Operation and Maintenance

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October 30, 2017

In the Figure 29 example, Schedule 4 is set to start two hours after Schedule 3, but schedule 3 is set to use Power Profile 3, which has a duration of four hours. As a result, Schedule 3 overruns into when Schedule 4 should be running, creating a system conflict. Make sure a proceeding schedule is set to start after a preceding schedule has finished. This will ensure the system throws no errors and can be used correctly.

Misconfigured/ Erroneous Setup

If the Week Schedule is configured incorrectly, the system will show that the schedule has been misconfigured or that there is some format error.

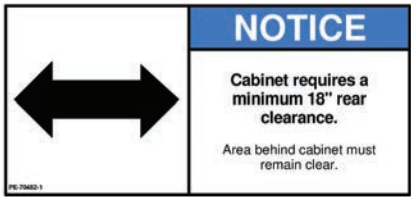
Misconfigured Weekly Setup

The system will note the day the misconfiguration occurred. Go to that page to investigate what went wrong. Figure 29 shows a system where the Sunday schedule was misconfigured. The page shows “Misconfigured Schedule on Sunday” in red font to make it stand out.

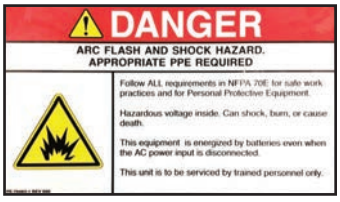
Location of Safety Labels

A

B



C



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part Number
A	⚠ DANGER	KEEP OUT. RISK OF ELECTRICAL SHOCK …	PE-70479-1
B★	*NOTICE*	REAR CLEARANCE …	PE-70482-1
C	⚠ DANGER	ARC FLASH AND SHOCK …	PE-70483-1

★Label is on the left and right sides of the PCS enclosure.

Symbols and Terminal Markings

I	The "I" symbol represents the power on button. When the button with the "I" symbol is pressed, the breaker places the equipment into a fully-powered state.
⏚	Equipment grounding conductor.
O	The "O" symbol represents the power off button. When the button with the "O" symbol is pressed, the breaker disconnects the load side from the power source. The dc breaker disconnects the SMS-250 from the battery. The ac breaker disconnects the ac output to the load.
⎓	Direct current, also indicated as dc.
~	Alternating current, also indicated as ac.

⚠ DANGER

The PureWave SMS-250 Storage Management System operates at hazardous 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 the PureWave SMS-250 system must be restricted only to qualified persons. See "Qualified Persons" 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 flame-retardant clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **ENCLOSURE.** Do not open access doors unless the system is offline or otherwise authorized by S&C Electric Company.
6. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components, ensuring the dead-front access panels are in place after maintenance and before operation.
7. **HAZARDOUS VOLTAGES.** High-voltage dc is present even without utility power connected. Hazardous voltages should also be expected in all interconnecting components and lines.

   To maintain safety, the user should use a padlock on the door of the power conversion system. The door and the use of the padlock provide protection to inadvertent contact with hazardous voltages.
8. **GROUNDING.** For grounding purposes, the proceeding must be followed:
   - The PCS ground bar in the cable termination area must be connected to a suitable earth ground for testing before energizing the unit and at all times when energized.
   - The overall ground system should be sufficient to limit the ground potential rise, step voltage, and touch voltage to acceptable limits as determined by the utility's practices and the National Electric Safety Code.
9. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, locked open, and tested.
10. **ADDITIONAL CONNECTIONS.** The user should not attempt to connect any additional logic controls or power connections to the PureWave SMS-250 system (beyond the connections shown on the interconnect drawing) without having received written approval from S&C Electric Company.

    Interrupters, terminal pads, and disconnect blades on disconnect style models may be energized with the interrupters in any position.
11. **INSULATED HAND TOOLS.** To use insulated hand tools, the proceeding must be followed:
    - Insulated hand tools are required when working on or around any energized equipment. Use only properly rated tools for the energy present.
    - Tool inventories should be kept to ensure that all tools that enter the system enclosure are removed prior to energizing the system.
12. **EMERGENCY PROCEDURES AND EQUIPMENT.** For emergency procedures:
    - The owner should develop policies and procedures for handling emergency situations.
    - It is the responsibility of the owner to develop site-specific emergency action plans for response to such situations.
13. **ADDITIONAL SAFETY INSTRUCTIONS.** Consult the battery supplier for additional safety instructions and procedures regarding the battery used for the PureWave SMS-250 system.

Enclosure

The enclosure houses the power conversion system. The weatherproof, tamper-resistant NEMA 4 enclosure helps protect the system from environmental factors and unauthorized interference. Access to the system components shall be by means of a door at the front of the enclosure. Vents for air flow are located on the back. See Figure 1.

Figure 1. Front and rear view of the PCS enclosure.

LCD Screen

A four-line, 40 character liquid-crystal display shall be mounted on the control panel, protected by a clear plastic window. The display shall indicate status information such as voltages (ac), currents (ac), power (ac), vars (ac), battery voltage (dc), inverter state, operating mode, and active alarms. See Figure 2.

Figure 2. Location of the LCD screen.

Week Setup

Up to eight schedules can be implemented per day. Each schedule should be configured in chronological order by time to ensure the scheduling works correctly.

The following steps should be made to configure the schedule:

STEP 1. Check the Enabled check box to make sure the configured schedule is put into operation if required.

STEP 2. Enter the desired profile number from the *Profile Setup* screen into the Profile # box.

STEP 3. Press the Enter key on the keyboard to store. Once stored, the active value is shown in blue to the right-hand side of the Profile # box, as shown circled in red in Figure 27.

STEP 4. Enter the desired start time for the profile in the Time of Day box and press the Enter key on the keyboard to store. Once stored, the active value is shown in blue to the right-hand side of the Time of Day box, as indicated in red in Figure 27.

The selected profile will start at that particular time on that particular day and run for the duration configured into the profile. Once all scheduling for each day has been configured, the profile can be seen graphically at the bottom of the *Week Setup* screen, as shown in Figure 27.

For the scheduling to operate, select the **Schedule Follow** operation mode from the *Command & Control* screen, as shown in Figure 28.

User Interface

The PureWave SMS-250 can be controlled through the user interface located at the top left side of the unit. Figure 5 shows the controls available on the user interface.

Figure 5. User interface.

The controls on the user interface are as follows:

SMS CONTROL–This switch enables the user to switch control from SCADA mode (SCADA ENABLE) to HMI mode (SCADA DISABLE) and vice versa.

RESET–This black pushbutton, when pressed, enables the user to administer a manual reset.

INVERTER STOP– This red pushbutton, when pressed, enables the user to stop any running operation. Pushing this button will open the ac and dc circuit breakers.

WEB SERVER CONNECTION–The user can use this connection port to connect locally to the system via Human Machine Interface (HMI) mode.

PRE-CHARGE–This key-lock is used when any work or maintenance requires the inverter to be de-energized. When the inverter stop pushbutton is pressed and the pre-charge key is turned to the OFF position (ac and dc circuit breakers are open), the inverter bridge will discharge to a safe level in 5 minutes.

⚠ WARNING

Capacitors in the PCS may have residual charge after the pre-charge key has been turned off. If there is no load connected to the unit, wait 5 minutes for the capacitors to discharge before proceeding with work or maintenance.

When the pre-charge key-lock is in the OFF position, the key can be removed. The inverter bridge will remain de-energized until the key is inserted and turned to the ON position (and source power is restored). Once the key-lock is in the ON position, the key cannot be removed unless it is turned back to the OFF position.

Profile Setup

Up to 20 power profiles can be created to characterize the way the system behaves. These profiles are then selected for use in the *Week Setup* screen at particular times on particular days of the week, as desired. Each profile consists of the following configuration points:

1. **Starting Power** – This is the Power value the system will output when the profile becomes active, which is the time and day the profile is assigned to in the *Week Setup* screen.
2. **Section 1 Duration** – This is how long the system will transit between the Starting Power and the Section 2 Power.
3. **Section 2 Power** – This is the system **Power** value at the end of Section 1 Duration.
4. **Section 2 Duration** – This is how long the system will transit between the Section 2 Power and the Section 3 Power.
5. **Section 3 Power** – This is the system **Power** value at the end of Section 2 Duration.
6. **Section 3 Duration** – This is how long the system will transit between the Section 3 Power and the End Power.
7. **End Power** – This is the system Power value at the end of Section 3 Duration.
   - For Charging, a negative value should be entered into a Power Configuration box.
   - For Discharging, a positive value should be entered into a Power Configuration box.

The graphical representation to the right of the configuration pane provides a view of the charging and discharging profile graphically to make it easier to visualize the configuration.

Profile 2:

A profile for charging for two hours at 250 kW and then immediately discharging at 250 kW for two hours would be as follows:

1. Starting Power: -250 kW
2. Section 1 Duration: 120 min
3. Section 2 Power: -250 kW
4. Section 2 Duration: 0 min
5. Section 3 Power: 250 kW
6. Section 3 Duration: 120 min
7. End Power: 250 kW

Profile 3:

A profile for charging for two hours at 250 kW and then immediately discharging for two hours starting at 250 kW and ramping down to 0 kW would be as follows. (Note: The system would linearly reduce the discharge power from 250 kW to 0 kW over a two-hour period, so at one hour the discharge power would be 125 kW.)

1. Starting Power: -250 kW
2. Section 1 Duration: 120 min
3. Section 2 Power: -250 kW
4. Section 2 Duration: 0 min
5. Section 3 Power: 250 kW
6. Section 3 Duration: 120 min
7. End Power: 0 kW

After creating the desirable profiles to use, configure the days and times the particular profiles should run within the *Week Setup* screen.

Note to User: If the schedule ends in a value different from 0 kW, the schedule will keep (in the case of the Profile 2 example) discharging until it runs out of battery power or meets another schedule. To command it to stop, change the power mode to **Commanded Power** at 0 kW.

Figures 25 and 26 on page 21 show examples of how the profiles can be created and seen graphically in any desired fashion. S&C recommends creating different charging profiles in Profiles 1-10 and different discharging profiles in Profiles 11-20, each having an **End Power** value of 0 kW to ensure the system sits in idle—neither charging or discharging—at the end of a schedule.

6. Section 3 Duration: 120 min
7. End Power: 0 kW

After creating the desirable profiles to use, configure the days and times the particular profiles should run within the Week Setup page.

Note to User: If the schedule ends in a value different from 0 kW, the schedule will keep (in the case of the Profile 2 example) discharging until it runs out of battery power or meets another schedule. To command it to stop, change the power mode to Commanded Power at 0 kW.

Figures 25 and 26 show examples to see how the profiles can be created and seen graphically in any desired fashion. S&C recommends creating different charging profiles in Profiles 1-10 and different discharging profiles in Profiles 11-20, each having an End Power value of 0 kW to ensure the system sits in idle—neither charging or discharging—at the end of a schedule.

Radio Provisions

The PCS enclosure is supplied with provisions for radio communication. A removable panel to mount the radio and 24-Vdc power are located next to the LCD circuitry on the inside of the enclosure door. See Figure 16.

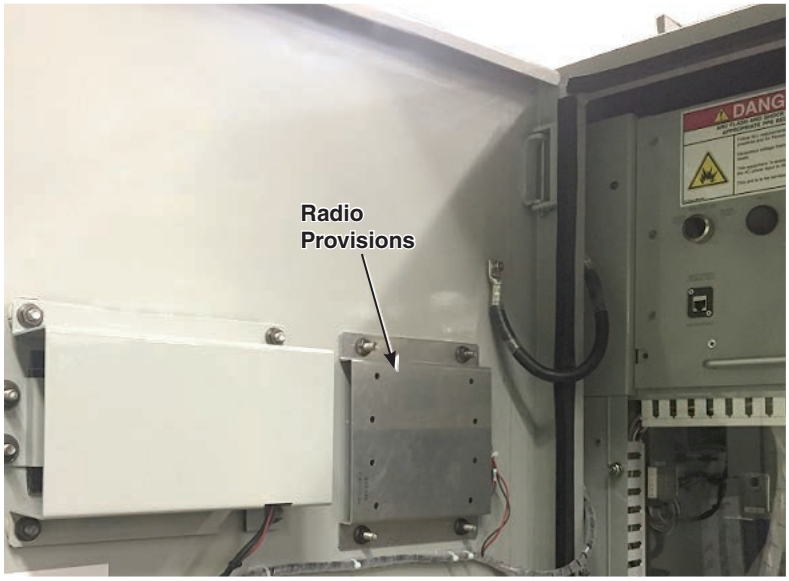


Figure 16. Provisions for radio communication.

Human Machine Interface (HMI)

A laptop computer can be used to control and monitor the PureWave SMS-250 via the Web-based HMI. Before connecting to the PureWave SMS-250, the user computer network settings need to be configured to the following:

- An IP address of 192.168.10.n, where n is a number greater than 0 and less than 100. This number cannot be 81, which is reserved for the battery.
- The subnet mask should be set to 255.255.255.0.
- The default gateway can be the same as the IP address.
- Domain Name System (DNS) is not needed.

After the user computer network settings are configured, the user can attempt to connect to the HMI control by doing the following:

- Using an Ethernet cable, connect the computer to the WEB SERVER CONNECTION port on the user interface.
- Open Firefox Web browser. Other Web browsers may not support all the features.
- Enter the URL, http://192.168.10.100, into the address bar to access the HMI screens.
- When prompted, provide the username and password (username: operator; password: pass123).

The user is now ready to navigate through the HMI screens.

NOTICE

The HMI has two levels of access credentials. The Level 1 access enables the user to observe the system's functions. The Level 2 access gives the user credentials to control the system. Contact the system administrator if there are any issues with HMI accessibility.

HMI Program

The HMI program contains the following screens that, when selected, show the status of the PureWave SMS-250 system and its different components. The screens are as follows:

PureWave SMS-250 System Oneline

The PureWave SMS-250 System Oneline tab displays an overview of the PureWave SMS-250 system that includes the status of the island and ac and dc circuit breakers. If the circuit breaker is red, this indicates that the circuit breaker is closed. If the circuit breaker is green, this indicates that the circuit breaker is open.

The oneline screen also shows the inverter, utility, and battery information. The green box at the left shows the alarm and communication status, system state, and current real and reactive power output values. If the alarm types and/or communication items are green, there are no alarms present and/or the communications are good. If the alarms and/or communication items are red, an alarm is present and/or the communication item(s) is not working. See Figure 17.

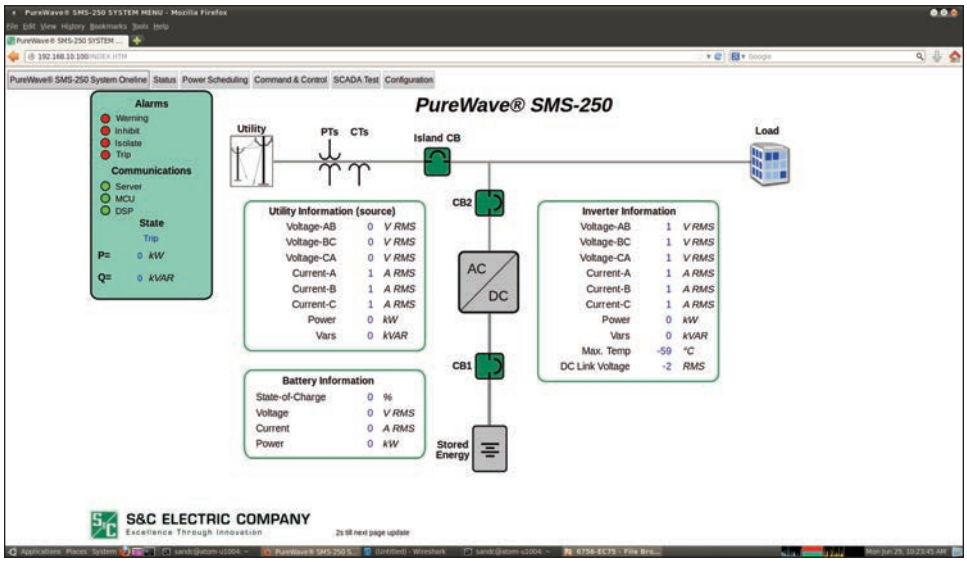


Figure 17. *PureWave SMS-250 System Oneline* screen.

Status

The **Status** tab displays the **Alarm**, **Analog**, and **Digital** status for the PureWave SMS-250 system. Figure 18 shows where the user can find these screens by hovering the mouse over the **Status** tab to display the status drop-down menu items: **Alarm Status**, **Analogs**, and **Digitals**. To open the *Alarm Status* screen, click on the **Alarm Status** option after you hover over the **Status** menu.

Figure 19 is the *Alarm Status* screen, which displays the status of the alarms. In addition, the user can hover the mouse over the listed alarm to display a tool-tip pop-up window that provides a description of what the alarm is and the suggested troubleshooting actions to clear it. This feature only works with Firefox Web browser.

To open the *Digital inputs/outputs* screen, hover over the **Status** tab and click on the **Digitals** drop-down option. See Figure 21 on page 17.

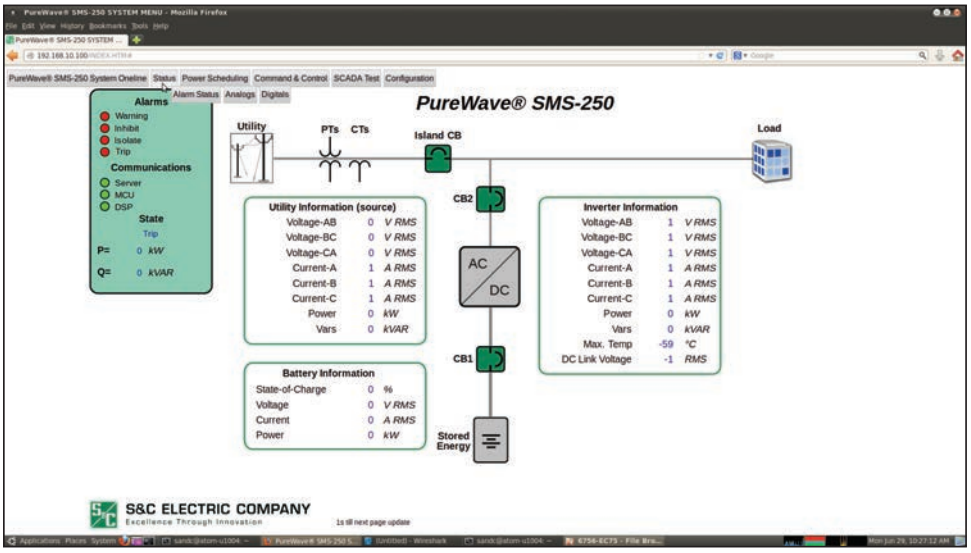


Figure 18. The Status drop-down menu.

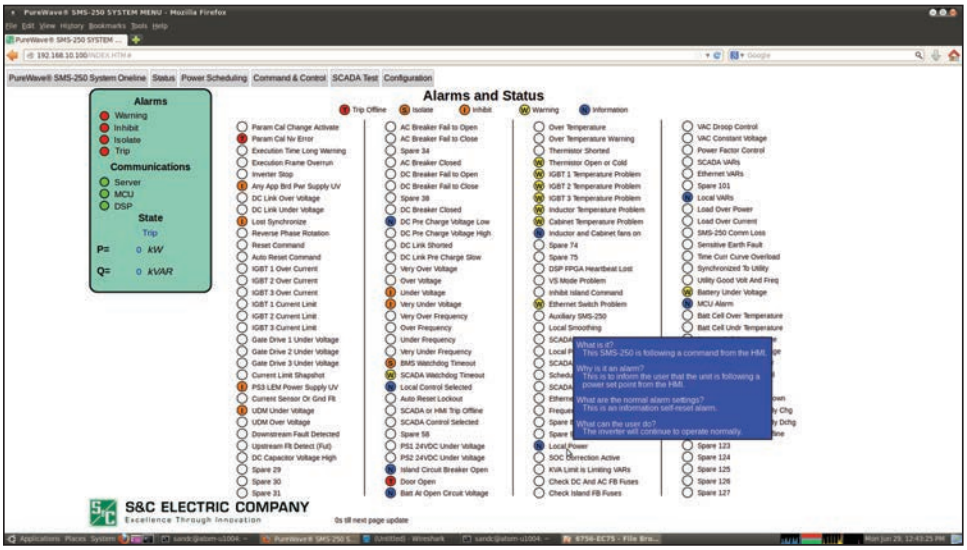


Figure 19. The *Alarm* and *Status* screen.

