PM180 Rev 0 23/02/10

THOMSON™
POWER SYSTEMS

TSC 7320

TRANSFER SWITCH CONTROLLER

INSTALLATION, OPERATING & SERVICE MANUAL

9087A - 198th Street, Langley, BC, Canada V1M 3B1 · Telephone (604) 888-0110
Email: info@thomsonps.com · www.thomsonps.com

REGAL®

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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.

Controller Firmware Version

R0, 23/02/10	Original Release

Operating & Service Manual Version

Rev 0 23/02/10	Original release

Related Product Instruction Manuals

- TSC 7320 Modbus^{TM} Communication, PM174
- TS 870 TSC 7320 Installation, Operating, & Service Manual, PM175
- TS 870 TSC 7320 Quick Start Guide, PM173
- TS 970 TSC 7320 Quick Start Guide, PM176, PM177
- TS 880 TSC 7320 Installation, Operating, & Service Manual, PM178

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 7320 controller utilizes a powerful ARM microprocessor, which provides high accuracy for all voltage sensing and timing functions. The **TSC 7320** is factory configured to control all the operational functions and display features of the automatic transfer switch. All features of the **TSC 7320** are fully programmable from the front panel graphical screen display and are security PIN protected.

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.

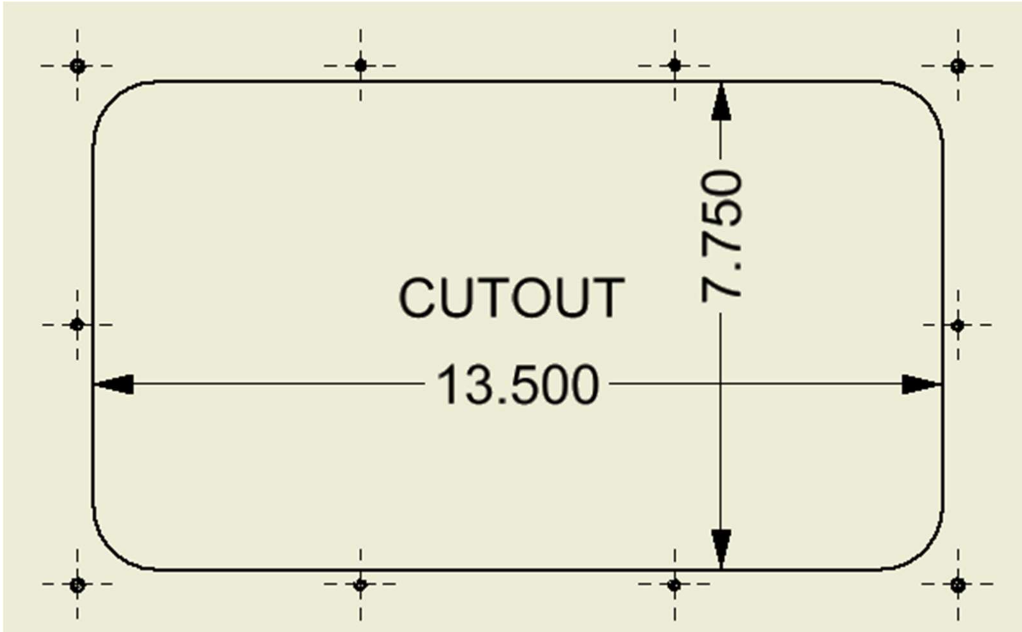
> **WARNING**
>
> **Failure to confirm and match transfer switch voltage with the system voltage could cause serious equipment damage.**

If the transfer switch requires reconfiguring, the TSC 7320 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.**

