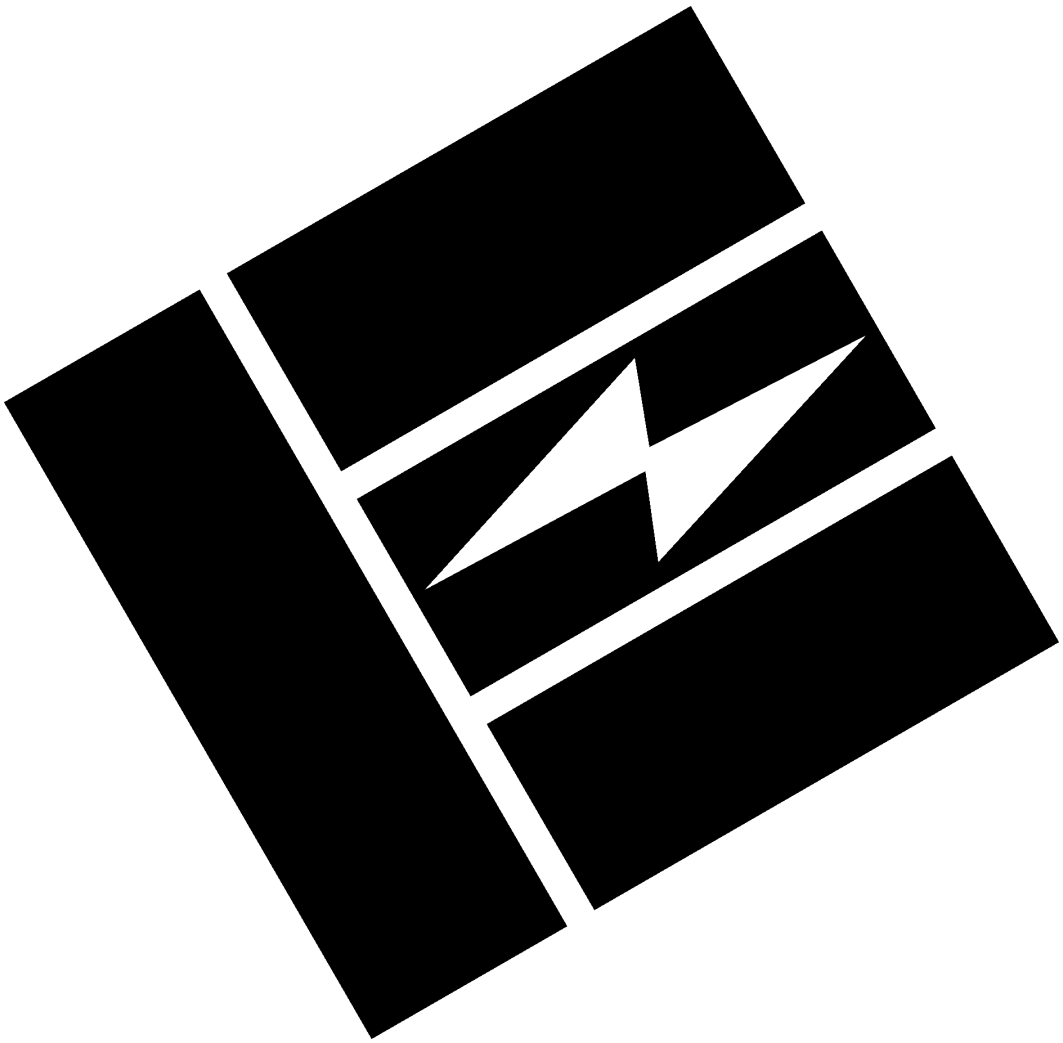
MX Drives User's Guide Addendum #5 CE-Marked Drive Installation



P/N 400268-05
Rev.: A2
Date: January 2, 1998

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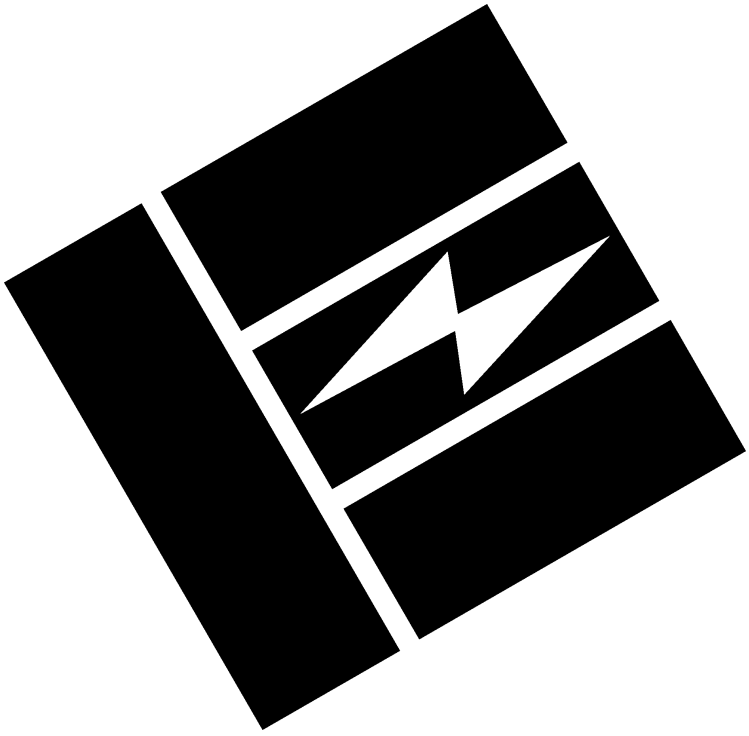

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January 1998, Revision A2

This document has been prepared to conform to the current release version of the MX Positioning Drive system. Because of our extensive development efforts and our desire to further improve and enhance the product, inconsistencies may exist between the product and documentation in some instances. Call your customer support representative if you encounter an inconsistency.

Customer Service

EMERSON Motion Control offers a wide range of services to support our customer's needs. Listed below are some examples of these services.

Service Support (612) 474-8833

EMERSON Motion Control's products are backed by a team of professionals who will service your installation wherever it may be. Our customer service center in Minneapolis, Minnesota is ready to help you solve those occasional problems over the telephone. Our customer service center is available 24 hours a day for emergency service to help speed any problem solving. Also, all hardware replacement parts, should they ever be needed, are available through our customer service organization.

Need on-site help? EMERSON Motion Control provides service, in most cases, the next day. Just call EMERSON's customer service center when on-site service or maintenance is required.

Training Services (612) 474-1116

EMERSON Motion Control maintains a highly trained staff of instructors to familiarize customers with EMERSON Motion Control's products and their applications. A number of courses are offered, many of which can be taught in your plant upon request.

Application Engineering

An experienced staff of factory application engineers provided complete customer support for tough or complex applications. Our engineers offer you a broad base of experience and knowledge of electronic motion control applications.

