

Compumotor

EMC Installation Guide

Compumotor Division
Parker Hannifin Corporation
p/n 88-015436-01B July 1997



IMPORTANT

User Information

To ensure that the equipment described in this user guide, as well as all the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to identify and comply with the applicable standards and codes. **WARNING:** *Failure to comply with applicable codes and standards can result in damage to equipment and/or serious injury to personnel.*

Personnel who are to install and operate the equipment should study this user guide and all referenced documentation prior to installation and/or operation of the equipment.

In no event will the provider of the equipment be liable for any incidental, consequential, or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with the use of this user guide or the equipment.

© **Compumotor Division of Parker Hannifin Corporation, 1996**
—All Rights Reserved—

The information in this user guide, including any apparatus, methods, techniques, and concepts described herein, are the proprietary property of Parker Compumotor or its licensors, and may not be copied, disclosed, or used for any purpose not expressly authorized by the owner thereof.

Since Parker Compumotor constantly strives to improve all of its products, we reserve the right to change this user guide and equipment mentioned therein at anytime without notice.

Technical Assistance ☺ *Contact your local automation technology center (ATC) or distributor, or ...*

.....

North America and Asia:

Parker Hannifin
Compumotor Division
5500 Business Park Drive
Rohnert Park, CA 94928
Telephone: (800) 358-9070
Fax: (707) 584-3793
FaxBack System: (800) 936-6939
BBS: (707) 584-4059
E-Mail: tech_help@cmotor.com

Europe (non-German speaking):

Parker Digiplan
21 Balena Close
Poole, Dorset
England BH17 7DX
441-202-690-911
441-202-600-820

Germany Austria, Switzerland:

Hauser Elektronik GmbH
Robert-Bosch-Str. 22
D-77656 Offenburg
Germany
49-781-509-300
49-781-509-176

Contents

CHAPTER ① GENERAL PRODUCT PHILOSOPHY	5
Safety Considerations	5
General Considerations Applicable to all Products	5
External enclosures	5
AC supply filtering	6
Control signal connections	6
Motor Cabling	6
Ferrite absorber specifications	6
Handling and installing the ferrite absorbers	7
CHAPTER ② INSTALLATION	9
Controllers & Indexers	9
External Enclosure	9
Filtering the AC mains supply	9
Control Signal Wiring	9
Step Motor Drives	12
External Enclosure	12
Filtering the AC mains supply	12
Motor Connections	12
Control Signal Wiring	13
Servo Motor Drives	18
TQ Series	18
Standard Compumotor Motors	18
Motor Cables	19
Motor Feedback Cables	19
Servo Motors	19
APEX Drives	21
Standard Compumotor Motors	22
Motor Cables	22
Motor Feedback Cables	22
Servo Motors	23
OEM Series Drives	25
Standard Compumotor Motors & Motors Without Removable Cabling	26
Motors with Removable Cabling	26
Motor Cables	26
Motor Feedback Cables	27
Motors	27
APPENDIX A - AC INPUT FILTERS	29

Figures

Figure 1 - Ferrite Sleeve Installation	7
Figure 2 - P-Clip Installation	7
Figure 3 - 6000 Series Controller/Indexer	10
Figure 4 - OEM6000 Series Controller/Indexer	11
Figure 5 - S Series Step Motor Drive	14
Figure 6 - SX Series Step Motor Drive / Indexer	15
Figure 8 - ZETA6104 Step Motor Drive/Indexer	17
Figure 9 - Step Motor Detail - P-Clip, Safety Earth	18
Figure 10 - TQ10(X) Servo Drive (Controller)	20
Figure 11 - SM Servo Motor Detail - P-Clip, Safety Earth	21
Figure 12 - APEX Drive	24
Figure 13 - Servo Motor Detail - P-Clip, Safety Earth	25
Figure 14 - OEM Series Step/Servo Drive (Controller/Indexer)	28

CHAPTER ①

General Product Philosophy

Compumotor products currently fall into four main categories:

- 6000 Stand-alone controllers
- Step Motor Drives
- Servo Motor Drives
- OEM Series Drives

Existing products that were not designed originally for EMC compliance will require specific measures to be taken during installation. These measures vary according to the type of product. 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 instructions 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.

It should be stressed that although these recommendations are based on expertise acquired during tests carried out on each of the product types, it is impossible for Compumotor to guarantee the compliance of any particular installation. This 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 Applicable to all Products

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.

Packaged products must be mounted to a conductive 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 and controllers 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 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 drive or transformer, if required, and run the input cable and any earth cables close to the panel.

Appendix A lists Compumotor Product along with the recommended AC Input Power Filter.

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 (at least 8 inches) from relays and contactors. 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 like a high impedance 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	28.5mm
Inside diameter	10.7mm	13.77mm
Length	28.5mm	28.57mm
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 19mm diameter heat-shrink sleeving (See figure 1). 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.

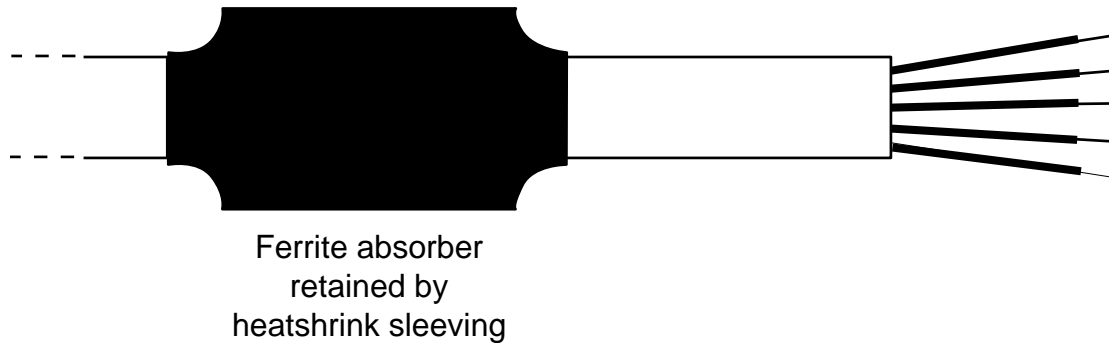


Figure 1 - Ferrite Sleeve Installation

P-Clip Installation Details

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

When installing a P-Clip, Figure 2, install as close to the cable end as possible, provided a suitable ground, backplane, earth stud or bus bar is accessible, (this may mean removing the 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 P-clip 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 P-Clip is recommended. Cover any exposed bare metal with petroleum jelly to resist corrosion.

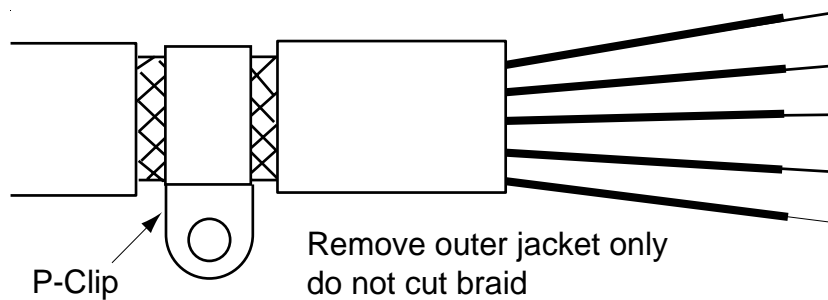


Figure 2 - P-Clip Installation

CHAPTER ②

Installation

Controllers & Indexers

Applicable Products: Model 6200, 6250, 6270, OEM6200, OEM6250
Referenced Figures: 1, 2, 3, 4

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

External Enclosure

Before mounting the controller, remove the paint from the rear face of the lower mounting hole as shown in Figures 3 and 4, and if necessary from the corresponding area on the rear panel of the enclosure. This is to guarantee a good high-frequency connection between the product case and the cabinet. After mounting the unit use petroleum jelly on the exposed metal to minimize the risk of future corrosion.

Filtering the AC mains supply

Most controls incorporate a switch-mode power supply operating directly from the AC input. The substantial filtering effect of a mains isolation transformer is therefore not available, and additional external filtering is required. The solution offered uses a single filter to control both differential and common-mode emissions. The manufacturer's part numbers for suitable filters are:

Corcom part number: 3EB1
Schaffner part number: FN610-3/06

Mount the filter within 2 inches (50mm) of the Controller/Indexer as shown in Figure 3. Again ensure that there is no paint on the rear panel behind the filter mounting lugs - it is vital that there is good large-area 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 the panel, local earth stud or bus bar. Connect the earth terminal on the case of the filter to the earth stud. Route the supply cable so that it runs close to the walls within the cabinet.

Fit a ferrite absorber over the cable before wiring the filter output terminals to the AC input on the Controller/Indexer. Locate the absorber as close as possible to the controller/indexer using heat-shrink sleeving, as shown in Figure 1. Take the Controller/Indexer earth connection from the same stud that retains the filter case earth, as shown in Figure 3.

