

SIEMENS

MICROMASTER 440

Operating Instructions

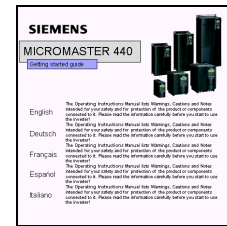
Issue B1



MICROMASTER 440 Documentation

Getting Started Guide

Is for quick commissioning with SDP and BOP.



Operating Instructions

Gives information about features of the MICROMASTER 440, Installation, Commissioning, Control modes, System Parameter structure, Troubleshooting, Specifications and available options of the MICROMASTER 440.



Parameter List

The Parameter List contains the description of all Parameters structured in functional order and a detailed description. The Parameter list also includes a series of function plans.



Reference Manual

The Reference Manual gives detailed information about engineering communication troubleshooting and maintenance.



Catalogues

In the catalogue you will find all the necessary information to select an appropriate inverter, as well as filters, chokes, operator panels and communication options.



SIEMENS

MICROMASTER 440

Operating Instructions User Documentation

Valid for

Issue 10/01

Converter Type
MICROMASTER 440

Control Version
1.6

Issue B1

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Further information can be obtained from Internet website:

<http://www.siemens.de/micromaster>

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Other functions not described in this document may be available. However, this fact shall not constitute an obligation to supply such functions with a new control, or when servicing.

We have checked that the contents of this document correspond to the hardware and software described. There may be discrepancies nevertheless, and no guarantee can be given that they are completely identical. The information contained in this document is reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

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Siemens-Aktiengesellschaft

Foreword

User Documentation

**WARNING**

Before installing and commissioning the inverter, you must read all safety instructions and warnings carefully including all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Information is also available from:

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Customers can access technical and general information at:

<http://www.siemens.de/micromaster>

Contact address

Should any questions or problems arise while reading this manual, please contact the Siemens office concerned using the form provided at the back this manual.

Definitions and Warnings



DANGER

indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in a property damage.

NOTICE

indicates a potential situation which, if not avoided, may result in an undesirable result or state.

NOTE

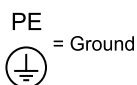
For the purpose of this documentation, "Note" indicates important information relating to the product or highlights part of the documentation for special attention.

Qualified personnel

For the purpose of this Instruction Manual and product labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved.

He or she must have the following qualifications:

1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.
3. Trained in rendering first aid.



- ◆ PE – Protective Earth uses circuit protective conductors sized for short circuits where the voltage will not rise in excess of 50 Volts. This connection is normally used to ground the inverter.
- ◆ - Is the ground connection where the reference voltage can be the same as the Earth voltage. This connection is normally used to ground the motor.

Use for intended purpose only

The equipment may be used only for the application stated in the manual and only in conjunction with devices and components recommended and authorized by Siemens.

Safety Instructions

The following Warnings, Cautions and Notes are provided for your safety and as a means of preventing damage to the product or components in the machines connected. This section lists Warnings, Cautions and Notes, which apply generally when handling MICROMASTER 440 Inverters, classified as **General, Transport & Storage, Commissioning, Operation, Repair and Dismantling & Disposal**.

Specific Warnings, Cautions and Notes that apply to particular activities are listed at the beginning of the relevant chapters and are repeated or supplemented at critical points throughout these sections.

Please read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your MICROMASTER 440 Inverter and the equipment you connect to it.

General



WARNING

- ◆ This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with **Warnings** or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.
- ◆ Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.
- ◆ Risk of electric shock. The DC link capacitors remain charged for five minutes after power has been removed. **It is not permissible to open the equipment until 5 minutes after the power has been removed.**
- ◆ **HP ratings are based on the Siemens 1LA motors and are given for guidance only; they do not necessarily comply with UL or NEMA HP ratings.**



CAUTION

- ◆ Children and the general public must be prevented from accessing or approaching the equipment!
- ◆ This equipment may only be used for the purpose specified by the manufacturer. Unauthorized modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the equipment can cause fires, electric shocks and injuries.

NOTICE

- ◆ Keep these operating instructions within easy reach of the equipment and make them available to all users
- ◆ Whenever measuring or testing has to be performed on live equipment, the regulations of Safety Code VBG 4.0 must be observed, in particular §8 "Permissible Deviations when Working on Live Parts". Suitable electronic tools should be used.
- ◆ Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Transport & Storage



WARNING

- ◆ Correct transport, storage, erection and mounting, as well as careful operation and maintenance are essential for proper and safe operation of the equipment.
-



CAUTION

- ◆ Protect the inverter against physical shocks and vibration during transport and storage. Also be sure to protect it against water (rainfall) and excessive temperatures (see *table on page 82*).
-

