Conext™ Core XC Series, 0G-XC-BB: Modbus/RS485 Wiring

AP-XC-104
Revision A

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

This document is in addition to, and incorporates by reference, the relevant product manuals for Conext Core XC Series grid tie photovoltaic inverters. Before reviewing this document, you must read the relevant product manuals. Unless specified, information on safety, specifications, installation and operation is as shown in the primary documentation received with the product. Ensure you are familiar with that information before proceeding.

Failure to follow these instructions will result in death or serious injury.

Introduction

Most Conext Core XC Series Grid Tied Photovoltaic Inverters communicate using Modbus/RS485 connections to a monitoring and control system that is located in the same photovoltaic (PV) box as the inverter. This arrangement provides isolation for the inverter electronics.

Occasionally the inverter communication lines are routed outside of the boundary of a PV box and connected to devices such as array boxes. If fiber optic cables are used to carry the signals between the boxes, isolation can be maintained. If copper wiring is used to carry the signals, however, the wiring may conduct power surges (from lightning or ground differentials between nodes) back into the inverter.

This Application Note explains the communication cabling requirements for Conext Core XC Series grid tie photovoltaic inverters at sites where the inverter is connected to devices outside of the PV box via copper wiring.

Related Documents

- *Modbus over Serial Line Specification and Implementation Guide, version 1.02, Modbus.org, December 2006.*
- *Conext Core XC Series Grid Tie Photovoltaic Inverter, 0G-XC-BB, Planning and Installation Manual (document number: 990-5738)*

Schneider Electric

- *IEC 61000-4-5. Electromagnetic compatibility (EMC) –Part 4-5: Testing and measurement techniques –Surge immunity test. 2nd edition. International Electrotechnical Commission, 2005.*
- *ANSI/ TIA/ EIA-485-A-1998 Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*

Safety

In the Conext Core XC Series, the Modbus/RS485 communication circuits are to be connected only to external Modbus/RS485 circuits that meet the requirements for both:

- Safety Extra-Low Voltage (SELV)
  SELV is a common designation that refers to a circuit in which the voltages within the circuit and from the circuit to ground have values that are not a shock hazard, under both normal and single fault conditions. This is achieved by the design of the circuits, and by maintaining protective separation (fault-tolerant insulation and isolation) between the SELV circuits and all hazardous voltage circuits, both within the inverter and in the installation.
- Decisive voltage class A (DVC-A)
  DVC indicates the minimum required level of shock hazard protection for the circuit. The DVC-A classification means that under both normal and single fault conditions the voltage levels of the circuit are:
  - for AC circuits:
    - voltage levels ≤ 25 VAC_{rms} (up to ≤ 50 VAC_{rms} for max. 0.2 s under fault condition)
    - voltage levels ≤ 35.4 VAC_{pk} (up to ≤ 71 VAC_{pk} for max. 0.2 s under fault condition)
  - for DC circuits:
    - voltage levels ≤ 60 VDC_{mean} (up to ≤ 120 VDC_{mean} for max. 0.2 s under fault condition)

  DVC-A circuits are not a shock hazard and they must be kept isolated and insulated from all hazardous voltage circuits with voltage levels higher than those described above in order to maintain the DVC-A classification.

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- Connect only to Safety Extra Low Voltage (SELV) and DVC-A circuits.
- The circuits provided for use with external communications and control equipment are designed to provide isolation from neighboring hazardous circuits within the inverter. The communications and control circuits within the Conext Core XC Series are floating from ground and are classified as SELV and DVC-A. They must be connected only to other SELV and DVC-A circuits in a manner which maintains all the circuits within SELV and DVC-A limits and prevents ground loops. Separate conduit entries must be provided for the communications and control circuits and the PV array circuits and all AC circuits.
- Physical and electrical separation of the communications and control circuits from non-SELV and non-DVC-A electrical circuits must be maintained both within the inverter and external to the inverters.

Failure to follow these instructions will result in death or serious injury.

