

ENGINEERING PUBLICATION

MOTION CONTROL DIVISION

PRODUCT: SIGMA- II & SIGMA-5 SUBJECT: WIRING GUIDELINES

CATEGORY: APPLICATION NOTES

ENGINEER: Bill Leang

DISTRIBUTION: MCD

Summary: Noise reduction wiring and grounding techniques/guidelines are described in this application note. Troubleshooting examples are also provided for reference.

Wiring Guidelines

Use of proper wiring and grounding techniques are important for optimal servo system performance. The following are guidelines for wiring the Yaskawa Sigma II and Sigma-5 servo systems:

1. Keep the motor and power cables separated from the encoder and signal cables (30 cm). Never run signal wires along power cables, or in the same duct or bundle them together.
2. Use shielded encoder cables.
3. Don't introduce ground loops. Ground loops are created whenever a ground reference is established at more than one location.
4. Always connect servomotor frame terminal FG to the servo amplifier FG terminal. If the servomotor is only grounded via the machine, switching noise current will flow from the amplifier through motor stray capacitance.
5. Position the input reference device and noise filter as close to the servo amplifier as possible.
6. Always install a surge absorber circuit in the relay, solenoid, and electromagnetic contactor coils.
7. Do not share the power supply with an electric welder or electrical discharge machine. When the servo amplifier is placed near a high-frequency oscillator, install a noise filter on the input side of the power supply line.

Refer to Section 5.8 in the *Sigma II Series Servo System User's Manual* (Yaskawa publication # YEA-SIA-S800-32.2x) and section 3.7 in the *Sigma-5 Series User's Manual* (Manual # SIEP S80000045x) for more details

Using Noise Filters

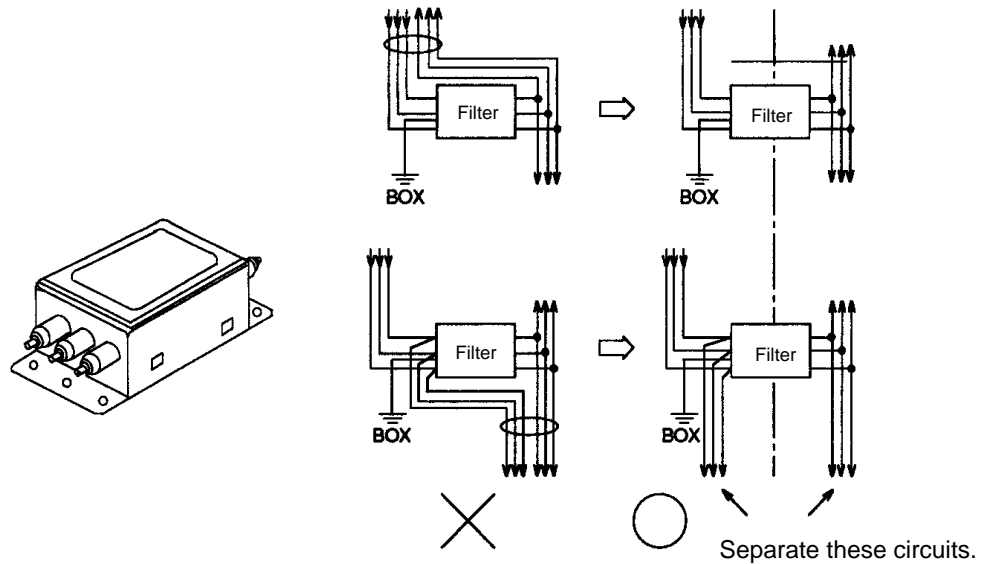
Use a noise suppression filter to prevent noise generated by the power supply line. The filter also reduces the amount of noise generated by the amplifier that are transferred to the power line. Install a noise filter on the power supply line if other peripheral equipment are connected to the same line.

Installation and Wiring a Noise Filter

Incorrect application of a noise filter significantly reduces its benefits. Follow the following instructions for best results.

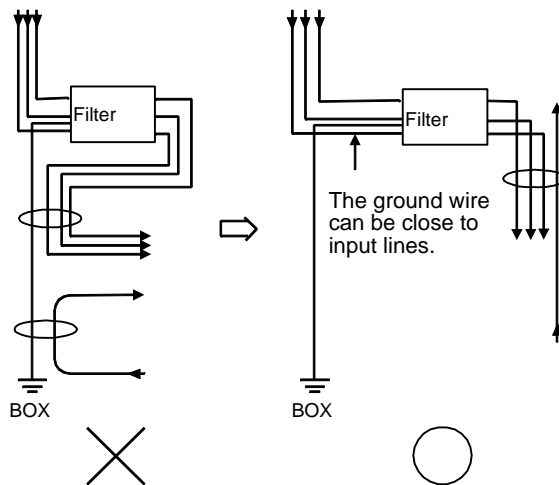
Separate the input lines from the output lines.