Commissioning



WARNING

- ◆ Work on the device/system by **unqualified** personnel or failure to comply with warnings can result in severe personal injury or serious damage to material. Only suitably qualified personnel trained in the setup, installation, commissioning and operation of the product should carry out work on the device/system.
 - ◆ Only permanently-wired input power connections are allowed. This equipment must be grounded (IEC 536 Class 1, NEC and other applicable standards).
 - ◆ If a Residual Current-operated protective Device (RCD) is to be used, it must be an RCD type B. Machines with a three-phase power supply, fitted with EMC filters, must not be connected to a supply via an ELCB (Earth Leakage Circuit-Breaker - see *DIN VDE 0160, section 5.5.2 and EN50178 section 5.2.11.1*).
 - ◆ The following terminals can carry dangerous voltages even if the inverter is inoperative:
 - the power supply terminals L/L1, N/L2, L3.
 - the motor terminals U, V, W, DC+/B+, DC-, B- and DC/R+
 - ◆ This equipment must not be used as an 'emergency stop mechanism' (see *EN 60204, 9.2.5.4*)
-



CAUTION

The connection of power, motor and control cables to the inverter must be carried out as shown in Figure 2-7 on page 31, to prevent inductive and capacitive interference from affecting the correct functioning of the inverter.

Operation



WARNING

- ◆ MICROMASTERS operate at high voltages.
- ◆ When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.
- ◆ Emergency Stop facilities according to EN 60204 IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Any disengagement of the Emergency Stop facility must not lead to uncontrolled or undefined restart.
- ◆ Wherever faults occurring in the control equipment can lead to substantial material damage or even grievous bodily injury (i.e. potentially dangerous faults), additional external precautions must be taken or facilities provided to ensure or enforce safe operation, even when a fault occurs (e.g. independent limit switches, mechanical interlocks, etc.).
- ◆ Certain parameter settings may cause the inverter to restart automatically after an input power failure.
- ◆ Motor parameters must be accurately configured for motor overload protection to operate correctly.
- ◆ This equipment is capable of providing internal motor overload protection in accordance with UL508C section 42. Refer to P0610 and P0335, i²t is ON by default. Motor overload protection can also be provided using an external PTC (disabled by default P0601).
- ◆ This equipment is suitable for use in a circuit capable of delivering not more than 10,000 symmetrical amperes (rms), for a maximum voltage of 230V/460V/575V when protected by a H or K type fuse (see *Tables starting on page 81*).
- ◆ This equipment must not be used as an 'emergency stop mechanism' (see EN 60204, 9.2.5.4)

Repair



WARNING

- ◆ Repairs on equipment may only be carried out by **Siemens Service**, by repair centers **authorized by Siemens** or by qualified personnel who are thoroughly acquainted with all the warnings and operating procedures contained in this manual.
- ◆ Any defective parts or components must be replaced using parts contained in the relevant spare parts list.
- ◆ Disconnect the power supply before opening the equipment for access

Dismantling & Disposal

CAUTION

- ◆ The inverter's packaging is re-usable. Retain the packaging for future use or return it to the manufacturer.
- ◆ Easy-to-release screw and snap connectors allow you to break the unit down into its component parts. You can then re-cycle these component parts, dispose of them in **accordance with local requirements or return them to the manufacturer.**

1 Overview

This Chapter contains:

A summary of the major features of the MICROMASTER 440 range.

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1.1 The MICROMASTER 440

The MICROMASTER 440s are a range of frequency inverters for controlling the speed of three phase AC motors. The various models available range from the 120 W single-phase input to the 75 kW three phase input.

The inverters are microprocessor-controlled and use state-of-the-art Insulated Gate Bipolar Transistor (IGBT) technology. This makes them reliable and versatile. A special pulse-width modulation method with selectable Pulse frequency permits quiet motor operation. Comprehensive protective functions provide excellent inverter and motor protection.

The MICROMASTER 440 with its default factory settings is ideal for a large range of simple motor control applications. The MICROMASTER 440 can also be used for more advanced motor control applications via its comprehensive functionality.

The MICROMASTER 440 can be used in both 'stand-alone' applications as well as being integrated into 'Automation Systems'.

