APPENDIX B

EMC Installation Guide

General Product Philosophy

Meeting requirements for electromagnetic compatibility (EMC) compliance will require specific measures to be taken during installation of the OEM750/OEM750X. The ultimate responsibility for ensuring that the EMC requirements are met rests with the systems builder.

It is important to remember that for specific installations, the full protection requirements of the EMC Directive 89/336/EEC need to be met before the system is put into service. This must be verified either by inspection or by testing. The following EMC installation recommendations are intended to assist in ensuring that the requirements of the EMC directive are met. It may be necessary to take additional measures in certain circumstances and at specific locations.

Although these recommendations are based on expertise acquired during tests carried out on the OEM750/OEM750X, it is impossible for Compumotor to guarantee the compliance of any *particular* installation. Compliance will be strongly influenced by the physical and electrical details of the installation and the performance of other system components. Nevertheless it is important to follow ***all*** the installation instructions if an adequate level of compliance is to be achieved.

Safety Considerations

These products are intended for installation according to the appropriate safety procedures including those laid down by the local supply authority regulations. The recommendations provided are based on the requirements of the Low Voltage Directive and specifically on EN60204. It should be remembered that safety must never be compromised for the purpose of achieving EMC compliance. Therefore in the event of a conflict occurring between the safety regulations and the following recommendations, ***the safety regulations always take precedence.***

General Considerations

EXTERNAL ENCLOSURES

The measures described in these recommendations are primarily for the purpose of controlling conducted emissions. To control radiated emissions, all drive and control systems must be installed in a steel equipment cabinet which will give adequate screening against radiated emissions. This external enclosure is also required for safety reasons. There must be *no user access* while the equipment is operating. This is usually achieved by fitting an isolator switch to the door assembly. The OEM750/OEM750X must be mounted to a conductive, earthed panel. If this has a paint finish, it will be necessary to remove the paint in certain areas where specified.

To achieve adequate screening of radiated emissions, all panels of the enclosure must be bonded to a central earth point. The enclosure may also contain other equipment and the EMC requirements of these must be considered during installation. Always ensure that drives are mounted in such a way that there is adequate ventilation.

AC SUPPLY FILTERING

These recommendations are based on the use of proprietary screen filter units which are readily available. However the full EMC test includes a simulated lightning strike which will damage the filter unless adequate surge suppression devices are fitted. These are not normally incorporated into commercial filters since the lightning strike test can be destructive. This test is normally carried out on the overall system and not on individual components, therefore the surge protection should be provided at the system boundary.

Try to arrange the layout of drive, power supply and filter so that the AC input cable is kept away from the filter output leads. It is preferable for the current path to be as linear as possible without doubling back on itself - this can negate the effect of the filter. Mount the filter within 2 inches (50mm) of the power supply or transformer, if required, and run the input cable and any earth cables close to the panel.

CONTROL SIGNAL CONNECTIONS

High-quality braided-screen cable should be used for control connections. In the case of differential inputs, it is preferable to use cable with twisted pairs to minimize magnetic coupling. This applies to both analog and digital signals. Control cables leaving the enclosure should have the cable screen returned to a local ground point near the product. Where screened leads are used in control circuits that are only opto-isolated at one end, the screen must be referenced to earth at the non-isolated end. Where there is isolation at both ends of the connection, earth the screen at the receiving end. This is to give protection against coupled noise impulses and fast transient bursts.

Remember to route control signal connections well away from relays and contactors—at least 8 inches (200 mm). Control wiring should not be laid parallel to power or motor cables and should only cross the path of these cables at right angles. Bear in mind that control cables connected to other equipment within the enclosure may interfere with the controller or drive, particularly if they have come from outside the cabinet. Take particular care when connecting external equipment with the cabinet door open, for instance a computer or terminal; static discharge may cause damage to unprotected inputs.

MOTOR CABLING

In order to prevent electrical cross-talk, motor cables not incorporating a braided screen shield must remain within earthed metal conduit the entire exposed length of travel. It is advised that each high power motor cable utilize its own conduit.

FERRITE ABSORBER SPECIFICATIONS

The absorbers described in these installation recommendations are made from a low-grade ferrite material which has high losses at radio frequencies. They therefore act as a lossy element in this waveband.

