Operation

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Qualified Persons

⚠ WARNING

Only qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive parts of electrical equipment
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed
- The proper use of special precautionary techniques, personal protective equipment, insulated and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read this Instruction Sheet

NOTICE

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating the S&C Three-Phase Battery Charger. Become familiar with the Safety Information and Safety Precautions on pages 3 and 4. The latest version of this publication is available online in PDF format at **https://www.sandc.com/en/contact-us/product-literature/**.

Retain this Instruction Sheet

This instruction sheet is a permanent part of the S&C Three-Phase Battery Charger. Designate a location where users can easily retrieve and refer to this publication.

Proper Application

⚠ WARNING

The equipment in this publication is only intended for a specific application. The application must be within the ratings furnished for the equipment. The S&C Three-Phase Battery Charger is typically located in the PM operator enclosure for S&CPad-Mounted Gear or the CCU enclosure for the Scada-Mate® and Scada-Mate® SD Switching System.

Warranty

The warranty and/or obligations described in S&C's Price Sheet 150, "Standard Conditions of Sale—Immediate Purchasers in the United States," (or Price Sheet 153, "Standard Conditions of Sale—Immediate Purchasers Outside the United States"), plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute the immediate purchaser's or end user's exclusive remedy and a fulfillment of the seller's entire liability. In no event shall the seller's liability to the immediate purchaser or end user exceed the price of the specific product that gives rise to the immediate purchaser's or end user's claim. All other warranties, whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150 (or Price Sheet 153), and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 (OR PRICE SHEET 153) IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150 (OR PRICE SHEET 153).

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these various signal words:

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards that will likely result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices that can result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that can result in minor personal injury if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that can result in product or property damage if instructions are not followed.

Following Safety Instructions

If any portion of this instruction sheet is unclear and assistance is needed, contact the nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website **sandc.com**, or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE

Read this instruction sheet thoroughly and carefully before installing the S&C Three-Phase Battery Charger.

Replacement Instructions and Labels

If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

⚠ DANGER

S&C Pad-Mounted Switchgear and Scada-Mate and Scada-Mate SD Switching Systems operate at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS**. Access to S&C switchgear must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT**. Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "CAUTION," "WARNING," or "DANGER" labels.
5. **OPENING DOORS.** Do not force doors open. Forcing a door open can damage the latching mechanism. If optional key interlocks are provided, correctly position the interlocks so the doors can be opened.
6. **CLOSING AND LOCKING DOORS.**
   - Doors must be securely closed and latched, with padlocks in place at all times unless work is being performed inside the enclosure.
   - For pad-mounted gear, Mini-Rupter® Switches have switch-operating shaft access covers located on the sides of the pad-mounted gear enclosure. They must be closed and padlocked at all times unless the switches are being operated.
   - For PME pad-mounted gear, do not close a door on a TransFuser™ Mounting in the **Open** position with a fuse in the mounting. The door will strike the fuse pull-ring, which will interfere with door-closing. The door may be closed if the fuse is removed from the mounting.
   - For PMH pad-mounted gear, do not close a door on a fuse in the **Open** position. The door will strike the fuse pull-ring, which will interfere with door-closing. The door may be closed if the fuse is removed from the mounting.
7. **OPERATING MECHANISM AND BASE**. Scada-Mate and Scada-Mate SD Switching Systems contain fast-moving parts that can severely injure fingers. Do not remove or disassemble operating mechanisms or remove access panels on the Scada-Mate and Scada-Mate SD switch base unless directed by S&C Electric Company.
8. **ENERGIZED COMPONENTS.**
   - Always assume both sets of power terminals on any Mini-Rupter Switch or fuse in pad-mounted gear are energized unless proved otherwise by test, by visual evidence of open-circuit conditions on both sets of terminals, or by observing both sets of terminals are grounded.
   - For Scada-Mate and Scada-Mate SD Switching Systems, always consider all parts live until de-energized, tested, and grounded.
   - The Three-Phase Battery Charger contains the following energized components:
     - 300 Volts in pins 1 through 10 in the J3 connector
     - 30 Volts for the other wire connection terminals (pins 11 through 20 in the J3 connector, J2 connector, and J4 connector)
9. **BACKFEED**. Mini-Rupter Switches and fuses in pad-mounted gear may be energized by backfeed.

TABLE CONTINUED ►

⚠ DANGER

S&C Pad-Mounted Switchgear and Scada-Mate and Scada-Mate SD Switching Systems operate at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

10. **GROUNDING**.
    - For pad-mounted gear, make sure enclosure is properly grounded to the station or facility ground.
    - After the pad-mounted gear has been completely disconnected from all sources of power and tested for voltage, install suitable grounding cables in all compartments before touching any device to be inspected, replaced, serviced, or repaired in the high-voltage compartments.
    - For Scada-Mate and Scada-Mate SD Switching Systems, before energization and at all times when energized, the switch base and control unit enclosure must be connected to suitable earth ground at the base of the pole in accordance with the S&C instruction sheet furnished with the device.
11. **SWITCH POSITION.**
    For pad-mounted gear:
    - Always confirm the **Open/Close** position of Mini-Rupter Switches by visually observing the position of the switch blades.
    - Switches may be energized by backfeed.
    - Switches may be energized in any position.

    For Scada-Mate and Scada-Mate SD Switching Systems:
    - Always confirm the **Open/Close** position of load-interrupter switches by visually observing the indicator.
    - Interrupters, terminal pads, and disconnect blades on disconnect-style models may be energized from either side of the Scada-Mate and Scada-Mate SD switch.
12. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.

Overview

The purpose of this document is to instruct users how to operate the Three-Phase Battery Charger to supply power to communication devices such as radios, protection and control devices, and motor loads while the gear is energized and in service. When source power is lost, a 24-Vdc battery pack is used to allow for communications and operations during an outage.

The charger can be power by three S&C Voltage Sensors (refer to the gear's wiring diagram for compartment location) or an externally supplied 120-Vac source. Refer to Appendix D on page 30 for additional functional details.

This document also instructs users on how to identify the status of the battery and to be familiar with the use the graphical user interface (GUI) computer application software to monitor the gear. Table 1 on page 7 provides the description of the components.

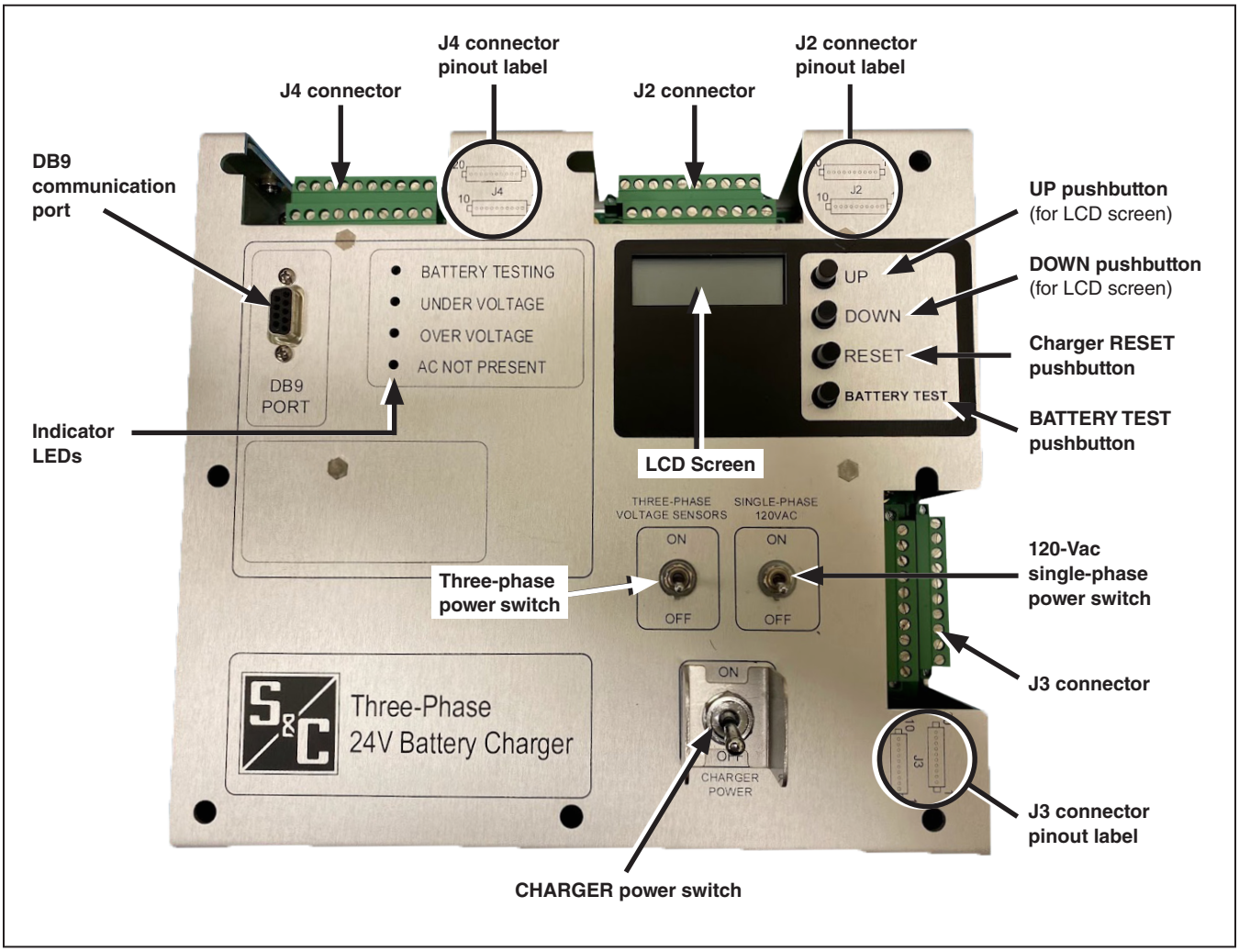


Figure 1. The Three-Phase Battery Charger components.

Table 1. Component Descriptions

Component or Label	Type	Description
CHARGER POWER	Switch	The charger will be powered from any of the three sources (three-phase voltage sensors, 120 Vac, or battery) when this switch is turned on. Charging power is exported from the charger only when the battery is connected.
THREE-PHASE VOLTAGE SENSORS	Switch	Turns on/off the three-phase voltage sensors to the charger
SINGLE-PHASE 120 VAC	Switch	Turns on/off the 120-Vac single-phase ac source to the charger
DB9 PORT	DB9 connection port	Using a USB-to-DB9 serial cable, this port is used to connect a computer to the charger in order to use the GUI application software
Upper-right green connector①	Wire connection terminals	This is the J2 connector. Used to connect output wires
Lower-right green connector①	Wire connection terminals	This is the J3 connector. Used to connect power wires
Upper-left green connector①	Wire connection terminals	This is the J4 connector. Used to connect control wires
J2 connector pinout label	Drawing label	Shows the pin locations to connect the output wires
J3 connector pinout label	Drawing label	Shows the pin locations to connect the power wires
J4 connector pinout label	Drawing label	Shows the pin locations to connect the control wires
UP②	Pushbutton	Used to increment digits on the LCD screen. The digit displayed after the maximum will roll back to the minimum digit
DOWN②	Pushbutton	**Push and hold:** Used to change programming modes on the LCD screen **Push:** Used to shift to the next digit(s) on the LCD screen
RESET②	Pushbutton	Used to reset the charger when any of these occurs: The battery is bad The battery has open cells The battery has been removed
BATTERY TEST②	Pushbutton	Used to test the battery
BATTERY TESTING	LED	Indicator turns on during battery testing
UNDER VOLTAGE	LED	Turns on when the battery voltage is lower than 21 Vdc with battery connected only (no ac power) Turns on when battery voltage is lower than 22 Vdc during a battery test with battery connected only (no ac power) Turns on when battery voltage is lower than 23 Vdc during a battery test when ac power is present (voltage sensors or 120 Vac)
OVER VOLTAGE	LED	Turns on when the battery voltage is higher than 34 Vdc because of a possible charger issue. Contact S&C Electric Company.
AC NOT PRESENT	LED	Turns on when the charger is powered by the battery only
Screen	LCD screen	Used to show menus and status of the battery charger
Low-Voltage disconnect	Internal control circuit	At a battery voltage of 19 Vdc, all continuous loads and motor loads are powered off to prevent damage to the battery due to deep discharge. **Note:** The time to a **Low-Voltage Disconnect** state varies with the amount of continuous load, the state of charge on the battery at the time ac power is lost, the ambient temperature of the gear, and the number of motor operations taken while running on battery power only

① Refer to Appendix B on page 26 for wire connector pin location details.