Figures 20 and 21 show the *Analogs* and *Digitals* status menu screens, respectively. To open the *Analog inputs* screen, hover over the **Status tab** and click on the **Analogs** drop-down option.

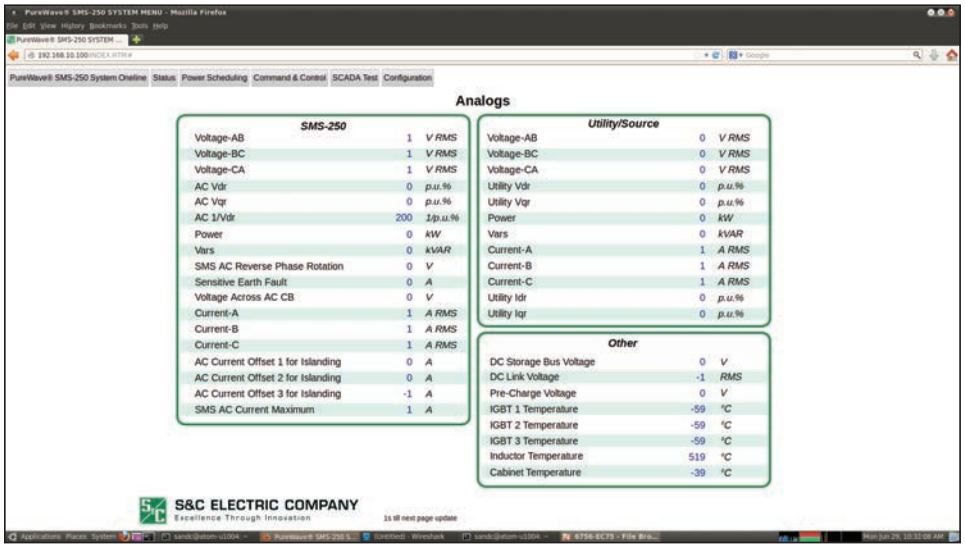


Figure 20. The *Analogs* status screen.

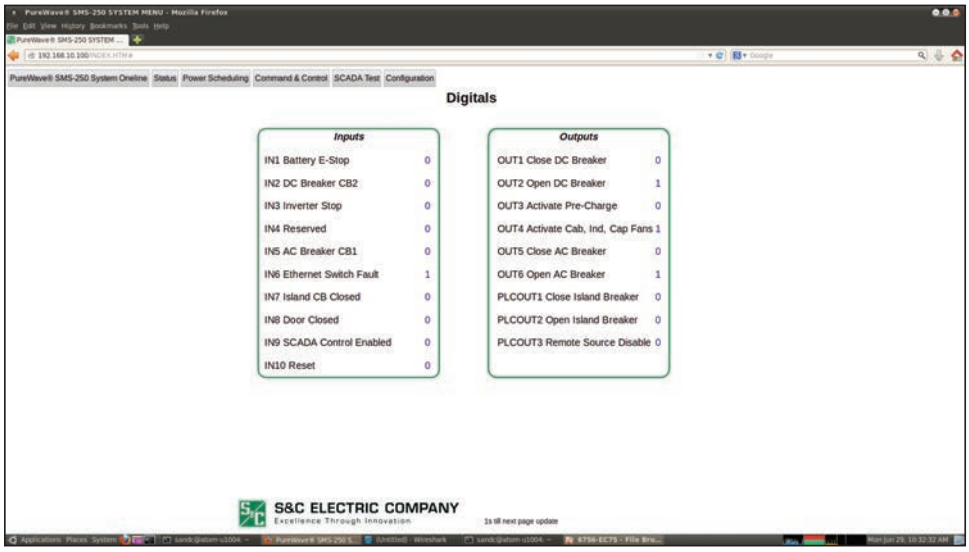


Figure 21. The *Digitals* status screen.

Overview

The **Power Scheduling** tab enables the charging and discharging of the PureWave SMS-250 system at desired time durations and power levels during any time of the week. As seen in Figure 22, hover the mouse over the **Power Scheduling** tab to display the **Profile Setup** and **Week Setup** power scheduling drop-down menu items. The screens for these menu items are shown in Figures 23 and Figure 24 respectively. To open the *Profile Setup* screen, hover over the **Power Scheduling** tab and click on **Profile Setup** drop-down menu item.

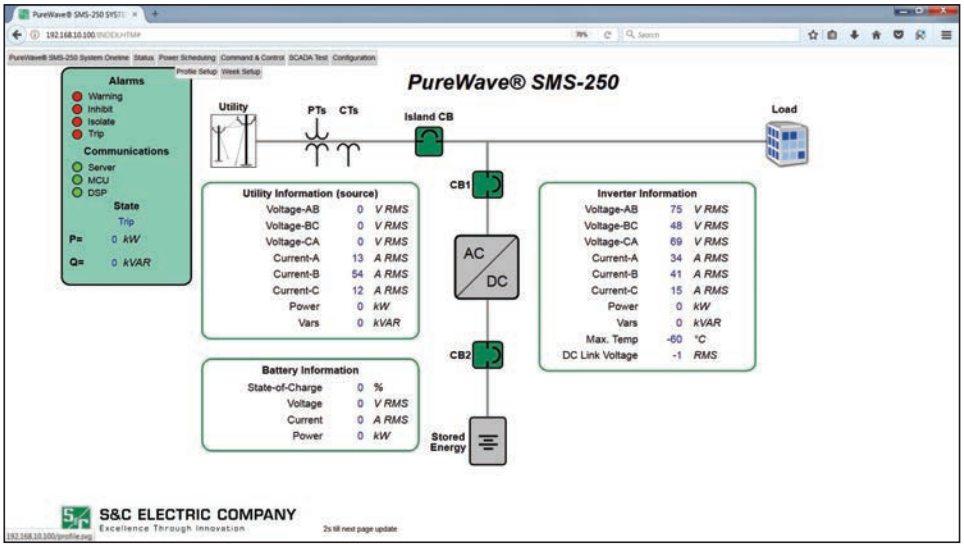


Figure 22. The Power Scheduling tab.

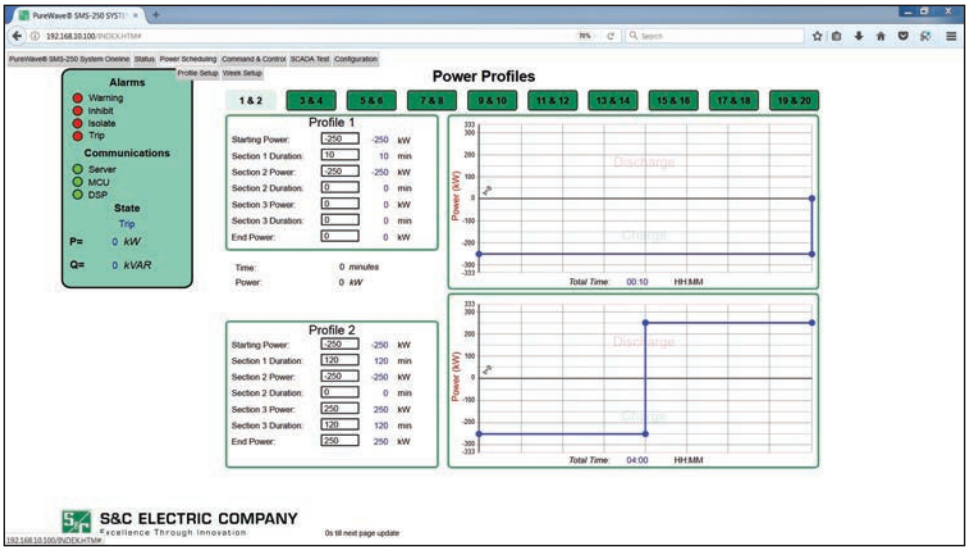


Figure 23. The *Power Profiles* screen.

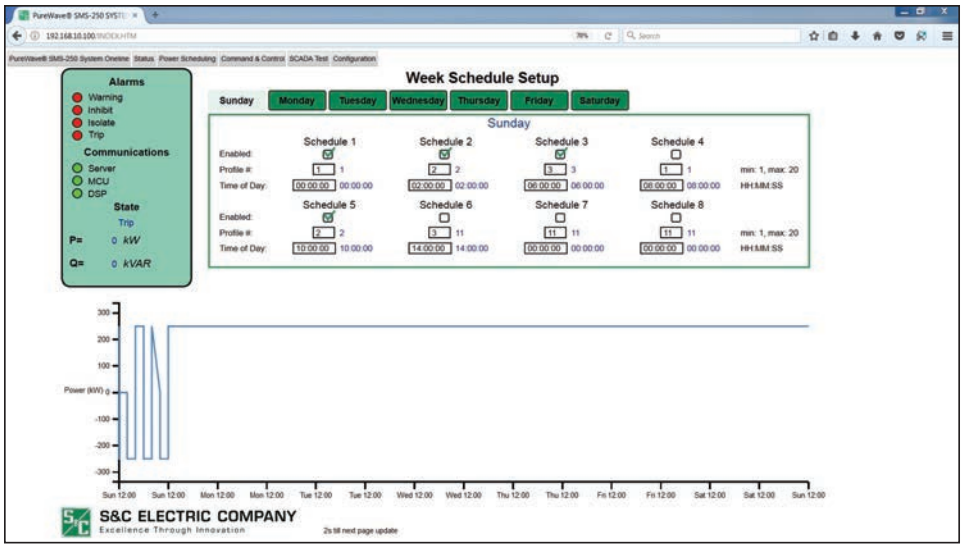


Figure 24. The *Week Schedule Setup* screen.

Profile Setup

Up to 20 power profiles can be created to characterize the way the system behaves. These profiles are then selected for use in the *Week Setup* screen at particular times on particular days of the week, as desired. Each profile consists of the following configuration points:

1. **Starting Power** – This is the Power value the system will output when the profile becomes active, which is the time and day the profile is assigned to in the *Week Setup* screen.
2. **Section 1 Duration** – This is how long the system will transit between the Starting Power and the Section 2 Power.
3. **Section 2 Power** – This is the system **Power** value at the end of Section 1 Duration.
4. **Section 2 Duration** – This is how long the system will transit between the Section 2 Power and the Section 3 Power.
5. **Section 3 Power** – This is the system **Power** value at the end of Section 2 Duration.
6. **Section 3 Duration** – This is how long the system will transit between the Section 3 Power and the End Power.
7. **End Power** – This is the system Power value at the end of Section 3 Duration.
   - For Charging, a negative value should be entered into a Power Configuration box.
   - For Discharging, a positive value should be entered into a Power Configuration box.

The graphical representation to the right of the configuration pane provides a view of the charging and discharging profile graphically to make it easier to visualize the configuration.

Examples

Profile 1:

A profile for charging for 10 minutes at 250 kW and then resting back to 0 kW after this time would be as follows:

1. Starting Power: -250 kW
2. Section 1 Duration: 10 min
3. Section 2 Power: -250 kW
4. Section 2 Duration: 0min
5. Section 3 Power: 0 kW
6. Section 3 Duration: 0 min
7. End Power: 0 kW

Profile 2:

A profile for charging for two hours at 250 kW and then immediately discharging at 250 kW for two hours would be as follows:

1. Starting Power: -250 kW
2. Section 1 Duration: 120 min
3. Section 2 Power: -250 kW
4. Section 2 Duration: 0 min
5. Section 3 Power: 250 kW
6. Section 3 Duration: 120 min
7. End Power: 250 kW

Profile 3:

A profile for charging for two hours at 250 kW and then immediately discharging for two hours starting at 250 kW and ramping down to 0 kW would be as follows. (Note: The system would linearly reduce the discharge power from 250 kW to 0 kW over a two-hour period, so at one hour the discharge power would be 125 kW.)

1. Starting Power: -250 kW
2. Section 1 Duration: 120 min
3. Section 2 Power: -250 kW
4. Section 2 Duration: 0 min
5. Section 3 Power: 250 kW
6. Section 3 Duration: 120 min
7. End Power: 0 kW

After creating the desirable profiles to use, configure the days and times the particular profiles should run within the *Week Setup* screen.

Note to User: If the schedule ends in a value different from 0 kW, the schedule will keep (in the case of the Profile 2 example) discharging until it runs out of battery power or meets another schedule. To command it to stop, change the power mode to **Commanded Power** at 0 kW.

Figures 25 and 26 on page 21 show examples of how the profiles can be created and seen graphically in any desired fashion. S&C recommends creating different charging profiles in Profiles 1-10 and different discharging profiles in Profiles 11-20, each having an **End Power** value of 0 kW to ensure the system sits in idle—neither charging or discharging—at the end of a schedule.

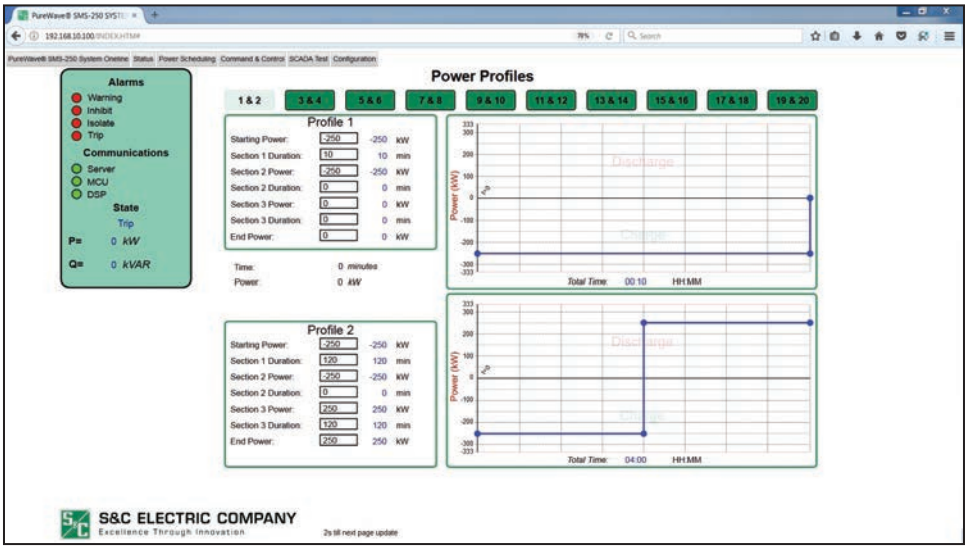


Figure 25. *Power Profiles* screen with Profiles 1 and 2 configuration examples shown within the SMS-250 HMI.

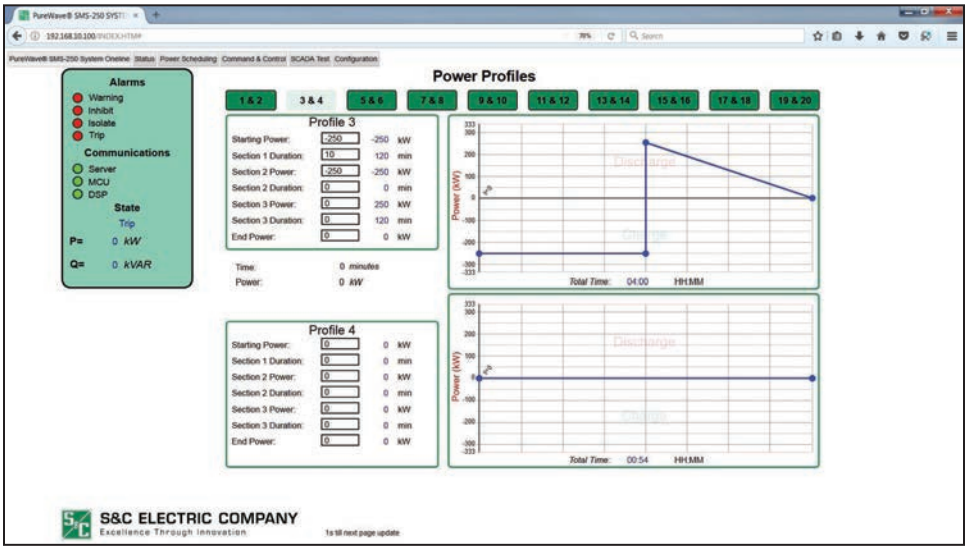


Figure 26. *Power Profile* screen with a Profile 3 configuration example shown within the SMS-250 HMI.

Week Setup

Up to eight schedules can be implemented per day. Each schedule should be configured in chronological order by time to ensure the scheduling works correctly.

The following steps should be made to configure the schedule:

STEP 1. Check the Enabled check box to make sure the configured schedule is put into operation if required.

STEP 2. Enter the desired profile number from the *Profile Setup* screen into the Profile # box.

STEP 3. Press the Enter key on the keyboard to store. Once stored, the active value is shown in blue to the right-hand side of the Profile # box, as shown circled in red in Figure 27.

STEP 4. Enter the desired start time for the profile in the Time of Day box and press the Enter key on the keyboard to store. Once stored, the active value is shown in blue to the right-hand side of the Time of Day box, as indicated in red in Figure 27.

The selected profile will start at that particular time on that particular day and run for the duration configured into the profile. Once all scheduling for each day has been configured, the profile can be seen graphically at the bottom of the *Week Setup* screen, as shown in Figure 27.

For the scheduling to operate, select the **Schedule Follow** operation mode from the *Command & Control* screen, as shown in Figure 28.

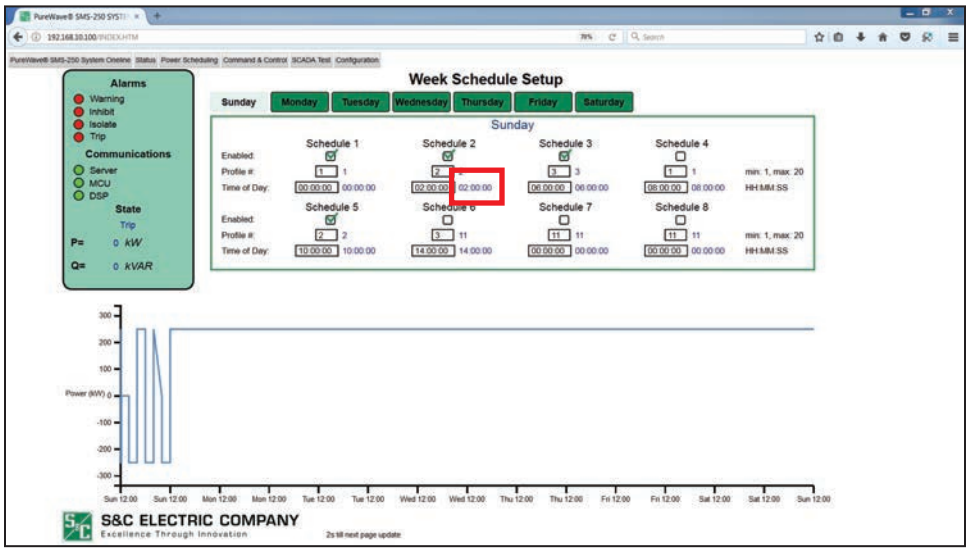


Figure 27. *Week Schedule Setup* screen with a graphical weekly profile (stored parameters indicated in red).

