Set button and then exit the setting phase by clicking on *Done*.

> *Note.*   All the parameters are stored in volatile RAM until the configuration is saved in the converter's EEPROM (see the section entitled Saving and Restoring the Parameters). All the configuration data will be lost if the drive is switched off during execution of the Freeze command.

Limitation Functions   The following parameters allow you to set the drive current limits and the current protection function tripping thresholds.

Note that In is the converter's rated current in A (rms) and that Ip is the peak current in A (rms).

Continuous Current	The current the motor can absorb continuously; the maximum value that can be set is the same as In. The tripping of protection functions Ixt of the converter and I2xt of the motor automatically limit the current that can be delivered to this value. Access is password protected.
Peak Current	The maximum short-time current (2 s) that the motor can absorb. The maximum value that can be set is the same as Ip.
Brake Current	The current value during dynamic motor braking. The setting range extends from zero to 1.2 In.
Overspeed Threshold	the tripping threshold of the overspeed protection function. The setting range extends from zero to the maximum permissible speed.
Motor I2xt Threshold	The tripping threshold of motor protection function I2xt. The setting range extends from zero to 1.1 In. Access is password protected.
Motor Thermal Constant	The motor's thermal time constant. It can be set to from 1 to 55 minutes. Access is password protected.
Motor poles	Number of magnetic pole pairs in the motor. This datum can only be set automatically by launching the procedure that searches for the number of pole pairs and the angle between the motor and resolver (see the section entitled The Autophasing Procedure).

> ⚠ **WARNING!** Command *Select Motor* defines automatically the value of the following parameters in order to get the best performance for motor-drive association.

In addition, the following parameters (that form an essential part of the *Command Generator* window) can also be accessed: *Speed Command Adjust*, *Reference Offset Compensation*, *Speed Proportional Gain* and *Speed Integrative Gain*.

Selecting the Operating Mode	The MiniVector 300 converter is designed to operate in speed or external analogue reference current control mode. It is however possible to switch the reference to the internal digital waveform generator to set up the regulators. *Speed/Current Loop Selection* selector allows you to switch between current control mode and speed control mode.
Current mode	In current operating mode the external reference drives the current loop directly; the adjustment is performed using the space vectors technique with direct axes in quadrature with the motor to optimise the torque generated for a given current delivered.
Speed mode	In speed operating mode, the external reference controls the speed control loop, which in its turn drives the innermost current loop.
External Reference Conditioning	The *Reference Source Selection* selector allows you to choose between four speed or current loop control modes:

- *External*: control by the reference analogue signal with the application of a digital filter;

- *Internal*: control by the internal digital signal. In this case the motor runs at the maximum speed set with the parameter *Speed Command Adjust*;

- *External with Ramp*: analogue control with application of ramp filter;

- *External without BW Filter*: analogue control without digital filter.

Reference Offset Compensation	Compensation of the offset present in the analogue reference input. The compensation range is ±300 mV.
Reference Range Adjust	Amplifies the reference input by between 100% and 400% Makes it possible to give full control to the converter even with an input of less than ± 10 V, down to a minimum of ± 2.5 V. If the input level is ± 4 V, for example, you should set the amplification to 250% (4 V× 2.5 = 10 V).
Reference Bandwidth Adjust	Sets the bandwidth for the filter on the external reference input to between 5 Hz and 5 kHz.
Ramp Acceleration Adjust	Sets the duration of the ramp to between 0.01 s and 50.00 s. This time should be seen as the time taken by the ramp to go from zero speed to the maximum speed set with the parameter *Speed Command Adjust*.

Tuning the Speed Loop	The following parameters allow you to configure the speed loop:

Speed Command Adjust	Sets the maximum speed that a command can demand of the servomotor. In the case of an internal command, it serves to set the speed of the motor itself. This parameter does not have any effect when the internal digital waveform generator is being used.
Speed Proportional Gain	Speed loop proportional gain.
Speed Integral Gain	Speed loop integral gain

Tuning the Current Loop The following settings can be made in the *Current Regulator* window.

