THOMSON
POWER SYSTEMS

TSC 900

TRANSFER SWITCH CONTROLLER

INSTALLATION, OPERATING & SERVICE MANUAL

Part ID 013190

PM151 REV 5 16/04/19

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1. INTRODUCTION

1.1. PRODUCT REVISION HISTORY

The following information provides an historical summary of changes made to this product since the original release.

SCU Firmware Version

621, 15/04/07	Original Release
867, 15/10/03	Add Closed Transition Transfer Capability, Misc. Feature Enhancements & Bug Fixes
888, 15/10/28	Add Dual Source Capability, Misc. Feature Enhancements & Bug Fixes
902, 15/11/18	Add Remote Load Dump Control (RLDC) feature capability

GHC Firmware Version

1.0.0.0 15/04/07	Original Release
1.1.0.xxxxx 15/10/03	Add Closed Transition Transfer Capability, Misc. Feature Enhancements & Bug Fixes
1.1.0.16017 15/10/30	Add Dual Source Capability, Misc. Feature Enhancements & Bug Fixes
1.1.5805.19916 15/11/18	Add Remote Load Dump Control (RLDC) feature capability
1.1.5952.22994 16/04/19	Update Alarm Tag Names, add GHC Firmware Update, Misc. Feature Enhancements & Bug Fixes

Operating & Service Manual Version

Rev 0 15/04/07	Original release
Rev 1 15/10/08	Add Closed Transition Transfer Capability, Misc. Feature Enhancements & Bug Fixes
Rev 2 15/11/11	Add Dual Source Capability, Misc. Feature Enhancements & Bug Fixes
Rev 3 15/11/24	Add Remote Load Dump Control (RLDC) Feature capability
Rev 4 16/01/15	Update Alarm Tag Names, add GHC Firmware Update, Add TSC 900 Faceplate mounting information
Rev 5 16/04/19	Miscellaneous minor manual revisions

Related Product Instruction Manuals

- TSC 900 Modbus™ Communication, PM152
- TS 870 Instruction Manual, PM062
- TS 870 Quick Start Manual, PM150
- TS 880 Instruction Manual, PM064

Contact Thomson Power Systems, to obtain these instruction manuals. A soft-copy of the most current versions of these manuals are available at www.thomsonps.com.

1.2. GENERAL DESCRIPTION

The TSC 900 controller utilizes multiple 32-bit microprocessor-based design technology, which provides high accuracy for all voltage sensing and timing functions. Digital Signal Processing (DSP) technology is utilized for all voltage, frequency and current sensing. The **TSC 900** is factory configured to control all the operational functions and display features of the automatic transfer switch. All features of the **TSC 900** are fully programmable from the front panel color graphical touchscreen display and are security password protected. The graphical touchscreen display screen provides a user-friendly operator interface with many display options available.

2. INSTALLATION

CAUTION!!!

This equipment contains static-sensitive parts. Please observe the following anti-static precautions at all times when handling this equipment. Failure to observe these precautions may cause equipment failure and/or damage.

The following precautions must be observed:

- Discharge body static charge before handling the equipment (maintain exposed body contact with a properly grounded surface while handling the equipment, a grounding wrist strap can/should also be utilized).
- Do not touch any components on the printed circuit board with your hands or any other conductive equipment.
- Do not place the equipment on or near materials such as Styrofoam, plastic and vinyl. Place the equipment on properly grounded surfaces and only use an anti-static bag for transporting the equipment.

2.1. GENERAL INFORMATION

NOTE:

Installations should be done in accordance with all applicable electrical regulation codes as required.

The following installation guidelines are provided for general information only pertaining to typical site installations. For specific site installation information, consult Thomson Power Systems as required. **NOTE:** Factory installations of THOMSON POWER SYSTEMS supplied transfer switches that have been tested and proven may deviate from these recommendations.

2.2. NOTES TO INSTALLER

If the transfer switch has programmable/multi-tap system voltage capability (refer to electrical schematic), confirm the transfer switch has been configured for the system voltage.

WARNING

Failure to confirm and match transfer switch voltage with the system voltage could cause serious equipment damage.

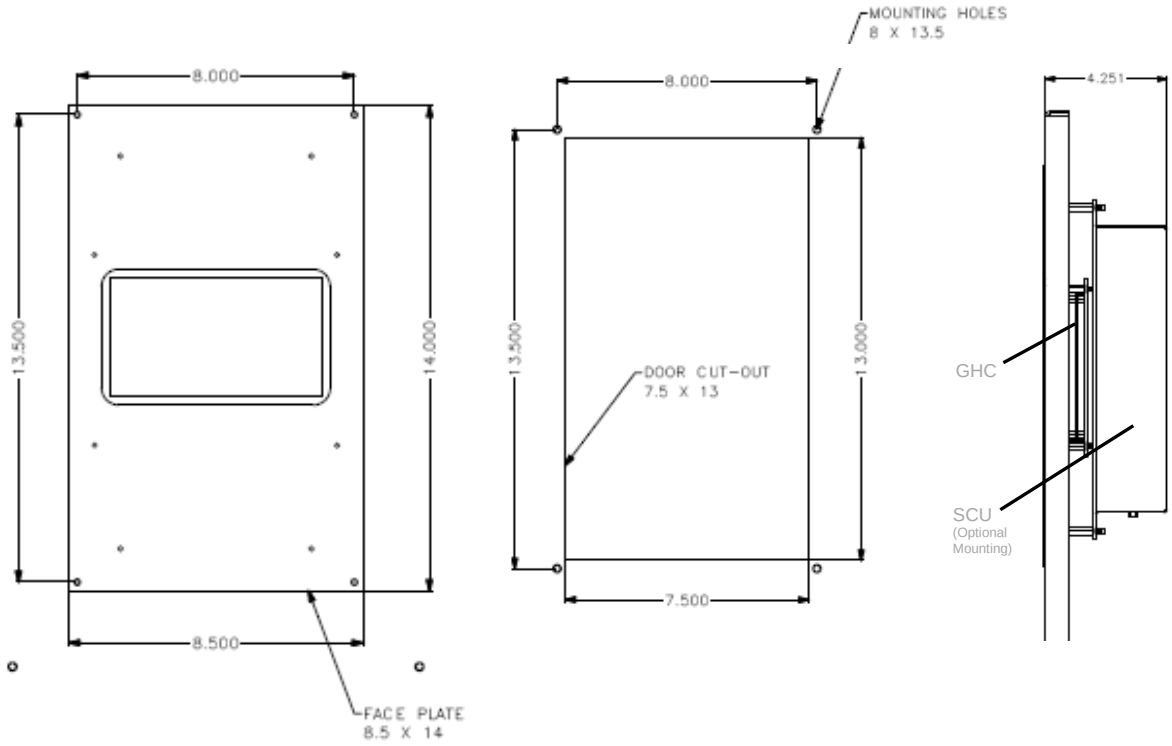
If the transfer switch requires reconfiguring, the TSC 900 controller will also require reprogramming.

CAUTION!!!

Qualified personnel must complete all installation and/or service work performed only. Failure to do so may cause personal injury or death.

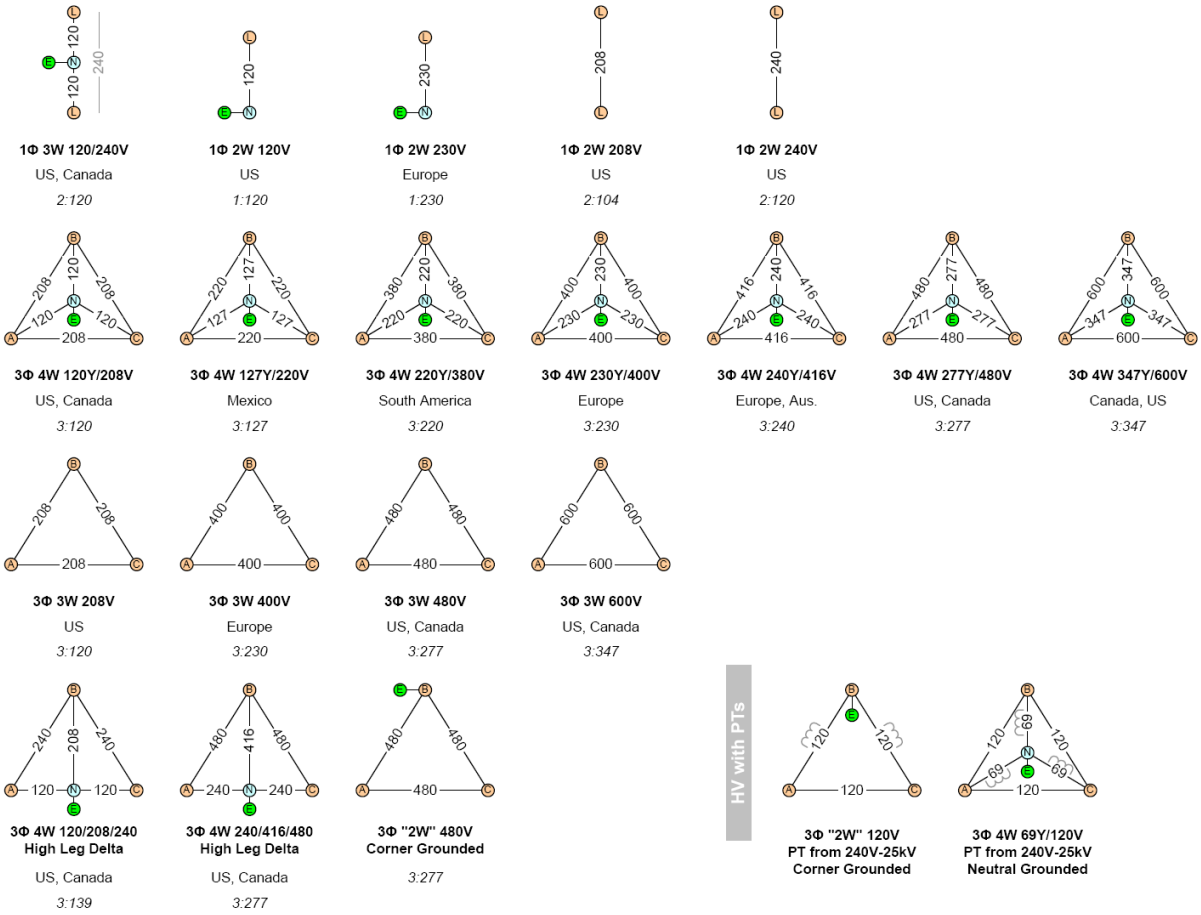
2.3. TSC 900 GHC MOUNTING

When the TSC 900 display (GHC) is supplied as part of a Thomson Power System automatic transfer switch, the GHC is mounted on the ATS door with PEM studs as part of the door design. When the TSC 900 GHC is supplied loose for door mounting, it can be supplied with a door mounting faceplate with Lexan overlay (PART No's 014222, 014221) which requires a rectangular door cut-out and mounting holes to be drilled as per the following drawings.



2.4. AC VOLTAGE SENSING INPUT

The TSC 900 can accept direct AC voltage sensing inputs on the generator, utility and load from 120-600VAC (nominal). Sources up to 600VAC (phase to phase) can be connected wye or delta with grounded or ungrounded neutral without the need for additional sensing transformers. The TSC 900 voltage sensing can support the following types of electrical systems:



Refer to Section 5.10.2 for system voltage programing instructions.

Voltage sensing connections for the most common applications are shown in the following diagrams.

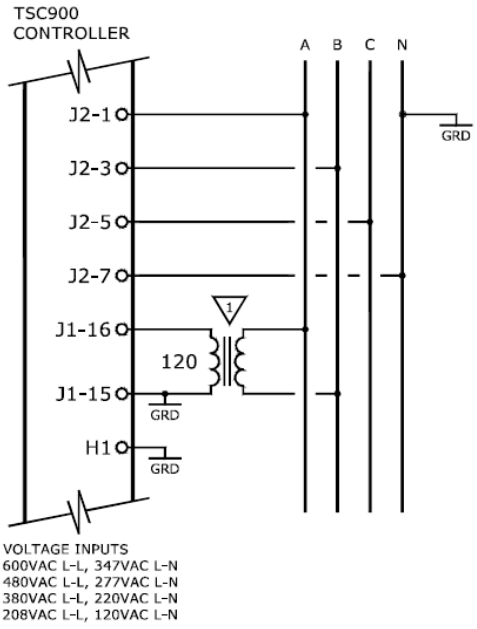


FIG:1
3Ø, 4W, 208/380/480/600VAC DIRECT SENSING

NOTE: UTILITY VOLTAGE SENSING AND CONTROL POWER SHOWN ONLY.

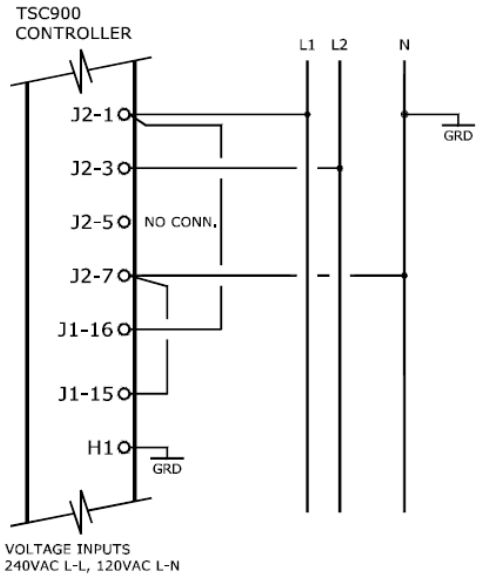


FIG:2
1Ø, 3W, 120/240VAC DIRECT SENSING

NOTE: UTILITY VOLTAGE SENSING SHOWN ONLY.

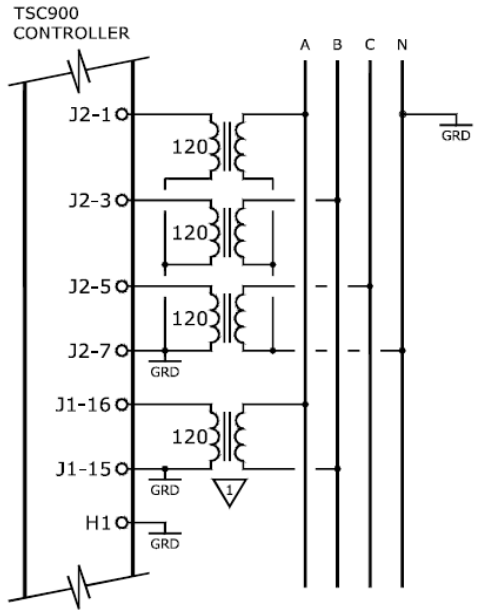


FIG:3
3Ø, 4W, WYE PT'S

NOTE: UTILITY VOLTAGE SENSING SHOWN ONLY.

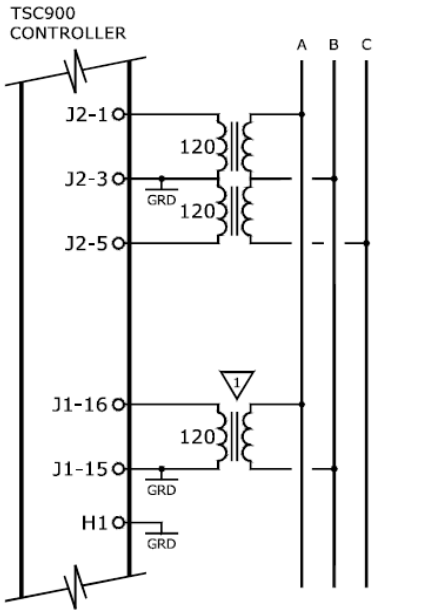


FIG:4
3Ø, 3W, DELTA PT'S

NOTE: UTILITY VOLTAGE SENSING SHOWN ONLY.

2.5. AC CURRENT SENSING INPUT

The TSC 900 can accept 4 x 0-5Aac current inputs from the secondary windings of current transformers (CT's). CT's are to be connected on the load side of the ATS (Phase A, B, C & N). Wiring of CT primary and secondary windings must be done in strict accordance with schematic diagram to ensure the correct phasing on 3 phase systems.

WARNING

Do <u>not</u> unplug any current transformer inputs while energized as severe high voltages can develop which may cause personal injury or death.

Current sensing connections for the most common applications are shown in the following diagrams.

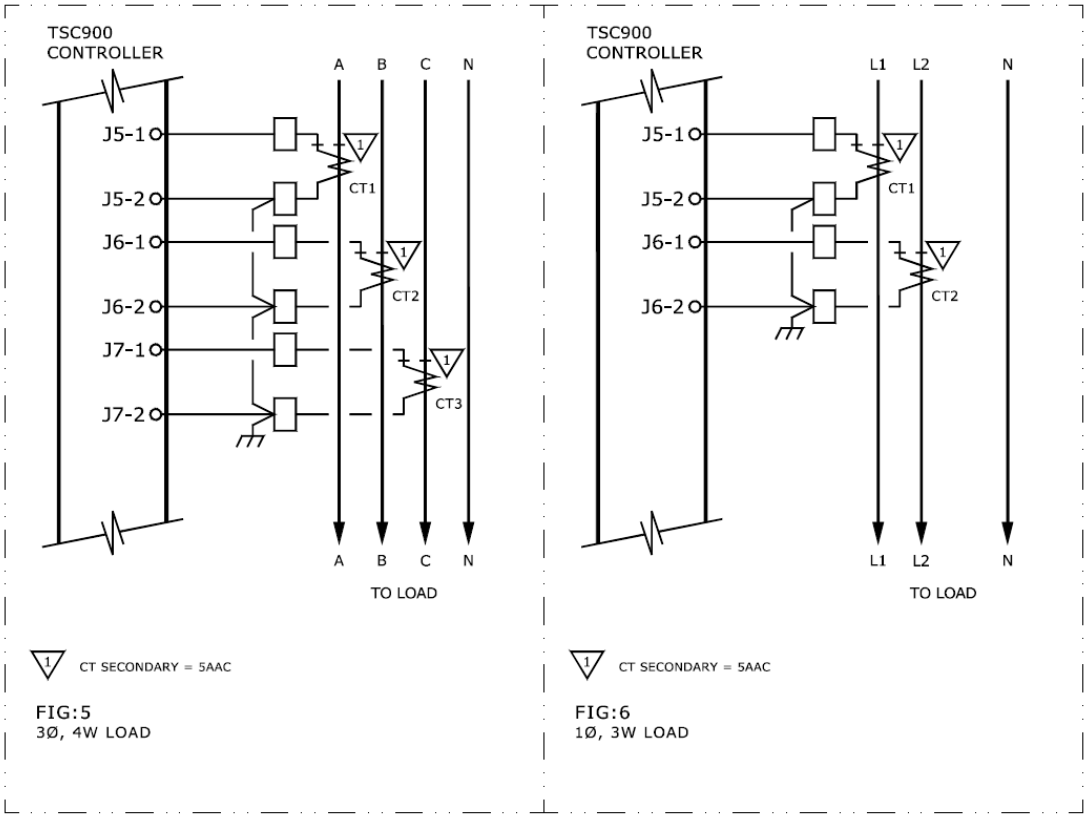


FIG:5
3Ø, 4W LOAD

FIG:6
1Ø, 3W LOAD

2.6. AC CONTROL POWER INPUT

The TSC 900 requires 120VAC (nominal) control power input voltage. Independent AC control power is required from both utility and generator supplies via potential transformers. AC control power is utilized for internal TSC 900 control circuits and external control device loads. The TSC 900 typically requires approximately 12VA AC power for internal control circuits but may draw up to 30VA dependent upon external loads connected. The maximum external load is limited by output contact ratings (i.e. 10A resistive, 120/250VAC). Total AC control power requirements for each supply must be determined by adding both internal and external load requirements.

2.7. AUXILIARY DC CONTROL POWER INPUT

The TSC 900 can be optionally supplied with 24VDC auxiliary control power input voltage for applications requiring continuously energized control and display features. The maximum input power draw is 25W. The 24VDC power must be from a regulated/filtered DC supply with maximum +-10% voltage range.

2.8. PROGRAMMABLE INPUTS

The TSC 900 provides Qty 16 Programmable Inputs. Each input is activated by external contact closure to common (i.e. DC Negative ground). Each programmable input can be independently programmed to different functions. Refer to Programming section for available features.

2.9. OUTPUTS

The TSC 900 provides the following types of output circuits:

Engine Start Contacts	Qty 2	Isolated Form B contacts (10A, 250VAC Resistive)
Programmable Output Contacts	Qty 8	Isolated Form C contacts (2A, 250VAC Resistive)
Close to Utility (SRC1) Supply	Qty 1	120VAC[1], 10A (Resistive) powered output contact
Close to Gen (SRC2) Supply	Qty 1	120VAC[1], 10A (Resistive) powered output contact
Trip Utility (SRC1) Supply	Qty 1	120VAC[1], 10A (Resistive) powered output contact
Trip Gen (SRC2) Supply	Qty 1	120VAC[1], 10A (Resistive) powered output contact

[1] **NOTE:** Output voltage is dependent upon AC control power input voltage.

Interposing relays are required between the TSC 900 outputs and the end device if loads exceed the output current rating.

2.10. EXTERNAL ATS CONTROL WIRING

As a minimum, all external control wiring to/from the ATS must conform to the local regulatory authority having jurisdiction on electrical installations. Specific wire sizes listed below are for typical circuits of distances up to 500ft (150m)[1], are as follows:

Utility or Generator Voltage Sensing #14 AWG (2.5mm^2)

Transfer output signals	#14 AWG (2.5mm^2)
Remote Start Contact for Engine Controls	#14 AWG (2.5mm^2)

NOTE: For long control wire runs or noisy electrical environments the control wires should be twisted & shielded with a suitable drain wire. The shielded cable drain wire must be grounded at one end only. The drain wire grounding location may vary as micro-processor controllers generally exist at both ends (engine generator set & transfer switch) and one may be more susceptible depending on the level of induced noise. The most susceptible controller will require the shield ground point as close as possible to the controller. Wire runs from 500ft to 1000ft should be twisted and shielded and increased to #12 AWG where total loop resistance is greater than 5 ohms.

[1]For distances exceeding 1000ft. (300m) consult Thomson Power Systems

2.11. REMOTE START CONTACT FIELD WIRING

Field wiring of a remote start contact from a transfer switch to a control panel should conform to the following guidelines to avoid possible controller malfunction and/or damage.

2.8.1. Remote start contact wires (2 #14 AWG (2.5mm^2)) should be run in a separate conduit (ferromagnetic type) and in all cases separated from any AC wiring.

2.8.2. Avoid wiring near AC power cables to prevent pick-up of induced voltages.

2.8.3. An interposing relay may be required if field-wiring distance is excessively long (i.e. greater than 1000 feet (300m)) and/or if a remote contact has a resistance of greater than 5.0 ohms. In extremely noisy environments, the wire run lengths indicated may not provide reliable operation and can only be corrected by the use of an interposing relay. The interposing relay is generally installed at the engine controls and utilizes DC power. It is strongly suggested that the ground return wire of the interposing relay be used for the interface to the TSC 900 remote start contact, this will ensure integrity of the DC power supply to the engine generator set controls in the event of a shorted or grounded wire remote start interface wire.

2.8.4. The remote start contact provided is voltage free (i.e. dry contact). Exposing the remote start contact to voltage or current levels in excess of its rating will damage the transfer controller.

2.12. COMMUNICATION CABLE INSTALLATION

Communication cable wiring from the controller's communication port must be suitably routed to protect it from sources of electrical interference. Guidelines for protection against possible electrical interference are as follows:

- Use high quality, shielded cable only with drain wire grounded at the controller end only.
- Route the communication cable at least 3 M (10') away from sources of electrical noise such as variable speed motor drives, high voltage power conductors, UPS systems, transformers, rectifiers etc.
- Use separate, dedicated conduit runs for all communication cables. Do not tightly bundle communication cables together in the conduit. Conduit should be ferromagnetic type near sources of possible electrical interference. The entire length of conduit should be grounded to building earth ground.
- When communication cables must cross over low or high voltage AC power conductors, the communication cables must cross at right angles and not in parallel with the conductors.

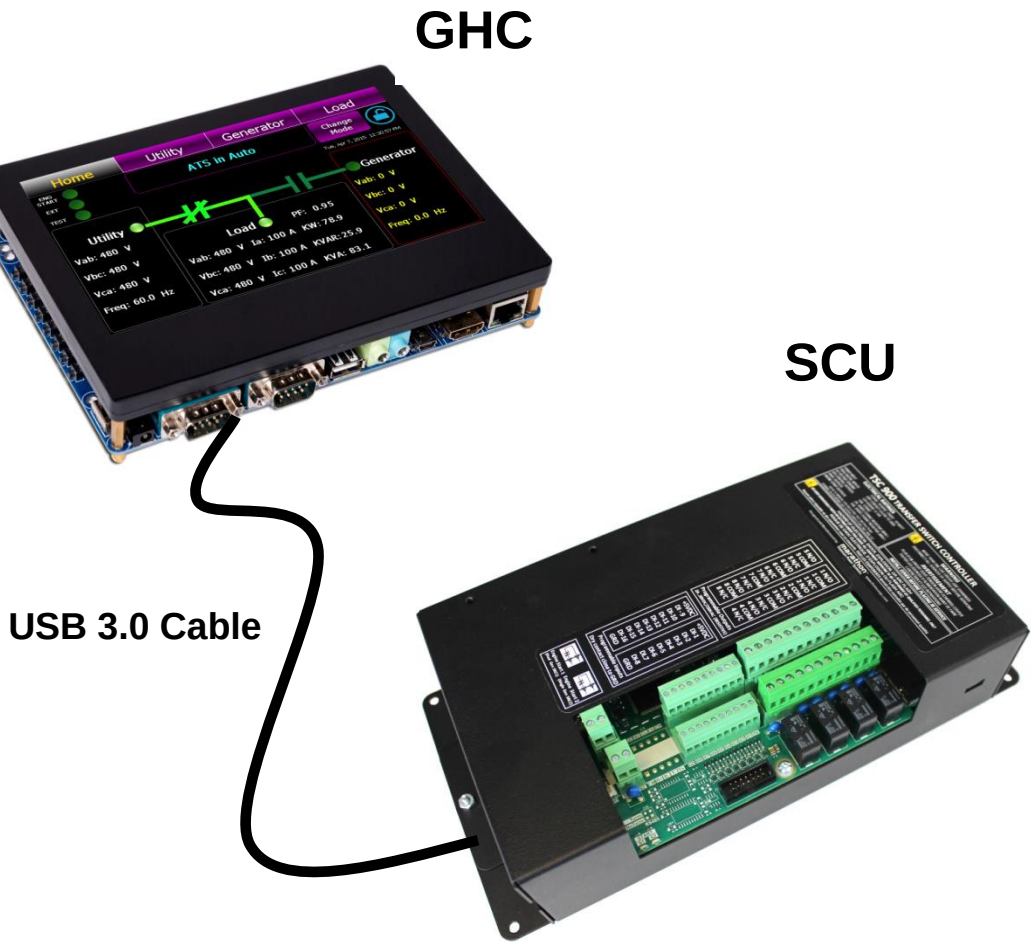
For additional information on protection against electrical interference, contact THOMSON POWER SYSTEMS factory.

2.13. DIELECTRIC TESTING

Do not perform any high voltage dielectric testing on the transfer switch with the TSC 900 controller connected into the circuit, as serious damage will occur to the controller. All AC control fuses or control/sensing circuit isolation plugs connected to the TSC 900 must be removed/disconnected if high voltage dielectric testing is performed on the transfer switch.

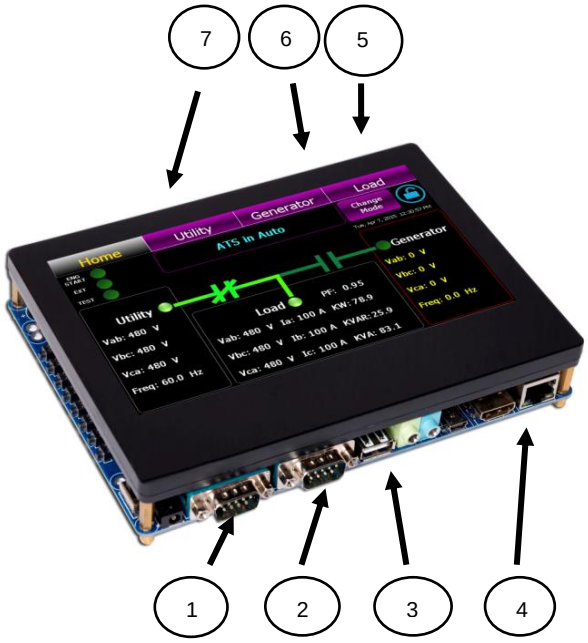
3. DESCRIPTION

The TSC 900 controller consists of two parts; a front door mounted graphical touch screen display (GHC), and a switch control unit (SCU) which is mounted inside the transfer switch door. The two parts are interconnected via a USB 3.0A-to-micro-B high speed communication cable which includes DC power.



3.1. GRAPHICAL HMI CONTROLLER (GHC) DISPLAY HARDWARE

The GHC Display is shown as in FIGURE 7. The GHC is interconnected to the SCU via a plug-in USB cable. The main features of the GHC Display are described as follows with reference to FIGURE 7.

