

# **EMC INSTALLATION INFORMATION**

***For:***

**Stepper Motors**

**Stepper Drives**

**Brushless Servo Motors**

**Brushless Servo Drives**

**Motion Controllers**

***AUTOMATED MOTION SYSTEMS PTY.LTD.***

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# EMC STATEMENT

This information is based on our interpretation of the *EMC Framework* introduced by the *Australian Communications Authority*. AUTOMATED MOTION SYSTEMS PTY. LTD. recommends its customers should seek independent advice to determine the affect of the *EMC Framework* on their manufactured products.

From January 1999 the *EMC framework* is intended to ensure that most electrical and electronic products sold on the Australian market are constructed so they do not cause excessive electromagnetic interference (EMI) and their performance is not adversely affected by electromagnetic interference.

If you are manufacturing machines for sale within Australia, the *EMC Framework* requires you to certify that the machine conforms to the framework. This may involve having the machine tested by an accredited organisation and labelling it with the C-tick mark.

The following products we supply carry the CE mark which is used in Europe to show that the products conform to a primary European standard similar to those given in the *EMC Framework*. Using these products which carry the CE mark may reduce the risk of EMI, but does not automatically guarantee that your machine will conform to the *EMC Framework* in Australia.

The EMC Framework does not apply to mechanical components that do not carry electrical currents, such as couplings, gearheads, and timing belts and pulleys.

The following motors, drives and other products are designed to be incorporated into other equipment which in itself will be subject to testing to the *EMC Framework* and the products are excluded from the *EMC Framework*. For example, a stepper motor is not requirede to conform to the framework. It is only a component in a system and cannot operate without a power supply, drive card, controller and cabling. The completed machine as a system must conform to the *EMC Framework* and the ultimate responsibility for ensuring the EMC requirements are met rests with the system builder. Usually the Technical Construction File route is taken to ensure a machine complies with the EMC framework.

## Products Affected:

<b>RTA drives</b>	<b>SD stepping motors</b>	<b>S &amp; H controllers</b>
<b>STEBON motors</b>	<b>ELTRA encoders</b>	<b>SIL process instruments</b>
<b>SANYO DENKI brushless AC servo motors and drives</b>		

AUTOMATED MOTION SYSTEMS cannot guarantee that your machine will comply with the *EMC Framework* and is not responsible if it does not comply. The EMI generated will emanate not only from our motors and drives, but also from other components in the system and installation such as cabling, power supplies, controllers, enclosures and earthing. However, with careful design and installation methods we suggest as follows, in most cases EMC compliance can be achieved. Stepper and servo motors and drives inherently produce EMI due to high frequency switching of large currents. Care must be taken with earthing and cabling methods.

These products are intended for installation by technically qualified personnel, according to the appropriate safety procedures laid down by the local supply authority regulations. It should be noted that safety must never be compromised for the purpose of achieving EMC compliance. If a conflict occurs between safety regulations and the suggestions for achieving EMC compliance we suggest below, the safety regulations always take precedence. In most cases, a solution meeting both requirements can be found.

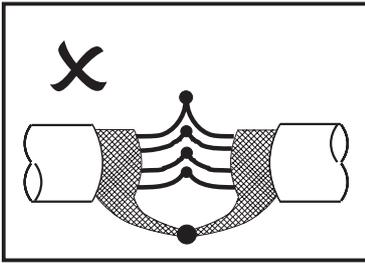
Dean Walker  
(B.E. Hons.)  
Director  
AUTOMATED MOTION SYSTEMS PTY. LTD.  
(A.B.N. 94 009 232 535)

# MOTOR CABLES

Due to the high frequency switching of motor currents, special screened cables must be used for the motors. For a stepper motor, a 5 conductor cable is necessary, 4 for windings and one for earth. For AC brushless servomotors, a 4 conductor cable is necessary, 3 for the 3 phase windings and one for earth. The screen must be high quality braid with a PVC protective outer layer. Metallised plastic or foil screens are not suitable as the shielding is insufficient. Conductor thickness should be chosen depending on motor current.

