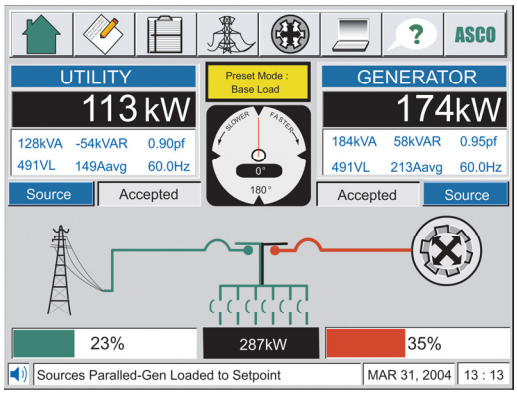
User's Guide

ASCO® 7000 Series, Catalog 7ASLS, 7ASLB, & 7ASLD Soft Load Controller used in Automatic Closed-Transition Soft Load Transfer Systems

2004-2011



Section Page

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Welcome

⚠ DANGER

Use extreme caution when working on the Soft Load Transfer System. Do not touch power terminals; shock, burns, or death could result !

⚠ WARNING

To avoid severe equipment damage and personal injury, the engine-generator set must have automatic shutdown devices and electrical system must have protective devices.

CAUTION

To avoid damaging equipment and causing unstable system operation, these adjustment procedures must be performed only by authorized and trained persons.

REFER TO DRAWINGS PROVIDED

Refer to the outline drawings and wiring diagrams provided with your 7000 Series 7ASLS, 7ASLB, or 7ASLD System. These drawings show the installation and connection details and accessories.

USER NAME / PASSWORD

The Soft Load Controller graphical user interface is protected from parameter changes by login restrictions.

The default user name and password is `admin` (lowercase letters must by used).

To change password; see Section 3, Security Tools.

ABBREVIATIONS USED

These abbreviations are used in this user's guide:

ASI	ASCO Services Inc.
EG	Engine Generator
G5C	Group 5 Controller
GUI	Graphical User Interface
PM	Power Manager Xp
SLC	Soft Load Controller
SLTS	Soft Load Transfer System
VR	Voltage Regulator

MANUALS THAT YOU MAY NEED

In addition to this User's Guide for the Soft Load Controller, you may need to review these manuals:

- 7000 Series 7ACTS or 7ACTB *Operator's Manual*:

E7ACTS	150-400A	*381333-128*
J7ACTS	150-600A	*381333-284*
F7ACTS	600-800A	*381333-128*
H7ACTS	600-1200A	*381333-203*
G7ACTS	1600-3000A	*381333-128*
F7ACTS	3000-4000A	*381333-128*
E7ACTB	150-400A	*381333-134*
J7ACTB	150-600A	*381333-308*
F7ACTB	600-800A	*381333-135*
H7ACTB	600-1200A	*381333-194*
G7ACTB	1600-3000A	*381333-136*
F7ACTB	3000-4000A	*381333-137*

- *Group 5 Controller User's Guide* *381333-126*
- *Power Manager Operator's Manual* *381333-199*
- *Serial Module Installation Manual* *381333-240*
- Circuit Breaker Manual for 7ASLD Systems (available from the circuit breaker manufacturer)

If you do not have these manuals and need them, contact your local ASCO Power Technologies office or representative, or visit www.ascopower.com. Manuals are available both in printed and PDF file format.

OTHER TECHNICAL DOCUMENTS

In addition to the manuals, these technical documents are also available:

- *Connectivity to the ASCO Soft Load Controller via Serial Modbus® RTU Communications Protocol* *381339-241*
- *Implementation and Application of Aggregate Power Control (APC) Features for the ASCO Soft Load Controller* *381339-254*
- *Detection and Termination of an Unintentional Island during Utility Interconnect with the ASCO 7000 Series Soft Load Transfer System* *381339-290*

SCOPE OF THIS USER'S GUIDE

This user's guide explains the operation and application of the 7000 Series Automatic Closed-Transition Soft Load Transfer System (SLTS).

Section 1 — General Information

INTRODUCTION

Closed-transition transfer permits transfer of load between two independent power sources without interruption of power flow. Where transients from block loading of the Engine Generator (EG) are undesirable, the sources can be paralleled while the load is softly transferred from the utility to the EG and vice versa. Soft load control actively biases the EG to produce synchronism with the utility and controlled loading and unloading. With this control method, this transfer system has the inherent ability to provide peak load demand control. Additionally, maintained parallel operation of the EG with the utility is possible, in a variety of control modes.

APPLICATION

The SLTS is an integrated package of ASCO Power Technologies designed components consisting of:

- One Automatic Closed-Transition Transfer Switch (7ASLS), or Automatic Closed-Transition Transfer & Bypass-Isolation Switch (7ASLB), or two power circuit breakers (7ASLD) switching device.
- One Group 5 Controller (power switching controls, permissive functions, time delays) G5C
- Two Power Manager Xps (protective relaying and power metering) PM
- One Soft Load Controller (EG control, graphical user interface, remote communications) SLC

The SLTS is designed to support single EG applications to provide a combination of emergency standby functionality with the ability to perform extended paralleling functions to eliminate the effects of block loading. The system is not intended for use in multiple-engine paralleling systems.

Four operating modes are available whereby the SLTS provides control signals to the EG governor and voltage regulator. The soft loading controls only support governors and voltage regulators that accept analog controls as outlined on the pre-order checklist. If the voltage regulator only supports raise/lower contacts, then the VR (voltage regulator) must be replaced or have the ability to provide VAR/PF controls of its own.

Soft Load Transfer

Soft Load Transfer provides a gentle (soft) transfer of load from one source to another. Allowing the EG to load and/or unload with the adjustable ramp time eliminates undesired transients.

Base Load Mode

Base Load Mode allows the generator output to be fixed regardless of the load on the transfer device. This allows the EG to run at its most efficient level (i.e. 80% of rated). In *Base Load Mode*, EG power is constant and load fluctuations are carried by the incoming utility service. It is important to realize that if the load drops below the generator base load value, the EG will export power from the switching device.

Import or Export Mode

Import and *Export Modes* provide a fixed level from/to the utility. In *Base Load Mode* the utility tracks the load, but in *Import* or *Export Mode* the EG tracks the load.

SYNCHRONIZER

The SLC actively controls the output of the EG to synchronize its voltage, frequency, and phase angle to the utility prior to paralleling. Source synchronization reduces transients that occur upon paralleling. The SLC uses a low voltage DC or pulse width modulated (PWM) signal to control the EG speed governor and match the EG frequency and phase angle to that of the utility source. The criteria for paralleling are frequency difference less-or-equal to +/- 0.2 Hz and phase angle difference less-or-equal to +/- 5 electrical degrees. For voltage matching, the SLC uses either a low voltage DC signal or controls raise/lower contacts (external accessory) connected to the EG VR. The voltage difference must be less-or-equal to 5% (default setting, range is selectable up to 10%) for paralleling. It is implied that the sources to be paralleled must have matching phase sequences.

LOAD (kW) CONTROL

The SLC controls the real power (kW) output of the EG when connected in parallel with the utility. This is accomplished via the same physical connection to the EG governor which controls frequency and phase angle when isolated from the utility. When paralleled with the utility, the EG cannot alter the power system frequency, yet it can carry load. The SLC Load Control signal will control the kW output of the EG in accordance with the setpoint specified in the GUI.

POWER FACTOR (kVAR) CONTROL

The SLC controls the operating power factor of the EG when connected in parallel with the utility. This is accomplished via the same physical connection to the EG VR which controls voltage when isolated from the utility. When paralleled with the utility, the EG cannot alter the power system voltage, yet excitation can vary which correlates to the operating power factor. The SLC Power Factor Control signal will control the operating power factor of the EG in accordance with the setpoint (0.80 to 1.00 lagging) specified in the GUI.

Section 2 — System Description

OVERVIEW

The SLTS comprises four ASCO central electronic control elements:

- Soft Load Controller (SLC)
- Group 5 Controller (Power Control Center) G5C
- Power Manager Xp (Utility-side) PM
- Power Manager Xp (EG-side) PM

The SLC is the master controller that orchestrates soft load operation and data aggregation. It features a touch-screen LCD graphical user interface (GUI) for configuration and monitoring. The SLC continually communicates on a private bus with the Group 5 Controller (G5C) and both Power Manager Xps (PM).

The G5C *Power Control Center* is responsible for physical control of the ATS or breaker switching mechanisms and communication with the SLC. The system software architecture has been designed such that the G5C resumes master control in the event of a source failure or communication failure in the private bus. This ensures power will be supplied to the load from the best available source.

The PM provides power system measurement and protection functions. Two PMs are included in the SLTS. One device monitors and protects the utility feed and the other monitors and protects the EG feed. The configuration of each PM is accomplished via the SLC GUI. However, the PMs are standalone devices that function independent of the SLC and the G5C.

SYSTEM INITIATION METHODS

When initiated, the SLC executes the user defined control mode, also known as the *Preset Mode*. The *Preset Mode* can be defined for either soft load transfer or maintained parallel operation. Additionally, the *Preset Mode* can be disabled, resulting in a closed-transition transfer with passive synchronization when the system is initiated. See **Section 3**, page 3-1, for details on *Preset Mode* options.

If the *Preset Mode* is enabled, the following sequence commences:

1. EG is started.
2. System waits for acceptable voltage and frequency.
3. Voltage, frequency, and phase angle of the EG are synchronized with the utility.
4. Sources are paralleled.
5. Power (kW) and power factor (PF) are controlled in accordance with the Preset Mode selection, Power Factor selection, and Ramp Time.
6. Operating point is achieved and maintained for the duration of the initiation request.

The system can be initiated either locally or remotely.

Local Initiation

The system can be initiated locally via any single instance or combination of the following actions:

- User control panel *Transfer Control* switch (*Transfer Preset Mode*)
- User control panel *Transfer Control* switch (*Transfer To Generator Islanded Mode*)
- Timer-based initiation via the GUI
- KW demand-based initiation via the GUI
- Schedule-based initiation via the GUI
- Engine exercise with load via the G5C

The user control panel has a three-position *Transfer Control* switch that can initiate the system. If the switch is placed in the *Transfer Preset Mode* position, the *Preset Mode* is executed if enabled. If Preset Mode is disabled, a closed-transition transfer is initiated. If the switch is placed in the *Transfer To Generator Islanded Mode* position a transfer to the EG source will be executed. The transfer will include Soft Load Control only if a *Preset Mode* is enabled. Note that a *Preset Mode* selection of a maintained parallel operating mode will be overridden in this case.

The *Timer* feature executes the Preset Mode in accordance with a Start Time and Run Duration. This is a non-repetitive initiation mode, and will be self-clearing upon conclusion. See **Section 3**, page 3-2, for more information on this feature.

The *KW Demand* feature executes the Preset Mode in accordance with a Start and Reset kW Demand value. This is a repetitive initiation mode that executes every time the Start value is exceeded. See **Section 3**, page 3-2, for more information on this feature.

The *Schedule* feature executes the Preset Mode in accordance with calendar-based settings. This is a repetitive initiation mode. See **Section 3**, page 3-3, for more information on this feature.

Engine exercise with load is a user selectable option in the G5C (refer to *User's Guide 381333-126*). When initiated, a transfer to the EG source will be executed. If a Preset Mode is enabled, the transfer will include soft load control. Note that a Preset Mode selection of a maintained parallel operation mode will be overridden in this case. This is a repetitive calendar-based initiation mode.

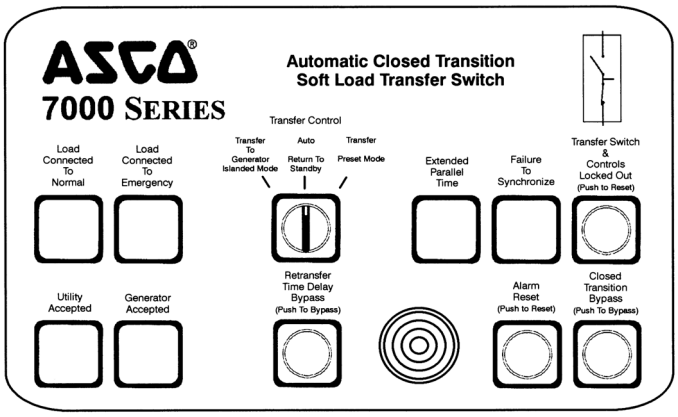
Remote Initiation

The system can be initiated remotely via the HTML or Modbus[1] interface, both described in detail later in this document. The HTML interface is accessed via a standard web browser, and exposes the user to the Timer feature. Thus, via this web interface, the Timer feature of the SLC can be configured to affect remote initiation. The Modbus interface exposes the user to the Timer, kW-Demand, and Schedule interfaces to affect remote initiation.

USER INTERFACE

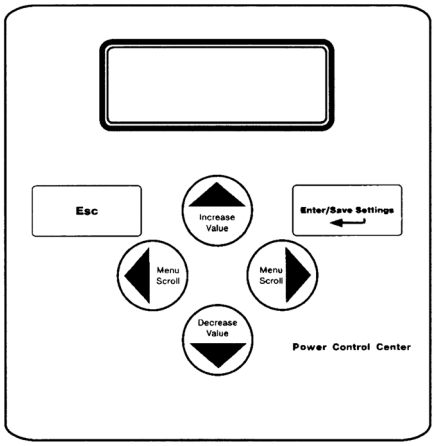
The user interface of the SLTS consists of four primary components: The user control panel, the SLC touchscreen GUI, the G5C *Power Control Center*, and external communications interface.

User Control and Indicator Panel



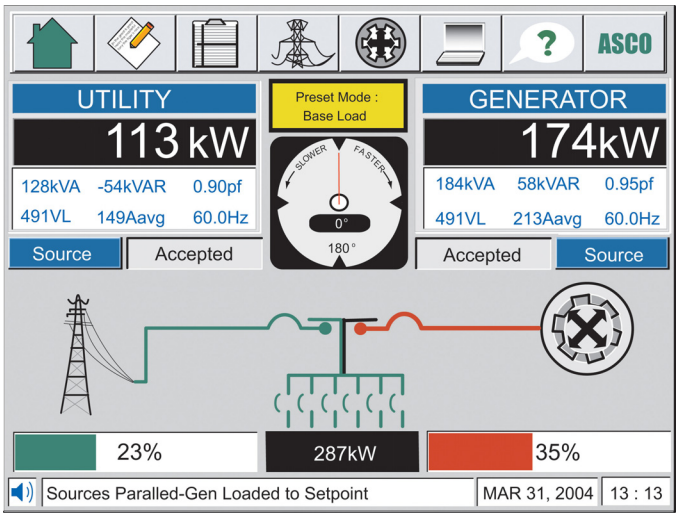
The user control and indicator panel of the SLTS is the functional equivalent of that found on a standard *ASCO 7000 Series* 7ACTS automatic closed-transition transfer switch. The only exceptions are that the control switch can initiate transfers with soft load control when the Preset Mode is enabled, and an Alarm Horn is added for user-defined audible alarms.

Group 5 Controller (G5C) Power Control Center



The G5C *Power Control Center* is properly configured at the factory for operation in the SLTS. During normal operation, the user focus should be on the SLC GUI. See *User's Guide 381333-126* for more information on the Group 5 Controller.

SLC Touchscreen GUI



The SLC Touchscreen GUI is the central user interface of the SLTS. It provides access to all pertinent monitoring and control settings. The display consists of a 6.5-inch backlit color LCD with touchscreen for navigation and control. Details on navigation and configuration appear later in this section.

External Communications

The SLC facilitates external communications via one Ethernet port and one serial RS485 port. The Ethernet port supports HTML and Open Modbus (TCP/IP) protocols while the RS485 port supports Modbus only. The SLC produces HTML web pages, which can be displayed with a standard web browser. A custom application is required for Modbus communications. Refer to **Section 5 External Communications** for further information.

