Installation Guide

Unidrive *LV*
Unidrive VTC *LV*
Unidrive LFT *LV*

model sizes 1 to 3

Universal Variable Speed Drive
for induction and servo motors
0.37kW to 22kW
(0.5HP to 30HP)

Part Number: 0460–0037
Issue Number: 1

General information

The manufacturer accepts no liability for any consequences resulting from inappropriate , negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive (Drive) with the motor.

The contents of this User Guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the User Guide, without notice.

Important...

Drive software version

This product is supplied with the latest version of user-interface and machine-control software. If this product is to be used with other Control Techniques variable speed drives in an existing system, there may be some differences between their software and the software in this product. These differences will cause a difference in functions. This may also apply to variable speed drives returned from a Control Techniques Service Centre.

If there is any doubt, contact a Control Techniques Drive Centre.

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Declaration of Conformity

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UNI1201	UNI1202	UNI1203	UNI1204	UNI1205
UNI2201	UNI2202	UNI2203		
UNI3201	UNI3202	UNI3203	UNI3204	

The AC variable speed drive products listed above, including the VTC and LFT variants, have been designed and manufactured in accordance with the following European harmonised, national and international standards:

EN60249	Base materials for printed circuits
IEC326-1	Printed boards: general information for the specification writer
IEC326-5	Printed boards: specification for single- and double-sided printed boards with plated-through holes
IEC326-6	Printed boards: specification for multilayer printed boards
IEC664-1	Insulation co-ordination for equipment within low-voltage systems: principles, requirements and tests
EN60529	Degrees of protection provided by enclosures (IP code)
UL94	Flammability rating of plastic materials
UL508C	Standard for power conversion equipment
EN50081-1[1]	Generic emission standard for the residential, commercial and light industrial environment
EN50081-2	Generic emission standard for the industrial environment
EN50082-2	Generic immunity standard for the industrial environment
EN61800-3	Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods

[1] Conducted emission. See the relevant EMC Data Sheet.

These products comply with the Low Voltage Directive 73/23/EEC, the Electromagnetic Compatibility (EMC) Directive 89/336/EEC and the CE Marking Directive 93/68/EEC.

W. Drury
Executive Vice President, Technology
Newtown

Date: 20th September 1999

These electronic Drive products are intended to be used with appropriate motors, controllers, electrical protection components and other equipment to form complete end products or systems. Compliance with safety and EMC regulations depends upon installing and configuring Drives correctly, including using the specified input filters. The Drives must be installed only by professional assemblers who are familiar with requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used. Refer to the Installation Guide. A *Unidrive EMC Data Sheet* is also available giving detailed EMC information.

1 Safety Information

1.1 Warnings, Cautions and Notes

A **Warning** contains information which is essential for avoiding a safety hazard.

A **Caution** contains information which is necessary for avoiding a risk of damage to the product or other equipment.

A **Note** contains information which helps to ensure correct operation of the product.

1.2 Electrical safety – general warning

The voltages used in the Drive can cause severe electric shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the Drive.

Specific warnings are given at the relevant places in this Installation Guide and the accompanying User Guide.

The installation must comply with all relevant safety legislation in the country of use.

1.3 System design

The Drive is intended as a component for professional incorporation into complete equipment or systems. If installed incorrectly the Drive may present a safety hazard. The Drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control mechanical equipment which can cause injury.

Close attention is required to the electrical installation and the system-design to avoid hazards either in normal operation or in the event of equipment malfunction. System-design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this Installation Guide carefully.

To ensure mechanical safety, additional safety devices such as electro-mechanical interlocks may be required. The Drive must not be used in a safety-critical application without additional high-integrity protection against hazards arising from a malfunction.

1.4 Environmental limits

Instructions in this Installation Guide regarding transport, storage, installation and use of Drives must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

1.5 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective earth (ground) connections.

This Installation Guide contains instructions for achieving compliance with specific EMC standards.

Within the European Union, all machinery in which this product is used must comply with the following directives:

98/37/EC: Safety of Machinery

89/336/EEC: Electromagnetic Compatibility.

1.6 Safety of personnel

The STOP function of the Drive does not remove dangerous voltages from the output of the Drive or from any external option unit.

The Stop and Start controls or electrical inputs of the Drive must not be relied upon to ensure safety of personnel. If a safety hazard could exist from unexpected starting of the Drive, an interlock that electrically isolates the Drive from the AC supply must be installed to prevent the motor being inadvertently started.

Careful consideration must be given to the functions of the Drive which might result in a hazard, either through their intended functions (eg. Auto-start) or through incorrect operation due to a fault or trip (eg. stop/start, forward/reverse, maximum speed).

Under certain conditions, the Drive can suddenly discontinue control of the motor. If the load on the motor could cause the motor speed to be increased (eg. hoists and cranes), a separate method of braking and stopping the motor must be used (eg. a mechanical brake).

Before connecting the AC supply to the Drive, it is important that you understand the operating controls and their operation. If in doubt, do not adjust the Drive. Damage may occur, or lives put at risk. Carefully follow the instructions in this Installation Guide.

Before making adjustments to the Drive, ensure all personnel in the area are warned. Make notes of all adjustments that are made.

1.7 Risk analysis

In any application where a malfunction of the Drive could lead to damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk. This would normally be an appropriate form of independent safety back-up system using simple electro-mechanical components.

1.8 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

Standard squirrel-cage induction motors are designed for single-speed operation. If it is intended to use the capability of the Drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.

Low speeds may cause the motor to over-heat because the cooling fan becomes less effective. The motor should then be fitted with a protection thermistor. If necessary, a separate cooling fan should be used.

If a Drive is to be used to control a number of motors, special measures need to be taken to ensure protection of the motors; refer to *Motor protection* in Appendix A *Motor Information*.

1.9 Adjusting parameters

Some parameters have a profound effect on the operation of the Drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

2 Installing the Drive

Warning

Adhere to the instructions

The mechanical and electrical installation instructions must be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the Drive and any external option unit, and the way in which they are operated and maintained, comply with the requirements of the Health and Safety at Work Act in the United Kingdom or applicable legislation and regulations and codes of practice in the country in which the equipment is used.

Warning

Competence of the installer

The Drive must be installed only by professional assemblers who are familiar with the requirements for safety and EMC. The assembler is responsible for ensuring that the end-product or system complies with all the relevant laws in the country where it is to be used.

Note

Unless otherwise stated, instructions and information in this Installation Guide relate to all versions of the Unidrive.

2.1 Environmental requirements

Warning

Installation in an enclosure

The Drive must be protected against water, condensation and electrically conductive contamination. When the gland plate and appropriate glands are fitted, the Drive can attain ingress protection to NEMA 1 and IP40 (in accordance with IEC529). UL listing is valid when the Drive is installed in a type 1 enclosure as defined in UL 50.

Warning

Authorized access

The enclosure should prevent access by anyone except for authorized, trained service personnel.

Warning

Fire enclosure

The Drive case is not classified as a fire enclosure. When this protection is required, the Drive should be installed in a fire enclosure.

Warning

Hazardous areas

The Drive must not be located in a classified hazardous area unless the Drive is installed in an approved enclosure and the installation is certified.

Warning

Before a Drive is used in the fully sinusoidal Regeneration mode, the Drive and the accompanying motoring Drive(s) must be modified. Contact the supplier of the Drive for details.

1. Refer to Appendix C *Data* for details of the environmental requirements.
2. If condensation is likely to occur when the Drive is not in use, an anti-condensation heater must be installed. This heater must be switched off when the Drive is in use; automatic switching is recommended.
3. If the Drive is to be mounted directly above any heat-generating equipment (such as another Drive), the maximum temperature of the air immediately below the Drive should be taken as the ambient temperature for the Drive.
4. If the Drive is to be mounted beneath other equipment, such as another Drive, the Drive should not cause the ambient temperature requirements of the equipment to be exceeded.
5. When compliance with EMC emission standards is required, the enclosure must be made of metal but does not require special EMC features.

UL-listing requirements are given in Appendix B.

2.2 EMC considerations

Depending on the requirements of the installation, one of the following levels of electromagnetic compatibility (EMC) should be adopted:

Routine EMC precautions

These precautions are recommended when strict compliance with emission standards is not required. The risk of disturbing adjacent electronic equipment is minimized by adopting these precautions.

Compliance with EMC emission standards

These precautions are recommended when strict compliance with emission standards is required. In addition, it is recommended that these precautions are taken when the Drive is installed in a residential area, or adjacent to sensitive electronic equipment such as radio receivers or similar.

Compliance with EN61800-3 (standard for Power Drive Systems)

Meeting the requirements of this standard depends on the environment that the Drive is intended to operate in, as follows:

Operation in the first environment

Observe the guidelines given in *Compliance with EMC emission standards*. An RFI filter will always be required. Some model sizes may require additional filtering techniques to be applied.

Operation in the second environment

An RFI filter may not be required. Follow the guidelines given in *Routine EMC* precautions or *Compliance with EMC emission standards* depending on the requirements of the end user.

Caution

The second environment typically includes an industrial low-voltage power supply network which does not supply buildings used for domestic purposes. Operating the Drive in this environment without an RFI filter may cause interference to nearby electronic equipment whose sensitivity has not been appreciated. The user must take remedial measures if this situation arises. If the consequences of unexpected disturbances are severe, it is recommended that the emission limits of EN50081-2 be adhered to.

Instructions are given later in this chapter for these levels of EMC. Refer to Appendix C *Data* for further information on compliance with EMC standards and definitions of environments.

Detailed instructions and EMC information are given in the *Unidrive* LV *EMC Data Sheet* which is available from the Drive Centres and distributors listed at the end of this *Installation Guide*.

Compliance data is given in Appendix C *Data*.

Note

The installer of the Drive is responsible for ensuring compliance with the EMC regulations that apply where the Drive is to be used.

The Drive will comply with the standards for emission, such as EN50081–2, only when the instructions given in *Planning the installation* and *Wiring recommendations* later in this chapter are followed closely.

2.3 Planning the installation

Instructions in numbered steps

The instructions in this section are contained in numbered steps. In some of these steps you will need to make a note of a value for future reference and, to help with identification, the number of the step.

AC supply protection

Warning

The AC supply to the Drive must be fitted with suitable protection against overload and short-circuits. Table 2–1 shows recommended fuse ratings. Failure to observe this recommendation will cause a risk of fire.

STEP 1 Include a fuse of the specified rating in each phase of the AC supply. The use of the following types of fuse is recommended:

- Europe: Type gG HRC industrial fuses to IEC 269 (BS88)
- USA: RK1 600VAC

An MCB or MCCB having the correct thermal and magnetic trip ratings may be used in place of fuses, on condition the fault-current clearing capacity is sufficient for the installation.

Note

UL listing is dependent on the use of the correct type of UL-listed fuse, and applies when the symmetrical short-circuit current does not exceed 5kA. Refer to Appendix B *UL Listing Information*.

Table 2–1 ***Fuse ratings for all versions of the Unidrive LV***

Model	Fuse rating
UNI 1201	6 A
UNI 1202	10 A
UNI 1203	10 A
UNI 1204	16 A
UNI 1205	16 A
UNI 2201	16 A
UNI 2202	20 A
UNI 2203	35 A
UNI 3201	40 A
UNI 3202	60 A
UNI 3203	70 A
UNI 3204	80 A

Power cables

Warning

Wiring must be in accordance with local regulations and codes of practice. The table below shows typical cable sizes for power input and output wiring. In the event of a conflict, local regulations prevail.

Cable type and size

STEP 2 For the following power connections...

- AC supply to RFI filter (when used)
- AC supply (or RFI filter) to Drive
- Drive to motor
- Drive to braking resistor

... use 105°C (221°F) pvc-insulated cable of suitable voltage rating and having copper conductors, as shown in Table 2–2.

Table 2–2 Cable sizes

Model	Cable size	
UNI 1201	1.5 mm^2	16 AWG
UNI 1202	2.5 mm^2	14 AWG
UNI 1203	2.5 mm^2	14 AWG
UNI 1204	2.5 mm^2	14 AWG
UNI 1205	2.5 mm^2	14 AWG
UNI 2201	2.5 mm^2	14 AWG
UNI 2202	4 mm^2	10 AWG
UNI 2203	4 mm^2	10 AWG
UNI 3201	6 mm^2	8 AWG
UNI 3202	10 mm^2	6 AWG
UNI 3203	16 mm^2	4 AWG
UNI 3204	25 mm^2	4 AWG

When EMC emission requirements are to be met, shielded cable or steel wire armoured cable may be required for the following:

- AC supply to enclosure
- Drive to motor
- Drive to braking resistor when part of the cable is outside the enclosure

For further details, see *Wiring guidelines* later in this chapter.

Motor cable

STEP 3 Since capacitance in the motor cable causes loading on the output of the Drive, ensure the cable length does not exceed the values given in Table 2–3.

Note

Maximum length of the encoder cable

When a Unidrive *LV* or Unidrive LFT *LV* is to be used in a closed-loop system and with long motor cables, the corresponding length of the encoder cable may cause an excessive supply-voltage drop between the Drive and encoder. In this case, do not use the Drive to supply the encoder; install a separate DC supply close to the encoder.

Table 2–3 Maximum cable lengths

Model	Maximum cable length * (PWM switching frequency at 3kHz)	
	m	ft
UNI 1201	65	210
UNI 1202	100	330
UNI 1203	130	430
UNI 1204	200	660
UNI 1205	300	990
UNI 2201 ~ UNI 2203	300	990
UNI 3201 ~ UNI 3204	200	660

* Cable lengths in excess of the specified values may be used only when special techniques are adopted; refer to the supplier of the Drive.

The maximum cable length is reduced from that shown in the table under the following conditions:

- **PWM switching frequency exceeding 3kHz in model size 3** The maximum cable length is reduced in proportion to the increase in PWM switching frequency, eg. at 9kHz, the maximum length is $^1/_3$ of that shown.
- **High-capacitance cables** Most cables have an insulating jacket between the cores and the armour or shield; these cables have a low capacitance and are recommended. Cables that do not have an insulating jacket tend to have high capacitance; if a cable of this type is used, the maximum cable length is half that quoted in the table. (Figure 2–1 shows how to identify the two types.)

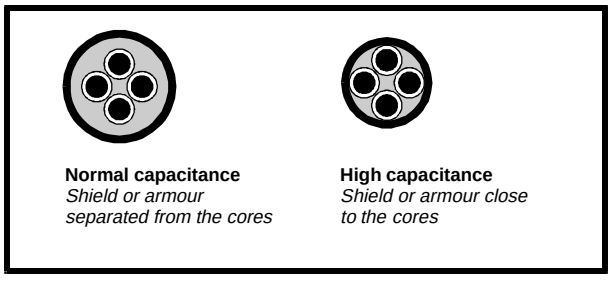


Figure 2–1 Cable construction influencing the capacitance

Multiple motors

Special requirements apply when the Drive is to control more than one motor. Refer to Appendix A *Motor Connections*.

Isolator switch in the motor cable

An isolator switch may be connected in the motor cable for safety purposes. Refer to the following Warning and Note.

Warning

The isolator switch must not be operated when the Drive is enabled. (If an AC-rated switch is used and the Drive is producing a low output frequency when the switch is opened, severe arcing can occur which will prevent the switch from breaking the circuit.)

A suitable interlock arrangement can be used, such as an isolator switch fitted with additional contacts that open before the main contacts. These additional contacts should be used to disable the Drive.

Note

If the isolator switch is closed when the Drive is enabled, the Drive may trip.

When EMC compliance is required, refer to *Variations in the EMC wiring recommendations* later in this chapter.

Output current, PWM switching frequency, Ambient temperature

Thermal protection

Note

The Drive can supply the rated current up to an ambient temperature of 40°C (104°F) (depending on the PWM switching frequency used).

The Drive can be operated in an ambient temperature up to 50°C (122°F) at de-rated output current. In this case, ensure the value of parameter 0.46 *Motor rated current* does not exceed the value given in Table 2-5.

The Drive has two forms of thermal protection for the power output stage (IGBT bridge), as follows:

1. A thermistor mounted on the heatsink monitors the heatsink temperature. If this exceeds 95°C (203°F), the thermistor will cause the Drive to trip. The display will indicate **Oh2**.
2. Intelligent thermal modelling estimates (by calculation) the junction temperature of the IGBTs. There are two temperature thresholds which cause the following to occur:
   - If the first threshold is reached, the PWM switching frequency is halved in order to reduce dissipation in the IGBTs. (When the frequency is halved, the value of parameter **0.41** *PWM switching frequency* remains at the value set by the user; if the frequency is 3kHz or 4.5kHz, no halving occurs). Then at one second intervals, the Drive will attempt to restore the original PWM switching frequency. This will be successful if the estimated temperature has reduced sufficiently.
   - If the estimated temperature has continued to rise and reaches a second threshold, the Drive will trip. The display will indicate **Oh1**.