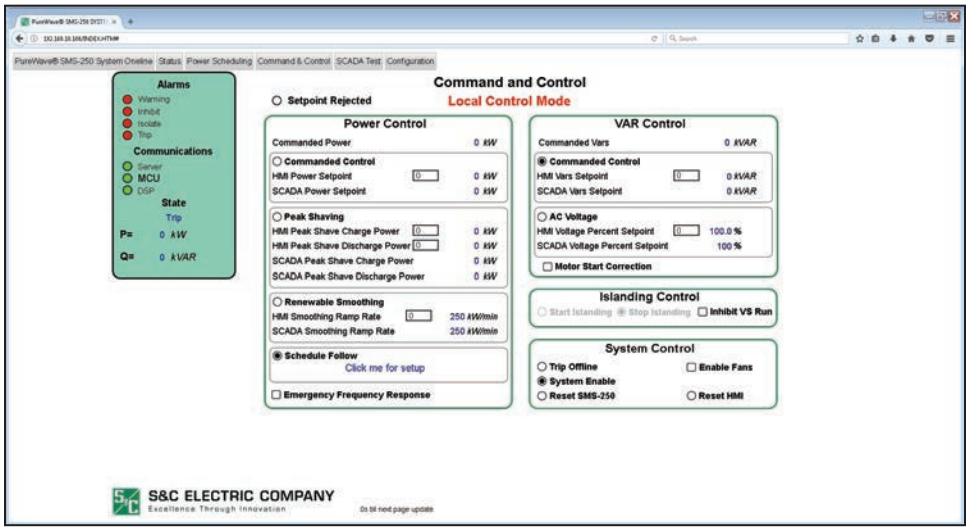


Figure 28. *Command and Control* screen with the Schedule Follow setting selected.

Misconfigured/ Erroneous Setup

If the Week Schedule is configured incorrectly, the system will show that the schedule has been misconfigured or that there is some format error.

Misconfigured Weekly Setup

The system will note the day the misconfiguration occurred. Go to that page to investigate what went wrong. Figure 29 shows a system where the Sunday schedule was misconfigured. The page shows "Misconfigured Schedule on Sunday" in red font to make it stand out.

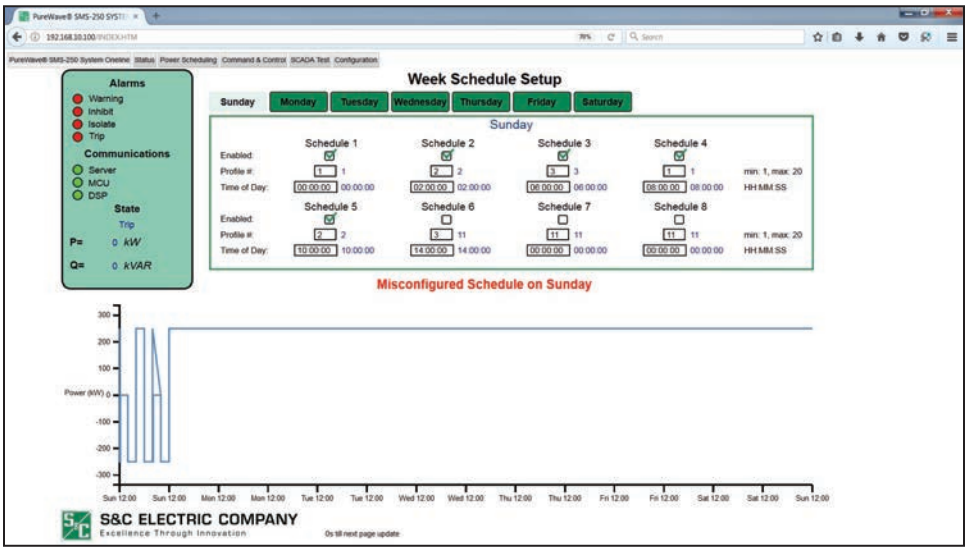


Figure 29. The *Week Schedule Setup* screen with a misconfigured schedule.

In the Figure 29 example, Schedule 4 is set to start two hours after Schedule 3, but schedule 3 is set to use Power Profile 3, which has a duration of four hours. As a result, Schedule 3 overruns into when Schedule 4 should be running, creating a system conflict. Make sure a proceeding schedule is set to start after a preceding schedule has finished. This will ensure the system throws no errors and can be used correctly.

Format Error in Weekly Setup

If a Profile # is entered out of range (1-20) or a Time of Day is entered in a format other than format HH:MM:SS, then the system will throw a format error and the value will not be processed. See Figure 30. To fix the issue, make sure the inputs are created as shown on the far right of the window (indicated in green).

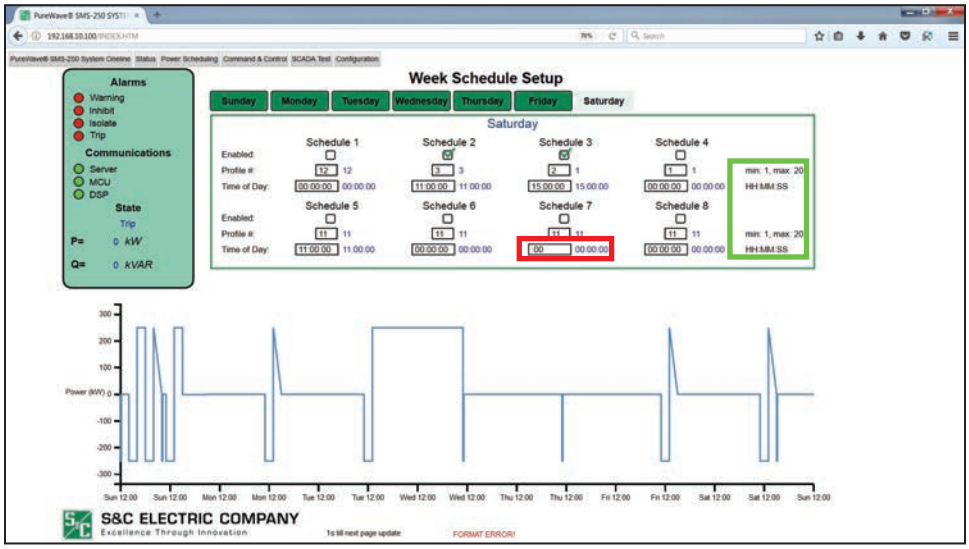


Figure 30. The *Week Schedule Setup* screen with no format errors.

Command and Control

The **Command and Control** tab enables the user to command real or reactive power to the load. It also allows the user to choose different modes of operation, such as **Peak Shaving**, **Renewable Smoothing**, **Schedule Follow**, or **Islanding**. See Figure 31.

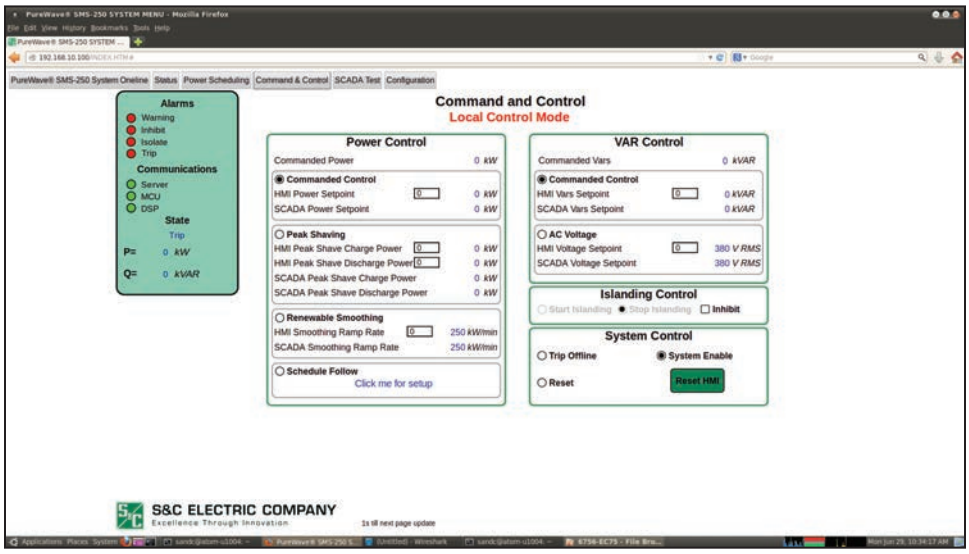


Figure 31. The *Command and Control* screen.

SCADA Test

The **SCADA Test** tab enables the user to change SCADA inputs and outputs (analog and digital) for a desired time to verify that the SCADA system is functioning properly. As seen in Figure 32, the user can hover the mouse over the **SCADA Test** tab to display the SCADA test drop-down menu items: **AI** (Analog Inputs), **AO** (Analog Outputs), **DI** (Digital Inputs), and **DO** (Digital Outputs). Figures 33, 34 (on page 26), and 35 (on page 27) show the respective screens for these menu items. To open any of these windows, click on the corresponding drop-down menu option.

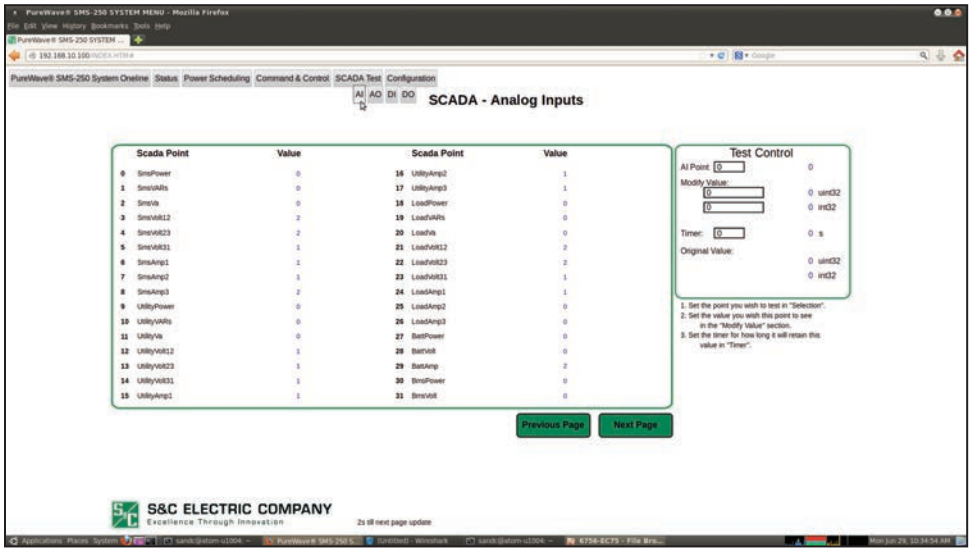


Figure 32. The *SCADA–Analog Inputs* screen, Test drop-down menu.

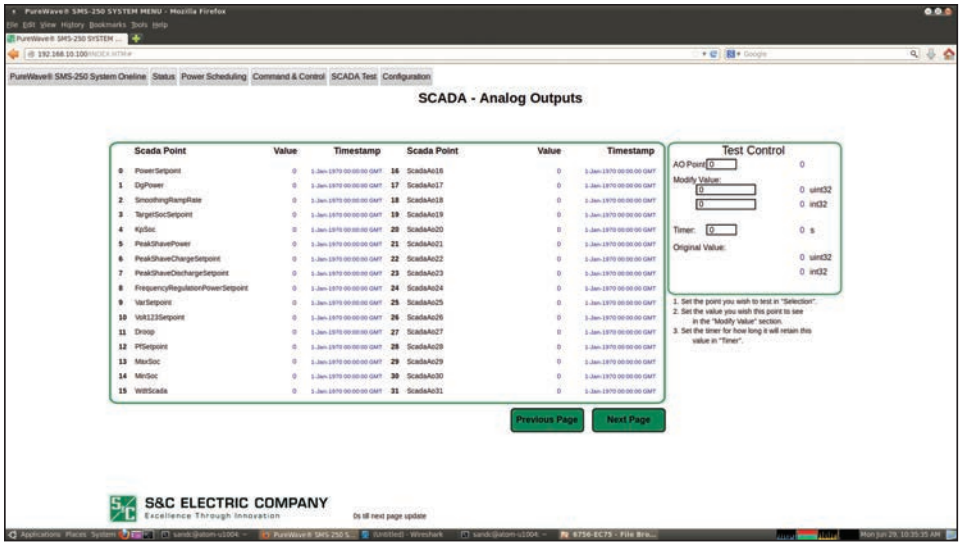


Figure 33. The *SCADA–Analog Outputs* screen.

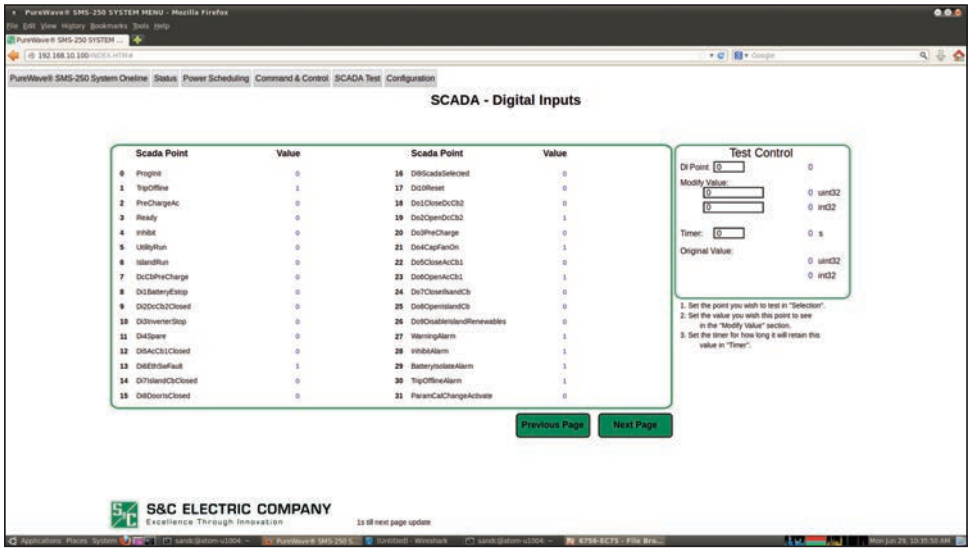


Figure 34. The *SCADA–Digital Inputs* screen.

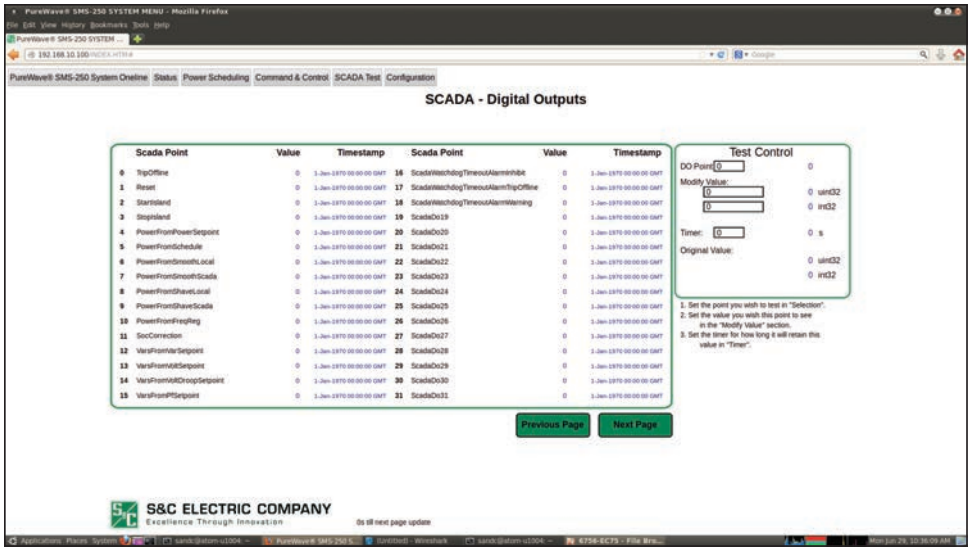


Figure 35. The *SCADA–Digital Outputs* screen.

Configuration

The **Configuration** tab enables the user to change communications and field settings. As seen in Figure 36, the user can hover the mouse over the **Configuration** tab to display the configuration **Field Parameters** and **Communication** drop-down menu items. Figures 37 and 38 (on page 28) show the screens for these menu items, respectively. Hovering the mouse over each parameter in these figures reveal a tool-tip pop-up window that describes what the parameter means.

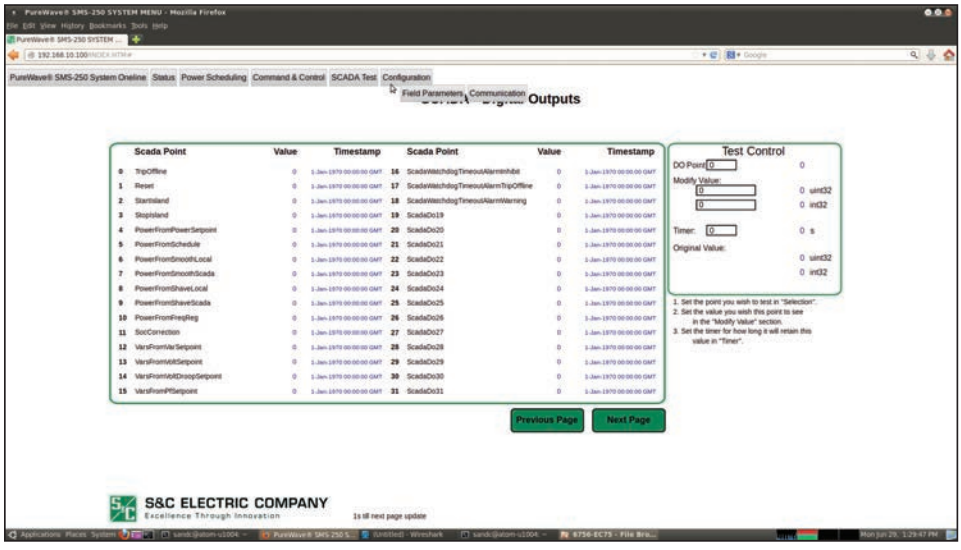


Figure 36. The Configuration drop-down menu.

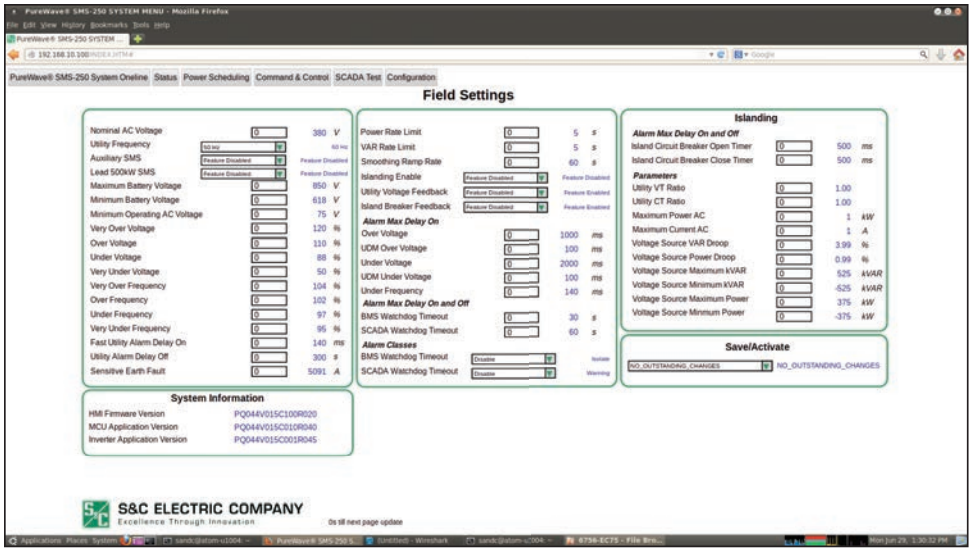


Figure 37. The *Field Settings* screen.

