



Automatic Transfer Switch Controller Training TSC 900

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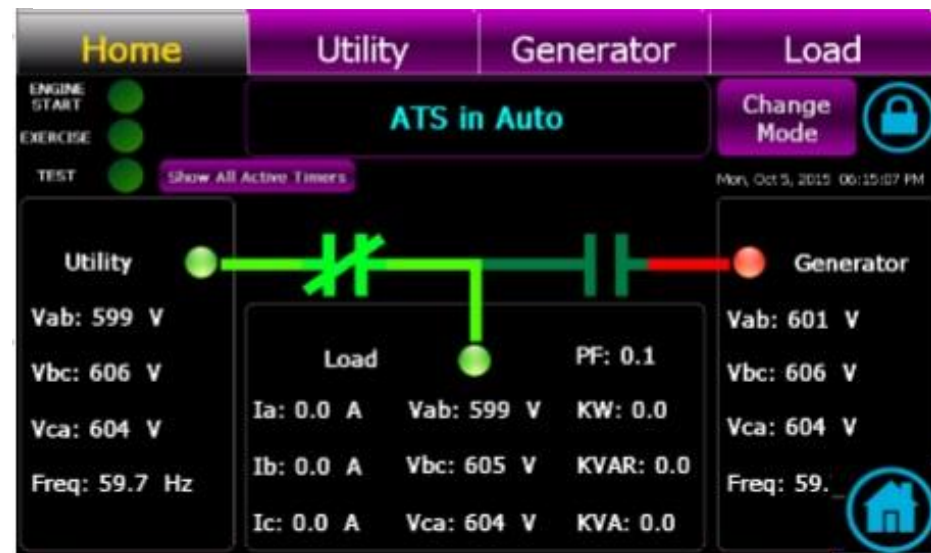
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TSC900

Automatic Transfer Switch Controller

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- 2.) Components
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- 5.) Alarms
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1.) TSC 900 Overview

Two Piece Controller

Graphical HMI Controller (GHC)

- Door Mounted
- Communication Ports
- Monitoring Display
- Operator Control Objects



Switch Control Unit (SCU)

- Control Panel Mounted
- Interface to Transfer Switch Mechanism
- Voltage Sensing Connections
- Programmable Input/Output Connections



1.) TSC 900 Overview

TSC 900 Applications

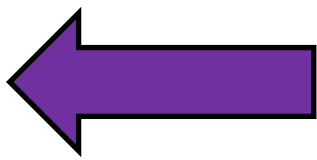
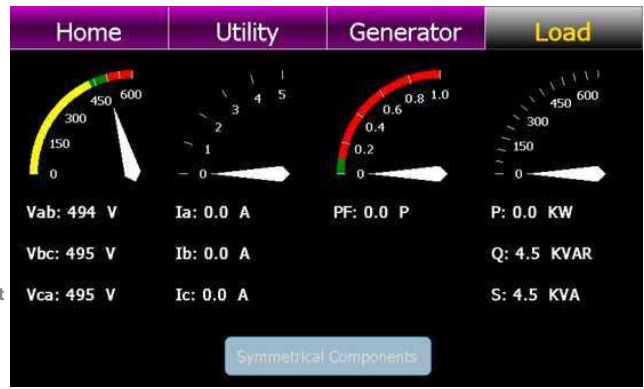
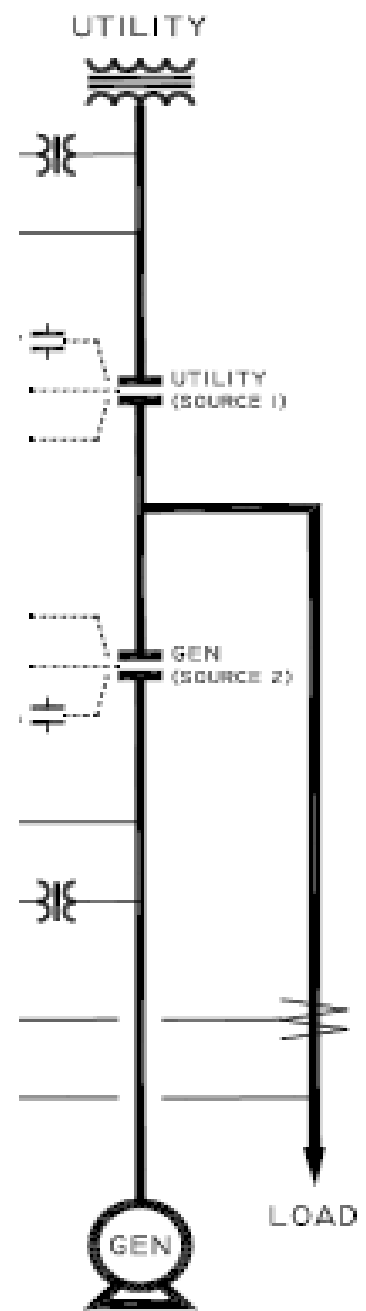
- Automatic Emergency Standby ATS
- Open or Closed Transition Transfer Controls
- Closed Transition Fast transfer or Soft Load Capability
- Load transfer utilizing Neutral Delay or In-phase monitor
- In-phase drift synch enables Fast Open transitions
- Service entrance ATS option with utility disconnect switch (US models only)
- Single phase or 3 phase systems, rated 100-4000A



1.) TSC 900 Overview

TSC 900 Power Metering

- True RMS Power Metering Options
- Load kW, kVA, kVAR and Power Factor
- Advanced Metering with Energy Counters & Trending
- Load Current 3 Phase
- +/-1.5% Power Accuracy (Full Scale)
- Voltage 3 Phase, L-L, L-N (2 Sources + Load)
- System Frequency
- Programmable PT/CT Ratio



1.) TSC 900 Overview

TSC 900 Specifications

Performance

- Operating Temperature -20°C to +55°C (-4°F-131°F)
- Storage Temperature -30°C to +75°C (-22°F-167°F)
- Voltage Sensing Accuracy +/-0.5% Full Scale
- Current Sensing Accuracy +/-1.0% Full Scale
- Power Input 120VAC Nominal +10%, -30%, 50/60Hz /24 Vdc

Certifications/Compliance

- UL 1008/CSA 178 Emergency Rated Automatic Transfer Switches
- UL 508/CSA 14 Industrial Control Equipment
- FCC CFR 47 Part 15 Class A
- Output Contacts (Prog) 2A, 250VAC, 30VDC Resistive (max)
- EN 61000 Series Electromagnetic Noise Immunity/Radiation