STEP 4 Note that the Drive can deliver an overload current, as shown in Table 2–4.

Table 2–4 Overload current

Unidrive LV
Open-loop
Up to 150% of the rated current for 60 seconds
Closed-loop Vector
Up to 175% of the rated current for 60 seconds
Closed-loop Servo
Up to 175% of the rated current for 4 seconds
Unidrive VTC LV
For a variable-torque load
Up to 120% of the rated current for 60 seconds
Unidrive LFT LV operating on standard S4/S5 duty cycle
Open-loop
Up to 150% of the rated current
Closed-loop Vector
Up to 175% of the rated current
Closed-loop Servo
Up to 175% of the rated current

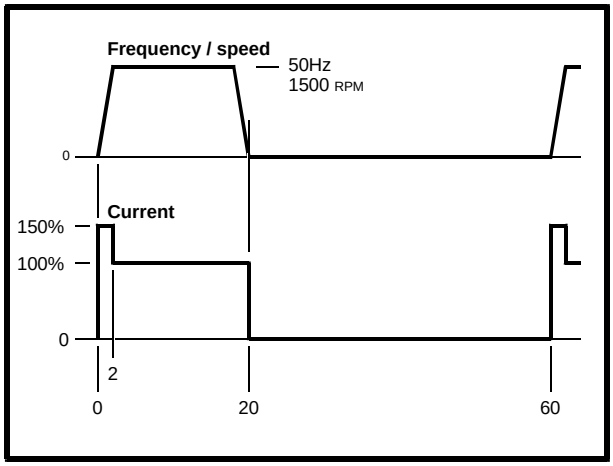


Figure 2–2 Standard S4/S5 duty cycle (Unidrive LFT LV)

Unidrive LV and Unidrive VTC LV Refer to Table 2–5 to find the maximum continuous output current that can be obtained for the required ambient temperature and PWM switching frequency. The maximum ambient temperature can be 40°C or 50°C (104°F or 122°F). Note that the nominal power rating of the Drive may not be achieved above 40°C.

Caution

Operation in a maximum ambient temperature of 50°C (122°F)

Unless the precaution described here is taken, the Drive will limit the maximum continuous output current only to the value for 40°C, and not to the value stated in Table 2–5 for 50°C.

Make a note of the value for 50°C; you will need to refer to it when you reach *Configuring the Drive for the motor* in Chapter 2 of the *User Guide*.

At that point, ensure that the value to be entered in parameter 0.46 *Motor – rated current* does not exceed the noted value.

Unidrive LFT LV Refer to Table 2–6 to find the maximum continuous output current that can be obtained for the ambient temperature for a standard **S4/S5** duty-cycle or for continuous operation. Refer to a Drive Centre or distributor for information on other duty ratios.

Make a note of this step number and the following:

- **Unidrive LV and Unidrive VTC LV** Chosen maximum ambient temperature.
- **Unidrive LV and Unidrive VTC LV** Chosen **PWM switching frequency** for each Drive.
- **All Unidrive LV versions** From Table 2–7, the maximum **power dissipation** (heat) figure (P_{DISS}) at the chosen PWM switching frequency for each Drive (this figure is the total power dissipation at the maximum continuous output current available at the chosen PWM switching frequency, and includes power dissipated in option modules when fitted). Power dissipation in the Unidrive LFT is the same as that for the standard Unidrive when operating at 9kHz PWM switching frequency.
- **Unidrive LV and Unidrive VTC LV** If the maximum ambient temperature will be 50°C (122°F), note the value of the maximum permissible output current obtained from Table 2–5. This will be the maximum value that parameter **0.46** *Motor – rated current* should be set at.

***Table 2–5 Maximum permissible continuous output current for Unidrive* LV *and Unidrive VTC* LV**

40°C (104°F) ambient	Nominal rating		Maximum permissible continuous output current				
Model	**kW**	**HP**	**3kHz**	**4.5kHz**	**6kHz**	**9kHz**	**12kHz**
UNI 1201	0.37 kW	0.5	2.1 A	2.1 A	2.1 A	2.1 A	2.1 A
UNI 1202	0.55 kW	0.75	2.8 A	2.8 A	2.8 A	2.8 A	2.8 A
UNI 1203	0.75 kW	1.0	3.8 A	3.8 A	3.8 A	3.8 A	3.8 A
UNI 1204	1.1 kW	1.5	5.6 A	5.6 A	5.6 A	5.6 A	4.5 A
UNI 1205	2.2 kW	3.0	9.5 A	9.5 A	8.5 A	7.0 A	5.5 A
UNI 2201	3.0 kW	4.0	12.0 A	12.0 A	12.0 A	12.0 A	11.7 A
UNI 2202	4.0 kW	5.0	16.0 A	16.0 A	16.0 A	14.2 A	11.7 A
UNI 2203	5.5 kW	10.0	25.0 A	21.7 A	18.2 A	14.2 A	11.7 A
UNI 3201	7.5 kW	15.0	34.0 A	34.0 A	34.0 A	28.0 A	23.0 A
UNI 3202	11 kW	20.0	46.0 A	46.0 A	40.0 A	32.0 A	26.6 A
UNI 3203	15 kW	25.0	60.0 A	47.0 A	40.0 A	32.0 A	26.7 A
UNI 3204	22 kW	30.0	74.0 A	56.0 A	46.0 A	35.0 A	28.0 A
50°C (122°F) ambient	**Nominal rating**		**Maximum permissible continuous output current**				
Model	**kW**	**HP**	**3kHz**	**4.5kHz**	**6kHz**	**9kHz**	**12kHz**
UNI 1201	0.37 kW	0.5	2.1 A	2.1 A	2.1 A	2.1 A	2.1 A
UNI 1202	0.55 kW	0.75	2.8 A	2.8 A	2.8 A	2.8 A	2.8 A
UNI 1203	0.75 kW	1.0	3.8 A	3.8 A	3.8 A	3.8 A	3.3 A
UNI 1204	1.1 kW	1.5	5.6 A	5.6 A	5.1 A	4.0 A	3.3 A
UNI 1205	2.2 kW	3.0	6.9 A	5.9 A	5.1 A	4.0 A	3.3 A
UNI 2201	3.0 kW	4.0	12.0 A	12.0 A	12.0 A	11.6 A	9.7 A
UNI 2202	4.0 kW	5.0	16.0 A	16.0 A	14.7 A	11.6 A	9.7 A
UNI 2203	5.5 kW	10.0	20.0 A	17.3 A	14.7 A	11.6 A	9.7 A
UNI 3201	7.5 kW	15.0	34.0 A	34.0 A	28.0 A	21.0 A	17.9 A
UNI 3202	11 kW	20.0	44.0 A	36.0 A	31.0 A	24.0 A	20.6 A
UNI 3203	15 kW	25.0	44.0 A	36.0 A	31.0 A	24.0 A	20.9 A
UNI 3204	22 kW	30.0	50.0 A	41.0 A	34.0 A	26.0 A	23.0 A

Table 2–6 Maximum permissible output current for Unidrive LFT LV (at 9kHz PWM switching frequency)

Model	Nominal rating		Maximum permissible output current		
	kW	HP	Standard duty cycle at 40°C	Continuous operation at 40°C	Continuous operation at 50°C
UNI 1201 LFT	0.37 kW	0.5	2.1 A	2.1 A	2.1 A
UNI 1202 LFT	0.55 kW	0.75	2.8 A	2.8 A	2.8 A
UNI 1203 LFT	0.75 kW	1.0	3.8 A	3.8 A	3.3 A
UNI 1204 LFT	1.1 kW	1.5	5.6 A	4.0 A	3.3 A
UNI 1205 LFT	2.2 kW	3.0	9.5 A	4.3 A	3.3 A
UNI 2201 LFT	3.0 kW	4.0	12.0 A	12.0 A	11.0 A
UNI 2202 LFT	4.0 kW	5.0	16.0 A	14.2 A	11.0 A
UNI 2203 LFT	5.5 kW	10.0	25.0 A	14.2 A	11.0 A
UNI 3201 LFT	7.5 kW	15.0	34.0 A	28.0 A	21.0 A
UNI 3202 LFT	11 kW	20.0	46.0 A	32.0 A	24.0 A
UNI 3203 LFT	15 kW	25.0	60.0 A	33.0 A	24.0 A
UNI 3204 LFT	22 kW	30.0	74.0 A	35.0 A	26.0 A

Table 2–7 Maximum total power dissipation (Unidrive LV, Unidrive VTC LV and Unidrive LFT LV)

Model	Nominal rating		Maximum total power dissipation				
	kW	HP	3kHz	4.5kHz	6kHz	9kHz	12kHz
UNI 1201	0.37kW	0.5	80 W	80 W	90 W	90 W	90 W
UNI 1202	0.55kW	0.75	90 W	90 W	100 W	100 W	110 W
UNI 1203	0.75kW	1.0	100 W	110 W	110 W	120 W	130 W
UNI 1204	1.1kW	1.5	130 W	130 W	140 W	150 W	150 W
UNI 1205	2.2kW	3.0	180 W	190 W	190 W	190 W	170 W
UNI 2201	3.0kW	4.0	210 W	230 W	250 W	280 W	310 W
UNI 2202	4.0kW	5.0	270 W	290 W	310 W	320 W	310 W
UNI 2203	5.5kW	10.0	400 W	380 W	360 W	330 W	310 W
UNI 3201	7.5kW	15.0	570 W	620 W	670 W	660 W	630 W
UNI 3202	11kW	20.0	730 W	800 W	770 W	730 W	700 W
UNI 3203	15kW	25.0	950 W	830 W	790 W	740 W	710 W
UNI 3204	22kW	30.0	1090 W	990 W	920 W	850 W	800 W

The default PWM switching frequency is a follows...

Unidrive LV and Unidrive VTC LV: 3kHz
Unidrive LFT LV: 9kHz

Using an RFI filter

STEP 5 For compliance with the emission standards such as EN 50081-1 or EN 50081-2, use the recommended RFI filter as shown in Table 2–8. Use one RFI filter for each Drive. (Standards that are met are specified in Appendix C *Data*)

Make a note of this step number and the following for each filter to be used:

- Size code or part number
- Maximum power dissipation figure
- IP rating

Table 2–8 RFI filter data

Model	RFI filter			
	Size	Part number	Maximum power dissipation (W)	IP rating
UNI 1201	*A*	4200–0010	25	IP20
UNI 1202	*A*	4200–0010	25	IP20
UNI 1203	*A*	4200–0010	25	IP20
UNI 1204	*A*	4200–0010	25	IP20
UNI 1205	*A*	4200–0010	25	IP20
UNI 2201	*B*	4200–0027	40	IP20
UNI 2202	*B*	4200–0027	40	IP20
UNI 2203	*B*	4200–0027	40	IP20
UNI 3201	*C*	4200–1051	60	IP00
UNI 3202	*C*	4200–1051	60	IP00
UNI 3203	*D*	4200–1071	100	IP00
UNI 3204	*D*	4200–1071	100	IP00

Model size 1

When the motor cable is to exceed 50m (165 feet), use RFI filter size *B* (4200–0027).

Using a braking resistor

Braking occurs when the Drive is decelerating the motor, or is preventing the motor from gaining speed due to mechanical influences. During braking, energy is returned to the Drive by the motor.

When the motor is being braked by the Drive, the maximum regenerated power that the Drive can absorb is equal to the power dissipation (losses) of the Drive.

When the regenerated power is likely to exceed these losses, a braking resistor must be connected.

By default, the Drive brakes the motor under PI control which extends the deceleration time as necessary in order to keep the DC bus at a constant voltage. The method of braking can be changed; if required, refer to Appendix D Menu 0 Parameters in the *User Guide*.

Note

When a braking resistor is used, the Drive should be operated in FASt ramp mode. If this is not done, instability may arise. See *Braking resistor* in Chapter 2 of the User Guide.

Housing the resistor, and routing the connecting cable

Warning

High temperatures

Braking resistors can reach high temperatures. Locate braking resistors so that damage cannot result.

Use cable having insulation capable of withstanding high temperatures.

Warning

Overload protection

It is essential that an overload protection device is incorporated in the braking resistor circuit; this is described in *Protection circuit for an optional braking resistor* in STEP 8.

STEP 6 When a braking resistor is to be mounted outside the enclosure, ensure that it is mounted in a ventilated metal housing that will perform the following functions:

- Prevent inadvertent contact with the resistor
- Allow adequate ventilation for the resistor

When compliance with EMC emission standards is required, external connection requires the cable to be armoured or shielded, since it is not fully contained in a metal enclosure.

Internal connection does not require the cable to be armoured or shielded.

Minimum resistances and power ratings

Table 2–9 Minimum resistance values and peak power rating for the braking resistor at 40°C (104°F)

Model	Minimum resistance	Instantaneous power rating
UNI 1201 ~ UNI 1205	20Ω	15kW
UNI 2201	20Ω	15kW
UNI 2202, UNI 2203	15Ω	20kW
UNI 3201 ~ UNI 3204	5Ω	60kW

The minimum resistance allows the braking resistor to dissipate up to approximately 300% of the power rating of the Drive for up to 60 seconds.

For high-inertia loads or under continuous braking, the *continuous power* dissipated in the braking resistor may be as high as the power rating of the Drive. The total *energy* dissipated in the braking resistor is dependent on the amount of energy to be extracted from the load.

The instantaneous power rating refers to the short-term maximum power dissipated during the *on* intervals of the pulse width modulated braking control cycle. The braking resistor must be able to withstand this dissipation for short intervals (milliseconds). Higher resistance values require proportionately lower instantaneous power ratings.

In most applications, braking occurs only occasionally. This allows the continuous power rating of the braking resistor to be much lower than the power rating of the Drive. It is essential, though, that the instantaneous power rating and energy rating of the braking resistor are sufficient for the most extreme braking duty that is likely to be encountered.

Optimization of the braking resistor requires a careful consideration of the braking duty. This is described more fully in *Optimizing an optional braking resistor* in the *Unidrive Advanced User Guide*.

STEP 7 Select a value of resistance for the braking resistor that is not less than the specified minimum resistance. Larger resistance values may give a cost saving, as well as a safety benefit in the event of a fault in the braking system. Braking capability will then be reduced, which may cause the Drive to trip during braking. If this occurs, refer to *Deceleration rate* in Chapter 2 of the *User Guide*.

STEP 8 Estimate the average power that will be dissipated in the resistor. A method of estimating this power is described in *Optimizing an optional braking resistor* in the *Unidrive Advanced User Guide*. Make a note of this step number and the average power to be dissipated in the resistor.

Thermal protection circuit for the braking resistor

The thermal protection circuit must disconnect the AC supply from the Drive if the resistor becomes overloaded. Figure 2–3 shows a typical circuit arrangement.

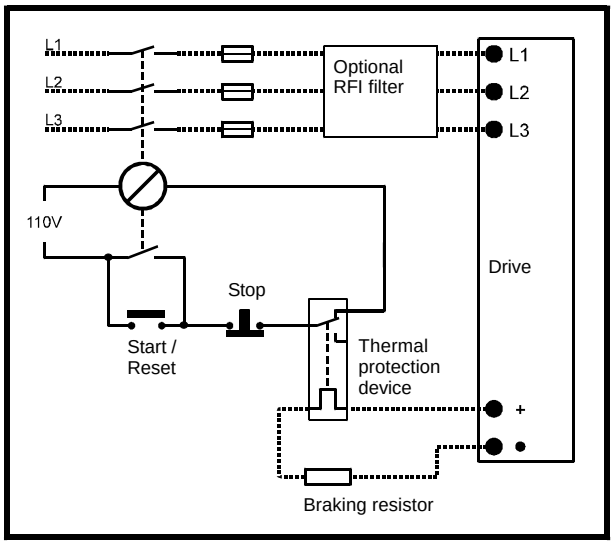


Figure 2–3 Typical protection circuit for a braking resistor

Enclosure layout

STEP 9 Use one of the following enclosure layouts, depending on the requirements of the installation:

Routine EMC precautions Refer to Figure 2–4 which shows the recommended layout for two Drives, and the signal and power cables.

Compliance with EMC emission standards Refer to Figure 2–5 which shows the recommended layout for two Drives, two RFI filters, and the signal and power cables.

STEP 10 Decide whether the enclosure is to be sealed or ventilated, as follows:

A sealed enclosure can give a high ingress-protection rating, but with reduced heat removal capabilities. If possible, locate heat-generating equipment (other than braking resistors) in the lower part of the enclosure to encourage internal convection. If necessary, a taller enclosure, and/or air-circulation fans inside the enclosure, can be used. For calculating the minimum size of sealed enclosure that will adequately cool the Drive(s), refer later in this chapter to *Calculating the size of a sealed enclosure.*

If a high ingress-protection rating is not required, a ventilated enclosure can be used with a fan to supply forced air cooling; this can give a lower ambient temperature than a sealed enclosure. For calculating the minimum required volume of cooling air, refer later in this chapter to *Calculating the air-flow in a ventilated enclosure*.

