2240001 Power Supply Quick Start Guide

2G Engineering

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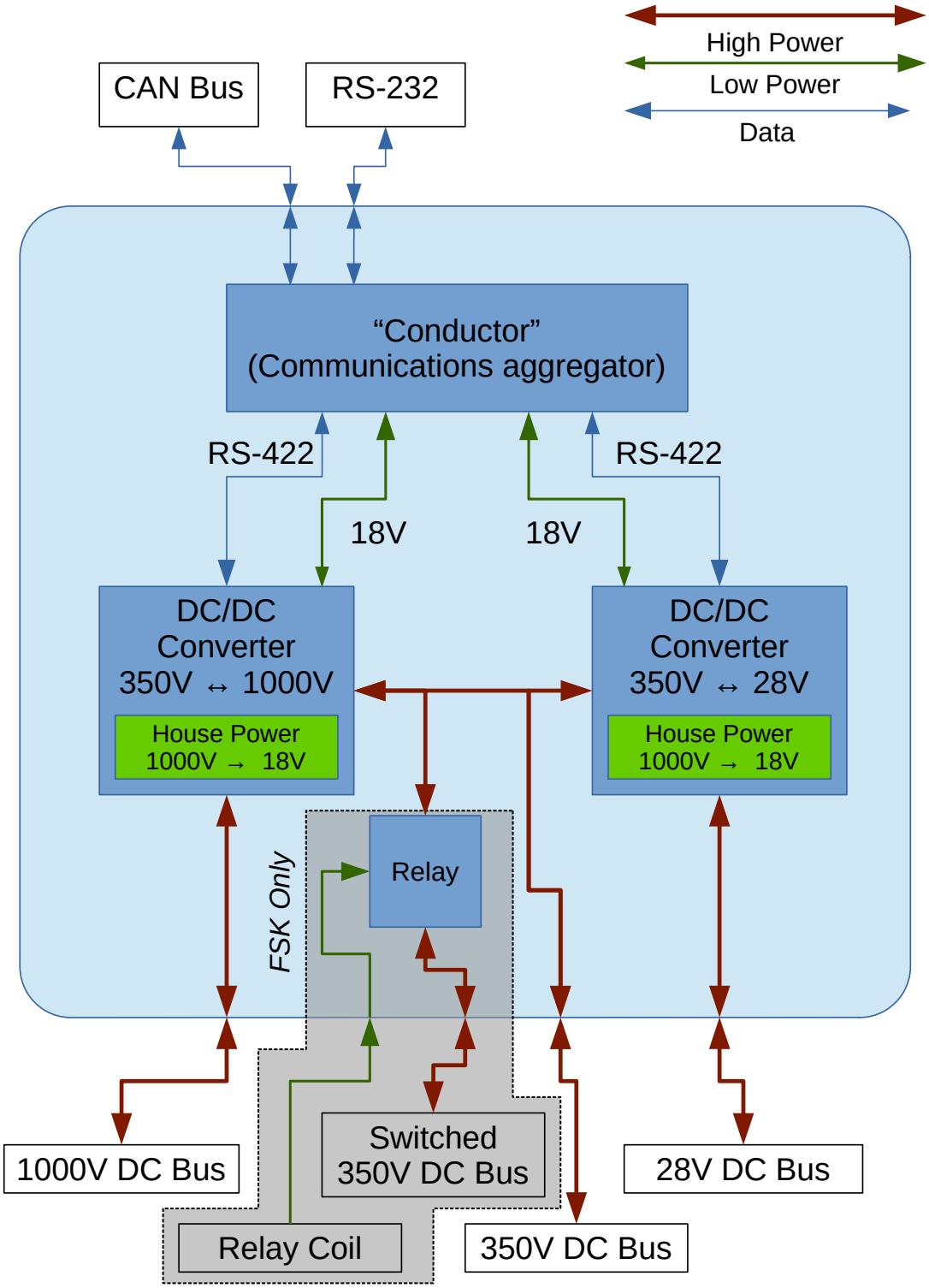
REVISION HISTORY

REV	DATE	Editor	DESCRIPTION
-	1-16-2024	JL	Initial Release

Block Diagram



Theory of Operation

The power supply system is designed to facilitate bidirectional transfer of DC power along a tether by converting two 350V nominal busses to a 1000V nominal tether bus. Two power supply boxes are provided per system, one for each end of the tether. The boxes are configured as either EHM (base station) or FSK (remote). Each box is made up of two bidirectional DC/DC converter modules, one in a 350 to 1000V configuration, and one in a 350 to 28V configuration. Communications between these modules and the outside world is facilitated using a communications aggregator board called the conductor.