⚠ **WARNING!** Command *Select Motor* defines automatically the value of the following parameters in order to get the best performance for motor-drive association.

Current Proportional Gain   Current loop proportional gain.

Current Integrative Gain   Current loop integral gain.

Encoder Resolution

Encoder Simulation Resolution   Sets the encoder output resolution. The resolution setting can be chosen from four values: 128, 256, 512 and 1024 pulses per revolution.

Resolver Phase Adder   Sets the phase angle between the motor magnetic axis and resolver. This parameter can be determined automatically by launching the Autophasing procedure (see the section entitled The Autophasing Procedure). Access to this parameter is password protected.

Autophasing

The Autophasing procedure allows you to determine the number of motor poles and the angle between the motor magnetic axis and resolver automatically. The procedure can be launched when setting the *Motor poles* parameter (*Startup Assistant* window) and *Resolver Phase Adder* parameter (*Resolver Converter* window). In addition, the Autophasing procedure also provides basic diagnostics on the correctness of the converter wiring and represents an initial test to check that the converter itself is operating correctly.

Note. When you use ABB motors it is not necessary to do this procedure because the motors are already adjusted in the factory.

⚠️ **WARNING!** The Autophasing function enables the converter's power stage and causes the motor to move. Disconnect the motor from the mechanical transmission components to ensure that the procedure is executed correctly and does not cause any problems with the axis to which the drive may already be connected.

The drive remains disabled at the end of the procedure for safety reasons. Click on the *General enable* button in the *Power Drive* window to enable it again.

The Autophasing procedure may not be completed in certain circumstances, in which case a diagnostic message is displayed, suggesting what action should be taken:

- *No power input enable*: hardware not enabled; activate the Enable input and start the procedure again.

- *Motor with 2 inverted phases*: the motor phases have been connected the wrong way round, such that the motor turns anticlockwise instead of clockwise during the procedure; switch off the drive, change over the connections and repeat the procedure.

- *Not moving motor*: make sure that the motor is connected to the converter correctly and that no protection functions have been tripped.

- *Unknown motor type*: the procedure automatically recognises motors with 2, 4, 6 and 8 poles; check the number of motor poles and enter the number manually if necessary.

Dynamic Braking

The MiniVector 300 converter features an emergency braking system known as 'dynamic braking' that consists in short circuiting the motor's terminals while monitoring the current that flows through them. The value of the braking current can be set with the *Brake Current* parameter.

Dynamic braking is active when the converter is disabled and when a fault occurs (with the exception of overcurrent and overvoltage faults), providing the digital release input (*BRK UNLOCK*) is kept low (connected to 0 V).

Compared to other braking techniques, dynamic braking offers the advantage of being able to operate even when there is no feedback from the resolver, which would otherwise, for example, make it impossible stop the motor using a zero speed command.

Saving And Restoring Parameters

The parameters must be copied from the volatile memory after the driver has been configured as required by the application and saved in the permanent memory in the servo amplifier. Use the Freeze Configuration command in the Commands pull-down menu to execute this operation. The program also asks you to enter the name of a file in which to store the parameters to be saved on the PC's hard disk.

You can also save the current configuration of the parameters to a file on disk using the command Save As. in the File menu. The configurations saved to PC can be useful as documentation on the application and also be used to initialise other drives with the same parameters. You can do this using the command Open... in the File menu. The file selected is used to set the drive parameters automatically.

Don't forget to execute the Freeze Configuration command at the end of this procedure to permanently save the configuration loaded.

The converter is disabled for safety reasons while the data is being loaded from the file; click on the *General enable* button in the *Power Drive* window to enable it again.

The command *Commands – Select Motor*, on the other hand, accesses the library of preset motor-converter configuration files.

In cases were certain parameters have been set incorrectly, you can load the default (factory set) values again using the command *Commands – Specials – Flash upgrade – Reset Parameters*.