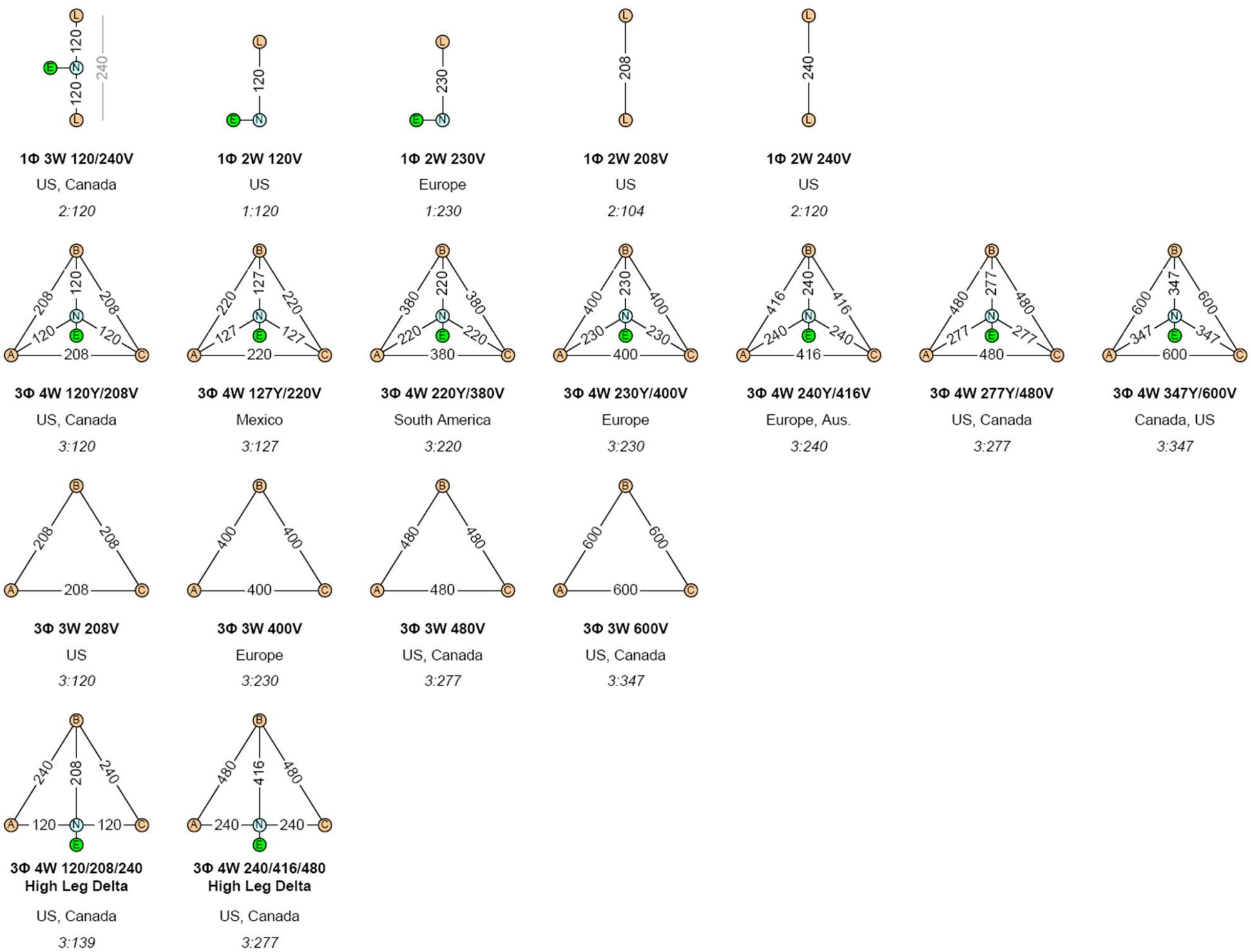
2.3. MOUNTING

When the TSC 7320 controller is supplied as part of a Thomson Power System automatic transfer switch, the controller is mounted on the ATS door with screw clamps that are supplied with the controller. When the TSC 7320 GHC is supplied loose for door mounting, it requires a rectangular door cut-out that is 13.5” W x 7.75” L.


CUTOUT
13.500
7.750

2.4. AC VOLTAGE SENSING INPUT

The TSC 7320 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 7320 voltage sensing can support the following types of electrical systems:



Refer to SECTION 5.3 for system voltage programing instructions.

2.5. AC CURRENT SENSING INPUT

The TSC 7320 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).

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

2.6. AC CONTROL POWER INPUT

The TSC 7320 requires 24VDC control power input voltage. Independent AC control power is required from both utility and generator supplies via potential transformers. The potential transformers then supply voltage to 24VDC power supplies. The TSC 7320 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 7320 can be additionally supplied with 24VDC auxiliary control power input voltage for applications requiring continuously energized control and display features. The maximum input power draw is 25W. The 24VDC power must be from a regulated/filtered DC supply with maximum +-10% voltage range.

2.8. PROGRAMMABLE INPUTS

The TSC 7320 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 SECTION 3.2 for more information.

2.9. PROGRAMMABLE OUTPUTS

The TSC 7320 is provided from the factory with 8 programmable digital outputs (24VDC) and 2 programmable dry contact outputs. See SECTION 3.3 for more information

Interposing relays are required between the TSC 7320 outputs and the end device if loads exceed the output current rating.