The 1000V module in the EHM is configured to regulate the tether at a constant ~850V DC. This allows for approximately 150V of drop across the tether when the FSK module is sourcing power. It will automatically move energy either from the 1000V bus to the 350V bus or from the 350V bus to the 1000V bus, as necessary, to maintain tether bus regulation. This implies that the 350V bus, in turn, needs to be able to both source and sink power.

The 1000V module in the FSK is configured to regulate its 350V bus at a constant 350V. It will automatically move energy either from the 1000V bus to the 350V bus or from the 350V bus to the 1000V bus, as necessary, to maintain local 350V bus regulation. This allows for use with a 4-quadrant source/load such as a motor-generator. From the perspective of the FSK, the 1000V bus is more or less unregulated; It is allowed to rise as high as the fault shutdown limit of the module (typically 1075V), or fall as low as the undervoltage lockout limit (typically 775V). Under normal operating conditions, it should be constrained by the EHM bus regulation and the resistance of the tether.

The 28V modules in both the EHM and FSK are configured as unidirectional DC/DC converters with constant current/constant voltage (CC/CV) control. This makes them suitable for use as battery chargers for lithium-ion batteries.

The conductor is used to bridge communications between the two DC/DC converter modules and the outside world. It combines communications from multiple devices into a single Modbus endpoint and provides protocol bridging for CANopen access.

Hardware Setup

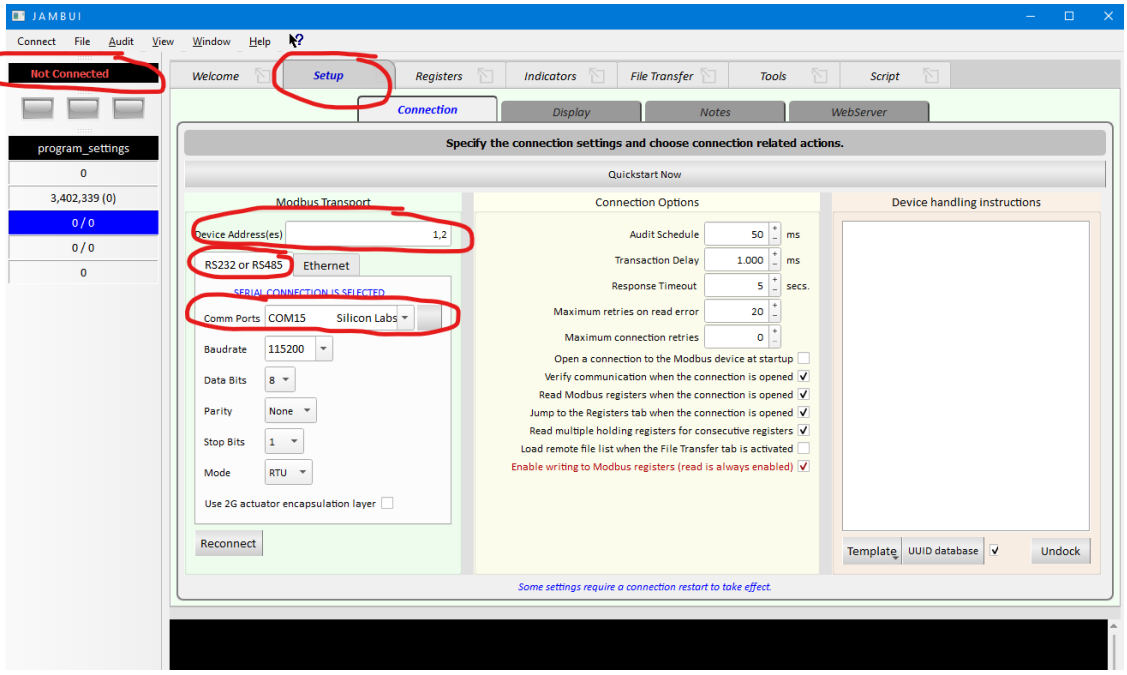
1. Connect RS-232 and/or CAN data lines from the appropriate connector on the power supply to an RS-232 port or PCAN-USB adapter.
2. Connect DC power to the 350V DC pins (EHM variant) or the 1000V DC pins (FSK variant).
3. Assuming there are no faults in the system, the ~1000V bus (EHM variant) or 350V bus (FSK variant) will be energized 15 seconds after the DC input is applied. The 28V bus will be energized 25 seconds after the DC input is applied.
4. 15 seconds after power is applied, the power supply should be ready to accept a connection from JAMBUI or another Modbus or CANOpen client.