STEP 11 For compliance with EMC emission standards, ensure the enclosure is fitted with an unpainted metal back-plate for mounting the Drive and RFI filter. For example, a zinc plated steel back-plate is suitable (see Figure 2–5).

STEP 12 Ensure the Drive is installed vertically for best flow of cooling air through the Drive and heatsink.

STEP 13 Ensure the clearances around the Drive are as follows:

Above and below: ≥100mm (4 in)

Both sides: ≥5mm ($^1/_4$ in)

Note

When surface mounting a model size 3, allow a clearance of 150mm (6in) above the Drive; this is required for dismounting. A minimum clearance of 100mm (4in) is required for ventilation.

For overall dimensions and weights of the Drive and RFI filter, see Appendix C *Data*.

STEP 14 When compliance with EMC emission standards is required, the RFI filter must be installed at the specified position for each Drive (see Figure 2–5).

STEP 15 When a braking resistor is to be used, it can be installed outside or inside the enclosure. When installed inside, it must be mounted in the upper part of the enclosure to prevent it heating the other equipment by convection.

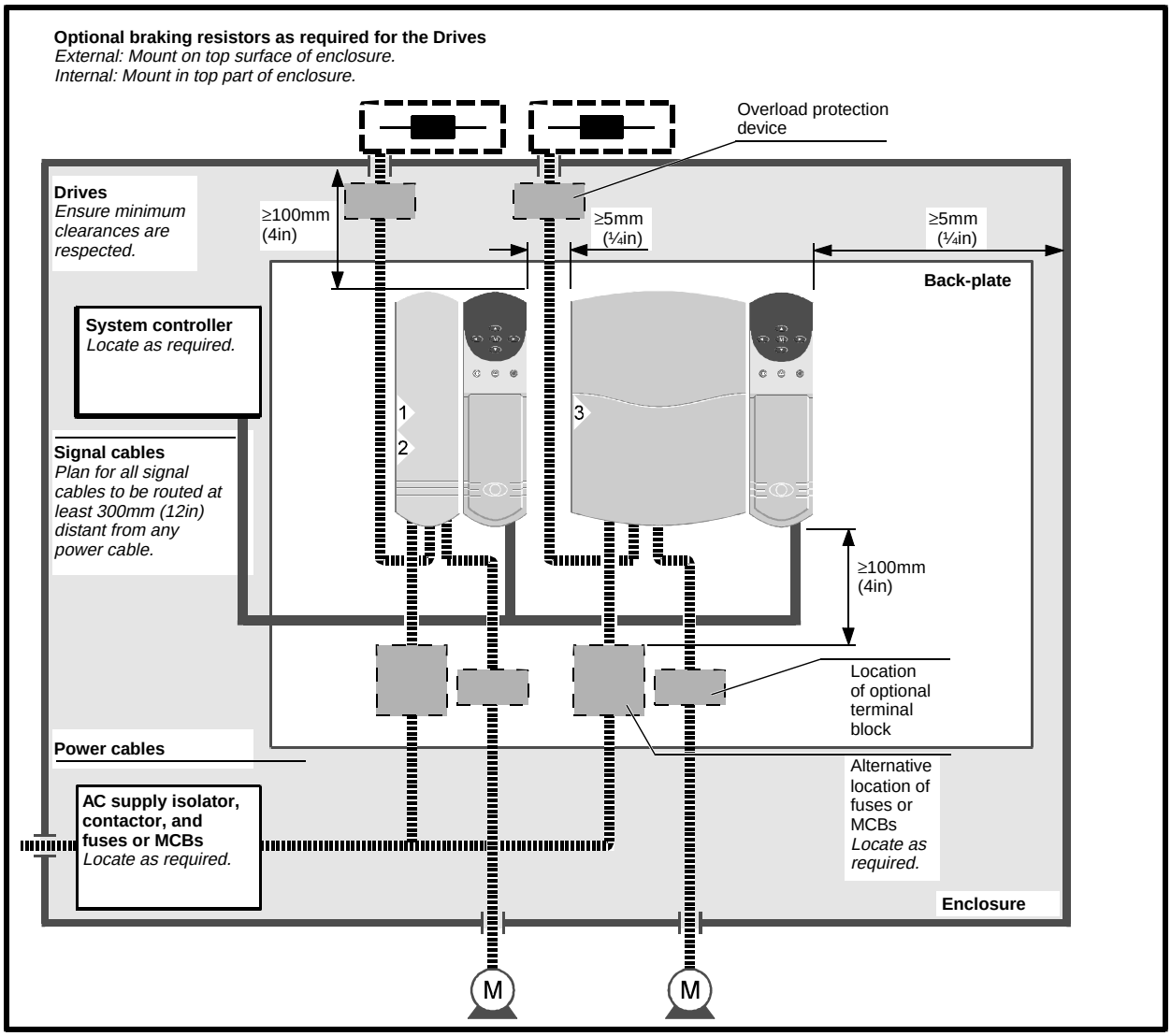


Figure 2–4 Recommended layout for routine EMC precautions (wiring recommendations are given in Figure 2–21)

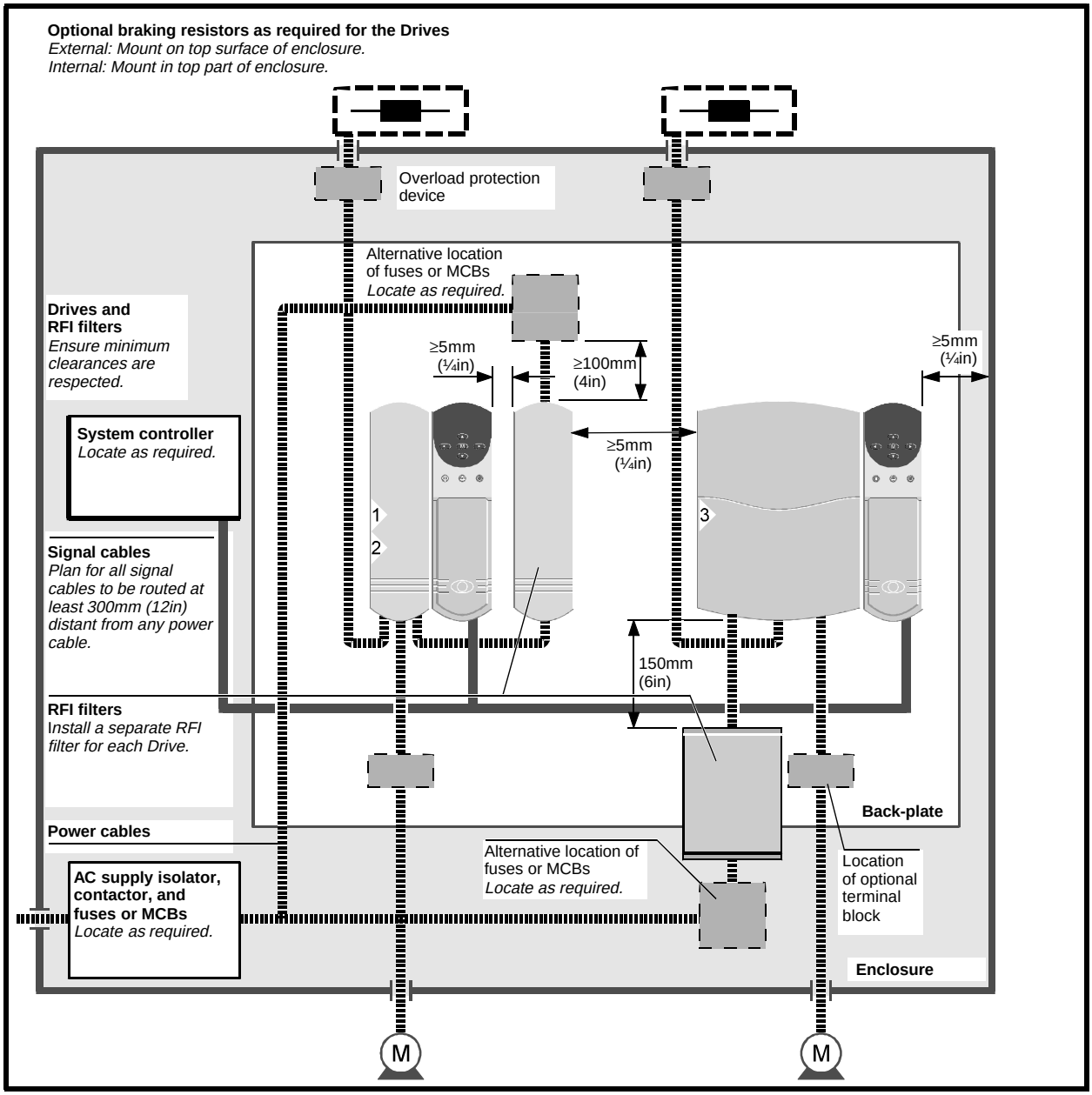


Figure 2–5 Recommended layout for compliance with EMC emission standards (wiring recommendations are given in Figures 2–22 and 2–23)

2.4 Calculating the enclosure size

STEP 1 Add the dissipation figures from step 4 of *Planning the installation* for each Drive that is to be installed in the enclosure. Make a note of this step number and the total value.

STEP 2 If an RFI filter is to be used with each Drive, add the dissipation figures from step 5 of *Planning the installation* for each RFI filter that is to be installed in the enclosure. Make a note of this step number and the total value.

STEP 3 If the braking resistor is to be mounted inside the enclosure, add the average power figures from step 8 of *Planning the installation* for each braking resistor that is to be installed in the enclosure. Make a note of this step number and the total value.

STEP 4 Make a note of this step number and the total heat dissipation (in Watts) of any other equipment to be installed in the enclosure.

STEP 5 Add the heat dissipation figures obtained (as appropriate) from steps 1, 2, 3 and 4 above. This gives a figure in Watts for the total heat that will be dissipated inside the enclosure. Make a note of this figure and the step number.

Calculating the size of a sealed enclosure

The enclosure transfers internally generated heat into the surrounding air by natural convection (or external forced air flow); the greater the surface area of the enclosure walls, the better is the dissipation capability. Only the surfaces of the enclosure that are unobstructed (not in contact with a wall or floor) can dissipate heat.

Calculate the minimum required unobstructed surface area $\mathbf{A_e}$ for the enclosure from:

$$A_e = \frac{P}{k(T_{int} - T_{ext})}$$

Where:

- $\mathbf{A_e}$ Unobstructed surface area in m^2 ($1m^2 = 10.8\ ft^2$)
- $\mathbf{T_{ext}}$ Maximum expected ambient temperature in °C *outside* the enclosure
- $\mathbf{T_{int}}$ Maximum permissible ambient temperature in °C *inside* the enclosure
- **P** Power in Watts dissipated by *all* heat sources in the enclosure
- **k** Heat transmission coefficient of the enclosure material in $W/m^2/°C$

Example

To calculate the size of an enclosure for the following:

- Two UNI 1205 models
- Each Drive to operate at 4.5kHz PWM switching frequency
- RFI filter for each Drive
- Braking resistors are to be mounted outside the enclosure
- Maximum ambient temperature inside the enclosure: 40°C
- Maximum ambient temperature outside the enclosure: 30°C

Dissipation of each Drive: 190W (from step 4 in *Planning the installation*)

Dissipation of each RFI filter: 25W (max) (from step 5 in *Planning the installation*)

Total dissipation: 2 x (190 + 25) = 430W

The enclosure is to be made from painted 2mm ($^3/_{32}$in) sheet steel having a heat transmission coefficient of $5.5W/m^2/°C$. Only the top, front, and two sides of the enclosure are to be free to dissipate heat.

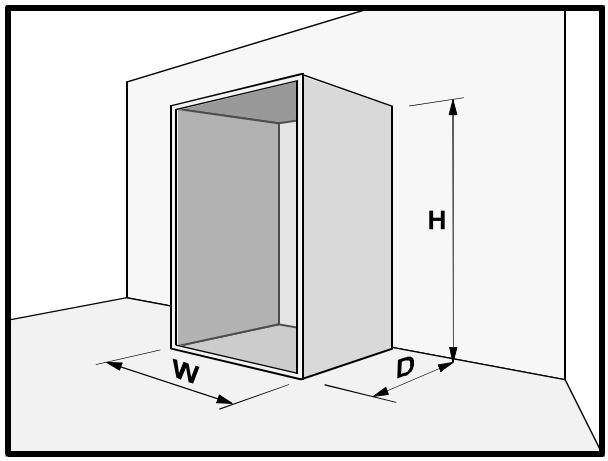


Figure 2–6 Enclosure having front, sides and top panels free to dissipate heat

Insert the following values:

T_{int}	40°C
T_{ext}	30°C
k	5.5
P	430W

The minimum required heat conducting area is then:

$$A_e = \frac{430}{5.5(40 - 30)} = 7.8m^2\ (85ft^2)$$

(1m = 3.3 ft)

Estimate two of the enclosure dimensions — the height (H) and depth (D), for instance. Calculate the width (W) from:

$$W = \frac{A_e - 2HD}{H + D}$$

Inserting **H** = 2m and **D** = 0.6m, obtain the minimum width:

$$W = \frac{7.8 - (2 \times 2 \times 0.6)}{2 + 0.6} = 2.1m\ \ (6ft\ 10in)$$

If the enclosure is too large for the space available, it can be made smaller only by attending to one or all of the following:

- Using a lower PWM switching frequency to reduce the dissipation in the Drives (return to step 4 in *Planning the installation*)
- Reducing the ambient temperature outside the enclosure, and/or applying forced-air cooling to the outside of the enclosure
- Reducing the number of Drives in the enclosure
- Removing other heat-generating equipment

Calculating the air-flow in a ventilated enclosure

The dimensions of the enclosure are required only for accommodating the equipment. The equipment is cooled by the forced air flow.

Calculate the minimum required volume of ventilating air from:

$$V = \frac{3kP}{T_{int} - T_{ext}}$$

Where:

V	Air-flow in m^3 per hour
T_{ext}	Maximum ambient temperature in °C outside the enclosure
T_{int}	Maximum ambient temperature in °C inside the enclosure
P	Power in Watts dissipated by *all* heat sources in the enclosure
k	Ratio of $\frac{p_0}{P_l}$

Where:

P_0 is the air pressure at sea level

P_l is the air pressure at the installation

Typically use a factor of 1.2 to 1.3, to allow also for pressure-drops in dirty air-filters.

Example

To calculate the size of an enclosure for the following:

- Three UNI 3201 models
- Each Drive to operate at 6kHz PWM switching frequency
- RFI filter for each Drive
- Braking resistors are to be mounted outside the enclosure
- Maximum ambient temperature inside the enclosure: 40°C
- Maximum ambient temperature outside the enclosure: 30°C

Dissipation of each Drive: 670W (from step 4 in *Planning the installation*)

Dissipation of each RFI filter: 60W (max) (from step 5 in *Planning the installation*)

Total dissipation: 3 x (670 + 60) = 2190W

Insert the following values:

T_{int}	40°C
T_{ext}	30°C
k	1.3
P	2190W

Then:

$$V = \frac{3 \times 1.3 \times 2190}{40 - 30} = 854m^3\ /\ hr\ (504\ ft^3\ /\ min)$$

($1m^3/hr = 0.59ft^3/min$)

2.5 Installing the Drive and RFI filter

Warning

Lifting the Drive

The weight of model size 3 is 22kg (49 lbs). Use appropriate safeguards when lifting this model.

Removing the terminal covers

The Drive is fitted with one or two terminal covers depending on the model size. When model sizes 1 and 3 are through-panel mounted, the terminal cover(s) must first be removed in order for access to be gained to the lower mounting holes.

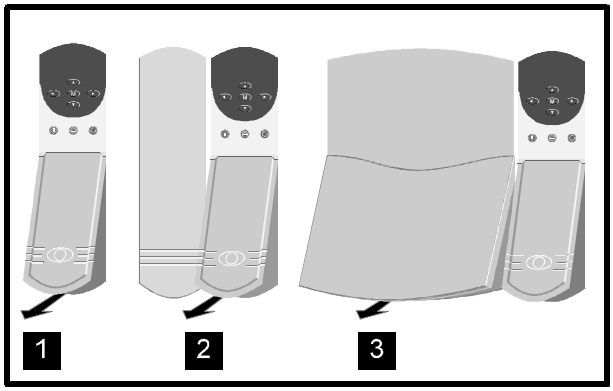


Figure 2–7 Removing the terminal covers

The terminal cover(s) of all models must be removed for access to the electrical connectors.