Firmware Update

Along with a new release of the "MiniVector Interface" graphic interface, an updated version of the firmware for the converter is also distributed. This version can be downloaded into the converter using the command *Commands – Specials – Flash upgrade – Download Firmware*. While the firmware is updated the converter is disabled and the LED indicator on the front panel is red, flashing on and off.

If, at power-up, you see the red LED flashing on and off, it means that a valid firmware version is missing on the converter; download the firmware using the above command.

Troubleshooting

This section deals with managing emergency conditions and identifying possible fault causes. A brief explanation of the drive internal operation is also given.

Converter Status

The Minivector 300 converter can be in a number of different operating conditions depending on the external commands it receives and the events that occur when it is on. Each of these conditions is a converter *status*:

- *Stop Status*: the converter is disabled, with the green LED flashing on and off; if a protection function (warning) is active, it is indicated by the yellow LED flashing on and off, while in case of a fault the LED produces a sequence of red and green flashes indicating the error that has occurred. The *BRK UNLOCK* control allows you to release the holding brake and inhibit dynamic braking; the *ENABLE* control puts the converter in its Running status.

- *Running Status*: the converter is fully enabled for operation and the power stage is active; the green LED comes on with a steady light (yellow if there are any warnings); there are no faults; the *ENABLE* control takes the converter back into Stop status. If there are any faults, it goes automatically into Stop status.

Emergency Stop Features

If the drive is enabled, it goes into Stop status when a fault occurs. This condition is signalled externally by activation of the fault output and the LED on the converter's front panel, which emits an error code. Dynamic motor braking is enabled in all cases with the exception of the Overcurrent, Overvoltage and Power Supply Fault (EVSN) protection functions, while the holding brake can always be released if present. Dynamic braking and the holding brake will, however, only operate if the release input (*BRK UNLOCK*) is kept low (connected to 0 V).

Fault Reset

Once the converter has gone into Stop status because of a fault it stays there for as long as the causes of the fault remain and the *ENABLE* input is not activated. If the causes of the fault have ceased, to reset all the protections you can simply disable and then re-enable the converter.

Fault codes are listed in Appendix A.

Chapter 6 - EMC Standards

Overview   This Chapter describes EMC guidelines and requirements for the installation of MINIVECTOR 300 Servodrives.

Statement   The converter is a product designed to be incorporated in a more complex equipment.

Therefore electromagnetic compatibility depends on the installation, wiring and grounding of the equipment.

In this manual are given instructions for installation in order to obtain conformity with actual standards for electromagnetic compatibility. This information have been collected after a comprehensive test campaign and their purpose is to make the job of the end user as easy as possible.

Reference Standards   The following current regulations has been used for product certification:

- EN61800-3   Semiconductor power converters for adjustable speed electric drive system. Part 3, first edition, 1996).

Definitions

Restricted distribution   Mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

First environment   Environment that includes domestic premises. It also includes establishments directly connected without intermediate transformers to a low-voltage power supply network, which supplies buildings used for domestic purposes.