1.2 Features

Main Characteristics

- Easy installation
- Easy commissioning
- Rugged EMC design
- Can be operated on IT line supplies
- Fast repeatable response time to control signals
- Comprehensive range of parameters enabling configuration for a wide range of applications
- Simple cable connection
- Output relays
- Analog outputs (0 – 20 mA)
- 6 Isolated and switchable NPN/PNP digital inputs
- 2 Analog inputs:
 - ◆ AIN1: 0 – 10 V, 0 – 20 mA and -10 to +10 V
 - ◆ AIN2: 0 – 10 V, 0 – 20 mA
- The 2 analog inputs can be used as the 7th and 8th digital inputs
- BiCo technology
- Modular design for extremely flexible configuration
- High switching frequencies for low-noise motor operation
- Detailed status information and integrated message functions
- External options for PC communications, Basic Operator Panel (BOP), Advanced Operator Panel (AOP), PROFIBUS communications module

Performance Characteristics

- Sensorless Vector Control
- Flux Current Control (FCC) for improved dynamic response and motor control
- Fast Current Limitation (FCL) for trip-free operation
- Built-in DC injection brake
- Compound braking to improve braking performance
- Acceleration/deceleration times with programmable smoothing
- Closed-loop control using PID (Proportional, Integral and Differential) control loop function, with auto-tuning
- Built-in braking chopper
- Selectable up and down ramps
- 4-point ramp smoothing
- Multi-point V/f characteristic
- parameter sets which can be switched, allowing one inverter to control several alternative processes

Protection characteristics

- Overvoltage/undervoltage protection
- Overtemperature protection for the inverter
- Ground fault protection
- Short-circuit protection
- i^2t thermal motor protection
- PTC/KTY for motor protection

2 Installation

This Chapter contains:

- General data relating to installation
- Dimensions of Inverter
- Wiring guidelines to minimize the effects of EMI
- Details concerning electrical installation

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WARNING

- ◆ Work on the device/system by **unqualified** personnel or failure to comply with warnings can result in severe personal injury or serious damage to material. Only suitably qualified personnel trained in the setup, installation, commissioning and operation of the product should carry out work on the device/system.
 - ◆ Only permanently-wired input power connections are allowed. This equipment must be grounded (IEC 536 Class 1, NEC and other applicable standards).
 - ◆ If a Residual Current-operated protective Device (RCD) is to be used, it must be an RCD type B. Machines with a three-phase power supply, fitted with EMC filters, must not be connected to a supply via an ELCB (Earth Leakage Circuit-Breaker EN50178 Section 5.2.11.1).
 - ◆ The following terminals can carry dangerous voltages even if the inverter is inoperative:
 - the power supply terminals L/L1, N/L2, L3.
 - the motor terminals U, V, W, DC+/B+, DC-, B- and DC/R+
 - ◆ Always wait **5 minutes** to allow the unit to discharge after switching off before carrying out any installation work.
 - ◆ This equipment must not be used as an 'emergency stop mechanism' (see *EN 60204, 9.2.5.4*)
 - ◆ The minimum size of the earth-bonding conductor must be equal to or greater than the cross-section of the power supply cables.
-

CAUTION

The connection of power, motor and control cables to the inverter must be carried out as shown in Figure 2-7 on page 31, to prevent inductive and capacitive interference from affecting the correct functioning of the inverter.

2.1 General

Installation after a Period of Storage

Following a prolonged period of storage, you must reform the capacitors in the inverter. The requirements are listed below.