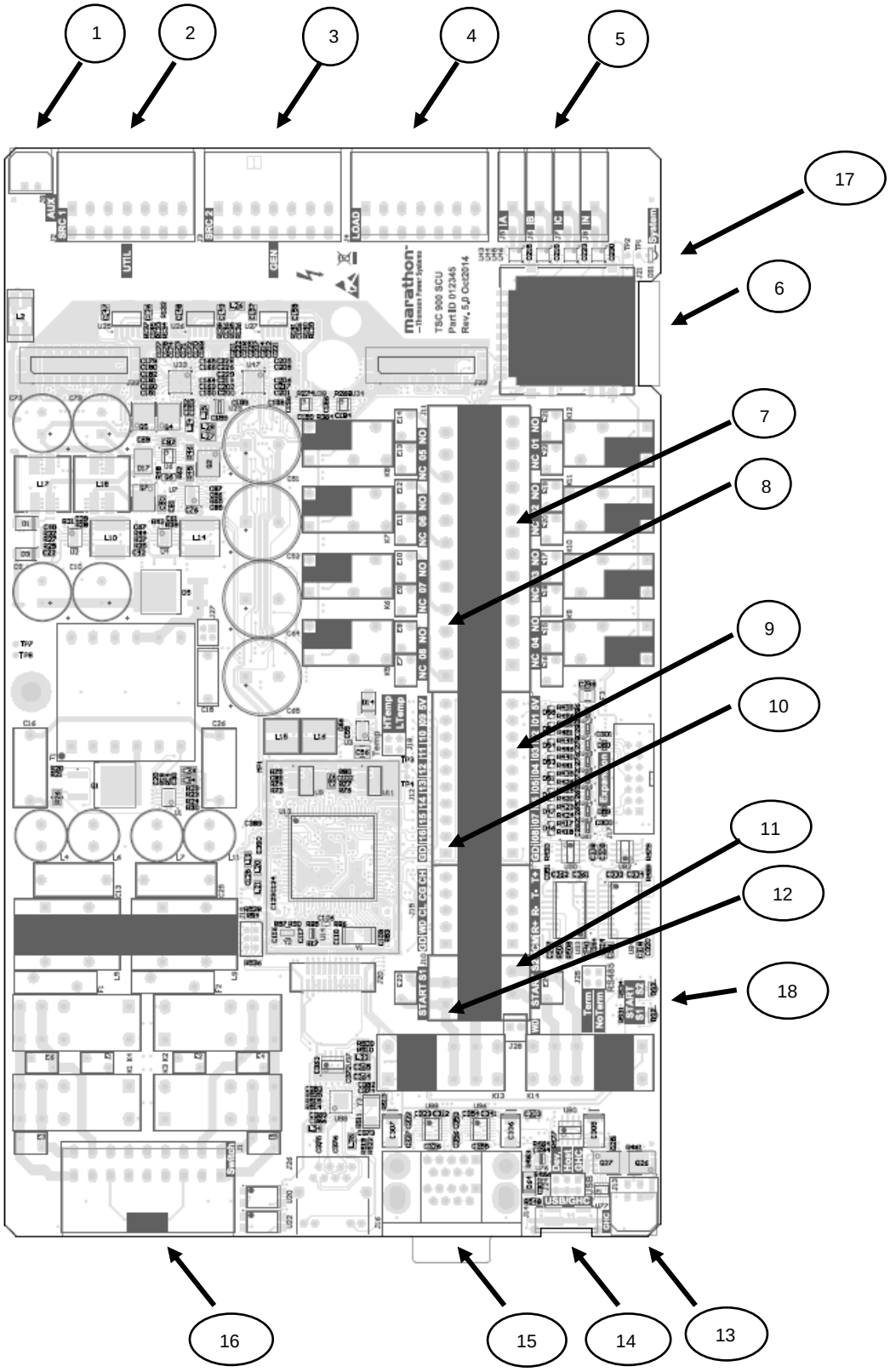


FIGURE# 7

1. RS232 Communication Port #1: This port is utilized for Modbus RTU Serial communication
2. RS232 Communication Port #2: This port is utilized RS232 Serial communication
3. USB Communication Port #1: This port is utilized for communication from GHC to TSC 900 SCU module.
4. Ethernet Communication Port: This port is utilized for Modbus TCP Ethernet communication
5. USB Communication Port #2: This port is utilized for customer use.
6. USB Communication Port #3: This port is utilized for customer use.
7. SD Memory Card Slot: This is used for program operation and memory storage

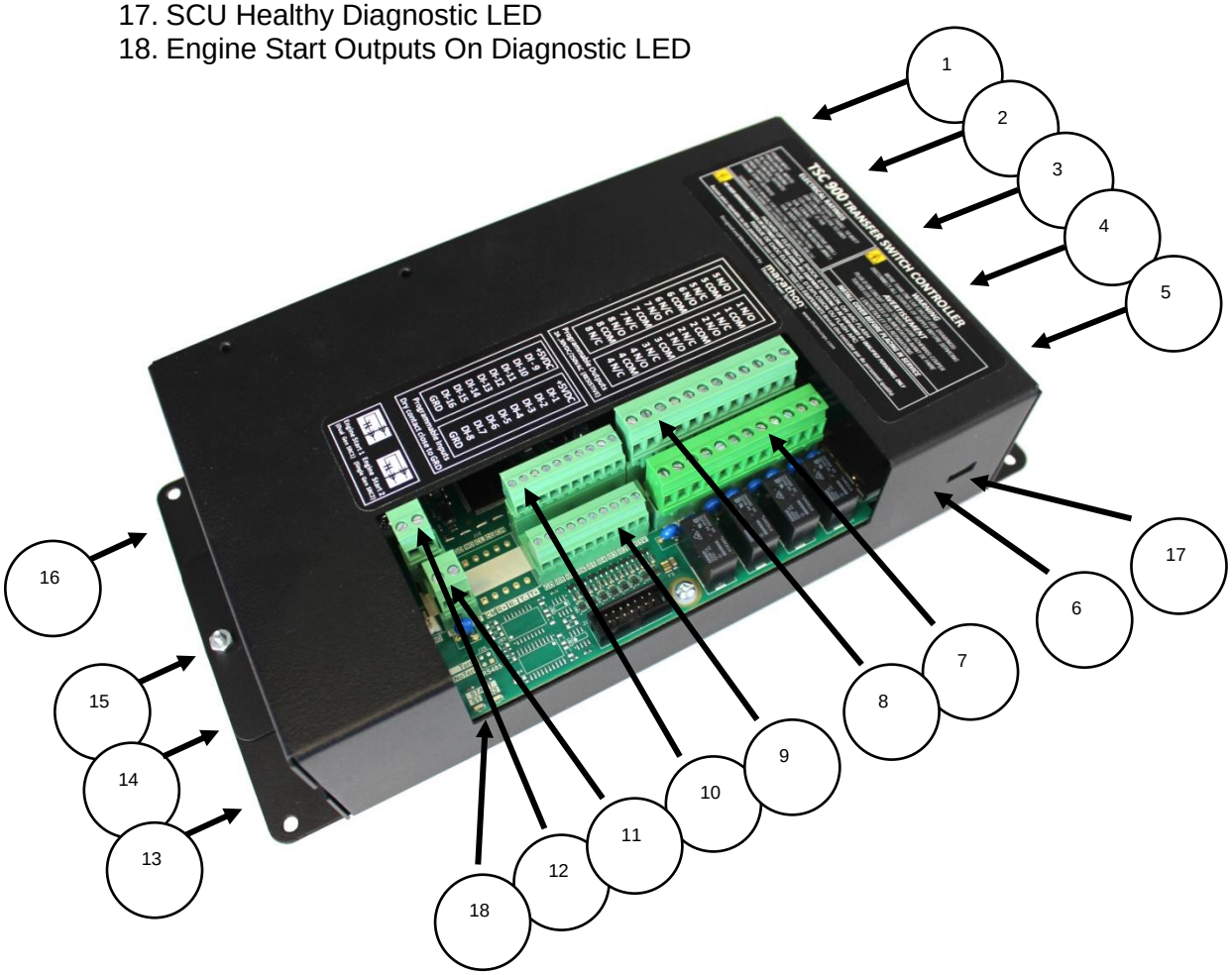
3.2. SWITCH CONTROL UNIT (SCU) HARDWARE

The Switch Control Unit internal PCB is shown in the following diagram:



The Switch Control Unit (SCU) with case and main I/O connections are detailed in the following diagram:

1. J9 – 24VDC Auxiliary Control Power
2. J2 – Utility Voltage Sensing (PH A, B, C, N)
3. J3 – Generator Voltage Sensing (PH A, B, C, N)
4. J4 – Load Voltage Sensing (PH A, B, C, N)
5. J5,6,7,8 – Load Current Sensing (PH A, B, C, N)
6. J21 –SCU SD Memory Card (Card Located inside case-not shown)
7. J11a Programmable Output Contacts #1-4
8. J11b Programmable Output Contacts #5-8
9. J12a Programmable Inputs #1-8
10. J12b Programmable Inputs #9-16
11. J10a Engine Start 2 Contact (Single Gen SRC 2)
12. J10b Engine Start 1 Contact (Dual Gen SRC 1)
13. J13 – GHC Aux 5VDC Power
14. J14- GHC USB Port
15. J15 – RS232 Programming Port
16. J1 – ATS Control
17. SCU Healthy Diagnostic LED
18. Engine Start Outputs On Diagnostic LED



3.3. ATS OPERATION MODE DESCRIPTIONS

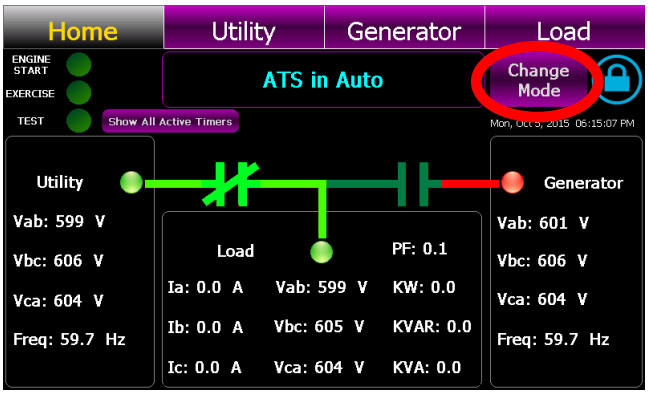
The TSC 900 has the following main operating modes as described per the table below:

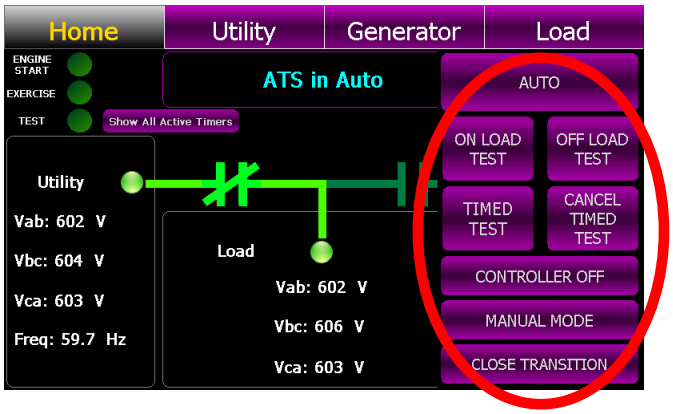
Mode	Description	ATS Mechanism Control Outputs	Engine Start Output
AUTO	ATS automatically transfers to generator (source 2) during a utility (source 1) failure and automatically returns power to utility once restored	Outputs automatically operate ATS mechanism per automatic sequence of operation	Output contact closes to start engine during a utility (source 1) failure and opens to stop engine once utility power has transferred back on load.
OFF	ATS is Out of Service - will not automatically operate during a utility power failure	Outputs remain in their last state to keep ATS in its current position	Output is disabled - engine will not start during a utility power failure[1] Engine will stop if it was previously running
MANUAL	ATS is Out of Service -will not automatically operate during a utility power failure. ATS can be operated manually for testing or emergency operation	Outputs de-energize to allow ATS to be operated manually	Output is disabled - engine will not start during a utility power failure[1]. Engine will stop if it was previously running
SERVICE DISCONNECT	ATS transfers to neutral position to disconnect power to the load. ATS will not automatically operate during a utility power failure.	Outputs momentarily energize to move ATS mechanism to the neutral position	Output is disabled - engine will not start during a utility power failure[1]. Engine will stop if it was previously running
ON LOAD TEST	When ONLOAD TEST mode is initiated, a utility power failure condition will be simulated which will cause engine to start and ATS will transfer to generator supply. When TEST mode is terminated, ATS will transfer back to utility supply and engine will stop	Outputs automatically operate ATS mechanism per automatic sequence of operation	Output contact closes to start engine during the ONLOAD TEST mode. Output automatically opens when test mode is terminated and ATS is back on utility power
OFF LOAD TEST	When OFF LOAD TEST mode is initiated, engine will start and run off load. When OFF LOAD TEST mode is terminated, engine will stop	Outputs do not change state unless utility or generator supply fails in Off Load test mode	Output automatically closes to start engine during the OFF LOAD test mode. Output automatically opens when test mode is terminated
TIMED TEST	When a TIMED TEST is initiated, the ATS will perform test per the selected type (i.e. on load or off load) and time period. The Generator, will continue to run for the TIMED TEST duration, then will automatically stop.	Outputs operate ATS mechanism per automatic sequence of operation if programmed for ON LOAD TEST operation.	Output contact closes to start engine during the TIMED TEST mode. Output automatically opens when exercise mode is terminated
EXERCISE SCHEDULE	When an EXERCISE SCHEDULE occurs, the ATS will perform exercise test on the pre-selected calendar date and time. The Generator will operate on load or off load as selected, and will continue to run for the Exercise duration period as selected. If a re-occurring Exercise mode is selected, ATS will repeat an exercise test based on the calendar dates and times as selected.	Outputs operate ATS mechanism per automatic sequence of operation if programmed for ON LOAD TEST operation.	Output contact closes to start engine during the EXERCISE test mode. Output automatically opens when exercise mode is terminated

[1] The TSC 900 requires continuous control power (i.e. utility/gen power on, or 24VDC aux power on) to keep the automatic engine start output disabled. If control power is de-energized, the engine start output will close in approximately 3 minutes, once its internal control power reservoir de-energizes. This in turn will cause a repeating engine start/stop event every 3-4 minutes. To prevent engine start/stop cycling condition upon loss of control power, the local engine control panel should be selected for the OFF operating mode.

Operating modes for the ATS are selected either via the TSC 900 GHC Home page screen (using the "*Change Mode*" button) as shown on the screen images below or can be selected via external control switches as optionally connected to the TSC 900 Programmable inputs.

Refer to Section 4 - Operating Instructions for further information.





3.4. AUTOMATIC SEQUENCE OF OPERATION

3.4.1. OPEN TRANSITION TRANSFER

Note: For specific device settings and ranges, refer to Section 6 - Factory Default Programming.

Under normal operating conditions, the transfer switch operates automatically during a failure and restoration of utility power and does not require operator intervention.

When utility supply voltage drops below a preset nominal value on any phase, an engine start delay circuit will be initiated. Following expiry of the engine start delay period an engine start signal (contact closure) will be given.

Once the engine starts, the transfer switch controller will monitor the generators voltage and frequency levels. Once the generator voltage and frequency rises above preset values, a warm up time delay will be initiated. Once the warm up timer expires, the transfer to utility supply signal will be removed (i.e. contact opening) and the transfer to generator supply signal (contact closure) will be given to the transfer switch mechanism. The load will then transfer from the utility supply (i.e. opening the utility power switching device) to the generator supply (closing the generator power switching device) to complete a break-before-make open transition transfer sequence.

The generator will continue to supply the load until the utility supply has returned and the retransfer sequence is completed as follows: When the utility supply voltage is restored to above the preset values on all phases, a utility return delay circuit will be initiated. Following expiry of the utility return timer, the transfer to generator supply signal will be removed (contact opening), the transfer to utility supply signal (contact closure) will be given to the transfer switch mechanism. The load will then be transferred from the generator supply back to the utility supply. During the utility re-transfer sequence, a neutral position delay circuit can be employed which will cause the transfer mechanism to pause in the “neutral position (i.e. with both transfer power switching devices open) for the duration of the neutral delay timer setting, once the time delay expires, the re-transfer sequence will be completed.

An engine cooldown timer circuit will be initiated once the load has successfully re-transferred back onto the utility supply. Following expiry of the cooldown delay period the engine start signal will be removed (remote start contact opened) to initiate stopping of the generator set.

3.4.2. CLOSED TRANSITION TRANSFER

For transfer switches equipped with the closed transition transfer option (i.e. ATS Model Code Digit #13 “Operation Type” 3 or 4), the TSC 900 is configured to provide additional

logic for this application. When the TSC 900 controller receives an input signal for Closed Transition Transfer Mode, the TSC 900 is configured to operate as follows:

Under normal closed transition operating conditions, the transfer switch operates automatically during a failure and restoration of utility power and does not require operator intervention.

When utility supply voltage drops below a preset nominal value on any phase, an engine start delay circuit will be initiated. Following expiry of the engine start delay period an engine start signal (contact closure) will be given.

Once the engine starts, the transfer switch controller will monitor the generator voltage and frequency levels. When the generator voltage and frequency rises above preset values, a warm up time delay will be initiated. When the warm up timer expires the transfer to utility supply signal will be removed (logic contact(s) opening) and the transfer to generator supply signal (logic contact(s) closure) will be given to the transfer switch Power Switching Devices. The load will then transfer from the utility supply (i.e. opening the utility power switching device) to the generator supply (closing the generator power switching device) to complete a break-before-make open transition transfer sequence.

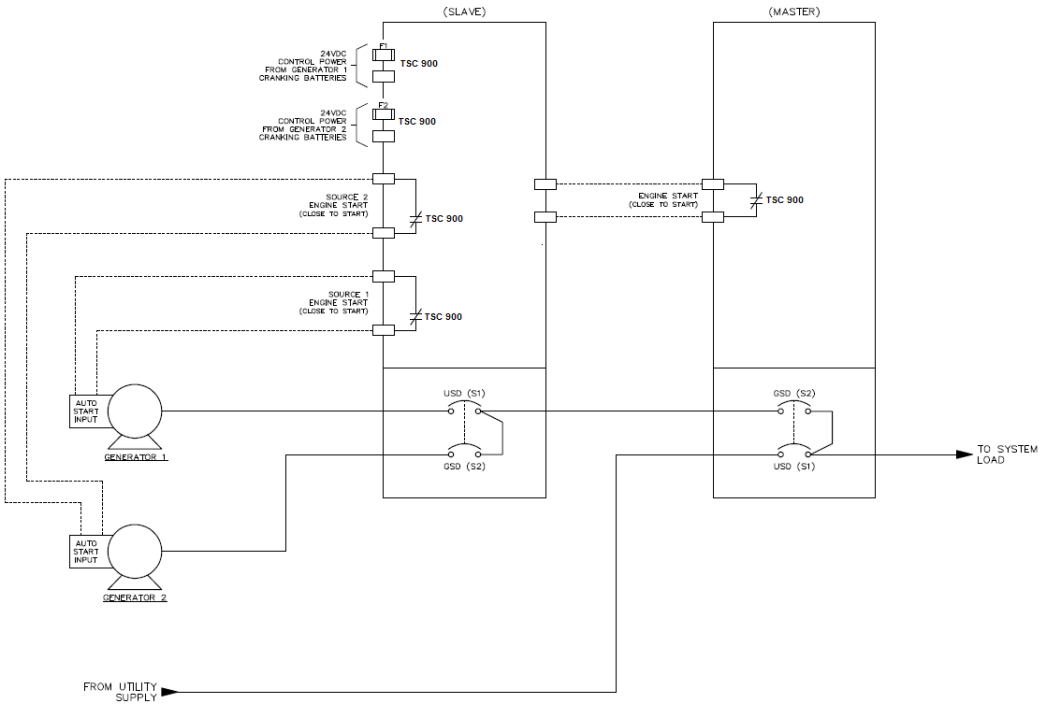
The generator will continue to supply the load until the utility supply has returned and the retransfer sequence is completed as follows: When the utility supply voltage is restored to above the preset values on all phases, a utility return delay circuit will be initiated. Following expiry of the utility return timer, the utility power-switching device will close when it is in synchronism with the generator supply. If the transfer switch is supplied with a Fast (Momentary) Closed Transition transfer control option, the generator power switching device will immediately trip within ~100 milliseconds after the utility power switching device closes to complete the “make-before-break” re-transfer sequence. If the transfer switch is supplied with a “Soft-Load” Closed Transition transfer control option, the generator power switching device will remain closed for a longer time period to allow a soft-load power transfer sequence to be completed via external loading controller. The generator power switching device will then trip open to complete the “make-before-break” re-transfer sequence.

An engine cooldown timer circuit will be initiated once the load has successfully re-transferred back onto the utility supply. Following expiry of the cooldown delay period, the engine start signal will be removed (remote start contact opened) to initiate stopping of the generator set.

3.4.3. DUAL SOURCE ATS

ATS may be supplied with the following 3 types of optional Dual Source system configurations:

- **DU** - **Dual Utility ATS**: Used for systems consisting of one ATS connected to two utilities with at least one source continually energized to the ATS. ATS will automatically switch to the alternate source upon failure of the preferred source.
- **DPG** - **Dual Prime Gen ATS**: Used for systems consisting of one ATS connected to two generators with one generator continually energized to the ATS. ATS will automatically switch to the alternate generator upon failure of the preferred source.
- **DSG** - **Dual Standby Gen ATS (Slave ATS):** Used for systems consisting of two ATS's in a Master/Slave Configuration. Refer to the following diagram. Only the "Slave" ATS is to be ordered and configured with the **"**DSG" option. The Master ATS is to be ordered as a standard ATS. The "Slave" ATS will be connected to two generators which are normally de-energized and are signaled to start from the Master ATS.



3.4.3.1. DUAL UTILITY ATS

A Dual Utility application allows an operator to select which source is "preferred" (i.e. Either source may be selected as Preferred), therefore, the alternate source will act as the standby source. The "PREFERRED" selected source will continuously operate on load. The non-selected preferred source (standby) will

remain off load. The standby source will automatically transfer on load should the "Preferred" source fail once the "Transfer From Preferred Source Delay*"* timer expires. When the "Preferred" selected source is returned to normal operating status, the load will automatically retransfer back to the "Preferred" selected source once the "Return to Preferred Source Delay" timer expires. If the PREFERRED SOURCE selector switch is turned to the non-operating source, the load will automatically transfer to this new "Preferred" source once the "Transfer From Preferred Source Delay*"* timer expires.

3.4.3.2. DUAL PRIME GENERATOR ATS

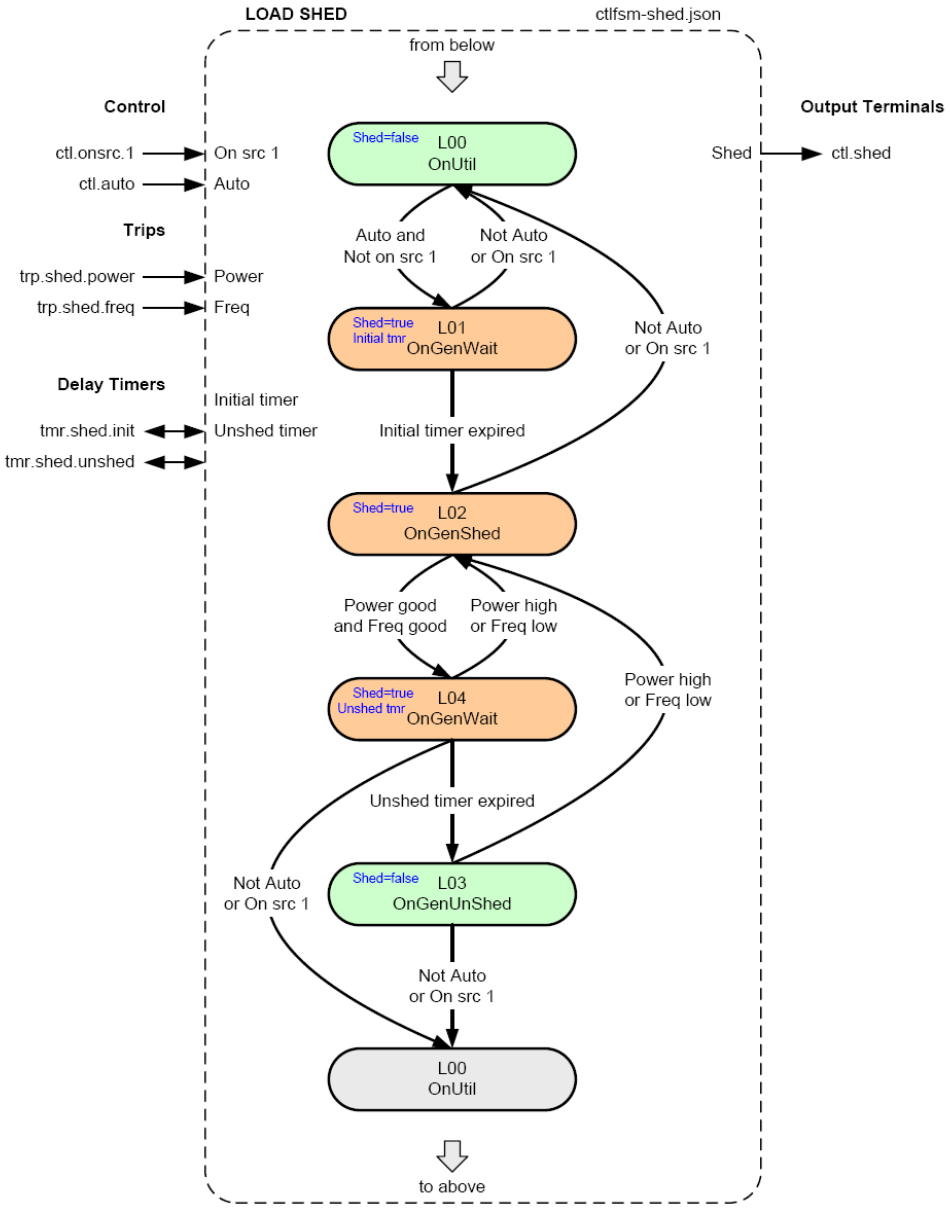
A Dual Prime Generator application allows an operator to select which generator is "preferred" (i.e. Either generator may be selected as Preferred), therefore, the alternate generator will act as the standby source. The "PREFERRED" selected generator will continuously operate on load with an engine start signal maintained. The non-selected preferred generator (standby) will remain off load. The standby generator will be signaled to automatically start the engine and transfer on load (following its warm up delay period) should the "Preferred" generator fail once the "Transfer From Preferred Source Delay*"* timer expires. When the "Preferred" selected generator is returned to normal operating status, the load will automatically retransfer back to the "Preferred" selected generator once the "Return to Preferred Source Delay*"* timer expires. If the PREFERRED SOURCE selector switch is turned to the non-operating generator, the load will automatically transfer to this new "Preferred" generator once the "Transfer From Preferred Source Delay*"* timer expires. The originally selected "Preferred" unit will continue to operate for its cool down period then stop. An automatic Engine Run-Hour balancing program is provided for configuration/use in the Dual Prime Mode. When enabled it will automatically start/stop and transfer each engine (Genset) on/off load to try to balance engine running hours as stored in memory. Refer to programming section 5 for further details. Should a "trouble alarm" occur on the operating "Preferred" source, the ATS will automatically transfer to the "Standby Source until the trouble alarm condition is reset. **Note**: the "trouble alarm" operation feature requires a digital programmable inputs (i.e. Default inputs Source 1 –IP13, Source 2 –IP14) to be pre-configured and wired to the appropriate engine-generator set controller.

3.4.3.3. DUAL STANDBY GENERATOR ATS

Under normal Utility Power operation, power to the load will be fed from the Master ATS via closed Utility power switching device. The Dual Standby ("Slave") ATS remains de-energized with both generators stopped. Should the utility power fail, the Master ATS will send a common gen start signal to the Dual Standby ATS. The Dual Standby ATS will then send a start signal to one or both Gensets (programmable) to start. The Dual Standby ATS will transfer to the "Preferred" selected generator position. Once generator voltage is established back to the Master ATS, the load will automatically transfer onto the operating generator. The "Standby" Gen will automatically stop if selected to do so. The "Preferred" selected generator will be continuously connected to the load via the Master ATS until Utility Power is re-established. Should the "Preferred" generator fail while on load, the "standby" selected generator set will automatically start and the load will be automatically transferred to the "standby" generator. When the utility power returns to normal, the Master ATS will transfer the load back to the utility supply and will send a signal to the Dual Standby ATS to stop the operating generator. The operating generator unit will continue to run for its cool down period then stop. An automatic Engine Run-Hour balancing program is provided for configuration/use in the Dual Prime Mode. When enabled it will automatically start/stop and transfer each engine (Genset) on/off load to try to balance engine running hours as stored in memory. Refer to programming section 5 for further details. **Note**: the "trouble alarm" operation feature requires a digital programmable inputs (i.e. Default inputs Source 1 –IP13, Source 2 –IP14) to be pre-configured and wired to the appropriate engine-generator set controller.

3.4.4. AUTOMATIC LOAD SHED OPERATION

The TSC 900 can be configured for automatic Load Shedding operation by use of a programmable output contact. Under normal utility power conditions, the Load Shed control is not activated. When a utility power failure occurs and the ATS transfers to the generator supply, the Load Shed circuit is automatically initiated for a pre-programmed time delay setting. Once the Load Shed initiate timer expires, the Load Shed circuit is reset. Automatic Load Shed can also be configured for automatic Load Shed based on generator under frequency and/or ATS load kW (over power) set points. The automatic sequence of operation is further described as per the following state diagram. **Note**: to disable Load Shed feature, Load Shed Initiate and Reset timers must be set to zero. Refer to Section 5.15 for programming instructions



3.4.5. TEST MODE

3.4.5.1. ON LOAD TEST (OPEN TRANSITION TRANSFER)

When an operator selects an ON LOAD TEST mode, the ATS controller will initiate a simulated utility power failure condition. The transfer switch will operate as per a normal utility power fail condition with all normal time delays enabled. The neutral delay circuit logic will be active during transfer to and from the generator supply (i.e. when both sources of power are available). The transfer switch will remain on generator supply while in the Test mode. When the Test mode is manually canceled, the ATS will re-transfer back to the utility supply following the utility return delay, then the generator will cooldown before stopping.

3.4.5.2. ON LOAD TEST (CLOSED TRANSITION TRANSFER)

When a load test is initiated in the closed transition transfer mode, the generator will start and following its warm up delay, the generator will close its power-switching device when it is in synchronism with the utility supply. If the transfer switch is supplied with a “Momentary” Closed Transition transfer control option, the utility power switching device will immediately trip open within ~100 milliseconds after the generator power switching device closes to complete the “make-before-break” transfer sequence. If the transfer switch is supplied with a “Soft-Load” Closed Transition transfer control option, the utility power switching device will remain closed long enough to allow a soft-load power transfer sequence to be completed as controlled by an external device. The utility power switching device will then trip open to complete the “make-before-break” transfer sequence. The generator will continue to supply the load until the test mode has been removed and the re-transfer sequence is completed as follows: The utility power-switching device will close when it is in synchronism with the generator supply via external logic device. If the transfer switch is supplied with a “Momentary” Closed Transition transfer control option, the generator power switching device will immediately trip open within ~100 milliseconds after the utility power switching device closes to complete the “make-before-break” re-transfer sequence. If the transfer switch is supplied with a “Soft-Load” Closed Transition transfer control option, the generator power switching device will remain closed long enough to allow a soft-load power transfer sequence to be completed as controlled by an external device. The generator power switching device will then trip open to complete the “make-before-break” re-transfer sequence.

3.4.6. ABNORMAL SEQUENCE OF OPERATION

3.4.6.1. GENERATOR FAILURE ON LOAD

Should the generator set fail while on load, the transfer switch will automatically re-transfer the load back to the utility supply if within nominal limits. The utility return timer will be bypassed in this condition.

NOTE:

This operating condition applies to a normal utility failure as well as any test condition.

3.4.6.2. TRANSFER SWITCH FAIL ALARM LOGIC

The TSC 900 controller contains logic to detect a transfer mechanism failure. Should a failure be detected, a forced transfer to the alternate supply will be initiated if the TSC 900 is programmed for force transfer. Refer to the programming Section 5.11.6 for further information in Force Transfer operation.

3.4.6.3. SERVICE ENTRANCE ATS

Service Entrance Rated ATS's provide a manually initiated operation sequence which signals the ATS mechanism to transfer from either connected source to the neutral position to de-energize the ATS Load. This operation mode is activated by the Service Disconnect control switch. Once in the Service Disconnected mode, the TSC 900's transfer control outputs and engine start circuits are disabled. When the Service Disconnect control switch is de-activated, the ATS will transfer back to the available source to re-energize the ATS Load. **Note**: the TSC 900 programmable digital input for Service Disconnect mode must be used in conjunction with a Service Disconnect control switch which changes the source of control power to the TSC 900 output contacts to enable transfer to the neutral position.

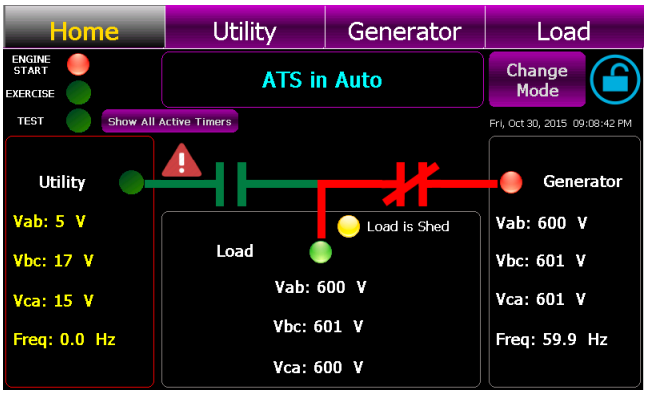
3.5. GHC DISPLAY MAIN MENU PAGE DESCRIPTIONS

The GHC software provides the TSC 900 control and monitoring information which is visible on the GHC Display or remote PC. All screen page navigation is controlled by a touchscreen display using a “finger swipe” motion and/or button press actions. The GHC has pre-programmed display pages which are selected manually using the touchscreen display. The display pages are organized into the following main menu pages in software:

Note: the “Sync” page will only be visible for ATS applications that are capable of fast in-sync transfer

3.5.1. HOME PAGE

The Home Page is utilized as a summary control and monitoring screen for the ATS. This screen provides a mimic bus showing current ATS position, identifies which sources are energized, voltage levels and overall ATS operating mode. Phase to phase system voltages will be displayed for each source and load.

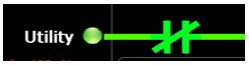


The standard default mimic bus will automatically change color as follows:

- Utility –dark green = de-energized, light green = energized
- Generator - dark green = de-energized, red = energized

Note: Mimic Bus colors maybe customized to alternate colors.

Refer to Section 3.6.9 Power Switching Device status is depicted as follows:

- Utility Closed:  Generator Closed: 

The following Status LEDs are shown on the Home page:

LED	Label	Light Off	Light On	Light Flashing
	Engine Start (RED)	Engine is not commanded to start/run	Engine is commanded to start/run	n/a
	Exercise (Yellow)	Exercise Schedule is not enabled or active	Exercise Schedule is enabled but not currently active	Exercise is currently active
	Test (Yellow)	Test is not active	Local Test is active (On Load or Off Load)	Remote Test is active
	Load Shed (Yellow)	Load Shed is not active	Load Shed is activated	n/a

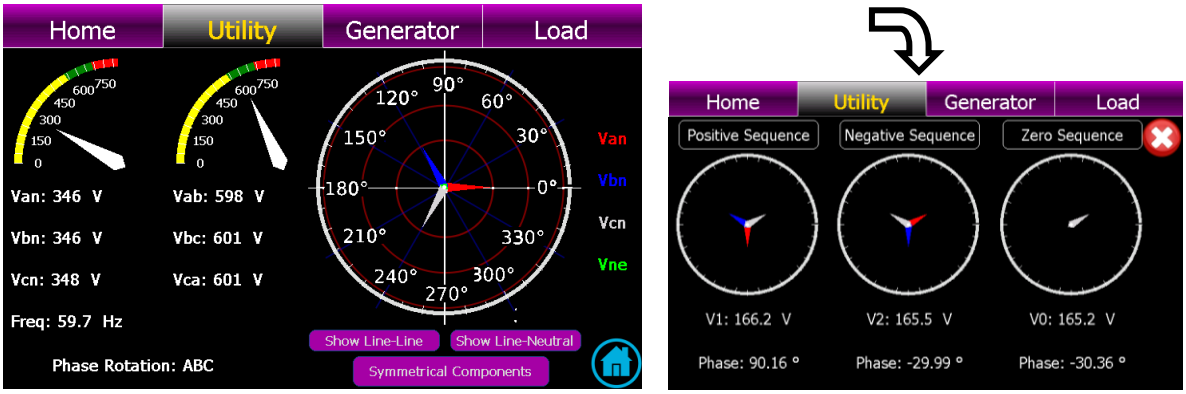
Test or Timed test modes can be activated from the Home page by press of the “Change Mode” button which activates a pull down menu.

Refer to Section 5 of this manual for operating procedures.

	Alarm Icon –flashes when a new Alarm has been activated	Press to view active alarms
	Alert Icon -flashes when a source changes to an abnormal condition	Press to view active voltage source alerts
	Security Icon - Settings Locked (Read only mode)	Press to access security login
	Security Icon - Settings Un-Locked (Read/write mode)	Press to access security login

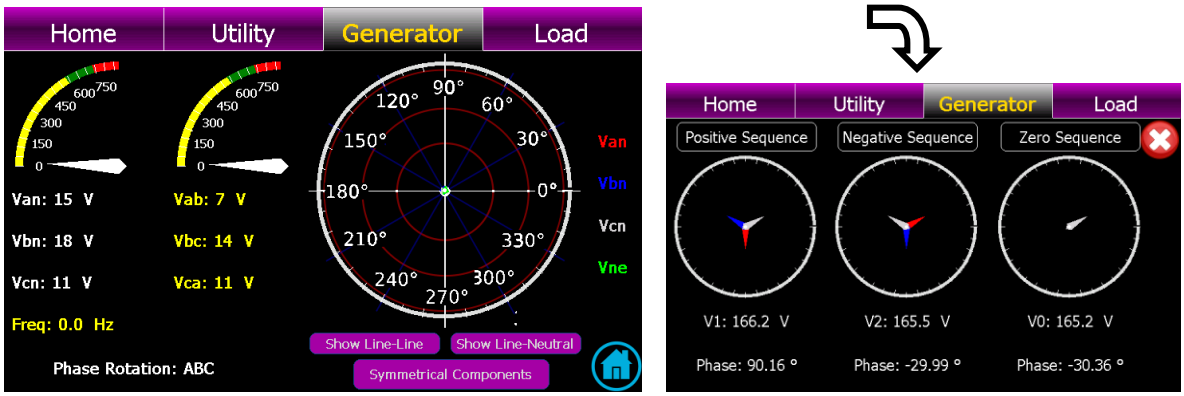
3.5.2. UTILITY METERING PAGE

The utility metering page provides detailed voltage and frequency metering data for the utility supply. Metering data is displayed in both text and graphical representation. Phase to phase and phase to neutral voltages are displayed as well as a Phasor diagram showing relative phase angles and magnitudes between phases. A shortcut button is provided to access the Utility Symmetrical components information screen as follows:



3.5.3. GENERATOR METERING PAGE

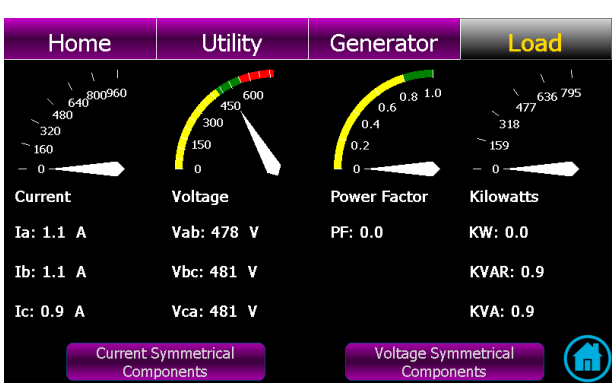
The generator metering page provides detailed voltage and frequency metering data for the generator supply. Metering data is displayed in both text and graphical representation. Phase to phase and phase to neutral voltages are displayed as well as a Phasor diagram showing relative phase angles and magnitudes between phases. A shortcut button is provided to access the Generator Symmetrical components information as shown for Utility Metering.