Second environment   Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Installation in First Environment
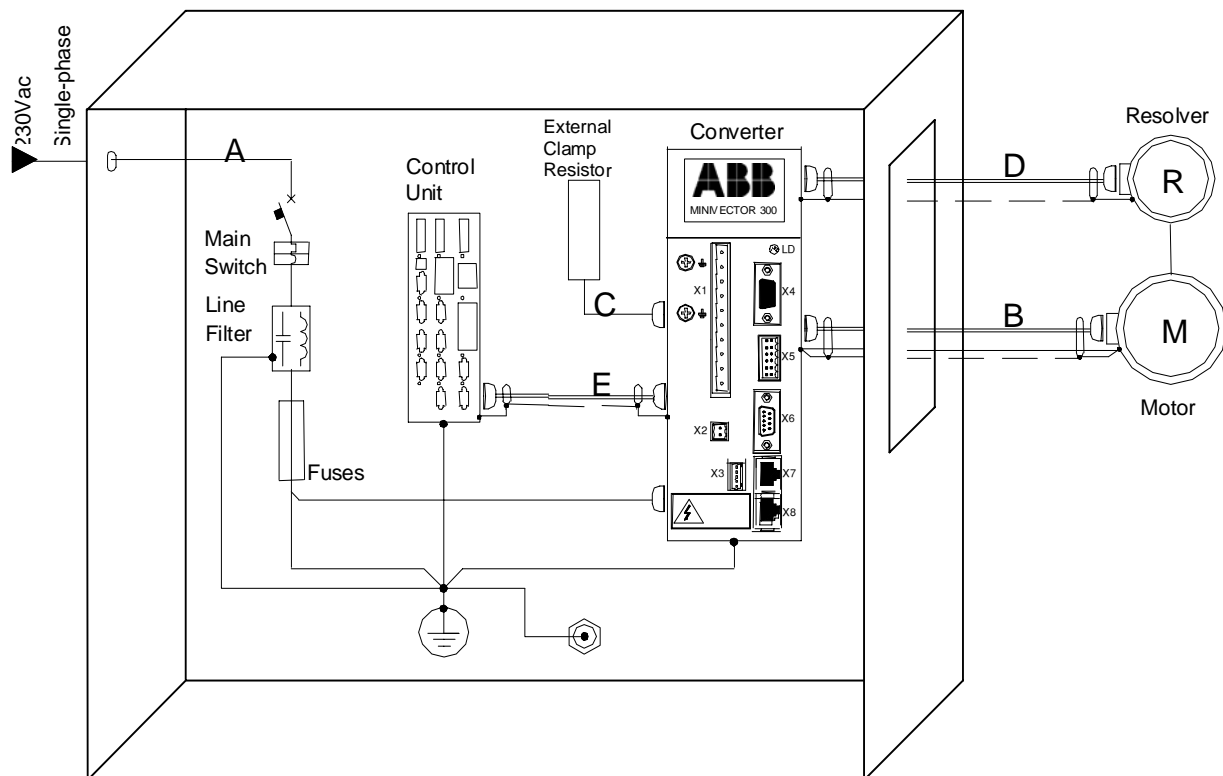
- **Supply cable (A)**: no prescription.

- **Motor cable (B)**: to prevent emission of the motor cable is recommended to use of shielded cable. The shield must be conn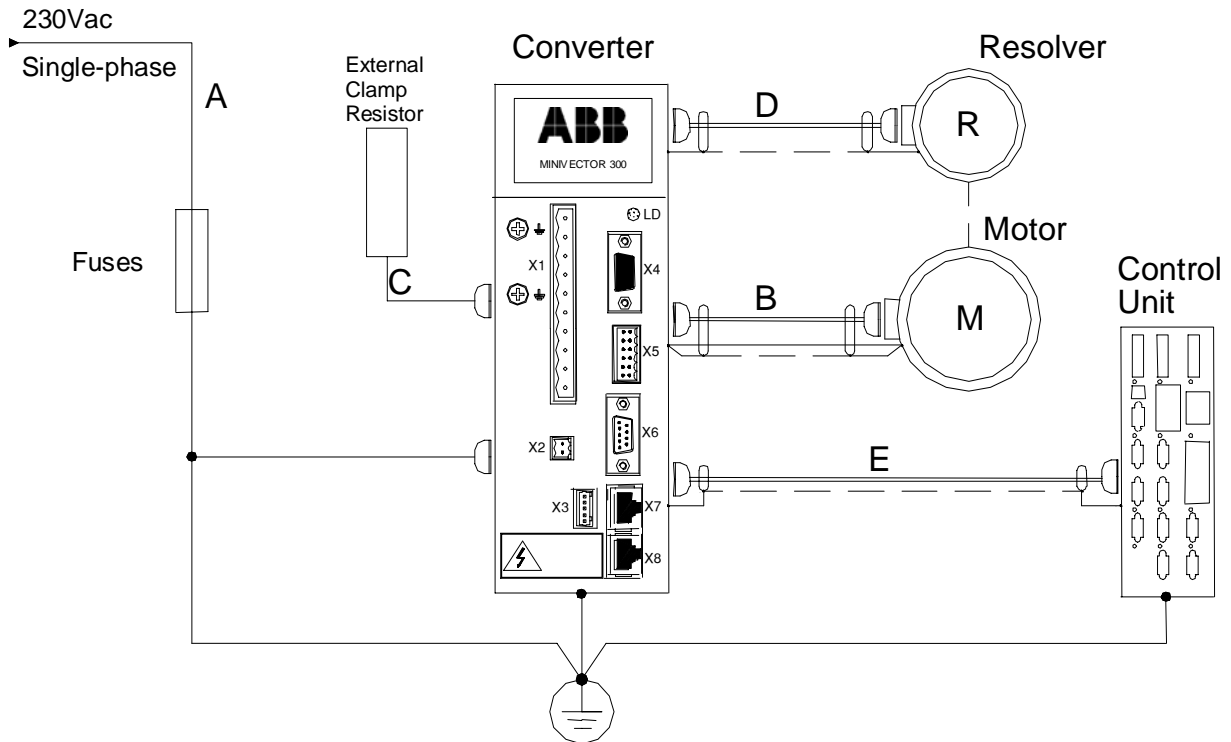ected to the converter ground terminal and to the ground terminal of the motor. The cable length must be less or equal 25m.