Bulletin Board System (612) 474-8835

EMERSON Motion Control maintains a BBS which provides you access to software updates, and technical information and services.

Communications protocol: 300 to 28,800 baud, N, 8, 1

FAX (612) 474-8711

Internet Website www.emersonemc.com

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Declaration of Conformity

Manufacturer's Name:	EMERSON Motion Control
Manufacturer's Address:	1365 Park Road Chanhassen, MN 55317 USA

Declares That The Following Products:

Products Description:	MX Series 460V Digital Brushless Servo Amplifier
Model Number:	MX-280-CE, MX-440-CE, MX-850-CE, MX-1300-CE, MX-1600-CE, MX-2600-CE, MX-3200-CE, MX-4800-CE
System Options:	None

Designed and manufactured in accordance with the following European harmonized national and international standards.

EN 60249	Base materials for printed circuits.
IEC 326-1	Printed boards: General information for the specification writer.
IEC 326-5	Printed boards: Specification for single and double sided printed boards with plated through holes.
IEC 326-6	Printed boards: Specification for multilayer printed boards.
IEC 664-1	Insulation coordination for equipment within low-voltage systems: Principles, requirements and tests.
EN 60529	Degrees of protection provided by enclosures (IP code).
UL94	Flammability rating of plastic materials.
UL508	MX-3200-CE and MX-4800-CE only.

Supplementary Information

The products herewith comply with the requirements of the Low Voltage Directive (LVD) 73/23/EEC and CE Marking Directive 93/68/EEC.

This electronic drive product is intended to be used with an appropriate motor, electrical protection components and other equipment to form a complete end product or system. It must only be installed by a professional assembler who is familiar with requirements for safety and electromagnetic compatibility ("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 product manual for installation guidelines.

January 2, 1998

Bradley Schwartz/ VP Engineering — Date

European Contact: EMERSON Electric Company
Control Techniques Drives LTD
79 Mochdre Industrial Estate
Newtown, Powys SY16 4LE

Introduction

This addendum (*MX Drives User's Guide Addendum #5 CE-Marked Drive Installation*) applies to the MX Servo Drives conforming to the requirements of the LVD (Low Voltage - 73/23/EEC) and CE Marking Directive 93/68/EEC directives for CE compliance.

This addendum provides the Declaration of Conformity for the MX Servo Drives; MX-280-CE, MX-440-CE, MX-850-CE, MX-1300-CE, MX-1600-CE, MX-2600-CE, MX-3200-CE and MX-4800-CE.

Much of the information presented in the *MX Drives User's Guide* (P/N 400268-00) will apply to these components. In the event of a conflict between this addendum and the *MX Drives User's Guide*, the following will be the order of precedence:

1. Safety codes or regulations.
2. *MX Drives User's Guide Addendum #5 CE-Marked Drive Installation* (P/N 400268-05).
3. *MX Drives User's Guide Addendum #1 through 4* (P/N 400268-01 through 400268-04).
4. *MX Drives User's Guide* (P/N 400268-00).

Installation Guidelines

The series of MX drives were shown to be in compliance with the LVD requirements and the majority of the EMC directives. Compliance testing was accomplished by a certified independent testing facility and through self-certification to industry standards.

Safety Considerations

This servo drive product (Drive) is intended for professional incorporation into a complete system. If installed incorrectly it may present a safety hazard. The product 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 the instruction manual carefully.

Enclosure

The Drive is intended to be mounted in an enclosure which prevents access except by trained and authorized personnel, and which prevents the

ingress of contamination. It is designed for use in an environment classified as pollution degree 2 in accordance with IEC664-1. This means that only dry, non-conducting contamination is acceptable.

Electrical Installation

⚠ WARNING

General warning

Failure to follow safe installation guidelines can cause death or serious injury. The voltages used in the unit 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 it.

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

AC supply Isolation device

The AC supply must be removed from the Drive using an approved isolation device or disconnect before any servicing work is performed, other than adjustments to the settings or parameters specified in the manual. The Drive contains capacitors which remain charged to a potentially lethal voltage after the supply has been removed. Allow at least 8 minutes after removing the supply before carrying out any work which may involve contact with electrical connections to the Drive.

Products connected by plug and socket

A special hazard may exist where the Drive is incorporated into a product which is connected to the supply by a plug and socket. When unplugged, the pins of the plug may be connected to the Drive input, which is separated from the charge stored in the capacitor only by semiconductor devices. To avoid any possibility of electric shock from the pins, if they are accessible, a means must be provided for automatically isolating the plug from the Drive – eg. a latching contactor.

Grounding (Earthing, equipotential bonding)

The Drive must be grounded by a conductor sufficient to carry the prospective fault current in the event of a fault. The ground connections shown in the manual must be adhered to.

Fuses

Fuses or over-current protection must be provided at the input in accordance with the instructions in the manual. Failure to observe the instructions closely may cause a fire hazard.

⚠ WARNING

Isolation of control circuits

The control circuits are isolated from the power circuits in the Drive by basic insulation only. The installer must ensure that the external control circuits are isolated from human contact by at least one layer of insulation rated for use at the applied AC supply voltage.

Braking Resistors

The precautions described in this addendum for braking resistors are essential to avoid the risk of fire in the event of unexpectedly high braking energy or loss of control of the braking circuit.

Setting up, commissioning and maintenance

It is essential that changes to the Drive settings are given careful consideration. Depending on the application, a change could have an impact on safety. Appropriate precautions must be taken against inadvertent changes or tampering.

Restoring default parameter set in certain applications may cause unpredictable or hazardous operation.

Safety of machinery, and safety-critical applications

Within the European Union all machinery in which this product is used must comply with Directive 89/392/EEC, Safety of Machinery.

The Drive hardware and software are designed and tested to a high standard, and failures are very unlikely. However the level of integrity offered by the Drive control functions – for example stop/run, limit switch inputs and maximum speed limit – are not sufficient for use in safety-critical applications without additional independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment, and further protection provided where needed.

Electromagnetic Compatibility (EMC)

The product is designed to high standards of EMC, and data is provided in the EMC compatibility data section of this document. Under extreme conditions the product might cause or suffer from disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the relevant EMC legislation in the country of use.

Within the European Union, equipment into which this product is incorporated must comply with 89/336/EEC, Electromagnetic Compatibility.

⚠ WARNING

Failure to follow safe installation guidelines can cause death or serious injury. You are responsible for providing emergency interlock switches that will remove AC power from the system any time the emergency stop is activated. The safety ground connections should only be disconnected for servicing, and only after all AC power has been removed. Even after the removal of AC power, there is still stored energy in the drives that must be dissipated before servicing. Wait a minimum of eight minutes before servicing drives.

