



Submittal for Approval

Prepared for City of Cannon Beach
PO 072522

Cannon Beach Midway Sourcewell 120617-CAT



Image Shown may not reflect actual configuration

(Qty. 1) Caterpillar C2.2 Standby Genset – 30kW, 240/120V Delta
(Qty. 1) Thomson Series 873 ATS – 100A, 240/120V Delta

PPSI File Number 21-0515
August 25, 2022

SINCE 1936



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Founded in 1936, Peterson is the authorized Cat dealer in Northern California, Oregon, and Southwest Washington. We have the right people and resources to develop a power systems solution that meets your needs and specifications, regardless of application or working environment.

We consider your technical and commercial requirements early in the design process and follow through to assure our system meets your expectations. Our sales and project management teams provide the best equipment, in the right application, delivered on-time, and operating as designed. Our product support team assures your system provides reliable and dependable service to keep your business running.

We provide a wide selection of equipment and system solutions:

- Standby power to 4MW, packaged enclosures, tanks, and accessories
 - Diesel and gaseous fuel
 - Paralleling switchgear, transfer switches, uninterruptable power supply
- Prime and continuous power
 - Diesel and gaseous fuel
 - Cogen and combined heat & power (CHP)
 - Control systems
- Industrial engines
 - Power take off, hydraulic drives and clutches
 - Control systems
- Marine systems
 - Diesel
 - Generators
 - Propulsion systems
 - Controls
- Rental
 - Generators, temperature control, air compressors, and accessories
- Product support
 - Factory-trained technicians, local parts availability, service agreements, 24-hour service

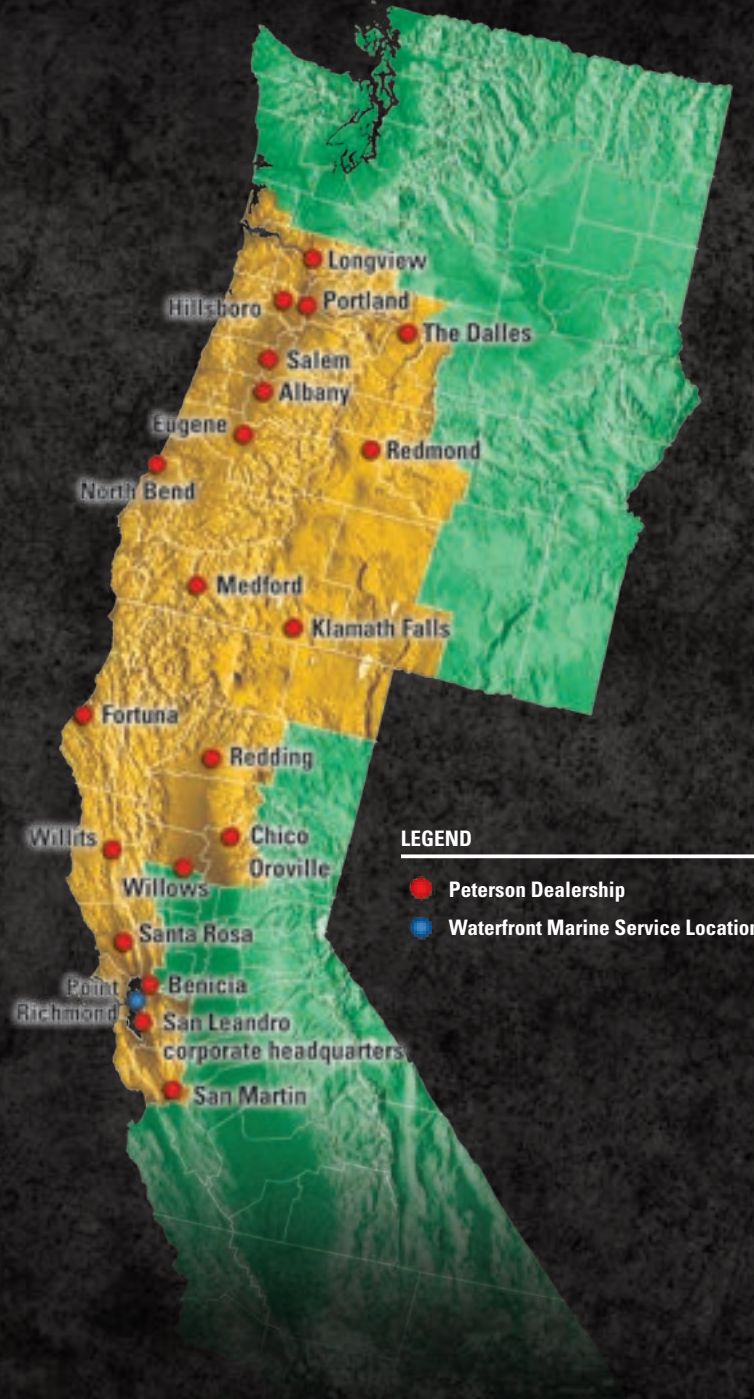
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AWARDS AND CERTIFICATIONS



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SECTION I

Bill of Materials

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Bill of Materials

Project Name: Cannon Beach Midway Sourcewell
Peterson Project No. 210515

Date: August 12, 2022

Item	Qty.	Description
1	1	Caterpillar C2.2 Diesel Driven Standby Engine Generator Set • 30kW Standby Generator Set • 240/120 Volts, Three Phase, 60hz, 1800 rpm • UL2200 Listed • EPA Certified for Stationary Emergency Use • IBC Seismic Certification • GCCP 1.2 Control Panel • NFPA 110 Alarm Bundle • Circuit Breaker: (1) 100A Main Circuit Breaker 100% Rated, LSI with Shunt Trip and Aux Contacts • PMG Excitation • Jacket Water Heater • Anti-Condensation alternator Winding Space Heater, Unit Mounted • DC Charging Alternator • Starting Motor • AC Battery Charger • Starting Battery w/ Rack • Seismic Vibration Isolators • 5 Year Manufacturer's Warranty • Package Genset Test • Operation and Maintenance Manuals • Freight: FOB Jobsite *Fuel by Others
2	1	Indoor Generator Set • Muffler, Flex and Wall Thimble Shipped Loose
3	1	Caterpillar FTDW052 Diesel Fuel Tank • UL 142 with Minimum 110% Secondary Tank Capacity • 74 Gallons Total Capacity, 68 Gallons Usable Capacity • 5 Gallons Spill Containment with Overfill Prevention • 24 hours run time at 100% load
4	1	Thomson TS873 Automatic Transfer Switch • 100 Amp, 240/120V Delta, 3-Phase, Service Entrance Rated • 3-Pole, Open Transition, NEMA 1 Enclosed • TSC 900 Controller

SINCE 1936

Item	Qty.	Description
5	1	Startup • Startup Performed During Regular Business Hours • Installation Inspection of Equipment in Our Scope of Supply • Verification of Proper Operation of Generator Auxiliary Components • Engine Generator Startup and Verification of Proper Operation • Two Hour, 1.0PF Load Bank Test Run using 50ft Cable Standard Length • Program and Test Transfer Switch *Fuel provided by others.
6	1	Training • One (1) Two-Hour Training Session with Owner's Representatives Performed During Regular Business Hours
7		Turn-Key Installation • Electrical Permitting • Run New Conduit and Wire between New Generator Set and ATS • Anchor New Generator and ATS to Pad • Install Radiator Ducting, Exhaust Muffler, Flex and Thimble • Offloading and Setting of a Genset done by City of Cannon beach *Installation does not include New Building Wiring

Notes (N), Deviations (D), Exceptions (E):

(N) Fuel not included

(N) Coordinated breakers are not provided at time of quoting - Upcharges could apply if required

Caterpillar Application and Installation Guides provide information regarding system design and installation considerations, which must be adhered to for equipment to function properly. Please consult with the project specific design engineer and/or your Caterpillar representative if you have any questions.



SECTION II

Drawings

SINCE 1936

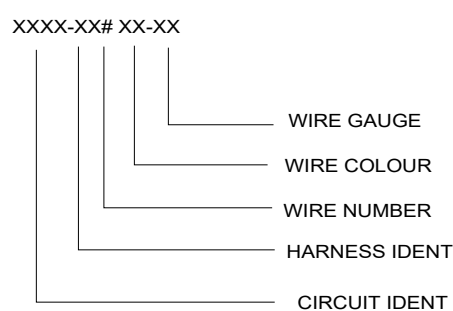
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THIS DIAGRAM IS FOR GENSET MODELS D25 & D30
FOR USE WITH : C2.2T & C2.2TA ENGINES WITH E- GOVERNOR
GCCP 1.2 CONTROLLER

SIGNAL NAMES

CIRCUIT_ID	COLOR	DESCRIPTION
10	WH	POSITIVE RUN/STOP
101	WH	UNSWITCHED BTRY_+)
108	WH	BTRY (+)_(FUSED_10A)
11	WH	AUX CONTACT COMMON
12	WH	AUX CONTACT NC
123	WH	FLG_BTRY (+)_(FUSED_5A)
14	WH	AUX_CONTACT_NO
14	WH	PMG_A PHASE TO AVR X2
148	WH	ELR_BTRY (+)_(FUSED_2A)
15	RD	PMG_B PHASE TO AVR X1
16	RD	PMG_C PHASE TO AVR X2
174	WH	ENCLOSURE_ESTOP_#11 TO E-C1_#1
17C	WH	ESTOP LINK
200	WH	MAIN CHASSIS GROUND
208	WH	BTRY (-)
21	WH	AUX CONTACT COMMON
22	WH	AUX CONTACT_NC
229	WH	GND FOR ANALOG INPUTS
24	WH	AUX CONTACT_NO
314	WH	SPEED ADJUST
315	WH	SPEED ADJUST
316	WH	SPEED ADJUST
344	WH	EMER_STOP_SW_#22 TO A-C10_#2
345	WH	A-C10 TO EMER_STOP_A TERMINAL
346	WH	EMER_STOP_SW_#12 TO_#21
347	WH	EMER_STOP_SW_#11 TO_CONTROLLER_#3
4	WH	CRANKING CONTROL
41	BK	MAGNETIC PICKUP -
42	WH	MAGNETIC PICKUP +
5	WH	ENCLOSURE_ESTOP_#22 TO E-C1_#2
5+	RD	GENERATOR EXCITER (+)
53A	WH	FUEL CONTROL
5VDC	WH	5VDC_OIL_PRESS_SENSING_SUPPLY (+)
-6	BK	GENERATOR EXCITER (-)
79	WH	REMOTE_START_CONTROLLER_#42
9	RD	AVR_X1 TO_GENERATOR_T7
951	CU	PLG_MODBUS_A TO_CONTROLLER_#52
952	BK	PLG_MODBUS_B TO_CONTROLLER_#51
953	CU	PLG_MODBUS_SCR TO_CONTROLLER_#50
954	WH	ANNUNCIATOR MODBUS A
955	BK	ANNUNCIATOR MODBUS B
956	CU	ANNUNCIATOR MODBUS_SCR
A309	WH	AHR_#A1 TO_CONTROLLER_#8
A666	WH	ELR_#14 TO_ENC_LIGHT_ELC-1_#1
AC101	WH	120VAC_(FUSED_20A) TO_GFCI_#LINE
AC102	WH	120VAC_(FUSED_10A) TO_BATT_CHRG_#L
AC199	WH	SHORE_POWER_NEUTRAL
AC179	WH	120VAC_(FUSED_6A) TO_AHR_#12
C1	WH	SHUNT TRIP
C2	WH	SHUNT TRIP
C353	WH	GLOW PLUG
C354	WH	GLOW PLUG
D_POS	WH	CHARGER ALTERNATOR EXCITATION
E486	WH	SENSING_V_- PHASE_A
E487	WH	SENSING_V_- PHASE_B
E488	WH	SENSING_V_- PHASE_C
E494	WH	CT_V_- PHASE_A
E495	WH	CT_V_- PHASE_B
E496	WH	CT_V_- PHASE_C
E498	WH	CT_RTN COMMON
ET	WH	ANALOG_I/P SIGNAL_(ENGINE_TEMPERATURE)
F409	WH	SENSING_V_NEUTRAL
F434	WH	GEN_PHASE_A
F435	WH	GEN_PHASE_B
F436	WH	GEN_PHASE_C
F5	WH	AVR_#F-
F6	WH	AVR_#F+
L1	WH	GENERATOR_L1_PHASE
L2	BK	GENERATOR_L2_PHASE
L3	BK	GENERATOR_L3_PHASE
LINK	WH	ENCLOSURE_ESTOP LINK
MPU_NEG	WH	MAG PICKUP NEGATIVE
MPU_POS	WH	MAG PICKUP POSITIVE
N	BK	GENERATOR_NEUTRAL
N756	WH	ANLG_HORN_#1
OP	WH	ANALOG_I/P SIGNAL_(OIL_PRESSURE)
P733	WH	ANLG_INP_1_(+)
R957	WH	PRE-HEAT
R958	WH	DISCRETE_OUT_9
R959	WH	DISCRETE_OUT_10
SCRN	CU	MAG PICKUP_SCRN
U	RD	AVR SENSING
V	RD	AVR SENSING
W	RD	AVR SENSING
X661	WH	ECR_#87 STARTER_MAG_SW
Y797	WH	ENG_J1939_DATALINK_+
Y798	BK	ENG_J1939_DATALINK_-
Y799	CU	ENG_J1939_DATALINK_SHLD
Y983	WH	LOW COOLANT_LEVEL TO_CNTRL_#43
Y984	WH	FUEL LEVEL TO_CNTRL_#44
Y985	WH	ENCLOSURE_LIGHT_SW TO_CNTRL_#46
YGN	BK	GENERATOR_GND

WIRE NAME DEFINITION



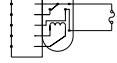
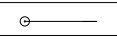
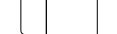
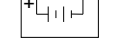
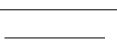
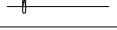
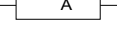
COLOUR ABBREVIATIONS

ABBREVIATION	DESCRIPTION
RD	RED
WH	WHITE
OR	ORANGE
YL	YELLOW
PK	PINK
BK	BLACK
GY	GREY
PU	PURPLE
BR	BROWN
GN	GREEN
BU	BLUE
CU	COPPER
GN-YL	GREEN-YELLOW

ABBREVIATIONS

ABBREVIATIONS	DESCRIPTION
AC	ALTERNATING CURRENT
AHR	ALTERNATOR HEATER RELAY
AVR	AUTOMATIC VOLTAGE REGULATOR
BATT	BATTERY
CR	CONTROL RELAY
DC	DIRECT CURRENT
ECM	ENGINE CONTROL MODULE
ECR	ENGINE CRANK RELAY
ELR	ENCLOSURE LIGHTS RELAY
E-STOP	EMERGENCY STOP
FCR	FUEL CONTROL RELAY
FLS	FUEL LEVEL SENDER
GFR	GENERAL FAULT RELAY
GND	GROUND
GRR	GENERATOR RUNNING RELAY
LCL	LOW COOLANT LEVEL
MCB	MINIATURE CIRCUIT BREAKER
OF	AUXILIAR SWITCH
PMG	PERMANENT MAGNET GENERATOR
Q/1	AUXILIAR SWITCH
SD	ALARM SWITCH
STR	SHUNT TRIP RELAY
SY	ALARM SWITCH
TERM	PANEL TERMINAL
VFC	VOLT FREE CONTACT

SYMBOL LEGEND TABLE

	MINIATURE CIRCUIT BREAKER
	EMERGENCY STOP PUSHBUTTON
	FUSED AUTOMOTIVE RELAY
	RESISTOR
	EARTH/GROUND
	CURRENT TRANSFORMER
	PANEL TERMINAL
	TERMINAL
	CONNECTOR
	BATTERY
	SPLICE
	WIRE
	SCREEN CABLE
	FUSE

INDEX TABLE

SHEET INDEX	DESCRIPTION
1	CROSS REFERENCE SHEET INDEX. NOTES
2	CONTROL SCHEMATIC
3	POWER SCHEMATIC
4	POWER SCHEMATIC (SINGLE PHASE)
5	ADDITIONAL OPTIONS
6	AC OPTIONS
7	ADDITIONAL INFORMATION

HARNESS LAYER TABLE

IDENT	PART NO	CHG	LOC	DESCRIPTION	NOT
HARNASS AS.	-	-	-	-	-
A	620-2274	0	SH2	MAIN HARNASS	-
AN	578-6063	1	SH5	ANNUNCIATOR HARNASS	-
AX	565-9586	0	SH5	AUX CONTACTS AND SHUNT TRIP	-
C	396-1978	0	SH2	E-STOP LINK (OPEN SET)	-
CD	505-2916	0	SH6	GFCI HARNASS	-
E	396-1928	3	SH2	E-STOP HARNASS (ENCLOSED SET)	-
EL	505-8468	0	SH6	ENCLOSURE LIGHTS HARNASS	-
ER	604-4015	0	SH6	BATTERY-CHARGER HARNASS	-
FR	505-8326	0	SH6	SHORE POWER L1 LINK	-
GR	605-3114	0	SH5	GENSET RUNNING & COMMON ALARM	-
LR	394-7591	0	SH3	R220 AVR	-
LS	480-1626	3	SH3	D350 SENSING	-
LPA	NA	-	SH3	AVR CONNECTOR (LS SUPPLIED)	-
P	362-0449	3	SH3	D350 AVR- PMG/AREP	-
PLC	616-0721	0	SH7	PL444 ENCLOSED SET	-
PLD	616-0724	0	SH7	PL444 OPEN SET	-
RC	604-4020	0	SH6	ALTERNATOR SPACE HEATER HARNASS	-
WIRE AS./CABLE AS.	-	-	-	-	-
N	-	-	SH2	BATTERY NEGATIVE	-
P	-	-	SH2	BATTERY POSITIVE	-

NOTE A: FACTORY WIRING NOT PROVIDED AS STANDARD. REFER TO MANUFACTURER INSTALLATION INSTRUCTIONS.

NOTE B: RESISTOR TO BE REMOVED IF ADDITIONAL EXPANSION MODULES ARE CONNECTED.

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IS1E187A INT-PROP
 E1E2220 DRAWINGS
 E1E1049 BRAND MARKINGS
 E1E013Y CONFIDENTIALITY
 E1E012A INTERPRETATION
 E1E0011 INTPR & TOL
 Caterpillar Confidential Yellow

Level 1 listed

UNLESS OTHERWISE SPECIFIED CONSIDERABLE USE OF STANDARD AND AISC BASIC	TYPE TYPICAL	FORM FINISH
THIRD ANGLE PROJECTION	SHEET 1 OF 2	W97
	W97 CONTROL	

CATERPILLAR

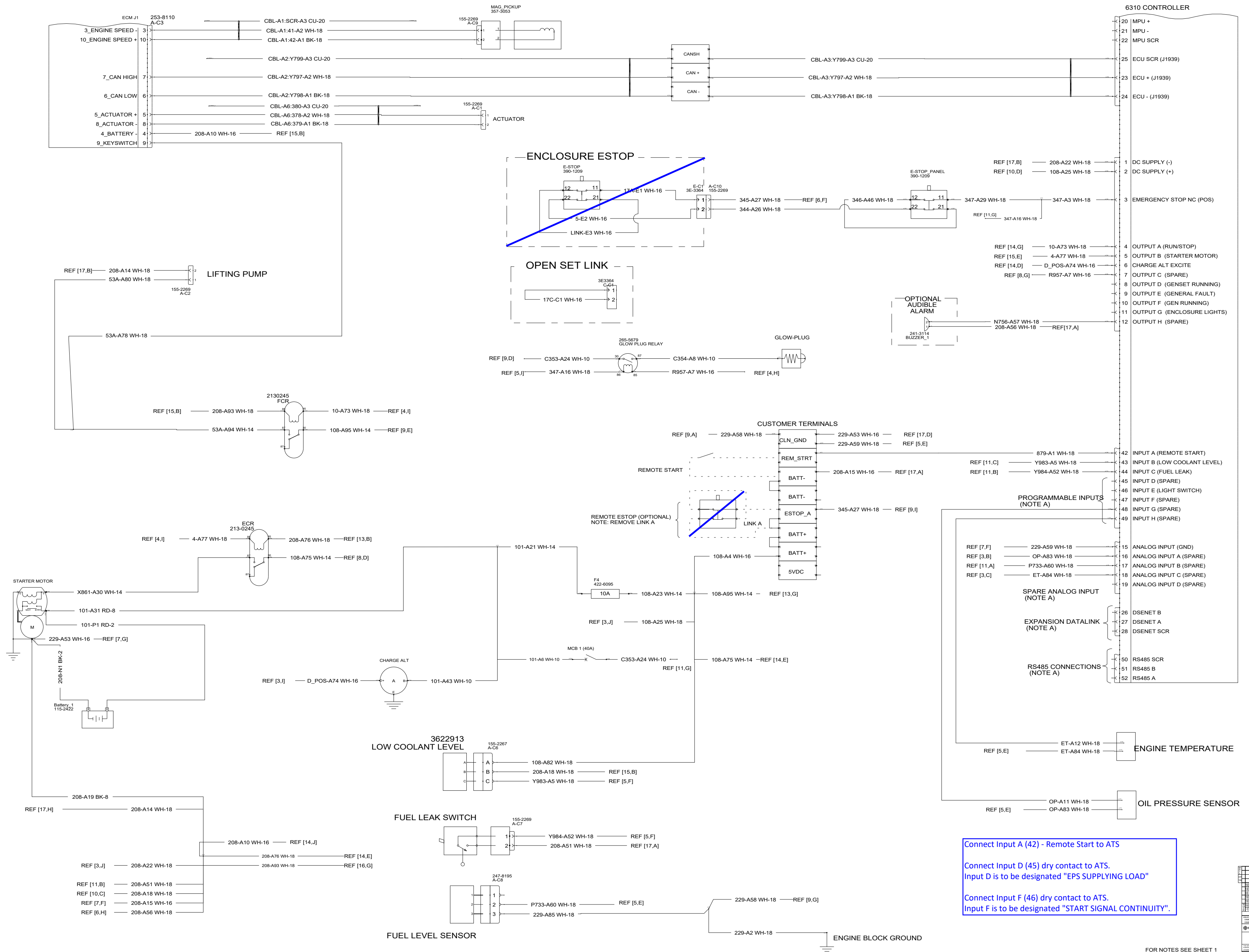
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DIAGRAM WIRING
 (D25 & D30 UL NA)

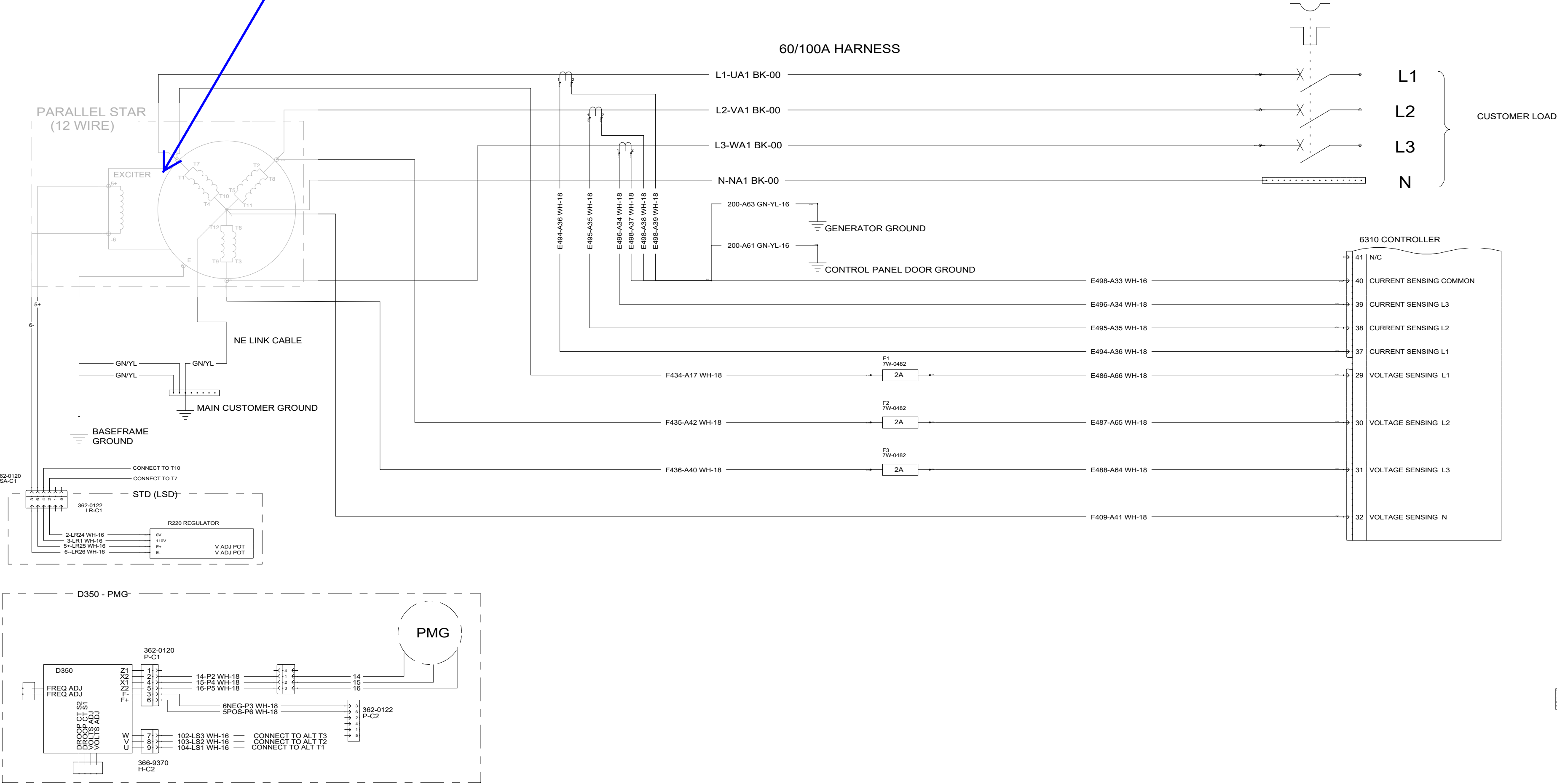
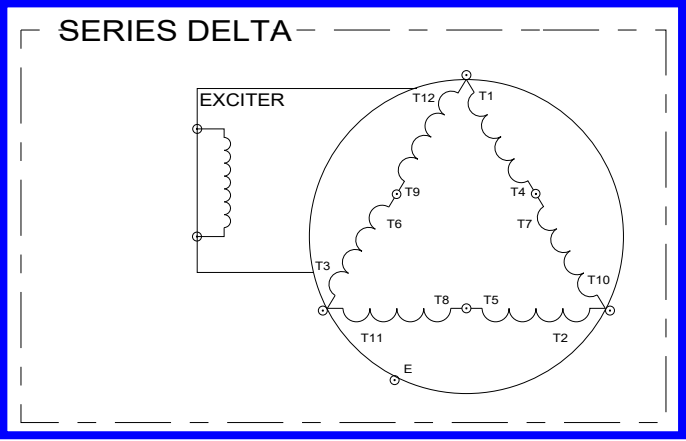
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CONTROL SCHEMATIC

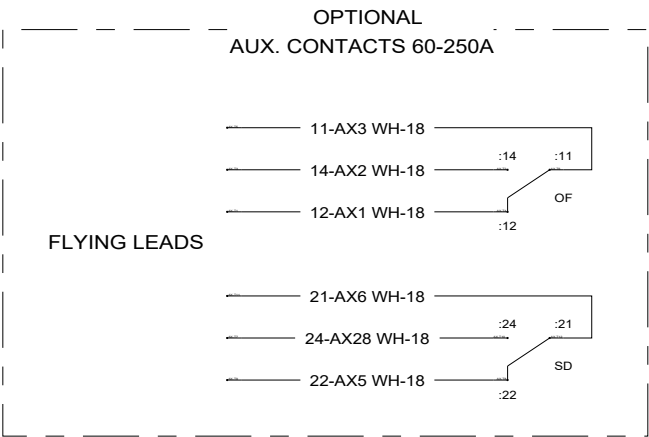
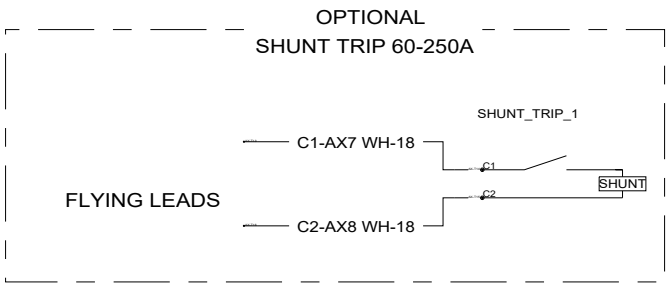
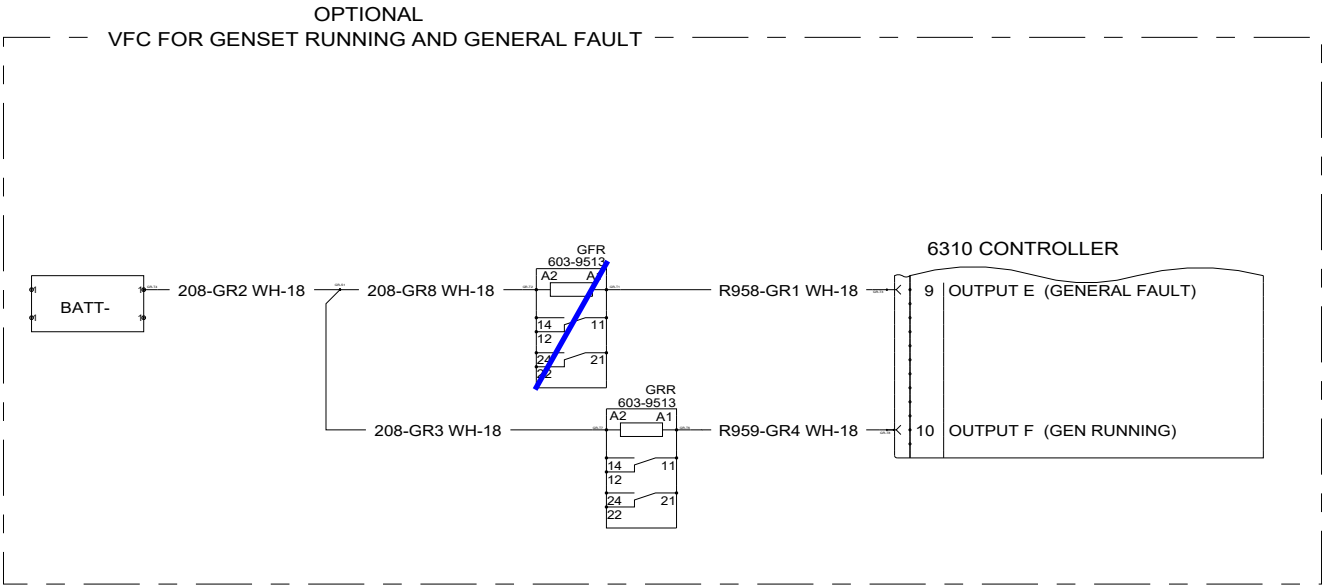


POWER SCHEMATIC



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ADDITIONAL OPTIONS



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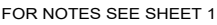
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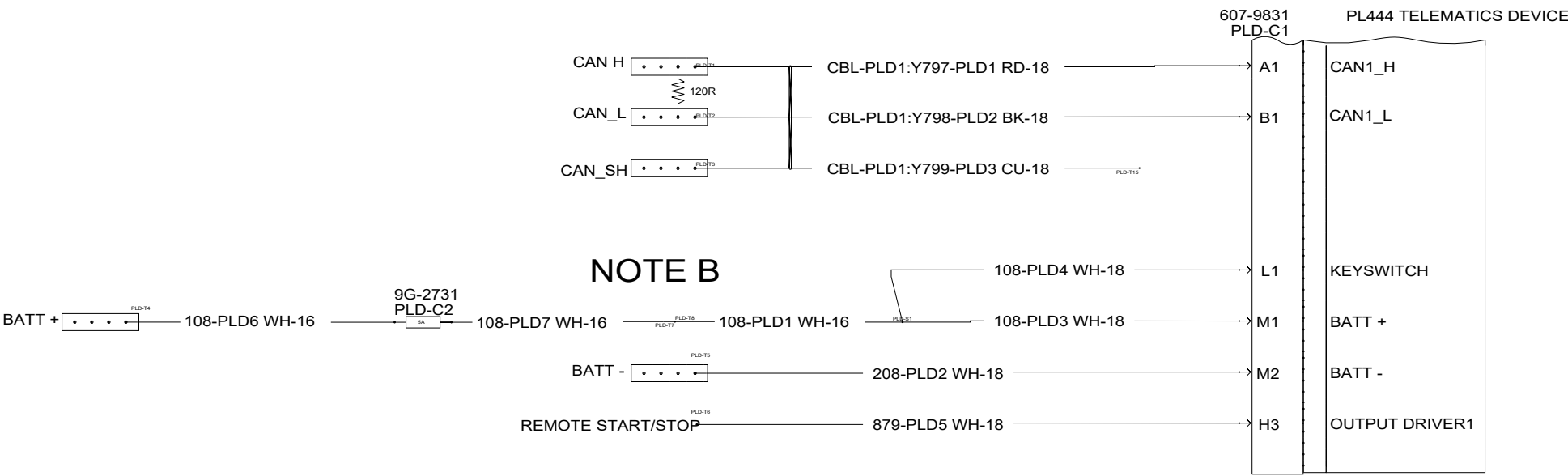
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1E15167A INT-PROP 1E12722G DRAWING 1E0158W BRAND MARKINGS 1E0013Y CONFIDENTIALITY 1E0012A IDENTIFICATION 1E0011 INTRP & TOL Centipillar Confidential Yellow			
PROC & ENG		PRIMARY READER	
UNLESS OTHERWISE SPECIFIED DIMENSIONS WHO TOL ARE BASIC		REGION TYPE	PRIMARY READER A
THIRD ANGLE PROJECTION	SHEET 6 WORK CONTROL	8 W071	
This drawing is the property of Centipillar and is not to be reproduced, copied, modified, or otherwise used without the written permission of Centipillar. It is to be used for the purpose intended and is not to be used for any other purpose. It is to be kept confidential and is not to be disclosed to any third party without the written permission of Centipillar.			
DIAGRAM-WIRING (D25 & D30 UL NA)			
620-2231		JUL 2007	2231



PL444 TELEMATICS

FUW OPEN SETS



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
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K																	K
J																	J
I																	I
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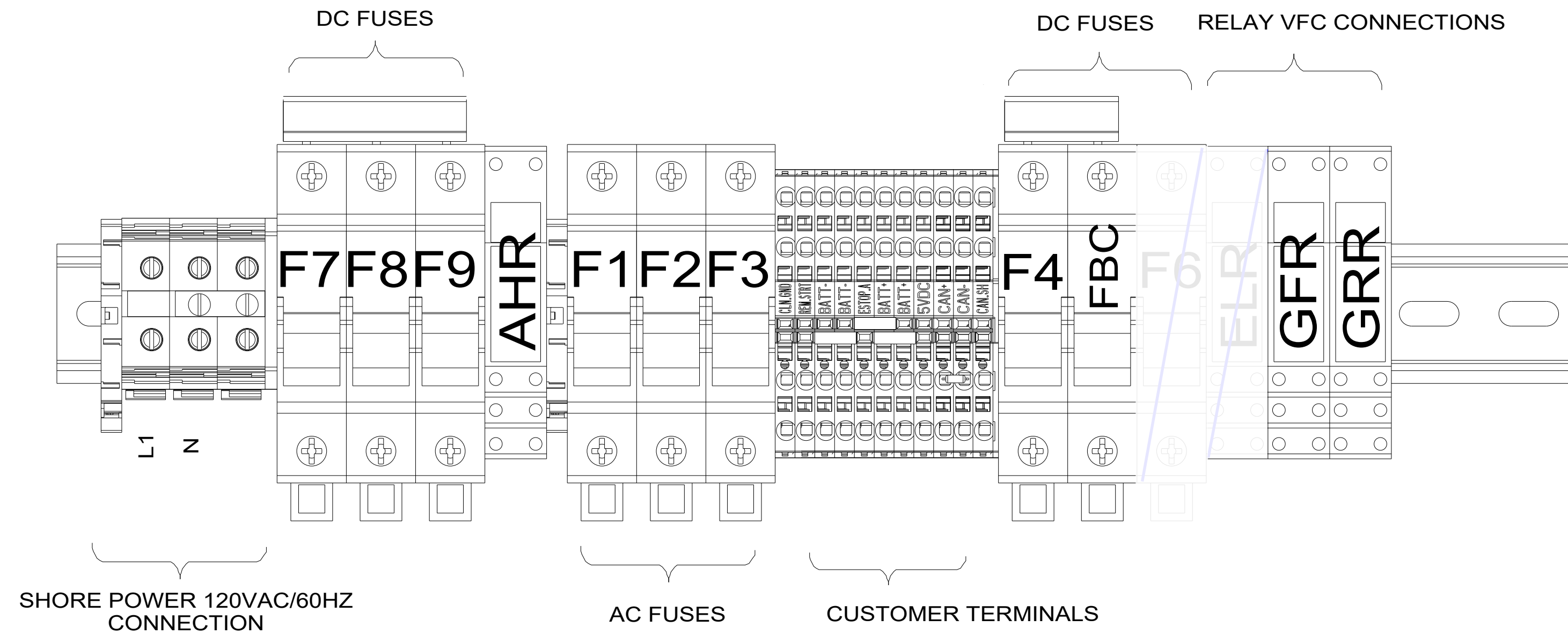
FOR NOTES SEE SHEET 1

K

COMPONENT	DESCRIPTION
AHR	ALTERNATOR SPACE HEATER RELAY
F7	GF1 FUSE (20A)
F8	BATTERY CHARGER FUSE (10A)
F9	ALTERNATOR HEATER FUSE (6A)

FUSE ID	CURRENT RATING	WIRE ID	DESCRIPTION
F4	10A	101; 108	PANEL SUPPLY
FBC	15A	101; 108	BATTERY CHARGER
F6	2A	148; 101	ENCLOSURE LIGHTS

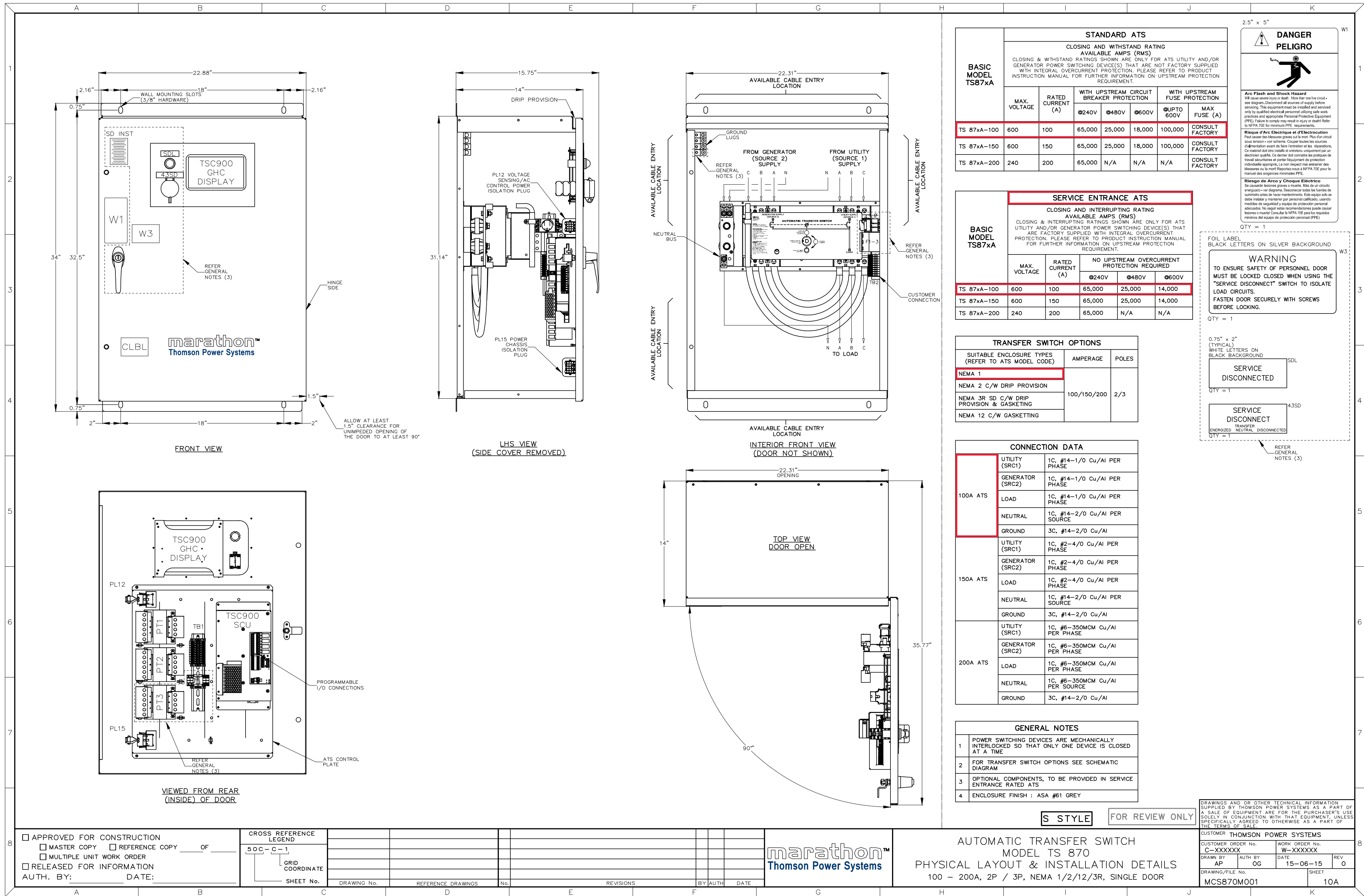
RAIL	CURRENT RATING	DESCRIPTION
GFR	8A	GENERAL FAULT RELAY
GRR	8A	GENSET RUNNING RELAY
ELR	8A	ENCLOSURE LIGHTS RELAY

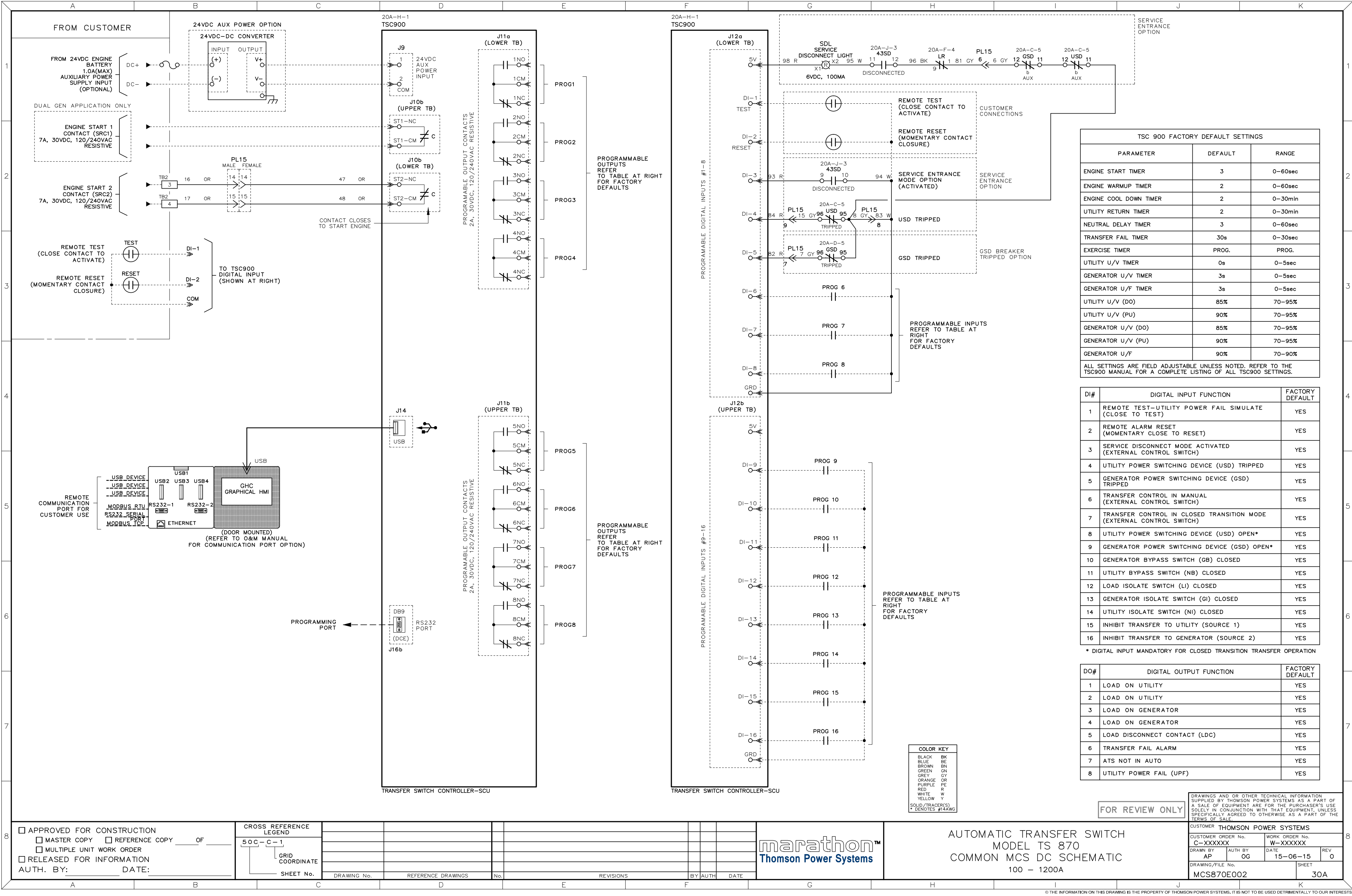


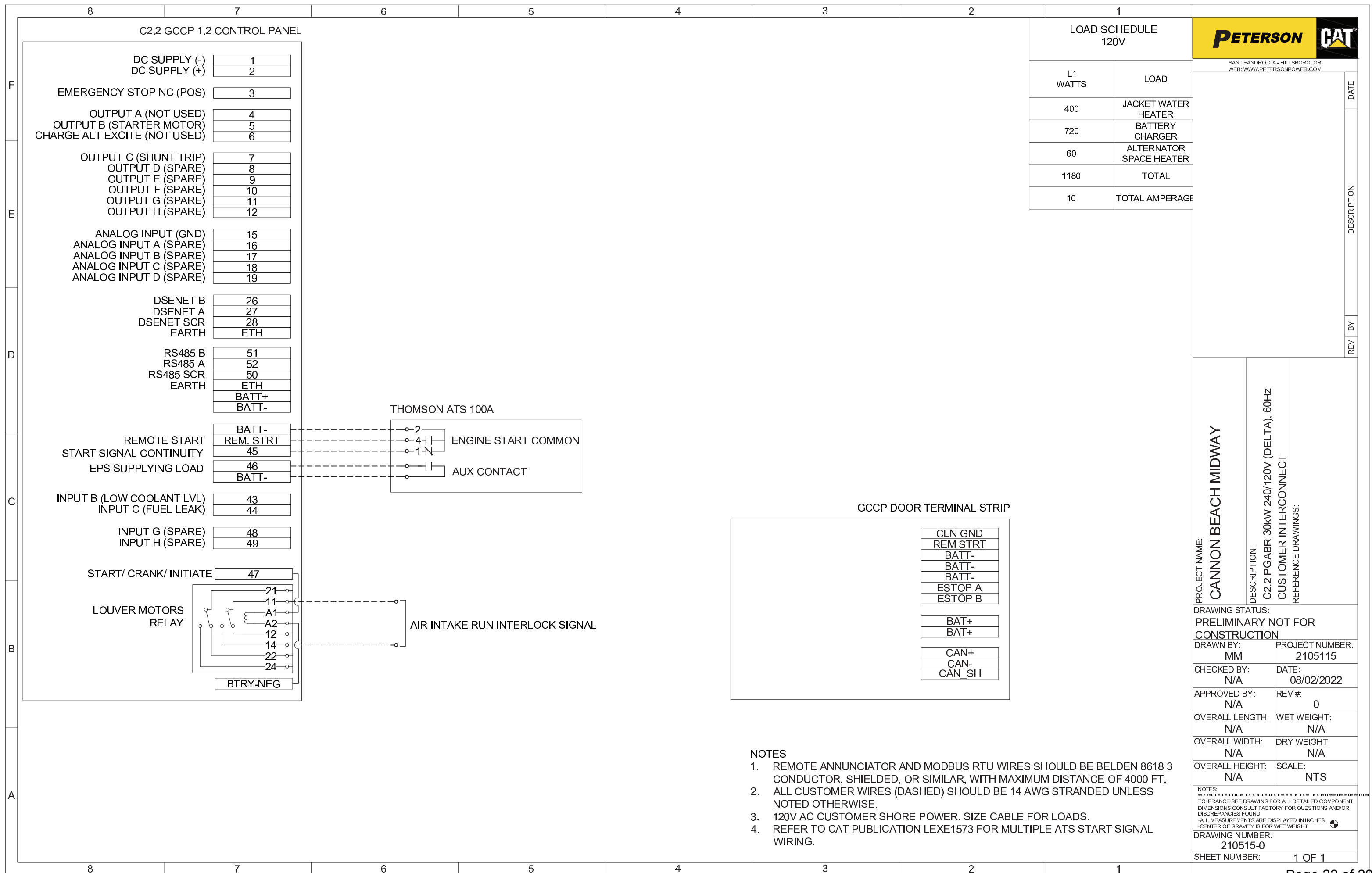
COMPONENT	DESCRIPTION
L1	SHORE POWER AC SUPPLY LINE
N	SHORE POWER AC SUPPLY NEUTRAL

FUSE ID	CURRENT RATING	WIRE ID	DESCRIPTION
F1	2A	F434; E486	L1 SENSING AC
F2	2A	F435; E487	L2 SENSING AC
F3	2A	F436; E488	L3 SENSING AC

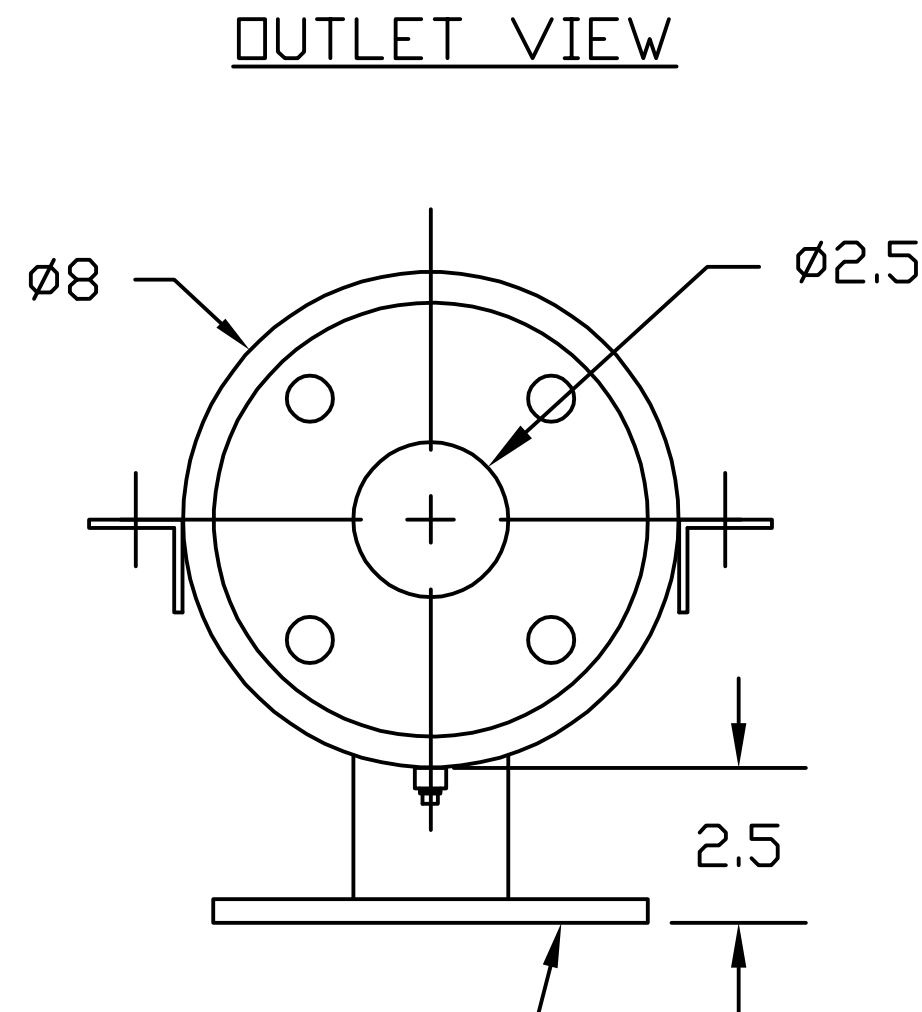
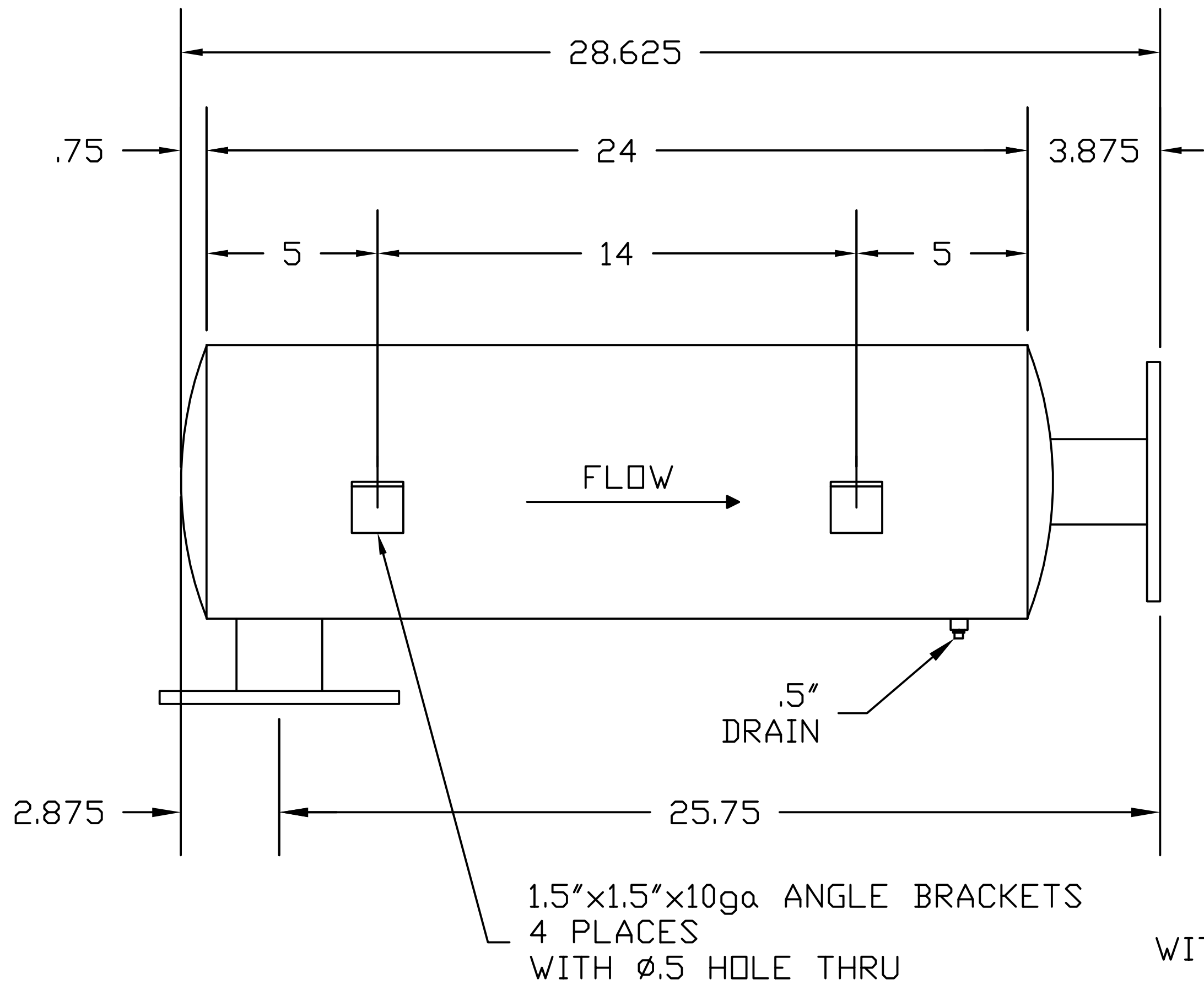
TERMINAL ID	WIRE ID	DESCRIPTION
CLN_GND	229	CLEAN GROUND FOR ANALOG INPUTS
REM_STRT	879	REMOTE START INPUT
BATT-	208	BATTERY NEGATIVE
BATT-	208	BATTERY NEGATIVE
ESTOP_A	345	GENSET CONTROLLER ESTOP INPUT
BATT+	108	BATTERY POSITIVE (10A FUSED)
BATT+	108	BATTERY POSITIVE (10A FUSED)
5VDC	5VDC	+5VDC OIL PRESSURE SENSOR
CAN+	Y797	CAN + COMMS
CAN-	Y798	CAN - COMMS
CAN_SH	Y799	CAN SH COMMS