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2.) TSC900 Components



-GHC Display
Hardware

-SCU Printed Circuit
Board (PCB) Layout

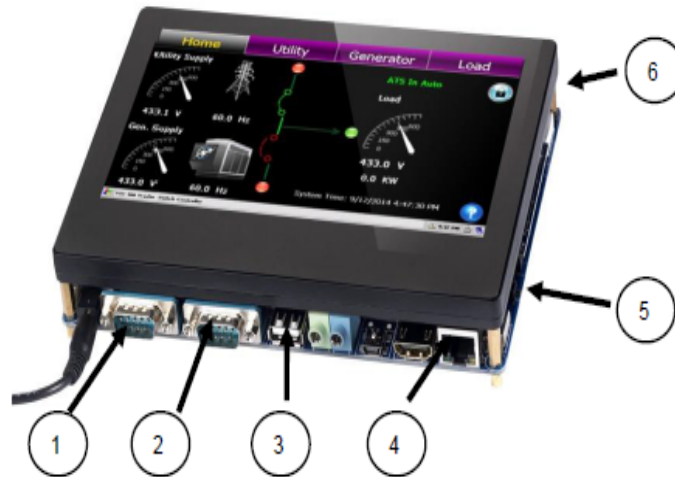
-SCU Case and
Connections

- Communication Ports

-Battery Back up

2.) Components

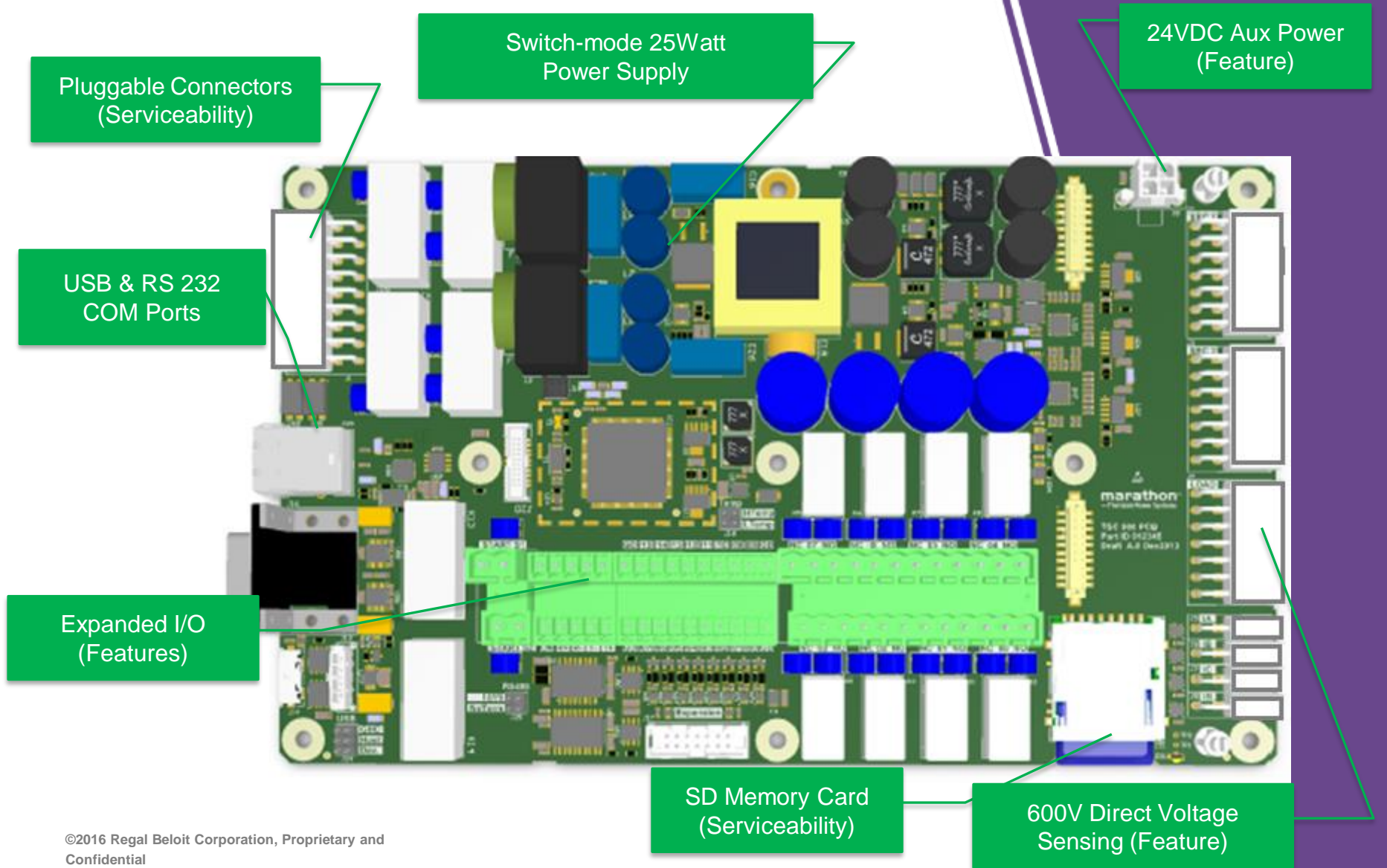
GHC Display Hardware



1. RS232 Communication Port #1: This port is utilized for Modbus RTU Serial communication
2. RS232 Communication Port #2: This port is utilized for Modbus RTU 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.

