

Application Note



(Sample product shown)

Recommended Cable Grounding Practices

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WRIGHT**

All Cabled Products

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Scope

Best practices for grounding of Curtiss-Wright/Parvus products requiring 38999 cables, whether they be Ethernet switches/routers, mission computer products, or other specialty systems which might be sold with or without system cable harnesses.

Examples of Cable Interfaces

Many interface cables are used in Curtiss-Wright/Parvus systems including USB, CAN-Bus, Serial, Digital I/O, various display cables, 1553, and others. Using the sample product pictured, there are three cables, J1, J2, and J3 which have a variety of interface types. J4 is not used in this app note.



Figure 0) Sample product with 3 of 4 cable harnesses attached to 38999 connectors.

Power Cables, Typically J1

These are usually unshielded cables with three pins including chassis, power and ground (figure 1). Power cables typically do not require additional shielding however a customer may wish to create their own shielded cable as required by their application. Typically a braided shield material would be used for the shielding.



Figure 1) Typical low wattage system power cable, J1.

High Speed Cable Harness

Curtiss-Wright/Parvus does not always group high-speed signals into high-speed vs. low-speed cables, but the sample cable displayed provides a good example of high-speed interface types which require different shielding for the various interfaces: These interfaces include three USB3.0, one USB2.0, two (unshielded) gigabit Ethernet GbE, and three audio interfaces (see figure 2). All of these interfaces (except for GbE) include an individual ground (GND) point inside of the 38999 connecting to that cable's foil shielding and are left floating at the other end. Some applications may warrant an AC-coupled end termination for one or all of these interfaces but that is left for the cable user to determine. The two GbE interfaces are CAT5E not requiring a shield due to the magnetic coupling requirement of the Ethernet standards combined with fully twisted differential pairs consistent with CAT5E cable.



Figure 2) Cable High Speed Data Interface Cable.

Cable Harness with HDMI, CAN-bus and Serial Interface Examples

This cable harness includes a fully shielded HDMI interface (see more detail below) along with several unshielded low-speed interfaces including four serial port cables (RS232/RS422/RS485), two CAN-bus cables, and a GPIO cable. Each of the unshielded interfaces include a GND wire, but no shielding. It is up to the customer to provide shielding for any of these interfaces as needed.



Figure 3) Miscellaneous Interfaces Cables.

Additional Information for HDMI Shielding

An HDMI interface will have braided shield around all of the differential pairs in the HDMI interface but also foil shielding for each differential pair within the cable. The HDMI cable is manufactured this way. All shielding is connected within the 38999 connector (and not the other cable end) and different GND pins are provided for each differential pair's shield connection. See figure 4.

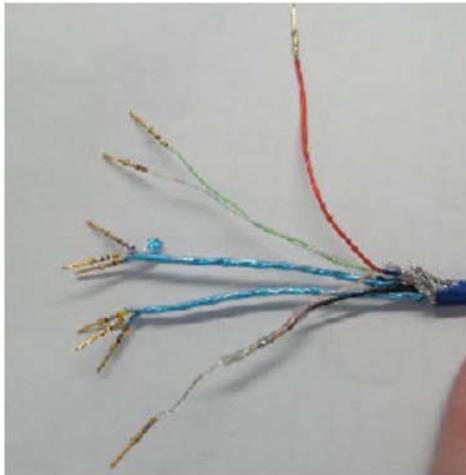


Figure 4) Additional detail for an HDMI shielded interface.

General Cable Shielding Recommendations.

*In most cases, for shielded cables Curtiss-Wright/Parvus recommends shielding connected to CHASSIS or ground at only one end of the interface cable. In all cases, if the other end of the interface cable is to be terminated at all, it should be terminated with a capacitor between the cable shield and chassis ground to avoid unintentional current loops. The value of the capacitor selected by the end user. Again, only one end of the cable shielding is connected to chassis and that end is at the device. *Connecting both ends to chassis is likely to create undesirable current loops and contribute to overall EMI issues.**

Considerations for Aircraft

In some cases (as per customer requirements) it is permissible to ground whole cable shield harnesses at both ends, but only if the inner cable interfaces contain separate grounded shields connected to each at one end only. Such a case may occur when the system is being installed on an aircraft and is usually done for lightning strike considerations. Considerations include:

- 1) Lightning is more likely to strike aircraft than ground vehicles.
- 2) System failures on expensive aircraft are more likely to cause serious safety issues.

In aircraft, for purposes of lightning protection, the entire airframe is to be considered GND. Therefore the outer-most shielding of a cable harness is often grounded on both ends. Yes, this can create current loops across the length of the cable and back through the aircraft frame which will contribute to EMI but this is exactly what is needed when a lightning strike happens. To maintain signal integrity the *internal* harness interfaces must still be shielded with a connection at only one end.

Yes, double shielding can add a little weight to the aircraft, but the double shielding is the only way to achieve both objectives of 1) lightning strike mitigation and 2) avoid current loops which can contribute to EMI degrading signal integrity.

Parvus does not supply double shielded cables and this is up to the customer to build their own cables as required.



Figure 5) Recommended Chassis Ground for Double-Ended Cables.

The red arrow in figure 5 shows the best location for chassis ground cable shielding attachments. This location is the best for attaching braided outer shield wires because of proximity to the power connector; power connector J1 has additional connections to chassis inside of the device which help with radiated emissions, hence the impedance of this path is the lowest possible. Provide a secure connection to this mounting hole as directed in your product mounting instructions. Then if it is your intention to ground the cable at both ends, a similar low-impedance path will need to be identified on the other end of your cable.

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