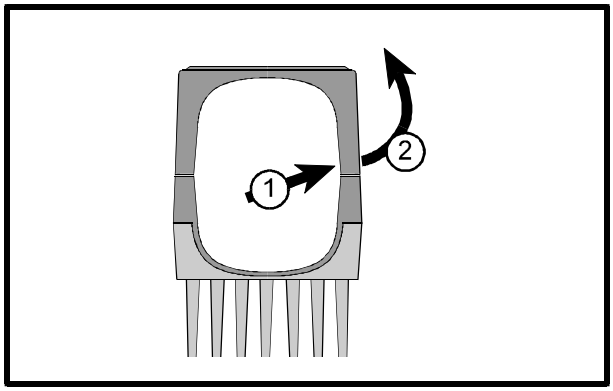


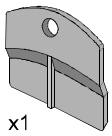
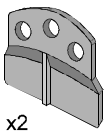
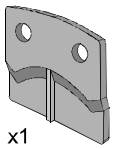
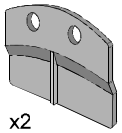
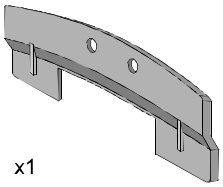
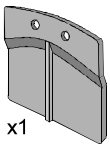
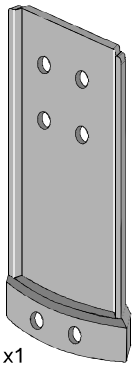
Figure 2–8 View from the underside showing how a terminal cover is removed from the Drive

Remove terminal covers, as follows:

1. Working on either side of the terminal cover, push the inner edge of the cover firmly outward until it becomes unclipped.
2. Swing the side of the cover outward and upward until the remaining clips become released.
3. Remove the gland plate (you may need to replace it later).

Mounting brackets supplied with the Drive

Table 2–10 General views of the mounting brackets

Model size	Through-panel	Surface
1	 x1	 x2 Upper and lower
2	 x1	 x2 Upper and lower
3	 x1	 x1 Upper  x1 Lower

Rear view of the brackets. The brackets are not shown to scale.

Fixing hole size: M6 ($^{1}/_{4}$ in)

Surface-mounting the Drive

1. Use the two surface-mounting brackets. These are manufactured from metal. Ensure the brackets make direct electrical contact with the back-plate; for example, tap M6 ($^{1}/_{4}$ in) threaded holes in the back-plate in the positions shown in Figure 2–10 to accept the mounting screws. (For model size 1, you may use the central or, preferably, the two outer screw holes in the mounting bracket.)
2. Insert the surface mounting brackets into the slots in the top and bottom of the Drive heatsink, as shown in Figure 2–9.

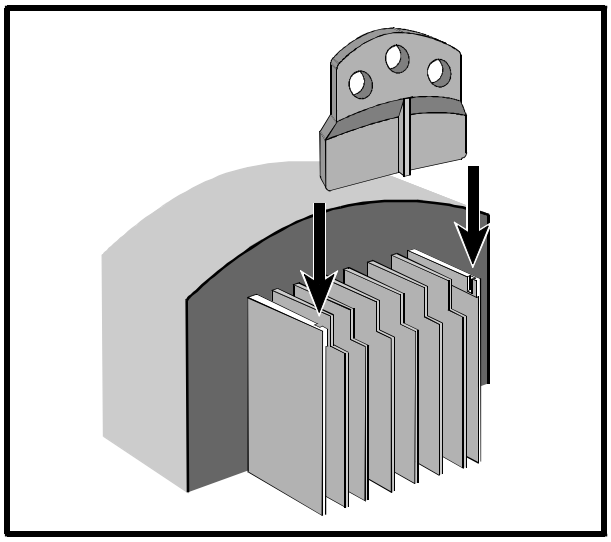


Figure 2–9 General representation showing the fitting of a surface mounting bracket in a heatsink

3. Retain the mounting brackets to the back-plate using electrically conducting screws.

Note

When surface mounting a model size 3, allow a clearance of 150mm (6in) above the Drive; this is required for dismounting. A minimum clearance of 100mm (4in) is required for ventilation.

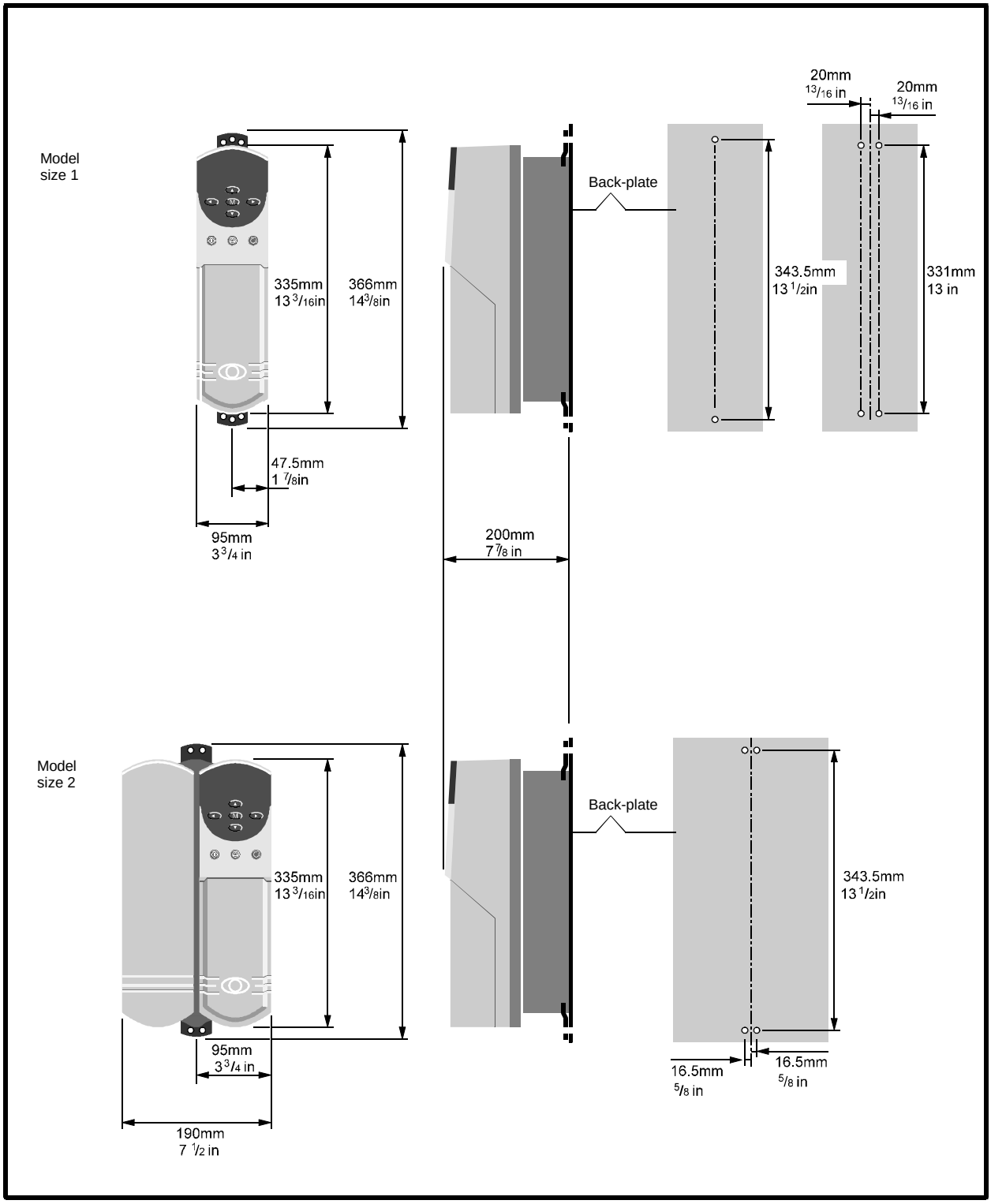


Figure 2–10 Surface mounting of model sizes 1 and 2

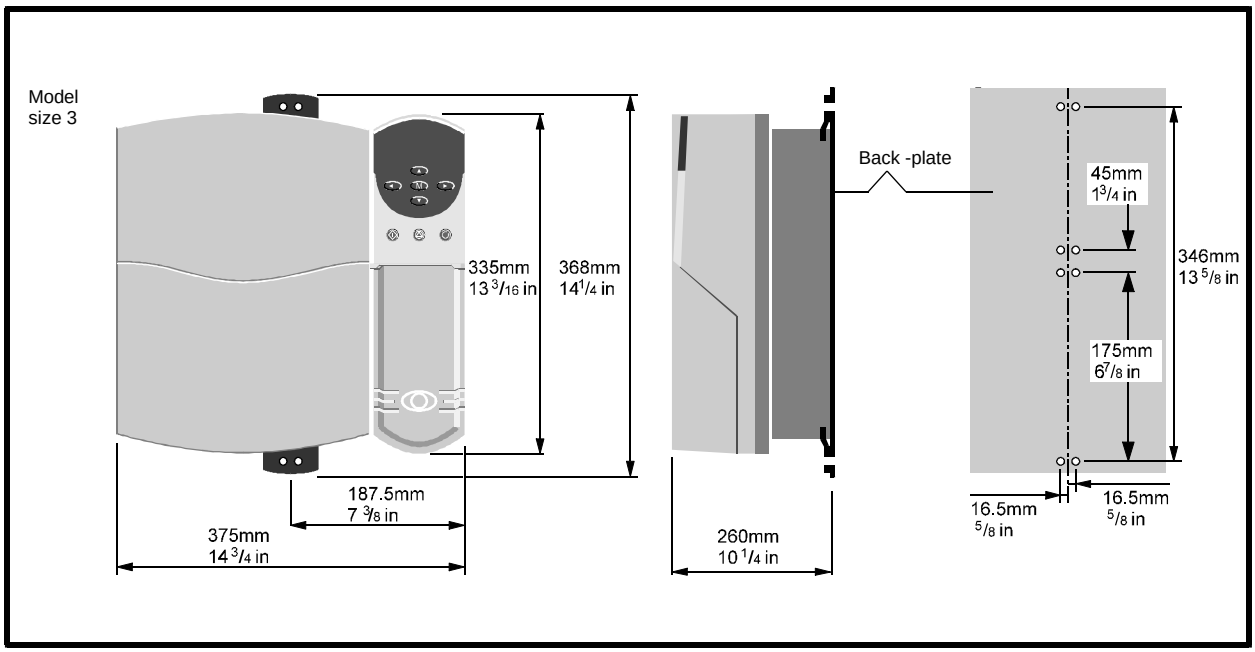


Figure 2–11 Surface mounting of model size 3

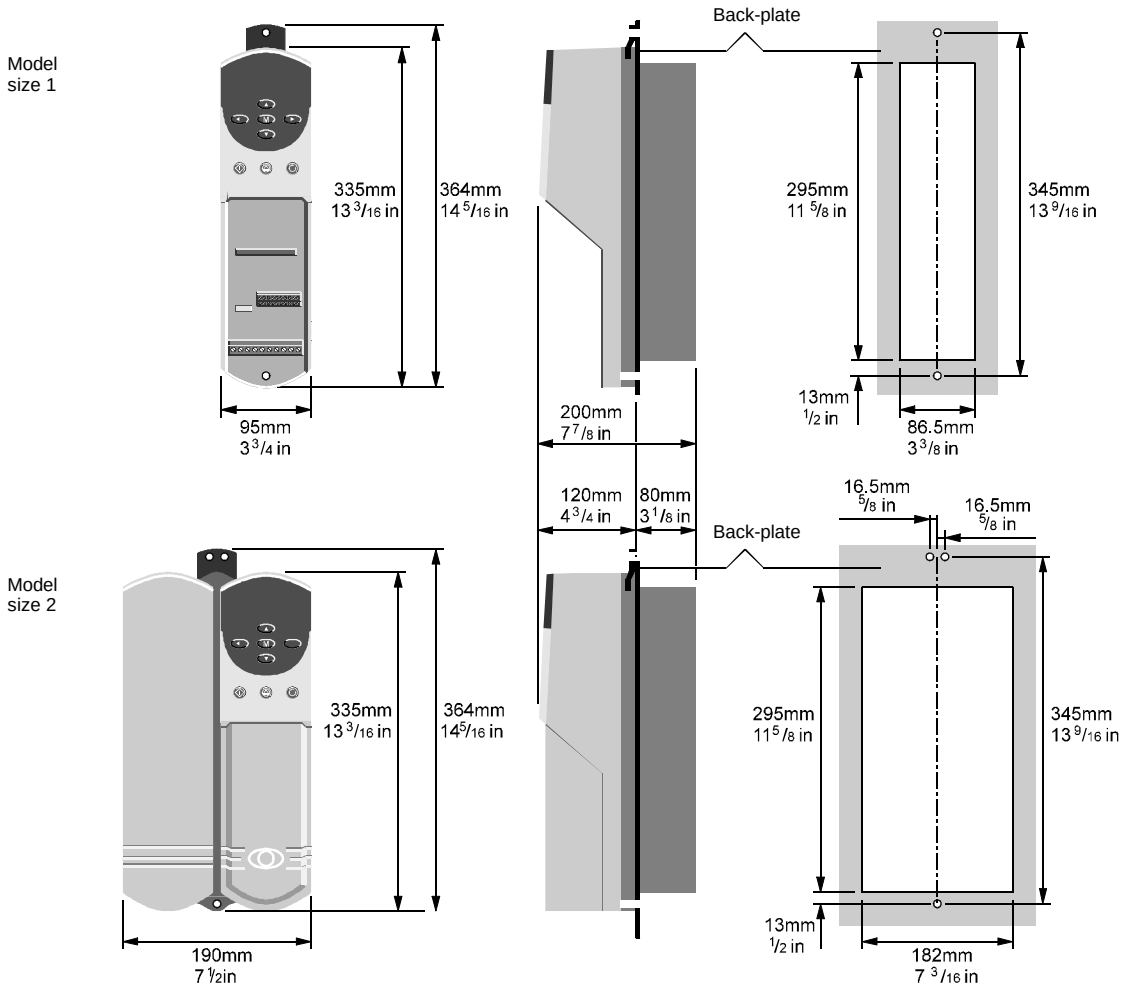


Figure 2–12 Through-panel mounting of model sizes 1 and 2

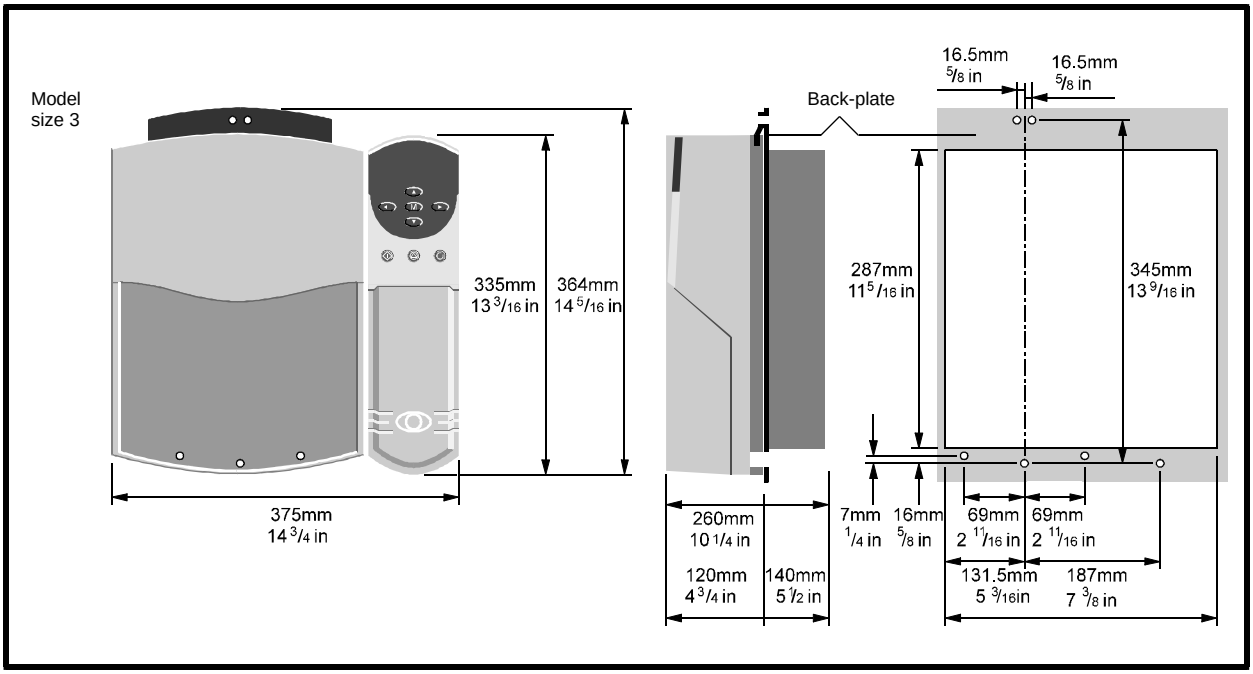


Figure 2–13 Through-panel mounting of model size 3

Through-panel mounting the Drive

1. Cut an aperture in the back-plate as shown in Figure 2–12 or 2–13 as appropriate.
2. Use the through-panel mounting bracket. This is manufactured from metal and is used to secure the top of the Drive to the back-plate; the bottom of the Drive is secured to the back-plate by screw(s) passed through a hole in the casing and heatsink.