[1] Modbus is a registered trademark of Gould Inc.

GUI NAVIGATION

The GUI has been designed to be intuitive and easy to learn. The methodology employed in the GUI primarily consists of the distinction between monitoring and configuration screens. For monitoring screens, the navigation is accomplished via an icon-based task bar appearing at the *top* of the screen. For configuration screens, navigation and control is accomplished via an icon-based task bar appearing at the *bottom* of the screen.

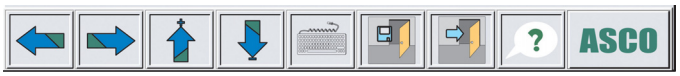
Monitoring Navigation Task Bar

The Monitoring Task Bar appears at the top of the screen for the monitoring screens. The icons and their tasks appear in the table below.

	HOME	Returns the display to the Home (Main) Screen.
	SETUP MENU	Provides access to System Settings and Tools.
	EVENT LOG	Displays chronological Events.
	UTILITY STATUS	Displays the status and settings of UTILITY Protective Functions. Allows Latched Alarm Acknowledgement.
	GENERATOR STATUS	Displays the status and settings of GENERATOR Protective Functions. Allows Latched Alarm Acknowledgement
	SYSTEM STATUS	Displays System Alarms and the status of various SYSTEM settings.
	HELP	Displays the HELP menu.
ASCO	ABOUT	Displays the ABOUT screen.

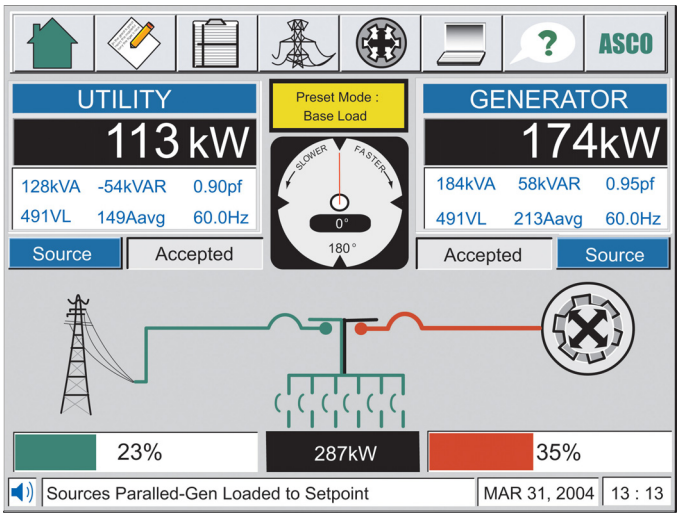
Configuration Navigation Task Bar

The Configuration Task Bar appears at the bottom of the screen for the configuration screens. The icons and their tasks appear in the table below.



	Left and Right Arrow keys	Provides Page Navigation.
	+Up and -Down keys	Provides Value Increment/ Decrement of the selected field.
	keyboard button	Launches a keypad window for direct entry of a desired quantity into the selected field.
	'Doorway with Disk' key	Used to save new settings. A user must possess valid privilege access level to save settings.
	'Doorway with Arrow' key	Exits the screen with no changes.
	'Question Mark' key.	Provides context specific help.

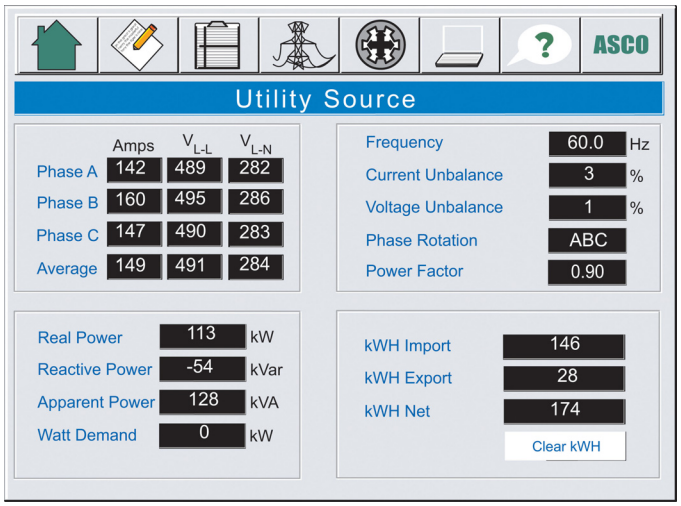
HOME screen



The *HOME* screen is the main screen of the SLC application. It features the Monitoring Navigation Task Bar at the top of the screen with the emphasis on the House icon. Below the task bar lies symmetrical summary areas for each power source: Utility and Generator. These source summaries provide a compact view of summary power data for each source, including real, reactive, and apparent power, average line voltage, average current, power factor, frequency, and source availability. Additionally, the title bar for each source summary is a touch link to a new screen containing detailed power source measurements. In between these summary areas are a text box displaying the Preset Mode

and a synchroscope. The synchroscope provides an analog and digital display of the electrical phase difference of the two sources. Directly below the synchroscope lies a one-line diagram of the power system, with total real power display and bar graphs indicating a percentage of real power from each source. The one-line diagram is a dynamic graphic that changes in relation to the position of the switching devices in the power system. Additionally, the flywheel graphic which represents the EG is an animated graphic which spins when the EG is accepted. Finally, at the bottom of the screen lies a status bar. The status bar displays the most recent event to occur, the present date, and time. At the far left of the status bar lies a speaker icon, which is a touch link to silence an active alarm horn.

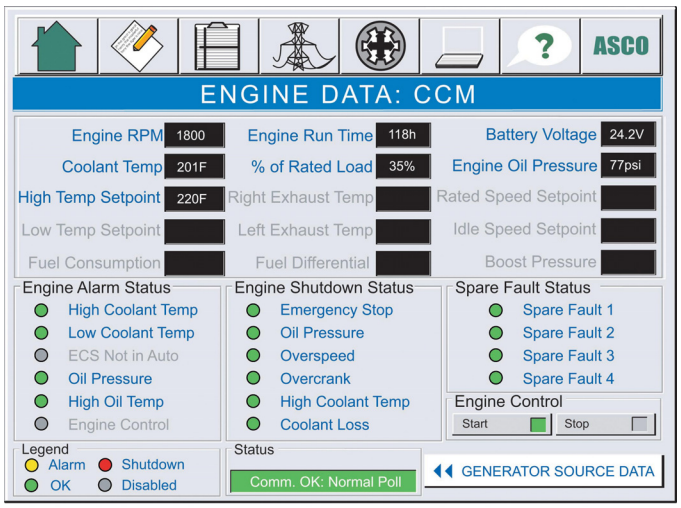
Source Detail Screens



The title bars of the source summaries from the HOME screen are touch links to new screens containing detailed power source measurements.

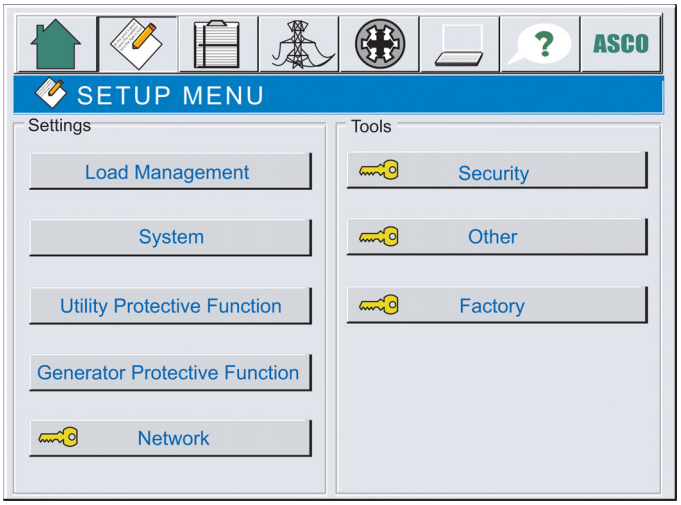
Each screen features a display of accumulated kWh and a reset button. The reset button is used to zero the accumulated readings and reset the counting. Use of the reset button requires Privilege Level L6. If engine communications are enabled, the Generator Detail screen will also contain a toggle button to bring the Engine Communications screen.

Engine Communications Screen



The *ENGINE COMMUNICATIONS* screen displays analog data, alarms, and shutdowns received via the engine communications link. Additionally, a status field displays the status of communications with the remote device. Further details on engine communications appear in **Section 5 External Communications**.

Setup Menu



The *SETUP MENU* is a screen featuring button links to various setup areas. The Setup Menu is accessed via the Pencil and Paper icon of the Monitoring Navigation Task Bar. Due to the differing nature of the various setup links, two access methodologies have been employed. The first methodology (*password out*) requires a security privilege to *exit* the screen and save changes whereas the second (*password in*) requires a security privilege to *enter* the screen. Password privileges are described in more detail in Section 3, Security Tools. The *password out* requirement applies to the Load Management, System, and Protective Functions setup screens. The *password in* requirement

applies to the Network Setup, Security Setup, Other Tools, and Factory Tools screens, as denoted by the *key* icon. Entry to any of the setup screens results in the removal of the Monitoring Navigation Task Bar and the addition of the Configuration Navigation Task Bar.

Load Management Setup Screens

The *LOAD MANAGEMENT SETTINGS* screens permit configuration of Preset Mode parameters, Generator Limits, Generator Power Factor, Timer settings, kW Demand settings, and Schedule settings. This area is accessed via the Load Management button of the Setup Screen. Access to this area follows the *password out* methodology. Changes to any parameter in this area will require Privilege Level L1.

System Setup Screens

The *SYSTEM SETTINGS* screens permit configuration of Nominal System settings, Nominal Source settings, Control Gains, Voltage Regulator bias type and limits, Governor bias type and limits, Engine Control mode, Engine Communication settings and Aggregate Power Control settings. Many of the settings in this area are completed at the factory or during commissioning and will not require change in the future. This area is accessed via the System button of the Setup Screen. Access to this area follows the *password out* methodology. Changes to any parameter in this area will require Privilege Level L2.

Utility Protective Function Setup Screens

The *UTILITY PROTECTIVE FUNCTION SETTINGS* screens permit configuration of the protective relays for the Utility power source. This area is accessed via the Utility Protective Function button of the Setup Screen. There are twelve screens each corresponding to the twelve configurable protective functions. Selections exist for parameter type, trip level, reset level, trip time delay, reset time delay, output relay(s), and output type (latched, audible) for each individual protective function. Access to this area follows the *password out* methodology. Changes to any parameter in this area will require Privilege Level L3.

Generator Protective Function Setup Screens

The *GENERATOR PROTECTIVE FUNCTION SETTINGS* screens permit configuration of the protective relays for the Generator power source. This area is accessed via the Generator Protective Function button of the Setup Screen. There are twelve screens each corresponding to the twelve configurable protective functions. Selections exist for parameter type, trip level, reset level, trip time delay, reset time delay, output relay(s), and output type (latched, audible) for each individual protective function. Access to this area follows the *password out* methodology. Changes to any parameter in this area will require Privilege Level L3.

Network Setup Screens

The *NETWORK SETTINGS* screens permit configuration of the Ethernet, Email, and Modbus settings. The desired settings for these screens vary from site to site. This area is accessed via the Network button of the Setup Screen. Access to this area follows the *password in* methodology, with Administrator (`admin`) Privilege Level only.

Security Tools Screens

The *SECURITY TOOLS* area employs the *password in* methodology. This area is accessed via the Security button of the Setup Screen Tools group. Three screens are presented if a user with Administrator (`admin`) Privilege Level enters the Security Tools area: Change Password, Add User(s), and Delete User(s). Otherwise, only the Change Password screen is presented. In summary, any registered user can change his/her password. Only the Administrator has the ability to add and delete users.

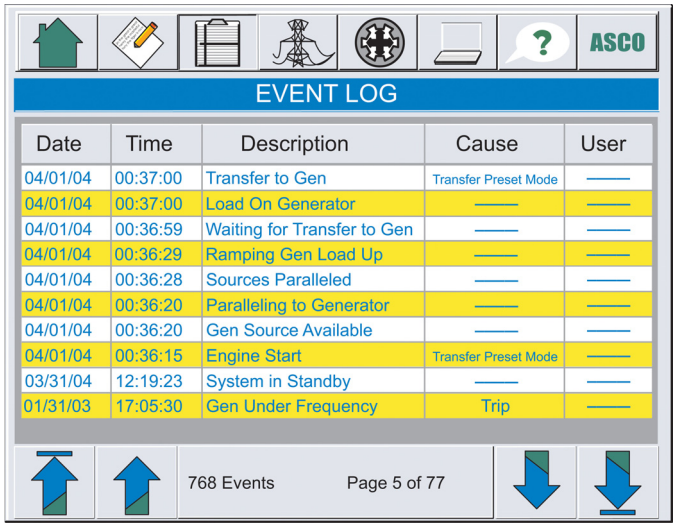
Other Tools Screens

The *OTHER TOOLS* area employs the *password in* methodology, with Privilege Level L4. This area is accessed via the Other button of the Setup Screen Tools group. Contained in this area are settings for the date, time, and language. Daylight Savings Time can be disabled or enabled for either Mar/Nov or Apr/Oct. Additionally, buttons are available to temporarily disable the touchscreen (for cleaning), calibrate the touchscreen, view the Utility Setup Log, and view the Generator Setup Log. If this area is entered with Administrator (`admin`) Privilege Level, three additional tools are available: Clear Event Log, Dump Event Log, and Dump Configuration.

Factory Tools Screens

The *FACTORY TOOLS* area employs the *password in* methodology, with the Service Privilege Level required. This area is accessed via the Factory button of the Setup Screen Tools group. This area is for access only by ASCO manufacturing and service personnel. This area contains links for various diagnostics, controls, and service data. There is also a link to terminate the SLC application to facilitate software upgrades.

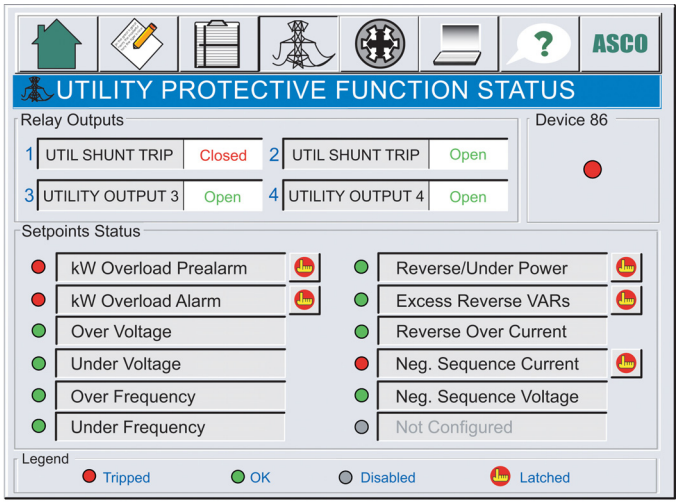
Event Log



Date	Time	Description	Cause	User
04/01/04	00:37:00	Transfer to Gen	Transfer Preset Mode	——
04/01/04	00:37:00	Load On Generator	——	——
04/01/04	00:36:59	Waiting for Transfer to Gen	——	——
04/01/04	00:36:29	Ramping Gen Load Up	——	——
04/01/04	00:36:28	Sources Paralleled	——	——
04/01/04	00:36:20	Paralleling to Generator	——	——
04/01/04	00:36:20	Gen Source Available	——	——
04/01/04	00:36:15	Engine Start	Transfer Preset Mode	——
03/31/04	12:19:23	System in Standby	——	——
01/31/03	17:05:30	Gen Under Frequency	Trip	——

The clipboard icon of the Monitoring Navigation Task Bar accesses the *Event Log*. This area contains a chronological listing of the most recent system events, including Protective Function Trips/Resets/ Acknowledgements, alarms, and control state changes. It has a maximum capacity of 1000 events. When the log is filled to capacity, the oldest events are dropped to make room for new events.