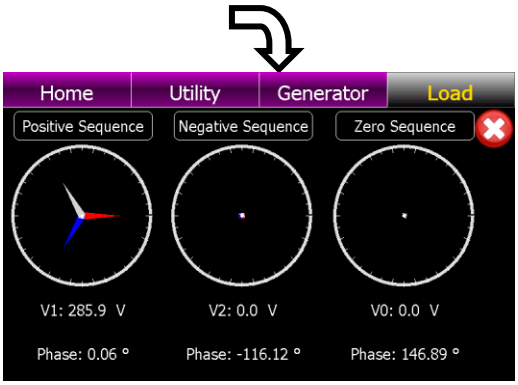


3.5.4. LOAD METERING PAGE

The load metering page provides detailed voltage, current and power metering data for the ATS load bus. Metering data is displayed in both text and graphical representation. Phase to phase voltages are displayed. A shortcut button is provided to access the Load Bus Symmetrical components information.

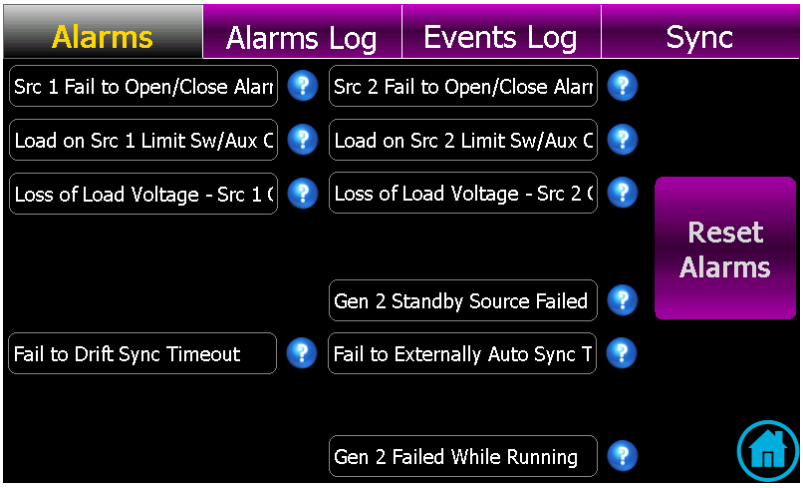
Note: Load CT and/or Load Power Metering options must be supplied with the ATS to provide load current and power data.





3.5.5. ALARMS PAGE

The TSC 900 alarms page displays available alarms based on the model type of ATS supplied. Any active alarms will be highlighted with Red background fill. A reset button is provided on this page to reset all activated alarms. The following is a screen shot for a standard open transition ATS.



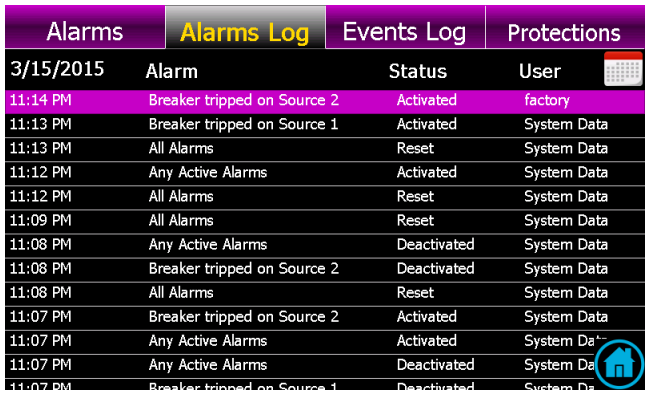
The following Alarms are provided on the TSC 900

ALARM NAME	ALARM DESCRIPTION
Src 1 Fail to Open/Close Alarm TAG: alm.xfr.mech.1	Alarm is activated if the Src 1 (Utility) power switching device fails to open or close during a transfer sequence within the pre-defined time period. Time delay is programmable –see Section 5.12.9.
Src 2 Fail to Open/Close Alarm TAG: alm.xfr.mech.2	Alarm is activated if the Src 2 (Gen) power switching device fails to open or close during a transfer sequence within the pre-defined time period. Time delay is programmable –see Section 5.12.9.
Load on Src 1 Limit Sw/Aux Contact Failure TAG: alm.xfr.detect.1	Alarm is activated if the "Load On Utility" (Src 1) input signal to the TSC 900 is lost during normal operation, while the Utility is supplying the load.
Load on Src 2 Limit Sw/Aux Contact Failure TAG: alm.xfr.detect.2	Alarm is activated if the "Load On Generator" (Src 2) input signal to the TSC 900 is lost while the Generator is running and is supplying the load.
Loss of Load Voltage -SRC 1 Contacts Open TAG: alm.xfr.trip.1	Alarm is activated if the ATS is in the Utility (SRC 1) position and its power switching device contacts open causing a loss of ATS load voltage.
Loss of Load Voltage -SRC 2 Contacts Open TAG: alm.xfr.trip.2	Alarm is activated if the ATS is in the Generator (SRC 2) position and its power switching device contacts open causing a loss of ATS load voltage.
Gen 2 Standby Source Failed to Start TAG: alm.gen.muststart.2	Alarm is activated if the standby selected genset (Gen 2) fails to start and reach nominal voltage and frequency within a pre-defined time period from when an engine start signal was initiated. Time delay is programmable –see Section 5.12.11.
Gen 1 Standby Source Failed to Start TAG: alm.gen.muststart.1	On Dual Gen systems, alarm is activated if the standby selected genset (Gen 1) fails to start and reach nominal voltage and frequency within a pre-defined time period from when an engine start signal was initiated. Time delay is programmable –see Section 5.12.11.
Fail to Drift Sync Timeout TAG: alm.xfr.sync	Alarm is activated if a transfer to alternate source is initiated and the two sources fail to Draft Sync and reach acceptable synchronization limits within the pre-defined time period. Time delay is programmable –see Section 5.16.1. Alarm is only active on Transfer switches configured for Open Transition-in Sync (Model X) or Closed Transition (Fast or Soft-load Models 3 / 4)
Fail to Externally Auto Sync Timeout TAG: alm.xfr.sync.ext	Alarm is activated if a transfer to alternate source is initiated and the two sources fail to Auto Sync and reach acceptable synchronization limits within the pre-defined time period. Time delay is programmable –see Section 5.16.2. Alarm is only active on Transfer switches configured with an external automatic synchronizer used in Closed Transition (Fast or Soft-load (Models 3 / 4) applications.
Src 1 Fail to Unload TAG: alm.xfr.unload.1	Alarm is activated if during a Closed Transition Transfer sequence, the utility supply (SRC 1) fails to unload within the pre-defined time period. Time delay is programmable –see Section 5.16.3. Alarm is only active on Transfer switches configured with an external load sharing controller used in Closed Transition Soft-load (Model 4) applications.
Src 2 Fail to Unload TAG: alm.xfr.unload.2	Alarm is activated if during a Closed Transition Transfer sequence, the generator supply (SRC 2) fails to unload within the pre-defined time period. Time delay is programmable –see Section 5.16.3. Alarm is only active on Transfer switches configured with an external load sharing controller used in Closed Transition Soft-load (Model 4) applications.

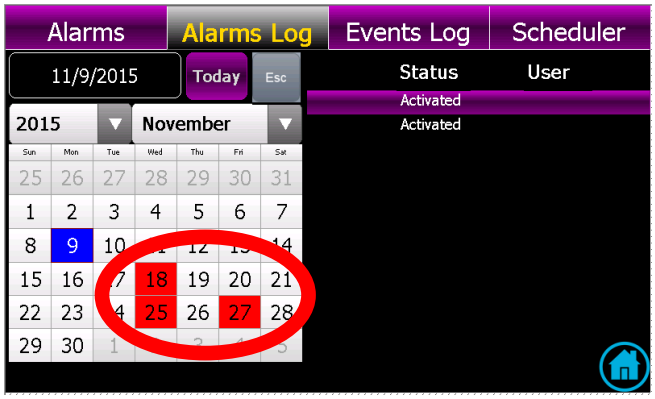
3.5.6. ALARMS LOG PAGE

The alarms log page shows time/date stamped information as to when alarms have occurred. A drop down menu is provided to select a desired filter to view the logs.

Note: A calendar date must be selected for the desired date to determine if any logs are visible on that date.



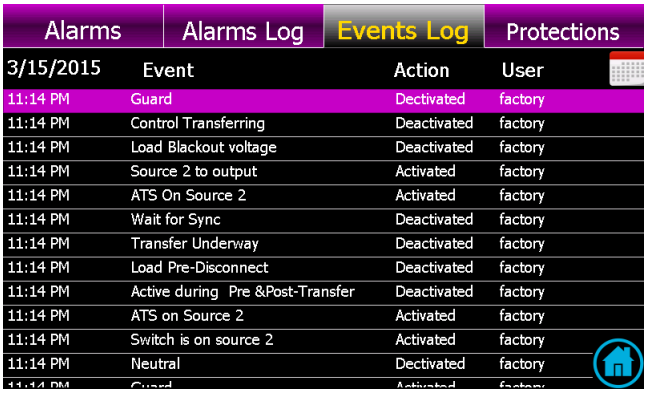
When the Calendar pop-up is selected, any calendar dates with alarm logs present will be highlighted by a “red” box on that date as per the following display.



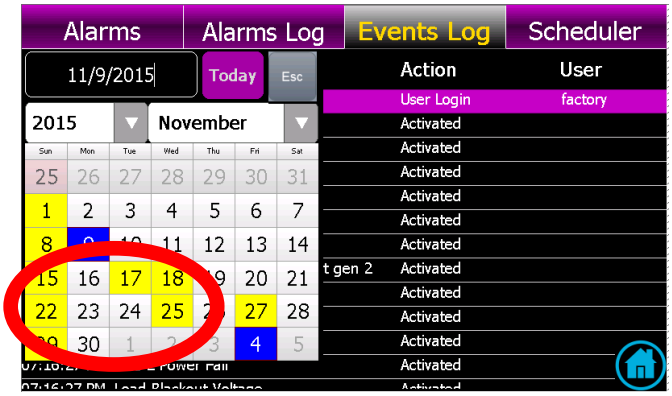
3.5.7. EVENTS LOG PAGE

The events log page shows time/date stamped information as to when events have occurred. A drop down menu is provided to select a desired filter to view the logs.

Note: A calendar date must be selected for the desired date to determine if any logs are visible on that date.



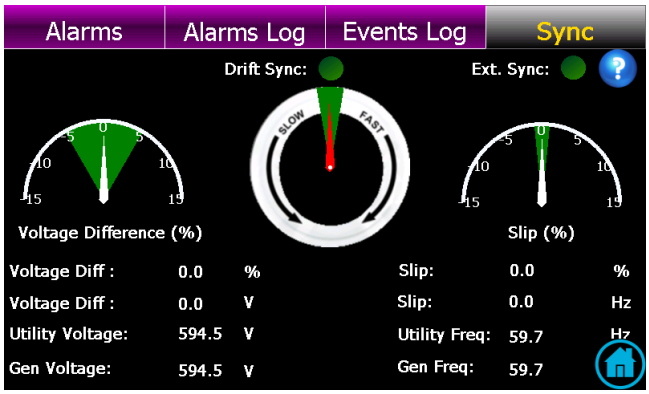
When the Calendar pop-up is selected, any calendar dates with Event logs present will be highlighted by a “yellow” box on that date as per the following display.



3.5.8. SYNC PAGE

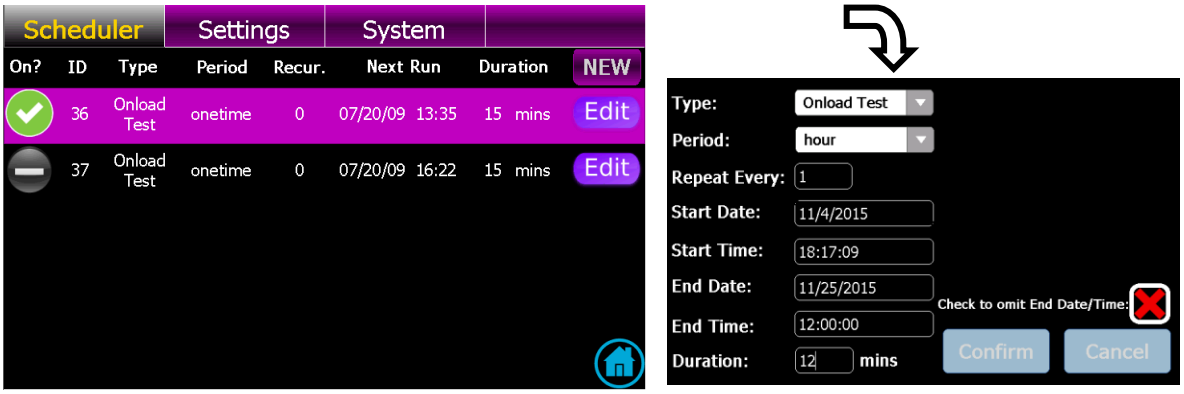
The SYNC page is utilized for applications when the ATS is provided with closed transition or open transition in-sync transfer capability. This page will display the phase angle difference, voltage difference and slip frequency difference between two available sources.

Note: The Sync page is only visible if the ATS model is capable of closed transition transfer operation or open transition in-sync transfer operation.



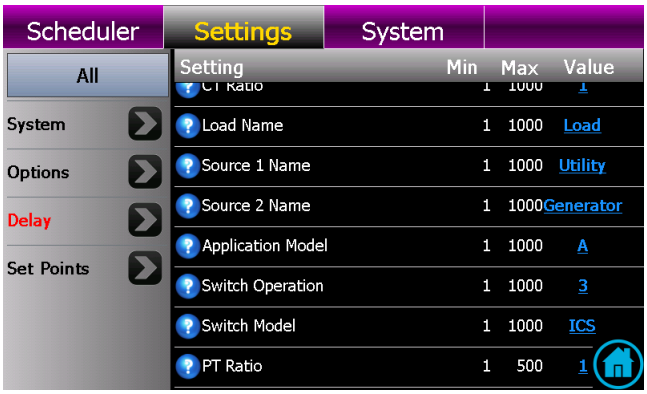
3.5.9. SCHEDULER PAGE

The scheduler page is utilized to set on load or off-load Exercise events using a calendar based scheduler. Multiple exercise events, dates and times can be selected. By pressing the “New” or “Edit” buttons a pop-up menu will appear as shown below. Refer to Operating Instruction section of this manual for further details on how to configure the Exercise Scheduler.



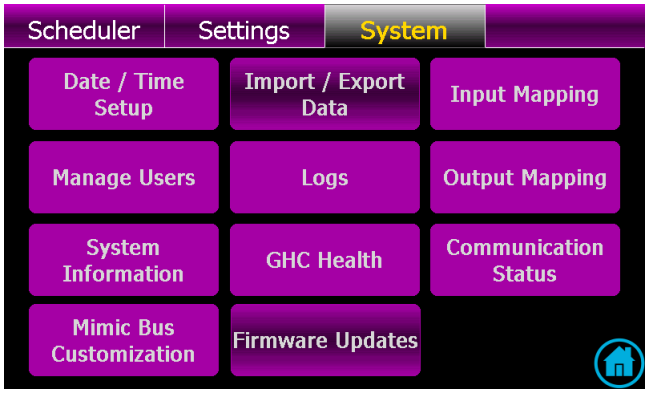
3.5.10. SETTINGS PAGE

The settings page is utilized for programming or configuring any timer, voltage set point, frequency set point, I/O mapping or optional features in the controller. The settings can be viewed via different filter settings based on function. Refer to the Programming section of this manual for further details on function programming.



3.5.10 SYSTEM PAGE

The System Page is utilized for viewing or programming specific settings based on the application. Each System sub-menu page can be viewed by selecting the specific button. Refer to Section 3.6 for description of each submenu.

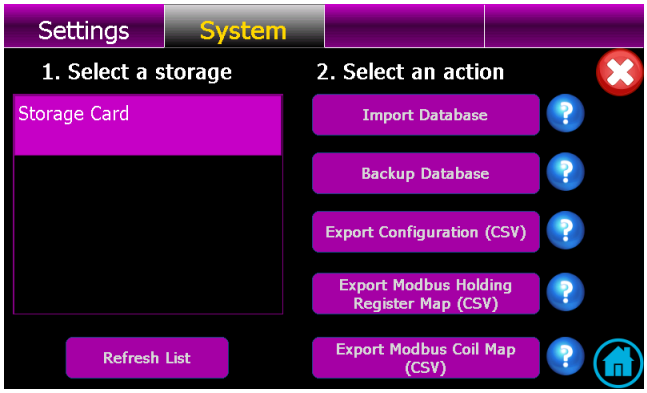


3.6. GHC DISPLAY SYSTEM SUBMENU PAGE DESCRIPTIONS

The system page is utilized for viewing and/or programming site specific settings based on the application. Different sub-menu pages are available as shown below. Each System sub-menu pages can be viewed by selecting the specific button. Refer to Section 5 for programming description of each submenu. **Note**: To exit any submenu, press the red x icon.

3.6.1. IMPORT/EXPORT DATA

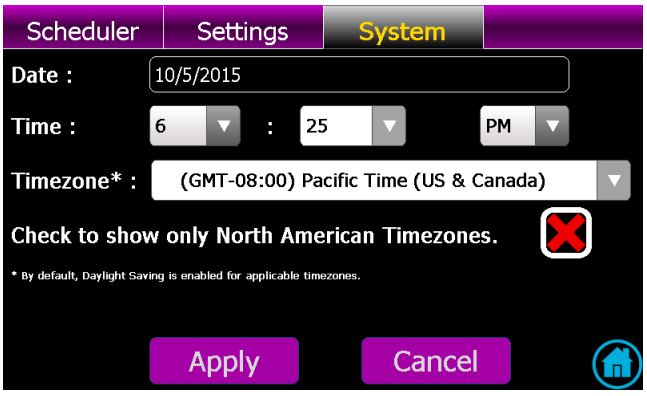
The import/back-up data page is utilized for importing either new program settings or updated firmware. Current controller settings can also be backed-up or restored from the GHC SD memory card. Refer to the Programming section of this manual for further details on import/back-up operating procedures.



3.6.2. DATE / TIME SETUP

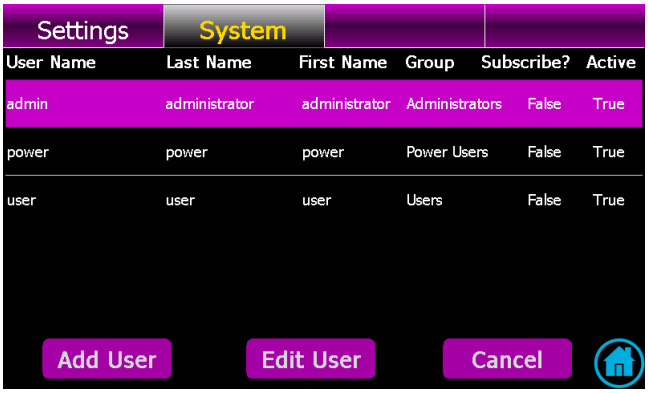
The date/time setup page is utilized for changing the TSC 900 real time clock settings to match the installed location.

Refer to the Section 5.4 for further details on time/date change procedures.



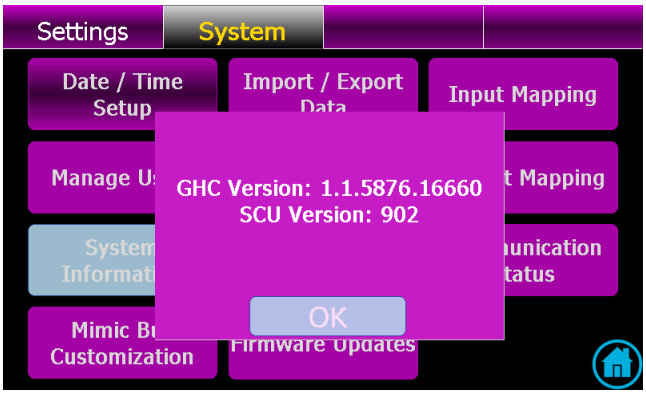
3.6.3. MANAGE USERS

The manage users page shows what users currently exist in the controller and allows new users to be added as required. Refer to the Programming section of this manual for further details on editing or adding new users.



3.6.4. SYSTEM INFORMATION

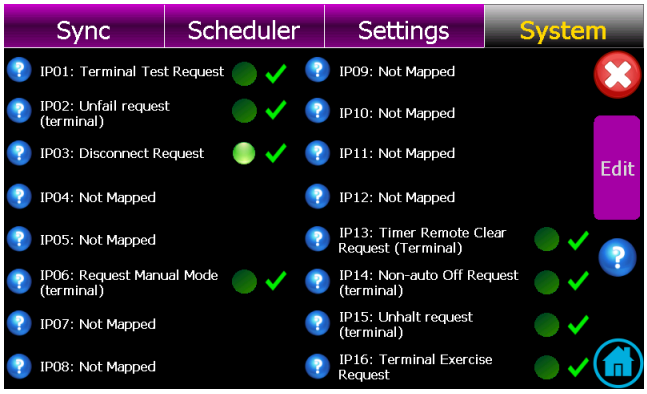
The System page shows what current firmware versions are installed on the TSC 900 controller.



3.6.5. INPUT MAPPING

The input mapping page shows what functions the TSC 900 programmable digital inputs are configured for and which inputs are currently activated.

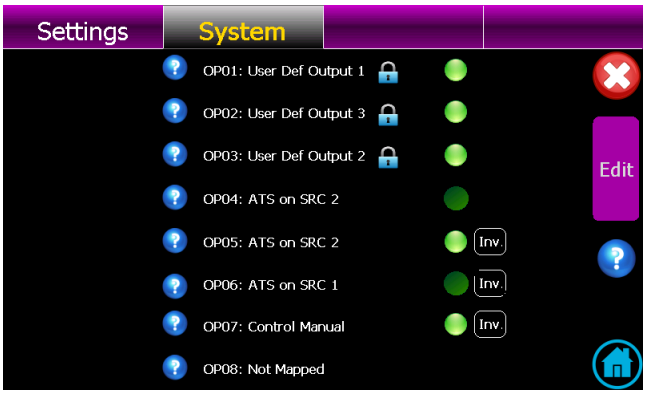
Refer to the Section 5.8 of this manual for further details on configuring the digital input mappings.



3.6.6. OUTPUT MAPPING

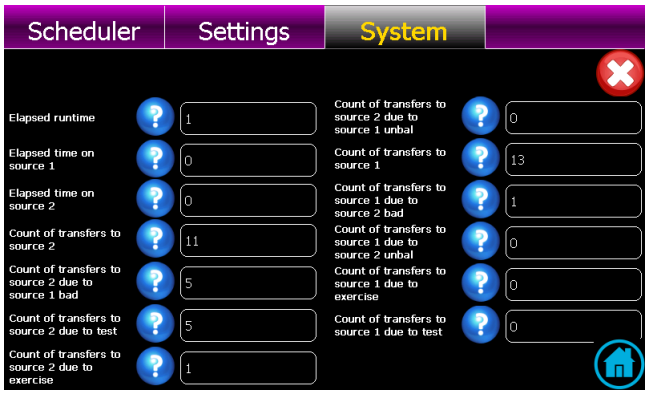
The output mapping page shows what functions the TSC 900 programmable relay output are configured for and which outputs are currently activated.

Refer to the Section 5.9 of this manual for further details on configuring the relay output mappings.



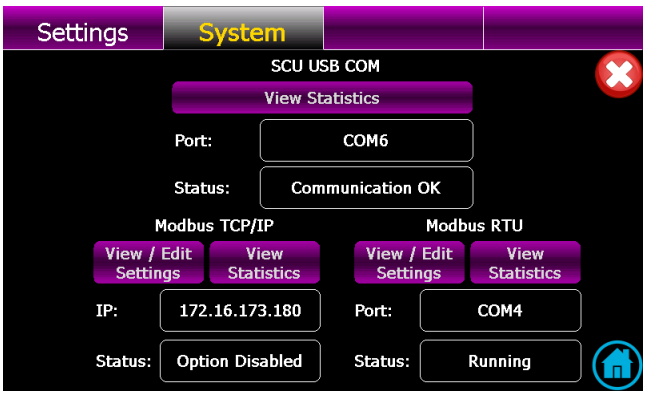
3.6.7. LOGS

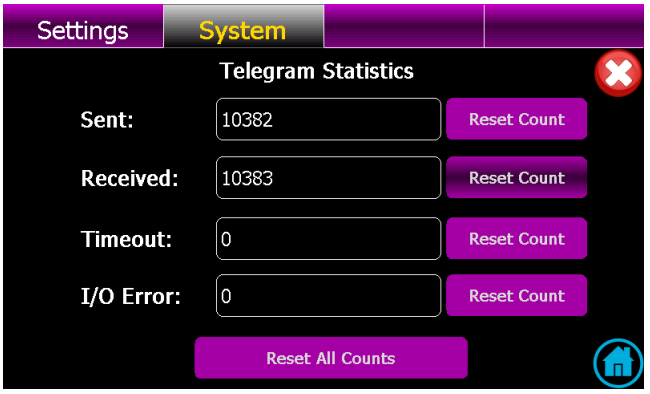
The logs page shows the available data logs the controller is logging on a real-time basis.

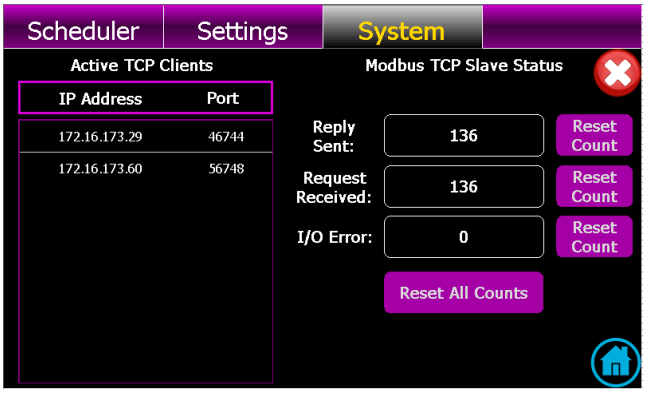


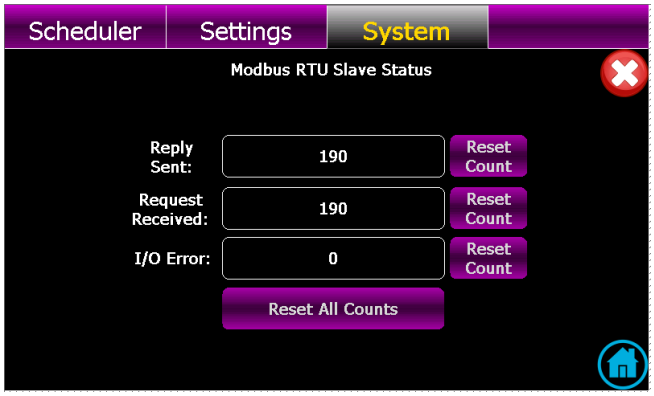
3.6.8. COMMUNICATION STATUS

The communication status page shows status of all TSC 900 controller communication ports including Serial (RS232) port, Ethernet (TCP/RTU) ports and the SCU-GHC USB ports. Specific com port settings and operating statistics can be accessed via this screen. Refer to Section 5.6 for remote communication set-up programming information. For further information on remote com settings and/or Modbus data addressing, refer to separate product manual PM0152 “TSC 900 MODBUS COMMUNICATION MANUAL”.



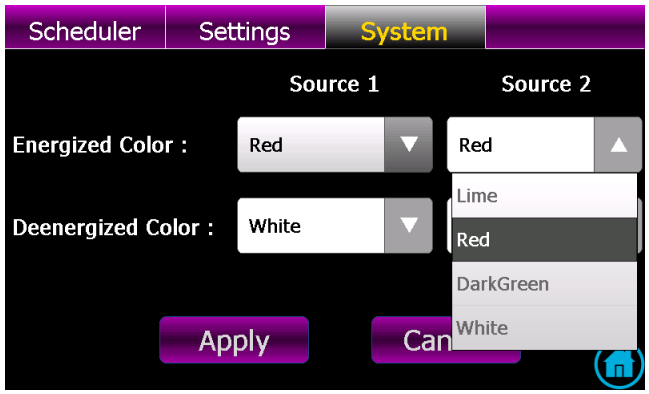






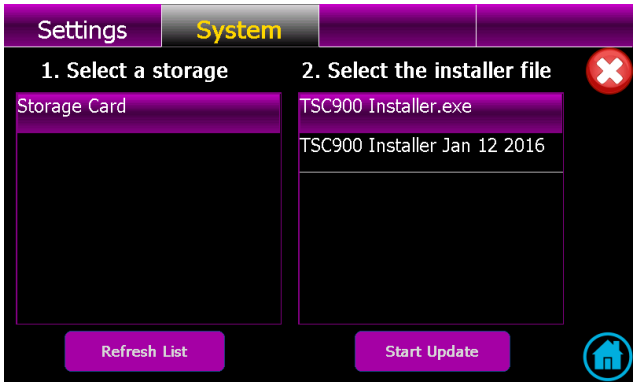
3.6.9. MIMIC BUS CUSTOMIZATION

The mimic bus customization page allows the colors of the Home Page mimic bus to be changed to a different color scheme as desired. Changing mimic bus colors requires login security level of “Power” or higher.



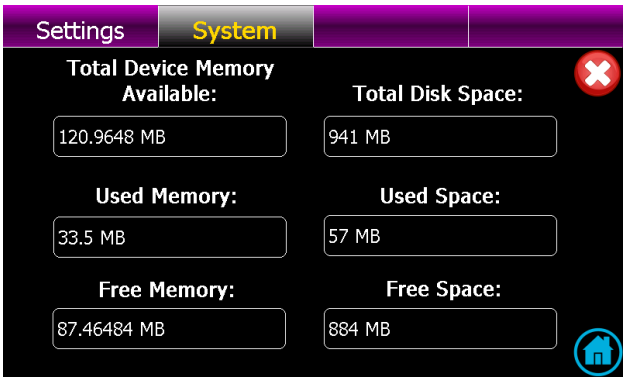
3.6.10. FIRMWARE UPDATES

The firmware updates page allows the user to update new firmware in the GHC display and/or the SCU controller. Contact Thomson Power Systems for applicable Service Bulletin which details the GHC and SCU firmware update procedure.



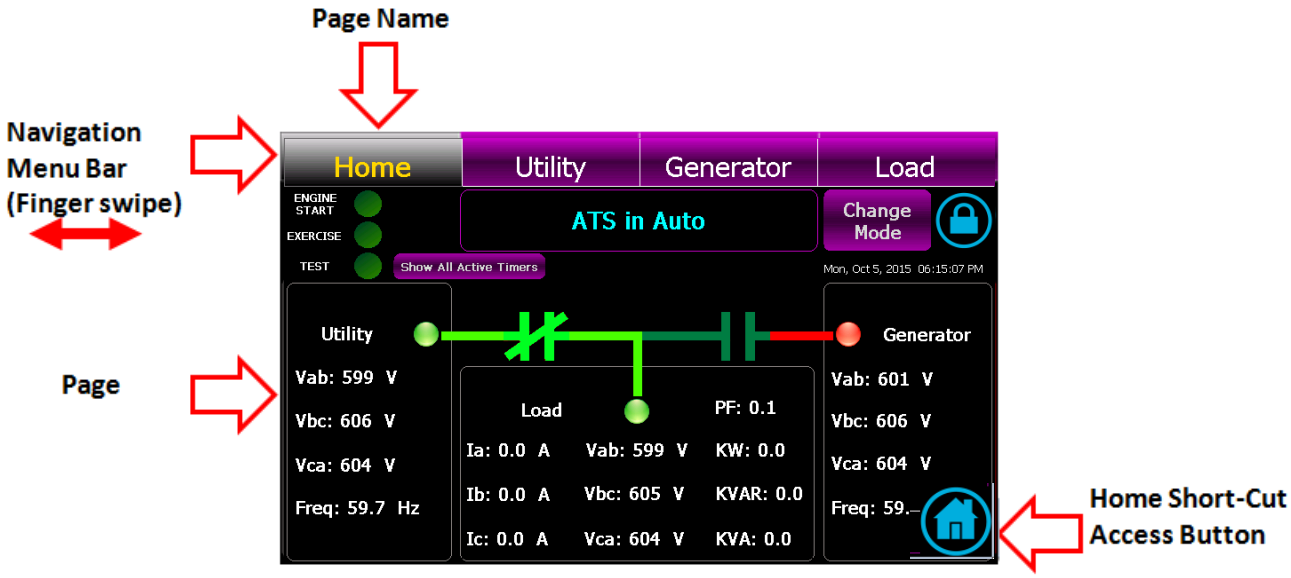
3.6.11. *GHC HEALTH*

The GHC health page provides diagnostic information for the GHC with regards to memory utilization.