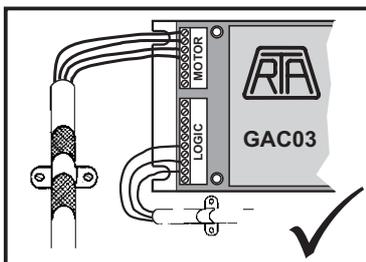
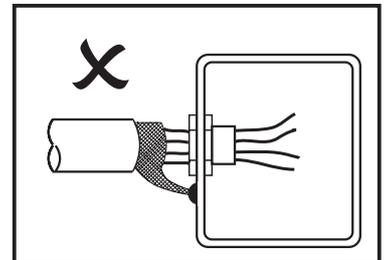
## RECOMMENDED SOURCE

Cable: CONCAB 130-0010-005, 5 core x 1mm<sup>2</sup>  
(Agent: *Edward Keller Australia P/L, Treotham Australia*)



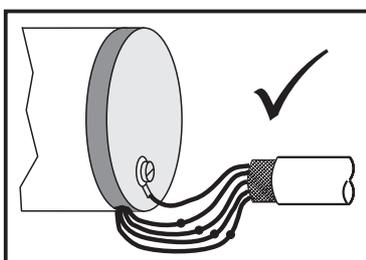
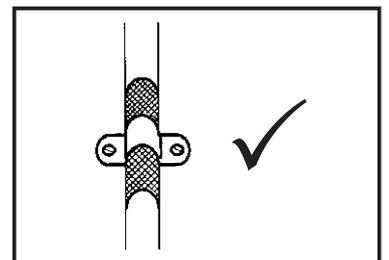
There should be no break in the 360° coverage that the screen provides, except at ends. If a connector must be used, it should be metallic and maintain 360° coverage of the screen.

The cable screen must not be bonded to the enclosure at the point of entry. The whole cable including screen should enter the enclosure and the screen should be grounded internally.



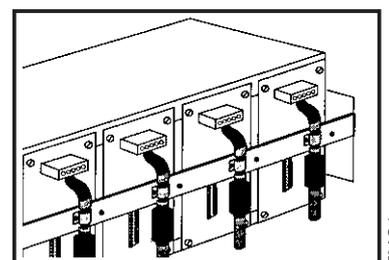
Within the cabinet, all motor cables should lie in the same trunking. They should be separated from low level control signals. Control signals should also be separated from power cables.

Motor cables must be clamped to the panel in the cabinet using 360° coverage such as P-clips or clamps. Remove the protective sleeve at that point so the screen is electrically connected to the panel.



Stepper motors with terminal boxes are better for EMC compliance, but are much more expensive. If motors with unscreened flying leads are used, join these leads to the braided screened cable within 100mm of the motor. Most stepper motors have an earth screw for the earth connection. Connect the earth conductor in the cable to this screw.

When connecting a motor cable to a GAC drive, clamp the screen to the panel using a clip, as close to the drive terminal as possible. When connecting motor cables to a rack containing GMD or GMH drives, a different approach is needed. Construct an earthing bus bar and bolt it to the back of the rack. Clamp the cable screens to this bus bar using cable clamps or P-clips.



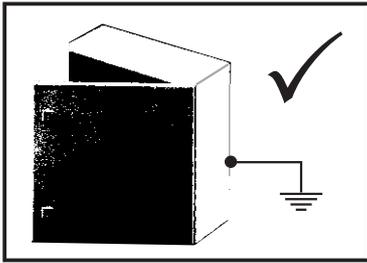
These are recommendations only and we do not guarantee the compliance of any installation.

# ENCLOSURES

To control radiated emission of EMI the drive, power supply, and motion control circuitry must be enclosed in a steel equipment enclosure. This is not only an EMC requirement but is also necessary for operator safety and environmental protection of the equipment. Most enclosures have an internal base plate for attaching devices and a hinged door. The hinged door is often used as a control panel and is fitted with switches, indicators and keypads.