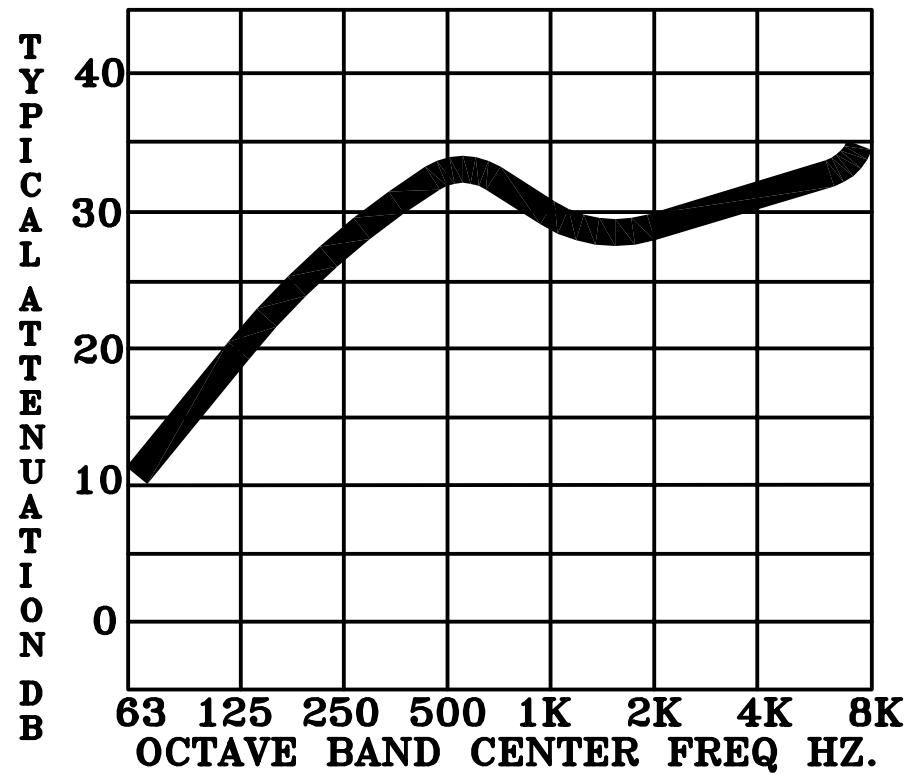
REV	DATE	REVISION	BY
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2.5" A.S.A. FLG
2 PLACES
7" O.D.
5.5" B.C.
WITH 4-.75Ø HOLES THRU
EQUALLY SPACED

NOTES:

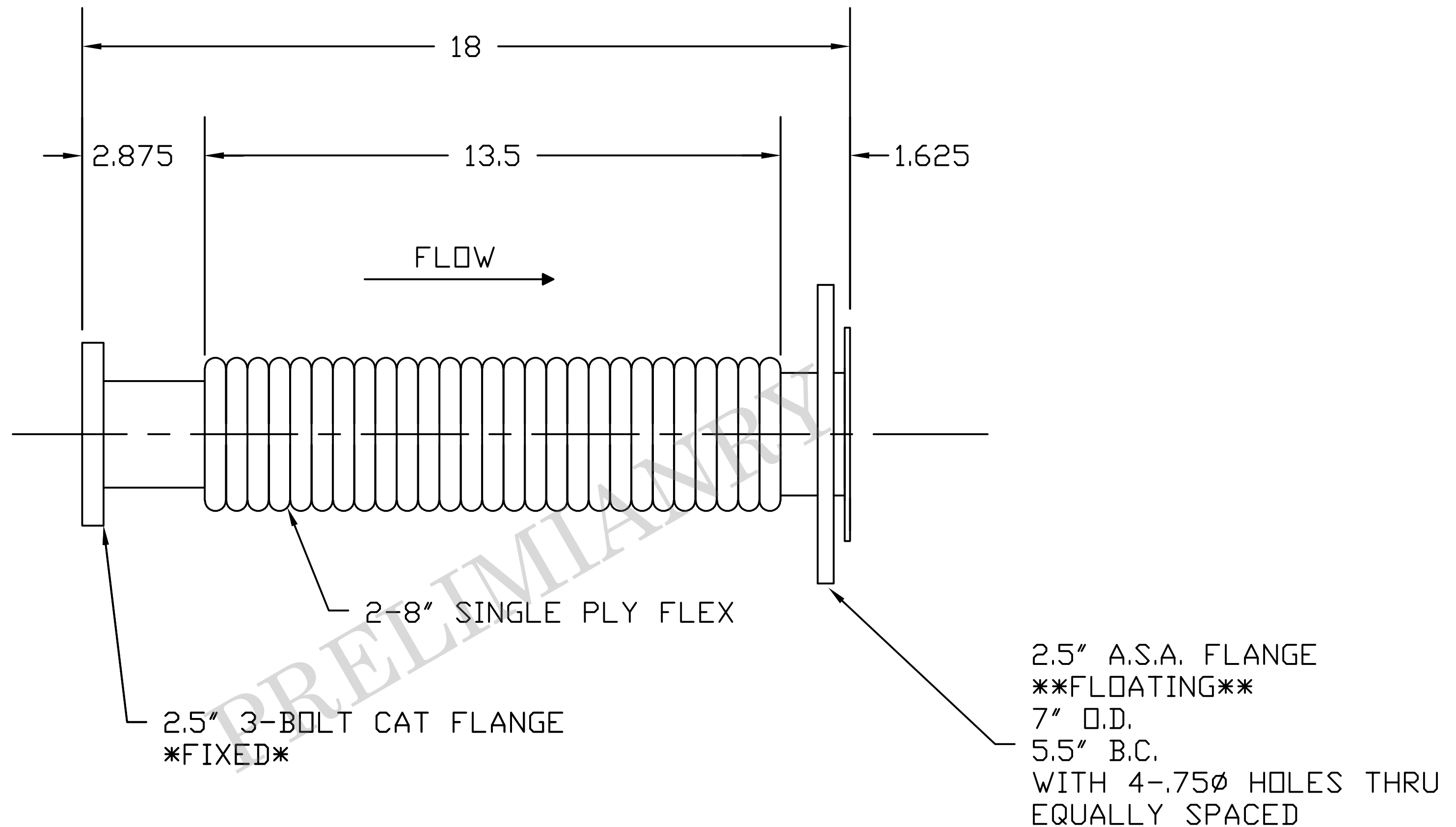
1. MATERIAL: CARBON STEEL
2. PAINTED WITH HIGH TEMP. PAINT AND PRIMER
3. HORIZONTAL MOUNT



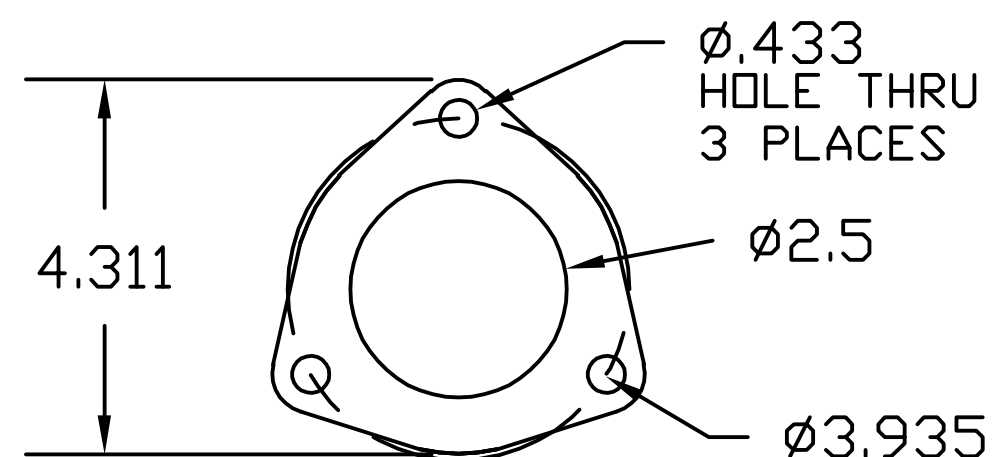
ENGINE:		CFM:	FPM:	KW:	WT: 28 Lbs	PRESSURE DROP H2O
UNLESS OTHERWISE SPECIFIED- 1) DIMENSIONS ARE IN INCHES 2) TOLERANCES ARE: .XXX± .010 ANGLES± 1/2° .XX± .030 SURFACE FINISH .X± .062 FRACTIONS ± ✓ MAX.		HARCO ENGINE PRODUCTS HARCO MANUFACTURING CO. 1000 INDUSTRIAL PARKWAY, NEWBERG, OR, 97132-7071, USA (503)537-0600 FAX(503)-537-0601 THIS DRAWING, IN DESIGN AND DETAIL, IS PROPERTY OF HARCO MANUFACTURING COMPANY.				
		APPROVALS	DATE	TITLE CRITICAL GRADE 824VRS 2-8 SI H		
		DRAWN MJB	09/11/06			
CHECKED				SCALE 1:7	CAD NO. #904A-1B	SHEET
APPROVED				PLOTTED	DWG. NO.	A

ITEM	QTY	DESCRIPTION
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CUSTOMER APPROVED DWG:



2.5" CAT FLANGE DETAIL



NOTES:

1. MATERIAL: FLEX IS 321 STAINLESS STEEL, FLANGES AND PIPE ARE CARBON STEEL
2. PAINTED WITH HIGH TEMP. PAINT AND PRIMER

UNLESS OTHERWISE SPECIFIED- 1) DIMENSIONS ARE IN INCHES 2) TOLERANCES ARE: .XXX± .010 ANGLES± 1/2° .XX± .030 SURFACE FINISH .X± .062 FRACTIONS ± ✓ MAX.		HARCO ENGINE PRODUCTS HARCO MANUFACTURING CO. 1000 INDUSTRIAL PARKWAY, NEWBERG, OR, 97132-7071, USA (503)537-0600 FAX(503)-537-0601 THIS DRAWING, IN DESIGN AND DETAIL, IS PROPERTY OF HARCO MANUFACTURING COMPANY.		
APPROVALS	DATE	TITLE HSPF 2-8 SP 2-8 CAT x 2-8 ASA		
DRAWN VAL.B.	8-3-22			
CHECKED		SCALE NTS	CAD NO. 832228	SHEET
APPROVED		PLOTTED	DWG. NO.	A

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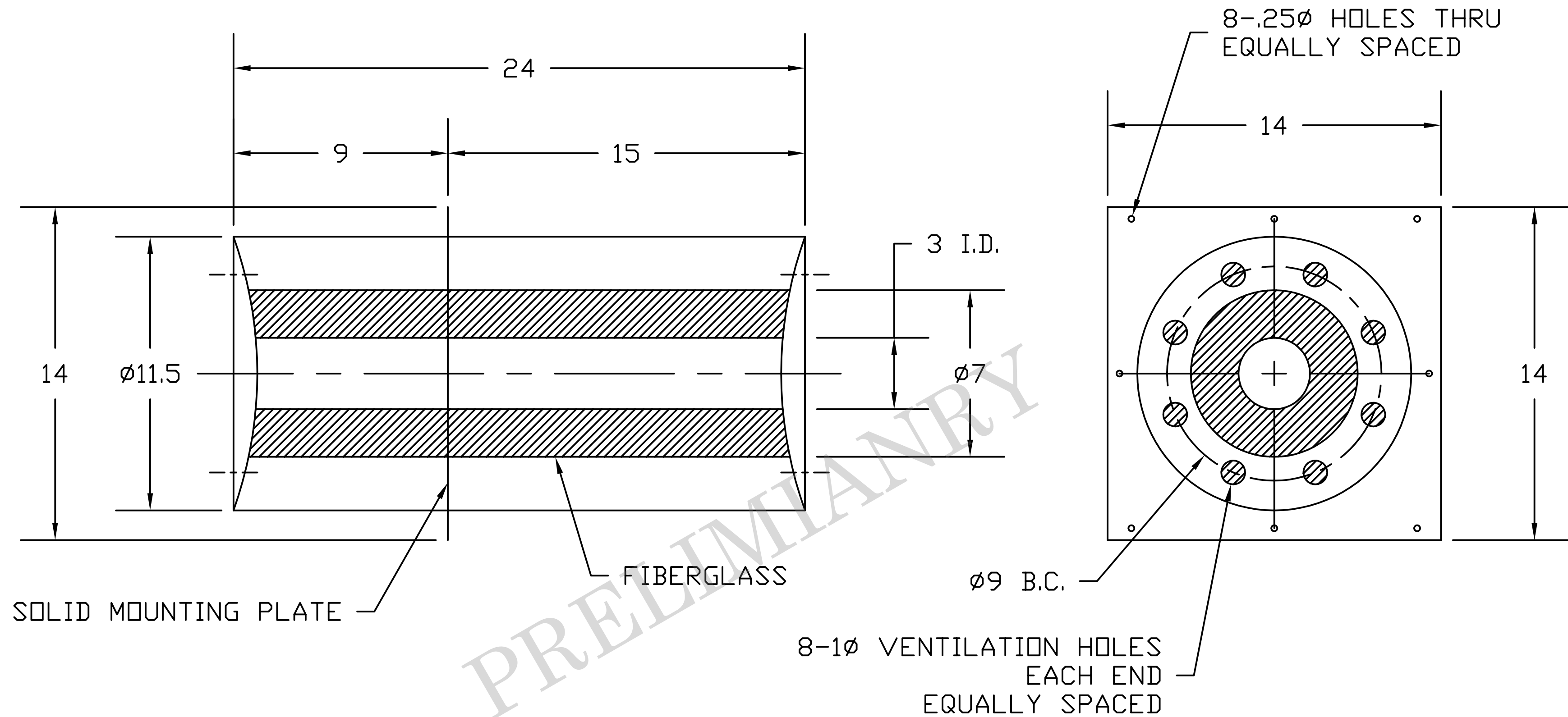
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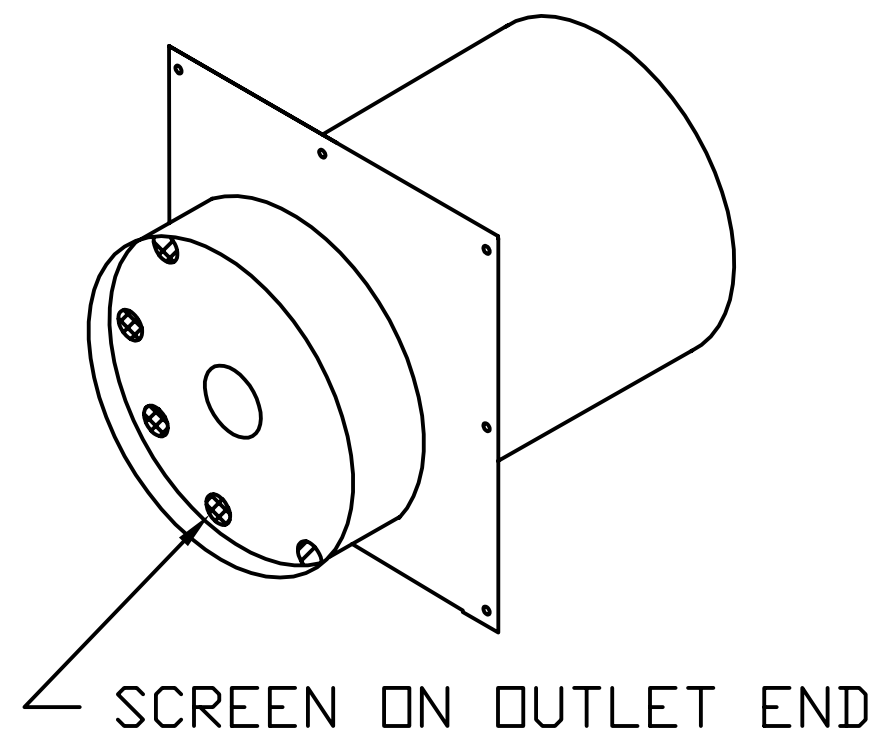
REVISION

BY



NOTES:

1. MATERIAL: ALL 304 S.S.
2. THIMBLE FOR 6" THICK WALL AND 2.5" PIPE (2.875" O.D.)
3. THIMBLE IS TRIPLE WALL CONSTRUCTION
4. THIMBLE INCLUDES LOOSE PLATE



SCREEN ON OUTLET END

ENGINE:	CFM:	FPM:	KW:	WT:	PRESSURE DROP H2O
UNLESS OTHERWISE SPECIFIED- 1) DIMENSIONS ARE IN INCHES 2) TOLERANCES ARE: .XXX± .010 ANGLES± 1/2° .XX± .030 SURFACE FINISH .X± .062 FRACTIONS ± ✓ MAX.					
APPROVALS		DATE		TITLE	
DRAWN MJB		05/15/06		WALL/ROOF THIMBLE 2-8	
CHECKED		SCALE 1:8		CAD NO. #470250	SHEET
APPROVED		PLOTTED		DWG. NO.	A

ITEM

QTY

DESCRIPTION

CUSTOMER APPROVED DWG:

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SECTION III

Product Data

SINCE 1936

Cat® D30

Diesel Generator Sets



Standby : 60 Hz



Image shown may not reflect actual configuration.

Engine Model	Cat® C2.2 In-line 4, 4-cycle diesel
Bore x Stroke	84 mm x 100 mm (3.3 in x 3.93 in)
Displacement	2.2 L (134 in³)
Compression Ratio	23.3:1
Aspiration	Turbocharged air to air charge cooling
Fuel Injection System	Electronically actuated Mechanical Cassette type

Model	Standby 60 Hz ekW	Emission Strategy
D30	30	EPA TIER 4i (EPA 40 CFR Part 1039 Interim Tier 4)

Package Performance

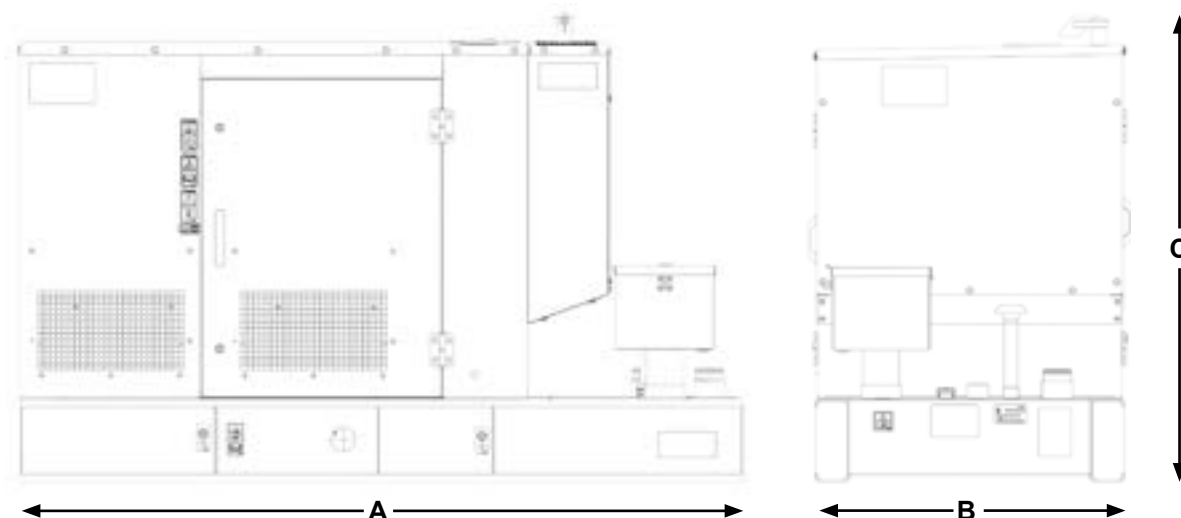
Performance	Standby	
	3-Phase	1-Phase
Frequency	60	60
Genset Power Rating, kVA	37.5	37.5
Genset power rating with fan, kW, 3p@ 0.8 & 1p@1.0 power factor	30	30
Performance Number	P3524C	P3524C
Fuel Consumption		
100% load with fan, L/hr (gal/hr)	9.8 (2.59)	9.8 (2.59)
75% load with fan, L/hr (gal/hr)	7(1.85)	7(1.85)
50% load with fan, L/hr (gal/hr)	5.1(1.35)	5.1(1.35)
Cooling System¹		
Radiator air flow, m³/min (cfm)	TBD	TBD
Radiator air flow restriction (system), kPa (in. water)	TBD	TBD
Engine coolant capacity, L (gal)	3.6 (0.95)	
Radiator coolant capacity, L (gal)	TBD	
Total coolant capacity, L (gal)	TBD	
Inlet Air		
Max. Combustion Air Intake Restriction kPa (in. water)	6.4 (25.7)	6.4 (25.7)
Combustion air inlet flow rate, m³/min (cfm)	2.49 (87.9)	2.49 (87.9)
Exhaust System		
Exhaust stack gas temperature, °C (°F)	478 (892)	478 (892)
Exhaust gas flow rate, m³/min (cfm)	8.4 (296.6)	8.4 (296.6)
Exhaust system backpressure (maximum allowable) kPa (in. water)	10.2 (41.0)	10.2 (41.0)
Heat Rejection		
Heat rejection to jacket water, kW (Btu/min)	37.7 (2144)	37.7 (2144)
Heat rejection from Alternator, kW (Btu/min)	4.2 (238)	4.6 (262)
Heat rejection to atmosphere from engine, kW (Btu/min)	4.6 (262)	4.6 (262)
Heat rejection to exhaust (total) kW (Btu/min)	29.0 (1649)	29.0 (1649)

D30 Diesel Generator Sets Electric Power



Alternator ³	60 Hz				
Voltages	480/277	240/120	208/120	600/346	240/120
Motor starting capability @ 30% Voltage Dip, skVA	54	42	42	56	54
Current Amps	45	90	104	36	125
Frame Size	M1717L4				M1736L4
Excitation	S.E				
Temperature Rise, °C	125/40	125/40	125/40	125/40	105/40

Weights and Dimensions



SEE GENERATOR SET DRAWING IN THE DRAWING SECTION

APPLICABLE CODES AND STANDARDS:

AS1359, CSA C22.2 No100-04, UL142, UL489, UL869, UL2200, NFPA37, NFPA70, NFPA99, NFPA110, IBC, IEC60034-1, ISO3046, ISO8528, NEMA MG1-22, NEMA MG1-33, 2006/95/EC, 2006/42/EC, 2004/108/EC.

Note: Codes may not be available in all model configurations. Please consult your local Cat Dealer representative for availability.

STANDBY: Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

RATINGS: Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions.

www.cat.com/electricpower

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GEN SET PACKAGE PERFORMANCE DATA [LS5905]

AUGUST 01, 2022

Performance Number: P3524A

Sales Model: C2.2 DITA	Combustion: DI	Aspr: TA
Engine Power: 49 HP	Speed: 1,800 RPM	After Cooler:
Manifold Type:	Governor Type:	After Cooler Temp(F): 32
Turbo Quantity:	Engine App: GP	Turbo Arrangement:
Hertz: 60	Application Type: PACKAGE-DIE	Engine Rating: PGS
Rating Type: STANDBY	Certification:	Strategy:

EMISSIONS DATA

***** J1

No notes were found for this certification...

REFERENCE EXHAUST STACK DIAMETER	0 IN
WET EXHAUST MASS	0.0 LB/HR
WET EXHAUST FLOW (-- STACK TEMP)	--
WET EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	--
DRY EXHAUST FLOW RATE (32 DEG F AND 29.98 IN HG)	--
FUEL FLOW RATE	--

The powers listed above and all the Powers displayed are Corrected Powers

Identification Reference and Notes

Engine Arrangement:	Lube Oil Press @ Rated Spd(PSI):	0.0
Effective Serial No:	Piston Speed @ Rated Eng SPD(FT/Min):	--
Primary Engine Test Spec:	Max Operating Altitude(FT):	0.0
Performance Parm Ref:	PEEC Elect Control Module Ref	
Performance Data Ref:	P3524A PEEC Personality Cont Mod Ref	
Aux Coolant Pump Perf Ref:		
Cooling System Perf Ref:	Turbocharger Model	
Certification Ref:	Fuel Injector	
Certification Year:	Timing-Static (DEG):	--
Compression Ratio:	0.0 Timing-Static Advance (DEG):	--
Combustion System:	DI Timing-Static (MM):	--
Aftercooler Temperature (F):	32 Unit Injector Timing (MM):	--
Crankcase Blowby Rate(CFH):	-- Torque Rise (percent)	0.0
Fuel Rate (Rated RPM) No Load(Gal/HR):	-- Peak Torque Speed RPM	1800
Lube Oil Press @ Low Idle Spd(PSI):	0.0 Peak Torque (LB.FT):	141.6

Reference
Number: P3524A

J1

Parameters
Reference:

Reference Number: P3524A

Version Symbol:

Change Level:

Sales Model: C2.2 DI TA

Eff. Serial Number Prefix:

Engr. Model:

Description	Answer	Unit
<i>Air Intake System</i>		
The installed system must comply with the system limits below for all emissions certified engines to assure regulatory compliance.		
MAX ALLOW INTAKE RESTR W/CLEAN ELEMENT	0.0	IN WTR
MAX ALLOW INTAKE RESTR W/DIRTY ELEMENT	0.0	IN WTR
ALLOW PRESS DROP-COMPR OUT TO MANF IN	0.0	IN HG
MAX TURBO INLET AIR TEMPERATURE	32	DEG F
<i>Cooling System</i>		
ENGINE ONLY COOLANT CAPACITY	0.0	GAL
REGULATOR START-TO-OPEN TEMP	32	DEG F
REGULATOR FULL OPENING TEMPERATURE	32	DEG F
<i>Engine Spec System</i>		
CYLINDER ARRANGEMENT	VERTICAL	
NUMBER OF CYLINDERS	4	CYL
CYLINDER BORE DIAMETER	3.3071	IN
PISTON STROKE	3.9370	IN
TOTAL CYLINDER DISPLACEMENT	135	CU IN
COMPRESSION RATIO (TO ONE)	0	
CRANKSHAFT ROTATION (FROM FLYWHEEL END)	CCW	
CYLINDER FIRING ORDER		
STROKES/COMBUSTION CYCLE	4	STROKES
<i>Exhaust System</i>		
The installed system must comply with the system limits below for all emissions certified engines to assure regulatory compliance.		
<i>Fuel System</i>		
MAX ALLOW FUEL SUPPLY LINE RESTRICTION	0.0	IN HG
MAX ALLOW FUEL RETURN LINE RESTR	0.0	IN HG
FUEL SYSTEM TYPE		
<i>Lube System</i>		
MAXIMUM ALLOWABLE OIL TEMP	32	DEG F
MIN LI OP W/SAE 10W30 OIL @ 99 DEG C	0.0	PSI
<i>Mounting System</i>		
ENG WET WT W/OIL AND WATER W/O FUEL	0	LB
DRY WT ENG ONLY (DRAINED OF FLUIDS)	0	LB
ENGINE LENGTH	0.0000	IN
ENGINE HEIGHT	0.0000	IN
ENGINE WIDTH	0.0000	IN
<i>Starting System</i>		

Component Performance Number: EM0045

Radiator Data

Radiator Part Number: 3424376
Radiator Type: A3.8CTS
Front Area: 3.77 ft2
Radiator Dry Weight: 97.0 lbs
Radiator Wet Weight: 125.7 lbs
Radiator Water Capacity High Temp Circuit: 2.0 gal
Radiator Water Capacity Low Temp Circuit: NA gal
Center of Gravity (X): NA in (Distance from front face of core)
Center of Gravity (Y): NA in (Distance from bottom of radiator support)
Center of Gravity (Z): NA in (Distance from center line of core)

Engine Data

Performance Number: P3524A
Sales Model: C2.2 DITA
EKW: NA
Rating: STANDBY
Speed: 1800
Settings: NA
IM ATAAC Temp Deg F: 122

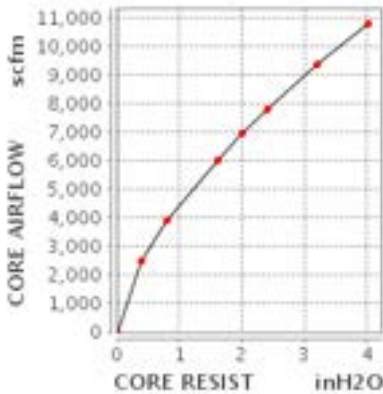
Combination Data

Pully Ratio: 1.1
Fan Power: 1.34102 hp

Ambient Restrictions (1/2 inH2O)			Ambient Restrictions (3/4 inH2O)			Ambient Restrictions (1.00 inH2O)		
984 Feet	2460 Feet	4921 Feet	984 Feet	2460 Feet	4921 Feet	984 Feet	2460 Feet	4921 Feet
----- Max Ambient Pre-alarm Deg F -----								
NA	NA	NA	NA	NA	NA	NA	NA	NA

Air Flow Restrictions (1/2 inH2O)	Air Flow Restrictions (3/4 inH2O)	Air Flow Restrictions (1.00 inH2O)
2648	1836	NA

CORE RESIST inH2O	CORE AIRFLOW scfm
0	0
0.4	2,510.88
0.8	3,891.68
1.61	6,038.81
2.01	6,957
2.41	7,804.55
3.21	9,358.4
4.02	10,806.3



Reference**Number:** EM0045

No notes found...

Parameters**Reference:** TM6016

RADIATOR CORE DATA:

FOR OPEN GENERATOR SET ELECTRIC POWER APPLICATIONS, CORE AIR FLOW RESISTANCE DATA INCLUDES ENGINE, GENERATOR, AND COOLING PACKAGE. ADDITIONAL AIRFLOW RESISTANCE DUE TO CUSTOMER SUPPLIED ITEMS SUCH AS INLET/EXHAUST LOUVERS, SOUND ATTENUATION, OR INLET/EXHAUST AIR PIPEWORK IS NOT INCLUDED.

ALL OTHER APPLICATIONS OUTSIDE OF OPEN ELECTRIC POWER, CORE AIR FLOW RESISTANCE IS FOR FREE STANDING CORE ONLY.

CORE PERFORMANCE DATA IS BASED ON AN AIR DENSITY OF 1.20 KG/M3 (0.075 LB/CU FT)

AMBIENT CAPABILITY:

AMBIENT CAPABILITY AND ALTITUDE CAPABILITY LISTED ON THIS PAGE REFLECTS THE CAPABILITY OF THE COOLING SYSTEM AT THE MAXIMUM GENERATOR RATING. AMBIENT CAPABILITY FOR STANDBY AND MISSION CRITICAL STANDBY RATINGS REPORTED AGAINST A JACKET WATER ENGINE EXIT TEMPERATURE LIMIT OF 104C (219F). ALL OTHER RATINGS REPORTED AT 99C (210F).

AMBIENT AND ALTITUDE CAPABILITY MUST BE VERIFIED FOR THE ENGINE AND GENERATOR IN THE ENGINE PERFORMANCE SECTION OF TMI.

NON TIER 4 EMISSION RATINGS ASSUME 4C (7F) AIR TO CORE RISE, TIER 4 EMISSION RATINGS ASSUME 6C (9F).

ALL PERFORMANCE SHOWN WITH 50/50 GLYCOL COOLANT.

LAST UPDATED: 09/11/2020

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Web Master(s): [PSG Web Based Systems Support](#)

Current Date: 8/1/2022, 2:05:54 PM

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Feature Code:	NAC314P	Rating Type:	STANDBY	Sales model Package:	D30
Engine Sales Model:	404D-22TAG	Engine Arrangement Number:	6241783	Hertz:	0
EKW W/F:	30.0	Noise Reduction:	0 dBA	Back Pressure:	13.66 inH2O

Engine Package Information

Engine Package Data

Package Cooling Information
Open Cooling Data

% Load	Airflow Rate scfm			Ambient Capability Sea Level (Deg F)			Ambient Capability 300 m (Deg F)			Ambient Capability 600 m (Deg F)			Ambient Capability 900 m (Deg F)		
	0	1/2	3/4	0	1/2	3/4	0	1/2	3/4	0	1/2	3/4	0	1/2	3/4
	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O	inH2O
100.0	3778	3107	2719	149	145	141	145	141	138	141	138	134	138	134	131
75.0	3778	3107	2719	186	183	179	183	179	176	179	176	172	176	172	168
50.0	3778	3107	2719	199	195	192	195	192	188	192	188	185	188	185	181
25.0	3778	3107	2719	206	203	199	203	199	195	199	195	192	195	192	188

SA Level 1 Canopy Cooling Data

% Load	Airflow Rate scfm	Ambient Capability Sea Level (Deg F)	Ambient Capability 300 m (Deg F)	Ambient Capability 600 m (Deg F)	Ambient Capability 900 m (Deg F)
100.0	2577	138	134	131	127
75.0	2577	177	174	170	167
50.0	2577	190	186	183	179
25.0	2577	199	195	192	188

Package Sound Information
Sound Comments :

Open Sound Data

Distance: 3.3 Feet

EKW W/F	% LOAD	OVERALL SOUND DB(A)	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
30.0	100.0	86.78	79.0	83.3	85.4	82.3	78.6	74.5	67.1
22.5	75.0	86.68	78.6	82.5	85.4	82.4	78.5	74.1	66.5
15.0	50.0	86.68	78.3	81.7	84.5	83.3	78.1	73.0	64.9
7.5	25.0	86.15	78.3	82.6	85.2	81.8	77.8	73.3	65.2

Distance: 23.0 Feet

EKW W/F	% LOAD	OVERALL SOUND DB(A)	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
30.0	100.0	74.0	70.4	76.1	72.5	68.7	65.0	62.3	52.9
22.5	75.0	73.9	68.2	75.3	71.4	69.9	64.8	61.5	52.4
15.0	50.0	73.83	69.8	75.4	71.6	69.1	65.2	62.2	52.8
7.5	25.0	73.81	71.5	75.4	71.7	68.7	64.9	62.7	54.3

Distance: 49.2 Feet

EKW W/F	% LOAD	OVERALL SOUND DB(A)	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
30.0	100.0	68.0	64.4	70.1	66.5	62.7	59.0	56.3	46.9
22.5	75.0	67.9	62.2	69.3	65.4	63.9	58.8	55.5	46.4
15.0	50.0	67.8	63.8	69.4	65.6	63.1	59.2	56.2	46.8
7.5	25.0	67.8	65.5	69.4	59.7	62.7	58.9	56.7	48.3

SA Level 1 Canopy Sound Data

Distance: 3.3 Feet

EKW W/F	% LOAD	OVERALL SOUND DB(A)	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
30.0	100.0	75.2	78.6	80.1	74.2	66.1	61.9	60.3	55.6
22.5	75.0	74.4	76.6	79.2	74.1	65.3	60.5	58.6	52.9
15.0	50.0	73.8	75.7	78.5	73.7	65.2	59.6	56.9	49.9
7.5	25.0	73.78	75.2	78.6	73.4	66.1	59.2	56.0	48.7

Distance: 23.0 Feet

EKW W/F	% LOAD	OVERALL SOUND DB(A)	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
30.0	100.0	64.3	72.3	69.7	61.4	55.5	51.2	49.7	45.5
22.5	75.0	63.5	68.9	69.4	61.2	55.3	50.1	48.0	42.5
15.0	50.0	62.8	67.3	68.5	61.0	55.1	50.1	47.0	40.3
7.5	25.0	62.4	65.9	68.1	60.9	55.1	49.0	46.3	39.3

Distance: 49.2 Feet

EKW W/F	% LOAD	OVERALL SOUND DB(A)	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
30.0	100.0	58.3	66.3	63.7	55.4	49.5	45.2	43.7	39.5
22.5	75.0	57.5	62.9	63.4	55.2	49.3	44.1	42.0	36.5
15.0	50.0	56.8	61.3	62.5	55.0	49.1	44.1	41.0	34.3
7.5	25.0	56.4	59.9	62.1	54.9	49.1	43.0	40.3	33.3

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M Frame

Standby Power

10 - 385 kVA, 50 Hz

12.5 - 400 kVA, 60 Hz

DETAILS:

M Frame Generators are designed, manufactured and marketed in an ISO 9001 and ISO 14001 environments and designed to meet vibration levels per IEC 60034-14.

Main components

Housing

- Made of Steel frame, Aluminium or Cast iron
- Compact rigid assembly to better withstand genset vibrations

Insulation

- Class H

Shield

- Made of Aluminium or cast iron depending on frame

Shaft

- Made of carbon steel and obtained by lamination (EN 10083 – 2)
- Single bearing with coupling disc

Automatic Voltage Regulator

- Standard - R120 / R121 / R150 / R180 / D350
- Optional – Integrated Voltage regulator (Excitation module with Compatible EMCP Controller)

Fan

- Made of Plastic or cast Aluminium.

Construction

- Enclosure : ODP - Open Drip Proof
- Degree of protection : IP 23 as per IEC 60034 - 5
- Cooling System : IC 01 as per IEC 60529

Certificates and testing

- Generators are designed in compliance with:
 - IEC 60034 - 1
 - NEMA MG 1.32 – 33
 - ISO 1940
 - NFC 51-111
- Generators conform to EU rules (CE marking).
- UL/CSA certifications available on request
- Adheres to ISO 8528 Group G performance

Operating conditions

- **Radio Interference**
Generators can be equipped with Class B Group 1 radio interference filters as defined by EN 61000 – 6
- **THD (Total Harmonic Distortion)**
The no-load voltage wave form is sinusoidal with THD level below 2% and up to 4% depending on frame.
- **Vibration**
Measurement, evaluation and limits of vibration severity are in accordance with IEC 60034-14

TECHNICAL DATA

Stator/Rotor Core

- Laminated and enamel-insulated on both sides to minimise eddy-current losses

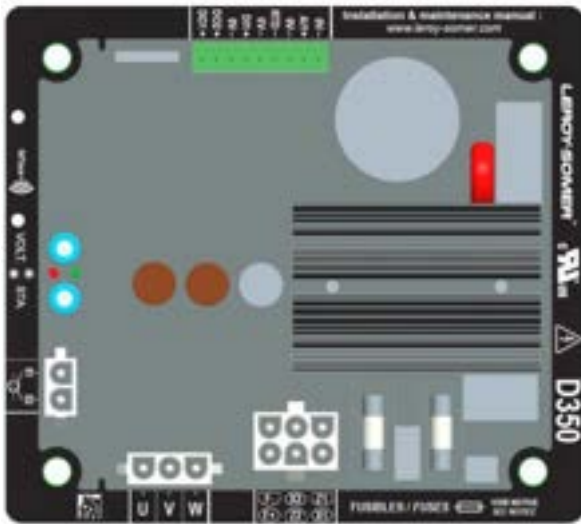
Bearing

- Single antifriction bearing grease lubricated (ball type)
- Permanently greased bearings (Optional Regreasable ball bearings with grease nipple)
- Theoretical lifetime of bearings is in excess of 20,000 (L10h as per ISO 281/1, standard horizontal construction generators, without external forces (radial and/or axial)). Floating bearing located on the ND end side

OPERATIONAL CONSIDERATIONS

Parallel Operation

- M Frame generators are provided with an amply sized damper cage, 2/3 Winding pitch and are suitable for parallel operations with other generators, when equipped with the paralleling unit



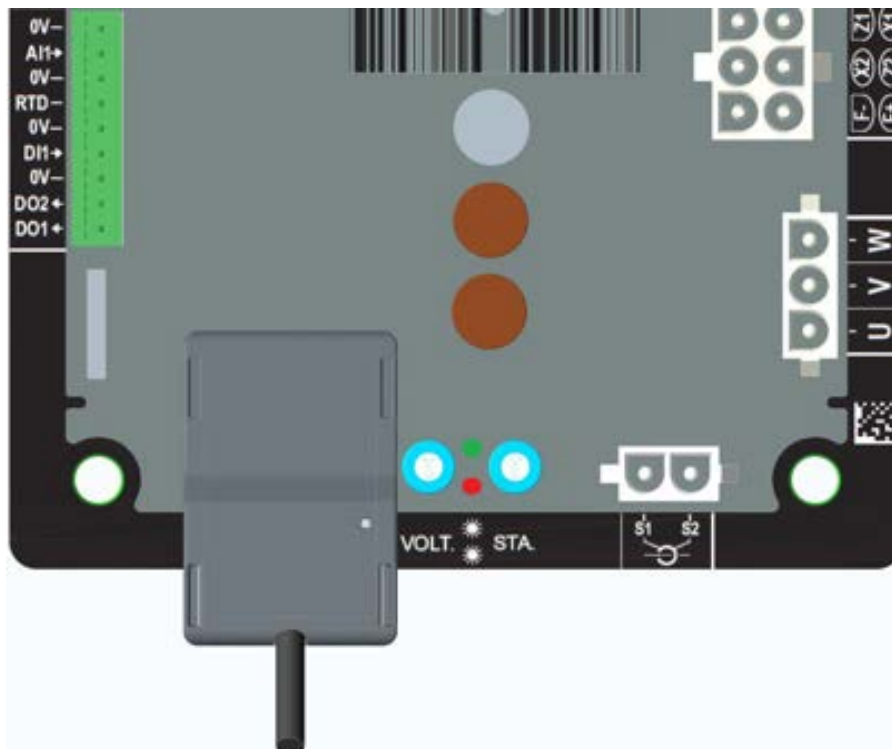
D350 AVR

The D350, Digital Voltage Regulator is used to regulate alternators with a field current of less than 5 A in continuous operations, and 10 A maximum in the event of short-circuit for 10 seconds maximum.

Its design is in accordance with mounting in a generator terminal box or a control cabinet. It is required, at a minimum, to follow the local protection and safety standards, especially those specific to electrical installations for voltages of 300 VAC phase-to-neutral maximum.

NFLink™ configuration module

The D350 is equipped with NFC technology for communication and configuration purposes. The configuration module is placed over the two dedicated positioning holes on the plastic enclosure as shown below. Once the configuration is done, the NF Link must be removed as it is not supposed to be left on the



Technical characteristics

D350 regulator can be used to perform the following functions:

Voltage regulation

- With or without reactive droop compensation (Reactive droop to allow parallel operation)
- With or without line droop compensation.

Regulation of the field current, or manual mode, which allows direct control of the field current.

The D350 can also be used to:

- Adjust the reference for the regulation mode in progress, using an analogue input (0-10V and potentiometer)
- Monitoring of temperature sensor (Pt100 or CTP)
- Limit the minimum field current delivered to the exciter field
- Monitoring of the maximum stator current limit
- Loss of voltage sensing
- Withstand a sudden short-circuit for 10 seconds maximum in AREP, PMG
- Signals monitoring (events logger).
- 2 digital outputs for various trip, regulation mode and measurement data

Alternator voltage sensing:

- 3 phases without neutral, 2 phases or 1 phase with neutral
- Three-phase range 0-530VAC
- Consumption < 2VA

Stator current measurement with CT:

- Range 0-1A or 0-5A
- Consumption < 2VA

Power supply:

- 4 terminals for PMG, AREP, SHUNT
- Range 50-277 VAC
- Consumption max < 3000VA

Field excitation:

- Rated 0-5 A
- Short-circuit 10A max.
- Field winding resistance > 4 ohms

Frequency:

- Range 10-100Hz

- Regulation accuracy: $\pm 0.25\%$ of the average of the three phases on a linear load, with harmonic distortion less than 5%
- Voltage adjustment range: 0 to 150% of the rated voltage
- Quadrature droop adjustment range: -20% to 20%
- Under frequency protection: integrated, adjustable threshold, slope adjustable from 0.5 to 3V/Hz in steps of 0.1 V/Hz
- Excitation ceiling: adjustable by configuration at 3 points
- Environment: ambient temperature from -40°C to $+65^{\circ}\text{C}$, relative humidity of less than 95% non-condensing, mounted in a cabinet or in a terminal box

Easy Reg Advanced:

- All the D350 settings are entered / configured using the "EasyReg Advanced" software.
- This program is only compatible with computers running WINDOWS® versions Windows 7 and Windows 10 operating systems.

Dimensions:

- Height : 52.9mm
- width : 125mm
- Length : 140mm

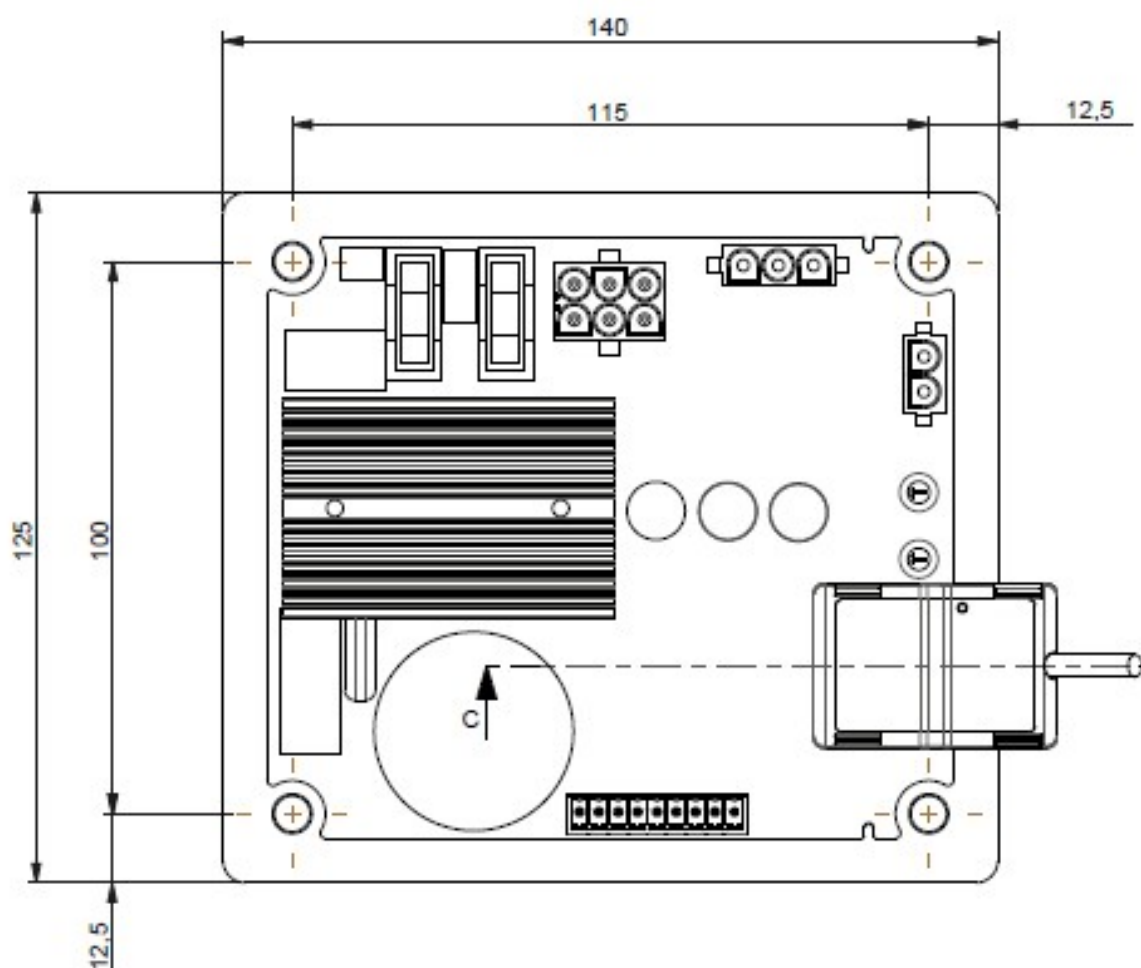
Mounting:

- Holes spacing on the Length : 115mm
- Holes spacing on the width: 100mm

Weight: 0.45kg

Conformity to standards

- EMC: IEC 61000-6-2, IEC 61000-6-4
- Humidity: IEC 60068-1 and test in accordance with IEC 60068-2-14
- Dry heat: IEC 60068-2-2
- Damp heat: IEC 60028-2-30
- Cold: IEC 60068-2-1



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GCCP 1.2 - Control Panel

GCCP 1.2 is an auto Start Control Module suitable for a wide variety of diesel gen-set applications. Monitoring an extensive number of engine parameters, the modules will display warnings, shutdown and engine status information on the backlit LCD screen, illuminated LEDs and remote PC.

FEATURES

- 4-line back-lit LCD text display
- Multiple display languages
- Five-key menu navigation
- LCD alarm indication
- Customisable power-up text and images
- Data logging facility
- Internal PLC editor
- Protections disable feature
- Fully configurable via PC using USB & RS485 communication
- Front panel configuration with PIN protection
- Power save mode
- 3-phase generator sensing and protection
- Generator current and power monitoring (kW, kvar, kVA, pf)
- kW and kvar overload and reverse power alarms
- Over current protection
- Unbalanced load protection
- Breaker control via fascia buttons
- Fuel and start outputs configurable when using CAN Support for 0 V to 10 V & 4 mA to 20 mA sensors
- 8 configurable digital inputs (3 available for Customer use)
- 8 configurable digital outputs (5 available for Customer use)
- 4 configurable analogue inputs (3 available for Customer Use)
- CAN, MPU and alternator frequency speed sensing in one variant
- Real time clock
- Engine pre-heat and post-heat functions
- Engine run-time scheduler
- Engine idle control for starting & stopping
- Fuel usage monitor and low fuel level alarms
- 3 configurable maintenance alarms

BENEFITS

- Hours counter provides accurate information for monitoring and maintenance periods
- User-friendly set-up and button layout for ease of use
- Multiple parameters are monitored & displayed simultaneously for full visibility
- The module can be configured to suit a wide range of applications for user flexibility
- PLC editor allows user configurable functions to meet user specific application requirements.
- RS485 Communication port can be used for the Remote Monitoring Communication (Compatible with Cat PLG)

SPECIFICATION

DC SUPPLY

CONTINUOUS VOLTAGE RATING

8 V to 35 V Continuous
5 V for upto 1 minute

CRANKING DROPOUTS

Able to survive 0 V for 100 ms, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries.

LEDs and backlight will not be maintained during cranking.

MAXIMUM OPERATING CURRENT

260 mA at 12 V, 150 mA at 24 V

MAXIMUM STANDBY CURRENT

145 mA at 12 V, 85 mA at 24 V

CHARGE FAIL/EXCITATION RANGE

0 V to 35 V

GENERATOR & MAINS (UTILITY) VOLTAGE RANGE

15 V to 415 V AC (Ph to N)
26 V to 719 V AC (Ph to Ph)

FREQUENCY RANGE

3.5 Hz to 75 Hz

MAGNETIC PICKUP VOLTAGE RANGE

+/- 0.5 V to 70 V

FREQUENCY RANGE

10,000 Hz (max)

INPUTS

DIGITAL INPUTS A TO H

Negative switching

ANALOGUE INPUTS A & D

Configurable as:

Negative switching digital input 0 V to 10 V sensor
4 mA to 20 mA sensor Resistive sensor

ANALOGUE INPUTS B & C

Configurable as:

Negative switching digital input Resistive sensor

OUTPUTS

OUTPUT A & B (FUEL & START)

15 A DC at supply voltage

AUXILIARY OUTPUTS C, D, E, F, G & H

2 A DC at supply voltage

DIMENSIONS OVERALL

216 mm x 158 mm x 43 mm
8.5" x 6.2" x 1.5"

PANEL CUT-OUT

184 mm x 137 mm
7.2" x 5.3"

MAXIMUM PANEL THICKNESS

8 mm
0.3"

STORAGE TEMPERATURE RANGE

-40°C to +85°C
-40 °F to +185 °F

OPERATING TEMPERATURE RANGE

-30°C to +70°C
-22 °F to +158 °F

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Cat GCCP 1.2 / 1.3 controllers and accessories providing readings of the generator current require current transformers to measure the current. CT measurements are used by different instruments to provide protection against generator overcurrent. Some are as follows:

Current Instrumentation

The CTs are used to display current, show VA, kW and pf (cosΦ).

Instantaneous Overcurrent Protection

As soon as the current is detected as being above the trip point the module will generate an alarm condition.

Delayed Overload Protection (Timer only)

When the current is detected as being above the trip point, a timer begins. If the current remains above the trip point for the period of the timer, the overcurrent alarm is generated.

Delayed Overload protection (IDMT alarm)

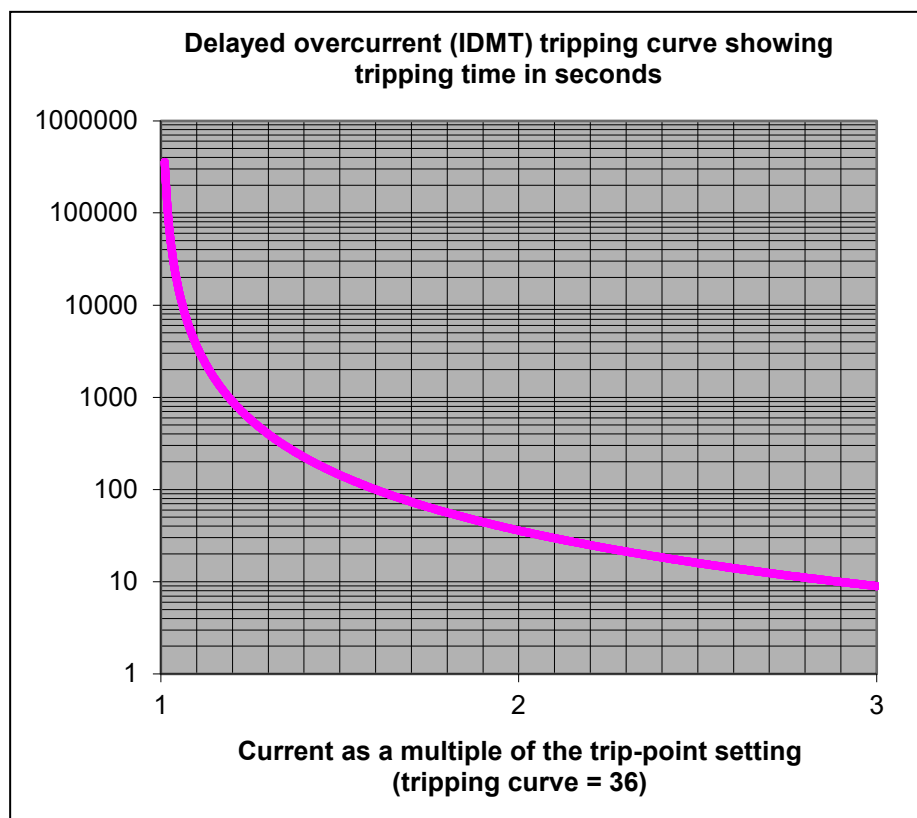
When the current is detected as being above the trip point, a warning alarm is generated, the set continues to run on load.

The IDMT curve is now followed.

The amount of overload determines how fast the module will trip the generator.

Using the factory default settings of *Time multiplier = 36*, *Delayed Overcurrent = 100%* allows the generator to run at 110% for one hour (3600 seconds) before the generator is tripped. (typical IDMT curve is shown below).

As the factory settings are designed to protect a *typical brushless alternator* there is usually no requirement to change them.



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Cat® Batteries



Cat® Batteries—Greater Starting Power— Lower Maintenance—Longer Life

Cat® Premium High Output (PHO) batteries are used in all Cat® Machines and Engine Gen-Sets. They are designed to meet stringent Caterpillar design specifications, which provide industry leading cold cranking amps (CCA) capability and maximum vibration resistance.

Maintenance Free or low maintenance designs are available in wet and dry configurations.

General Service Line batteries are available in Maintenance Free or low maintenance designs. Wide selections of BCI group sizes are available for automotive, light truck, bus, industrial, agricultural, marine, recreational and valve regulated (VRLA-AGM & Gel) applications.