4. OPERATING INSTRUCTIONS

The GHC software provides the TSC 900 control and monitoring information which is visible on the GHC Display or remote PC. All screen page navigation is controlled by a touchscreen display using a "finger swipe" motion and/or button press actions. The GHC has pre-programmed display pages which are selected manually using the touchscreen display. The following screen naming conventions will be used throughout the document when describing the GHC software screens:



4.1. GHC SCREEN PAGE NAVIGATION

Two methods are available to manually select a desired screen page as follows:

1) Navigation Menu Bar –a finger swipe motion can be used (swipe left or right) on the menu bar itself.

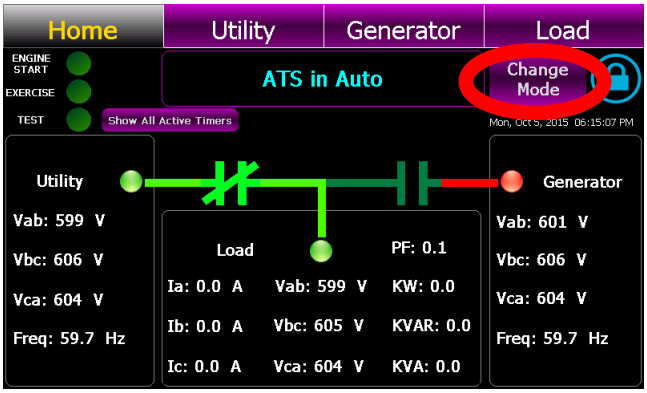
2) Home Short-Cut Button - To directly access the Home Page from any screen press the following ICON:

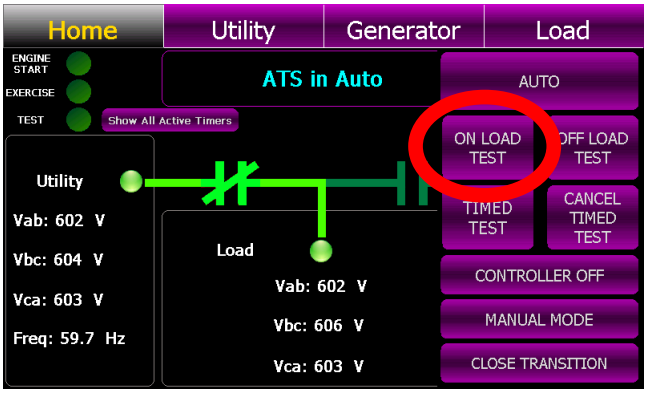
4.2. HELP INFORMATION

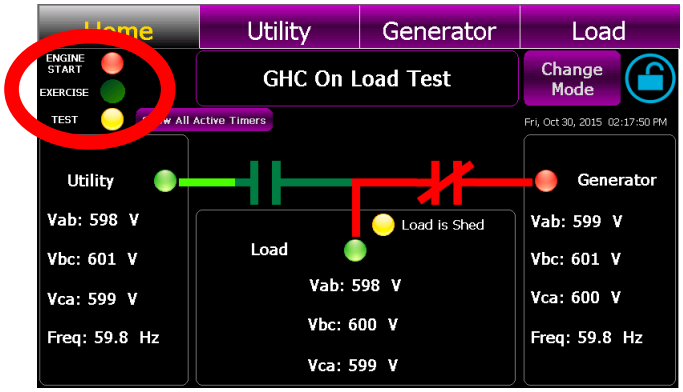
Help Information screens are available whenever a question mark Icon is displayed. Press the Icon to open up further information on the specific item.

4.3. ON LOAD TEST INSTRUCTIONS (UTILITY POWER FAIL SIMULATION)

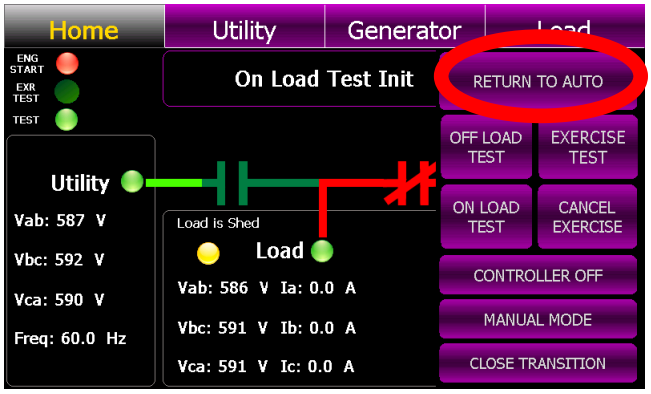
To perform an On Load Test and simulate a utility power fail condition, press the "*Change Mode*" control button on the GHC Home Page and select "ON LOAD TEST" mode from the available list of modes as shown below. The "TEST" light on the upper left-hand corner of the screen will turn Yellow to indicate mode is activated and the "ENGINE START" light will turn Red. The generator will start and transfer on load per Automatic Sequence.





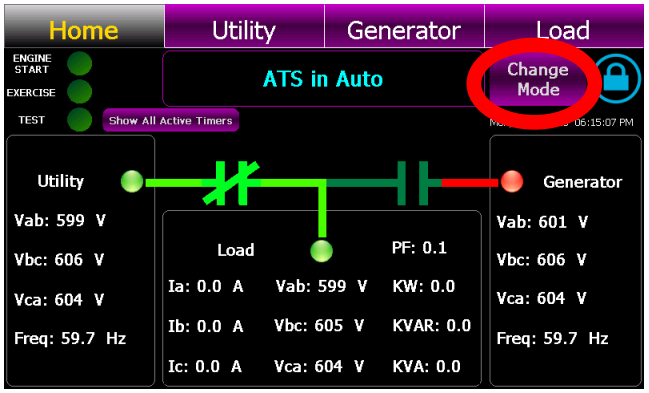


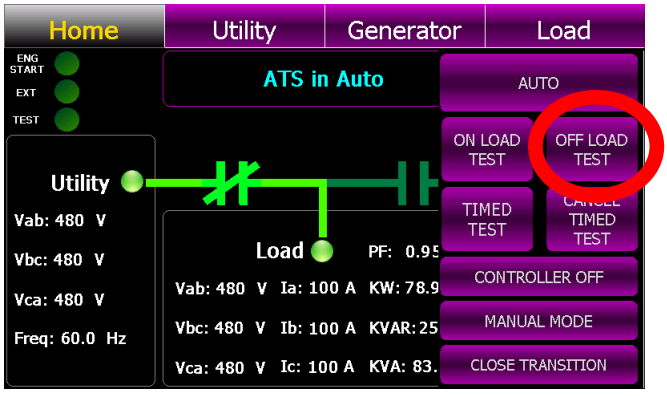
To cancel On Load Test, press the "*Change Mode*" control button on the GHC Home Page and select "RETURN TO AUTO" mode from the available list of modes as shown below. The "Test" and "Engine Start" lights on the upper left-hand corner of the screen will go off and the load will re-transfer back to the utility power per Automatic Sequence.



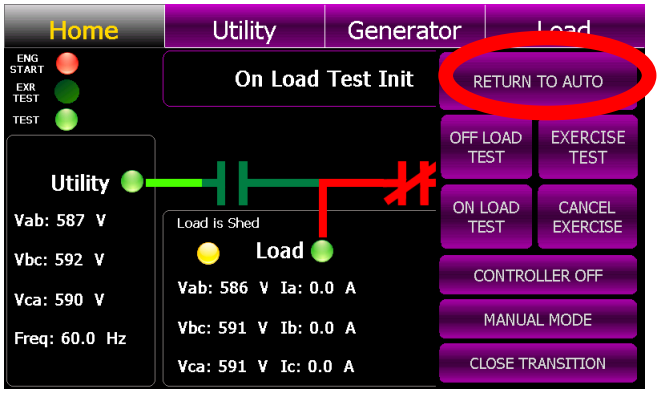
4.4. OFF LOAD TEST INSTRUCTIONS (GENERATOR NO LOAD TEST)

To perform an "Off Load" Test mode to run the generator set without transferring on load, press the "*Change Mode*" control button on the GHC Home Page and select "OFF LOAD TEST" mode from the available list of modes as shown below. The "TEST" light on the upper left-hand corner of the screen will turn Yellow to indicate mode is activated and the "ENGINE START" light will turn Red. The generator will start and transfer on load per Automatic Sequence. The generator will start and will run continuously.



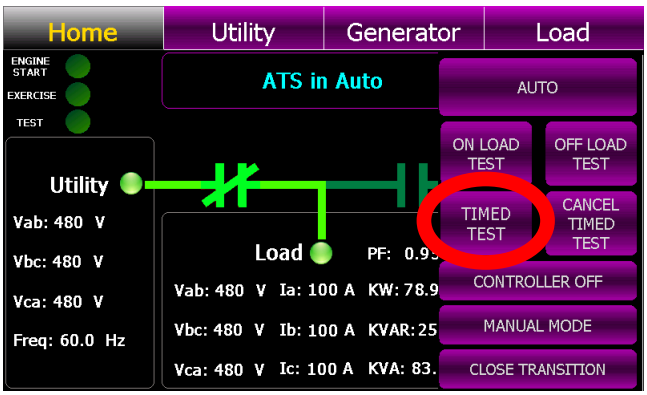


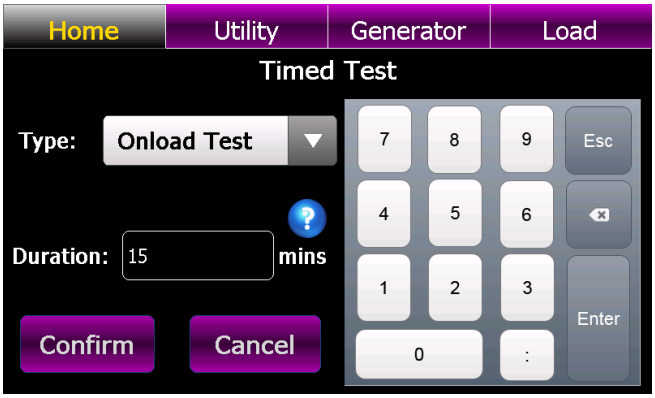
To cancel the "Off load" Test, press the "*Change Mode*" control button on the GHC Home Page and select "*RETURN TO AUTO*" mode from the available list of modes as shown below. The "Engine Start" light on the upper left-hand corner of the screen will go off and the generator set will stop.



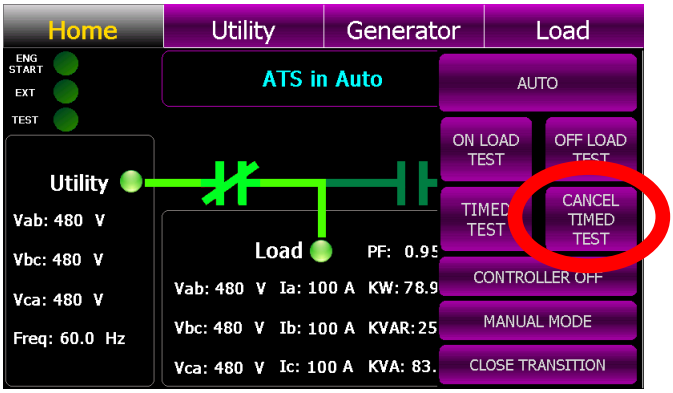
4.5. TIMED TEST INSTRUCTION

To perform a TIMED TEST, press the "*Change Mode*" control button on the GHC Home Page and select "*TIMED TEST*" mode from the available list of modes as shown below. A Pop-up screen will appear as shown below. Enter in desired type of test (i.e. ONLOAD or OFFLOAD) and the duration time in minutes. Once the "*Confirmed*" button is pressed, the "TEST" light on the upper left-hand corner of the screen will turn Yellow to indicate mode is activated and the "ENGINE START" light will turn Red. The generator will start and if selected for On Load test, the generator will transfer on load per automatic sequence and remain operating on load for the duration of time entered, then will automatically re-transfer back to the utility supply.



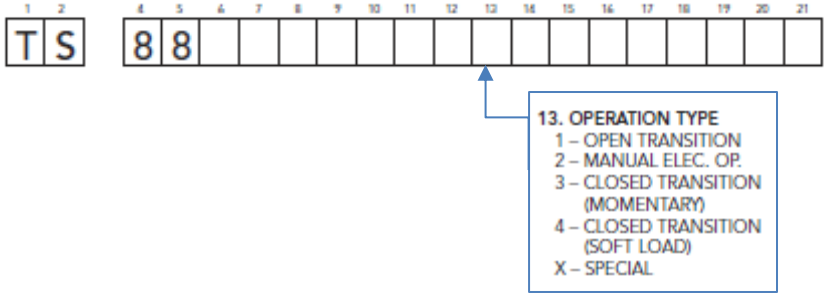


To cancel TIMED TEST mode, press the "*Change Mode*" control button on the GHC Home Page and select "*CANCEL TIMED TEST*" mode from the available list of modes as shown below.

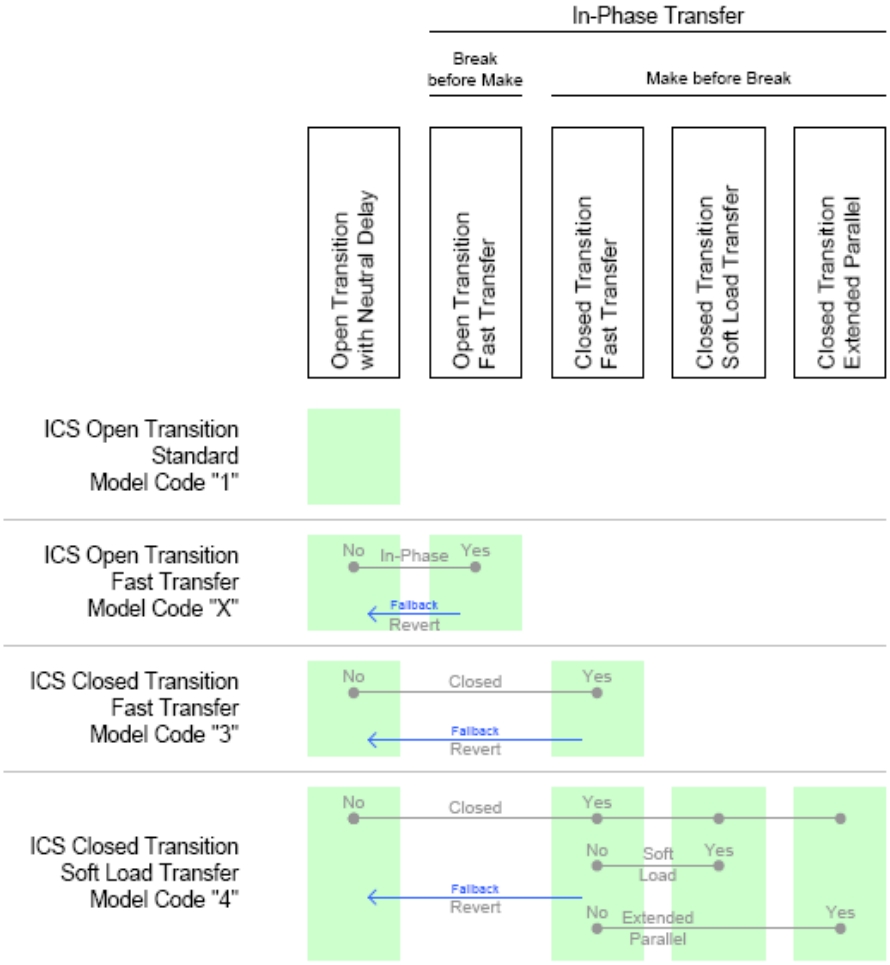


4.6. OPEN/CLOSED TRANSITION TRANSFER OPERATION

The ATS may be supplied with a number of different Open or Closed Transition Transfer operational features. The ATS model code depicts the options available as shown below:



Operational behavior of an ATS equipped with these different features is depicted in the following diagram:

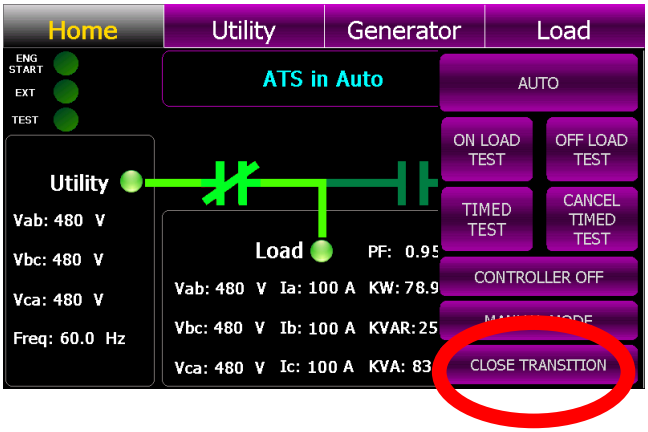


4.6.1. OPEN TRANSITION IN-SYNC TRANSFER OPERATION (MODEL X)

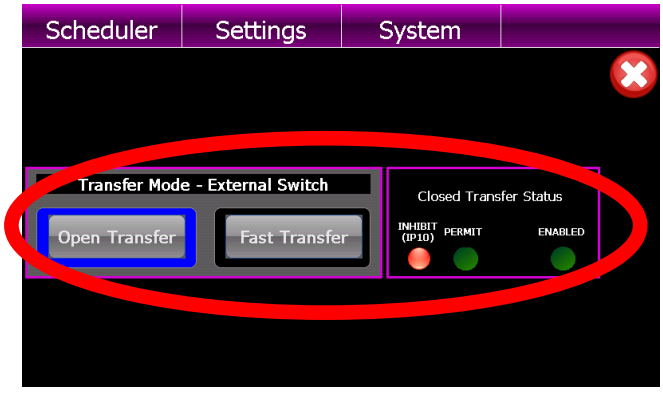
If the ATS is supplied with ATS Model X feature (i.e. Open Transition – In-sync Transfer), the ATS will operate as per automatic sequence of operation (open transition) however all transfers will occur using in-sync transfer control sensing instead of neutral delay control logic. All In-sync transfer operations will occur only when both sources of power are available and within normal operating limits. **Note**: Open Transition In-sync Transfer operation is only possible if the ATS mechanism is equipped for in-sync operation and optional feature is enabled in Settings. Refer to Section 5.11.26 for further details.

4.6.2. CLOSED TRANSITION OPERATION (FAST TRANSFER MODEL 3)

If the ATS is supplied with Closed Transition Transfer –Fast Transfer (i.e. Model 3) features, the CLOSED TRANSITION control selection will be provided on the GHC display via the Change Mode button selection.



When the CLOSED TRANSITION button is selected, a pop-up screen will appear showing operation mode selections as shown below;

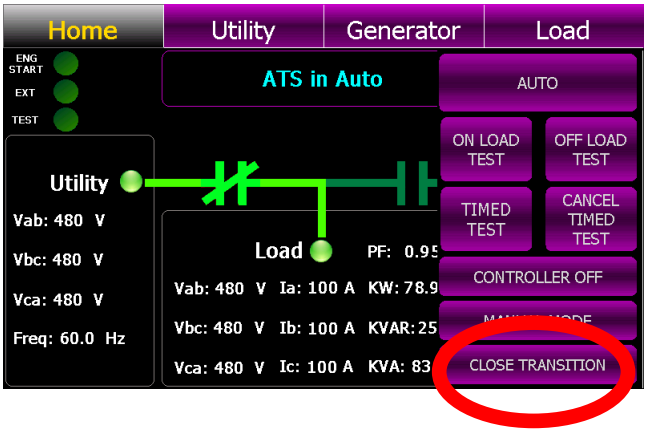


The left-hand side of the display shows the current position of the ATS control modes (i.e. Open Transfer or Fast (Closed) Transfer) based on current selection of the internal GHC display buttons or external control switch as maybe provided. To change between operating modes, select desired operation using the GHC display buttons or external switch as provided.

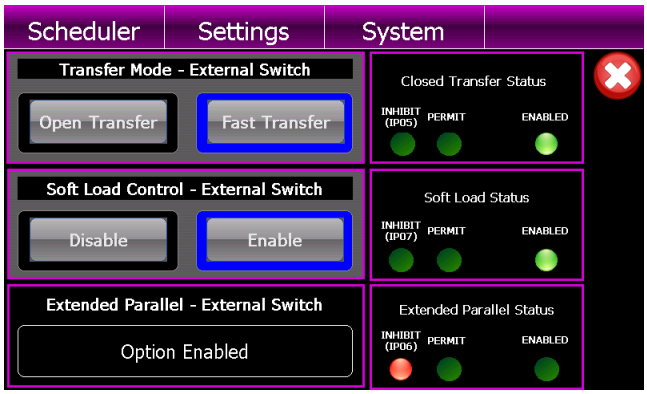
The right-hand side of the display shows the status of the Closed Transition Transfer "Permit" or Inhibit" signals. Depending on the operating status of the ATS, Closed Transition Transfer will be inhibited should only 1 source of supply be available or Protection Lock-out relay has been activated. **Note**: Closed Transfer operation is only possible if the optional feature is enabled in Settings. Refer to Section 5.11.17 for further details.

4.6.3. CLOSED TRANSITION OPERATION (SOFT-LOAD TRANSFER MODEL 4)

If the ATS is supplied with Closed Transition Transfer Soft-load Transfer (i.e. Model 4) features, the CLOSED TRANSITION control selection will be provided on the GHC display via the Change Mode button selection.



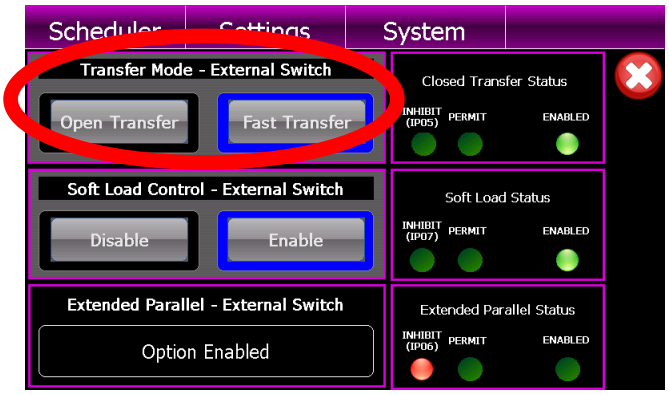
When the CLOSED TRANSITION button is selected, a pop-up screen will appear showing operation mode selections as shown below;



The left-hand side of the display shows the current position of the ATS control modes. Model 4 ATS provides 3 different operating mode via GHC Display button or external control switches as follows:

4.6.3.1. TRANSFER MODE SELECTION

Transfer mode selection may be done via internal GHC display buttons, or external control switch. This selection is shown on the GHC display as indicated below.

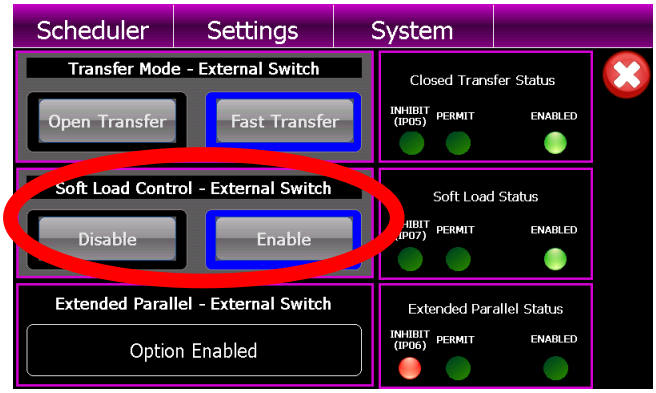


This provides operator selection of desired transfer modes as follows;

- **OPEN TRANSFER:** The ATS will only operate in an Open Transition transfer (i.e. break-before-make) sequence. The two sources will not be permitted to operate in parallel under any circumstance.
- **FAST TRANSFER:** The ATS will operate in a Fast (Closed) Transition transfer sequence if both sources are available. The two sources will be permitted to stay in parallel for a maximum of 100 milliseconds only.

4.6.3.2. SOFT-LOAD CONTROL SELECTION

Soft-Load transfer mode selection may be done via internal control push buttons, or external control switch. This selection is shown on the GHC display as indicated below.



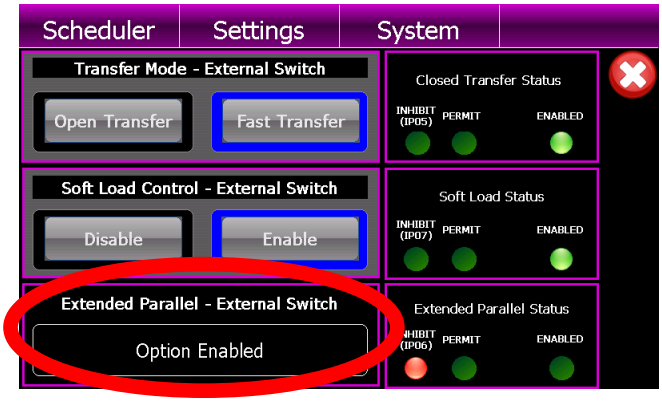
This provides operator selection of desired operating modes as follows;

- **DISABLE:** The Soft-Load operating mode is disabled in this mode. The ATS will operate in either Open or Closed Transition Fast Transition as selected.

- **ENABLE:** The ATS will operate in a Soft-Load Closed Transition transfer sequence if both sources are available. The two sources will be permitted to stay in parallel for a maximum of 10 seconds only to allow loads to be ramped between the sources by an external controller. **Note**: Soft-Load Closed Transition operation is only possible if the optional feature is enabled in Settings. Refer to Section 5.11.21 for further details.

4.6.3.3. EXTENDED PARALLEL SELECTION

Extended Parallel operating mode selection may be done via internal control push buttons, or external control switch. This selection is shown on the GHC display as indicated below.



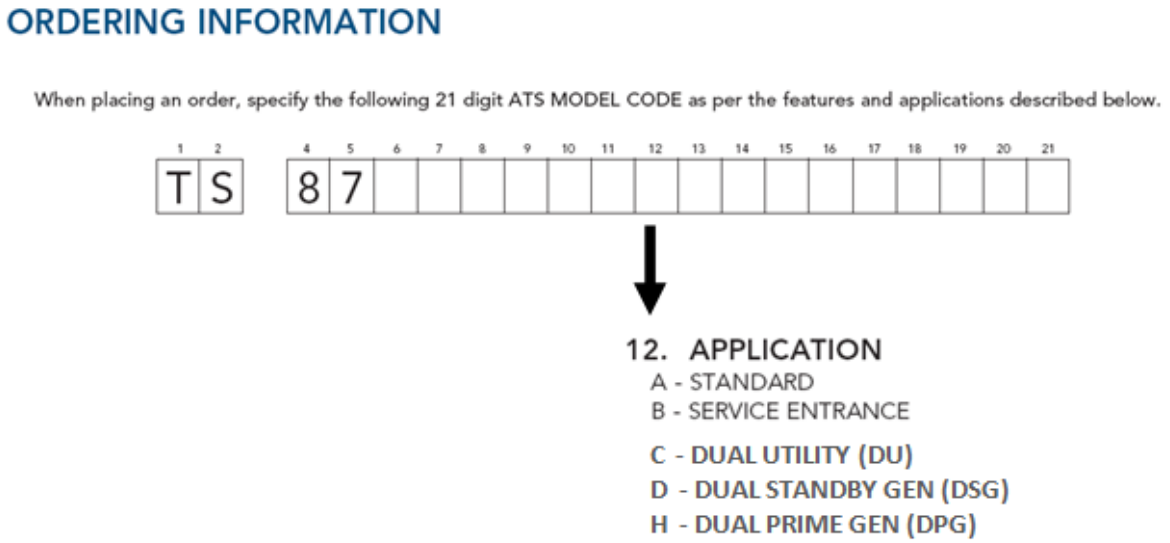
This provides operator selection of desired operating modes as follows;

- **OPTION DISABLE:** The Extended Paralleling operating mode is disabled in this mode. The ATS will operate in either Open or Closed Transition transfer as selected.

- **OPTION ENABLED:** The ATS will operate with both sources closed to the ATS load bus for an extended period of time as controlled by an external device. **Note**: Extended Parallel Closed Transition operation is only possible if the optional feature is enabled in Settings. Refer to Section 5.11.20 for further details.

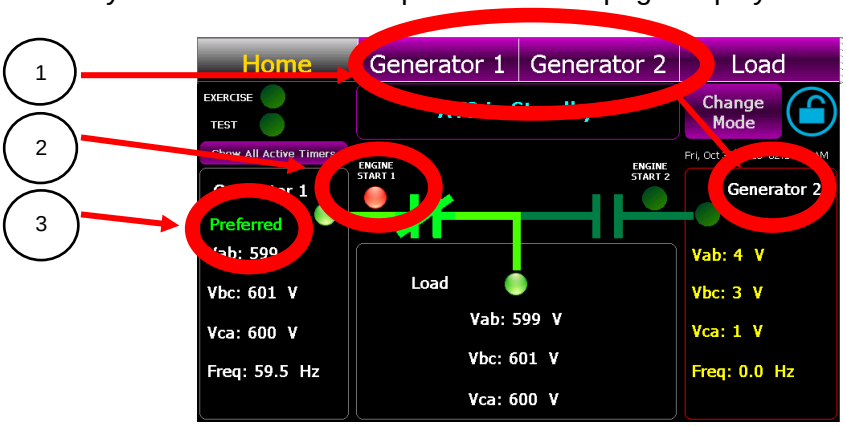
4.7. DUAL SOURCE ATS OPERATION

The ATS may be supplied with three different Dual Source Transfer operational features. The ATS model code depicts the options available as shown below:



Refer to Section 3.4.3 for automatic sequence of operation descriptions for the 3 types of dual source systems.

Dual source systems will have a unique GHC home page display as shown below:



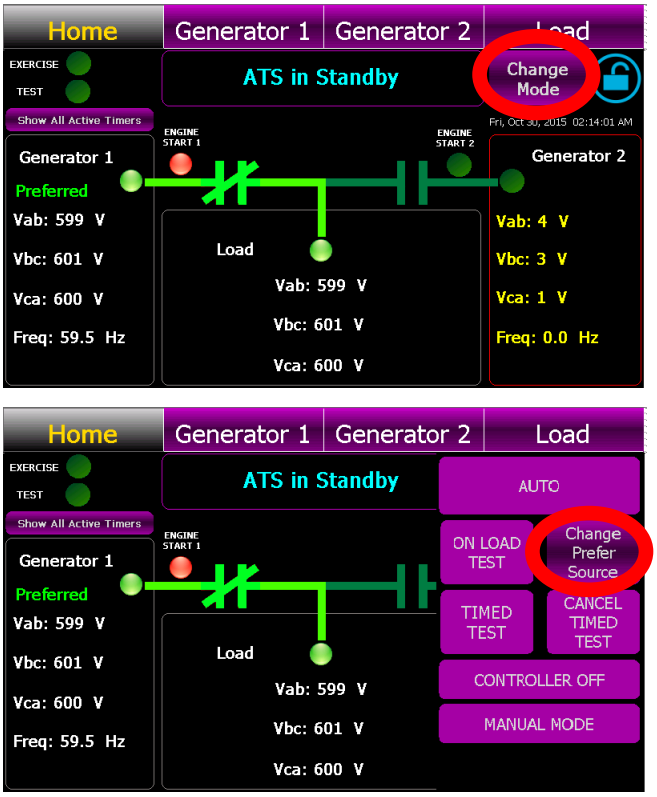
1. Source Names: Each source will have its unique name displayed on the top navigation bar as well as adjacent to the mimic bus source inputs. These names are configurable. Refer to Sections 5.10.9 - 5.10.10 for programming information

2. Engine Start Status: For dual generator applications, two engine start status lights are provided as indicated above. Red indicates when an engine start is activated.

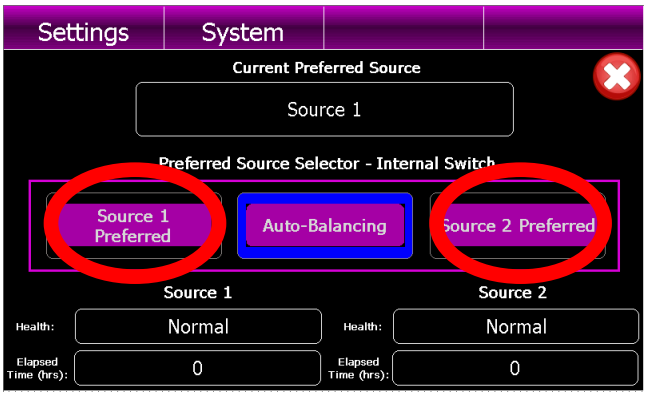
3. Preferred Source Indication: When a source is selected as the “Preferred source”, it will be indicated via text as indicated above. Preferred source selection maybe via External control switch or TSC 900 GHC display.

4.7.1. DUAL SOURCE - CHANGING PREFERRED UNITS (GHC CONTROL)

To change the "Preferred Source" on an ATS using the GHC screen source selection, press the "*Change Mode*" control button on the GHC Home Page and select "CHANGE PREFER SOURCE" from the available list of modes as shown below.



A Preferred Source selection screen will pop-up as shown below. Using the buttons provided, select the desired source. Once the new preferred source is selected, the transfer switch will automatically transfer to the new source as described in Section 3.4.3 provided it is operating at normal voltage and frequency.



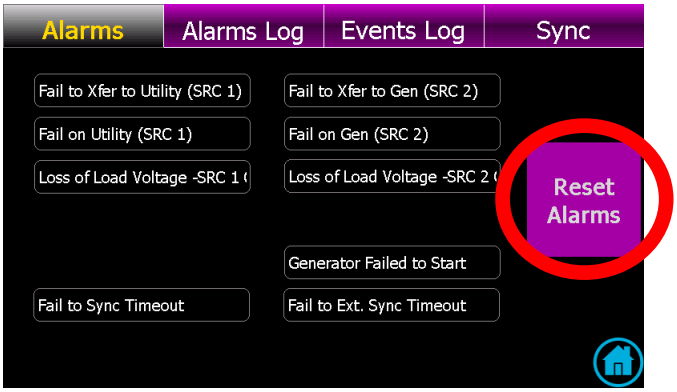
To operate the ATS in **AUTO-BALANCING** operation mode, select the AUTO-BALANCING button. Refer to Section 5.11.23 for programming details.

To exit the Preferred Source selection screen, press the Red X icon.

4.8. TRANSFER FAIL ALARM RESET

Should a Transfer fail alarm occur, the flashing ALARM ICON will appear on the GHC Home page as shown below. If the transfer switch is pre-programmed as Force Transfer, the ATS will automatically transfer to the alternate source (if available) and will still stay locked onto the alternate source unit the Transfer Fail alarm is manually reset by the ATS operator.