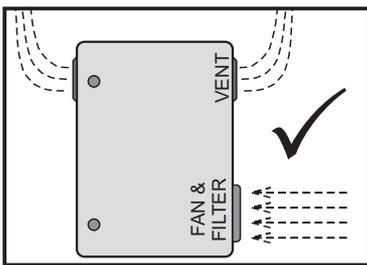
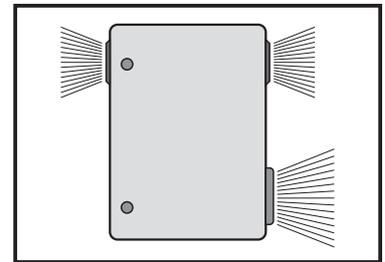
## RECOMMENDED SOURCES

HIMAL, RITTAL, SAREL, KLOCKNER MOELLER, LUME, SCHROFF, VERO



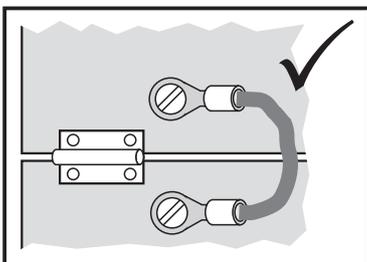
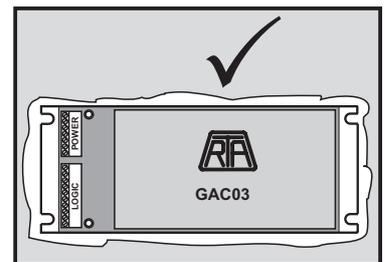
The enclosure must be well earthed. This is achieved by both mounting the enclosure on the metal body of a machine which is earthed and cable connection to electrical earth.

The enclosure must be sealed, noting that any opening or aperture cut for non metallic device fitted into the front panel is a possible source of EMI. Fans and filters which are often made from plastic may be a source of radiated EMI. It may be necessary to use EMC gasket material and gauze to prevent EMI leakage.



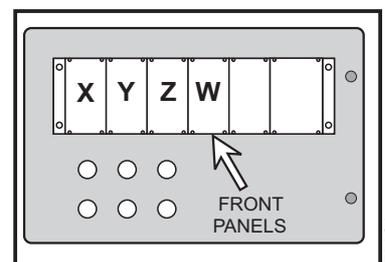
It is still necessary to ensure the drives and transformer all have adequate cooling. Filters may be needed on fans to ensure dust and metal particles do not enter the enclosure.

Drives, motion controllers and filters usually have metal bases and must be mounted onto a conductive base plate which is also grounded. If the panel has a paint finish, the paint must be removed in the areas where equipment is mounted to ensure a low resistance path.



Hinged doors must also be earthed as there may not be low resistance path through the hinge. Most enclosures are supplied with threaded copper earthing studs for this purpose.

Some drives are designed to mount in racks. When the rack is mounted on the front panel of the enclosure, rack front panels must be fitted to ensure EMC compliance. If the rack is mounted wholly inside the enclosure then front panels are not necessary.



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# AC SUPPLY FILTERING

It is recommended that a mains filter is used on the primary side of the transformer used to energise the drive. These are readily available and prevent conducted EMI from transmitting back into the mains supply. They have two terminals on the input side for 'A' and 'N' and two on the output side. Usually a third terminal on the input side is an earth and is internally connected to the metal case. If there is a PLC or motion controller in the same enclosure, do not connect this to the output of the filter. The filter should be used for the drive power supply and electrically noisy devices only.

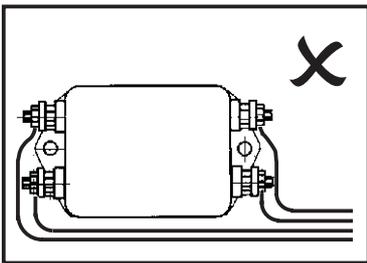
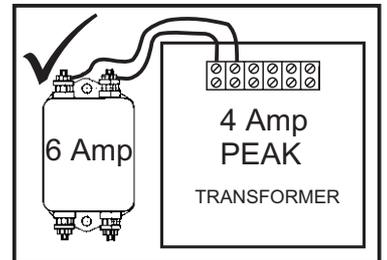
## RECOMMENDED SOURCE

SCHAFFNER Model FN-2070-6-06 (Agent: Westek Industrial Products P/L, VIC)  
 SAMIL Model NFM-205 (Agent: Carinda International P/L, N.S.W.)