Braking (Shunt) Resistor Protection

In applications which use the bus shunt (braking) resistors, the braking duty cycle must be carefully considered. If the application requirements exceed the resistor wattage rating, the power dissipated will overheat the resistor. This overheating could increase the risk of fire, and would likely cause damage to the resistor and the drive if the internal drive shunt resistors are used. Thermal overload protection relays can provide a means of signaling the system to stop if the duty cycle is exceeded by tripping the main AC breaker. This method also protects against high AC line voltages which can have the same effect. The relay contacts are not intended to directly break the DC current to the resistor.

NOTE

In order to maintain the CE rating on these drives, one of the resistor protection options shown in Figures 1 and 2 must be used. If the shunt resistor jumper is used or an external shunt is used without one of the protection options, the drive will operate and the shunt resistor circuit will be functional but the CE rating will be voided.

Electrical Connections

NOTE

In order to maintain the CE rating on these drives, one of the resistor protection options shown in Figures 1 and 2 must be used. If the shunt resistor jumper is used or an external shunt is used without one of the protection options, the drive will operate and the shunt resistor circuit will be functional but the CE rating will be voided.

The following diagrams show how to connect a Telemechanique brand overload relay to protect the internal resistor, or external resistors if used, for the drives stated. For relay sizing, see Overload Relay Sizing Data section.

Drive Sizes MX-280-CE and MX-440-CE

⚠ CAUTION

If external resistors or a resistor protection option is used, ensure that the internal resistor is disconnected by removing any wire link between terminals 3 and 5 on the Drive Shunt Terminals.

The normally closed contacts 95 and 96 will open on an overload trip condition and can be used to stop further regeneration by interrupting the AC power to the drive.

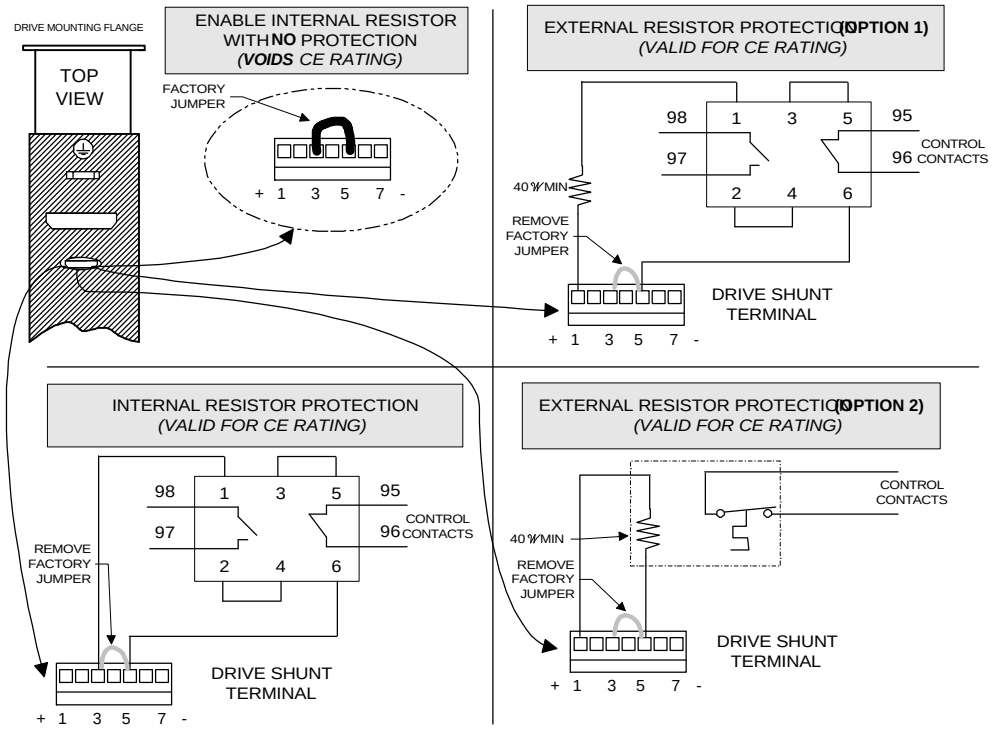


Figure 1 Electrical Connections for Drives MX-280-CE and MX-440-CE

Drive Sizes MX-850-CE, MX-1300-CE, MX-1600-CE, and MX-2600-CE

⚠ CAUTION

If an external shunt resistor is being used, remove the jumper plug between the two way spade receptacle on the bottom of the amplifier.

The normally closed contacts of the overload relay will open on a trip condition and can be used to stop further regeneration by interrupting the AC power to the drive.