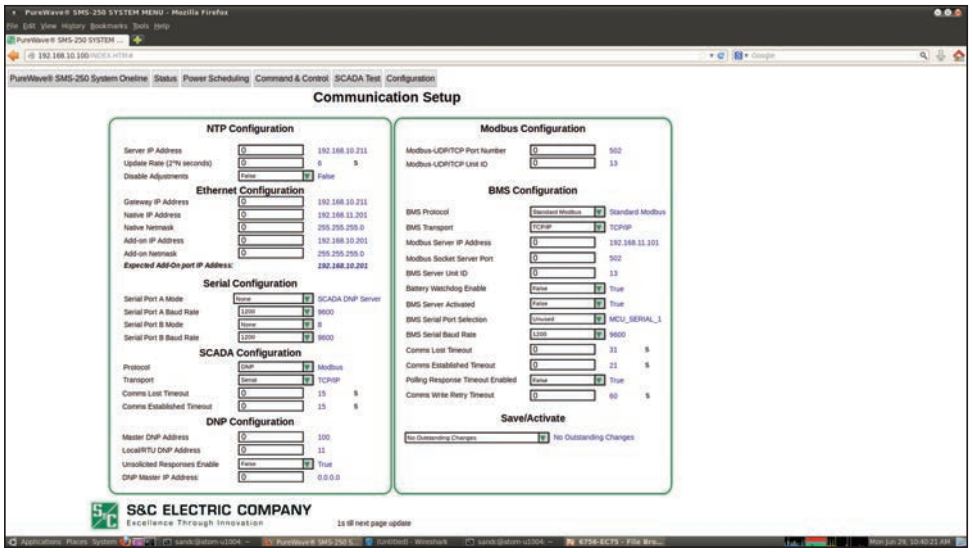


Figure 38. The *Communication Setup* screen.

Examples

Profile 1:

A profile for charging for 10 minutes at 250 kW and then resting back to 0 kW after this time would be as follows:

1. Starting Power: -250 kW
2. Section 1 Duration: 10 min
3. Section 2 Power: -250 kW
4. Section 2 Duration: 0min
5. Section 3 Power: 0 kW
6. Section 3 Duration: 0 min
7. End Power: 0 kW

Resets

Alarm conditions can be cleared in any of three ways. Table 3 describes the three resets available for the PureWave SMS-250 system: Auto, Manual, and Self.

Table 3. Reset Types for the PureWave SMS-250 System

Resets	Description
Auto	This type of reset is automatically performed until a predetermined reset count has been reached.
Manual	This type of reset will require a person to use the HMI or a SCADA connection, or to push the RESET button on the user interface of the PCS, to reset the system.
Self	This type of reset will automatically clear an alarm when it is no longer active.

Alarm Types

The alarms of the PureWave SMS-250 system are categorized into five alarm types: **Information Status, Warning, Inhibit, Battery Isolate**, and **Trip Offline**. Table 4 describes each alarm type.

Table 4. Alarm Types for the PureWave SMS-250 System

Alarm Type	Description
Information Status	Indicates the status of the PureWave SMS-250 system and will not affect the proper operation of the system
Warning	Indicates a problem that may need attention but will not affect the proper operation of the system (The system will continue to operate.)
Inhibit	Indicates a problem that needs attention and will affect the proper operation of the system (The inverter will stop operating and the ac and dc circuit breakers will remain closed.)
Battery Isolate	Indicates a problem that needs attention and will affect the proper operation of the system (The dc circuit breaker will open, and the ac circuit breaker will remain closed. This will cause the inverter to lose the ability to produce/consume real power, but reactive-power operation will remain unaffected,)
Trip Offline	Indicates a problem that needs attention and will affect the proper operation of the system (The system will not operate and the ac and dc circuit breakers will open.)

Basic Operation

The following describes how the user can operate the PureWave SMS-250 system using HMI (**SCADA Disable**) and SCADA (**SCADA Enable**) modes. Toggle the SMS CONTROL switch on the user interface to select the desired mode.

To Trip the PureWave SMS-250 System Offline

To stop the storage-management system, the user can push the INVERTER STOP button located on the user interface. The **Trip Offline** state can also be activated as follows:

- HMI: On the PCS user interface, toggle the SMS CONTROL switch to the **SCADA Disable** state. Then, on the *Command-Control* HMI screen, under the **System Control** menu, click on the **Trip Offline** radio button for the PureWave SMS-250 to go to the **Trip Offline** state.
- SCADA: The user can select DNP Point 0 (Trip Offline) to issue a pulse-on request for the PureWave SMS-250 to go to the **Trip Offline** state.

Starting the PureWave SMS-250 System

To start the storage management system, if the INVERTER STOP button on the user interface was pressed, the button will need to be twisted and released to its not-pressed position for the system to go to the **Ready** state (barring any other **Trip Offline** or **Inhibit** alarms). If the INVERTER STOP button was not pressed, then either of the following actions can be taken:

- HMI: On the PCS user interface, make sure the SMS CONTROL switch is in the **SCADA Disable** position. Then, on the *Command-Control* HMI screen under the **System Control** menu click on the **System Enable** radio button for the system to go to the **Ready** state.
- SCADA: If the SCADA **Trip Offline** command is set, the user can clear the bit at DNP Point 0 (Trip Offline) to issue a latch-off request for the **Trip Offline** state for the PureWave SMS-250 system to go to the **Ready** state. After the bit is cleared, a **Reset** command must be pulsed to complete the process.

Resetting the PureWave SMS-250 System

To manually reset the storage-management system, the user can press the RESET button on the user interface. In addition, either of the following can be used to reset the PureWave SMS-250 system:

- HMI: On the PCS user interface, toggle the SMS CONTROL switch to the **SCADA Disable** state. Then, on the *Command-Control* HMI screen under the **System Control** menu, click on the **Reset** radio button for the PureWave SMS-250 system to reset.
- SCADA: The user can select the DNP Point 1 (Reset) to send a pulse-on request for the PureWave SMS-250 system to reset.

Ready ➔ CS Run

- HMI: On the user interface, toggle the SMS CONTROL switch to the **SCADA Disable** state. On the *Command-Control* HMI screen, choose the desired control mode and enter the power or vars value. This allows the PureWave SMS-250 system to go to the **CS Run** state.
- SCADA: Select the desired power or vars control mode and pulse on its DNP Point for the PureWave SMS-250 system to go the **CS Run** state.

Island Modes

The **VS Run** mode can be configured in three ways: automatic islanding, where the PureWave SMS-250 controls the islanding breaker; automatic islanding, where the utility controls the islanding breaker; and commanded islanding, where the PureWave SMS-250 does not have utility voltage or island breaker feedback. In addition, the **VS Run** mode can be tested with an HMI or SCADA command as described in detail below.

NOTICE

To run the **Island** mode, the islanding panel must be installed.

Automatic Islanding with the PureWave SMS-250 Controlling the Breaker: In this mode, the PureWave SMS-250 controls the islanding circuit breaker. It will command the island circuit breaker open by closing the island circuit breaker open contact when it sees a Utility Disturbance Monitor (UDM) overvoltage or a UDM undervoltage event, or an overfrequency or underfrequency event for the time specified on the *Configuration—Field Parameters* HMI screen. When island circuit breaker feedback voltage is zero, indicating the island circuit breaker is open, the PureWave SMS-250 will run in the island mode providing power to the islanded load. When utility power returns and is at a normal voltage and frequency for 300 seconds (configurable on the *Configuration—Field Parameters* HMI screen), the PureWave SMS-250 system will synchronize with the utility and command the island circuit breaker to close. When the island circuit breaker feedback voltage (24 Vdc) returns, indicating that the island circuit breaker is closed, the PureWave SMS-250 system will stop islanding.

NOTICE

The PureWave SMS-250 system open contact must be wired to open the island circuit breaker.

The PureWave SMS-250 system close contact must be wired to close the island circuit breaker.

Islanding circuit breaker feedback must be configured so that, when the island circuit breaker is closed, there is voltage (24 Vdc), and when it is open, the voltage (24 Vdc) is zero.

For this mode, the user must use the *Configuration—Field Parameters* HMI screen to enable the following features:

- **Islanding**
- **Utility Voltage**
- **Island Breaker**

Automatic Islanding with the Utility Controlling the Breaker: In this mode, the utility has control of opening and closing the island circuit breaker. When an island state is necessary, the utility commands the island circuit breaker to open. When the PureWave SMS-250 sees a UDM overvoltage or a UDM undervoltage, or an overfrequency or underfrequency, and the island circuit breaker feedback voltage is zero volts, the PureWave SMS-250 will move to the **VS** mode. After the utility voltage returns, the PureWave SMS-250 system will turn on the **Synchronized to Utility** alarm and set the SCADA status point. When the utility sees that the ac voltage is good and the PureWave SMS-250 system is synchronized, it can close the island circuit breaker. The PureWave SMS-250 will stay in **VS Run** mode (islanding) until the utility voltage has been within tolerance for 300 seconds. After this condition is met and the islanding circuit breaker feedback voltage (24 Vdc) returns, indicating the island circuit breaker is closed, the PureWave SMS-250 switches to **CS Run** mode, stopping the **Island** state. The 300-seconds setting is configurable on the *Configuration—Field Parameters* HMI screen.

NOTICE

Islanding Breaker Feedback must be configured so there is voltage (24 Vdc) when the island circuit breaker is closed and no voltage when it is open.

For this mode, the user must use the *Configuration—Field Parameters* HMI screen to enable the following features:

Islanding Enable

Utility Voltage Feedback

Island Breaker Feedback

Utility Commanded Islanding: In this mode, the utility has control of the opening and closing of the island circuit breaker. When the **Start Island** SCADA control point is set, the PureWave SMS-250 system will move to the **Island** mode. When the utility voltage and frequency return to normal, the utility issues the **Stop Island** SCADA control point. When the SCADA status point for the **Island Run** state is clear, the utility can command the island circuit breaker to close.

For this mode, the user must use the *Configuration—Field Parameters* HMI screen to enable the following features:

Islanding Enable

Utility Voltage Feedback

Island Breaker Feedback

Island Test Modes

The following modes can be used to test the automatic-islanding capability of the PureWave SMS-250 without the disturbance:

HMI Commanded Islanding: In this mode, with the PureWave SMS-250 controlling the Islanding Breaker, the PureWave SMS-250 is in **Local** mode and will receive a **Start Island** command. When the island circuit breaker feedback voltage is zero, indicating that the island circuit breaker is open, the PureWave SMS-250 system will run in the **Island** mode providing power to the islanded load. When the **Stop Island** command is received and the utility is providing power at a normal voltage and frequency, the PureWave SMS-250 system will synchronize to the utility and command the island circuit breaker to close. When the island circuit breaker feedback voltage (24 Vdc) returns, indicating that the island circuit breaker is closed, the PureWave SMS-250 system will stop islanding.

NOTICE

The PureWave SMS-250 system open contact must be wired to open the island circuit breaker.

The PureWave SMS-250 system close contact must be wired to close the island circuit breaker.

The **Islanding Breaker Feedback** mode must be configured so there is voltage (24 Vdc) when the island circuit breaker is closed and no voltage when it is open.

For this mode, the user must toggle the SMS CONTROL switch to the **SCADA Disable** state. The manual controls are radio buttons located on the *Command and Control* HMI screen in the **Island Control** window.

In addition, the user must use the *Configuration—Field Parameters* HMI screen to enable the following features:

- **Islanding Enable**
- **Utility Voltage Feedback**
- **Island Breaker Feedback**

SCADA Commanded Islanding: In this mode, with the PureWave SMS-250 controlling the islanding breaker, the PureWave SMS-250 system is in **Remote** mode and will receive a **Start Island** command. When the island circuit breaker feedback voltage (24 V) goes to zero, indicating that the island circuit breaker is open, the PureWave SMS-250 system will run in the **Island** mode providing power to the islanded load. When the **Stop Island** command is received and the utility is providing power at a normal voltage and frequency, the PureWave SMS-250 system will synchronize to the utility and command the island circuit breaker to close. When the island circuit breaker feedback voltage (24 Vdc) returns, indicating that the island circuit breaker is closed, the PureWave SMS-250 system will stop islanding.

NOTICE

The PureWave SMS-250 system open contact must be wired to open the island circuit breaker.

The PureWave SMS-250 system close contact must be wired to close the island circuit breaker.

The Islanding Breaker Feedback must be configured so there is voltage (24 Vdc) when the island circuit breaker is closed and no voltage when it is open.

For this mode, the user must toggle the SMS CONTROL switch to the **SCADA Enable** setting. Then, the user can select DNP Point 2 (Start Island) to issue a pulse-on request for the PureWave SMS-250 system to go to the **VS Run** state.

CS Run ➔ Ready

- HMI: On the PCS user interface, toggle the SMS CONTROL switch to the **SCADA Disable** state. Then, on the *Command-Control* HMI screen, change the values of the control mode so that there are no power or vars required. This allows the PureWave SMS-250 system to go to the **Ready** state.
- SCADA: Change the values of the control mode so that there are no power or vars required so the PureWave SMS-250 system can go to the **Ready** state.

VS Run ➔ Ready (for Island Test Modes)

The PureWave SMS-250 system automatically moves to the **Ready** state when the utility source has been restored. However, the storage-management system can also be manually commanded to the **Ready** state as follows:

- HMI: On the PCS user interface, toggle the SMS CONTROL switch to the **SCADA Disable** state. Then, on the **Command-Control** HMI screen under the **Islanding Control** menu, click on the **Stop Island** radio button for the PureWave SMS-250 system to go to the **Ready** state.
- SCADA: The user can select the DNP Point 3 (Stop Island) to issue a pulse-on request for the PureWave SMS-250 system to go to the **Ready** state.

Troubleshooting Tips

The PureWave SMS-250 system contains an extensive self-diagnosis system. If any abnormal condition occurs, the system will activate an alarm.

Following is a list of alarms categorized by alarm type in order of: **Information Status, Warning, Inhibit, Battery Isolate, and Trip Offline.**

NOTICE

The alarms in the following tables are listed according to alarm type at the time of shipment. Alarms may be reconfigured during operation and should be documented accordingly.

The troubleshooting tips listed in the tables 5 through 9 are for guidance purposes. Please contact S&C Electric Company if more troubleshooting assistance is required or if there are any doubts about how to handle an alarm event.

Information Status Alarms

These notifications provide the status of the PureWave SMS-250 system and will not affect the proper operation of the system. See Table 5 for the listed **Information Status** alarms.

Table 5. PureWave SMS-250 Information Status Alarms

Alarm	Description	Reset Type
Ac Breaker Closed	**What is it?** This alarm indicates that the circuit breaker is closed and has been closed for 300 ms. **Why is it an alarm?** The auxiliary contacts on circuit breakers may not close exactly when the main contacts close. This alarm is used to verify the circuit breaker has been closed for some time before moving to another state that requires a closed circuit breaker. **What are the normal alarm settings?** This is a self-reset information alarm that is used by the main state machine to verify the circuit breaker is closed. **What can the user do?** Because this is an information alarm, it does not change the operation of the PureWave SMS-250 system so no action is required.	SELF
Auto Reset Command	**What is it?** This alarm indicates an **Auto Reset** command has been sent. **Auto Reset** commands allow the inverter to try resetting a problem, but if it returns quickly, the reset commands are locked out. **Why is it an alarm?** This is an alarm for troubleshooting purposes so S&C technicians can see when auto resets have been sent and what the results were. **What are the normal alarm settings?** This is an informational alarm that self-resets and causes a snapshot to be taken. **What can the user do?** Because this is an information alarm and is self-resetting, there is no user action necessary.	SELF
Auxiliary SMS-250	**What is it?** This PureWave SMS-250 system is taking commands from a lead PureWave SMS-250 system. **Why is it an alarm?** To inform the user that this is an auxiliary unit. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Battery at Open Circuit Voltage	**What is it?** This alarm is used to know when to keep the battery voltage the same to avoid charging or discharging the battery. When a battery is being charged or discharged, if the battery voltage is held at the voltage that it is at while dc current is flowing, the dc current will slowly go from the existing value to zero while continuing to charge or discharge the battery. **Why is it an alarm?** When the inverter is running vars and no power, we want to hold the power at zero. This can only be done after the battery voltage has relaxed to its open circuit value. **What are the normal alarm settings?** This is an information self-reset alarm with a 10-minute delay to allow the battery to return to its open circuit value. **What can the user do?** This information alarm requires no actions from the user.	SELF
Current Limit Snapshot	**What is it?** This alarm is on when any phase goes into current limit. **Why is it an alarm?** The alarm is used to take a snapshot when a current limit occurs, but it also minimizes the number of snapshots. **What are the normal alarm settings?** This is a self-resetting alarm that takes a snapshot. There is a 10-second delay off, so after there are no current-limit snapshots for 10 seconds, the alarm clears. **What can the user do?** This alarm should clear after 10 seconds. If it doesn't clear, one of the current-limit alarms is probably on or is going on and off. Look at the individual alarms to try and find the phase that is keeping this alarm on.	SELF
Dc Breaker Closed	**What is it?** This alarm indicates that the circuit breaker is closed and has been closed for 300 ms. **Why is it an alarm?** The auxiliary contacts on circuit breakers may not close exactly when the main contacts close. This alarm is used to verify that the circuit breaker has been closed for some time before moving to another state that requires a closed circuit breaker. **What are the normal alarm settings?** This is a self-reset information alarm that is used by the main state machine to verify that the circuit breaker is closed. **What can the user do?** Because this is an information alarm, it does not change the operation of the PureWave SMS-250 system so no action is required.	SELF
Dc Pre-charge Voltage High	**What is it?** This alarm indicates that the dc pre-charge voltage is above what we expect. This will cause problems with charging the dc link. **Why is it an alarm?** When over the expected pre-charge voltage, the DC link will not charge as expected, resulting in a pre-charge alarm. This alarm separates the possible causes to allow better troubleshooting. **What are the normal alarm settings?** This is a self-reset informational alarm. **What can the user do?** This is caused because the voltage for pre-charging the dc link is higher than expected. If this alarm is on, additional troubleshooting by a trained technician is required.	SELF

TABLE CONTINUED ►

Table 5. PureWave SMS-250 Information Status Alarms—Continued

Alarm	Description	Reset Type
Dc Pre-charge Voltage Low	**What is it?** This alarm indicates that the dc pre-charge voltage is below what we expect. This will cause problems with charging the dc link. **Why is it an alarm?** When the expected pre-charge voltage is not present, the dc link will not charge as expected resulting in a pre-charge alarm. This alarm separates the possible causes to allow better troubleshooting. **What are the normal alarm settings?** This is a self-reset informational alarm. **What can the user do?** This is caused because the voltage for pre-charging the DC link is lower than expected. If this alarm is on, additional troubleshooting by a trained technician is required.	SELF
Emergency Frequency Response Active	**What is it?** This indicates the line frequency is no longer within the defined deadband and the PureWave SMS-250 is either providing or consuming real power to bring the line frequency back into the deadband. **Why is it an alarm?** This alarm provides notice that the PureWave SMS-250 is no longer operating in its configured power mode but instead is trying to control the line frequency. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Ethernet Power	**What is it?** This PureWave SMS-250 system is following an Ethernet power command, this is an auxiliary PureWave SMS-250 system following a Lead PureWave SMS-250 system or a master control. The lead or master control is sending the power set point over Ethernet. **Why is it an alarm?** This is to inform the user that the unit is following a power set point from an Ethernet command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Ethernet Vars	**What is it?** The PureWave SMS-250 system is following a var command from the Ethernet connection to the lead PureWave SMS-250 system or a master control. **Why is it an alarm?** This is to inform the user that the unit is following a var command from the Ethernet connection. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Frequency Regulation Power	**What is it?** This PureWave SMS-250 system is following a Frequency Regulation signal supplied over SCADA. **Why is it an alarm?** This is to inform the user that the unit is following a power set point from a Frequency Regulation signal. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Inductor and Cabinet fans on	**What is it?** When either the cabinet or the inductor winding gets too hot, both the fan in the inductor area and the cabinet fan are commanded on. **Why is it an alarm?** This alarm allows the user to see when these fans are commanded on. If the IGBT thermistor is open, it is an open or broken thermistor. The thermistor is broken or cold if the temperature is under -25° C (-13° F). This can happen in a very cold ambient temperature. **What are the normal alarm settings?** This is a self-reset alarm without a snapshot. **What can the user do?** If the ambient temperature is very low, this alarm can be a normal condition. If it is not cold, it is possible that the IGBT is damaged. If the inverter is running, the IGBTs are fine, but if this alarm occurs with an over current alarm, refer the problem to a trained technician.	SELF
Inhibit Island Command	**What is it?** There has been a customer command to prevent islanding of the system. **Why is it an alarm?** This shows the unit will not island during a utility disturbance or commanded island. **Why are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally. If the unit is required to island, remove the **Inhibit Island** command through SCADA or an HMI command.	SELF
Island Circuit Breaker Open	**What is it?** This alarm indicates the islanding circuit breaker is open. **Why is it an alarm?** This will inform the user the islanding circuit breaker is open. The alarm is used when moving to or from the islanding mode. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** This information alarm requires no actions from the user.	SELF