Do not put the input and output lines in the same duct or bundle them together.



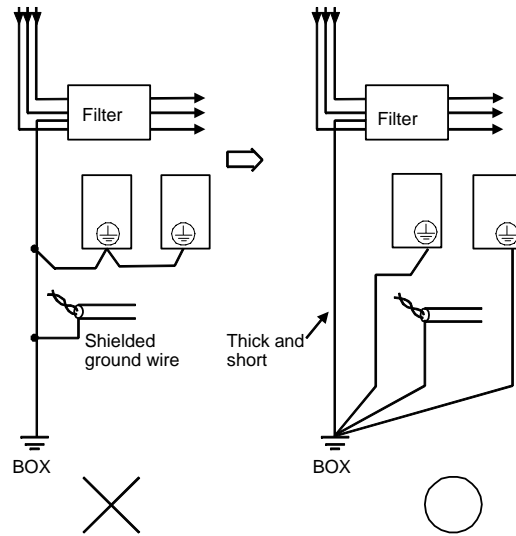
Isolate the noise filter ground wire from the output lines.

Do not put the noise filter ground wire, output lines and other signal lines in the same duct or bundle them together.

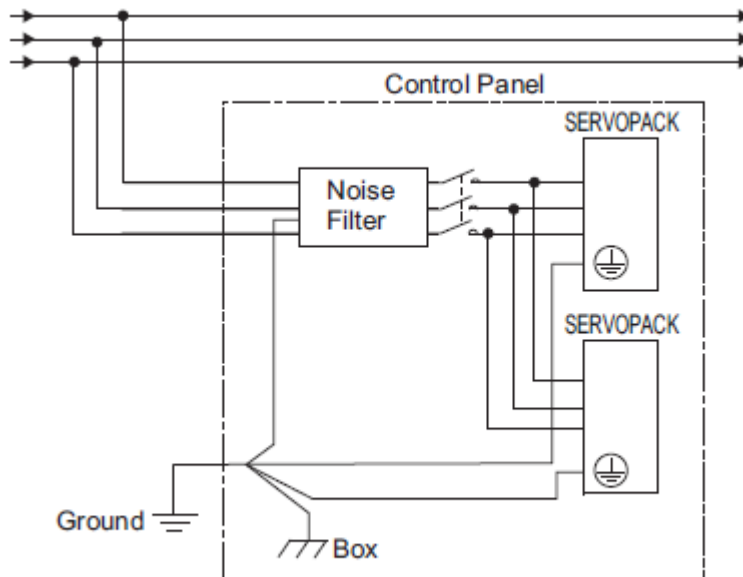


Connect the noise filter ground wire directly to the ground plate.

Do not connect the noise filter ground wire to other ground wires.



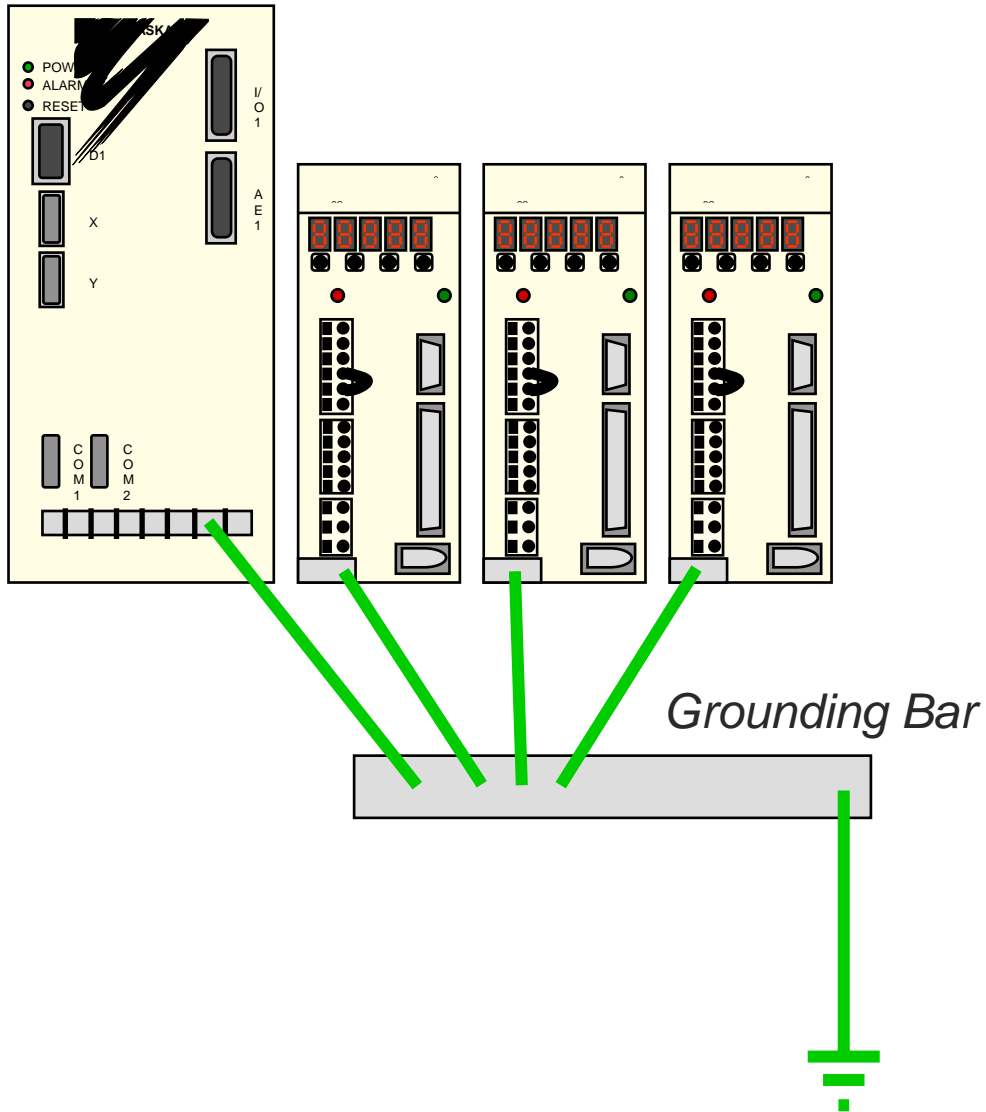
If a noise filter is located inside an enclosure, connect the noise filter ground wire and the ground wires from other devices inside to the ground plate of the enclosure first, then ground these wires.