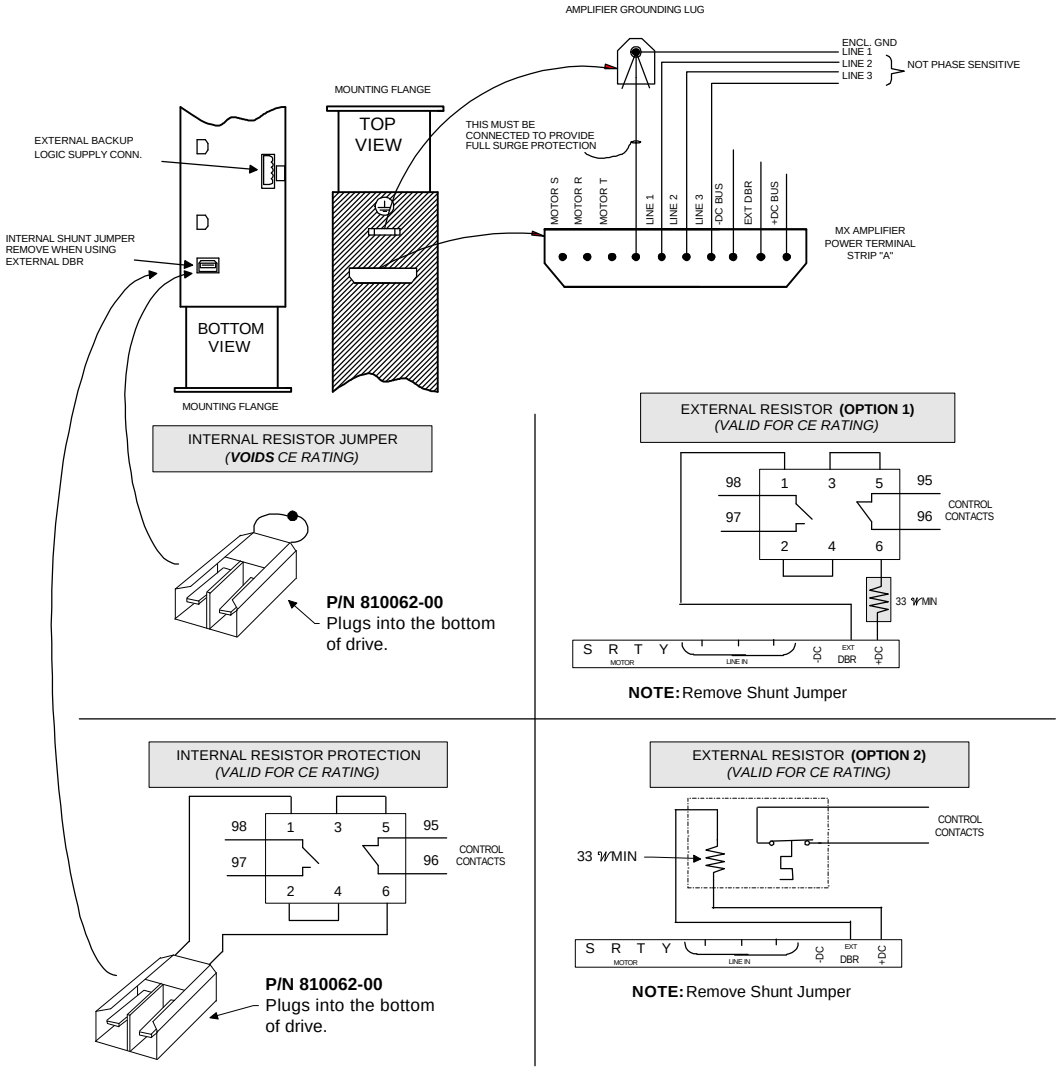


Figure 2 Electrical Connections for Drives MX-850-CE through MX-2600-CE

Overload Relay Sizing Data

Telemecanique type LR2-Dx3xx have been tested to operate well in this application; however, other similar types of overload relays would also be satisfactory.

Specifications Required:

P_{max} - maximum power dissipation

t_{max} - maximum time for P_{max} dissipation

R - total braking resistance

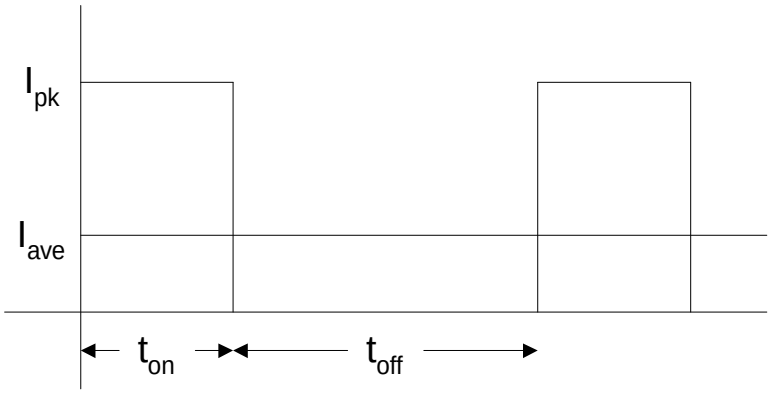
V_{dc} - max d.c. bus voltage (750 VDC on ***MX*** drives, 325 VDC on ***LX*** drives running at 230 VAC)

During the period of dissipation, the average current through the resistor is calculated by:

$$I_{ave} = \frac{P_{max}}{V_{max}}$$

where; V_{max} = maximum DC bus voltage.

The braking control of the drive actually uses a chopper transistor to switch in the resistor, so the actual current waveform in the resistor similar to that shown below.



where:

$$I_{pk} = \frac{V_{max}}{R}$$

The duty cycle of the transistor is calculated as:

$$D = \frac{I_{ave}}{I_{pk}} = \frac{t_{on}}{t_{on} + t_{off}}$$

The RMS current in the resistor can now be calculated by:

$$I_{rms} = \sqrt{I_{pk}^2 * D}$$

The relay should be set up for the expected RMS current in the resistor and the value of t_{max}.

Example 1:

Specify a thermal overload for use with an ***MX-440-CE*** drive using its internal resistor. The application is working the resistor close to its maximum specification of 1.5kW for 10 seconds, with 90 seconds cooling time. The nominal resistance is 80Ω.

Data:

P_{max} = 1.5kW

t_{max} = 10 seconds

R = 80Ω

V_{dc} = 750V

The average current and peak current can now be calculated:

$$I_{ave} = \frac{1500}{750} = 2.0A \qquad I_{pk} = \frac{750}{80} = 9.4A$$

The duty cycle for the resistor during the braking period can now be calculated as:

$$D = \frac{2.0}{9.4} = 0.21$$

For the conditions given above, the RMS current in the resistor will be:

$$I_{rms} = \sqrt{9.4^2 * 0.21} = 4.3A$$

From data for the **Telemecanique type LR2-Dx3xx** relays an overload factor of 4 is required to trip after 10 seconds:

$$I_{set} = \frac{4.3}{4} = 1.1A$$

The current that must be set on the relay must be 1.1A, so relay type **LR2-D1306** (1.0A to 1.6A) should be used.

The short circuit condition will overload the relay by a factor of 8.5, and this will cause the relay to trip out after approximately 4 seconds.

Compatibility Data

Product

MX-280-CE, MX-440-CE, MX-850-CE, MX-1300-CE, MX-1600-CE, MX-2600-CE, MX-3200-CE, MX-4800-CE

Immunity

The drives comply with the following international and European harmonized standards for immunity:

Standard	Type of immunity	Test specification	Application	Level
EN 61000-4-2*	Electrostatic discharge	6kV contact discharge 8kV air discharge	Module enclosure	Level 3 (industrial)
ENV 50140*	Radio frequency radiated field	10V/m prior to modulation 80 - 1000MHz 80% AM (1kHz) modulation	Module enclosure	Level 3 (industrial)
ENV 50141*	Conducted radio frequency	10V/m prior to modulation 0.15 - 80MHz 80% AM (1kHz) modulation	Control and power lines	Level 3 (industrial)
EN 61000-4-4*	Fast transient burst	5/50ns 2kV transient at 5kHz repetition frequency via coupling clamp	Control lines	Level 4 (industrial harsh)
		5/50ns 2kV transient at 5kHz repetition frequency by direct injection	Power lines	Level 3 (industrial)
IEC 1000-4-5	Surges	Common mode 4kV 1.2/50µs waveshape	AC supply lines: line to earth	Level 4
		Differential mode 2kV 1.2/50µs waveshape	AC supply lines: line to line	Level 3
EN 50082-1	Generic immunity standard for the residential, commercial and light - industrial environment			Complies
EN 50082-2	Generic immunity standard for the industrial environment Calls up basic standards marked *			Complies

The immunity is achieved without any additional measures such as filters or suppressors. To ensure correct operation the wiring guidelines specified in the User's Guide must be carefully adhered to.

All inductive components such as relays, connectors, electromagnetic brakes etc. associated with the drive must be fitted with appropriate suppression, otherwise the immunity of the drive may be exceeded.