   Ensure the bracket and heatsink make direct electrical contact with the back-plate; for example, tap M6 ($^{1}/_{4}$ in) threaded holes in the back-plate in the positions shown in Figure 2–12 or 2–13 to accept the mounting screws.
3. Insert the through-panel mounting bracket into the recess in the top of the Drive heatsink, as shown in Figure 2–14.

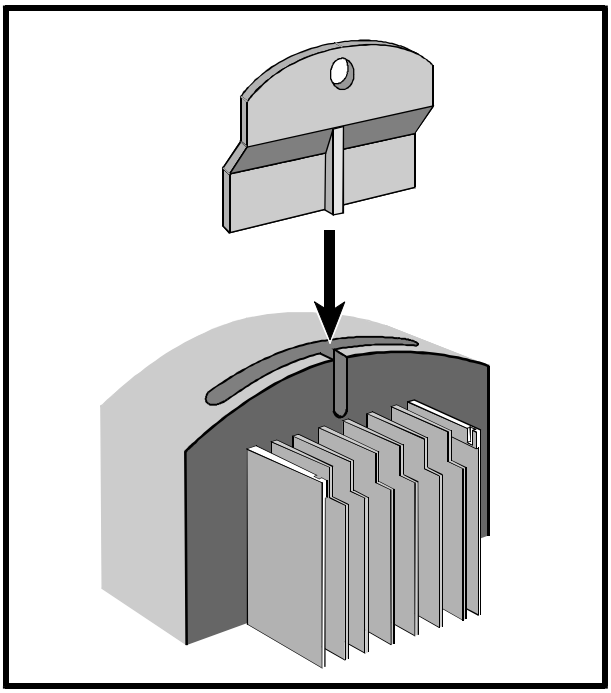


Figure 2–14 General representation showing the fitting of a through-panel mounting bracket in the top of the Drive

4. If a seal is required between the Drive and the back-plate, attach the foam sealing strip (supplied with the Drive) around the edges of the aperture in the back-plate so that the flange on the heatsink will press against the foam strip.
5. Insert the Drive into the aperture.
6. Secure the bottom of the Drive to the panel using electrically conducting screw(s).
7. Secure the through-panel mounting bracket to the panel using electrically conducting screw(s).

Caution **When the Drive is through-panel mounted, a baffle plate must be fitted at the rear of the heatsink.**

Fitting a baffle plate

Warning **If the Drive has been used, the heatsink may be hot. Human contact with the heatsink should be restricted.**

When the Drive is through-panel mounted, the fitting of a baffle plate causes the heatsink to act as a chimney; this enhances the air flow along the heatsink fins to aid cooling (this naturally occurs when the Drive is surface mounted).

You may make a baffle plate from any suitable conducting or non-conducting material and attach it to the heatsink by the method described as follows.

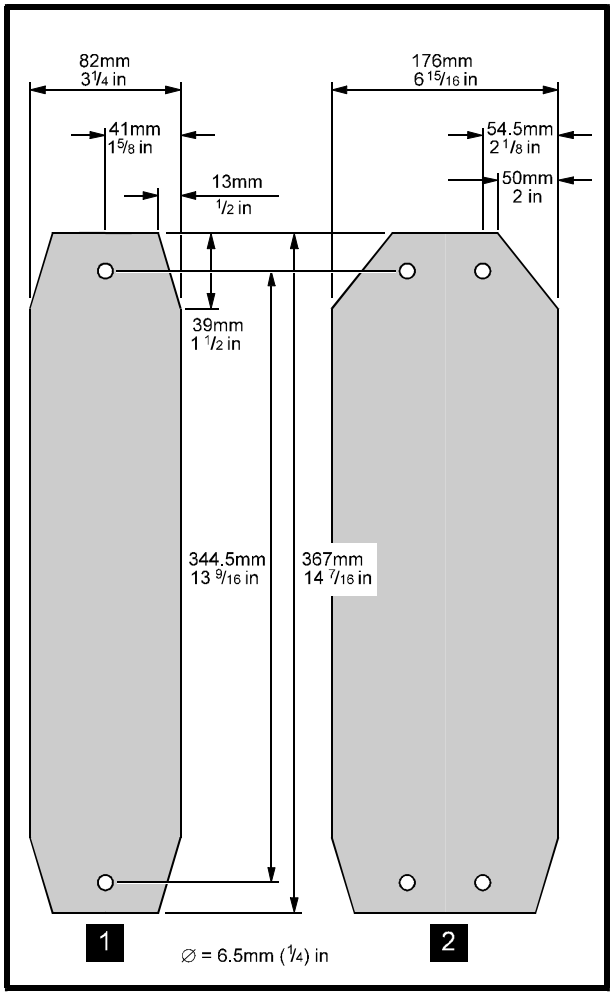


Figure 2–15 Dimensions for the fabrication of baffle plates for model sizes 1 and 2

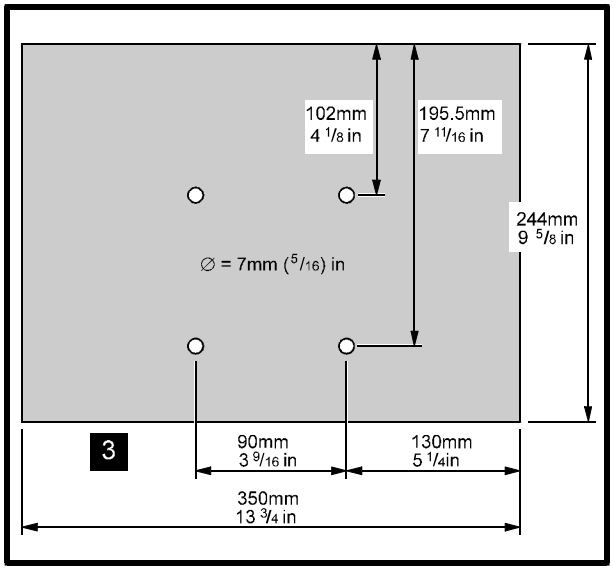


Figure 2–16 Dimensions for the fabrication of baffle plates for model size 3

Attaching a fabricated baffle plate to the heatsink

Table 2–12 Methods of attaching the baffle plate

Model size	Method of attachment
1 2	Use the surface mounting brackets.
3	Use M6 x 12mm max (or equivalent) thread-forming screws to screw into the holes in the heatsink, or tap the holes to a suitable thread size.

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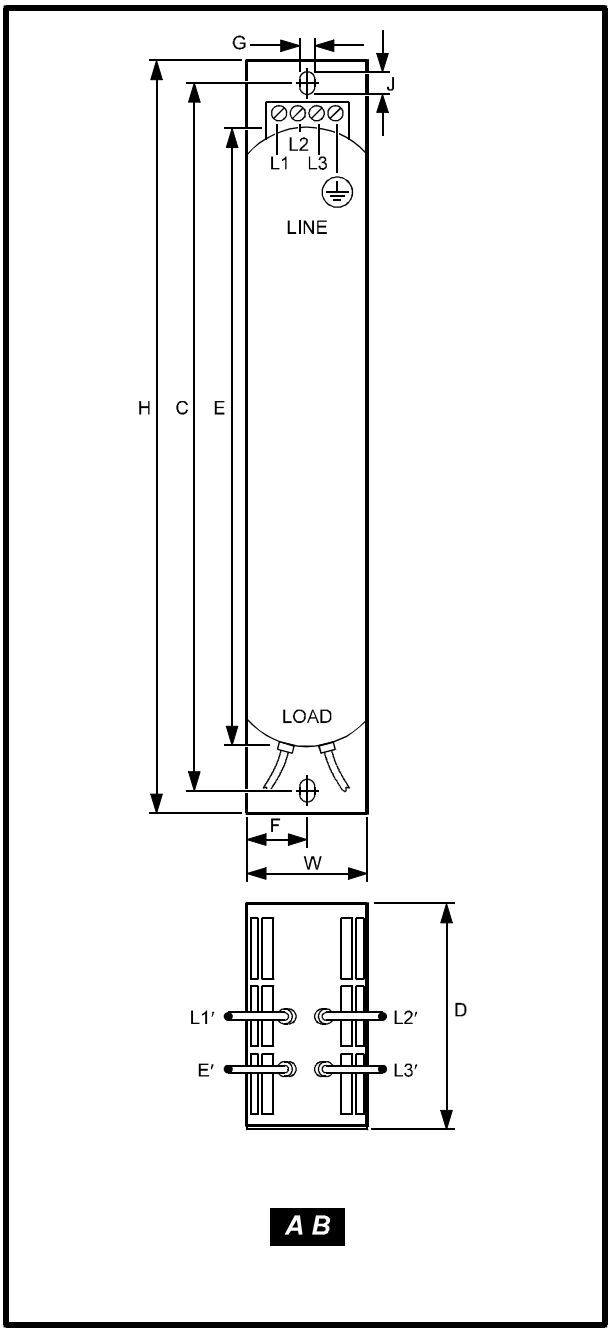
Mounting the RFI filter

The RFI filters can be surface-mounted only.

Mount the RFI filter at the specified location in relation to the Drive. In the case of filter sizes C to D, ensure the LOAD terminals face the Drive.



Dimension	RFI filter size	
	A **4200-0010**	***B*** **4200-0027**
C	378mm $14^{7}/_{8}$ in	388mm $15^{1}/_{4}$ in
D	114.5mm $4^{1}/_{2}$ in	114.5mm $4^{1}/_{2}$ in
E	335mm $13^{3}/_{16}$ in	335mm $13^{3}/_{16}$ in
F	25mm 1 in	37.5mm $1^{1}/_{2}$ in
G	6.4mm $^{1}/_{4}$ in	6.4mm $^{1}/_{4}$ in
H	396mm $15^{9}/_{16}$ in	406mm 16 in
J	10mm $^{3}/_{8}$ in	10mm $^{3}/_{8}$ in
W	50mm $1^{15}/_{16}$ in	75mm $2^{15}/_{16}$ in

Figure 2–17 Principal dimensions of RFI filters sizes A and B, and the locations of the terminals

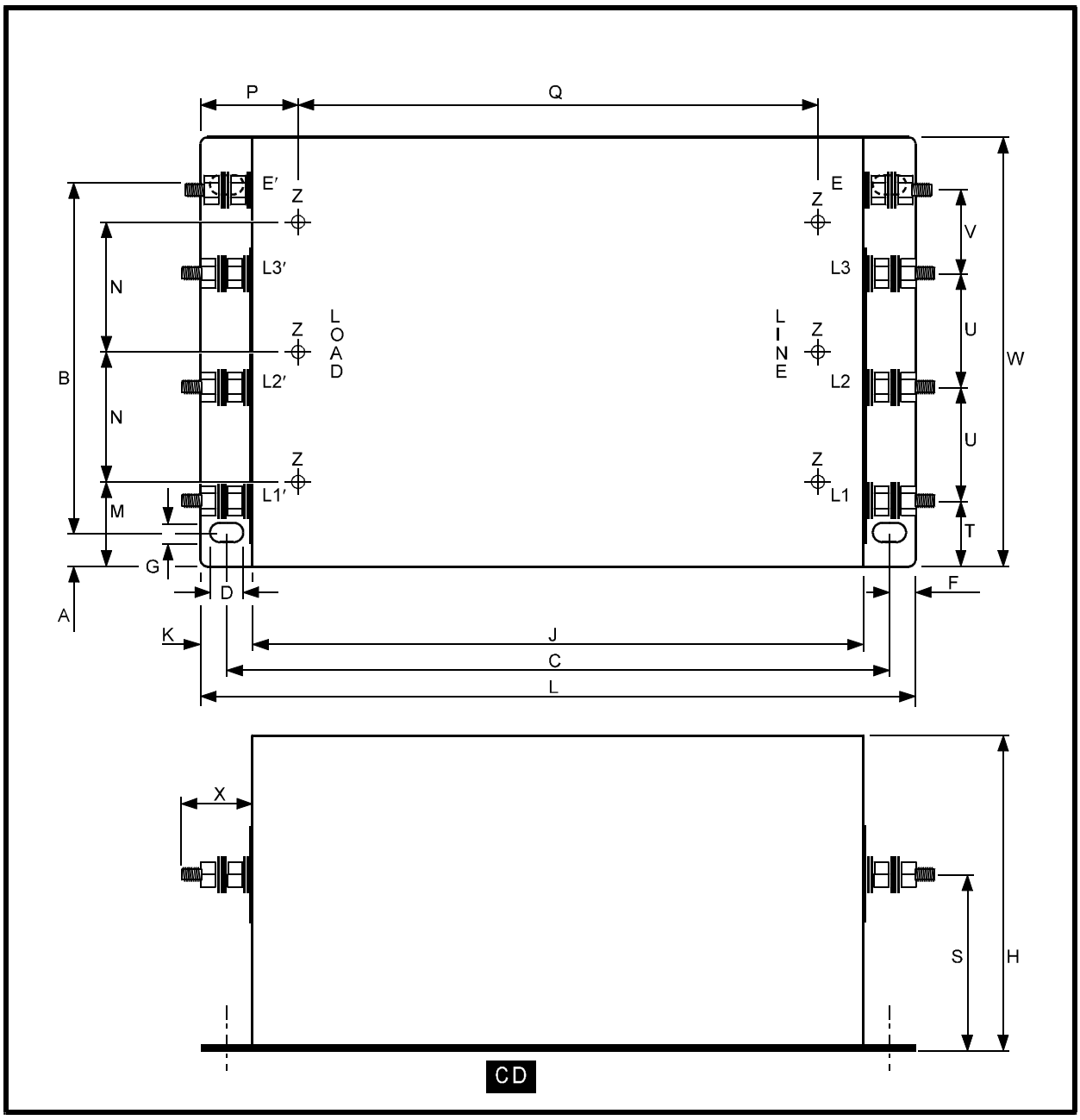


Figure 2–18 Principal dimensions of RFI filters sizes C and D, and the locations of the terminals

Dimension	RFI filter size	
	C 4200–1051	*D* 4200–1071
A	15mm $^{9}/_{16}$ in	15mm $^{9}/_{16}$ in
B	160mm $6^{5}/_{16}$ in	160mm $6^{5}/_{16}$ in
C	305mm 12 in	305mm 12 in
D	15mm $^{9}/_{16}$ in	15mm $^{9}/_{16}$ in
F	12.5mm $^{1}/_{2}$ in	12.5mm $^{1}/_{2}$ in
G	6.5mm $^{1}/_{4}$ in	6.5mm $^{1}/_{4}$ in
H	145mm $5^{11}/_{16}$ in	145mm $5^{11}/_{16}$ in
J	280mm $11^{3}/_{16}$ in	280mm $11^{3}/_{16}$ in
K	25mm 1 in	25mm 1 in
L	330mm 13 in	330mm 13 in
M	35mm $1^{3}/_{8}$ in	35mm $1^{3}/_{8}$ in
N	60mm $2^{3}/_{8}$ in	60mm $2^{3}/_{8}$ in
P	45mm $1^{3}/_{4}$ in	45mm $1^{3}/_{4}$ in
Q	240mm $9^{7}/_{16}$ in	240mm $9^{7}/_{16}$ in
S	80mm $3^{1}/_{8}$ in	80mm $3^{1}/_{8}$ in
T	30mm $1^{3}/_{16}$ in	30mm $1^{3}/_{16}$ in
U	50mm 2 in	50mm 2 in
V	40mm $1^{9}/_{16}$ in	40mm $1^{9}/_{16}$ in
W	190mm $7^{1}/_{2}$ in	190mm $7^{1}/_{2}$ in
X	40mm $1^{9}/_{16}$ in	40mm $1^{9}/_{16}$ in
Z	M5 x 10mm	M5 x 10mm
Terminals	M8	M8

2.6 Power connections

Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- **AC supply cables and connections**
- **Output cables and connections**
- **Many internal parts of the Drive, and external option units**

Isolation device

The AC supply must be disconnected from the Drive using an approved isolation device before any cover is removed from the Drive or before any servicing work is performed.