Control Signal Wiring

High-quality braided screen cable should be used for control connections. In the case differential outputs (such as step and direction), it is preferable to use cable with twisted pairs to minimize magnetic coupling. A connection is made to the cable screen at the controller end by exposing a short length of the braided screen and anchoring this to earth using a P-clip, see Figure 2. Fit a ferrite absorber close to the I/O connector and run the cable down to the mounting panel as shown in Figures 3 & 4.

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.

50 Pin Ribbon Cable

It is recommended when using the 50 Pin Ribbon Cable I/O found on the 6000 Series Indexers that a terminal break out box such as the VM-50 be used, as shown in Figures 3 & 4. Mount the VM50 close to the Controller/Indexer keeping the ribbon cable as short as possible. Bundle any excess ribbon cable and secure close to a panel wall. Individual I/O points will require the use of individually shielded cable runs, with braids bonded to the panel (close to VM50) with a P-clip.

Communications

In applications that require serial communications with the Drive-Indexer, special care must be taken in assuring proper wiring practices are utilized. Good quality braided screen cable should be used for the communication cabling. In the specific case of differential mode (RS-485) protocol, twisted pair cable shall be used. 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 down to the mounting panel as shown in Figures 3 and 4. Expose a short length of the braided screen and anchor to the panel with a P-clip. Avoid routing communication cables near high power lines, and sources of high energy impulses.

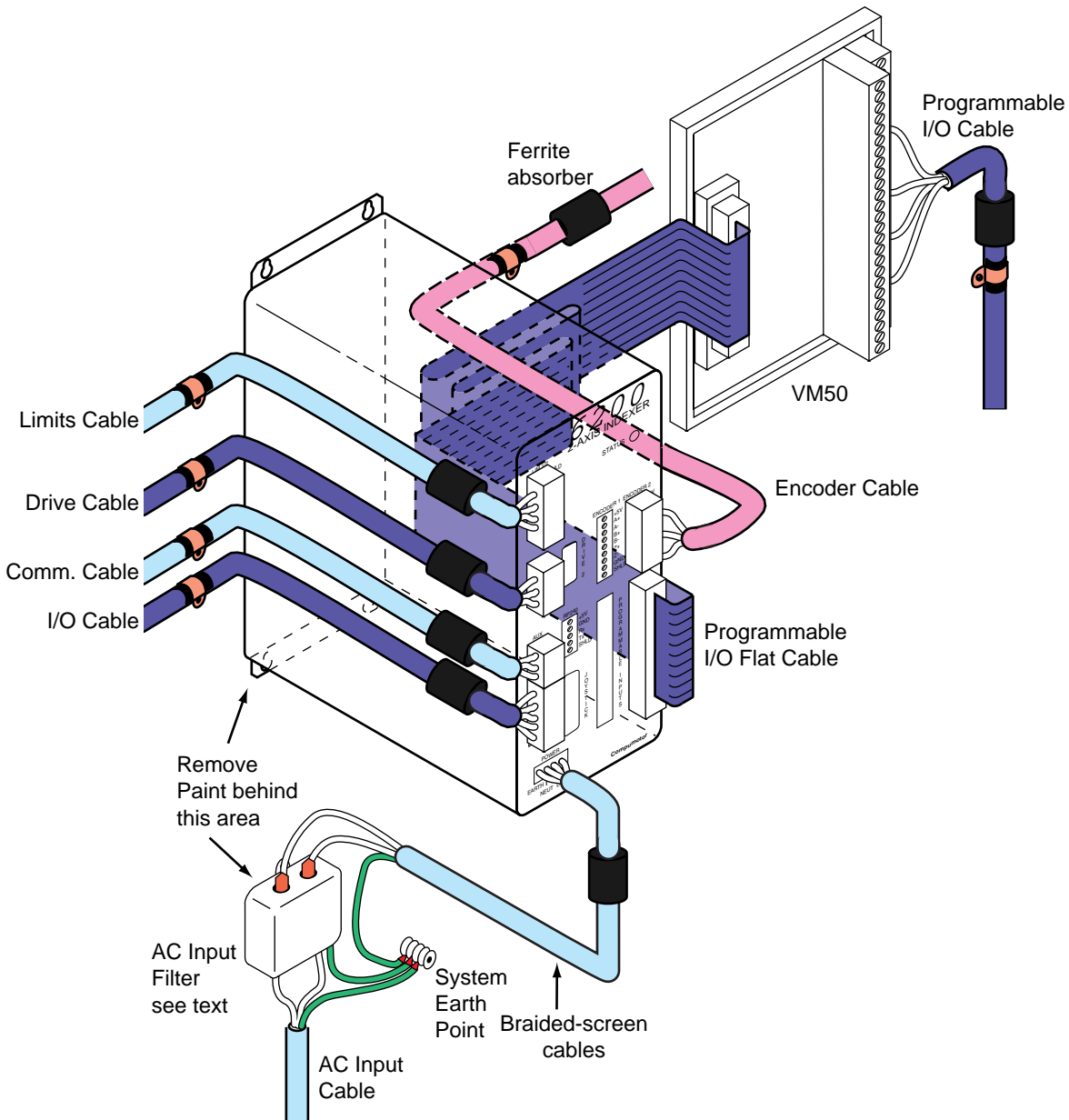


Figure 3 - 6000 Series Controller/Indexer

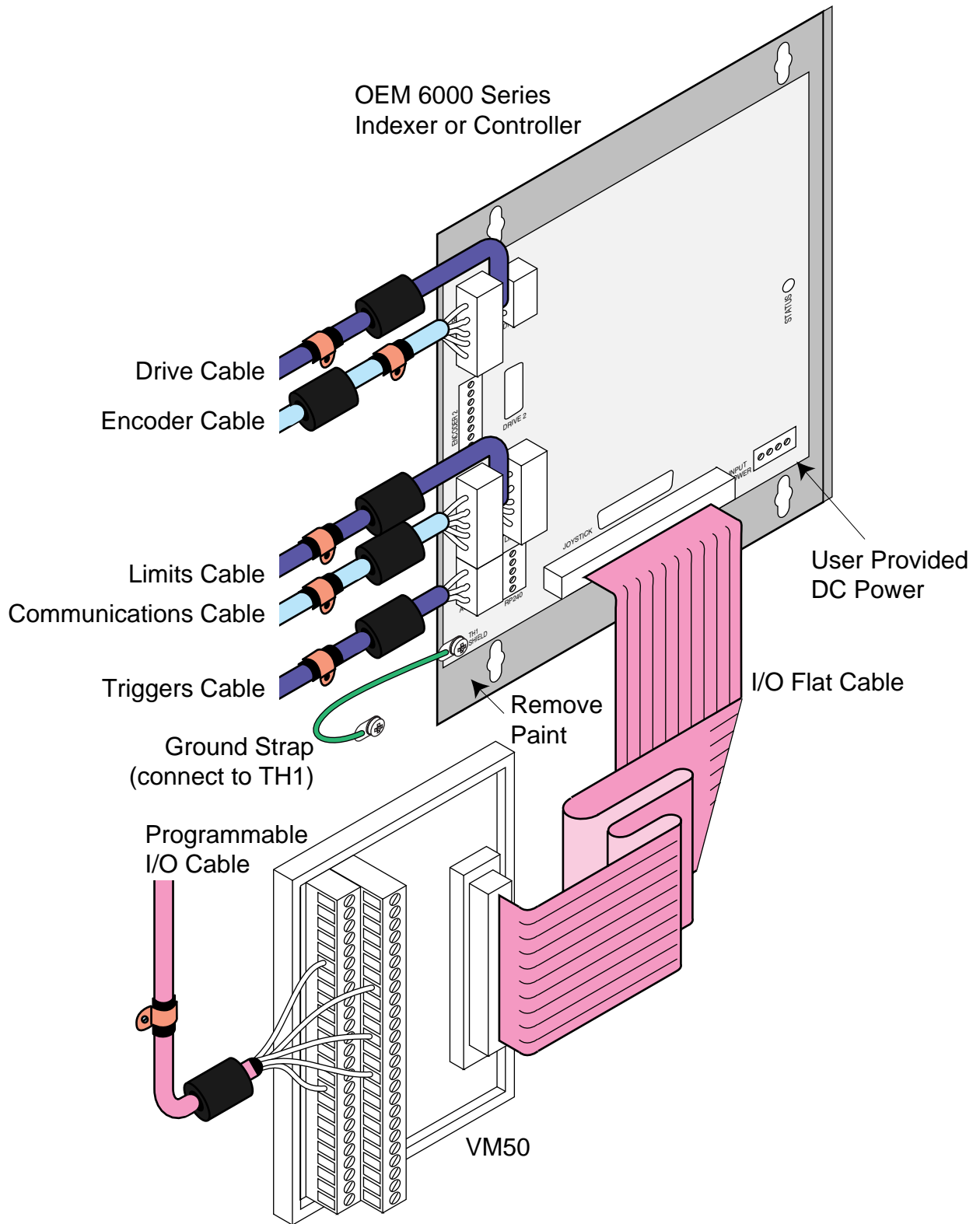


Figure 4 - OEM6000 Series Controller/Indexer

Step Motor Drives

Applicable Products: S, SX, ZETA4, ZETA6104
Referenced Figures: 1, 2, 5, 6, 7, 8, 9

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

External Enclosure

Before mounting the drive, remove the paint from the rear face of the mounting hole that will be closest to the input filter location as shown in Figures 5 through 8, and if necessary from the corresponding area on the rear panel of the enclosure. 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.