World's Toughest Batteries



Premium High Output—Maximum Vibration Resistance

- Vibration Resistance...five times the Industry Standard
- Exclusive "flat top" BCI group 4D & 8D batteries are Maintenance Free and have the industries highest cold cranking amps (CCA)
- Popular BCI group 31 Maintenance Free batteries with industry leading cold cranking amps...up to 1000 (CCA), for electric power, machine or on-highway truck and bus applications. Deep cycle models are available for truck, marine or recreational usage

Specifications for Cat Premium High Output Batteries-Available Worldwide

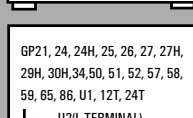
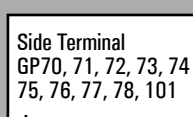
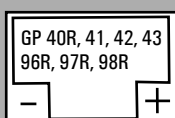
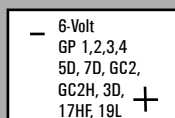
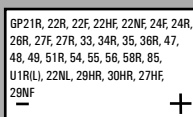
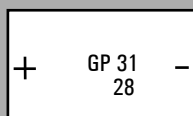
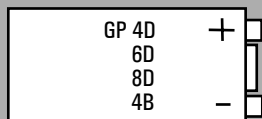
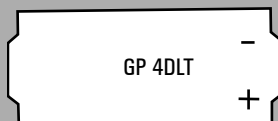
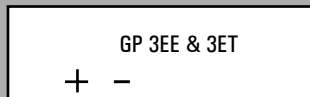
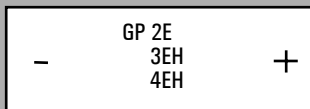
BCI Group Size	Part No.	CCA ≈	RC Mins †	Volts	Amp Hr. Capacity @ 20 Hrs.	Construction Notes	Accessibility - Fluid Level Check Hours	Length In (mm)	BCI Overall Dimensions		Nominal Weight		
									Width In (mm)	Height In (mm)	Wet Lb (kg)	Dry Lb (kg)	Nominal Acid to Fill Qt (liter)
8D	153-5720	1500	465	12	210	C/MFA	A - 1000	20.5 (520)	10.8 (275)	9.8 (248)	132 (59.9)	-	-
8D	101-4000	1400	400	12	190	LAC+	A - 1000	20.8 (527)	11.0 (278)	9.8 (248)	132 (59.9)	86 (39.0)	18.0 (17.0)
4D	153-5710	1400	425	12	200	C/MFA	A - 1000	20.5 (520)	8.6 (218)	9.8 (248)	119 (54.0)	-	-
4D	9X-9730	1300	400	12	190	LAC+	A - 1000	20.8 (527)	8.6 (218)	9.8 (248)	120 (54.0)	81 (36.8)	14.8 (14.0)
4D	153-5700	1125	305	12	145	C/MFA	A - 1000	20.5 (520)	8.6 (218)	9.8 (248)	101 (45.8)	-	-
4D	9X-9720	1000	275	12	140	LAC+	A - 1000	20.8 (527)	8.6 (218)	9.8 (248)	102 (45.8)	59 (26.8)	15.9 (15.0)
31	175-4390	1000	180	12	90	C/MFA/S	A - 1000	12.9 (329)	6.8 (172)	9.3 (236)	60 (27.2)	-	-
31	175-4370	825	190	12	100	C/MFA/S**	A - 1000	12.9 (329)	6.8 (172)	9.3 (236)	61 (27.2)	-	-
31	175-4360	710	185	12	100	C/MFA/S***	A - 1000	12.9 (329)	6.8 (172)	9.3 (236)	62 (28.1)	-	-
QTY. 1	31/30H	115-2422	1000	170	90	C/MFA	A - 1000	12.9 (329)	6.8 (172)	9.5 (241)	63 (28.6)	-	-
31/30H	115-2421	950	170	12	90	C/MFA+	A - 1000	12.9 (329)	6.8 (172)	9.5 (241)	64 (29.1)	44 (20.0)	6.6 (6.2)
31/30H	9X-3404(1)	950	165	12	95/100	C/MF	NA	13.0 (331)	6.8 (172)	9.5 (241)	58 (26.3)	-	-
31/30H	3T-5760	750	165	12	95/100	C/MF	AV - 1000	13.0 (331)	6.8 (172)	9.5 (241)	56 (25.4)	-	-
65	230-6368	850	140	12	70	C/MF	NA	11.9 (304)	7.5 (191)	7.5 (191)	46 (20.9)	-	-
24	153-5656	650	110	12	52	C/MF	NA	11.0 (279)	6.9 (174)	9.0 (229)	39 (17.7)	-	-

Construction Notes:

Batteries use SAE taper post design and are shipped wet except as:

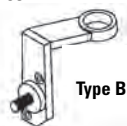
- LAC = Low Maintenance - Hybrid Construction
- C = Calcium Lead Alloy Grid Design
- MF = Maintenance Free Non-Accessible
- MFA = Maintenance Free Accessible
- A = Accessible
- NA = Non-Accessible
- AV = Accessibility Varies - Accessibility varies depending on supplier used. If it has caps, it is accessible and fluid levels should be checked.
- S = Stud Terminals
- + = Shipped Dry Only
- * = Side Terminals Only
- ** = Starting and Deep Cycle Battery
- *** = Deep Cycle and Starting Battery
- ≈ = Cold Cranking Amps for 30 seconds at 0° F (-18° C)
- † = Reserve Capacity Minutes minimum of 25 amp output at 80° F (27° C)
- SDT
- 1 = Available in EAME and China only

BCI Terminal Locations



Terminal layout for 250-0473 8D
Transit Bus Battery.
Terminal not available for service.

1/2" - 13 Steel Positive Stud
3/8" - 16 Steel Negative Stud



Cat Premium High Output Batteries — Built Tough to Exceed Demanding Performance Test Requirements:

• 100 hour Vibration Testing – Five Times the Industry Standard

Battery must be able to withstand vibration forces without suffering mechanical damage, loss of capacity, loss of electrolyte or without developing internal/external leaks

Battery must pass a high rate discharge test after the vibration testing

• Five 72-hour Deep Discharge/Recharge Test Cycles

Battery must recover to 25 charging amps within 20 minutes and meet Industry Electrical Performance Standards

• 30 Day Complete Discharge Test

Battery must recover to 25 charging amps within 60 minutes and meet Industry Electrical Performance Standards after recharging

• SAE J2185 Life Cycle Test

Battery subject to deeper discharge and charge cycles at extreme temperatures not normally encountered in starting a machine or vehicle

• Cold Soak Test

Battery cold soaked at sub-freezing temperatures and then tested by starting an equally cold engine



Battery Accessories

Group 31 - Charging Posts for Stud Terminals - Part # 4C-5637

Screw-in Charging Posts for Side Terminals - Part # 4C-5638

Wing Nut - Part # 2B-9498 for Part #'s 175-4390/175-4370/175-4360/8C-3628

Wing Nut - Part # 3B-0723 for Part #'s 8C-3638 and 8C-3639

Booster Cable 12' (3.66 m) - Part # 4C-4911

Booster Cable 20' (6.00 m) - Part # 4C-4933

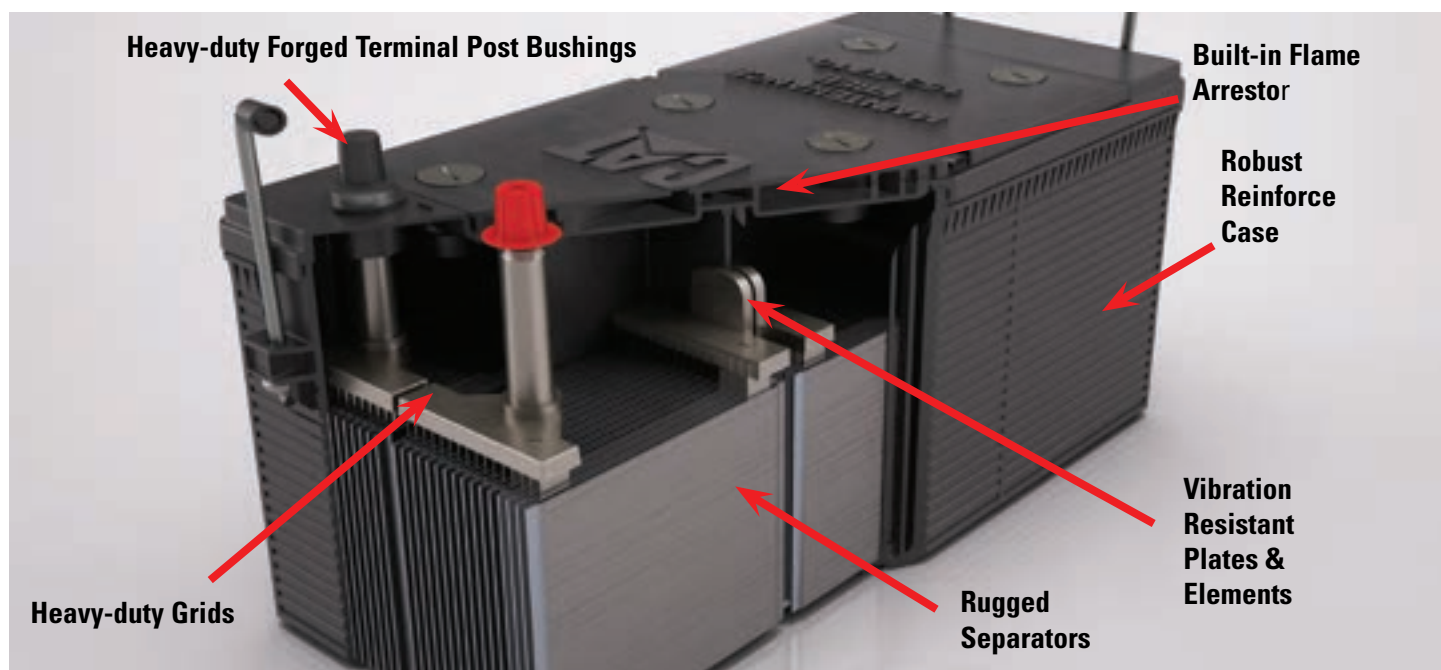
Heavy Duty Commercial Fast Charger (110V) - Part # 4C-4921

Heavy Duty Commercial Fast Charger (220V) - Part # 4C-4910

Note: Ratings and Part Numbers are subject to change without notice.



Recycle all scrap batteries.
We accept lead-acid batteries for recycling.



Robust Components = Long Life + Reliable Starts

- Heavy-duty forged terminal post bushings provide maximum strength and resistance to acid seepage that causes corrosion and black posts. Thicker internal terminal posts provide lower electrical resistance and higher cold cranking amp output.
- Rugged microporous polyethylene envelope separators protect against “shorts” and vibration damage.
- Maintenance Free batteries utilize calcium lead alloy on both positive and negative plates that reduces gassing and water consumption. Automotive batteries have Silver (Ag) Calcium Alloy Grids for resistance to high underhood temperatures.
- Heavy-duty, full frame battery grids with no sharp edges. Durable plates with optimum acid/paste combination provides better charge acceptance after a deep discharge.
- Positive and Negative plates are anchored to the container bottom and the cell element is locked at the top for maximum vibration resistance. Straps are thicker, heavier and cast (not welded) into the plates.
- Manifold vented cover with built-in Flame Arrestor...a safety feature that directs corrosive gases away from the battery and hold-downs.
- Robust reinforced case provides extra strength in all temperature extremes. Brickwork design on sides reduces chance of punctures and case flexing. Embossed part number and descriptors for easy serviceability.

CAT® DEALERS DEFINE WORLD-CLASS PRODUCT SUPPORT.

We offer you the right parts and service solutions, when and where you need them.

The Cat Dealer network of highly trained experts keeps your entire fleet up and running to maximize your equipment investment.





Image shown might not reflect actual configuration

BATTERY CHARGER

The intelligent battery charger has been developed with safety, usability, optimised battery performance and maximum battery lifetimes in mind.

A comprehensive range of input and output protections ensures a continued safe charging environment also enabling the use of the charger as a power supply.

FEATURES

- Intelligent two, three and four stage charging profiles
- Configurable to suit most battery types (12V/24V)
- Adjustable current limit
- Can be used as a battery charger, power supply or both at the same time
- Automatic or Manual boost and storage charge functions to help maintain battery condition
- Digital Microprocessor Technology
- Temperature compensation for battery charging
- Low Output Ripple and superb line regulation
- Three LED Indicators
- AC input Under voltage
- AC input Over voltage
- Battery charger output Over voltage
- Battery charger output Over current
- Optional battery temperature compensation with over temperature protection
- Output short circuit and Inversion polarity with auto recovery
- Configurable charge termination
- UL1236 /UL1564 Compliant

Automatic Boost Mode

- Boosts and equalises cell charge improving battery performance and life

Power Save Mode

- Once the battery is fully charged the chargers switch to Eco-Power to save energy

Communication

- Can be integrated into external systems through MODBUS RTU using RS485
- Fully configurable via PC Software

BENEFITS

- Fully flexible to maximise the life of the battery
- Suitable for a wide range of battery types
- Switched mode design
- Minimum 86% efficiency throughout full operating range
- No external intervention for boost mode
- Multiple chargers can be linked together to provide larger current output
- Can be permanently connected to battery and mains (utility) supply. No need to disconnect through high load conditions.

SPECIFICATION

AC SUPPLY

VOLTAGE RANGE 90 V to 305 V (L-N)

FREQUENCY RANGE

48 Hz to 64 Hz (L-N)

DC OUTPUT RATING

10 A DC at 24 V DC

RIPPLE AND NOISE

<1%

EFFICIENCY

>86%

REGULATION LINE

<0.5%

LOAD

2%

TEMPERATURE SENSOR INPUT

PT1000

PROTECTIONS

Short Circuit
DC Over Voltage
DC Over Current
Reverse Polarity
Over Temperature
AC Under & Over Voltage

CHARGE FAILURE RELAY

3 A at 30 V DC volt free relay

DIMENSIONS OVERALL

70 mm x200 mm x 130 mm
2.7" x 7.9" x 5.1"

WEIGHT

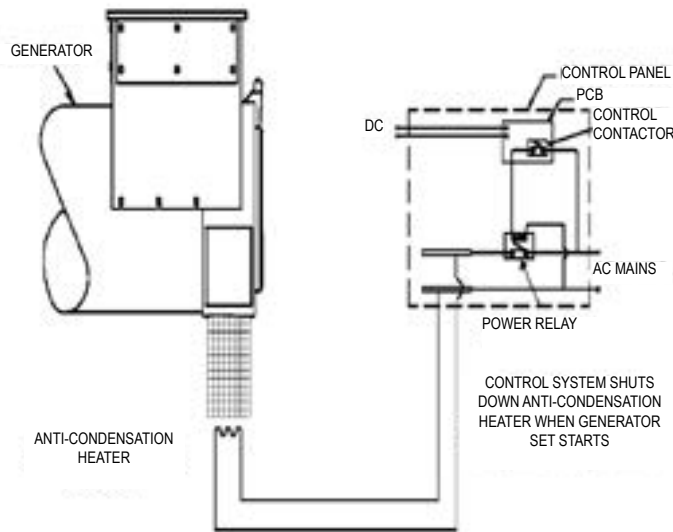
0.75 kg

OPERATING TEMPERATURE RANGE

-30 °C to +80 °C
-22 °F to +176 °F

STORAGE TEMPERATURE RANGE

-40 °C to +70 °C
-22 °F to +158 °F



Generator Anti-condensation Heater AH1H

Appropriate when the generator set is to be sited in a low ambient and/or high humidity environment, the heater maintains the AC generator at a suitable temperature to prevent winding corrosion due to condensation.

The heater itself is powered by a 110/120 volt (VAC 120) or 208/240 volt (VAC 240) AC auxiliary supply protected by a fuse inside the main control panel. When the generator set is not running the heater is automatically connected to the AC supply through a power relay mounted in the control panel. Upon receiving a start signal the AC supply is automatically disconnected by the power relay and automatically reconnected when the start signal is removed and the engine has stopped.

Generator Frame	Nominal Heater Power Consumption (Watts)
LC15XX, M17XX	60
LC31XX, M22XX	100
LC50XX, M27XX	250

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WHH2 – Coolant Heater

Features

The heater assembly is ULC compliant:

- Block Drain Screw In (Straight element)
- Simple to replace the existing block drain plug
- 120V type more common, 240V type also available

Direct plug in to the cylinder block (plug and play).

No coolant lines, easy to install (less parts).

Consumes less than 400W power – No thermostat, no loss of heat from coolant lines.

Connects directly to shore power.

Appropriate when generator set is to be sited in low ambient environment, the heater maintains the engine coolant above 38°C (100°F) to facilitate rapid starting and load acceptance.

The heater is automatically switched to shore power when the generator set is switched off.

Upon generator set starting the AC power to heater is automatically disconnected by the power relay and automatically reconnected when the start signal is removed and the engine has stopped.

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20A Tamper-Resistant, Weather-Resistant GFCI Receptacles

Features and Benefits

- Automatically tests the GFCI every time the reset button is pushed in. The GFCI will not reset if the GFCI circuit is not functioning properly.
- By blocking reset of the GFCI if protection has been compromised, SmartLockPRO reduces the possibility of end-users incorrectly assuming that a reset GFCI outlet is providing ground fault protection when it actually is not.
- A line-load reversal diagnostic feature is provided which prevents the GFCI from being reset and stops power from being fed to the GFCI receptacle face or through to downstream devices. A green LED indicator on the GFCI's face also illuminates to alert the installer to the line-load wiring reversal.

Weather-Resistant GFCIs

- Meet UL 498 requirements for weather-resistant receptacles.

Tamper-Resistant GFCIs

- Shutter mechanism inside the receptacle blocks access to the contacts unless a two-prong plug is inserted, helping ensure foreign objects will be locked out.

Product Features

- Grounding: GFCI ground fault
- Feature: Weather and tamper-resistant
- Amperage: 20 Amp
- Voltage: 125 Volt
- NEMA: 5-20R
- Trip Level: Class A, 5mA plus or minus 1mA
- Pole: 2
- Wire: 3
- Color: White

Standards and Certifications

- NEMA: WD-6
- ANSI: C-73
- UL498: File E13399
- CSA C22.2 No. 42: File LR-57811
- NOM: 057
- UL 943: File E48380

Receptacles contained in a weather resistant box and in-use cover.



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CAT[®] PRODUCT LINK[™] TECHNOLOGY



PRODUCT LINK[™]

Cat[®] Product Link[™] PL444

The PL444 is designed as a reliable, low-cost, engine agnostic telematics solution which is easy to install. The device comes pre-configured with a standard set of parameters including hours and location which report each day and enables immediate alerting of fault codes. Server side geofencing is also available so you can be confident your asset is in the right place. The PL444 will be used by multiple industries and functionality varies by industry.

Data Available Includes:

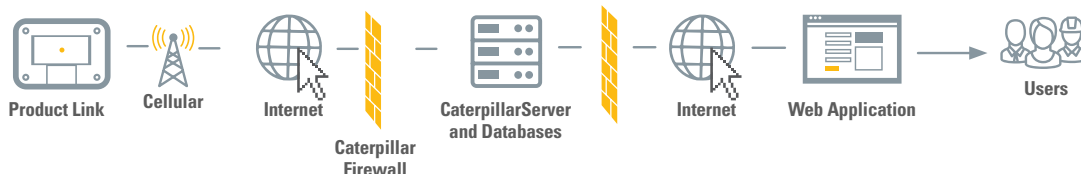
- [+] Status of Asset
- [+] Engine Parameters
- [+] Events and Alarms
- [+] Location
- [+] Electrical Parameters
- [+] Fuel Consumption & Fuel Level

HIGH-LEVEL SECURITY OVERVIEW

Product Link's end-to-end system is designed with multi-layer security controls and safeguards to protect against unauthorized access and disclosure. High-level security safeguards include, but are not limited to:

- [+] Cryptographically secured to protect against unauthorized Product Link device software changes
- [+] Encrypted and authenticated remote connection
- [+] Caterpillar IT infrastructure secured utilizing generally accepted information security principles and practices
- [+] Only outbound remote connection, initiated by the Product Link device, is allowed. Device does not participate in or respond to general Internet traffic
- [+] Secure Caterpillar Equipment Management web application connection with user login authentication and role-based access controls

END-TO-END ARCHITECTURE



PL444 4G LTE RADIO TECHNICAL SPECIFICATIONS

HOW IT WORKS

The PL444 integrates a positioning receiver with a 4G LTE cellular communication system that will fall back to 3G or 2G signal if necessary to establish a connection. The PL444 will transfer hours, location and other asset data to Caterpillar to be viewed and analyzed through Caterpillar equipment management software.

INPUT VOLTAGE

Voltage Range	[+] 9.0V to 32.0V DC
Protection	[+] Reverse polarity

CURRENT CONSUMPTION (TYPICAL)

Sleep Current	[+] <3 mA
Idle Current (non-transmitting)	[+] <300 mA
Peak Current	[+] <6A

PHYSICAL SPECIFICATIONS

Enclosure Material	[+] Plastic Cover (PBT+ASA GF30 FR) Aluminum Backplate (AlMg2.5 / H22; H23)
Dimensions (mm)	[+] 215.5 x 141.2 x 37.5
Weight	[+] 0.45 kg
Interface Connectors	[+] 48 pin Molex
LEDs	[+] Orange (GNSS), Yellow (Cellular), Blue (Data link), White (Bluetooth*)

ENVIRONMENT

Operating Temperature	[+] -40°C to +85°C
Storage Temperature	[+] -40°C to +95°C
Ingress Protection	[+] IP66/67 (MATING CONNECTOR MUST BE INSTALLED)
Humidity	[+] SAE J1455
Vibration	[+] 9.8 Grms random (24-2000 Hz), up to 0.5 g ² /Hz

COMMUNICATIONS

Datalink	[+] J1939/CAN
Datalink	[+] Modbus (RS-485)
Wireless	[+] 4G LTE with 2G/3G fallback
Wireless	[+] Bluetooth®/BLE 5.0

INPUTS / OUTPUTS

Low Side Drivers (300 mA max)	[+] 2
Switch to Ground	[+] 1
Keyswitch	[+] 1



Note: In the case of an extended outage, the capacity of the message queue can be exceeded and some data will be lost as older messages are overwritten.

POSITIONING (GNSS)

Signal Tracking	[+] GPS/Galileo/GLONASS/BeiDou
Accuracy	[+] <6 m (95%)
Antenna	[+] Internal

BLUETOOTH* LOW ENERGY

Version:	[+] BLE 5.0
Band:	[+] 2.4 GHz (2.42-2.48 GHz)
Antenna:	[+] Internal

REGULATORY COMPLIANCE: PL444 (NA)

FCC, IC, UL/CSA 62368-1, RED, RoHS, WEEE, REACH

REGULATORY COMPLIANCE: PL444 (EU)

RCM, EAC, EN 62368-1, CE RED, RoHS, WEEE, REACH

CELLULAR COMMUNICATIONS

CELLULAR COMMUNICATIONS PL444 (NA): 604-9580

4G LTE Cat 4	[+] + 2, 4, 5, 7, 12/17, 13
3G	[+] +2, 4, 5
2G	[+] +2, 5
Operating Temperature	[+] -30°C to +70°C
Antenna	[+] 2x Internal (Primary + Diversity) to support 2x2 MIMO
SIM	[+] eUICC chip

CELLULAR COMMUNICATIONS PL444 (EU): 604-9581

4G LTE Cat 4	[+] + 1, 3, 7, 8, 20, 28A
3G	[+] +1, 3, 8
2G	[+] +3, 8
Operating Temperature	[+] -30°C to +70°C
Antenna	[+] 2x Internal (Primary + Diversity) to support 2x2 MIMO
SIM	[+] eUICC chip

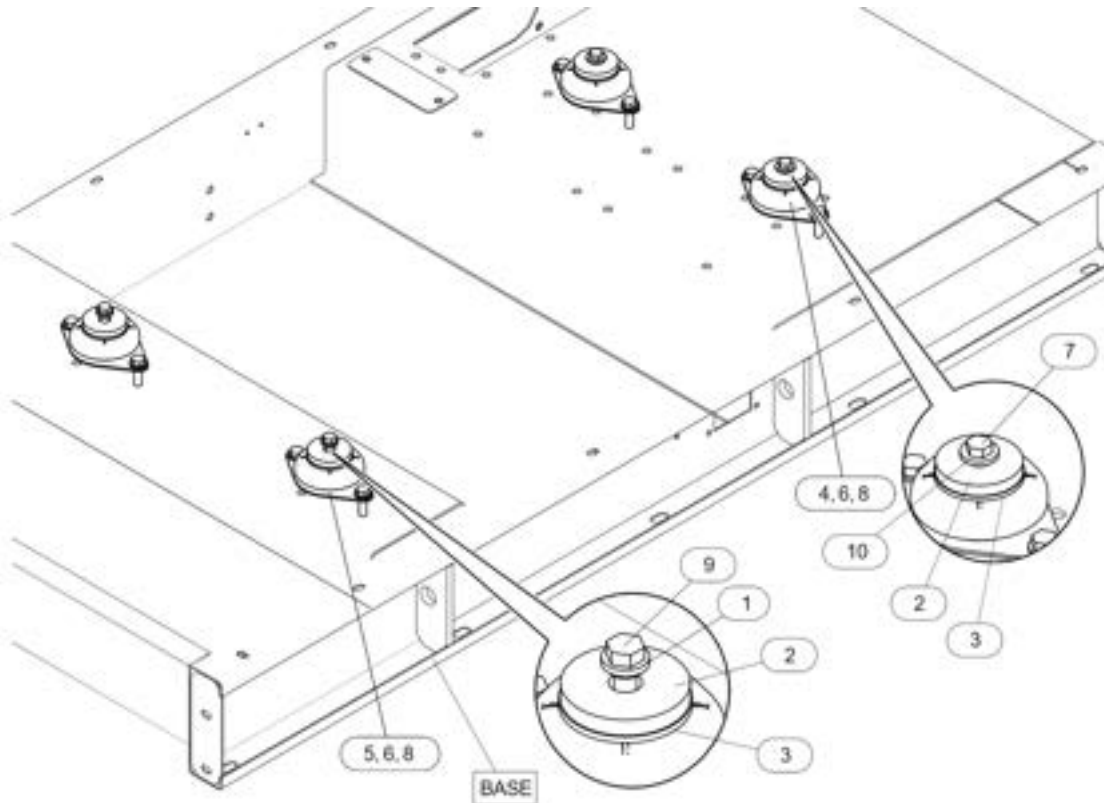
*Bluetooth is a future capability.

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VIBRATION ISOLATORS



594-9942 MOUNTING GP-ENGINE

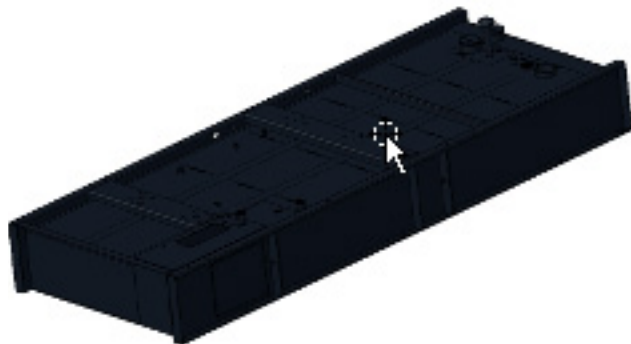
S/N 2F41-UP

AN ATTACHMENT

Individual Parts

	Part Number	Part Name	Quantity Reqd
1	262-2705	Washer-Shoulder	2
2	287-0305	Washer (18X60X18-MM THK)	4
3	353-9720	Washer (15.5X70X6-MM THK)	4
4	596-7324	Mount	2
5	596-7325	Mount	2
6	8T-4183 M	Bolt (M12X1.75X46-MM)	8
7	8T-4194 M	Bolt (M12X1.75X58-MM)	2
8	8T-4223	Washer-Hard (13.5X25.5X3-MM THK)	8
9	8T-4910 M	Bolt (M12X1.75X86-MM)	2
10	5P-1076	Washer-Hard (13.5X38X4-MM THK)	2

M - Metric Part



D20 – D30 Integral Fuel Tanks

Image shown may not reflect actual product.

Features

- UL Listed for United States (UL 142, ULC601)
- Dual wall
- Low fuel level warning standard, customer configurable warning or shutdown
- Primary tank leak detection switch in containment basin
- Tank design provides capacity for thermal expansion of fuel
- Fuel supply dip tube is positioned so as not to pick up fuel sediment
- Fuel return and supply dip tube is separated by sufficient distance to prevent immediate re-supply of heated return fuel
- Interior tank surfaces coated with a solvent-based thin-film rust preventative
- Primary and secondary tanks are leak tested at 13.8 kPa (2 psi) minimum
- Compatible with open packages and enclosures
- Gloss black polyester alkyd enamel exterior paint
- Welded steel containment basin (minimum of 110% of primary tank capacity)
- Direct reading fuel gauge

Integral

- Integral diesel fuel tank is incorporated into the generator set base frame
- Robust base design includes linear vibration isolators between tank base and engine generator

Options

- Audio/visual fuel level alarm
- 5 gal (18.9 L) spill containment
- Fuel tank fill pipe and lockable cap
- Overfill prevention Valve

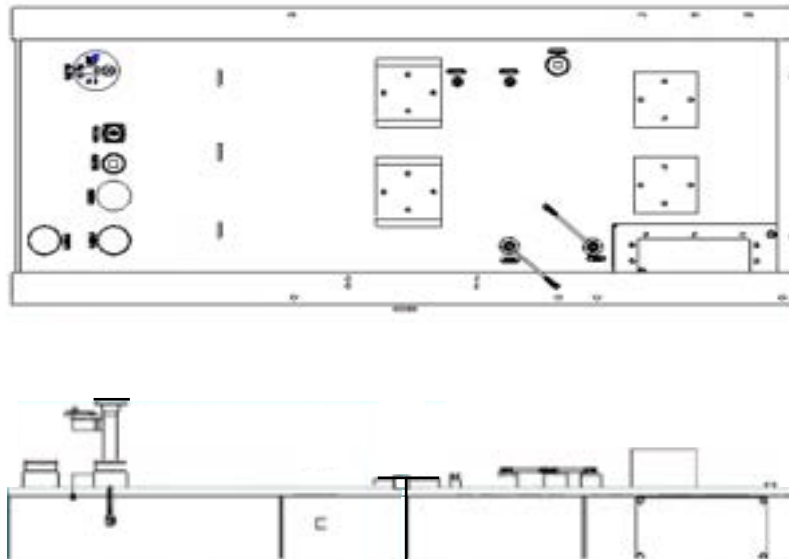
Weights & Dimensions

A. Fuel Tank and Package Weights and Dimensions

Configuration	Feature Code	Dry Weight		Width 'W'		Length 'L'		Height 'H'		Overall Package Height with Tank			
										Open		Enclosed	
		kg	lb	mm	in	mm	in	mm	in	mm	in	mm	in
24 Hrs Integral fuel tank	FTDW052	247	545	2250	89	970	38	259	10	1232	49	1468	58
48 Hrs Integral fuel tank	FTDW054	309	681	2250	89	970	38	424	17	1306	51	1633	64
72 Hrs Integral fuel tank	FTDW056	371	818	2250	89	970	38	594	23	1330	52	1803	71

B. Fuel Tank Capacities

Configuration	Feature Code	Single Wall / Dual Wall	Total Capacity		Useable Capacity	
			Litre	Gallon	Litre	Gallon
24 Hrs Integral fuel tank	FTDW052	Dual Wall	280	74	258	68
48 Hrs Integral fuel tank	FTDW054	Dual Wall	516	136	495	131
72 Hrs Integral fuel tank	FTDW056	Dual Wall	760	201	738	195



C. Run time (in Hours)

Configuration	Feature Code	Rating	Run time at various loads (Hours)					
			100%		75%		50%	
		ekW	Hrs	L/hr	Hrs	L/hr	Hrs	L/hr
Integral fuel tank	FTDW052	20	37	7	54	5	74	4
		25	28	9	42	6	56	5
		30	25	10	40	7	53	5
	FTDW054	20	72	7	103	5	141	4
		25	53	9	81	6	108	5
		30	49	10	76	7	101	5
	FTDW056	20	107	7	154	5	211	4
		25	79	9	121	6	160	5
		30	72	10	114	7	151	5

Tanks include RH stub-up area directly below the circuit breaker or power terminal strips.

Fuel tanks and applicable options facilitate compliance with the following United States NFPA Code and Standards:

NFPA 30: Flammable and Combustible Liquids Code

NFPA 37: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines

NFPA 110: Standard for Emergency and Standby Power Systems

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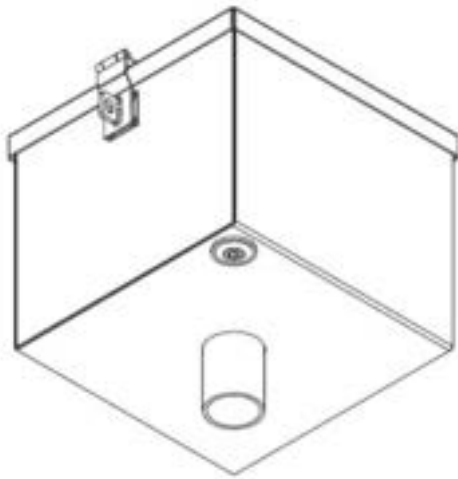


Image shown may not reflect actual configuration

5 Gallon Steel Spill Containment Box

Durable spill containment box designed for containment of small spills during filling of an above ground storage tank.

Features

- Optional overfill prevention valve
- Lockable hinged cover.

Dimensions

- Height: 13.08"
- Height with pipe: 13.40"
- Body Width: 12.38"
- Width: 13.68"
- Weight: 22 lbs.

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Overfill Prevention Valve for use with 5 and 7.5 Gallon Spill Containment

The overfill prevention valve is installed at the fill port of a fuel tank.

Used in a pressurized tight fill application, the valve helps prevent tank overfills by closing when the liquid level reaches shut off capacity level.

The overfill prevention valve can eliminate hazardous liquid spills.

Features

- Installs in a 2" NPT or 4" NPT opening
- Accepts pressure delivery of product
- Provides tanks with large fuel storage capacity at shutoff height
- Provides positive shut off of fuel
- Retro-fits to an existing AST*
- Mechanical in operation – no user interface required
- Compatible with diesel fuel
- Minimum operating pressure of 5 PSI
- Maximum operating pressure of 40 PSI

* Aboveground Storage Tank

Code Compliance

- UL listed, ULC listed

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FUEL LEVEL ALARMS - FSS

CRITICAL LOW FUEL LEVEL SHUTDOWN AND LOW FUEL LEVEL ALARM

These options provide an alarm on low fuel level and a shutdown on critical low fuel level. This warning is reported by an indicator light on the control panel with an audible alarm also available as an option. This warning can additionally be relayed to a remote annunciator.

Note: Standard Fuel Fill, UL Rated Emergency-vent, Standard vent, Fuel Sender & Leak Detection Probe are included as standard on generator sets fitted with UL Listed fuel tanks.



CRITICAL HIGH FUEL LEVEL ALARM

This option provides an alarm on critical high fuel level. This warning is reported by an indicator light on the control panel with an audible alarm also available as an option. This warning can additionally be relayed to a remote annunciator.

Information contained in this publication may be considered confidential. Discretion is recommended when distributing.

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SYSTEM DESCRIPTION

TS 870-SERIES AUTOMATIC TRANSFER SWITCHES WITH SERVICE ENTRANCE RATING

Quantity: 1
Model: TS873A0100B1AG5ANKAA
Encl. Type: Nema1
Amps: 100A
Poles: 3P
Voltage: 120/240V (Delta)
Phase / Wire: 3/4W
OCP: On Utility
Weight: 143lb
Dimensions: 31.1"H x 22.3"W x 14.0"D
WCR: 25KAIC@480V

Standard Features Include:

TSC 900 Microprocessor Based Transfer switch controller with:

Door Mounted Graphical Color 7" Touchscreen Operator Interface – Security Password Enabled Programming
Source Available/Source Connected Mimic Bus
Voltage sensing, True RMS, 3-Phase (Utility/Gen/Load)
Under/Over Voltage Protection Set Points (Utility & Gen)
Under/Over Frequency Protection Set Points (Utility & Gen)
3-Phase Metering of Utility/Gen/Load Voltage & Frequency
System Phase Sequence /Phase Rotation Detection
Engine Start delay timer, 0-60s, Engine Cool-down delay, 0-30m, Engine Warm up timer, 0-60s
Neutral Position Delay timer, 0-60s, Transfer to utility timer, 0-30m
(2) Engine Start Contact, 10A, Form C
(8) Programmable Relay Contact Outputs 2A, 250VAC, 30VDC
Load Shed Programmable Output
Local power fail simulation test switch
Remote Load Test/Peak Shave Input
Programmable Test/Exerciser Timer – Calendar Based
Fail to Transfer Alarm/Forced Transfer Detection
Pre/Post Transfer Load Disconnect Control Output
Service Entrance Disconnect Switch with Padlock-ready Cover, Pilot Light, & SE Label

Added Features:



Peterson Power Systems
Cannon Beach - Midway WTP
100A SE ATS

SERIES TS 870 • 100 - 1200 AMP AUTOMATIC TRANSFER SWITCHES

COMMERCIAL & INDUSTRIAL

REGAL[®]

THOMSON POWER SYSTEMS TS 870 AUTOMATIC TRANSFER SWITCHES OFFER THE FOLLOWING:

ENCLOSED CONTACT POWER SWITCHING UNITS

- Fully enclosed silver alloy contacts provide high withstand rating & 100% continuous current rating
- 3 cycle short circuit current withstand
- 10 cycle 6X overload current rating
- Completely isolated utility and generator side power switching units
- Power switching units can incorporate over current protection, allowing cost savings in upstream devices
- Not damaged if manually switched while in service

RELIABLE MOTOR-OPERATED TRANSFER MECHANISM

- Heavy duty brushless gearmotor and operating mechanism provide mechanical interlocking (for open transition ATS) and extreme long life
- Stored Energy: Motor Operators for fast CTTS
- Safe manual operation permits operation under adverse conditions

SUPERIOR SERVICEABILITY

- All mechanical and control devices are visible and front accessible
- All control wires and power busses are front accessible
- Plug-in TSC 900 Transfer Switch Controller

CONTROL FEATURES

- TSC 900 microprocessor based controller with 7" color touch screen graphical display and programmable inputs/outputs
- Isolation plug permits disconnecting control circuits from all power sources

PRODUCT DATA

- Models from 100 - 1200A continuous current
- Available 2, 3 or 4 pole
- All models 50/60Hz rated
- Voltage range 120 - 600VAC
- 3 phase, 3 or 4 wire systems
- Open Transition or Closed Transition ATS
- 1000/1200A offer fast Open Transition transfer, with in-phase monitoring

QUALITY ASSURANCE

- ISO 9001 Registered

SEISMIC CERTIFICATION

TS 870 ATS is certified for installation and operation per the following requirements:

- IBC 2012 – Section 13, Occupancy Category IV
- ASCE7 - 05 Region 3 (minimum SS=200%)

SAFETY STANDARDS

- UL 1008 Automatic Transfer Switches for use in Emergency Systems
- CSA C22.2 No. 178 Automatic Transfer Switches
- NFPA 110 Standard for Emergency and Standby Power Systems

WARRANTY

- 2 year limited warranty included

Thomson Power Systems TS 870 Automatic Transfer Switches employ two mechanically interlocked power switching units with a microprocessor based controller to automatically start a generator and transfer system load to a generator supply in the event of a utility supply failure. System load is then automatically re-transferred back to the utility supply following restoration of the utility power source to within normal operating limits. All load transfer sequences are "Open Transition" (i.e. "break-before make") with adjustable neutral position delay to ensure adequate voltage decay for preventing out of phase transfers.

TS 870 Automatic Transfer Switches are certified to UL 1008 & CSA 178 Standards for use in Emergency Power System applications.

All TS 870 Transfer Switch models have been 3 cycle withstand current tested in accordance with UL 1008 & CSA 178. Additionally they can withstand 6 times overload for 10 cycles. The standard TS 870 Automatic Transfer Switch is rated for 100% system load. The TS 870 design allows optional use of integral over current trip elements within the power switching units. All TS 870 Automatic Transfer Switches use a TSC 900 microprocessor based controller which provides all necessary control functions for fully automatic operation. The controller is equipped with 7" color touch screen graphical display which provides operating status and controls. All parameters and configurations are entered without opening the front door.



SERVICE ENTRANCE ATS (For U.S. Market Only)

Thomson Power Systems TS 870 Service Entrance (SE) Automatic Transfer Switches incorporate an isolating mechanism and over current protection on the utility supply thereby removing the need to have a separate, upstream circuit breaker/disconnect switch. This unique Service Entrance Rated Automatic Transfer Switch design is incorporated into a standard sized Automatic Transfer Switch enclosure.

Standard features of the Service Entrance Rated Automatic Transfer Switch include a NEMA 1 rated enclosure, pad-lockable Service Disconnect control switch and status indications.

TS 870 SE Service Disconnect operation ensures a high level of safety for system maintenance personnel. Normal operation and performance of the Automatic Transfer Switch is unaffected by the Service Entrance ATS feature. The TS 870 SE Automatic Transfer Switch is rated for the system load and requires upstream over current protection on the generator supply.

The TS 870 SE Automatic Transfer Switches use a type TSC 900 microprocessor based controller.

WITHSTAND CURRENT RATINGS (ALL MODELS)

MODEL	RATED CURRENT (AMPS)	MAX VOLTAGE (VAC)	WITHSTAND CURRENT RATING AMPS (RMS) ¹		
			@240V	@480V	@600V
TS 87xA-0100	100A	600	65,000	25,000	18,000
TS 87xA-0150	150A	600	65,000	25,000	18,000
TS 87xA-0200	200A	240	65,000	N/A	N/A
TS 87xA-0250	250A	600	65,000	65,000	35,000
TS 87xA-0400	400A	600	65,000	50,000	35,000
TS 87xA-0600	600A	600	65,000	50,000	35,000
TS 87xA-0800	800A	600	65,000	50,000	35,000
TS 87xA-1000	1000A	600	200,000	100,000	65,000
TS 87xA-1200	1200A	600	200,000	100,000	65,000

¹ Note: For power switching devices equipped with optional over current trip units, standard interrupting ratings are identical to withstand ratings shown at 240V and 480V. For interrupting ratings at 600V, contact Thomson Power Systems.

ENCLOSURE DIMENSIONS/CABLE TERMINALS (ATS ONLY) (NEMA 1, ASA #61 GRAY)

AMPERAGE	# OF POLES	DIMENSIONS INCHES (mm) ¹			SHIPPING WEIGHT lbs (kg)	TERMINAL RATING ³	
		HEIGHT	WIDTH	DEPTH		QTY (PER PHASE)	RANGE
100A	2, 3, 4	31.1" (790)	22.3" (566)	14" (356)	143 lbs (65)	1	#14 - 1/0
150A	2, 3, 4	31.1" (790)	22.3" (566)	14" (356)	143 lbs (65)	1	#2 - 4/0
200A	2, 3, 4	31.1" (790)	22.3" (566)	14" (356)	143 lbs (65)	1	#6 - 350 mcm
250A	2, 3, 4	35.1" (892)	27.3" (693)	14" (356)	172 lbs (78)	1	#6 - 350 mcm
400A	2, 3	43.1" (1095)	34.3" (871)	13" (330)	227 lbs (103)	2	2/0 - 500 mcm
400A	4	48.1" (1222)	37.8" (960)	14.5" (368)	256 lbs (116)	2	2/0 - 500 mcm
600A	2, 3	46.1" (1171)	36.3" (922)	14.5" (368)	248 lbs (113)	2	2/0 - 500 mcm
600A	4	48.1" (1222)	37.8" (960)	14.5" (368)	256 lbs (116)	2	2/0 - 500 mcm
800A	2, 3	48.1" (1222)	37.8" (960)	14.5" (368)	309 lbs (140)	3	2/0 - 500 mcm
800A	4	63.1" (1603)	40.8" (1036)	14.5" (368)	367 lbs (167)	3	2/0 - 500 mcm
400A - 800A CTTS	2, 3, 4	64" (1626)	30" (762)	13" (356)	400 lbs (181)	3	2/0 - 500 mcm
1000A/1200A (All)	2, 3, 4	70" (1780)	34.3" (871)	14" (356)	550 lbs (249)	4	4/0 - 500 mcm

¹ Enclosure dimensions are for reference (NOT FOR CONSTRUCTION).

³ All cable connections suitable for copper or aluminum.

⁴ Optional terminal ratings are available in some models – Consult Thomson Power Systems.

Optional NEMA 3R & 4X class enclosures available — consult Thomson Power Systems.

For ATS with Distribution Breaker Option contact factory for dimensions.

STANDARD FEATURES (With TSC 900 Controller)

- 7" color touch screen graphical display for monitoring 3 Phase Utility/Generator voltage, system frequency and timer countdown operation
- Front Panel Programming using touch screen graphical display with password security
- Load on Utility & Load on Generator indication
- Utility & Generator Source available indication
- 3 Phase Voltage sensing on Utility & Generator Sources
- Generator AC frequency sensing
- Utility under voltage control setpoint 70 - 95% (adjustable)
- Generator under voltage control setpoint 70 - 95% (adjustable)
- Generator under frequency control setpoint 70 - 90% (adjustable)
- Engine warmup timer 0-60 min. (adjustable)
- Utility return timer 0-60 min. (adjustable)
- Engine start timer 0-60 sec. (adjustable)
- Engine cooldown timer 0-60 min. (adjustable)
- Neutral position delay timer 0-120 sec. (adjustable)
- Load Disconnect Contact (LDC) for pre/post transfer control to signal external building systems such as elevators during transfer operations
- Programmable Generator Exercise Timer (EXT) with easy to use event, Calendar Based, On-load or Off-load Programmability
- Real-time clock c/w battery backup & daylight savings programming
- Data logging including total transfers to generator, total utility power failures, load on utility hours, load on generator hours and utility or generator voltage/frequency data at time of fault
- Eight user Programmable Output Contacts rated 2A, 120/240V resistive, Form C. Each output contact is user programmable to 20 different functions including: Load on Utility, Load on Gen, Load Disconnect Contact (LDC), Fail to Transfer (FTT), Utility Power Available (UPA), Generator Power Available (GPA), Utility Power Fail, Engine start, ATS Not in Auto, and ATS in Auto. The Transfer Switch is pre-programmed with the following outputs enabled:
 - Load on Utility
 - Load on Gen
 - Load Disconnect Contact (LDC)
 - Fail to Transfer (FTT)
 - ATS Not in Auto
- Local utility power fail simulation test
- Remote utility power fail simulation test pushbutton input
- Local plant exercise initiate pushbutton control
- Engine start contact (7A, 120/240VAC resistive max.)
- Transfer fail/forced transfer logic
- Automatic force transfer to alternate supply should load voltage become de-energized
- 50 or 60Hz capable (115V control power)
- Remote Load Test/Peak Shave Input
- NEMA 1 Enclosure
- Solid Neutral on 4 Wire Systems
- Auto Configuring System Voltage Type (3 wire delta or 4 wire Wye capable without additional sensing transformers)
- Under/Over Frequency Protection - Utility and Generator Sources
- 3 Phase Over Voltage Protection - Utility and Generator Sources
- Phase Sequence and Phase Rotation Protection between Utility and Generator Sources
- Voltage Phase Loss/Unbalance Protection
- Programmable Inputs (Quantity 16 Digital Input-voltage free input)
- RS232 Modbus™ Remote Communication Port (Modbus™ Serial RTU) via GHC
- Optional Ethernet Modbus Remote Communication Port (Modbus™ TCP) via GHC
- USB Communication Port (Quantity 3 via GHC)
- Serviceable Plug-in Connectors
- Event Logging (Time/Date Stamping)



ORDERING INFORMATION

When placing an order, specify the following 20 digit ATS MODEL CODE as per the features and applications described below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
T	S		8	7	3	A	0	1	0	0	B	1	A	G	5	A	M	K	A	A

1-3. SERIES

TS - TRANSFER SWITCH

4 & 5. MODEL

87 - 870 SWITCH

6. POLES

2 - 2 POLE

3 - 3 POLE

4 - 4 POLE

7. CONFIGURATION TYPE

A - ATS

E - DOUBLE BYPASS - 4 BRKR⁹

X - SPECIAL

8 - 11. AMPERAGE

0100

0150

0200⁵

0250

0400

0600

0800

1000

1200

12. APPLICATION

A - STANDARD

B - SERVICE ENTRANCE

C - DUAL UTILITY CONTROL

D - DUAL STANDBY GEN (Slave ATS)

H - DUAL PRIME GEN CONTROL

X - SPECIAL

13. OPERATION TYPE

1 - OPEN TRANSITION

2 - MANUAL ELEC. OP.

3 - CLOSED TRANSITION (MOMENTARY)⁷

X - SPECIAL

14. SAFETY STANDARDS

A - UL 1008 (Service Entrance)

B - CSA C22.2 NO 178

C - UL 1008 / CSA 178

X - NOT APPLICABLE

15. VOLTAGE

1Ø 3 WIRE

D - 120/240

3Ø 4 WIRE (GROUNDED NEUTRAL)

E - 120/208¹

F - 127/220

G - 120/240¹ (DELTA)

H - 220/380²

S - 230/400²

J - 240/416

K - 254/440

M - 277/480¹

N - 347/600¹

Y - MULTI-VOLTAGE (STOCK SWITCHES ONLY)¹
Customer Configurable

3Ø 3 WIRE

P - 208

Q - 220

R - 240

U - 416

V - 480

W - 600

X - SPECIAL

16. CONTROLLER

5 - TSC 900 c/w GHC Graphic Display

7 - NONE (MANUAL)

17. ENCLOSURE TYPE

A - NEMA 1, ASA #61 GRAY

B - NEMA 2, ASA #61 GRAY

C - NEMA 12, ASA #61 GRAY

D - NEMA 3R SD, ASA #61 GRAY

E - NEMA 3R DD, ASA #61 GRAY

F - NEMA 3RX/4X DD

(304 STAINLESS STEEL)³

G - NONE (OPEN STYLE)

L - NEMA 3RX/4X DD

(316 STAINLESS STEEL)³

X - SPECIAL

18. UTILITY SWITCHING DEVICE

D - MOLDED CASE SWITCH DRAWOUT⁹
(400 - 1200A)

E - MOLDED CASE SWITCH DRAWOUT⁹
C/W ELECTRONIC TRIP (400-1200A)

F - MOLDED CASE SWITCH DRAWOUT⁹
C/W ELECTRONIC TRIP & GF (400-1200A)

K - MOLDED CASE SWITCH (100 - 1200A)

M - MOLDED CASE SWITCH C/W THER-MAG
TRIP (100-200A)

N - MOLDED CASE SWITCH C/W ELECTRONIC
TRIP (250-1200A)

P - MOLDED CASE SWITCH C/W ELECTRONIC
& GF TRIP (250-1200A)

19. GENERATOR SWITCHING DEVICE

D - MOLDED CASE SWITCH DRAWOUT⁹
(400 - 1200A)

E - MOLDED CASE SWITCH DRAWOUT⁹
C/W ELECTRONIC TRIP (400-1200A)

F - MOLDED CASE SWITCH DRAWOUT⁹
C/W ELECTRONIC TRIP & GF (400-1200A)

K - MOLDED CASE SWITCH (100 - 1200A)

M - MOLDED CASE SWITCH C/W THER-MAG
TRIP (100-200A)

N - MOLDED CASE SWITCH C/W ELECTRONIC
TRIP (250-1200A)

P - MOLDED CASE SWITCH C/W ELECTRONIC
& GF TRIP (250-1200A)

20. POWER CONNECTIONS

A - STANDARD

B - ATS CONNECTION PLATE 100A-400A

C - ATS CONNECTION PLATE 600A-800A

D - ATS CONNECTION PLATE 1000A-1200A

E - ATS CONNECTION PLATE 100A-400A FOR U&G

F - ATS CONNECTION PLATE 600A-800A FOR U&G

G - ATS CONNECTION PLATE 1000A-1200A FOR U&G

X - SPECIAL

21. ATS CONNECTION CONFIGURATION

A - STANDARD

B - ALTERNATE B (400-1200A)

C - ALTERNATE C (400-1200A)

D - ALTERNATE D (400-1200A)

NOTES

¹ MULTI-VOLTAGE CAPABLE

² FOR 50 Hz APPLICATION

³ STANDARD ENCLOSURE RATING IS N3RX
AT 800A, N4X FOR 1000/1200A

AND 600A AND BELOW

⁵ 240V MAX

⁷ CLOSED TRANSITION OPTION 400A - 1200A ONLY

⁹ DOUBLE BYPASS OPTION 400A - 1200A ONLY

AVAILABLE IN STOCK

The following standard ATS models are available from stock:

AMPERAGE	3 POLE	2 POLE OPTION TS 872	SERVICE ENTRANCE RATED ATS	SOLID NEUTRAL	MULTI- VOLTAGE (CUSTOMER CONFIGURABLE 208-600V)	TSC 900 CONTROLLER	NEMA 1 ENCLOSURE	NEMA 3R ENCLOSURE OPTION	8 PROGRAMMABLE OUTPUT CONTACTS (2A,240VAC)	MODBUS™ RTU REMOTE COMMUNICATION PORT (SERIAL RS 232)
100A	Standard	Available Option in Stock		Standard	Standard	Standard	Standard	Available Option in Stock	Standard	Standard
150A	Standard	Available Option in Stock		Standard	Standard	Standard	Standard	Available Option in Stock	Standard	Standard
200A	Standard	Available Option in Stock	Available Option in Stock	Standard	240V Max	Standard	Standard	Available Option in Stock	Standard	Standard
250A	Standard	Available Option in Stock	Available Option in Stock	Standard	Standard	Standard	Standard	Available Option in Stock	Standard	Standard
400A	Standard	Available Option in Stock	Available Option in Stock	Standard	Standard	Standard	Standard	Available Option in Stock	Standard	Standard
600A	Standard	Available Option in Stock	Available Option in Stock	Standard	Standard	Standard	Standard	Available Option in Stock	Standard	Standard
800A	Standard	Available Option in Stock	Available Option in Stock	Standard	Standard	Standard	Standard	Available Option in Stock	Standard	Standard

Standard

Available Option in Stock



OPTIONAL FEATURES (Specify separately from ATS MODEL CODE when ordering)

CODE

DESCRIPTION

AUXILIARIES:

AUX-BG	Generator Bypass Auxiliary Contact
AUX-BU	Utility Bypass Auxiliary Contact
KOTS	Key Operated Test Switch - Auto/Off/Engine Start/Test
PPR-10	Programmable Power Relay Includes 10A Form C Contact Wired to Terminal Block (Up to Qty 3). Requires 24Vdc External Control Power
TS-STG	24Vdc or 120VAC Shunt Trip Generator Switch (external power source required)
TS-STU	24Vdc or 120VAC Shunt Trip Utility Switch (external power source required)

COMMUNICATION:

EMB-TCP/IP	Ethernet Modbus™ Remote Communication Port (Modbus™ TCP) via GHC
RS485A	RS 232 to RS 485 Remote Communication Adapter
WF-USB	WIFI USB Stick
THS 900	Remote Communication Application - Windows Based
RA 900	* Requires EMB-TCP/IP Option

ENCLOSURE:

GHC-SS	Sunshade for GHC Screen
LCK	Enclosure Lockable Door (Single point T-Handle lock)
TS-H1	Enclosure Strip Heater c/w Thermostat (120VAC external power source required)
TS-H2	Enclosure Strip Heater c/w Thermostat (internally powered from ATS load)

FUNCTION:

DU	Dual Utility Control Package
DSG	Dual Standby Generator Control Package (Slave ATS). Requires 24DCC Option to Power TSC 900
DPG	Dual Prime Generator Control Package.
MTS	Manually Initiated Electrically Operated Transfer Switch c/w Source Selector Switch, Position Indicating Lights, Source Available Lights
TCP	Transfer Switch Connection Plate for Generator Supply
TS-SS	Internal Multi-Voltage Selector Switch (208V/240V/480V)

METERING:

LPM	Transfer Switch Load Power Metering CT Kit (Amp, Volt, Freq, kW, kVA, PF) **Requires CT Kit
CTKxxxx	Current Transformer Kit (xxxx -Specify CT Size 0100, 0150, 0250, 0400, 0600, 0800, 1200) **Requires LPM Option
MUP	Multifunction Utility Protective Relay – Basler IPS100 (Protection Functions 27, 32, 47, 50/51, 67, 81O/U) Note: May be required by local utility for Momentary CT applications. Consult factory for other makes and models

POWER:

24DCC	24 Volt DC-DC Converter, Regulated
SPD	Surge Protection Device

OTHER:

3YR	Additional 12 Month Parts & Labour Warranty
5YR	Additional 48 Month Parts & Labour Warranty



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NOTE: Specifications subject to change without notice.