TABLE CONTINUED ►

Table 5. PureWave SMS-250 Information Status Alarms—Continued

Alarm	Description	Reset Type
KVA Limit Is Limiting Vars	**What is it?** The PureWave SMS-250 system is not outputting the commanded amount of vars because of the real power flow occurring at the same time. **Why is it an alarm?** The user will not see the expected amount of vars because of the real power flow occurring at the same time. The unit is limited by its maximum kVA rating. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate at a reduced capacity. To generate the full reactive power expected, the user would have to reduce the real power command.	SELF
Local Control Selected	**What is it?** This alarm indicates that the control of the system is being done locally, not from SCADA. **Why is it an alarm?** So the state of the SCADA/Local select switch can be seen from the controls, as well as remotely. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** This is for information only, the inverter will continue to operate based on the commands from the HMI.	SELF
Local Peak Shave	**What is it?** ThisPureWave SMS-250 system is peak shaving from a local command. **Why is it an alarm?** This is to inform the user the unit is peak shaving from a local command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Local Power	**What is it?** This PureWave SMS-250 system is following a command from the HMI. **Why is it an alarm?** This is to inform the user that the unit is following a power set point from the HMI. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Local Smoothing	**What is it?** This PureWave SMS-250 system is smoothing from a local command. **Why is it an alarm?** This is to inform the user that the unit is smoothing from a local command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Local Vars	**What is it?** The PureWave SMS-250 system is following a var command from the local control. **Why is it an alarm?** This is to inform the user that the unit is following a var command from the local control. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
MCU Alarm	**What is it?** This alarm can indicate one or more issues originating from the MCU; for example, that there is a problem with the compact flash card used to store snapshots or a communications issue with the HMI device or an external I/O device. **Why is it an alarm?** The compact flash card stores snapshots. The snapshots are used to review the history of the PureWave SMS-250 system so events can be analyzed after they occur. Without the compact flash card, this feature is no longer available. If it's a comms issue with the HMI or I/O device, then servicing may be required. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** Replace the compact flash card with another compact flash card, preferably the wide-temperature range high-cycle compact flash model that is supplied by S&C. For HMI or external I/O device communications, check network cabling and status of network switches. If this does not solve the problem, contact S&C service and report the alarm.	SELF
Motor Start Correction	**What is it?** The PureWave SMS-250 system is maintaining the voltage (droop or constant voltage) by quickly responding to large changes in the load current. **Why is it an alarm?** This is to inform the user that the unit is maintaining the voltage by quickly responding to large changes in the load current. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Power Factor Control	**What is it?** The PureWave SMS-250 system is maintaining the Power Factor. **Why is it an alarm?** This is to inform the user that the unit is maintaining the power factor. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF

TABLE CONTINUED ►

Table 5. PureWave SMS-250 Information Status Alarms—Continued

Alarm	Description	Reset Type
Reset Command	**What is it?** This alarm indicates that a **Reset** command has been received. **Why is it an alarm?** This is an alarm only for troubleshooting purposes so S&C technicians can see when a **Reset** command been received and what the results were. **What are the normal alarm settings?** This is an informational alarm that self-resets and causes a snapshot to be taken. **What can the user do?** Because this is for information and is self-resetting, there is no user action necessary.	SELF
SCADA Control Selected	**What is it?** This alarm indicates that the control of the system is being done using SCADA. **Why is it an alarm?** So the state of the SCADA / LOCAL select switch can be seen from the controls. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate based on the SCADA commands.	SELF
SCADA Peak Shave	**What is it?** This PureWave SMS-250 system is peak shaving from a SCADA command. **Why is it an alarm?** This is to inform the user that the unit is peak shaving from a SCADA command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
SCADA Power	**What is it?** This PureWave SMS-250 system is following a SCADA power setpoint. **Why is it an alarm?** This is to inform the user that the unit is following a power setpoint from a SCADA command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
SCADA Smoothing	**What is it?** This PureWave SMS-250 system is smoothing from a SCADA command. **Why is it an alarm?** This is to inform the user that the unit is smoothing from a SCADA command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
SCADA Vars	**What is it?** The PureWave SMS-250 system is following a var command from the SCADA control. **Why is it an alarm?** This is to inform the user that the unit is following a var command from the SCADA control. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Scheduled Power	**What is it?** This PureWave SMS-250 system is peak shaving from a SCADA command. **Why is it an alarm?** This is to inform the user that the unit is peak shaving from a SCADA command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
SOC Correction Active	**What is it?** During smoothing or frequency regulation, the signal may contain a power offset that is slowly charging or discharging the battery. Turning on the SOC correction will bias the power to move toward the nominal SOC, so if the battery SOC is higher than the desired SOC, it will add a small discharge to the commanded signal to move back toward the nominal SOC. **Why is it an alarm?** This is to inform the user that the unit is doing SOC correction. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Synchronized to Utility	**What is it?** This alarm shows that the PureWave SMS-250 system is synchronized to the utility side of the island circuit breaker. **Why is it an alarm?** This alarm verifies synchronization before transitioning from an **Island** mode to a **Utility-Connected** mode, so the transition back to the utility will be seamless. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally. If the alarm is not working as expected, contact S&C service and report the alarm.	SELF

TABLE CONTINUED ►

Table 5. PureWave SMS-250 Information Status Alarms—Continued

Alarm	Description	Reset Type
Utility Good Volt and Freq	**What is it?** This alarm shows the utility voltage is good and the frequency is good. If the PureWave SMS-250 system is in **Island** mode, it will not transition back to **Utility-Connected** mode. **Why is it an alarm?** This alarm verifies the utility voltage and frequency are good before transitioning from an **Island** mode to a **Utility-Connected** mode, so the transition back to the utility will be seamless. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally. If the alarm is not working as expected, contact S&C service and report the alarm.	SELF
Vac Constant Voltage	**What is it?** The PureWave SMS-250 system is following a constant voltage. **Why is it an alarm?** This is to inform the user the unit is following a **Constant Voltage** command. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally.	SELF
Vac Droop Control	**What is it?** The PureWave SMS-250 system is following a Voltage-Droop curve. **Why is it an alarm?** This is to inform the user the unit is following a voltage-droop curve. **What are the normal alarm settings?** This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally	SELF

Warning Alarms

These alarms indicate a problem that may need attention but will not affect the proper operation of the system. The system will continue to operate when a **Warning** condition is being displayed. See Table 6 for the listed **Warning** alarms:

Table 6. PureWave SMS-250 Warning Alarms

Alarm	Description	Reset Type
Battery Under Voltage	**What is it?** This alarm shows the battery voltage is below the minimum voltage defined for the battery. **Why is it an alarm?** This system should not connect to the battery or run the battery. **What are the normal alarm settings?** This is a self-reset warning alarm. **What can the user do?** This could be caused because the battery is not connected to the PureWave SMS-250 system. In this case, the alarm can be cleared by connecting the battery to the PureWave SMS-250 system, typically by closing the circuit breaker in the battery container. If this is not the cause, contact S&C service and report the alarm.	SELF
BMS Req SOC Recalc	**What is it?** The battery is requesting to charge or discharge so it can recalculate its state of charge. **Why is it an alarm?** The battery is requesting to discharge so it can recalculate its state of charge. **What are the normal alarm settings?** This is a warning self-reset alarm. **What can the user do?** Send a **Discharge** command to the battery can reach bottom of charge. If the alarm remains, contact S&C to investigate further.	SELF
Cabinet Temperature Problem	**What is it?** The PureWave SMS-250 monitors the temperature of the cabinet thermistor. If there is an **Over-temperature** warning, an over-temperature event occurs, a thermistor has shorted, or a **Thermistor Open** alarm occurs based on the cabinet temperature, this alarm is set. **Why is it an alarm?** This alarm allows the user to see whether the cabinet temperature was the cause of the alarm. **What are the normal alarm settings?** This is a warning self-reset alarm with a snapshot. **What can the user do?** See the base-alarm description for suggested actions.	SELF
CS Over Load Cool Down	**What is it?** This is a current-source alarm indicating the system was over 400 A for too long. Too long is defined by an equation that calculates the junction temperature in a maximum ambient temperature while running at 100% current. This method gives the same response to an overload regardless of the conditions so the user can coordinate protection with other devices. **Why is it an alarm?** The PureWave SMS-250 system can run above rated current for a short period of time. Once this period of time expires, the system can only run at 400 A and under. This allows a 5-minute cool-down period before allowing the current to exceed the rating again. **What are the normal alarm settings?** This is a warning self-reset alarm. **What can the user do?** The inverter will continue to operate normally, but overload capability will not be allowed until the alarm clears. Wait five minutes for the alarm to clear.	SELF

TABLE CONTINUED ►

Table 6. PureWave SMS-250 Warning Alarms

Alarm	Description	Reset Type
Ethernet Switch Problem	**What is it?** The Ethernet switch ETH1 is reporting a problem. **Why is it an alarm?** If ETH1 stops working, the HMI and the web pages cannot communicate with the controls. **What are the normal alarm settings?** This is an informational alarm that is self-reset. No snapshot is taken. **What can the user do?** Verify by looking at ETH1 if the fault light is on. This will light if an Ethernet cable that normally communicates at all times through the switch is unplugged. Check all the blue Ethernet cable connections.	SELF
Emergency Freq Response Misconfigured	**What is it?** This alarm indicates the Emergency Frequency Response power curves are configured improperly. **Why is it an alarm?** The Emergency Frequency Response will not function if the settings are incorrect. **What are the normal alarm settings?** This is an warning self-reset alarm. **What can the user do?** Correct the settings so the alarm clears and the Emergency Frequency Response can function.	SELF
Execution Time Long Warning	**What is it?** The software for the PureWave SMS-250 system runs in a loop that executes every 208 microseconds. If it takes longer than expected to execute, this alarm will turn on. **Why is it an alarm?** This alarm informs S&C the calculation loop is taking longer than expected. **What are the normal alarm settings?** This is a warning alarm with a manual reset so a single loop that runs long will turn on the warning. A snapshot is taken so S&C engineers can evaluate the conditions when the alarm occurred. **What can the user do?** All the user can do is reset the alarm. S&C would like to know if the alarm turns on, so if the alarm is reset by a user, please let S&C Electric Company know the alarm was on and has been reset.	SELF
IGBT 1 Current Limit	**What is it?** This alarm indicates the current in the indicated phase reached 1080 A peak, or 800 A RMS. This can occur in the **Island** mode when the load is first picked up or when a new transient load is added. When we reach current limit, the IGBTs are turned off for the remainder of the 208-microsecond cycle then allowed to turn on again in the next 208-microsecond cycle. **Why is it an alarm?** This alarm is an indication that the inverter is working at its limit. The alarm has a time delay off to keep it from causing too many snapshots. **What are the normal alarm settings?** This is a warning self-reset alarm with no snapshot and a 0.1-second delay off that is used for future troubleshooting. **What can the user do?** If this alarm is continually on, the alarm could be the result of a bad current sensor power supply.	SELF
IGBT 1 Temperature Problem	**What is it?** Each IGBT package has a thermistor on the baseplate of the IGBT. The PureWave SMS-250 system monitors the temperature of each thermistor. If there is an overotemperature warning, an over temperature, a thermistor shorted, or a thermistor open alarm on IGBT1, this alarm comes on. **Why is it an alarm?** This alarm allows the user to see if IGBT1 was the cause of the alarm. **What are the normal alarm settings?** This is a warning self-reset alarm with a snapshot. **What can the user do?** See the base alarm description for suggested actions.	SELF
IGBT 2 Current Limit	**What is it?** This alarm indicates the current in the indicated phase reached 1080 A peak, or 800 A RMS. This can occur in the **Island** mode when the load is first picked up or when a new transient load is added. When we reach current limit, the IGBTs are turned off for the remainder of the 208-microsecond cycle then allowed to turn on again in the next 208-microsecond cycle. **Why is it an alarm?** This alarm is an indication the inverter is working at its limit. The alarm has a time delay off to keep it from causing too many snapshots. **What are the normal alarm settings?** This is a warning self-reset alarm with no snapshot and a 0.1-second delay off that is used for future troubleshooting. **What can the user do?** If this alarm is continually on, the alarm could be the result of a bad current sensor power supply.	SELF
IGBT 2 Temperature Problem	**What is it?** Each IGBT package has a thermistor on the baseplate of the IGBT. The PureWave SMS-250 system monitors the temperature of each thermistor. If there is an over-temperature warning, an over temperature occurred, a thermistor shorted, or there is a thermistor open alarm on IGBT2, this alarm comes on. **Why is it an alarm?** This alarm allows the user to see whether IGBT2 was the cause of the alarm. **What are the normal alarm settings?** This is a warning self-reset alarm with a snapshot. **What can the user do?** See the base alarm description for suggested actions.	SELF

TABLE CONTINUED ►

Table 6. PureWave SMS-250 Warning Alarms

Alarm	Description	Reset Type
IGBT 3 Current Limit	**What is it?** This alarm indicates that the current in the indicated phase reached 1080 A peak, or 800 A RMS. This can occur in the **Island** mode when the load is first picked up or when a new transient load is added. When we reach current limit, the IGBTs are turned off for the remainder of the 208-microsecond cycle then allowed to turn on again in the next 208-microsecond cycle. **Why is it an alarm?** This alarm is an indication that the inverter is working at its limit. The alarm has a time delay off to keep it from causing too many snapshots. **What are the normal alarm settings?** This is a warning self-reset alarm with no snapshot and a 0.1-second delay off that is used for future troubleshooting. **What can the user do?** If this alarm is continually on, the alarm could be the result of a bad current sensor power supply.	SELF
IGBT 3 Temperature Problem	**What is it?** Each IGBT package has a thermistor on the baseplate of the IGBT. The PureWave SMS-250 system monitors the temperature of each thermistor. If there is an over-temperature warning, an over temperature occurred, a thermistor shorted, or there is a thermistor open alarm on IGBT3, this alarm comes on. **Why is it an alarm?** This alarm allows the user to see whether IGBT3 was the cause of the alarm. **What are the normal alarm settings?** This is a warning self-reset alarm with a snapshot. **What can the user do?** See the base alarm description for suggested actions.	SELF
Inductor Temp Problem	**What is it?** The PureWave SMS-250 system monitors the temperature of the inductor winding. If there is an over-temperature warning, an over temperature occurred, a thermistor shorted, or there is a thermistor open alarm based on the inductor winding temperature, this alarm comes on. **Why is it an alarm?** This alarm allows the user to see whether the inductor winding temperature was the cause of the alarm. **What are the normal alarm settings?** This is a warning self-reset alarm with a snapshot. **What can the user do?** See the base alarm description for suggested actions.	SELF
Load Over Current	**What is it?** This alarm shows the current going to the island breaker is greater than the PureWave SMS-250 system can handle. **Why is it an alarm?** It is used to block the transition to **Island** mode when the PureWave SMS-250 system cannot provide enough current to the island. **What are the normal alarm settings?** The threshold for this alarm is set at the current rating of the PureWave SMS-250 system. This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally but will not transition to **Island** mode in the event of a utility disturbance.	SELF
Load Over Power	**What is it?** This alarm shows the power going to the island breaker is greater than the PureWave SMS-250 system can handle. **Why is it an alarm?** It is used to block the transition to **Island** mode if the PureWave SMS-250 system cannot provide power to the island. **What are the normal alarm settings?** The threshold for this alarm is set at the power rating of the PureWave SMS-250 system. This is an information self-reset alarm. **What can the user do?** The inverter will continue to operate normally but will not transition to **Island** mode in the event of a utility disturbance.	SELF
Over Temp Warning	**What is it?** Each IGBT package has a thermistor on the baseplate of the IGBT. The PureWave SMS-250 system monitors the temperature of each thermistor. Additionally, the inductor has an RTD to monitor its temperature. Also, the cabinet has a thermistor to monitor the top of cabinet ambient temperature. Finally, the transformer has a relay to signal over temperature and, in some cases, liquid level gauge, pressure vacuum gauge (-5PSIG and +7.5PSIG), and pressure relief device alarms. **Why is it an alarm?** If the IGBT, inductor, cabinet, or transformer gets too hot, damage to components could occur. Before damage occurs, this alarm stops inverter operation. **What are the normal alarm settings?** This is an inhibit auto reset alarm with a snapshot. **What can the user do?** One cause of this problem is restricted air flow. The user can look at the outside of the PureWave SMS-250 system to make sure there are no restrictions near the air intakes for the PureWave SMS-250 system. If there are no visible restrictions, the problem should be referred to a trained technician.	SELF