Filtering the AC mains supply

A filter must be installed between the incoming AC supply and the input to the drive. The manufacturer's part numbers for suitable filters are:

Corcom part number: 10VV1
Schaffner part number: FN670-10/06

Mount the filter within 2 inches (50mm) of the drive as shown in Figures 5 through 8. Ensure that there is no paint on the mounting panel under the filter mounting lugs - it is vital that there is good large-area 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 back-plane. 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 drive. Locate the absorber as close as possible to the drive using heat-shrink sleeving, see Figure 1. Take the drive earth connection from the same stud that retains the filter case earth, as shown in Figures 5 through 8.

Motor Connections

Standard Compumotor Motors

Parker Compumotor S Series and ZETA Series step motor systems ship with motors that do not incorporate the use of a braided screen for the control of conducted emissions. Therefore when used in installations where the motor cable is not within earthed conduit the entire length of travel, the standard motor cable should not be used.

At the drive end of the motor cable, fit a ferrite absorber over the cable before wiring to the motor connector (it may be necessary to remove the existing connector). Locate the absorber as close as possible to the connector using heat-shrink sleeving.

For motors with exposed cabling (not within earthed conduit), follow the guidelines below:

Removable Cabling	Remove the motor cable from the standard motor, and replace with a suitable cable described below, see <i>Motor Cables</i> .
Permanent Cabling	Cut off cable in excess of approximately 4 inches (10 cm). Configure the motor for series or parallel operation and attach a suitable braided screen cable to the motor, see <i>Motor Cables</i> below.

Termination of the braid shield at the motor must be made using a 360° bond to the motor body, and this may be achieved by using a suitable clamp. Many stepper motors are designed to accommodate an appropriate terminal gland which can be used for this purpose. If this is not the case, P-clip the braid to the rear end bell of the motor housing, as shown in Figure 9. This will not only provide a good high frequency bond, but strain relief as well.

At the drive end, run the motor cable down to the mounting panel, expose a short length of braiding and anchor to the panel with a P-clip. The S and ZETA Series require a safety earth connection to the motor, see Figure 9 (green and yellow striped wire) - take this from the stud or bus bar. Run the safety earth lead alongside the motor lead. Note that the motor cable should be kept away from I/O cables carrying control signals.

Motor Cables

For 10 foot (replacement) cable lengths, use 4-core 1mm² (AWG 18) (SWG 20) braided screen cable for the motor connections on S6 and ZETA4 drives, and 4-core 1.5mm² (AWG 14) (SWG 16) cable for the S8 drive. At the drive end, 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.

All after-market 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, tachometers and Hall effect sensors 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 devices 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 in-line 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 P-clip 360° bond as shown in Figure 2. Differential signals should use twisted pair cable to minimize magnetic coupling. At the receiving end, fit a ferrite absorber over the feedback cable before wiring the connector, then P-clip the braid to a suitable ground, (metal back-plane of drive mounting panel, or earth point of device that receives the feedback), Figures 6 & 8.

Step Motors

It is preferable to use motors with screw terminations whenever 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, as shown in Figure 9. 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.

Control Signal Wiring

High-quality braided screen cable should be used for control connections. In the case of the S and ZETA series drives which have differential step-direction inputs, it is preferable to use cable with twisted pairs to minimize magnetic coupling. 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 down to the mounting panel as shown in Figures 5 through 8. Expose a short length of the braided screen and anchor to the panel with a P-clip.

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.

50 Pin Ribbon Cable

It is recommended when using the 50 Pin Ribbon Cable I/O found on the ZETA6104 that a terminal break out box such as the VM-50 be used, see Figure 8. Mount the VM50 close to the ZETA6104 keeping the ribbon cable as short as possible. Bundle any excess ribbon cable and secure close to a panel wall. Individual I/O points will require the use of individually shielded cable runs, with braids bonded to the panel (close to VM50) with a P-clip.

Communications

In applications that require serial communications with the Drive-Indexer, special care must be taken in assuring proper wiring practices are utilized. Good quality braided screen cable should be used for the communication cabling. In the specific case of differential mode (RS-485) protocol, twisted pair cable shall be used. 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 down to the mounting panel as shown in the diagrams. Expose a short length of the braided screen and anchor to the panel with a P-clip. Avoid routing communication cables near high power lines, and sources of high energy impulses.