The recommended components are produced by Parker Chomerics (617-935-4850) and are suitable for use with cable

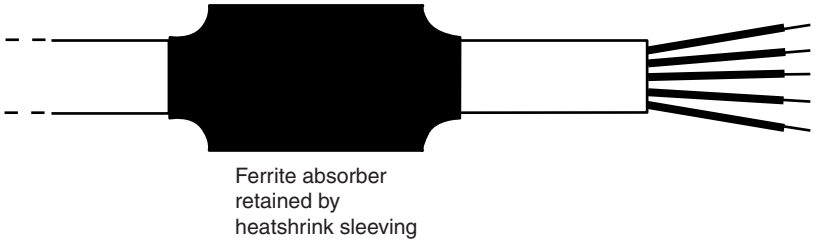
having an outside diameter up to 10 – 13mm. The specification is as follows:

Chomerics part number	83-10-M248-1000	83-10-A637-1000
Outside diameter	17.5mm (0.69 in.)	28.5mm (1.12 in.)
Inside diameter	10.7mm (0.42 in.)	13.77mm (0.54 in.)
Length	28.5mm (1.12 in.)	28.57mm (1.13 in.)
Impedance at 25MHz	80Ω	135Ω
Impedance at 100MHz	120Ω	210Ω
Curie temperature	130°C	130°C

(*the device should not be operated near this temperature*)

HANDLING AND INSTALLING THE FERRITE ABSORBERS

Take care when handling the absorbers—they can shatter if dropped on a hard surface. For this reason the suggested method of installation is to use a short length of heat-shrink sleeving, as shown below. This gives a degree of physical protection while the cable is being installed. The sleeving should have a shrink ratio of at least 2.5:1. Cable ties may be used as an alternative; however, they give no physical protection to the absorber.



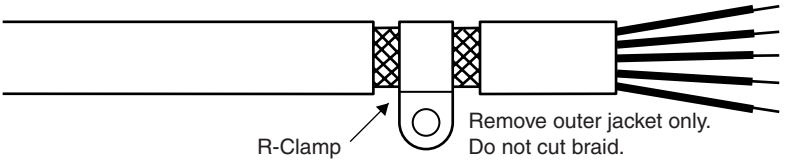
Ferrite Sleeve Installation

R-CLAMP INSTALLATION DETAILS

The function of the R-clamp is to provide a 360 degree metallic contact and thus a convenient means of ensuring a proper radio frequency ground. When dealing with electromagnetic interference issues, it is important to remember that continuity—a DC connection—does not at all speak to the integrity of an AC (high-frequency) bond. High-frequency bonding typically involves wide, flat cabling to establish a suitable system ground. When applied properly, the R-clamp has been shown to give an adequate high-frequency contact.

When installing an R-clamp, as shown in the next figure, install it as close to the cable end as possible. Mount the R-clamp to a suitable ground, backplane, earth stud or bus bar—this may require removing paint from a cabinet or panel.

Remove only the outer (vinyl) jacket of the braided screen cable; this allows the braid to continue to the cable connector. Be careful not to damage the braid. Snap the R-clamp over the exposed braid, and adjust for a tight fit. Secure the clip to the designated ground with a machine screw and lock washer. The use of brass or other inert conductive metal R-clamp is recommended. Cover any exposed bare metal with petroleum jelly to resist corrosion.



R-Clamp Installation

OEM Series Products

Applicable Products: OEM750, OEM750X, OEM300, OEM1000

Please read this section in conjunction with the general considerations applicable to all products.

EXTERNAL ENCLOSURE

Before mounting the drive, ensure that the mounting location is flat and free from paint or other non conductive surface coatings, if necessary remove paint from the corresponding mounting area. This is to guarantee a good high-frequency connection between the drive case and the cabinet. After mounting the unit use petroleum jelly on the exposed metal to minimize the risk of future corrosion. Do not forget to insert a thermally conductive strip or apply thermal paste between the drive and mounting area, if the mounting location is to serve as a heatsink.

FILTERING THE DC POWER SUPPLY

In most installations, the DC power supply (providing DC voltage to the OEM Drive) will require fitting of a mains filter. A suitable filter and particular mounting recommendations should be made available by the power supply manufacturer.

When using Compumotor's OEM300 or OEM1000 DC power supply delivering less than 300 watts, or the OEM1000 delivering more than 300 watts, the recommended mains filters are:

Compumotor Product	**Recommended AC Input Filter**	
OEM300	CORCOM	6VN1
	SCHAFFNER	FN670-3/06
OEM1000 (< 300 Watts)	CORCOM	6VN1
	SCHAFFNER	FN670-3/06
OEM1000 (> 300 Watts)	CORCOM	10VN1
	SCHAFFNER	FN670-10/06

Corcom World Headquarters
Phone: 847-680-7400
Fax: 847-680-8169

Schaffner EMC Inc.
Phone: 201-379-7778
Fax: 201-379-1151

Mount the filter within 2 inches (50mm) of the power supply (see the next figure). Ensure that there is no paint on the mounting panel under the filter mounting lugs - it is vital that there is a large-area conductive contact between the filter and the panel.