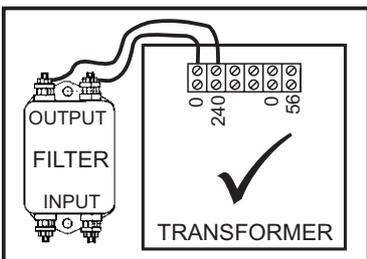
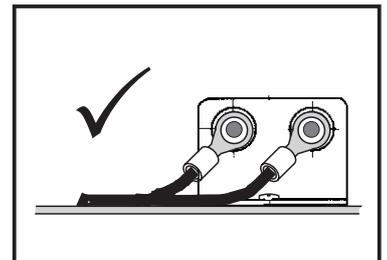
Filters must be mounted on a conductive base plate. Leakage currents can be very high so earthing is important.

Filters must be sized according to current demand.



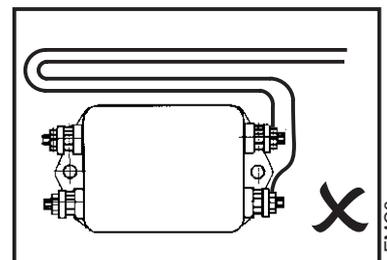
When connecting, keep the input cables away from the output cables.

Run input cables as close to the base plate as possible.



Mount the filter as close as possible to the transformer.

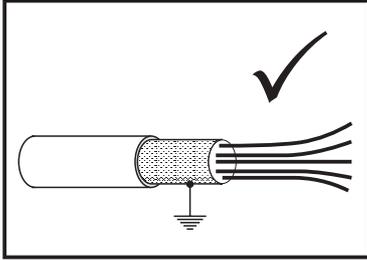
Keep cables as linear as possible, avoiding doubling back as this negates the effect of the filter.



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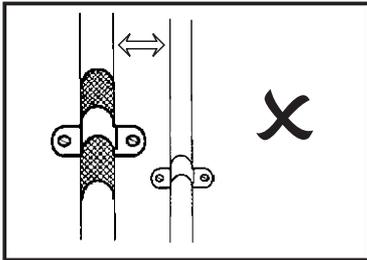
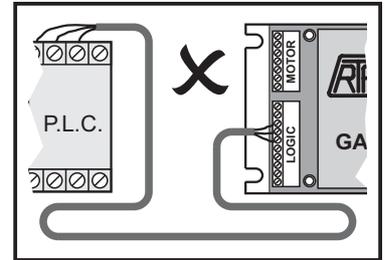
# CONTROL CABLES

The drive in the enclosure will probably be the greatest source of EMI. This is why control signals to the drive such as STEP, DIRECTION, FAULT, DE-ENERGISE, CURRENT REDUCTION must all use screened cable. If STEP signal cables are not screened, interference spikes picked up by the cable may be interpreted as motor steps by the drive, leading to position errors. Cables with foil screens are not recommended as the shielding is inadequate.



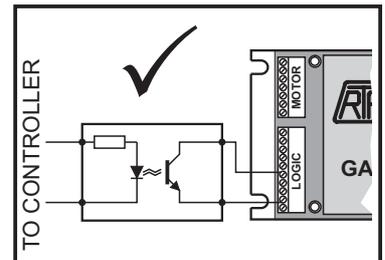
Use metal braided screened cables.  
Connect the screen to ground (0V common).

Keep control cables as short as possible.



Route control cables away from motor and power cables.

If running cables longer than 6 metres, use a buffered alternative to open collector signal, such as relay or opto isolated signals. When using opto isolators for step signals ensure their switching frequency is fast enough and the output switches sufficiently low, below the drive threshold.