Connecting

Using RS-232

- Open the JAMBUI application.
- Switch to the Setup tab.
- Make sure “RS232 or RS485” is selected as the communications type.
- Select the RS-232 COM port from the “Comm Ports” dropdown menu in JAMBUI.

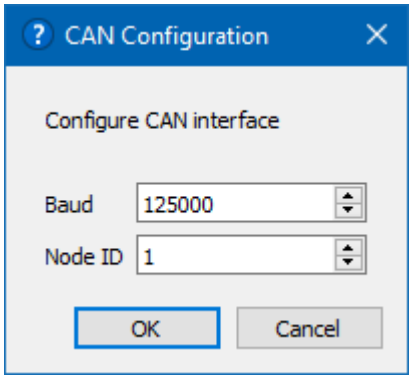
- Enter the Modbus address that you wish to connect to. The power supplies default to Modbus address 1.



- Follow the instructions in the “Using JAMBUI” section to open the connection and begin communication with the power supply.

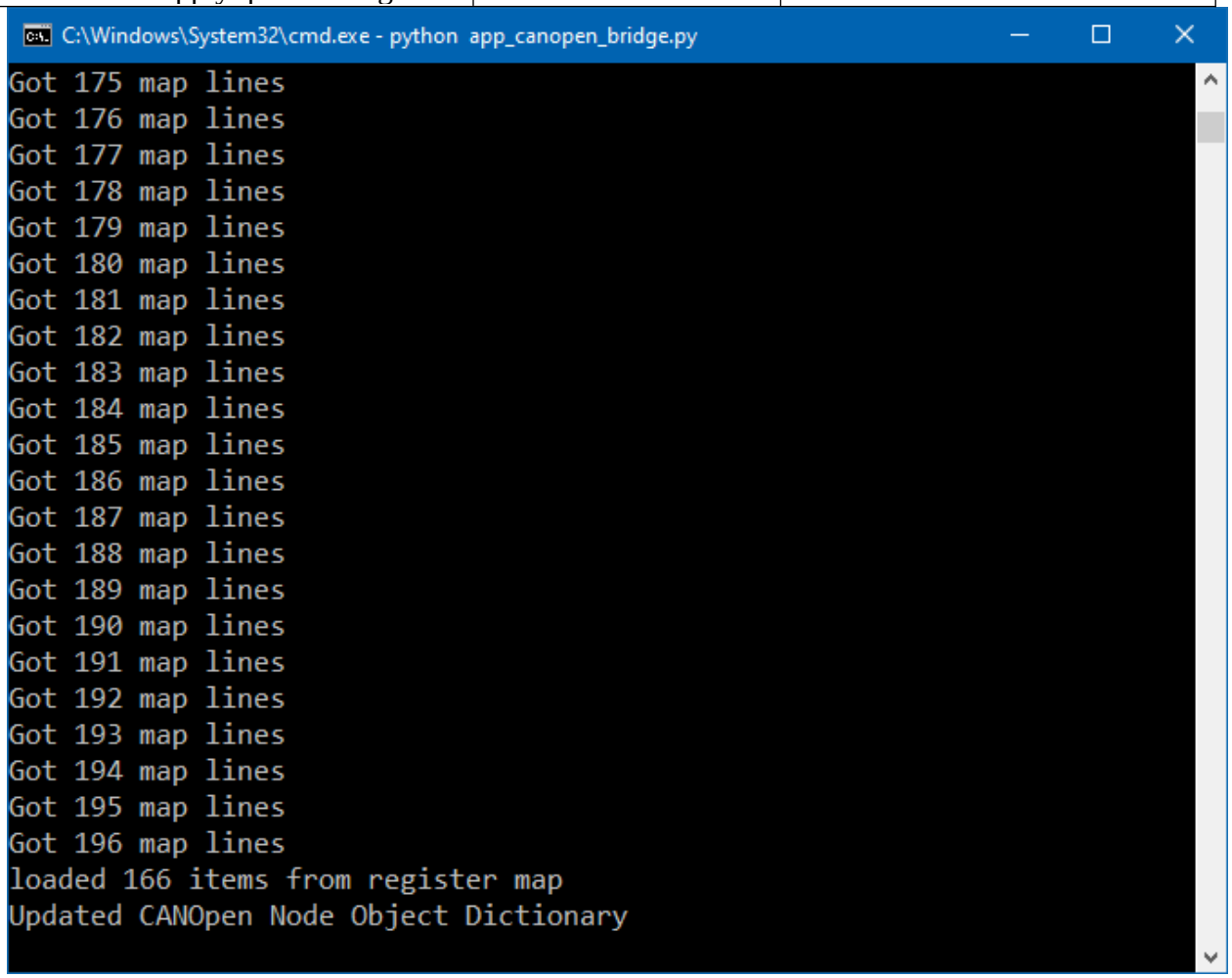
Using CAN

- Make sure the unit is connected to the PCAN-USB adapter, and the PCAN-USB adapter is connected to your computer.
- Open the CANOpen-Modbus bridge application. You will see the following CAN Configuration window:

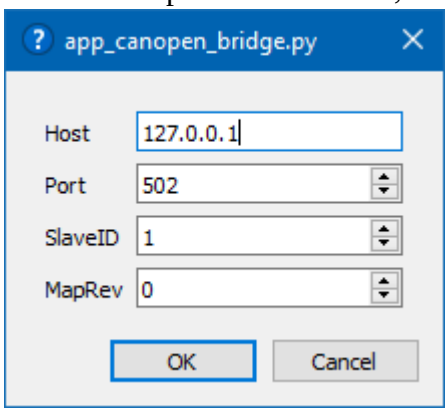


The default settings in this window correspond with the unit’s factory default settings. You should only need to modify this configuration if you have changed the unit’s CAN settings.

- The console window will report progress as it downloads the register map from the device. This will take about 30 seconds. Once connected, you can save a copy of the register map using JAMBUI to speed up future connections.



- Once the map has been loaded, the following app configuration window will be displayed:

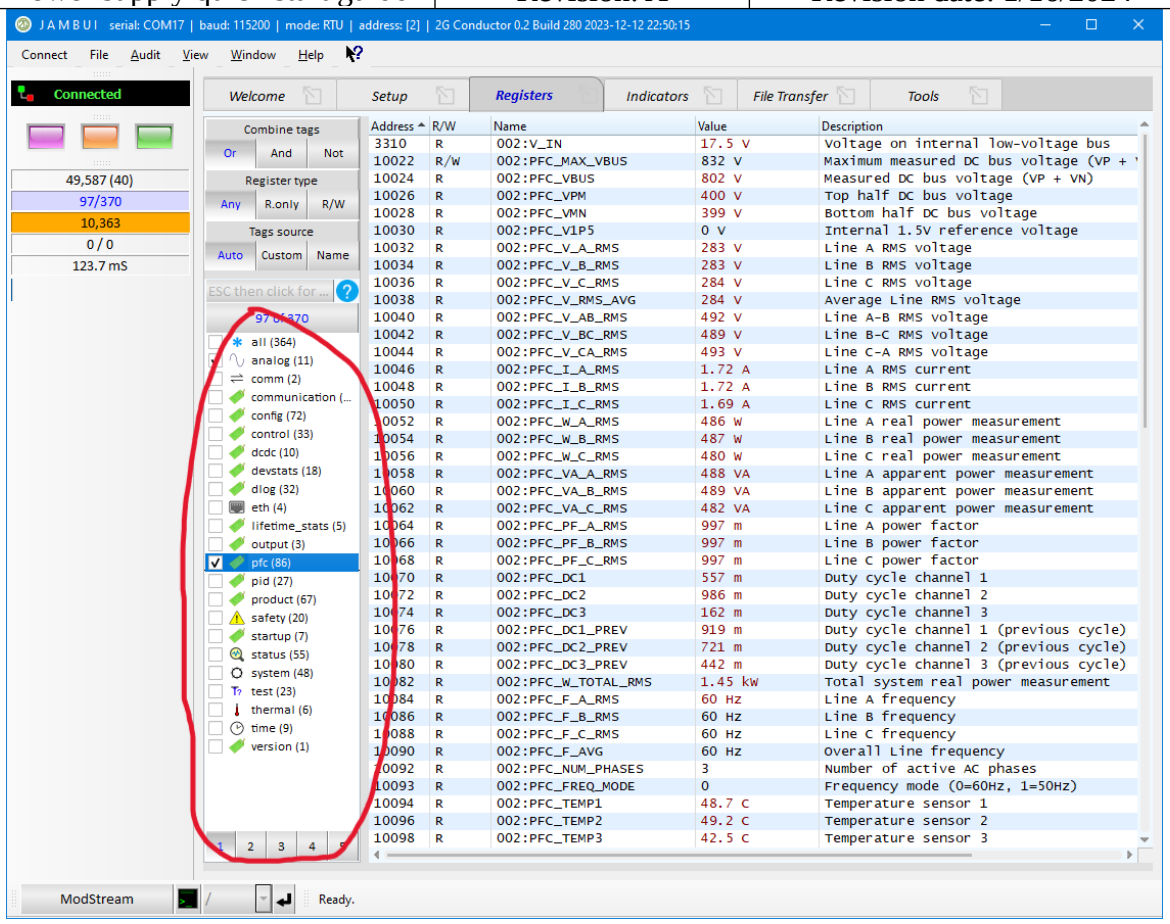


You should be able to click OK here without making any changes.

- Open the JAMBUI application.
- Switch to the Setup tab.
- Make sure “Ethernet” is selected as the communications type.
- Enter 127.0.0.1 for the IP address, and 502 for the port.
- Follow the instructions in the “Using JAMBUI” section to open the connection and begin communication with the power supply.

Using JAMBUI

- Once the connection settings have been entered, click the “Not Connected” button to open the connection. If everything is connected and configured correctly, JAMBUI will begin communication with the selected device(s) and start downloading the register map(s). A bar at the bottom of the window will indicate the progress of this operation.
- Once the connection has completed and all the registers have been downloaded, JAMBUI will automatically switch to the Registers tab.
- The registers tab shows a list of all registers on the connected devices. By default, registers are sorted by their register number.
    - Registers on the power supply are subdivided by subsystem. All registers associated with the 1000V-350V power supply stage will be prefixed with either “EHMPSU1KV” or “FSKPSU1KV”, and all registers associated with the 350V-28V power supply stage will be prefixed with either “EHMPSU28V” or “FSKPSU28V”. Registers from the power supply without one of these prefixes are related to the power supply conductor subsystem and are generally irrelevant for customer use.
    - Each register has one or more category tags associated with it. Registers can be filtered based on these category tags by selecting them from the list on the left half of the window. Category tags that may be of interest for customer use include:
        - analog – for feedback on the operation of the DC/DC subsystem, such as voltages and current.
        - dcdc – for controlling the operation of the power supply outputs and feedback on system state.
        - config – for configuration of power supply operating parameters.
    - In addition to reducing the amount of visual clutter on the screen, selecting fewer registers will also increase the update rate, giving you a better view of what the system is doing.
    - If you would like to show individual registers, rather than an entire category, you can do this by pressing the F4 key and selecting the “Persist” checkbox for the register(s) of interest, then pressing F4 again.



Power Supply Control & Configuration

Please see the separate document “2240003 DC-DC Converter Module User Manual” for documentation of the control and configuration registers for the individual DC/DC modules.