Conducted Emission

Radio frequency emission in the frequency range from 150kHz to 30MHz is mainly conducted out of the equipment through electrical wiring. It is essential for compliance with emission standards that the recommended filter and a **shielded** (screened) motor cable are used. Most types of cable can be used provided it has an overall shield. The shield formed by the armoring of steel wired armored cable or metal core liquid-tight flexible conduit is acceptable. The capacitance of the cable forms a load on the drive and should be kept to a minimum. Compliance tests were done with cable having a capacitance between the three power cores and the shield of 412pF per meter, which is typical of steel wire armored cable. Wiring guidelines are given in Figures 3 and 4 which shows full precautions where minimum emissions are required.

When used with the recommended filters, the drive complies with the requirements for **conducted emission** in the following standard:

Motor cable length (m)	MX-280-CE, MX-440-CE	MX-850-CE, MX-1300-CE, MX-1600-CE	MX-2600-CE
1	I	I	I
5	I	I	I
10	I	I	I
50	I	I	I
100	I	I	I
150	I*	I	#

Key to table	Standard	Description	Frequency range	Limits	Application
I	EN50081-2	Generic emission standard for the industrial environment	0.15 - 0.5MHz	79dBµV quasi peak 66dBµV average	AC supply lines
			0.5 - 5MHz	73dBµV quasi peak 60dBµV average	
			5 - 30MHz	73dBµV quasi peak 60dBµV average	
*	Emission level met using RFI input filter part # **960302-01** & 2 x ferrite ring part # **MPF**				
#	Special techniques will be required e.g. series input filters, output filters - contact supplier				

Recommended Line Filters

The recommended filters are shown in the following table:

Drive	Motor cable length (m)	Filter arrangement (EMERSON Motion Control Part #'s)	
		Input filter	Output ferrite rings
MX-280-CE, 440-CE	1 to 100	960301-01	2 x **MPF** (installed per drwg)
MX-280-CE, 440-CE	101 to 150	960302-01	2 x **MPF** (installed per drwg)
MX-850-CE, 1300-CE, 1600-CE	1 to 150	960302-01	2 x **MPF** (installed per drwg)
MX-2600-CE	1 to 100	960303-01	2 x **MPF** (installed per drwg)
MX-3200-CE	1 to 100	Consult Factory	None Req.
MX-4800-CE	1 to 100	Consult Factory	None Req.

Input Filters Recommended	
EMC Part Number	**RASMI Part Number**
960301-01	RS3010-IDF/CT
960302-01	RS3020-IDF/CT
960303-01	RS3030-IDF/CT
MPF	RS-OC/2

Rasmi Electronics Ltd.
14A Tanfield Lea Industrial Estate
Stanley, Co. Durham DH9 9UU, England

Telephone: Stanley (0207) 232159
FAX: (0207) 232016

Radiated Emission

The limits for emission required by the generic industrial emission standard are summarized in the following table:

Radiated emission from 30 to 1000MHz				
Standard	**Application**	**Frequency range**	**Limits**	**Comments**
EN50081-2	Enclosure	30 - 230MHz	40dBµV/m quasi peak at 10m	Standard specifies limits of 30 and 37dBµV/m respectively at a measuring distance of 30m; emissions may be measured at 10m if limits are increased by 10dB
		230 - 1000MHz	47dBµV/m quasi peak at 10m	

Related Product Standards

The radiated emission levels specified in EN50081-2 are equivalent to the levels required by the following product standards:

Radiated emissions from 30 to 1000MHz		
Generic standard	**Product standard**	
EN50081-2	EN55011 Class A Group 1 CISPR 11 Class A Group 1	Industrial, scientific and medical equipment
	EN55022 Class A CISPR 22 Class A	Information technology equipment

Test Data

The test data is based on radiated emission measurements made on a standard steel enclosure containing a single MX-280-CE drive, in a calibrated open area test site.

Test Installation Details

A standard Rittall enclosure was used having dimensions 1900mm (high) x 600mm (wide) x 500mm (deep). Two ventilation grilles, both 200mm square, were provided on the upper and lower faces of the door.

The Drive and recommended RFI input filter were installed on to the internal back-plate of the enclosure, the filter casing making electrical contact with the back-plate by the mounting screws. Standard unshielded power cable was used to connect the enclosure to the AC supply.

The motor was connected by 5m of shielded cable (steel braided - type SY) and mounted externally. The motor cable was interrupted by a DIN rail terminal block mounted in the enclosure (Refer to Figure 5). However, in the test arrangement, instead of bonding the motor cable screen to the back-plate using metal clamps, the shield pigtails (50mm long) were bonded to the back plate through a grounded DIN rail terminal block. The motor shield was not bonded to the enclosure wall at the point of entry.

A 2m shielded control cable was connected to the drive control terminals, but it was isolated from the enclosure wall.

The Drive was run at 20 RPM at it's switching frequency of 8kHz.

No additional EMC preventative measures were taken such as EMI gaskets around the enclosure doors.

Radiated Emission Test Results

The industrial radiated emissions test covers the 30 to 1000 Mhz band and the drive passed except in the 30 to 82 Mhz band as shown in the table below. The limits in this band were exceeded by no more than 10 db.

Frequency MHz	Emission dB V/m	Level required by industrial standard EN50081-2 at 10m
31	41	40
32	48	40
33	50	40
34	48	40
35	44	40
39	44	40
46	43	40
63	41	40
64	43	40
65	48	40
66	41	40
68	42	40
69	43	40
71	45	40
73	43	40
74	46	40
75	46	40
76	45	40
81	43	40
82	42	40

Enclosure Construction

For many installations, an enclosure will have a back-plate which will be used to mount variable speed drive modules, RFI filters and ancillary equipment. The motor cable should be bonded to the back-plate close to the Drive before it leaves the enclosure wall (Refer to *Wiring guidelines in* Figure 3 and 4). However there is no disadvantage if the motor cable is bonded at the point of exit as well, through the normal conduit or gland fittings.

Depending on construction, the enclosure wall used for cable entry may have separate panels that could make poor electrical contact with the rest of the enclosure at high frequencies. If the motor cable is only bonded to these surfaces and not to a back-plate, then the enclosure may provide insufficient attenuation of RF emissions.

It is the bonding to a common metal plate which minimizes radiated emission. In the tests described, opening the enclosure door had little effect on the emission level, showing that the enclosure design is not critical. Also, no further reduction in the level of emission was observed by directly grounding the Drive heatsink to the back-plate.

Wiring Guidelines

The wiring guidelines on the following pages should be observed to achieve minimum emissions. The details of individual installations may vary, but details which are indicated in the guidelines to be important for EMC must be adhered to closely.