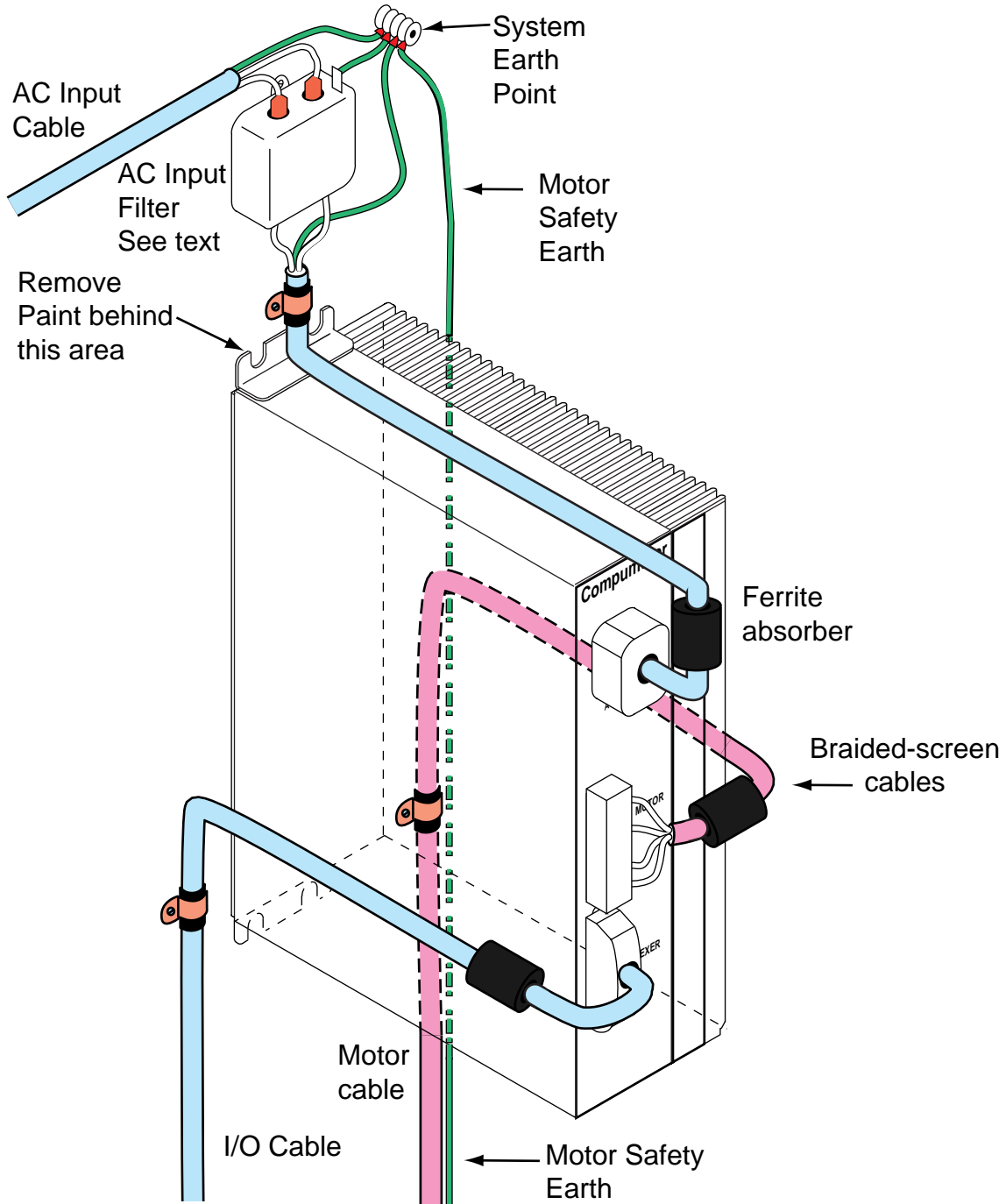


Figure 5 - S Series Step Motor Drive

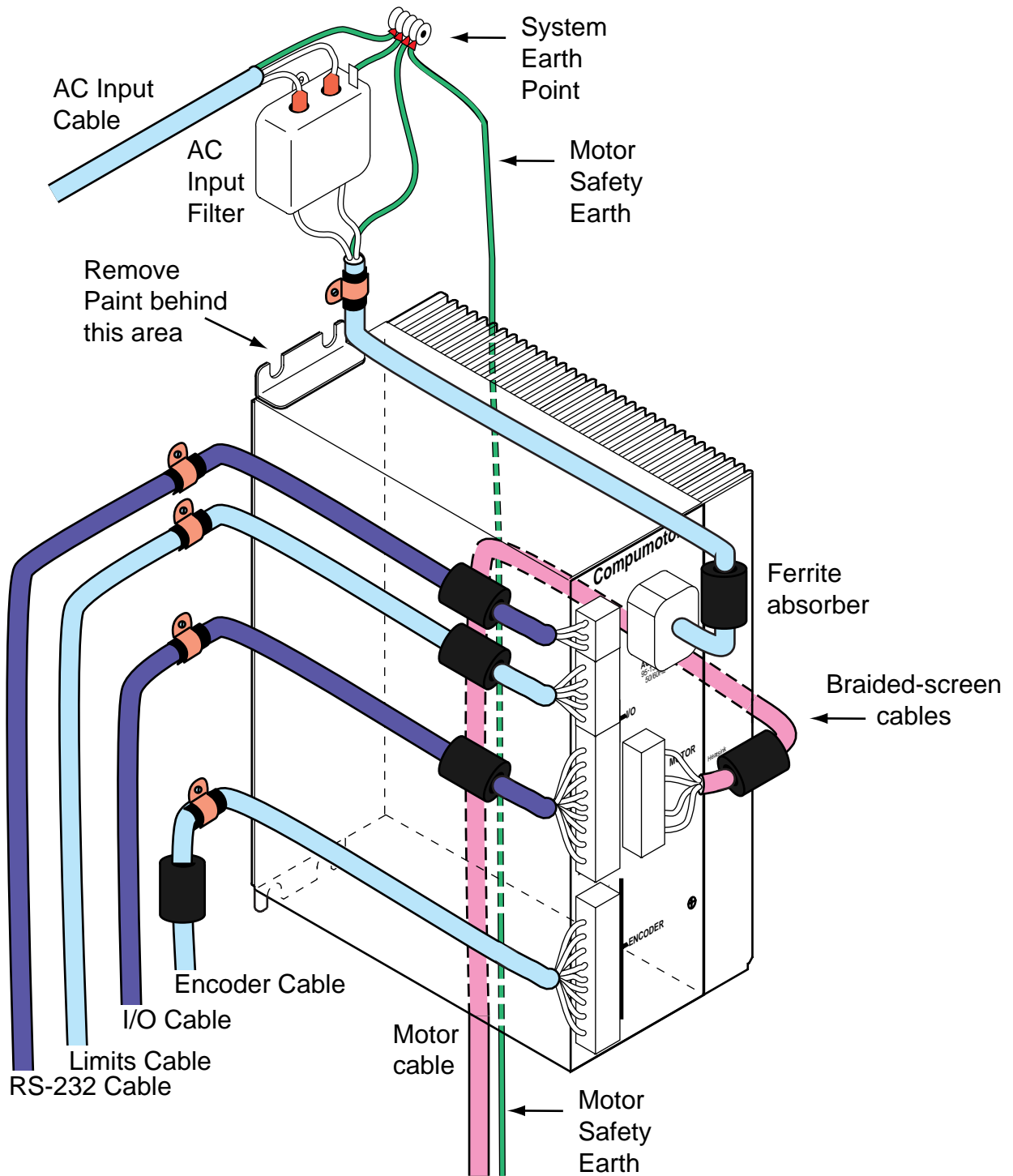


Figure 6 - SX Series Step Motor Drive / Indexer

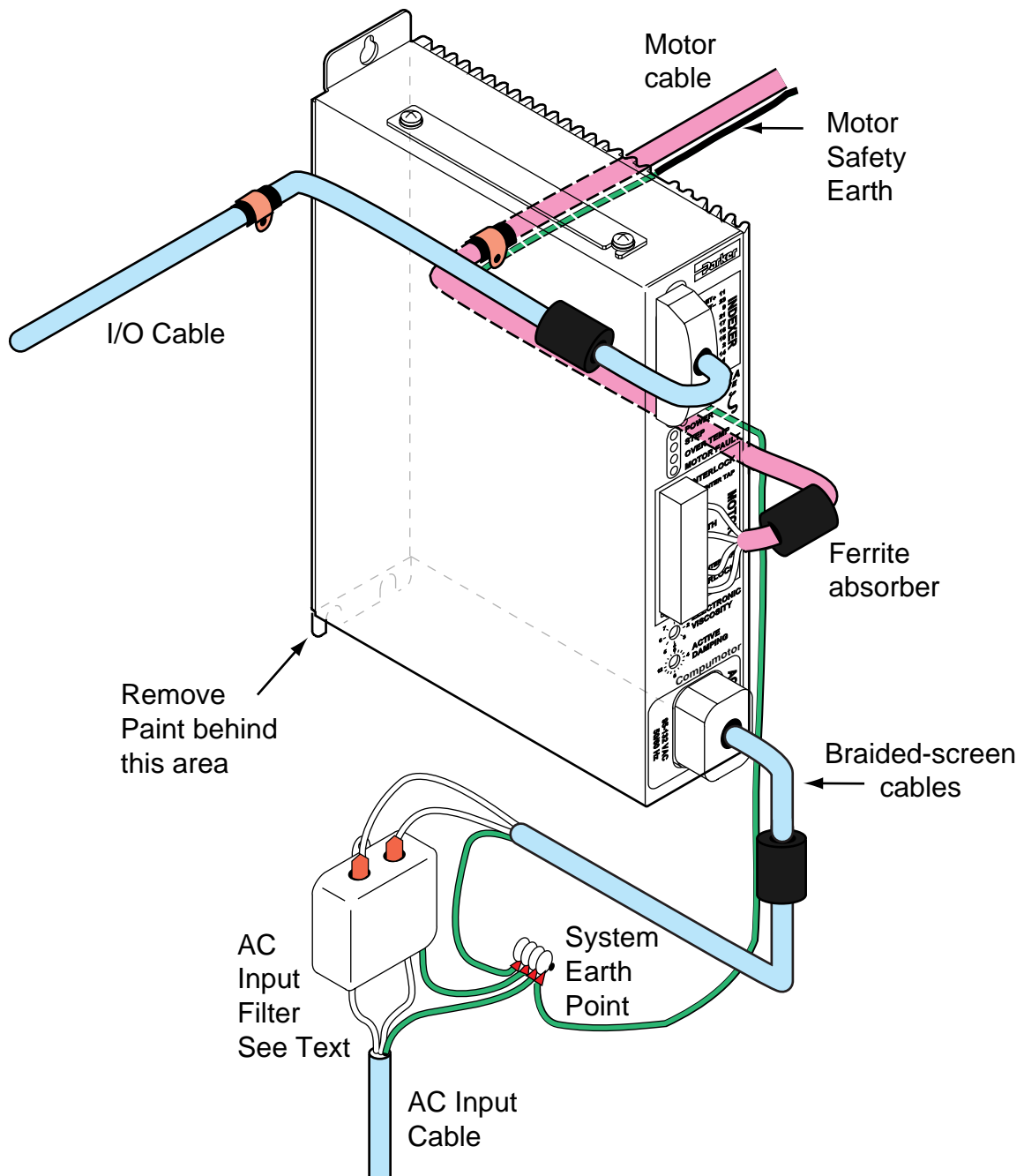


Figure 7 - ZETA4 Step Motor Drive

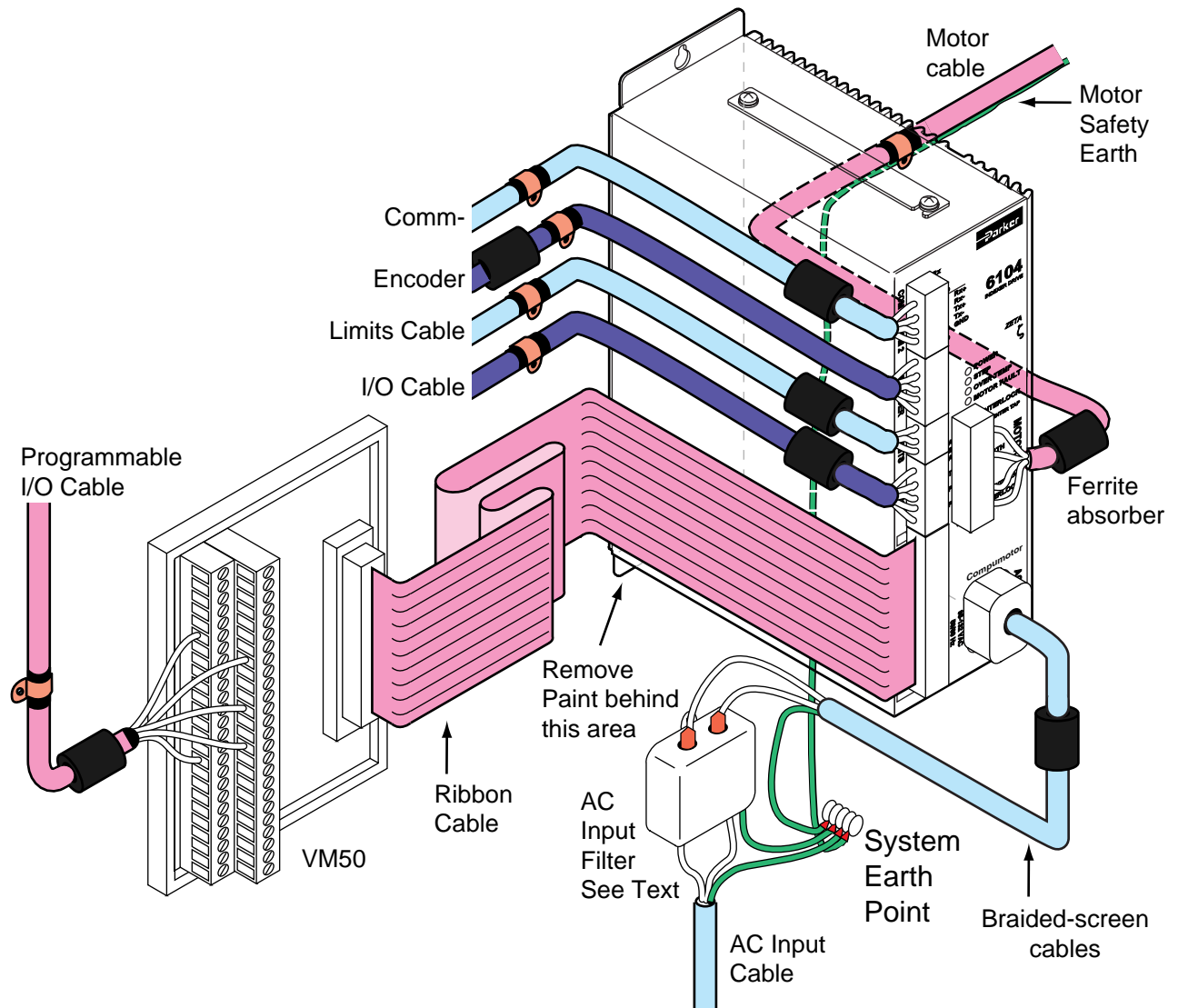


Figure 8 - ZETA6104 Step Motor Drive/Indexer

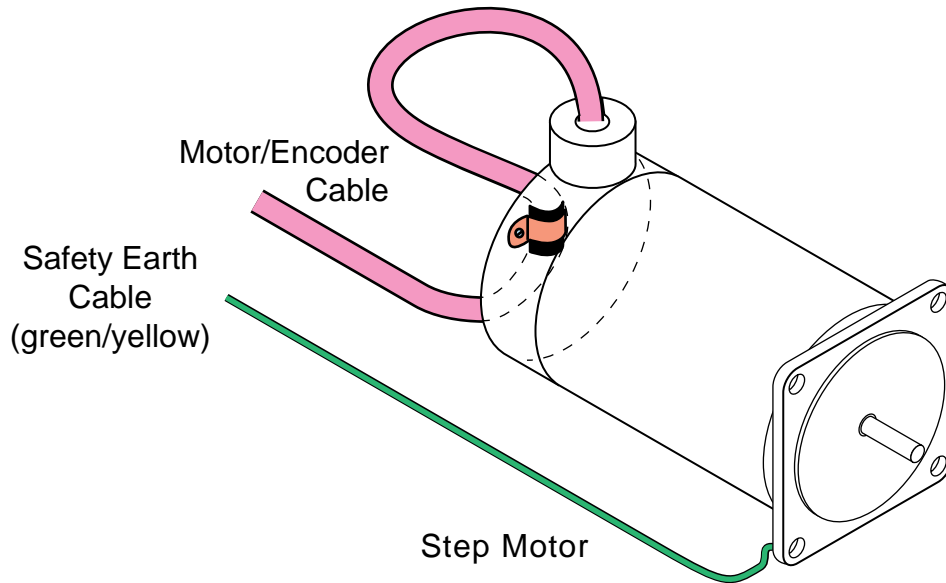


Figure 9 - Step Motor Detail - P-Clip, Safety Earth

Servo Motor Drives

Applicable Products: TQ10, TQ10X, TQ10SD
 Referenced Figures: 1, 2, 10, 11

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

TQ Series

Before mounting the drive, remove the paint from the rear face of the mounting hole that will be closest to the input filter location as shown in Figure 10 (applicable only when TQ-HS3 is used), and if necessary from the corresponding area on the rear panel of the enclosure. Don't forget to insert the thermally conductive strip supplied with the TQ10 before mounting, as described in the TQ10 User Guide. After mounting the unit use petroleum jelly on the exposed metal to minimize the risk of future corrosion.

Filtering the AC mains supply

A filter must be installed between the incoming AC supply and the input to the drive. Suitable filters are:

Corcom part number: 10VV1
 Schaffner part number: FN670-10/06.

Mount the filter within 2 inches (50mm) of the drive as shown in Figure 10. Ensure that there is no paint on the mounting panel under the filter mounting lugs - it is vital that there is 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 back-plane. 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, Figure 1, over the cable before wiring the filter output terminals to the AC input on the drive, see Figure 10. Locate the absorber as close as possible to the drive using heat-shrink sleeving. Take the drive earth connection from the same stud that retains the filter case earth.

Motor Connections

Standard Compumotor Motors

Parker Compumotor TQ10 servo motor systems ship with motors that do not incorporate the use of a braided screen to control conducted emissions. Therefore when used in installations where the motor cable is not within earthed conduit the entire length of travel, the standard motor cable should not be used.

For motors with exposed cabling (not within earthed conduit), follow the guidelines below:

Removable cabling	Remove the motor cable from the standard motor, and replace with a suitable cable described below, see <i>Motor Cables</i> .
Permanent cabling	Cut off cable in excess of approximately 4 inches (10 cm), and attach a suitable cable described below, see <i>Motor Cables</i> .