To determine which transfer alarm condition has been triggered, press the ALARM ICON to navigate to the ALARMS Page as shown below. Once the specific alarm condition has been determined and the necessary corrective action has been implemented, the alarm can be reset by pressing the “RESET ALARMS” button.

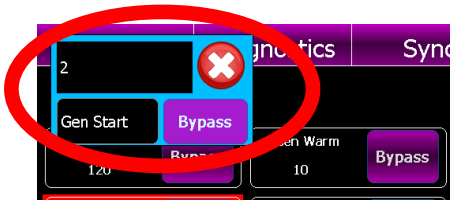


4.9. TIMER BYPASS

The following automatic sequencing time delays can be temporarily bypassed when the time function is active as shown on the TSC 900 GHC display:

- Utility Return Timer
- Cooldown Timer
- Warm up Timer
- Neutral Delay Timer
- Pre and Post Transfer Delay

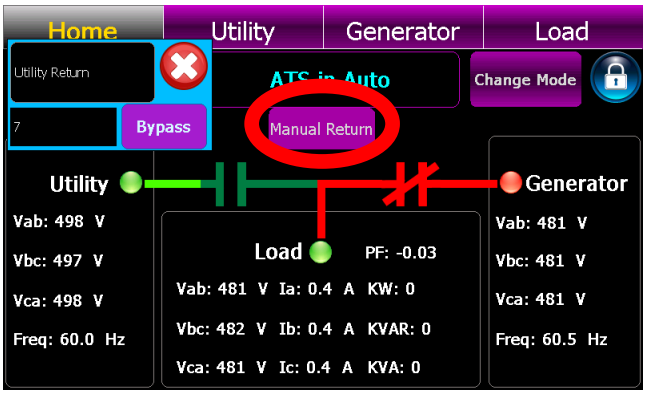
This feature is typically used when testing to avoid waiting for the complete duration of the time period. To activate the bypass function, press the BYPASS button when the timer is in operation as displayed on the screen.



NOTE: The Time delay functions will return to the normal time settings on the subsequent automatic operating sequence.

4.10. MANUAL UTILITY RETRANSFER CONTROL

If the TSC 900 is pre-programmed to provide a Manual return to the utility supply following a utility power failure, an operator can decide when to initiate the re-transfer sequence by pressing the “MANUAL RETURN” button when displayed on the GHC Home page as shown below.



NOTE:

The manual re-transfer sequence will only be initiated if the button is pressed and the utility supply (source 1) is at nominal voltage and frequency levels.

4.11. SERVICE DISCONNECT MODE

For transfer switches equipped with the Service Entrance Mode option, the TSC 900 is configured to provide additional logic for the application. When the TSC 900 controller receives an input signal from the door mounted Service Disconnect switch to transfer to the neutral position, the TSC 900 control outputs will change state to cause the ATS mechanism to move to the neutral position. The ATS operator must wait ~2 seconds to allow the ATS to move to the neutral position before selecting the “Disconnected” position. When the Service Disconnect switch is moved to the “Disconnected” position, all transfer logic control outputs from the TSC 900 are disconnected and the engine start signal is disabled. When the Service Disconnect switch is returned to the “Energized position, the TSC 900 control outputs are re-connected and will change state to cause the ATS mechanism to transfer back to the Utility position.

NOTE:

For Transfer Switches equipped with the Remote Load Dump Control (RLDC) feature, Digital input DI03 will be mapped to Service Disconnect Mode Initiated which is utilized to move the ATS to the neutral position when RLDC is activated.

4.12. PHASE UNBALANCE PROTECTION ALARM RESET

When the TSC 900 is programmed with Phase Unbalance protection enabled, should a transfer occur due to an out of limit phase unbalance condition, an alarm message will be shown on the TSC 900 GHC display “UTILITY (or GEN) UNBALANCED”. The Phase unbalance feature may be user programmed to provide two different re-transfer operating sequences (i.e. AUTO or MANUAL RETRANSFER). When the “AUTO” re-transfer mode is selected, the load will be automatically re-transferred back to the original source and does not require operator intervention. When the “MANUAL” retransfer mode is selected, a re-transfer back to the original source will not occur until the ALARM RESET button is pressed by ATS operator. For further details on phase unbalance programming refer to Section 5.13.7 up to 5.13.10.

NOTE: When in the MANUAL RETRANSFER mode, if the alternate source fails, the alarm lockout will not be bypassed inhibiting the load to re-transfer back to the original source even if within limits. The reason the re-transfer is inhibited is phase unbalance is generally only detected when load is applied to the source and the condition will appear to clear when the load is removed, as such allowing a re-transfer to the failed source previously determined to have a phase balance fault will only result in multiple unnecessary transfers of the load between sources. Retransfer is set to lockout and requires operator intervention.

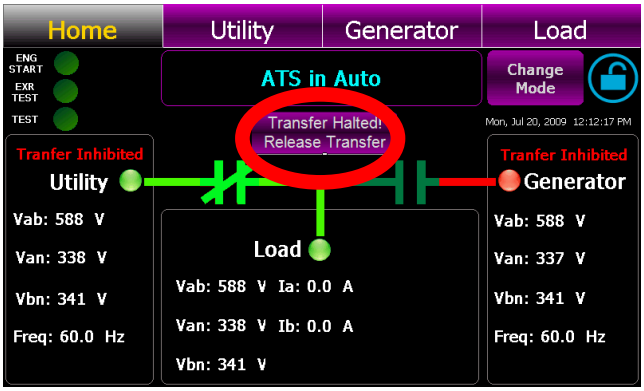
4.13. TRANSFER HALTED ALARM RESET

Should a transfer switch failure occur during a transfer to a new intended source, a “TRANSFER HALTED” alarm will be posted to the GHC home screen as shown below. The transfer switch will remain in this current position until the Transfer Halted condition is manually reset by ATS operator utilizing the RELEASE TRANSFER reset button on the GHC home page.

NOTE:

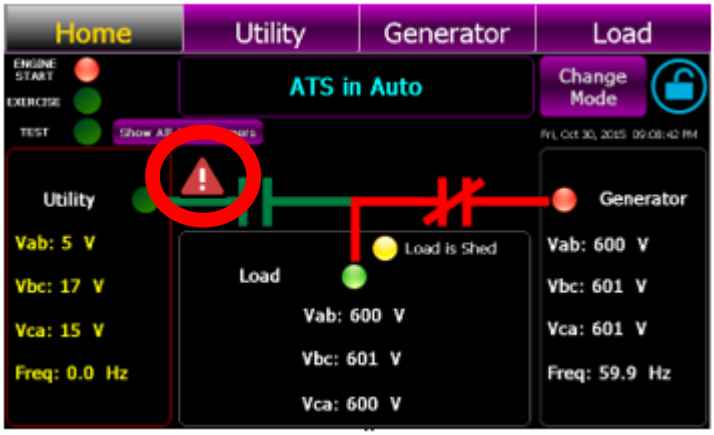
The TRANSFER HALTED condition will be initiated by one of the following operating conditions:

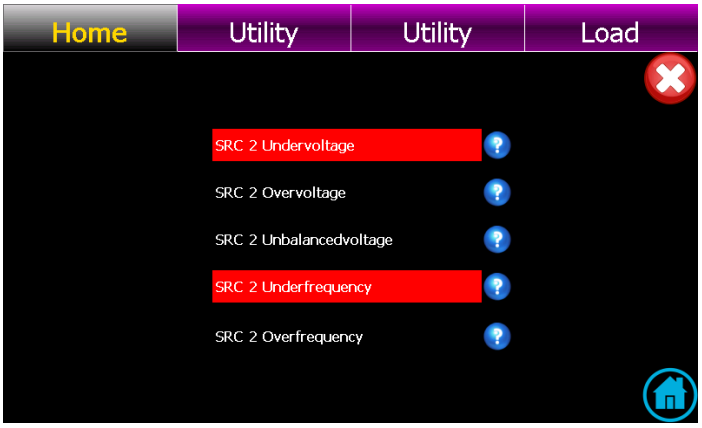
- Power Switching Device fail to close or open
- Reverse Phase Rotation between connected sources
- Phase unbalance alarm



4.14. ABNORMAL SOURCE ALERT

Should an abnormal source condition be detected by the TSC 900, a red Source Alert triangle Icon will automatically start flashing on the home screen as shown below. To view which specific condition has triggered the alert, press the alert Icon and a pop-up screen will be displayed as shown below. The Abnormal Source Alert is provided for both Utility (SRC 1) or Gen (SRC 2) and will automatically reset should the source return to within normal limits. The alert does not require resetting for automatic operation to resume.





5. PROGRAMMING INSTRUCTIONS

5.1. PASSWORD SECURITY DESCRIPTION (USERS ADMIN)

To prevent un-authorized access, users are required to “Login” in order to:

- Acknowledge and reset alarms
- Change operating modes
- Change Configuration settings
- Manage Users
- Map Inputs/Outputs

The device security is organized in groups. Using the Users Management screen, a device Administrator can create new users, enable and disable access for existing users. There is one default user created for every group: admin, power and user. It is the responsibility of the installer to ensure the default passwords are changed during ATS commissioning.

Group Name	Rights	Default User Login	Default Password
Administrators	Allowed to manage users	admin	pass
Power Users	Allowed to change ATS mode, send commands in the system and modify settings	power	pass
Users	Acknowledge and reset alarms, Manual Return and Un-halt the switch after a failure	user	pass

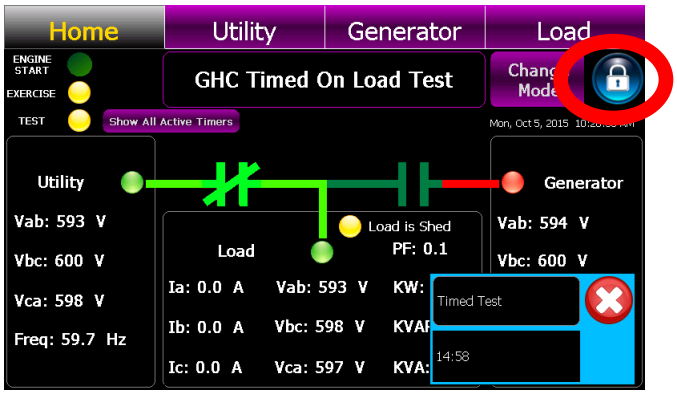
Once a user logs in they are not automatically logged out. Action attempts to functions that require elevated rights will trigger a pop-up message box

Note on Privacy: The GHC is not storing user passwords. Using an encryption mechanism, a hash of the UserID + Password+ encryption key is created and stored. During the login process the UserID + the provided password + key is used to rebuild the hash and compare with the stored one.

5.2. USER LOGIN PROCEDURE

With the transfer switch energized, follow the procedure below to Login to the TSC 900 controller:

- Navigate to the “Home” Page below and select the Locked Icon as shown below



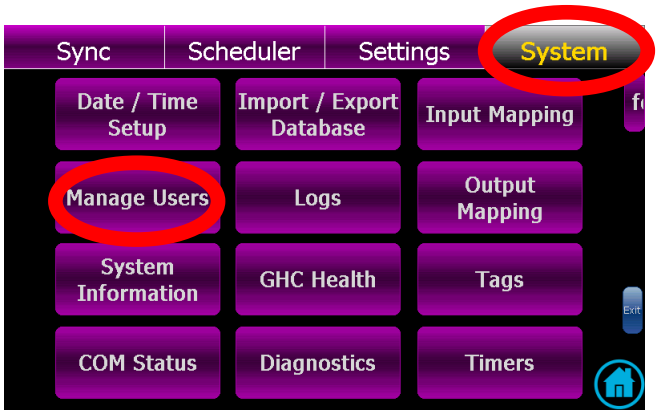
- The Login entry screen automatically pops-up as shown below. Select User Name drop down box and choose desired group, then type in password, then select “*Apply*” button. **Note**: Initial Factory Default Password is “***pass***”

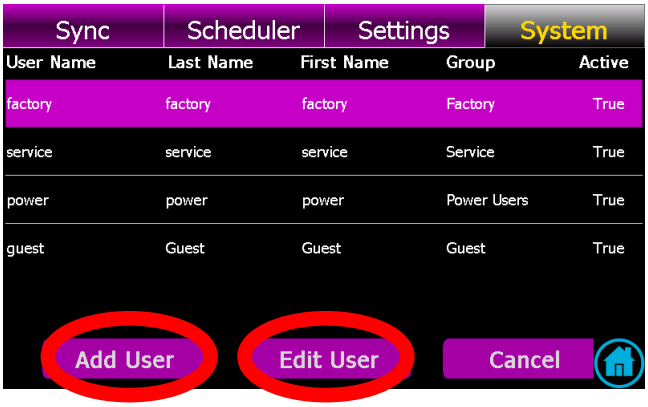
- A Login confirmation screen will pop-up if attempt was successful. Select Return to go back to the Home Page.

5.3. ADMINISTRATOR PASSWORD MANAGEMENT PROCEDURE

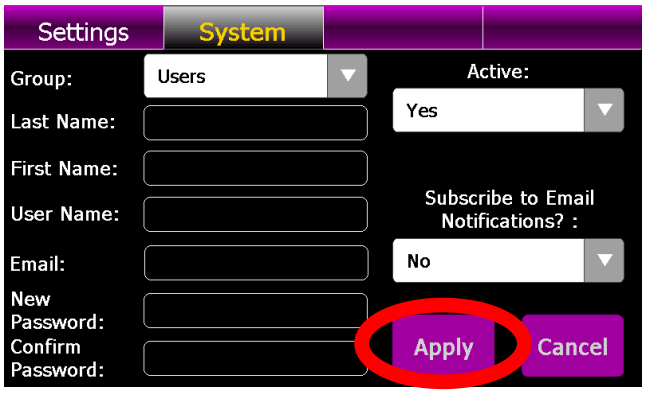
With the transfer switch energized, follow the procedure below to add or edit a list of ATS users.

- Navigate to the “System” Page and select “Manage Users” as shown below
- When the “Manager Users” button is pressed, the following pop-up screen will appear. This page will indicate which existing users have been entered already and new users to be added or existing users to be edited. Select desired action button (i.e. Add User or Edit User)





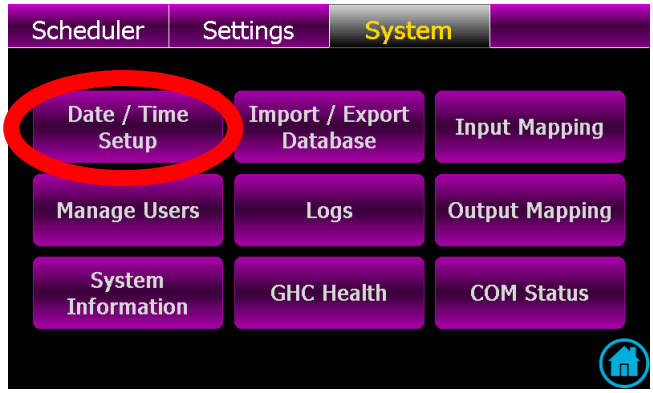
- To Add a user, press “Add User” button and the following pop-up screen will appear. Complete the information as listed, then press Apply to accept the change.



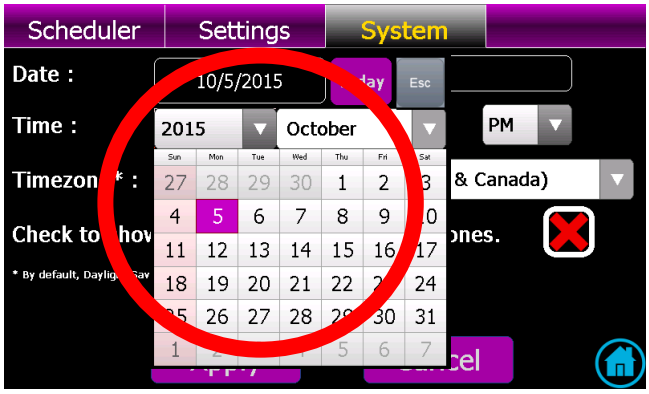
5.4. SYSTEM TIME/DATE ADJUSTMENT

To adjust the TSC 900 controller's internal time clock, follow the detailed procedure below.

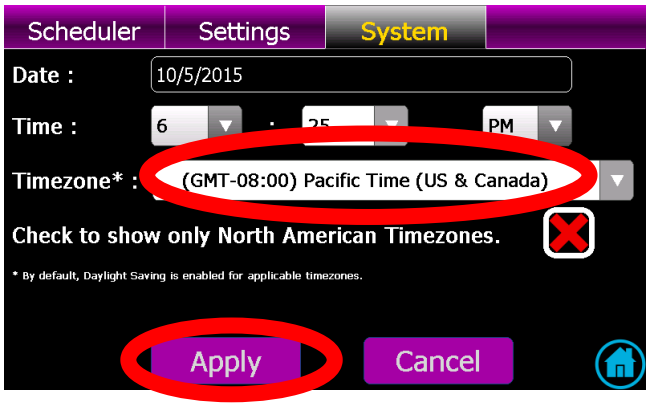
- Navigate to SYSTEM screen and press TIME/DATE SETUP button as shown below.



- Select Date field and a calendar will automatically pop-up to allow selection of day, month and year as shown below.



- Select Time fields and drop down lists will appear to allow selection of desired hour, minute and AM/PM settings.
- Select Time zone field and a drop down list will appear to allow selection of desired time zone. **Note:** To show only North American Time Zones, select check box as shown below



- Once correct time/date & time zone is entered, then use the Apply button to accept the change.

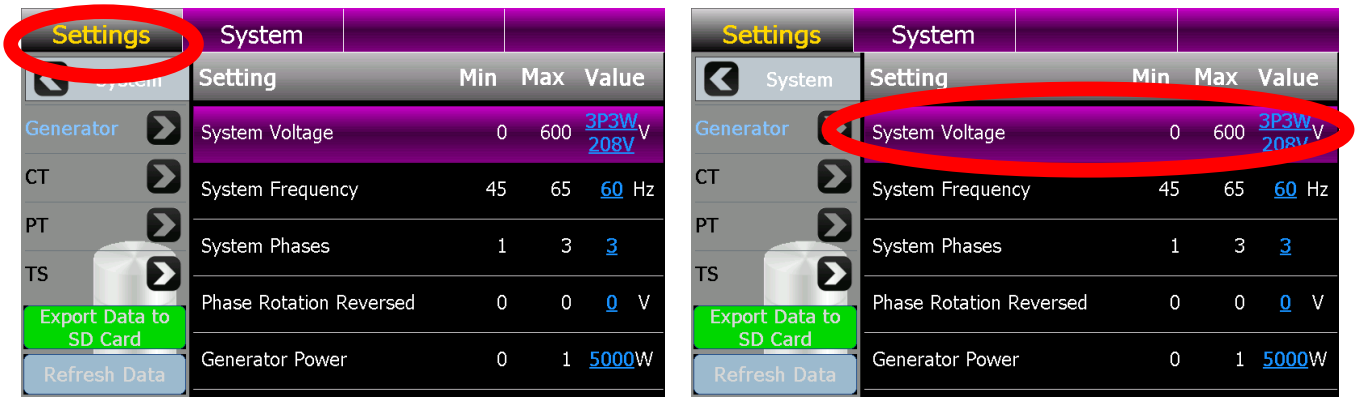
5.5. VOLTAGE CHANGE PROCEDURE

To change system voltage on the TSC 900 controller, the transfer switch must be energized to provide control power to the controller to allow software programming. If safe to do so, energize Transfer Switch on either Utilty or Generator sources and follow the programming procedure shown below.

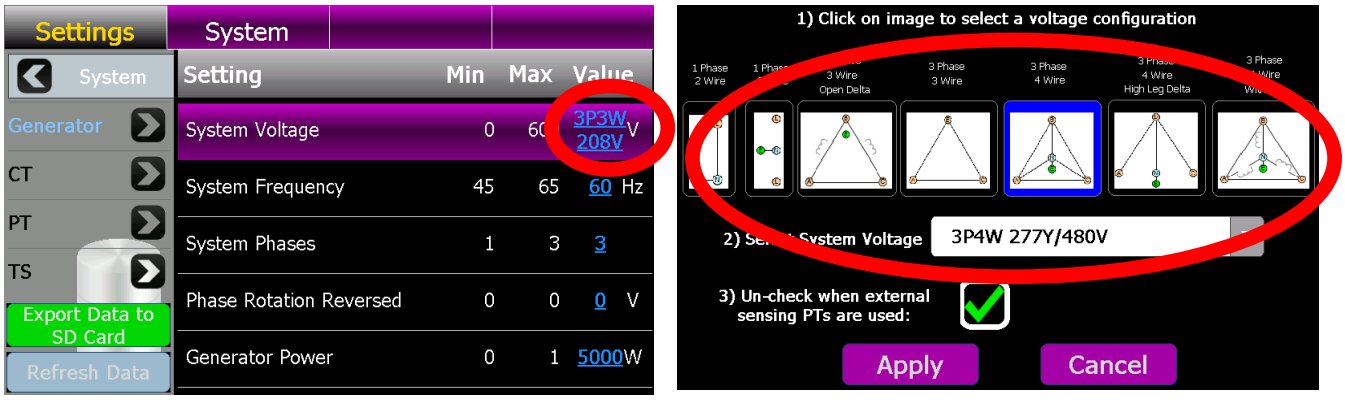
NOTES:

1. The following instructions detail re-programming the TSC 900 controller only. Additional procedures are required to change the voltage sensing transformer taps inside the ATS. Refer to separate ATS model instructions.
2. The TSC 900 controller does not contain any voltage jumpers on the printed circuit board. All voltage changes are done via software programming only.

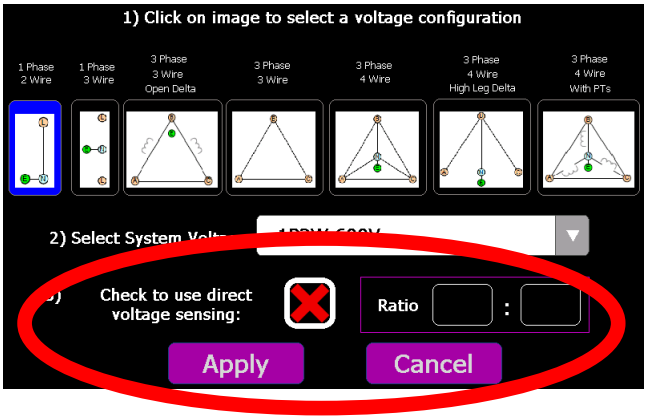
- Login to the TSC 900 with a level of “POWER” or “ADMIN” as described in Section 5.2.
  Note: Initial Factory Default Password is “***pass***”
- Once successfully logged in, From the TSC 900 DISPLAY Home Page, navigate to the “**Settings**” Page shown below and select “**System Voltage**” parameter as shown below.



- On the System Voltage Row, select the type of system configuration (i.e. wye or delta) per voltage diagrams provided, then select the applicable voltage from the drop down list as shown below. If the desired voltage is not listed, select “Custom” and enter the Line to Line System voltage. For a complete list of voltage configurations supported, refer to Section 2.4



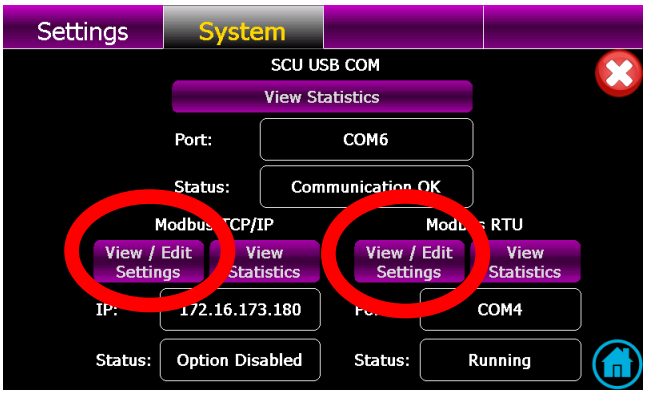
- If utilizing external voltage sensing potential transformers, un-check the identified PT box, then enter the applicable PT primary and secondary winding voltages as shown below. The controller will calculate the required PT ratio for the application.



- To confirm the change, press the “Apply” button.

5.6. REMOTE COMMUNICATION SETUP

To adjust the TSC 900 controller's remote communication settings, navigate to the Systems Page, then select the Communication Status page. The following page will be displayed. To change settings, select the required "View / Edit Settings" buttons as indicated below.



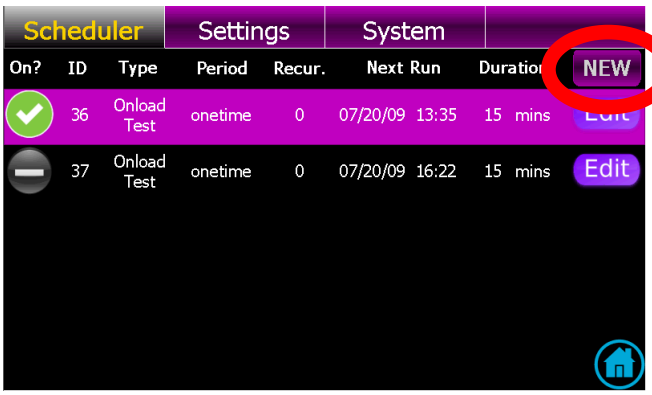
For further information on remote com settings and/or Modbus data addressing, refer to separate product manual PM0152 "TSC 900 MODBUS COMMUNICATION MANUAL".

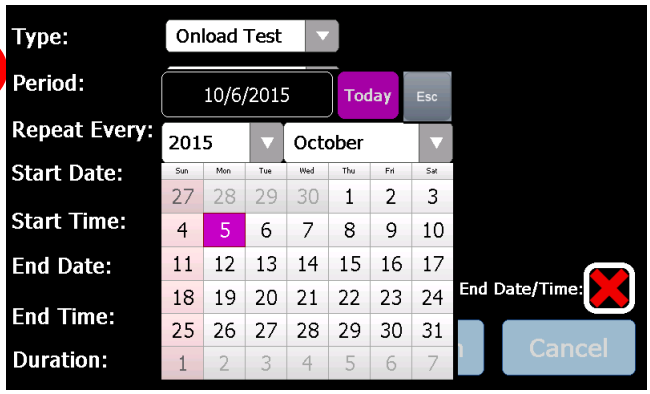
5.7. EXERCISE TIMER SETUP

The TSC 900 controller has a built-in calendar based programmable exercise timer. The exercise timer is fully programmable for, day of week, time of day, duration of the test and type of test mode (i.e. On Load or Off Load). The exercise timer utilizes the TSC 900 GHC internal real-time clock for referencing all timing functions. The GHC real-time clock utilizes a battery back-up power source to retain correct time/date settings during short duration utility power failures.

5.7.1. ADDING NEW EXERCISE SCHEDULE EVENT

- From the GHC Home Page, navigate to the GHC "Scheduler" Page and select NEW as shown below;

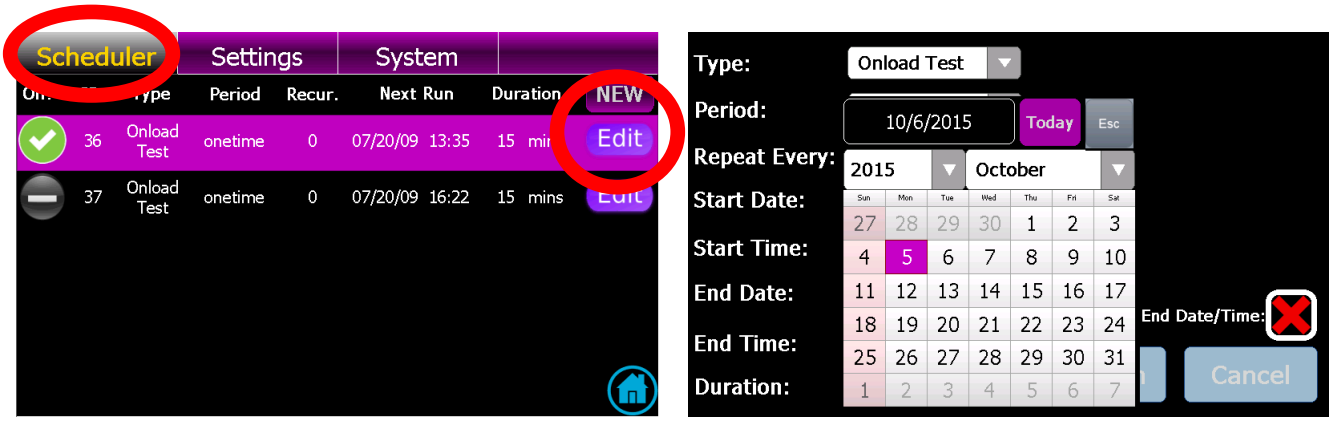




- Once in the Scheduler Editor page, select desired Exercise type (on load or off load), then select desired Exercise schedule (i.e. period, reoccurrence, start time, stop time, end date, end time and exercise duration).

5.7.2. EDITING EXISTING EXERCISE SCHEDULE EVENT

- From the GHC Home Page, navigate to the GHC "Scheduler" Page, select desired schedule (row) to be edited, then select EDIT button on the selected item as shown below;



- Once in the Scheduler Editor page, select desired Exercise type (on load or off load), then select desired Exercise schedule (i.e. period, reoccurrence, start time, stop time, end date, end time and exercise duration).

5.8. PROGRAMMABLE DIGITAL INPUT MAPPING

All 16 Programmable inputs can be mapped to a number of different parameters to suit the application. In addition, programmable inputs may be programmed with custom names to suit a specific application. The TSC 900 is provided with factory programmed default settings based upon the ATS configuration. Refer to the following sections for specific default program tables.

5.8.1. TS 870 STANDARD/SERVICE ENTRANCE INPUT DEFAULTS:

Inputs	GHC Descriptions	SCU TAG Names
IP01	Remote Test - Utility Power Fail Simulate	test.req.remote.a
IP02	Remote Alarm Reset	ctl.reset.req
IP03	Service Disconnect Mode Activated	ctl.discon.req.a
IP04	Utility Power Switching Device (USD) Tripped	tip.switch.tripped.1
IP05	Generator Power Switching Device (GSD) Tripped	tip.switch.tripped.2
IP06	Transfer Control in Manual	ctl.man.req.a
IP07	Not mapped	
IP08	Not mapped	
IP09	Not mapped	
IP10	Not mapped	
IP11	Not mapped	
IP12	Not mapped	
IP13	Not mapped	
IP14	Not mapped	
IP15	Inhibit Transfer to Utility (Source 1)	ilk.xfr.tosrc.1.inhibit
IP16	Inhibit Transfer to Generator (Source 2)	ilk.xfr.tosrc.2.inhibit

5.8.2. TS 870 DUAL SOURCE INPUT DEFAULTS:

Inputs	GHC Descriptions	SCU TAG Names
IP01	Remote Test - Source 1 Power Fail Simulate	test.req.remote.a
IP02	Remote Alarm Reset	ctl.reset.req
IP03	Service Disconnect Mode Activated	ctl.discon.req.a
IP04	SRC 1 Power Switching Device Tripped	tip.switch.tripped.1
IP05	SRC 2 Power Switching Device Tripped	tip.switch.tripped.2
IP06	Transfer Control in Manual	ctl.man.req.a
IP07	Not mapped	
IP08	Not mapped	
IP09	Not mapped	
IP10	Not mapped	
IP11	Not mapped	
IP12	Not mapped	
IP13	Source 1 Alarm Input	pfs.trouble.1
IP14	Source 2 Alarm Input	pfs.trouble.2
IP15	Source 1 Prime Unit Selected	pfs.req.1
IP16	Source 2 Prime Unit Selected	pfs.req.2

5.8.3. TS 880 (ICS) STANDARD/SERVICE ENTRANCE INPUT DEFAULTS:

Inputs	GHC Descriptions	SCU TAG Names
IP01	Remote Test - Utility Power Fail Simulate	test.req.remote.a
IP02	Remote Alarm Reset	ctl.reset.req
IP03	Service Disconnect Mode Activated	ctl.discon.req.a
IP04	Utility Power Switching Device (USD) Tripped	tip.switch.tripped.1
IP05	Not mapped	
IP06	Transfer Control in Manual (External Control	ctl.man.req.a
IP07	Not mapped	
IP08	Utility Power Switching Device (USD) Open*	tip.switch.opened.1
IP09	Generator Power Switching Device (GSD) Open*	tip.switch.opened.2
IP10	Not mapped	
IP11	Not mapped	
IP12	Not mapped	
IP13	Not mapped	
IP14	Not mapped	
IP15	Closed Transition Extended Parallel	ilk.xfr.tosrc.1.inhibit
IP16	Inhibit Transfer to Generator (Source 2)	ilk.xfr.tosrc.2.inhibit

5.8.4. TS 880 (ICS) CLOSED TRANSITION INPUT DEFAULTS:

Inputs	GHC Descriptions	SCU TAG Names
IP01	Remote Test - Utility Power Fail Simulate	test.req.remote.a
IP02	Remote Alarm Reset	ctl.reset.req
IP03	Service Disconnect Mode Activated	ctl.discon.req.a
IP04	Utility Power Switching Device (USD) Tripped	tip.switch.tripped.1
IP05	Closed Transition Extended Parallel	ilk.xfr.parallel.permit
IP06	Transfer Control in Manual	ctl.man.req.a
IP07	Transfer Control in Closed Transition Mode	ilk.xfr.closed.permit
IP08	Utility Power Switching Device (USD) Open*	tip.switch.opened.1
IP09	Generator Power Switching Device (GSD) Open*	tip.switch.opened.2
IP10	Closed Transition Inhibit (Utility Protection Relay	ilk.xfr.closed.inhibit.prot
IP11	Gen (Source 2) Unloaded	ctl.unloaded.2
IP12	Utility (Source 1) Unloaded	ctl.unloaded.1
IP13	In-Sync Transfer Permit	ctl.synced.ext
IP14	Closed Transition Soft-Load	ilk.xfr.soft.permit
IP15	Inhibit Transfer to Utility (Source 1)	ilk.xfr.tosrc.1.inhibit
IP16	Inhibit Transfer to Generator (Source 2)	ilk.xfr.tosrc.2.inhibit

5.8.5. PROGRAMMABLE INPUT FUNCTION LIST

The following input functions can be mapped to any programmable input. Note: inputs can be programmed only once (i.e. same input type cannot be utilized on multiple programmable inputs).