2.) Components

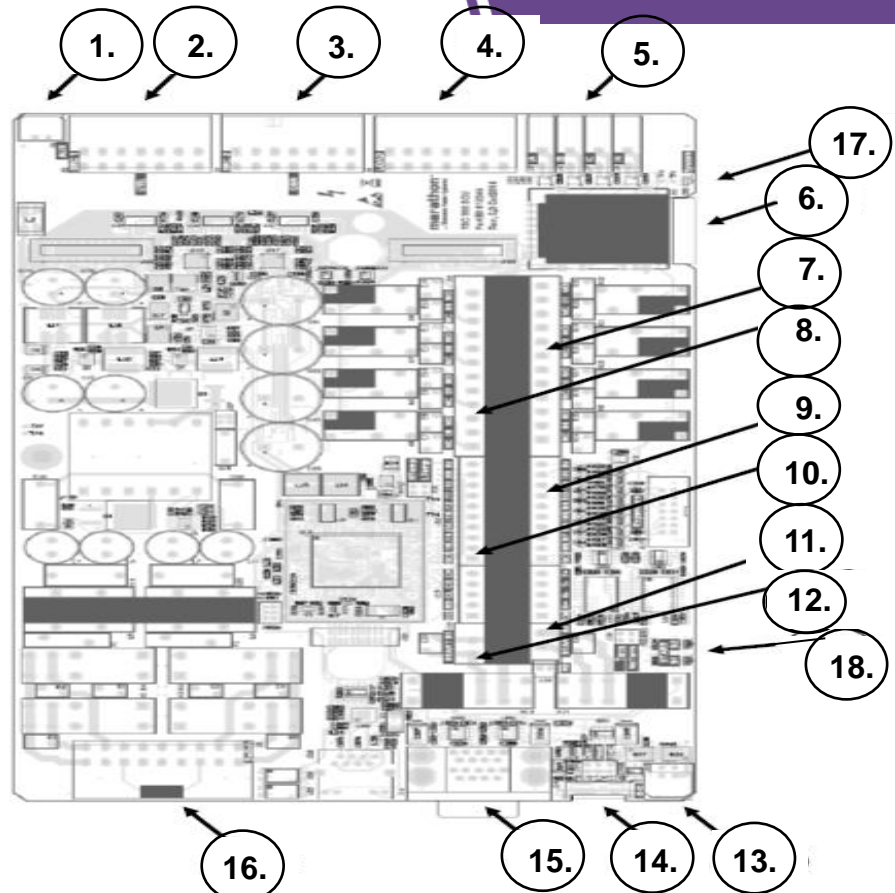
SCU PCB Layout



2.) Components: TSC 900 SCU CONNECTIONS



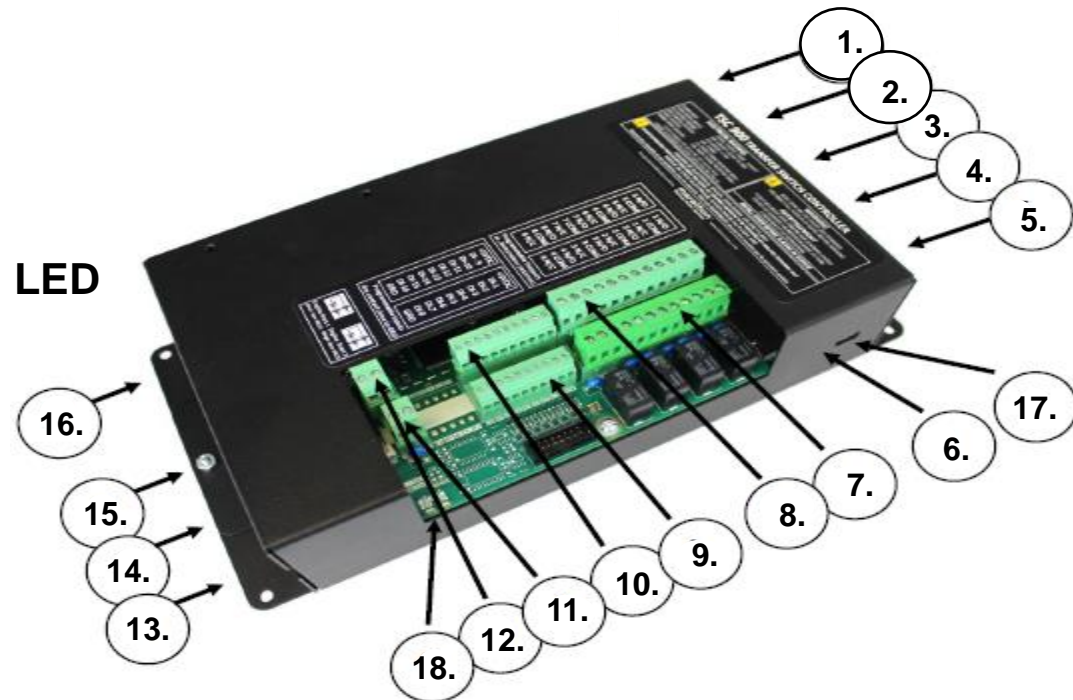
- 1. J9 – 24VDC Auxiliary Control Power
- 2. J2 – Utility Voltage Sensing (Phase ABC, N)
- 3. J3 – Generator Voltage Sensing (Phase ABC, N)
- 4. J4 – Load Voltage Sensing (Phase ABC, N)
- 5. J5,6,7,8 – Load Current Sensing (Phase ABC, N)
- 6. J21 – SCU SD Memory Card (Located inside case)
- 7. J11a – 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 Contact 2
(Single Gen Src 2)
- 12. J10b – Engine Start Contact 1
(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



2.) Components: TSC 900 SCU CONNECTIONS WITH CASE



1. J9 – 24VDC Auxiliary Control Power
2. J2 – Utility Voltage Sensing (Phase ABC, N)
3. J3 – Generator Voltage Sensing (Phase ABC, N)
4. J4 – Load Voltage Sensing (Phase ABC, N)
5. J5,6,7,8 – Load Current Sensing (Phase ABC, N)
6. J21 – SCU SD Memory Card (Located inside case)
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 Contact 2 (Single Gen Src 2)
12. J10b – Engine Start Contact 1 (Dual Gen Src 1)
13. J13 – GHC Aux 5VDC Power
14. J14 – GHC USB Port
15. J15 – RS232 Programming Port
16. J1 – ATS Control
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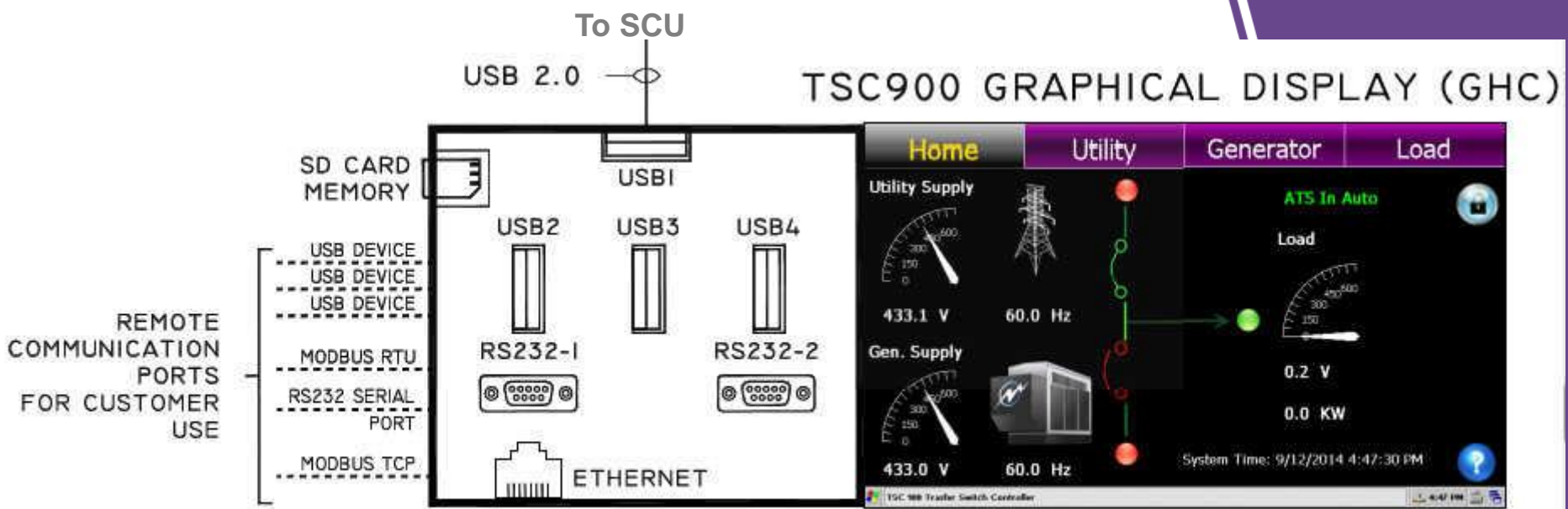


2.) Components:

TSC 900 Communication Ports



- All Customer COM ports are on GHC
- SCU has 2 COM ports
 - USB - to talk to GHC
 - RS232 - for Factory Programming Only