Utility Protective Function Status

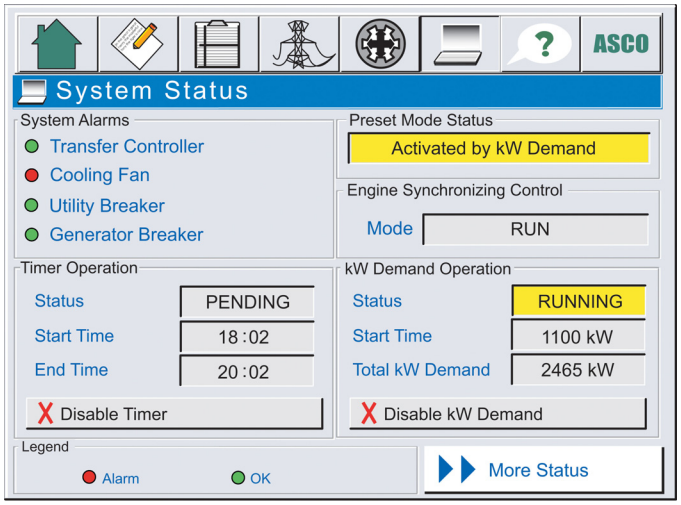


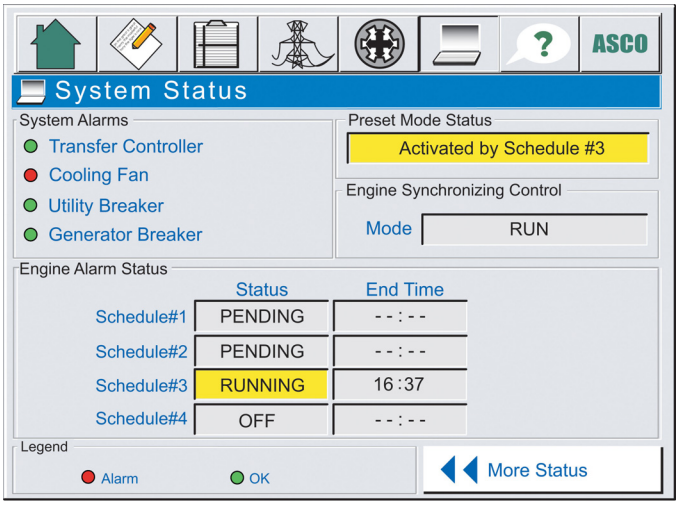
The utility tower icon of the Monitoring Navigation Task Bar accesses the *Utility Protective Function Status* screen. This screen provides at-a-glance monitoring of the Utility Protective Functions. A summary of the state of each of the four Utility-side output relays, including their user-defined descriptive names appear with a summary of all twelve configurable protective functions and Device 86 status. The output relay status area has a text display stating open or closed. The protective functions and Device 86 status area have an iconic status representation: green dot for ok, red dot for tripped, gray dot for disabled, and a pointed finger icon button for a latched function. Latched protective functions can be acknowledged by pressing the pointed finger button. The Device 86 feature can be Reset in the same manner as Acknowledging a latched protective function, however, the fault condition must be cleared for Reset permission. Acknowledgement of latched protective function or Reset of Device 86 requires Privilege Level L5.

Generator Protective Function Status

The generator flywheel icon of the Monitoring Navigation Task Bar accesses the *Generator Protective Function Status* screen. This screen provides at-a-glance monitoring of the Generator Protective Functions. A summary of the state of each of the four Generator-side output relays, including their user-defined descriptive names appear with a summary of all twelve configurable protective functions and Device 86 status. The output relay status area has a text display stating open or closed. The protective functions and Device 86 status areas have an iconic status representation: green dot for ok, red dot for tripped, gray dot for disabled, and a pointed finger icon button for a latched function. Latched protective functions can be acknowledged by pressing the pointed finger button. The Device 86 feature can be Reset in the same manner as Acknowledging a latched protective function, however, the fault condition must be cleared for Reset permission. Acknowledgement of latched protective function or Reset of Device 86 requires Privilege Level L5.

System Status





The computer icon of the Monitoring Navigation Task Bar accesses the *System Status* screen. This screen provides at-a-glance monitoring of vital system status points. It includes an iconic representation (green dot/red dot) summarizing various System Alarms. Elsewhere, text areas summarize the Preset Mode Status, Engine Control Mode, Timer Status, kW Demand Status, and Schedule Status. Note that a toggle button provides switching between the Timer / kW Demand status and the Schedule Status. There are several key features to this screen, which make it vital for system analysis.

The Preset Mode status summary is vital since there are numerous manual and automatic methods of initiation. This permits a user to immediately assess why a system is running, without analyzing all the possibilities. The engine control mode display is a handy summary because it alerts the user if the system is in a Run or Sync Check mode. This display alone can avert operational confusion. The displays of the Timer/kW Demand/Schedule status alert the user to the present state and (if active) reset point of the respective feature. More importantly, buttons are presented in the status area to terminate the active mode directly instead of disabling it from the Setup area. In the cases of the Timer and kW Demand features, buttons are presented to disable the feature. For Schedules, buttons are presented to Cancel the presently running Schedule, but the overall feature remains enabled for its next iteration.

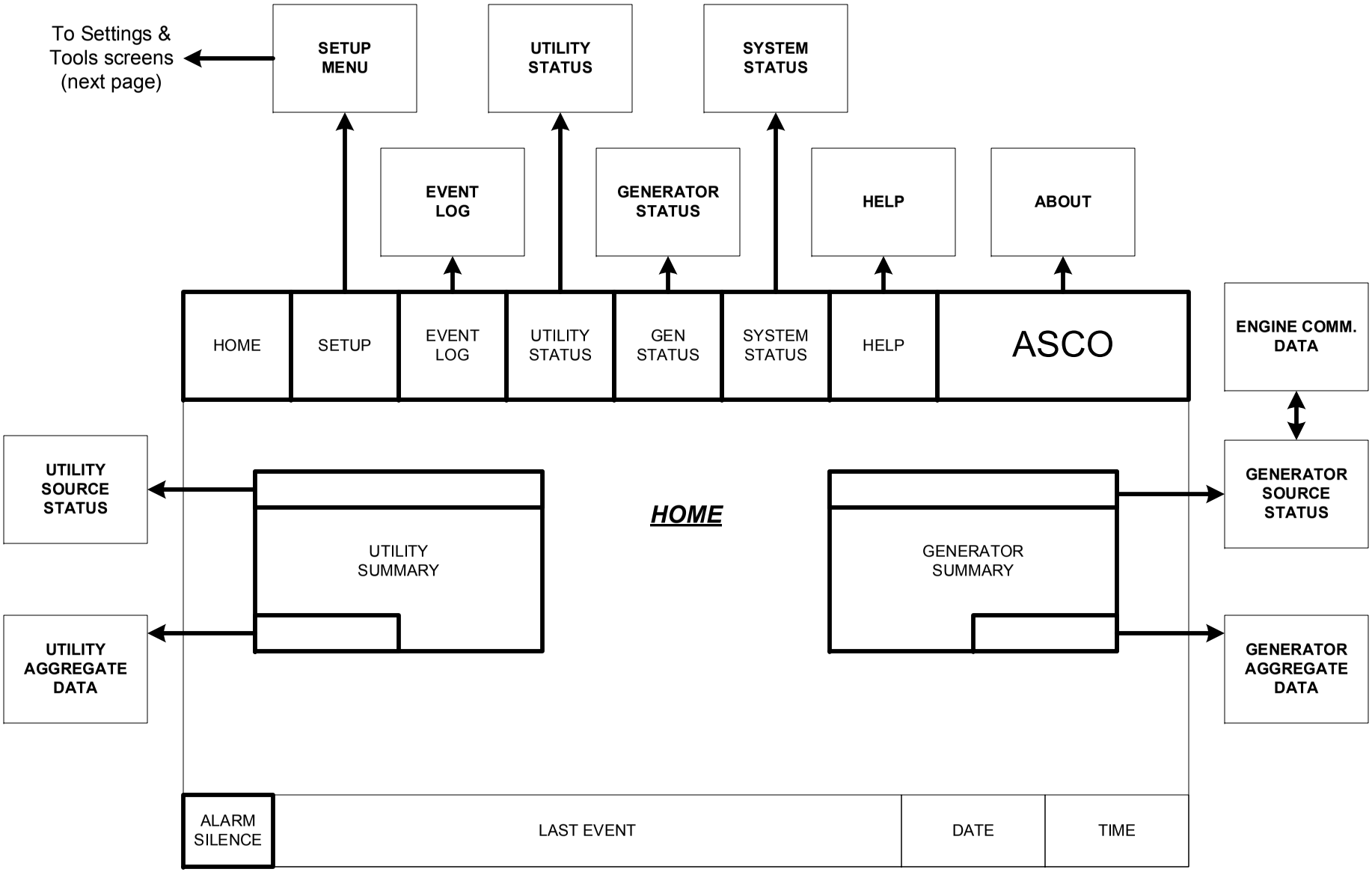
The *System Alarms* summary shows the State (Tripped or OK) of the Transfer Controller Alarms, the Cooling Fan, the Utility and Generator breakers. Transfer Controller Alarms comprise any combination of Extended Parallel Alarm, Failure to Synchronize Alarm, or Transfer Lockout Alarm and can only be cleared via the escutcheon panel Alarm Reset button. The Cooling Fan Alarm can only be cleared by resumption of proper Cooling Fan operation. A Breaker Alarm can be cleared once the Breaker is closed.

Help

The question mark *?* icon of the Monitoring Navigation Task Bar accesses the main *Help* area. Inside this area are new navigation tools to access online help text.

About

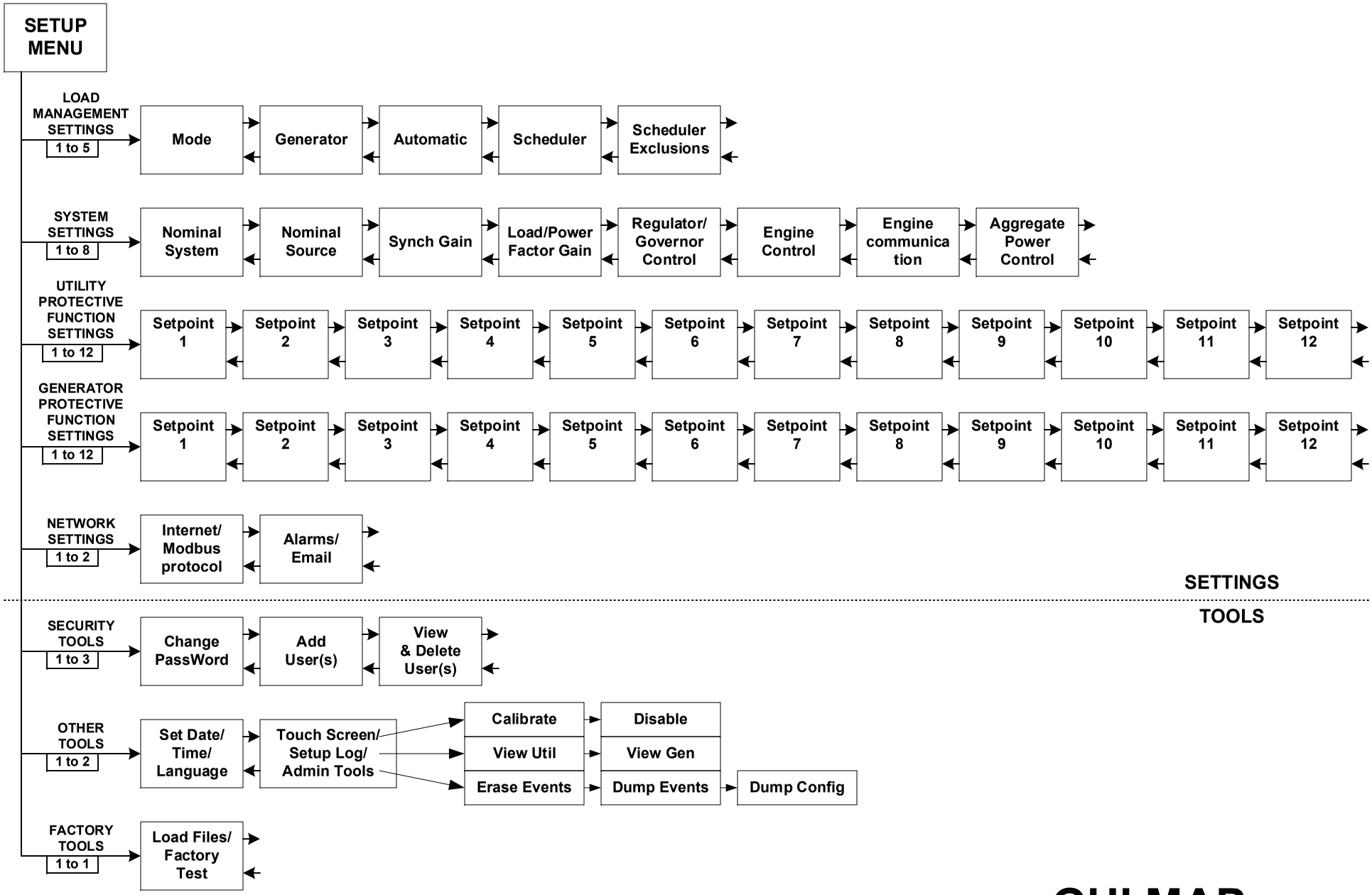
The *ASCO* icon of the Monitoring Navigation Task Bar accesses the *About* screen. This screen provides information about ASCO and the software codes for the four main electronic control units. The software version is displayed as XXXXXX-0XX. The last three digits indicate the version.



NOTES

1) From the HOME screen, each of the sub screens can be reached by touching the appropiate button as designated by the arrows.
2) From the sub screens, HOME and the other sub screens can be reached.
3) The top task bar stays in each of the sub screens.
4) Touch ALARM SILENCE to turn off the audible alarm.

GUI MAP



GUI MAP

NOTES

1) Each screen has a help button that takes the user to a screen specific help screen.
2) For setting sub menus, log in dialog box appears when the sub menu is exited, except for Network settings the log in dialog box appears when entered.
3) For tool sub menus, log in dialog box appears when the sub menu is entered.

Section 3 — Software Configuration

This section describes the various user-configurable software parameters in detail. See the *Setup Menu* on page 2-4.

LOAD MANAGEMENT PARAMETERS

The *LOAD MANAGEMENT SETTINGS* area allows viewing and modification of *Mode Settings*, *Generator Settings*, *Automatic Settings*, *Schedule Settings*, and *Schedule Exclusions*. Modification of any of these settings requires access Privilege Level L1.

⚠ CAUTION

To avoid damaging the Soft Load Transfer System and other components of the electrical system, use extreme caution when modifying any parameter while the system is performing active control.

Mode Settings Screen

Switching Device

This box selects the transfer switching *Device*. The three devices are: CTTS, Bypass CTTS, and Dual Breaker. This parameter is preset at the factory, and is locked from user changes. It is set to match the actual switching device of the SLTS to ensure proper operation.

Preset Mode

The *Preset Mode* indicates the desired operating mode of the SLC. There are five preset mode options: *Disabled*, *Soft Load Transfer*, *Base Load*, *Import*, and *Export*. The *Transfer Control* switch (user control panel), Timer, kW Demand, or Schedules can initiate the Preset Mode. Note that no changes to the Preset Mode are permitted while the system is performing active control.

- **Disabled**
  This option disables the soft load function and allows the switching device to operate as a closed-transition transfer device with minimum overlap time and passive synchronization.

