KOLLMORGEN
Because Motion Matters™

EMI Checklist

Summary: This Application Note describes the various methods and combinations of methods for grounding and shielding. Following these recommendations will help minimize or eliminate problems encounters with electrical noise in your application

Details: The following guidelines will help you reduce problems associated with electromagnetic interference (EMI) noise in your application. These recommendations come from the collective experiences of Kollmorgen engineers who have solved many noise problems in the field.

1. Ensure good connections between cabinet components.

   Connect the back panel and cabinet door to the cabinet body using several conductive braids. Never rely on hinges or mounting bolts for ground connections. Provide an electrical connection across the entire back surface of the drive panel. Electrically-conductive panels such as aluminum or galvanized steel are preferred. For painted and other coated metal parts, remove all coating behind the drive.

2. Ensure good ground connection.

   Connect from cabinet to proper earth ground. Ground leads should be the same gauge as the leads to main power, or one gauge smaller.

3. Use Kollmorgen cables.

   Experience has shown that customers who use Kollmorgen power and feedback cables have far fewer problems than customers who build their own, or purchase third party cables not familiar with servo cable requirements. Route the power cables separate from control cables with a minimum of 200mm separation to improve interference immunity. If a motor power cable is used that includes cores for brake control, the brake control cores must be separately shielded. If it is necessary to cross power and control cables, cross at 90 degrees.

4. Ground shielding at both ends.

   Ground all shielding with large areas (low impedance), with metalized connector housings or shield connection clamps wherever possible. For cables entering a cabinet, connect shields on all 360 degrees of the cable. Never connect a simple “pigtail”.

5. With separate mains filters, maintain separation of leads entering and exiting the mains filter (line power filter).

   Locate the filter as close as possible to the point where the incoming power enters the cabinet. If it is necessary for input power and motor leads to cross, cross them at 90 degrees.

6. Feedback lines may not be extended, since the shielding would be interrupted and the signal processing may be disturbed.

   Install all feedback cables with an adequate cross-section per IEC 60204, and use the required cable material to reach maximum cable length.

7. Splice cables properly.

   If you need to divide cables, use connectors with metal backshells. Ensure that both shells connect along the full 360 degrees of the shields. No portion of the cable should be unshielded. Never divide a cable across a terminal strip.

8. Use differential inputs for analog signals.

   Noise susceptibility in analog signals is greatly reduced by using differential inputs. Use twisted pair, shielded signal lines, connecting shields at both ends.

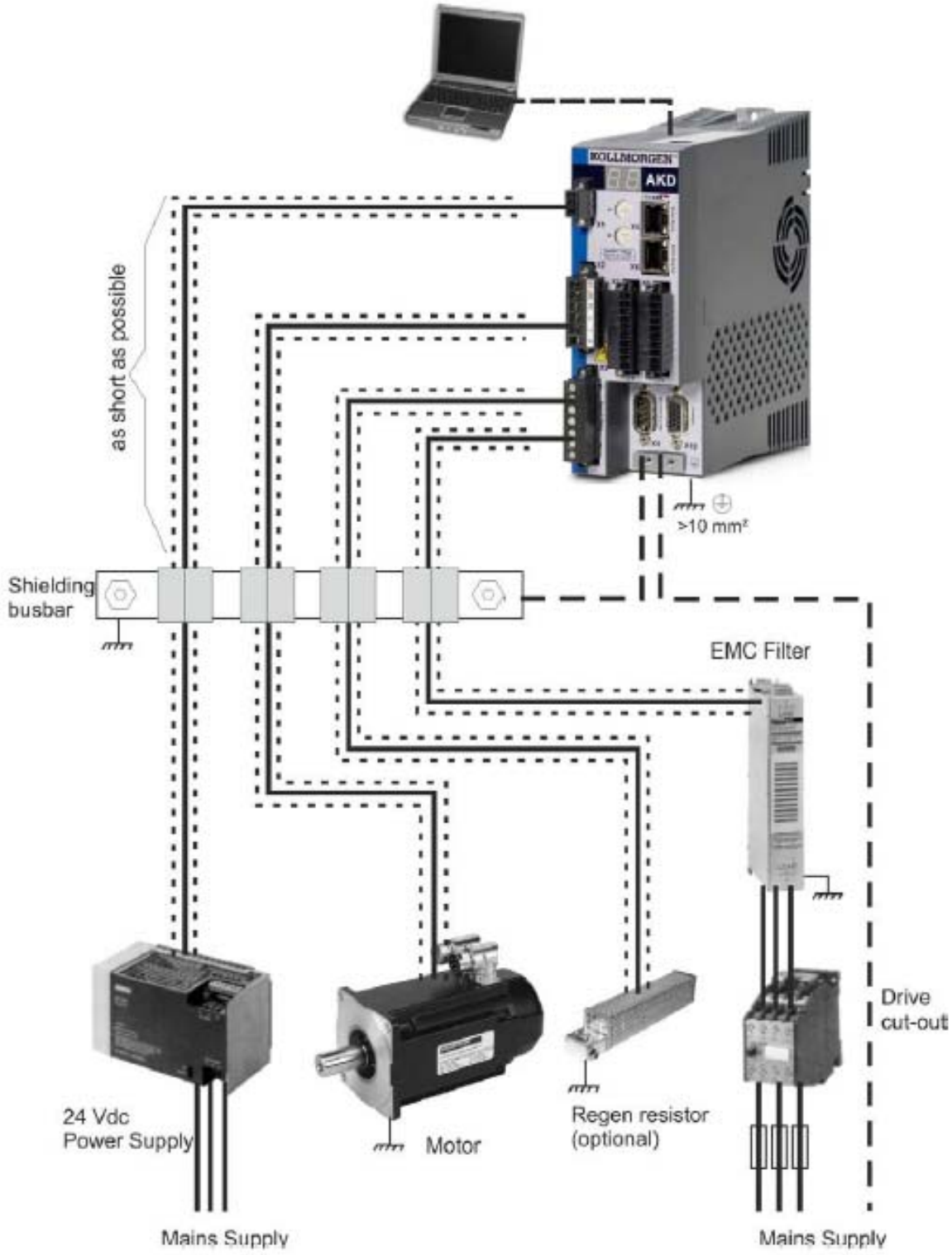
9. Lines between drives and filters and external regeneration resistors must be shielded.