APPLICATION CONSIDERATIONS

The proper selection and application of power generation products and components, including the related area of product safety, is the responsibility of the customer. Operating and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, and other factors can materially affect the application and operating results of the products and components and the customer should carefully review its requirements. Any technical advice or review furnished by Regal Beloit America, Inc. and its affiliates with respect to the use of products and components is given in good faith and without charge, and Regal assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

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APPENDIX "C"

THOMSON POWER SYSTEMS®



SEISMIC CERTIFICATE

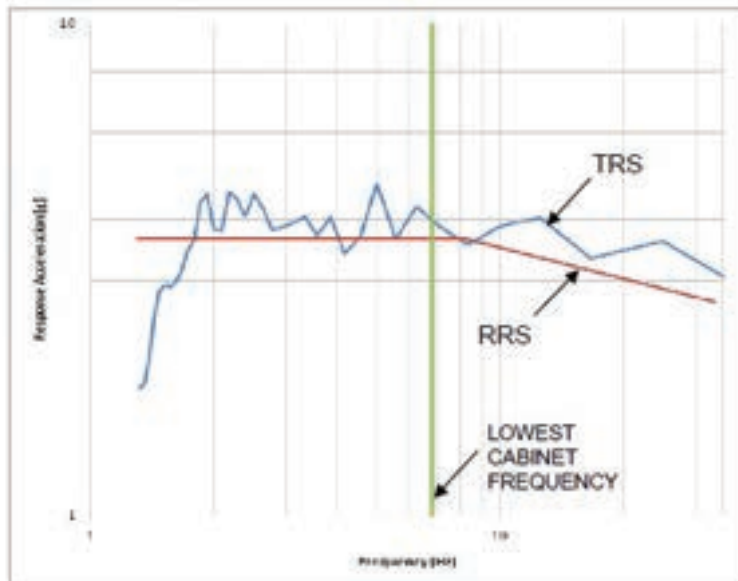
Seismic Certification

Thomson Technology – Automatic Transfer Switches

TS 840, 870, 880

Approved for use in Seismic Applications

Thomson Technology has seismically certified its line of **Automatic Transfer Switches** including all models of **TS 840, 870, 880**. The certification was done by shake-table testing according to the nationally recognized standard, AC156. The standard covers seismic design requirements for non-structural components according to IBC 2006 and ASCE7-05.



Dr. Carlos E. Ventura, PE
Director, TVP Engineering Ltd.
Certifying Company



Norm Schmidt
Vice President, Engineering and Administration
Thomson Technology

Shake-table tests were performed at Alpha Seismic and Environmental Test Laboratory and the Earthquake Engineering Research Facility, University of British Columbia. The figure shows a representative Test Response Spectrum (TRS) plotted with 5% damping against the AC156 Required Response Spectrum (RRS) with a S_a value of 342%. For more details, please refer to the certification notes.

TS 870

AUTOMATIC TRANSFER SWITCH WITH TSC 900 CONTROLLER (OPEN & CLOSED TRANSITION)

INSTALLATION, OPERATING & SERVICE MANUAL

Part #006332

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1. PRODUCT REVISION HISTORY

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

Operating & Service Manual Version

Rev 0	04/11/19	Original release.
Rev 1	05/03/08	Changes to incorporate reversing style ATS Motor for 100-250A transfer switches.
Rev 2	05/05/26	Revisions to Section 8 and Section 18 .
Rev 3	06/05/08	Revisions to Section 15 .
Rev 4	07/07/31	Changes to Incorporate new S-Style 400A mechanism
Rev 5	08/03/05	Changes to Incorporate new S-Style mechanism (100A, 150A, 200A, 250A, 600A, 800A)
Rev 6	08/08/01	Changes to Incorporate optional TSC 80e Transfer Controller
Rev 7	09/01/01	Changes to Incorporate standard TSC 80e Transfer Controller
Rev 8	10/01/25	Changes to Incorporate Seismic Certification and Mounting Requirements
Rev 9	14/01/08	Update to Marathon Thomson Power System Logo
Rev 10	15/04/07	Changes to incorporate TSC 900 Transfer Switch Controller
Rev 11	16/04/19	Added Closed Transition Transfer models, and Motor Operator Style ATS mechanisms

Contact Thomson Power Systems, to obtain applicable instruction manuals or if in doubt about any matter relating to installation, operation or maintenance. Soft copy of the most current version is available at www.thomsonps.com.

NOTE: All information contained in this manual is for reference only and is subject to change without notice.

Related Product Instruction Manuals

- TS 870 Quick Start Instruction Manual, PM150
- TSC 900 Transfer Switch Controller, PM151
- TSC 900 Modbus™ Communication, PM152

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

2. EQUIPMENT STORAGE

The following procedures are required for correct storage of the transfer switch prior to installation.

CAUTION

Failure to store and operate equipment under the specified environmental conditions may cause equipment damage and void warranty.

2.1. EQUIPMENT STORAGE

The transfer switch shall be stored in an environment with a temperature range not exceeding -4° to +158° Fahrenheit (-20° to +70° Celsius) and a humidity range not exceeding 5%-95% non-condensing. Before storing, unpack sufficiently to check for concealed damage. If concealed damage is found, notify the ATS supplier and the Carrier immediately. Repack with the original, or equivalent packing materials. Protect from physical damage. Do not stack. Store indoors in a clean, dry, well ventilated area free of corrosive agents including fumes, salt and concrete/cement dust. Apply heat as necessary to prevent condensation.

3. NOTES TO INSTALLER

DANGER

Arc Flash and Shock Hazard. Will cause severe injury or death.

Do not open equipment until ALL power sources are disconnected

This equipment must be installed and serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Failure to do so may cause personal injury or death

3.1. **INSTALLATION CODES/PERMITS:**

Suitable permits are required by local authorities having jurisdiction prior to installing standby generator sets and automatic transfer switches.

3.2. **APPLICATION:**

The TS 870 Transfer Switch is Listed by Underwriters Laboratories (UL) to Safety Standard UL 1008 for Transfer Switches for Emergency Standby applications. This product is intended for installation and operation on legally required standby applications for emergency power systems as defined by the National Electrical Code (NEC).

3.3. **INSTALLATION LOCATION:**

The standard TS 870 transfer switch is designed for indoor wall mounting or outdoor wall mounting with NEMA 3R rating. The transfer switch must be installed in an environment where the temperature range is within +5° to +122° Fahrenheit (-15° to +50° Celsius) and humidity range not exceeding 5%-95% non-condensing.

NOTE: The transfer switch must not be installed in a location where it is subjected to direct sunlight on the front of the transfer switch door. In these applications, an optionally available sun-shade kit must be installed.

3.4. **POWER CABLING:**

All power cabling entering/exiting the enclosure must be installed in suitably sized conduit per NEC/CEC requirements. Ampacity, type and voltage rating of current carrying conductors must also comply with NEC/CEC requirements and local authorities having jurisdiction. To ensure satisfactory installation of this equipment, refer to manual [SECTION 15](#) Cable Terminal Information regarding power cable connection tightness requirements. All mechanical and electrical connections must be checked for tightness prior to placing this equipment in service to ensure proper operation and to validate applicable warranty coverage.

3.5. **CONTROL WIRING:**

All control wiring for engine start, load shed, alarm and remote test must be installed in separate conduits from all power cabling and must utilize suitably sized conduits per NEC/CEC requirements. All control wiring shall be sized for minimum #18 AWG. Control wiring type and voltage rating must also comply with NEC/CEC requirements and local authorities having jurisdiction.

NOTE: All field wiring/communication cabling that may be field installed directly onto any ATS door mounted components must be suitably routed and protected across the door hinge to prevent possible mechanical damage upon door opening and/or door closing.

3.6. GENERATOR SET AUTOMATIC OPERATION:

The TS 870 transfer switch operates in conjunction with any generator set with remote automatic starting capabilities utilizing a 2 wire, remote start control contact input. A dry contact is provided for remote generator starting control (contact closes to start generator and opens to stop generator).

3.7. LOAD TYPES:

The standard TS 870 is suitable for control of motors, electric discharge lamps, tungsten filament lamps, and electric heating equipment where the sum of motor full-load ampere ratings and the ampere ratings of other loads do not exceed the ampere rating of the switch and the tungsten load does not exceed 30 percent of the switch rating.

3.8. UPSTREAM OVER CURRENT PROTECTION (NON-SERVICE ENTRANCE RATED TS 870):

Non-Service Entrance Rated TS 870 transfer switch models do not contain any integral over current protection and require upstream over current protection devices for both Utility and Generator sources.

3.9. UPSTREAM OVERCURRENT PROTECTION (SERVICE ENTRANCE RATED TS870):

Service Entrance rated TS 870 transfer switch models contain integral over current protection for the Utility source as standard. Service Entrance rated TS 870 transfer switches do not contain any integral over current protection for the generator source and requires upstream generator source over current protection. The Service Entrance rated TS 870 is rated for 80% maximum continuous loading of load types as described per [SECTION 3.7](#).

3.10. WITHSTAND/INTERRUPTING CURRENT RATINGS:

Refer to electrical ratings shown in [SECTION 16](#) for withstand/Interrupting current ratings. Short circuit currents listed for Standard type ATS are Withstand ratings. Short circuit currents listed for Service Entrance type ATS are Interrupting ratings based on the ratings of the supplied utility service disconnect circuit breaker utilized.

3.11. TRANSFER SWITCHES WITH INTEGRAL OVER CURRENT PROTECTION

For models of transfer switch with integral over current protection, the over current protection must be set prior to operation. The equipment will be shipped from the factory with a long-time current setting of 100% (of the equipment rating) and maximum short-time/instantaneous current and time delay settings.

WARNING

Do Not Energize this equipment until device settings have been verified to ensure proper system protection & coordination. Failure to do so may result in equipment failure.

Refer to **SECTION 5.2.2** of this manual for additional information on operation of the Transfer switch following an over current trip condition. Refer to information supplied with the transfer switch documentation package for adjustment procedures on the power switching units over current protection trip unit. Contact the factory if any additional information is required.

3.12. TRANSFER SWITCHES WITH MULTI-TAP VOLTAGE CAPABILITY

If the transfer switch has programmable multi-tap voltage capability (i.e. ATS Model Code with Voltage Code “Y”), confirm the transfer switch has been configured for the correct system voltage prior to installation.

WARNING

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

The voltage selections and connections are shown on the drawings supplied with each transfer switch. The factory default settings will be indicated on the calibration label attached on the inside of the enclosure door (supplied loose on open style models). A blank label is included to record the applicable settings if the configuration is changed from the factory default settings.

To change the transfer switch voltage, refer to TS 870 System Voltage Change Procedure, Appendix B. Contact Thomson Power Systems for further information as may be required.

3.13. REMOTE START CONTACT FIELD WIRING

As a minimum, the remote engine start control field wiring shall conform to the local regulatory authority on electrical installations. 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.

- 3.5.1.** Minimum #14 AWG (2.5mm²) wire size shall be used for distances up to 100ft (30m)¹). For distances exceeding 100 ft. (30m) consult Thomson Power Systems
- 3.5.2.** Remote start contact wires should be run in a separate conduit.
- 3.5.3.** Avoid wiring near AC power cables to prevent pick-up of induced voltages.
- 3.5.4.** An interposing relay may be required if field-wiring distance is excessively long (i.e. greater than 100 feet (30m)) and/or if a remote contact has a resistance of greater than 5.0 ohms.
- 3.5.5.** The remote start contact must be voltage free (i.e. dry contact). The use of a powered contact will damage the transfer controller.

3.14. 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 and control circuit isolation plugs connected to the TSC 900 must be removed if high voltage dielectric testing is performed on the transfer switch.

3.15. INSTALLATION OF OPEN TYPE TRANSFER SWITCHES

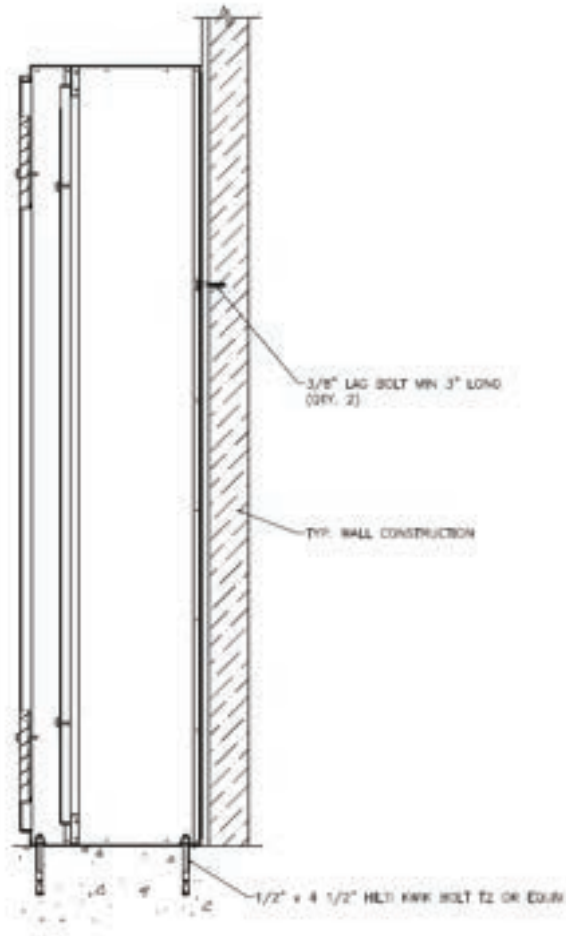
Please refer to the factory for additional information.

3.16. SEISMIC ANCHORING

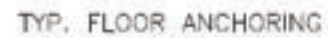
Model TS870 Automatic Transfer Switches and Automatic Transfer and Bypass Isolation Switches in "standard" enclosures are seismic certified under AC156 building code for non-structural components.

Standard enclosures are all transfer switch enclosures Thomson Power Systems offers in NEMA 1, NEMA 2, NEMA 3R and NEMA 4X for the above listed product.

The transfer switch must be installed per the anchoring details provided for seismic qualification. The equipment can be mounted in alternate means and still qualify if a qualified Civil Engineer designs the alternate method of anchoring.



TYP. FLOOR/WALL ANCHORING
(REFER TO NOTE 5)



Anchoring Notes:

1. Anchoring must be designed according to IBC 2012 or latest version.
2. The anchoring details shown are recommended according to the seismic certification; design Engineer may use alternate anchors within the scope of IBC.
3. Wall anchors in concrete; use a typical concrete anchor as necessary.
4. Expansion anchors as shown. To be installed according to manufacturer's recommendation.
5. The 800-1200A NEMA 3R ATS enclosure may be floor/wall mounted or it may be free standing (floor mounted only); If free standing it must be a minimum of 12" (305mm) away from pipes, conduits or other obstructions to allow for sway during a seismic event.

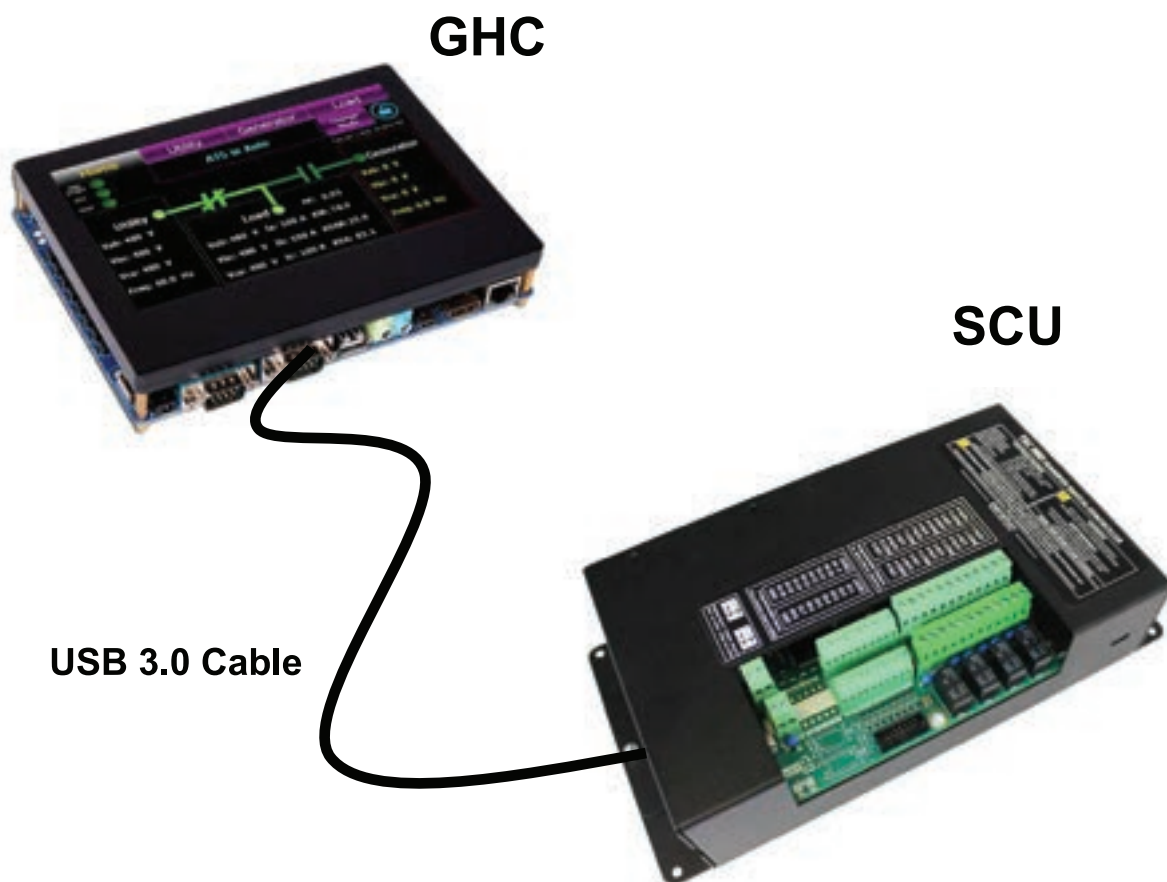
4. GENERAL DESCRIPTION

Thomson Power Systems TS 870 series of Automatic Transfer Switches employ two mechanically interlocked enclosed contact power switching units and a microprocessor based controller to automatically transfer system load to a generator supply in the event of a utility supply failure. System load is then automatically re-transferred back to the utility supply following restoration of the utility power source to within normal operating limits.

The standard TS 870 series Automatic Transfer Switch is rated for 100% system load and requires upstream over current protection. The TS 870 Automatic Transfer Switch may be supplied with optional integral over current protection within the enclosed contact power switching units for applications such as Service Entrance Rated equipment. Refer to [SECTION 6](#) of this manual for detailed information on current protection.

4.1. TSC 900 ATS CONTROLLER

The TS 870 series transfer switches use a type TSC 900 microprocessor based controller, which provides all necessary control functions for fully automatic operation. 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 3.0 high speed communication cable which includes DC power.

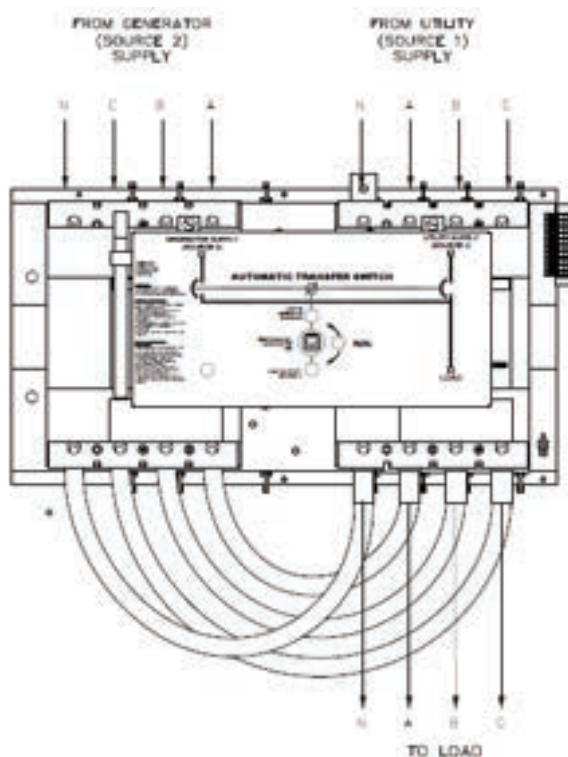


For further information on the TSC 900 Transfer Controller, refer to separate instruction manual PM151.

4.2. ATS POWER SWITCHING MECHANISM

Four types of ATS power switching mechanisms are provided with TS 870 Series ATS based on amperage size and optional features supplied with the ATS as described below.

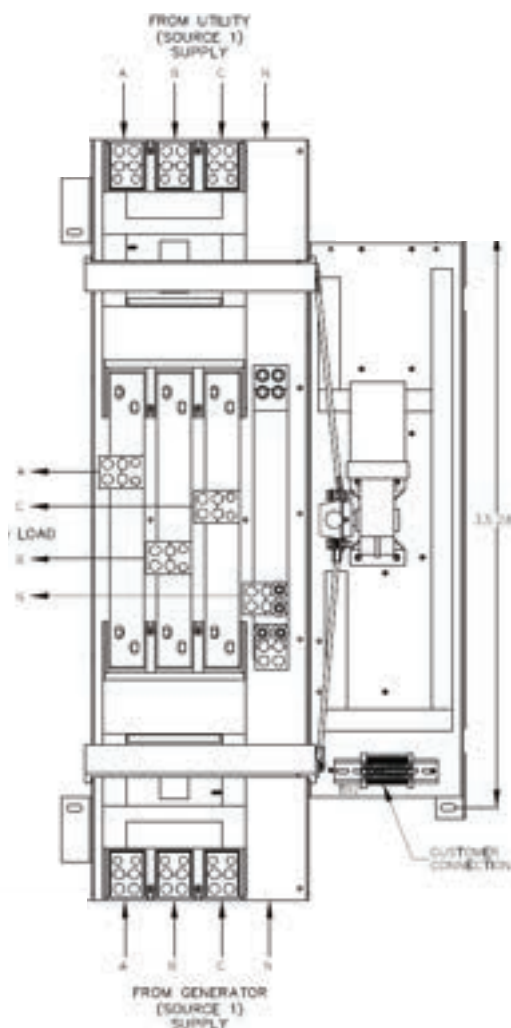
4.2.1. “S”- STYLE ATS MECHANISM (100A-800A, OPEN TRANSITION)



The ATS mechanism consists of 2 power switching devices which are mounted in a horizontal (i.e. side-by-side) configuration. The ATS mechanism provides a positive mechanical interlock to prevent both power switching units from being closed at the same time. The ATS mechanism utilizes a single 120VAC reversible gear motor drive which is mounted in between the two power switching devices. The transfer switch gear motor utilizes the power from the source to which the electrical load is being transferred. The gear motor drives a common drive hub assembly which in-turn operates the power switching device toggles via independent operating arms. Two limit switches are utilized to disconnect control power to the gear motor once correct operating positions are reached.

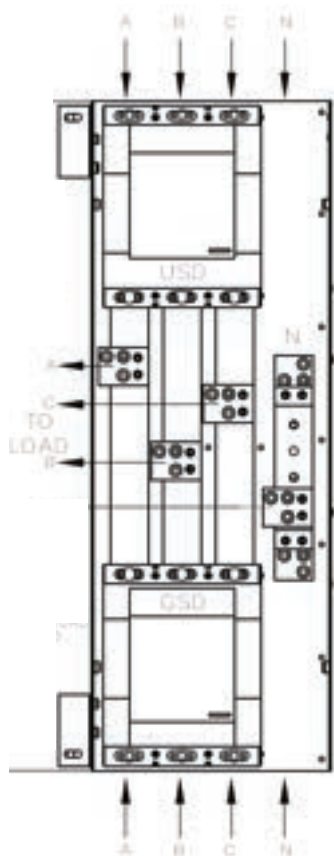
On 100-250A transfer mechanisms, the load-side of the power switching devices are interconnected via power cable. On 400-800A transfer mechanisms, the load-side of the power switching devices are interconnected via bus bars. The TSC 900 transfer controller provides a standard neutral position delay timer to allow adequate voltage decay during transfer operation to prevent out of phase transfers

4.2.1. "T"- STYLE ATS MECHANISM (1000A-1200A, OPEN TRANSITION)



The ATS mechanism consists of 2 power switching devices which are mounted in a vertical stacked configuration. The ATS mechanism provides a positive mechanical interlock to prevent both power switching units from being closed at the same time. The ATS mechanism utilizes a single 120VAC reversible gear motor drive which is mounted in between the two power switching devices. The transfer switch gear motor utilizes the power from the source to which the electrical load is being transferred. The gear motor drives a common drive hub assembly which in-turn operates the power switching device toggles via independent operating arms. Two limit switches are utilized to disconnect control power to the gear motor once correct operating positions are reached. The TSC 900 transfer controller provides a standard neutral position delay timer to allow adequate voltage decay during transfer operation to prevent out of phase transfers.

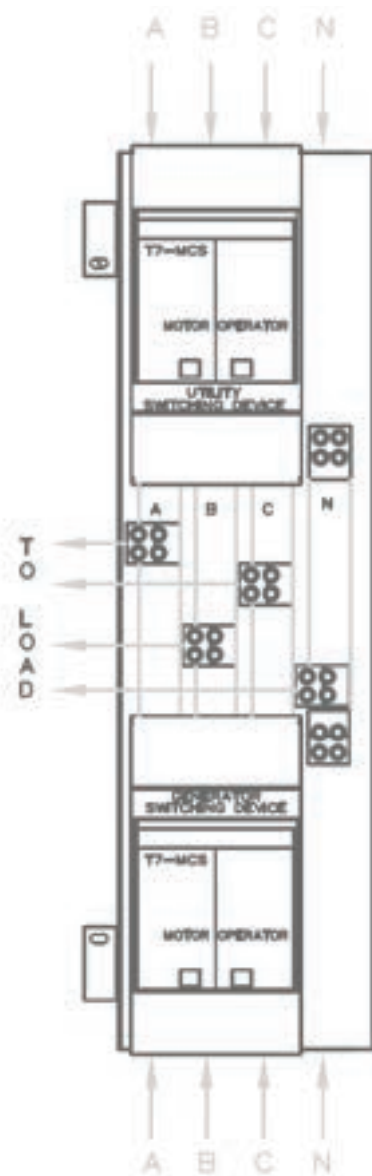
4.2.2. MO- STYLE ATS MECHANISM (400A-800A CLOSED TRANSITION)



The ATS mechanism consists of 2 power switching devices which are mounted in a vertical stacked configuration. Each power switching device uses a 120VAC motor operator with individual spring charging mechanism and shunt trip/close coils. The transfer switch mechanism utilizes the power from the source to which the electrical load is being transferred to.

The Closed Transition transfer feature allows a make-before-break transfer sequence when both sources of power are available. For Closed Transition operation, the TSC 900 transfer controller provides in-phase closing protection to ensure all transfers are in synchronism prior to closing.

4.2.3. MO- STYLE ATS MECHANISM (1000A-1200A OPEN & CLOSED TRANSITION)



The ATS mechanism consists of 2 power switching devices which are mounted in a vertical stacked configuration. Each power switching device uses a 120VAC motor operator with individual spring charging mechanism and shunt trip/close coils. The transfer switch mechanism utilizes the power from the source to which the electrical load is being transferred to. Open Transition type transfer switches are equipped with a cable interlock mechanism to prevent both power switching devices being closed at the same time.

Closed Transition type transfer switches allow a make-before-break transfer sequence when both sources of power are available. For Closed Transition operation, the TSC 900 transfer controller provides in-phase closing protection to ensure all transfers are in synchronism prior to closing.

4.3. PRODUCT MODEL CODE

The type of TS 870 series transfer switch supplied is identified by way of a 21 digit product code which appears on the equipment rating plate, or model, on the door of the transfer switch, and on the transfer switch drawings. The model code structure and definitions are as follows:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
T	S		8	7																

1-3. SERIES
TS - TRANSFER SWITCH

4 & 5. MODEL
87 - 870 SWITCH

6. POLES
2 - 2 POLE
3 - 3 POLE
4 - 4 POLE

7. CONFIGURATION TYPE
A - ATS
E - DOUBLE BY PASS - 4 BREAK¹
X - SPECIAL

8 - 11. AMPERAGE
0100
0150
0200²
0250
0400
0600
0800
1000
1200

12. APPLICATION
A - STANDARD
B - SERVICE ENTRANCE
C - DUAL UTILITY CONTROL
D - DUAL STANDBY GEN (Slave ATS)
H - DUAL PRIME GEN CONTROL
X - SPECIAL

13. OPERATION TYPE
1 - OPEN TRANSITION
2 - MANUAL ELEC. OP
3 - CLOSED TRANSITION (MOMENTARY)³
X - SPECIAL

14. SAFETY STANDARDS
A - UL 1008 (Service Entrance)
B - CSA C22.2 NO 178
C - UL 1008 / CSA 178
X - NOT APPLICABLE

15. VOLTAGE
10 3 WIRE
D - 120/240

3Ø 4 WIRE (GROUNDED NEUTRAL)
E - 120/208⁴
F - 120/220
G - 120/240⁴ (DELTA)
H - 220/380²
S - 230/400²
J - 240/415
K - 254/440
M - 277/480⁴
N - 347/600⁴
Y - MULTI-VOLTAGE (STOCK SWITCHES ONLY)¹
Customer Configurable

3Ø 3 WIRE
P - 208
Q - 220
R - 240
U - 415
V - 480
W - 600
X - SPECIAL

16. CONTROLLER
5 - TSC 900 c/w GHC Graphic Display
7 - NONE (MANUAL)

17. ENCLOSURE TYPE
A - NEMA1, ASA #01 GRAY
B - NEMA2, ASA #01 GRAY
C - NEMA12, ASA #01 GRAY
D - NEMA3R SD, ASA #01 GRAY
E - NEMA3R DD, ASA #01 GRAY
F - NEMA3RDX4X DD
(304 STAINLESS STEEL)⁵
G - NONE (OPEN STYLE)
L - NEMA3RDX4X DD
(316 STAINLESS STEEL)⁵
X - SPECIAL

18. UTILITY SWITCHING DEVICE
D - MOLDED CASE SWITCH DRAWOUT⁶
(400 - 1200A)
E - MOLDED CASE SWITCH DRAWOUT⁶
C/W ELECTRONIC TRIP (400-1200A)
F - MOLDED CASE SWITCH DRAWOUT⁶
C/W ELECTRONIC TRIP & GF (400-1200A)
K - MOLDED CASE SWITCH (100 - 1200A)
M - MOLDED CASE SWITCH C/W THER-MAG
TRIP (100-200A)
N - MOLDED CASE SWITCH C/W ELECTRONIC
TRIP (250-1200A)
P - MOLDED CASE SWITCH C/W ELECTRONIC
& GF TRIP (250-1200A)

19. GENERATOR SWITCHING DEVICE
D - MOLDED CASE SWITCH DRAWOUT⁶
(400 - 1200A)
E - MOLDED CASE SWITCH DRAWOUT⁶
C/W ELECTRONIC TRIP (400-1200A)
F - MOLDED CASE SWITCH DRAWOUT⁶
C/W ELECTRONIC TRIP & GF (400-1200A)
K - MOLDED CASE SWITCH (100 - 1200A)
M - MOLDED CASE SWITCH C/W THER-MAG
TRIP (100-200A)
N - MOLDED CASE SWITCH C/W ELECTRONIC
TRIP (250-1200A)
P - MOLDED CASE SWITCH C/W ELECTRONIC
& GF TRIP (250-1200A)

20. POWER CONNECTIONS
A - STANDARD
B - ATS CONNECTION PLATE 100A-400A
C - ATS CONNECTION PLATE 600A-800A
D - ATS CONNECTION PLATE 1000A-1200A
E - ATS CONNECTION PLATE 100A-400A FOR U&G
F - ATS CONNECTION PLATE 600A-800A FOR U&G
G - ATS CONNECTION PLATE 1000A-1200A FOR U&G
X - SPECIAL

21. ATS CONNECTION CONFIGURATION
A - STANDARD
B - ALTERNATE B (400-1200A)
C - ALTERNATE C (400-1200A)
D - ALTERNATE D (400-1200A)

NOTES

- ¹ MULTI-VOLTAGE CAPABLE
- ² FOR 50 Hz APPLICATION
- ³ STANDARD ENCLOSURE RATING IS N3RX
AT 800A, N4X FOR 1000/1200A
AND 600A AND BELOW
- ⁴ 240V MAX
- ⁵ CLOSED TRANSITION OPTION 400A - 1200A ONLY
- ⁶ DOUBLE BY PASS OPTION 400A - 1200A ONLY

4.4. TYPICAL COMMISSIONING PROCEDURES

CAUTION

Commissioning procedures must be performed by qualified personnel only. Ensure the Automatic Transfer Switch (ATS) ATS Power Chassis & Voltage Sensing Isolation Plugs PL12 & PL 15 are disconnected prior to energizing the supply sources. Manually place the transfer switch mechanism in the neutral position prior to applying power. Failure to do so may result in equipment failure or personal injury.

NOTE: The Typical Automatic Transfer Switch Commissioning Procedures Model Series TS 870, Appendix A, is provided for general information only pertaining to typical site installations and applications. Contact Thomson Power Systems for further information as may be required.

5. AUTOMATIC SEQUENCE OF OPERATION

5.1. STANDARD ATS - OPEN TRANSITION

When utility supply voltage drops below a preset nominal value (adjustable from 70% to 100% of nominal) on any phase, an engine start delay circuit is initiated and the transfer to utility supply signal will be removed (i.e. contact opening). Following expiry of the engine start delay period (adjustable from 0 to 60 sec.) 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. Once the generator voltage and frequency rises above preset values (adjustable from 70% to 95% of nominal), the engine warm-up timer will be initiated. Once the warm-up timer expires (adjustable from 0 to 60 min.), 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 to the generator supply via the motor driven mechanism.

The generator will continue to supply the load until the utility supply has returned. The retransfer sequence is completed as follows: when the utility supply voltage is restored to above the preset values (adjustable from 70% to 95% of nominal) on all phases, a transfer return delay circuit will be initiated. Following expiry of the Utility Return Timer (adjustable from 0 to 60 min.), the Transfer to Generator Supply signal will be removed (contact opening), then the Transfer to Utility Supply signal (contact closure) will be given to the transfer switch mechanism. The ATS will then retransfer the load from the generator supply back to the utility supply.

NOTE: A neutral delay timer circuit will delay the transfer sequence in the neutral position (i.e. both power switching devices open) until the neutral delay time period expires.

An engine cooldown timer circuit will be initiated once the load is transferred from the generator supply. Following expiry of the cooldown delay period (adjustable from 0 to 60 minutes), the engine start signal will be removed (contact opening) to initiate stopping of the generator set.

5.2. **STANDARD ATS - CLOSED TRANSITION**

NOTE: This section applies only to Closed Transition configured transfer switches.

For transfer switches equipped with the Closed Transition transfer option, the ATS 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.

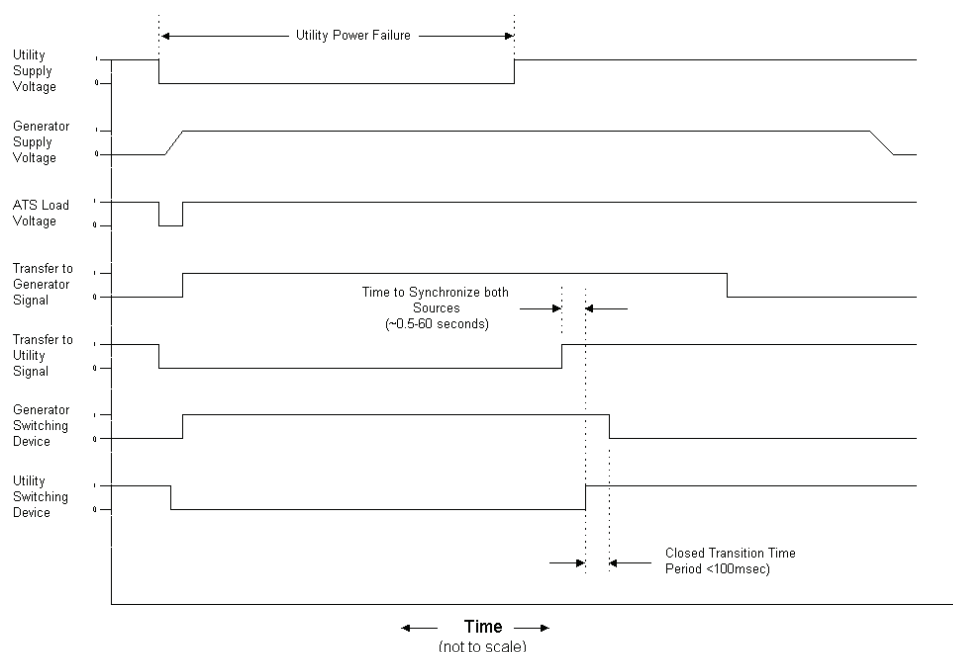
When utility supply voltage drops below a preset nominal value (70 - 99% of rated adjustable) on any phase, an engine start delay circuit will be initiated and the transfer to utility supply signal will be removed (i.e. contact opening). Following expiry of the engine start delay period (0 - 60 sec. adjustable) 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 (70 – 99% nominal adjustable) a warm up time delay will be initiated. Once the warm up timer (0-60 Min adjustable) expires, 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) via motor driven mechanism 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 present values (70 - 99% of rated adjustable) on all phases, a re-transfer sequence will be initiated once the Utility Return timer expires. The utility will close its power switching device when it is in synchronism with the generator supply utilizing the TSC 900 in-phase detector. The generator power switching device will immediately trip open approximately 50-100 milliseconds after the utility power switching device closes to complete the make-before-break re-transfer sequence.

An engine cooldown timer circuit will be initiated once the load is transferred from the generator supply. Following expiry of the cooldown delay period (0 - 60 min.

adjustable) the engine start signal will be removed (contact opening) to initiate stopping of the generator set.



Closed Transition Operation Sequence Diagram

(Normal Power Failure & Return Sequence)

The following operating sequences and time delays are associated with closed transition type transfer switches which momentarily parallel two sources of supply for less than 100 milliseconds. For closed transition type transfer switches, which utilize extended parallel operation for soft-loading operating sequences, refer to separate instruction manual.

1. Transfer Control Switch (Open/Closed Transition): A two position selector switch is provided on the front of the transfer switch for operator selection of desired operation. The 2 positions are as follows:
 - OPEN TRANSITION: The transfer switch will operate in a “break-before-make” open transition sequence during load transfers. A programmed neutral delay period will occur during the transfer sequence to ensure voltage decays on the load bus before load is re-applied. The two sources will not be paralleled at any time during operation in this mode.

- **CLOSED TRANSITION:** When both sources of supply are available, the transfer switch will operate in a “make-before-break” closed transition sequence during load transfers.

NOTE: If only one source of supply is available during an initiated transfer sequence, the control system will automatically revert to an open transition transfer sequence.

2. **Synchronizing Protection:** To ensure both sources are in synchronism prior to initiating a closed transition transfer sequence, a TSC 900 in-phase monitor is used. The GHC has a Sync page to allow monitoring of phase and voltage of the 2 sources. The in-phase relay will block a closed transition transfer sequence until both sources phase angle and voltages are within programmed limits. The synch check relay settings are field programmable (+5 to 20 Deg Phase Angle ($\Delta\omega$) and 1-10% voltage difference (ΔU) and they are factory set as follows:

Factory settings

When the product is delivered from the factory, the following basic settings will be set:

ΔU :	5% of $\pm U_{EB}$
t_R :	0.5 sec.
$\Delta\phi$:	$\pm 10^\circ$
Dead bus:	OFF

NOTE: The standard closed transition transfer switch does not contain an automatic synchronizer to control the generators frequency or voltage to bring it within limits of the sync check relay. For correct closed transition transfer operation, the system requires the generators frequency to be set within 0.25% of nominal frequency and the generators voltage to be set within 0.5% of nominal voltage.

3. **Closed Transition Time Period:** The time period in which both sources of supply are paralleled together during the closed transition transfer sequence is 50-100 milliseconds (maximum). The time period is inherently controlled by operation of auxiliary contacts from the power switching devices (i.e. when one switching device closes, its aux contact closes to initiate tripping of the opposite switching device).
4. **Closed Transition Failure Mode Operation:** The TSC 900 continually monitors the closed transition operation time period. The TSC 900 is factory set for 100 milliseconds that allows normal closed transition operation (i.e. both power switching devices remain closed for less than 100 milliseconds). The alarm circuit is not activated under normal operation. Should the closed transition operation time exceed 100 milliseconds (i.e. both power switching devices remain closed for longer than the normal closed transition time period plus the setting of TSC 900 timer, the following sequence of events will occur:
 - TSC 900 time delay period will expire and will activate auxiliary trip relay.

- If the transfer switch was transferring power from the generator source to the utility source and the generator switching device failed to open, an auxiliary trip relay will trip open the utility power switching device to immediately separate the two power sources. If the transfer switch was transferring power from the utility source to the generator source and the utility switching device failed to open, an auxiliary trip relay will trip open the generator power switching device to immediately separate the two power sources.

NOTE: The maximum time period both sources will remain paralleled under this failure mode is 200 milliseconds.

- The original source (i.e. prior to the transfer sequence) will remain on load, separated from the other source. An alarm light and TSC 900 controller will indicate a failure condition which must be manually reset before the transfer switch will re-attempt subsequent transfers. For further information on the TSC 900 features and operation, refer to the separate product instruction manual.

NOTE: Two alarm contacts are provided for the Closed Transition Failure Mode (i.e. one for a failed generator power switching device and one for the utility power switching device. The contacts are for customer use to remotely trip open upstream devices should an abnormal condition persist.

5. Transfer Fail Alarm (Switching Device Fail to Close): The TSC 900 provides a timer detect and alarm abnormal operating conditions. Should a power switching device fail to close for any reason within a 5-minute time period, an alarm light and alarm relay contact will be activated. For further information on the TSC 900 features and operation, refer to the separate product instruction manual.

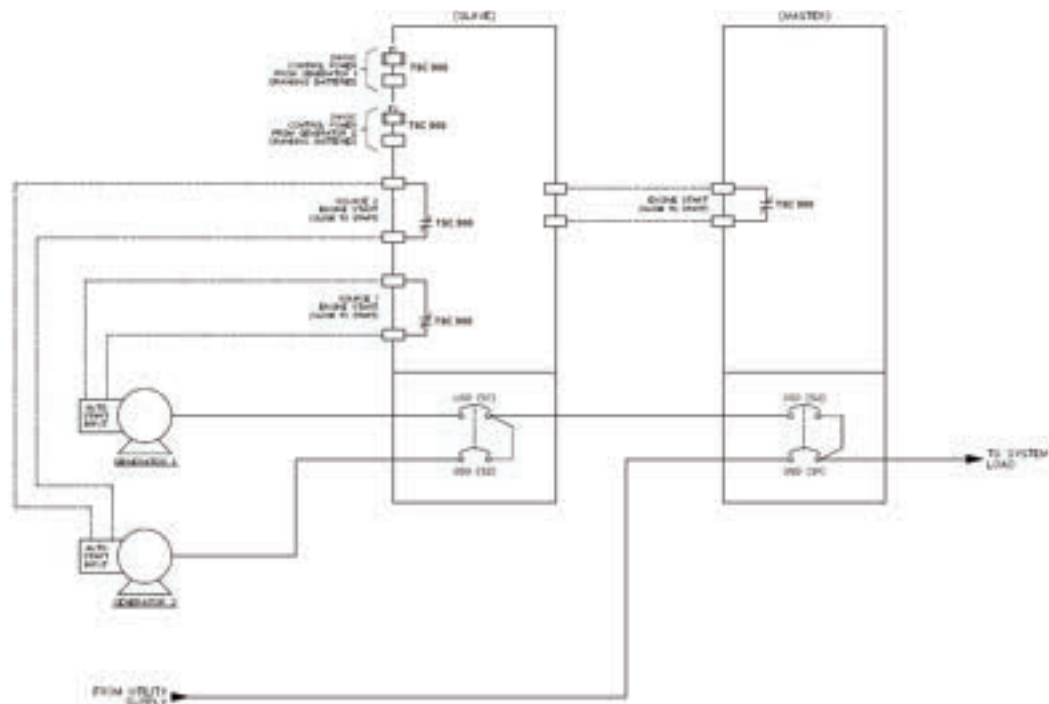
5.3. DUAL SOURCE ATS

NOTE: This section applies only to Dual Source configured transfer switches.

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.



5.3.1. 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, or 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.

5.3.2. 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, or 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 (generator set) on/off load to try to balance engine running hours as stored in memory. Refer to TSC 900 Instruction manual for detailed programming instructions.

5.3.3. 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 generator sets (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 (generator set) on/off load to try to balance engine running hours as stored in memory. Refer to TSC 900 Instruction manual for detailed programming instructions.

5.4. SERVICE ENTRANCE RATED ATS

NOTE: This section applies only to Service Entrance configured transfer switches.

5.4.1. NORMAL OPERATION

Under normal conditions, the load is energized from the utility supply through the closed utility transfer power switching device. If the utility power fails, the generator will start and the load will be re-energized via the closed generator transfer power switching device. In the normal operating mode, the Service Disconnect switch shall be in the energized position.

5.4.2. OVER CURRENT TRIP

Should the utility power switching device trip open due to an over current condition, TSC 900 transfer controller will initiate an engine start signal and will permit transfer of the load to the generator supply provided the TSC 900 is programmed for Forced Transfer. The utility source will be locked out and the load will remain on the generator supply until the TSC 900 alarm signal is manually reset.

Refer to the TSC 900 Instruction Manual for further details on Transfer Fail/Force Transfer operation.

Should the generator power switching device trip open due to an over current condition, TSC 900 transfer controller will initiate transfer of the load to the utility supply provided the TSC 900 is programmed for "Forced Transfer". The generator source will be locked out and the load will remain on the utility supply until the TSC 900 alarm signal is manually reset.

5.4.3. SERVICE DISCONNECT PROCEDURE

To perform a service disconnect (i.e. to disconnect the utility and generator supplies), the following procedure is required:

1. Move the Service Disconnect control switch located on the door of the transfer switch to the Transfer to Neutral position and wait 2 seconds for the ATS to complete a transfer to the neutral position.
2. Once the ATS has transferred to the neutral position, move the Service Disconnect control switch to the Disconnected position.
3. Verify that the Service Disconnected pilot light is illuminated. If the Light is illuminated, the service has been successfully disconnected and it is safe to perform any maintenance procedures as required. In this condition, the transfer switch is in the neutral position, with both utility and generator transfer power switching devices open. The transfer switch will remain in this condition, regardless of condition of the utility and generator supplies.

NOTE: If the Service Disconnect Light is not illuminated, additional procedures are required (refer to the following procedure #5.2.4).

4. Attach safety lockout padlock to the "Service Disconnect" control switch to prevent unauthorized change in operating condition and verify transfer switch door is locked closed. If the door is not locked, turn and remove door key.

WARNING

Close and lock the transfer switch enclosure door before connecting power sources.

5. To re-energize the load, remove the padlock(s) from the service disconnect control switch, and move the switch to the Energized position. The transfer switch will immediately return to the utility or generator supply if within normal operating limits.

5.4.4. ADDITIONAL SERVICE DISCONNECT PROCEDURES (S-STYLE 100A-800A OPEN TRANSITION MECHANISM)

If the Service Disconnected pilot light is not illuminated, the service will not have been successfully disconnected and therefore it is not safe to perform any maintenance until the following additional procedures are performed:

DANGER

Arc Flash and Shock Hazard. Will cause severe injury or death. Do not open equipment until ALL power sources are disconnected.

This equipment must be installed and serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Failure to do so may cause personal injury or death.

1. Open the door to the transfer switch using a suitable tool and opening the door lock with the key.
2. Visually inspect the actual position of the transfer switch mechanism. If the position of the transfer switch mechanism is clearly in the neutral position and the load bus is de-energized on all phases, the service has been successfully disconnected. Proceed to Step. 4.

If the position of the transfer switch mechanism is not in the neutral position or the load bus is energized, further procedures are required.

NOTE: If the position of the transfer switch mechanism is clearly in the Neutral position, the Service Disconnected pilot light may not have illuminated due to the following reasons:

- a) Utility and generator supply voltages are not present (the TSC 900 requires AC supply voltage to be present to power the pilot light).
- b) The pilot light may be burnt out. The bulb should be immediately replaced with a 6Vdc rated LED bulb.

a. Failure of one or more of the sensing/logic contacts. A qualified service technician is required to trouble shoot this specific condition. Switch the utility control circuit isolation switch to the de-energized position to remove utility control power. To isolate the AC voltage sensing and control circuits, remove the isolation plugs PL12 and PL15.

NOTE: The AC power conductors will still remain energized. Once all the control and voltage sensing circuits are de-energized and isolated the Service Disconnected pilot light will not illuminate due to loss of control power.

NOTE: To return the transfer switch back to normal operation, the utility control circuit disconnect switch and ATS Power Chassis & Voltage Sensing Isolation Plugs (PL12 & PL 15) must be switched on and reconnected for correct operation.

3. If the position of the transfer switch mechanism is not in the Neutral position, manually operate the transfer switch mechanism as follows:

NOTE: Refer to product drawings in sections 12, 13 & 14 for identification of Transfer Switch Mechanism style supplied with the Transfer Switch.

- **S-Style Mechanism:** Insert the operating handle into the front of the transfer mechanism and turn the operating handle until the position indication on the mechanism clearly shows the Neutral position.

WARNING

Failure to move the mechanism to the Neutral Position may result in serious personal injury or death due to electrical shock.

4. Close the transfer switch door securely using a suitable tool. Lock the door in the closed position and remove the key.

WARNING

Failure to positively lock closed and secure the transfer switch door may result in serious personal injury or death due to electrical shock.

5. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized change in operating condition and verify transfer switch door is locked closed.

6. To re-energize the load, remove the padlock(s) from the service disconnect control switch, and move the switch to the Energized position. The transfer switch will immediately return to the utility or generator supply if within normal operating limits.

5.4.5. ADDITIONAL SERVICE DISCONNECT PROCEDURES (MO STYLE ATS MECHANISM)

If the Service Disconnected pilot light is not illuminated, the service will not have been successfully disconnected and therefore it is not safe to perform any maintenance until the following additional procedures are performed:

DANGER

Arc Flash and Shock Hazard. Will cause severe injury or death. Do not open equipment until ALL power sources are disconnected.

This equipment must be installed and serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Failure to do so may cause personal injury or death.

1. Visually inspect the actual position of the transfer switch power switching devices. If both power switching devices indicate they are open, the transfer switch is clearly in the Neutral position, the service has been successfully disconnected. Proceed to Step. 4.

If either power switching device is not in the Open position, or the load bus is energized, further procedures are required.

NOTE: If the power switching devices are both Open, the Service Disconnected pilot light may not have illuminated due to the following reasons:

- a) Utility and generator supply voltages are not present (the TSC 900 requires AC supply voltage to be present to power the pilot light).
- b) The pilot light may be burnt out. The bulb should be immediately replaced with a 6Vdc rated LED bulb.
- b. Failure of one or more of the sensing/logic contacts. A qualified service technician is required to trouble shoot this specific condition. Switch the utility control circuit isolation switch to the de-energized position to remove utility control power. To isolate the ATS Power Chassis & Voltage Sensing circuits, remove the isolation plugs PL12 and PL15.

NOTE: The AC power conductors will still remain energized. Once all the control and voltage sensing circuits are de-energized and isolated the

Service Disconnected pilot light will not illuminate due to loss of control power.

NOTE: To return the transfer switch back to normal operation, the utility control circuit disconnect switch and ATS Power Chassis & Voltage Sensing Isolation Plugs (PL12 & PL 15) must be switched on and reconnected for correct operation.

2. If the position of both power switching units are not in the Open position, the power switching units must be manually operated as follows. To operate manually, push the power switching units Open pushbutton. The unit should then open. Repeat for the other power switching unit.
3. Close all transfer switch doors securely using a suitable tool. Lock the door in the closed position and remove the key.

WARNING

Failure to move the mechanism to the Neutral Position may result in serious personal injury or death due to electrical shock.

4. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized change in operating condition and verify transfer switch door is locked closed.
5. To reenergize the load, remove the padlock(s) from the service disconnect control switch, and move the switch to the Energized position. The transfer switch will immediately return to the utility or generator supply if within normal operating limits.

5.5. TEST MODES

The transfer switch may be tested utilizing the TSC 900 GHC display push-buttons, optional four position test switch (If fitted) or remote power fail test switch. A simulated utility power failure condition will be activated when the test mode is selected. The transfer switch will operate as per a normal utility power fail condition.

The transfer switch will remain on generator supply until the test mode is terminated. It will then immediately transfer back to the utility supply and then continue to operate the generator set for its cooldown period then stop.

NOTE: The transfer switch will automatically return to the utility supply (if within nominal limits) if the generator set fails while in the test mode.

6. OVER CURRENT PROTECTION

Thomson Power Systems **TS 870** series of Automatic Transfer Switches may be supplied with or without integral over current protection as described below:

6.1. STANDARD TS 870 AUTOMATIC TRANSFER SWITCH

The standard TS 870 Automatic Transfer Switch does not contain any integral over current protection and requires upstream over current protection devices for both Utility and Generator sources. The Standard TS 870 can withstand a maximum short circuit fault current as noted in [SECTION 16](#) of this manual. The standard TS 870 transfer switch model without integral over current protection is identified in the product model code. Refer to [SECTION 4.3](#) of this manual for further details on model coding.

6.2. OPTIONAL TS 870 AUTOMATIC TRANSFER SWITCH WITH INTEGRAL OVER CURRENT PROTECTION

TS 870 transfer switches will have integral over current protection supplied on the Utility source as standard. The type of over current protection utilized is dependent upon ATS amperage size and optional features specified. For transfer switches rated 100A through 200A, over current protection is non-adjustable thermal-magnetic type trip units. For transfer switches rated 250A through 1200A over current protection is adjustable electronic type with long time & instantaneous trip unit elements with optional ground fault protection elements.

NOTE: Ground fault protection is supplied as standard on 1000A and 1200A transfer switches that are used on systems greater than 240V.

An upstream over current protection device is required on the generator source which feeds the TS 870 Transfer Switch if integral over current protection option is not specified on the ATS.

NOTE: For models of transfer switch with adjustable integral over current protection trip units, the over current protection must be set prior to operation. The equipment will be shipped from the factory with a long-time current setting of 100% (of the equipment rating) and maximum instantaneous/short-time current and time delay settings.

WARNING

Do Not Energize this equipment until device settings have been verified to ensure proper system protection & coordination. Failure to do so may result in equipment failure.

Refer to [SECTION 4.3](#) Product Model Code for types of integral over current protection which are supplied with the transfer switch.



7. GENERAL NOTES ON SERVICING TRANSFER SWITCH MECHANISMS

DANGER

Arc Flash and Shock Hazard. Will cause severe injury or death. Do not open equipment until ALL power sources are disconnected. This equipment must be installed and serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Failure to do so may cause personal injury or death.

NOTE: Refer to section 4.2 of this manual for identification of Transfer Switch Mechanism styles supplied for the Transfer Switch.

When performing any service work on the transfer mechanism, it is imperative that the following be observed:

7.1. To maintain mechanical integrity, ensure that:

- On T Style mechanisms, all limit switches are correctly adjusted to provide full travel of the power switching device toggles without exerting unnecessary forces associated with excessive travel. Ensure that power switching device travel far enough to reset any internal trip unit (it is more important for the toggle to go fully in the Off direction, than in the On direction).
- Mechanical interlocking is correct when one power switching opens well before the other should close.
- All fasteners are adequately tightened.
- The operating linkages are not damaged or bent, and that all bearing points operate freely.
- On S Style transfer switch mechanisms, check nylock nuts on bolt pivot points. Operation arms should move freely without excessive play.