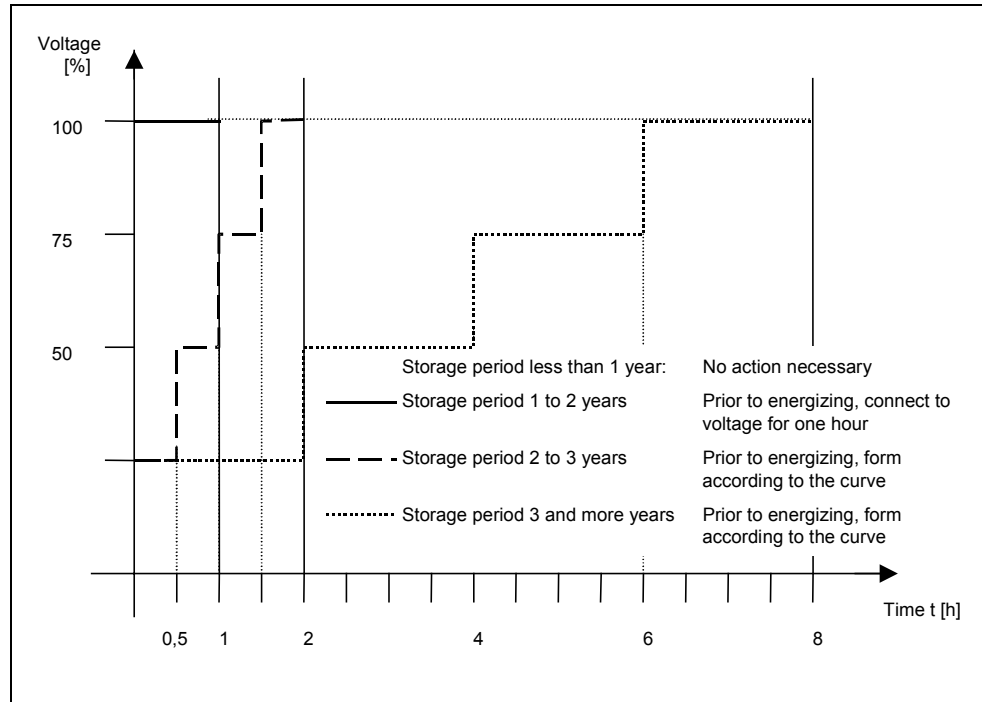


Figure 2-1 Forming

2.2 Ambient operating conditions

Temperature

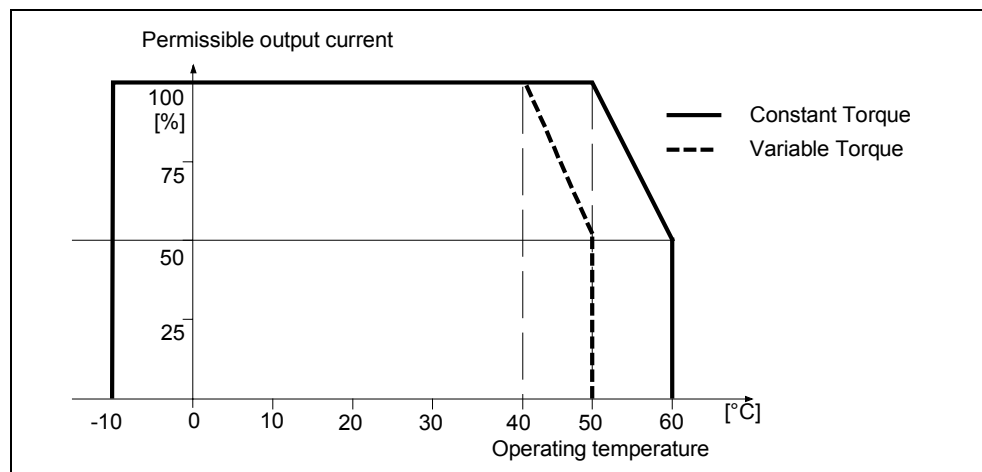


Figure 2-2 Ambient operating temperature

Humidity Range

Relative air humidity $\leq 95\%$ Non-condensing

Altitude

If the inverter is to be installed at an altitude > 1000 m or > 2000 m above sea level, derating will be required:

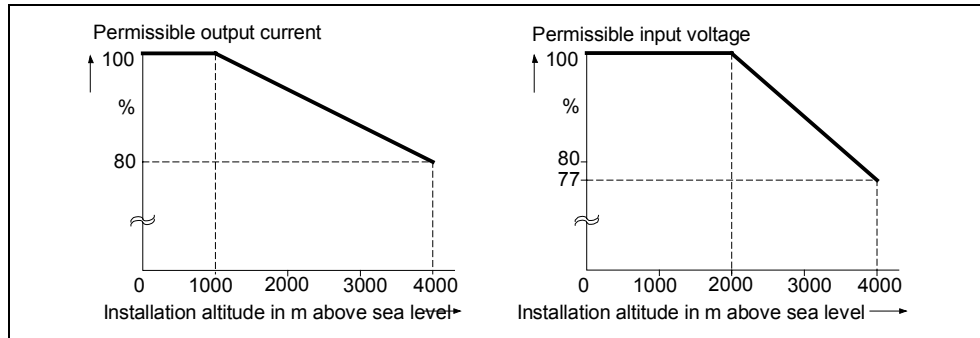


Figure 2-3 Installation altitude

Shock and Vibration

Do not drop the inverter or expose to sudden shock. Do not install the inverter in an area where it is likely to be exposed to constant vibration.

Mechanical strength to DIN IEC 68-2-6

- Deflection: 0.075 mm (10 ... 58 Hz)
- Acceleration: 9.8 m/s^2 ($> 58 \dots 500$ Hz)

Electromagnetic Radiation

Do not install the inverter near sources of electromagnetic radiation.

Atmospheric Pollution

Do not install the inverter in an environment, which contains atmospheric pollutants such as dust, corrosive gases, etc.

Water

Take care to site the inverter away from potential water hazards, e.g. do not install the inverter beneath pipes that are subject to condensation. Avoid installing the inverter where excessive humidity and condensation may occur.

Installation and cooling

CAUTION

The inverters **MUST NOT** be mounted horizontally.

The inverters can be mounted without any clearance at either side.

Allow 100 mm clearance above and below the inverter. Make sure that the cooling vents in the inverter are positioned correctly to allow free movement of air.