- **Soft Load Transfer**
  This option allows the switching device to perform soft load transfers to the alternate power source. When initiated, the SLC will synchronize the EG to the utility and parallel the sources. Next, the system will immediately cause the EG to take on load to a preset value (Generator Minimum Load Setpoint) and generator excitation to increase towards the preset power factor setting. Over the course of the Ramp Time, the load will be shifted in equal increments until the utility reaches the user-defined Cutoff value. At that point the utility feed will be disconnected and the EG will carry the entire load. The SLC will relinquish governor and VR control unless the option to stay synchronized is selected.

- **Base Load**
  This option provides extended parallel operation of the power sources; the EG runs continuously in parallel with the utility until operation is discontinued. When initiated, the SLC will synchronize the EG to the utility and parallel the sources. Next, the system will immediately cause the EG to take on load to a preset value (Generator Minimum Load Setpoint) and generator excitation to increase towards the preset power factor setting. Over the course of the Ramp Time, the load is added in equal increments to the EG until it reaches the Base Load Setpoint. From this point on, the EG will operate at, and maintain, the Power Factor setting and Base Load Setpoint. Any variations in load are carried by the utility. Note that it is possible to Export power while in Base Load mode if the total load drops below the Base Load Setpoint.

- **Import**
  This option provides extended parallel operation of the power sources; the EG runs continuously in parallel with the utility until operation is discontinued. When initiated, the SLC will synchronize the EG to the utility and parallel the sources. Next, the system will immediately cause the engine to take on load to a preset value (Generator Minimum Load Setpoint) and generator excitation to increase towards the preset power factor setting. Over the course of the Ramp Time, the load is added in equal increments to the EG until the utility is down to the Import Setpoint. From this point on, the EG will operate at, and maintain, the Power Factor setting and Import Setpoint. Any variations in load are carried by the EG, up to the Generator Maximum Load Setpoint. Note that the SLC will ensure that the EG produces no less power than the Generator Minimum Load Setting at all times while paralleled. The functional implication is that it is possible to Export power while in Import mode if the total load drops below the Generator Minimum Load Setting. The quantity of power Exported will be the difference between the Generator Minimum Load Setting and the total load.

- **Export**

  This option provides extended parallel operation of the power sources; the EG runs continuously in parallel with the utility until operation is discontinued. When initiated, the SLC will synchronize the EG to the utility and parallel the sources. Next, the system will immediately cause the EG to take on load to a preset value (Generator Minimum Load Setpoint) and generator excitation to increase towards the preset power factor setting. Over the course of the Ramp Time, the load will be added in equal increments to the EG until the utility is receiving the Export Setpoint. From this point on, the EG will operate at, and maintain, the Power Factor setting and Export Setpoint. Any variations in load are carried by the EG, up to the Generator Maximum Load Setpoint. In this mode, the EG produces power to carry the entire load plus the Export value. Note that in the SLC, a signing convention is applied whereby the Export setpoint is a negative number and the Import setpoint is a positive number. Also note that the SLC ensures the EG produces power within the boundaries of the Generator Minimum and Maximum Load settings.

Load Control Options

The *Load Control* settings contain options required for all preset modes of operation: Utility Cutoff and Ramp Time. The Utility Cutoff parameter specifies the load value whereby the utility will separate from parallel operation with the EG. This quantity is in percent of Generator Full Scale Power. This is an applicable parameter for Preset Mode Soft Load Transfer, *Transfer To Generator* switch (user control panel), and Engine Exercise with Load Transfer via the G5C *Power Control Center*. The Ramp Time parameter specifies the time (in seconds) over which load transitions will occur for all soft transitions.

Load Setpoint Options

The parameters under *Load Setpoint* are available only if Base Load, Import, or Export preset mode is selected. If the Base Load preset mode option is chosen, the Base Load setpoint must be specified. This sets the desired operating point of the preset mode, and the quantity is in percent of Generator Full Scale Power. If Import preset mode is chosen, the Import setpoint must be specified. This sets the desired operating point of the preset mode, with the quantity in positive kW. Finally, if Export preset mode is chosen the Export setpoint must be specified. This sets the desired operating point of the preset mode, with the quantity in negative kW.

Generator Settings Screen

The *Generator Settings* screen contains the configuration of the minimum and maximum operating limits of the EG, and the desired power factor during parallel operation. These quantities are required parameters for all modes of operation.

The *Minimum* parameter specifies the minimum real power output of the EG. The value is expressed in terms of the Generator Full Scale Power. The SLC will not control the EG's real power output below this quantity.

The *Maximum* parameter specifies the maximum real power output of the EG. The value is expressed in terms of the Generator Full Scale Power. The SLC will not control the EG's real power output above this quantity.

The *Power Factor* parameter specifies the desired power factor during parallel operation. The SLC will control the generator excitation to produce the specified power factor. Note that power factor control via the SLC requires connection to a VR that accepts a remote voltage control signal and is capable of voltage droop.

Automatic Settings Screen

The *Automatic Settings* screen contains the configuration of the timer and kW demand operation settings.

Timer Operation

This feature allows unattended initiation of the Preset Mode based upon a time setting. The feature must be *Enabled*, with a start time and run duration specified. The start time must be for the present day, and cannot be set retroactively (only future start times are valid). The run duration has a maximum limit of 23:59, and can extend into the next day. When the Timer Operation expires or is otherwise terminated, the time settings are automatically cleared, and the feature is disabled. Once activated and running, changes to this feature are limited to disabling the feature or modifying the run duration.

kW Demand Operation

This feature allows unattended initiation of the Preset Mode based upon a kW Demand of the load. kW Demand is a time average value of the instantaneous real power. The time average window duration is settable from 1 to 15 minutes. For operation, the feature must be *Enabled*, with Start, Reset, and Reset Time Delay values specified. The Start value determines the kW Demand value that initiates the Preset Mode. The Reset value determines the kW Demand value that terminates the Preset Mode. The Reset time delay determines the amount of time the kW Demand must remain at or below the Reset value before Preset Mode termination. Once

activated and running, changes to this feature are prohibited with the exception of disabling it. The current total kW Demand is the sum of the Utility and Generator values, and can be found in the System Status screen. The discrete values of Utility and Generator kW Demand can be found in the Utility and Generator Source Detail screens. Note that any changes to the Average Window setting will reset the accumulated values of Utility and Generator kW Demand.

Scheduler Settings Screen

The *Scheduler Settings* screen contains the configuration of the four available *Schedules*. The schedules allow unattended initiation of the Preset Mode based upon a time and date setting. A schedule must be Enabled, with the Start Date, Start Time, Duration, End Date, and Run Days specified. The start date must precede the end date. The duration has a maximum limit of 23:59, and can extend into the next day. When the end date is passed, the given schedule is automatically disabled. Time or date changes to an actively running schedule are only asserted after the schedule expires or is cancelled. Changes to the system clock will not affect actively running schedules. Schedules can be configured to overlap one another for continuous operation in excess of 23:59. Active schedules can be cancelled from the System Status screen, leaving the overall feature enabled for its next iteration. Schedules can be inhibited from running on selected days specified in the Exclusion List.

Scheduler Exclusions Screen

The *Scheduler Exclusions* screen allows the user to set calendar dates on which active Schedules are inhibited. This screen allows entry of up to 10 Exclusion Date settings. Scheduler Exclusion settings are added or deleted only after Saving and exiting.

SYSTEM SETTINGS PARAMETERS

The *SYSTEM SETTINGS* area allows viewing and modification of *Nominal System*, *Nominal Source*, *Synchronization Gain*, *Load/Power Factor Gain*, *Governor/Regulator*, *Engine Control Mode*, *Engine Communications Settings*, and *Aggregate Power Control* settings. Modification of any of these settings requires access Privilege Level L2. These settings should not require modification after system startup. Extreme caution must be taken when making any changes to System Settings!

⚠ CAUTION

To avoid damaging the Soft Load Transfer System and other components of the electrical system, do not make any changes to the system settings without consulting ASI.

Nominal System Settings Screen

The *Nominal System Settings* screen contains the configuration of the *Power Manager Wiring*, *Nominal Voltage*, *Nominal Frequency*, and *PT Ratio*. The Power Manager Wiring specifies whether the PM voltage connections are 4 Wire - WYE or 3 Wire - Delta. The Nominal Voltage and Frequency fields are not settable, they are obtained from settings in the G5C *Power Control Center*. The PT Ratio specifies the voltage scaling to be applied for the PM voltage connections. System voltages of 600 V or less should use PT Ratio of 120:120.

Nominal Source Settings Screen

The *Nominal Source Settings* screen contains the specifications for each source's Full Scale Power, Full Scale Current, and CT Ratio. The Full Scale Power quantity is used for control system and protective function computations. The typical Full Scale Power value matches the EG nameplate rating. The Full Scale Current is used for protective function computations only. The typical Full Scale Current value matches the SLTS ampacity rating. The CT Ratio should match the value on the Current Transformers.

Synchronization Gain Settings Screen

The *Synchronization Gain Settings* screen contains the Proportional and Integral Gain settings for Voltage Matching, Frequency, and Phase angle. These settings determine the response of the SLC's control loop for source synchronization. The screen also features a *TEST* button located on the Configuration Navigation Task Bar to test Gain values in conjunction with the user control panel switch. Note that the Engine Control Mode must be set to SYNC CHECK to avoid paralleling the sources while testing synchronization gains.

Load / Power Factor Gain Settings Screen

The *Load/Power Factor Gain Settings* screen contains the Proportional and Integral Gain settings for Load Control and Power Factor Control. There is also a Derivative Gain setting for Load Control. These settings determine the response of the SLC's control loop for Load and Power Factor Control. The screen also features a *TEST* button located on the Configuration Navigation Task Bar to test Gain values in conjunction with the front panel switch. Note that the Engine Control Mode must be set to *RUN* or *PERMISSIVE* to test these gain settings, because paralleled sources are required for this evaluation.

Voltage Regulator / Governor Control Settings

This screen contains the specifications for the Voltage Regulator and Governor Input Bias Voltage Range and Type. Consult the VR and governor manufacturer's data sheet for proper settings.

For VR control, there are two options for bias type: DC Voltage and Raise/Lower Dry Contacts. This selection is made in accordance with the requirements of the VR. If DC Voltage is selected, the DC Range must be specified. The SLC Voltage Regulator DC output is selectable up to +/-9.0V in 0.1V increments. If Raise/Lower Dry Contacts is selected, the SLC Voltage Regulator output will produce signals to control an external device (Accessory 106E) that contains Raise/Lower contacts. Note that power factor control can not be accomplished by the SLC for VRs that do not accept voltage control signals. It is required that the VRs with raise/lower contacts be equipped with their own power factor or kVAR control mechanism.

For governor control, there are two options for bias type: *DC Voltage* and *Pulse Width Modulated* (PWM) 10 Vpk 500 Hz. This selection is made in accordance with the governor requirements. If DC Voltage is selected, the DC Maximum, DC Zero Bias, and DC Minimum must be specified. The SLC Governor DC output is selectable up to +/-9.0 V in 0.1 V increments. If PWM 10 Vpk 500 Hz is selected, the output signal characteristics are fixed and no further specifications are required.

Engine Control Settings Screen

This screen contains selections for the *Engine Control Mode*, *Stabilization Time Delay*, and *Generator Sync* option. The Engine Control Mode specifies the joint operating method of the switching device and generator. There are three Modes: *RUN*, *PERMISSIVE*, and *SYNC CHECK*. *RUN* Mode provides full soft load operation with active synchronization. This is the standard option for this setting. *PERMISSIVE* Mode provides soft load operation with passive synchronization. This selection is taken when it is desirable to not have the SLC perform synchronization. *SYNC CHECK* Mode inhibits soft load operation but provides active synchronization. This selection is typically used for tuning and testing the synchronizing and voltage matching functions.

The *Stabilization Time Delay* parameter permits a time delay prior to synchronizing. This timer only applies when the EG is not previously running.

The checkbox selection *Always Sync Gen to Available Utility* causes the EG to synchronize to an accepted utility source when the load is isolated to the generator.

The Unintentional Islanding Protection parameters are advanced settings that most users have no need to activate. Further details can be found in document 381339-290 (see page ii, Other Technical Documents).

Engine Communication Settings Screen

This screen contains selections for the *Engine Communications* interfaces. The SLC supports communications with two engine communications devices: The Caterpillar® CCM (Customer Communication Module) and the Caterpillar EMCP 3.X. For either interface, a variety of selectable options are available.

Communication Port Options for this parameter are *COM4 – Serial RS232* or *COM9 – Serial RS485*. Select the desired port per the external communications device requirements. Note that Accessory 106D is required to use port COM9.

Baud Rate Selections range from *2400 n81* to *115200 n81*. Select the desired baud rate in accordance with the external communications device requirements.

Login Password (Caterpillar® CCM only) For Caterpillar® CCM units that have password protection enabled, a login password may be required. Refer to the CCM specification for more details.

Address (Caterpillar® EMCP only) Specify the unit address (1 – 247) of the EMCP communications device.

Units Choose whether analog data are displayed in English or Metric units.

Audible Choose whether engine Alarms and/or Shutdown will cause the alarm horn to sound.

Analog Data Points, Alarms, Shutdowns, Spare Faults Select from the provided lists which available points are to be monitored.

Aggregate Power Control Settings Screen

This screen contains optional configuration for communication with an external PM(s), for the purpose of aggregating power data. Because the *Aggregate Power Control* feature requires Accessory 106D, the options in the screen may be disabled if Accessory 106D is not installed. With the Aggregate Power Control feature enabled, the SLTS may be configured for Import Mode control and/or kW Demand based operation which accounts for utility power measured at the service entrance. Additionally, Aggregate Power Control enables the SLTS maintained parallel control modes to account for emergency loads between the EG and the SLTS, to prevent against overload. A detailed specification on the Aggregate Power Control feature is available in document *381339-254*.

UTILITY AND GENERATOR PROTECTIVE FUNCTION PARAMETERS

The *Protective Function Settings* screens allow viewing and modification of protective functions for each power source. The protective functions reside in the PM, but are configured via the SLC GUI. Twelve unique protective functions can be assigned for each power source. Each protective function screen contains settings for Setpoint Name, Trip Level, Reset Level, Trip Time Delay, Reset Time Delay, Output Selection, and Alarm Type. Modification of any of these settings requires access Privilege Level L3.

Setpoint Name Selection

This box specifies the type of protective function to configure. If a Digital Input is selected, an additional field is added to give the input a user-defined name. For example, a system may be equipped with a fuel level sensor that closes a contact when the fuel level is low. This sensor contact can be wired into a Digital Input. Next, a Setpoint can be configured in the SLC for this sensor with a descriptive name such as *Low Fuel* assigned to it. Thus, when the contact closes or opens, event log entries are recorded and additional hard-wired logic can execute.

Trip Level Selection

The value in the *Trip Level* box specifies the level at which the selected protective function will Trip after the Trip Time Delay has expired. The interface will prevent the user from entering a Trip Level that conflicts with the Reset Level. For Digital Input selections, the Trip Level is selectable as High Transition or Low Transition only.

Reset Level Selection

The value in the *Reset Level* box specifies the level at which the selected protective function will Reset after the Reset Time Delay has expired. The interface will prevent the user from entering a Reset Level that conflicts with the Trip Level. For Digital Input selections, the Reset Level is the opposite of the indicated Trip Level.

Trip Time Delay Selection

The value in the *Trip TD* box determines the amount of time the associated setpoint parameter must remain at, or exceed, the Trip Level before the protective function is Tripped. For no additional time delay on response, select *INST* (instantaneous).

Reset Time Delay Selection

The value in the *Reset TD* box determines the amount of time the associated setpoint parameter must remain at, or exceed, the Reset Level before the protective function is Reset. This selection has a minimum of 1 second.