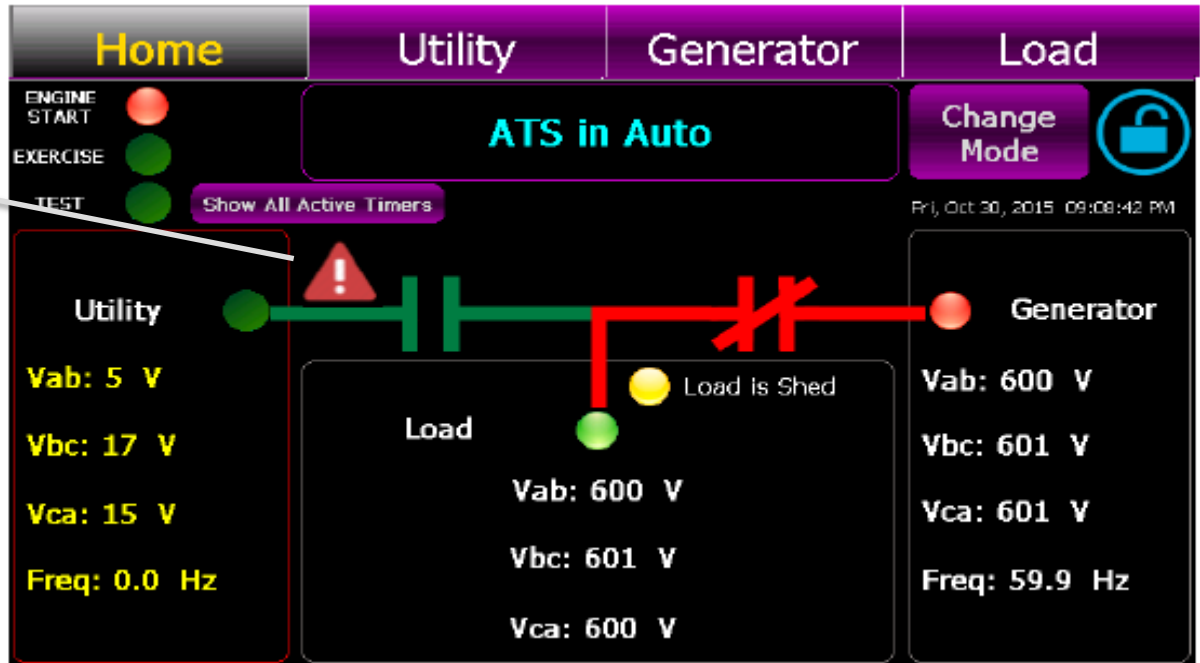
3.) TSC 900 GHC Software

- GHC Home Page
- GHC Status LEDs
- Screen Page Navigation



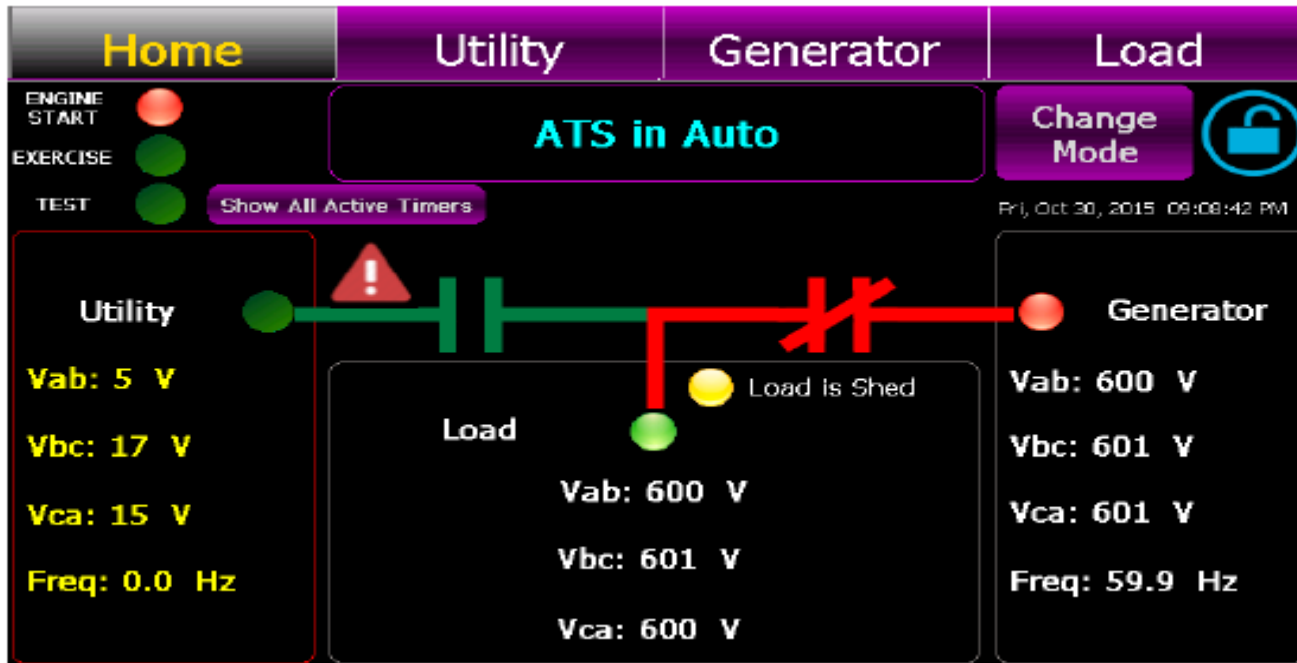
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Protection trip Indicates:
 - Under Voltage / Over Voltage or
 - Under Frequency / Over Frequency



3.) TSC 900 GHC Software

GHC Status LEDs



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



3.) TSC 900 GHC Software SCREEN PAGE NAVIGATION



FINGER-SWIPE MOTION CAN BE USED

HOME SHORT-CUT ACCESS BUTTON (PRESS)

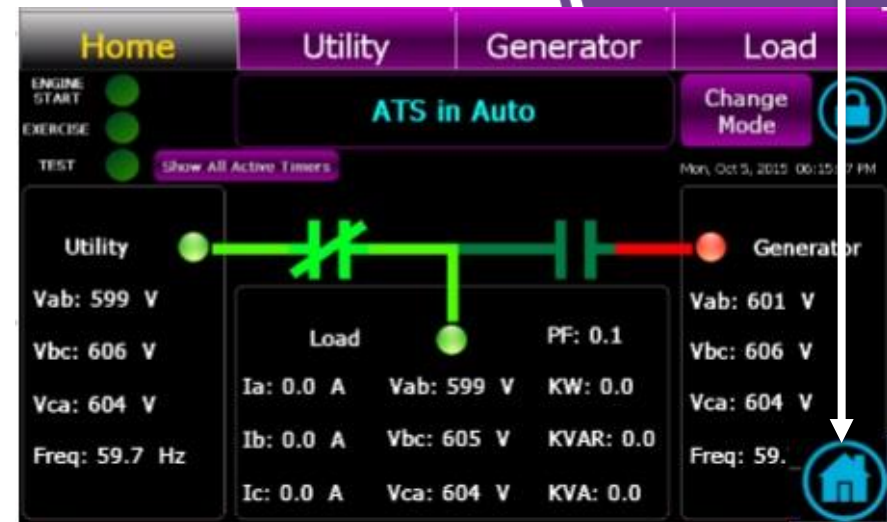


Pressing Utility goes to the Utility Metering Page

Pressing Generator goes to the Gen Metering Page

Pressing Load goes to the Load Metering Page

**Pressing Change Mode goes to Change Modes:
(On load / Off load, timed tests, Auto/Manual)**



3.) TSC 900

GHC Software SCREEN PAGE NAVIGATION



The display pages are organized into the following main menu pages :