2.3 Mechanical installation



WARNING

- ◆ To ensure the safe operation of the equipment, it must be installed and commissioned by qualified personnel in full compliance with the warnings laid down in these operating instructions.
- ◆ Take particular note of the general and regional installation and safety regulations regarding work on dangerous voltage installations (e.g. EN 50178), as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).
- ◆ The mains input, DC and motor terminals, can carry dangerous voltages even if the inverter is inoperative; wait **5 minutes** to allow the unit to discharge after switching off before carrying out any installation work.
- ◆ The inverters can be mounted adjacent to each other. If they are mounted on top of each other, however, a clearance of 100 mm has to be observed.

Table 2-1 Dimensions and Torques of MICROMASTER 440

Frame-Size		Overall Dimensions		Fixing Method	Tightening Torque
A	Width x Height x Depth	mm	73 x 173 x 149	2 x M4 Bolts 2 x M4 Nuts 2 x M4 Washers for fitting on standard rail	2.5 Nm with washers fitted
		inch	2.87 x 6.81 x 5.87		
B	Width x Height x Depth	mm	149 x 202 x 172	4 x M4 Bolts 4 x M4 Nuts 4 x M4 Washers	2.5 Nm with washers fitted
		inch	5.87 x 7.95 x 6.77		
C	Width x Height x Depth	mm	185 x 245 x 195	4 x M5 Bolts 4 x M5 Nuts 4 x M5 Washers	2.5 Nm with washers fitted
		inch	7.28 x 9.65 x 7.68		
D	Width x Height x Depth	mm	275 x 520 x 245	4 x M8 Bolts 4 x M8 Nuts 4 x M8 Washers	3.0 Nm with washers fitted
		inch	10.82 x 20.47 x 9.65		
E	Width x Height x Depth	mm	275 x 650 x 245	4 x M8 Bolts 4 x M8 Nuts 4 x M8 Washers	3.0 Nm with washers fitted
		inch	10.82 x 25.59 x 9.65		
F	Width x Height x Depth	mm	350 x 850 mm x 320 height with filter 1150	4 x M8 Bolts 4 x M8 Nuts 4 x M8 Washers	3.0 Nm with washers fitted
		inch	13.78 x 33.46 x 12.60 height with filter 45.28		

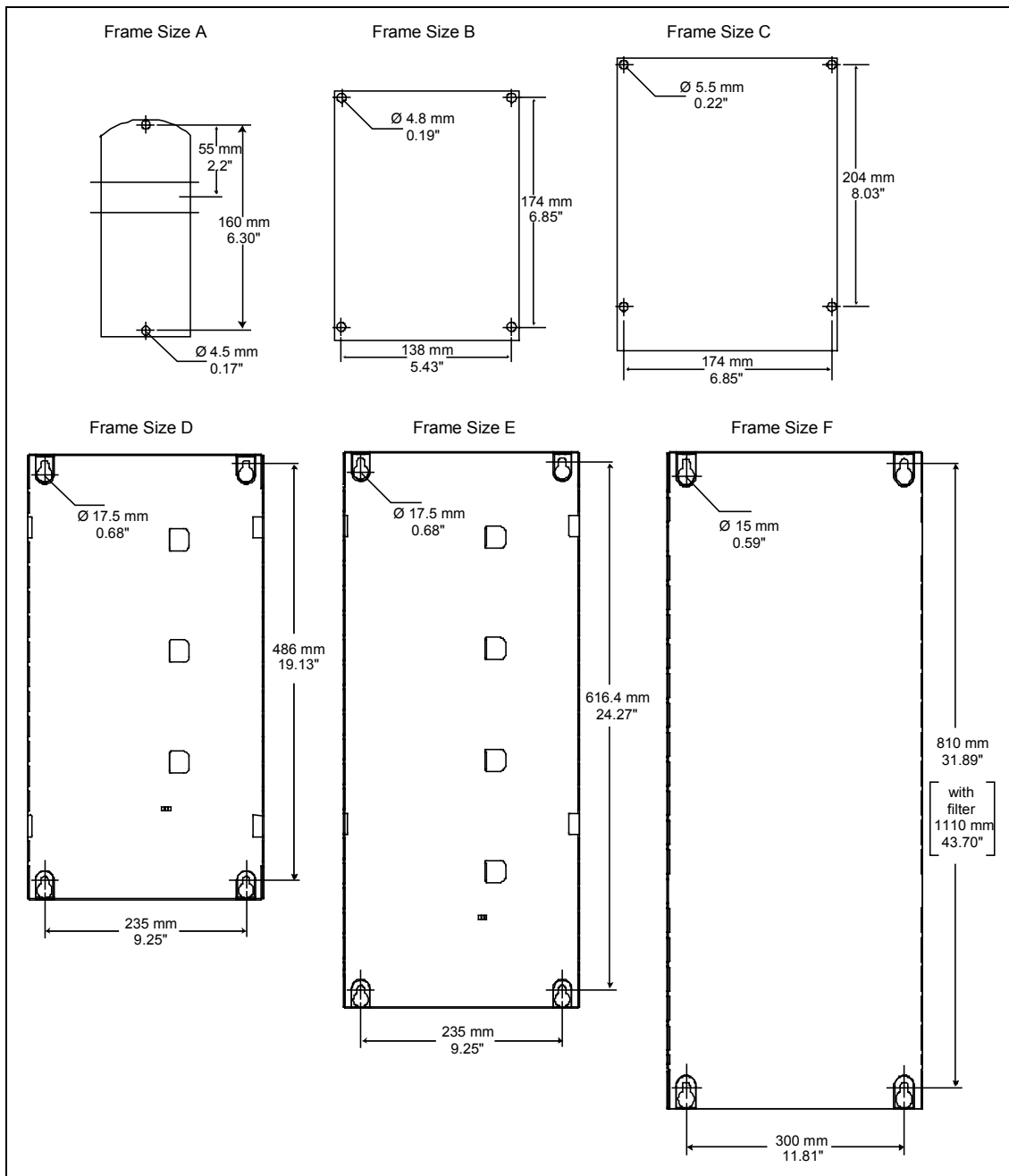
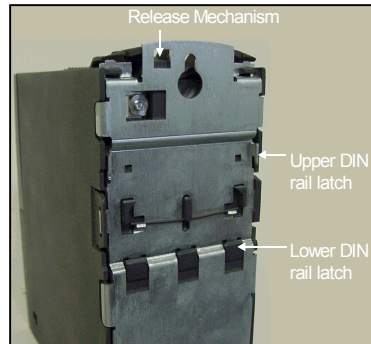