7.2. To maintain electrical integrity, ensure that:

- All electrical connections, especially power connections, are clean and adequately tightened. Corroded or loose power connections will cause destructive heating, and may cause premature tripping.
- All insulating devices are in place and in good condition.
- No moisture or other contamination is present.
- Electrical conductors are adequately secured away from moving parts.

7.3. To maintain operational integrity, ensure that:

- All control devices are in good condition and correctly calibrated.
- All control devices including TSC 900 connectors are adequately secured in their plug-in fixtures.

Only qualified personnel should undertake Service work. Failure to correctly maintain an automatic transfer switch may present a hazard to life and equipment. Full operational testing must be done prior to placing a transfer switch in service subsequent to any maintenance or repair. Any service work involving electrical components requires high-potential testing to ensure that required insulation levels have been maintained.

8. ATS MANUAL OPERATING INSTRUCTIONS

DANGER

Arc Flash and Shock Hazard. Will cause severe injury or death. Do not open equipment until ALL power sources are disconnected. This equipment must be operated only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Failure to do so may cause personal injury or death.

8.1. S-STYLE ATS -MANUAL OPERATION

The transfer switch maybe operated manually for maintenance or emergency operation conditions provided both Utility and Generator supplies are de-energized prior to manual operation.



DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH

This equipment must be serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE).

Many components of this equipment operate at line voltage.

DO NOT TOUCH. Use only electrically isolated tools.

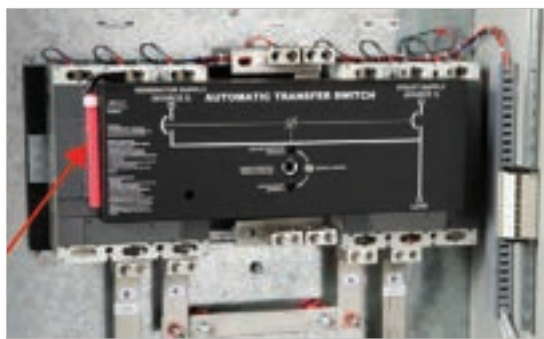
Install and close all covers before applying power to this equipment

Do not open covers to equipment until ALL power sources are disconnected

Failure to do so may cause personal injury or death

Once both Utility and Generator supplies are de-energized the following procedure can be used to operate the Transfer Switch manually.

1. Disconnect the ATS Power Chassis & Voltage Sensing Isolation Plugs (PL12 & PL15) to prevent automatic operation.
2. Open ATS enclosure door and locate Manual Operation Handle provided with the transfer switch (see photo below)



Manual Operation Handle



3. Insert manual handle into the center hole of the transfer switch mechanism.
4. To manually operate mechanism, rotate handle to the desired position as labeled on the ATS mechanism cover. Do not over-torque handle once position has been attained.
5. Once ATS is manually operated to desired position, re-close ATS enclosure door, then re-energize supply sources to re-energize the load.



8.2. T-STYLE ATS -MANUAL OPERATION

The transfer switch maybe operated manually for maintenance or emergency operation conditions provided both Utility and Generator supplies are de-energized prior to manual operation.



DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH

This equipment must be serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE).

Many components of this equipment operate at line voltage.

DO NOT TOUCH. Use only electrically isolated tools.

Install and close all covers before applying power to this equipment

Do not open covers to equipment until ALL power sources are disconnected

Failure to do so may cause personal injury or death

Once both Utility and Generator supplies are de-energized the following procedure can be used to operate the Transfer Switch manually.

1. Disconnect the ATS Power Chassis & Voltage Sensing Isolation Plugs (PL12 & PL15) to prevent automatic operation.
2. Open ATS enclosure door and locate Manual Operation Handle knob (see photo below).



Manual Operation
Handle Knob



3. Pull the manual handle towards yourself to dis-engage the manual handle rod from the motor drive mechanism.
4. To manually operate mechanism, push Manual Operation Handle knob handle up or down to the desired position as labeled on the ATS Toggle arms.
5. Once ATS is manually operated to desired position, re-close ATS enclosure door, then re-energize supply sources to re-energize the load.



8.3. MO STYLE ATS -MANUAL OPERATION

The MO-Style Transfer Switch can be operated manually using either electrically operated push buttons located on the front of the ATS door, or using the mechanical operated pushbuttons inside the ATS on the front of each power switching device.

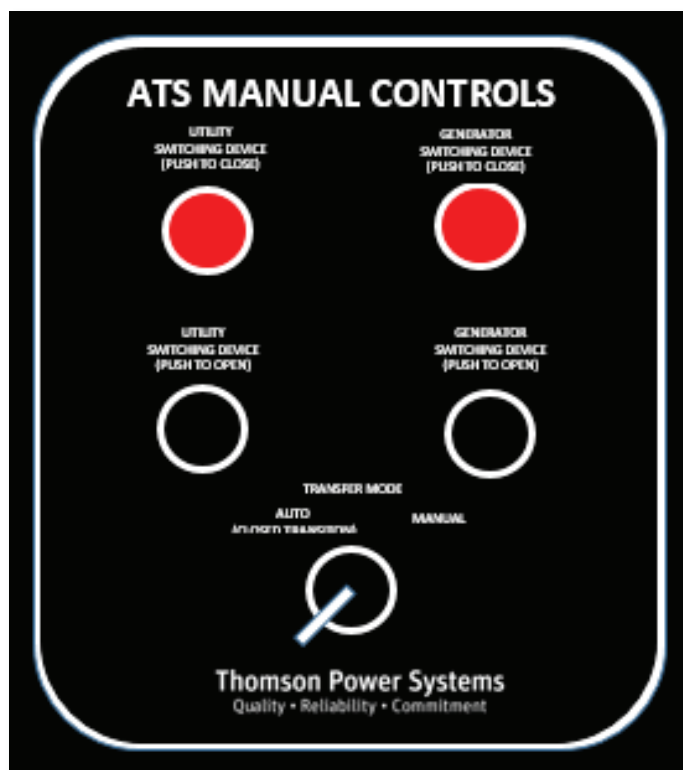
NOTE: It is not recommended to use the internally mounted pushbuttons unless in an emergency condition should the electrical operated buttons fail to operate the ATS manually.

8.3.1. ELECTRICALLY OPERATED ATS DOOR PUSH BUTTONS

Manual Operation of the ATS is selected either by a door mounted 2 position control switch or via internal software selection on the TSC 900 Controller.

AUTO: This selects automatic operation of the transfer switch. The power switching device will automatically open/close as detailed in the sequence of operation per section 5 of this manual.

MAN: This position inhibits automatic operation and automatic engine starting. The power switching device can be manually operated via electrically interlocked push buttons located on the front of the ATS door and position pilot lights.



NOTE

When the Manual Mode is selected the engine start output logic is disabled. Where generator voltage is required during manual operation the local generator controls must be set for manual operation.

MANUAL TRANSFER TO GEN SUPPLY (Open Transition)

To transfer manually to generator supply, follow procedure listed below;

1. Turn the Transfer Switch door mounted Mode selector to Manual or Select Man mode on TSC 900 Controller (refer to TSC 900 manual for further information).
2. Manually start the generator set at its local control panel, and ensure it is operating at normal voltage and frequency, with its output circuit breaker closed.
3. Manually open the utility power switching device using the Open pushbutton located on the ATS door. Verify the utility power switching device contacts are open via Green (O) Open contact status flag.
4. Ensure the generator power switching device's spring mechanism is fully charged as indicated by Yellow –Spring Charged flag. If the power switching device is not charged, it maybe manually charged by locating the manual charge handle mechanism on the face of the power switching device, then pulling forward and then down 1-6 times until the Yellow Spring Charged flag is displayed. Refer to Diagrams #1 & 2 below and the power switching device's manual for further information.

NOTE:

The yellow OK Flag indicates the power switching device is charged however it may not be ready to close if the transfer switch mechanical or electrical interlocks are not satisfied.

5. If the generator supply is at normal voltage and frequency levels, manually Close the generator power switching device using the Red (I) Mechanical Close pushbutton located on the face of the power

switching device. Refer to Diagrams #1 & #2 below. Verify the generator power switching device contacts are closed via Red (I) Closed contact status flag.

NOTE:

If the Transfer Switch is supplied with Closed Transition Transfer feature, the mechanical close push button on the face of the power switching unit is not available for use. A separate electrical close push button located on the power switching unit door is provided for manual closing. Power switching unit closure is only permitted in open transition mode (i.e. Utility power switching device must be open)

MANUAL TRANSFER TO UTILITY SUPPLY (Open Transition)

To transfer manually to the utility supply, follow procedure listed below;

1. Turn the Transfer Switch door mounted System Operation Mode selector to MANUAL or Select MAN mode on TSC 900 Controller (refer to TSC 900 manual for further information).
2. Manually open the generator power switching device using the red (O) Mechanical Open pushbutton located on the face of the power switching device. Refer to Diagram #1. Verify the generator power switching device contacts are open via Green (O) open contact status flag.
3. Ensure the utility power switching device's spring mechanism is fully charged as indicated by yellow –Charged OK flag. If the power switching device is not charged, it maybe manually charged by locating the manual charge handle mechanism on the face of the power switching device, then pulling forward and then down 1-4 times until the yellow Charged OK flag is displayed. Refer to diagram #1 and the power switching device's manual for further information.

NOTE

The yellow OK Flag indicates the power switching device is charged however it may not be ready to close if the transfer switch mechanical or electrical interlocks are not satisfied

4. If the utility supply is at normal voltage and frequency levels, manually Close the utility power switching device using the black (I) Mechanical Close pushbutton located on the face of the power switching device. Refer to Diagram #1. Verify the utility power switching device contacts are closed via red (I) closed contact status flag.

NOTE:

If the Transfer Switch is supplied with Closed Transition Transfer feature, the mechanical close push button on the face of the power switching unit is not available for use. A separate electrical close push button located on the power switching unit door is provided for manual closing. Power switching unit closure is only permitted in open transition mode (i.e. Gen power switching device must be open)

5. The generator set should be manually turned off at the local control panel.

8.3.2. MECHANICALLY OPERATED POWER SWITCHING DEVICE PUSH BUTTONS

MANUAL TRANSFER TO GENERATOR SUPPLY (Open Transition)

To transfer manually to generator supply, follow procedure listed below;

1. Turn the Transfer Switch door mounted System Operation Mode selector to manual or Select MAN mode on TSC 900 Controller (refer to TSC 900 manual for further information).
2. Manually start the generator set at its local control panel, and ensure it is operating at normal voltage and frequency, with its output circuit breaker closed.
3. Manually open the utility power switching device using the red (O) Mechanical Open pushbutton located on the face of the power switching device. Refer to Diagrams #1 & 2 below. Verify the utility power switching device contacts are open via Green (O) open contact status flag.
4. Ensure the generator power switching device's spring mechanism is fully charged as indicated by yellow –Spring Charged flag. If the power switching device is not charged, it maybe manually charged by locating the manual charge handle mechanism on the face of the power switching device, then pulling forward and then down 1-6 times until the yellow Spring Charged flag is displayed. Refer to Diagrams #1 & 2 below and the power switching device's manual for further information.

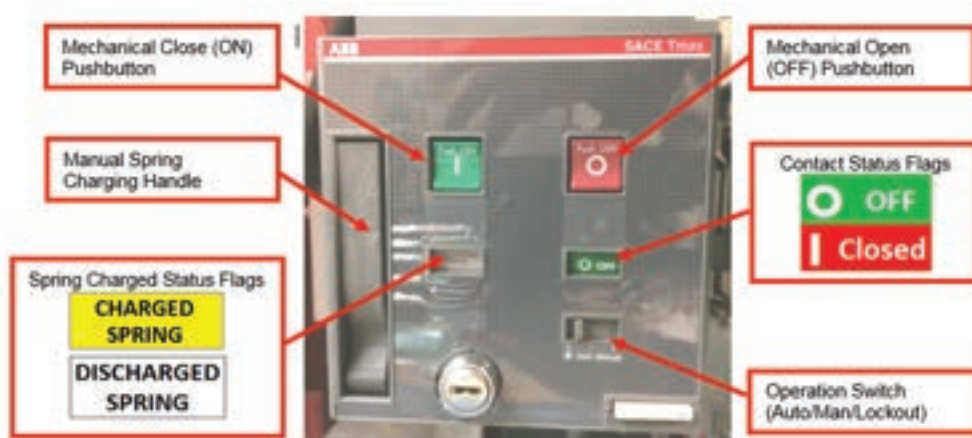
NOTE

The yellow OK Flag indicates the power switching device is charged however it may not be ready to close if the transfer switch mechanical or electrical interlocks are not satisfied.

5. If the generator supply is at normal voltage and frequency levels, manually Close the generator power switching device using the red (I) Mechanical Close pushbutton located on the face of the power switching device. Refer to Diagrams #1 & #2 below. Verify the generator power switching device contacts are closed via red (I) closed contact status flag.

NOTE

If the Transfer Switch is supplied with Closed Transition Transfer feature, the mechanical close push button on the face of the power switching unit is not available for use. A separate electrical close push button located on the power switching unit door is provided for manual closing. Power switching unit closure is only permitted in open transition mode (i.e. Utility power switching device must be open)

**DIAGRAM #1****DIAGRAM #2**

**1000A-1200A Open/Closed Transition ATS
Power Switching Device**



MANUAL TRANSFER TO UTILITY SUPPLY (Open Transition)

To transfer manually to the utility supply, follow procedure listed below;

1. Turn the Transfer Switch door mounted System Operation Mode selector to MANUAL or Select MAN mode on TSC 900 Controller (refer to TSC 900 manual for further information).
2. Manually open the generator power switching device using the red (O) Mechanical Open pushbutton located on the face of the power switching device. Refer to Diagram #1. Verify the generator power switching device contacts are open via green (O) open contact status flag.
3. Ensure the utility power switching device's spring mechanism is fully charged as indicated by yellow –Charged OK flag. If the power switching device is not charged, it maybe manually charged by locating the manual charge handle mechanism on the face of the power switching device, then pulling forward and then down 1-4 times until the yellow Charged OK flag is displayed. Refer to diagram #1 and the power switching device's manual for further information.

NOTE

The yellow OK Flag indicates the power switching device is charged however it may not be ready to close if the transfer switch mechanical or electrical interlocks are not satisfied.

4. If the utility supply is at normal voltage and frequency levels, manually Close the utility power switching device using the black (I) Mechanical Close pushbutton located on the face of the power switching device. Refer to Diagram #1. Verify the utility power switching device contacts are closed via red (I) closed contact status flag.

NOTE

If the Transfer Switch is supplied with Closed Transition Transfer feature, the mechanical close push button on the face of the power switching unit is not available for use. A separate electrical close push button located on the power switching unit door is provided for manual closing. Power switching unit closure is only permitted in open transition mode (i.e. Gen power switching device must be open)

5. The generator set should be manually turned off at the local control panel.



RECOMMENDED MAINTENANCE**DANGER**

Arc Flash and Shock Hazard. Will cause severe injury or death.

Do not open equipment until ALL power sources are disconnected

This equipment must be installed and serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE).

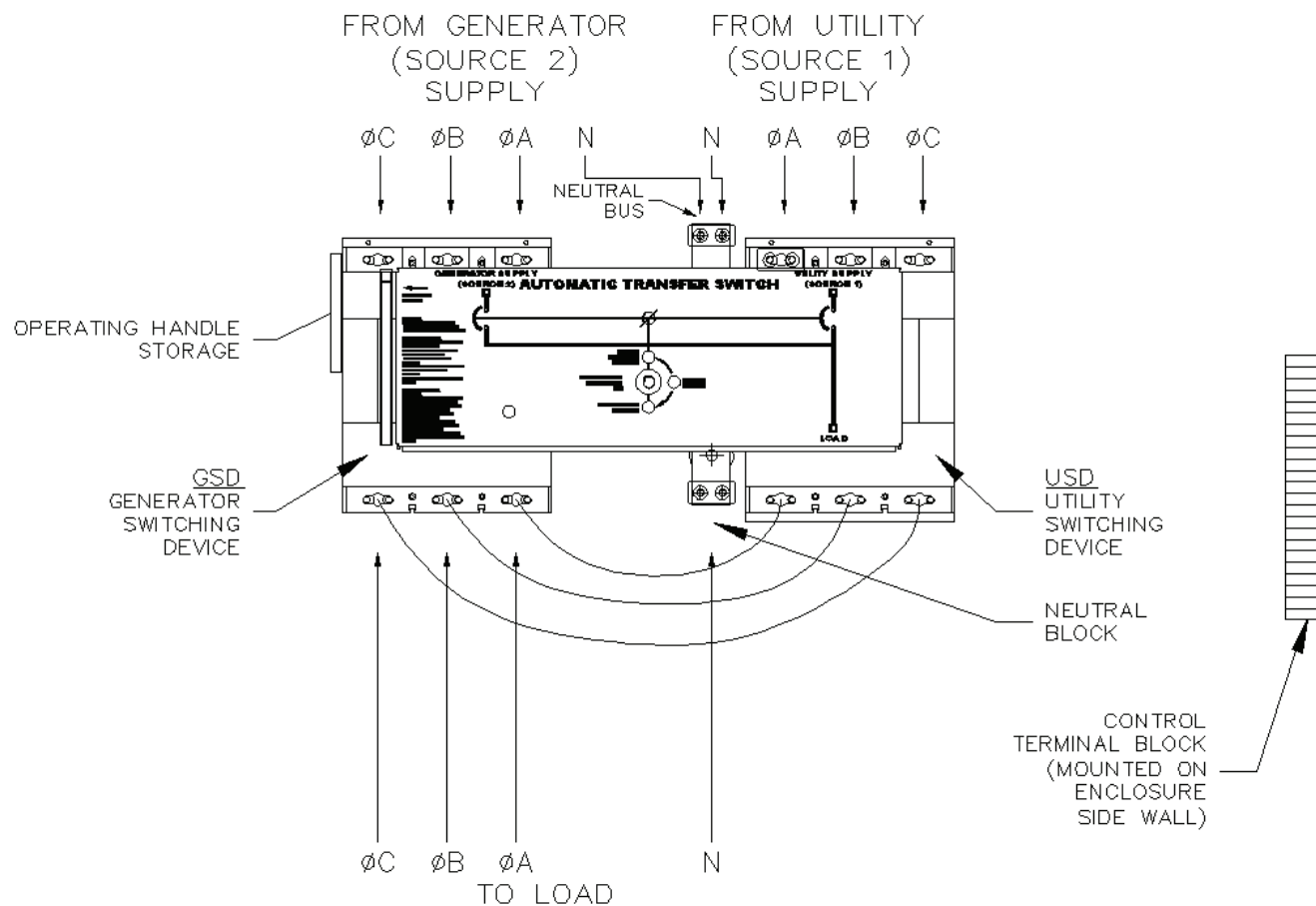
Failure to do so may cause personal injury or death

- 10.1.** DO NOT perform dielectric tests on the equipment with the control components in the circuit.
- 10.2.** Check if control components are tight in sockets.
- 10.3.** Periodically inspect all terminals (load, line and control) for tightness. Re-torque all bolts, nuts and other hardware. Clean or replace any contact surfaces, which are dirty, corroded or pitted.
- 10.4.** Transfer switches should be in a clean, dry and moderately warm location. If signs of moisture are present, dry and clean transfer switch. If there is corrosion, try to clean it off. If cleaning is unsuitable, replace the corroded parts. Should dust and/or debris gather on the transfer switch, brush, vacuum, or wipe clean. DO NOT blow dirt into power switching devices.
- 10.5.** Test the transfer switch operation. While the unit is exercising, check for freedom of movement, hidden dirt, corrosion or any excessive wear on the mechanical operating parts. Ensure that the power switching device travel is correct.
- 10.6.** Verify all program settings on the TSC 900 controller as per the TSC 900 component calibration label on the rear cover of the controller.
- 10.7.** Transfer Mechanism 1000A-1200A-T Style ensure that the manual handle moves freely on the hub when the lock pin is disengaged. If lubrication is necessary, apply medium weight (SAE 20) oil sparingly.
- 10.8.** Transfer Mechanism 1000A-1200A T Style - yoke pivot bearings and rod ends are permanently lubricated and do not require maintenance.
- 10.9.** Transfer Mechanism 100A-800A S Style - lubrication of drive hub/operator arm interface. Use high viscosity moly lubricant.
- 10.10.** The motor and gearbox on all Transfer Mechanism styles are permanently lubricated, and should not require attention under normal operating circumstances.

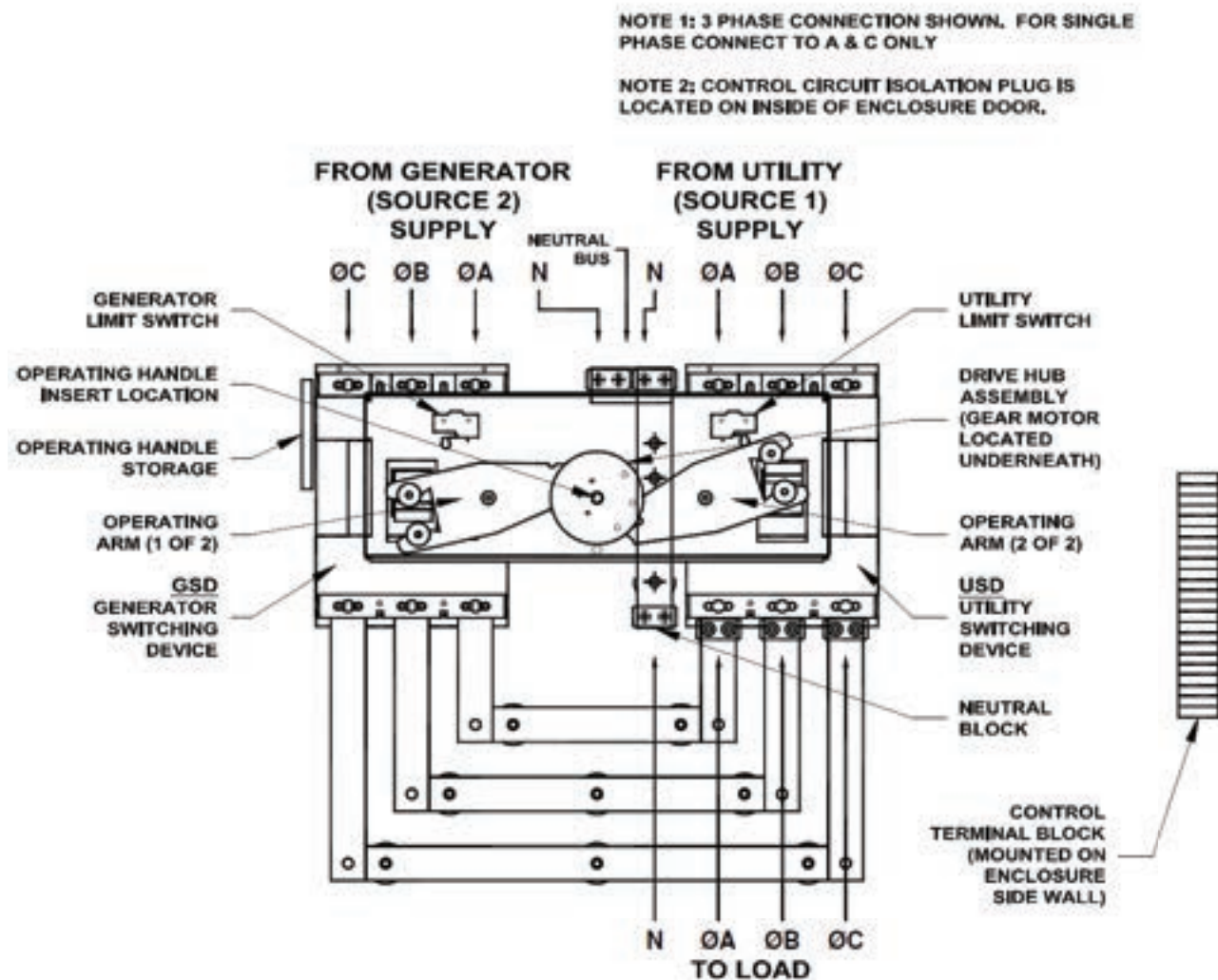
9. FRONT VIEW (TYPICAL) 3 / 4 POLE 100A-250A S-Style TRANSFER MECHANISM

NOTE 1: 3 PHASE CONNECTION SHOWN. FOR SINGLE PHASE CONNECT TO A & B ONLY

NOTE 2: CONTROL CIRCUIT ISOLATION PLUG IS LOCATED ON INSIDE OF ENCLOSURE DOOR.



10. FRONT VIEW (TYPICAL) 3 POLE 400A-800A S-Style TRANSFER MECHANISM (Mechanism Front Cover Removed)



11. FRONT VIEW (TYPICAL) 3 / 4 POLE MOTOR OPERATOR (MO) STYLE TRANSFER MECHANISM (400A-800A CLOSED TRANSITION, 1000-1200A)



12. CABLE TERMINAL INFORMATION

BASIC MODEL	TERMINAL RATING		CONNECTION TIGHTNESS (In-lbs.)	
	QTY PER PHASE	RANGE	TERMINAL MOUNTING SCREW	CABLE CLAMP
TS 87xA-0100	1	#14-1/0	120	50
TS 87xA-0150	1	#2-4/0	120	120
TS 87xA-0200	1	#6-350MCM	150	275
TS 87xA-0250	1	#6-350MCM	150	275
TS 87xA-0400 ¹	2	2/0- 500MCM	72	275
TS 87xA-0600 ¹	2	2/0- 500MCM	72	275
TS 87xA-0800 ¹	3	2/0- 500MCM	110	375
TS 87xA-1200 ¹	4	4/0- 500MCM	375	375

1. Optional terminal ratings are available in some models – Consult Thomson Power Systems.
2. For other model types not shown, contact Thomson Power Systems for further information.

13. REQUIREMENTS FOR UPSTREAM CIRCUIT PROTECTIVE DEVICES

13.1. WITHSTAND CURRENT RATINGS (ALL MODELS WITHOUT INTEGRAL OVERCURRENT PROTECTION OPTION)

BASIC MODEL	MAX. VOLTAGE	RATED CURRENT (A)	WITHSTAND CURRENT RATING AMPS (RMS) ¹		
			@240V	@480V	@600V
TS87xA-0100	600	100	65,000	25,000	18,000
TS87xA-0150	600	150	65,000	25,000	18,000
TS87xA-0200	240	200	65,000	N/A	N/A
TS87xA-0250	600	250	65,000	35,000	25,000
TS87xA-0400	600	400	65,000	50,000	35,000
TS87xA-0600	600	600	65,000	50,000	35,000
TS87xA-0800	600	800	65,000	50,000	35,000
TS87A-1000/1200	600	1000/1200	65,000	50,000	42,000

1. Standard ratings only are shown. Consult Thomson Power Systems for versions with higher withstand current ratings.
2. For other model types not shown, contact Thomson Power Systems for further information.

13.2. INTERRUPTING CAPACITY CURRENT RATINGS (ALL MODELS WITH INTEGRAL OVERCURRENT PROTECTION OPTION)

BASIC MODEL	MAX. VOLTAGE	RATED CURRENT (A)	INTERRUPTING CAPACITY CURRENT RATING AMPS (RMS) 1		
			No Upstream Overcurrent Protection Required		
			@240V	@480V	@600V
TS87xA-0100	600	100	65,000	25,000	14,000
TS87xA-0150	600	150	65,000	25,000	14,000
TS87xA-0200	240	200	65,000	N/A	N/A
TS87xA-0250	600	250	65,000	35,000	22,000
TS87xA-0400	600	400	65,000	50,000	25,000
TS87xA-0600	600	600	65,000	50,000	25,000
TS87xA-0800	600	800	65,000	50,000	25,000
TS87xA-1000/1200	600	1000/1200	65,000	50,000	50,000

1. Standard ratings only are shown. Consult Thomson Power Systems for versions with higher interrupting capacity current ratings.
2. For other model types not shown, contact Thomson Power Systems for further information.

14. GROUND FAULT SITE TEST REQUIREMENTS

Per NEC and UL1008, a ground fault protected system shall be performance tested when first installed on site. A written record of this shall be made and be available to the authority having jurisdiction. A form is provided at the back of this manual for this purpose – see **SECTION 22**.

Confirm and record actual trip set points in the form provided which is to be made available on request by inspection authority.

14.1. PERFORMANCE TEST

Qualified Field Service technicians require a calibrated current injection test apparatus and must be knowledgeable in breaker testing to provide primary neutral CT injection up to or greater than the trip set point as selected by the responsible party. As indicated in the NEC,

the maximum setting of the ground fault protection shall be 1200 amps, and the maximum time delay shall be 1 second for ground faults equal to or greater than 3000 amps.

The inspection authority should be contacted to confirm actual test requirements as these may vary by region or local code requirements.

The interconnected system shall be evaluated to ensure compliance with the appropriate schematic drawings. The proper location of sensors and power cabling shall be determined. The grounding points of the system shall be verified to determine that ground paths do not exist that would bypass the sensors. The use of high-voltage testers and resistance bridges may be required. A simulated fault current is to be generated by a coil around the sensors. The reaction of the circuit-interrupting device is to be observed for correct response. The results of the test are to be recorded on the test form provided.

15. TROUBLESHOOTING

DANGER

Arc Flash and Shock Hazard. Will cause severe injury or death.

Do not open equipment until ALL power sources are disconnected

This equipment must be installed and serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Failure to do so may cause personal injury or death

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
	TSC 900 connection plugs are unplugged (J1,2,3,4)	Verify all TSC 900 connectors are fully inserted
	ATS Power Chassis & Voltage Sensing 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 Utility power switching unit close coil (MO Style ATS Mechanism only)	Verify Utility power switching device close coil is fully functional.
	Defective generator power switching unit trip coil (open transition) (MO Style ATS Mechanism only)	Verify Gen power switching device trip coil is fully functional. The generator power switching unit must be open before the utility power switching device is permitted to close (open transition).
	Defective ATS mechanism motor (S or T-Style ATS Mechanism only)	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

Will not re-transfer to utility source upon restoration (cont'd)	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 Utility closed control contact (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 (S or T-Style ATS Mechanism only)	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.
	Faulty Generator power switching device auxiliary switch (MO Style ATS Mechanism only)	Verify Generator side auxiliary switch (G-AUX) n/c contact is closed and is low resistance when Generator switching device is open. Verify TSC 900 Digital input for Gen Power Switching Device is Open has been activated
	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
	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
Will not transfer to generator source upon failure of utility source	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
	TSC 900 connection plugs are unplugged (J1,2,3,4)	Verify all TSC 900 connectors are fully inserted

Will not transfer to generator source upon failure of utility source (con't)	ATS Power Chassis & Voltage Sensing 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.
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
GHC Display is not showing any system information	GHC screen may be 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

GHC Display is not showing any system information (con't)	Defective GHC Display	- Temporarily unplug GHC USB cable for 5 seconds then re-inset to reboot GHC controller. 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 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.

16. REPLACEMENT PARTS

Replacement parts are available for the transfer switch as follows:

NOTE

When ordering replacement parts please provide the following information:

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

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

Component Description	Thomson Power Systems Part Number	Comments
TSC 900 SCU Controller Service Replacement	TSC900SCUSR	Must program set points via software prior to use. Refer to TSC 900 Instruction Manual.
TSC 900 GHC Display Service Replacement	TSC900GHCSR	Contact Thomson Power Systems Service Dept. for installation procedures.
Limit Switch 1 n/o, 1 n/c (all ATS Models)	004929	Must install and adjust for proper operation before use. Contact Thomson Power Systems Service Dept. for installation/adjustment procedures
Transfer Switch Motor (100A-250A S Style Mechanism) 120V 20 watt 1 PH	007701	Motor is supplied with gear box assembly. Contact Thomson Power Systems Service Department for installation procedures
Transfer Switch Motor (400A-800A S Style Mechanism) 120V 30 watt 1 PH	007961	Motor is supplied with gear box assembly. Contact Thomson Power Systems Service Department for installation procedures
Transfer Switch Motor (1000A-1200A T-Style Mechanism) 120V 1/10 hp 1 PH	001075	Motor is supplied with gear box assembly. Contact Thomson Power Systems Service Department for installation procedures
120VAC Load Relay (LR), 14 pin Square	001276	Must ensure coil voltage is correct
120VAC 10A Auxiliary Plug-in Relay, 11 pin Square (UX/GX)	001278	Must ensure coil voltage is correct

Component Description	Thomson Power Systems Part Number	Comments
120VAC Auxiliary Plug-in Timer	001515	Must ensure coil voltage is correct
100VA Control Transformer	002159	

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

17. 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: Email sales@thomsonps.com

Warranty replacement/Warranty Repair: Email support@thomsonps.com

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.

18. NOTES

19. PERFORMANCE TEST FORM

This form should be retained by those in charge of the building electrical installation in order to be available to the authority having jurisdiction.

Date	Personnel	Tests performed	Comments
		Interconnection evaluation	
		Grounding point evaluation	
		Fault current test:	
		Ground fault settings - _____	
		Simulated current - _____	
		Results - _____	

APPENDIX “A”

THOMSON POWER SYSTEMS®

	TYPICAL TS 870 ATS COMMISSIONING PROCEDURES (S-Style 100A-800A)
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NOTE: The following commissioning procedures are provided for general information only pertaining to typical site installations and applications. Contact Thomson Power Systems for further information as may be required.

A) Pre-Energization Checks

1. Verify the generator and utility supply voltages match the model of the ATS ordered. If a different voltage is required, refer to procedure in Appendix B for voltage change programming procedure.
2. Confirm power cable size is correct for the lugs supplied in the transfer switch (line, load, and neutral) and are properly torqued.
3. Confirm transfer switch has been adequately grounded per NEC/CEC requirements.
4. Confirm power cables have been Insulation Resistance Tested to ensure no cross phase connections or conduction to ground.
5. Check to ensure there is no mechanical damage.
6. Check to ensure no packaging materials or tools are left inside the transfer switch.
7. Verify control wiring connected to terminal blocks are properly installed (i.e. no frayed ends, screws are tight, no damage, etc.).
8. Ensure ATS Power Chassis & Voltage Sensing Isolation Plugs (PL12 & PL15) are inserted and all TSC 900 Controller plugs are inserted prior to operation.
9. Visually verify the transfer switch mechanism is closed in the utility position as indicated on the mechanism cover.
10. Verify correct control wire interconnects have been installed to the generator set auto start/stop controls.

NOTE: The ATS Engine Start contact closes to start the engine and opens to stop the engine.

11. Ensure the inside of the transfer switch is clean from all dust, and other foreign materials.
12. Close ATS enclosure door and tighten all door screws.
13. Visually verify on the transfer switch enclosure that there are no gaps, holes, or potential for water ingress.

APPENDIX “A”

THOMSON POWER SYSTEMS®



TYPICAL TS 870 ATS COMMISSIONING PROCEDURES (S-Style 100A-800A)



B) Equipment Energization

DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH

This equipment must be serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE). Many components of this equipment operate at line voltage. DO NOT TOUCH. Use only electrically isolated tools. Failure to do so may cause personal injury or death

6. Confirm Utility, Generator and loads can be energized in a safe manner.
7. Energize utility supply and wait approximately 2 minutes for the TSC 900 Display to successfully perform an initial boot-up process. A Thomson Power Systems Logo will be displayed during the booting process.



NOTE: under normal operation, TSC 900 Display will not require a re-booting process due to use of a control power reservoir circuit which maintains DC control power under normal operating sequences

8. Once the TSC 900 has successfully completed the boot-up process, confirm utility voltage on the TSC 900 DISPLAY Home page is displaying the correct voltage to match the rating of the ATS, and the ATS Mechanism is in the Utility position.
9. To allow any changes to the TSC 900 controller settings, A Security Login level of Admin or Power must be entered into the TSC 900 Controller (Refer to TSC 900 O&M Manual or TS 870 Quick Start Guide) for further Security programming details.

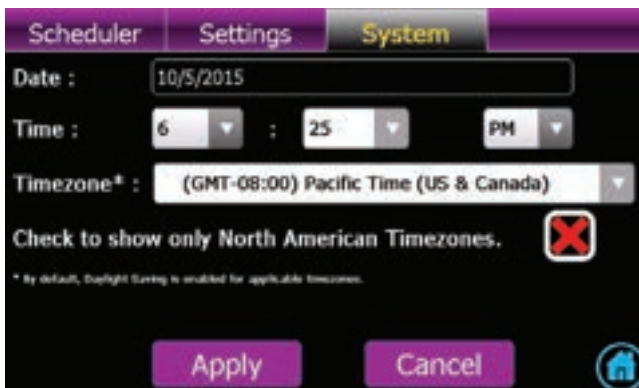
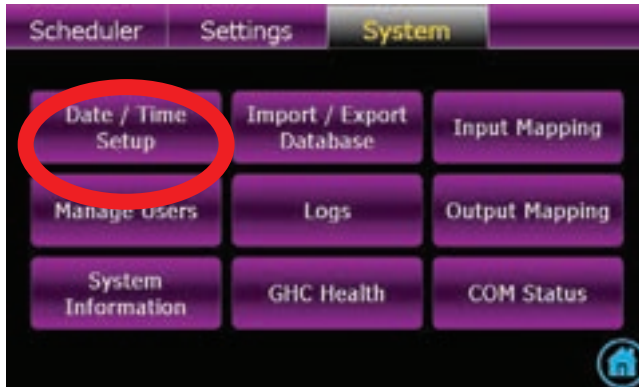
NOTE: Initial Factory Default Password is: **pass** For security purposes, it is strongly recommended to change the group passwords from the factory defaults.

10. Set the TSC 900 Internal time clock – On the TSC 900 DISPLAY, navigate to System screen and press Date/Time Setup button as shown below. Select calendar date/year and enter time in HR:MIN

APPENDIX “A”

THOMSON POWER SYSTEMS®

	TYPICAL TS 870 ATS COMMISSIONING PROCEDURES (S-Style 100A-800A)
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11. Verify the status of the following indicator lights on the TSC 900 Display Home page:
 - Utility Source Green light is On
 - Load on Utility Green light is On
12. Run the generator manually and confirm generator voltage on the TSC 900 DISPLAY Home page is displaying the correct voltage to match the rating of the ATS.
13. With generator still running, confirm generator phasing matches that of the Utility supply by viewing the Utility and Generator metering pages with phase rotation indication on the TSC 900 DISPLAY. If phase rotation does not match, de-energize ATS and re-confirm supply rotation and power wiring is correct.
14. Verify the TSC 900 DISPLAY Home Page Generator Source Red Light is On
15. Manually stop generator and place the generator controls in the Automatic position.
16. To confirm automatic starting and load transferring of the generator, press the Change Mode control button on the TSC 900 DISPLAY home page and select On Load Test mode. The generator will start

APPENDIX “A”

THOMSON POWER SYSTEMS®



TYPICAL TS 870 ATS COMMISSIONING PROCEDURES (S-Style 100A-800A)

and transfer on load per Automatic Sequence. The following lights on the TSC 900 Display home page should be on: Generator Start, Generator Source available and Load on Generator Red light.

17. To stop the generator and transfer load back to the utility supply, press the Change Mode control button on the TSC 900 DISPLAY home page and select Return to Auto mode. The load will re-transfer back to the utility power as per Automatic Sequence.
18. Perform a utility power outage test by opening the upstream utility feeder breaker to the ATS. The TSC 900 Display Utility Supply available light will turn off; the generator set will start after the three second engine start delay has expired and the generator will start and transfer on load as per Automatic Sequence.
19. Return Utility supply voltage to the ATS by re-closing the upstream utility breaker. The load should re-transfer back to the utility supply as per Automatic Sequence.

APPENDIX “B”

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TS 870 SYSTEM VOLTAGE CHANGE PROCEDURE

The system voltage change procedure is a 2 step process 1) ATS Potential Transformer Tap Change and 2) TSC 900 Software Programming. Details of each step are as follows:

1) ATS Potential Transformer Tap Change



HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH

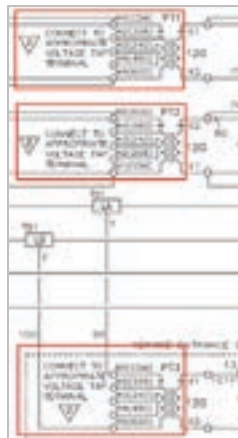
This equipment must be serviced only by qualified electrical personnel utilizing safe work practices and appropriate Personal Protective Equipment (PPE).

Many components of this equipment operate at line voltage. DO NOT TOUCH. Use only electrically isolated tools.

Install and close all covers before applying power to this equipment

Do not open covers to equipment until ALL power sources are disconnected

1. Ensure all power sources are de-energized and are safely Locked-out from service prior to opening the transfer switch enclosure door.
2. Disconnect AC Sensing and ATS Power Chassis Circuit Isolation Plugs PL12 & PL15.
3. Change voltage transformer primary taps settings as follows to match new system voltage on all potential transformers (PTs). (Refer to wiring schematic diagram below).



APPENDIX “B”

THOMSON POWER SYSTEMS®



TS 870 SYSTEM VOLTAGE CHANGE PROCEDURE

4. Carefully remove the potential transformer high voltage side covers by prying up on the edge of the cover with a ¼" Flat Head Blade screwdriver and lifting off.



NOTE: You can also use your finger to pry up on the edge of the PT cover.

5. Remove the screw on the PT Tap which is the correct voltage selected for the application (i.e. H2-208V, H3-240V, H4-480V or H5-600V)

H6-Not Used H5-600V H4-480V H3-240V H2-208V H1 (Never Changes)



APPENDIX “B”

THOMSON POWER SYSTEMS®



TS 870 SYSTEM VOLTAGE CHANGE PROCEDURE

CAUTION: Brace PT terminal block with your hand when loosening or tightening ANY screws.

6. Remove the screw and red ring terminal connected to the incorrect (existing) PT voltage terminal. Install the screw and red ring terminal to the new selected PT Tap Terminal based on required voltage and tighten while supporting the terminal block. Make sure the ring terminal is not misaligned or the PT cover will not fit back on.



7. Install the extra screw back onto the old PT location and tighten.



CAUTION

Confirm that PT screws are correctly tightened, and do not put strain on the PT Tap wires.

8. Replace the PT cover. PT covers should 'snap' in place, confirm they are installed correctly by gently "twisting" the PT cover. **DO NOT** use excessive force.
9. Repeat the steps 1 to 5 for all Potential Transformers.

NOTE: 2 to 3 PT's will be installed in the Transfer Switch depending on the Model type.

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APPENDIX “B”

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TS 870 SYSTEM VOLTAGE CHANGE PROCEDURE

2) TSC 900 Software Programming

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 Utility or Generator sources and follow the programming procedure shown below.

NOTE: The TSC 900 controller does not contain any system voltage jumpers on the printed circuit board. All voltage changes are done via software programming only.

1. **Security Password Login:** To allow a change in voltage setting, a Security Login with a level of “POWER” or “ADMIN” is required. Navigate to the “HOME” Page and select the Security Lock Icon located on the upper right hand corner per screen shot shown below. A pop-up Security Login Page will appear. Next from the Security Login Page, Select User Name drop down box and choose (POWER or ADMIN), then type in password, then select “Apply” button. Refer to TSC 900 O&M Manual or TS 870 Quick Start Guide for further Security programming details.

NOTE: Initial Factory Default Password is “*pass*”



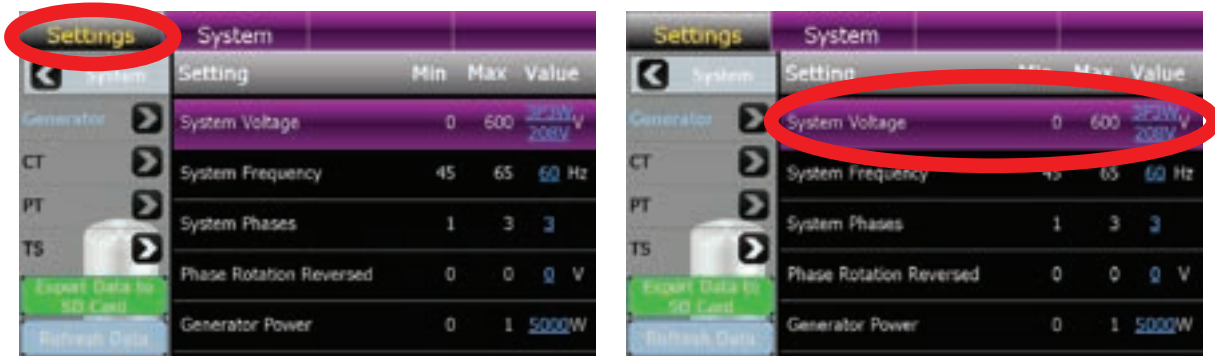
APPENDIX “B”

THOMSON POWER SYSTEMS®

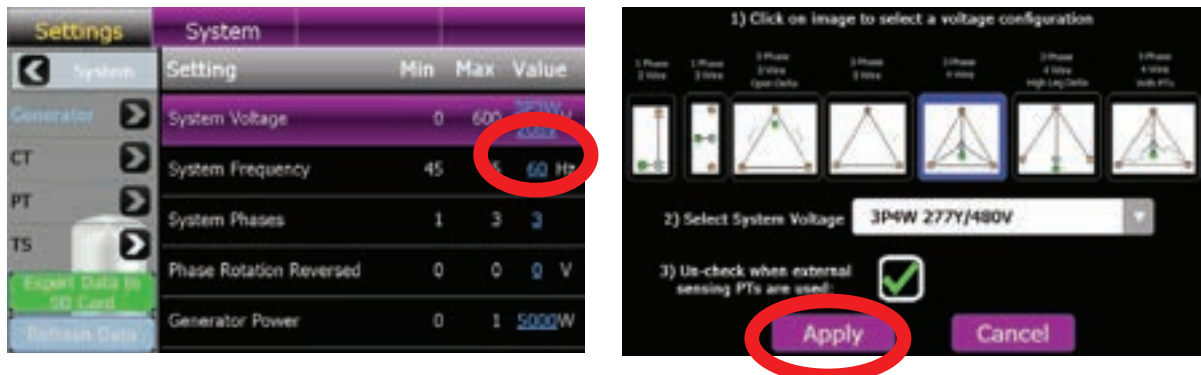


TS 870 SYSTEM VOLTAGE CHANGE PROCEDURE

- Once successfully logged in, From the TSC 900 DISPLAY Home Page, Navigate to the Settings Page below and select System Voltage as shown below.



- On the System Voltage Row, select the underlined System Voltage value and from the drop down list which appears, select the desired voltage for the application as shown below. To confirm the change, press the Apply button.



APPENDIX "C"

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SEISMIC CERTIFICATE

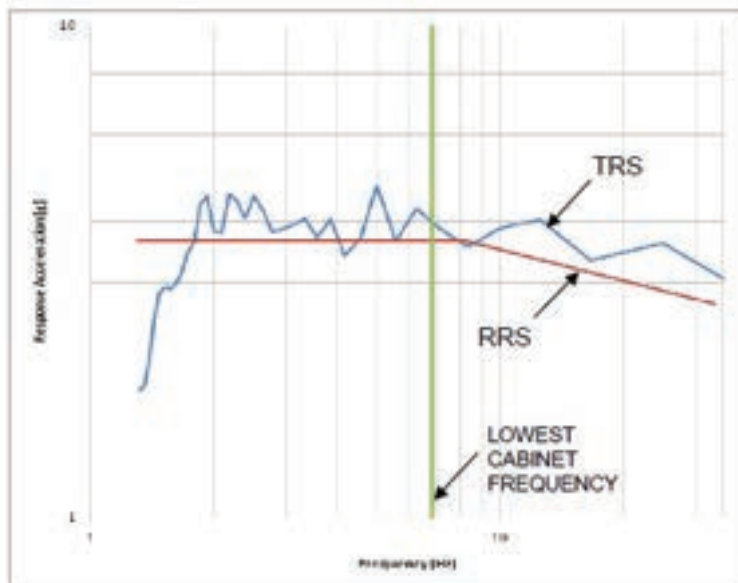
Seismic Certification

Thomson Technology – Automatic Transfer Switches

TS 840, 870, 880

Approved for use in Seismic Applications

Thomson Technology has seismically certified its line of **Automatic Transfer Switches** including all models of **TS 840, 870, 880**. The certification was done by shake-table testing according to the nationally recognized standard, AC156. The standard covers seismic design requirements for non-structural components according to IBC 2006 and ASCE7-05.



Dr. Carlos E. Ventura, PE
Director, TVP Engineering Ltd.
Certifying Company



Norm Schmidt
Vice President, Engineering and Administration
Thomson Technology

Shake-table tests were performed at Alpha Seismic and Environmental Test Laboratory and the Earthquake Engineering Research Facility, University of British Columbia. The figure shows a representative Test Response Spectrum (TRS) plotted with 5% damping against the AC156 Required Response Spectrum (RRS) with a S_a value of 342%. For more details, please refer to the certification notes.



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TSC 900

TRANSFER SWITCH CONTROLLER

INSTALLATION, OPERATING & SERVICE MANUAL

Part #013190

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12. NOTES

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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
1022 , 18/03/12	Add Power Contactor ATS Features and misc. new features & bug fixes
1025 , 18/22/03	Power Contactor bug fixes

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
2.0.6643.24647 18/10/03	Add Power Contactor ATS Features and misc. new features & 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
Rev 6 18/06/19	Manual revisions for Firmware 1025/2.0.xxx

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 touch screen display and are security password protected. The graphical touch screen 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.

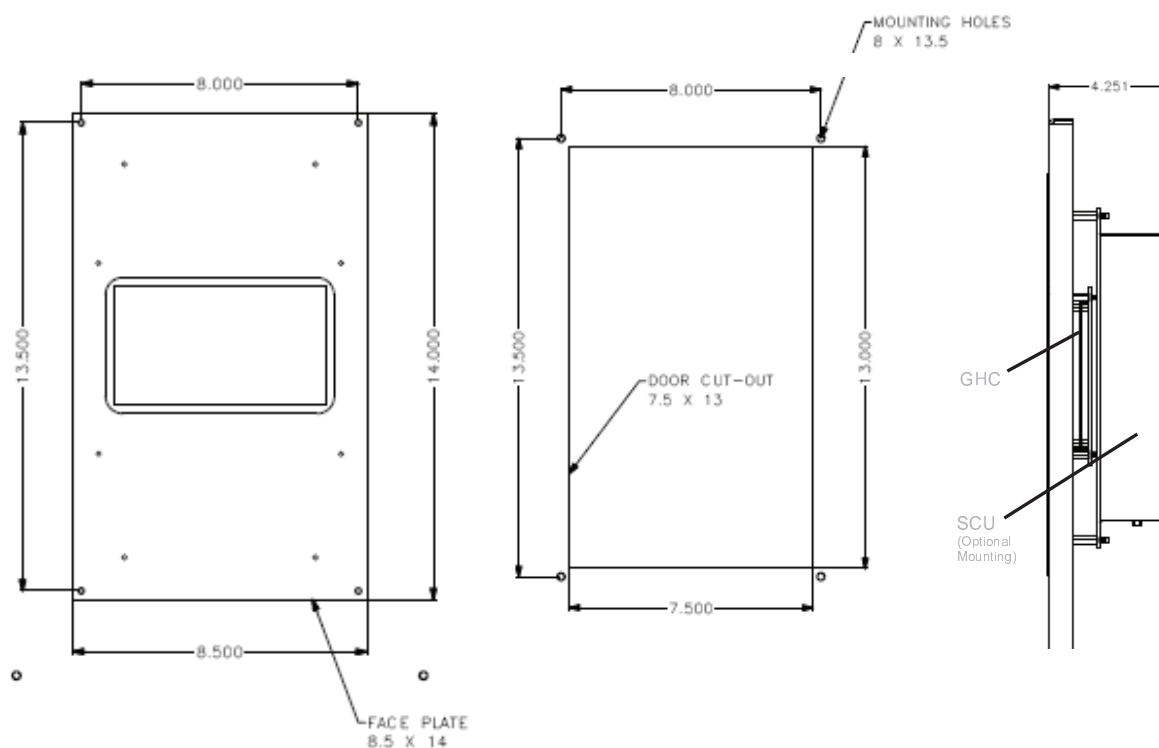
If the transfer switch requires reconfiguring, the TSC 900 controller will also require reprogramming.

CAUTION

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

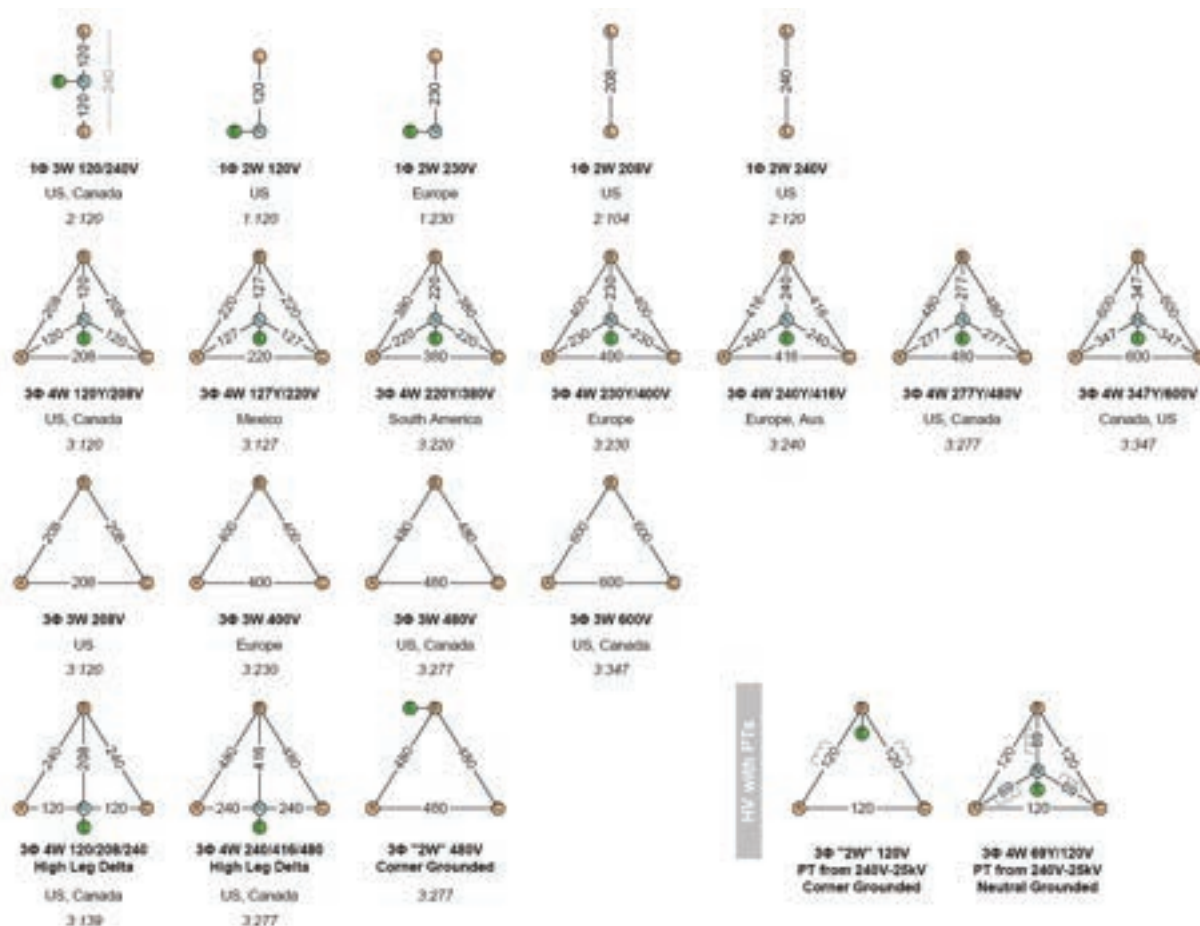
2.3. TSC 900 GHC MOUNTING

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.