② S&C recommends using the GUI application software to operate and configure the charger. See pages 9 to 14. For manual operation, refer to Appendix A on page 23.

LCD Screen

When the charger is on, the LCD screen will display the charger status. Information displayed on the LCD screen depends on either of the following:

- If the charger is powered from the battery only
- If the charger is powered from either the 120-Vac single-phase or three-phase power source with the battery connected

Display on the screen when the charger is powered from battery only: If the charger is powered from battery only, the following information will be displayed on the LCD screen:

Battery status:

- BAT OK–Battery is good
- BAT LOW–Battery is low
- BAT BAD–Bad battery

Internal temperature (°F)

Time (24-hour format)

Date (MM/DD/YYYY format)

BV – Battery voltage

Battery test history

NOTICE

The battery test results on the LCD screen will be overwritten by the results of subsequent battery tests. The battery test results on the LCD screen are also cleared if the charger is turned off and then turned back on.

This information will automatically scroll on the LCD screen every three seconds.

Display on the screen when the charger is powered from either ac source with the battery connected: If the charger is powered from an ac source (either 120-Vac single-phase or three-phase voltage sensors) with the battery connected, the following information will be displayed on the LCD screen:

Battery Status:

- BAT OK–Battery is good
- BAT LOW–Battery is low
- BAT BAD–Bad battery
- NO BAT-Battery not present

Charger Status:

- CHR OK–Charger is good
- CHR UV–Charger undervoltage
- CHR OV–Charger overvoltage

Internal temperature (°F)

Time (24-hour format)

Date (MM/DD/YYYY format)

CV–Charger Voltage

BC–Battery Charge Current

Battery test history

NOTICE

The battery test results on the LCD screen will be overwritten by the results of subsequent battery tests. The battery test results on the LCD screen are also cleared if the charger is turned off and then turned back on.

This information will automatically scroll on the LCD screen every three seconds.

Accessing the GUI Application Software

The GUI application software is used to operate and configure the charger. S&C recommends using this application instead of manually operating and configuring the charger through the pushbuttons on the charger. To use the pushbuttons, please refer to Appendix A on page 23 of this instruction sheet.

Complete the following steps to log in to the GUI application:

STEP 1. Obtain the USB-to-DB9 serial cable and connect the DB9 end to the DB9 PORT on the charger and the USB end to the user's computer.

NOTICE

The GUI application software BatteryCharger.exe file can be downloaded by logging in to S&C's customer portal at **sandc.com/en/support/sc-customer-portal**.

STEP 2. Run the BatteryCharger.exe file from the computer to launch the GUI application.

STEP 3. When the GUI application *Login* screen opens, enter the User Name and Password as shown in Figure 2 to log in:

NOTICE

To obtain the User Name and Password to log in to the GUI application, please contact S&C Electric Company.

STEP 4. Click on the **Login** button to access the GUI application. The user can also click on the **Cancel** button to clear the User Name and Password text boxes.

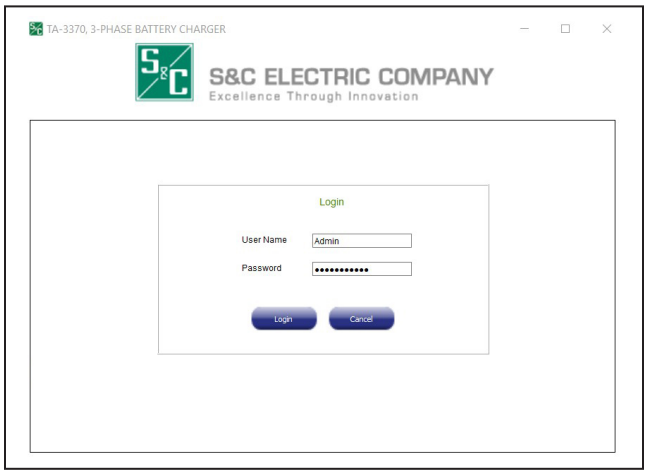


Figure 2. The GUI application *Log-in* screen.

Navigating the GUI Application Software

When logged in to the GUI application software, the user will see five tabs across the top of the screen from left to right:

- Firmware Upload
- Battery Status
- Settings
- Battery Test
- Battery Test History

To the left side of each tab screen is a side window that shows the available communication ports, the connected port, and the status of the connection. See Figure 3. At the bottom of the side window is a reference to the version of the GUI application software.

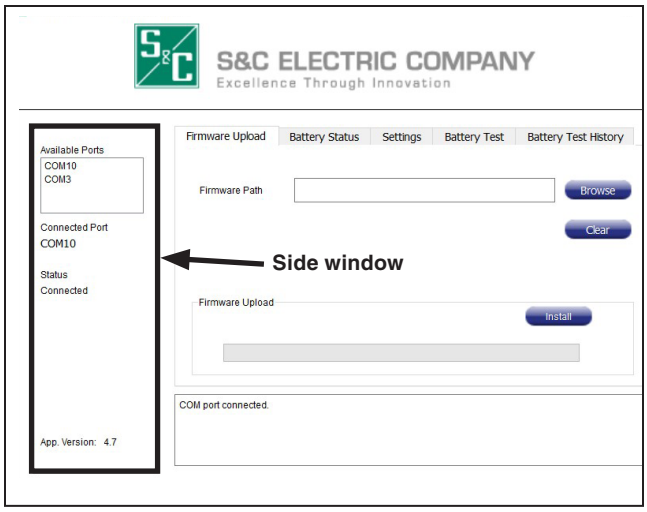


Figure 3. The side window.

Firmware Upload Tab

The **Firmware Upload** tab is the default screen when the user logs in and is used for updating the charger firmware. See Figure 4. Table 2 defines the fields and buttons in the *Firmware Upload* screen.

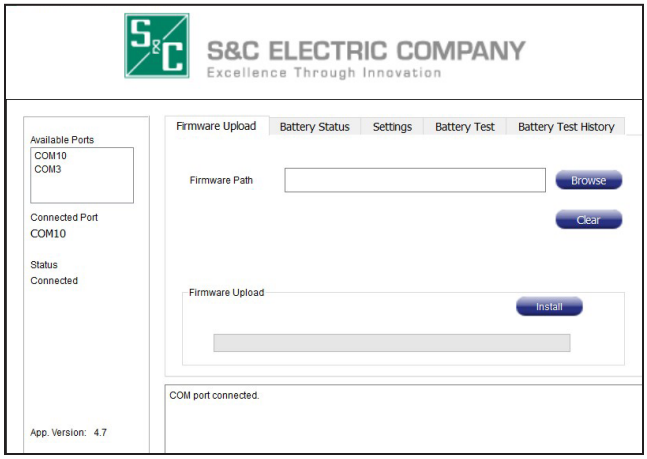


Figure 4. The *Firmware Upload* screen.

Table 2. Firmware Upload Field and Button Descriptions

Field or Button	Description
Firmware Path	This field allows the user to enter the location of the firmware file using the **Browse** button.
Browse	This button allows the user to select the firmware file from the computer.
Clear	This button is used to clear the **Firmware Path** field.
Install	This button is used to start the firmware upload. While updating, the user is restricted from accessing other tabs.
Firmware Upload	This status bar shows the % completion of the firmware upload.

Complete the following steps to download the latest firmware to the charger:

STEP 1. Obtain the USB-to-DB9 serial cable. Connect the DB9 end to the DB9 PORT of the charger and the USB end to the computer.

STEP 2. Log in to the S&C customer portal at **sandc.com/en/support/sc-customer-portal** to download the latest version of the firmware to the computer.

STEP 3. Log in to the GUI application software. In the **Firmware Upload** tab (See Figure 4 on page 10), select the file from the computer and download the firmware to the charger by clicking on the **Install** button.

Battery Status Tab

The *Battery Status* screen is used to view the status of the charger. See Figure 5.

NOTICE

The ***Battery Status*** screen may need to be refreshed to capture present data. Click on the **Battery Status** tab to refresh.

The two buttons on this screen are:

Convert to °C – This button enables the user to convert the temperature seen on the screen to degrees centigrade. The button can also revert the temperature shown on the screen from degrees centigrade to degrees Fahrenheit.

Alarm Reset – This button enables the user to reset external alarms with these conditions:

- Battery Bad
- Battery Under Voltage
- Battery Over Voltage
- Battery Removed
- Battery with Open Cells

Figure 5. The *Battery Status* screen.

Figure 6. No Battery status.

For Battery Removed or Battery with Open Cell alarms: To replace a battery or to clear the battery records:

STEP 1. Disconnect the two-pin connector separating the battery from the charger. See Figure 15 on page 16.

STEP 2. Run a battery test by clicking on the **Battery Test** button in the **Battery Test** tab. See Figure 9 on page 13.

STEP 3. Confirm the "No Battery" message appears on the *Battery Status* screen. See Figure 5 on page 11.

STEP 4. Connect the desired battery. Click on the **Alarm Reset** button to enable the battery to reconnect to the charger. When the button is clicked, a message will pop up, "Do you want to override the BAT Records?" See Figure 7.

Table 3. Field Descriptions for the Settings Tab

Field	Description
Battery Charger Current	The user can set the battery charger current. The current range is from 0.000 to 0.500 amperes. A read-back of this value is displayed on the *Battery Status* screen under the **User Set Max Current** field.
Date/Time	The user can configure the date and time. By placing the cursor on the exact parameter, the user can click on the up and down arrows to increment or decrement the values respectively. The date and time can also be entered by means of the keyboard numbers and traversing left and right by using the keyboard arrows. Date is in the form of MM/DD/YYYY and time is in the form of HH:MM:SS (24-hour format).
Get PC Time button	This button allows the user to set the **Date/Time** field to the present date/time of the connected computer. To apply the time, the Date/Time box must be checked and the **Save** button must be clicked on.
Remove battery from charger under BAD condition or less than 19.0 V①	The charger will disconnect the battery from the charger under the **Battery Bad** condition or if battery voltage is less than 19.0 V. Select the **Yes** option if the battery should be disconnected. Selecting the **No** option may drain the battery below its recoverable voltage level. Battery back up time will be longer; however, some loads may not operate correctly. Select the **No** option if the battery should not be disconnected. A read-back of this selection is displayed on the *Battery Status* screen under the **Bad Battery or Under 19.0 V Action** field.
Save button	This button allows the user to save the changes made to the checked/selected configurable fields.
Update Setting	This status bar shows the % completion of the saving process when the **Save** button is used.

① Default answer is the **Yes** option (recommended).