Grounding

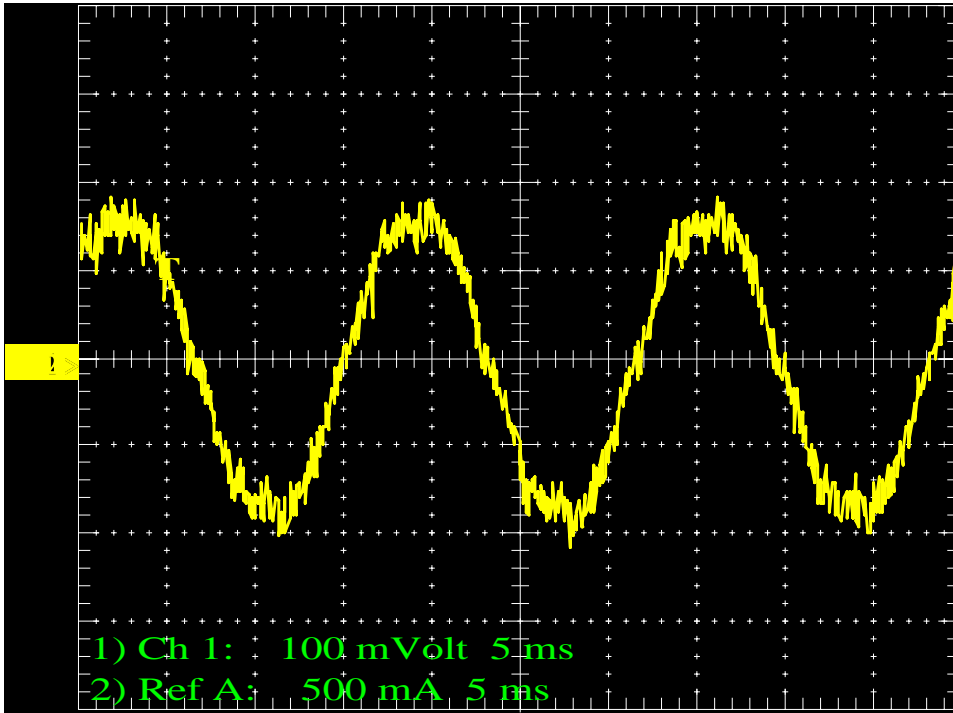
All components in a control system should have their chassis ground points tied together at a single point. This point should then be connected with a single conductor to an earth ground. This will prevent ground loops and insure that all components are properly grounded against shock hazard.