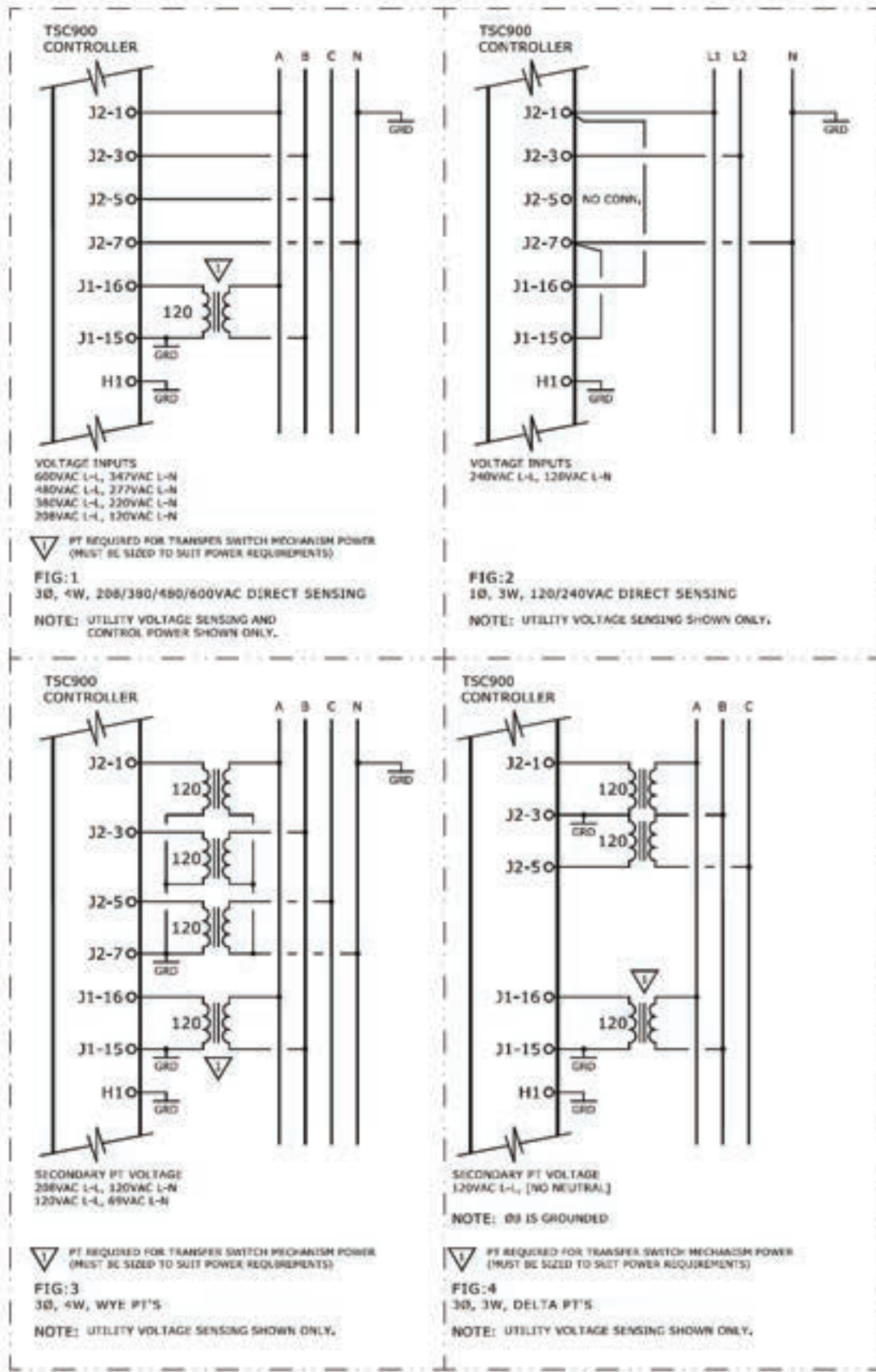
2.4. AC VOLTAGE SENSING INPUT

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 programming instructions.

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



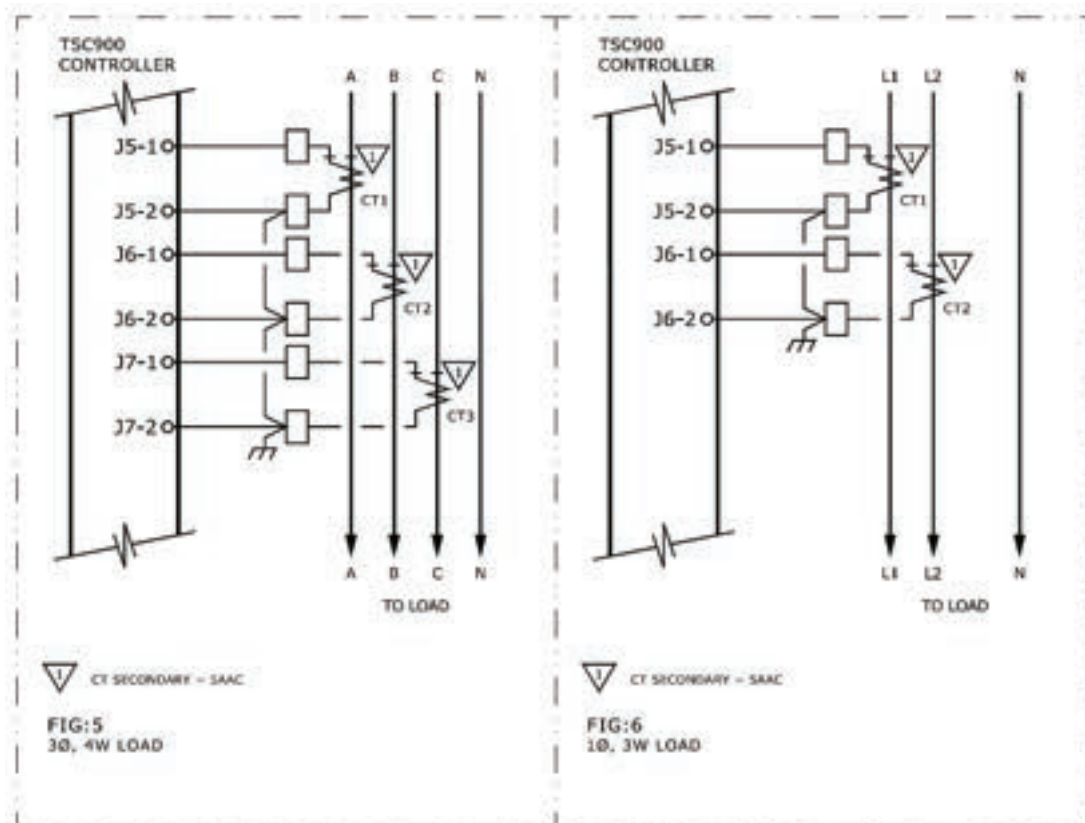
2.5. AC CURRENT SENSING INPUT

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 not 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.



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 $\pm 10\%$ 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.

¹For 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 (2.5mm²)) 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

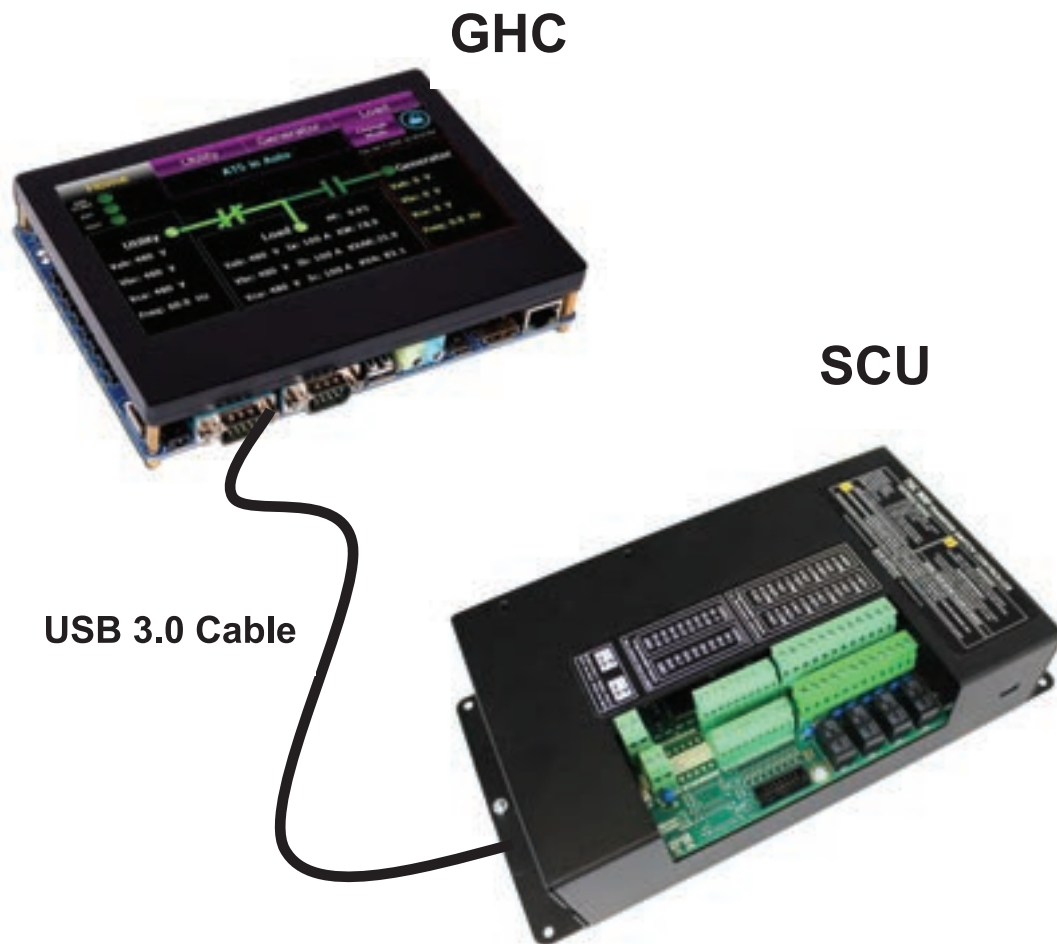
For additional information on protection against electrical interference, contact Thomson Power Systems factory.

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.

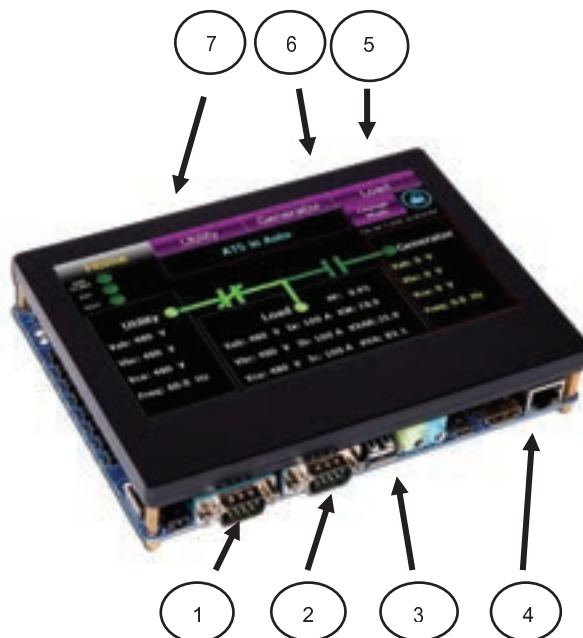
3. DESCRIPTION

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

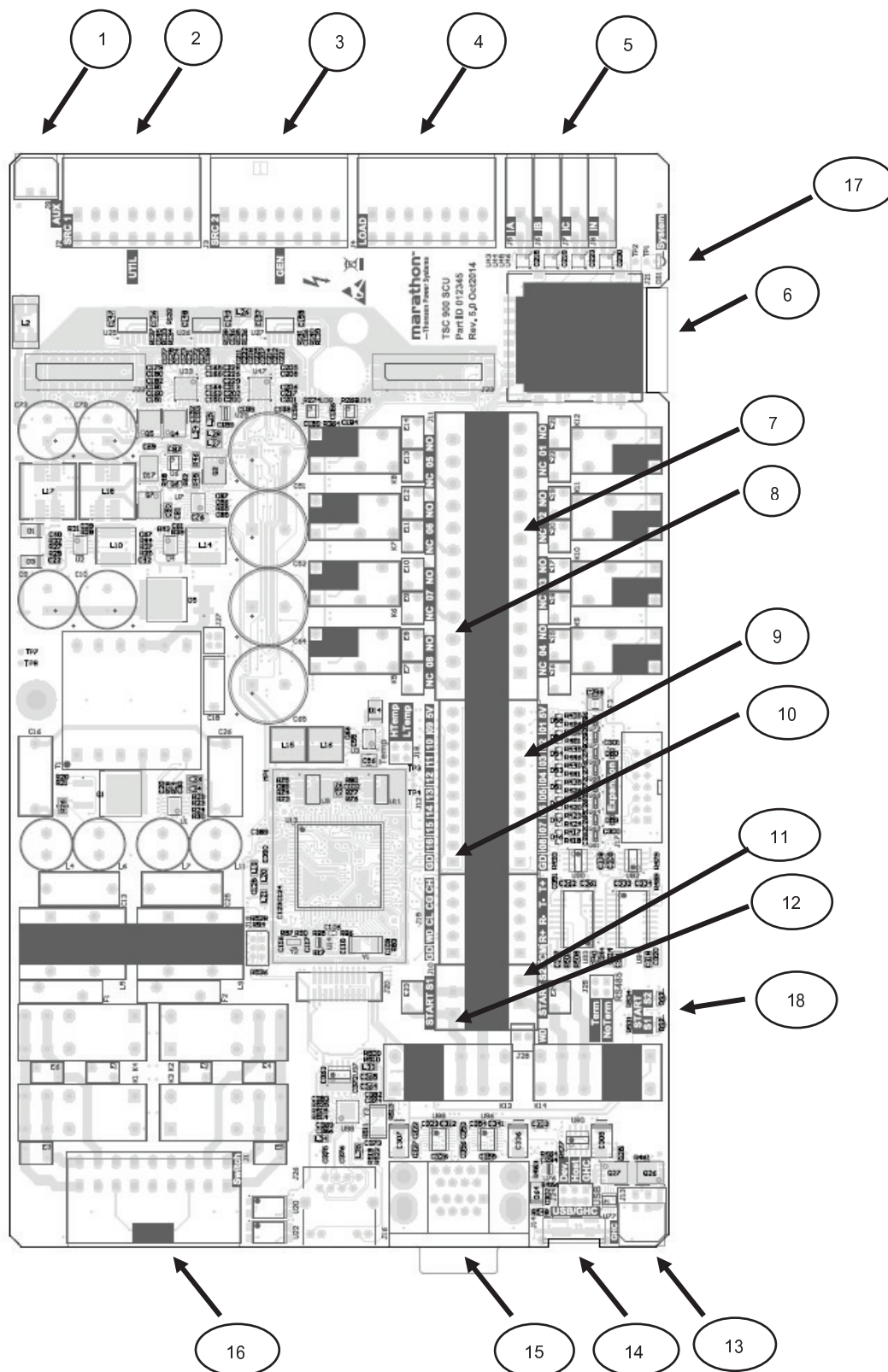
The GHC Display is shown as in FIGURE 7. The GHC is interconnected to the SCU via a plug-in USB cable. The main features of the GHC display are described as follows with reference to FIGURE 7.



FIGURE# 7

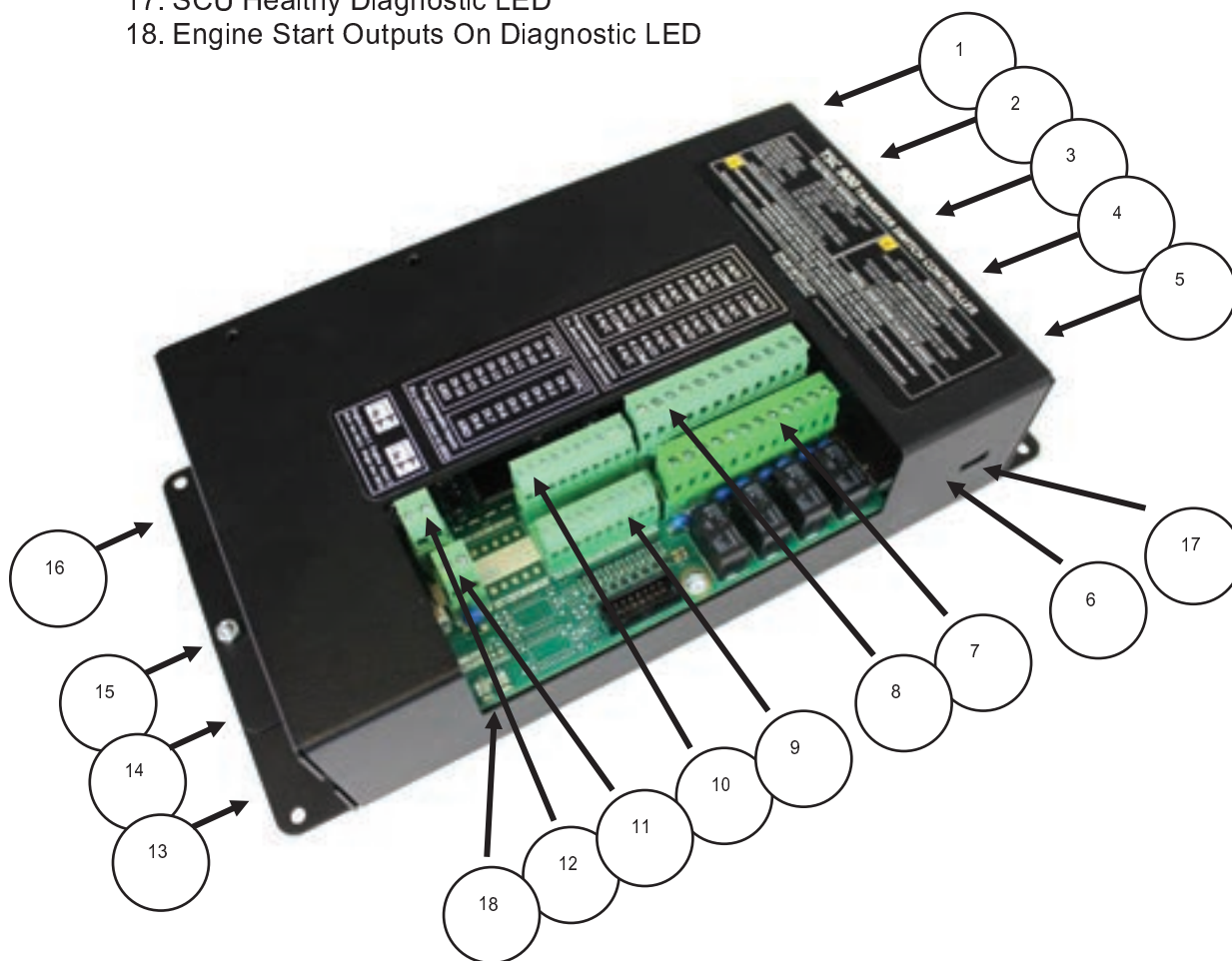
1. RS232 Communication Port #1: This port is utilized for Modbus RTU Serial communication
2. RS232 Communication Port #2: This port is utilized RS232 Serial communication
3. USB Communication Port #1: This port is utilized for communication from GHC to TSC 900 SCU module
4. Ethernet Communication Port: 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

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 <u>not</u> 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 <u>not</u> 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 <u>not</u> 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 (NEUTRAL DELAY)

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 rise above preset values, a warmup time delay will be initiated. Once the warmup 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. OPEN TRANSITION (FAST, IN-PHASE) TRANSFER

NOTE: This transfer operation type is applicable to Power Contactor type ATS or those with spring-charged motor operated breaker types. 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 rise above preset values, a warmup time delay will be initiated. Once the warmup 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 timer will be initiated. Following expiry of the utility return timer, the TSC 900 controller will verify the difference of voltage, frequency and phase angle between the generator and utility sources, and once an in-phase condition is detected, the generator power switching device will open, then the utility power switching device will close within ~150 milliseconds to complete the fast (in-phase) break-before-make 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. CLOSED TRANSITION (FAST, IN-PHASE) 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 rise above preset values, a warmup time delay will be initiated. When the warmup 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.

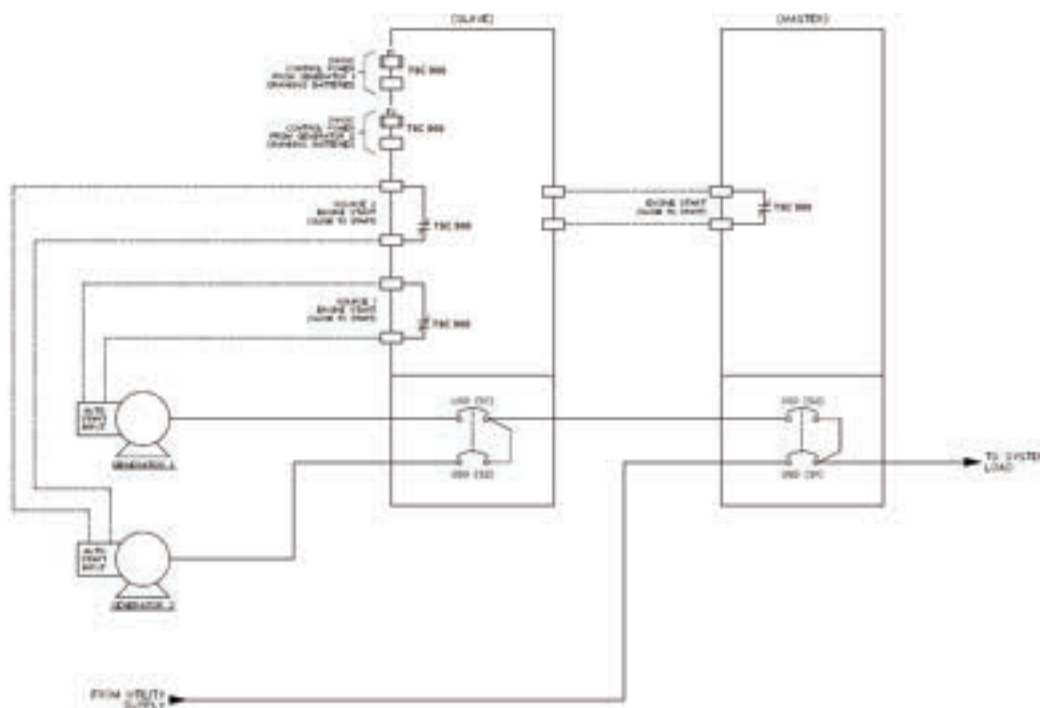
An engine cooldown timer circuit will be initiated once the load has successfully re-transferred back onto the utility supply. Following expiry of the cooldown delay period,

the engine start signal will be removed (remote start contact opened) to initiate stopping of the generator set.

3.4.4. 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



3.4.5. 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.

3.4.5.1. 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 warmup 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 cooldown 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 (generator set) 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.

3.4.5.2. 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 generator sets (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 generator 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 cooldown 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 (generator set) 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.

3.4.6. AUTOMATIC LOAD SHED OPERATION

Load Shed strategies are used when the backup generator is not sized to supply all ATS loads. TSC900 monitors the generator output KW and frequency to determine when to connect or disconnect non-critical loads to maximize utilization and to prevent the generator from overload and shutdown.

TSC900 Load Shed is available in three configurations:

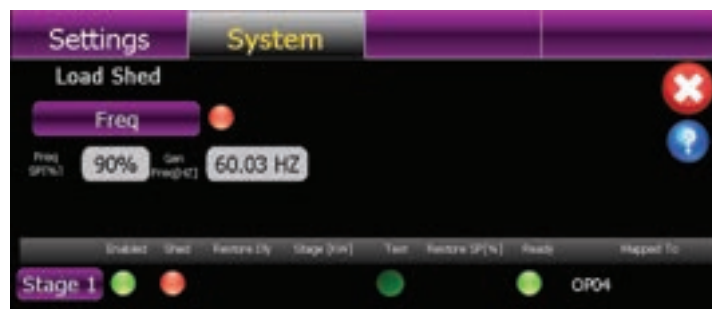
- Basic Load Shed (based on monitoring the generator frequency)
- One Stage KW Load Shed (based on monitoring the generator frequency and KW)
- Advanced Load Shed (Four Stages with individual KW restore setpoints)

NOTE: Load Shed is only provided for Utility-Generator type applications. The Basic and the One Stage kW Load Shed are available for all models. KW Load Shed requires the Load Power Metering (LPM) option. The Advanced Load Shed (ALS) feature is only available on the S-Style and Power Contactor models. ALS requires LPM purchase and activation.

3.4.6.1. BASIC LOAD SHED

TSC900 monitors the generator frequency to determine when it is required to shed load. Under normal utility power conditions, the Load Shed control is not activated. The Load Shed logic is automatically initiated when the utility power fails or during an ATS On Load Test. The Load Shed output can be either activated before transferring to the generator (when the option Shed All On Start is enabled) or it can be deferred until the ATS is on the generator and the under-frequency protection element triggers a Shed Load request.

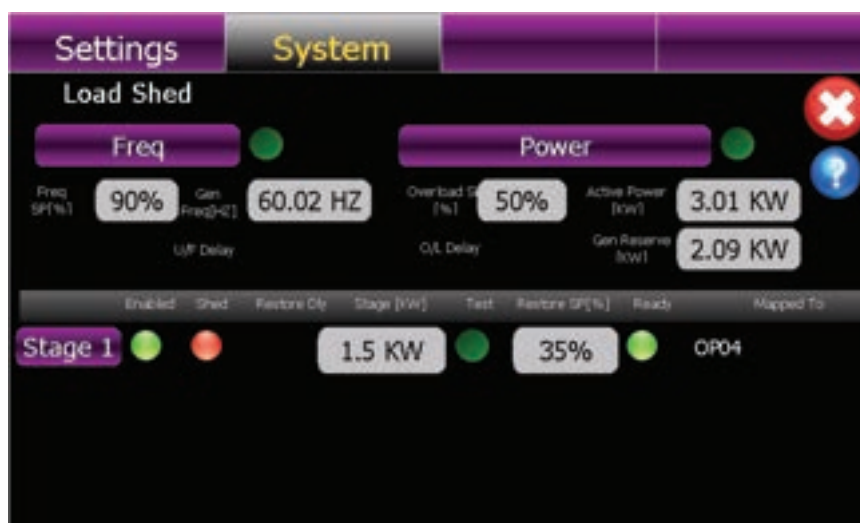
Once the generator frequency recovers, the Load Shed output is reset after a configurable time delay. The Load Shed output is automatically reset when the ATS returns to utility.



3.4.6.2. ONE STAGE KW LOAD SHED

Available when the Load Powering Metering (LPM) option is enabled. TSC900 monitors the generator frequency and KW to determine when is required to shed load. Under normal utility power conditions, the Load Shed control is not activated. The Load Shed logic is automatically initiated when the utility power fails or during an ATS On Load Test. The Load Shed output can be either activated before transferring to the generator (when the option Shed All On Start is enabled) or it can be deferred until the ATS is on the Generator and the under-frequency or the overload protection element trigger a Shed Load request.

Once the generator frequency and KW recover within allowable limits, the Load Shed output is reset after configurable time delay. The Load Shed output is automatically reset when the ATS returns to utility.



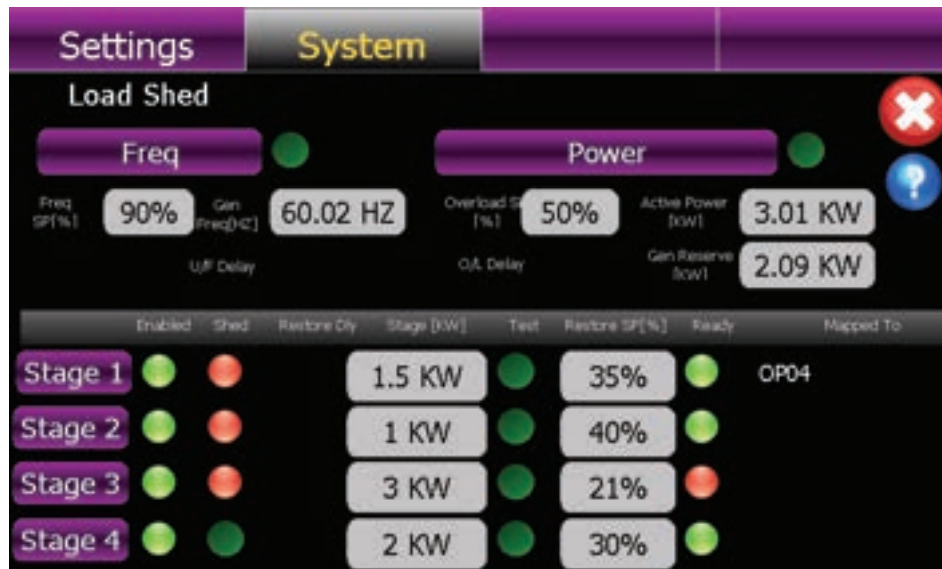
3.4.6.3. ADVANCED LOAD SHED

TSC900 Advanced Load Shed is using proactive strategies to connect and disconnect loads to the generator, to maximize utilization without overloading the generator.

The generator under-frequency and overload protection elements have independent overload and under-frequency shed delays and can be enabled independently. The under-frequency protection can be used to accelerate the load shed and prevent generator shut-down.

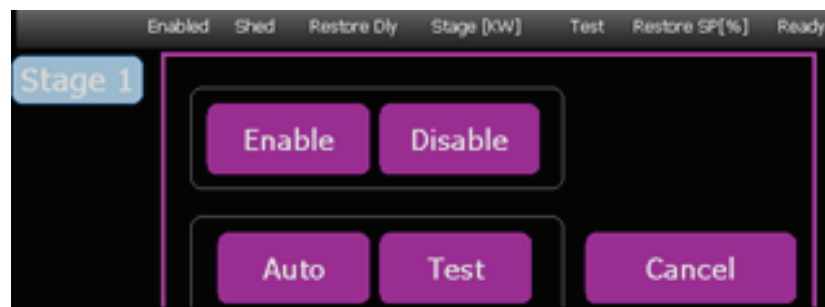
On overload or over-frequency conditions, loads are shed based on a priority system. The lower priority loads (Stage 1) loads are shed first and the higher priority loads (Stage4) are shed last. After the generator power and frequency return to normal the loads are restored in reversed priority order.

Each stage has a programmable kW level associated with it. A stage priority will only be connected if there is enough bus reserve kW capacity available and the frequency is normal. This method minimizes loads cycling, where a load is connected, then shed immediately after due to overload or under-frequency conditions. For further tuning of the restore process, independent restore timers are provided for every stage.



3.4.6.4. STAGE MANUAL CONTROL

Every stage can be manually controlled. A stage can be Enabled or Disabled. If Enabled a stage can be in Auto or Test mode. In Auto the stage is controlled by the load shed logic. When Disabled a stage will always be connected. When in Test mode a stage will always be disconnected. Disabled or Test stages will always be skipped by the load shed/restoration routines.



NOTE: Refer to [SECTION 5.15](#) for programming instructions

3.4.7. TEST MODE

3.4.7.1. ON LOAD TEST (OPEN TRANSITION NEUTRAL DELAY)

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.

3.4.7.2. ON LOAD TEST (OPEN TRANSITION IN-PHASE TRANSFER)

When an operator selects an On Load Test mode, the ATS controller will initiate a simulated utility power failure condition. Once the Engine Start delay and gen warm-up timers have expired, the TSC 900 controller will verify the difference of voltage, frequency and phase angle between the generator and utility sources, and once an in-phase condition is detected, the utility power switching device will open, then the generator power switching device will close within ~150 milliseconds to complete the fast (in-phase) break-before-make transfer sequence. 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.

3.4.7.3. 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 warmup 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.

3.4.8. ABNORMAL SEQUENCE OF OPERATION

3.4.8.1. 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.

3.4.8.2. 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.

3.4.8.3. Fail to Transfer (In-Phase Detection)

Should the transfer switch not immediately transfer following expiry of a normal automatic mode sequence timer (e.g. Gen Warmup Timer, Utility Return Timer) and both generator and utility supplies are available, the generator and utility supplies may not be in phase as required by the in-phase transfer detection sensor. Should the generator and utility supplies fail to reach an in-phase condition for a time period of 5 minutes, an alarm condition will be activated. This alarm condition will cause the following events to occur:

- **In-Phase Bypass Transfer:** The transfer switch will bypass the in-phase detection circuitry and force a transfer to the intended source. Re-transfer back to the original source will be permitted with the Wait to Transfer alarm still present
- **Alarm Activated:** the alarm will be activated. The alarm will not go out until the alarm condition is reset

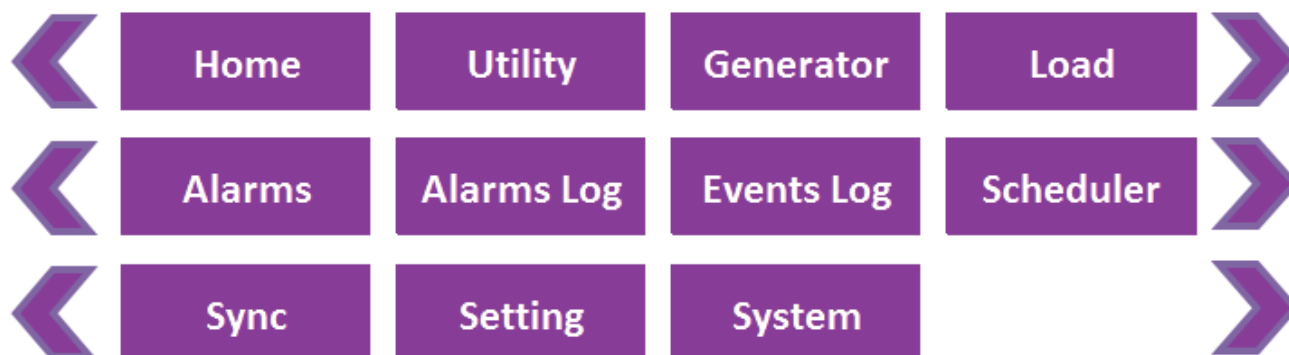
3.4.8.4. SERVICE ENTRANCE ATS

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

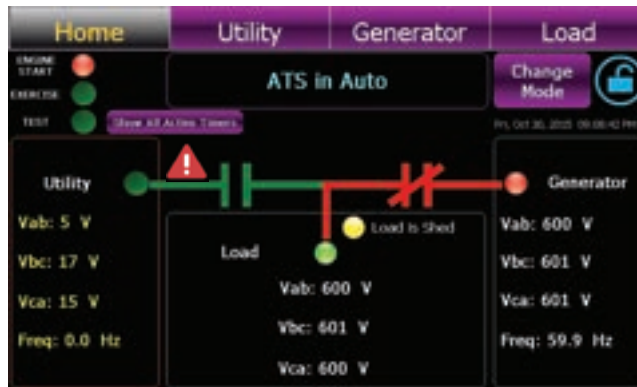
The GHC software provides the TSC 900 control and monitoring information which is visible on the GHC Display or remote PC. All screen page navigation is controlled by a touch screen display using a finger swipe motion and/or button press actions. The GHC has pre-programmed display pages which are selected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

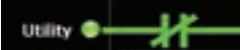
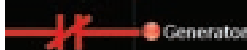


The standard default mimic bus will automatically change color as follows:

- 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

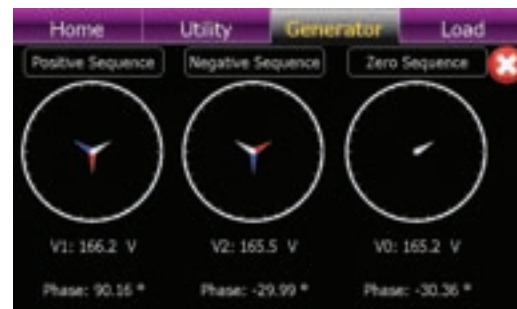
3.5.2. UTILITY METERING PAGE

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

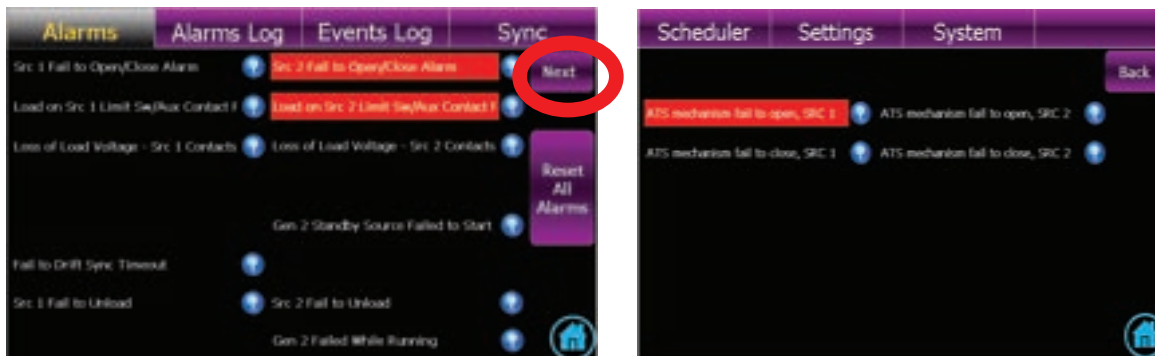
The load metering page provides detailed voltage, current and power metering data for the ATS load bus. Metering data is displayed in both text and graphical representation. Phase to phase voltages are displayed. A shortcut button is provided to access the Load Bus Symmetrical components information.

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. Some models can discriminate between Fail to Open and Fail to Close alarms. Use the Next button to navigate to the next alarms screen.



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 generator set (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 generator set (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.

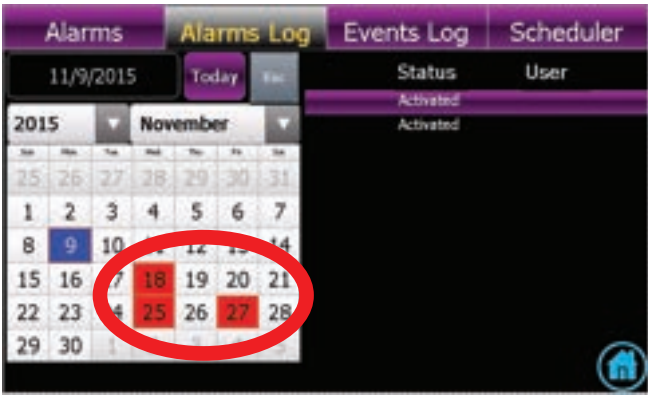
3.5.6. ALARMS LOG PAGE

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.

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

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.

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
11:14 PM	Ground	Activated	factory

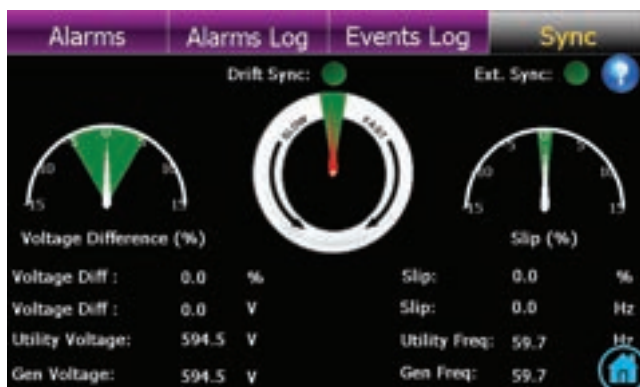
When the Calendar pop-up is selected, any calendar dates with Event logs present will be highlighted by a yellow box on that date as per the following display.

Alarms		Alarms Log		Events Log	Scheduler		
11/9/2015		Today	Fac	Action	User		
2015		November		User Login	factory		
25	26	27	28	29	30	31	Activated
1	2	3	4	5	6	7	Activated
8	9	10	11	12	13	14	Activated
15	16	17	18	19	20	21	Activated
22	23	24	25	26	27	28	Activated
29	30	1	2	3	4	5	Activated

3.5.8. SYNC PAGE

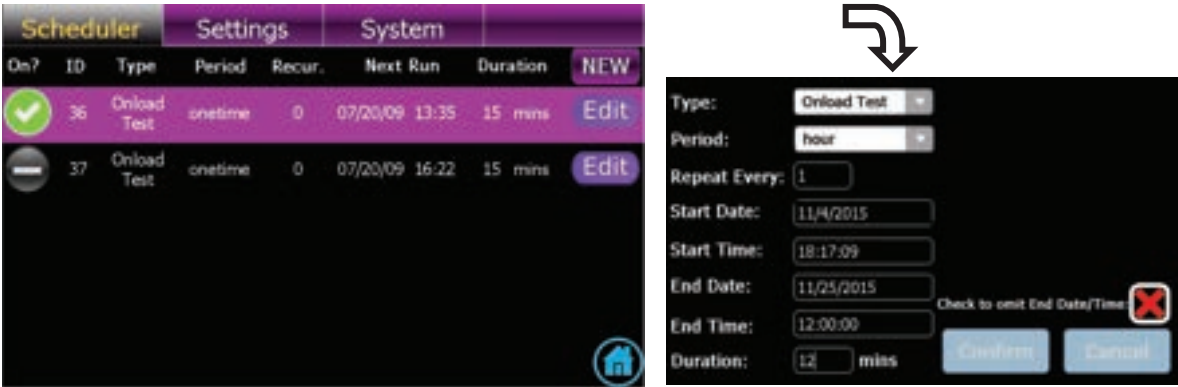
The Sync page is utilized for applications when the ATS is provided with closed transition or open transition in-sync transfer capability. This page will display the phase angle difference, voltage difference and slip frequency difference between two available sources.

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.



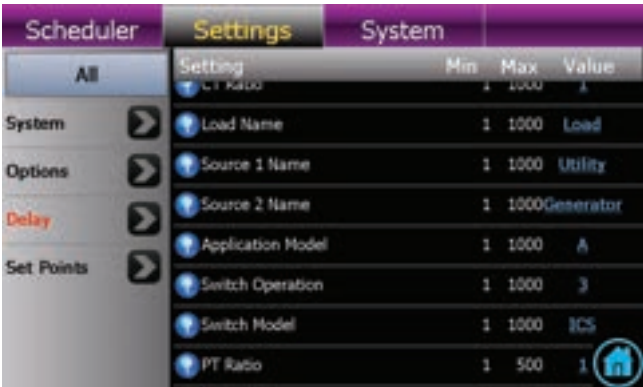
3.5.9. SCHEDULER PAGE

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

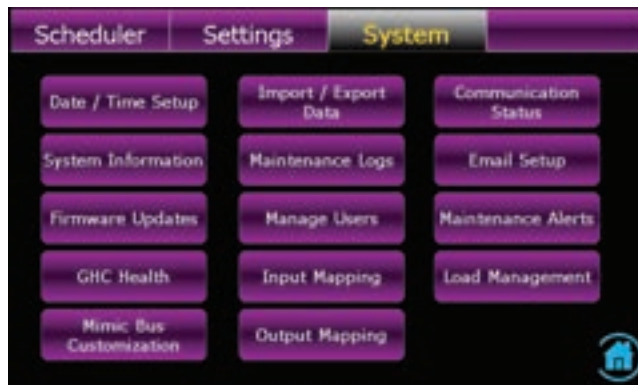
The settings page is utilized for programming or configuring any timer, voltage setpoint, frequency setpoint, I/O mapping or optional features in the controller. The settings can be viewed via different filter settings based on function. Refer to the Programming section of this manual for further details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



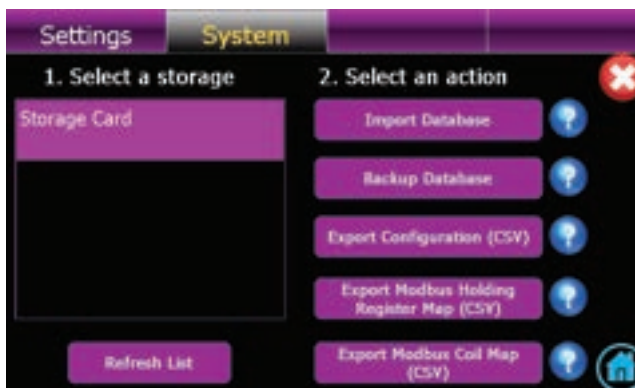
3.6. GHC DISPLAY SYSTEM SUBMENU PAGE DESCRIPTIONS

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 sub-menu.

NOTE: To exit any sub-menu, 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.

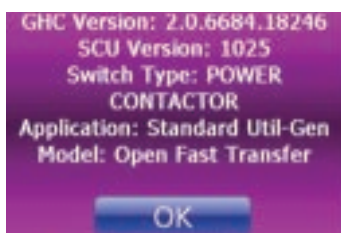
3.6.3. MANAGE USERS

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.

User Name	Last Name	First Name	Group	Subscribe?	Active
admin	administrator	administrator	Administrators	False	True
power	power	power	Power Users	False	True
user	user	user	Users	False	True

3.6.4. SYSTEM INFORMATION

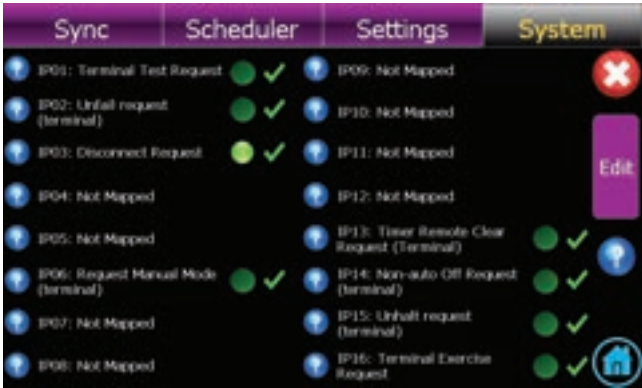
The System page shows what current firmware versions are installed on the TSC 900 controller.



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.

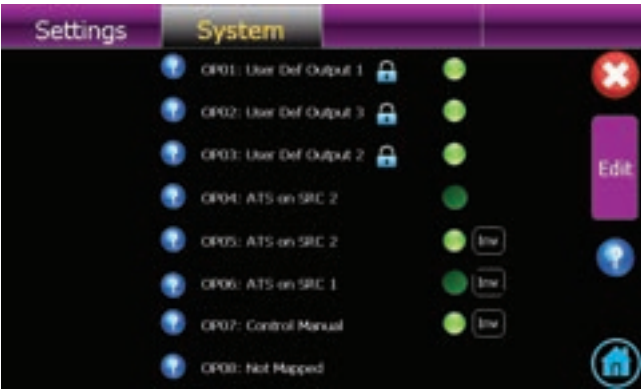
Refer to the [SECTION 5.8](#) of this manual for further details on configuring the digital input mappings.



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.



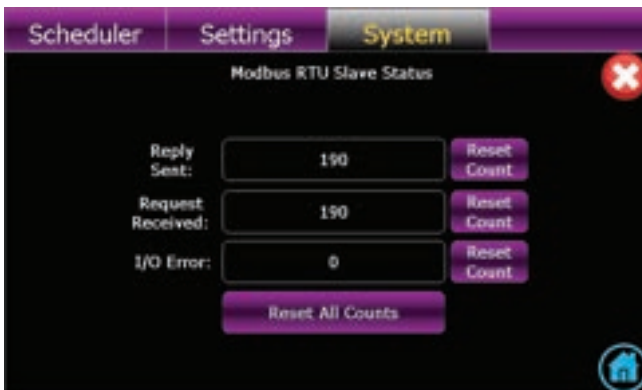
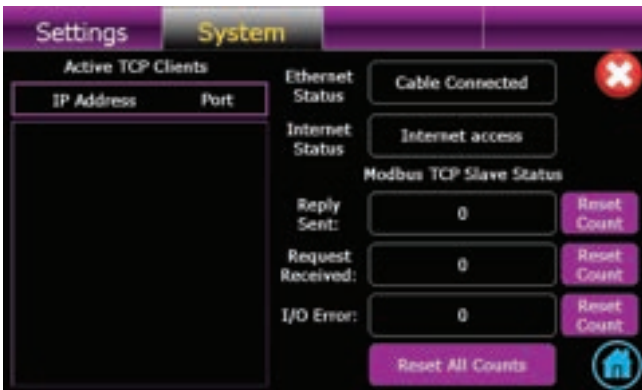
3.6.7. LOGS

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



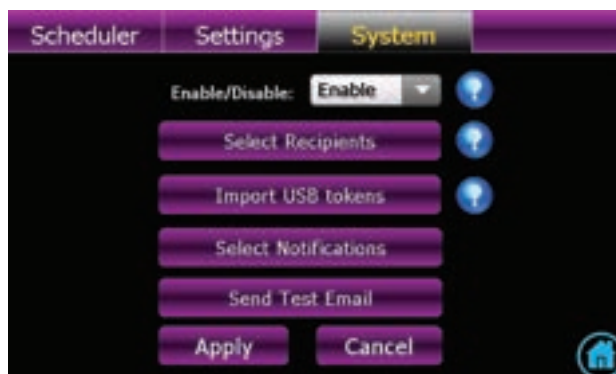
3.6.8. COMMUNICATION STATUS

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 EMAIL AND PUSH NOTIFICATION SETUP

This page is used to activate, configure and test email and push notifications. The configuration process requires an email address for users subscribed to the email notifications and a subscription to the Pushover service for mobile users. The set-up process is detailed under the [REMOTE COMMUNICATION SETUP](#).



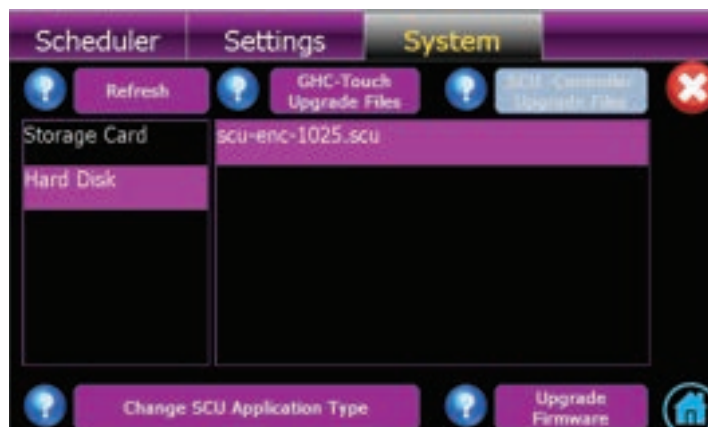
3.6.10. MIMIC BUS CUSTOMIZATION

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.



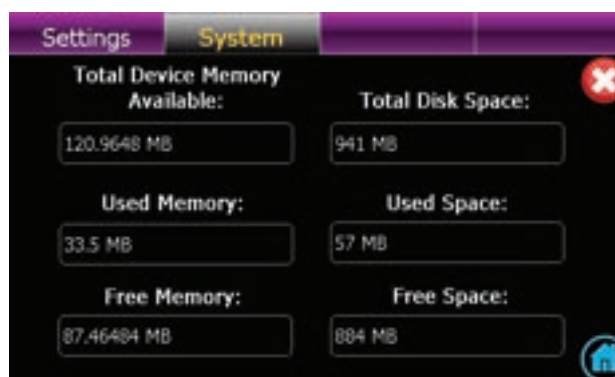
3.6.11. FIRMWARE UPDATES

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 bulletins which details the GHC and SCU firmware update procedure.



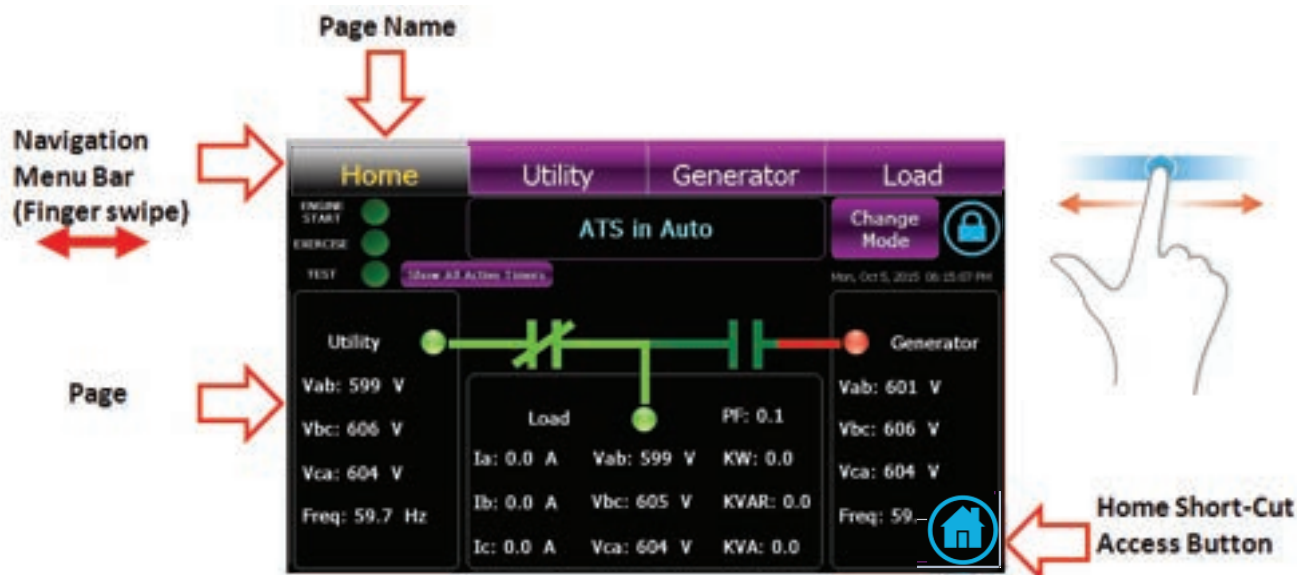
3.6.12. GHC HEALTH

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:



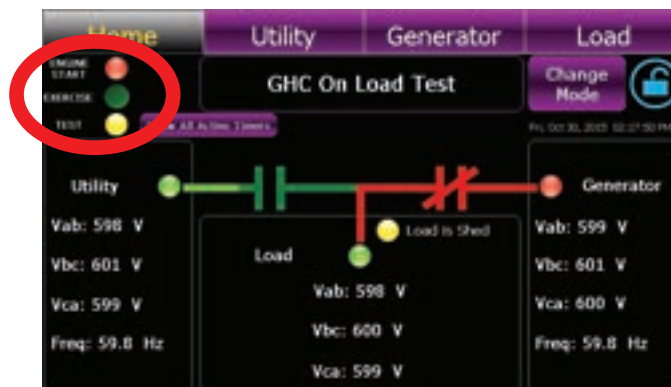
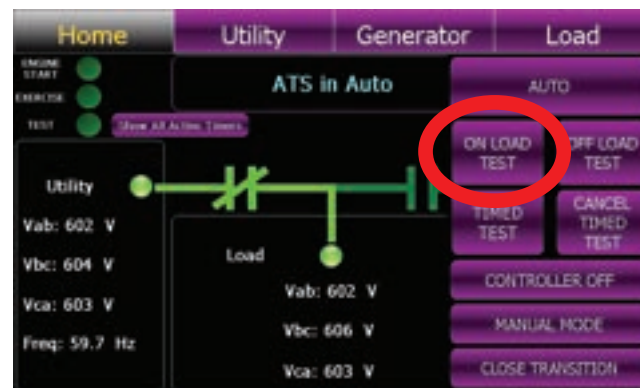
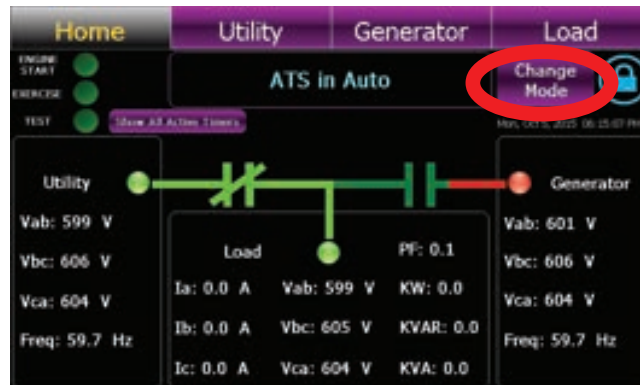
4.2. HELP INFORMATION

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

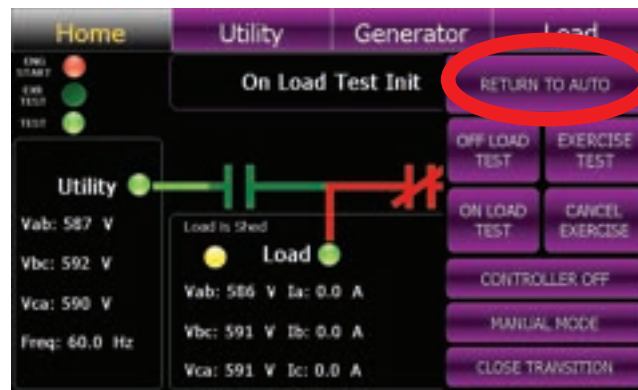


4.3. ON LOAD TEST INSTRUCTIONS (UTILITY POWER FAIL SIMULATION)

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 the automatic sequence.