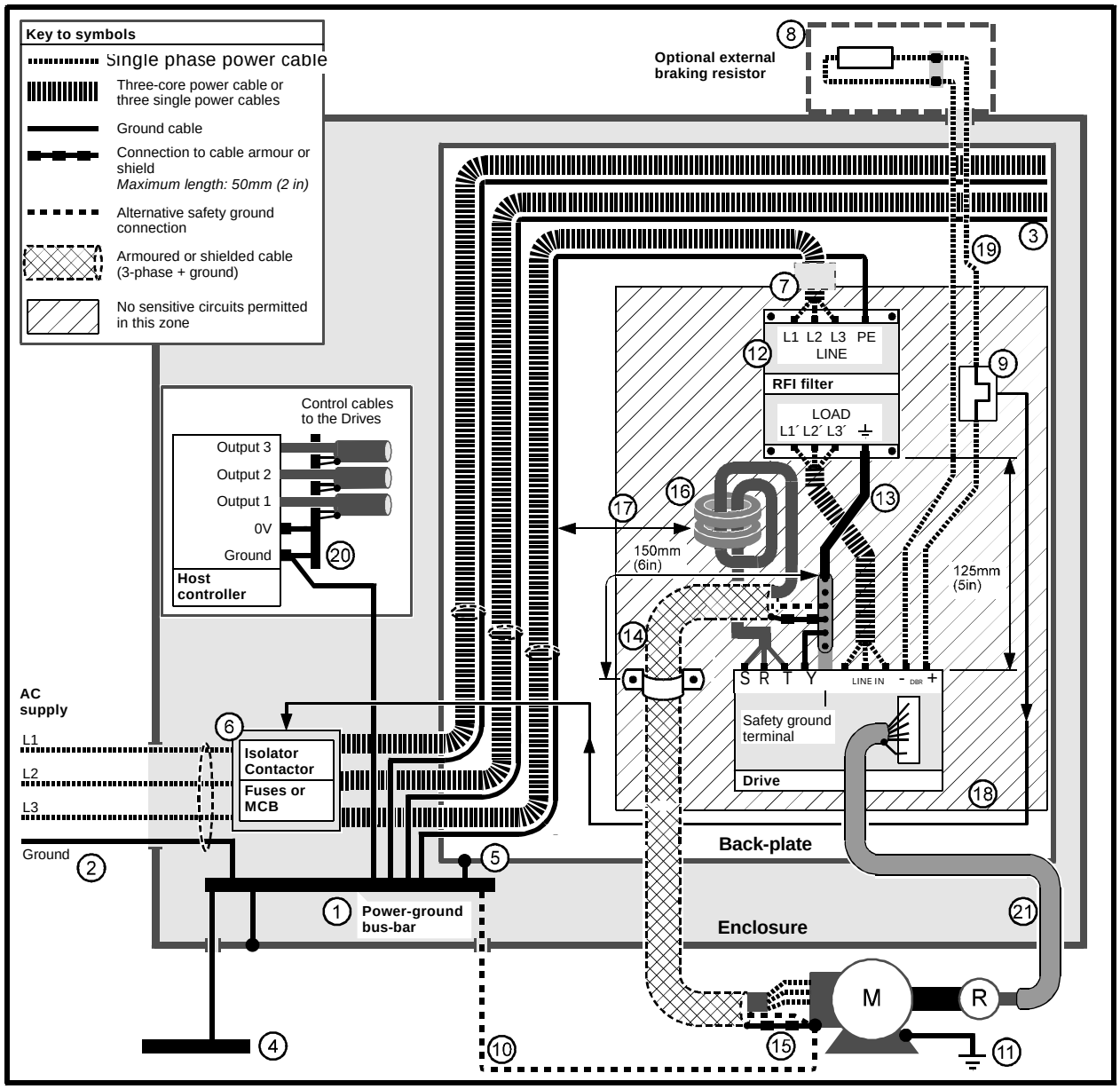


Figure 3 Wiring Guidelines for MX-280-CE through MX-2600-CE

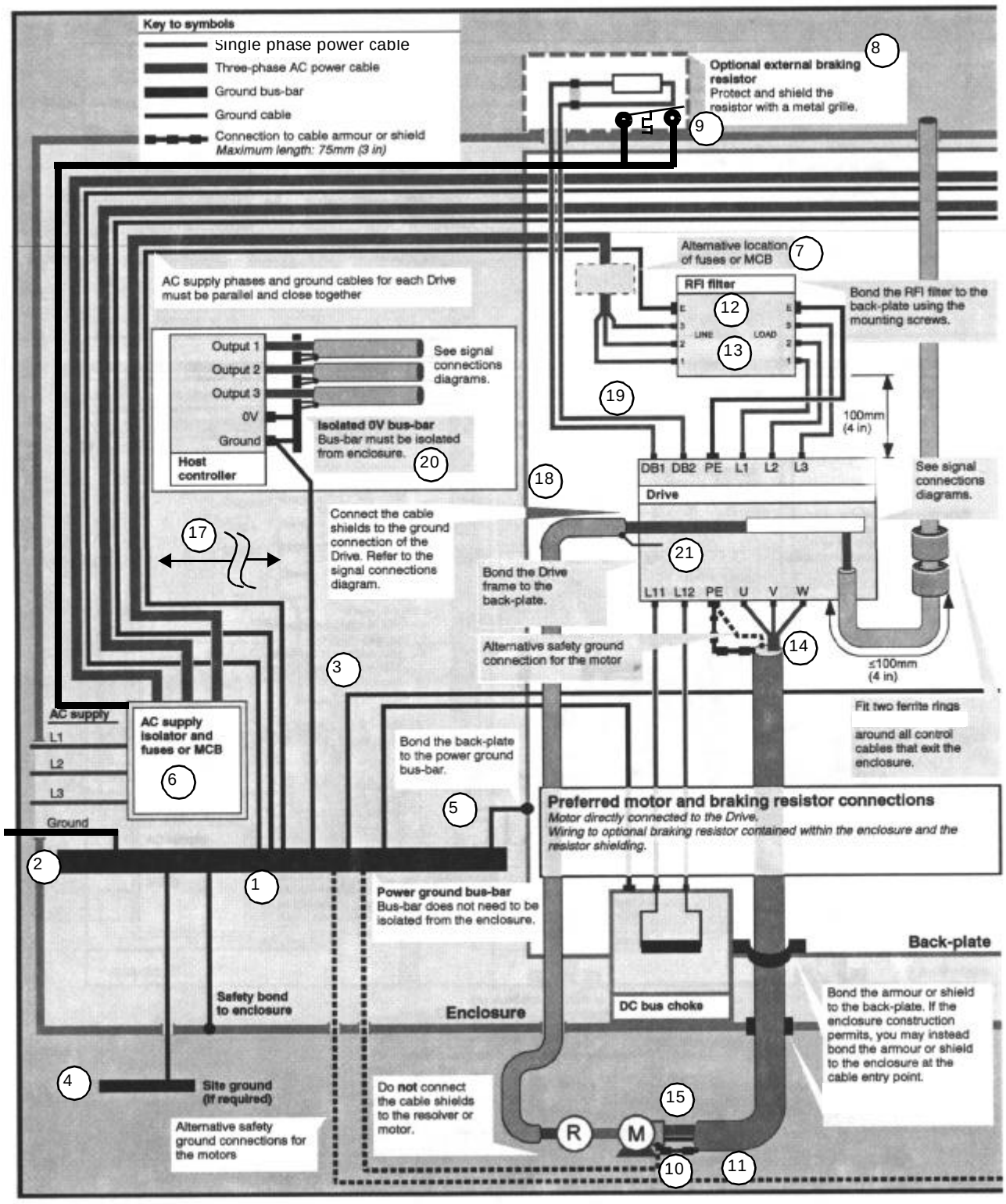


Figure 4 Wiring Guidelines for MX-3200-CE and MX-4800-CE

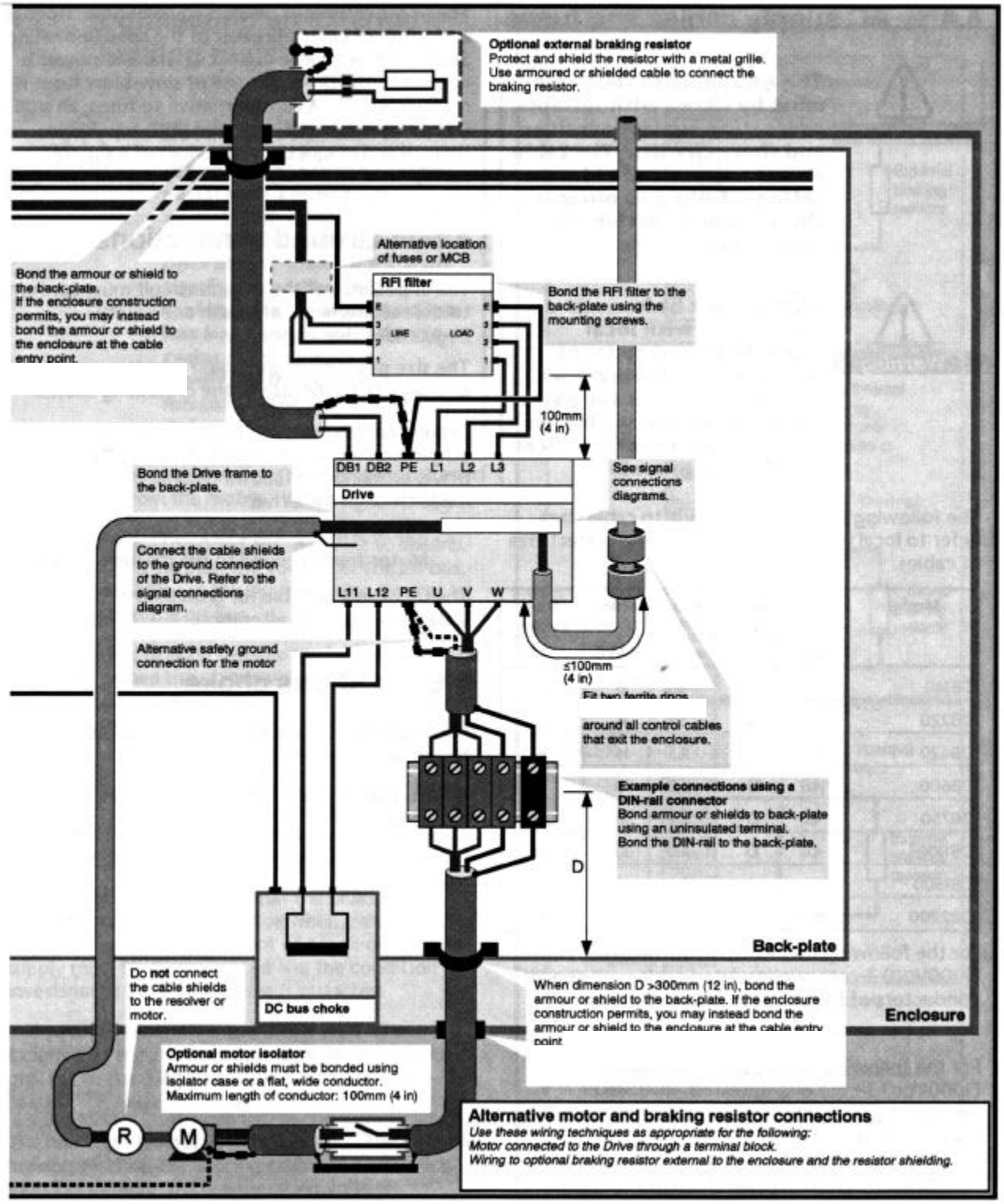


Figure 4 Wiring Guidelines for MX-3200-CE and MX-4800-CE (continued)

General Guidelines

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

Special Guidelines for EMC Control

12. RFI filter mounted 125mm (5in) from the Drive. The RFI filter casing is directly grounded to the back-plate by the mounting screws. Ensure that the screws make direct electrical connection to the back-plate, for example by using screw threads tapped in the back-plate.
13. Connect the safety ground terminal of the Drive to the RFI filter ground (load side) via a 60mm long extension busbar and a 90mm long braided cable* which has a minimum width of 10mm. Minimize length of cables between drive and filter.

    *A braided cable of nominal size 12 (2.3mm with basic construction 24 x 12/0.2mm was used in actual tests.
14. A shielded (screened) or steel wire armored cable must be used to connect the Drive to motor. Shield of the motor cable must be taken to the extension busbar by a very short connection which does not exceed 50mm (2 in) in length. The shield must be bonded to the back-plate using a metal cable clamp, the clamp positioned no further than 150mm (6 in) from the drive.
15. Shield at motor end must be taken to the motor frame ground terminal by a very short connection which does not exceed 50mm (2 in) in length.
16. Pass the drive output phases (RST) through the ferrite rings two times as shown.

17. Ensure that the AC supply and ground cables are at least 100mm (4 in) from the Drive and motor cable.

18. Avoid sensitive signal circuits in a zone extending 0.3m (12 in) all around drive.

19. Unshielded wiring to 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. Ensure a minimum spacing of 0.3m (12 in) from signal wiring and the supply side wiring of the RFI filters.

20. If the control circuit 0V is to be grounded, this should be done at the host controller (e.g. PLC) and not at the drive to avoid injecting noise currents into the 0V circuit.

21. Connect the shield of the resolver cable to terminal B18 (0V connection). Refer to the signal connections diagram in the User Guide.

Variations

Interruptions to the Motor Cable

The motor cable should ideally be a single run of shielded cable having no interruptions. In some situations it may be necessary to interrupt the cable, for example, to connect the motor cable to a terminal block within the Drive enclosure, or to fit an isolator switch to allow safe working on the motor. In these cases the following guidelines should be observed.

Terminal Block Within Enclosure

The motor cable shields should be bonded to the back-plate using non-insulated 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.