Examples of Single-Point Ground:



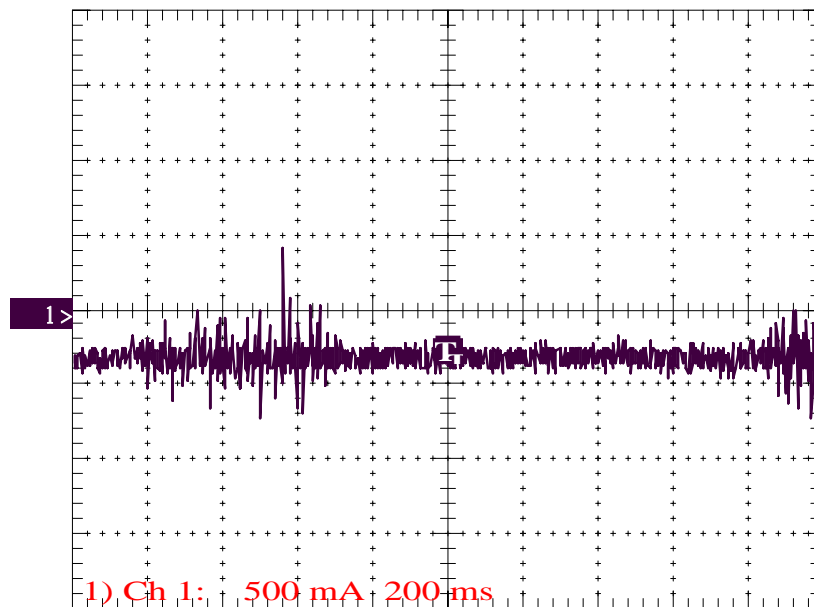


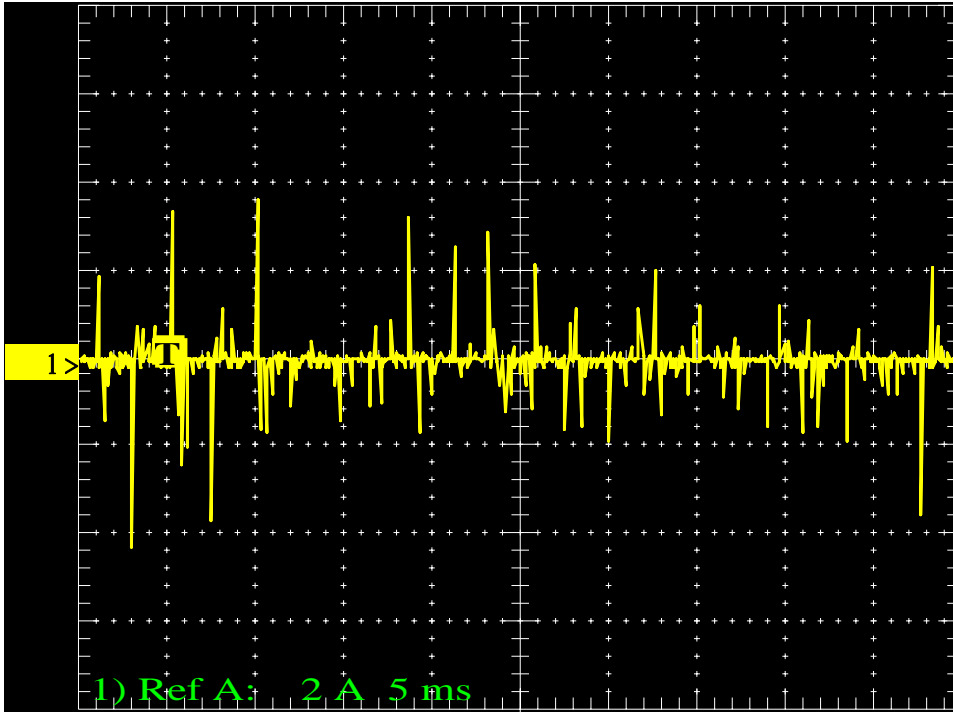
Troubleshooting Grounding Problems - Examples :



The field ground (FG) current of a machine. 60 Hz AC current is flowing in the FG wire. This may be caused by a ground fault somewhere in the building. This condition will cause nuisance tripping of the servo amplifier.

The graph below shows the current flowing in the field ground (FG) wire of the host controller in a machine cabinet. Notice that there is about 300 mA of DC current in this FG wire. The SG is also tied to FG in the cabinet. This condition will cause slow drift of the reference signal to the servo amplifier.





Normal FG current of a 400V Sigma II system at stand-still with Servo ON. This is the common mode current due to the switching of the IGBT's in the amplifier. Based on past experiences, the peak of the current pulses should be less than or equal to 2A during normal operation of a properly grounded servo system.





Test equipment setup and placement are shown in the last two photos. Equipment used to troubleshoot and obtain the above graphs:

- Tektronix THS730A digital storage scope
- Tektronix A622 AC/DC current probe
- Tektronix WaveStar PC-based waveform capture software

Noise on the Reference Input Line

Normally, the signal ground (SG) of the reference input signal should be isolated from frame ground (FG). However, if the reference input is affected by noise, ground the 0V line (SG) of the reference input. If the motor wiring is enclosed in a metal conduit, ground the conduit and its junction box also. All grounds must be made to only one point in the system as illustrated above.