- **Clamp resistor (C)**: connected through twisted cable with length less or equal 2m.

- **Motor signal cable (D)**: shielded cable with length less or equal 25m.

- **Control connections (E)**: shielded cable with length less or equal 3m.

- **Network filter**: Siemens B84142-A XXR with following characteristics:

  - Nominal voltage: 440/250 Vac, 50/60Hz

  - Phase number: 2

  - Temperature range: -25..+40 degrees

  - Nominal current: range XX = 10 A

- **Cabinet**: All equipments should be installed in metal cabinet closed over all sides.

Conformity In this configuration the converter is compliant with the regulations referenced above

Installation in Industrial Environment

- **Supply cable (A)**: no prescription.

- **Motor cable (B)**: to prevent emission of the motor cable is recommended to use of shielded cable. The shield must be connect to the converter ground terminal and to the ground terminal of the motor. The cable length must be less or equal 25m.

- **Clamp resistor (C)**: connected through twisted cable with length less or equal 2m.

- **Motor signal cable (D)**: shielded cable with length less or equal 25m.

- **Control connections (E)**: shielded cable with length less or equal 3m.

Conformity   In this configuration the converter is compliant with all the regulation referenced above regarding immunity (EN50082-2).

In this configuration the converter is not compliant to the emission regulation EN55011 (Emission, Generic standard).

In this configuration the converter is compliant to the product specific regulation EN61800-3 for the class 'Restricted distribution' and 'Second environment'.

Overview   This section provides descriptions of Warnings and Faults for MINIVECTOR 300.

Faults and Warnings   The *Startup Assistant* window features indicator lights that show any alarms that have been tripped. These alarms can be divided into two categories:

- Warnings indicate a current overload in the converter (protection function Ixt) or motor (I2xt); the drive is not stopped but its performance is automatically limited;

- Faults (malfunctions indicate that there is a fault or potentially dangerous condition that makes it necessary to stop the motor immediately.

Please find further information concerning operating procedures for error removal in *Emergency Stop Features* and *Fault Reset*.

The following table describes LED signalling.