Digital Output Selection

Four Digital Output contacts are available for each protective function. Any combination may be chosen. Fields are provided for entering user-defined names for each output. For example, a Digital Output contact may be wired to a circuit containing a beacon such that the beacon illuminates for selected Setpoint Trips. As such, the Digital Output name may be defined as *Alarm Beacon*.

Alarm Type Selection

There are two Alarm Type check boxes for each protective function: *Audible* and *Latched*. Selecting *Audible* will activate the Alarm Horn when the associated protective function trips. This Alarm Horn can be silenced from the icon on the Home Screen Status Bar. Selecting *Latched* will latch the protective function's Digital Output(s) (or act as a logical alarm if no Digital Outputs are selected) when a Trip occurs. A Latched Protective Function must be Acknowledged from the Associated Protective Function Status Screen to clear.

Device 86 Selection

As part of the Digital Output group selection, the Protective Function Settings screen has an additional checkbox to Enable or Disable the Device 86 feature. The Device 86 feature is a master lockout relay which only acts upon protective functions associated with Digital Output 1. A Device 86 Trip can be Reset from the Protective Function Status Screens only if the fault condition has met Reset requirements. For example, assume that Setpoint 1 is set for 109% Overvoltage on output DO1, and Setpoint 2 is set for 107% Overvoltage on output DO2. Neither Setpoint is configured as Latched, but Device 86 is enabled. Here, if the voltage were at 108%, DO2 closes (Setpoint 2 Trip) and then opens (Setpoint 2 Reset) when the voltage has fallen below the reset point. Device 86 does not become activated in that scenario. Conversely, when voltage exceeds 108%, DO1 will also close (Setpoint 1 Trip) and Device 86 *is* activated, meaning that DO1 will not open when Setpoint 1 Resets. DO1 only opens when Setpoint 1 Resets AND an operator acknowledges the Device 86 Trip.

NETWORK SETTINGS PARAMETERS

The *NETWORK SETTINGS* screens allow viewing and modification of the *Ethernet*, *Modbus*, *Site Information*, and *Email Alarm* configuration settings**.**
The Network Settings screens are accessible only by the Administrator (`admin`).

Internet / Modbus Protocol Settings

The *Ethernet Port* settings must be enabled and properly configured for the SLC to support HTML web communications, email messaging, and Open Modbus TCP/IP Communications. For HTML web and Open Modbus TCP/IP Communications, a valid IP Address, Subnet Mask, and Default Gateway must be entered. Email messaging requires that a valid outgoing email server address be entered. These addresses are entered in the dotted decimal format (`xxx.xxx.xxx.xxx`).

Below the *Ethernet Port* settings group lies the Site Information group. The Site Information consists of Site Name, Site Location, Contact Name, and Contact Number and is provided for users to give the SLC a descriptive identity. These fields accept text up to 25 characters in length. The Site Information is displayed on the HTML pages and is available through Modbus.

The *Modbus Protocol Settings* group permits configuration of the Modbus communication feature. A unique address from 1 - 247 must be selected and two protocol choices are available: TCP/IP Open Modbus, or Serial RS485. If TCP/IP is selected, the SLC will respond to valid Modbus commands received through TCP/IP. If Serial RS485 is selected, the Baud Rate (9600 n81 or 19.2k n81) must be selected. Serial RS485 Modbus communications takes place on the port labeled TB4 COM6. Detailed specifications on the SLC's implementation of Modbus support are available in document *381339-241*.

The Alarms and Email Settings groups allow configuration of email preferences. One source and five destination addresses may be specified. Additionally, an SMTP password may be entered for networks requiring SMTP authentication. The SLC will login (AUTH LOGIN) using the SMTP password entered. Applications that do not require SMTP authentication may leave the SMTP password blank. There are three types of email messages that the SLC can send: Alarms, Status, and Test email.

Alarm Email is configured via the check boxes for Setpoint Alarms and Other Alarms. A variety of events and alarms are available to select for email messaging upon their occurrence. When a selected event or alarm occurs, emails are sent to all valid addresses.

Status Email is a periodic email message to user-selected addresses, which indicates the Control State of Soft Load Controller. The frequency of Status Email messaging varies depending upon the user selection.

The *Test Email* button allows verification of the email feature by sending a test message to all addresses. The Test Result window will indicate the number of successful email transmissions. Use this button for initial verification of the email settings.

SECURITY TOOLS

The *SECURITY TOOLS* screen allows all users to change their Logon Passwords. Additional screens for New User Additions and User Deletions are accessible by the Administrator (`admin`) only. User names and passwords are case-sensitive.

Password Change

A user changes his or her password via the *Change Password* screen. There are text boxes provided to enter and confirm (reenter) the new password. Passwords have an eight-character limit. The new password is saved after the *Save* button on the Configuration Navigation Task Bar is selected.

The SLC comes with the Administrator user name and password predefined. The Administrator user name is `admin` and the password is also `admin`. This, and all other user names and passwords are case-sensitive. The Administrator password can be changed, but the new password should be written down and stored in a safe location.

Adding a New User

The SLC permits a total of eight users to be defined by the Administrator. A new user is added via the *Add User(s)* screen. There are text boxes provided to the new user name and to enter and confirm (reenter) the new password. User names and passwords have an eight-character limit. User names must be unique. When adding a new user to the system, a Privilege Level must be assigned. The new user is added after the Save button on the Configuration Navigation Task Bar is selected.

Privilege Levels

There are six *Privilege Levels* available for assignment (L1 – L6). By default, each registered user must have at least one of the following privileges assigned:

- *L1 Privilege* permits modification of Load Management Settings.
- *L2 Privilege* permits modification of System Control Settings.
- *L3 Privilege* permits modification of Utility and Generator Protective Function Settings.
- *L4 Privilege* permits modification of the System Date, Time, & Language in *OTHER TOOLS* screen.
- *L5 Privilege* permits the user to Acknowledge Alarms and reset Device 86 in the Status screens.
- *L6 Privilege* permits the user to reset the accumulated energy registers (kWh) in the Source Detail screens.

Viewing or Deleting Registered Users

The Administrator has the privilege of viewing the list of registered users, including their passwords and Privilege Levels. This is accomplished via the View/Delete User(s) screen. To delete a user, select the check box adjacent to the user to be removed, then select the *Save* button on the Configuration Navigation Task Bar.

OTHER TOOLS

The *OTHER TOOLS* screen allows the user to set the date, time, and the language used for the display. In addition, there are buttons to calibrate or disable the touch screen, or view the (utility or generator) setup logs. If the Administrator accesses this area, buttons are available to Clear the Event Log, Dump the Event Log, or Dump the Configuration Settings from this area. Changes to the Date, Time or Language are saved if the *Save* button on the Configuration Navigation Task Bar. Access to these features and settings requires Privilege Level L4 or Administrator privilege.

Calibrate Touch Screen

The *Calibrate* button in the touch screen group allows recalibration of the touch screen. Use a blunt, narrow-tipped object to touch the targets displayed on the screen, and follow the on-screen instructions.

Setup Logs

The *Setup Log* group contains two buttons: *View Utility* and *View Generator*. Selecting either button will display a log holding records of the most recent changes made to the Protective Function or Nominal Settings of each source. Each Setup Log has a maximum capacity of 200 entries. When a log is filled to capacity, the oldest entries are dropped to make room for new entries.

Disable Touch Screen

The *Disable* button in the touch screen group will disable the touch screen for 15 seconds to allow for cleaning.

Administrative Tools Group

The *Administrative Tools* group contains three buttons enabled for the administrator only: *Erase Event Log*, *Dump Event Log*, and *Dump Configuration*. The *Erase Event Log* button will clear the contents of the Event Log. The *Dump Event Log* and *Dump Configuration* keys will output the Event Log or Configuration Settings in ASCII text format to the serial port labeled J1 COM1. The output is RS232, 9600 Baud, No Parity, 8 Data Bits, and 1 Stop Bit. This output can go directly to a serial-enabled printer or to a terminal program on a PC.

Daylight Saving Time

Clock advances 1 hour in Spring, sets back 1 hour in Fall

Three* options for setting Daylight Savings Time are:

Disable	Off (setting where DST is not used)
*Mar/Nov** beginning 2007	2 am on 2nd Sunday in March 2 am on 1st Sunday in November
Apr/Oct	2 am on 1st Sunday in April 2 am on last Sunday in October

Touch ***Save & Exit*** after making your selection.

* Software version XXXXXX-014; click **ASCO** icon on menu.

FACTORY TOOLS

The *FACTORY TOOLS* screen is accessible only by ASI service technicians. This area is used for product upgrades and diagnostics.

⚠ CAUTION

To avoid damaging the Soft Load Transfer System and other components of the electrical system, do not make any changes in Factory Tools without consulting ASI.

Section 4 — Engine-Generator Control and Adjustment

⚠ DANGER

Use extreme caution when working on the SLTS. Do not touch power terminals; shock, burns, or death could result!

⚠ WARNING

To avoid severe equipment damage and personal injury, the engine-generator set must have automatic shutdown devices and electrical system must have protective devices.

⚠ CAUTION

To avoid damaging equipment and causing unstable system operation, these adjustment procedures must be performed only by authorized and trained persons.

OVERVIEW AND THEORY

Four key tasks comprise the EG control of a paralleling control system: Voltage Matching, Frequency/Phase Angle Matching, Load (kW) Control, and Power Factor (kVAR) Control. The SLC accomplishes these four tasks via the direct connection to the EG governor and VR. Voltage, Frequency, and Phase Angle Matching, a.k.a. synchronizing occurs prior to paralleling. Load and Power Factor Control occurs once the sources are paralleled. Each of these four tasks is achieved via feedback control algorithms. These algorithms are embedded in the SLC software and influenced by user selections for gains and operating limits. A successful operating system requires robust algorithms and measurement capability, plus proper gain selections to ensure stable operation.

FREQUENCY AND PHASE ANGLE SYNCHRONIZATION

Frequency and Phase Angle Synchronization refers to the matching of the EG frequency and phase angle to that of the utility source. This synchronization is required for paralleling with minimal transients. The SLC performs this task by controlling the speed governor with a remote voltage signal. The governor, in turn, controls the engine fuel rate, resulting in speed/frequency changes. The criteria for paralleling are frequency difference less-or-equal to +/- 0.2 Hz and phase difference less-or-equal to +/- 5 electrical degrees. When the system is initiated, the control algorithms will bias the governor to synchronize to the above criteria.

VOLTAGE MATCHING

Voltage Matching is also required for paralleling with minimal transients. The SLC performs this task by controlling the VR with a remote voltage signal. The VR controls the terminal voltage of the generator by adjusting the field excitation. The requirement for paralleling is voltage difference less-or-equal to 5% (default setting, range is selectable up to 10% within the G5C). When the system is initiated, the control algorithms will bias the voltage regulator to synchronize to the above requirement.

REAL POWER (LOAD) CONTROL

Once the sources are paralleled, the infinite bus (utility) controls the power system frequency. Thus, the SLC connection to the governor no longer influences frequency. However, the changes in fuel rate produced by the governor result in changes in engine output torque, which directly relates to real power (kW) output. Thus the same connection previously used for frequency and phase angle matching now becomes the kW or load control point. The SLC switches its governor control mode upon paralleling from synchronization to load control, and follows the ramp profile to the operating point. The control logic is designed to keep the operating level between the user-defined minimum and maximum kW levels, regardless of actual load.

POWER FACTOR CONTROL

Once the sources are paralleled, the infinite bus (utility) controls the power system voltage. Thus, the SLC connection to the VR no longer influences terminal voltage. However, the changes in excitation produced by the VR result in changes in operating power factor, which directly relates to reactive power (kVAR) flow. Thus the same connection previously used for voltage matching now becomes the power factor control point.

CONTROL GAINS

ASCO Power Technologies has derived control gain settings for many popular VRs and governors. Most SLTSs are delivered with the proper gains pre-installed, if the customer equipment is known at the time of manufacture. Though these settings may not be ideal for every install, they should provide a basis from which only fine-tuning adjustments are required.

There can be cases where derived gains do not exist (i.e. untested governors or VRs) or where the system is completely tuned on site. In such cases, the goal is to select synchronization settings that provide rapid matching of generator frequency, phase angle, and voltage to utility without any oscillations, and load/ power factor control settings, which also provide stable control.

The algorithms employed to control the engine are composed of *Proportional* and *Integrating* gain compon-ents, and values must be set for both gains for each parameter (Voltage, Frequency, Phase Angle, Load, and Power Factor). In the SLC, the *Proportional* and *Integrating* gain products are summed together to produce the resultant output bias for each control parameter. The *Proportional* component, as implied, produces output directly scaled to the input (the error between desired and actual target). The *Integrating* component produces output scaled to the input time error (the error between desired and actual target as a function of accumulated time).

The fastest and most stable response is achieved with proportional gain. However, convergence to zero error is not possible without integral gain. Therefore, a typical parameter will consist of a proportional gain component to rapidly approach the target vicinity and a smaller integral component to drive the error to zero. Note that too much integral gain can cause instability, oscillations, and large overshoots. Large overshoots are also possible with too much proportional gain. The proper balance must be achieved between both gains to avoid instability or 'hunting'.

The *Load Control* parameter features a Derivative Gain in addition to Proportional and Integral. The *Load Control Derivative Gain* adjusts the load bias in relation to the rate-of-change of the load. This parameter can lead to very unstable load performance when loads are instantaneously added or dropped. **Thus, it is recommended that the *Load Control Derivative Gain* is always set to zero.**

SYNC CHECK TESTING

Sync check testing refers to evaluation of system performance as a synchronizer and voltage matcher, with no subsequent load or power factor control. Selecting *SYNC CHECK* as the Engine Control Mode (in the System Settings area) enables sync check testing. System performance can be monitored from the *HOME* screen or from the *TEST* screen accessible from the *SYSTEM SETTING - Synchronization Gain Settings* screen. Verify that the *Engine Control Mode* is set for *SYNC CHECK* prior to initiating any testing by checking the *System Status* screen.

With the system properly configured for sync check testing, the test can be initiated via the *Transfer Control* switch to *Transfer Preset Mode* (user control panel). The desired output is stable voltage, frequency, and phase angle matching. Observe performance via the voltage display, frequency display, and the synchroscope. Return the switch to *Auto* to stop the test. Performance can be adjusted by modifying the appropriate gain settings in the *SYSTEM SETTINGS – Synchronization Gain Settings* screen, then repeating the test. When satisfied with system performance, the final gain settings should be saved, and sync check mode can be disabled.

SOFT TRANSFER TESTING

Soft transfer testing is accomplished with the *Preset Mode* set for *Soft Load Transfer*, and manual operation of the *Transfer Preset Mode* switch. System performance can be monitored from the *HOME* screen or from the *TEST* screen accessible from the *SYSTEM SETTINGS - Load/Power Factor Gain Settings* screen. For operator and equipment safety during initial testing, protective relaying should be configured and shunt trip operation verified prior to beginning. Note that nuisance protective function trips or erratic control is possible on initial testing and, as such, caution is advised.

With the system properly configured, initiate the test by turning the *Transfer Control* switch to *Transfer Preset Mode* (user control panel). The system will synchronize the sources and parallel the switching mechanism. Observe the real and reactive power flow. The real power (kW) should be smoothly increasing on the EG and decreasing on the utility, in accordance with the ramp time, until the utility cutoff is reached whereby the system will isolate the load to the EG. The reactive power flow should always be positive on the EG side while paralleled. Unless significant negative VARs are present, do not try to evaluate power factor control during this mode because the load is constantly changing. Power factor control will be verified during Maintained Parallel Testing.

Return the *Transfer Control* switch to *Auto* at anytime to stop the test. Performance can be adjusted by modifying the appropriate Gain settings in the *SYSTEM SETTINGS - Load/Power Factor Gain Settings* screen, then repeating the test. When satisfied with system performance, the final gain settings should be saved.