Termination of the braid shield at the motor must be made using a 360° bond to the motor body or mounting flange, and this may be achieved by using a suitable clamp. Many servo motors are designed to accommodate MS style connections or an appropriate terminal gland which can be used for this purpose, (in the case of MS style connectors, ensure that the cable braid is in full contact with the metal MS connector body). If this is not the case, P-clip the braid, see Figure 2, to the rear end bell of the motor housing, (on Compumotor Servo Motors rather than securing the cable braid to the motor end bell, P-clip the braid to the conductive motor mounting surface as shown in Figure 11). 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 (it may be necessary to remove the existing connector). Locate the absorber as close as possible to the connector using heat-shrink sleeving. Run the motor cable down to the mounting panel, expose a short length of braiding and anchor to the panel with a P-clip. The TQ10 requires a safety earth connection to the motor (green and yellow striped wire) - take this from the stud or bus bar. Run the safety earth lead alongside the motor lead. Note that the motor cable should be kept away from I/O cables carrying control signals.

Motor Cables

Braided Screen cable with at least 80% coverage should be used for after-market motor cables. Consult the TQ10 user guide for require cable gages and number of conductors.

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 unshielded and run close to the drive or other sources of electrical noise.

Motor Feedback Cables

Feedback devices such as encoders, tachometers and Hall effect sensors 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 devices 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 in-line 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 P-clip 360° bond as shown in Figure 2. Differential signals should use twisted pair cable to minimize magnetic coupling. At the receiving end, fit a ferrite absorber over the feedback cable before wiring the connector, then P-clip the braid to a suitable ground, (metal back-plane of drive mounting panel, or earth point of device that receives the feedback), Figure 10.

Servo Motors

It is preferable to use motors with screw terminations whenever possible. If flying-lead motors are used, it is important that the unshielded 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.

Control Signal Wiring

High-quality braided screen cable should be used for control connections. In cases where the signal transmission is in differential mode, it is preferable to use cable with twisted pairs to minimize magnetic coupling. 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 down the mounting panel as shown in Figure 10. Expose a short length of the braided screen and anchor to the panel with a P-clip.