Connect the incoming AC supply cable to the push-on terminals on the filter, with the earth lead connected to a local earth stud, bus bar or metal backplane. Route the supply cable so that it runs close to the walls of the enclosure. Connect the earth terminal on the filter case to the earth stud.

Fit a ferrite absorber over the cable before wiring the filter output terminals to the AC input on the power supply. Locate the absorber as close as possible to the power supply using heat-shrink sleeving (see the next figure). Take the power supply earth connection from the same stud that retains the filter case earth.

Attach the DC power supply output to the OEM750/ OEM750X, using 2-core 1.5mm^2 (AWG 14) (SWG 16) twisted wiring, as shown in the next figure. Route these wires away from motor cables and other high current cabling, while keeping their length as short as possible.

The filters specified above allow multiple OEM series drives to be used with Compumotor's OEM300 or OEM1000 power supplies, that is, one filter per DC power supply.

Motor Connections

COMPUMOTOR MOTORS, AND OTHER MOTORS WITH NON-REMOVABLE CABLING

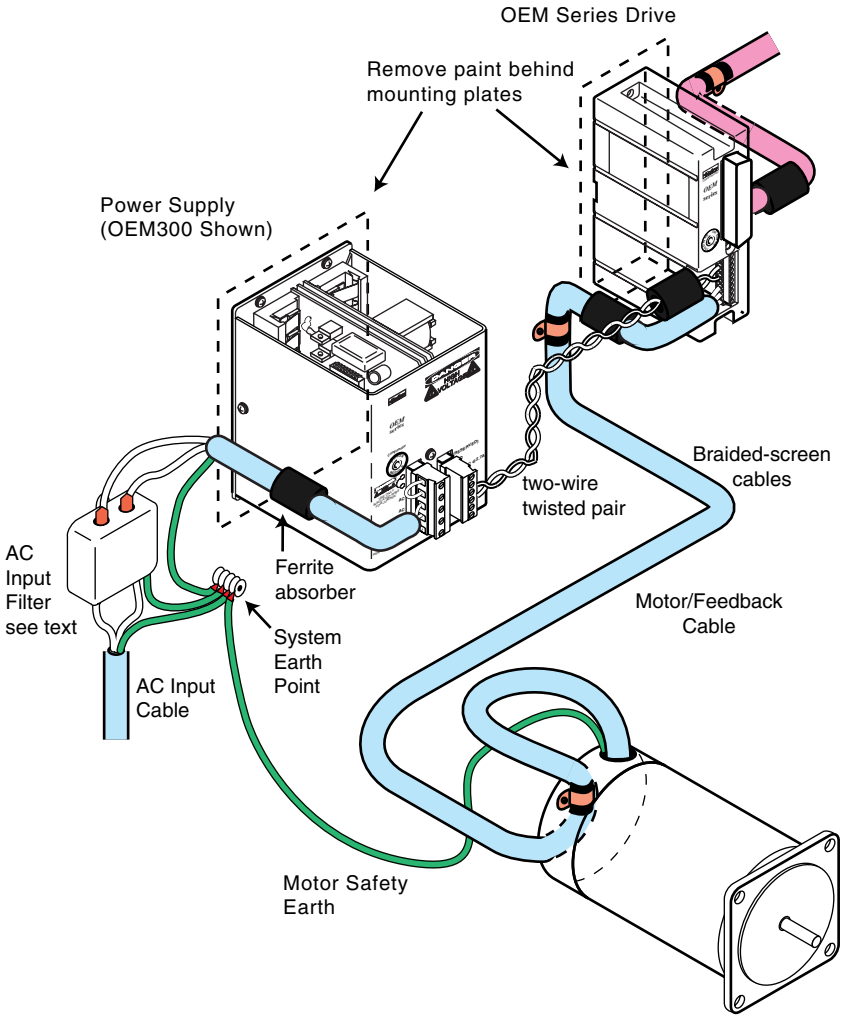
Except for the C10 cabling option of the RS motors, Parker Compumotor OEM Series drive/motor systems ship with motors that do not incorporate braided screen. (Applicable motors are OS Series, RS Series with the L10 option, and OEM Series motors.)