Figure 7. The battery test results override pop up window.

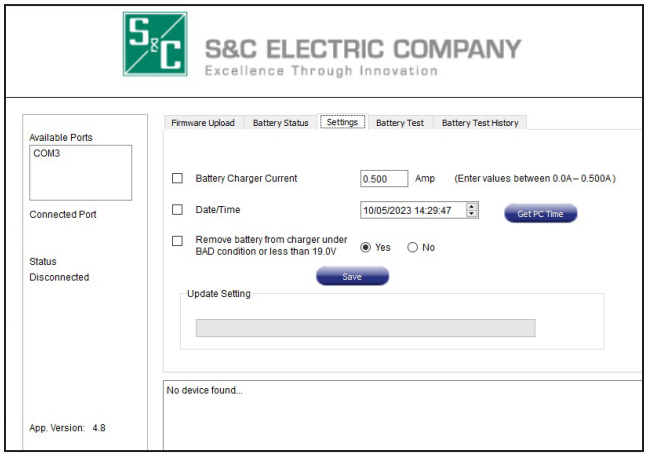


Figure 8. Fields on the *Settings* screen that are configurable.

STEP 5. Click on the **Yes** button if battery test results must be overwritten. This is recommended if the battery was replaced so records from the old battery are not displayed for a newly installed battery.

STEP 6. Click on the **No** button if battery test results must be stored. This is recommended if the battery was just unplugged for maintenance.

Settings Tab

In the **Settings** tab, the user can configure the charger with the fields shown in Figure 8 on page 12. Each setting must have the box to the left of the setting checked in order to be saved. Table 3 on page 12 shows the descriptions of the fields shown on the *Settings* screen.

Battery Test Tab

The *Battery Test* screen can be accessed by clicking on the **Battery Test** tab. This screen is used to conduct a battery test. See Figure 9.

To conduct a battery test, click on the **Battery Test** button. The user cannot access any other tabs until battery test is complete. The status box will be updated during the battery test, and the progress bar will visually show the progression of the test. See Figure 10. The results of the latest battery test since the charger powered up will be displayed in the fields below the progress bar, also shown in Figure 10. The results will automatically update after completion of a GUI initiated battery test. The results can be refreshed by clicking on the **Battery Test** tab.

NOTICE

During the first 24-hour operation period, with ac power present, the battery is automatically tested every two hours. After that, when ac power is present and the charger is turned on, the battery is tested once a day at midnight (per the time on the charger). If the battery is powering the charger because of a loss of ac source, a battery test will occur every two hours. The battery test is used to measure effective battery capacity and can be started remotely with the GUI application **Battery Test** command, as shown in Figure 9, by the Battery Test Start input relay through the J2 connector, or by the BAT TEST pushbutton on the charger, as described in Appendix A on page 23

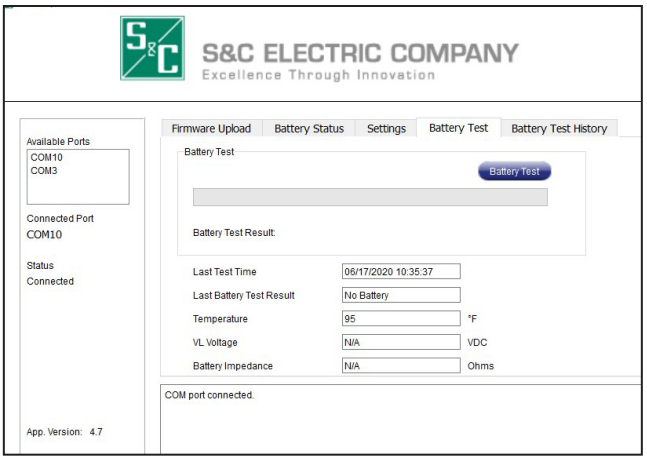


Figure 9. The *Battery Test* screen.

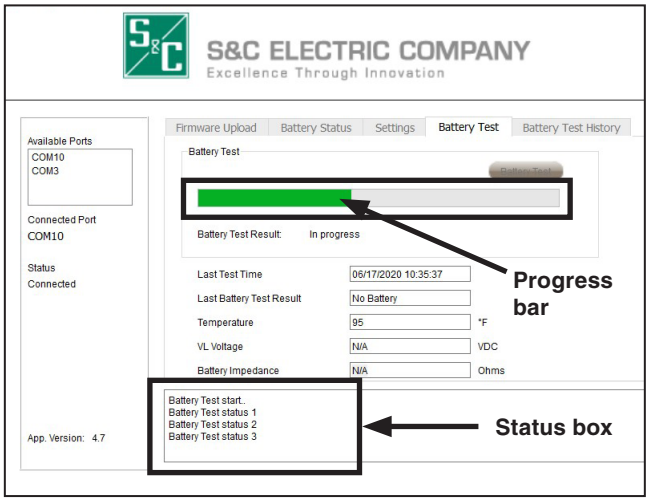


Figure 10. The *Battery Test* screen status box and progress bar.

Battery Test History Tab

The **Battery Test History** tab enables the user to view automated test reports. Manually initiated tests are not displayed in the *Battery Test History* screens. The latest battery test results since charger power up can be seen on the **Battery Test** tab (see Figure 11) or on the LCD screen.

The report subtabs in this screen are as follows:

First 12 Test Records–Displays the first 12 battery test records that are automatically initiated (Manual battery tests are not captured in this record.)

First Year Monthly Records–Displays the battery test records from the first year

Latest 1 Year Monthly Records–Displays the battery test records of the present year

The reports will show the date, time, battery status, temperature, voltage, and impedance.

Complete the following steps to view the battery test history reports:

STEP 1. Select a report subtab (First 12 Test Records, First Year Monthly Records, or Latest 1 Year Monthly Records).

STEP 2. Click on the **Test History** button. This will display the subtab report.

NOTICE

If the data does not appear, click on the **Test History** button again to refresh the data.

STEP 3. If desired, the user can export the data as a CSV file by clicking on the **Export To CSV** button. A pop-up window will appear and display the directory where the file is saved on the computer.

STEP 4. When the file is located, the user can open it using software such as Microsoft Excel®, Notepad, Google Sheets, etc. See Figure 12.

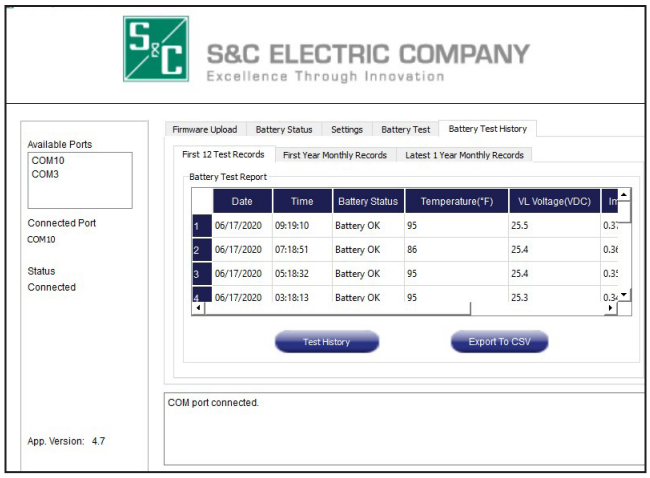


Figure 11. The *Battery Test History* screen.

	A	B	C	D	E	F
1	Date	Time	Battery Status	Temperature(Â°F)	VL Voltage(VDC)	Impedance(Ohms)
2	06/17/2020	09:19:10	Battery OK	95	25.5	0.37
3	06/17/2020	07:18:51	Battery OK	86	25.4	0.36
4	06/17/2020	05:18:32	Battery OK	95	25.4	0.35
5	06/17/2020	03:18:13	Battery OK	95	25.3	0.34
6	06/17/2020	01:17:54	Battery OK	95	25.2	0.33
7	06/16/2020	23:17:34	Battery OK	95	25.1	0.31
8	06/16/2020	21:17:17	Battery OK	95	25	0.32
9	06/16/2020	19:16:58	Battery OK	95	24.9	0.31
10	06/16/2020	17:16:39	Battery OK	95	24.9	0.29

Figure 12. An exported battery test history report.

Power Switch Operation and Configuration

The charger has three power switches, as shown in Figure 13:

- A CHARGER POWER switch
- A SINGLE-PHASE 120-VAC power switch
- A THREE-PHASE VOLTAGE SENSORS power switch

Complete the following steps to turn on the charger (assuming all power sources are connected to the charger):

STEP 1. Turn on the desired power switch to power the charger from an ac source (either the THREE-PHASE VOLTAGE SENSORS power switch or the SINGLE-PHASE 120-VAC power switch).

STEP 2. After the desired power source switch is turned on, turn on the CHARGER POWER switch. The LCD screen will turn on and the charger will power on.

NOTICE

If the charger has a battery connection, a 120-Vac single-phase power source connection, and a three-phase power source connection, and all three switches are turned on, the charger will be powered by the 120-Vac single-phase power source as a default.

If the charger has a battery connection, but no 120-Vac single-phase power source connection and no three-phase power source connection, and all three switches are turned on, the charger will be powered by the battery.

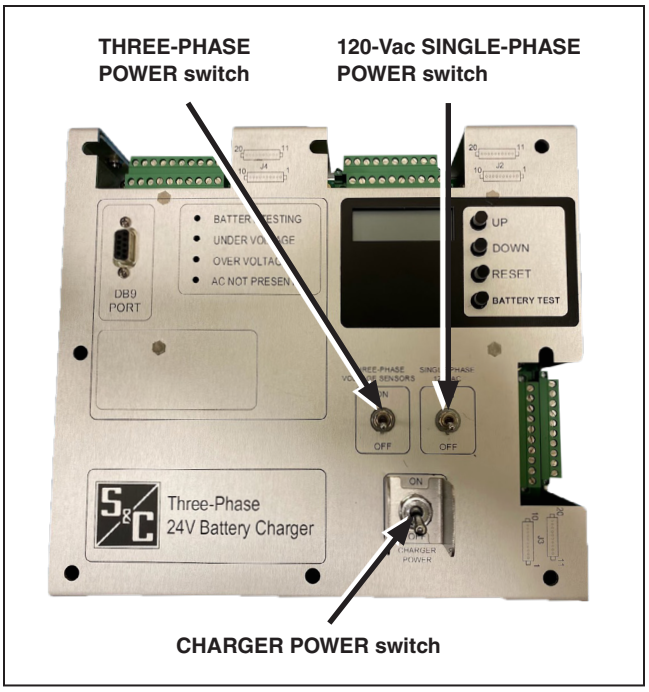


Figure 13. The charger's three power switches.

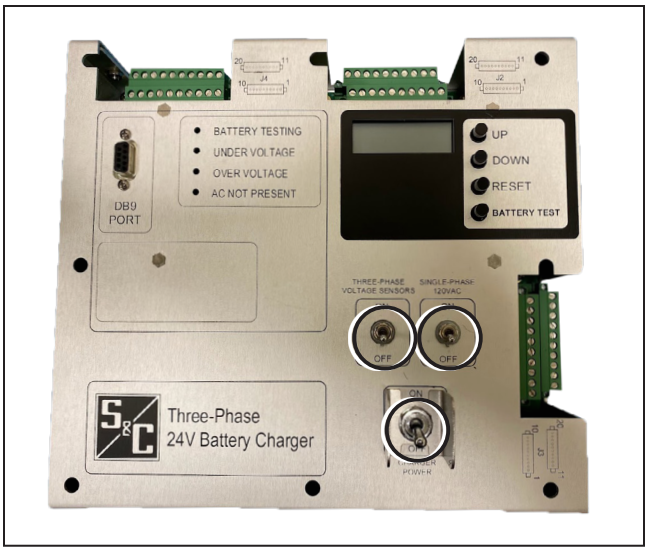


Figure 14. Switches in the Off position.