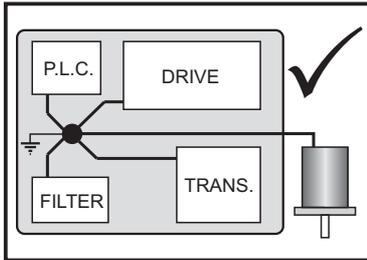


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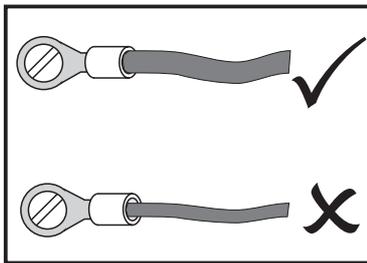
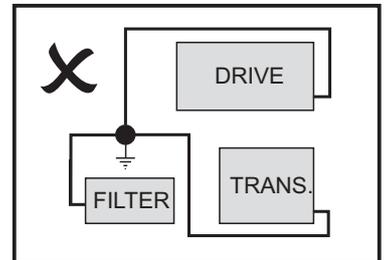
# EARTHING

Whether a system complies with EMC framework depends highly on cabling methods and layout of components. It must be noted that normal safety wiring rules apply and safety considerations take priority over EMC. Each piece of electronic equipment must be wired to an earth point, even if it is already mounted on an earthed panel. Motor and power cable screens must be bolted to the panel using clips.



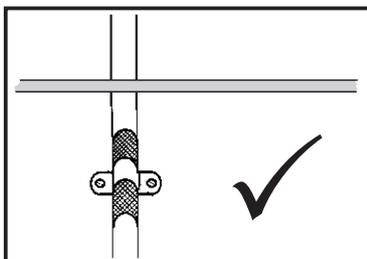
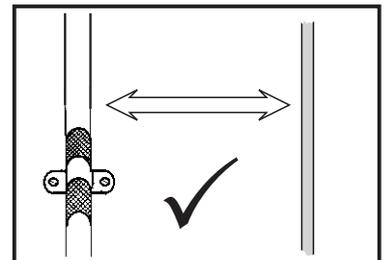
Within the enclosure, where possible, take all earth leads to a common point. This may mean doubling cables in some areas.

Keep the earth cable runs as short as possible. Long earth cables have a higher impedance.



Use low impedance conductors for earth lines. Thin cables have higher resistance than thick cables.

Separate motor and power cables from control cables, preferably 300mm apart. Do not run power or motor cables in parallel with control cables at close proximity.



Avoid crossing power or motor cables with control cables, but if you must do this, do so at 90° to avoid EMI pickup.

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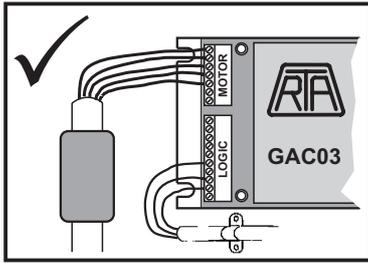
# FERRITE CORES

Motor cables should be fitted with a ferrite core absorber which has high losses at radio frequencies. The ferrite core must be located as close to the drive as possible, before the motor cable leaves the enclosure. Failure to use a ferrite core may result in interference to radio and mobile phone reception.

## RECOMMENDED SOURCE

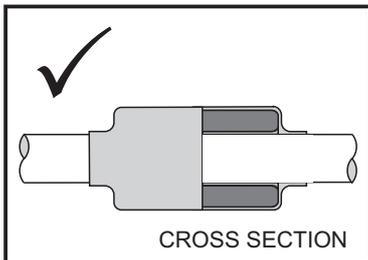
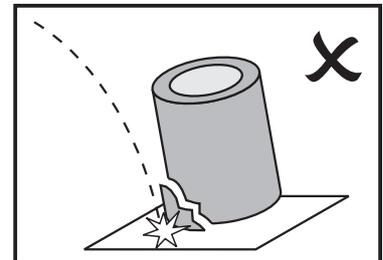
FARNELL ELECTRONICS

Part Number: 449-568 28.5mm long x 10.7mm ID



Locate the ferrite core next to the drive but inside the enclosure.

Ferrites are brittle and shatter easily if dropped on a hard surface. Take care when handling..



Lock the ferrite onto the cable by fitting some 19mm diameter heatshrink over it and shrinking it onto the cable. If heat shrink is not available, use cable ties but these will give no protection to the ferrite..

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