

Appendix E

EMC Installation Guidelines

General Product Philosophy

Compumotor products that were not designed originally for EMC compliance, such as the APEX615n, 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.

The next section of this Appendix lists the recommended AC Input Power Filter for the APEX615n.

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 (617-935-04850) 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.

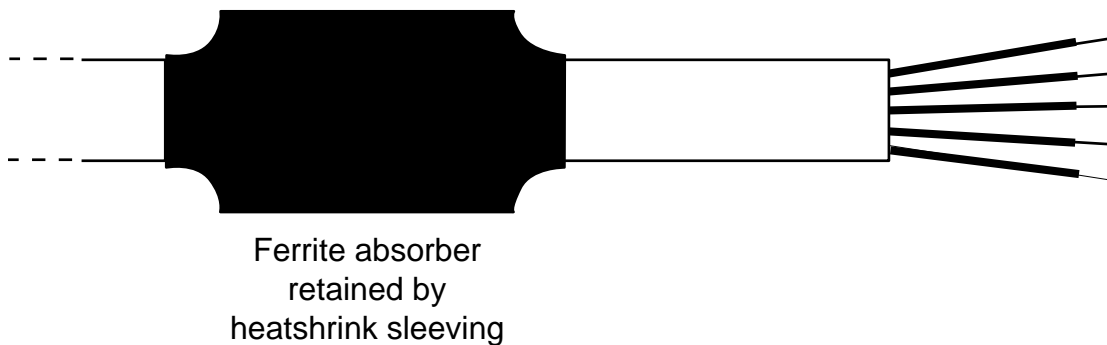


Figure 1 - Ferrite Sleeve Installation

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.

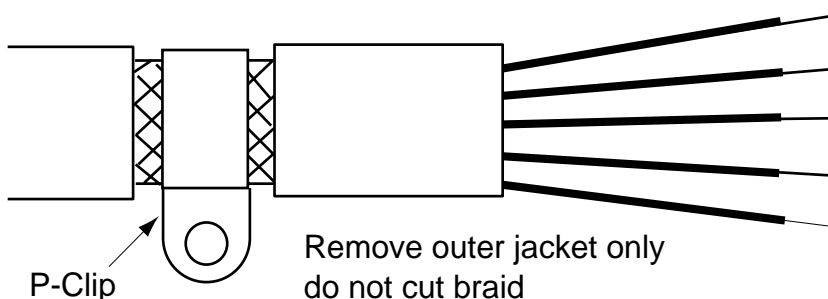


Figure 2 - P-Clip Installation

APEX615n Servo Controller/Drive

Applicable Products: **APEX6151, APEX6152, APEX6154**

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

To insure proper grounding of the APEX615n Controller/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:

| Controller/ Drive | Filter Manufacturer | AC Control Filter 120/240VAC | AC Mains | AC Mains |
|----------------------|------------------------|------------------------------------|---------------------------------|---------------------------------|
| | | | Filter 1-Phase 120/240VAC | Filter 3-Phase 120/240VAC |
| APEX6151 | Schaffner | FN610-3-06 | FN2070-16-06 | Not Applicable |
| | Schaffner | FN2070-3/06 | | Not Applicable |
| | Corcom | 3EB1 | * | Not Applicable |
| APEX6152 | Schaffner | FN610-3-06 | FN258-16-07 | FN258-16-07 |
| | Schaffner | FN2070-3/06 | | Not Applicable |
| | Corcom | 3EB1 | * | 20AYT6C |
| APEX6154 | Schaffner | FN610-3-06 | FN258-16-07 | FN258-16-07 |
| | Schaffner | FN2070-3/06 | | FN258-30-07 |
| | Corcom | 3EB1 | * | 20AYT6C |

* Test Pending

Mount the filter within 2 inches (50mm) of the drive as shown in Figure 4. 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 3 shows the controller/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 4. 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 cablingRemove the motor cable from the standard motor, and replace with a suitable cable described below, see *Motor Cables*.

Permanent cablingCut off cable in excess of approximately 4 inches (10 cm), and attach 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 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 3). 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 APEX615n Controller/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 unshielded 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 4.

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.