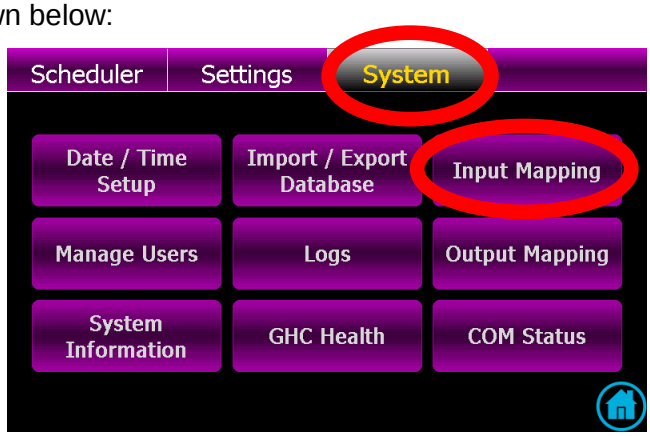
TagName	TagDescription
ctl.discon.req.a	Service Disconnect Mode Activated
ctl.inputs.i01	User Def Input 1
ctl.inputs.i02	User Def Input 2
ctl.inputs.i03	User Def Input 3
ctl.inputs.i04	User Def Input 4
ctl.inputs.i05	User Def Input 5
ctl.inputs.i06	User Def Input 6
ctl.inputs.i07	User Def Input 7
ctl.inputs.i08	User Def Input 8
ctl.inputs.i09	User Def Input 9
ctl.inputs.i10	User Def Input 10
ctl.inputs.i11	User Def Input 11
ctl.inputs.i12	User Def Input 12
ctl.inputs.i13	User Def Input 13
ctl.inputs.i14	User Def Input 14
ctl.inputs.i15	User Def Input 15
ctl.inputs.i16	User Def Input 16
ctl.man.req.a	Transfer Control in Manual
ctl.off.req.a	Non-Auto Off Request (Remote)
ctl.reset.req	Reset Alarm Request
ctl.rtn.req.a	Manual Return Request (Remote)
ctl.start.1.remote.a	Off Load Test Request (GEN 1)
ctl.start.2.remote.a	Off Load Test Request (Remote)
ctl.stdby.req	Standby Request
ctl.sync.ext.fail	Ext. Sync Check Failed
ctl.synced.ext	Ext. Sync Check Permitted
ctl.unfail.req.a	Unfail Request (Remote)
ctl.unhalt.req.a	Unhalt Request (Remote)
ctl.unloaded.1	SRC 1 Unload Permitted
ctl.unloaded.2	SRC 2 Unload Permitted

TagName	TagDescription
ilk.xfr.closed.inhibit	Closed Transition Mode Inhibit
ilk.xfr.closed.inhibit.prot	Closed Transition Inhibit Prot
ilk.xfr.closed.permit	Closed Transition Mode Permit
ilk.xfr.inphase.inhibit	In-Phase Transfer Inhibit
ilk.xfr.inphase.permit	In-Phase Transfer Permit
ilk.xfr.ndtbypass.inhibit	NDT Bypass Inhibit
ilk.xfr.ndtbypass.permit	NDT Bypass Permit
ilk.xfr.parallel.inhibit	Enable Extended Parallel Transfer Inhibit (CTTS Model 4)
ilk.xfr.parallel.permit	Enable Extended Parallel Transfer Permit (CTTS Model 4)
ilk.xfr.revert.inhibit	Revert to Open Transition Inhibited
ilk.xfr.revert.permit	Revert to Open Transition Permited
ilk.xfr.soft.inhibit	Soft Load ATS Mode Inhibit
ilk.xfr.soft.permit	Soft Load ATS Mode Permit
ilk.xfr.tosrc.1.inhibit	Inhibit Transfer to SRC 1
ilk.xfr.tosrc.1.permit	Permit Transfer to SRC 1
ilk.xfr.tosrc.2.inhibit	Inhibit Transfer to SRC 2
ilk.xfr.tosrc.2.permit	Permit Transfer to SRC 2
pfs.pause	Pause Automatic Source Alternation
pfs.req.1	SRC 1 Prime Unit Selected
pfs.req.2	SRC 2 Prime Unit Selected
pfs.trouble.1	SRC 1 Alarm Input
pfs.trouble.2	SRC 2 Alarm Input
test.req.remote.a	Remote Test Request
tip.switch.opened.1	SRC 1 Power Switching Device Opened
tip.switch.opened.2	SRC 2 Power Switching Device Opened
tip.switch.tripped.1	SRC 1 Power Switch. Device Tripped
tip.switch.tripped.2	SRC 2 Power Switch. Device Tripped
tmr.clr.remote.a	Clear Timers Request (Remote)

5.8.6. PROGRAMMABLE INPUT FUNCTION MAPPING

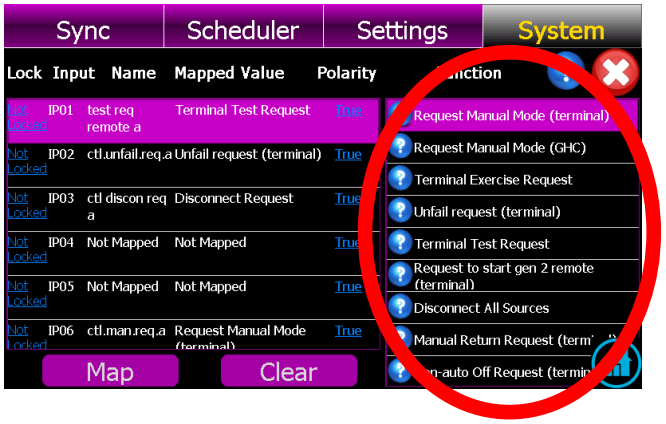
To edit programmable inputs, follow the procedure listed below:

a) From the GHC Home Page, navigate to the “SYSTEM” Page and select “Input Mapping” as shown below:



b) With the Input Mapping page displayed, press the EDIT button as shown below:

c) With the Input Mapping page displayed, select the desired programmable input # (row) to be edited, then select the desired function for mapping (scroll up or down to navigate to desired function):



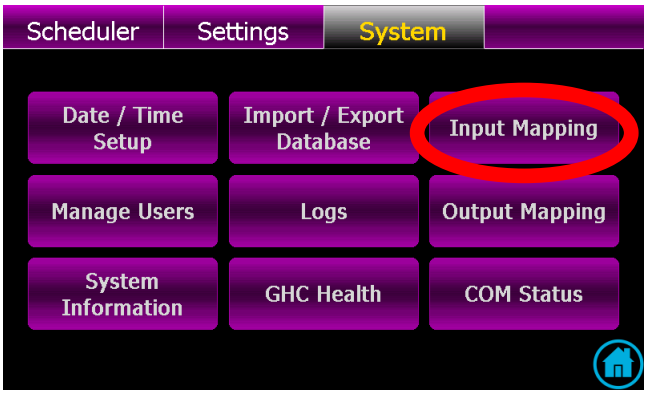
d) Once desired function is selected, press Map button to accept the change.

e) To return to the input mapping page once the change is accepted, press red X icon on the screen.

5.8.7. PROGRAMMABLE INPUT USER DEFINED CUSTOM NAME MAPPING

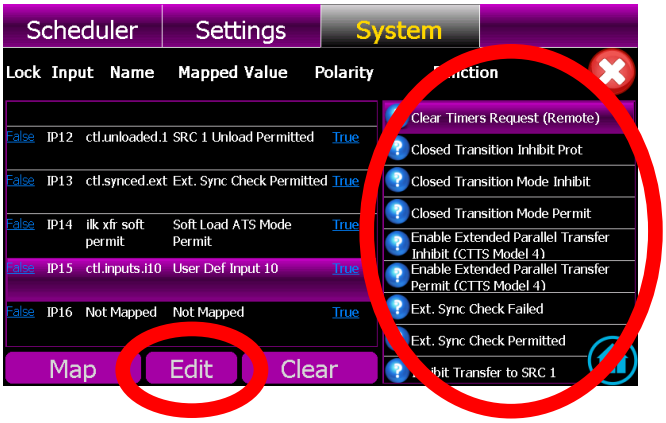
Up to 16 Programmable inputs may be programmed with custom names to suit specific applications (e.g. Low Fuel Level Alarm). To edit or add custom names to a programmable input, follow the procedure listed below:

a) From the GHC Home Page, navigate to the “SYSTEM” Page and select “Input Mapping” as shown below:

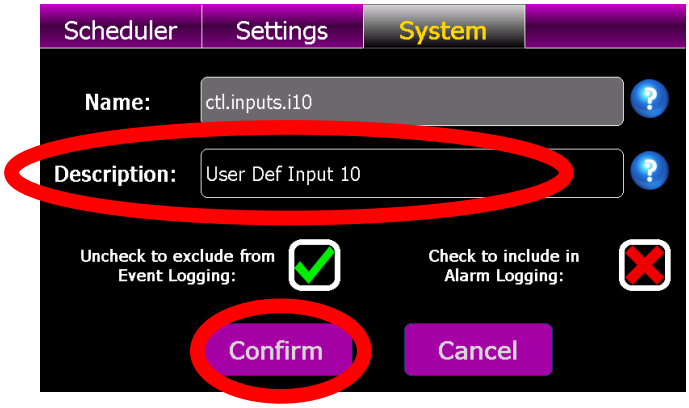


b) With the Input Mapping page displayed, press the EDIT button as shown below:

c) With the Input Mapping page displayed, select the desired programmable input # (row) to be edited, then select one of the available USER DEFINED 1-16 functions listed on the right-hand side of the screen. Once selected, use the “Edit” button as shown below.



d) The following Edit input screen will pop-up to allow entering a custom name into the description field. Once the custom name is entered, you can select if the programmable input is to be included or excluded from the TSC 900 alarms feature. Select the required check box as shown. Once complete, press the “Confirm” but to complete the entry.



5.9. PROGRAMMABLE OUTPUT MAPPING

All 8 Programmable outputs can be mapped to a number of different parameters to suit the application. The TSC 900 is provided with factory programmed default settings based upon the ATS configuration. Refer to the following sections for specific default program tables.

5.9.1. TS 870 STANDARD/SERVICE ENTRANCE OUTPUT DEFAULTS:

Outputs	GHC Descriptions	SCU TAG Names
OP01	Load on Utility	ctl.onsrc.1
OP02	Load on Utility	ctl.onsrc.1
OP03	Load on Generator	ctl.onsrc.2
OP04	Load on Generator	ctl.onsrc.2
OP05	Load Disconnect Contact (LDC) (Pre/Post	ctl.ldc
OP06	Transfer Fail Alarm	alm.any
OP07	ATS Not in Auto	!ctl.auto
OP08	Utility Power Fail (UPF)	trp.src.1.any

5.9.2. TS 870 DUAL SOURCE OUTPUT DEFAULTS:

Outputs	GHC Descriptions	SCU TAG Names
OP01	Load on Source 1	ctl.onsrc.1
OP02	Load on Source 1	ctl.onsrc.1
OP03	Load on Source 2	ctl.onsrc.2
OP04	Load on Source 2	ctl.onsrc.2
OP05	Load Disconnect Contact (LDC) (Pre/Post	ctl.ldc
OP06	Transfer Fail Alarm	alm.any
OP07	ATS Not in Auto	!ctl.auto
OP08	Source 1 Power Fail (UPF)	trp.src.1.any

5.9.3. TS 880 (ICS) STANDARD/SERVICE ENTRANCE OUTPUT DEFAULTS:

Outputs	GHC Descriptions	SCU TAG Names
OP01	Load on Utility	ctl.onsrc.1
OP02	Load on Utility	ctl.onsrc.1
OP03	Load on Generator	ctl.onsrc.2
OP04	Load on Generator	alm.any
OP05	Load Disconnect Contact (LDC) (Pre/Post	ctl.ldc
OP06	Not Mapped	
OP07	Not Mapped	
OP08	Not Mapped	

5.9.4. TS 880 (ICS) CLOSED TRANSITION OUTPUT DEFAULTS:

Outputs	GHC Descriptions	SCU TAG Names
OP01	Load on Utility	ctl.onsrc.1
OP02	Load on Utility	ctl.onsrc.1
OP03	Load on Generator	ctl.onsrc.2
OP04	Transfer Fail Alarm	alm.any
OP05	Load Disconnect Contact (LDC) (Pre/Post	ctl.ldc
OP06	Automatic Sync Initiate	ctl.sync.ext
OP07	Generator (Source 2) Unload	ctl.unload.2
OP08	Utility (Source 1) Unload	clt.unload.1

5.9.5. PROGRAMMABLE OUTPUT FUNCTION LIST

The following output functions can be mapped to any programmable output. Note: outputs can be programmed multiple times to provide additional output contacts of same type.

TagName	TagDescription
alm.any	ATS Common Fail Alarm
alm.gen.failtorun.1	Gen 1 Failed While Running
alm.gen.failtorun.2	Gen 2 Failed While Running
alm.gen.muststart.1	Gen 1 Standby Source Failed to Start
alm.gen.muststart.2	Gen 2 Standby Source Failed to Start
alm.onsrc.1	Src 1 Fail to Transfer Common Alarm
alm.onsrc.2	Src 2 Fail to Transfer Common Alarm
alm.xfr.detect.1	Load on Src 1 Limit Sw/Aux Contact Failure
alm.xfr.detect.2	Load on Src 2 Limit Sw/Aux Contact Failure
alm.xfr.fail	ATS Fail to Transfer Common Alarm
alm.xfr.mech.1	Src 1 Fail to Open/Close Alarm
alm.xfr.mech.2	Src 2 Fail to Open/Close Alarm
alm.xfr.sync	Fail to Drift Sync Timeout
alm.xfr.sync.ext	Fail to Externally Auto Sync Timeout
alm.xfr.trip.1	Loss of Load Voltage - Src 1 Contacts Open
alm.xfr.trip.2	Loss of Load Voltage - Src 2 Contacts Open
alm.xfr.unload.1	Src 1 Fail to Unload
alm.xfr.unload.2	Src 2 Fail to Unload
ctl.auto	Controller in Auto
ctl.breaker.1.trip	SRC 1 Trip Breaker
ctl.breaker.2.trip	SRC 2 Trip Breaker
ctl.discon.req.a	Service Disconnect Mode Activated
ctl.discon.req.b	Disconnect Request (GHC)
ctl.disconnected	Service Entrance Disc. Init
ctl.goto.discon	Disconnect All Sources
ctl.goto.man	De-Energize All Sources
ctl.halted	System Halted
ctl.ldc	Load Disconnect Contact (Pre/Post Transfer)
ctl.ldc.post	Load Post-Disconnect
ctl.ldc.pre	Load Pre-Disconnect
ctl.manual	Control Manual
ctl.off	Control Off
ctl.off.req.a	Non-Auto Off Request (Remote)
ctl.off.req.b	Non-Auto Off Request (GHC)
ctl.onsrc	Load on Either Source
ctl.onsrc.1	Load on SRC 1
ctl.onsrc.2	Load on SRC 2
ctl.outputs.o01	User Def Output 1
ctl.outputs.o02	User Def Output 2

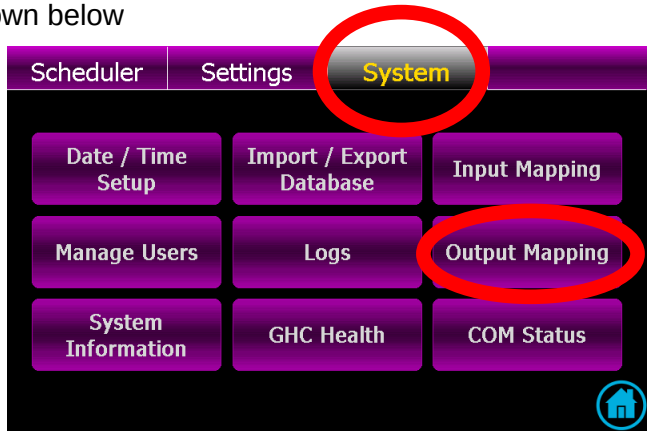
TagName	TagDescription
ctl.outputs.o03	User Def Output 3
ctl.outputs.o04	User Def Output 4
ctl.outputs.o05	User Def Output 5
ctl.outputs.o06	User Def Output 6
ctl.outputs.o07	User Def Output 7
ctl.outputs.o08	User Def Output 8
ctl.reset.req	Reset Alarm Request
ctl.rtn.req.a	Manual Return Request (Remote)
ctl.rtn.req.b	Manual Return Request (GHC)
ctl.shed	Load is Shed
ctl.src.1.avail	SRC 1 Available
ctl.src.2.avail	SRC 2 Available
ctl.start.2.remote.a	Off Load Test Request (Remote)
ctl.start.2.remote.b	Off Load Test Request (GHC)
ctl.stdby.req	Standby Request
ctl.sync.ext	Auto Sync Initiate
ctl.sync.ext.fail	Ext. Sync Check Failed
ctl.synced.ext	Ext. Sync Check Permitted
ctl.transferring	Control Transferring
ctl.underway	Transfer Underway
ctl.unload.1	SRC 1 Unload Initiate
ctl.unload.2	SRC 2 Unload Initiate
ctl.unloaded.1	SRC 1 Unload Permitted
ctl.unloaded.2	SRC 2 Unload Permitted
ctl.waiting	Wait for Sync
ena.xfr.closed	Closed Transfer (Model 3/4)
ena.xfr.inphase	In-Phase Transfer (Model X)
ena.xfr.ndtbypass	Neutral delay timer bypass
ena.xfr.parallel	Enable Extended Parallel Transfer (CTTS Model 4)
ena.xfr.revert	Revert to Open Transfer
ena.xfr.soft	Enable Soft Load Transfer (CTTS Model 4)
ena.xfr.tosrc.1	Enable Transfer to SRC 1
ena.xfr.tosrc.2	Enable Transfer to SRC 2
exr.active	Exercise Active
exr.active.offload	Exercise Active Offload
exr.active.onload	Exercise Active Onload
exr.req.local	Local Exercise Request
exr.req.remote.a	Terminal Exercise Request
exr.req.remote.man	Manual Exercise Request (GHC)
ilk.xfr.tosrc.1.inhibit	Inhibit Transfer to SRC 1

TagName	TagDescription
ilk.xfr.tosrc.1.permit	Permit Transfer to SRC 1
ilk.xfr.tosrc.2.permit	Permit Transfer to SRC 2
sync.xfr.trigger	Sources are In-Phase
test.active	Test Active
test.active.local	Local Test Active
test.active.remote	Remote Test Active
test.req.remote.a	Remote Test Request
test.req.remote.b	GHC Test Request
tip.switch.onsrc.1	ATS on SRC 1
tip.switch.onsrc.2	ATS on SRC 2
tip.switch.opened.1	SRC 1 Power Switching Device Opened
tip.switch.opened.2	SRC 2 Power Switching Device Opened
tip.switch.tripped.1	SRC 1 Power Switch. Device Tripped
tip.switch.tripped.2	SRC 2 Power Switch. Device Tripped
tmr.rtn	Return to Preferred Source
tmr.stdby.pref	Wait for Preferred Source
tmr.util.rtn	UTIL Return
top.start.2	Engine Start Request SRC 2
top.switch.bksrc.1	Breaker 1 to output
top.switch.bksrc.2	Breaker 2 to output
top.switch.tosrc.1	SRC 1 to output
top.switch.tosrc.2	SRC 2 to output
trp.load.volt.black	Load Blackout Voltage
trp.shed.freq	Load Shed Freq Active
trp.shed.power	Load Shed kW Active
trp.src.1.any	SRC 1 Power Fail
trp.src.1.freq.over	SRC 1 Overfrequency
trp.src.1.freq.undr	SRC 1 Underfrequency
trp.src.1.volt.over	SRC 1 Overvoltage
trp.src.1.volt.reverse	SRC 1 Voltage Rotation Reversed
trp.src.1.volt.unbal	SRC 1 Unbalancedvoltage
trp.src.1.volt.undr	SRC 1 Undervoltage
trp.src.2.any	SRC 2 Power Fail
trp.src.2.freq.over	SRC 2 Overfrequency
trp.src.2.freq.undr	SRC 2 Underfrequency
trp.src.2.volt.over	SRC 2 Overvoltage
trp.src.2.volt.reverse	SRC 2 Voltage Rotation Reversed
trp.src.2.volt.unbal	SRC 2 Unbalancedvoltage
trp.src.2.volt.undr	SRC 2 Undervoltage
trp.sync.any	Synchronization Out-of-Spec

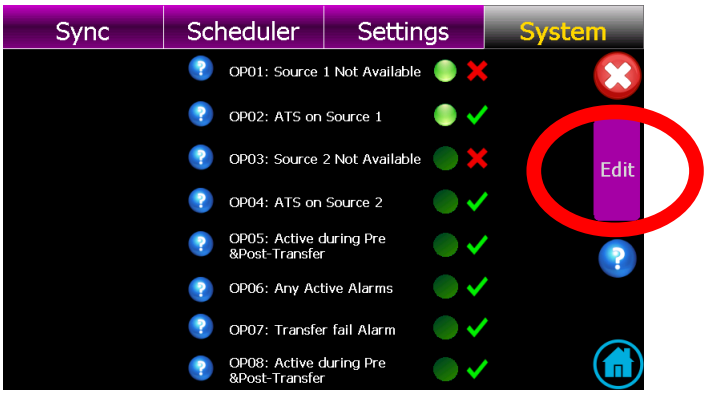
5.9.6. PROGRAMMABLE OUTPUT FUNCTION MAPPING

The edit the programmable outputs, follow the procedure listed below:

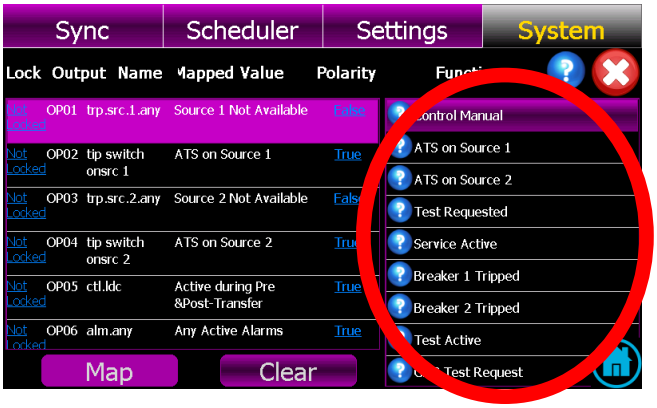
a) From the GHC Home Page, navigate to the “SYSTEM” Page and select Output Mapping as shown below



b) With the Output Mapping page displayed, press the EDIT button as shown below:



c) With the Output Mapping page displayed, select the desired programmable output # (row) to be edited, then select the desired function for mapping (scroll up or down to navigate to desired function):



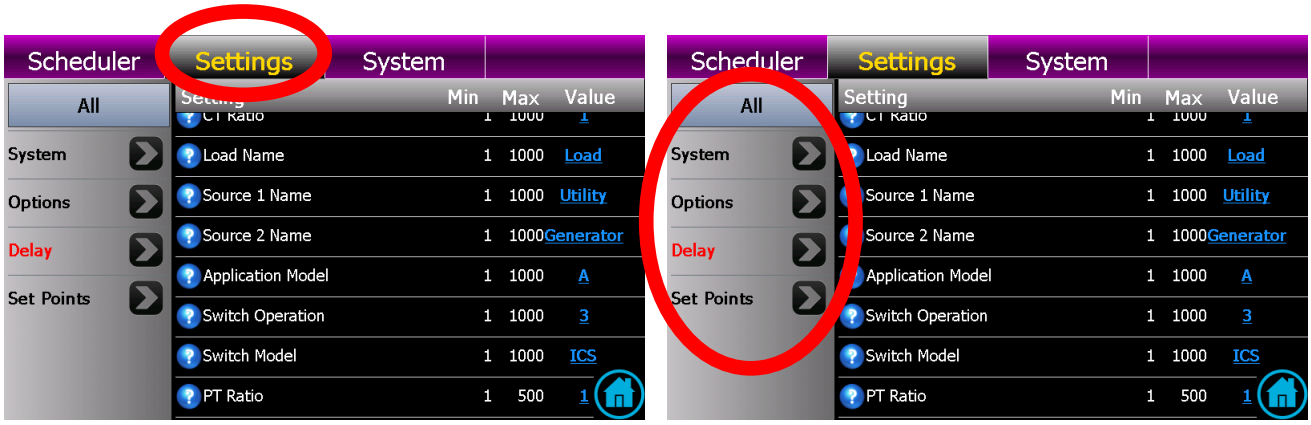
d) Once desired function is selected, press Map button to accept the change.

e) To return to the output mapping page once the change is accepted, press red X icon on the screen.

5.10. SYSTEM SETTINGS

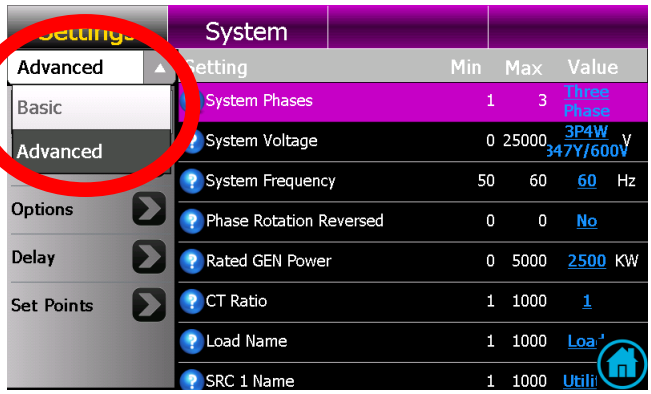
Note: For specific device settings and ranges, refer to Section 6 - Factory Default Programming.

The TSC 900 controller provides a flexible control system to allow specific operation for a wide range of applications. To program settings, navigate to the “Settings” page as shown below. Once on the Settings Page, select the group of Settings by adjusting the filter and scroll through available list of functions as available.



System settings are organized into the following 3 main groups as selected by drop-down list selection shown below:

- **Basic** - The Basic group contains the most commonly used settings to configure a standard transfer switch.
- **Advanced** – Advanced settings group contains less commonly used features which allow users to customize the operation of the transfer switch to suit the application.
- **Factory** - The Factory group of settings are only accessible through a Factory password and allow the ATS to be configured for specific applications.



Refer to Section 6 for a complete list of all Settings and their associated groups.

5.10.1. SYSTEM PHASES

Set to match the power distribution system used on the automatic transfer switch (i.e. either single phase or 3 phase system).

5.10.2. SYSTEM VOLTAGE

Set to nominal system voltage as expressed in “phase to phase” voltage. (E.g. A 347/600-volt system would be entered as “600”.) A drop down list of common voltages appears when the blue underlined value is selected. Refer to Section 2.4 for a listing of available AC system voltage sensing configurations possible with a TSC 900.

5.10.3. SYSTEM FREQUENCY

Set to nominal system frequency of either 50Hz or 60Hz.

5.10.4. PHASE ROTATION REVERSED

The Transfer switch is configured from the factory to operate on a normal *A-B-C* (Positive) phase rotating system (i.e. Option Feature set for “**NO**”). This allows for correct operation of voltage sensing and power metering option (if equipped) utilizing the TSC 900’s internal symmetrical component algorithms (i.e. positive/negative/zero sequence components). If the system is to operate on a *C-B-A* (Reverse) phase rotating system, set this feature to “YES”. **Note**: Automatic transfers between sources will be halted (i.e. blocked) if both source phase rotations are not matched. Refer to Section 4.13 for further operating information on Transfer Halt conditions.

5.10.5. RATED GENERATOR POWER

Set to match the 100% power rating of the connected Generator set in kilowatts. This setting is utilized for the kW Load Shed set point calculations.

5.10.6. CT RATIO (CURRENT TRANSFORMER)

When load bus current transformers (CTs) are utilized in the ATS, set to value of the specific ratio of the CT size being used (e.g. If using 400:5 rated CT’s, enter a value of 80).

5.10.7. PT RATIO (POTENTIAL TRANSFORMER)

For direct voltage sensing wiring connections from 208 to 600 volts, enter a value of “1.0”. When potential transformers are utilized for voltage sensing, enter the transformer ratio. (E.g. When using 600:120 potential transformers, enter a value of “5.0”). The ratio is programmable in tenths to allow minor correction factors to be used for non-standard potential transformer ratios.

5.10.8. LOAD NAME

The GHC Display can be configured to display a unique name in place of the text “Load” as desired. When a new text name is entered, it will be utilized throughout the GHC display in place of where the text “Load” was previously utilized.

5.10.9. SOURCE 1 (UTILITY) NAME

The GHC Display can be configured to display a unique name in place of the text “Source 1” (i.e. Utility) as desired. When a new text name is entered, it will be utilized throughout the GHC display in place of where the text “Source 1” was previously utilized.

5.10.10. SOURCE 2 (GEN) NAME

The GHC Display can be configured to display a unique name in place of the text “Source 2” (i.e. Gen) as desired. When a new text name is entered, it will be utilized throughout the GHC display in place of where the text “Source 2” was previously utilized.

5.10.11. APPLICATION MODEL

The GHC Display will display the ATS application model type it is configured to (i.e. STD, SE, DS etc.). This is a “read-only” parameter and cannot be changed.

5.10.12. SWITCH OPERATION

The GHC Display will display the Switch Operation type it is configured to (i.e. Open Transition, Closed Transition, Manually Operated, etc.). This is a “read-only” parameter and cannot be changed.

5.10.13. SWITCH MODEL

The GHC Display will display the Switch Model type it is configured to (i.e. ATS Mechanism Type S, T or ICS). This is a “read-only” parameter and cannot be changed.

5.11. OPTION SETTINGS

The TSC 900 has a number of options which can be set depending on type. To program Options, navigate to the “Settings” page. Once on the Settings Page, select the “OPTIONS” on the left side menu bar, and scroll through available list of functions as available.

5.11.1. SRC 2 (GEN) COMMIT TO TRANSFER

The TSC 900 transfer switch controller contains a “SRC 2 (GEN) COMMIT TO TRANSFER” logic selection feature. This feature is user programmable and allows 2 different functional settings which are described below:

NO (DISABLED): The transfer switch will <u>not</u> commit to transfer to the generator (SRC 2) after the engine start delay has expired, but will return to the utility supply if immediately restored.

YES (ENABLED): The transfer switch will commit to transfer to the generator (SRC 2) after the engine start delay has expired. “Selecting” the “ENABLED” mode will prevent numerous engine starting and stopping sequences if the utility supply is continuously fluctuating beyond the pre-set limits. The feature is automatically cancelled after expiry of the Gen Commit to Transfer timer (5 mins adjustable) should the generator fail to start.

5.11.2. ENABLE LOAD SHED ON UNDER FREQUENCY

When the Load Shed under frequency feature is enabled, the Load Shed control logic will utilize load frequency threshold set points to determine when a Load Shed condition is activated. Refer to Section 5.15 for programming the Load Shed frequency threshold set points.

5.11.3. ENABLE LOAD SHED ON OVER POWER

When the Load Shed over power feature is enabled, the Load Shed control logic will utilize load power (i.e. kW) threshold set points to determine when a Load Shed condition is activated. Refer to Section 5.15 for programming the Load Shed power threshold set points.

5.11.4. HALT OPERATION ON PHASE REVERSAL

When the Halt Operation on Reversed Phase Reversal is enabled, the ATS will not transfer between sources unless both sources match the selected phase rotation (i.e. both positive or negative rotation).

5.11.4.1. MANUAL SRC 1 (UTILITY) RETRANSFER CONTROL

The TSC 900 transfer switch controller contains a “MANUAL SRC 1 (UTILITY) RETRANSFER CONTROL” feature, which allows an operator initiated re-transfer sequence to occur when utility power has returned following a power failure. This feature is user programmable and allows 2 different functional settings which are described below:

NO (DISABLED): The transfer switch will automatically re-transfer back to the utility supply if within nominal pre-programmed limits and following expiry of the Utility Return Timer.

YES (ENABLED): The transfer switch will remain on the generator supply until system operators manually initiate the re-transfer sequence by utilizing the Manual Re-Transfer button on the GHC display home screen or utilizing a remote input push button wired into a programmable input configured for manual

re-transfer. NOTE: The transfer switch will automatically re-transfer back to the utility supply if the generator supply fails.

5.11.5. FORCE TRANSFER

The TSC 900 transfer switch controller contains a “FORCE TRANSFER” feature which can be enabled to allow the ATS to automatically force a transfer to the alternate source should an abnormal operating condition be detected with the ATS. The TSC 900 controller will detect abnormal conditions such as loss of ATS load voltage due to a tripped power switching device or the transfer mechanism limit switch is not in the correct state. The Force Transfer feature is user programmable and allows 2 different functional settings as described below:

NO (DISABLED): Force transfer to alternate source is disabled in this mode. If an abnormal operating condition is detected by the TSC 900 controller, a Transfer Switch Fail Alarm will be posted on the GHC display. The TSC 900 controller will keep the ATS mechanism in the current position and will take no further action. The alarm condition may be reset utilizing the Reset button on the GHC Alarm page.

YES (ENABLED): If an abnormal operating condition is detected by the TSC 900 controller, a Transfer Switch Fail Alarm will be posted on the GHC display and the controller will immediately force a transfer to the alternate source if available and within nominal limits. Note: “The transfer switch will remain on the alternate source indefinitely until the “Transfer Fail” alarm condition is manually reset on the GHC Alarm page”.

5.11.6. GHC SLEEP MODE TIMEOUT

The GHC display will automatically turn off and go in to a “sleep” mode to preserve display operating lifetime. The sleep mode will be activated if a key press is not activated within the pre-set time period. Touching the “Resume” button on the display will automatically reactivate the GHC display screen to full brilliance.

5.11.7. LOAD POWER METERING

If the ATS was purchased with the LPM (Load Power Metering) Option, the power metering can be enabled for display on the GHC by setting the value to YES.

5.11.8. MODBUS RTU

If the ATS was purchased with the Modbus serial (RTU) remote communication Option, the com port on the GHC can be enabled by setting the value to YES.

5.11.9. MODBUS TCP/IP

If the ATS was purchased with the Modbus TCP/IP Ethernet remote communication Option, the com port on the GHC can be enabled by setting the value to YES.