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 TQ10X, special care must be taken in assuring proper wiring practices are utilized. Good quality braided screen cable should be used for the communication 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 down to the mounting panel as shown in Figure 10. Expose a short length of the braided screen and anchor to the panel with a P-clip. Avoid routing communication cables near high power lines, and sources of high energy impulses.

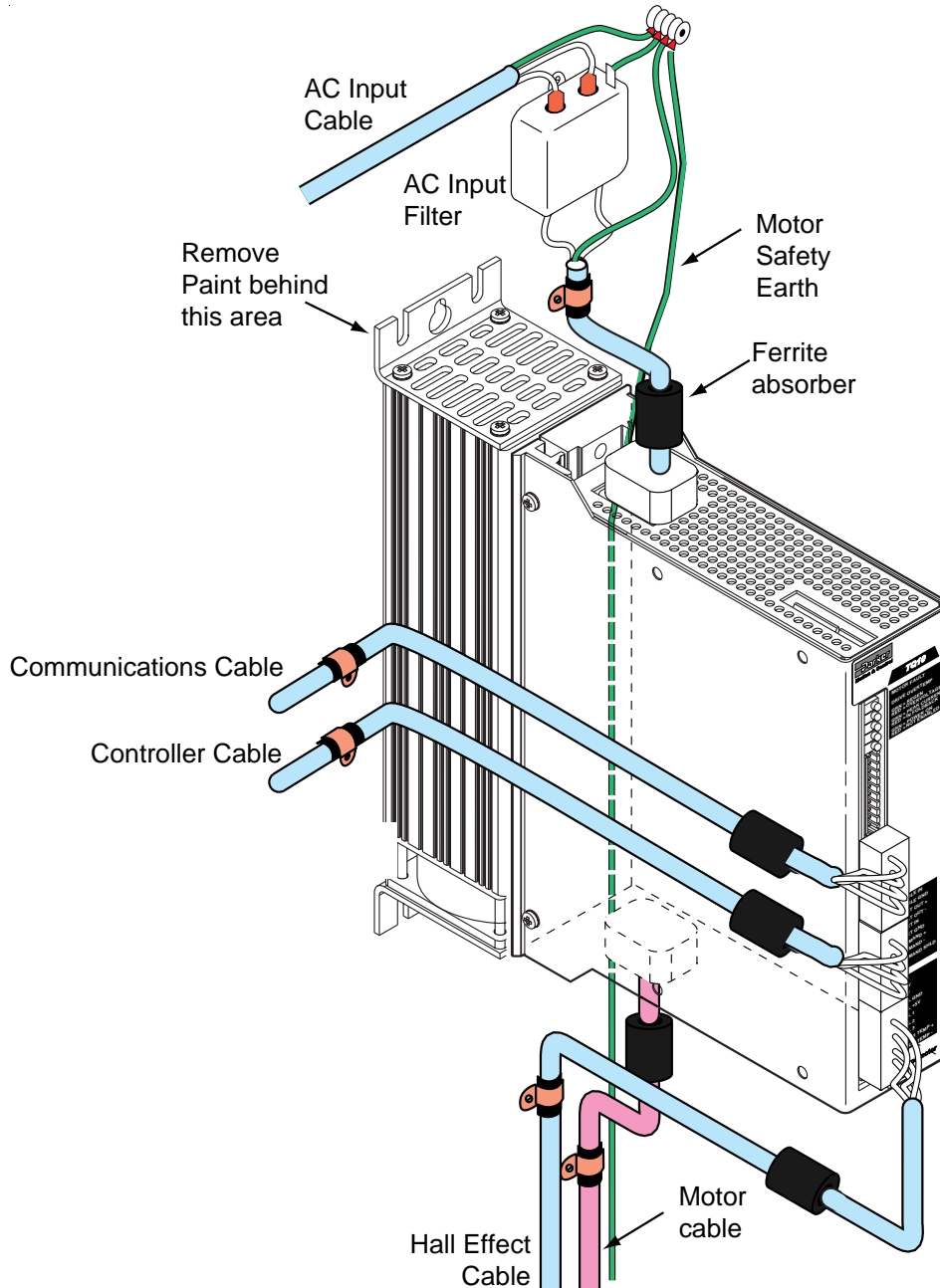


Figure 10 - TQ10(X) Servo Drive (Controller)

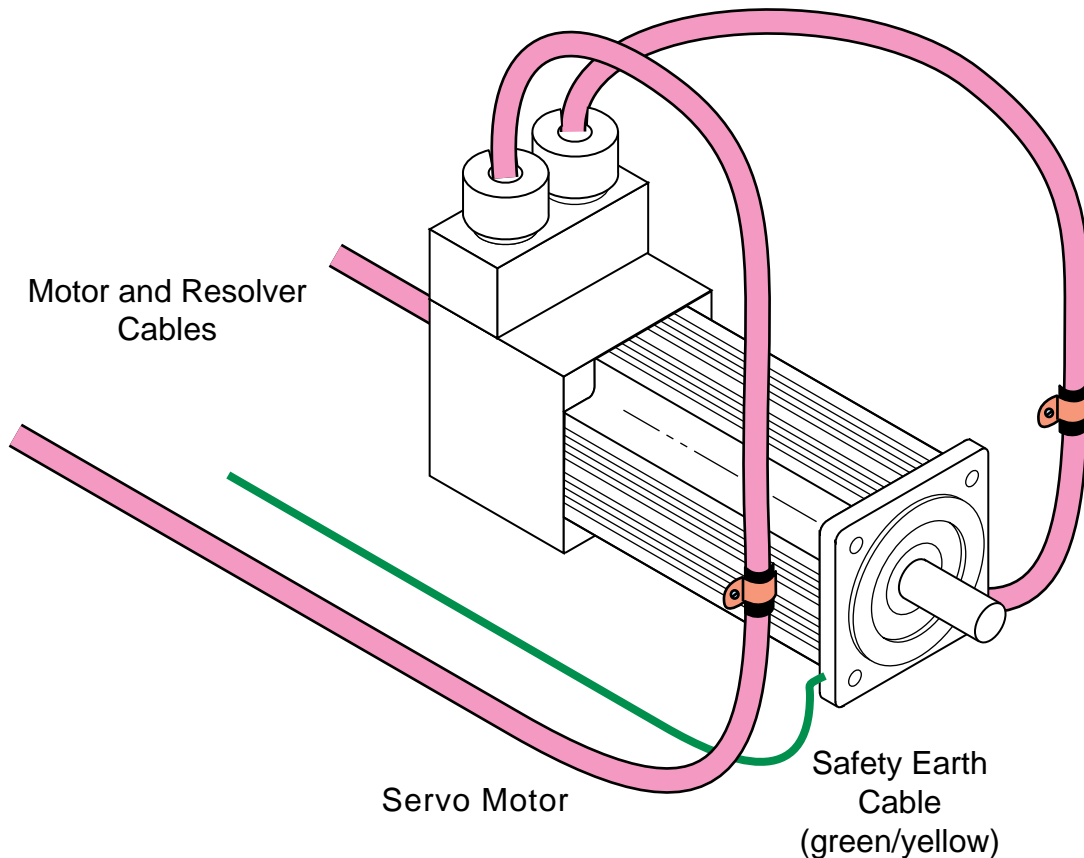


Figure 11 - SM Servo Motor Detail - P-Clip, Safety Earth

APEX Drives

Applicable Products: APEX10, 6151, APEX20, 6152, APEX40, 6154
 Referenced Figures: 12, 13

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

To insure proper grounding of the APEX Drive, remove paint from the rear panel that is located behind the upper right mounting slot on the drive. The upper right slot is unpainted. You can use a star washer with the mounting screw in this slot to provide a grounding path from the chassis ground to the unpainted mounting surface. After mounting the unit use petroleum jelly on the exposed metal to minimize the risk of future corrosion.

Filtering the AC mains supply

A filter must be installed between the incoming AC supply and the input to the drive. Suitable filters are:

Drive	Filter Manufacturer	AC Control Filter	AC Mains	
			Filter 1-Phase	Filter 3-Phase
APEX10/6151	Schaffner	FN610-3-06	FN2070-16-06	Not Applicable
	Corcom	3EB1	*	Not Applicable
APEX20/6152	Schaffner	FN610-3-06	FN258-16-07	FN258-16-07
	Corcom	3EB1	*	20AYT6C
APEX40/6154	Schaffner	FN610-3-06	FN258-16-07	FN258-16-07
	Corcom	3EB1	*	FN258-30-07 20AYT6C

* Test Pending

Mount the filter within 2 inches (50mm) of the drive as shown in Figure 12. Ensure that there is no paint on the mounting panel under the filter mounting lugs - it is vital that there is large-area conductive contact between the filter and the panel.

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

Figure 12 shows the drive system with two separate AC line filters. Another option is to use the AC mains filter to power the AC control input.