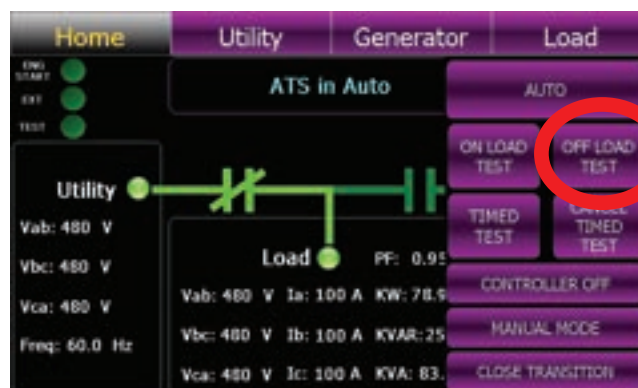
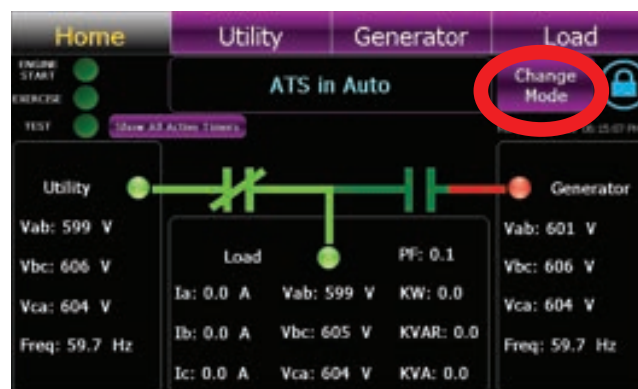


To cancel On Load Test, press the Change Mode control button on the GHC Home Page and select Return To Auto mode from the available list of modes as shown below. The Test and Engine Start lights on the upper left-hand corner of the screen will go off and the load will re-transfer back to the utility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

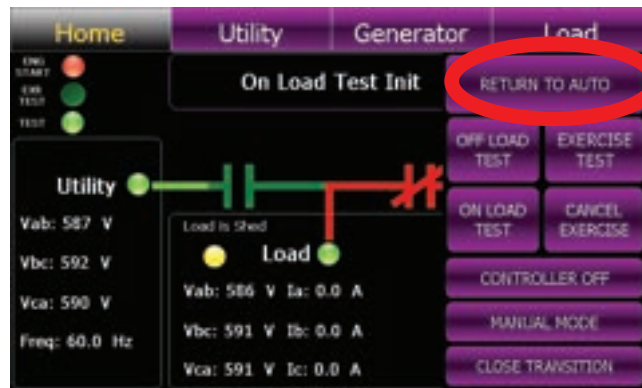


4.4. OFF LOAD TEST INSTRUCTIONS (GENERATOR NO LOAD TEST)

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.

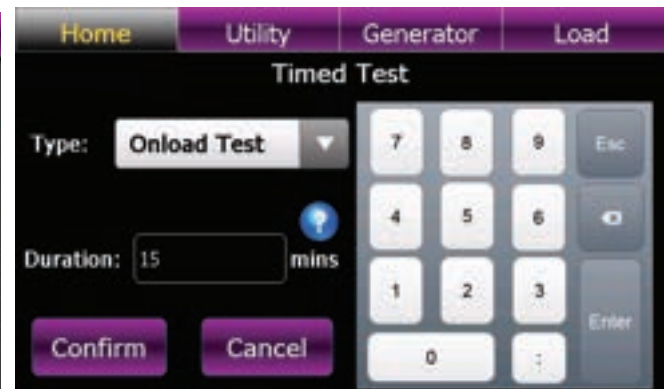
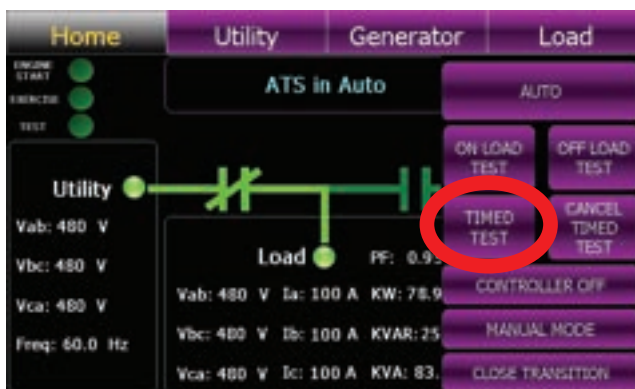


To cancel the Off load Test, press the Change Mode control button on the GHC Home Page and select Return To Auto mode from the available list of modes as shown below. The Engine Start light on the upper left-hand corner of the screen will go off and the generator set will stop.

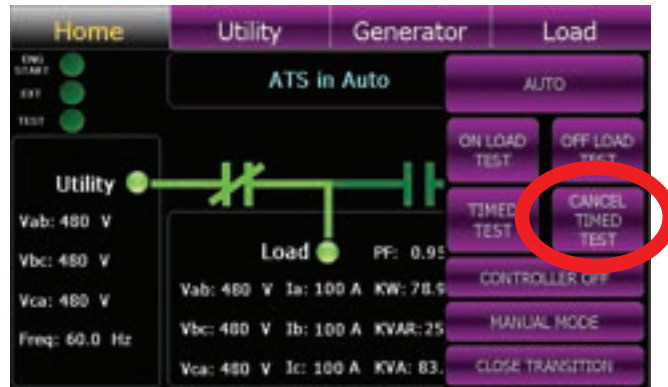


4.5. TIMED TEST INSTRUCTION

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.

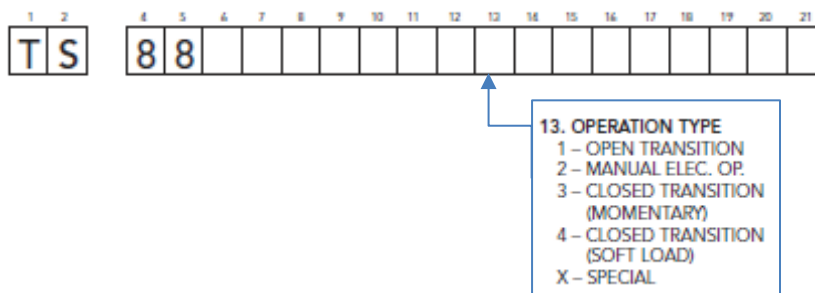


To cancel Timed Test mode, press the Change Mode control button on the GHC Home Page and select Cancel Timed Test mode from the available list of modes as shown below.

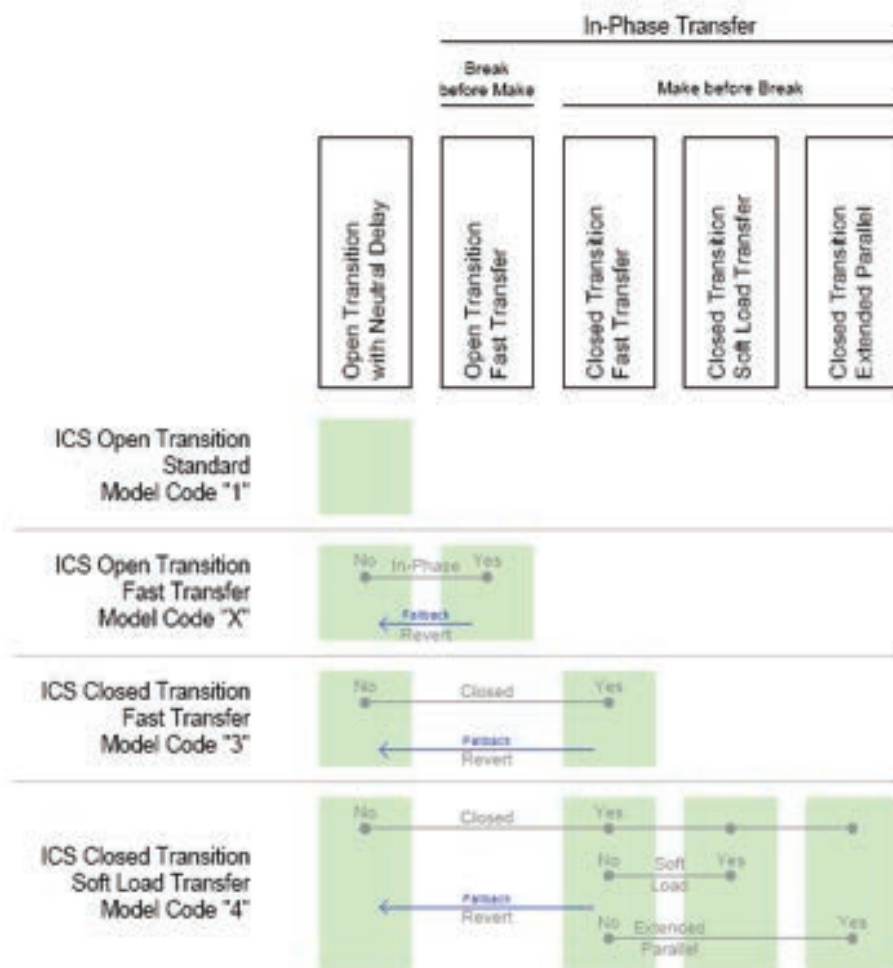


4.6. OPEN/CLOSED TRANSITION TRANSFER OPERATION

The ATS may be supplied with several 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:



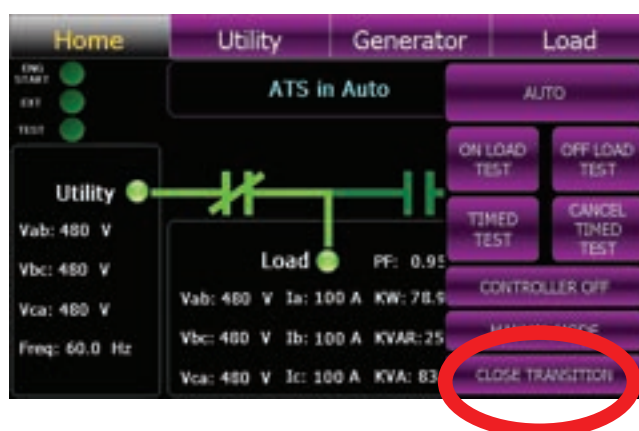
4.6.1. OPEN TRANSITION IN-SYNC TRANSFER OPERATION (MODEL X)

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.

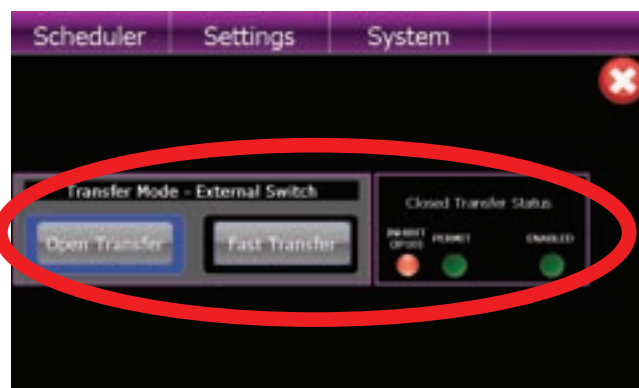
NOTE: Open Transition In-sync Transfer operation is only possible if the ATS mechanism is equipped for in-sync operation and optional feature is enabled in Settings. Refer to [SECTION 5.11.26](#) for further details.

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;

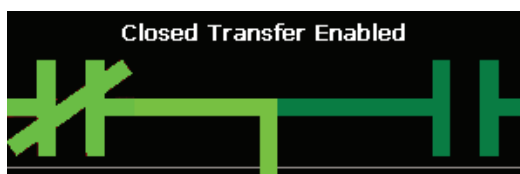


The left-hand side of the display shows the current position of the ATS control modes (i.e. Open Transfer or Fast (Closed) Transfer) based on current selection of the internal

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 buttons are disabled when an external switch is 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.

The Home Screen will indicate when the Closed Transition Transfer is enabled. Any condition inhibiting the Closed Transition Transfer will remove the label.

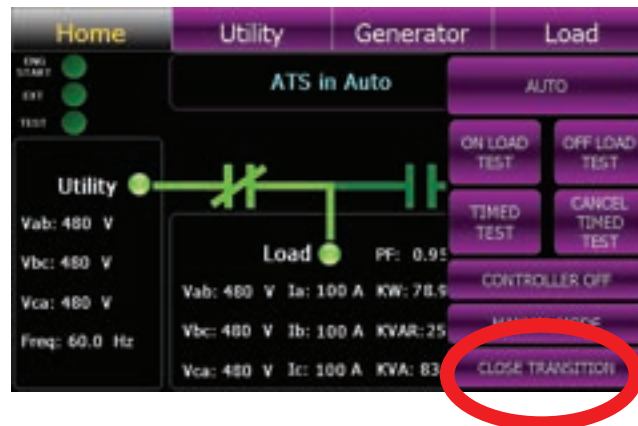


NOTE: When an External Switch (Optional) is used, the Close Transition Option `opt.xfr.closed` must be enabled in the Settings and the Close Transfer Inhibit `ilk.xfr.closed.inhibit` mapped to a Digital Input (Default DI7). If instead the Internal Switch is used, the Close Transition Option `opt.xfr.closed` must be disabled in the Settings and the Close Transfer Inhibit `ilk.xfr.closed.inhibit` mapping removed. See table below. Refer to [SECTION 5.11.17](#) for further details.

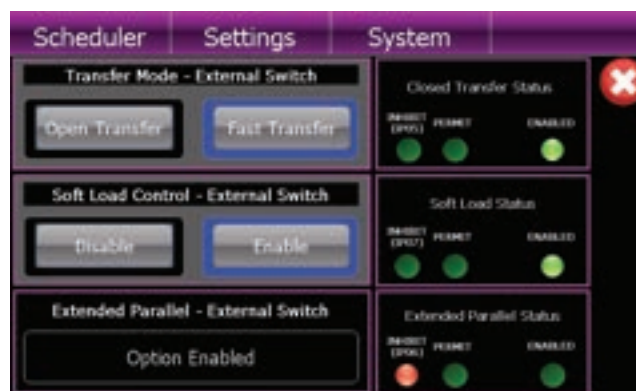
Tag	Description	Internal Switch (Software)	External Switch
<code>opt.xfr.closed</code>	Closed Transfer Option	FALSE	TRUE
<code>ilk.xfr.closed.permit</code>	Closed Transfer Permit		X
<code>ilk.xfr.closed.inhibit</code>	Closed Transfer Inhibit	FALSE (Tag not mapped to DI)	Default Mapping - DI7

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 Close Transition control selection will be provided on the GHC display via the Change Mode button selection.



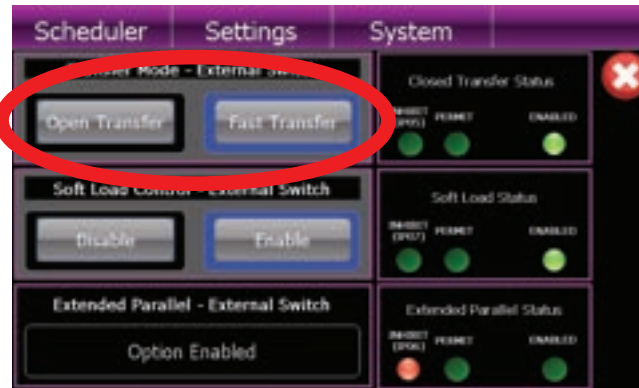
When the Close Transition button is selected, a pop-up screen will appear showing operation mode selections as shown below;



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.

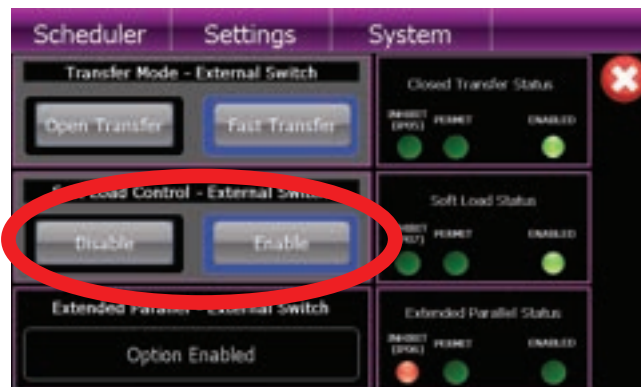


This provides operator selection of desired transfer modes as follows;

- **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 pushbuttons, 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;

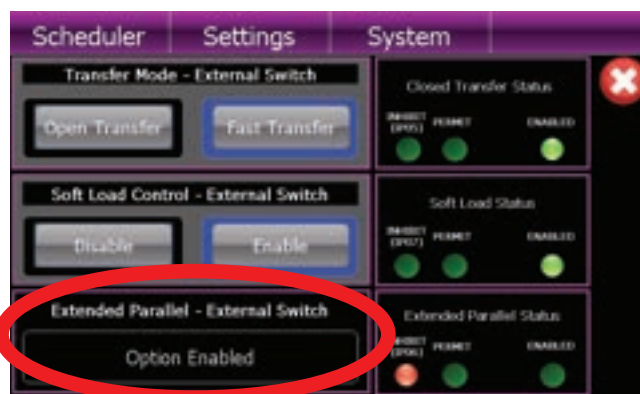
- **DISABLE:** The Soft-Load operating mode is disabled in this mode. The ATS will operate in either Open or Closed Transition Fast Transition as selected
- **ENABLE:** The ATS will operate in a Soft-Load Closed Transition transfer sequence if both sources are available. The two sources will be permitted

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 pushbuttons, 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:

ORDERING INFORMATION

When placing an order, specify the following 21 digit ATS MODEL CODE as per the features and applications described below.

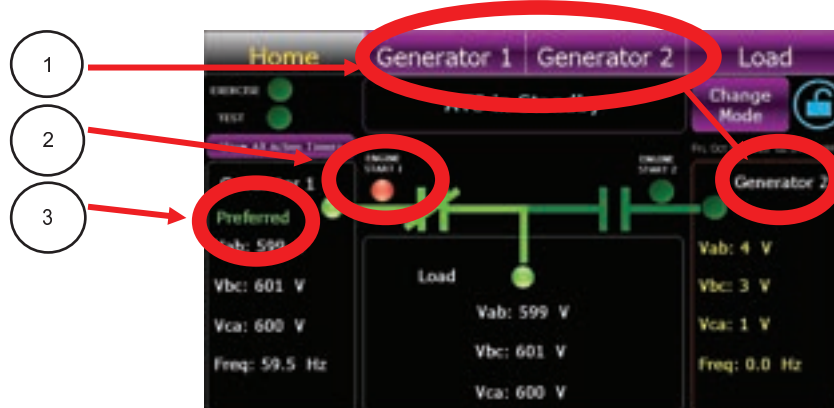
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
T	S		8	7																

12. APPLICATION

- A - STANDARD
- B - SERVICE ENTRANCE
- C - DUAL UTILITY (DU)
- D - DUAL STANDBY GEN (DSG)
- H - DUAL PRIME GEN (DPG)

Refer to [SECTION 3.4.3](#) for automatic sequence of operation descriptions for the 3 types of dual source systems.

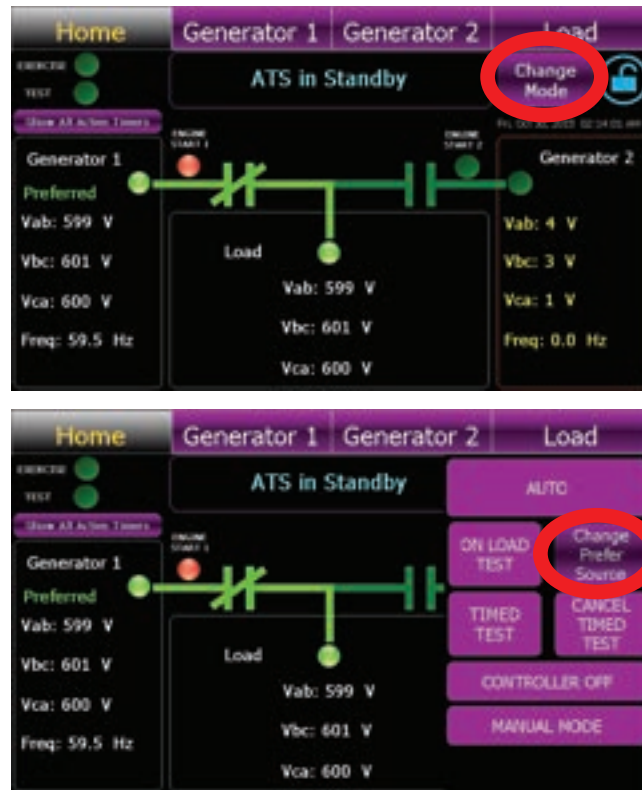
Dual source systems will have a unique GHC home page display as shown below:



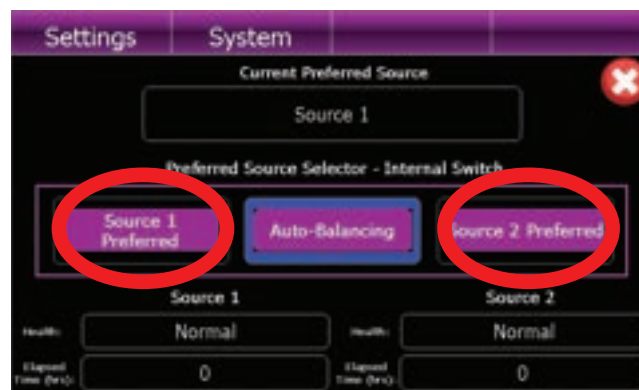
- Source Names:** Each source will have its unique name displayed on the top navigation bar as well as adjacent to the mimic bus source inputs. These names are configurable. Refer to [SECTIONS 5.10.9 - 5.10.10](#) for programming information
- Engine Start Status:** For dual generator applications, two engine start status lights are provided as indicated above. Red indicates when an engine start is activated
- Preferred Source Indication:** When a source is selected as the Preferred source, it will be indicated via text as indicated above. Preferred Source selection may be made 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 Preferred 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.

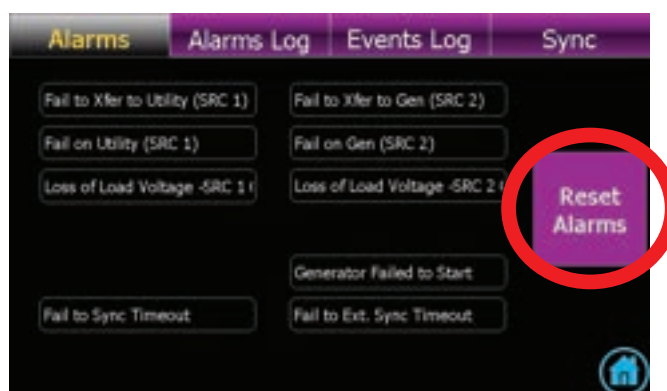
To exit the Preferred Source selection screen, press the red x icon.

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.

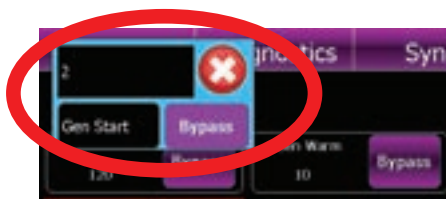


4.9. TIMER BYPASS

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
- Warmup Timer
- Neutral Delay Timer
- Pre and Post Transfer Delay

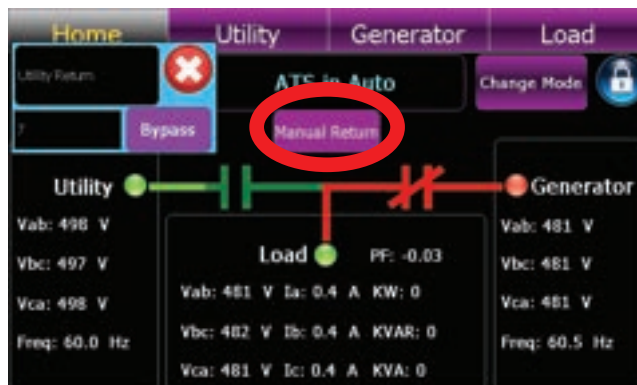
This feature is typically used when testing to avoid waiting for the complete duration of the time period. To activate the bypass function, press the Bypass button when the timer is in operation as displayed on the screen.



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 (generator) 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 the phase unbalance is generally only detected when load is applied to the source. 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.

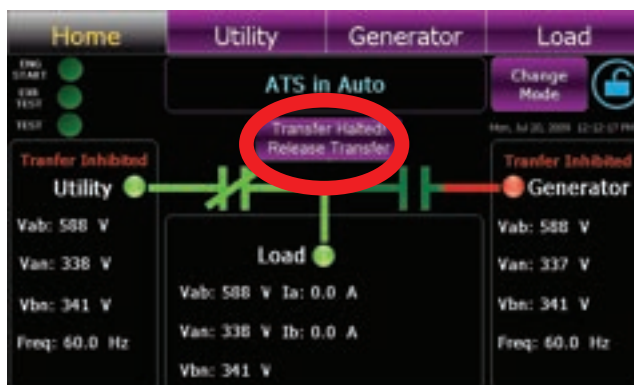
4.13. TRANSFER HALTED ALARM RESET

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

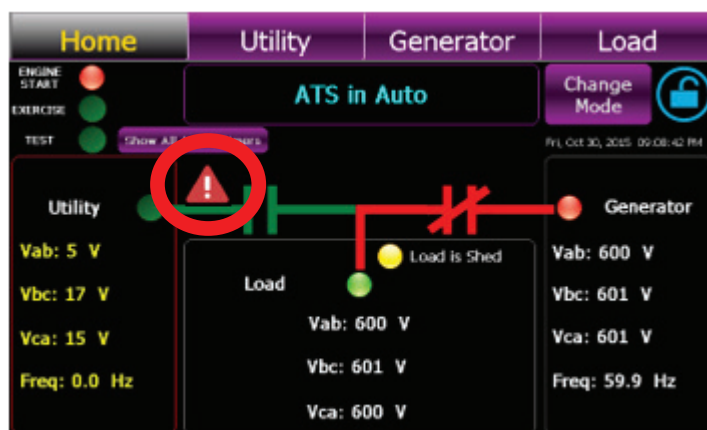
The Transfer Halted condition will be initiated by one of the following operating conditions:

- 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 Generator (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

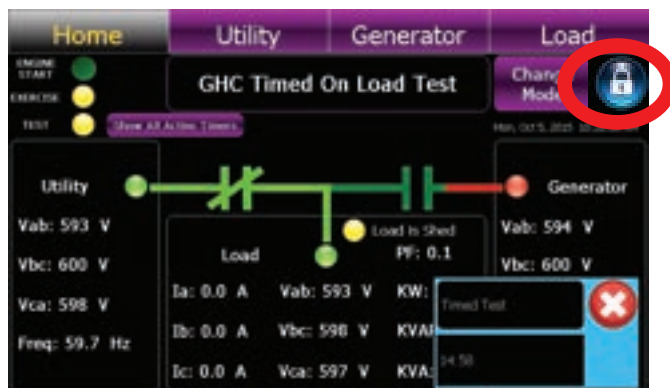
Once a user logs in they are not automatically logged out. Action attempts to functions that require elevated rights will trigger a pop-up message box

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

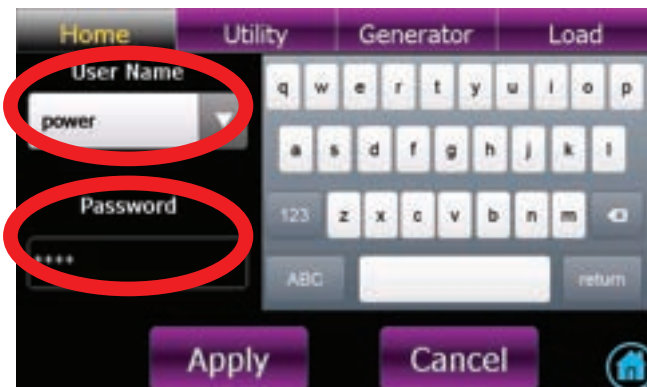
With the transfer switch energized, follow the procedure below to Login to the TSC 900 controller:

- 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**

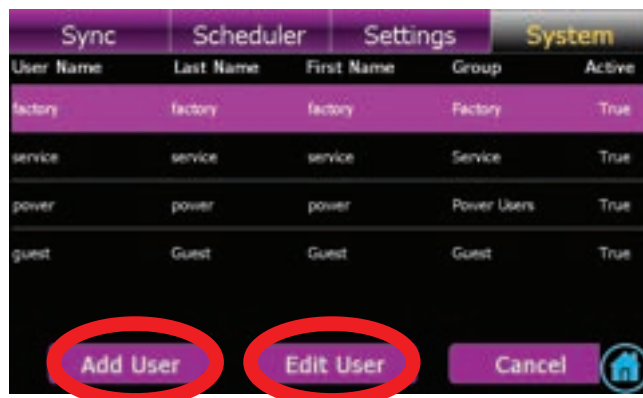
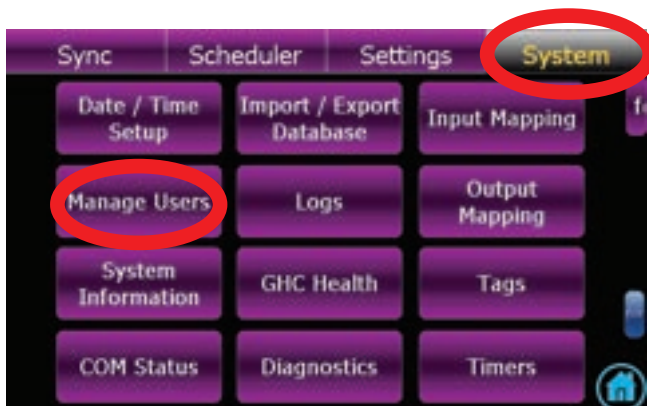


- A Login confirmation screen will pop-up if attempt was successful. Select Return to go back to the home page.

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)



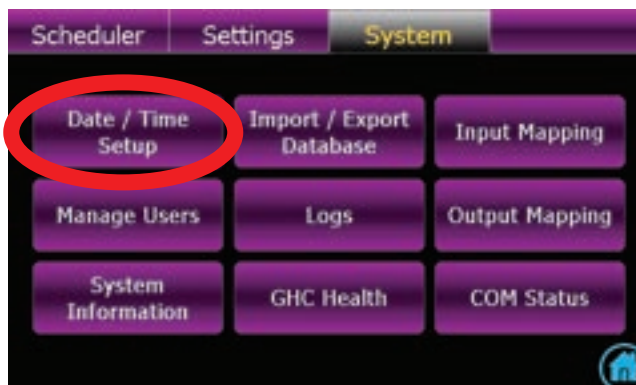
- To Add a user, press Add User button and the following pop-up screen will appear. Complete the information as listed, then press Apply to accept the change.

Settings		System	
Group:	Users	Active:	Yes
Last Name:			
First Name:			
User Name:		Subscribe to Email Notifications? :	No
Email:			
New Password:			
Confirm Password:		Apply	Cancel

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.

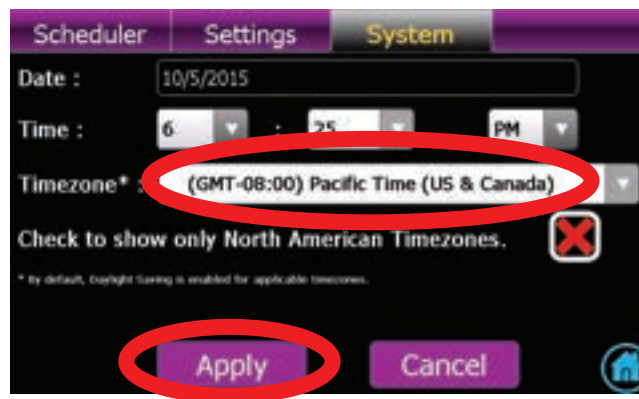


- Select Date field and a calendar will automatically pop-up to allow selection of day, month and year as shown below.



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

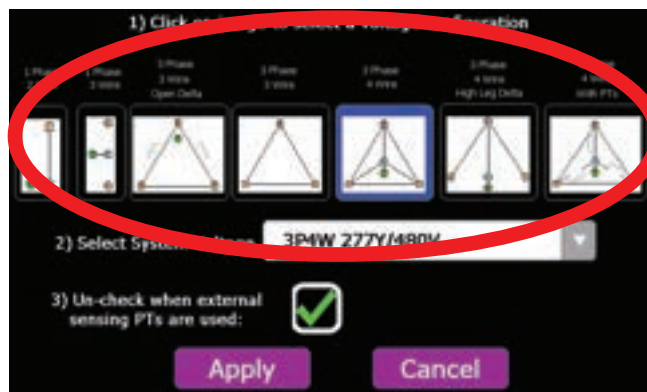
5.5. VOLTAGE CHANGE PROCEDURE

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 the Transfer Switch on either Utility or Generator sources and follow the programming procedure shown below.

NOTE

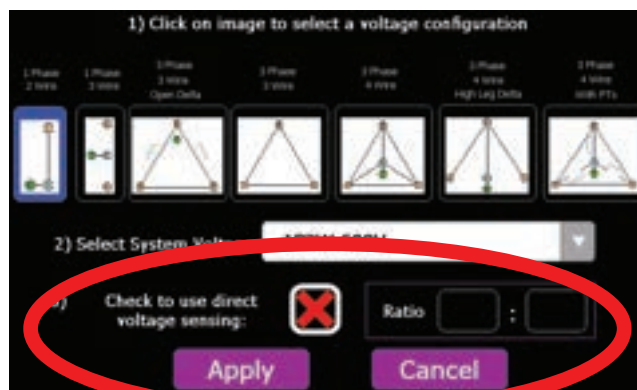
1. The following instructions detail re-programming the TSC 900 controller only. Additional procedures are required to change the voltage sensing transformer taps inside the ATS. Refer to separate ATS model instructions
2. The TSC 900 controller does not contain any voltage jumpers on the printed circuit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



-
- Settings** **System**
- | | Setting | Min | Max | Value |
|-----------|-------------------------|-----|-----|-------|
| Generator | System Voltage | 0 | 600 | 380V |
| CT | System Frequency | 45 | 65 | 60 Hz |
| PT | System Phases | 1 | 3 | 3 |
| TS | Phase Rotation Reversed | 0 | 0 | 0 V |
| | Generator Power | 0 | 1 | 5000W |
- Export Data to SD Card
- Refresh Data

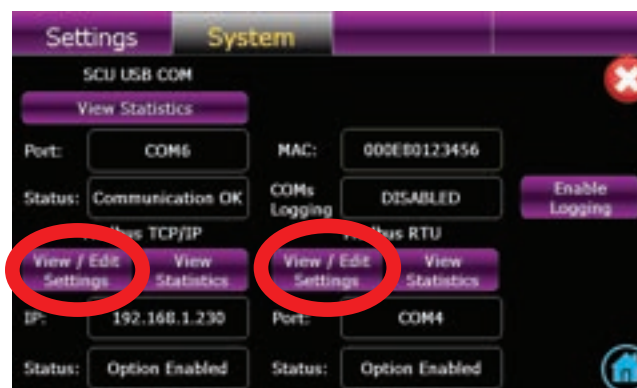
- If utilizing external voltage sensing potential transformers, un-check the identified PT box, then enter the applicable PT primary and secondary winding voltages as shown below. The controller will calculate the required PT ratio for the application.



- 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 Communications Manual.

5.6.1. EMAIL NOTIFICATIONS SETUP

This section provides instructions for setting-up and activating the email notification service of the GHC. When enabled, GHC can send alert emails to subscribed recipients.

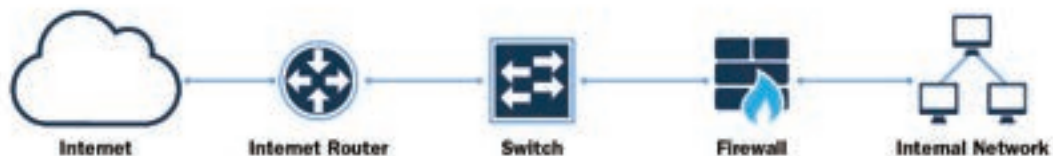
LEGAL DISCLAIMER: To provide email and mobile push notifications TSC900 is employing the use of third party software services and therefore the availability of these services may be impacted by factors outside of TSC 900 control.

These services are provided on an as is and as available basis without any warranties of any kind. In connection with any warranty, contract we shall not be liable for any incidental or consequential damages, lost profits, or damages resulting from lost data or business interruption resulting from the use or inability to access and use the services, even if we have been advised of the possibility of such damages.

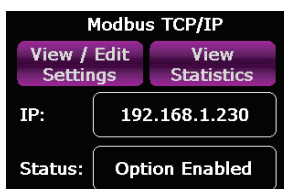
5.6.1.1. PRE-REQUISITES.

To provide access for the email services Internet connection is required. Follow the steps below to connect the GHC to Internet:

- To comply with the best network border protection practices, the GHC must be installed behind a network firewall. For small businesses or isolated locations, the router, switch and firewall functions may be integrated by one device
- For support concerning the network set-up, contact your network IT administrator



- Typically, dynamic IP addresses are used for Internet connected devices. The DHCP server automatically assigns IP addresses and replicates the DNS settings required to connect to the Internet. If Modbus TCP/IP is also enabled on the GHC, the IP address assigned by the DHCP cannot change through GHC reboots. DHCP IP address reservation is required to permanently allocate a specific IP to the MAC address of the GHC device
- Set-up IP Address
 - From the Modbus TCP/IP section select View/Edit Settings select the View/Edit Settings button



- For DHCP addressing, select DHCP from the Address Type dropdown, then press the Apply button. If Static IP addressing is preferred, use the IP Address, Default Gateway and DNS settings provided by your network Administrator

The screenshot shows the 'System' tab in the settings menu. The 'Address Type' is set to 'Static'. The 'IP Address' is 192.168.1.230, 'Subnet Mask' is 255.255.255.0, 'Default Gateway' is 192.168.1.1, and 'DNS' is 192.168.1.1. There are 'Apply' and 'Cancel' buttons on the right.

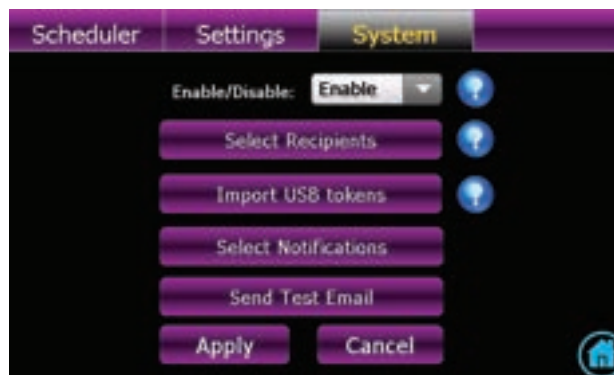
- Internet connection verification
 - To verify the GHC is connected to the internet select the View Statistics button and confirm the Internet Status is Internet access.

The left screenshot shows the 'Modbus TCP/IP' settings with 'View / Edit Settings' and 'View Statistics' buttons. The IP is 192.168.1.230 and the status is 'Option Enabled'. The right screenshot shows the 'System' tab with 'Active TCP Clients' table, 'Ethernet Status' (Cable Connected), 'Internet Status' (Internet access), and 'Modbus TCP Slave Status' (Reply Sent: 38, Request Received: 38, I/O Error: 0). There are 'Reset Count' buttons for each status and a 'Reset All Counts' button at the bottom.

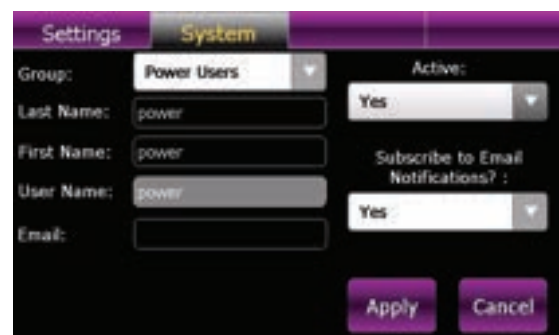
5.6.1.2. EMAIL SETUP

Once the connection to Internet is confirmed, use the System page to select the Email Setup button.

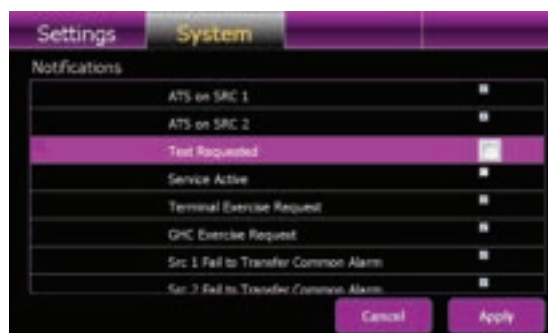
- Select Enable from the dropdown then press the Apply button



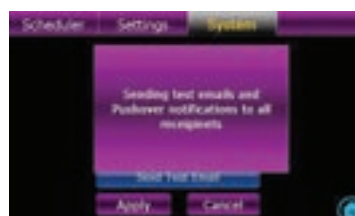
- To subscribe users to the notifications service, press the Select Recipients button, select the corresponding user to edit, enter the email address then confirm setting by pressing the Apply button



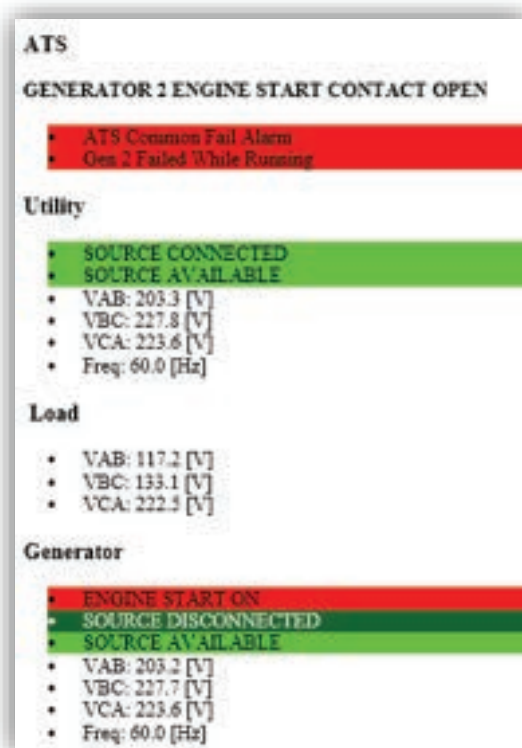
- To select on what type on events the GHC will send emails press the Select Notifications button. Use the check boxes to select the events and press Apply



- To confirm the email service works properly, press the Send Test Email button. A test email will be sent to all subscribed email recipients. Should the GHC fail to connect to the email services, an error message will be displayed



- The GHC is ready to send emails
- The email message is HTML formatted and will display:
 - ATS name (The ATS name is customizable under the Settings > System > ATS Name menu)
 - Event that triggered the notification
 - The active alarms are listed using a red background on separate lines
 - Line voltage and frequency metering information for both sources and the load
 - Source Available/Not Available and Source Connected/Not Connected status
 - Engine Start status for Generators



5.6.2. PUSH NOTIFICATIONS FOR MOBILE SUBSCRIBERS

This section provides instructions for setting-up and activating the push notification service on the GHC. When enabled, the GHC can send push notifications to subscribed recipients. The service is limited to Android and iPhone users.

LEGAL DISCLAIMER: To provide email and mobile push notifications TSC900 is employing the use of third party software services and therefore the availability of these services may be impacted by factors outside of TSC900 control.

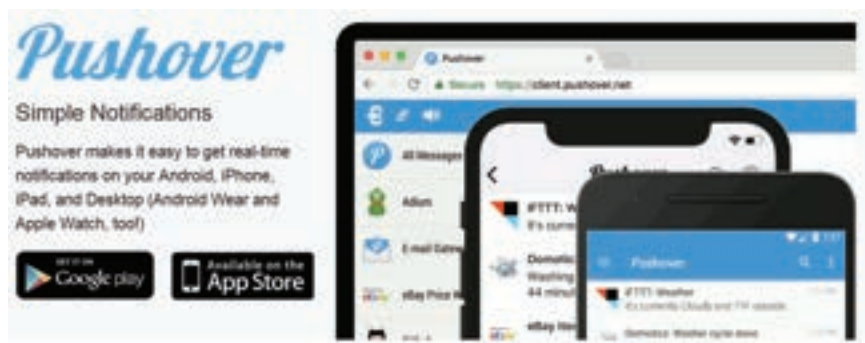
These services are provided on an “as is” and “as available” basis without any warranties of any kind. In connection with any warranty, contract we shall not be liable for any incidental or consequential damages, lost profits, or damages resulting from lost data or business interruption resulting from the use or inability to access and use the services, even if we have been advised of the possibility of such damages.

5.6.2.1. PRE-REQUISITES.

To provide access for the push notification services Internet connection is required. Follow the pre-requisite steps from the previous section [EMAIL NOTIFICATIONS SETUP](#) to connect the GHC to Internet.

5.6.2.1. MOBILE NOTIFICATIONS SETUP.

Use Google Play™ or App Store™ to download the corresponding Android™ or iPhone *Pushover*™ application



- Launch the Pushover app on the phone and follow the steps to sign-up for the Service. A one-time modest activation fee will be charged

- A subscription confirmation email and a token (user key) will be sent to the address provided during registration

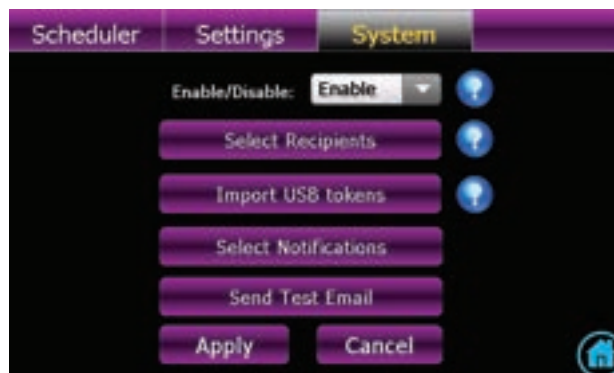


- Use Notepad or a similar text editor application to create a file named pushover.txt and copy/paste the token from the email to it. Multiple tokens can be added on separate lines

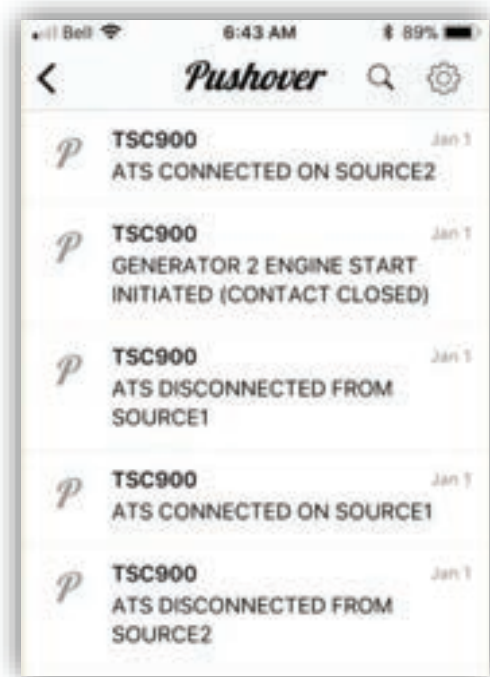
Place the file on a USB thumb drive and insert the drive into the GHC.



- Select the Import USB tokens, then the Apply button



- The subscribed tokens will be registered with the GHC. The GHC will display a success or failure message for the operation
- Select the Send Test Email button to send out test emails and test push notifications to the subscribed email and mobile users
- The GHC is ready send push notifications to mobile users
- If the subscriber is outside the cell phone provider data coverage area an SMS text message will be sent instead



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

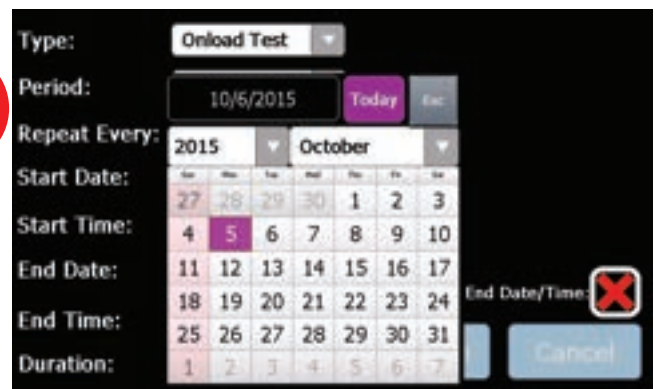
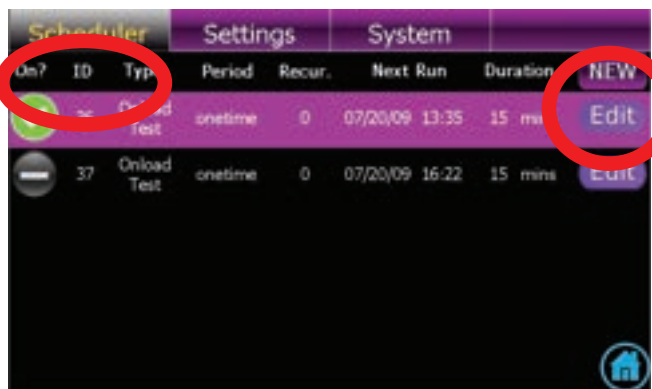
From the GHC Home Page, navigate to the GHC Scheduler page and select New as shown below:



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 870/970 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 870/970 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).

Tag Name	Description
ctl.discon.req.a	Service Disconnect Mode Activated (External Control Switch)
ctl.inputs.i01 to 16	User Def Input 1 to 16
ctl.man.req.a	Transfer Control in Manual (External Control Switch)
ctl.off.req.a	Non-Auto Off Request (Terminal)
ctl.reset.req	Remote Alarm Reset (Momentary Close to Reset)
ctl.rtn.req.a	Manual Return Request (Terminal)
ctl.start.1.remote.a	Off Load Test Request Generator 1
ctl.start.2.remote.a	Off Load Test Request Generator 2
ctl.stdbby.req	Standby Request
ctl.sync.ext.fail	Ext. Sync Check Failed
ctl.synced.ext	Ext. Sync Check Permitted
ctl.unfail.req.a	Unfail Request (Terminal)
ctl.unhalt.req.a	Unhalt Request (Terminal)
ctl.unloaded.1	SRC 1 Unload Permitted
ctl.unloaded.2	SRC 2 Unload Permitted
ilk.xfr.closed.inhibit	Transfer Control in Closed Transition Mode- activate to inhibit (External Control Switch)
ilk.xfr.closed.inhibit.prot	Transfer Control in Closed Transition Mode - activate to permit (External Control Switch)
ilk.xfr.closed.permit	Transfer Control in Closed Transition Mode - activate to permit (External Control Switch)
ilk.xfr.inphase.inhibit	NDT Bypass Inhibit
ilk.xfr.inphase.permit	NDT Bypass Inhibit
ilk.xfr.ndtbypass.inhibit	NDT Bypass Inhibit
ilk.xfr.ndtbypass.permit	NDT Bypass Permit
ilk.xfr.parallel.inhibit	Transfer Control in Closed Transition Mode - Activate to Permit (External Control Switch)
ilk.xfr.parallel.permit	Transfer Control in Closed Transition Mode - Activate to Permit (External Control Switch)
ilk.xfr.revert.inhibit	Transfer Control- Revert to Open Transition inhibited when active
ilk.xfr.revert.permit	Transfer Control- Revert to Open Transition permitted when active
ilk.xfr.soft.inhibit	Transfer Control in Closed Transition Mode - Activate to Permit (External Control Switch)
ilk.xfr.soft.permit	Transfer Control in Closed Transition Mode - activate to permit (External Control Switch)
ilk.xfr.tosrc.1.inhibit	Inhibit Transfer to Utility (Source 1)
ilk.xfr.tosrc.1.permit	Permit Transfer to Utility (Source 1)
ilk.xfr.tosrc.2.inhibit	Inhibit Transfer to Generator (Source 2)
ilk.xfr.tosrc.2.permit	Permit Transfer to Generator (Source 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 (Close to Test)
tip.switch.closed.1	SRC 1 Power Switching Device Closed
tip.switch.closed.2	SRC 1 Power Switching Device Closed
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 Switching Device (USD) Tripped
tip.switch.tripped.2	SRC 2 Power Switching Device (GSD) Tripped
tmr.clr.remote.a	Clear Timers Request (Remote)

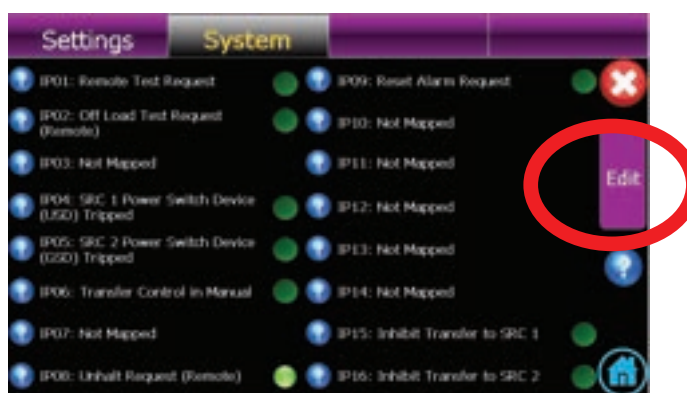
5.8.6. PROGRAMMABLE INPUT FUNCTION MAPPING

To edit programmable inputs, follow the procedure listed below:

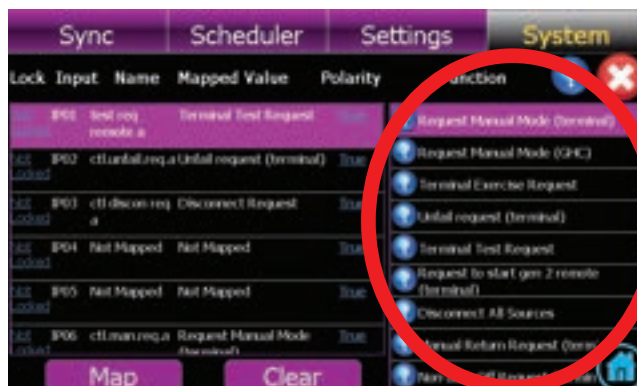
- From the GHC Home Page, navigate to the Systems page and select Input Mapping as shown below:



- With the Input Mapping page displayed, press the Edit button as shown below:



- 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:

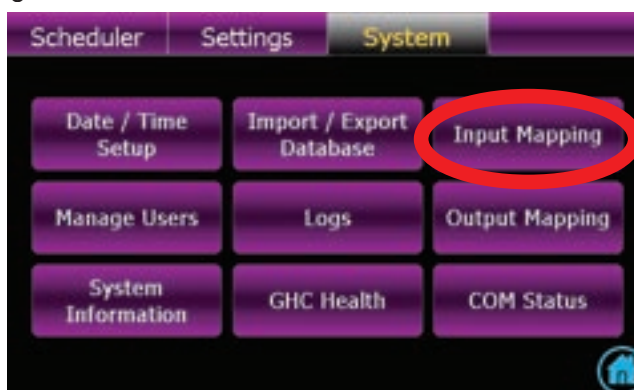


- Once desired function is selected, press Map button to accept the change
- To return to the input mapping page once the change is accepted, press red x icon on the screen

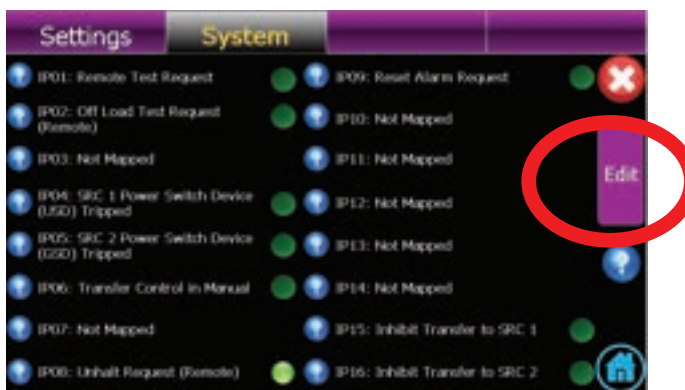
5.8.7. PROGRAMMABLE INPUT USER DEFINED CUSTOM NAME MAPPING

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:

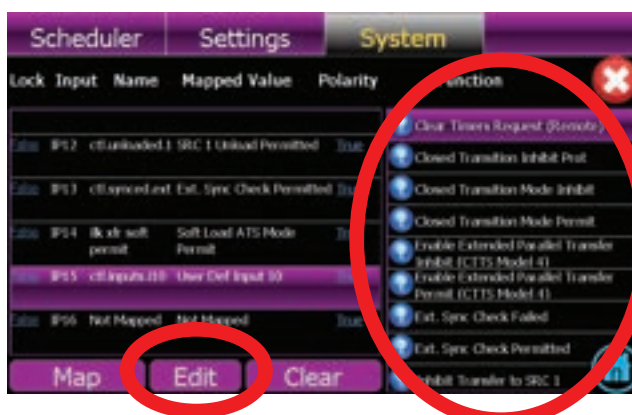
- From the GHC Home Page, navigate to the System page and select Input Mapping as shown below:



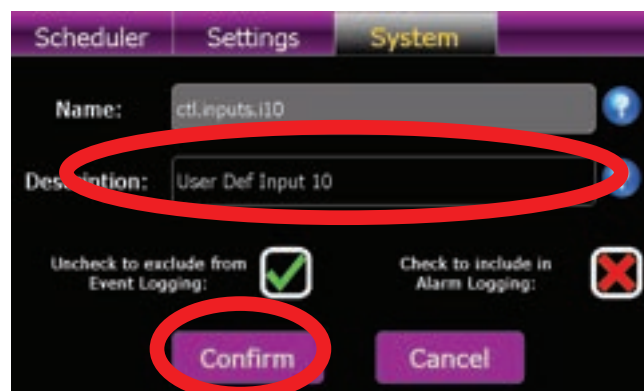
- With the Input Mapping page displayed, press the Edit button as shown below:



- 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:



- 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 button 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	ctl.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.