TABLE CONTINUED ►

Table 6. PureWave SMS-250 Warning Alarms

Alarm	Description	Reset Type
PS1 24-Vdc Under Voltage	**What is it?** There are two 24-Vdc power supplies that serve the PureWave SMS-250 system. One is connected to the ac utility line, where a three-phase bridge rectifier provides the highest of the three line-to-line voltages to the input of the 24-Vdc power supply. The other 24-Vdc power supply input comes from the battery input to the PureWave SMS-250 system. This input provides power to transition to the **Island** mode. This alarm means the power supply fed from the dc bus is not working. **Why is it an alarm?** If either of the power supplies stops working and there is not a good reason, the system operator needs to know so the problem can be resolved. **What are the normal alarm settings?** This is a warning self-reset alarm that takes a snapshot. **What can the user do?** If there is both ac and dc voltage at the inverter terminals, the problem should be referred to a trained technician.	SELF
PS2 24-Vdc Under Voltage	**What is it?** There are two 24-Vdc power supplies that serve the PureWave SMS-250 system. One is connected to the ac utility line, where a three-phase bridge rectifier provides the highest of the three line-to-line voltages to the input of the 24-Vdc power supply. The other 24-Vdc power supply input comes from the battery input to the PureWave SMS-250 system. This input provides power to transition to the **Island** mode. This alarm means the power supply fed from the utility is not working. **Why is it an alarm?** If either of the power supplies stops working and there is not a good reason, the system operator needs to know so the problem can be resolved. **What are the normal alarm settings?** This is a warning that is self-reset. A snapshot is taken for future troubleshooting. **What can the user do?** If there is both ac and dc voltage at the inverter terminals, the problem should be referred to a trained technician.	SELF
Reduced Storage Capacity	**What is it?** One or more batteries in the system is either unavailable or has a reduced capacity. **Why is it an alarm?** If the system is an islanding system, the runtime in **Island** mode may be reduced if batteries are unavailable/unusable. In a non-islanding system, the battery may not meet the needs of the load if batteries are unavailable/unusable. **What are the normal alarm settings?** This is a warning self-reset alarm. **What can the user do?** Contact S&C to investigate further.	SELF
SCADA Watchdog Timeout	**What is it?** Often the PureWave SMS-250 system is controlled by a SCADA system. When this is the case, the system should follow the SCADA commands to perform the expected functions. **Why is it an alarm?** Loss of communication can result in the PureWave SMS-250 system continuing a function that is no longer desirable. An example would be smoothing, where the SCADA is providing a power signal from a wind turbine to smooth. The PureWave SMS-250 system charges and discharges the battery to smooth out the power from the wind. If SCADA communication is lost, the best action for the PureWave SMS-250 system is to stop operation. **What are the normal alarm settings?** This is an inhibit self-reset alarm. A snapshot is not taken because the state will change resulting in a snapshot of the event. **What can the user do?** The class of the alarm and the time delay are field settings and can be changed to be appropriate for the operating mode. These class changes are available in the field settings or from SCADA. If this alarm is occurring on a regular basis, there could be a problem with the physical connection. A trained technician can troubleshoot this problem.	SELF
SMS-250 Comm Loss	**What is it?** This alarm is only used with two PureWave SMS-250 inverters running as a PureWave SMS-250 system. When the alarm is on, it shows that a lead PureWave SMS-250 system is not communicating with an auxiliary PureWave SMS-250 system or an auxiliary PureWave SMS-250 system is not communicating with a lead PureWave SMS-250 system or master control. **Why is it an alarm?** is used to stop operation of an auxiliary PureWave SMS-250 system, or reduce the power and current available on a lead PureWave SMS-250 system. **What are the normal alarm settings?** The threshold for this alarm is set at a communication loss for 30 seconds. This is a warning self-reset alarm. **What can the user do?** This is the result of a bad Ethernet connection to the DSP Ethernet. Check the Ethernet cable on both ends. If needed, replace the cable. Cables between two PureWave SMS-250 systems are crossover Ethernet cables. Cables between a master control and a PureWave SMS-250 system are normal Ethernet cables.	SELF

TABLE CONTINUED ►

Table 6. PureWave SMS-250 Warning Alarms

Alarm	Description	Reset Type
Thermistor Open or Cold	**What is it?** Each IGBT package has a thermistor on the baseplate of the IGBT. The PureWave SMS-250 system monitors the temperature of each IGBT and the cabinet thermistor. If a thermistor is open, it looks like a low temperature. The RTD looks like a high temperature if it is open. **Why is it an alarm?** If the IGBT or cabinet thermistor is open, we call it an open or broken thermistor. We call the thermistor broken or cold if the temperature is under -25°C (-13°F). This can happen in a very cold ambient temperature. The RTD is open if the temperature is above 200°C (392°F). **What are the normal alarm settings?** This is a warning self-reset alarm without a snapshot. **What can the user do?** If the ambient temperature is very low, this alarm can be a normal condition. If it is not cold, it is possible that the IGBT is damaged. If the inverter is running, the IGBTs are fine, but if this alarm occurs with an over current alarm refer the problem to a trained technician.	SELF
Transformer Problem	**What is it?** The PureWave SMS-250 system provides two dry-contact relay inputs to monitor external equipment. These two digital inputs can be used to monitor transformer over temperature, the liquid level gauge or pressure-vacuum gauge, or a pressure-relief device in an oil-filled transformer. **Why is it an alarm?** This alarm allows the user to identify extreme situations in external equipment, such as transformers. **What are the normal alarm settings?** This is a warning self-reset alarm with a snapshot. **What can the user do?** See the base alarm description for suggested actions.	SELF
Thermistor Shorted	**What is it?** Each IGBT package has a thermistor on the baseplate of the IGBT, as does the cabinet. The PureWave SMS-250 monitors the temperature of each thermistor. If a thermistor has shorted, it looks like a high temperature. When shorted, the inductor RTD looks like a low temperature. **Why is it an alarm?** If a thermistor or RTD has shorted, instead of calling the temperature an over-temperature event, we call it a shorted thermistor. We call the thermistor shorted if the temperature is over 200°C (392°F), much higher than we ever expect from the IGBT baseplate or cabinet. The RTD is shorted if the temperature is below -25°C (-13°F). **What are the normal alarm settings?** This is a warning self-reset alarm without a snapshot. **What can the user do?** This is probably a wiring problem, either in the inverter or on the IGBT pole. The problem should be referred to a trained technician.	SELF
VsModeProblem	**What is it?** The island breaker is open, but there is no **Island** command. **Why is it an alarm?** This puts the system in an unexpected state. **What are the normal alarm settings?** This is a warning self-reset alarm. **What can the user do?** The inverter will continue to operate normally. Contact S&C service and report the alarm.	SELF

Inhibit Alarms

These alarms indicate a problem that needs attention and will affect the proper operation of the system. The inverter will stop operating when an **Inhibit** condition is being displayed. The ac and dc circuit breakers will remain closed. See Table 7 for the listed **Inhibit** alarms:

Table 7. PureWave SMS-250 Inhibit Alarms

Alarm	Description	Reset Type
Any App Brd Pwr Supply UV	**What is it?** The application board has several on board power supplies that are derived from the 24-V incoming power. If any of these supplies is below the required value, this alarm will indicate the problem. **Why is it an alarm?** These supplies are critical to the proper operation of the PureWave SMS-250 system inverter. **What are the normal alarm settings?** This is an inhibit alarm with an auto reset. It will reset itself a couple of times, then lock out if the event continues. **What can the user do?** This is a problem with the application board. The control box will need to be replaced by a qualified technician.	AUTO
Check Dc and Ac Feedback Fuses	**What is it?** This alarm shows that, with the dc circuit breaker indicating it is closed, the dc battery and dc link voltages are different, or it indicates that,with the ac breaker indicating closed, there is voltage across the ac circuit breaker. A typical setting is a voltage difference of 20 V when the difference should be 0 V. **Why is it an alarm?** The alarm shows that the voltage is not the expected voltage. **What are the normal alarm settings?** This is an inhibit self-reset alarm. **What can the user do?** Look at the data on the *Status-Analog* screen to see whether the difference is on the ac or dc side. The ac side looks at the voltage across the ac circuit breaker. Check fuses F4, F5, and F6 if there is voltage across the ac circuit breaker and it is closed. If it is on the dc side, the dc link voltage will not match the storage voltage. If this is the case, check F1 and F2. If the fuses are all good, then the conductivity of the ac or dc circuit breaker could be the problem. If this is the case, contact S&C service with the results of the troubleshooting.	SELF

TABLE CONTINUED ►

Table 7. PureWave SMS-250 Inhibit Alarms—Continued

Alarm	Description	Reset Type
Check Island Feedback Fuses	**What is it?** This alarm shows that, with the island circuit breaker indicating it is closed, the ac-input voltage and island-input voltages are different. A typical setting is a voltage difference of 20 V when the difference should be 0 V. **Why is it an alarm?** The alarm shows that the voltage is not the expected voltage. **What are the normal alarm settings?** This is a warning self-reset alarm. **What can the user do?** Look at the data to see whether the low voltage is on the island or PureWave SMS-250 system side. If it is on the island side, one at a time check the island-feedback fuses (they are external to the PureWave SMS-250 system). If the low voltage is on the PureWave SMS-250 system side, the conductivity of the island circuit breaker could be the problem. If this is the case, contact S&C service with the results of the troubleshooting.	SELF
Dc Link Over Voltage	**What is it?** This alarm indicates that the dc link is 5 volts higher than the battery maximum voltage. The battery maximum voltage threshold is configurable and can be as high as 850 Vdc. The threshold can be seen on the web-based browser screen as one of the parameters by users who have permission to view this screen. **Why is it an alarm?** A battery voltage that is higher than the maximum allowed battery voltage can damage the battery. **What are the normal alarm settings?** This is an inhibit alarm with an auto reset. A snapshot is taken for future troubleshooting at the S&C factory. **What can the user do?** If the auto reset has locked out, the user can reset the alarm.	AUTO
Dc Link Under Voltage	**What is it?** This alarm indicates the dc link is at less than 90% of the line-to-line peak voltage. **Why is it an alarm?** A dc link voltage that is lower than the minimum 90% of the peak voltage causes major current distortion. **What are the normal alarm settings?** This is an inhibit alarm with a self-reset. A snapshot is taken for future troubleshooting at the S&C factory. **What can the user do?** The alarm will reset itself when the voltage is returned into its normal range.	AUTO
Downstream Fault Detected	**What is it?** This alarm shows there is fault current flowing in the utility connection. **Why is it an alarm?** If there is a downstream fault, the PureWave SMS-250 system should not move to the **Island** mode because the utility is better at restoring the voltage than the PureWave SMS-250 system. In addition, the utility can supply more fault current to cause downstream protection to open clearing the fault. **What are the normal alarm settings?** Current through the island circuit breaker that is over 2 PU (800 A for a single PureWave SMS-250 system). This is an inhibit self-reset alarm. **What can the user do?** The inverter will inhibit for 1 second after the fault clears. If the alarm is continuously active, the PureWave SMS-250 system is seeing currents over 2 PU (800 A for a single PureWave SMS-250 unit). If this is not expected, contact S&C service and report the alarm.	SELF
Dsp Fpga Heartbeat Lost	**What is it?** This alarm indicates that the FPGA and the DSP processors are not properly communicating. **Why is it an alarm?** This FPGA is responsible for the modulation and current limiting of the inverter. If it is not properly communicating with the DSP, the inverter may not be able to properly control the current. **What are the normal alarm settings?** This is an inhibit manual reset alarm. **What can the user do?** The user can send a reset. If the alarm clears, the communication has been restored. If the alarm persists after a reset has been sent, contact S&C service and report the alarm.	MANUAL
Fpga Hardware Alarm	**What is it?** This alarm indicates the FPGA has detected a voltage or current that exceeds the system limit. This can indicate the LEM currents were too high (also indicated by an IGBT **Over-Current** alarm), the Dc Link voltage was too high (also indicated by a DC Link **Over-Voltage** alarm), the precharge voltage was too high (also indicated by a **DC Pre-Charge Voltage High** alarm), the sensitive earth fault voltage was too high (also indicated by a **Sensitive Earth Fault** alarm), or the filter-capacitor voltages were too high (only indicated by this alarm). **Why is it an alarm?** When a hardware threshold is reached, the IGBTs will shut down to protect the system. **What are the normal alarm settings?** This is an inhibit manual reset alarm. **What can the user do?** Note the other alarms that are present (**Dc Link Over Voltage**, I**GBT Over Current**, **Dc Pre-Charge Voltage High**, **Sensitive Earth Fault**). Contact S&C service and report the alarms.	SELF
Gate Drive 1 Under Voltage	**What is it?** Each of the IGBTs has a gate drive. The gate drive requires power connected to the IGBT emitter. This connection moves with respect to ground requiring an isolated gate-drive power supply. Each of these power supplies is monitored for undervoltage, typically at 13.5 V on the 15-V gate power supply. **Why is it an alarm?** If an IGBT is driven with a low voltage, the IGBT will switch slower. If the voltage gets low enough, the voltage across the IGBT goes up rapidly, resulting in high-power loss resulting in a high-temperature IGBT. The power-supply voltage is an early indication of a problem. **What are the normal alarm settings?** This alarm is an auto-reset inhibit alarm with a snapshot. **What can the user do?** A reset may clear the problem. If not contact S&C.	AUTO

TABLE CONTINUED ►

Table 7. PureWave SMS-250 Inhibit Alarms—Continued

Alarm	Description	Reset Type
Gate Drive 2 Under Voltage	**What is it?** Each of the IGBTs has a gate drive. The gate drive requires power connected to the IGBT emitter. This connection moves with respect to ground requiring an isolated gate-drive power supply. Each of these power supplies is monitored for undervoltage, typically at 13.5 V on the 15-V gate power supply. **Why is it an alarm?** If an IGBT is driven with a low voltage, the IGBT will switch slower. If the voltage gets low enough, the voltage across the IGBT goes up rapidly resulting in high-power loss resulting in a high-temperature IGBT. The power-supply voltage is an early indication of a problem. **What are the normal alarm settings?** This alarm is an auto-reset inhibit alarm with a snapshot. **What can the user do?** A reset may clear the problem. If not contact S&C.	AUTO
Gate Drive 3 Under Voltage	**What is it?** Each of the IGBTs has a gate drive. The gate drive requires power connected to the IGBT emitter. This connection moves with respect to ground requiring an isolated gate-drive power supply. Each of these power supplies is monitored for undervoltage, typically at 13.5 V on the 15-V gate power supply. **Why is it an alarm?** If an IGBT is driven with a low voltage, the IGBT will switch slower. If the voltage gets low enough, the voltage across the IGBT goes up rapidly, resulting in high-power loss resulting in a high-temperature IGBT. The power-supply voltage is an early indication of a problem. **What are the normal alarm settings?** This alarm is an auto-reset inhibit alarm with a snapshot. **What can the user do?** A reset may clear the problem. If not contact S&C.	AUTO
Lost Synchronize	**What is it?** The PureWave SMS-250 inverter synchronizes to the voltage input at its terminals using a Phase Lock Loop (PLL). The PLL should always be locked to the input voltage. However, it is possible that the PLL could lose its lock. **Why is it an alarm?** The current from the inverter is locked to the inverter angle from the inverter PLL. If the angle is not correct, the power and vars from the inverter will not be correct. **What are the normal alarm settings?** The inverter must be within 10 degrees of the three-phase input voltage. This is an inhibit alarm that is self-resetting and defined as a utility disturbance. A snapshot is taken for future troubleshooting at the S&C factory. **What can the user do?** If the user sees this alarm when the utility-voltage frequency and phase rotation are good, they should contact the factory for support. If the voltage or frequency or phase rotation is bad, the inverter may not be able to lock to the utility until the voltage and frequency are both within tolerance.	SELF
Over Frequency	**What is it?** This alarm looks at the line frequency at the inverter ac connection. If this frequency is above the **Over-frequency** threshold, it sets the alarm. **Why is it an alarm?** This alarm is used to comply with IEEE 1547 to inhibit operation in the event of an **Over-frequency** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Over-Frequency** settings. To change the sensitivity, time delay on can be changed or the frequency threshold as a percent of the base frequency can be changed.	SELF
Over Voltage	**What is it?** This alarm looks at the RMS line-to-line voltage of each of the three phases at the inverter ac connection and, if any are above the **Overvoltage** threshold, it sets the alarm. **Why is it an alarm?** This alarm is used to comply with IEEE 1547 inhibiting operation in the event of an **Overvoltage** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Voltage** settings. To change the sensitivity, time delay on can be changed or the voltage threshold as a percent of nominal voltage can be changed.	SELF
Parameter Cal Change Activate	**What is it?** The SMS has what we call parameters. These are variables that help to calibrate and define the operation of the system. An example of calibration is that we calibrate the dc battery voltage. The actual voltage might be 702.5 Vdc. Without calibration, the SMS might read 697.8 Vdc. In the factory, we calibrate the voltage so it is within 0.1% of a high-accuracy calibrated meter. **Why is it an alarm?** This alarm comes on when we change a parameter, and it goes off after a 0.1-second delay. We use this alarm to stop inverter operation and allow the new parameter(s) to change with the inverter not switching. **What are the normal alarm settings?** This is an inhibit alarm that is self-clearing after 0.1 seconds. A snapshot is taken to show that the inverter inhibited because the parameters had changed. **What can the user do?** This alarm goes off by itself. The user cannot do anything to clear the alarm, but the alarm should never be on for more than the refresh time of the user interface.	SELF

TABLE CONTINUED ►

Table 7. PureWave SMS-250 Inhibit Alarms—Continued

Alarm	Description	Reset Type
PS3 LEM Power Supply UV	**What is it?** The PureWave SMS-250 current sensors are Hall Effect current sensors that can sense both ac and dc current. They are actively powered using a dual 15-V power supply. The +15 V and -15 V are both monitored by the controls to make sure that the current sensors have good voltage. **Why is it an alarm?** Current feedback is essential to the PureWave SMS-250 inverter. If we lose a power supply, the current feedback will not follow the primary current. This will cause misoperation of the inverter. **What are the normal alarm settings?** This is an auto-reset inhibit alarm that takes a snapshot. The threshold for under voltage is 13.5 V on each of the 15-V supplies. **What can the user do?** The auto-reset lockout can be reset, but if the problem persists the inverter will need to be looked at by qualified personnel.	AUTO
Reverse Phase Rotation	**What is it?** This alarm indicates that the PureWave SMS-250 inverter is connected to a voltage that is rotating L1 - L3 - L2 instead of L1 - L2 - L3 with the voltage positive zero crossing occurring on L1 then L2 and finally L3 as expected. **Why is it an alarm?** The inverter controls expect a phase rotation of L1 - L2 - L3 and are configured for this phase rotation. **What are the normal alarm settings?** This is a Trip Offline self-reset alarm. **What can the user do?** If this alarm is on and stays on, the phase rotation should be corrected by swapping the utility connection wires, for instance between L2 and L3.	SELF
Time Current Curve Overload	**What is it?** This is an islanding alarm that indicates we are over 400 A for too long. Too long is defined by an equation that calculates the junction temperature in a maximum ambient temperature when running at 100% current. This method gives the same response to an overload regardless of the conditions so the user can coordinate protection with other devices. **Why is it an alarm?** If the current is too high for too long, the IGBTs could be damaged. **What are the normal alarm settings?** This is a manual-reset inhibit alarm that takes a snapshot. **What can the user do?** If this occurs, it is because of a high load or a fault in the load when islanding. To reduce the occurrence of this alarm when the cause is an overload, the Island load should be reduced.	MANUAL
Under Frequency	**What is it?** This alarm looks at the line frequency at the inverter ac connection. If this frequency is below the **Under-frequency** threshold, it sets the alarm. **Why is it an alarm?** This alarm is used to comply with IEEE 1547 to inhibit operation in the event of an **Under-frequency** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Under-Frequency** settings. To change the sensitivity, time delay on can be changed or the frequency threshold as a percent of the base frequency can be changed.	SELF
UDM Over Voltage	**What is it?** UDM is an acronym for utility-disturbance monitor. When the utility, as measured on the utility side of the islanding switch, has a disturbance and an island is needed to continue to supply the load, a fast detection of the island is needed. This alarm looks at the RMS line-to-line voltage of each of the three phases at the inverter ac connection and, if any are above the **Overvoltage** threshold, it sets the alarm. This generally takes time because the measured RMS voltage is a filtered calculation. **Why is it an alarm?** This gives us a fast detection of a utility problem so we can island, while the overvoltages and undervoltages in the slow alarms are used to prevent islanding unintentionally. **What are the normal alarm settings?** This is an information self-reset alarm that is also a utility disturbance. **What can the user do?** The inverter will respond based on the **Voltage** settings. To make the system less sensitive, time delay on can be added or the voltage can be increased.	SELF
UDM Under Voltage	**What is it?** UDM is an acronym for utility-disturbance monitor. When the utility, as measured on the utility side of the islanding switch, has a disturbance and an island is needed to continue to supply the load, a fast detection of the island is needed. This alarm looks at the RMS line-to-line voltage of each of the three phases at the inverter ac connection and, if any are below the **Undervoltage** threshold, it sets the alarm. This generally takes time because the measured RMS voltage is a filtered calculation. **Why is it an alarm?** This gives a fast robust detection of a utility problem so we can island, while the overvoltage and undervoltages in the slow alarms are used to prevent us from islanding unintentionally. **What are the normal alarm settings?** This is an information self-reset alarm that is also a utility disturbance. **What can the user do?** The inverter will respond based on the **Voltage** settings. To make the system less sensitive, the voltage level or time delay on can be added or the voltage can be reduced.	SELF