Fit a ferrite absorber, Figure 1, over the cable before wiring the filter output terminals to the AC input on the drive, see Figure 12. Locate the absorber as close as possible to the drive using heat-shrink sleeving. Take the drive earth connection from the same stud that retains the filter case earth.

Motor Connections

Standard Compumotor Motors

Compumotor servo motor systems ship with motors that do not incorporate the use of a braided screen to control conducted emissions. Therefore when used in installations where the motor cable is not within earthed conduit the entire length of travel, the standard motor cable should not be used.

For motors with exposed cabling (not within earthed conduit), follow the guidelines below:

Removable cabling	Remove the motor cable from the standard motor, and replace with a suitable cable described below, see <i>Motor Cables</i> .
Permanent cabling	Cut off cable in excess of approximately 4 inches (10 cm), and attach a suitable cable described below, see <i>Motor Cables</i> .

Termination of the braid shield at the motor must be made using a 360° bond to the motor body or mounting flange, and this may be achieved by using a suitable clamp. Many servo motors are designed to accommodate MS style connections or an appropriate terminal gland which can be used for this purpose, (in the case of MS style connectors, ensure that the cable braid is in full contact with the metal MS connector body). If this is not the case, P-clip the braid, see Figure 2, to the rear end bell of the motor housing, (on Compumotor Servo Motors rather than securing the cable braid to the motor end bell, P-clip the braid to the conductive motor mounting surface as shown in Figure 13). 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 (it may be necessary to remove the existing connector). Locate the absorber as close as possible to the connector using heat-shrink sleeving. Run the motor cable down to the mounting panel, expose a short length of braiding and anchor to the panel with a P-clip. The APEX Drive requires a safety earth connection to the motor (green and yellow striped wire) - take this from the stud or bus bar. Run the safety earth lead alongside the motor lead. Note that the motor cable should be kept away from I/O cables carrying control signals.

Motor Cables

Braided Screen cable with at least 80% coverage should be used for after-market motor cables. Consult the Apex User Guide for require cable gages and number of conductors.

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, tachometers, Hall effect sensors, and resolvers 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 devices 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 in-line 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 P-clip 360° bond as shown in Figure 2. Differential signals should use twisted pair cable to minimize magnetic coupling. At the receiving end, fit a ferrite absorber over the feedback cable before wiring the connector, then P-clip the braid to a

suitable ground, (metal back-plane of drive mounting panel, or earth point of device that receives the feedback), Figure 12.

Servo Motors

It is preferable to use motors with screw terminations whenever 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.

Control Signal Wiring

High-quality braided screen cable should be used for control connections. In cases where the signal transmission is in differential mode, it is preferable to use cable with twisted pairs to minimize magnetic coupling. 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 down to the mounting panel as shown in Figure 12. Expose a short length of the braided screen and anchor to the panel with a P-clip.

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 APEX615n, special care must be taken in assuring proper wiring practices are utilized. Good quality braided screen cable should be used for the communication 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 down to the mounting panel as shown in Figure 12. Expose a short length of the braided screen and anchor to the panel with a P-clip. Avoid routing communication cables near high power lines, and sources of high energy impulses.