   Install all power cables with an adequate cross-section per IEC 60204 and use the required cable material to reach maximum cable length.

10. Shielding with an external busbar.

    EMC filtering must be done externally by the user if necessary, which requires the use of shielded cables. Kollmorgen recommends a star point shield connection, for example, with a shielding busbar.

Shielding Concept

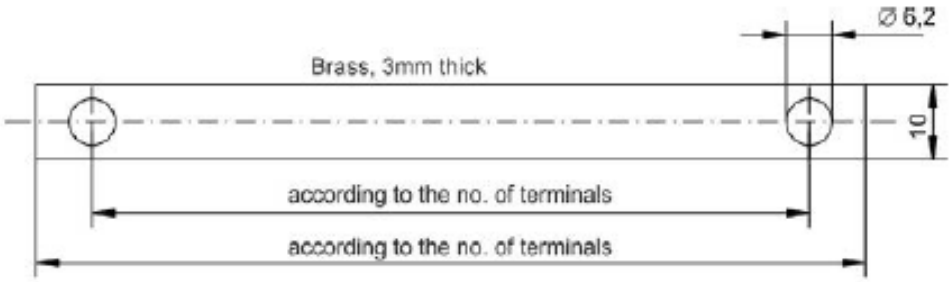


Shielding Busbar Example:

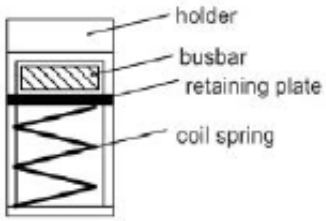
The power cable shields (line in, motor cable, external regen resistor) can be routed to an additional busbar via shield clamps. Kollmorgen recommends using Weidmuller KBLÙ shield clamps.

A possible scenario for setting up a busbar for the KBLÙ shield clamps follows:

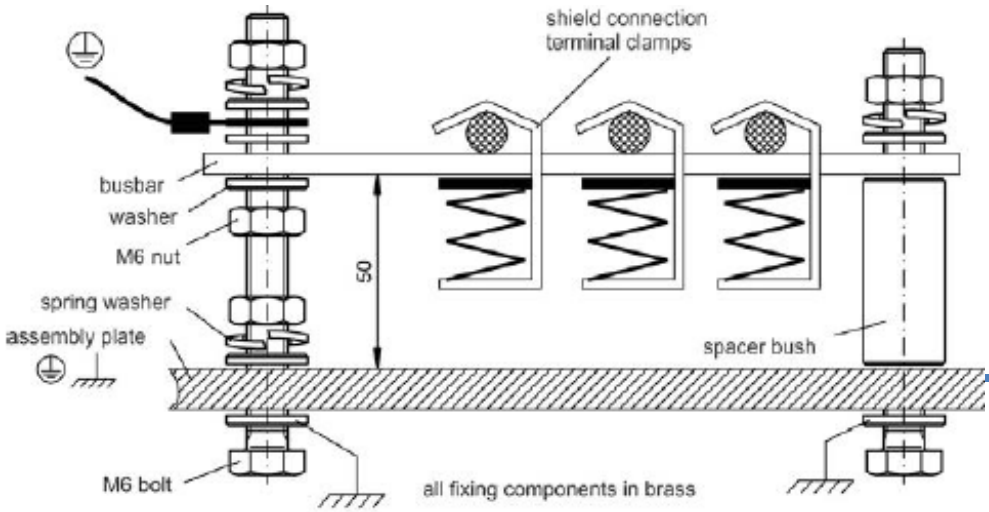
1. Cut a busbar of the required length from a brass rail (cross section 10x3 mm) and drill holes as indicated below. All clamps required must fit between the mounting holes.