TABLE CONTINUED ►

Table 7. PureWave SMS-250 Inhibit Alarms—Continued

Alarm	Description	Reset Type
Under Voltage	**What is it?** This alarm looks at the RMS line-to-line voltage of each of the three phases at the inverter ac connection and, if any are below the **Undervoltage** threshold, it sets the alarm. **Why is it an alarm?** This alarm is used to comply with IEEE 1547 to inhibit operation in the event of an **Undervoltage** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Voltage** settings. To change the sensitivity, time delay on can be changed or the voltage threshold as a percent of nominal voltage can be changed.	SELF
Very Over Frequency	**What is it?** This alarm looks at the line frequency at the inverter ac connection. If this frequency is above the **Very Over-Frequency** threshold, it sets the alarm. **Why is it an alarm?** This alarm is in addition to IEEE 1547 and inhibits operation in the event of a **Very Over-Frequency** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Very Over Frequency** settings. To change the sensitivity, time delay on can be changed or the frequency threshold as a percent of the base frequency can be changed.	SELF
Very Over Voltage	**What is it?** This alarm looks at the RMS line-to-line voltage of each of the three phases at the inverter ac connection and, if any are above the **Very Over-Voltage** threshold, it sets the alarm. **Why is it an alarm?** This alarm gives us a faster response than the **Overvoltage** alarm. It is used to comply with IEEE 1547. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the voltage settings. To change the sensitivity, time delay on can be changed or the voltage threshold as a percent of nominal voltage can be changed.	SELF
Very Under Frequency	**What is it?** This alarm looks at the line frequency at the inverter ac connection. If this frequency is below the **Very Under-Frequency** threshold, it sets the alarm. **Why is it an alarm?** This alarm is used to comply with IEEE 1547 to inhibit operation in the event of a **Very Under-Frequency** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Very Under-Frequency** settings. To change the sensitivity, time delay on can be changed or the frequency threshold as a percent of the base frequency can be changed.	SELF
Very Under Voltage	**What is it?** This alarm looks at the RMS line-to-line voltage of each of the three phases at the inverter ac connection and, if any are below the **Very Under-Voltage** threshold, it sets the alarm. **Why is it an alarm?** This alarm is used to comply with IEEE 1547 to inhibit operation in the event of a **Very Under-Voltage** condition. **What are the normal alarm settings?** This is an inhibit self-reset alarm that is also a utility disturbance and takes a snapshot. **What can the user do?** The inverter will respond based on the **Voltage** settings. To change the sensitivity, time delay on can be changed or the voltage threshold as a percent of nominal voltage can be changed.	SELF
Over Temperature	**What is it?** The **Over Temperature** alarm can be set to monitor the temperature in the IGBTs, the inductors, and the cabinet with the following setpoints: IGBTs >114.4°C (238°F), cabinet >60°C (140°F), Inductors >170°C (338°F). The **Over Temperature** alarm also can be set to monitor the transformer when the transformer problem warning alarm digital input is active. **Why is it an alarm?** If the IGBT, inductor, cabinet, or transformer gets too hot, damage to components could occur. Before damage occurs, this alarm stops inverter operation. **What are the normal alarm settings?** This is an inhibit auto reset alarm with a snapshot. **What can the user do?** One cause of this problem is restricted air flow. The user can look at the outside of the SMS-250 and make sure that there are no restrictions near the air intakes for the SMS-250. If there are no visible restrictions, the problem should be referred to a trained technician.	SELF

Battery Isolate Alarms

These alarms indicate a problem that needs attention and will affect the proper operation of the system. The system will operate on a limited basis when a **Battery isolate** condition is being displayed. The dc circuit breaker will open. See Table 8 for the listed **Battery Isolate** alarms:

Table 8. PureWave SMS-250 Battery Isolate Alarms

Alarm	Description	Reset Type
Battery Cell Over Temperature	**What is it?** A battery cell is reporting that it is too hot. **Why is it an alarm?** A battery cell has overheated, so continued operation of the pack could be dangerous. **What are the normal alarm settings?** This is a battery isolate (DC breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. The cell may cool down over time. If the cell does not cool down and the alarm remains, contact S&C to investigate further.	SELF
Battery Cell Under Temperature	**What is it?** A battery cell is reporting that it is too cold. **Why is it an alarm?** A battery cell has cooled down below the operational range, so continued operation of the pack could be detrimental to battery health. **What are the normal alarm settings?** This is a battery isolate (dc breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. The cell may heat up over time. If the cell does not heat up and the alarm remains, contact S&C to investigate further.	SELF
Battery Cell Over Voltage	**What is it?** A battery cell is reporting that it has overcharged. **Why is it an alarm?** A battery cell has over charged so continued operation of the pack could be dangerous. **What are the normal alarm settings?** This is a battery isolate (dc breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. The cell may equalize its charge over time. If the cell does not equalize and the alarm remains, contact S&C to investigate further.	SELF
Battery Cell Under Voltage	**What is it?** A battery cell is reporting that it has discharged to a very low level. **Why is it an alarm?** A battery cell has discharged beyond normal operating range so continued operation of the pack could be dangerous. **What are the normal alarm settings?** This is a battery isolate (dc breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. The cell may equalize its charge over time. If the cell does not equalize and the alarm remains, contact S&C to investigate further.	SELF
Battery Requests Shutdown	**What is it?** The battery is reporting that it needs to shut down. **Why is it an alarm?** The battery is reporting it needs to power down, so continued operation of the pack could be dangerous. **What are the normal alarm settings?** This is a battery isolate (dc breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. If the alarm remains, contact S&C to investigate further.	SELF
Battery String Over Current	**What is it?** The battery string has had too much current flow. **Why is it an alarm?** A battery string is reporting that the inverter produced more than the expected current flow. **What are the normal alarm settings?** This is a battery isolate (dc breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. The dc breaker opening should prevent the flow of current. If it does not contact S&C to investigate further.	SELF
BMS Watchdog Timeout	**What is it?** Many advanced battery systems have a battery-management system to help protect the battery from running in a way that will damage the battery. This system monitors temperature, current, and voltage on individual cells or on blocks of cells to make sure the conditions for safe operation with long battery life are maintained. **Why is it an alarm?** It is important to make sure the communication link with the Battery Management System (BMS) is working so the battery is properly managed. The watch dog is a timer that makes sure that good communication has occurred within the watchdog time. If not, the PureWave SMS-250 system stops charging and discharging the battery. **What are the normal alarm settings?** This is an inhibit self-reset alarm. A snapshot is not taken because the state will change resulting in a snapshot of the event. **What can the user do?** The class of the alarm and the time delay are field settings and can be changed to be appropriate for the battery. If this alarm is occurring on a regular basis, there could be a problem with the physical connection. A trained technician can troubleshoot this problem.	SELF

TABLE CONTINUED ►

Table 9. PureWave SMS-250 Trip Offline Alarms—Continued

Alarm	Description	Reset Type
Internal Battery Communications Failure	**What is it?** The BMS is reporting that it is having issues communicating internally. **Why is it an alarm?** The battery is reporting potentially incorrect data so continued operation of the pack could be dangerous. **What are the normal alarm settings?** This is a battery-isolate (dc breaker will open) self-reset alarm. **What can the user do?** The inverter will not be able to produce real power while this alarm is present. The pack may correct its communication issue over time. If the alarm remains, contact S&C to investigate further.	SELF

Trip Offline Alarms

These alarms indicate a problem that needs attention and will affect the proper operation of the system. The system will not operate when a **Trip Offline** condition is being displayed. The ac and dc circuit breakers will also open. See Table 9 for the listed **Trip Offline** alarms:

Table 9. PureWave SMS-250 Trip Offline Alarms

Alarm	Description	Reset Type
Ac Breaker Fail to Close	**What is it?** This alarm indicates the circuit breaker is open when it is sent a **Close** command. **Why is it an alarm?** The circuit breakers should follow their commands. **What are the normal alarm settings?** This is a manual-reset trip-offline alarm that takes a snapshot. There is a 15-second delay to allow the circuit breaker to close after the command is given. **What can the user do?** Verify that there is not a circuit breaker **Overcurrent** alarm. If there is, reset this alarm. Verify that the inverter stop is not active by pulling it out. Check the spring status. If the circuit breaker has a Discharged Spring message, the motor operator is not charged. The breaker can still be closed by charging the spring by manually pulling down on the charging handle several times. Reset the system and see if the circuit breaker closes.	MANUAL
Ac Breaker Fail to Open	**What is it?** This alarm indicates the circuit breaker is closed when it is being commanded open. **Why is it an alarm?** The circuit breakers should follow their commands, especially the open commands. **What are the normal alarm settings?** This is a manual-reset trip-offline alarm that takes a snapshot. There is a 1-second delay to allow the circuit breaker to open after the command is given. **What can the user do?** If the circuit breaker is closed, try pressing the inverter stop. This should open the circuit breaker. If this causes the circuit breaker to open, the output block on the inverter controls has been damaged, replace the output block or the inverter controls.	MANUAL
Auto Reset Lockout	**What is it?** An auto reset causes several resets to occur to try and clear an **Auto Reset** alarm. After the resets are complete, the system will go to the **Trip Offline** state. **Why is it an alarm?** This is the alarm that takes the system to the **Trip Offline** state and informs the user of the reason for being in the **Trip Offline** state. **What are the normal alarm settings?** This is a **Trip-Offline** manual-reset alarm without a snapshot. A state change should accompany the change from an inhibit to a **Trip Offline** alarm. **What can the user do?** The user can issue a reset to clear this alarm. The system should then be watched to see if the original alarm condition returns. If it returns, troubleshoot the alarm that is causing this alarm, not this alarm.	MANUAL
BMS Requested Trip Offline	**What is it?** This alarm shows that the BMS has opened a contact to stop the inverter from charging or discharging the battery. **Why is it an alarm?** If the Battery sends a **Trip-Offline** command, the inverter will trip offline. This shows the reason for the trip offline. **What are the normal alarm settings?** This is a **Trip Offline** self-reset alarm. **What can the user do?** This alarm comes from the battery system. Check F8; this is used to protect the 24-Vdc used to power the external dry contact. If F8 is OK, refer to the battery owner's manual to troubleshoot the alarm.	SELF
Current Sensor or Ground Fault	**What is it?** The output of our PureWave SMS-250 inverter is a three-phase delta. In a three-phase delta output, the three-phase currents must add to zero. This alarm looks at the sum of the three-phase currents. If it gets too high or low, this alarm is activated. This could be caused by a ground fault that results in current flowing in the ground as well as the three phases. **Why is it an alarm?** Current feedback is essential to the PureWave SMS-250 inverter. If we lose a current sensor, the current feedback will not follow the primary current. This will cause misoperation of the controls. If there is a ground fault, we need to stop operation. **What are the normal alarm settings?** This is a manual-reset **Trip-Offline** alarm that takes a snapshot. The threshold for tripping the inverter is 20 A. **What can the user do?** If the cause of the alarm is a ground fault, the system should not be re-started without first looking for ground faults. This requires a qualified technician.	MANUAL

TABLE CONTINUED ►

Table 9. PureWave SMS-250 Trip Offline Alarms—Continued

Alarm	Description	Reset Type
Dc Breaker Fail to Close	**What is it?** This alarm indicates that the circuit breaker is open when it ireceives a **Close** command. **Why is it an alarm?** The circuit breakers should follow their commands. **What are the normal alarm settings?** This is a manual-reset **Trip-Offline** alarm that takes a snapshot. There is a 15-second delay to allow the circuit breaker to close after the command is given. **What can the user do?** Verify that there is not a circuit-breaker **Overcurrent** alarm. If there is, reset this alarm. Verify that the inverter stop is not active by pulling it out. Check the spring status. If the circuit breaker has a Discharged Spring message, the motor operator is not charged. The breaker can still be closed by charging the spring by manually pulling down on the charging handle several times. Reset the system and see if the circuit breaker closes.	MANUAL
Dc Breaker Fail to Open	**What is it?** This alarm indicates that the circuit breaker is closed when it receives an **Open** command. **Why is it an alarm?** The circuit breakers should follow their commands, especially the open commands. **What are the normal alarm settings?** This is a manual-reset **Trip-Offline** alarm that takes a snapshot. There is a 1-second delay to allow the circuit breaker to open after the command is given. **What can the user do?** If the circuit breaker is closed, try pressing the inverter stop. This should open the circuit breaker. If this causes the circuit breaker to open, the output block on the inverter controls has been damaged. Replace the output block or the inverter controls.	MANUAL
Dc Link Pre Charge Slow	**What is it?** The control waits 3-time constants to get to 90% of the ideal voltage on the dc link when charging from the ac or dc side. **Why is it an alarm?** If the expected voltage is not reached, something is wrong with the pre-charge circuit. **What are the normal alarm settings?** This is an auto-reset warning alarm. **What can the user do?** The system can be reset, but there is a 2-minute delay to allow the pre-charge resistors to cool. One cause of this is a bad precharge resistor, or there is a high-impedance fault across the dc link. If this alarm cannot be overcome, additional troubleshooting by a trained technician is required.	AUTO
Dc Link Shorted	**What is it?** This alarm indicates that the dclink voltage is coming up very slowly. **Why is it an alarm?** The dclink precharge resistors can overheat and get damaged if they dissipate too much power for too long. **What are the normal alarm settings?** This is a manualreset **TripOffline** alarm that takes a snapshot. **What can the user do?** This may be caused by the PRECHARGE KEY switch in the **Off** position. If so, turn the PRECHARGE KEY switch on and reset the system. It will take 2 minutes to clear the alarm before precharge is attempted again. If the key switch is on and this alarm is on, additional troubleshooting by a trained technician is required.	MANUAL
Dc Capacitor Voltage High	**What is it?** This alarm shows that the dc voltage is getting close to the rated voltage of the capacitor. **Why is it an alarm?** The alarm shows the voltage on a capacitor is higher than expected. **What are the normal alarm settings?** This is a **Trip-Offline** manual-reset alarm that takes a snapshot. **What can the user do?** A reset can be used to see if the alarm was caused by a temporary condition. If the alarm continues to be set, the inverter needs service. Contact S&C service and report the alarm.	MANUAL
Cabinet Door Open	**What is it?** This alarm indicates the PureWave SMS-250 door is open. **Why is it an alarm?** This will inform the user the door is open and the system cannot run because of this. **What are the normal alarm settings?** This is **Trip-Offline** self-reset alarm. **What can the user do?** Close the door. If it is desirable for other reasons to run the system with the door open, the standard door switch can be defeated by pulling out the plunger. The plunger is reset when the door is closed.	SELF
Execution Frame Overrun	**What is it?** The software for the PureWave SMS-250 system runs in a loop that executes every 208 microseconds. If a second loop starts while the first loop is still running, this alarm will turn on. **Why is it an alarm?** If the execution loop restartsthe calculations for turning on and off, the IGBTs can have a problem resulting in unexpected current. Before that happens, the inverter is turned off. **What are the normal alarm settings?** This is a **TripOffline** alarm with a manual reset that takes a snapshot of the conditions when the alarm occurs. **What can the user do?** All the user can do is to reset the alarm. S&C would like to know if the alarm turns on, so if the alarm is reset by a user, please let S&C know that the alarm was on and has been reset.	MANUAL
IGBT 1 Over Current	**What is it?** This alarm indicates the current in the indicated phase went beyond 1190-A peak, the peak of a current limited 880-A RMS waveform. This should not occur because the current limit for the phase should turn off the IGBTs in the phase leg, reducing the current. **Why is it an alarm?** This is an alarm to protect the IGBT from excessive current. **What are the normal alarm settings?** This is a **TripOffline** manual-reset alarm with a snapshot for future troubleshooting. **What can the user do?** It is possible that a utility transient caused the alarm. Check the **Broken-Thermistor** alarm and the IGBT1, IGBT2 and IGBT3 **Temperature Problem** alarms. If the broken thermistor is clear or if it is set and the **IGBT 1-3 Temperature** alarms are clear, the system can be reset. If the **Broken-Thermistor** alarms are present, do not reset the alarm and call S&C for service.	MANUAL

TABLE CONTINUED ►

Table 9. PureWave SMS-250 Trip Offline Alarms—Continued

Alarm	Description	Reset Type
IGBT 2 Over Current	**What is it?** This alarm indicates the current in the indicated phase went beyond 1190-A peak, the peak of a current limited 880-A RMS waveform. This should not occur because the current limit for the phase should turn off the IGBTs in the phase leg reducing the current. **Why is it an alarm?** This is an alarm that is in place to protect the IGBT from excessive current. **What are the normal alarm settings?** This is a **TripOffline** manualreset alarm with a snapshot for future troubleshooting. **What can the user do?** It is possible that a utility transient caused the alarm. Check the **Broken-Thermistor alarm** and the IGBT1, IGBT2 and IGBT3 **Temperature Problem** alarms. If the broken thermistor is clear or if it is set and the **IGBT 1-3 Temperature** alarms are clear, the system can be reset. If the **Broken-Thermistor** alarms are present, do not reset the alarm and call S&C for service.	MANUAL
IGBT 3 Over Current	**What is it?** This alarm indicates the current in the indicated phase went beyond 1190-A peak, the peak of a current limited 880-A RMS waveform. This should not occur because the current limit for the phase should turn off the IGBTs in the phase leg reducing the current. **Why is it an alarm?** This is an alarm that is in place to protect the IGBT from excessive current. **What are the normal alarm settings?** This is a **Trip-Offline** manual-reset alarm with a snapshot for future troubleshooting. **What can the user do?** It is possible that a utility transient caused the alarm. Check the **Broken-Thermistor** alarm and the IGBT1, IGBT2 and IGBT3 **Temperature Problem** alarms. If the **Broken-Thermistor** alarm is clear or if it is set and the **IGBT1-3 Temperature** alarms are clear, the system can be reset. If the broken thermistor alarms are present, do not reset the alarm and call S&C for service.	MANUAL
Inverter Stop	**What is it?** There is a red mushroom pushbutton on the inverter. When pressed, it causes the inverter to stop operating and opens the ac and dc circuit breakers. The opening of the ac and dc circuit breakers is a combination of hardware and software, either of which will cause the breakers to open. **Why is it an alarm?** This **Trip-Offline** alarm causes the inverter to stop operation and move to a state where the battery and utility are disconnected. This is the function of the STOP button. **What are the normal alarm settings?** This is a **Trip-Offline** alarm that is reset when the mushroom switch is twisted clockwise to release the inverter stop. **What can the user do?** This alarm should clear when the mushroom switch is twisted clockwise. A snapshot will be taken when this alarm is asserted.	SELF
Parameter Cal Nv Error	**What is it?** This alarm indicates the main processor read the nonvolatile memory where the parameters and calibration values are stored and found some corrupt data. This checks the memory using a cyclical redundancy check or CRC. **Why is it an alarm?** Corrupt memory in the inverter settings or calibration can cause a malfunction in the inverter. **What are the normal alarm settings?** Nonvolatile memory is checked when the system is powered up or when the nonvolatile memory is changed. A single-bit error will cause the alarm. This is a **Trip-Offline** alarm with a manual reset and no snapshot. **What can the user do?** This is a problem that the user cannot fix with a reset. It is possible, but very unlikely, that a power cycle will clear the error. The system will need to be reprogrammed or replaced (probably replaced) if the cause is a hardware problem.	MANUAL
SCADA or HMI Trip Offline	**What is it?** The SCADA system and/or the local HMI can send a **Trip-Offline** command to take the PureWave SMS-250 system offline. **Why is it an alarm?** If the SCADA system or the local HMI commands the system offline, this alarm indicates the **Offline** conditon. **What are the normal alarm settings?** This is a **Trip-Offline** manual-reset alarm that takes a snapshot. **What can the user do?** To clear this alarm, the SCADA must send a 0 to the SCADA **Trip-Offline** bit register or the local HMI must toggle off the HMI **Trip-Offline** bit register.	MANUAL
Sensitive Earth Fault	**What is it?** The **Sensitive Earth Fault** alarm indicates the three-phase input current does not sum to zero. **Why is it an alarm?** When operating properly, the PureWave SMS-250 three-phase currents sum to zero. **What are the normal alarm settings?** This is a **Trip-Offline** manual-reset alarm. **What can the user do?** The alarm can be reset to bring the inverter back to an **Operating** mode. However if the fault continues to occur, the ground fault should be researched and eliminated.	MANUAL

NOTICE

The PureWave SMS-250 system is capable of servicing the distributedpower generation needs of its users when operated within its design limitations and specifications. Nonproprietary operation specifications for the PureWave SMS-250 system beyond those identified in this instruction sheet may be obtained from S&C Electric Company.