Stored charge

The Drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the Drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

AC supply by plug and socket

Special attention must be given if the Drive is installed in equipment which is connected to the AC supply by a plug and socket. The AC supply terminals of the Drive are connected to the internal capacitors through rectifier diodes which do not give isolation. If the plug terminals can be touched when the plug is disconnected from the socket, a means of automatically isolating the plug from the Drive must be used (eg. a latching relay).

Warning

STOP function

The STOP function does not remove dangerous voltages from the Drive or any external option units.

Warning

Ground leakage current – model size 3

Ground leakage current is typically 5mA at 220V 50Hz. A fixed ground connection must be made before AC power is applied. In some applications, safety regulations require a duplicate ground connection.

Measured by the method described in IEC950 Annex D.

Ground connections (earthing, equi-potential bonding)

The ground terminal of the Drive must be connected to the system ground of the AC supply. The ground wiring must conform to local regulations and codes of practice.

Refer to *Wiring recommendations* later in this chapter.

Warning

The ground loop impedance must conform to the requirements of local safety regulations.

The Drive must be grounded by a connection capable of carrying the prospective fault current until the protective device (fuse, etc) disconnects the AC supply.

The ground connections must be inspected and tested at appropriate intervals.

Power and ground terminals

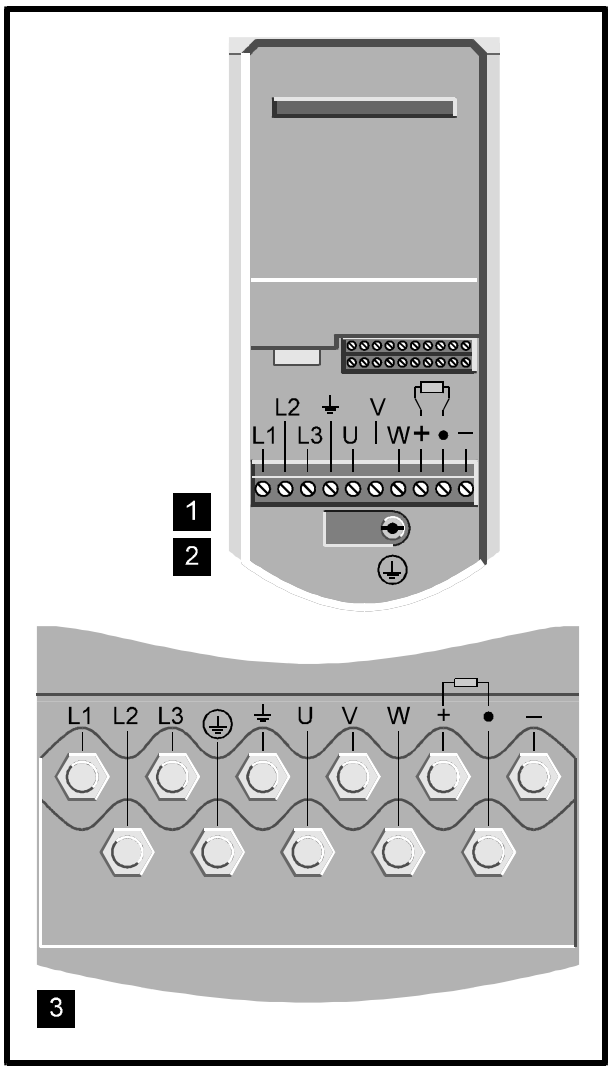


Figure 2–20 Locations of the power and ground terminals

Terminal sizes and tightening torques

Warning

To avoid a fire hazard and maintain validity of the UL listing, adhere to the specified tightening torques for the power and ground terminals. Refer to the following tables.

Drive

Table 2–13 Mechanical data for the Drive terminals

Model size	Power terminals		Ground terminal	
	Size Type	Torque	Size Type	Torque
1	Plug-in terminal block	0.5 N.m 4.4 lb.in	M4 (Torx/ slot-head screw)	3 N.m 2.2 lb.ft
2	Plug-in terminal block	0.5 N.m 4.4 lb.in	M4 (Torx/ slot-head screw)	3 N.m 2.2 lb.ft
3	M10 stud	15 N.m 11 lb.ft	M10 stud	15 N.m 11 lb.ft
Torque tolerance			±10%	

RFI filter

Table 2–14 Mechanical data for the RFI filter terminals

Size	Power terminals		Ground terminal	
	Size Type	Torque	Size Type	Torque
A	Screw terminals	0.7 N.m 6. lb.in	Screw terminals	0.7 N.m 6. lb.in
B	Screw terminals	0.7 N.m 6. lb.in	Screw terminals	0.7 N.m 6. lb.in
C	M8 stud	12.6 N.m 9 lb.ft	M8 stud	12.6 N.m 9 lb.ft
D	M8 stud	12.6 N.m 9 lb.ft	M8 stud	12.6 N.m 9 lb.ft
Torque tolerance			±10%	

Using the gland plate and cable glands

Warning

When the gland plate(s) are not fitted, objects less than 60mm ($2^{1}/_{2}$ in) wide can pass through the cable entry opening and possibly make contact with live parts inside the Drive.

Fit the gland plate and cable glands as required. Before fitting cable glands, push out sufficient blanking caps from the gland plate.

Note that the IP rating of the Drive is reduced if any holes in the gland plate are left open. The rating is affected as follows:

Gland plate not fitted	IP00
Gland plate fitted Unused holes uncovered	IP10
Gland plate and glands fitted Blanking caps covering unused holes	IP40

Table 2–15 Diameters of the holes in the gland plate

Model size	Gland plate hole diameter	
	Control signal wiring	Power cables
1	20mm $^{3}/_{4}$ in	20mm $^{3}/_{4}$ in
2	20mm $^{3}/_{4}$ in	20mm $^{3}/_{4}$ in
3	20mm $^{3}/_{4}$ in	28mm $1^{1}/_{16}$ in

2.7 Wiring recommendations

Observe the wiring recommendations given in this section. Recommendations are given separately for the following:

Routine EMC precautions

- Recommended when strict compliance with emission standards is not required.
- Minimized risk of disturbing adjacent electronic equipment.

Compliance with EMC emission standards

- Strict compliance with emission standards.
- When the Drive is installed in a residential area, or adjacent to sensitive electronic equipment such as radio receivers or similar.

The details of individual installations may vary, but details which are indicated in the recommendations to be important for EMC must be adhered to closely.

For further details when EMC emission requirements are to be met, refer to the *Unidrive* LV *EMC Data Sheet* for the size of Drive used.

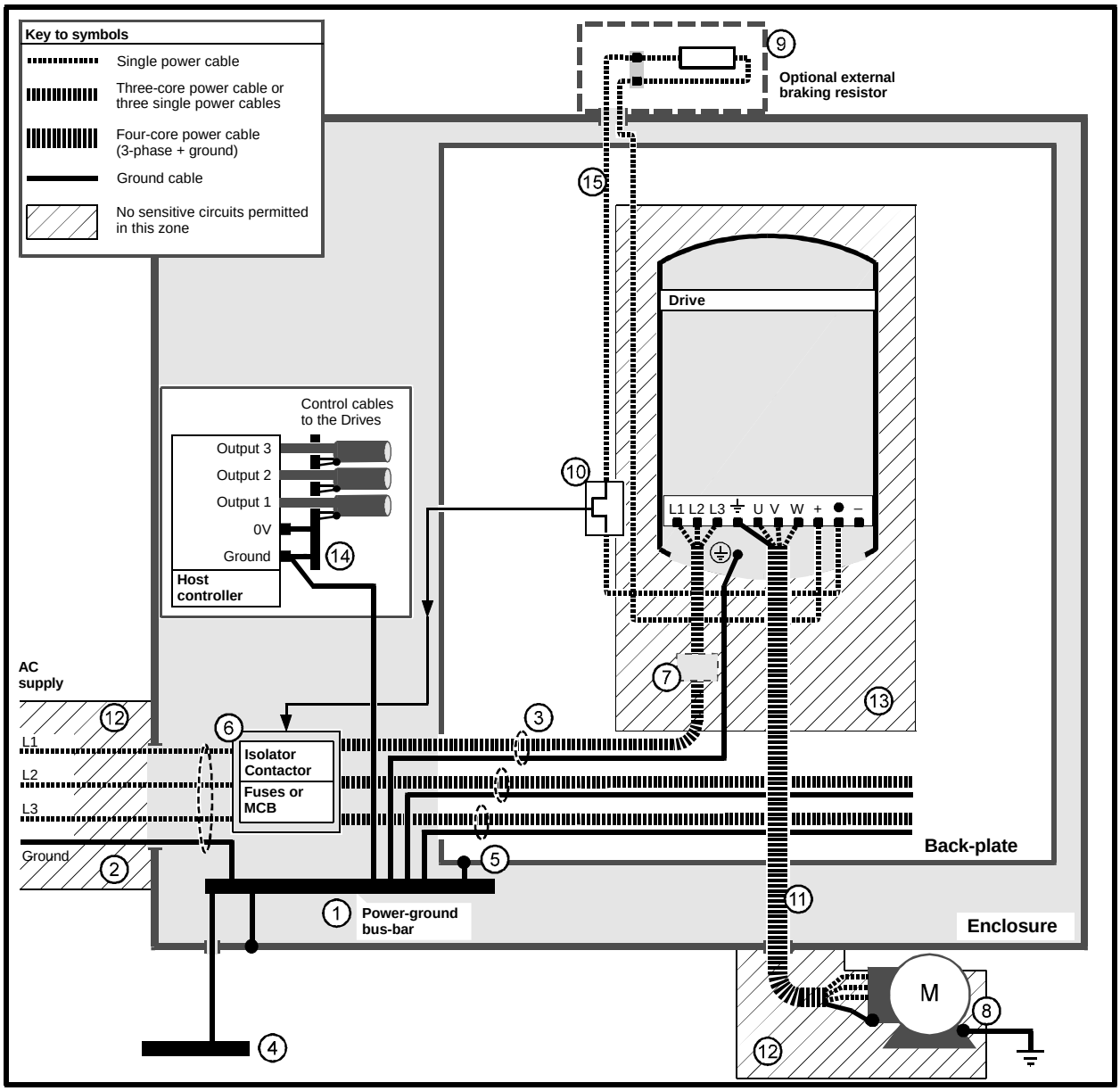


Figure 2–21 Wiring guidelines for routine EMC precautions (model sizes 1 to 3)

General features

1. Single power-ground bus-bar, or low-impedance ground terminal.
2. Incoming AC supply ground connected to the power ground bus-bar.
3. Connect grounds of any other circuits to the power ground bus-bar.
4. Site ground, if required.
5. Metal back-plate, safety bonded to the power ground bus-bar.
6. System isolator, circuit contactors and fuses/MCB.
7. Alternative position for Drive fuses/MCB.
8. Motor-frame ground connection, if required.
9. Optional braking resistor mounted externally, protected by a metal grille.
10. Thermal protection device to protect the braking resistor.

Routine EMC precautions

11 Use four-core cable to connect the motor to the Drive as shown. The ground conductor in the motor cable must be connected only to the ground terminals of the Drive and motor; it must not be connected directly to the power-ground bus-bar.

12. If the wiring for sensitive signal circuits is to be parallel to an unshielded motor cable (or cables for an unfiltered power supply) for more than 1 metre (3 feet), ensure the separation is at least 0.3m (12 in).

    If the parallel run is to exceed 10 metres (30 feet), increase the separation proportionally. For example, if the parallel run is to be 40 metres, the spacing must be 0.3 x 40 ÷ 10 = 1.2 metres.

    When a motor-thermistor is used, this constraint does not apply to the cable connecting the thermistor to the Drive. The motor-thermistor cable must be shielded (as shown in Figures 3–4 and 3–5 in the *User Guide*).

13. Do not place sensitive signal circuits in a zone extending 0.3m (12 in) all around the Drive.
14. If the control circuit 0V is to be grounded, this should be done at the system controller (eg. PLC) and not at the Drive. This is to avoid injecting noise currents into the 0V circuit.
15. When the braking-resistor wiring is unshielded, ensure a minimum spacing of 0.3m (12 in) from signal wiring.

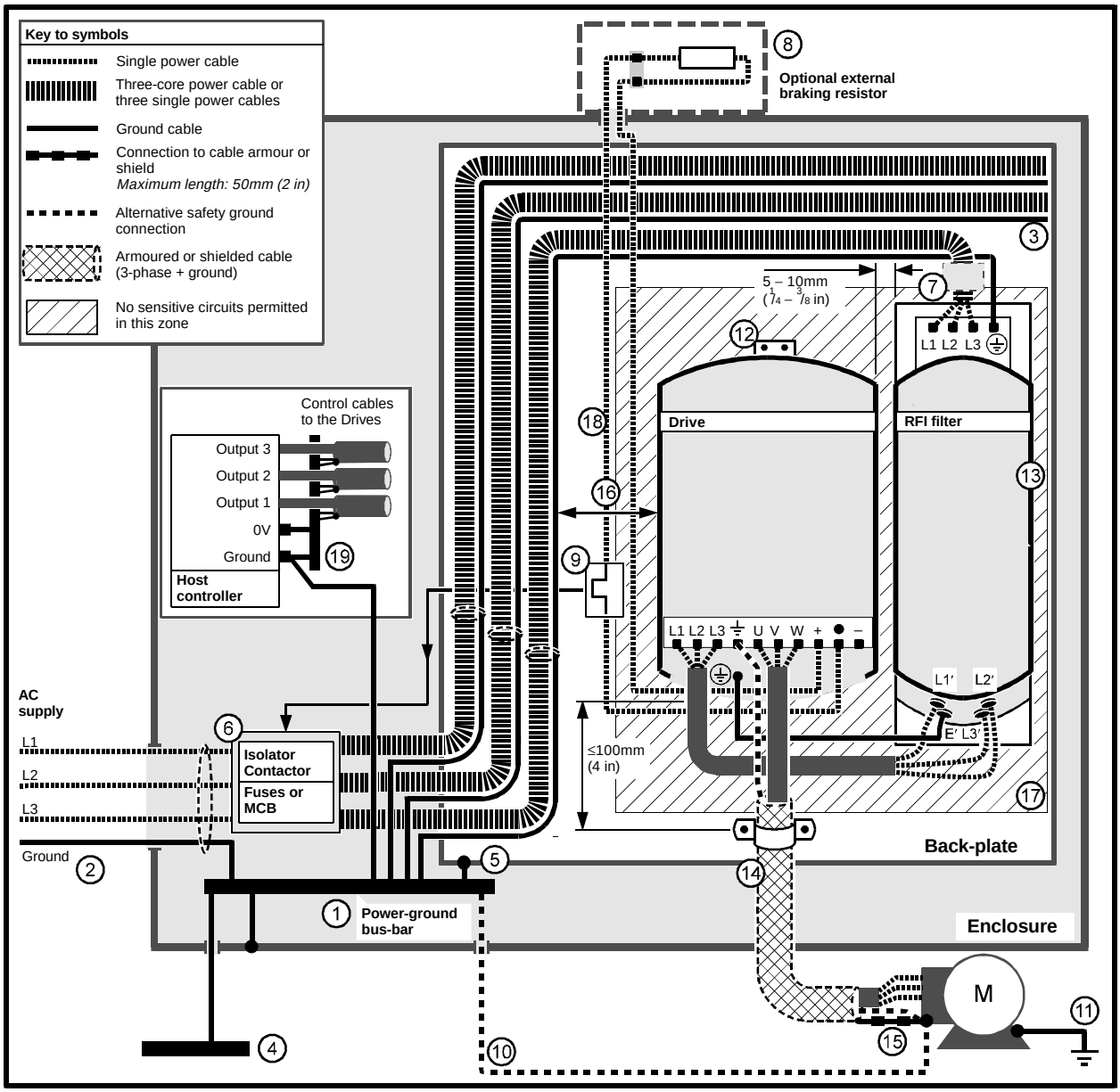


Figure 2–22 Wiring guidelines for compliance with EMC emission standards (model sizes 1 and 2)

Compliance with EMC emission standards (model sizes 1 and 2)

General features

1. Single power ground bus-bar or low-impedance ground terminal.
2. Incoming AC supply ground connected to the power ground bus-bar.
3. Connect grounds of any other circuits to the power ground bus-bar.
4. Site ground if required.
5. Metal back-plate, safety bonded to the power ground bus-bar.
6. System isolator, circuit contactors and fuses/MCB.
7. Alternative position for Drive fuses.
8. Optional braking resistor mounted externally, protected and shielded by a metal grille.
9. Thermal overload device to protect the braking resistor.
10. Alternative safety ground for the motor.
11. Motor-frame ground connection, if required.