Connecting and Powering On the Charger with a 24-Volt Battery

Complete the following steps to connect and power on the charger with a 24-Vdc battery:

STEP 1. Make sure the SINGLE-PHASE 120 VAC power switch, the THREE-PHASE VOLTAGE SENSORS power switch, and the CHARGER POWER switch are in the **Off** position. See Figure 14 on page 15.

STEP 2. Making sure the two-pin connector is disconnected, use a small flathead screwdriver to confirm the 24-Vdc battery wires to the charger are connected. The battery positive wire should be connected to pin 1 and the battery negative wire should be connected to pin 4 of the J2 connector. See the J2 connector pinout label on the charger faceplate for exact pin locations to terminate the wires. For a description of wiring connector installation, see Appendix B page 26.

STEP 3. Connect the two-pin connector. See Figure 15. Before turning on the charger, use a voltmeter to confirm the voltage at the J2 connector. Voltage across pin 1 (battery positive) and pin 4 (battery negative) should be between 20 Vdc and 26 Vdc (depending on the battery state of charge). See Figure 16.

STEP 4. Turn the CHARGER POWER switch to the **On** position. The charger will turn on, and the LCD screen will display the charger and battery status. See Figure 17.

NOTICE

With the CHARGER POWER switch on, the battery will power the charger if no 120-Vac single-phase power source or three-phase power source is supplied to the charger, regardless of the SINGLE-PHASE 120 VAC or THREE-PHASE VOLTAGE SENSORS power switch positions.

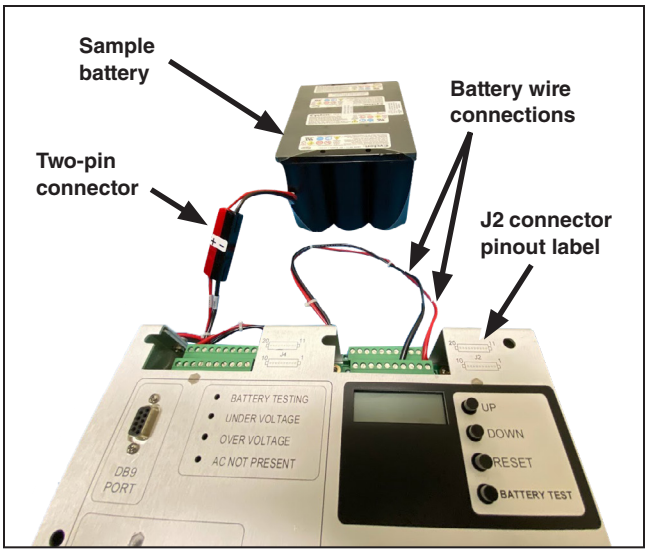


Figure 15. Battery wires connected to the J2 connector. The J2 connector pinout label is used as a reference for battery wire connection locations.

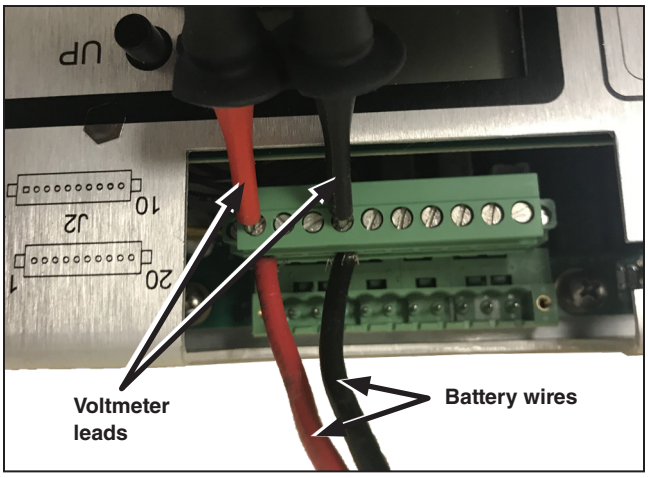


Figure 16. Locations to test the battery connections using a voltmeter.

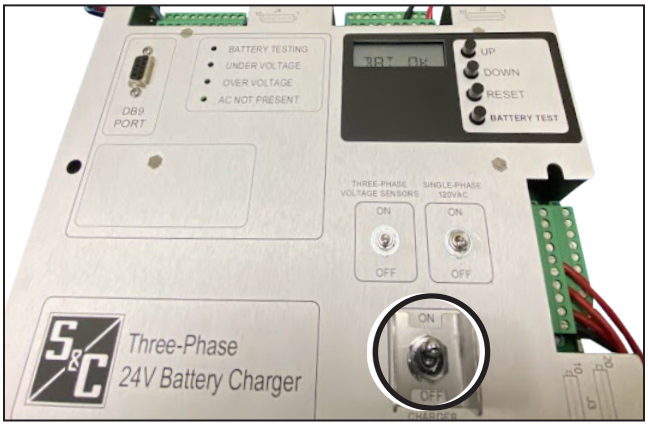


Figure 17. The LCD screen will turn on when the CHARGER POWER switch is in the On position if a battery is connected.

Removing the Battery for Maintenance or Replacement

Complete the following steps to remove a battery:

STEP 1. Disconnect the two-pin connector separating the battery from the charger. See Figure 15 on page 16.

STEP 2. Run a battery test by clicking on the **Battery Test** button in the **Battery Test** tab. See Figure 9 on page 13.

STEP 3. Confirm the **No Battery** message appears on the *Battery Status* screen.

STEP 4. To install a new battery or to rewire the existing battery to the charger, follow Steps 2 through 4 on page 16.

STEP 5. Using the **Battery Status** tab in the GUI application (Figure 9 on page 13), click on the **Alarm Reset** button to reset the charger. A pop-up window will ask, "Do you want to override the BAT (battery) records?" Selecting the **No** option means the battery records will not be overwritten. Selecting the **Yes** option means all battery records will be deleted and new battery records will be stored. This enables the charger to connect to the battery.

Connecting and Powering On the Charger with a 120-Vac Single-Phase Source

Complete the following steps to connect and power on the charger using a 120-Vac single-phase source:

STEP 1. Make sure the SINGLE-PHASE 120 VAC power switch, the THREE-PHASE VOLTAGE SENSORS power switch, and the CHARGER POWER switch are in the **Off** position. See Figure 14 on page 15.

STEP 2. Using a small flathead screwdriver, connect the 120-Vac power source wires to the J3 connector by connecting the ground wire to pin 10, the line (hot) wire to pin 9, and the neutral wire to pin 8. See the J3 connector pinout label on the charger faceplate for exact pin locations to terminate the wires. See Figure 18 on page 18. For a description of wiring connector installation, see Appendix B on page 26.

STEP 3. Plug in the 120-Vac source and use a voltmeter to confirm the voltage at the J3 connector before turning the SINGLE-PHASE 120 VAC power switch **On**. The voltage between pin 10 (ground wire) and pin 9 (line wire) should be 120 Vac +/-10%. See Figure 22(a). The voltage between pin 10 (ground wire) and pin 8 (neutral wire) should be less than 1 Vac. See Figure 19(b).

STEP 4. Making sure the two-pin battery connector is disconnected, use a small flathead screwdriver to secure the 24-Vdc battery wires to the charger by connecting the battery positive wire to pin 1 and battery negative wire to pin 4 of the J2 connector. See the J2 connector pinout label on the charger faceplate for exact pin locations to terminate the wires. Now, connect the two-pin connector so the battery is connected to the charger. See Figure 15 on page 16. For a description of wiring connector installation, see Appendix B on page 26.

STEP 5. Before turning on the charger, use a voltmeter to confirm the voltage at the J2 connector. Voltage at pin 1 (battery positive) and pin 4 (battery negative) should be between 20 Vdc and 26 Vdc (depending on the battery state of charge). See Figure 16 on page 16.

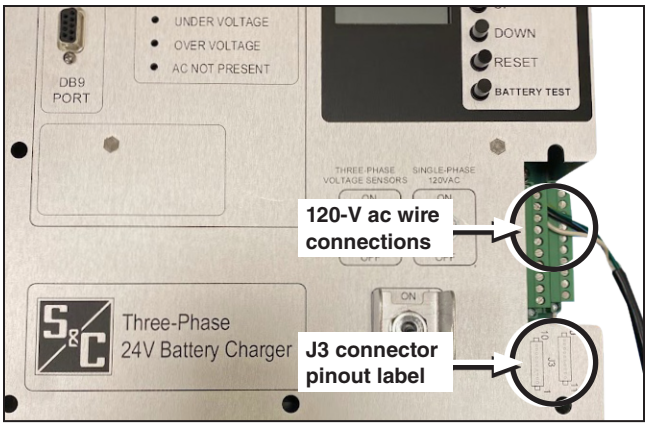


Figure 18. 120-Vac wires connected to the J3 connector. The J3 connector pinout label is used as a reference for wire connection locations.

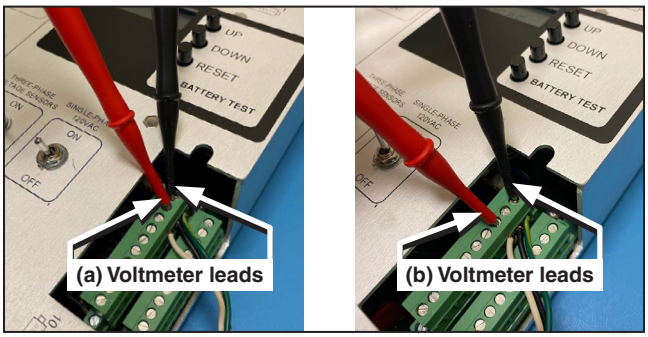


Figure 19. Locations to test the 120-Vac power source using a voltmeter: (a) measuring pin 10 to pin 9, and (b) measuring pin 10 to pin 8.

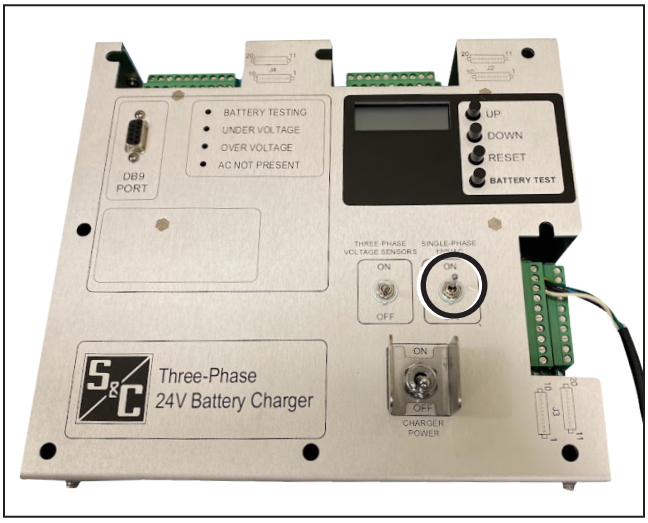


Figure 20. The SINGLE-PHASE 120 VAC power switch in the On position.

STEP 6. Turn the SINGLE-PHASE 120 VAC power switch to the **On** position. See Figure 20 on page 18.

STEP 7. Turn the CHARGER POWER switch to the **On** position. The charger will turn on, and the LCD screen will display the charger and battery status. See Figure 21.

NOTICE

If all three power switches are turned on and the sources are present, the charger is powered by the 120-Vac single-phase power source.