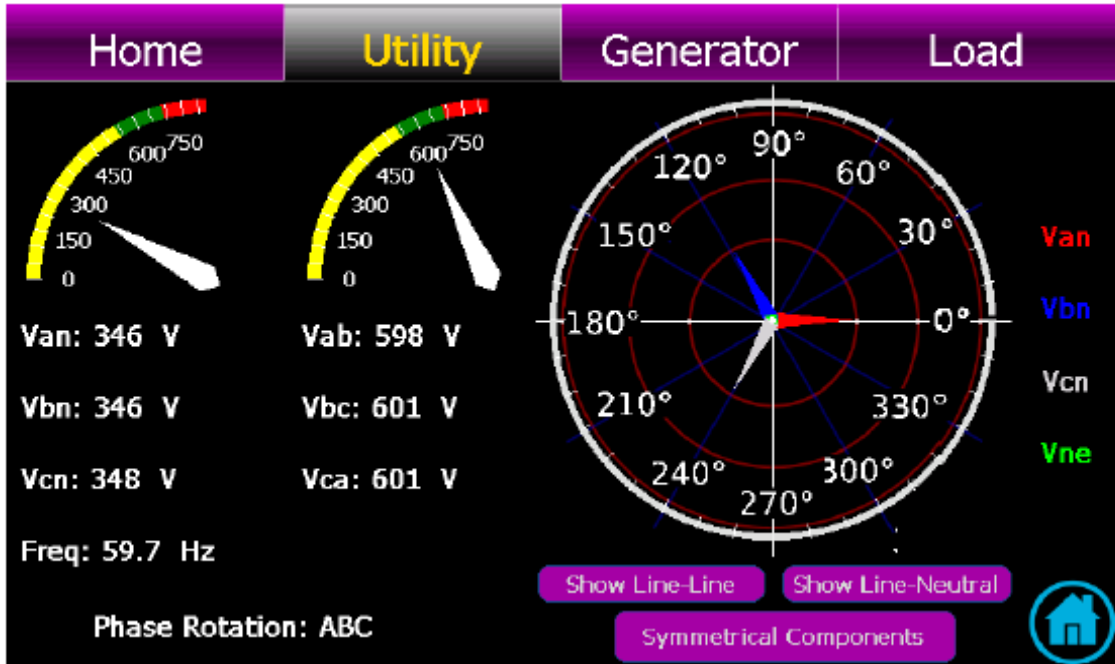


NOTE: the Sync page will only be visible for ATS applications that are capable of fast in-sync transfer