Therefore when motor cabling is not confined within earthed conduit, it is necessary to shield the exposed length of cable and properly bond it to earth. In installations where the motor cable is within earthed conduit for the entire length of travel, the standard motor cable can be used.

To extend motor cables cut off cable in excess of approximately 4 inches (10 cm). Configure the motor for series or parallel operation and attach the braided screen cable to the motor. The use of a terminal block or other hardware is recommended, as inline splicing on high power cables is not allowed.

Termination of the braid shield at the motor must be made using a 360° bond to the motor body. This may be achieved by using a suitable clamp. R-clamp the braid (see previous figure) to the rear end bell of the motor housing, shown in the next figure. This will not only provide a good high frequency bond, but strain relief as well.

At the drive end of the motor cable, fit a ferrite absorber over the cable before wiring to the motor connector. Locate the absorber as close as possible to the connector using heat-shrink sleeving. Expose a short length of braiding and anchor to the panel with an R-clamp. Note that the motor cable should be kept away from I/O cables carrying control signals.



Motor with Non-Removable Cabling

COMPUMOTOR RS SERIES MOTOR WITH C10 OPTION

The C10 option for Compumotor's RS Series motors includes a removable braided cable and all necessary hardware for making an EMC compliant installation. At the motor end of the motor cable, follow the installation instructions that are included with the C10 cable kit.

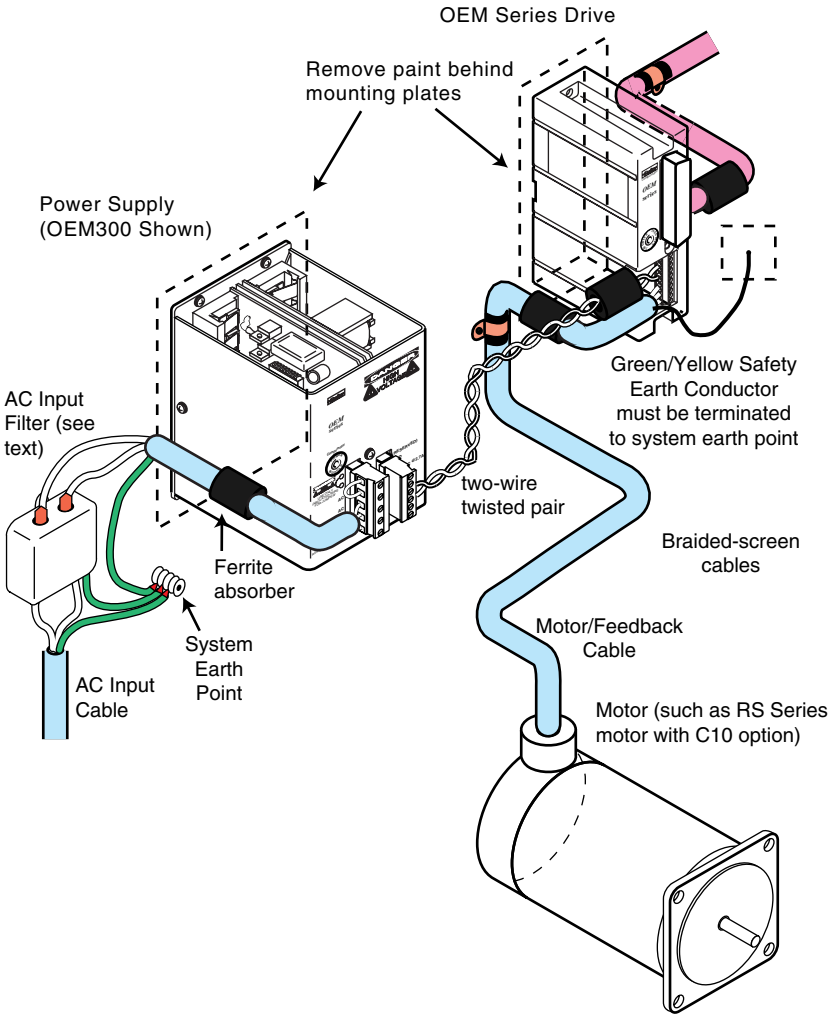
At the drive end of the motor cable, fit a ferrite absorber over the cable before wiring to the motor connector. Locate the absorber as close as possible to the connector using heat-shrink sleeving. Expose a short length of braiding and anchor to the panel with an R-clamp. Note that the motor cable should be kept away from I/O cables carrying control signals.