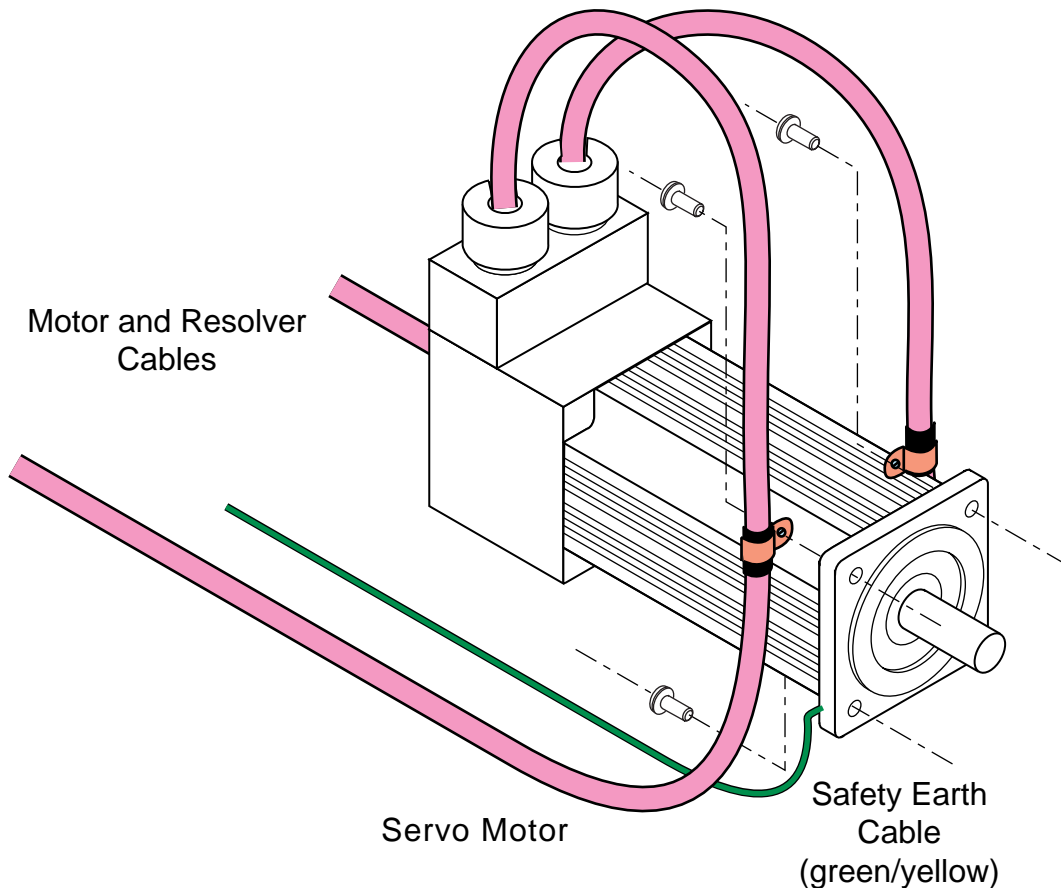


Figure 3: Servo Motor Detail - P-Clip, Safety Earth

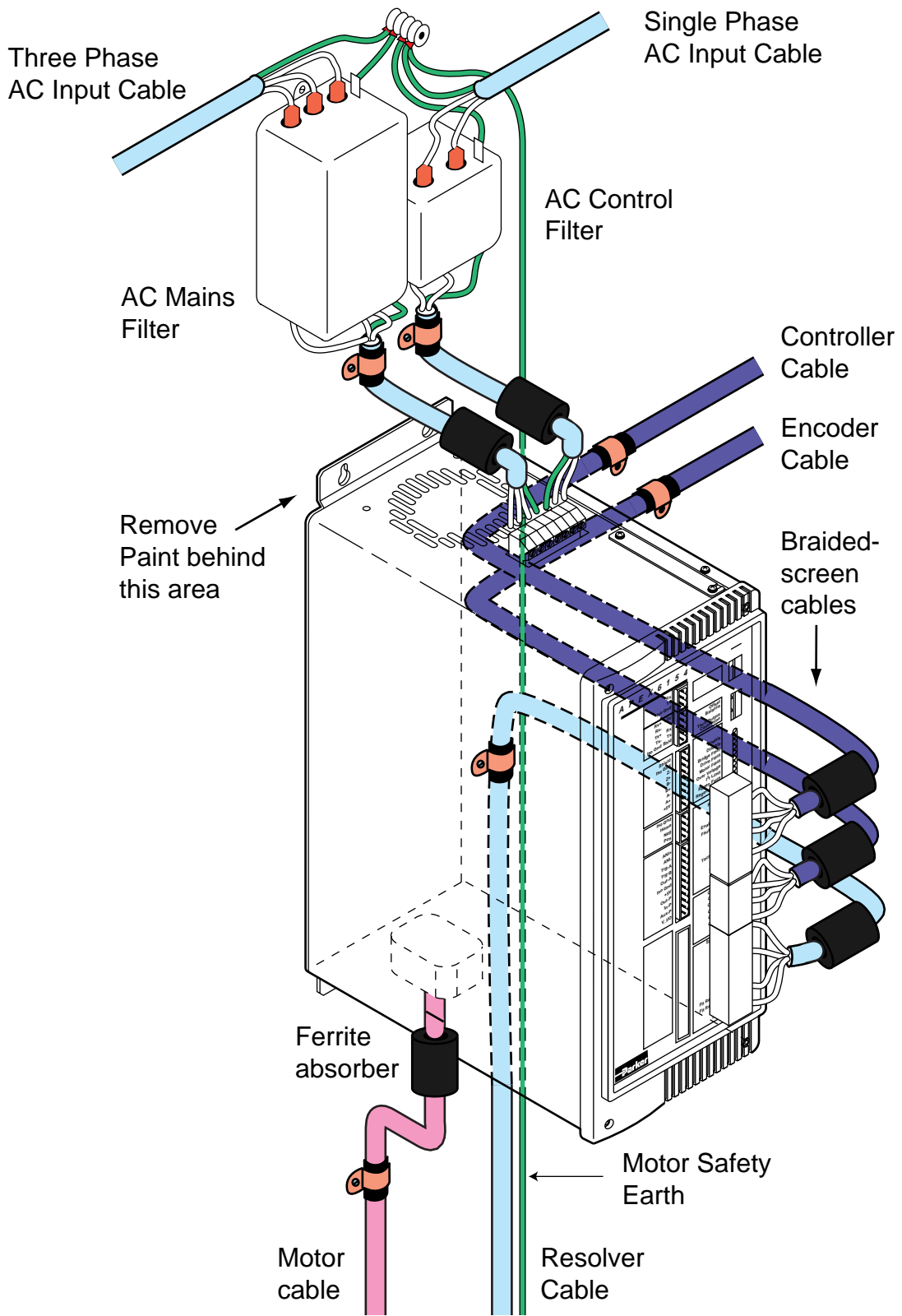


Figure 4 - APEX 615n AC, Motor, Drive Cables and Filters