Figure 2-4 Drill pattern for MICROMASTER 440

2.3.1 Mounting on standard rail, Frame Size A

Fitting the Inverter a 35 mm standard rail (EN 50022)



1. Fit the inverter to the rail using the upper rail latch.



2. Push the inverter against the rail and the lower rail latch should click into place.

Removing the Inverter from the rail



1. To disengage the release mechanism of the inverter, insert a screwdriver into the release mechanism.
2. Apply a downward pressure and the lower rail latch will disengage.
3. Pull the inverter from the rail.

2.4 Electrical installation



WARNING

The inverter must always be grounded.

- ◆ To ensure the safe operation of the equipment, it must be installed and commissioned by qualified personnel in full compliance with the warnings laid down in these operating instructions.
- ◆ Take particular note of the general and regional installation and safety regulations regarding work on dangerous voltage installations (e.g. EN 50178), as well as the relevant regulations regarding the correct use of tools and personal protective gear.
- ◆ Never use high voltage insulation test equipment on cables connected to the inverter.
- ◆ The mains input, DC and motor terminals, can carry dangerous voltages even if the inverter is inoperative; wait **5 minutes** to allow the unit to discharge after switching off before carrying out any installation work.

CAUTION

The control, power supply and motor leads **must** be laid separately. Do not feed them through the same cable conduit/trunking.

2.4.1 General



WARNING

The inverter must always be grounded. If the inverter is not grounded correctly, extremely dangerous conditions may arise within the inverter which could prove potentially fatal.

Operation with ungrounded (IT) supplies

The MICROMASTER will operate from ungrounded supplies and will continue to operate if an input phase is shorted to ground. If an output phase is shorted to ground, the MICROMASTER will trip and indicate F0001.

On ungrounded supplies, it will be necessary to remove the 'Y' capacitor from the inside of the unit and fit an output choke. The procedure for removing this capacitor is described in Appendices O to J.

Operation with Residual Current Device

If an RCD (also referred to as ELCB or RCCB) is fitted, the MICROMASTER inverters will operate without nuisance tripping, provided that:

- ☑ A type B RCD is used.
- ☑ The trip limit of the RCD is 300mA.
- ☑ The neutral of the supply is grounded.
- ☑ Only one inverter is supplied from each RCD.
- ☑ The output cables are less than 50m (screened) or 100m (unscreened).

Operation with long cables

All inverters will operate at full specification with cable lengths up to 50 m screened or 100 m unscreened.

2.4.2 Power and motor connections



WARNING

The inverter must always be grounded.

- ◆ Isolate the mains electrical supply before making or changing connections to the unit.
 - ◆ Ensure that the inverter is configured for the correct supply voltage: single / three-phase 230 V MICROMASTERS must not be connected to a higher voltage supply.
 - ◆ When synchronous motors are connected or when coupling several motors in parallel, the inverter must be operated with voltage/frequency control characteristic (P1300 = 0, 2 or 3).
-



CAUTION

After connecting the power and motor cables to the proper terminals, make sure that the covers have been replaced properly before supplying power to the unit!