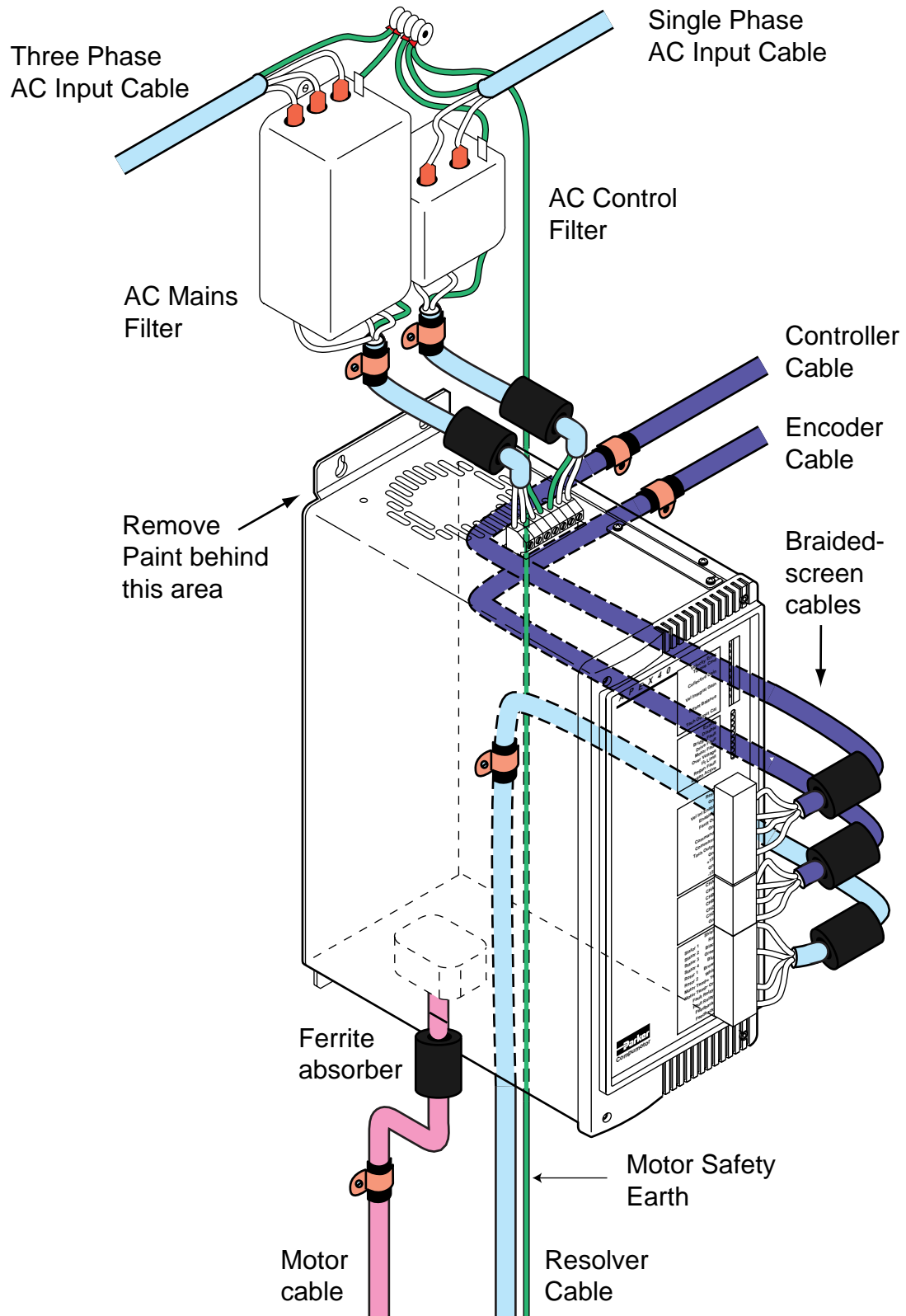


Figure 12 - APEX Drive

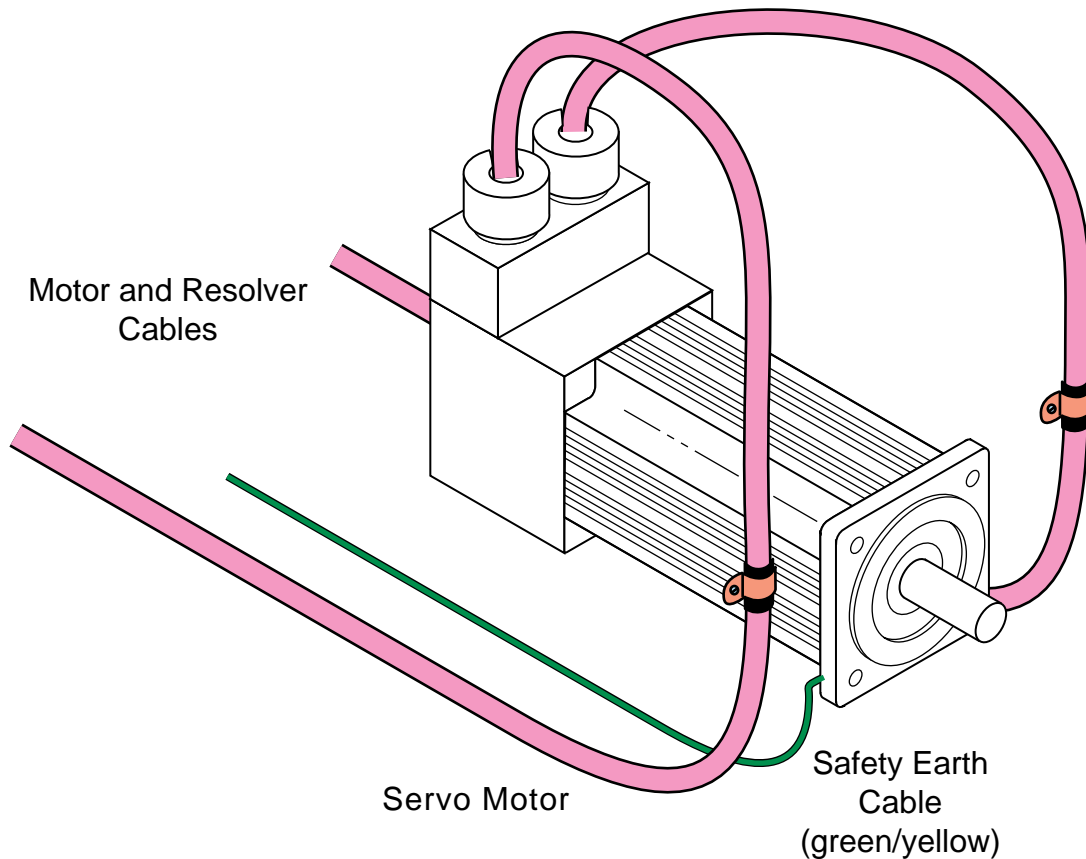


Figure 13 - Servo Motor Detail - P-Clip, Safety Earth

OEM Series Drives

Applicable Products: OEM350, OEM350X, OEM650, OEM650X, OEM670, OEM670X, OEM670SD

Referenced Figures: 1, 2, 14

Please read this 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, as shown in Figure 14. 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 D.C. 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, the recommended mains filters are:

Corcom part number: 6VN1
Schaffner part number: FN670-3/06

When using the OEM1000 power supply delivering more than 300 Watts, the recommended mains filters are:

Corcom part number: 10VN1
Schaffner part number: FN670-10/06

Mount the filter within 2 inches (50mm) of the power supply as shown in Figure 14. 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 back-plane. 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 Figure 1. Take the power supply earth connection from the same stud that retains the filter case earth.

Attach the DC power supply output to the OEM Series Drive, using 2-core 1.5mm² (AWG 14) (SWG 16) twisted wiring as shown in Figure 10. 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

Standard Compumotor Motors & Motors Without Removable Cabling

Parker Compumotor OEM Series drive-motor systems ship with motors that do not incorporate braided screen. 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 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.

Termination of the braid shield at the motor must be made using a 360° bond to the motor body, and this may be achieved by using a suitable clamp. P-clip the braid, see Figure 2, to the rear end bell of the motor housing, shown in Figure 14. 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 a P-clip. Note that the motor cable should be kept away from I/O cables carrying control signals.

Motors with Removable Cabling

Remove the motor cable from the standard motor, and replace with a suitable cable described below, see '*Motor Cables*'.

Termination of the braid shield at the motor must be made using a 360° bond to the motor body, and this may be achieved by using a suitable clamp. P-clip the braid to the rear end bell of the motor housing, see Figure 14. 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 a P-clip. Note that the motor cable should be kept away from I/O cables carrying control signals.

Motor Cables

Use 4-core 1mm² (AWG 16) (SWG 18) cable for the OEM350 and use 4-core 1.5mm² (AWG 14) (SWG 16) cable for the OEM650 series drives, and 3-core 1.5mm² (AWG 14) (SWG 16) cable for the OEM670 drive.

All after-market 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, tachometers and Hall effect sensors 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 devices 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 in-line 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 P-clip 360° bond as shown in Figure 14. Differential signals should use twisted pair cable to minimize magnetic coupling. At the receiving end P-clip the braid to a suitable ground, (metal back-plane of drive mounting panel, or earth point of device that receives the feedback).

Motors

It is preferable to use motors with screw terminations whenever 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 (step motors only), 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 OEM series drives which have 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 down to the mounting panel as shown in Figure 14. Expose a short length of the braided screen and anchor to the panel with a P-clip.

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 Drive-Indexer, 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 down to the mounting panel as shown in Figure 14. Expose a short length of the braided screen and anchor to the panel with a P-clip. Avoid routing communication cables near high power lines, and sources of high energy impulses.

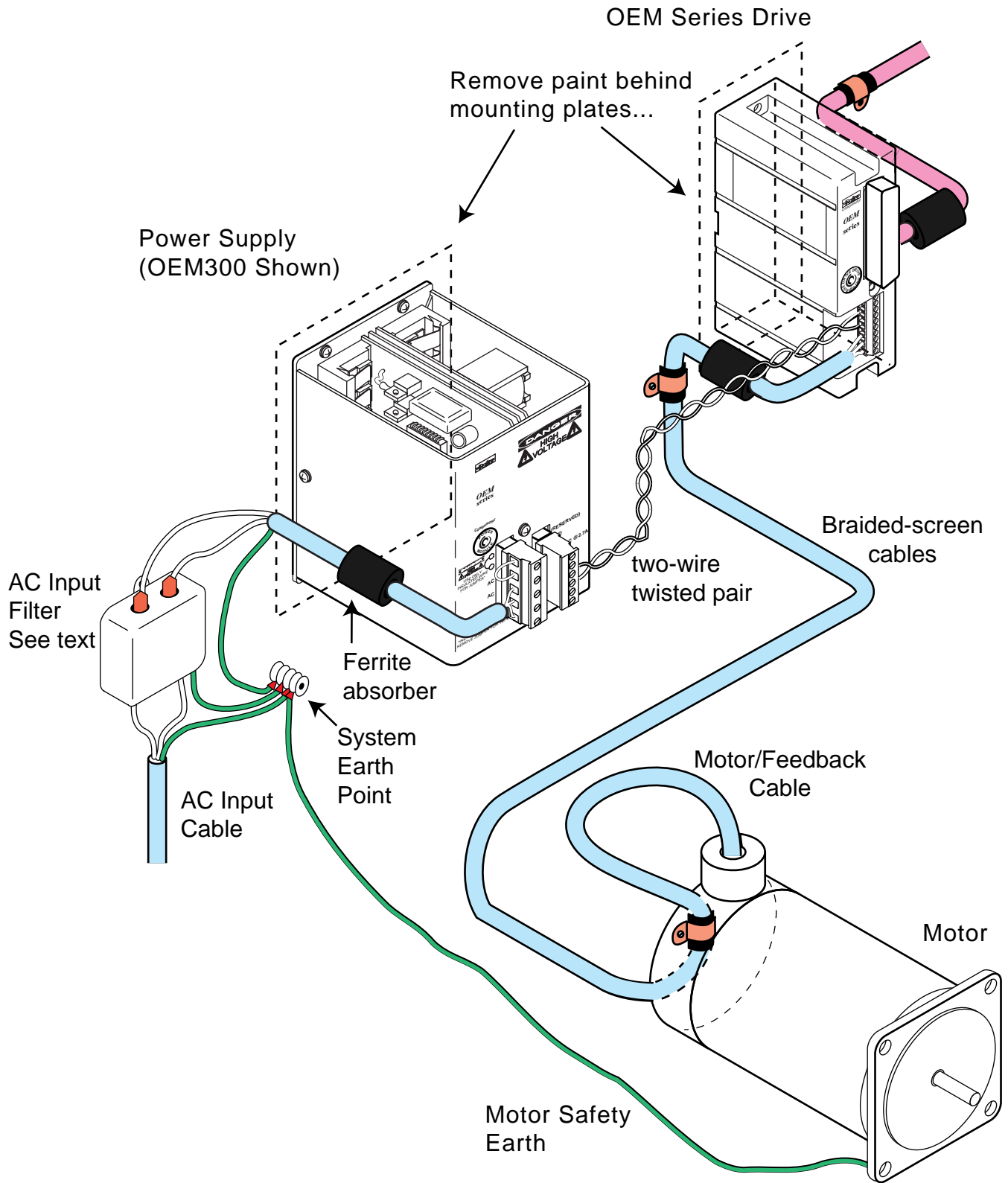


Figure 14 - OEM Series Step / Servo Drive (Controller/Indexer)

AppendixA - AC Input Filters

Compumotor Product	Recommended AC Input Filter	
MODEL 6200, 6250, 6270	CORCOM	3EB1
	SCHAFFNER	FN610-3/06
S,SX	CORCOM	10VV1
	SCHAFFNER	FN670-10/06
ZETA, ZETA6104	CORCOM	10VV1
	SCHAFFNER	FN670-10/06
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
TQ10	CORCOM	10VV1
	SCHAFFNER	FN670-10/06
APEX10/6151	CORCOM	3EB1
	SCHAFFNER	FN610-3-06
APEX20/6152	CORCOM	3EB1
		20AYT6C
	SCHAFFNER	FN610-3-06
		FN258-16-07
APEX40/6154	CORCOM	3EB1
		20AYT6C
	SCHAFFNER	FN610-3-06
		FN258-30-07
		FN258-16-07
		FN258-30-07

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

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