Connecting and Powering On the Charger with S&C Three-Phase Voltage Sensors

Complete the following steps to connect and power on the charger with S&C three-phase voltage sensors:

STEP 1. Make sure the SINGLE-PHASE 120 VAC power switch, the THREE-PHASE VOLTAGE SENSORS power switch, and the CHARGER POWER switch are in the **Off** position. See Figure 14 on page 15.

STEP 2. Using a small flathead screwdriver, connect the three-phase voltage sensor power source wires to the J3 connector by connecting the Phase 1 ground wire to pin 1, Phase 1 line wire (hot) to pin 2, Phase 2 ground wire to pin 5, Phase 2 line wire (hot) to pin 6, Phase 3 ground wire to pin 3 and Phase 3 line (hot) to pin 4. See Figure 22. Screw torque is 5 inch-pounds. For a description of wiring connector installation, see Appendix B on page 26.

STEP 3. Use a voltmeter to confirm the voltage at the J3 connector before turning the THREE-PHASE VOLTAGE SENSORS power switch to the **On** position. Voltage between pin 1 and pin 2, pin 3 to pin 4, and pin 5 to pin 6 should be in between 5 Vac and 6.5 Vac (depending on the system line voltage). See Figure 23(a), Figure 23(b), and Figure 23(c).

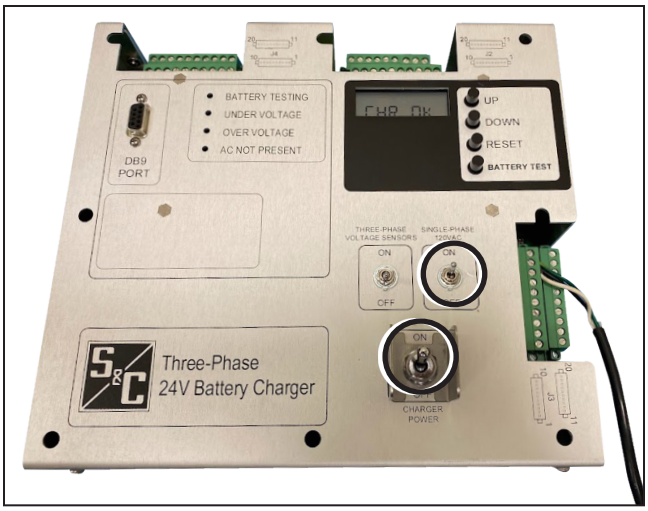


Figure 21. The CHARGER POWER and SINGLE-PHASE 120 VAC power switches are in the On position. The LCD screen will turn on if the 120-Vac power source or the battery is connected.

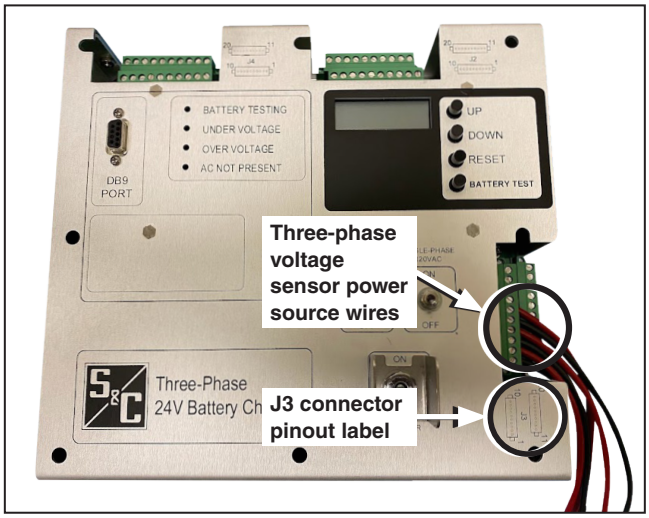


Figure 22. The three-phase voltage sensor power source wires connected to the J3 connector. The J3 connector pinout label is used as a reference for wire connection locations.

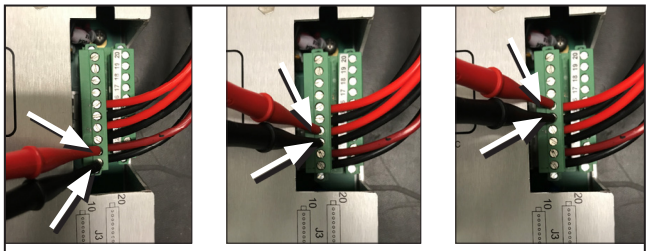


Figure 23. Locations to test the three-phase voltage sensor power source wire connections using a voltmeter: (a) measuring pin 1 to pin 2, (b) measuring pin 3 to pin 4, and (c) measuring pin 5 to pin 6.

STEP 4. Making sure the two-pin battery connector is disconnected, use a small flathead screwdriver to connect the 24-Vdc battery to the charger by connecting the battery positive lead to pin 1 and the battery negative lead to pin 4 on the J2 connector. Now, connect the two-pin battery connector so the battery is connected to the charger. See Figure 15 on page 16.

STEP 5. Before turning on the charger, use a voltmeter to confirm the voltage at the J2 connector. Voltage at pin 1 (battery positive) and pin 4 (battery negative) should be between 20 Vdc and 26 Vdc (depending on the battery state of charge). See Figure 16 on page 16. For a description of wiring connector installation, see Appendix B on page 26.

STEP 6. Turn the THREE-PHASE VOLTAGE SENSORS power switch to the **On** position. See Figure 24.

STEP 7. Turn the CHARGER POWER switch to the **On** position. The charger will turn on and the LCD screen will display the charger and battery status. See Figure 25.

NOTICE

If all three power switches are turned on and there is no 120-Vac single-phase power source connected to the charger, the charger will be powered by the three-phase power source.

If there is a 120-Vac single-phase power source connected to the charger, the 120-Vac single-phase power source will power the charger as the default.

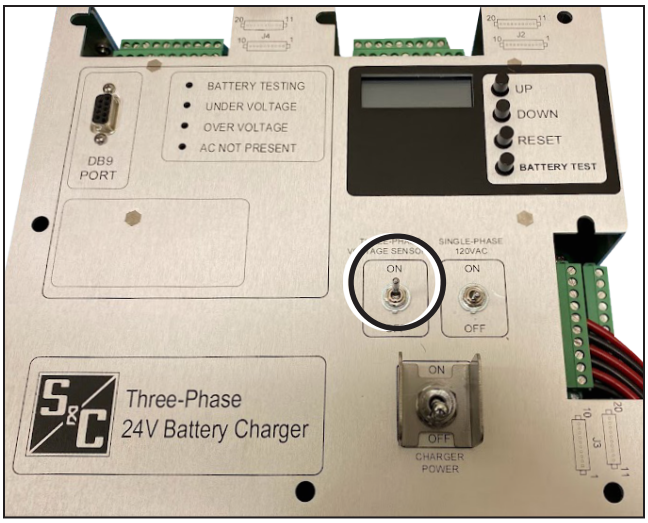


Figure 24. The THREE-PHASE VOLTAGE SENSORS power switch in the On position.

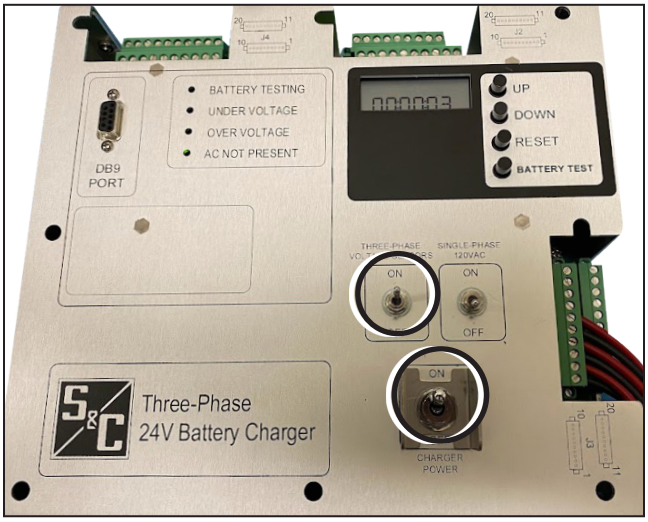


Figure 25. The CHARGER POWER and THREE-PHASE VOLTAGE SENSORS power switches in the On position. The LCD screen will turn on if the three-phase power source or battery is connected.

Troubleshooting Tips

Any issues the charger and battery have are displayed on the LED indicators on the charger, on the LCD screen on the charger, or on the *Battery Status* screen of the GUI application software. Table 4 shows action items that can resolve issues with the charger and battery.

Table 4. Troubleshooting Tips

Issue	Reason
The UNDERVOLTAGE and OVERVOLTAGE LEDs are lit on the charger	This error indicates BAT BAD. During the battery test, if the battery voltage is less than 23 Vdc and the battery impedance is more than 700 milliohms, the **BAT BAD** error will occur. The charger will disconnect the battery by default. In the GUI application under the **Settings** tab, if the user selects the **No** option to disconnect the battery from the charger if the voltage is under 19.0 Vdc, or if the charger is in the **BAT BAD** condition, then the battery will not be disconnected from the charger if ac is present. **Troubleshooting Tip:** Reset the charger by using the GUI application or by using the RESET pushbutton to clear the error. Conduct the battery test again to check whether the **BAT BAD** error message appears again. If it appears again, change the battery.
Data not loading into the GUI application software	This is a possible error with the DB9 connection. **Troubleshooting Tip:** Close and reopen the GUI application. Check the communication cable (connecting the charger and PC) for loose connections. Restart the computer and reopen the GUI application if issues persist. If these actions do not resolve the issue, contact S&C Electric Company.
"BAT LOW" appears on the LCD screen or in the GUI application	Battery voltage is less than 22 Vdc during a battery test. **Troubleshooting Tip:** Make sure ac power is present. The charger will charge the battery and, when the battery voltage is greater than 22 Vdc, the BAT LOW warning will clear. Refer to Table 1 on page 7 for other conditions.
"CHR UV" appears on the LCD screen or in the GUI application	This occurs when the charger is providing a voltage that is lower than the threshold. The charger will still work normally. **Troubleshooting Tip:** Verify the ac source wiring is connected to the charger. Reset the charger to clear the warning. If the warning still appears after multiple resets, contact S&C Electric Company.
"CHR OV" appears on the LCD screen or in the GUI application	This occurs when the charger is providing a voltage that is higher than the threshold. The charger will still work normally. **Troubleshooting Tip:** Verify the ac source wiring is connected to the charger. Reset the charger to clear the warning. If the warning still appears after multiple resets, contact S&C Electric Company.

Table 5. Input Power Ratings

Input parameter	Rating
Three-phase current source (from three S&C voltage sensors)	140 – 195 mA at 20 VA output power from each voltage sensor
Auxiliary voltage	120 Vac ± 10%
Frequency	50 or 60 Hz

Output Power Requirement

Table 6. Output Power Ratings

Output parameter	Rating
Total output power (all three phases)	30 W
Radio output power at 13.8 Vdc	12 W (average), 27 W (maximum) during .25 second transmit every 5 seconds
To controls and motor loads	24 Vdc
Voltage to charge the 24-V battery	26.5 – 33 Vdc●

● Charger output voltage is temperature compensated to match battery chemistry and will vary between these voltage levels.