5.11.10. ENABLE SECURITY BYPASS

When the security bypass feature is enabled, it allows the ATS to be operated without a security login. The TSC 900 is supplied from the factory with this feature enabled to allow initial ATS operation during commissioning without the need for a security login. It is recommended to disable this feature once the ATS is turned over to the end user so that desired security passwords can be used. To enable the security bypass feature set the value to YES.

5.11.11. ENABLE NEUTRAL DELAY BYPASS

The TSC 900 transfer switch controller contains “NEUTRAL DELAY BYPASS” logic, which allows a shorter neutral delay timer period during transfer if the load bus voltage falls to safe levels before the transfer sequence is completed. This feature is user programmable and allows 2 different functional settings which are described below:

NO (DISABLED): The transfer switch neutral delay period will operate as per the Neutral Delay Timer setting.

YES (ENABLED): The transfer switch neutral delay period will be bypassed if the load bus voltage falls to safe levels before the transfer sequence is completed.

Note: the neutral delay timer will be bypassed in either “Enabled” or “Disabled” modes should the originating source voltage be in a de-energized (i.e. blackout) state prior to transfer.

5.11.12. ENABLE TRANSFERS TO SRC 1 (UTILITY)

The TSC 900 transfer switch controller contains “ENABLE TRANSFERS TO UTILITY” logic. This feature is user programmable and allows 2 different functional settings which are described below:

NO (DISABLED): The transfer switch will be inhibited from transferring to the Utility position.

YES (ENABLED): The transfer switch will be permitted to transfer to the Utility position.

5.11.13. ENABLE TRANSFERS TO SRC 2 (GENERATOR)

The TSC 900 transfer switch controller contains “ENABLE TRANSFERS TO GEN” logic. This feature is user programmable and allows 2 different functional settings which are described below:

NO (DISABLED): The transfer switch will be inhibited from transferring to the Generator position.

YES (ENABLED): The transfer switch will be permitted to transfer to the Generator position.

5.11.14. ENABLE FAIL TO AUTO SYNC ALARM

When the ATS is ordered with a Closed Transition option (i.e. ATS Model Code Digit #13 “Operation Type” 3 or 4), and an external synchronizer is supplied, a fail to auto sync alarm feature is available. When set to “YES” (i.e. enabled), it will post an alarm should the sources fail to auto synchronize after expiry of the Fail to Auto Sync timer (i.e. programmable per Section 5.16.2). The alarm will also activate the common TSC 900 "Transfer Fail" alarm output.

5.11.15. ENABLE HALT TRANSFER ON FAIL TO EXTERNAL SYNC CHECK

The TSC 900 transfer switch controller contains a “HALT TRANSFER ON FAIL TO EXTERNAL SYNC CHECK” logic selection feature. This feature is user programmable and controls how the external automatic synchronizer initiate output is controlled.

NO (DISABLED): The Automatic Sync Initiate Output will stay energized to continue an auto synchronizing operation irrespective if the “Fail to Auto Sync” timer expires or not.

YES (ENABLED): The Automatic Sync Initiate Output will be de-energized upon expiry of the “Fail to Auto Sync” time delay setting to halt further auto sync operation.

5.11.16. ENABLE CLOSED TRANSITION TRANSFER (CTTS MODEL 3 & 4)

When the ATS is ordered with a Closed Transition Transfer option (i.e. ATS Model Code Digit #13 “Operation Type” 3 or 4) the ATS can be selected for closed transition operation. When the option is set to YES, the ATS will operate in a Closed Transition transfer sequence dependent upon if both sources are available and the specific setting of the GHC Home Page or via external control switch (if fitted). Three operation mode settings are provided as follows:

- **Fast Transfer**: The two sources will be permitted to stay in parallel for a maximum of 100 milliseconds only. **Note:** the ATS will automatically revert to open transition transfer mode should only 1 source of power be available at time of transfer.
- **Soft-Load**: The two sources will be permitted to stay in parallel for a maximum of 10 seconds only to allow loads to be ramped between the sources by an external controller **Note:** the ATS will automatically revert to open transition transfer mode should only 1 source of power be available at time of transfer.
- **Extended Parallel**: Under normal operation, the two sources will be permitted to stay in parallel continuously following a closed transition transfer operation. **Note:** the ATS will automatically revert to open transition transfer mode should only 1 source of power be available at time of transfer.

When the option is set to NO, the ATS will only operate in Open Transition transfer mode, irrespective of GHC Home Page or via external control switch settings.

5.11.17. REVERT TO OPEN TRANSITION

For transfer switches equipped with closed transition transfer feature, the TSC 900 controller contains “REVERT to OPEN TRANSITION” logic. This logic allows the user to select how the ATS operates should the closed transition transfer operation fail to achieve an “in-sync” condition. This feature is user programmable and allows 2 different functional settings which as described below:

NO (DISABLED): The ATS will not automatically revert to open-transition transfer should the closed transition transfer operation fail to achieve an “in-sync” condition. The ATS will remain in its last position in an alarmed state. If the alarm is reset, the ATS will re-attempt a closed transition transfer operation sequence.

YES (ENABLED): The ATS will automatically revert to open-transition transfer should the closed transition transfer operation fail to achieve an “in-sync” condition for the allowed “in-sync wait” time delay period.

5.11.18. ENABLE FAIL TO UNLOAD ALARM (CTTS MODEL 4)

When the ATS is ordered with a Closed Transition soft-load option (i.e. ATS Model Code Digit #13 “Operation Type” 4), a fail to unload alarm feature is available. When feature is set to “Yes”, the TSC 900 controller will monitor the status of programmable inputs configured for Utility unloaded (DI-12) and Generator unloaded (DI-13). When enabled, it will post an alarm when the selected source fails to unload after expiry of the Fail to Unload timer (programmable per Section 5.16.3) following a soft-load power transfer. The alarm will also activate the common TSC 900 "Transfer Fail" alarm output.

5.11.19. ENABLE EXTENDED PARALLEL MODE (CTTS MODEL 4)

When the ATS is ordered with a Closed Transition soft-load option (i.e. ATS Model Code Digit #13 “Operation Type” 4), the ATS can be operated in Extended Parallel mode.

NO (DISABLED): The transfer switch will be inhibited from operating in Extended Parallel mode.

YES (ENABLED): The transfer switch will be permitted to operate in Extended Parallel mode provided the Option is set for YES or designated programmable input (i.e. default input IP05) is activated and both power sources are available at time of desired operation. **Note:** the ATS will automatically revert to open transition transfer mode should only 1 source of power be available at time of transfer.

5.11.20. ENABLE SOFT-LOAD TRANSFER (CTTS MODEL 4)

When the ATS is ordered with a Closed Transition soft-load option (i.e. ATS Model Code Digit #13 “Operation Type” 4), the ATS can be operated in Soft-Load mode.

NO (DISABLED): The transfer switch will be inhibited from operating in Soft-Load mode and will operate in either Open transition or Closed Transition Fast transfer modes.

YES (ENABLED): The transfer switch will be permitted to operate in Soft-Load closed transition mode provided the Option is set for YES or designated programmable input (i.e. default input IP14) is activated and both power sources are available at time of desired operation. **Note:** the ATS will automatically revert to open transition transfer mode should only 1 source of power be available at time of transfer.

5.11.21. ENABLE START OF MULTIPLE GENS WHEN RESUMING FROM STANDBY

When the ATS is ordered with a Dual Standby Generator (DSG) option, a control feature is provided to selection if one or both generators are to start when signaled during a utility power failure condition from the Master ATS.

NO (DISABLED): Only the “Preferred” selected Generator will be signaled to start from the Master ATS during a utility power failure condition.

YES (ENABLED): Both “Preferred” and “Standby” generator sets will be signaled to start from the Master ATS during a utility power failure condition.

5.11.22. PREFERRED SOURCE ALTERNATION INTERVAL

When the ATS is ordered with a Dual Source option, a control feature is provided to allow automatic changing of "Preferred" sources to balance operating hours. The feature allows a programmable time interval between 1 - 672 hours. **Note**: This control feature is only operational when the "Preferred" source selector is in the "AUTO" position. Refer to Section 4.7.1 for further details on Dual Source Operation.

5.11.23. TRIP UTILITY (SRC 1) WHEN CLOSED TRANSITION INHIBIT ACTIVATED

When the ATS is ordered with a Closed Transition option (i.e. ATS Model Code Digit #13 "Operation Type" 3 or 4), a control feature is provided which will trip open the selected source power switching device should an inhibit operation signal be activated by an external Utility supply protection relay (i.e. programmable digital input DI-10).

NO: The generator power switching device will immediately trip open if both power switching devices are closed during a closed transition transfer sequence and the Closed Transition Inhibit digital input is activated.

YES: The utility power switching device will immediately trip open if both power switching devices are closed during a closed transition transfer sequence and the Closed Transition Inhibit digital input is activated.

5.11.24. CURRENT METERING

If the ATS was purchased with the LPM (Load Power Metering Option) or CT kit option, the current metering can be enabled by setting the value to YES.

5.11.25. ENABLE OPEN TRANSITION IN-SYNC TRANSFER (ATS MODEL X)

The Open Transition Transfer setting will appear if the ATS is ordered with an Open Transition Transfer option (i.e. ATS Model Code Digit #13 "Operation Type" X, Open Transition In-sync Transfer).

NO: When the option is set to NO, the ATS will only operate in Open Transition transfer with neutral delay mode.

YES: When the option is set to YES, the ATS will operate in an Open Transition In-sync transfer sequence dependent upon if both sources are available. **Note**: the ATS will automatically revert to open transition transfer with neutral delay should only 1 source of power be available at time of transfer.

5.12. DELAY SETTINGS

The TSC 900 provides the following programmable time delay features:

5.12.1. UTILITY (SRC 1) RETURN DELAY

The utility return delay period will be initiated once the utility supply has returned within limits following a utility power failure condition. Select desired utility return delay time in seconds. If no delay is required, set this time delay to zero. The utility return delay will be bypassed should the generator fail during the time delay period.

Note: This time delay setting is only applicable for Standard/Service Entrance rated ATS with a Utility and Generator source connected. For ATS ordered with the Dual Source Option, refer to timer labeled as "*RETURN TO PREFERRED SOURCE DELAY"* per Section 5.12.19.

5.12.2. GEN (SRC 2) COOL DOWN DELAY

The generator (i.e. engine) cool down period will be initiated once the load has transferred from the generator supply. The engine start signal will be maintained until expiry of the cool down delay timer. Select desired generator cool down delay time in seconds. If no delay is required, set this time delay to zero. Cool down time is posted in 1-second decrements when active.

5.12.3. GEN (SRC 2) START DELAY

If the utility source power fails and its transient delay timers expire (e.g. 1 second UV, UF timers etc.), the "*GEN START Delay*" timer will start timing. Once it expires, the engine start output contact will close and the Generator will transfer on load once its Warm-up delay has expired. If a Generator was started and was running for longer than its Warm-up Timer setting, it will wait for the GEN START delay timer to time out before it transfers on load following the Utility source power failure. Select desired generator start delay time in seconds. If no delay is required, set this time delay to zero. The engine start output relay is normally energized when the utility power is within limits and de-energizes to start the generator.

Note: This time delay setting is only applicable for Standard/Service Entrance rated ATS with a Utility and Generator source connected. For ATS ordered with the Dual Source Option, refer to timer labeled as "*TRANSFER FROM PREFERRED SOURCE DELAY"* per Section 5.12.21.

5.12.4. GEN (SRC 2) WARM UP DELAY

A transfer to the generator supply will be initiated when the voltage and frequency are within limits and upon expiry of the warm-up delay timer. Select desired generator warm-up delay time in seconds. If no delay is required, set this time delay to zero.

5.12.5. TRANSFER NEUTRAL DELAY

The neutral delay time period will be initiated once both of the power-switching devices are in the open position during a transfer sequence. Select desired neutral delay time in seconds. If no delay is required, set this time delay to zero.

Note: The Neutral Delay timer maybe automatically bypassed subject to the setting of the "Neutral Bypass" feature (per Section 5.11.12) based on operating conditions or if the originating source voltage is in a de-energized (i.e. blackout) state prior to transfer.

5.12.6. TRANSFER PRE DELAY (LDC)

The pre-transfer delay period will be initiated upon an impending transfer in either direction when both sources of power are available. The pre-transfer output relay will energize "x" seconds prior to a load transfer based on the setting of the pre-transfer delay timer. The pre-transfer output relay will stay energized until the post-transfer delay time commences. If no delay is required, set this time delay to zero.

5.12.7. TRANSFER POST DELAY (LDC)

Immediately following a transfer in either direction, a post-transfer timer will start timing and the post-transfer output relay will energize. Once the post-transfer delay timer expires the post-transfer output relay will de-energize. If no delay is required, set this time delay to zero.

5.12.8. SRC 2 (GEN) GEN COMMIT TO TRANSFER DELAY

Should the generator fail to transfer on load with the "commit to transfer" feature enabled, the ATS will automatically re-transfer back to the utility supply if within nominal limits following expiry of the "Commit to Transfer" timer.

5.12.9. TRANSFER FAIL DELAY

The transfer fail timer is activated whenever a transfer sequence is initiated. The timer will activate a fail alarm condition if the transfer switch fails to successfully transfer within the transfer fail time delay setting.

5.12.10. TRANSFER MAX ERROR CONDITION DELAY

The TSC 900 controller continuously monitors the status of ATS mechanism position inputs (i.e. on source 1 and on source 2). If an abnormal condition is detected, the Transfer Max Error Condition Delay timer is activated. If the abnormal condition exists for longer than the time setting, a Transfer Fail alarm condition will be activated. This parameter will be factory set for the specific ATS mechanism type.

5.12.11. GEN (SRC 2) FAILED TO START DELAY

The TSC 900 controller monitors the status of the Generator voltage and frequency when the Engine Start output is activated. If the Generator voltage does not reach rated voltage & frequency within a pre-set time delay after the engine start out is activated, the GEN FAIL TO START alarm will be activated. Select desired time in seconds.

5.12.12. DISCONNECTION RESUME TIME

When the TSC 900 is signaled to return to an Automatic mode of operation, it will suspend any actions for the time setting of the DISCONNECTION RESUME timer to allow for operation states, alarms etc., to resume normal operation. This timer will be factory set for the specific ATS mechanism type.

5.12.13. TRIP RETRY ON/OFF PULSE TIME (SRC1&2)

The “Trip Retry On/Off Pulse Time” feature is utilized for ATS mechanisms which contain separate open and close coils to operate the power switching devices. When a power switching device fails to trip open for any reason, the TSC 900 will attempt to re-open it by providing an on/off pulse signal. The duration of the on/off pulse signal is set by the Trip Retry On/Off Pulse Time setting. The Trip Retry On/Off Pulse Time will be factory set for 100 milliseconds. **Note**: The duration of each on and off pulse signal is symmetrical (e.g. a Pulse time setting of 100 milliseconds will provide a 100 millisecond “on” pulse and 100 milliseconds “off” pulse. One Trip Retry ON/OFF pulse timer is provided for each source (i.e. Source 1 (Utility) and Source 2 (Gen) power switching devices.

5.12.14. TRIP RETRY DURATION TIMER (SRC1&2)

The “Trip Retry Duration Timer” is utilized for ATS mechanisms which contain separate open and close coils to operate the power switching devices. When a power switching device fails to open for any reason, the TSC 900 will attempt to re-open it by providing an on/off pulse signal. If a retry is unsuccessful, the TSC 900 will continue retrying until expiry of the Trip Retry Duration Timer. The Trip Retry Duration Timer will be factory set to allow 3 retry attempt cycles to occur. Based on a Retry Pulse timer setting of 100 milliseconds a Trip Retry Duration Timer is set for 600 milliseconds (i.e. (100 milliseconds On pulse + 100 milliseconds Off pulse) x 3 cycles). One Trip Retry Duration Timer is provided for each source (i.e. Source 1 (Utility) and Source 2 (Gen) power switching devices. These timers will be factory set for the specific ATS mechanism type.

5.12.15. CLOSE RETRY ON/OFF PULSE TIME (SRC1&2)

The “Close Retry On/Off Pulse Time” feature is utilized for ATS mechanisms which contain separate open and close coils to operate the power switching devices. When a

power switching device fails to close for any reason, the TSC 900 will attempt to re-close it by providing an on/off pulse signal. The duration of the on/off pulse signal is set by the Close Retry On/Off Pulse Time setting. The Close Retry On/Off Pulse Time will be factory set for 100 milliseconds. **Note**: The duration of each on and off pulse signal is symmetrical (e.g. a Pulse time setting of 100 milliseconds will provide a 100 millisecond "on" pulse and 100 milliseconds "off" pulse. One Close Retry ON/OFF pulse timer is provided for each source (i.e. Source 1 (Utility) and Source 2 (Gen) power switching devices.

5.12.16. CLOSE RETRY DURATION TIMER (SRC1&2)

The "Close Retry Duration Timer" is utilized for ATS mechanisms which contain separate open and close coils to operate the power switching devices. When a power switching device fails to close for any reason, the TSC 900 will attempt to re-close it by providing an on/off pulse signal. If a retry is unsuccessful, the TSC 900 will continue retrying until expiry of the Trip Retry Duration Timer. The Close Retry Duration Timer will be factory set to allow 3 retry attempt cycles to occur. Based on a Retry Pulse timer setting of 100 milliseconds a Close Retry Duration Timer is set for 600 milliseconds (i.e. (100 milliseconds On pulse + 100 milliseconds Off pulse) x 3 cycles). One Close Retry Duration Timer is provided for each source (i.e. Source 1 (Utility) and Source 2 (Gen) power switching devices. These timers will be factory set for the specific ATS mechanism type.

5.12.17. TIMER GUARD DELAY

The "Guard" Time delay is utilized for ATS mechanisms which contain separate open and close coils to operate the power switching devices. The Guard time is the intentional time delay in between the open and close signals from the TSC 900 controller during transfer. This is to ensure there is adequate time for the "open" coil to successfully release prior to initiating the signal to the associated "close" coil and vice versa. This parameter will be factory set for the specific ATS mechanism type.

5.12.18. FIND NEUTRAL DELAY

For transfer switches equipped with type "S", "T" or "M" operating mechanisms, the ATS neutral position is obtained by powering the gear motor drive for a specific time period to move the power switching device toggles to the open (i.e. "neutral") position. The "Find Neutral" timer is the setting in the TSC 900 controller period which controls the length of time the ATS motor is powered during transfer to the neutral position. This parameter will be factory set for the specific ATS mechanism type.

5.12.19. RETURN TO PREFERRED SOURCE DELAY

Note: this time delay setting is only applicable for ATS ordered with the Dual Source Option.

When the “Preferred” power source returns to normal following a power failure condition, the ATS will automatically re-transfer back to the “Preferred” source following expiry of the *RETURN TO PREFERRED SOURCE DELAY* timer. This timer is provided to ensure the source is stable for a desired period of time prior to resuming load supply. Select desired source return delay time in seconds. If no delay is required, set this time delay to zero. **NOTE:** This time delay will be bypassed should the “Standby” source fail during the time delay period.

5.12.20. WAIT FOR PREFERRED SOURCE DELAY

Note: this time delay setting is only applicable for ATS ordered with the Dual Gen Standby (DSG) Option.

When the ATS is ordered with a Dual Gen Standby option, a control feature is provided to allow the “Preferred” selected Generator to transfer on load before the “Standby” source is allowed to transfer for a pre-determined time delay. The “Standby” generator will automatically transfer on load should the “Preferred” generator fail to transfer on load once the WAIT FOR PREFERRED SOURCE DELAY timer expires. Select desired time in seconds. If no delay is required, set this time delay to zero.

5.12.21. TRANSFER FROM PREFERRED SOURCE DELAY

Note: this time delay setting is only applicable for ATS ordered with the Dual Source Option.

If the “Preferred” source power fails, and its transient delay timers expire (e.g. 1 second UV, UF timers etc.), the "*TRANSFER FROM PREFERRED SOURCE DELAY”* timer will start timing. Once it expires, the “Standby” source will transfer on load once its Warm-up delay has expired. **Note:** If the “Standby” source was previously energized at normal voltage and frequency levels for longer than its Warm-up Timer setting, it will wait for the "*TRANSFER FROM PREFERRED SOURCE DELAY”* timer to time out before it transfers on load following a “Preferred” source power failure. Select desired time in seconds. If no delay is required, set this time delay to zero.

5.13. UTILITY/GEN SET POINTS (VOLTAGE/FREQUENCY)

The TSC 900 controller provides 3-phase over voltage and under voltage sensing on both utility and generator supplies. Each sensor is individually programmable for pickup and dropout voltage set points (i.e. adjustable hysteresis) in addition to transient time delay settings. The TSC 900 controller also provides under and over frequency sensing on both utility and generator

supplies. Each sensor is individually programmable for pickup and dropout frequency set points (i.e. adjustable hysteresis) in addition to transient time delay settings. To program the voltage and frequency sensing features, refer to the following descriptions: **Note**: each of the following set points are programmable for each source (e.g. Utility -Source 1 and Generator - Source 2).

5.13.1. UNDER VOLTAGE DELAY (DROPOUT)

Select the desired source under voltage time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.13.2. UNDER VOLTAGE DROPOUT

Set to the desired source under voltage drop out set point as expressed in percentage of nominal system voltage. The dropout set point is the value which the internal sensor de-energizes to an abnormal state when any one phase of the source falls below the set point. An under voltage condition will be triggered following expiry of the under voltage time delay setting.

5.13.3. UNDER VOLTAGE PICKUP

Set to the desired source under voltage pick-up set point as expressed in percentage of nominal system voltage. The pick-up set point is the value which the internal sensor energizes to a normal state when all phases of the source rise above the set point.

5.13.4. OVER VOLTAGE DELAY (PICKUP)

Select the desired source over voltage time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.13.5. OVER VOLTAGE DROPOUT

Set to the desired source over voltage drop out set point as expressed in percentage of nominal system voltage. The dropout set point is the value which the internal sensor de-energizes to a normal state when all phases of the source falls a below the set point.

5.13.6. OVER VOLTAGE PICKUP

Set to the desired source over voltage pick-up set point as expressed in percentage of nominal system voltage. The pick-up set point is the value which the internal sensor energizes to an abnormal state when any one phase of the supply rises above the set point. An over voltage condition will be triggered following expiry of the over voltage time delay setting.

5.13.7. PHASE UNBALANCED VOLTAGE LATCH

When the phase unbalance latch feature is enabled, this programming prompt will affect operation of the retransfer sequence following an abnormal phase balance condition. Two retransfer modes of operation are selectable as follows:

NO (DISABLED): The controller will automatically initiate a retransfer sequence once the original sources phase unbalance condition returns within nominal limits as programmed.

YES (ENABLED): The controller will **not** automatically initiate a retransfer sequence following a phase unbalance alarm condition but the alarm will latch in. To initiate a re-transfer sequence, an operator must manually reset the phase unbalance alarm condition by pressing the ALARM RESET button on the GHC ALARMS page.

5.13.8. PHASE UNBALANCE DELAY (PICKUP)

Select the desired source phase unbalance time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.13.9. PHASE UNBALANCE DROPOUT

Set to the desired phase unbalance dropout set point as expressed in percentage of nominal negative sequence voltage. The dropout set point is the value which the internal sensor de-energizes to a normal state when all phases of the source falls a below the set point.

5.13.10. PHASE UNBALANCE PICK UP

Set to the desired source phase unbalance pick-up set point as expressed in percentage of nominal negative sequence voltage. The pick-up set point is the value which the internal sensor energizes to an abnormal state when any one phase of the supply rises above the set point. A phase unbalance condition will be triggered following expiry of the phase unbalance time delay setting.

5.13.11. UNDER FREQUENCY DELAY (DROPOUT)

Select the desired utility under frequency time delay setting. The setting is entered in seconds. If no delay is required, set this feature to zero.

5.13.12. UNDER FREQUENCY DROPOUT

Set to the desired source under frequency dropout set point as expressed in percentage of nominal system frequency. The dropout set point is the value which the internal sensor de-energizes to an abnormal state when the source's frequency falls below the set point. An under frequency condition will be triggered following expiry of the under frequency time delay setting.

5.13.13. UNDER FREQUENCY PICKUP

Set to the desired source under frequency pick-up set point as expressed in percentage of nominal system frequency. The pick-up set point is the value which the internal sensor energizes to a normal state when the source's frequency rises above the set point.

5.13.14. OVER FREQUENCY DELAY (PICKUP)

Select the desired source over frequency time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.13.15. OVER FREQUENCY DROPOUT

Set to the desired source over frequency dropout set point as expressed in percentage of nominal system frequency. The dropout set point is the value which the internal sensor de-energizes to a normal state when the source's frequency falls below the set point.

5.13.16. OVER FREQUENCY PICKUP

Set to the desired source over frequency pick-up set point as expressed in percentage of nominal system frequency. The pick-up set point is the value which the internal sensor energizes to an abnormal state when the source's frequency rises above the set point. An over frequency condition will be triggered following expiry of the over frequency time delay setting.

5.13.17. VOLTAGE SOURCE BLACKOUT DELAY (DROPOUT)

Select the desired source voltage blackout time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.13.18. VOLTAGE SOURCE BLACKOUT DROPOUT

This set point is utilized for neutral delay bypass and transfer fail logic. Set to the desired source voltage blackout dropout set point as expressed in percentage of nominal system voltage. The dropout set point is the value which the internal sensor de-energizes to an abnormal state when any one phase of the source voltage falls below the set point. A blackout voltage condition will be triggered following expiry of the source voltage time delay setting.

5.13.19. VOLTAGE SOURCE BLACKOUT PICKUP

This set point is utilized for neutral delay bypass and transfer fail logic. Set to the desired source voltage blackout pick-up set point as expressed in percentage of nominal system voltage. The pick-up set point is the value which the internal sensor energizes to a normal state when all phases of the source voltage rises above the set point.

5.13.20. VOLTAGE ROTATION REVERSAL DELAY (PICKUP)

Select the desired source phase reversal time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.13.21. VOLTAGE ROTATION REVERSAL DROP OUT

Set to the desired phase reversal dropout set point as expressed in percentage of nominal system voltage (i.e. sys.volt). The dropout set point is the value which the internal sensor de-energizes to a normal state when all phases of the source falls a below the set point which is indicative of a complete phase reversal condition.

5.13.22. VOLTAGE ROTATION REVERSAL PICK UP

Set to the desired source phase reversal pick-up set point as expressed in percentage of nominal system voltage (i.e. sys.volt). The pick-up set point is the value which the internal sensor energizes to an abnormal state when any one phase of the supply rises above the set point. A phase reversal condition will be triggered following expiry of the phase unbalance time delay setting.

5.14. LOAD VOLTAGE SET POINTS

The TSC 900 controller provides 3-phase voltage monitoring of the load. Load voltage set points are utilized to determine if the load is in a de-energized state for purposes of Transfer Failure alarming or Neutral Delay bypass operation. Each sensor is individually programmable for pickup and dropout set points (i.e. adjustable hysteresis) in addition to transient time delay settings. To program the sensing features, refer to the following descriptions:

5.14.1. LOAD VOLTAGE BLACKOUT DELAY (DROPOUT)

Select the desired source load voltage blackout time delay setting. The setting is entered in seconds. If no delay is required, set this time delay to zero.

5.14.2. LOAD VOLTAGE BLACKOUT DROPOUT

This set point is utilized for neutral delay bypass and transfer fail logic. Set to the desired load voltage blackout dropout set point as expressed in percentage of nominal system voltage. The dropout set point is the value which the internal sensor de-energizes to an abnormal state when any one phase of the load voltage falls below the set point. A blackout voltage condition will be triggered following expiry of the load voltage time delay setting.

5.14.3. LOAD VOLTAGE BLACKOUT PICKUP

This set point is utilized for neutral delay bypass and transfer fail logic. Set to the desired load voltage blackout pick-up set point as expressed in percentage of nominal system voltage. The pick-up set point is the value which the internal sensor energizes to a normal state when all phases of the load voltage rises above the set point.

5.15. LOAD SHED FREQUENCY & POWER SET POINTS

The TSC 900 controller provides Frequency and Power (kW) sensing on the load of the ATS for purposes of controlling the automatic Load Shedding feature. To enable these features, refer to Option settings per Section 5.11.2 and Section 5.11.3. Load Shed can be configured to operate when set points have been reached on bus under frequency and/or bus over power (kW) conditions. When a Load Shed condition is activated, a yellow colored status light will be shown on the GHC home page and a programmable output configured for Load Shed will be activated to control an external system load to be automatically disconnected. Each load bus sensor is individually programmable for pickup and dropout set points (i.e. adjustable hysteresis) in addition to transient time delay settings. Refer to Section 3.4.4 for further details on automatic Load Shed sequence of operation.

NOTES:

1. Load Shed operation based on Power (kW) is only available if the ATS is equipped with CT's on the load side of the ATS and Power Metering operation is enabled.
2. Automatic Load Shed operation on either bus under frequency or bus over power will only occur when the TSC 900 controller Mode is set for "AUTO". When the TSC 900 controller Mode is set for "MANUAL or OFF" the Load Shed relay will not operate.
3. To disable Load Shed feature, Load Shed Initiate and Reset timers must be set to zero

To program the sensing features, refer to the following descriptions:

5.15.1. LOAD SHED INITIATE DELAY

Once a transfer to Generator (SRC 2) condition is initiated, the Load Shed output will be activated to shed non-essential load and the Load Shed Initiate time period will start timing. Once the set time period expires, the Load Shed output will reset to allow the non-essential loads to be re-energized (i.e. reset to normal). Select desired time in seconds. If Load Shed is not required, set this time delay to zero.

5.15.2. LOAD SHED UNSHED DELAY

If a Load Shed condition had been activated by an abnormal set point threshold (i.e. under frequency or over power) and the condition returns to normal, the Load Shed Unshed time period will start timing. Once the set time period expires, the Load Shed output will reset to allow the non-essential loads to be re-energized (i.e. reset to normal). Select desired time in seconds If Load Shed is not required, set this time delay to zero.

5.15.3. LOAD SHED FREQUENCY DELAY (PICKUP)

Select the desired Load Shed time delay setting. The setting is entered in seconds within. If no delay is required, set this time delay to zero.

5.15.4. LOAD SHED FREQUENCY PICK UP

Set to the desired Load Shed frequency pick-up set point as expressed in percentage of nominal system frequency. The pick-up set point is the value which the internal sensor energizes to a normal state when the load frequency rises above the set point to cause a Load Shed condition to be reset.

5.15.5. LOAD SHED FREQUENCY DROP OUT

Set to the desired Load Shed frequency dropout set point as expressed in percentage of nominal system frequency. The dropout set point is the value which the internal sensor de-energizes to an abnormal state when the load frequency falls below the set point to cause a Load Shed condition to be activated. A Load Shed frequency condition will be triggered following expiry of the Load Shed frequency time delay setting.

5.15.6. LOAD SHED POWER (kW) DELAY (PICKUP)

Select the desired Load Shed time delay setting. The setting is entered in seconds within. If no delay is required, set this time delay to zero.

5.15.7. LOAD SHED POWER (kW) DROP OUT

Set to the desired Load Shed dropout set point as expressed in percentage of rated generator power. The dropout set point is the value which the internal sensor de-energizes to a normal state when the load kW falls below the set point to cause a Load Shed condition to be reset.

5.15.8. LOAD SHED POWER (kW) PICK UP

Set to the desired Load Shed pick-up set point as expressed in percentage of rated generator power. The pick-up set point is the value which the internal sensor energizes to an abnormal state when the load kW rises above the set point to cause a Load Shed condition to be activated. A Load Shed condition will be triggered following expiry of the Load Shed time over power delay setting.

5.16. IN-SYNC TRANSFER SET POINTS

The TSC 900 controller provides set points for in-sync transfer applications. To program the in-sync transfer features, refer to the following descriptions:

5.16.1. IN-SYNC WAIT DELAY

The TSC 900 transfer control logic includes an adjustable time delay for maximum time allowed to perform an in-sync transfer operation for Closed Transition type automatic transfer Switches or Open Transition In-Sync ATS's. If the selected time expires before

the transfer switch sources reach an in-sync condition, the Transfer Fail logic will be initiated. Select desired time in seconds.

5.16.2. EXTERNAL SYNC CHECK WAIT DELAY

When the ATS is ordered with a Closed Transition option (i.e. ATS Model Code Digit #13 “Operation Type” 3 or 4), and an external synchronizer is supplied, a sync check wait delay time feature is available. When the Fail to Sync alarm feature is enabled (refer to Section 5.11.15), this timer is programmed to allow the desired amount of time for the auto synchronizing process to occur. If the External Sync Check wait delay expires, an alarm will be posted and the ATS will either halt or continue auto synchronizing operation based on the setting of option feature “HALT TRANSFER ON FAIL TO AUTO SYNC” refer to Section 5.11.16 for programming information.

5.16.3. FAIL TO UNLOAD TIMER (CTTS MODEL 4)

When the ATS is ordered with a Closed Transition soft-load option (i.e. ATS Model Code Digit #13 “Operation Type” 4), a fail to unload alarm time delay feature is available. When the Fail to Unload alarm feature is enabled (refer to Section 5.11.19), this timer is programmed to allow the desired amount of time for a normal soft-unload process to occur following a closed transition transfer operation. Should the pre-programmed time expire before the source “unloaded” confirmation digital input signals are received transfer during a closed transition, an alarm will be posted. The alarm will also activate the common TSC 900 "Transfer Fail" alarm output.

5.16.4. CLOSED TRANSITION MAX OVERLAP TIMER

For Closed Transition Transfer applications, the TSC 900 transfer controller includes an adjustable time delay for the maximum allowable time the 2 sources can be connected in parallel. If this time delay is exceeded, one of the pre-selected source power switching devices will be automatically tripped open. In soft-load applications, this time delay is bypassed. Set to the desired time in seconds.

5.16.5. SOURCE FREQUENCY DIFFERENTIAL HIGHER THRESHOLD

Set to the desired source frequency differential higher set point as expressed in percentage of nominal system frequency. An in-sync transfer operation will be blocked if the measured difference between both source frequencies reaches a higher threshold value than specified.

5.16.6. SOURCE FREQUENCY DIFFERENTIAL LOWER THRESHOLD

Set to the desired source frequency differential lower set point as expressed in percentage of nominal system frequency. An in-sync transfer operation will be blocked if the measured difference between both source frequencies reaches a lower threshold value than specified.