When the load is isolated to the generator side, the synchronizer can be reevaluated. The difference now is that the synchronizer will be operating on a loaded EG, which responds differently than an unloaded EG. Follow the procedure detailed in Sync Check testing to reevaluate/retune the synchronizer in while isolated on the generator.

MAINTAINED PARALLEL TESTING

Maintained parallel testing is accomplished with the *Preset Mode* set for *Base Load*, and manual operation of the *Transfer Control* switch to *Transfer Preset Mode* (user control panel). System performance can be monitored from the *HOME* screen or from the *TEST* screen accessible from the *SYSTEM SETTINGS - Load/Power Factor Gain Settings* screen. For operator and equipment safety during initial testing, protective relaying should be configured and shunt trip operation verified prior to beginning. Note that nuisance protective function trips or erratic control is possible on initial testing and, as such, caution is advised.

With the system properly configured, initiate the test by turning the *Transfer Control* switch to *Transfer Preset Mode* (user control panel). The system will synchronize the sources and parallel the switching device. Observe the real and reactive power flow. The real power (kW) should be smoothly increasing on the EG and decreasing on the utility, in accordance with the ramp time, until the Base Load setpoint is reached. The reactive power flow should always be positive on the EG side. When the Base Load setpoint is reached, evaluate Power Factor control. The EG should be operating at the user-defined power factor setting.

Return the *Transfer Control* switch to *Auto* at anytime to stop the test. Performance can be adjusted by modifying the appropriate gain settings in the *SYSTEM SETTINGS - Load/Power Factor Gain Settings* screen, then repeating the test. When satisfied with system performance, the final gain settings should be saved.

Section 5 — External Communications

The SLC has several communication ports for external communications via multiple protocols. This includes communication with engine communication modules (ECM), communication on Modbus networks, HTML pages on Ethernet, and email.

ENGINE COMMUNICATIONS

Overview

Many EG manufacturers offer optional modules which communicate EG operational data. The SLC supports communications to 2 devices, the Caterpillar® CCM (Customer Communication Module) and the Caterpillar EMCP 3.X. In such an arrangement, the SLC is a master device and the ECM is a slave. The SLC supports a subset of the ECM's total protocol map, including a variety of analog data points, alarms, and shutdowns. Configuration for ECM communications is found in the *SYSTEM SETTINGS - Engine Communications* screen. Display of ECM data is found in the *Engine Data* screen under the *Generator Detail* screen. Engine Communications events, including communication status changes, alarm status changes, and shutdown status changes are logged in the *Event Log*.

Engine Communications Screen

The *Engine Communications* screen displays analog data, alarms, and shutdowns received via the engine communications link. Additionally, a status field displays the status of communications with the remote device. The analog data is displayed with the user-selected units. Alarms and shutdowns are displayed with an iconic status representation: green dot for ok, red dot for shutdown, yellow dot for alarm, and gray dot for disabled. Note that all icons and data fields are blackened if a communication error occurs.

Common Configuration Options

For either supported ECM, there are common and unique configuration options available for selection. The common options, tabulated below, comprise selection of Communication Port, Baud Rate, Display Units, and Audible Alerts.

Engine Communications – Common Configuration Options		
Option	Range	Restrictions
Communication Port	COM4 – Serial RS232 or COM9 – Serial RS485	Caterpillar CCM restricted to COM4 – Serial RS232 only
Baud Rate	2400 n81 to 115200	Caterpillar CCM restricted to 9600 n81
Display Units	English or Metric	None
Audible Alarms	Enabled or Disabled	None
Audible Shutdowns	Enabled or Disabled	None

Caterpillar® CCM Configuration Options

The Caterpillar CCM communicates using a proprietary protocol. The SLC offers a selectable menu of analog data, alarms, shutdowns, and spare fault monitoring points for the Caterpillar CCM. Additionally, remote start/stop control, user-defined spare fault descriptions, login password, and login password disable options are available. The *Remote Start/Stop Control* is grouped in with the menu of analog data points. If enabled, a user can start and stop the EG from the *Generator Detail* screen, via buttons on the screen. Note that, depending on operating mode, this ability to stop a running EG may conflict with an external start signal from the G5C *Power Control Center*. For *Spare Fault* identification, fields are provided to enter descriptive names for each *Spare Fault*. These fields have a 15-character limit. The login password and login password disable controls are provided for CCM units that have password protection enabled. For simplicity, it is recommended that password protection not be used. A detailed list of the monitoring points is tabulated below.

Engine Communications – Caterpillar CCM Monitoring Points			
Description	Analog	Alarm	Shutdown
Engine RPM	X		
Engine Run Time	X		
Battery Voltage	X		
Coolant Temperature	X		
Percent of Rated Load	X		
Engine Oil Pressure	X		
High Coolant Temperature Setpoint	X		
Low Coolant Temperature Setpoint	X		
Right Exhaust Temperature	X		
Left Exhaust Temperature	X		
Rated Speed Oil Pressure Setpoint	X		
Idle Speed Oil Pressure Setpoint	X		
Fuel Consumption Rate	X		
Fuel Pressure Differential	X		
Boost Pressure	X		
High Coolant Temperature		X	X
Low Coolant Temperature		X	
ECS Not in Auto		X	
Low Oil Pressure		X	X
High Oil Temperature		X	
Engine Control		X	
Emergency Stop			X
Overspeed			X
Overcrank			X
Coolant Loss			X
Spare Fault #1		X	X
Spare Fault #2		X	X
Spare Fault #3		X	X
Spare Fault #4		X	X

Caterpillar® EMCP Configuration Options

The Caterpillar EMCP communicates using the Modbus protocol. The SLC offers a selectable menu of analog data, alarms, and shutdowns monitoring points for the EMCP. Additionally, a field for the unit address, selectable from 1 to 247, is provided. A detailed list of the monitoring points is tabulated below.

Engine Communications – Caterpillar EMCP Monitoring Points			
Description	Analog	Alarm	Shutdown
Engine RPM	X		
Engine Run Time	X		
Battery Voltage	X		
Coolant Temperature	X		
Percent of Rated Load	X		
Engine Oil Pressure	X		
High Coolant Temperature Setpoint	X		
Low Coolant Temperature Setpoint	X		
Right Exhaust Temperature	X		
Left Exhaust Temperature	X		
Rated Speed Oil Pressure Setpoint	X		
Idle Speed Oil Pressure Setpoint	X		
Fuel Consumption Rate	X		
Fuel Pressure Differential	X		
Boost Pressure	X		
Coolant Temperature		X	X
ECS Not in Auto		X	
Oil Pressure		X	X
Oil Temperature		X	
Emergency Stop			X
Speed			X
Fail to Start			X

MODBUS® COMMUNICATIONS

Overview

Modbus[2] is an industrial communications protocol. The descriptions provided in this document are not intended as an all-encompassing detail specification of the Modbus standard and its implementations. Further details on Modbus are available on the World Wide Web. Detailed specifications on the SLC's implementation of Modbus support are available in document *381339-241*. The Modbus Protocol Settings group of the Network Settings screen contains configuration options for the Modbus communication feature.

Device Address and Protocol Types

The SLC functions as a slave on Modbus communication networks and the GUI allows assignment of a unique address from 1 through 247. The SLC also accepts supported broadcast commands sent to address 0. Modbus communication can be performed serially via RS485 or over a network using TCP/IP.

Serial communication occurs on the port labeled TB4 COM6 using the Modbus RTU protocol. The serial connection supports baud rates of 9600 and 19200, with 8 data bits, no parity, and 1 stop bit. Maximum response time from a Master request to a Slave response should be < 50 ms.

TCP/IP network communications use the Open Modbus protocol via TCP well-known port 502. Only one Modbus communications option (RS485 or TCP/IP) may be active at one time.

Supported Function Codes

The SLC supports Modbus function codes 0x03 (Read Holding), 0x06 (Preset Single), and 0x10 (Preset Multiple). User-modifiable data points must comply with the security privilege scheme employed via the GUI for successful processing of function codes 0x06 and 0x10.

Exception Responses

If the Modbus master device sends an unsupported command, attempts to read an invalid holding register, or attempts to write invalid data, the SLC issues an exception response. The following table lists the Exception responses supported by the SLC.

Supported Modbus Exception Responses		
Code	Name	SLC Implementation
01	Illegal Function	The slave does not support the function code contained in the master query packet.
02	Illegal Data Address	The slave does not support the Holding Register address referenced in the data field of the master query packet.
03	Illegal Data Value	The slave does not support the data referenced in the data field of the master query packet.
07	Negative Acknowledge	The slave is unable to perform the action requested due to an invalid privilege level, a temporary restriction, or an internal resource conflict.

A further note about the Negative Acknowledge Exception: As a safety measure, the SLC may not process certain requested actions while the system is actively controlling to prevent potential conflicts or unpredictable output. **As a rule of thumb, changes to operational settings should be performed only when the SLC is in Standby.**

[2] Modbus is a registered trademark of Gould Inc.

Data Access Methodology & Restrictions

Modbus communications follows a Data Access Methodology similar to that employed from the SLC GUI. Nearly all points available from the GUI with unrestricted access are also available via Modbus communications with unrestricted access. Thus, a user name / password login is not required to view Modbus data points.

For points requiring privileged access, the security scheme employed in the GUI is applied to Modbus communications. Refer to **Section 3, Security Tools**, for more information on the GUI security scheme. For Modbus communications, the default Privilege Level is L0, corresponding to *View Data Only*. Note that L0 Privilege Level is not available from the GUI because it is implied.

To modify a setting requiring a Privilege Level higher than L0, a valid login is required. Login is performed by writing a valid user name and password to the Modbus Login Name and Modbus Login Password registers. When complete, the SLC will replace the password with asterisks and update the Modbus Login Privilege register.

Login remains valid for 5 minutes from first Login or from the last attempt to perform a privileged action. After that, the Login will time-out, which clears the Modbus Login Password field and revises the Modbus Login Privilege to the default (L0).

EMBEDDED WEB SERVER

Overview

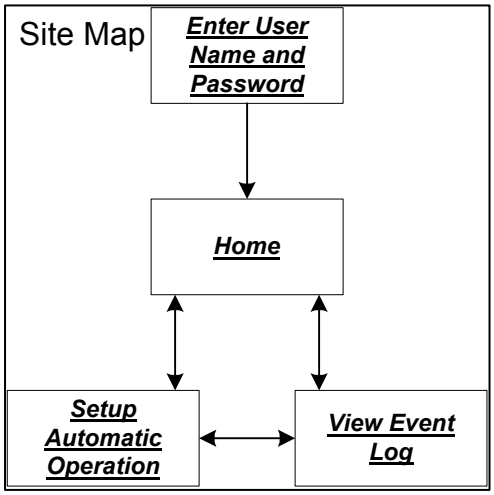
The SLC contains an embedded web server, which produces HTML pages viewable via standard web browser. The web server allows remote monitoring of power system data, the one-line diagram, and the event log. Additionally, remote control of the system is possible through the web interface via the Timer function. Access to the HTML pages for viewing and remote control is protected by the security scheme employed at the GUI. Only registered users can login to the system and view web pages. Furthermore, only registered users with Privilege Level L1 may modify the Timer settings via the web interface.

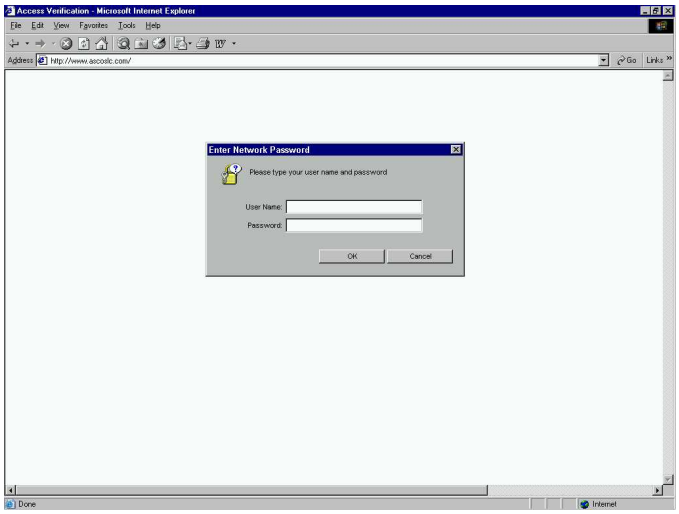
Description

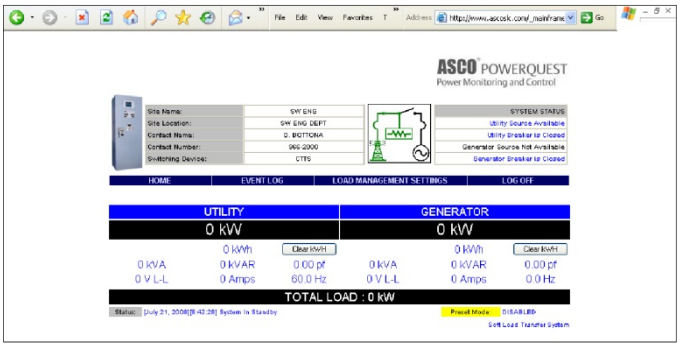
The web server is accessed via the Ethernet Port once the feature is enabled with an IP Address, Subnet Mask, and Default Gateway assigned. The web server configuration options are located in the Network Settings screen (refer to **Section 3, Network Settings**).

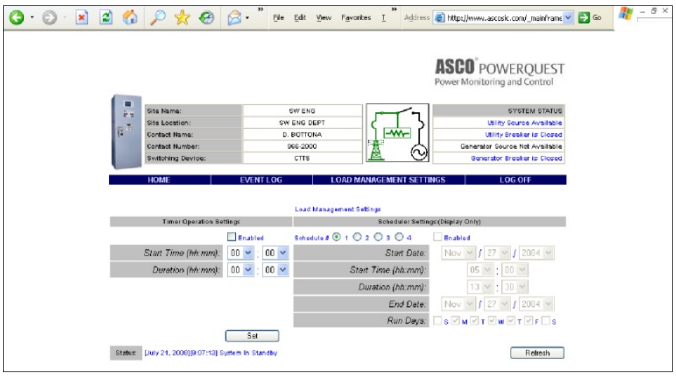
The HTML pages display the Site Name, Site Location, Contact Name, and Contact Number as defined in the Network Settings screen. Proper setup and operation of this feature may require the assistance of the on-site computer network system administrator.

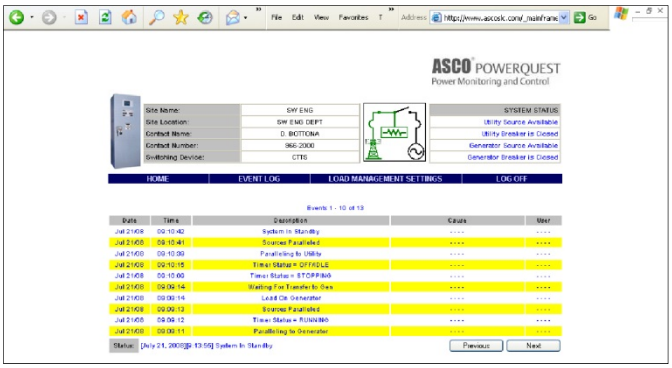
A Site Map and screen shots appear below.











EMAIL

The SLC can produce email messages, transmitted to a mail server via the Ethernet port. This feature requires Ethernet communications enabled and the assignment of a valid outgoing email server address. The email configuration options are located in the Network Settings screen (refer to **Section 3, Network Settings**). Up to five email addresses are supported with user-selectable email notifications as enumerated below.