Special features for EMC

12. Drive heatsink directly grounded to the back-plate using the metal mounting-brackets. Ensure that the screws make direct electrical connection to the back-plate, for example by using screw threads tapped in the backplate.
13. RFI filter mounted at the side of the Drive. Ensure a separation of 5 to 10mm ($^1/_4$ to $^3/_8$ in) from the Drive. The RFI filter casing is directly grounded to the back-plate by the fixing screws.
14. A shielded (screened) or steel-wire armoured cable must be used to connect the Drive to the motor. The shield must be bonded to the back-plate using an uninsulated metal cable-clamp. The clamp must be positioned no further than 100mm (4 in) from the Drive.
15. Connect the shield of the motor cable to the ground terminal of the motor frame using a link that is as short as possible and not exceeding 50mm (2 in) in length. A full 360° termination of the shield to the terminal housing of the motor is beneficial.
16. Ensure the AC supply and ground cables are at least 100mm (4 in) from the Drive.
17. Avoid placing sensitive signal circuits in a zone extending 0.3m (12 in) all around the Drive.
18. Unshielded wiring to the optional braking resistor(s) may be used, provided the resistor is either in the same enclosure as the Drive or the wiring does not run external to the enclosure. When the braking-resistor wiring is unshielded, ensure a minimum spacing of 0.3m (12 in) from signal wiring and the AC supply wiring to the RFI filters.
19. If the control circuit 0V is to be grounded, this should be done at the host controller (eg. PLC) and not at the Drive. This is to avoid injecting noise currents into the 0V circuit.

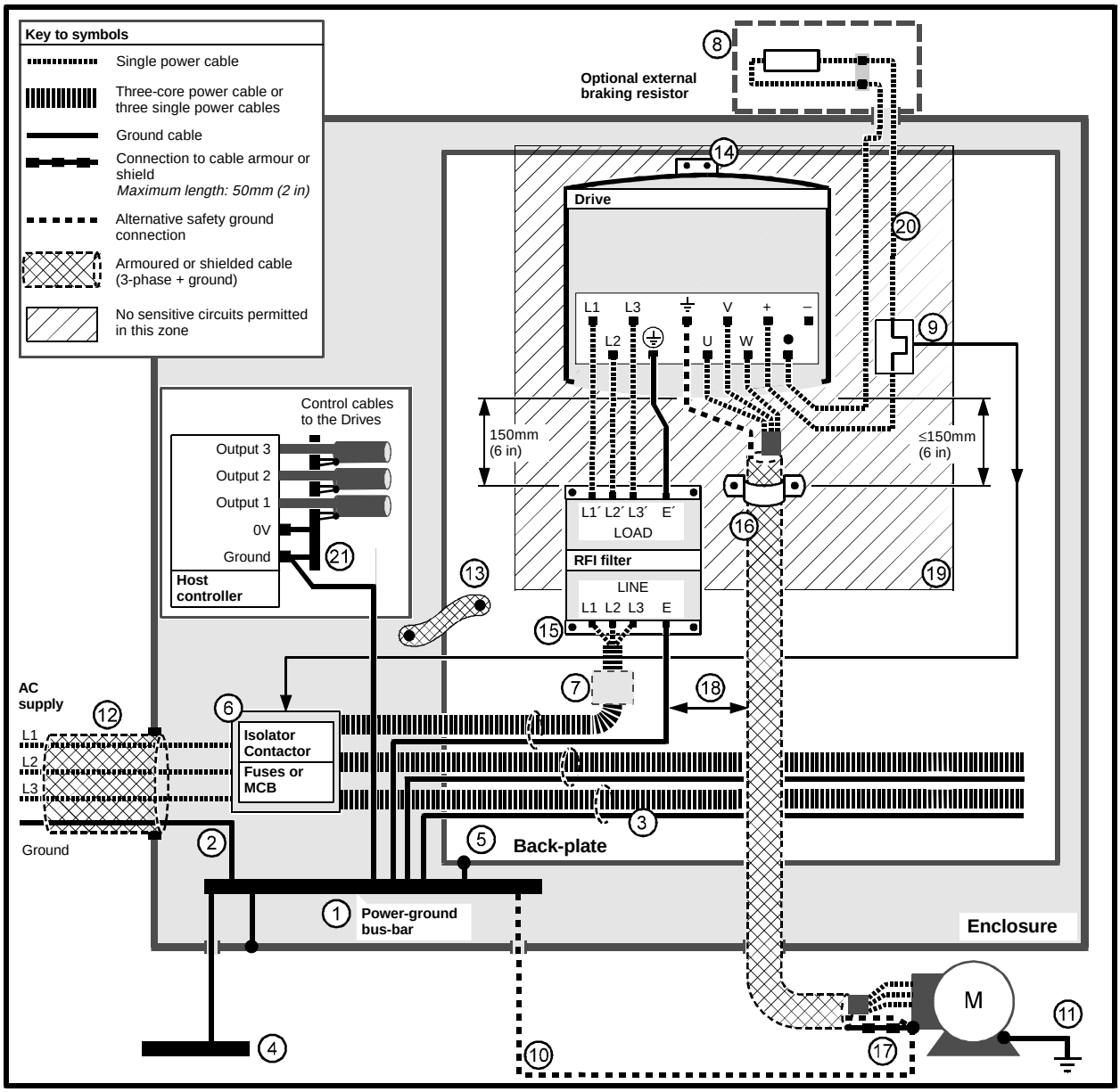


Figure 2–23 Wiring guidelines for compliance with EMC emission standards (model size 3)

Compliance with EMC emission standards (model size 3)

General features

1. Single power ground bus-bar or low-impedance ground terminal.
2. Incoming AC supply ground connected to the power ground bus-bar.
3. Connect grounds of any other circuits to the power ground bus-bar.
4. Site ground if required.
5. Metal back-plate, safety bonded to the power ground bus-bar.
6. System isolator, circuit contactors and fuses/MCB.
7. Alternative position for Drive fuses.
8. Optional braking resistor mounted externally, protected and shielded by a metal grille.
9. Thermal overload device to protect the braking resistor.
10. Alternative safety ground for the motor.
11. Motor-frame ground connection, if required.

Special features for EMC

12. Drive heatsink directly grounded to the back-plate using fixing screws. Screw threads tapped into the back-plate must be used to ensure that a direct electrical connection is made. An unpainted back-plate (eg. zinc-plated steel) is required.
13. RFI filter mounted 150mm (6 in) from the Drive. The RFI filter casing is directly grounded to the back-plate by the fixing screws. Minimize the length of cables between the Drive and RFI filter.
14. A shielded (screened) or steel-wire armoured cable must be used to connect the Drive to the motor. The shield must be bonded to the back-plate using an uninsulated metal cable-clamp. The clamp must be positioned no further than 150mm (6 in) from the Drive.
15. Connect the shield of the motor cable to the ground terminal of the motor frame using a link that is as short as possible and not exceeding 50mm (2 in) in length. A full 360° termination of the shield to the terminal housing of the motor is beneficial.
16. Ensure the AC supply and ground cables are at least 100mm (4 in) from the motor cable.
17. Avoid placing sensitive signal circuits in a zone extending 0.3m (12 in) all around the Drive.
18. Unshielded wiring to the optional braking resistor(s) may be used, provided the resistor is either in the same enclosure as the Drive or the wiring does not run external to the enclosure. When the braking-resistor wiring is unshielded, ensure a minimum spacing of 0.3m (12 in) from signal wiring and the AC supply wiring to the RFI filters.
19. If the control circuit 0V is to be grounded, this should be done at the host controller (eg. PLC) and not at the Drive. This is to avoid injecting noise currents into the 0V circuit.

2.8 Variations in the EMC wiring recommendations

Control wiring

Control wiring which is connected to the Drive and leaves the enclosure must have one of the following additional treatments:

- Pass the control cable(s) through a ferrite ring (part number 3225-1004). More than one cable can pass through a ferrite ring. Ensure the length of cable between the ferrite ring and the Drive is not greater than 125mm (5 in).
- Use one or more cables having a separate overall shield. Bond this shield(s) to the back-plate using an uninsulated metal clamp. Position the clamp not further than 100mm (4 in) from the Drive. Do not make any other connections to either end of the overall shield.

Interruptions to the motor cable

The motor cable should ideally be a single piece of shielded or armoured cable having no interruptions. In some situations it may be necessary to interrupt the cable, as in the following examples:

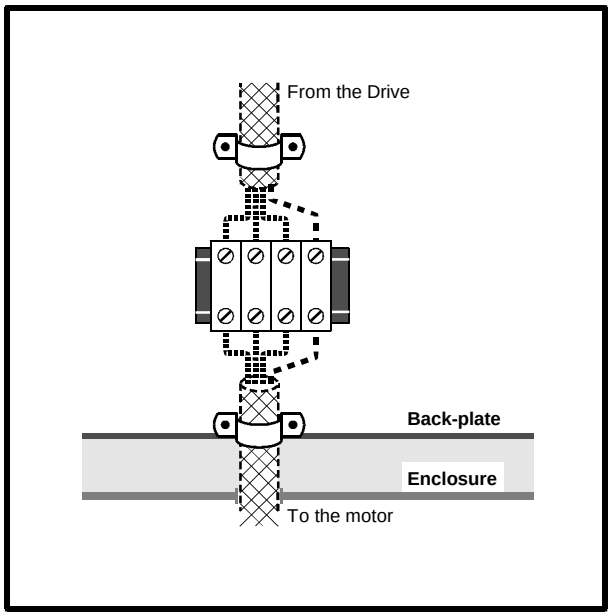
Connecting the motor cable to a terminal block in the Drive enclosure

Fitting a motor isolator switch for safety when work is done on the motor

In these cases the following guidelines should be followed.

Terminal block in the enclosure

The motor cable shields should be bonded to the back-plate using uninsulated metal cable-clamps which should be positioned as close as possible to the terminal block. Keep the length of power conductors to a minimum and ensure that all sensitive equipment and circuits are at least 0.3m (12 in) away from the terminal block.



(Refer to *Key to symbols* in Figure 2–22)

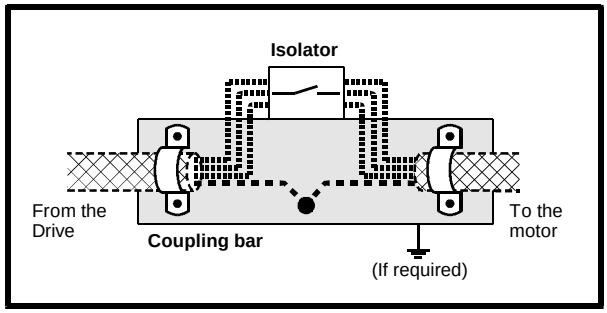
Figure 2–24 Connecting the motor cable to a terminal block in the enclosure

Using a motor isolator-switch

The motor cable shields should be connected by a very short conductor having a low inductance. The use of a flat metal coupling-bar is recommended; conventional wire is not suitable.

The shields should be bonded directly to the coupling-bar using uninsulated metal cable-clamps. Keep the length of the exposed power conductors to a minimum and ensure that all sensitive equipment and circuits are at least 0.3m (12 in) away.

The coupling-bar may be grounded to a known low-impedance ground nearby, for example a large metallic structure which is connected closely to the Drive ground.



(Refer to *Key to symbols* in Figure 2–22)

Figure 2–25 Connecting the motor cable to an isolator switch

2.9 Signal connections

The signal connections to be made depend on the method of control to be used. Refer to Chapter 2 *Getting Started*, Chapter 3 *Setting up the Drive* and Appendix C *Signal Connections* in the *User Guide*.

A Motor Connections

A.1 Cable length

It is not recommended that a Drive is operated with a motor-cable length greater than that specified in the table in *Planning the installation* in Chapter 2. If this is unavoidable, it is recommended that a sinusoidal filter is used to prevent the PWM switching components from entering the motor cable. Sinusoidal filters are available from specialist filter suppliers.

A.2 Multiple motors

Open-loop only

If the Drive is to control more than one motor, make connections as shown in Figure A–1. The maximum cable lengths given in the table in Chapter 2 *Installing the Drive* apply to the total length of cable from the Drive to the farthest motor.

It is recommended that each motor is connected through a protection relay since the Drive cannot protect each motor. For star connection, a sinusoidal filter or an output inductor must be connected as shown in Figure A–1, even when the cable lengths are less than the maximum permissible. For details, of inductor sizes refer to a Drive Centre or distributor listed at the end of the User Guide.

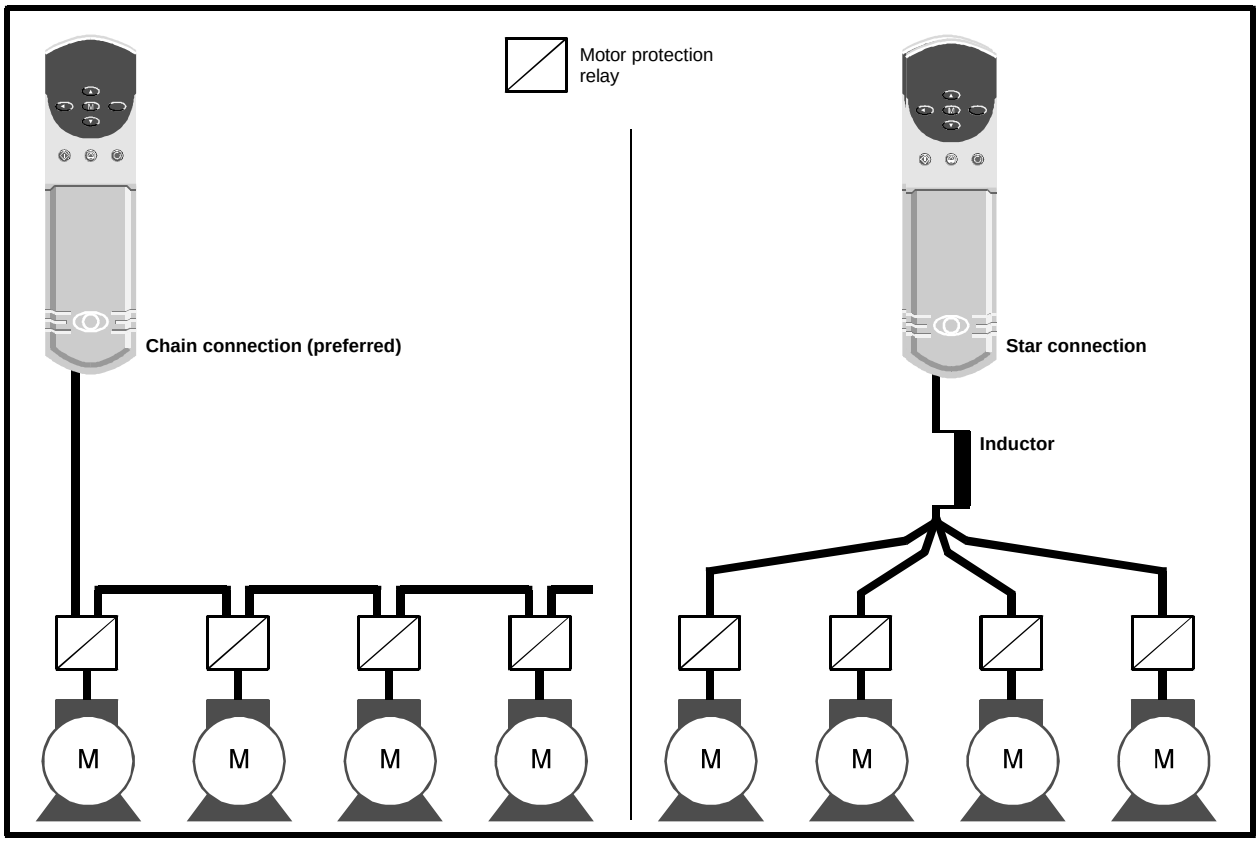


Figure A–1 Connecting motors in parallel

B UL Listing Information

The Drive conforms to UL listing requirements only when the following are observed:

- The Drive is installed in a type 1 enclosure, or better, as defined by UL50
- UL-listed fuses class RK1 600VAC are used in the AC supply
- Class 1 60/75°C (140/167°F) copper wire only is used in the installation
- The ambient temperature does not exceed 40°C (104°F) when the Drive is operating
- The terminal tightening torques specified in the table in *Terminal sizes and tightening torques* in Chapter 2 *Installing the Drive* are used

2.1 AC supply specification

The Drive is suitable for use in a circuit capable of delivering not more than 5000 RMS symmetrical Amperes at 268VAC RMS maximum.

2.2 Maximum continuous output current

The Drive models are listed as having the maximum continuous output currents (FLC) shown in Tables B–1 and B–2 (see Appendix C *Data* for details).