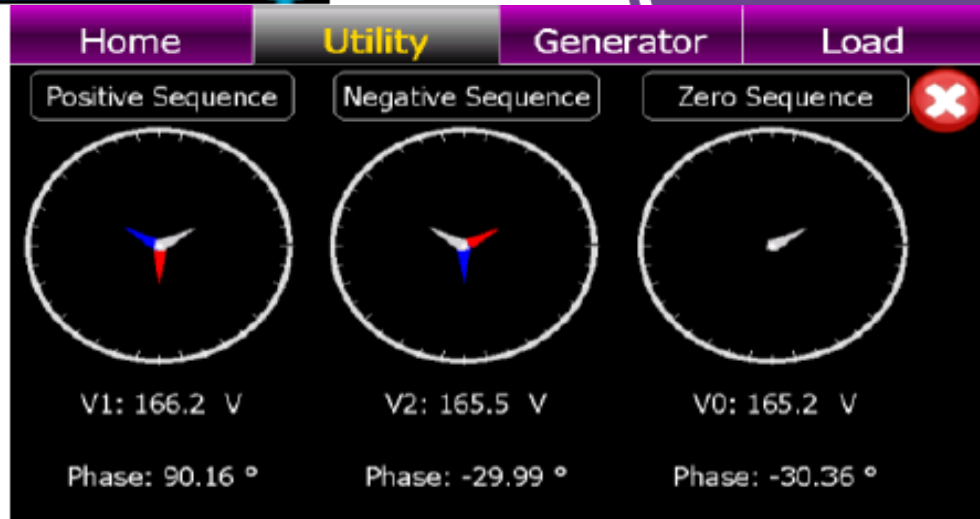


4.) TSC 900 Metering

Utility Metering Page

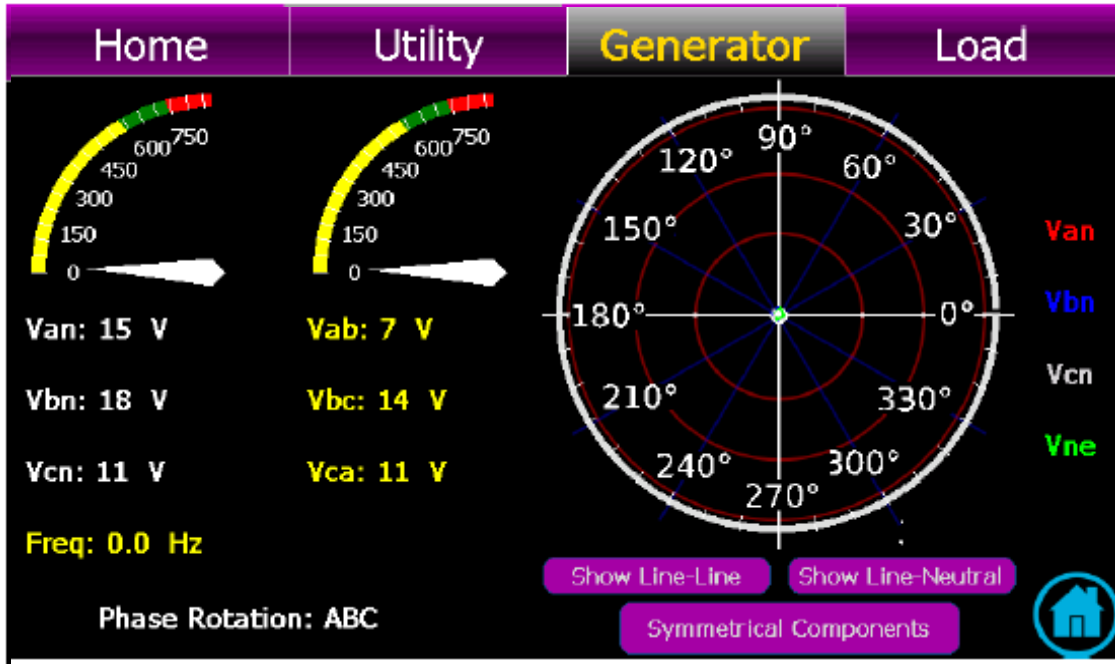


Press symmetrical button
To view Phase angles

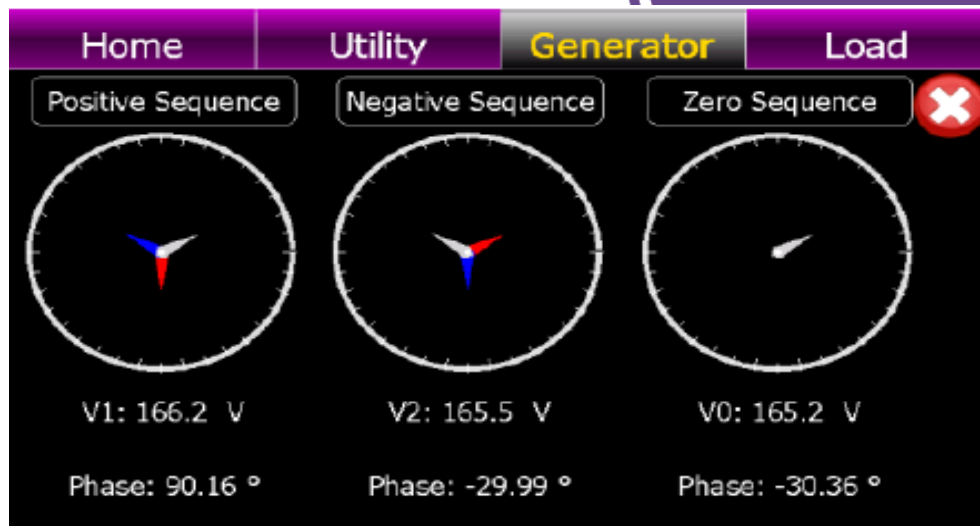


4.) TSC 900 Metering

Generator Metering Page

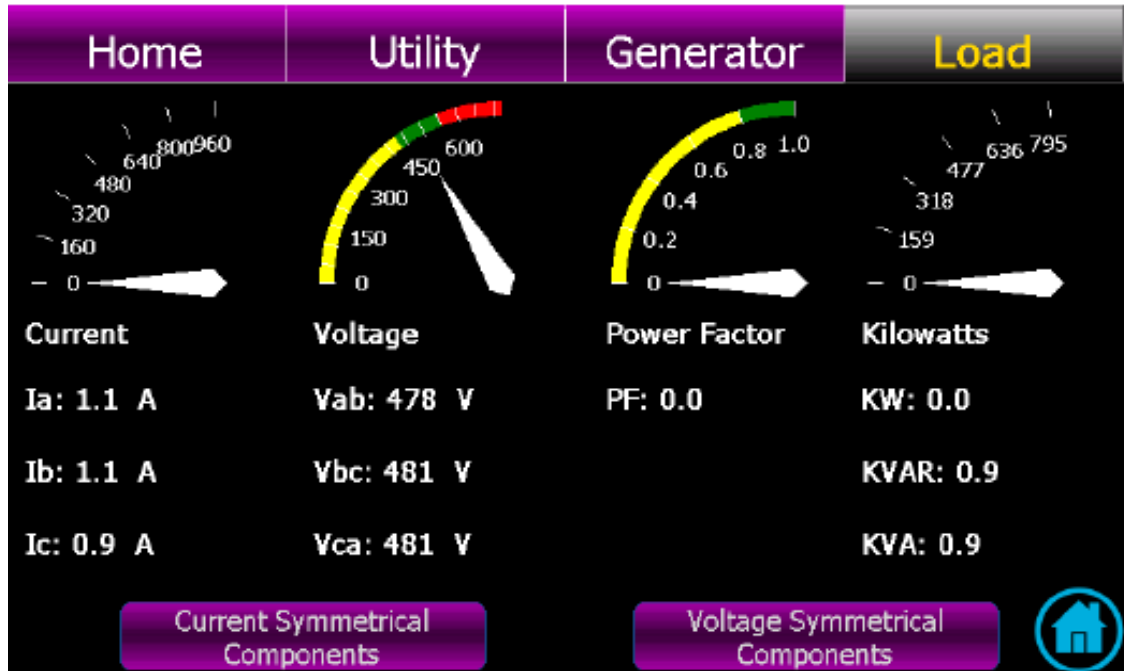


Press symmetrical button
To view Phase angles



4.) TSC 900 Metering

Load Metering Page



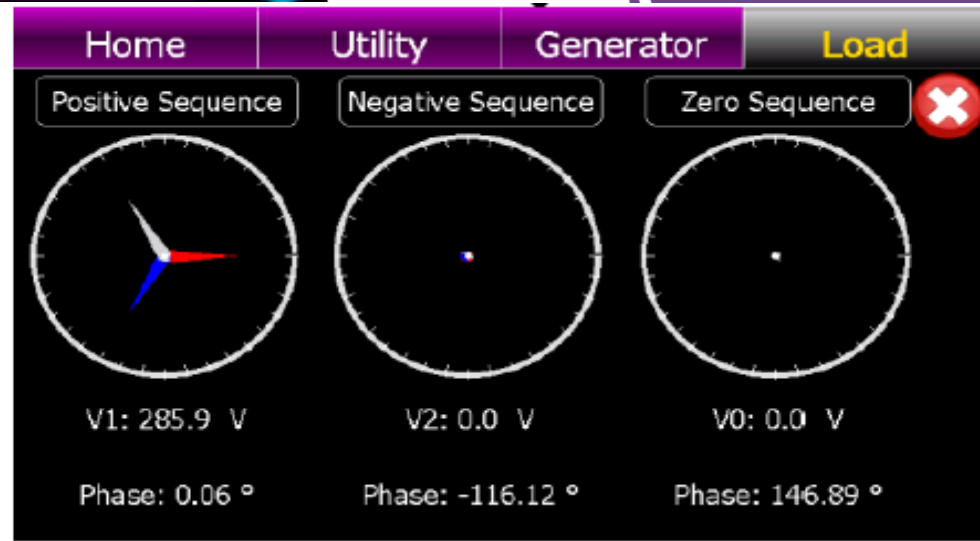
Current Symmetrical Components

Voltage Symmetrical Components



Press symmetrical button To view Phase angles

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



5.) TSC 900 Alarms

ALARMS PAGE



Alarms	Alarms Log	Events Log	Sync
Src 1 Fail to Open/Close Alarm	?	Src 2 Fail to Open/Close Alarm	?
Load on Src 1 Limit Sw/Aux Contact F	?	Load on Src 2 Limit Sw/Aux Contact F	?
Loss of Load Voltage - Src 1 Contacts	?	Loss of Load Voltage - Src 2 Contacts	?
		Gen 2 Standby Source Failed to Start	?
Fail to Drift Sync Timeout	?		
Src 1 Fail to Unload	?	Src 2 Fail to Unload	
		Gen 2 Failed While Running	



Pressing Next shows The Next page of Alarms available.

Scheduler	Settings	System	
		Back	
ATS mechanism fail to open, SRC 1	?	ATS mechanism fail to open, SRC 2	?
ATS mechanism fail to close, SRC 1	?	ATS mechanism fail to close, SRC 2	?

Note: An inhibit to transfer alarm could be from a Phase Reversal. This controller logic saves the system from a potentially Hazardous situation and/or equipment damage.

5.) TSC 900

Alarms

ALARMS LOG



Alarms	Alarms Log	Events Log	Protections
3/15/2015	Alarm	Status	User
11:14 PM	Breaker tripped on Source 2	Activated	factory
11:13 PM	Breaker tripped on Source 1	Activated	System Data
11:13 PM	All Alarms	Reset	System Data
11:12 PM	Any Active Alarms	Activated	System Data
11:12 PM	All Alarms	Reset	System Data
11:09 PM	All Alarms	Reset	System Data
11:08 PM	Any Active Alarms	Deactivated	System Data
11:08 PM	Breaker tripped on Source 2	Deactivated	System Data
11:08 PM	All Alarms	Reset	System Data
11:07 PM	Breaker tripped on Source 2	Activated	System Data
11:07 PM	Any Active Alarms	Activated	System Data
11:07 PM	Any Active Alarms	Deactivated	System Data
11:07 PM	Breaker tripped on Source 1	Deactivated	System Data

Selected Date

Alarms Alarms Log Events Log Scheduler

11/9/2015 Today Esc

Status User

Activated

Activated

2015 November

Sun	Mon	Tue	Wed	Thu	Fri	Sat
25	26	27	28	29	30	31
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5



5.) TSC 900 Alarms

EVENTS LOG



Alarms	Alarms Log	Events Log	Protections
3/15/2015	Event	Action	User
11:14 PM	Guard	Deactivated	factory
11:14 PM	Control Transferring	Deactivated	factory
11:14 PM	Load Blackout voltage	Deactivated	factory
11:14 PM	Source 2 to output	Activated	factory
11:14 PM	ATS On Source 2	Activated	factory
11:14 PM	Wait for Sync	Deactivated	factory
11:14 PM	Transfer Underway	Deactivated	factory
11:14 PM	Load Pre-Disconnect	Deactivated	factory
11:14 PM	Active during Pre & Post-Transfer	Deactivated	factory
11:14 PM	ATS on Source 2	Activated	factory
11:14 PM	Switch is on source 2	Activated	factory
11:14 PM	Neutral	Deactivated	factory



The Events Log Page has a calendar button which can show all of the alarms from a Selected Date