Environmental Requirements

Table 7. Environmental Ratings

Environmental parameter	Rating
Operating temperature	-40°C to +70°C (-40°F to +158°F)
Storage temperature	-40°C to +85°C (-40°F to +185°F)
Relative humidity	5% to 95% at 60°C (140°F), non-condensing

Regulatory Compliance

The Three-Phase Battery Charger complies to the following standards:

Emissions Testing:

- IEC 60255-26:2013 – Radiated RF emission

Immunity Testing:

- IEC 60255-26:2013 – Radiated RF immunity 80 – 2700 MHz
- IEEE C37.90.2 – Radiated Susceptibility
- IEC 60255-26:2013 – Electrical fast transient/burst immunity
- IEEE C37.90.1:2002 – Fast transient SWC
- IEC 60255-26:2013 – Conducted RF immunity
- IEEE C37.90.1 – Oscillatory transient SWC
- IEC 60255-26:2013 – Damped Oscillatory Burst
- IEC 60255-26:2013 – Surge immunity
- IEC 61000-4-8 – Magnetic Field
- IEEE C37.90.3 – Electrostatic discharge: air and direct
- IEC 60255-26 – Electrostatic Discharge: Air/direct

Environmental and Safety Testing:

- IEC 60255-27:2013 – Dielectric Strength
- IEC 60255-27:2013 – Insulation Resistance
- Mil-Std 810, 20 cycles -40°C to +70°C (-40°F to +158°F) – Temperature cycling

Using the Charger Pushbuttons for Manual Operation and Configuration

NOTICE

S&C recommends using the GUI application software to operate and configure the battery charger. See pages page 9 to page 14 for configuration instructions.

There are settings displayed on the LCD screen that are configured by S&C Electric Company and are not configurable by the user via the pushbuttons or the GUI application software. The only configurable values are the battery charger current, date, and time.

There are four pushbuttons to manually configure or operate the charger. The UP and DOWN pushbuttons are used for the LCD screen. The RESET and BATTERY TEST pushbuttons are used to perform the operation function for the charger. See Figure 26.

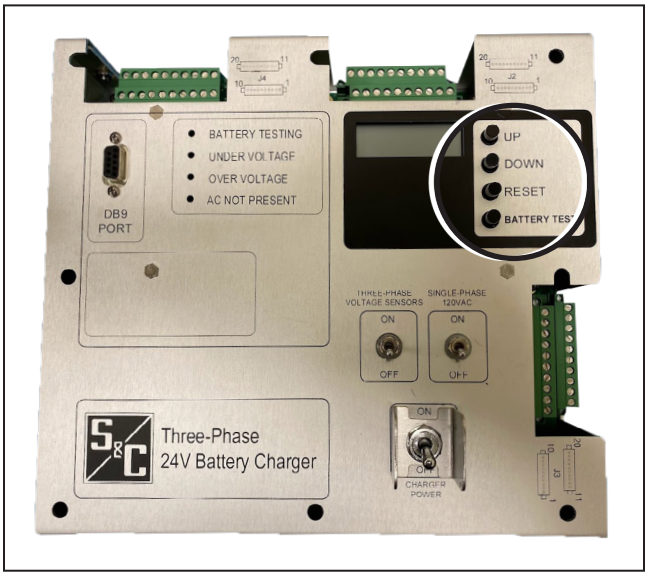


Figure 26. Location of the pushbuttons.

UP and DOWN Pushbuttons

The UP and DOWN pushbuttons can be used to manually configure the battery charger current, date, and time via the LCD screen.

NOTICE

S&C recommends using the **Settings** tab in the GUI application software to configure the battery charger. See pagepage 13 for configuration instructions.

Complete the following steps to manually set the battery charger current:

STEP 1. Push and hold the DOWN pushbutton until the **SET I** mode appears on the LCD screen. When the mode appears, immediately release the pushbutton.

STEP 2. When the pushbutton is released, **SET I** mode is active and the configured current value will be displayed. Push the DOWN pushbutton for a short time to select the digit position to adjust. The flashing digit position moves to the right once per push. The UP pushbutton increases the value of the flashing digit by 1. At 9, the next push goes to 0. The current can be set between 0.000 and 0.500 amps.

STEP 3. When the desired value is entered, repeatedly push the DOWN pushbutton until the screen displays "SAVE."

STEP 4. If the battery charger current is correct, push the UP pushbutton to store this value.

Complete the following steps to manually set the date:

STEP 1. Push and hold the DOWN pushbutton until the **RTC DAT** mode is displayed on the LCD screen. When the mode appears, immediately release the pushbutton.

STEP 2. When the pushbutton is released, the **RTC DAT** mode is active and the configured date will be displayed. The date is in the MM.DD. YYYY format. The month digits will be flashing, showing the month is ready to be configured. Push the UP pushbutton once to increment the digit by 1, if necessary.

NOTICE

The UP pushbutton increases the value of the digit by 1. At the maximum value (12 for month), the next push rolls over to the minimum value (1 for month). Certain digit positions within the configurable value do not follow the 0-through-9 concept; they instead have their own configurable values.

STEP 3. To select the subsequent day or year positions, push (or repeatedly push) the DOWN pushbutton to move the flashing position to the desired position. When the month, day, or year position is selected, repeatedly push the UP pushbutton to select the desired number.

STEP 4. When the date is correctly entered, repeatedly push the DOWN pushbutton until the screen displays "SAVE."

STEP 5. To save the date entered, push the UP pushbutton to store the desired value.

Complete the following steps to manually set the time of day:

STEP 1. Push and hold the DOWN pushbutton until the **RTC TIM** mode displays on the LCD screen. When the mode appears, immediately release the pushbutton.

STEP 2. When the pushbutton is released, **RTC TIM** mode is active, and the configured time will be displayed. The time is in 24-hour format (HH:MM:SS). The hour position will be flashing and is ready to be configured. Repeatedly push the UP pushbutton to increment the number, if necessary.

NOTICE

The UP pushbutton increases the value of the digit by 1. At the maximum value (23 for hour), the next push goes to the minimum value (0 for hour). Certain digit positions within the configurable value do not follow the 0-through-9 concept; they instead have their own configurable values.

STEP 3. To select another position, push the DOWN pushbutton, which will move the flashing position to the right. Push it again to go to another position to change its value.

STEP 4. When the desired value is entered, repeatedly push the DOWN pushbutton until the screen displays "SAVE."

STEP 5. If the time of day is correct, push the UP pushbutton to store this value.

RESET Pushbutton

The RESET pushbutton is used to clear external alarms caused by these battery conditions:

- Battery Bad
- Battery Removed/Battery with Open Cells

NOTICE

If the battery has been replaced or rewired to the charger, the user is required to push the RESET pushbutton to allow the battery to connect to the charger.

Pushing the RESET pushbutton does not cycle the power to the charger.

The RESET pushbutton will not clear all alarm conditions. The following alarm conditions do not require a push of the RESET pushbutton but will clear when the condition is no longer active:

- Battery under voltage
- Battery over voltage
- Ac present
- Charger over voltage

BATTERY TEST Pushbutton

NOTICE

The battery test can also be done remotely by applying external 24-Vdc to pin 6 (positive) and pin 7 (negative) of the J2 connector.

During the first 24-hour operation period, the battery is automatically tested every two hours. After that, when ac power is present and the charger is not turned off, the battery is tested once a day at midnight (per set charger time). If the battery is powering the charger because of a loss of the ac source, a battery test will occur every two hours.

To test the 24-Vdc battery without the use of a computer, the BATTERY TEST pushbutton can be used.

Complete the following steps to test the battery:

STEP 1. Press and hold the BATTERY TEST pushbutton for three seconds.

STEP 2. After releasing the pushbutton, the battery test will start in about five seconds. Looking at the LCD screen, the user will see a status bar during testing. When the status bar on the LCD screen is full, the test will be complete.

STEP 3. When the test is complete, the user can see the results of the battery test on the LCD screen by waiting until a “br” (battery record) text appears at the top of the LCD screen as the parameters scroll. Every parameter the “br” text is displayed over is the result of the test. The following parameters are measured/recorded:

- Battery status
- Date
- Time
- Temperature
- VL (voltage under load)
- BZ (battery impedance)

NOTICE

The battery test results on the LCD screen will be overwritten by the results of subsequent battery tests. The battery test results on the LCD screen are also cleared if the charger is turned off and then turned back on.

When the battery charger is powered from battery only (no ac present during testing), battery impedance (BZ) will display NA (not applicable). When ac is present during testing, battery impedance (BZ) displays in ohms.

Wiring Interface and Wiring Connector Installation

The charger has three wiring connector interfaces (J2, J3, and J4), each with two removable 10-terminal Phoenix interface connectors. See Figure 1 on page 6. Pins 1 through 10 are located in the upper row (inside) and pins 11 through 20 are on the lower row (outside). See Figure 27.

Complete the following steps to install a wire in a connector pin:

STEP 1. Using a small flathead screwdriver, unscrew the pin location needed to wire. See Figure 28.

STEP 2. When the pin screw is loosened, place the bare part of the wire in the square slot under the loosened screw and tighten the screw. Tighten the screw until tight. Torque value is 5 inch-pounds. Pull the wire to ensure it is installed properly and does not come out. The wire is now installed. See Figure 29.

NOTICE

For functional descriptions of the J2, J3, and J4 connector pin locations, please refer to Appendix B page 27.

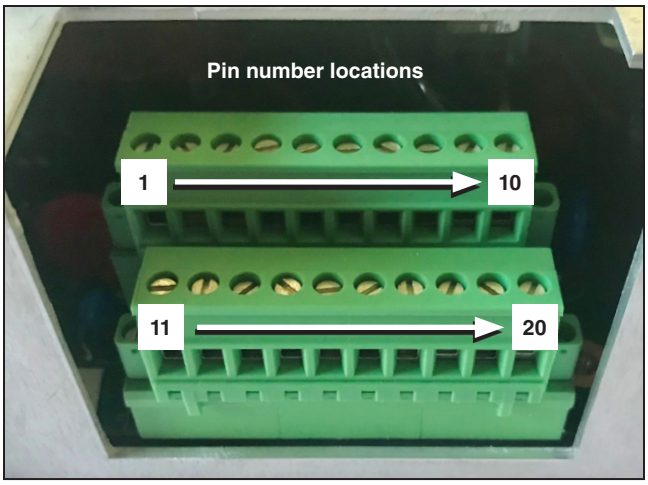


Figure 27. Wiring connector pin locations.

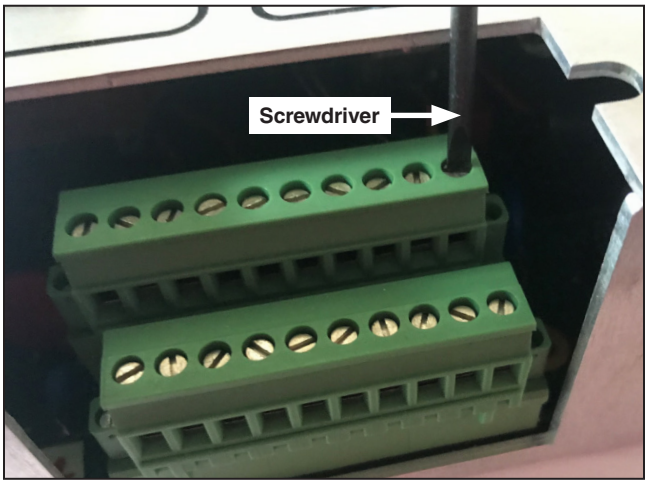


Figure 28. Loosening a pin screw to install a wire.