- Utility Protective Function Trips
- Utility Protective Function Resets
- Utility Protective Function Acknowledgements
- Generator Protective Function Trips
- Generator Protective Function Resets
- Generator Protective Function Acknowledgements
- Utility Breaker Open
- Generator Breaker Open
- Utility Source Not Available
- Generator Source Not Available
- Generator Source Available
- Lockout Alarm
- Transfer to Utility
- Transfer to Generator
- Sources Paralleled

Additionally, a Status email can be configured per a user-defined schedule that sends periodic Status Email messages. To facilitate configuration and verification, a Test button is available in the Email Settings screen to test each email address entered.

Appendix

SLTS Parameters, Defaults, Range

Load Management Settings – Modified with Privilege Level L1				
Description	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Switching Device	CTTS	CTTS, Bypass CTTS, or Dual Breaker		Should be preset by factory as appropriate
Preset Mode Select	Disabled	Disabled, Soft Load Transfer, Base Load, Import, Export		
Utility Cutoff	10	0 - 100	%	Percentage of Generator Full Scale kW
Ramp Time	15	0 – 600	seconds	
Base Load Setpoint	-	Gen Minimum Load – Gen Maximum Load	%	Percentage of Generator Full Scale kW
Import Setpoint	-	0 – 24999	kW	
Export Setpoint	-	–24999 – 0	kW	Cannot be set to exceed Generator Full Scale kW
Gen Minimum Load	10	0 – Gen Maximum Load %	%	Percentage of Generator Full Scale kW
Gen Maximum Load	100	Gen Minimum Load % - 100	%	“
Gen Power Factor	0.90	0.80 – 1.00		lagging
Timer Enable	FALSE	FALSE or TRUE		
Timer Start Hour	-	0 - 23		
Timer Start Minute	-	0 – 59		
Timer Duration Hour	-	0 - 23		
Timer Duration Minute	-	0 - 59		
kW Setpoint Enable	FALSE	FALSE or TRUE		
kW Setpoint Averaging Window	15	1 – 15	minutes	
kW Setpoint Start	0	kW Setpoint Reset - 24999	kW	
kW Setpoint Reset	0	0 - kW Setpoint Start	kW	
kW Setpoint Reset Time Delay	15	0 – 99	minutes	
Schedule Enabled	FALSE	FALSE or TRUE		
Schedule Start Month	-	January – December		
Schedule Start Date	-	1 – 31		
Schedule Start Year	-	2004 - 2099		
Schedule Start Hour	-	0 - 23		
Schedule Start Minute	-	0 – 59		
Schedule Duration Hour	-	0 - 23		
Schedule Duration Minute	-	0 - 59		
Schedule End Month	-	January – December		
Schedule #1 End Date	-	1 – 31		
Schedule End Year	-	2004 – 2099		
Schedule Run Days	-	Sun - Sat		Any combination
Schedule Exclusion Month	-	January – December		
Schedule Exclusion Date	-	1 – 31		
Schedule Exclusion Year	-	2004 – 2099		

System Settings – Modified with Privilege Level L2				
Parameter	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Power Manager Wiring	4W-Y	4W-Y or 3W-DELTA		May be preset by factory as appropriate
PT Ratio	120 :120	120 – 28200 :120		“
Utility Full Scale Power	10	10 – 24999	kW	“
Gen Full Scale Power	10	10 – 24999	kW	“
Utility Full Scale Current	1	1 – 29999	A	“

System Settings – Modified with Privilege Level L2				
Parameter	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Gen Full Scale Current	1	1 – 29999	A	“
Utility CT Ratio	300 : 5	5 – 24000 : 5 (multiples of 5 only)		“
Gen CT Ratio	300 : 5	5 – 24000 : 5 (multiples of 5 only)		“
Voltage Matching Proportional Gain	0.000	0.000 – 999.999		“
Voltage Matching Integral Gain	0.000	0.000 – 999.999		“
Frequency Proportional Gain	0.000	0.000 – 999.999		“
Frequency Integral Gain	0.000	0.000 – 999.999		“
Phase Proportional Gain	0.000	0.000 – 999.999		“
Phase Integral Gain	0.000	0.000 – 999.999		“
Load Proportional Gain	0.000	0.000 – 999.999		“
Load Integral Gain	0.000	0.000 – 999.999		“
Power Factor Proportional Gain	0.000	0.000 – 999.999		“
Power Factor Integral Gain	0.000	0.000 – 999.999		“
Load Derivative Gain	0.000	0.000 – 999.999		“
Voltage Regulator Bias Type	DC	DC or DRY CONTACT		“
Voltage Regulator Bias	0.0	0.0 – 9.0	VDC	“
Governor Bias Type	DC	DC or PWM		“
Governor Bias Minimum	0.0	-9.0 – Governor Bias DC Zero	VDC	“
Governor Bias Maximum	0.0	Governor Bias DC Zero – 9.0	VDC	“
Governor DC Zero	0.0	Governor Bias Minimum – Governor Bias Maximum	VDC	“
Engine Control Mode	RUN	RUN, SYNC CHECK, or PERMISSIVE		
Gen Stabilization Time Delay	0	0 – 60	Seconds	
Always Sync Gen to Available Utility	FALSE	FALSE or TRUE		
Language	ENGLISH	ENGLISH or SPANISH		
Engine Communications Type	Disabled	Disabled or Caterpillar CCM or EMCP		
Engine Comm. Port	-	COM4 - Serial RS232 or COM9 - Serial RS485		COM9 requires Accessory 106D
Engine Comm. Baud Rate	-	2400 n81 to 115200		
Engine Comm. Login Password	-	8 character limit		Caterpillar CCM only
Engine Comm. Login Password Disable	-	FALSE or TRUE		“
Engine Comm. Address	-	1 – 247		Caterpillar EMCP only
Engine Comm. Units	-	English or Metric		
Engine Comm. Monitoring Options	FALSE	FALSE or TRUE		
Aggregate Power Control (APC) Enable	FALSE	FALSE or TRUE		Requires Accessory 106D
APC Power Manager Enable	FALSE	FALSE or TRUE		“
APC Power Manager Description	-	20 character limit		“
APC Maximum Load (kW) Between Gen & SLTS	-	0 - Gen Full Scale Power	kW	“
APC Aggregate Utility Power Computation	-	Power Manager 1 - Power Manager 4, Default		“
APC kW Demand Activation	-	Default or Computed Demand		“
APC Import Mode Control	-	Default or Computed kW		“
Unintentional Islanding Enable	FALSE	FALSE or TRUE		See document 381339-290
Voltage (+/-)	0.000	0.000 – Governor Bias Maximum	volts	See document 381339-290
Ramp Rate	0.000	0.000 – 180.000	volts/ sec	See document 381339-290
Update Rate	50	50 – 2000	msec	See document 381339-290
Signal Type	Incremental	INCREMENTAL or PULSED		See document 381339-290
Time On	50	50 – Update Rate	msec	See document 381339-290
Dead Band (+/-)	0.00	0.00 – 1.50	Hz	See document 381339-290
Time Out	0.0	0.0 – 600.0	seconds	See document 381339-290

Utility Protective Functions – Modified with Privilege Level L3				
Description	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Digital Input #1 Name	PARALLEL SENSE1	15 character limit		
Digital Input #2 Name	PARALLEL SENSE2	“		
Digital Input #3 Name	UTILITY INPUT 3	“		
Digital Input #4 Name	UTILITY INPUT 4	“		
Digital Input #5 Name	UTILITY INPUT 5	“		
Digital Input #6 Name	UTILITY INPUT 6	“		
Digital Input #7 Name	UTILITY INPUT 7	“		
Digital Input #8 Name	UTILITY INPUT 8	“		
Digital Output #1 Name	UTIL SHUNT TRIP	“		
Digital Output #2 Name	UTIL SHUNT TRIP	“		
Digital Output #3 Name	UTILITY OUTPUT3	“		
Digital Output #4 Name	UTILITY OUTPUT4	“		
Device 86 Enabled	FALSE	FALSE or TRUE		
Setpoint #1 Parameter	Negative Sequence Voltage	Can be any Setpoint available in Power Manager Xp		
Setpoint #1 Trip Level	10	2 - 20	%	
Setpoint #1 Reset Level	7	0 - 18	%	
Setpoint #1 Trip Time Delay	Instantaneous	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #1 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #1 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #1 Latched	FALSE	FALSE or TRUE		
Setpoint #1 Audible	FALSE	FALSE or TRUE		
Setpoint #2 Parameter	Negative Sequence Current	Can be any Setpoint available in Power Manager Xp		
Setpoint #2 Trip Level	20	2 – 50	%	
Setpoint #2 Reset Level	15	0 – 48	%	
Setpoint #2 Trip Time Delay	Instantaneous	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #2 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #2 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #2 Latched	FALSE	FALSE or TRUE		
Setpoint #2 Audible	FALSE	FALSE or TRUE		
Setpoint #3 Parameter	Reverse Over Current	Can be any Setpoint available in Power Manager Xp		
Setpoint #3 Trip Level	10	1 - 500	%	Percentage of Utility Full Scale Current
Setpoint #3 Reset Level	0	0 - 490	%	“
Setpoint #3 Trip Time Delay	Instantaneous	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #3 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #3 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #3 Latched	FALSE	FALSE or TRUE		
Setpoint #3 Audible	FALSE	FALSE or TRUE		
Setpoint #4 Parameter	Reverse / Under Power	Can be any Setpoint available in Power Manager Xp		
Setpoint #4 Trip Level	-5	-100 to +26	%	Percentage of Generator Full Scale kW
Setpoint #4 Reset Level	0	-99 to +27	%	“
Setpoint #4 Trip Time Delay	0.5	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.

Utility Protective Functions – Modified with Privilege Level L3				
Description	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Setpoint #4 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #4 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #4 Latched	FALSE	FALSE or TRUE		
Setpoint #4 Audible	FALSE	FALSE or TRUE		
Setpoint #5 Parameter	Over Voltage	Can be any Setpoint available in Power Manager Xp		
Setpoint #5 Trip Level	110	102 - 115	%	Percent of Nominal Voltage
Setpoint #5 Reset Level	105	90- 113	%	“
Setpoint #5 Trip Time Delay	2.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #5 Reset Time Delay	2.0	1.0 – 10.0	seconds	
Setpoint #5 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #5 Latched	FALSE	FALSE or TRUE		
Setpoint #5 Audible	FALSE	FALSE or TRUE		
Setpoint #6 Parameter	Under Voltage	Can be any Setpoint available in Power Manager Xp		
Setpoint #6 Trip Level	85	70 – 98	%	Percent of Nominal Voltage
Setpoint #6 Reset Level	90	85 - 100	%	“
Setpoint #6 Trip Time Delay	2.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #6 Reset Time Delay	2.0	1.0 – 10.0	seconds	
Setpoint #6 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #6 Latched	FALSE	FALSE or TRUE		
Setpoint #6 Audible	FALSE	FALSE or TRUE		
Setpoint #7 Parameter	Under Frequency	Can be any Setpoint available in Power Manager Xp		
Setpoint #7 Trip Level	54.0	42.5 – 59.9	Hz	
Setpoint #7 Reset Level	57.0	42.6 – 60.0	Hz	
Setpoint #7 Trip Time Delay	1.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #7 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #7 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #7 Latched	FALSE	FALSE or TRUE		
Setpoint #7 Audible	FALSE	FALSE or TRUE		
Setpoint #8	Not Configured			
Setpoint #9 Parameter	Digital Input #1	Can be any Setpoint available in Power Manager Xp		Should not be modified
Setpoint #9 Trip Level	High Transition	High or Low Transition		“
Setpoint #9 Trip Time Delay	Instantaneous	Instantaneous – 10.0	seconds	“
Setpoint #9 Reset Time Delay	1.0	1.0 – 10.0	seconds	“
Setpoint #9 Output Relay	DO3	DO1 – DO4		“
Setpoint #9 Latched	FALSE	FALSE or TRUE		“
Setpoint #9 Audible	FALSE	FALSE or TRUE		“
Setpoint #10 Parameter	Digital Input #2	Can be any Setpoint available in Power Manager Xp		Should not be modified
Setpoint #10 Trip Level	High Transition	High or Low Transition		“
Setpoint #10 Trip Time Delay	2.0	Instantaneous – 10.0	seconds	“
Setpoint #10 Reset Time Delay	1.0	1.0 – 10.0	seconds	“
Setpoint #10 Output Relay	DO4	DO1 – DO4		“
Setpoint #10 Latched	FALSE	FALSE or TRUE		“
Setpoint #10 Audible	FALSE	FALSE or TRUE		“
Setpoint #11	Not Configured			
Setpoint #12	Not Configured			

Generator Protective Functions – Modified with Privilege Level L3				
Description	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Digital Input #1 Name	GEN INPUT 1	15 character limit		
Digital Input #2 Name	GEN INPUT 2	“		
Digital Input #3 Name	GEN INPUT 3	“		
Digital Input #4 Name	GEN INPUT 4	“		
Digital Input #5 Name	GEN INPUT 5	“		
Digital Input #6 Name	GEN INPUT 6	“		
Digital Input #7 Name	GEN INPUT 7	“		
Digital Input #8 Name	GEN INPUT 8	“		
Digital Output #1 Name	GEN SHUNT TRIP	“		
Digital Output #2 Name	GEN OUTPUT 2	“		
Digital Output #3 Name	GEN OUTPUT 3	“		
Digital Output #4 Name	GEN OUTPUT 4	“		
Device 86 Enabled	FALSE	FALSE or TRUE		
Setpoint #1 Parameter	KW Overload Prealarm	Can be any Setpoint available in Power Manager Xp		
Setpoint #1 Trip Level	90	2 - 100	%	Percentage of Generator Full Scale kW
Setpoint #1 Reset Level	85	0 - 98	%	“
Setpoint #1 Trip Time Delay	10.0	10.0 – 60.0	seconds	
Setpoint #1 Reset Time Delay	10.0	10.0 – 60.0	seconds	
Setpoint #1 Output Relay	NONE	DO1 – DO4		Any combination
Setpoint #1 Latched	FALSE	FALSE or TRUE		
Setpoint #1 Audible	FALSE	FALSE or TRUE		
Setpoint #2 Parameter	KW Overload Alarm	Can be any Setpoint available in Power Manager Xp		
Setpoint #2 Trip Level	100	2 – 120	%	Percentage of Generator Full Scale kW
Setpoint #2 Reset Level	95	0 – 118	%	“
Setpoint #2 Trip Time Delay	10.0	Instantaneous – 60.0	seconds	Instantaneous is 3 cycles max.
Setpoint #2 Reset Time Delay	10.0	10.0 – 60.0	seconds	
Setpoint #2 Output Relay	DO2	DO1 – DO4		Any combination
Setpoint #2 Latched	FALSE	FALSE or TRUE		
Setpoint #2 Audible	FALSE	FALSE or TRUE		
Setpoint #3 Parameter	Reverse / Under Power	Can be any Setpoint available in Power Manager Xp		
Setpoint #3 Trip Level	-8	-100 to +26	%	Percentage of Generator Full Scale kW
Setpoint #3 Reset Level	-2	-99 to +27	%	“
Setpoint #3 Trip Time Delay	2.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #3 Reset Time Delay	2.0	1.0 – 10.0	seconds	
Setpoint #3 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #3 Latched	FALSE	FALSE or TRUE		
Setpoint #3 Audible	FALSE	FALSE or TRUE		
Setpoint #4 Parameter	Excess Reverse VARs	Can be any Setpoint available in Power Manager Xp		
Setpoint #4 Trip Level	10	2 - 100	%	Percentage of Computed Generator Full Scale kVAR
Setpoint #4 Reset Level	5	0 - 98	%	“
Setpoint #4 Trip Time Delay	0.5	0.2 – 10.0	seconds	
Setpoint #4 Reset Time Delay	1.0	1.0 – 10.0	seconds	