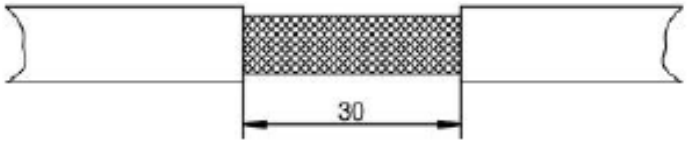
2. Squeeze together the coil spring and the supporting plate and push the busbar through the opening in the holder. **CAUTION** – Use pincers to reduce the risk of injury due to the spring force of the coil.



3. Mount the busbar with the shield clamps fitted on the assembly plate. Use either metal spacer bushes or screws with nuts and accessories to maintain a spacing of 50 mm. Earth the busbar using a single conductor with a cross-section of at least 2.5 mm^2



4. Strip the external cable sheath to a length of approximately 30 mm, taking care not to damage the braided shield. Push the shield clamp up and route the cable to it via the busbar. **NOTICE** – Make sure there is good contact between the shield clamp and the braided shield.



Shielding Connection to the Drive:

You can connect cable shielding directly to the drive by using grounding plates, shield connection clamps, and a motor connector with strain relief and grounding plates.

Grounding Plates should be mounted to the drive as shown below:

AKD-x0306 to x1206 types:
L-shape grounding plate (EU only)

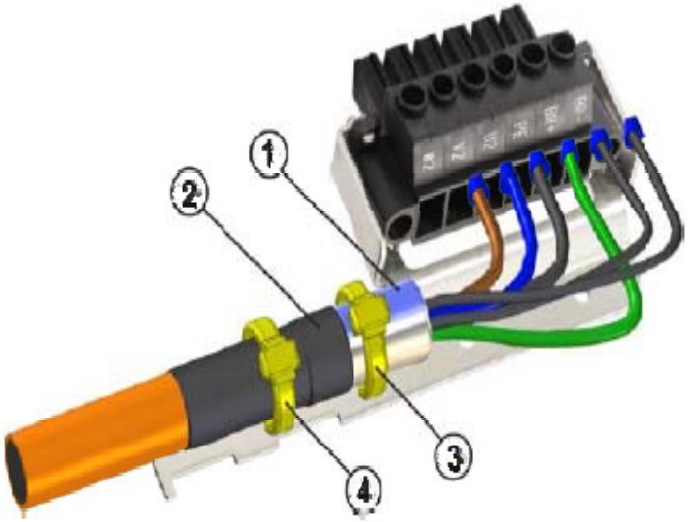
AKD-x02406 & zzz07 types:
flat grounding plate

Shield Connection Clamps hook into the grounding plate to ensure optimum contact between the shield and the grounding plate. Kollmorgen recommends using Phoenix Contact SK14 shield clamps with a clamp range of 6 to13 mm.

Motor Connector X2 with shielding connection

Alternative connection for the motor power connection by mating connector with strain releif. To assemble this for best results:

A) Strip the external cable sheath to a length of approximately 120 mm, taking care not to damage the braided shield. Push the braided shield (1) back over the cable and secure with a rubber sleeve (2) or shrink sleeve.
B) Shorten all the wires apart from the protective earth (PE) wire(Green/yellow) by about 20 mm so that the PE wire is now the longest. Strip all wires and fit with wire end ferrules.
C) Secure the braided shield of the cable to the shroud with a cable tie (3) and use a second tie (4) to fasten the cable over the rubber sleeve.



Wire the connector as show in the connection diagram and plug into the X2 socket on the front of the AKD. Screw the connector in place. This ensures that there is conductive contact over a large surface area between the braided shield and front panel.