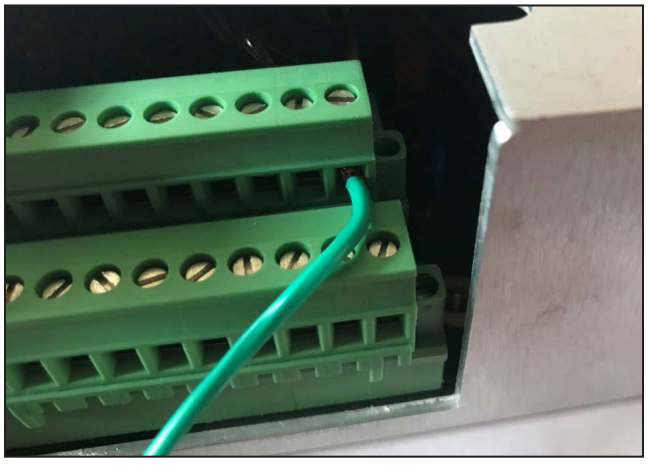


Figure 29. An installed wire.

Connector Pin Descriptions

Relay Input Voltage

The Battery Test Start (J2 connector, pins 6 and 7) and Alarm Reset (J2 connector, pins 8 and 9) contacts must be powered with 24 Vdc. Voltage must be applied for at least three seconds for the contact command to be recognized. See Table 8, Table 9 on page 28, and Table 10 on page 29.

Table 8. J2 Connector Input Definitions

Upper Row		
Pin Number	**Connection Name**	**Description**
1	BAT + (FIRST BATTERY 12 V+)	Battery (positive) connection
2	BAT Tie (FIRST BATTERY 12 V-)	Pin 2 and 3 are tied together to allow two 12-Vdc batteries to be placed in series to create a 24-Vdc battery.
3	BAT Tie (SECOND BATTERY 12 V+)	
4	BAT - (SECOND BATTERY 12 V-)	Battery (negative) connection
5	(-24) VDC OUTPUT	Negative supply to RTU
6	BAT TEST START INPUT (+)	Apply external 24 Vdc (positive to pin 6 and negative to pin 7) for 3 seconds to start the battery test.
7	BAT TEST START INPUT (-)	
8	ALARM RESET (+)	Apply external 24 Vdc(positive to pin 8 and negative to pin 9) for 3 seconds to reset all alarms. This reset will not cycle power to loads.
9	ALARM RESET (-)	
10	(-24) VDC OUTPUT	Negative supply to RTU
Lower Row		
Pin Number	**Connection Name**	**Description**
11	(+24) VDC OUTPUT	Positive supply to motor operator loads
12	(+24) VDC OUTPUT	
13	(-24) VDC OUTPUT	Negative supply to motor operator loads
14	(-24) VDC OUTPUT	
15	RADIO POWER +12 VDC	Positive supply to radio①
16	RADIO POWER -12 VDC	Negative supply to radio①
17	PHASE 3 ANALOG OUTPUT	Phase 3 analog output. 1 V = 32 mA at Phase 3 input current (J3.4)
18	PHASE 2 ANALOG OUTPUT	Phase 2 analog output. 1 V = 32 mA at Phase 2 input current (J3.6)
19	PHASE 1 ANALOG OUTPUT	Phase 1 analog output. 1 V = 32 mA at Phase 1 input current (J3.2)
20	ANALOG GROUND	Analog ground

① Radio power +12 Vdc and -12 Vdc are galvanically isolated from the chassis ground to allow for the chassis mounting of communication devices that may be positively grounded or negatively grounded.

Table 9. J3 Connector Input Definitions

Upper Row		
Pin Number	**Connection Name**	**Description**
1	PHASE 1 VOLTAGE SENSOR NEUTRAL	Phase 1 input current return from S&C voltage sensor
2	PHASE 1 VOLTAGE SENSOR LINE	Phase 1 input current from S&C voltage sensor
3	PHASE 3 VOLTAGE SENSOR NEUTRAL	Phase 3 input current return from S&C voltage sensor
4	PHASE 3 VOLTAGE SENSOR LINE	Phase 3 input current from S&C voltage sensor
5	PHASE 2 VOLTAGE SENSOR NEUTRAL	Phase 2 input current return from S&C voltage sensor
6	PHASE 2 VOLTAGE SENSOR LINE	Phase 2 input current from S&C voltage sensor
7	NO CONNECTION	–
8	AC INPUT NEUTRAL	Single-phase 120-Vac input connection
9	AC INPUT LINE	
10	EARTH GROUND	
Lower Row		
Pin Number	**Connection Name**	**Description**
11	(+24) VDC OUTPUT	Positive supply to RTU
12	(+24) VDC OUTPUT	
13	(+24) VDC OUTPUT	
14	OVER VOLTAGE INDICATOR NO 1	Relay dry contacts for battery **Over Voltage** condition indicator. The relay will turn on when the battery voltage is over 34 V. The battery will be disconnected from the charger. The relay will be latched until conditions are cleared.
15	OVER VOLTAGE INDICATOR COMMON 1	
16	OVER VOLTAGE INDICATOR NC 1	
17	OVER VOLTAGE INDICATOR NO 2	Relay dry contacts for battery **Over Voltage** condition indicator. The relay will turn on when the battery voltage is over 34 V. The battery will be disconnected from the charger. The relay will be latched until conditions are cleared.
18	OVER VOLTAGE INDICATOR COMMON 2	
19	OVER VOLTAGE INDICATOR NC 2	
20	(+24) VDC OUTPUT	Positive supply to RTU

Table 10. J4 Connector Input Definitions

Upper Row		
Pin Number	**Connection Name**	**Description**
1	UNDER VOLTAGE INDICATOR COMMON 1	Relay dry contacts for **Battery Under Voltage** condition indicator. The relay will turn on when the battery voltage is below 23 V when an ac source is present and 22 V when an ac source is not present. The relay will be latched until conditions are cleared. Refer to Table 4 on page 21 for more details. The alarm will clear on its own once the battery voltage gets above the UV alarm threshold.
2	UNDER VOLTAGE INDICATOR NO 1	
3	UNDER VOLTAGE INDICATOR NC 1	
4	BAT CHECK INDICATOR COMMON 2	Relay dry contacts for **Battery Test** indicator. The relay will turn on during the battery test and turn off when the battery test is complete.
5	BAT CHECK INDICATOR NC 2	
6	BAT CHECK INDICATOR NO 2	
7	BAT CHECK INDICATOR NO 1	Relay dry contacts for **Battery Test** indicator. The relay will turn on during the battery test and turn off when the battery test is complete.
8	BAT CHECK INDICATOR NC 1	
9	BAT CHECK INDICATOR COMMON 1	
10	OC INDICATOR NO 1	See details on pin 19 and 20
Lower Row		
Pin Number	**Connection Name**	**Description**
11	UNDER VOLTAGE INDICATOR NO 2	Relay dry contacts for **Battery Under Voltage** condition indicator. Relay will turn on when the battery voltage is below 23 V when an ac source is present and 22 V when an ac source is not present. The relay will be latched until conditions are cleared. The alarm will clear on its own once the battery voltage gets above the UV alarm threshold.
12	UNDER VOLTAGE INDICATOR NC 2	
13	UNDER VOLTAGE INDICATOR COMMON 2	
14	(+24) VDC OUTPUT	Positive supply to RTU
15	(-24) VDC OUTPUT	Negative supply to RTU
16	AC INDICATOR COMMON 2	Relay dry contacts for an ac source being present. The relay will turn on when there is no ac source (either 120 Vac or three-phase current source) supplying the charger. The relay will be latched until conditions are cleared.
17	AC INDICATOR NC 2	
18	AC INDICATOR NO 2	
19	OC INDICATOR COMMON 1	Relay dry contacts for **Open Cell** or **Battery Not Connected** condition indicator. Relay will turn on when there is no battery connected to charger or if a battery has open cell(s). The relay will be latched until the alarm is reset.
20	OC INDICATOR NC 1	

System Line-to-Ground Voltage Calibration

To calibrate the system line-to-ground voltage:

STEP 1. Record the voltage-sensor magnitude ratios of each voltage sensor in Table 11. The voltage-sensor magnitude ratio can be found on the Voltage-Sensor Data Yellow card (G-6244R6, page 2) shipped with the system.

Table 11. Voltage-Sensor Magnitude Ratios

Voltage-Sensor Magnitude Ratios		
Phase 1	Phase 3	Phase 2

STEP 2. Turn the THREE-PHASE VOLTAGE SENSORS power switch to the **Off** position and wait for 10 seconds. Using a voltmeter, measure the voltage (Vac) at the J3 connector and record the measurements in Table 12.

Table 12. Input Voltage

Input Output Voltage		
Phase 1 (J3-1 to J3-2)	Phase 3 (J3-3 to J3-4)	Phase 2 (J3-5 to J3-6)

STEP 3. Turn the THREE-PHASE VOLTAGE SENSORS power switch to the **On** position and wait for 10 seconds. Using a voltmeter, measure the voltage (Vac) at the J2 connector and record the measurements in the Table 13.

Table 13. Analog Output Voltage

Analog Output Voltage		
Phase 1 (J2-20 to J2-17)	Phase 3 (J2-20 to J2-19)	Phase 2 (J2-20 to J2-18)

STEP 4. Calculate the system line to ground voltage using the formula below. Record the line-to-ground voltage for each phase in Table 14.

System line-to-ground voltage = 1.006 × Input Voltage (Table 12) **× Voltage-Sensor Magnitude Ratios** (Table 11).

Table 14. System Line-to-Ground Voltage

System Line-to-Ground Voltage		
Phase 1	Phase 3	Phase 2

STEP 5. Calculate and record the adjust voltage-sensor ratios for each phase in Table 15. These adjust voltage-sensor ratios must be entered into the RTU to offset unit-to-unit variations in the charger when voltage sensors power the charger.

Adjust voltage-sensor ratios = System line-to-ground voltage (Table 14)**/ Analog output voltage** (Table 13).

Table 15. Adjust Voltage-Sensor Ratios

Adjust Voltage-Sensor Ratios		
Phase 1	Phase 3	Phase 2

Description of Operation

Normal condition energized in service, with battery connected

When the battery charger has ac power, it will maintain a charge on the battery pack and provide dc power for the control and communication devices. The battery is used in the event ac power is lost and acts as a backup power source to the continuous and motor operator loads. The battery is also used to provide the dc current necessary to run the switch motor operator.

After a motor operation, the battery charger will replenish the power removed from the battery during the motor operation. The voltage applied to the 24-Volt battery pack will vary depending on the ambient temperature inside the cabinet that is housing the charger and battery.

Loss of ac power (voltage sensors or 120 Vac)

For a majority of the time, ac power available to keep all controls and communication devices powered up and running. In the event ac power is lost (120-Vac source turns off or the three voltage sensors no longer have high voltage at their primary terminal connections), the battery charger will run all devices from the battery pack.

The size of the battery pack (ampere-hours) and the continuous loads connected will determine the battery backup time before an undervoltage alarm occurs. In many cases, the backup time is about 4 to 8 hours but will be shorter if motor operations are performed while running on the battery. After the battery reaches the low-voltage disconnect level, all continuous and motor loads are disconnected to prevent a deep discharge condition on the battery pack.

Description of low-voltage disconnect function

The low-voltage disconnect level for a 24-Volt battery is set by the firmware at 19.0 Vdc. Upon reaching this battery voltage, all continuous and motor loads are disconnected to prevent a deep discharge condition to the battery. This voltage value allows the battery to have a small amount of charge remaining in the event an electrical motor operation is needed. This would be done locally at the gear because of the lack of ac power.