Table 10. System Specifications

Description	Value or Range
Real/Reactive Power	263 kW/263 kVA
Secondary Voltage	380 Vac directly 400, 415, or 480 Vac using an auto transformer
Frequency	50 or 60 Hz
Dimensions (single enclosure)	36 W × 36 L × 80 H inches (914 × 914 × 2032 mm)
Weight	2,000 lbs (907.2 kg)

Table 11. Environmental Specifications

Description	Value or Range
Ambient Operating Temperature	-40°F to 104°F (-40°C to 40°C) without de-rating
Storage Ambient Temperature	-49°F to 140°F (-45°C to 60°C)
Humidity	0% to 100% condensing
Altitude	Sea level to 1,000 meters without de-rating
Seismic	Uniform Building Code Zone 4
Audible Noise	< 55 dBA at 3 meters when inverter is not running; < 65 dBA at 3 meters when inverter is running

Annual Inspections

After the PureWave SMS-250 system is commissioned and the unit is online, inspection and maintenance should be scheduled for the PCS on an annual basis to ensure the proper operation of the system. Schedules for maintenance should be reviewed by the customer based upon the given site conditions and, if required, the frequency of the recommended maintenance should increase to ensure the reliability of their PureWave SMS-250 system.

Maintenance Checklist

The following checklist provides the PureWave SMS-250 PCS inspection activities that are to be performed on an annual basis. The amount of dust and dirt accumulated in the units varies from site to site. Therefore, the customer should review schedules for maintenance based on the given site conditions and, if required, the frequency of the recommended maintenance may increase to ensure the reliability of the PureWave SMS-250.

S&C Electric Company has extended service agreements and spare parts kits available for the PCS. Please contact S&C Electric Company – Global Support Monitoring Center at (888) 762-1100.

Annual Maintenance Checklist

The PCS requires a minimal amount of maintenance to help ensure high system reliability and efficiency. The following checklist can be used as a reference to assist in properly maintaining the unit(s).

⚠ DANGER

Make sure the PCS is de-energized before performing maintenance on the equipment. Taking this necessary step will minimize serious injury or even death. Proper personal protective equipment (PPE) must be used.

Preparation

- ☐ Review the steps in this checklist to prepare the proper tools that will be needed to complete these maintenance tasks.
- ☐ Communicate with S&C Electric Company to identify any additional tasks that are expected to be accomplished during the annual maintenance visit.
- ☐ Coordinate with the site facilitator to obtain keys for the padlocks (if applicable) to unlock the door to the PCS enclosure(s).

Required Tools

- ☐ Shop vacuum
- ☐ Rags or paper towels
- ☐ General purpose cleaner (e.g. Simple Green)
- ☐ New CompactFlash Card for replacement (old card should be returned to S&C Electric Company)
- ☐ Ratchet wrench
- ☐ 11-mm socket
- ☐ 15-mm socket
- ☐ .5-M (20-inch) socket wrench extension
- ☐ 13-mm socket
- ☐ 7-mm socket
- ☐ 5.5-mm socket
- ☐ 3/8-inch socket
- ☐ Slot driver
- ☐ #1 Phillips
- ☐ #2 Phillips
- ☐ 3-mm hex wrench
- ☐ 8-mm hex wrench
- ☐ White lithium grease (door grease)

Arrival

☐ Discuss maintenance plan with site facilitator (if applicable).

☐ Record the following information:

Site Name: _____

Serial Number: _____

Control Mode (SCADA - Enabled or Disabled): _____

Current System State (from LCD): _____

Safety Checks

⚠ DANGER

Use lockout-tagout procedures before working on the PCS. Conduct the following checks to avoid damaging the equipment, personal injury, or even death.

☐ Open the PCS enclosure door and press the INVERTER STOP button located on the user interface panel.

☐ Verify the ac circuit breaker CB1 is open.

☐ Verify the dc circuit breaker CB2 is open.

☐ Use a meter with insulated leads that will not short to the dead front for the following steps:

- Verify there is line-to-line ac voltage from the bottom of F4 (ac fuse) to the bottom of F5 (ac fuse).
- Verify there is line-to-line ac voltage from the bottom of F5 to the bottom of F6 (ac fuse).
- Verify there is line-to-line ac voltage from the bottom of F6 to the bottom of F4.
- Verify there is dc voltage from the bottom of F1 (dc fuse) to the bottom of F2 (dc fuse).

☐ Disconnect the ac power that supplies the PureWave SMS-250 system.

☐ Lock open the ac power that supplies the PureWave SMS-250 system.

☐ Tag open the ac power that supplies the PureWave SMS-250 system.

☐ Disconnect the dc power that supplies the PureWave SMS-250 system.

☐ Lock open the dc power that supplies the PureWave SMS-250 system.

☐ Tag open the dc power that supplies the PureWave SMS-250 system.

☐ Verification

- Verify there is no ac voltage from the door bond to the bottom of F1.
- Verify there is no dc voltage from the door bond to the bottom of F1.
- Verify there is no ac voltage from the door bond to the bottom of F2.
- Verify there is no dc voltage from the door bond to the bottom of F2.
- Verify there is no ac voltage from the door bond to the bottom of F4.
- Verify there is no dc voltage from the door bond to the bottom of F4.
- Verify there is no ac voltage from the door bond to the bottom of F5.
- Verify there is no dc voltage from the door bond to the bottom of F5.
- Verify there is no ac voltage from the door bond to the bottom of F6.
- Verify there is no dc voltage from the door bond to the bottom of F6.
- Verify there is no ac voltage from the bottom of F1 to the bottom of F2.
- Verify there is no dc voltage from the bottom of F1 to the bottom of F2.
- Verify there is no ac voltage from the bottom of F4 to the bottom of F5.
- Verify there is no dc voltage from the bottom of F4 to the bottom of F5.
- Verify there is no ac voltage from the bottom of F5 to the bottom of F6.
- Verify there is no dc voltage from the bottom of F5 to the bottom of F6.
- Verify there is no ac voltage from the bottom of F6 to the bottom of F4.
- Verify there is no dc voltage from the bottom of F6 to the bottom of F4.

⚠ DANGER

Wait at least 5 minutes after disconnecting power before continuing work. The dc capacitor bus will go from its maximum voltage to a safe voltage in this timeframe. Waiting this amount of time will prevent equipment damage, personal injury, or even death.

⚠ CAUTION

To inspect the internal components of the PCS enclosure, the dead-front access panels require careful removal to prevent injury or equipment damage.

☐ Remove the three dead-front access panels from inside the PCS enclosure using a #2 Phillips driver for the screws at the top of each panel and a 13-mm socket wrench. See Figure 39.

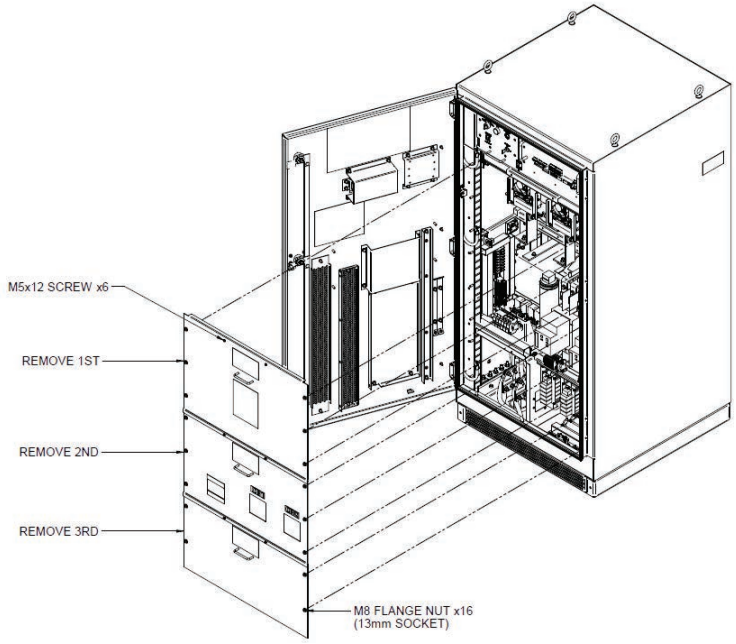


Figure 39. Dead-front access panel removal.

Maintenance Inspection

Enclosure

☐ Check painted surfaces for signs of deterioration or rust.

- Rust found? YES or NO (circle one)
- If yes, clean the rust and paint. Use S&C touch-up paint part number 9999-080 (ANSI 70 gray) for the PCS.
- If rust was found, but not cleaned and painted,
  Why? _____

☐ Check gaskets and seals around the door and the PCS enclosure opening.

- Are the gaskets and seals in good condition? YES or NO (circle one)
- If no, replace the gasket. Use S&C part number CD-2340.
- If gasket is not in good condition, but not replaced,
  Why? _____

Internal Components

☐ Inspect door latching mechanisms. Make sure the mechanism operates easily and holds the door closed. Grease if necessary.

☐ Clean all dirty components inside the PCS enclosure using the shop vacuum or a rag. These include:

- ☐ Enclosure interior.
- ☐ Dead-front access panels.
- ☐ Intake and outlet vents at the back of the enclosure.
- ☐ Fine screen at the bottom of enclosure (requires removal of painted steel screen using a 13-mm wrench/socket).

Clean PCS Enclosure Fans

☐ Inductor fan (requires removal of inductor fan cover. See Figure 40.)

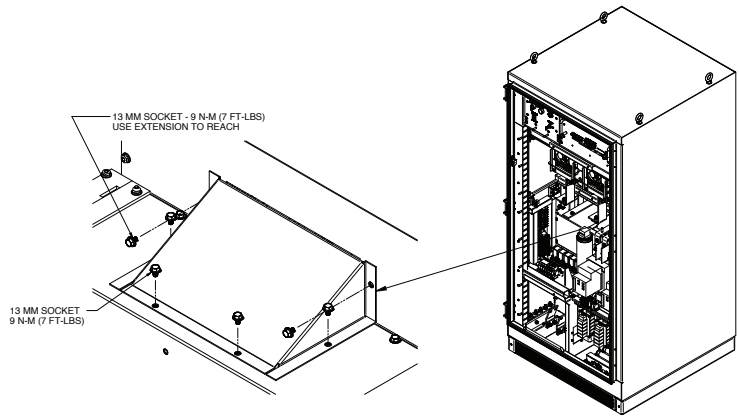


Figure 40. Removal of inductor fan cover.

☐ Three fans on the IGBT poles.

☐ Cabinet fan (located behind the pull-out control assembly at the top of the enclosure).

Fan Functionality Verification

Inductor Fan

☐ Verify the fans spin freely.

☐ Verify there is no bearing noise when the fan is rotating.

☐ Verify there is no rust visible.

IGBT Pole Fan #1

☐ Verify the fans spin freely.

☐ Verify there is no bearing noise when the fan is rotating.

☐ Verify there is no rust visible.

IGBT Pole Fan #2

☐ Verify the fans spin freely.

☐ Verify there is no bearing noise when the fan is rotating.

☐ Verify there is no rust visible.

IGBT Pole Fan #3

☐ Verify the fans spin freely.

☐ Verify there is no bearing noise when the fan is rotating.

☐ Verify there is no rust visible.

Cabinet Fan

☐ Verify the fans spin freely.

☐ Verify there is no bearing noise when the fan is rotating.

☐ Verify there is no rust visible.

NOTICE

If damage, rust, or any other problem is found, replace the fan.

Power electronic assemblies

☐ For IGBT inverter pole assembly servicing, install the service shelf in the PCS as illustrated in Figure 41.

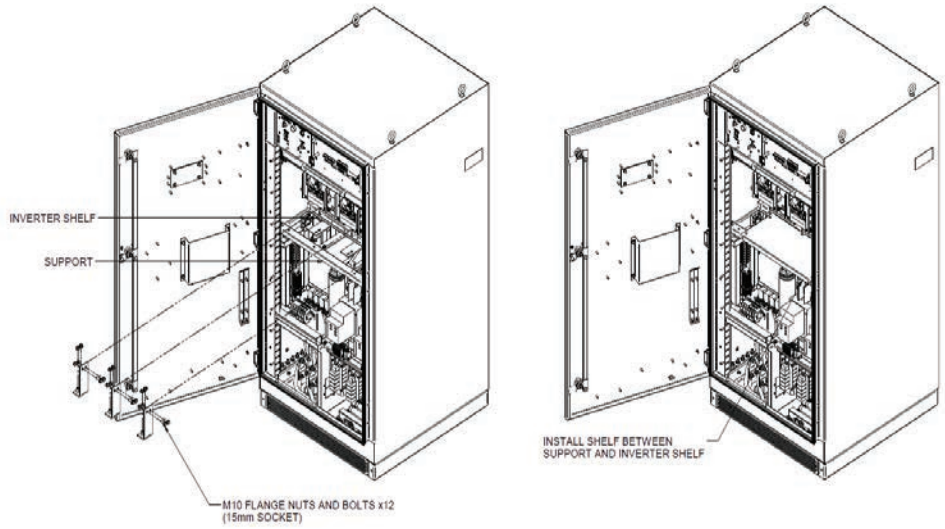


Figure 41. Shelf installation for pole(s) servicing.

☐ Remove the three IGBT inverter assemblies using the procedure located at the top inside of the PCS enclosure door.

For IGBT inverter assembly #1:

☐ Replace any damaged components.

☐ Check for and remove any foreign debris.

☐ Clean the IGBT pole, paying careful attention when cleaning the laminated bus bar.

☐ Check for signs of thermal or electrical stress as well as discolored components.

☐ Check capacitors for any signs of damage.

☐ Clean the large heat sinks.

For IGBT inverter assembly #2:

☐ Replace any damaged components.

☐ Check for and remove any foreign debris.

☐ Clean the IGBT pole, paying careful attention when cleaning the laminated bus bar.

☐ Check for signs of thermal or electrical stress as well as discolored components.

☐ Check capacitors for any signs of damage.

☐ Clean the large heat sinks.

For IGBT inverter assembly #3:

☐ Replace any damaged components.

☐ Check for and remove any foreign debris.

☐ Clean the IGBT pole, paying careful attention when cleaning the laminated bus bar.

☐ Check for signs of thermal or electrical stress as well as discolored components.

☐ Check capacitors for any signs of damage.

☐ Clean the large heat sinks.

☐ Replace the three IGBT assemblies (following the instructions located at the top-inside of the PCS door.

☐ Torque the bus connections and components according to Table 12 on the next page.

Table 12. Torque Requirements

Assembly	Part	Hardware	Tool	Torque [N-M]	Torque [Ft-Lbs]
Inverter Pole	Ground Wire	M6 Hex Nut	11-mm Socket	9.5	7
	Ground Bus	M6 Hex Nut	11-mm Socket	9.5	7
	Shorting Bus	M10 Flange Nut	15-mm Socket	54.2	40
	Typical Bus	M10 Flange Nut/Bolt	15-mm Socket	54.2	40
	Ac Connection	M10 Flange Bolt	15-mm Socket	54.2	40
Typical Bus Connections	N/A	M10 Flange Nut/Bolt	15-mm Socket	54.2	40
Inductor/Cabinet Fans	Terminal Blocks	M4 Terminals	Slot Driver	1.7	1.25
Dc Blowers	Terminal Blocks	M4x12 Screw	3-mm Hex	1.1	0.8
Circuit Breaker Terminal Block	Terminal Blocks	M3 Terminals	Slot Driver	0.5	0.4
Circuit Breaker	Bus Tabs	M10 Bolt	8-mm Hex	27.1	20
EMI Filter Board	Positive Leads	M10 Flange Nut	15-mm Socket	13.6	10
	Ground Studs	M6 Hex Nut	11-mm Socket	9.5	7
Input Box	CT PCB Terminals	10-32 Hex Nut	3/8-inch Socket	3.5	2.6
	Capacitor Terminal Block	Terminal Screws	#2 Phillips	3.9	2.9
	Relay Block Terminals	8-32 Screw	#2 Phillips	2.2	1.6
Islanding Tray	CT Terminal Block	#10-32 Terminals	Slot Driver	2	1.5
	Terminal Blocks	M4 Terminals	Slot Driver	1.7	1.25
	PLC	M3 Mounting	#1 Phillips	1.1	0.8
Resistor Tray	Contactor - Power	M4 Studs	7-mm Socket	1.4	1
	Contactor - Coil	M3 Studs	5.5-mm Socket	0.5	0.4
	Resistor Connections	M5x10 Screw	3-mm Hex	3.9	2.9
Dc Blower Terminal Block	Terminal Blocks	M3 Terminals	Slot Driver	0.5	0.4

☐ Verify that all accessible electrical control connections are tight (using a screwdriver).

Controls

☐ Open the top of the control assembly box and clean the control board with a shop vacuum, if needed.

☐ Verify there is no unusual particulate or fungal growth. If there is, take pictures and report it to S&C Electric Company for further evaluation.

☐ Close and re-fasten the top of the control assembly box.

☐ Remove the CompactFlash card and replace it with the new one.

Maintenance Completion

- ☐ Verify any damaged or inoperable components have been repaired or replaced.
- ☐ Verify all applicable maintenance tasks are complete.
- ☐ Verify all tools have been removed from the PCS enclosure.
- ☐ Visually inspect the PureWave SMS-250 to ensure nothing is out of place before re-energization.
- ☐ Replace and secure the dead-front access panels. See Figure 39 on page 66.
- ☐ Address and/or report any concerns the site facilitator may have.

Re-energization of the System

- ☐ Remove your tag from the ac source.
- ☐ Remove the lock from the ac source.
- ☐ Remove your tag from the dc source.
- ☐ Remove the lock from the dc source.
- ☐ Close the ac source to re-energize the PureWave SMS-250 system.
- ☐ Verify the fans start and run for 60 seconds.
  - Top screen on the back is the cabinet fan.
  - Next two screens down are the main IGBT blowers. Verify air flow on all three assemblies.
  - The fourth screen down is the inductor fan. Verify that it is working properly.
- ☐ Close the dc source to supply dc power to the PureWave SMS-250 system.
- ☐ With the site facilitator's approval, run the PureWave SMS-250 system to verify proper functionality:
  - Connect the laptop computer to the Ethernet connection and start the Human Machine Interface (HMI) browser.
  - Verify that the browser screens are working.
  - Toggle the SMS CONTROL switch on the user interface panel to the **SCADA DISABLE** position.
  - Set the HMI power control to the **Commanded Control** setting.
  - Set the HMI Power Setpoint to 0.
  - Set the HMI Var Control to the **Commanded Control** setting.
  - Set the HMI Vars Setpoint to 0.
  - Twist the inverter stop to bring the system to the **Ready** state.
  - Command a discharge of 50 kW.
  - Verify that the PureWave SMS-250 runs at 50 kW.
  - Set the Power Setpoint to 0 to stop the operation.
  - Disconnect the laptop computer.

Departure

Place the PureWave SMS-250 system in the desired control mode and state. Record these below:

Control Mode (SCADA - Enabled or Disabled): _____

System State: _____

☐ Close and padlock all access doors.

☐ Send the CompactFlash card to S&C Electric Company for analysis.

Annual Maintenance Performed By: _____

Date: _____