OTHER MOTORS WITH REMOVABLE CABLING

Remove the motor cable from the standard motor, and replace with a suitable cable described in *Motor Cables* following this section.

Termination of the braid shield at the motor must be made using a 360° bond to the motor body. This may be achieved with use of an appropriate threaded insert, or a suitable clamp. For the latter, R-clamp the braid to the rear end bell of the motor housing, as shown in the previous figure. This will not only provide a good high frequency bond, but strain relief as well.

At the drive end of the motor cable, fit a ferrite absorber over the cable before wiring to the motor connector. Locate the absorber as close as possible to the connector using heat-shrink sleeving. Expose a short length of braiding and anchor to the panel with an R-clamp. Note that the motor cable should be kept away from I/O cables carrying control signals.



Motor with Removable Cabling

MOTOR CABLES

Use 4-core 1.5mm² (AWG 14) (SWG 16) cable for the OEM750/OEM750X.

All aftermarket motor connections must be made using a high quality braided-screen cable. Cables using a metallized plastic foil for an earth screen are unsuitable and in fact provide very little screening. Terminating to the screen in a mechanically

stable manner is difficult because the screen itself is comparatively fragile - bending it in a tight radius can seriously affect the screening performance.

There must be no break in the 360° coverage that the screen provides around the cable conductors. If a connector must be used it should retain the 360° coverage, possibly by the use of an additional metallic casing where it passes through the bulkhead of the enclosure. The cable screen must *not* be connected to the cabinet at the point of entry. Its function is to return high-frequency chopping current back to the drive or controller. This may require mounting the connector on a sub-panel insulated from the main cabinet, or using a connector having an internal screen which is insulated from the connector housing.

Within the cabinet itself, all the motor cables should lie in the same trunking as far as possible. They must be kept separate from any low-level control signal cables. This applies particularly where the control cables are unscreened and run close to the drive or other sources of electrical noise.

MOTOR FEEDBACK CABLES

Feedback devices such as encoders and tachometers also require the use of high-quality braided screen cable. If it is necessary to replace the standard feedback cable, select a braided screen cable that matches the gage of the device's original cable and attach as close to the transducer as possible. Avoid complex and bulky connections that can cause degradation in feedback signal quality. If possible, use inline cable splicing techniques, and cover the splice point with heat-shrink tubing. Remove a section of the braided shield cable's insulation to expose the braid, and tie the braid to earth using the same R-clamp 360° bond as shown in the previous figure. Differential signals should use twisted pair cable to minimize magnetic coupling. At the receiving end, R-clamp the braid to a suitable ground (metal backplane of drive mounting panel, or earth point of device that receives the feedback).

MOTORS

It is preferable to use motors with screw terminations when-

ever possible. If flying-lead motors are used, it is important that the unscreened leads are converted into a braided-screen cable within 4 inches (10cm) of the motor body. A separate terminal box may be used for this purpose but the braided cable screen must be properly strapped to the motor body. Motors fitted with terminal boxes also allow local selection of series or parallel connection, reducing the cost of the cable running back to the drive. For safety reasons, the motor case must be grounded, either through the grounded machine mounting interface or with the addition of a safety ground wire (green and yellow striped wire).

CONTROL SIGNAL WIRING

High-quality braided screen cable should be used for control connections. In the case of the OEM750/OEM750X, which has differential step/direction inputs, it is preferable to use cable with twisted pairs to minimize magnetic coupling. I/O lines require that separate grounds be individually run for each I/O point. In the case of limits and other I/O that must reside external to the mounting cabinet, braided screen cable must also be used. Bond the braid to the machine frame earth ground at the sensor end. No connection is made to the cable screen at the drive itself. Fit a ferrite absorber close to the I/O connector and run the cable to the mounting panel as shown in the previous figures. Expose a short length of the braided screen and anchor to the panel with an R-clamp.

The level at which the I/O operates means that the signals are unlikely to meet EMC immunity requirements if taken outside the enclosure without proper screening.

COMMUNICATIONS

In applications that require serial communications with the OEM750X, special care must be taken in assuring proper wiring practices are utilized. Good quality braided screen cable should be used for the communications cabling. No connection is made to the cable screen at the drive itself. Fit a ferrite absorber close to the communications connector and run the cable to the mounting panel as shown in the previous figures. Expose a short length of the braided screen and anchor to the panel with an R-clamp. Avoid routing communication cables near high power lines, and sources of high energy impulses.