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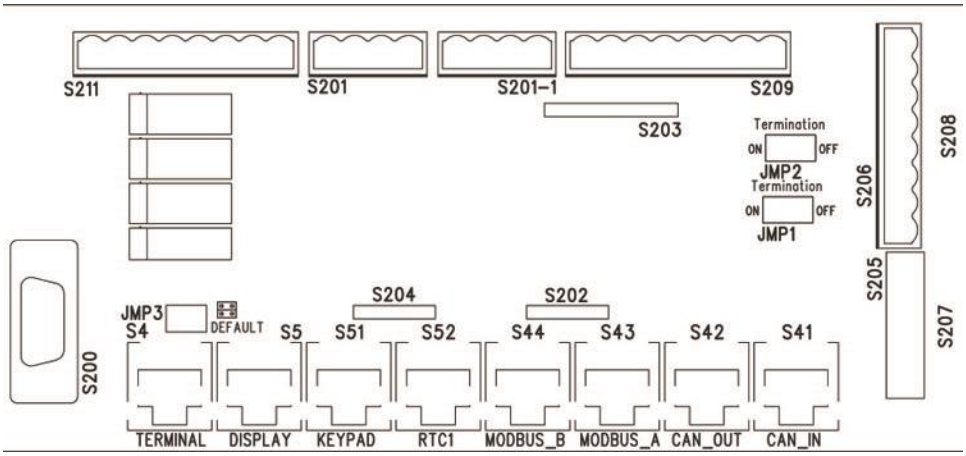
Inverter Connections

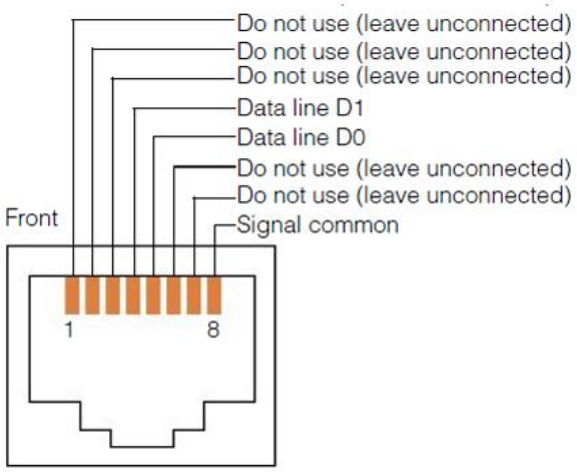
The Modbus/RS485 connectors in the Conext Core XC Series are located at S43 and S44 on the communications (CMX) board on the left wall of the DC cabinet, (see *Figure 1*).

Figure 1 Modbus/RS485 connectors



The details of the Modbus connections are shown in *Figure 2*.

Figure 2 Modbus connection details



The shield of the RJ45 male connector must be connected to the cable shield (drain). Do not connect the RJ45 connector shield to the signal common.

System Cable Shield and Signal Common Grounding

NOTICE
EQUIPMENT DAMAGE The signal common and the cable shield must each be connected directly to protective ground and at only one point for the entire bus. **Failure to follow these instructions can result in equipment damage.**

The **signal common** must be connected directly to the protective ground and must be connected at only one point for the entire bus. In general, this connection point is on the master device or on its tap.

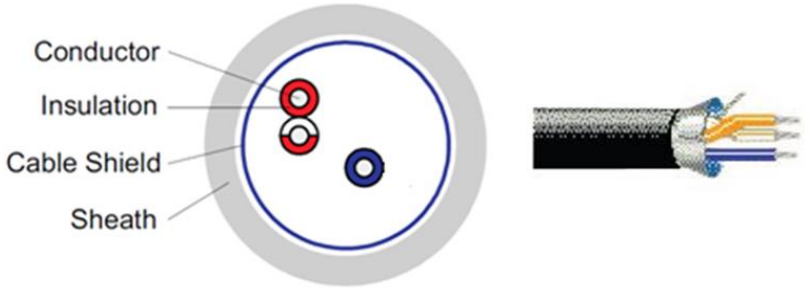
The cable shield must be connected directly to the protective ground and must be connected at only one point for the entire bus. The shield drain wire must not be used as a signal common.

In the system diagram shown in Figure 1 on page 1, the preferred point of connection of the cable shield and signal common to the protective grounding is at the SCADA (Supervisory Control and Data Acquisition) device.

Cabling

A 1.5 pair cable that is suitable for an EIA-485/Modbus/RS485 application is illustrated in *Figure 3*. The illustrated cable is Belden 3106A Multi-Conductor - EIA Industrial RS485 PLTC/CM.

Figure 3 Cable example



To properly select a cable, the system designer must consider factors such as local codes, environmental conditions (such as temperature), location (such as cable tray as opposed to direct burial), and the requirements for other equipment connected on the Modbus/RS485 network. Many cables meet the recommendations of the EIA-485 standard, including the shielded Cat 5 cable used in Ethernet network installations.

For more information please refer to the Modbus and EIA-485 standards (see *Related Documents on page 1*).

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Document Number: AP-XC-104 Revision A **Date:** March 2017

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