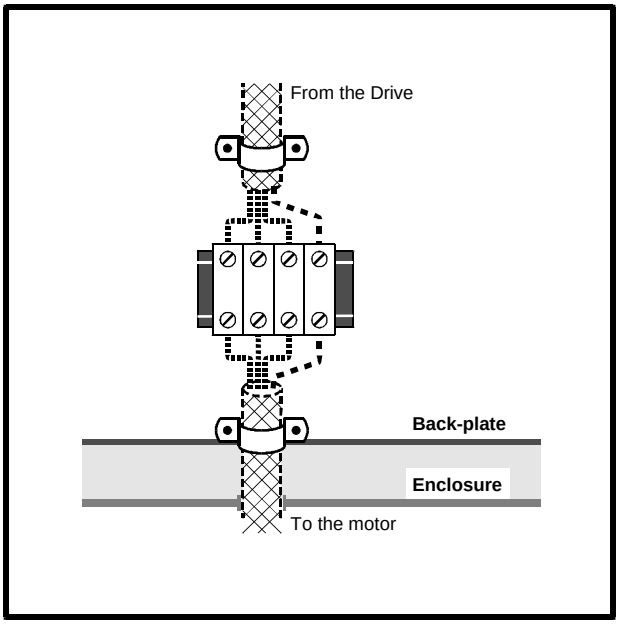


Figure 5 Connecting the Motor Cable to a Terminal Block in the Enclosure

Using a Motor Disconnect

The motor cable shields should be connected by a very short conductor having a low inductance. The use of a flat metal bar is recommended; conventional wire is not suitable. The shields should be bonded directly to the coupling bar using non-insulated metal cable-clamps. 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. 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.

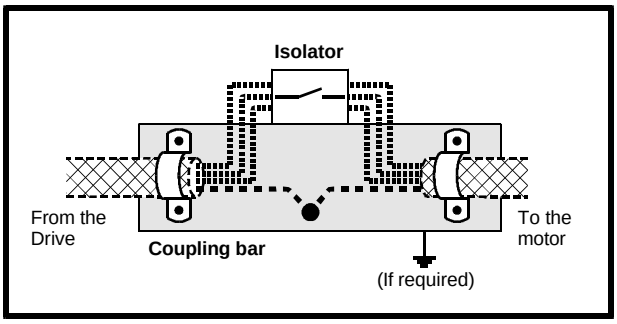


Figure 6 Connecting the Motor Cable to an Isolating Switch/Contactor

EMI/RFI AC Line and Motor Power Filters

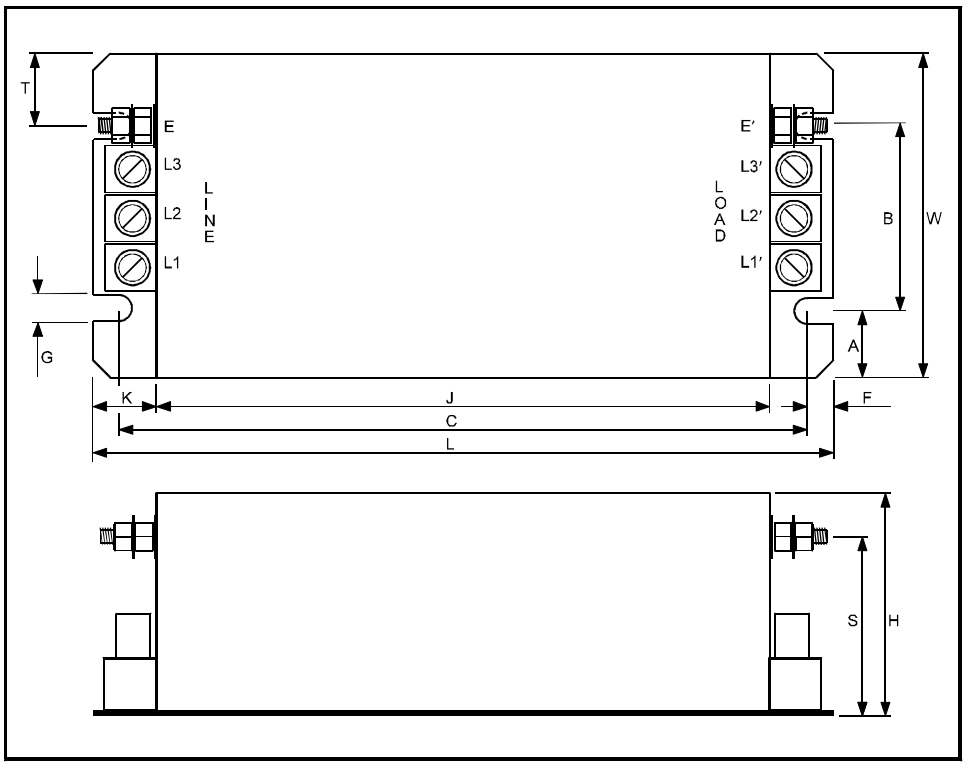
EMERSON Motion Control makes available a selection of EMI/RFI AC line filters. These are used to control conducted and radiated emissions as well as improve conducted immunity. These components are required to achieve compliance with the EMC directive as stated below.

EMI/RFI AC line filters, 960301-01, 960302-01, and 960303-01, are used in three-phase applications and are wired in accordance with Figure 3 and 4. For maximum effectiveness, individual filters should be located used on each drive ans should be a maximum distance of 5 inches (125mm) from the servo amplifier. However, many applications will meet the specifications when a single filter is used in a cabinet on multiple drives.

EMC Part Number	960301-01	960302-01	960303-01
Rasmi Electronics Part Number	RS3010-IDF/CT	RS3020-IDF/CT	RS3030-IDF/CT
Maximum continuous current rating (A rms)	10	20	30
Supply voltage rating			
Line to line	480V + 10%		
Line to ground	480V + 10%		
Supply frequency	48 to 62Hz		
Overload rating for 60 seconds	150% of rated current		
Earth leakage current	13mA at 400V, 50Hz - balanced supply line to line and line to ground		
(See Note1)	80mA at 400V, 50Hz - one phase disconnected		
Voltage drop at rated current - per line	<2V		
Discharge resistors	470kΩ star network between power lines, star point not connected to ground. Resistors fitted internally		
Ingress protection rating	IP20		
Ambient temperature	40°C		
Case temperature rise at rated current	<50°C		
Power loss at rated current (W)	12	22	28

1. Scale earth leakage current proportionately for other voltages and frequencies. For example, leakage current at 480V 60Hz is:

   $13\times (480/400) \times (60/50) = 19mA$



EMC Part Number	960301-01	960302-01	960303-01
Dimension	**mm**	**mm**	**mm**
A	17	17	17
B	76	106	106
C	238	258	258
F	6	6	6
G	7	7	7
H	60	60	60
J	220	240	240
K	15	15	15
L	250	270	270
S	47	47	47
T	17	17	17
W	110	140	140
Ground stud	M5 × 15	M5 × 15	M5 × 15