Alarms	Alarms Log	Events Log	Scheduler
11/9/2015	Today	Esc	
2015	November	Action	User
Sun	Mon	Tue	Wed
25	26	27	28
1	2	3	4
8	9	10	11
15	16	17	18
22	23	24	25
29	30	1	2
6	7	8	9
13	14	15	16
20	21	22	23
27	28	29	30
4	5	6	7



6.) TSC 900 SETTINGS PAGE

Scheduler	Settings	System		
All	Setting	Min	Max	Value
	CT Ratio	1	1000	1
System	Load Name	1	1000	Load
Options	Source 1 Name	1	1000	Utility
Delay	Source 2 Name	1	1000	Generator
Set Points	Application Model	1	1000	A
	Switch Operation	1	1000	3
	Switch Model	1	1000	ICS
	PT Ratio	1	500	1

SETTINGS PAGE IS UTILIZED FOR PROGRAMMING



6.) TSC 900 SETTINGS

SCHEDULER PAGE



Scheduler		Settings			System		
On?	ID	Type	Period	Recur.	Next Run	Duration	NEW
	36	Onload Test	onetime	0	07/20/09 13:35	15 mins	Edit
	37	Onload Test	onetime	0	07/20/09 16:22	15 mins	Edit

Press new or edit button



Type: Onload Test

Period: hour

Repeat Every: 1

Start Date: 11/4/2015

Start Time: 18:17:09

End Date: 11/25/2015

End Time: 12:00:00

Duration: 12 mins

Check to omit End Date/Time:

Confirm Cancel





REFER TO MANUAL FOR SUB MENU VIEWING/PROGRAMMING



6.) TSC 900 SETTINGS

SYNC PAGE



Alarms Alarms Log Events Log **Sync**

Drift Sync: ● Ext. Sync: ● ?

Voltage Difference (%)			Slip (%)		
Voltage Diff :	0.0	%	Slip:	0.0	%
Voltage Diff :	0.0	V	Slip:	0.0	Hz
Utility Voltage:	594.5	V	Utility Freq:	59.7	Hz
Gen Voltage:	594.5	V	Gen Freq:	59.7	Hz

The Synchron page is only visible if the ATS is Closed Transition or Open Transition with In-Synch Fast Transfer.