LED Colour	Description of the drive status
Red blinking	Firmware absent in the drive
Green blinking	Drive not enabled
Green	Drive enabled
Yellow	Warning status (see paragraph *Warnings*)
Red and green sequence	Fault status (see paragraph *Fault*)

Warnings   Warning status comprises:

Warning	Description
Drive protection function Ixt	Tripped when the mean current delivered by the converter exceeds the rated continuous current. Its action is to limit the current command to the value of the *Continuous Current* parameter. This protection function is deactivated when the current returns to within the preset limits.
Motor protection function I2xt	Tripped when the mean current absorbed by the motor exceeds the limit set with the parameter *Motor I2xt Threshold*. Its action is to limit the current command to the value of the *Continuous Current* parameter. This protection function is deactivated when the current returns to within the preset limits.

Faults The Faults and procedures for rectifying them are listed below. The error code in the column *Code* refers to the sequence of red and green flashes emitted by the LED indicator. If more than one fault is present, the highest priority fault is displayed (1 = highest priority).

G stands for green, R for red.

Error Code	Description	
GGGR	**Overvoltage Protection**	tripped when the voltage in the intermediate power stage exceeds the maximum limit; this protection function also disables the power stage.
GGRG	**Undervoltage Protection**	tripped when the voltage in the intermediate power stage falls below a minimum value; dynamic motor braking is allowed. This protection function is masked if the converter is in Stop status to enable it to be switched on with the auxiliary voltage only.
GGRR	**Power Supply Fault (EVSN)**	tripped when the auxiliary power supply voltages are outside the preset values.
GRGG	**Overcurrent Protection**	tripped following a current overload in the power stage IGBTs. This protection function disables the power stage immediately.
GRGR	**Resolver Fault**	absence of one or more resolver signals; dynamic braking is allowed.
GRRG	**Overspeed**	maximum speed limit exceeded; dynamic braking is allowed.
GRRR	**Overtemperature Motor**	motor overtemperature; dynamic motor braking is still allowed.
RGGG	**Overtemperature Drive**	converter overtemperature; dynamic motor braking is still allowed.
RGGR	**Internal Error**	communication error between microcontroller and DSP; may be due to a hardware fault on the control board. In order to reset this error it is necessary to turn off the converter.
RGRG	**24 V Brake Fault**	tripped when the 24 Vdc voltage necessary for driving the holding brake is missing.
RGRR	**Errore Checksum Parametri**	inconsistent checksum of parameters stored into the converter EEPROM. In order to reset this error it is necessary to reset parameters and turn off the converter.

Appendix B - Ambient Conditions

Operating Conditions	Operating conditions refer to the conditions the MNIVECTOR 300 device is subjected to when installed and commissioned.	
	Mechanical Installation	As prescribed in this Guide, *Chapter 3 - Installation*
	Electrical Installation	As prescribed in this Guide, *Chapter 3 - Installation*
	EMC Compliance	As prescribed in this Guide, *Chapter 5 - EMC Standards*
	Protection Degree	As prescribed in this Guide
	Air Temperature	0 to + 40 °C; + 40 to max. + 55 °C with derating of 2,5 %/°C
	Relative Humidity	Maximum 85 %, no condensation allowed
	Installation Altitude	0 to 1000 m.s.l.m.; 1000 to max. 2000 m.s.l.m. derating of 1% / 100 m.
	Vibrations	Not allowed. Vibration insulation devices must be adopted.
	Shock	Not allowed. Shock reduction or elimination methods must be adopted.
Storage Conditions	Storage conditions refer to the conditions the MNIVECTOR 300 device is subjected to during storage in the protective package.	
	Temperature	– 25 to + 55 °C. For short periods not exceeding 24h, up to +70 °C
	Relative Humidity	Maximum 85 %, no condensation allowed
	Vibrations	Not allowed.
	Shock	Not allowed.

Transportation Conditions

Transportation conditions refer to the conditions the device is subjected to during transportation in the protective package.

Temperature	– 25 to + 55 °C. For short periods not exceeding 24h, up to +70 °C
Relative Humidity	Maximum 85 %, no condensation allowed
Vibrations	Tolerated only with the converter in its original untouched packing.
Shock	Tolerated only with the converter in its original untouched packing.

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