Return of ac power (voltage sensors or 120 Vac)

Upon return of 120 Vac or three-phase voltage sensor power, the battery charger will turn itself on and connect to and begin to recharge the battery pack. Continuous loads will also be powered on so communications can resume. Depending on the battery's state of charge, the undervoltage alarm may remain on for a period of time until the battery voltage is above the alarm level.

Motor operations can be performed after the battery is allowed to store the capacity needed to run the motor operator. This recharge time depends on the battery's condition and whether a low-voltage disconnect occurred during the battery backup period.

Use of a battery with an unknown charge state

If a battery with an unknown charge state is going to be connected to the battery charger, the following test should be performed to measure the open circuit dc voltage of the battery, making sure it is above 18 Vdc. Battery packs with lower voltages can be used. However, it will not be known how quickly the battery can be recharged to full capacity and how it will perform when ac power is lost or when motor operations are commanded remotely.

S&C recommends keeping battery packs kept in storage charged with an appropriate battery charger at least once a year for 48 hours if the battery packs are stored at room temperature. Refer to the battery makers data sheets on storage duration as a function of ambient temperature. Battery float life when connected to a powered up charger varies with ambient temperature and can range from 2 to 5 years based on field experience at multiple customers. This battery charger is temperature-compensated to allow for the longest service duration possible.

Other battery makes and ratings —why this is important

The battery pack(s) used can range from 5 ampere-hours to 16 ampere-hours and may be specified by the customer because of battery backup time or connected continuous loads (protection and control, communication devices, etc.). The battery chemistry used is a sealed-lead acid or Valve Regulated Lead Acid (VRLA) design. There are several makers of these battery packs, and most follow a similar battery-charging profile over ambient temperature. If an alternate battery maker is under consideration, contact an S&C Electric Company sales office for guidance on how to qualify such a replacement battery.

Recovery of a deeply discharged battery in storage

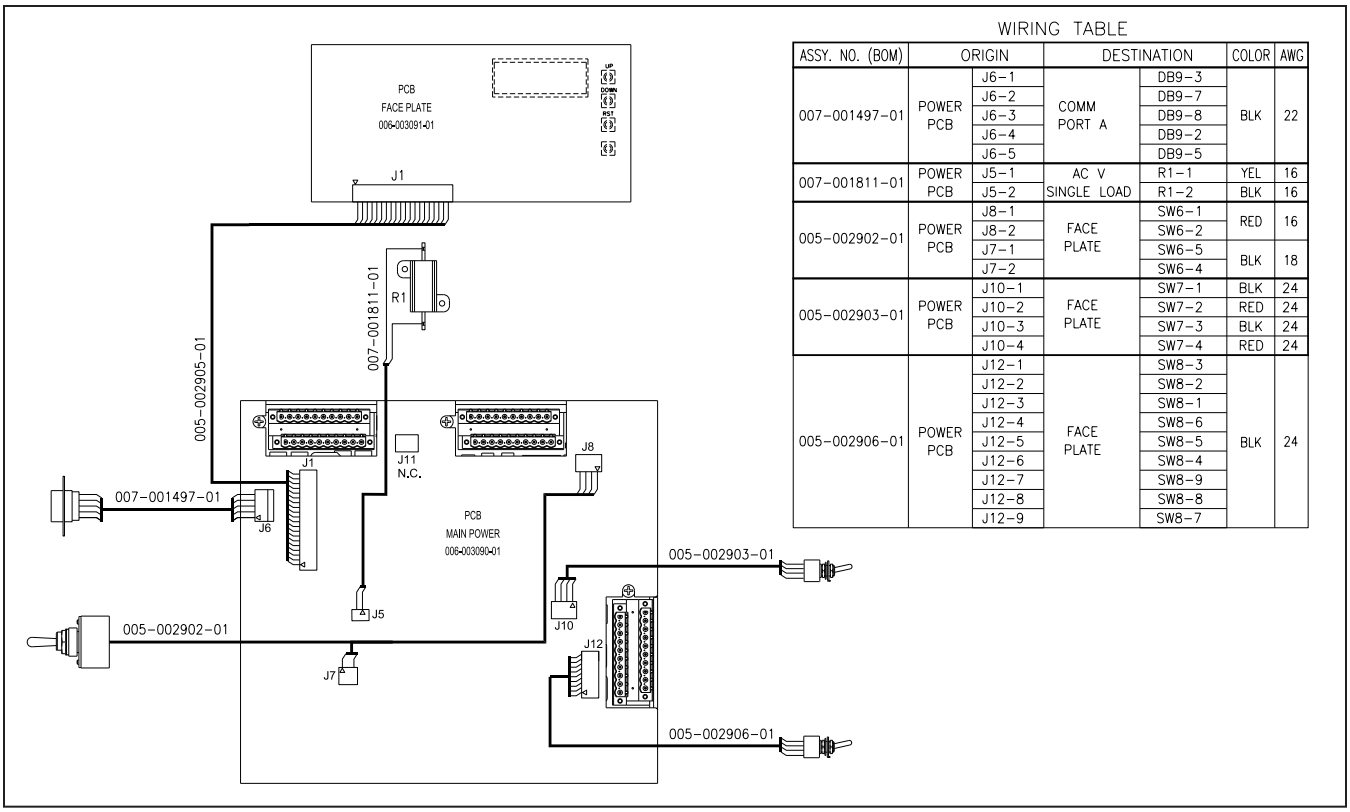
If it is necessary to use a deeply discharged battery with unknown history with the battery charger, the following tests can be performed. Measure the open circuit voltage of the battery and make sure that each 12-volt pack is at least 10.8 Vdc.

Perform a load test by connecting a load resistor with adequate power rating to draw 10% to 25% of the battery packs ampere-hour rating (for a 5 ampere-hour battery, draw 0.5 to 1 ampere of dc current for 10 seconds). Monitor the battery voltage under load. It should not fall below 10.5 Vdc. If it does, the battery pack may be too weak to recharge fully. If both tests pass successfully, then the battery can be considered for recharge using the battery charger.

Radio power and why it is isolated from earth ground

The gear designs incorporate communication devices for remote status and control. These devices are typically RF products that must meet industry standards for EMC compliance. This usually means the case of the communication device is metallic and there is a bonding connection between either the plus or minus terminal to the metallic case. This was recognized more than 30 years ago during the development of the Scada-Mate Switching System.

Battery charger designs that provide a +13.8 Vdc output for radio products are isolated from the earth ground to avoid grounding either side of the battery pack through the communication device. Therefore, radio power output terminals +12 Vdc and -12 Vdc are galvanically isolated from chassis ground to allow for chassis mounting of communication devices that may be positively grounded or negatively grounded.



WIRING TABLE

ASSY. NO. (BOM)	ORIGIN		DESTINATION		COLOR	AWG
007-001497-01	POWER PCB	J6-1	COMM PORT A	DB9-3	BLK	22
		J6-2		DB9-7		
		J6-3		DB9-8		
		J6-4		DB9-2		
		J6-5		DB9-5		
007-001811-01	POWER PCB	J5-1	AC V SINGLE LOAD	R1-1	YEL	16
		J5-2		R1-2	BLK	16
005-002902-01	POWER PCB	J8-1	FACE PLATE	SW6-1	RED	16
		J8-2		SW6-2		
		J7-1		SW6-5	BLK	18
		J7-2		SW6-4		
005-002903-01	POWER PCB	J10-1	FACE PLATE	SW7-1	BLK	24
		J10-2		SW7-2	RED	24
		J10-3		SW7-3	BLK	24
		J10-4		SW7-4	RED	24
005-002906-01	POWER PCB	J12-1	FACE PLATE	SW8-3	BLK	24
		J12-2		SW8-2		
		J12-3		SW8-1		
		J12-4		SW8-6		
		J12-5		SW8-5		
		J12-6		SW8-4		
		J12-7		SW8-9		
		J12-8		SW8-8		
		J12-9		SW8-7		

Figure 30. Interconnect diagram.

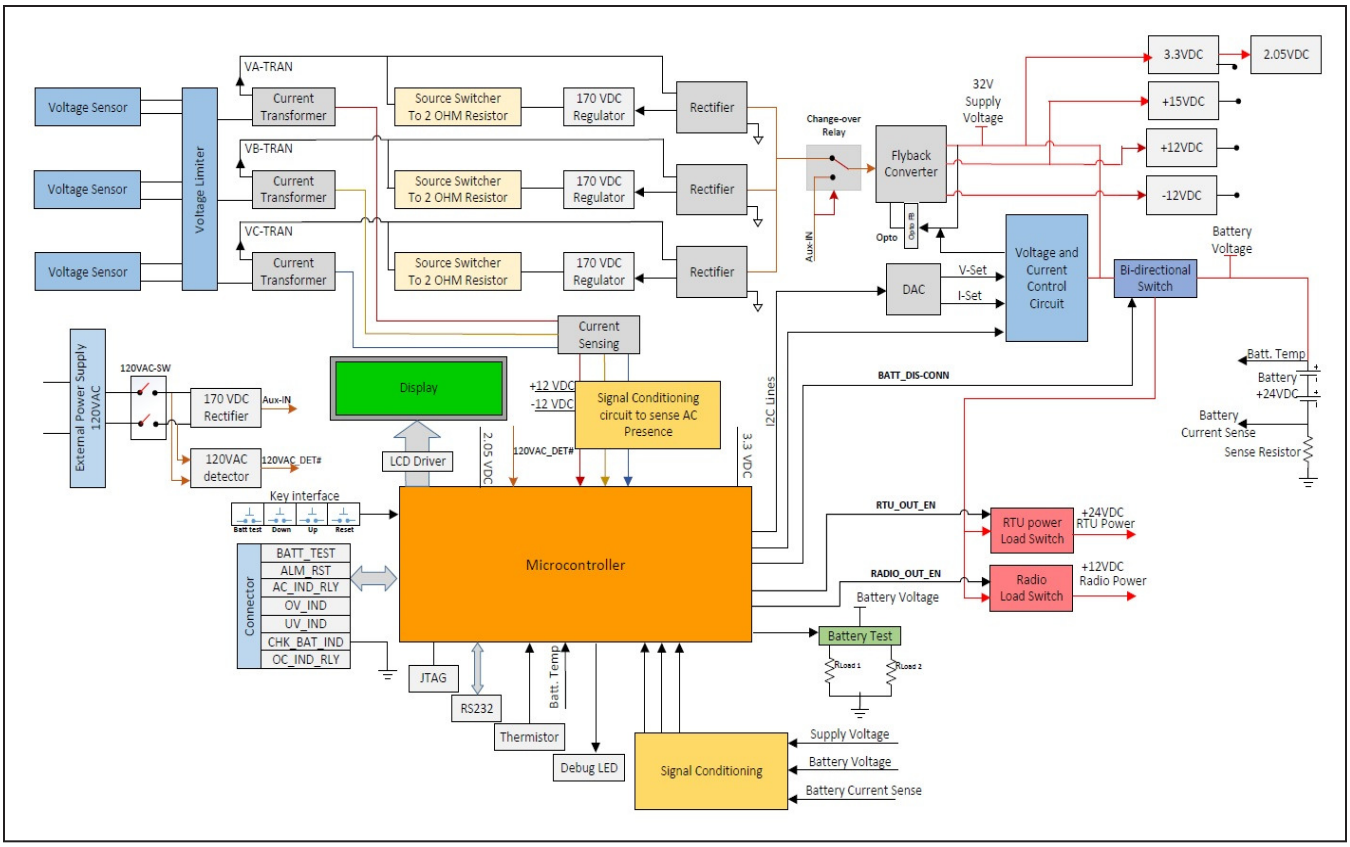


Figure 31. Charger block diagram.