7.) TSC 900 PROGRAMMING

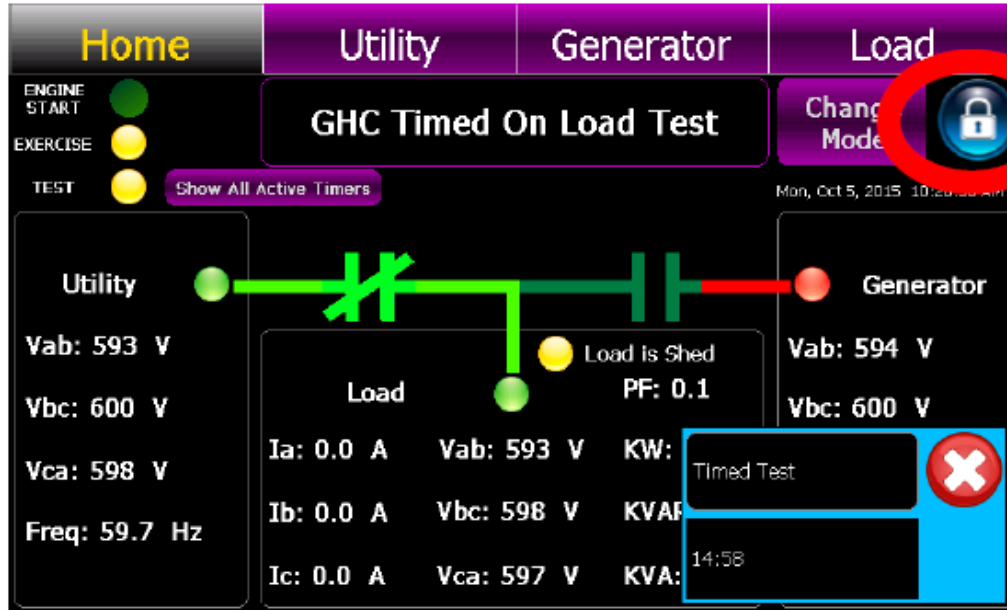
-Log in

-Inputs

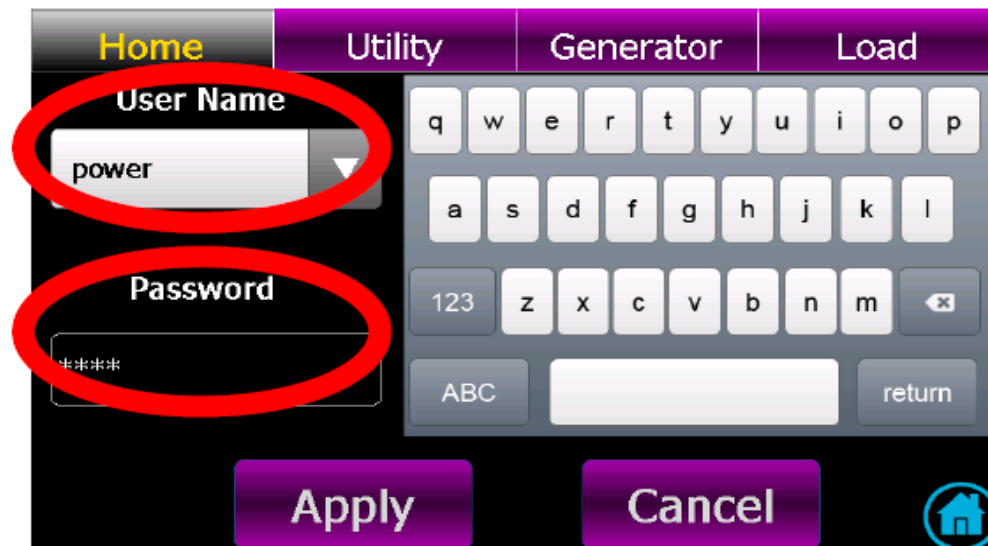
-Outputs

-Manual

7.) TSC 900 PROGRAMMING LOGIN



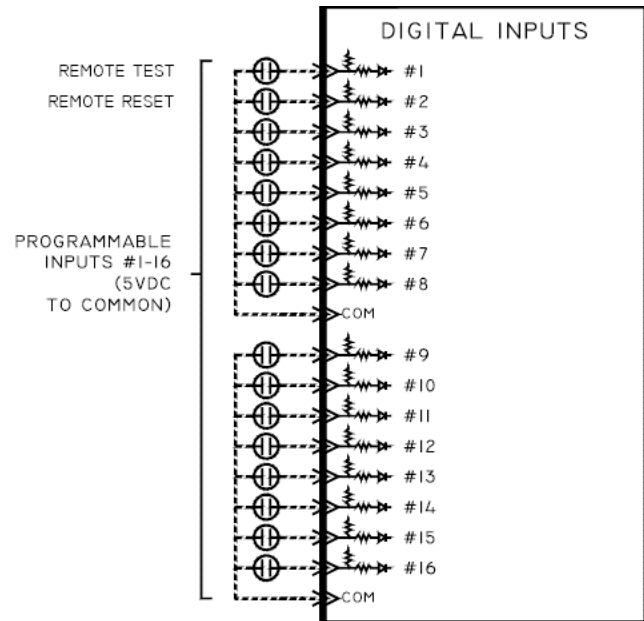
**SELECT LOCK ICON
AS SHOWN**



**SELECT "USER NAME"
AND SELECT ADMIN.
FACTORY DEFAULT
PASSWORD IS "pass"**

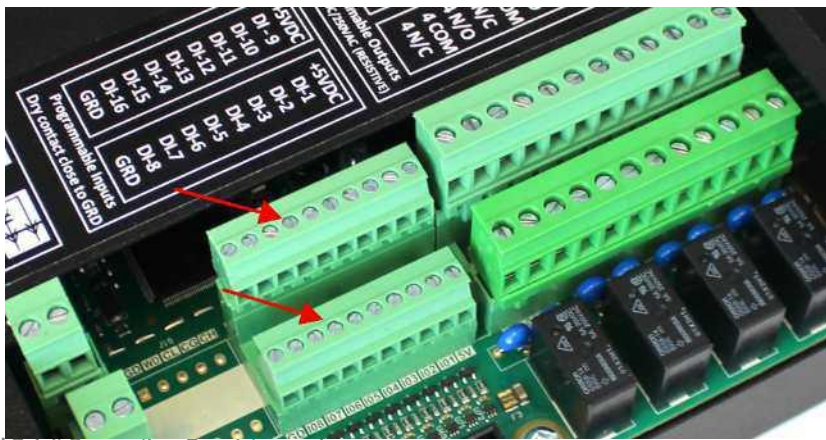
7.) TSC 900 PROGRAMMING

TSC 900 Programmable Inputs



- 16 Digital Inputs
- Dry contacts (Close to common)
- Fully Programmable (50+ Functions)
- Factory Defaults Set To:

DI#	DIGITAL INPUT FUNCTION
1	REMOTE TEST-UTILITY POWER FAIL SIMULATE (EXTERNAL SWITCH/PB)
2	REMOTE RESET. EXTERNAL PUSHBUTTON FOR TSC900 ALARMS
3	SERVICE ENTRANCE MODE-ACTIVATED
4	SERVICE ENTRANCE BREAKER (USD) TRIPPED
5	GSD TRIPPED
6	TRANSFER MODE-MAN MODE (EXTERNAL SW OPTION)
7	CTTS TRANSFER MODE-CLOSED TRANSITION MODE (EXTERNAL SW OPTION)
8	BYPASS SWITCH STATUS - GEN BYPASS CLOSED
9	BYPASS SWITCH STATUS - UTILITY BYPASS CLOSED
10	BYPASS SWITCH STATUS - GEN ISOLATE OPEN
11	BYPASS SWITCH STATUS - UTILITY ISOLATE OPEN
12	BYPASS SWITCH STATUS - LOAD ISOLATE OPEN
13	PERMIT TRANSFER TO UTILITY (SRC1)
14	INHIBIT TRANSFER TO UTILITY (SRC1)
15	PERMIT TRANSFER TO GEN (SRC2)
16	INHIBIT TRANSFER TO GEN (SRC2)



7.) TSC 900 PROGRAMMING



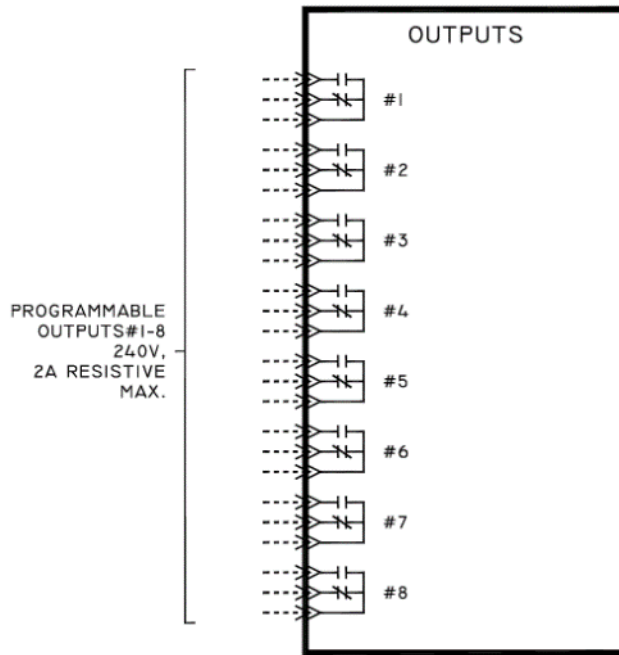
16 Digital Inputs

Sync	Scheduler	Settings	System
IP01: Terminal Test Request	IP09: Not Mapped		
IP02: Unfail request (terminal)	IP10: Not Mapped		
IP03: Disconnect Request	IP11: Not Mapped		
IP04: Not Mapped	IP12: Not Mapped		
IP05: Not Mapped	IP13: Timer Remote Clear Request (Terminal)		
IP06: Request Manual Mode (terminal)	IP14: Non-auto Off Request (terminal)		
IP07: Not Mapped	IP15: Unhalt request (terminal)		
IP08: Not Mapped	IP16: Terminal Exercise Request		



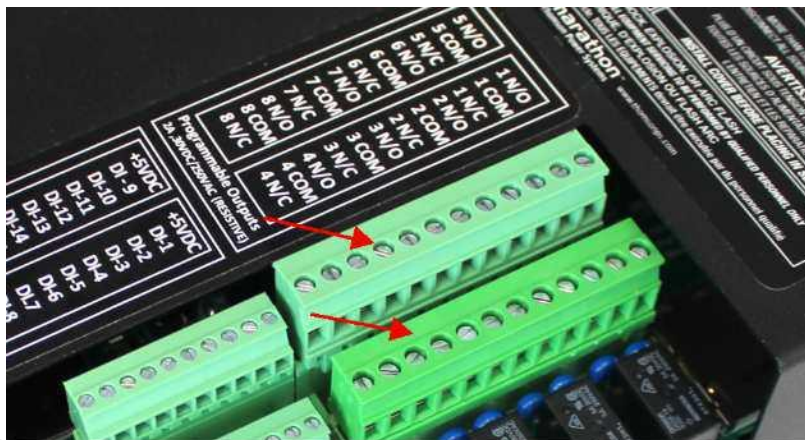
7.) TSC 900 PROGRAMMING

TSC 900 Programmable Outputs































- 8 Relay Contact Outputs
- Form C, 2A 240VAC Resistive
- Fully Programmable (50+ Functions)
- Direct Customer Connection on PCB (not wired out to interposing TB)
- High Current Outputs (10A) must use optional aux relay (option PPR-10)
- Factory Defaults Set To:

DO#	DIGITAL OUTPUT FUNCTION
1	LOAD ON UTILITY
2	LOAD ON UTILITY
3	LOAD ON GENERATOR
4	LOAD ON GENERATOR
5	LOAD DISCONNECT CONTACT (LDC)
6	FAIL TO TRANSFER (FTT)
7	ATS NOT IN AUTO
8	UTILITY POWER FAIL (UPF)



8 Digital Outputs

Sync	Scheduler	Settings	System
		OP01: Source 1 Not Available	  
		OP02: ATS on Source 1	  
		OP03: Source 2 Not Available	  
		OP04: ATS on Source 2	  
		OP05: Active during Pre & Post-Transfer	  
		OP06: Any Active Alarms	  
		OP07: Transfer fail Alarm	  
		OP08: Active during Pre & Post-Transfer	  

7.) TSC 900 PROGRAMMING

TSC 900 Programming Manual



**PLEASE REFER TO TSC900
MANUAL PM151r6 FOR MORE
DETAILED PROGRAMMING
INSTRUCTIONS.**

Questions?