Table B–1 Maximum continuous output current for standard and VTC models

Model	FLC (A)
UNI 1201	2.1
UNI 1202	2.8
UNI 1203	3.8
UNI 1204	5.6
UNI 1205	9.5
UNI 2201	12
UNI 2202	16
UNI 2203	25
UNI 3201	34
UNI 3202	46
UNI 3203	60
UNI 3204	74

Table B–2 Maximum continuous output current for LFT models

Model	FLC (A)
UNI 1201 LFT	2.1
UNI 1202 LFT	2.8
UNI 1203 LFT	3.8
UNI 1204 LFT	4.0
UNI 1205 LFT	4.3
UNI 2201 LFT	12.0
UNI 2202 LFT	14.2
UNI 2203 LFT	14.2
UNI 3201 LFT	28.0
UNI 3202 LFT	28.0
UNI 3203 LFT	32.0
UNI 3204 LFT	35.0

C Data

C.1 Drive

Power and current ratings

The input current is affected by the supply voltage and impedance. Therefore, to aid the selection of cables and fuses, the values of **Maximum continuous input current** stated are for the worst-case condition.

The values of maximum current for models 1201 to 1205 are stated for a 200V AC supply rated at ten times the kVA of the Drive, with 2% negative phase-sequence imbalance and a typical motor load.

The values of maximum current for models 2201 to 2203 and 3301 to 3304 are stated for a 200V AC supply having a 5kA short-circuit capability and a 2% negative phase-sequence imbalance.

The values of **Typical input current** are stated for a balanced 200V AC supply having a 5kA short-circuit capability; these values are given to aid calculations for power flow and power loss.

Unidrive LV and Unidrive VTC LV (at 40°C ambient temperature)

Model	Nominal rating		Maximum permissible continuous output current					Typical input current	Maximum cont. input current
	kW	HP	3kHz	4.5kHz	6kHz	9kHz	12kHz		
UNI 1201	0.37 kW	0.5	2.1 A	2.1 A	2.1 A	2.1 A	2.1 A	2.4 A	4.0 A
UNI 1202	0.55 kW	0.75	2.8 A	2.8 A	2.8 A	2.8 A	2.8 A	3.5 A	6.0 A
UNI 1203	0.75 kW	1.0	3.8 A	3.8 A	3.8 A	3.8 A	3.8 A	4.6 A	8.0 A
UNI 1204	1.1 kW	1.5	5.6 A	5.6 A	5.6 A	5.6 A	4.5 A	6.5 A	10.0 A
UNI 1205	2.2 kW	3.0	9.5 A	9.5 A	8.5 A	7.0 A	5.5 A	8.6 A	12.5 A
UNI 2201	3.0 kW	4.0	12.0 A	12.0 A	12.0 A	12.0 A	11.7 A	10.8 A	13.9 A
UNI 2202	4.0 kW	5.0	16.0 A	16.0 A	16.0 A	14.2 A	11.7 A	14.3 A	16.9 A
UNI 2203	5.5 kW	10.0	25.0 A	21.7 A	18.2 A	14.2 A	11.7 A	19.8 A	27.0 A
UNI 3201	7.5 kW	15.0	34.0 A	34.0 A	34.0 A	28.0 A	23.0 A	26.0 A	28.0 A
UNI 3202	11 kW	20.0	46.0 A	46.0 A	40.0 A	32.0 A	26.6 A	39.0 A	43.0 A
UNI 3203	15 kW	25.0	60.0 A	47.0 A	40.0 A	32.0 A	26.7 A	53.0 A	56.0 A
UNI 3204	22 kW	30.0	74.0 A	56.0 A	46.0 A	35.0 A	28.0 A	78.0 A	84.0 A

Unidrive LV and Unidrive VTC LV (at 50°C ambient temperature)

Model	Maximum permissible continuous output current				
	3kHz	4.5kHz	6kHz	9kHz	12kHz
UNI 1201	2.1 A	2.1 A	2.1 A	2.1 A	2.1 A
UNI 1202	2.8 A	2.8 A	2.8 A	2.8 A	2.8 A
UNI 1203	3.8 A	3.8 A	3.8 A	3.8 A	3.3 A
UNI 1204	5.6 A	5.6 A	5.1 A	4.0 A	3.3 A
UNI 1205	6.9 A	5.9 A	5.1 A	4.0 A	3.3 A
UNI 2201	12.0 A	12.0 A	12.0 A	11.6 A	9.7 A
UNI 2202	16.0 A	16.0 A	14.7 A	11.6 A	9.7 A
UNI 2203	20.0 A	17.3 A	14.7 A	11.6 A	9.7 A
UNI 3201	34.0 A	34.0 A	28.0 A	21.0 A	17.9 A
UNI 3202	44.0 A	36.0 A	31.0 A	24.0 A	20.6 A
UNI 3203	44.0 A	36.0 A	31.0 A	24.0 A	20.9 A
UNI 3204	50.0 A	41.0 A	34.0 A	20.0 A	23.0 A

Unidrive LFT LV (at 9kHz PWM switching frequency)

Model	Nominal rating		Maximum permissible output current			Nominal AC supply current
	kW	HP	Standard duty-cycle operation at 40°C	Continuous operation at 40°C	Continuous operation at 50°C	
UNI 1201LFT	0.37 kW	0.5	2.1 A	2.1 A	2.1 A	3.1 A
UNI 1202LFT	0.55 kW	0.75	2.8 A	2.8 A	2.8 A	3.2 A
UNI 1203LFT	0.75 kW	1.0	3.8 A	3.8 A	3.3 A	5.5 A
UNI 1204LFT	1.1 kW	1.5	5.6 A	4.0 A	3.3 A	8.4 A
UNI 1205LFT	2.2 kW	3.0	9.5 A	4.3 A	3.3 A	9.5 A
UNI 2201LFT	3.0 kW	4.0	12.0 A	12.0 A	11.0 A	13.7 A
UNI 2202LFT	4.0 kW	5.0	16.0 A	14.2 A	11.0 A	16.3 A
UNI 2203LFT	5.5 kW	10.0	25.0 A	14.2 A	11.0 A	24.3 A
UNI 3201LFT	7.5 kW	15.0	34.0 A	28.0 A	21.0 A	34.0 A
UNI 3202LFT	11 kW	20.0	46.0 A	32.0 A	24.0 A	46.0 A
UNI 3203LFT	15 kW	25.0	60.0 A	33.0 A	24.0 A	59.0 A
UNI 3204LFT	22 kW	30.0	74.0 A	35.0 A	26.0 A	74.0 A

AC supply requirements

Voltage: 200V ~ 240V ±10%

No. of phases: 3

Maximum supply imbalance:
2% negative phase sequence (equivalent to 3% voltage imbalance between phases)

Frequency range: 48 to 62 Hz

Line reactors

Line reactors reduce the risk of damage to the Drive that could result from severe phase unbalance or disturbances on the supply network. As a result of the following, for example...

- Power factor correction equipment connected close to the Drive
- Large DC Drives having no or ineffective line reactors connected to the supply
- Direct-on-line started motor(s) connected to the supply. When any of these motors are started, a dip is produced in excess of 20% of the actual AC supply voltage

...excessive peak current may flow in the input power circuit of the Drive. Such disturbances may cause nuisance tripping or in extreme cases, failure of the Drive.

When any of the following model sizes...

UNI1201
UNI1202
UNI1203
UNI1204
UNI1205

...are used on an AC supply where one of the conditions described above exists, **OR** the AC supply is rated at more than ten times the current rating of the Drive, it is strongly recommended that a line reactor of 2% reactance is included between the AC supply and the Drive. Model sizes 1205 and larger have an internal DC-bus choke; these models do not require a line reactor except under extreme supply conditions.

RFI filters (for EMC purpose) do not give adequate protection against these conditions.

For three-phase Drives, three individual reactors, or a single three-phase reactor should be used. Each Drive must have its own reactor(s).

Current ratings

Continuous: Not less than the continuous current rating of the Drive

Repetitive peak: Not less than *twice* the continuous current of the Drive.

Motor requirements

Number of phases: 3

Voltage: 200V ~ 240V ±10%

Temperature, humidity and cooling method

Ambient temperature range:
0°C to 50°C (32°F to 122°F). Output current de-rating must be applied at ambient temperatures between 40°C (104°F) and 50°C (122°F) (absolute maximum).

Minimum temperature at power-up: –10°C (14°F)

Cooling method: Forced convection

Maximum humidity:
95% non-condensing at 40°C (104°F)

Storage temperature range:
–40°C to 50°C (–40°F to 122°F)

Maximum storage time: After each 12 months, the capacitors will need re-forming; refer to the supplier of the Drive.

Altitude

Altitude range: 0 to 4000m (13000 ft), subject to the following conditions:

1000m to 4000m (3300 ft to 13000 ft) above sea level: De-rate the maximum output current from the specified figure by 1% per 100m (330 ft)

Vibration

Tested to ≤0.5g as specified in IEC 68–2–34

Ingress protection

Gland plate(s) not fitted: IP00

Gland plate(s) fitted; cable glands not fitted: IP10

Gland plate(s) fitted; cable-glands fitted: IP40, NEMA 1

Overall dimensions

- H Height including surface mounting brackets
- W Width
- D Projection forward of panel when surface mounted
- F Projection forward of panel when through-panel mounted
- R Projection rear of panel when through-panel mounted

Dimension	Model size		
	1	2	3
H	366mm 14 3/8	366mm 14 3/8	368mm 14 1/4 in
W	95mm 3 3/4 in	190mm 7 1/2 in	375mm 14 3/4 in
D	200mm 7 7/8 in	200 mm 7 7/8 in	260mm 10 1/4
F	120mm 4 1/4 in	120mm 4 1/4 in	120mm 4 1/4 in
R	80mm 3 1/8 in	80mm 3 1/8 in	140mm 5 1/2 in

Weights

Model size	kg	lb
1	4	8.8
2	8	17
3	22	49

Electromagnetic compatibility (EMC)

This is a summary of the EMC performance of the Drive. For full details, refer to the *Unidrive* LV *EMC Data Sheet* which can be obtained from a Drive Centre or distributor listed at the end of the User Guide.

Immunity

Compliance with immunity standards does not depend on installation details. Drives meet EN50082–2 (generic immunity standard for the industrial environment) and the following specifications from the IEC61000–4 group (derived from IEC801):

Part 2, Electrostatic discharge: Level 3

Part 3, Radio frequency field: Level 3

Part 4 Transient burst:
Level 4 at the control terminals
Level 3 at the power terminals

Part 5, Surge (at the AC supply terminals) (as specified by EN50082–2 informative annex):
Level 4 line-to-ground
Level 3 line-to-line

Part 6, Conducted radio frequency: Level 3

Emission

Compliance with emission standards depends on rigorous adherence to the installation guidelines, including the use of the specified RFI filter in the AC supply circuit. Compliance also depends on the PWM switching frequency used in the output stage of the Drive, and the length of the motor cable. For full details, refer to the *Unidrive EMC Data Sheet* which can be obtained from a Drive Centre or distributor listed at the end of the User Guide.

When installed according to the instructions the Drive can meet the emission requirements of CENELEC generic emission standards, as follows:

Unidrive size	EN50081-1 conducted	EN50081-1 radiated	EN50081-2 conducted	EN50081-2 radiated
1	Restricted motor cable length	No	Yes	Yes
2	Restricted motor cable length	No	Yes	Yes
3	No	No	Yes	Yes

The optional RFI filter specified below must be used:

Drive model	Use RFI filter...	
	Type	Part number
UNI 1201	*A*	4200–0010
UNI 1202	*A*	4200–0010
UNI 1203	*A*	4200–0010
UNI 1204	*A*	4200–0010
UNI 1205	*A*	4200–0010
UNI 2201	*B*	4200–0027
UNI 2202	*B*	4200–0027
UNI 2203	*B*	4200–0027
UNI 3201	*C*	4200–1051
UNI 3202	*C*	4200–1051
UNI 3203	*D*	4200–1071
UNI 3204	*D*	4200–1071

Power Drive Systems standard EN61800–3

The Drive meets the immunity requirements of EN61800–3 irrespective of the environment in which it is operating.

The emission requirements of this standard are also met depending on the environment category, as shown in the table below.

EN61800–3 defines the following:

- The **first environment** as one 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.
- The **second environment** is one that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.
- **Restricted distribution** is defined as a 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.

Note

If a Power Drive System is included as part of equipment covered by a separate EMC product standard, the EMC standard for the complete equipment applies.

Power Drive Systems standard EN61800–3		
Model size	Environment category	
	First environment	Second environment
UNI 1201 ~ UNI 1205 (Rated input current of Drive <25A)	Restricted distribution only: specified RFI filter required	No RFI filter required *
UNI 2201, UNI 2202 (Rated input current of Drive <25A)	Restricted distribution only: specified RFI filter required	No RFI filter required *
UNI 2203 (Rated input current of Drive >25A)	Specified RFI filter required	No RFI filter required *
UNI 3201 ~ UNI 3204 (Rated input current of Drive >25A)	Specified RFI filter required	No RFI filter required *

RFI filter(s) recommended where sensitive electronic systems are operating nearby.

Frequencies and speed

PWM switching frequency

Unidrive LV and Unidrive VTC LV: 3kHz nominal (selectable up to 12kHz)

Unidrive LFT LV: 9kHz nominal (selectable from 3kHz to 12kHz)

Maximum output frequency (open-loop): 2000Hz
Maximum speed (closed-loop): 30 000 RPM

Speed regulation:
(open-loop): 1 ~ 2%
(closed-loop): 0.01%

Speed control range:
(open-loop): >50:1
(closed-loop): >1000:1

Starts per hour

By electronic control: unlimited

By interrupting the AC supply:
model sizes 1 and 2: ≤20
model sizes 3 and 4: ≤10

Accuracy and resolution

The following data applies to the Drive only; it does not include the performance of the source of the control signals.

Open-loop frequency resolution...

Preset frequency reference: 0.1Hz

Precision frequency reference: 0.001Hz

Open-loop frequency accuracy...

Preset frequency reference: 0.03Hz or 0.01% of the reference, whichever is the larger value

Precision frequency reference: 0.0001Hz or 0.01% of the reference, whichever is the larger value

Closed-loop speed resolution
Unidrive LV *and Unidrive LFT* LV *only*...

Preset speed reference: 1 RPM

Precision speed reference: 0.01 RPM

Analog input 1: 0 RPM *

* The speed-loop algorithm ensures that the steady-state speed can change by infinitely small amounts in response to changes in the reference from these inputs.

Closed-loop speed accuracy
Unidrive LV *and Unidrive LFT* LV *only*...

Preset or precision speed reference: 0.00016 RPM or 0.01% of the reference, whichever is the larger value

C.2 Optional RFI filters

Ratings

Type	Part number	Max. continuous current	Ingress protection
A	4200–0010	10 A	IP20
B	4200–0027	27 A	IP20
C	4200–1051	50 A	IP 00
D	4200–1071	75 A	IP 00

Maximum current overload:
150% of rated current for 1 minute in a 10 minute period.

Voltage (phase-to-phase and phase-to-ground):
480V +10%

AC supply frequency: 48 to 62 Hz

Temperature

Type	Part number	Maximum ambient temperature at rated current	Case temperature rise at rated current
A	4200–0010	50 °C (122°F)	<30°C (86°F)
B	4200–0027	50 °C (122°F)	<40°C (104°F)
C	4200–1051	50 °C (122°F)	<40°C (104°F)
D	4200–1071	50 °C (122°F)	<40°C (104°F)

Power dissipation

Type	Part number	Power dissipation at rated current
A	4200–0010	25 W
B	4200–0027	40 W
C	4200–1051	60 W
D	4200–1071	100 W

Ground leakage current

Ground-leakage current when the AC supply is 400V at 50Hz is as follows:

Condition	*A*	*B*	*C* to *D*
Balanced supply phase-to-phase and phase-to-ground	3.4mA	4.4mA	33mA
One phase disconnected	25mA	35mA	210mA

For other AC supply voltages and frequencies, scale the values of leakage current proportionally.

Discharge resistors

A and *B*: 330KΩ in a star network between phases, with the star point connected by a 1MΩ resistor to ground.

C to *D*: 10MΩ between each phase and ground.

The discharge resistors are fitted internally.

Overall dimensions

Type	Part number	Dimension		
		H	W	D
A	4200–0010	396mm $15^{9}/_{16}$ in	50mm $1^{15}/_{16}$ in	114.5mm $4^{1}/_{2}$ in
B	4200–0027	406mm 16 in	75mm $2^{15}/_{16}$ in	114.5mm $4^{1}/_{2}$ in
C	4200–1051	330mm 13 in	190mm $7^{1}/_{2}$ in	145mm $5^{11}/_{16}$ in
D	4200–1071	330mm 13 in	190mm $7^{1}/_{2}$ in	145mm $5^{11}/_{16}$ in

Weights

Type	Part number	kg	lb
A	4200–0010	2	5
B	4200–0027	2.7	6
C	4200–1051	7.4	16
D	4200–1071	8	18