5.16.7. SOURCE VOLTAGE DIFFERENTIAL HIGHER THRESHOLD

Set to the desired source voltage differential higher set point as expressed in percentage of nominal system voltage. An in-sync transfer operation will be blocked if the measured difference between both source voltages reaches a higher threshold value than specified.

5.16.8. SOURCE VOLTAGE DIFFERENTIAL LOWER THRESHOLD

Set to the desired source voltage differential lower set point as expressed in percentage of nominal system voltage. An in-sync transfer operation will be blocked if the measured difference between both source voltages reaches a lower threshold value than specified.

5.16.9. TRANSFER SWITCH MECHANISM OPERATION TIME

The In-sync transfer logic includes an anticipatory closing delay to ensure in-sync transfers occur within pre-set voltage and frequency thresholds for a wide variety of ATS mechanism types. Enter in the time, in milliseconds, the specified ATS mechanism operation time to close a power switching device.

6. FACTORY DEFAULT PROGRAMMING

Function	Tag	Range	Factory Default Value	Basic	Advanced	Factory
System Configuration						
System Phases	sys.phases	1, 3	3 Ph	X	X	X
System Voltage	sys.volt	0 - 25000	277/480 V	X	X	X
System Frequency	sys.freq	50/60 Hz	60 Hz	X	X	X
Phase Rotation Reversed	sys.rot.reverse	YES/NO	NO	X	X	X
Rated GEN Power	sys.gen.pwr	0-5000 kW	2500 KW		X	X
CT Ratio	sys.ct.scale	1 - 1000	1		X	X
PT Ratio	sys.pt.scale	1 - 500	1		X	X
Load Name	sys.desc.load	n/a	Load		X	X
SRC 1 Name	sys.desc.src.1	n/a	Utility		X	X
SRC 2 Name	sys.desc.src.2	n/a	Gen		X	X
Application Model	sys.model.application	Read Only			X	X
Switch Operation	sys.model.operation	Read Only			X	X
Switch Model	sys.model.switch	Read Only			X	X
Option Settings						
SRC 2 (GEN) Commit to Transfer	opt.ctl.commit	YES/NO	NO		X	X
Enable Load Shed on Under Frequency	opt.shed.freq	YES/NO	YES		X	X
Enable Load Shed on Over Power	opt.shed.power	YES/NO	YES		X	X
Halt Operation on Phase Reversal	opt.ctl.haltonreverse	YES/NO	YES		X	X
Manual SRC 1 (Utility) Retransfer Control	opt.ctl.manrtn	YES/NO	NO		X	X
Force Transfer	opt.ctl.xfronfail	YES/NO	YES		X	X
GHC Sleep Mode Timeout	opt.disp.sleep.dly	0-6000 sec	300 sec		X	X
Load Power Metering	opt.lpm	YES/NO	NO		X	X
Modbus RTU	opt.modbus.rtu	YES/NO	YES		X	X
Modbus TCP/IP	opt.modbus.tcpip	YES/NO	NO		X	X
Enable Security Bypass	opt.security.mode	YES/NO	YES		X	X
Enable Neutral Delay Bypass	opt.xfr.ndtbypass	YES/NO	NO		X	X
Enable Transfers to SRC 1 (Utility)	opt.xfr.tosrc.1	YES/NO	YES		X	X
Enable Transfers to SRC 2 (Generator)	opt.xfr.tosrc.2	YES/NO	YES		X	X
Enable Fail to Auto Sync Alarm (CTTS Model 3/4)	opt.alm.sync.ext	YES/NO	NO		X	X
Enable Halt Transfer on Fail to Ext Sync Check (CTTS Model 3/4)	opt.xfr.sync.ext.haltonfail	YES/NO	NO		X	X
Enable Closed Transition Transfer (CTTS Model 3/4)[1]	opt.xfr.closed	YES/NO	NO		X	X
Revert to Open Transition[1]	opt.xfr.revert	YES/NO	YES		X	X
Enable Fail to Unload Alarm (CTTS Model 4)	opt.alm.unload	YES/NO	YES		X	X
Enable Extended Parallel Transfer (CTTS Model 4)	opt.xfr.parallel	YES/NO	NO		X	X
Enable Soft Load Transfer (CTTS Model 4)	opt.xfr.soft	YES/NO	NO		X	X
Enable Start of Multiple GENs When Resuming from Standby[2]	opt.ctl.stdby.multistart	YES/NO	NO		X	X
Preferred Source Alternation Interval[2]	opt.pfs.alt.interval	1-672 HRS	1 HR		X	X
Trip Utility (SRC 1) When Closed Transition Inhibit Activated[1]	opt.xfr.closed.tripaction	YES/NO	YES		X	X
Current Metering	opt.ct	YES/NO	NO			X
Advanced Power Metering	opt.apm	YES/NO	NO			X
Enable Open Transition In-Sync Transfer (ATS Operation Type X)	opt.xfr.inphase	YES/NO	YES			X

Function	Tag	Range	Factory Default Value	Basic	Advanced	Factory
Delay Settings						
UTIL Return Delay[3]	dly.util.rtn	0-1800 sec	300 sec	X	X	X
Gen Cool Down Delay	dly.gen.cool	0-3600 sec	300 sec	X	X	X
Gen Start Delay[3]	dly.gen.start	0-60 sec	3 sec	X	X	X
Gen Warm Up Delay	dly.gen.warm	0-3600 sec	2 sec	X	X	X
Transfer Neutral Delay	dly.xfr.neut	0-120 sec	3 sec	X	X	X
Transfer Pre-Delay (LDC)	dly.xfr.pre	0-120 sec	0 sec	X	X	X
Transfer Post Delay (LDC)	dly.xfr.post	0-120 sec	3 sec	X	X	X
SRC 2 (Gen) Commit to Transfer Delay	dly.commit	0-600 sec	300 sec		X	X
Transfer Fail Delay	dly.xfr.fail	0-120 sec	30 sec		X	X
Transfer Max Error Condition Delay	dly.xfr.swfail	2-30 sec	5 sec		X	X
Gen (SRC 2) Failed to Start Delay	stp.alm.gen.muststart.delay	0-300 sec	60 sec		X	X
Disconnection Resume Time	dly.discon.resume	0-10 sec	5.0 sec			X
Utility (SRC 1) Trip Retry ON/OFF Pulse Time[1]	dly.coil.brksrc.pulse.1	0.05 -5 sec	0.10 sec			X
Gen (SRC2) Trip Retry ON/OFF Pulse Time[1]	dly.coil.brksrc.pulse.2	0.05 -5 sec	0.10 sec			X
Utility (SRC 1) Trip Retry Duration Timer[1]	dly.coil.brksrc.retry.1	0.05 -30 sec	0.60 sec			X
Gen (SRC 2) Trip Retry Duration Timer[1]	dly.coil.brksrc.retry.2	0.05 -30 sec	0.60 sec			X
Utility (SRC 1) Close Retry ON/OFF Pulse Time[1]	dly.coil.tosrc.pulse.1	0.05 -5 sec	0.10 sec			X
Gen (SRC2) Close Retry ON/OFF Pulse Time[1]	dly.coil.tosrc.pulse.2	0.05 -5 sec	0.10 sec			X
Utility (SRC 1) Close Retry Duration Timer[1]	dly.coil.tosrc.retry.1	0.05 -30 sec	0.60 sec			X
Gen (SRC 2) Close Retry Duration Timer[1]	dly.coil.tosrc.retry.2	0.05 -30 sec	0.60 sec			X
Timer Guard Delay[1]	dly.xfr.guard	0.1-10 sec	0.2 sec			X
Find Neutral Delay[4]	dly.xfr.find	0-10 sec	1.0 sec			X
Return To Preferred Source Delay[2]	dly.rtn	0-1800 sec	300 sec	X	X	X
Wait For Preferred Source Delay[2]	dly.stdby.pref	0-300 sec	60 sec		X	X
Transfer From Preferred Source Delay[2]	dly.dprt	0-60 sec	5 sec	X	X	X

[1] Setting applicable only to ATS Operation Type 1, X, 3, 4

[2] Setting only visible in dual source configurations

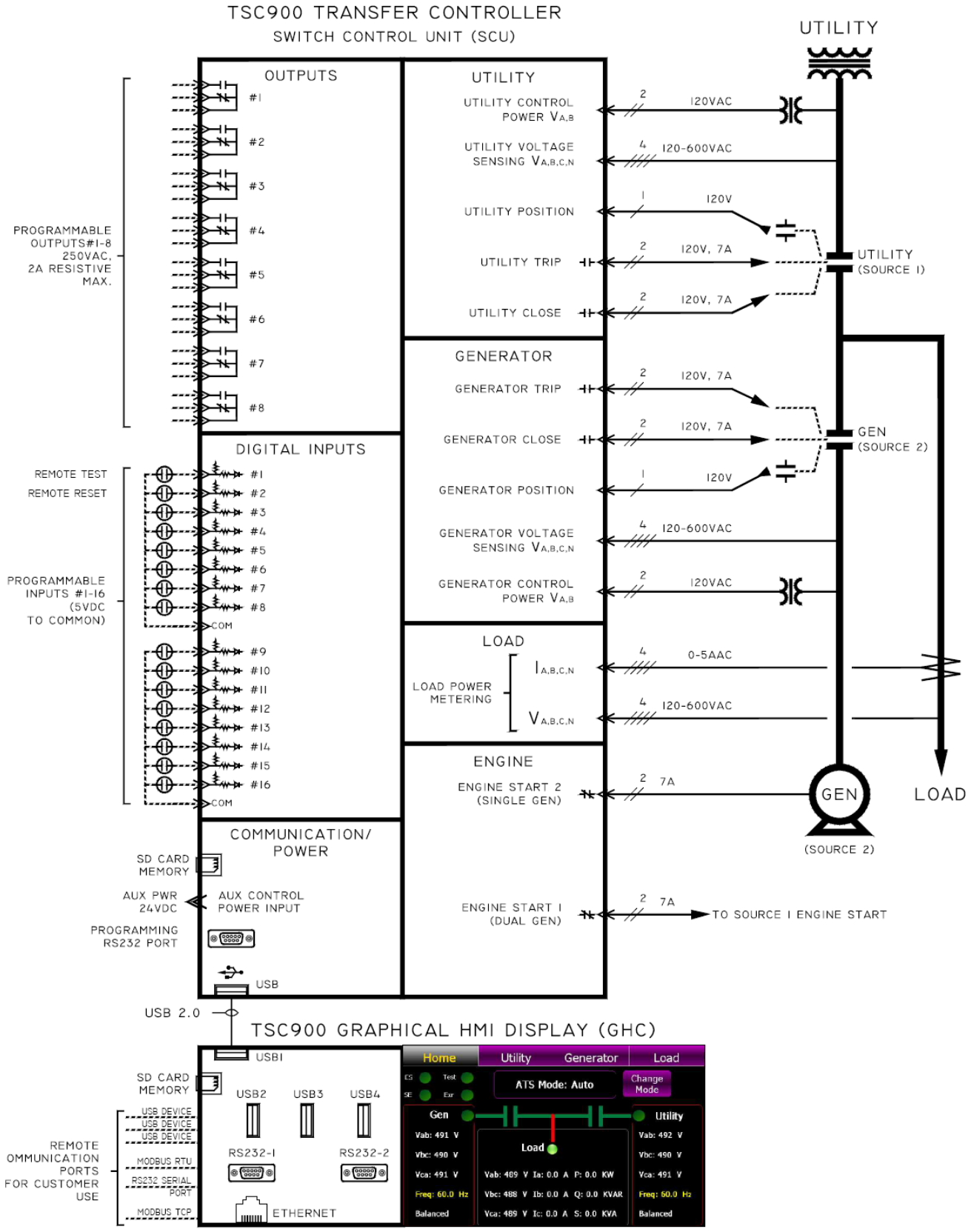
[3] Time delays not visible in dual source applications

[4] Find Neutral Delay S-Style =1.0sec, T-Style= 1.5 sec

Function	Tag	Range	Factory Default Value	Basic	Advanced	Factory
Source 1 (Utility) Set Points						
SRC 1 (Utility) Under Voltage Delay	stp.vsrc.1.volt.undr.delay	0-10 sec	1 sec		X	X
SRC 1 (Utility) Under Voltage Drop Out	stp.vsrc.1.volt.undr.drop	70-95%	85%	X	X	X
SRC 1 (Utility) Under Voltage Pick Up	stp.vsrc.1.volt.undr.pick	75-100%	90%	X	X	X
SRC 1 (Utility) Over Voltage Delay	stp.vsrc.1.volt.over.delay	0-10 sec	1 sec		X	X
SRC 1 (Utility) Over Voltage Drop Out	stp.vsrc.1.volt.over.drop	100-130%	110%		X	X
SRC 1 (Utility) Over Voltage Pick Up	stp.vsrc.1.volt.over.pick	100-130%	115%		X	X
SRC 1 (Utility) Phase Unbalance Latch	stp.vsrc.1.volt.unbal.latch	YES/NO	NO		X	X
SRC 1 (Utility) Phase Unbalance Delay	stp.vsrc.1.volt.unbal.delay	0-30 sec	5 sec		X	X
SRC 1 (Utility) Phase Unbalance Drop Out	stp.vsrc.1.volt.unbal.drop	0-100%	3%		X	X
SRC 1 (Utility) Phase Unbalance Pick Up	stp.vsrc.1.volt.unbal.pick	0-100%	5%		X	X
SRC 1 (Utility) Under Frequency Delay	stp.vsrc.1.freq.undr.delay	0-10 sec	1 sec		X	X
SRC 1 (Utility) Under Frequency Drop Out	stp.vsrc.1.freq.undr.drop	70-99%	85%		X	X
SRC 1 (Utility) Under Frequency Pick Up	stp.vsrc.1.freq.undr.pick	70-99%	90%		X	X
SRC 1 (Utility) Over Frequency Delay	stp.vsrc.1.freq.over.delay	0-10 sec	1 sec		X	X
SRC 1 (Utility) Over Frequency Drop Out	stp.vsrc.1.freq.over.drop	100-130%	110%		X	X
SRC 1 (Utility) Over Frequency Pick Up	stp.vsrc.1.freq.over.pick	100-130%	115%		X	X
SRC 1 (Utility) Voltage Rotation Reverse Delay	stp.vsrc.1.volt.reverse.delay	0-30 sec	2 sec			X
SRC 1 (Utility) Voltage Rotation Reverse Drop Out	stp.vsrc.1.volt.reverse.drop	0-100%	64%			X
SRC 1 (Utility) Voltage Rotation Reverse Pick Up	stp.vsrc.1.volt.reverse.pick	0-100%	68%			X
SRC 1 (Utility) Voltage Source Blackout Delay	stp.vsrc.volt.black.delay	0-10 sec	0 sec			X
SRC 1 (Utility) Voltage Source Blackout Drop Out	stp.vsrc.volt.black.drop	0-100%	20%			X
SRC 1 (Utility) Voltage Source Blackout Pick Up	stp.vsrc.volt.black.pick	0-100%	30%			X
Source 2 (Generator) Set Points						
SRC 2 (Gen) Under Voltage Delay	stp.vsrc.2.volt.undr.delay	0-10 sec	3 sec		X	X
SRC 2 (Gen) Under Voltage Drop Out	stp.vsrc.2.volt.undr.drop	70-95%	85%	X	X	X
SRC 2 (Gen) Under Voltage Pick Up	stp.vsrc.2.volt.undr.pick	75-100%	90%	X	X	X
SRC 2 (Gen) Over Voltage Delay	stp.vsrc.2.volt.over.delay	0-10 sec	3 sec		X	X
SRC 2 (Gen) Over Voltage Drop Out	stp.vsrc.2.volt.over.drop	100-130%	110%		X	X
SRC 2 (Gen) Over Voltage Pick Up	stp.vsrc.2.volt.over.pick	100-130%	115%		X	X
SRC 2 (Gen) Phase Unbalance Latch	stp.vsrc.2.volt.unbal.latch	YES/NO	NO		X	X
SRC 2 (Gen) Phase Unbalance Delay	stp.vsrc.2.volt.unbal.delay	0-30 sec	5 sec		X	X
SRC 2 (Gen) Phase Unbalance Drop Out	stp.vsrc.2.volt.unbal.drop	0-100%	3%		X	X
SRC 2 (Gen) Phase Unbalance Pick Up	stp.vsrc.2.volt.unbal.pick	0-100%	5%		X	X
SRC 2 (Gen) Under Frequency Delay	stp.vsrc.2.freq.undr.delay	0-10 sec	5 sec		X	X
SRC 2 (Gen) Under Frequency Drop Out	stp.vsrc.2.freq.undr.drop	70-99%	85%		X	X
SRC 2 (Gen)Under Frequency Pick Up	stp.vsrc.2.freq.undr.pick	70-99%	90%		X	X
SRC 2 (Gen) Over Frequency Delay	stp.vsrc.2.freq.over.delay	0-10 sec	3 sec		X	X
SRC 2 (Gen) Over Frequency Drop Out	stp.vsrc.2.freq.over.drop	100-130%	110%		X	X
SRC 2 (Gen) Over Frequency Pick Up	stp.vsrc.2.freq.over.pick	100-130%	115%		X	X
SRC 2 (Gen) Voltage Rotation Reverse Delay	stp.vsrc.2.volt.reverse.delay	0-30 sec	2 sec			X
SRC 2 (Gen) Voltage Rotation Reverse Drop Out	stp.vsrc.2.volt.reverse.drop	0-100%	64%			X
SRC 2 (Gen) Voltage Rotation Reverse Pick Up	stp.vsrc.2.volt.reverse.pick	0-100%	68%			X

Function	Tag	Range	Factory Default Value	Basic	Advanced	Factory
Load Set Points						
Load Voltage Blackout Delay	stp.load.volt.black.delay	0-10 sec	0 sec			X
Load Voltage Blackout Drop Out	stp.load.volt.black.drop	0-100%	20%			X
Load Voltage Blackout Pick Up	stp.load.volt.black.pick	0-100%	30%			X
Load Shed Initiate Delay	dly.shed.init	0-600 sec	180 sec		X	X
Load Shed Unshed Delay	dly.shed.unshed	0-60 sec	60 sec		X	X
Load Shed Frequency Delay	stp.shed.freq.delay	0-30 sec	3 sec		X	X
Load Shed Frequency Drop Out	stp.shed.freq.drop	50-100%	90%		X	X
Load Shed Frequency Pick Up	stp.shed.freq.pick	50-100%	95%		X	X
Load Shed Power Delay	stp.shed.power.delay	0-30 sec	5 sec		X	X
Load Shed Power Drop Out	stp.shed.power.drop	0-200%	70%		X	X
Load Shed Power Pick Up	stp.shed.power.pick	0-200%	100%		X	X
In-Sync Transfer Set Points						
In-Sync Wait Delay	dly.xfr.sync	0-1800 sec	300 sec		X	X
External Sync Check Wait Delay	dly.xfr.sync.ext	0-999 sec	180 sec		X	X
Fail to Unload Delay (CTTS Model 4)	dly.xfr.unload	0-1200 sec	10 sec		X	X
Closed Transfer Maximum Overlap Timer	dly.xfr.overlap	0-0.500 sec	0.45 sec			X
Source Frequency Diff Higher Threshold	stp.sync.freq.diff.over	0% - 4%	0.83%			X
Source Frequency Diff Lower Threshold	stp.sync.freq.diff.undr	-4% - 0%	-0.83%			X
Source Voltage Diff Higher Threshold	stp.sync.volt.diff.over	0% - 10%	5.00%			X
Source Voltage Diff Lower Threshold	stp.sync.volt.diff.undr	-10% - 0%	-5.00%			X
TS Mechanism Operation Time	sys.ts.delay	0-0.500 sec	0.050 sec			X

7. TSC 900 TYPICAL CONNECTION DIAGRAM



8. TSC 900 WIRING PIN CONNECTIONS

Connector	Pin #	Voltage	Description
J1	1	120-240VAC	Gen Power ATS Contact Power Common
J1	2	n/a	not used
J1	3	120VAC	On Gen (SRC 2) Input
J1	4	0 VAC	AC Common ground
J1	5	GRD	Earth Ground
J1	6	120VAC	On Utility (SRC 1) Input
J1	7	0 VAC	AC Common ground
J1	8	n/a	not used
J1	9	120-240VAC	Utility Power ATS Contact Power Common
J1	10	120-240VAC	Transfer to Gen (SRC2) Close Output
J1	11	120-240VAC	Utility (SRC1) Trip Output
J1	12	120VAC	Gen (SRC2) Control Power Input X1
J1	13	120VAC	Gen (SRC2) Control Power Input X2
J1	14	GRD	Earth Ground
J1	15	120VAC	Utility (SRC1) Control Power Input X1
J1	16	120VAC	Utility (SRC1) Control Power Input X2
J1	17	120-240VAC	Gen (SRC2) Trip Output
J1	18	120-240VAC	Transfer to Utility (SRC1) Close Output
J1	19	n/a	not used
J1	20	n/a	not used

Connector	Pin #	Voltage	Description
J2	1	0-600 VAC	Utility Voltage Sensing Phase A
J2	3	0-600 VAC	Utility Voltage Sensing Phase B
J2	5	0-600 VAC	Utility Voltage Sensing Phase C
J2	7	0-600 VAC	Utility Voltage Sensing Phase N

Connector	Pin #	Voltage	Description
J3	1	0-600 VAC	Gen Voltage Sensing Phase A
J3	3	0-600 VAC	Gen Voltage Sensing Phase B
J3	5	0-600 VAC	Gen Voltage Sensing Phase C
J3	7	0-600 VAC	Gen Voltage Sensing Phase N

Connector	Pin #	Voltage	Description
J4	1	0-600 VAC	Load Voltage Sensing Phase A
J4	3	0-600 VAC	Load Voltage Sensing Phase B
J4	5	0-600 VAC	Load Voltage Sensing Phase C
J4	7	0-600 VAC	Load Voltage Sensing Phase N

Connector	Pin #	Current	Description
J5	1	0-5AAC	Load Current Sensing Phase A, X1
J5	2	0-5AAC	Load Current Sensing Phase A, X2
J6	1	0-5AAC	Load Current Sensing Phase B, X1
J6	2	0-5AAC	Load Current Sensing Phase B, X2
J7	1	0-5AAC	Load Current Sensing Phase C, X1
J7	2	0-5AAC	Load Current Sensing Phase C, X2
J8	1	0-5AAC	Load Current Sensing Phase N, X1
J8	2	0-5AAC	Load Current Sensing Phase N, X2

9. TROUBLESHOOTING

A number of problems can cause the TSC 900 controller not to function properly. Refer to the following list of typical problems. Consult the factory for any detailed information or for any problems not listed.

CAUTION!!!

Before opening the enclosure to perform any service task, it is imperative to isolate the transfer switch from any possible source of power. Failure to do so may result in serious personal injury or death due to electrical shock.

Service procedures must be undertaken by qualified personnel only!

MALFUNCTIONS	PROBABLE CAUSES	CORRECTIVE ACTIONS
Will not re-transfer to utility source upon restoration	Utility Return Time delay period in TSC 900 has not yet expired.	Verify TSC 900-time delay setting
	A Load Test mode has been activated locally or remotely	Check TSC 900 GHC Home Page status indicators
	An Exercise Test mode has been activated by the TSC 900 scheduler	Check TSC 900 GHC Scheduler page
	Utility supply is not operating at correct voltage or frequency levels.	Verify correct nominal levels the utility source should be operating at and compare to TSC 900 settings for under/over voltage, voltage phase balance and under/over frequency
	TSC 900 has incorrect utility voltage or frequency settings for the ATS.	Re-Program TSC 900 with correct settings as required for voltage or frequency.
	Utility Phase Rotation is not matched with Generator supply (first time transfer).	Check Generator & Utility Voltage Phase rotation matches on TSC 900 GHC Utility & Generator Voltage Pages. If power cabling has non-matching phase rotation, reverse power conductors on one phase on one of the supplies
	Electrical interlock contact from Gen (Source 2) Switching Device (GSD) To TSC 900 controller is not working correctly	• Check TSC 900 Digital Input DI-09 is correctly mapped as “Source 2 Power switching device Opened • Check Digital input is correctly wired to Gen (Source 2) Switching Device “b” auxiliary contact • Check Gen (Source 2) Switching Device “b” auxiliary contact is operating correctly (contact to be closed when Switching Device is open)
	TSC 900 connection plugs are unplugged (J1,2,3,4)	Verify all TSC 900 connectors are fully inserted
	AC Voltage Sensing or Control Isolation plugs (PL12 or PL15) are unplugged	Verify both PL12 & PL15 connectors are fully inserted
	TSC 900 has “Transfer Fail” alarm activated.	Determine cause of alarm and rectify before TSC 900 is reset on GHC
	Defective ATS mechanism motor	Verify motor does not rotate when 120VAC is applied directly to motor leads. If defective Return to Thomson Power systems using RMA process
	A loose control wire connection	Check all wiring connections in the ATS
	Defective TSC 900 controller	• Verify TSC 900 has 120VAC control power applied to the utility control power input (J1- 15, 16) and Diagnostic green LED is flashing. • Verify TSC 900 has 120VAC control power applied to the ATS control contacts (J1-9) • Verify TSC 900 SCU has SD Memory Card fully inserted into socket. If defective Return to Thomson Power systems using RMA process
	Faulty motor limit switch	Verify Utility side limit switch (ULS) n/c contact is closed and is low resistance when ATS mechanism is <u>not</u> in the utility position.

MALFUNCTIONS	PROBABLE CAUSES	CORRECTIVE ACTIONS
Will not re-transfer to utility source upon restoration (cont'd)	A Transfer Inhibit signal has been activated	Check TSC 900 indicators if a utility transfer inhibit signal has been activated and reset)
	On Service Entrance Rated ATS, Service Disconnect switch is in the "De-Energized" or "Transfer to Neutral" positions.	Switch to the Energized position
	Electrical interlock contact from Gen (Source 2) Switching Device (GSD) To TSC 900 controller is not working correctly	• Check TSC 900 Digital Input DI-09 is correctly mapped as "Source 2 Power switching device Opened • Check Digital input is correctly wired to Gen (Source 2) Switching Device "b" auxiliary contact • Check Gen (Source 2) Switching Device "b" auxiliary contact is operating correctly (contact to be closed when Switching Device is open)
Will not transfer to generator source upon failure of utility source	On Service Entrance Rated ATS, Utility Voltage Disconnect switch inside ATS is switched to "Off" position.	Switch Utility Voltage Disconnect switch to the "On" position
	Warm-up time delay function has not timed out yet	Verify TSC 900 timer setting
	Generator set output circuit breaker which feeds ATS is open	Close generator set output circuit breaker
	Generator supply is not operating at correct voltage or frequency levels.	Verify correct nominal levels the generator should be operating at and compare to TSC 900 Settings for under/over voltage, voltage phase balance and under/over frequency
	TSC 900 has incorrect generator voltage or frequency settings for the ATS.	Re-Program TSC 900 with correct settings as required for voltage or frequency.
	Generator Phase Rotation may not match Utility supply (First Time Transfer).	Check Generator & Utility Voltage Phase rotation matches on TSC 900 GHC Utility & Generator Voltage Pages. If power cabling has non-matching phase rotation, reverse power conductors on one phase on one of the supplies
	Electrical interlock contact from Utility (Source 1) Switching Device (USD) To TSC 900 controller is not working correctly	• Check TSC 900 Digital Input DI-08 is correctly mapped as "Source 1 Power switching device Opened • Check Digital input is correctly wired to Utility (Source 1) Switching Device "b" auxiliary contact • Check Utility (Source 1) Switching Device "b" auxiliary contact is operating correctly (contact to be closed when Switching Device is open)
	TSC 900 connection plugs are unplugged (J1,2,3,4)	Verify all TSC 900 connectors are fully inserted
	AC Voltage Sensing or Control Isolation plugs (PL12 or PL15) are unplugged	Verify both PL12 & PL15 connectors are fully inserted
	TSC 900 has "Transfer Fail" alarm activated.	Determine cause of alarm and rectify before TSC 900 is reset on GHC
	Defective ATS mechanism motor	Verify motor does not rotate when 120VAC is applied directly to motor leads. If defective Return to Thomson Power systems using RMA process
	A loose control wire connection	Check all wiring connections in the ATS
	Defective TSC 900 controller	• Verify TSC 900 has 120VAC control power applied to the generator control power input (J1-12, 13) and Diagnostic green LED is flashing. • Verify TSC 900 has 120VAC control power applied to the ATS control contacts (J1-1). • Verify TSC 900 SCU has SD Memory Card fully inserted into socket. If defective Return to Thomson Power systems using RMA process
	Faulty motor limit switch	Verify Generator side limit switch (GLS) n/c contact is closed and is low resistance when ATS mechanism is <u>not</u> in the generator position.

MALFUNCTIONS	PROBABLE CAUSES	CORRECTIVE ACTIONS
Transfer to generator source without a power failure in the utility source	A Load Test mode has been activated locally or remotely	Check TSC 900 GHC Home Page status indicators
	An Exercise Test mode has been activated by the TSC 900 scheduler	Check TSC 900 GHC Scheduler page
	Utility supply is not operating at correct voltage or frequency levels.	Verify correct nominal levels the utility source should be operating at and compare to TSC 900 settings for under/over voltage, voltage phase balance and under/over frequency
	TSC 900 has incorrect utility voltage or frequency settings for the ATS.	Re-Program TSC 900 with correct settings as required for voltage or frequency.
	Utility power switching device has tripped open due to an over current condition and TSC 900 “Transfer Fail” alarm is activated on GHC.	Determine cause of alarm and rectify before TSC 900 is reset.
	A loose control wire connection	Check all wiring connections in the ATS
	Defective TSC 900 controller	• Verify TSC 900 is reading correct Utility Voltage or frequency on GHC as compared to separate meter. If Defective Return to Thomson Power Systems using RMA process
Generator does not start or stop when it should	Remote engine control panel is not set to automatic mode	Verify remote engine control panel is set for automatic operation
	Engine start contact is wired incorrectly from ATS to engine control panel	Verify engine start contact is wired correctly from ATS to engine control panel
	Incorrect TSC 900 Engine start contact is used	For single engine applications, use Engine Start Signal #2 contact on TSC 900 lower terminal block (J10b)
	TSC 900 Engine start contact terminal block (j10b) is unplugged	Verify 2 position TSC 900 terminal block j10b is fully inserted into controller and it is connected to correct position (i.e. lower TB)
	Defective TSC 900 SCU Engine Start relay/contact	• Verify Engine start signal LED diagnostic light is illuminated on SCU when engine is signaled to start. If LED is on, verify contacts are closing. If Defective Return TSC 900 SCU to Thomson Power Systems using RMA process
	Engine Start and/or Cooldown timers may be duplicated in both ATS control and Engine Control Panel	Disable timers in either ATS or Engine control panel.
No time delay when there should be	Incorrect TSC 900-time delay setting	Verify TSC 900 timer setting
Power is not available at the load terminals but the utility or generator power switching device appears to be closed to a live source	Utility or Generator power switching device has tripped open due to an over current condition.	Power Switching device must be reset by <u>manually</u> operating the ATS mechanism to the other source, then back to the source which was tripped.
	Mechanism has failed to operate the power switching device toggle far enough to close the power switching unit.	Limit switch failure or improper adjustment. Contact Thomson Power system for adjustment procedure of limit switch
The transfer switch has completed a transfer, but the motor has overheated and the internal thermal protector has opened	Limit switch failure or improper adjustment	Contact Thomson Power system for adjustment procedure or replacement of limit switch

MALFUNCTIONS	PROBABLE CAUSES	CORRECTIVE ACTIONS
Engine starts and stops every 3-4 minutes	TSC 900 has been selected for OFF mode and all control power has been removed to the TSC 900 controller	Maintain control power to TSC 900 at all times or change local engine control panel from Auto to OFF mode to prevent starting in Auto mode
GHC Display is not showing any system information	GHC screen maybe in a "sleep" mode.	Touch screen to re-activate LCD display
	GHC USB cable is unplugged at the GHC end or the SCU end	Verify USB cable is fully inserted into the GHC and SCU devices
	Defective GHC Display	• Temporarily unplug GHC USB cable for 5 seconds then re-insert to reboot GHC comptroller. Wait 30 seconds to determine if GHC reboots to normal operation. • Verify TSC 900 GHC has SD Memory Card fully inserted into socket. If defective Return to Thomson Power Systems using RMA process
	TSC 900 SCU Control board is not powered from 120VAC Utility supply, 120VAC Generator supply, or 24VDC aux supply (if fitted)	The GHC needs maintained 5VDC power from the TSC 900 SCU Control board at all times. Verify SCU is powered from either 120VAC Utility supply, 120VAC Generator supply, or 24VDC aux supply (if fitted).
	SCU USB Jumper (J24 on SCU PCB) is in the incorrect position	Verify SCU USB Jumper (J24 on SCU PCB) is in the "GHC" position.

NOTE

There are no user serviceable components located on the TSC 900 SCU printed circuit board. If the TSC 900 controller (i.e. SCU or GHC) are deemed to be defective, they must be returned to the Thomson Power Systems Factory for repair or replacement. Please refer to Product Return Policy section of this manual further information on product return procedures required.

10. REPLACEMENT PARTS

Service Replacement parts are available for the TSC 900 controller as follows:

TSC 900 SCU Controller Board P/N TSC900SCUSR

TSC 900 GHC Display P/N TSC900GHCSR

When ordering replacement parts, please provide the following information:

1. Transfer Switch Model code (e.g. TS 873AA0200AS)
2. Transfer Switch Serial Number (e.g. W-022345)

The above information can be found on the transfer switch rating plate located on the outside of the ATS door.

For other parts not listed, please contact Thomson Power Systems.

11. PRODUCT RETURN POLICY

Thomson Power Systems uses a Return Material Authorization (RMA) process. Please complete the Return Authorization Request Form (available on our web page) for return of goods, warranty replacement/repair of defective parts, or credit consideration and fax to the appropriate department.

Returns only: Sales Fax (604) 888-5606

Warranty replacement/Warranty Repair: Service Fax (604) 888-3370.

Upon receipt of your request, Thomson Power Systems will confirm with a copy of our Order Acknowledgement via fax advising the RMA number which should be used to tag the defective controller prior to shipment.

12. NOTES