Tag Name	Description
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 Switch/Aux Contact Failure
alm.xfr.detect.2	Load on Src 2 Limit Switch /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.mech.close.1	Transfer switch mechanism fail to close, Source 1
alm.xfr.mech.close.2	Transfer switch mechanism fail to close, Source 2
alm.xfr.mech.open.1	Transfer switch mechanism fail to open, Source 1
alm.xfr.mech.open.2	Transfer switch mechanism fail to open, Source 2
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.trip.ext.1	Loss of Load Voltage - Src 1 Contacts Open
alm.xfr.trip.ext.2	Loss of Load Voltage - Src 1 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	Trip Breaker SRC 1 (IP04)
ctl.breaker.2.trip	Trip Breaker SRC 2 (IP05)
ctl.discon.req.a	Service Disconnect Mode Activated (External Control Switch)
ctl.discon.req.b	GHC Disconnect Request
ctl.disconnect	Service Entrance Disc. Initiated
ctl.goto.discon	Disconnect All Sources
ctl.goto.man	De-Energize All Sources
ctl.halted	System Halted
ctl.inputs.i01 to 16	User Def Input 1 to16
ctl ldc	Load Disconnect Contact (LDC) (Pre/Post Transfer Output)
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 (Terminal)

ctl.off.req.b	Non-Auto Off Request (GHC)
ctl.outputs.o01 to 08	User Def Output 1 to 8
ctl.reset.req	Remote Alarm Reset (Momentary Close to Reset)
ctl.rtn.req.a	Manual Return Request (Terminal)
ctl.rtn.req.b	Manual Return Request (GHC)
ctl.shed	Load is Shed
ctl.shed.1.out	Load Shed Stage 1 is shed
ctl.shed.2.out	Load Shed Stage 2 is shed
ctl.shed.3.out	Load Shed Stage 3 is shed
ctl.shed.4.out	Load Shed Stage 4 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 Generator 2
ctl.start.2.remote.b	Off Load Test Request (GHC)
ctl.stdb.y.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
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 if closed fails (All Models)
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 Utility (Source 1)
ilk.xfr.tosrc.1.permit	Permit Transfer to Utility (Source 1)
ilk.xfr.tosrc.2.permit	Permit Transfer to Generator (Source 2)
pfs.pref.1	SRC 1 Preferred
pfs.pref.2	SRC 2 Preferred
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 (Close to Test)
test.req.remote.b	GHC Test Request
tip.switch.closed.1	SRC 1 Power Switching Device Closed
tip.switch.closed.2	SRC 1 Power Switching Device Closed
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 Switching Device (USD) Tripped
tip.switch.tripped.2	SRC 2 Power Switching Device (GSD) Tripped
tmr.rtn	ATS in Re-Transfer Mode
tmr.stdby.prf	Wait for Preferred Source
tmr.util.rtn	ATS in Re-Transfer Mode
top.start.1	Engine Start Request SRC 1
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	Source 1 to output
top.switch.tosrc.2	Source 2 to output
trp.load.volt.black	Load Blackout Voltage
trp.src.1.any	SRC 1 Power Fail
trp.src.1.freq.over	SRC 1 Over frequency
trp.src.1.freq.undr	SRC 1 Under frequency
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 Unbalanced voltage
trp.src.1.volt.undr	SRC 1 Under voltage
trp.src.2.any	SRC 2 Power Fail
trp.src.2.freq.over	SRC 2 Over frequency
trp.src.2.freq.undr	SRC 2 Under frequency
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 Unbalanced voltage
trp.src.2.volt.undr	SRC 2 Under voltage
trp.sync.any	Synchronization Out-of-Spec

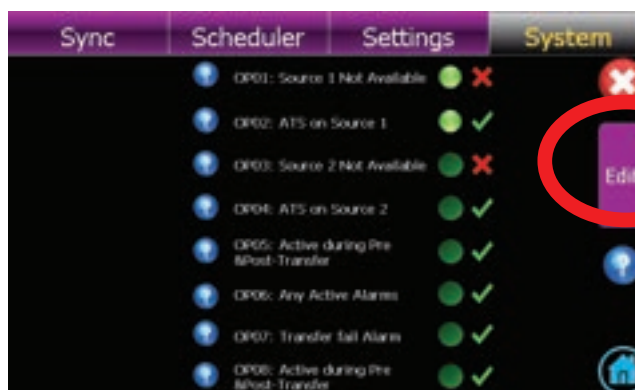
5.9.6. PROGRAMMABLE OUTPUT FUNCTION MAPPING

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

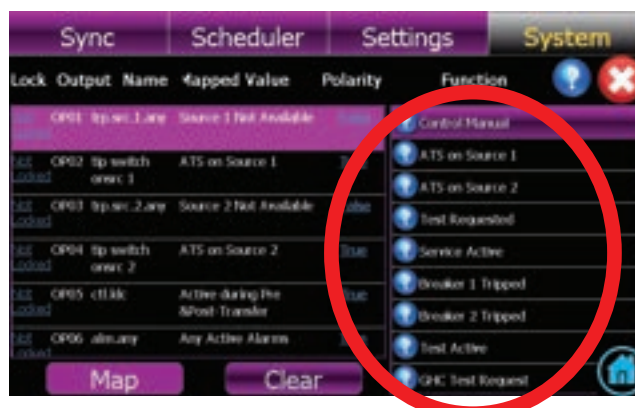
- From the GHC Home Page, navigate to the System page and select Output Mapping as shown below:



- With the Output Mapping page displayed, press the Edit button as shown below:



- 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):

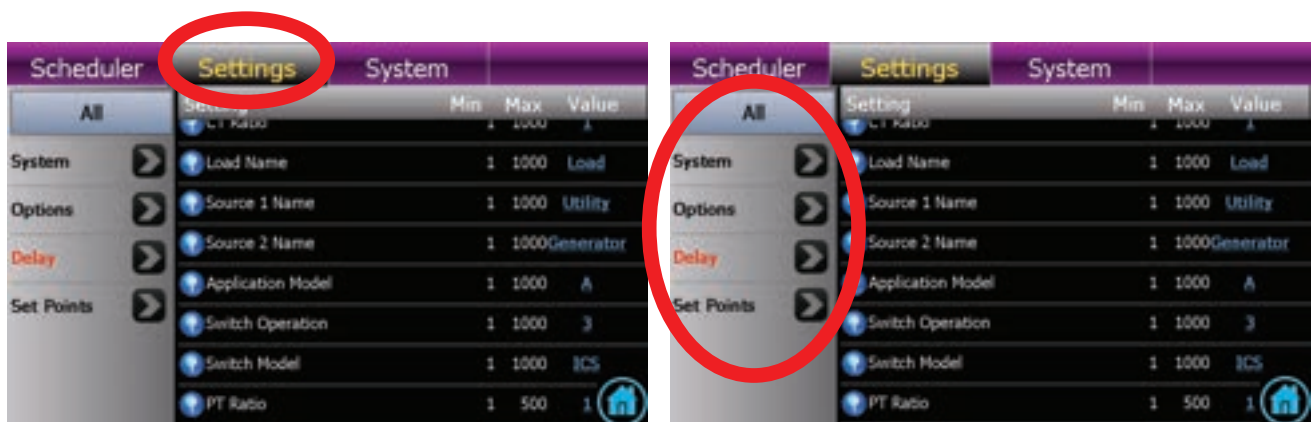


- Once desired function is selected, press Map button to accept the change.
- To return to the output mapping page once the change is accepted, press red x icon on the screen.

5.10. SYSTEM SETTINGS

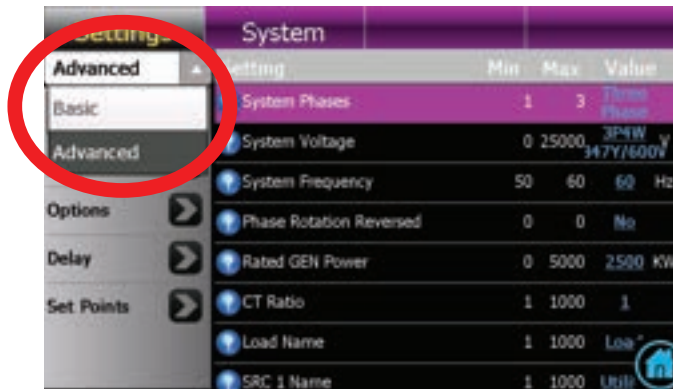
NOTE: For specific device settings and ranges, refer to [SECTION 6](#) - Factory Default Programming.

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 three 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 kW. This setting is utilized for the kW Load Shed setpoint 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. (i.e. 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. generator) 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 (GENERATOR) COMMIT TO TRANSFER

The TSC 900 transfer switch controller contains a SRC 2 (Generator) Commit To Transfer logic selection feature. This feature is user programmable and allows two different functional settings which are described below:

- **NO (DISABLED):** The transfer switch will not 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 generator 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 setpoints to determine when a Load Shed condition is activated. Refer to [SECTION 5.15](#) for programming the Load Shed frequency threshold setpoints.

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 setpoints to determine when a Load Shed condition is activated. Refer to [SECTION 5.15](#) for programming the Load Shed power threshold setpoints.

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 pushbutton 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 two 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.

To disable the sleep mode, set the GHC Sleep Mode Timeout to zero.

5.11.7. LOAD POWER METERING

If the ATS was purchased with the Load Power Metering (LPM) 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 two 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 two 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 Generator logic. This feature is user programmable and allows two 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 Transitions 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 two 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 one 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 select 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 Load Power Metering (LPM) 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) COOLDOWN DELAY

The generator (i.e. engine) cooldown period will be initiated once the load has transferred from the generator supply. The engine start signal will be maintained until expiry of the cooldown delay timer. Select desired generator cooldown delay time in seconds. If no delay is required, set this time delay to zero. Cooldown 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 Generator 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 Warmup delay has expired. If a Generator was started and was running for longer than its Warmup Timer setting, it will wait for the Generator 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) WARMUP DELAY

A transfer to the generator supply will be initiated when the voltage and frequency are within limits and upon expiry of the warmup delay timer. Select desired generator warmup 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 Generator 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 (Generator) 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 (Generator) 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 three 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 (Generator) power switching devices. These timers will be factory set for the specific ATS mechanism type.

5.12.17. TIMER GUARD DELAY

The Timer Guard 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 Warmup delay has expired.

NOTE: If the Standby source was previously energized at normal voltage and frequency levels for longer than its Warmup 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 SETPOINTS (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 setpoints (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 setpoints (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 setpoints 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 setpoint as expressed in percentage of nominal system voltage. The dropout setpoint is the value which the internal sensor de-energizes to an abnormal state when any one phase of the source falls below the setpoint. 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 Pickup Setpoint as expressed in percentage of nominal system voltage. The pick-up setpoint is the value which the internal sensor energizes to a normal state when all phases of the source rise above the setpoint.

5.13.4. OVER VOLTAGE DELAY (PICKUP)

Select the desired source Over Voltage Time Delay setpoint. 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 Dropout setpoint as expressed in percentage of nominal system voltage. The dropout setpoint is the value which the internal sensor de-energizes to a normal state when all phases of the source falls a below the setpoint.

5.13.6. OVER VOLTAGE PICKUP

Set to the desired source Over Voltage Pickup setpoint as expressed in percentage of nominal system voltage. The pick-up setpoint is the value which the internal sensor energizes to an abnormal state when any one phase of the supply rises above the setpoint. 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 setpoint as expressed in percentage of nominal negative sequence voltage. The dropout setpoint is the value which the internal sensor de-energizes to a normal state when all phases of the source falls a below the setpoint.

5.13.10. PHASE UNBALANCE PICK UP

Set to the desired Source Phase Unbalance Pickup setpoint as expressed in percentage of nominal negative sequence voltage. The pick-up setpoint is the value which the internal sensor energizes to an abnormal state when any one phase of the supply rises above the setpoint. 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 setpoint as expressed in percentage of nominal system frequency. The dropout setpoint is the value which the internal sensor de-energizes to an abnormal state when the source's frequency falls below the setpoint. 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 Pickup setpoint as expressed in percentage of nominal system frequency. The pickup setpoint is the value which the internal sensor energizes to a normal state when the source's frequency rises above the setpoint.



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

5.13.16. OVER FREQUENCY PICKUP

Set to the desired Source Over Frequency Pickup setpoint as expressed in percentage of nominal system frequency. The pickup setpoint is the value which the internal sensor energizes to an abnormal state when the source's frequency rises above the setpoint. 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 setpoint is utilized for neutral delay bypass and transfer fail logic. Set to the desired Source Voltage Blackout Dropout setpoint as expressed in percentage of nominal system voltage. The Dropout setpoint is the value which the internal sensor de-energizes to an abnormal state when any one phase of the source voltage falls below the setpoint. A blackout voltage condition will be triggered following expiry of the source voltage time delay setting.

5.13.19. VOLTAGE SOURCE BLACKOUT PICKUP

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

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

5.13.22. VOLTAGE ROTATION REVERSAL PICKUP

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

5.14. LOAD VOLTAGE SETPOINTS

The TSC 900 controller provides 3 phase voltage monitoring of the load. Load voltage setpoints 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 setpoints (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 setpoint is utilized for neutral delay bypass and transfer fail logic. Set to the desired Load Voltage Blackout Dropout setpoint as expressed in percentage of nominal system voltage. The dropout setpoint is the value which the internal sensor de-energizes to an abnormal state when any one phase of the load voltage falls below the setpoint. A blackout voltage condition will be triggered following expiry of the load voltage time delay setting.

5.14.3. LOAD VOLTAGE BLACKOUT PICKUP

This setpoint is utilized for Neutral Delay Bypass and Transfer Fail logic. Set to the desired Load Voltage Blackout Pickup setpoint as expressed in percentage of nominal system voltage. The pick-up setpoint is the value which the internal sensor energizes to a normal state when all phases of the load voltage rises above the setpoint.

5.15. LOAD SHED FREQUENCY & POWER SETPOINTS

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 setpoints 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 setpoints (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.

NOTE

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 setpoint 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 PICKUP

Set to the desired Load Shed Frequency Pickup setpoint as expressed in percentage of nominal system frequency. The pick-up setpoint is the value which the internal sensor energizes to a normal state when the load frequency rises above the setpoint 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 setpoint as expressed in percentage of nominal system frequency. The dropout setpoint is the value which the internal sensor de-energizes to an abnormal state when the load frequency falls below the setpoint 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. 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 Setpoint as expressed in percentage of rated generator power. The dropout setpoint is the value which the internal sensor de-energizes to a normal state when the load kW falls below the setpoint to cause a Load Shed condition to be reset.

5.15.8. LOAD SHED POWER (kW) PICKUP

Set to the desired Load Shed Pickup setpoint as expressed in percentage of rated generator power. The Pickup setpoint is the value which the internal sensor energizes to an abnormal state when the load kW rises above the setpoint 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.

5.15.9. LOAD SHED POWER (kW) PICKUP

Set to the desired Load Shed Pickup setpoint as expressed in percentage of rated generator power. The Pickup setpoint is the value which the internal sensor energizes to an abnormal state when the load kW rises above the setpoint 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.

5.15.10. STAGE 1-4 INSTALLED LOAD (KW)

Set to the estimated installed kW load. Setting ignored if the Enable Shed on Overpower option is not enabled (refer to [SECTION 5.12.3](#)). If a Stage is enabled and not in test mode, the load shed routines will compare the Stage installed kW with the generator reserve kW power and prevent Stage re-connection until enough kW capacity is available. This will prevent load cycling.

5.16. IN-SYNC TRANSFER SETPOINTS

The TSC 900 controller provides setpoints 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.

NOTE: If an external sync check relay is not used, reverse the Ext. Sync Check digital input polarity such way the External Sync permit is always enabled.

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 two 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 Threshold setpoint 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 Threshold setpoint 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 Threshold setpoint 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 Threshold setpoint 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 -600	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
Halt Operation on Phase Reversal	opt.ctl.haltreverse	YES/NO	YES		X	X
Manual SRC 1 (Utility) Retransfer Control	opt.ctl.manrtm	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.haltontail	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 ⁵	opt.ctl.stdbymultistart	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
Enable un-conditional inhibit to the preferred source (CTTS Model 3/4)	opt.ctl.unconrtm	YES/NO	YES			X
Enable low-pass filters in measurement algorithms	opt.meas.filter	YES/NO	NO			X
Email Notifications	opt.mail.notification	YES/NO	NO			X
Enable Start of Multiple GENs When Resuming from Standby ⁵	opt.ctl.stdbymultistart	YES/NO	NO			X
Request Source1 as preferred ²	opt.pfs.req.1	YES/NO	NO		X	X
Request Source2 as preferred ²	opt.pfs.req.2	YES/NO	NO		X	X
ICS coils are maintained energised	opt.coil.maintained	YES/NO	NO		X	X

Delay Settings						
UTIL Return Delay ³	dly.util.rtn	0-1800 sec	300 sec	X	X	X
Gen Cool Down Delay ³	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 ³	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 ⁵	dly.stdbypref	0-300 sec	60 sec		X	X
Transfer From Preferred Source Delay ²	dly.dprt	0-60 sec	5 sec	X	X	X
GEN 1 Cooldown Delay ³	dly.gen.1.cool	0-3600 sec	300sec		X	X
GEN 1 Warmup Delay ³	dly.gen.1.warm	0-3600 sec	2sec		X	X
GEN 2 Cooldown Delay ³	dly.gen.2.cool	0-3600 sec	300sec		X	X
GEN 2 Warmup Delay ³	dly.gen.2.warm	0-3600 sec	2sec		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 utility applications

⁴ Find Neutral Delay S-Style =1.0sec

⁵ Setting only visible in dual gen standby applications

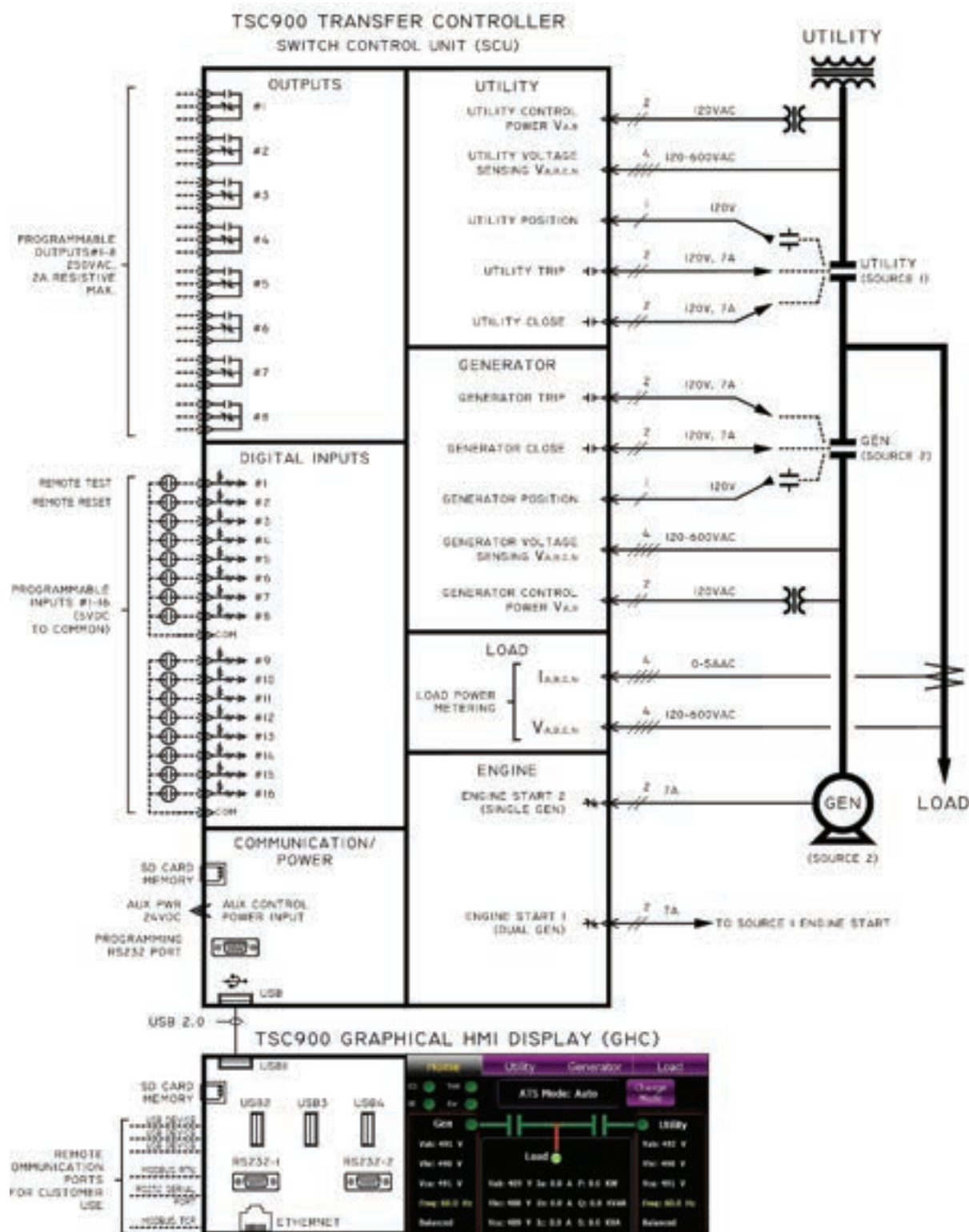


Function	Tag	Range	Factory Default Value	Basic	Advanced	Factory
Source 1 (Utility) Set Points						
SRC 1 (Utility) Under Voltage Delay	stp.vsrc.1.volt.undr.delay	0-10 sec	1 sec		X	X
SRC 1 (Utility) Under Voltage Drop Out	stp.vsrc.1.volt.undr.drop	70-95%	85%	X	X	X
SRC 1 (Utility) Under Voltage Pick Up	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%	10%		X	X
SRC 1 (Utility) Phase Unbalance Pick Up	stp.vsrc.1.volt.unbal.pick	0-100%	15%		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	70-95%	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	2s			X
SRC 1 (Utility) Voltage Rotation Reverse Drop Out	stp.vsrc.1.volt.unbal.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	0-1 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%	10%		X	X
SRC 2 (Gen) Phase Unbalance Pick Up	stp.vsrc.2.volt.unbal.pick	0-100%	15%		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



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
In-Sync Transfer Set Points (Applicable only to CTTS Model)						
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
LOAD shed setpoints (Applicable only to standard Uti-Gen Configuration)						
Enable Load Shed on Under Frequency	opt.shed.freq	YES/NO	YES		X	X
Shed On Freq Delay	dly.shed.freq	0-3600 sec	5sec		X	X
Enable Load Shed on Over Power	opt.shed.power	YES/NO	YES		X	X
Shed On Power Delay	dly.shed.power	0-3600 sec	10sec		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
Stage 1 installed load	stp.shed.stage.1.load	0-100000kw	0kw		X	X
Stage 2 installed load	stp.shed.stage.2.load	0-100000kw	0kw		X	X
Stage 3 installed load	stp.shed.stage.3.load	0-100000kw	0kw		X	X
Stage 4 installed load	stp.shed.stage.4.load	0-100000kw	0kw		X	X
Restore delay stage 1	dly.restore.1.power	0-3600 sec	10sec		X	X
Restore delay stage 2	dly.restore.2.power	0-3600 sec	10sec		X	X
Restore delay stage 3	dly.restore.3.power	0-3600 sec	10sec		X	X
Restore delay stage 4	dly.restore.4.power	0-3600 sec	10sec		X	X
Load Shed Init Delay	dly.shed.init	0-3600 sec	0sec		X	X
Load Shed Stage 1 Option	opt.shed.1	YES/NO	YES		X	X
Load Shed Stage 2 Option	opt.shed.2	YES/NO	NO		X	X
Load Shed Stage 3 Option	opt.shed.3	YES/NO	NO		X	X
Load Shed Stage 4 Option	opt.shed.4	YES/NO	NO		X	X
Load Shed Shed All on Transfer	opt.shed.power	YES/NO	NO		X	X
Advanced Load Shed Option	opt.shed	YES/NO	NO		X	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

Several 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
	Warmup 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: Email sales@thomsonps.com

Warranty replacement/Warranty Repair: Email support@thomsonps.com

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

[illegible]



Thomson Power Systems
9087A - 198th Street
Langley, BC, Canada V1M 3B1

Customer Support: 604-888-0110
Toll Free: 1-888-888-0110
Sales Email: sales@thomsonps.com
Service Email:

For Preventative Maintenance or Extended Warranty information contact our
Service Department at 604-888-0110 or email support@thomsonps.com

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SECTION IV

Documents

SINCE 1936

San Leandro, CA | www.petersonpower.com | Hillsboro, OR

Effective with sales to the first user on or after July 1, 2021

CATERPILLAR LIMITED WARRANTY

Industrial, Petroleum, Locomotive, and Agriculture Engine Products and Electric Power Generation Products

Worldwide

Caterpillar Inc. or any of its subsidiaries ("Caterpillar") warrants new and remanufactured engines and new and rebuild electric power generation products sold by it (including any products of other manufacturers packaged and sold by Caterpillar), to be free from defects in material and workmanship.

This warranty does not apply to engines sold for use in on-highway vehicle or marine applications; engines in machines manufactured by or for Caterpillar; C175, 3500 and 3600 series engines used in locomotive applications; 3000 Family engines, C0.5 through C4.4 and ACERT™ (C6.6, C7, C7.1, C9, C9.3, C11, C13, C15, C18, C27, and C32) engines used in industrial, mobile agriculture and locomotive applications; or Cat[®] batteries; or Electric Power Generation Products manufactured or assembled in India. These products are covered by other Caterpillar warranties.

This warranty is subject to the following:

Warranty Period

- For industrial engines, engines in a petroleum applications or Petroleum Power Systems (excluding petroleum fire pump application), or engines in a Locomotive application, or Uninterruptible Power Supply (UPS) systems, the warranty period is 12 months after date of delivery to the first user.
- For engines used in petroleum fire pump and mobile agriculture applications the warranty period is 24 months after date of delivery to the first user.
- For controls only (EPIC), configurable and custom switchgear products, and automatic transfer switch products, the warranty period is 24 months after date of delivery to the first user.
- For new CG132, CG170 and CG260 series power generation products the warranty period is 24 months after date of delivery to first user, but not to exceed 36 months from shipment from the Caterpillar place of manufacture.
- For electric power generation products other than CG132, CG170 and CG260 series in prime or continuous applications the warranty period is 12 months. For standby applications the warranty period is 24 months/1000 hours. For emergency standby applications the warranty period is 24 months/400 hours. All terms begin after date of delivery to the first user.
- For Caterpillar rebuild electric power generation products the warranty period is 12 months, but not to exceed 24 months from shipment of rebuilt electric power generation product from Caterpillar.
- For all other applications the warranty period is 12 months after date of delivery to the first user.

Caterpillar Responsibilities

If a defect in material or workmanship is found during the warranty period, Caterpillar will, during normal working hours and at a place of business of a Cat dealer or other source approved by Caterpillar:

- Provide (at Caterpillar's choice) new, Remanufactured, or Caterpillar approved repaired parts or assembled components needed to correct the defect.
- Note:** New, remanufactured, or Caterpillar approved repaired parts or assembled components provided under the terms of this warranty are warranted for the remainder of the warranty period applicable to the product in which installed as if such parts were original components of that product. Items replaced under this warranty become the property of Caterpillar.
- Replace lubricating oil, filters, coolant, and other service items made unusable by the defect.
- Provide reasonable and customary labor needed to correct the defect, including labor to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems, if required.

For new 3114, 3116, and 3126 engines and, new and Caterpillar rebuild electric power generation products (which includes the following: any new products of other manufacturers packaged and sold by Caterpillar)

- Provide travel labor, up to four hours round trip, if in the opinion of Caterpillar, the product cannot reasonably be transported to a place of business of a Cat dealer or other source approved by Caterpillar (travel labor in excess of four hours round trip, and any meals, mileage, lodging, etc. is the user's responsibility).

For all other products:

- Provide reasonable travel expenses for authorized mechanics, including meals, mileage, and lodging, when Caterpillar chooses to make the repair on-site.

User Responsibilities

The user is responsible for:

- Providing proof of the delivery date to the first user.
- Labor costs, except as stated under "Caterpillar Responsibilities," including costs beyond those required to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems.
- Travel or transporting costs, except as stated under "Caterpillar Responsibilities."

- Premium or overtime labor costs.
- Parts shipping charges in excess of those that are usual and customary.
- Local taxes, if applicable.
- Costs to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.
- Performance of the required maintenance (including use of proper fuel, oil, lubricants, and coolant) and items replaced due to normal wear and tear.
- Allowing Caterpillar access to all electronically stored data.

Limitations

Caterpillar is not responsible for:

- Failures resulting from any use or installation that Caterpillar judges improper.
- Failures resulting from attachments, accessory items, and parts not sold or approved by Caterpillar.
- Failures resulting from abuse, neglect, and/or improper repair.
- Failures resulting from user's delay in making the product available after being notified of a potential product problem.
- Failures resulting from unauthorized repairs or adjustments, and unauthorized fuel setting changes.
- Damage to parts, fixtures, housings, attachments, and accessory items that are not part of the engine, Cat Selective Catalytic Reduction System or electric power generation product (including any products of other manufacturers packaged and sold by Caterpillar).
- Repair of components sold by Caterpillar that is warranted directly to the user by their respective manufacturer. Depending on type of application, certain exclusions may apply. Consult your Cat dealer for more information.

(Continued on reverse side...)

This warranty covers every major component of the products. Claims under this warranty should be submitted to a place of business of a Cat dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write Caterpillar Inc., 100 N. E. Adams St., Peoria, IL USA 61629.

Caterpillar's obligations under this Limited Warranty are subject to, and shall not apply in contravention of, the laws, rules, regulations, directives, ordinances, orders, or statutes of the United States, or of any other applicable jurisdiction, without recourse or liability with respect to Caterpillar.

A) For products operating outside of Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT CATERPILLAR EMISSION-RELATED COMPONENTS WARRANTIES FOR NEW ENGINES, WHERE APPLICABLE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN.

CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.

For personal or family use engines or electric power generation products, operating in the USA, its territories and possessions, some states do not allow limitations on how long an implied warranty may last nor allow the exclusion or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary by jurisdiction. To find the location of the nearest Cat dealer or other authorized repair facility, call (309) 675-1000. If you have questions concerning this warranty or its applications, call or write:

In USA and Canada: Caterpillar Inc, 100 N.E. Adams St., Peoria, IL USA 61629, Attention: Customer Service Manager, Telephone 1 (309) 675-1000, outside the USA and Canada: Contact your Cat dealer.

B) For products operating in Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

THIS WARRANTY IS IN ADDITION TO WARRANTIES AND CONDITIONS IMPLIED BY STATUTE AND OTHER STATUTORY RIGHTS AND OBLIGATIONS THAT BY ANY APPLICABLE LAW CANNOT BE EXCLUDED, RESTRICTED OR MODIFIED ("MANDATORY RIGHTS"). ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED (BY STATUTE OR OTHERWISE), ARE EXCLUDED. WITHOUT LIMITING THE FOREGOING PROVISIONS OF THIS PARAGRAPH, WHERE A PRODUCT IS SUPPLIED FOR BUSINESS PURPOSES, THE CONSUMER GUARANTEES UNDER THE CONSUMER GUARANTEES ACT 1993 (NZ) WILL NOT APPLY.

NEITHER THIS WARRANTY NOR ANY OTHER CONDITION OR WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED (SUBJECT ONLY TO THE MANDATORY RIGHTS), IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

IF THE MANDATORY RIGHTS MAKE CATERPILLAR LIABLE IN CONNECTION WITH SERVICES OR GOODS, THEN TO THE EXTENT PERMITTED UNDER THE MANDATORY RIGHTS, THAT LIABILITY SHALL BE LIMITED AT CATERPILLAR'S OPTION TO (a) IN THE CASE OF SERVICES, THE SUPPLY OF THE SERVICES AGAIN OR THE PAYMENT OF THE COST OF HAVING THE SERVICES SUPPLIED AGAIN AND (b) IN THE CASE OF GOODS, THE REPAIR OR REPLACEMENT OF THE GOODS, THE SUPPLY OF EQUIVALENT GOODS, THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT GOODS.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

CATERPILLAR IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES UNLESS IMPOSED UNDER MANDATORY RIGHTS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.

C) For products supplied in Australia:

IF THE PRODUCTS TO WHICH THIS WARRANTY APPLIES ARE:

I. PRODUCTS OF A KIND ORDINARILY ACQUIRED FOR PERSONAL, DOMESTIC OR HOUSEHOLD USE OR CONSUMPTION; OR

II. PRODUCTS THAT COST AUD 100,000 OR LESS,

WHERE THOSE PRODUCTS WERE NOT ACQUIRED FOR THE PURPOSE OF RE-SUPPLY OR FOR THE PURPOSE OF USING THEM UP OR TRANSFORMING THEM IN THE COURSE OF PRODUCTION OR MANUFACTURE OR IN THE COURSE OF REPAIRING OTHER GOODS OR FIXTURES, THEN THIS SECTION C APPLIES.

THE FOLLOWING MANDATORY TEXT IS INCLUDED PURSUANT TO THE AUSTRALIAN CONSUMER LAW AND INCLUDES REFERENCES TO RIGHTS THE USER MAY HAVE AGAINST THE DIRECT SUPPLIER OF THE PRODUCTS: OUR GOODS COME WITH GUARANTEES THAT CANNOT BE EXCLUDED UNDER THE AUSTRALIAN CONSUMER LAW. YOU ARE ENTITLED TO A REPLACEMENT OR REFUND FOR A MAJOR FAILURE AND COMPENSATION FOR ANY OTHER REASONABLY FORESEEABLE LOSS OR DAMAGE. YOU ARE ALSO ENTITLED TO HAVE THE GOODS REPAIRED OR REPLACED IF THE GOODS FAIL TO BE OF ACCEPTABLE QUALITY AND THE FAILURE DOES NOT AMOUNT TO A MAJOR FAILURE. THE INCLUSION OF THIS TEXT DOES NOT CONSTITUTE ANY REPRESENTATION OR ACCEPTANCE BY CATERPILLAR OF LIABILITY TO THE USER OR ANY OTHER PERSON IN ADDITION TO THAT WHICH CATERPILLAR MAY HAVE UNDER THE AUSTRALIAN CONSUMER LAW.

TO THE EXTENT THE PRODUCTS FALL WITHIN THIS SECTION C BUT ARE NOT OF A KIND ORDINARILY ACQUIRED FOR PERSONAL, DOMESTIC OR HOUSEHOLD USE OR CONSUMPTION, CATERPILLAR LIMITS ITS LIABILITY TO THE EXTENT IT IS PERMITTED TO DO SO UNDER THE AUSTRALIAN CONSUMER LAW TO, AT ITS OPTION, THE REPAIR OR REPLACEMENT OF THE PRODUCTS, THE SUPPLY OF EQUIVALENT PRODUCTS, OR THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT PRODUCTS.

THE WARRANTY SET OUT IN THIS DOCUMENT IS GIVEN BY CATERPILLAR INC. OR ANY OF ITS SUBSIDIARIES, 100 N. E. ADAMS ST, PEORIA, IL USA 61629, TELEPHONE 1 309 675 1000, THE USER IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH MAKING A CLAIM UNDER THE WARRANTY SET OUT IN THIS DOCUMENT, EXCEPT AS EXPRESSLY STATED OTHERWISE IN THIS DOCUMENT, AND THE USER IS REFERRED TO THE BALANCE OF THE DOCUMENT TERMS CONCERNING CLAIM PROCEDURES, CATERPILLAR RESPONSIBILITIES AND USER RESPONSIBILITIES.

TO THE EXTENT PERMISSIBLE BY LAW, THE TERMS SET OUT IN THE REMAINDER OF THIS WARRANTY DOCUMENT (INCLUDING SECTION B) CONTINUE TO APPLY TO PRODUCTS TO WHICH THIS SECTION C APPLIES.

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Effective with sales to the first user on or after March 16, 2020

CATERPILLAR LIMITED WARRANTY

BATTERY

Worldwide

Caterpillar Inc, or any of its subsidiaries ("Caterpillar") warrants new batteries sold by it to be free from failures caused by defects in material and workmanship.

This warranty does not apply to:

- Cat® Energy Storage Systems
- Yellowmark™, A Caterpillar Brand batteries

This warranty is subject to the following:

- The warranty period is identified in the following table, starting from the date of battery sale or product delivery to the first user.

Application	Battery Type	
	Premium	General Service Line
	Warranty Period	Warranty Period
For lead acid starting batteries all applications covered by this warranty.	24 Months	12 Months
For Uninterruptible Power Supply (UPS), telecommunications, and electric power generation standby applications with separate charging systems (with respect to valve-regulated AGM (Absorbed Glass Mat) batteries).	N/A	12 Months
For deep cycle applications or applications without constant battery charging systems (i.e., auxiliary batteries for marine pleasure craft or recreational vehicles; electric trolling motor or golf cart applications which use batteries as their motive power; lawn garden applications, etc.).	3 Months	3 Months

Caterpillar Responsibilities

- Within the periods stated in the table under Warranty Period," Caterpillar will replace a battery, which it finds to be defective in material or workmanship with a new comparable battery at no cost to the user.
- This warranty will be honored upon return of the battery, during normal working hours, to a Cat dealer or other source approved by Caterpillar.

User Responsibilities

The user is responsible for:

- Providing proof of the date of battery sale or product delivery date to the first user.
- Taxes, installation, or transportation costs, which may result from replacement, are not included in this warranty.
- Expense identified as user cost under "Caterpillar Responsibilities".
- Costs to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.
- Performance of the required maintenance.

Limitations

Caterpillar is not responsible for:

- Failures resulting from any use or installation that Caterpillar judges improper.
- Failures resulting from abuse, neglect and/or improper repair.
- Failures resulting from user's delay in making the product available after being notified of a potential product problem.
- Failures resulting from unauthorized repairs or adjustments.

(Continued on reverse side...)

This warranty covers every major component of the products. Claims under this warranty should be submitted to a place of business of a Caterpillar dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write Caterpillar Inc., 100 N.E. Adams St., Peoria, IL USA 61629, telephone 1 (309) 675-1000, or go to URL, www.cat.com, Find Your Dealer

Caterpillar's obligations under this Limited Warranty are subject to, and shall not apply in contravention of, the laws, rules, regulations, directives, ordinances, orders, or statutes of the United States, or of any other applicable jurisdiction, without recourse or liability with respect to Caterpillar.

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THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN.

CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS, OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

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C) For products supplied in Australia:

IF THE PRODUCTS TO WHICH THIS WARRANTY APPLIES ARE:

I. PRODUCTS OF A KIND ORDINARILY ACQUIRED FOR PERSONAL, DOMESTIC OR HOUSEHOLD USE OR CONSUMPTION; OR

II. PRODUCTS THAT COST AUD 40,000 OR LESS,

WHERE THOSE PRODUCTS WERE NOT ACQUIRED FOR THE PURPOSE OF RE-SUPPLY OR FOR THE PURPOSE OF USING THEM UP OR TRANSFORMING THEM IN THE COURSE OF PRODUCTION OR MANUFACTURE OR IN THE COURSE OF REPAIRING OTHER GOODS OR FIXTURES, THEN THIS SECTION C APPLIES.

THE FOLLOWING MANDATORY TEXT IS INCLUDED PURSUANT TO THE AUSTRALIAN CONSUMER LAW AND INCLUDES REFERENCES TO RIGHTS THE USER MAY HAVE AGAINST THE DIRECT SUPPLIER OF THE PRODUCTS: OUR GOODS COME WITH GUARANTEES THAT CANNOT BE EXCLUDED UNDER THE AUSTRALIAN CONSUMER LAW. YOU ARE ENTITLED TO A REPLACEMENT OR REFUND FOR A MAJOR FAILURE AND COMPENSATION FOR ANY OTHER REASONABLY FORESEEABLE LOSS OR DAMAGE. YOU ARE ALSO ENTITLED TO HAVE THE GOODS REPAIRED OR REPLACED IF THE GOODS FAIL TO BE OF ACCEPTABLE QUALITY AND THE FAILURE DOES NOT AMOUNT TO A MAJOR FAILURE. THE INCLUSION OF THIS TEXT DOES NOT CONSTITUTE ANY REPRESENTATION OR ACCEPTANCE BY CATERPILLAR OF LIABILITY TO THE USER OR ANY OTHER PERSON IN ADDITION TO THAT WHICH CATERPILLAR MAY HAVE UNDER THE AUSTRALIAN CONSUMER LAW.

TO THE EXTENT THE PRODUCTS FALL WITHIN THIS SECTION C BUT ARE NOT OF A KIND ORDINARILY ACQUIRED FOR PERSONAL, DOMESTIC OR HOUSEHOLD USE OR CONSUMPTION, CATERPILLAR LIMITS ITS LIABILITY TO THE EXTENT IT IS PERMITTED TO DO SO UNDER THE AUSTRALIAN CONSUMER LAW TO, AT ITS OPTION, THE REPAIR OR REPLACEMENT OF THE PRODUCTS, THE SUPPLY OF EQUIVALENT PRODUCTS, OR THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT PRODUCTS.

THE WARRANTY SET OUT IN THIS DOCUMENT IS GIVEN BY CATERPILLAR INC. OR ANY OF ITS SUBSIDIARIES, 100 N. E. ADAMS ST, PEORIA, IL USA 61629, TELEPHONE 1 309 675 1000, THE USER IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH MAKING A CLAIM UNDER THE WARRANTY SET OUT IN THIS DOCUMENT, EXCEPT AS EXPRESSLY STATED OTHERWISE IN THIS DOCUMENT, AND THE USER IS REFERRED TO THE BALANCE OF THE DOCUMENT TERMS CONCERNING CLAIM PROCEDURES, CATERPILLAR RESPONSIBILITIES AND USER RESPONSIBILITIES.

TO THE EXTENT PERMISSIBLE BY LAW, THE TERMS SET OUT IN THE REMAINDER OF THIS WARRANTY DOCUMENT (INCLUDING SECTION B) CONTINUE TO APPLY TO PRODUCTS TO WHICH THIS SECTION C APPLIES.

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Caterpillar® Offers Sourcewell Members Extended Service Contract with Purchase of Standby Generator Sets

Effective on delivery August 1, 2016, through December 31, 2022



A Complimentary Platinum 4 Year Extended Service Contract (ESC) is yours when you purchase a Cat® Standby generator using the Sourcewell contract.

Now when you purchase a diesel generator set (excluding Tier 4) or gas generator set (450 kW and below) sold into standby applications, you'll receive a complimentary Platinum 4 Year ESC with no deductible. Run the generator up to 500 hours/year? It still qualifies as standby.

You may extend the ESC up to 10 years for an additional charge. Cat units are also eligible to upgrade to Platinum Plus Coverage.

(excludes Prime rated, Rental/Mobile, Cat GC and Large Gas products).

To learn more about Cat Electric Power, visit www.cat.com/powergeneration.



Call Sourcewell today at 1-888-894-1930, to identify your participating Cat Dealer, or visit the Sourcewell website for more information: <http://goo.gl/neIJAE>. Reference Cat Sourcewell contract #120617

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CATERPILLAR®
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Cat® Extended Service Coverage (ESC)

4 EASY STEPS TO PROTECT YOUR STANDBY GENERATOR SET

Your operation depends on reliable power. That’s why you trust Cat® generator sets. With Cat Financial Insurance Services, you get service coverage that’s just as durable and long-lasting. ESC for **new, used and overhauled standby generator sets** protects your investment and your peace of mind. Choosing coverage is as easy as following these four steps.

1 CHOOSE FROM A VARIETY OF COVERAGE OPTIONS

First, extend your protection beyond the original factory warranty by choosing the coverage option that’s right for your situation.

NEW ESC	Coverage for electric power standby generator sets is available in 36- to 120- month terms, in 12-month increments, if purchased before the end of your original factory warranty.
ADVANTAGE ESC	Coverage is available after the end of the original factory warranty in 12- to 60-month terms, in 12-month increments, and before the first overhaul. Your standby generator set is eligible if: > It’s less than four years from delivery date and accumulated less than 3,000 hours total use since new, OR > It’s less than 10 years from build date AND currently enrolled in New ESC or Advantage ESC, OR > It’s less than 10 years from build date AND currently covered by an authroized Cat dealer Customer Support Agreement (CSA), OR > It passes a qualifying inspection performed by an authorized Cat dealer in accordance with the Advantage Certification Inspection Worksheet.
OVERHAUL PROTECTION FOR COMMERCIAL (OPC) ESC	Coverage is available in 12- to 60- month terms, in 12-month increments. Your standby generator set is eligible once a qualifying overhaul has been completed by an authorized Cat dealer in accordance with the OPC Certification Worksheet.

2 IDENTIFY YOUR COVERAGE NEEDS

Next, identify the age and current operating hours of your generator set since delivery or overhaul. Then calculate your annual hours of use to choose the best ESC coverage terms to fit your needs.

BUILT FOR IT.™



3 SELECT YOUR COVERAGE LEVEL

Then, choose from our Silver, Gold, Platinum or Platinum Plus coverage levels to get the exact amount of protection you need based on the Coverage Matrix¹ and Additional Allowances.

COVERAGE MATRIX¹- PLATINUM PLUS

Cooling System	Silver	Gold	Platinum ²
Thermostat Housing	✓	✓	✓
Water Manifold Housing	✓	✓	✓
Jacket Water Precooler	✓	✓	✓
Jacket Water Pump		✓	✓
Thermostat			✓
Radiator & Fan			✓
Fuel System			
Steel Fuel Lines	✓	✓	✓
Fuel Shutoff Solenoid	✓	✓	✓
Fuel Injectors		✓	✓
Fuel Transfer Pump & Housing			✓
Fuel Priming Pump			✓
Fuel Transfer Pump			✓
Lubrication System			
Pan, Pump Cooler	✓	✓	✓
Crankcase Breather			✓
Engine Oil Pump Drive			✓
Prelubrication Pump			✓
Electric System			
Control Module (ECM)	✓	✓	✓
Sensors: All Engine Sensors	✓	✓	✓
Wiring Harness & Connectors			✓
Starter			✓
Engine Alternator			✓
Alternator End			
Alternator, including Rotor, Stator and Exciter	✓	✓	✓
Generator Controls		✓	✓
Power Center		✓	✓

Air Induction & Exhaust	Silver	Gold	Platinum ²
Exhaust Manifolds, Studs & Gaskets	✓	✓	✓
Inlet Air Heater Relay	✓	✓	✓
Intake Manifold	✓	✓	✓
Turbocharger(s)		✓	✓
Air-to-Air Aftercooler Cores			✓
Muffler/Exhaust System			✓
Exhaust Guards			✓
Diesel Oxydation Catalyst			✓
Short Block			
Cylinder Block Casting	✓	✓	✓
Crankshaft	✓	✓	✓
Connecting Rod Assembly	✓	✓	✓
Piston, Wrist Pin, Retainer Clip & Piston Rings	✓	✓	✓
Idle and Timing Gears			✓
Accessory Drive			✓
Cylinder Head			
Cylinder Head	✓	✓	✓
Intake & Exhaust Valves	✓	✓	✓
Valve Mechanism	✓	✓	✓
Camshaft, Camshaft Bearings, Key, Gear	✓	✓	✓
Front & Rear Covers			
Front Cover/Plate/Housing/Gears & Gaskets	✓	✓	✓
Vibration Damper	✓	✓	✓
Flywheel Housing & Gasket	✓	✓	✓
Crankshaft Front & Rear Seal			✓
Optional Aftertreatment Coverage			
Diesel Particulate Filter	✓ ³	✓ ³	✓ ³
Selective Catalytic Reduction	✓ ³	✓ ³	✓ ³

1 This Coverage Matrix is for reference only and does not represent a complete list of covered components. For additional information, please reference the appropriate ESC contract.

2 Platinum level coverage covers all as-shipped consist from the factory with Cat part numbers. Some exclusions may apply.

3 Recent emissions-compliant engines or generator sets may be equipped with a Diesel Particulate Filter (DPF) and/or a Selective Catalytic Reduction (SCR). We offer coverage at an additional costs on these emissions components. Silver, Gold, Platinum or Platinum Plus base level coverage is required.

Platinum Plus coverage covers all components covered by Platinum coverage plus additional Cat components, having a Cat part number, installed by an authorized dealer and approved using the Platinum Plus Additional Coverage Component List and Approval Verification form.

ADDITIONAL ALLOWANCES

	Travel/Mileage Limitations		Emergency Freight	Rental ⁵		Crane & Rigging ⁶	Overtime
Engine Displacement ⁴	Silver, Gold, Platinum	Platinum Plus Only	All Coverage Levels	Platinum Only	Platinum Plus Only	Platinum Plus Only	Platinum Plus Only
Up to 4 liters	2 hr/100 mi	10 hr/500 mi	\$500	\$2,500	\$5,000	\$1,000	\$1,500
Over 4 liters up to 7.5 liters	4 hr/200 mi	10 hr/500 mi	\$500	\$5,000	\$10,000	\$1,000	\$1,500
Over 7.5 liters up to 34 liters		10 hr/500 mi	\$500	\$10,000	\$20,000	\$5,000	\$1,500
Over 34 liters	8 hr/320 mi	10 hr/500 mi	\$500	\$15,000	\$40,000	\$12,500	\$1,500

4 Please refer to the generator set spec sheets for particular engine displacement.

5 Allowance is granted if covered failure repairs cannot be completed within 96 hours (for Platinum) or 48 hours (for Platinum Plus) of the authorized dealer technician's initial visit.

6 Allowance is granted if covered failure repairs cannot be completed within 48 hours of the authorized dealer technician's initial visit.

4 PURCHASE AND REGISTER YOUR ESC

Finally, work with your local Cat dealer to complete the process—and get the protection and peace of mind you deserve.

This is a brief description of ESC. It is subject to change without notice. In case of conflict, the ESC contract will govern.

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ULCERT
UL 2200 LISTING

INCLUDES THE FOLLOWING:

ALTERNATOR

Alternator insulation system is UL Recognized (UL 1446). PMG and AREP alternators are available. Automatic voltage regulators are UL Recognized.

WIRE HARNESS

AC, DC, and power harnesses are made with UL Listed wire and UL Listed terminals.

CONTROL PANEL

Control panels are comprised of UL Listed and UL Recognized components. EMCP is UL Recognized.

CIRCUIT BREAKER

Output circuit breaker is 100% rated and UL Listed.

TESTING

All UL Listed sets are designed and rigorously tested in accordance with UL Standard for Safety, UL 2200.

LABELING

Labeling meets UL requirements.

MECHANICAL OPTIONS

Mechanical options do not require UL Listing and, therefore, are not affected. The exceptions to this are:

FUEL TANKS

If a fuel tank is ordered with the unit, it must be UL Listed. Two versions are available: 24 hour integral (FCUL2) and 24/48 hour sub-base (FSBT)

ELECTRICAL OPTIONS

The table below shows electrical options that meet UL requirements:

EOS	Lube Oil Sump Heater
WCA1	Low Coolant Level Shutdown
WSS1	Low Coolant Temperature Alarm
AH1H	Anti-Condensation Heater
WHH	Coolant Heater
GOVES	Electronic Governor (Fully Adjustable)
FSS1	Critical Low Fuel Level Shutdown
FSS2	Low Fuel Level Alarm
FSSS	Critical High Fuel Alarm
PBCSUL	UL Listed Battery Charger
PBC10NU	NFPA Battery Charger, UL Listed

UL Listing is available on all diesel fuelled generator sets up to 17S kW at 60 Hz, 600 vac maximum.

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www.Cat.com/electricpower

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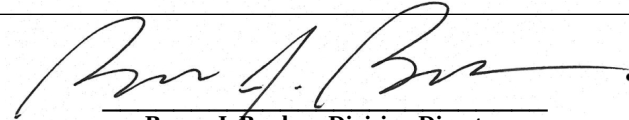


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2022 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: Perkins Engines Co Ltd
(U.S. Manufacturer or Importer)
Certificate Number: NPKXL02.2TIC-028

Effective Date:
09/29/2021
Expiration Date:
12/31/2022


Byron J. Bunker, Division Director
Compliance Division

Issue Date:
09/29/2021
Revision Date:
N/A

Model Year: 2022
Manufacturer Type: Original Engine Manufacturer
Engine Family: NPKXL02.2TIC

Mobile/Stationary Indicator: Stationary
Emissions Power Category: 37<=kW<56
Fuel Type: Diesel
After Treatment Devices: No After Treatment Devices Installed
Non-after Treatment Devices: Internal EGR, Smoke Puff Limiter

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.



This Generator Set (Retail Diesel) Pre-Start-up Checklist

Customer to return prior to scheduling Peterson Start-up.

This form must be completed by the electrical contractor customer and returned to the project manager listed below prior to start-up and testing by any representative of Peterson Power Systems. If any items on this checklist are found to be incomplete and/or incorrectly performed, additional charges will be assessed for any and all charges incurred in the correction and completion of this checklist (including travel time to site).

Return to:

Peterson Power Systems

Attn:

E-mail:

Customer Contact Information:

Project Name:

Site Contact:

Contractor:

Site Phone:

Project Mgr:

Site Address

Phone No:

*Requested Date of Startup:

No.	Yes	No	N/A	Description
1.	☐	☐	☐	Power conductors connected between generator set ATS.
2.	☐	☐	☐	Normal power available at line side of ATS.
3.	☐	☐	☐	Building load connected to load side of ATS.
4.	☐	☐	☐	Control wiring in separate conduit ran to ATS.
5.	☐	☐	☐	AC Accessories Circuit ran to Generator connection, breaker box.
6.	☐	☐	☐	Remote Communications and DC power conductors run to annunciator.
7.	☐	☐	☐	Fuel tank filled (<u>DO NOT FILL TAN IF PRESSURE TEST IS REQUIRED</u>).
8.	☐	☐	☐	Exhaust system installed. (May include insulation additional piping if required)
9.	☐	☐	☐	Fuel day tank pump circuit installed and connected.
10.	☐	☐	☐	Fuel supply return lines connected to engine (hose or black pipe).
11.	☐	☐	☐	Generator set anchored securely to pad.
12.	☐	☐	☐	Radiator air ductwork installed and operational (if applicable).
13.	☐	☐	☐	Generator set is free of all construction debris and encumbrances.
14.	☐	☐	☐	Battery installed, filled, and secured to rack. (If needs to be filled check here ☐)
15.	☐	☐	☐	Witnesses required (inspectors, fire marshal, etc.) have been notified.
16.	☐	☐	☐	Breaker trip units are adjusted per the electrical selective coordination study.
17.	☐	☐	☐	All wires are clearly identified with labels on both ends.

* Date and time of start-up is NOT guaranteed until confirmation by the project manager listed above.

SINCE 1936