NOTICE

- ◆ Ensure that the appropriate circuit-breakers/fuses with the specified current rating are connected between the power supply and inverter (*see chapter 7, Tables starting on page 83*).
 - ◆ Use Class 1 60/75°C copper wire only (for UL compliance). For tightening torque see Table 7-2 on page 83.
-

Access to the power and motor terminals

You can gain access to the mains and motor terminals by removing the covers (see also Appendices 0 to E).

The mains and motor connections must be made as shown in Figure 2-6.

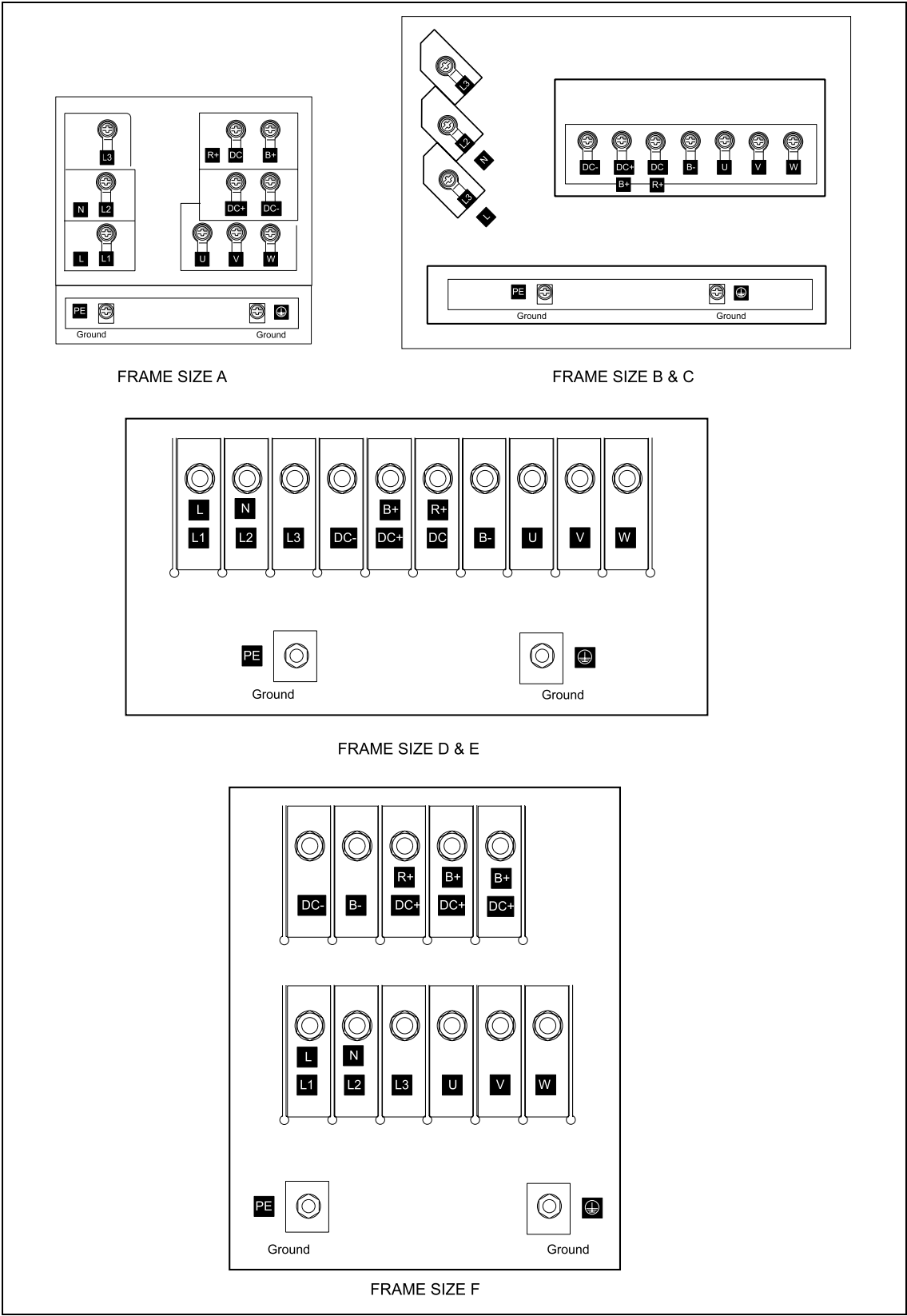


Figure 2-5 MICROMASTER 440 Connection Terminals

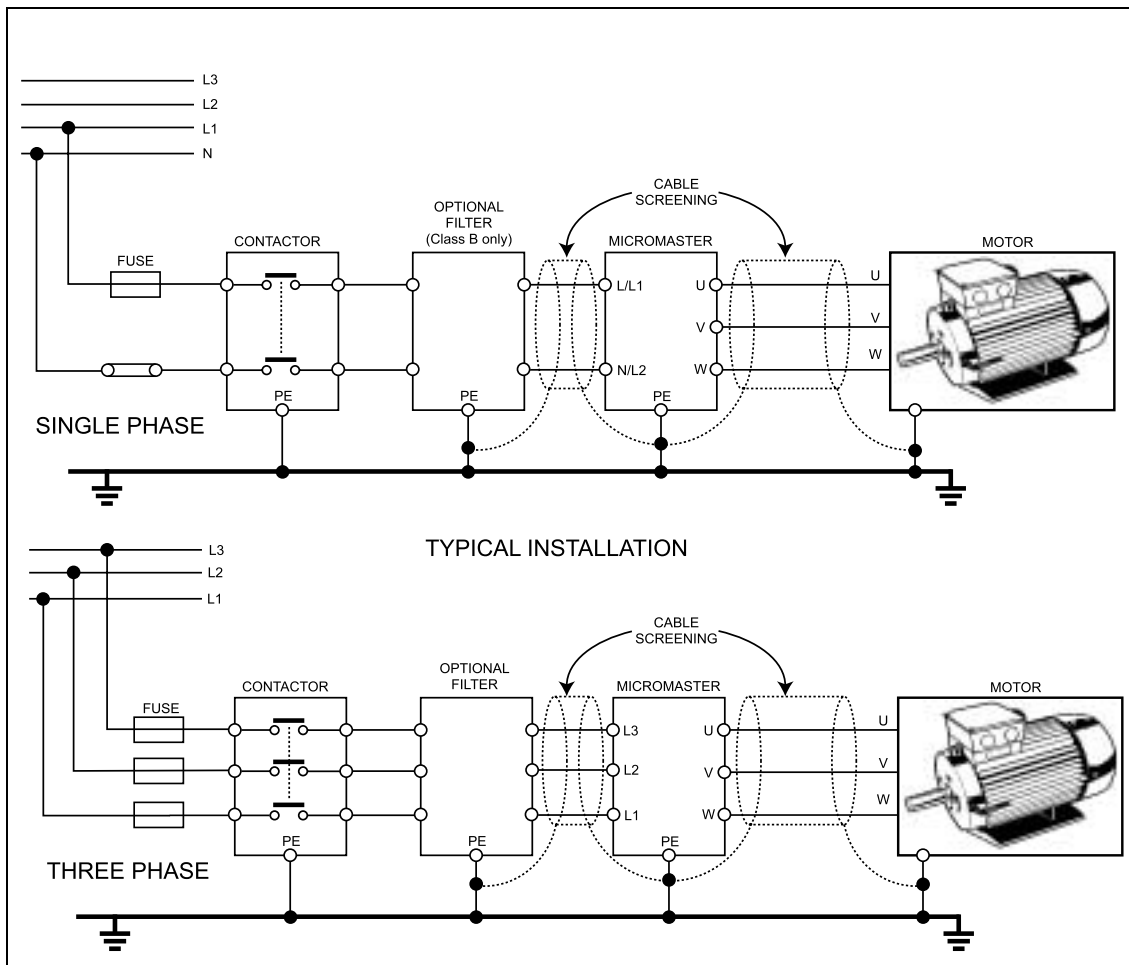


Figure 2-6 Motor and Power Connections

2.4.3 Avoiding Electro-Magnetic Interference (EMI)

The inverters are designed to operate in an industrial environment where a high level of EMI can be expected. Usually, good installation practices will ensure safe and trouble-free operation. If you encounter problems, follow the guidelines stated below.

Action to Take

- Ensure that all equipment in the cubicle is well grounded using short, thick grounding cable connected to a common star point or busbar
- Make sure that any control equipment (such as a PLC) connected to the inverter is connected to the same ground or star point as the inverter via a short thick link.
- Connect the return ground from the motors controlled by the inverters directly to the ground connection (PE) on the associated inverter
- Flat conductors are preferred as they have lower impedance at higher frequencies
- Terminate the ends of the cable neatly, ensuring that unscreened wires are as short as possible
- Separate the control cables from the power cables as much as possible, using separate trunking, if necessary at 90° to each other.
- Whenever possible, use screened leads for the connections to the control circuitry
- Ensure that the contactors in the cubicle are suppressed, either with R-C suppressors for AC contactors or 'flywheel' diodes for DC contactors fitted to the coils. Varistor suppressors are also effective. This is important when the contactors are controlled from the inverter relay
- Use screened or armored cables for the motor connections and ground the screen at both ends using the cable clamps



WARNING

Safety regulations **must not** be compromised when installing inverters!