Generator Protective Functions – Modified with Privilege Level L3				
Description	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Setpoint #4 Output Relay	DO1	DO1 – DO4		Any combination
Setpoint #4 Latched	FALSE	FALSE or TRUE		
Setpoint #4 Audible	FALSE	FALSE or TRUE		
Setpoint #5 Parameter	Over Voltage	Can be any Setpoint available in Power Manager Xp		
Setpoint #5 Trip Level	110	102 - 115	%	Percent of Nominal Voltage
Setpoint #5 Reset Level	105	90- 113	%	“
Setpoint #5 Trip Time Delay	2.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #5 Reset Time Delay	2.0	1.0 – 10.0	seconds	
Setpoint #5 Output Relay	DO2	DO1 – DO4		Any combination
Setpoint #5 Latched	FALSE	FALSE or TRUE		
Setpoint #5 Audible	FALSE	FALSE or TRUE		
Setpoint #6 Parameter	Under Voltage	Can be any Setpoint available in Power Manager Xp		
Setpoint #6 Trip Level	85	70 – 98	%	Percent of Nominal Voltage
Setpoint #6 Reset Level	90	85 - 100	%	“
Setpoint #6 Trip Time Delay	2.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #6 Reset Time Delay	2.0	1.0 – 10.0	seconds	
Setpoint #6 Output Relay	DO2	DO1 – DO4		Any combination
Setpoint #6 Latched	FALSE	FALSE or TRUE		
Setpoint #6 Audible	FALSE	FALSE or TRUE		
Setpoint #7 Parameter	Over Frequency	Can be any Setpoint available in Power Manager Xp		
Setpoint #7 Trip Level	66.0	50.1 – 66.0	Hz	
Setpoint #7 Reset Level	63.0	47.5 – 65.9	Hz	
Setpoint #7 Trip Time Delay	1.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #7 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #7 Output Relay	DO2	DO1 – DO4		Any combination
Setpoint #7 Latched	FALSE	FALSE or TRUE		
Setpoint #7 Audible	FALSE	FALSE or TRUE		
Setpoint #8 Parameter	Under Frequency	Can be any Setpoint available in Power Manager Xp		
Setpoint #8 Trip Level	54.0	42.5 – 59.9	Hz	
Setpoint #8 Reset Level	57.0	42.6 – 60.0	Hz	
Setpoint #8 Trip Time Delay	1.0	Instantaneous – 10.0	seconds	Instantaneous is 3 cycles max.
Setpoint #8 Reset Time Delay	1.0	1.0 – 10.0	seconds	
Setpoint #8 Output Relay	DO2	DO1 – DO4		Any combination
Setpoint #8 Latched	FALSE	FALSE or TRUE		
Setpoint #8 Audible	FALSE	FALSE or TRUE		
Setpoint #9	Not Configured			
Setpoint #10	Not Configured			
Setpoint #11	Not Configured			
Setpoint #12	Not Configured			

Network Settings – Modified with Administrator Privilege Level Only				
Description	**Default Value**	**Range / Restrictions**	**Units**	**Comments**
Ethernet Enabled	FALSE	FALSE or TRUE		
Ethernet IP Address	000.000.000.000	Valid dotted decimal address		Required for HTML, Email, and Modbus TCP/IP functionality
Ethernet Subnet Mask	000.000.000.000			“
Ethernet Default Gateway	000.000.000.000			
Outgoing Ethernet Mail Server	000.000.000.000			Required for Email functionality
Email Enabled	FALSE	FALSE or TRUE		
Site Name	(blank)	25 character limit		
Site Location	(blank)	“		
Contact Name	(blank)	“		
Contact Phone Number	(blank)	“		
Modbus Enabled	FALSE	FALSE or TRUE		
Modbus Address	1	1 – 247		
Modbus Port	SERIAL	SERIAL or TCP/IP		
Modbus Baud Rate	9600	9600 or 19200		Only applicable for serial Modbus
Email Addresses	(blank)	40 character limit		
Email Alarm Options	FALSE	FALSE or TRUE		
Status Email Enabled	FALSE	FALSE or TRUE		
Status Email Addresses	NONE	1 - 5		
Status Email Time Hour	0	0 - 23		
Status Email Time Minute	0	0 – 59		
Status Email Frequency	180	1 – 180	days	
SMTP Password	(blank)	40 character limit		

Site Connections

The following section describes Site Interface Connections, both required and optional, for use with the Soft Load Transfer System. Please refer to the wiring diagrams provided with the system for guidance towards customer field block access locations, termination points, and wire type requirements.

Required Interconnects

For proper operation, the SLTS must have connections to the EG 24VDC Battery, EG remote start, EG governor, EG voltage regulator, and to the source feeder breakers (transfer switch based systems only). For breaker pair systems and transfer switch based systems shipped with installed feeder breakers, the breaker interconnects should be pre-wired.

EG 24VDC Battery

The system must be connected to the EG 24VDC Battery for use as a tertiary power source and to derive a reliable source of power for the breaker shunt trip circuits.

EG Remote Start

The system must be connected to the EG remote start terminals for automatic operation, and for standby/outage emergency use.

EG Governor

The system must be connected to the EG Governor for frequency/phase angle and kW control. The governor must accept either a DC voltage control signal (adjustable up to +/- 9 VDC) or a Pulse Width Modulated (PWM) control signal (500 Hz, 10 Vpk). The required wiring for the SLC governor control signal (Gov + and Gov –) is twisted pair shielded. The shield is bonded at the SLTS and should not be bonded at the EG controls. There are typically two methods utilized for the governor connection: Direct Connection or a Switched Connection.

Direct Connection

This method of connection refers to governors with dedicated terminals for a remote speed control or load-sharing module, which if left unbiased, do not affect the performance of the governor. Thus, no permanent dependency between the SLC and the governor exists. These governors typically accept a bipolar DC signal (limits are equally balanced around 0 VDC). Here, the SLC governor control signal (Gov + and Gov –) may be directly wired into those governor inputs.

Switched Connection

This method of connection refers to governors with dedicated terminals for a remote speed control or load-sharing module, which if left unbiased, adversely affect the performance of the governor. In this case, a direct connection between the SLC and governor creates a permanent dependency, which may be undesirable. These governors typically accept an offset DC signal (limits not equally balanced around 0VDC) or a PWM signal. Here, the suggested interconnection is through a field-supplied control relay (example is shown on product wiring diagram). In this scheme, the SLC control signal (Gov + and Gov –) is switched into the governor inputs only when control is necessary. At all other times, the governor self-governs. It is important to note the following items.

- The control relay should be mounted in close physical proximity to the governor, on an isolated (vibration free) surface.
- The control relay should have a 24VDC coil and gold flashed contacts.
- Two additional wires (12 – 22 AWG) must be run from the SLTS to the coil of the control relay.
- A slight ‘bump’ in EG output frequency may occur on the transition to/from the SLC control signal.

EG Voltage Regulator

The system must be connected to the EG Voltage Regulator for voltage matching and power factor control. The voltage regulator must accept a bipolar DC voltage control signal (adjustable up to +/- 9 VDC). Additionally, the voltage regulator must be configured to operate in droop mode. Power factor or kVAR control, if present in the voltage regulator, must be disabled. The required wiring for the SLC voltage regulator control signal (Vreg + and Vreg –) is twisted pair shielded. The shield is bonded at the SLTS and should not be bonded at the EG controls. There are typically two methods utilized for the voltage regulator connection: Series Connection or a Direct Connection.

Series Connection

This method of connection refers to voltage regulators lacking dedicated terminals for a remote voltage control signal, but possessing a voltage control rheostat. Here, the rheostat circuit must be broken, with the SLC voltage regulator control signal (Vreg + and Vreg –) wired in series to complete the circuit (example is shown on product wiring diagram). When voltage control is inactive or the SLC is disabled, an internal relay contact (shunt) permanently closes this circuit. Note that physical disconnection of the voltage regulator control signal wiring may leave the circuit open, providing poor voltage regulation.

Direct Connection

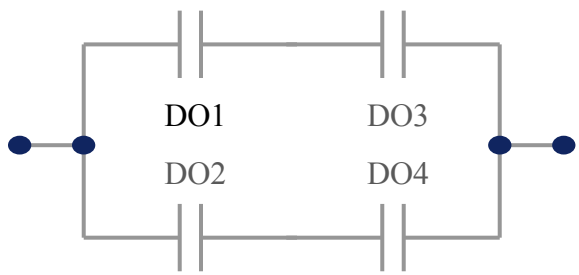
This method of connection refers to voltage regulators with dedicated terminals for a remote voltage control. Here, the SLC voltage regulator control signal (Vreg + and Vreg –) may be directly wired into those voltage regulator inputs.

Utility Feeder Breaker

The SLTS must be wired to the Utility Feeder Breaker for position sensing and shunt trip capability. These connections are made at the customer field block and ultimately route into the Utility Power Manager Xp. The position sensing circuit requires a Form B position contact from the breaker. The shunt trip circuit requires some background explanation.

The SLTS is a paralleling system and accordingly requires protective relaying to separate the sources in a fault scenario. The required method of source separation is via the shunt trip mechanism of a feeder breaker. This requirement stems from issues associated with clearing response time, and the fact that some faults may collapse the voltage, resulting in insufficient power to activate an ATS coil for contact opening. As such, protective relay setpoints are configured in the Power Manager Xp. These setpoints are configured to act upon output contacts in the Power Manager Xp. Accordingly, these contacts interface to the shunt trip mechanism to complete the scheme.

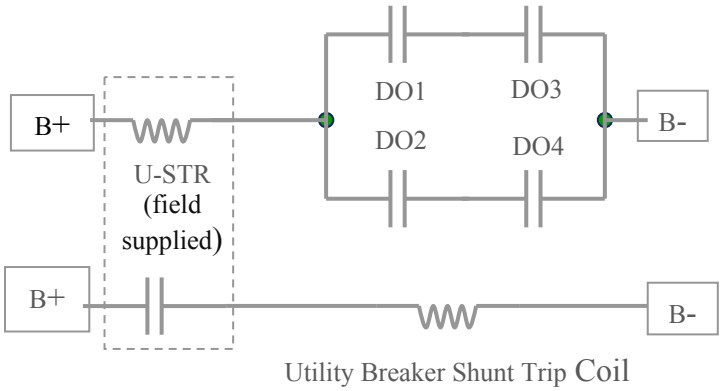
The Power Manager Xp has four output contacts available, DO1 – DO4. In the SLTS, all four Utility Power Manager Xp contacts have been pre-wired for certain protection schemes. Specifically, the series combination of DO1 and DO3 comprises one scheme whereas the series combination of DO2 and DO4 comprises another (see illustration).



In these schemes, protective functions are to be set to trip DO1 and /or DO2. The DO3 and DO4 outputs are pre-configured to close when the sources are paralleled, with variable time responses pertaining to when DO3 closes versus when DO4 closes. The schemes shown provide utility protective functions only when the sources are paralleled, by virtue of the series connection through DO3 or DO4.

Typical protection functions are to be configured to trip DO1, with DO3 having a minimal time delay. In practice, DO3 and DO4 should both be closed long before any protection functions activate DO1 or DO2. The DO2 output should be used in conjunction with 'non-recoverable' protective functions such as Under Power, because the time response on DO4 closure is delayed. For example, when an Under Power trip occurs, the power into the feeder at the point of measurement drops to zero, due to the opened breaker. Thus, the Under Power trip signal remains persistent and would prevent re-paralleling. With the breaker opened, however, the DO4 signal clears so the trip circuit remains incomplete. The DO2 - DO4 scheme permits re-paralleling by setting a sufficient time response to the DO4 closure such that power flow can be restored to the feeder. Here, the coordination would be such that the Under Power protection (DO2) clears (opens) prior to the closure of the paralleling contact (DO4).

The illustrated scheme presented above shows interface references, but is not a complete circuit. Shunt trip coil driving power must be applied to this circuit from a reliable source. Thus a field-supplied interface relay is suggested which could be configured as shown in the illustration below.



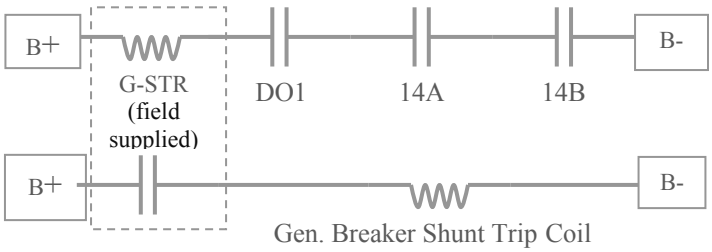
In the illustration, U-STR is the field-supplied interface coil for the shunt trip circuit, and B+/B- is EG battery power. The illustration refers to a 24VDC shunt trip unit, but would be easily adaptable to other voltages. Finally, an added benefit to the scheme shown is that it supports shunt trip coils whose current rating may exceed that of the Power Manager Xp DO contacts, thus alleviating a concern of overload damage to the contacts.

Generator Feeder Breaker

The SLTS must be wired to the Generator Feeder Breaker for position sensing and shunt trip capability. These connections are made at the customer field block and ultimately route into the Generator Power Manager Xp. The position sensing circuit requires a Form B position contact from the breaker. The shunt trip circuit is described below.

The Power Manager Xp has four output contacts available, DO1 – DO4. In the SLTS, the DO1 contact of the Generator Power Manager Xp has been pre-wired for protection. Specifically, a series combination of DO1, a utility-side position contact, and a generator-side position contact complete the scheme (see illustration).

In this scheme, protective functions are to be set to trip DO1. The 14A/14B contacts close when the sources are paralleled, thereby arming the trip circuit. The illustrated scheme presented above shows interface references, but is not a complete circuit. Shunt trip coil driving power must be applied to this circuit from a reliable source. Thus a field-supplied interface relay is suggested which could be configured as shown in the illustration below.



In the illustration, G-STR is the field-supplied interface coil for the shunt trip circuit, and B+/B- is EG battery power. The illustration refers to a 24VDC shunt trip unit, but would be easily adaptable to other voltages. Finally, an added benefit to the scheme shown is that it supports shunt trip coils whose current rating may exceed that of the Power Manager Xp DO contact, thus alleviating a concern of overload damage to the contact.

Optional Interconnects

The SLC can optionally be interconnected for HTML Communications, Email Notifications, Modbus® Communications, Engine Communications, and communications for Power Aggregation.

HTML Communications

The SLC contains an embedded web server that provides HTML pages for monitoring and control. To enable this feature, a network cable must be connected to the Ethernet port on the rear of the SLC, and appropriate network configurations set via the SLC GUI.

Email Notifications

The SLC can be configured to send email messages based upon certain system events. To enable this feature, a network cable must be connected to the Ethernet port on the rear of the SLC, and appropriate network and email configurations set via the SLC GUI. Email Notifications and HTML Communications occur via the same Ethernet port and network cable.

Modbus® Communications

The SLC supports Modbus® Communications for robust remote monitoring and control. Details on Modbus Communications are found in document *381339-241*. Modbus Communications are supported via either TCP / IP or serial RS 485. For TCP / IP communications, a network cable must be connected to the Ethernet port on the rear of the SLC, and appropriate network configurations set via the SLC GUI. Modbus TCP / IP Communications occur via the same Ethernet port and network cable as do Email Notifications and HTML Communications. For serial RS 485, connect to port COM 6 on the rear of the SLC.

Engine Communications

Communication with engine communications modules occurs via COM 4 or COM 9 on the rear of the SLC. Refer to the section on Engine Communications for more detail. Note that usage of COM 9 requires Accessory 106D, Serial Port Expansion Kit.

Communications for Power Aggregation

The Power Aggregation option requires the ability to communicate with remotely located Power Manager Xps. This communication occurs via COM 10 on the rear of the SLC Refer to document *381339-254* for more detail on Aggregation. Note that usage of COM 10 requires Accessory 106D, Serial Port Expansion Kit.

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