2.10. EXTERNAL ATS CONTROL WIRING

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

Utility or Generator Voltage Sensing	#14 AWG (2.5mm^2)
Transfer output signals	#14 AWG (2.5mm^2)
Remote Start Contact for Engine Controls	#14 AWG (2.5mm^2)

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

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

2.11. REMOTE START CONTACT FIELD WIRING

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

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

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

2.8.3. An interposing relay may be required if field-wiring distance is excessively long (i.e. greater than 1000 feet (300m)) and/or if a remote contact has a resistance of greater than 5.0 ohms. In extremely noisy environments, the wire run lengths indicated may not provide reliable operation and can only be corrected by the use of an interposing relay. The interposing relay is generally installed at the engine controls and utilizes DC power. It is strongly suggested that the ground return wire of the interposing relay be used for the interface to the TSC 7320 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

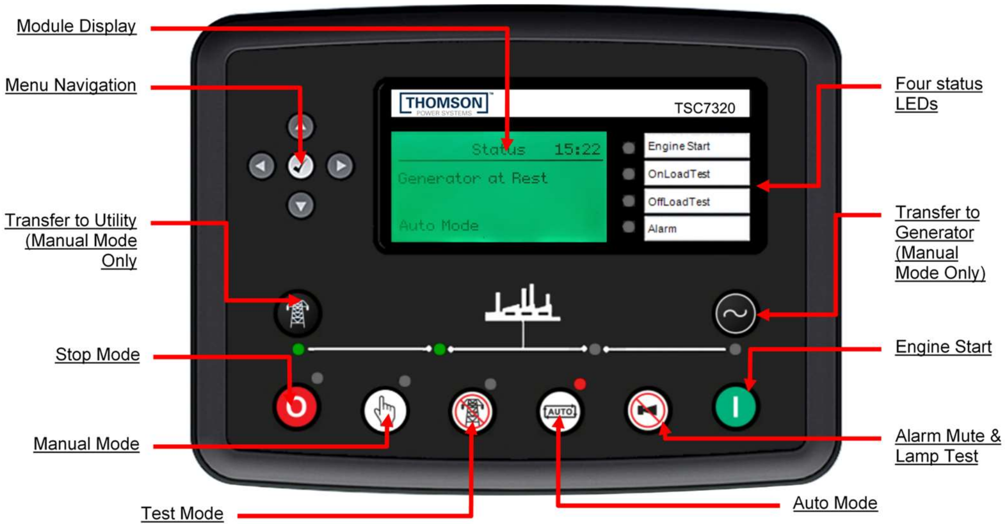
For additional information on protection against electrical interference, contact Thomson Power Systems factory.

2.13. DIELECTRIC TESTING

Do not perform any high voltage dielectric testing on the transfer switch with the TSC 7320 controller connected into the circuit, as serious damage will occur to the controller. All AC/DC control fuses or control/sensing circuit isolation plugs connected to the TSC 7320 must be removed/disconnected if high voltage dielectric testing is performed on the transfer switch.

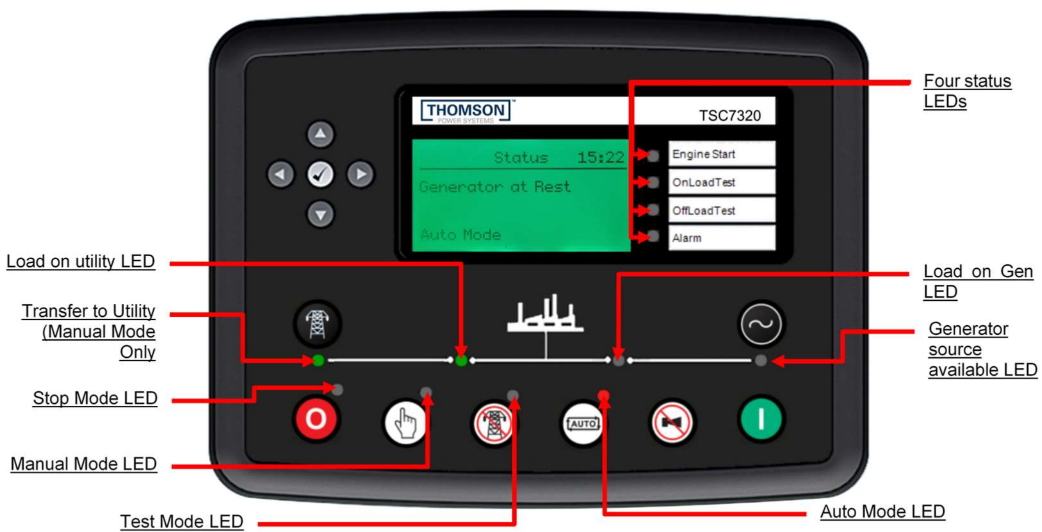
3. DESCRIPTION

The TSC 7320 controller is an all in one unit and does not require any communication cables to operate. The controller has 13 buttons on the front of the controller that can be used to change what the controller is displaying, changing the settings, and control the mechanism. See the figure below for more information.



3.1. FRONT PANEL LEDS

The front panel of the controller has 12 LEDs that display the position of the ATS, source availability, current controller mode, and some inputs / outputs.



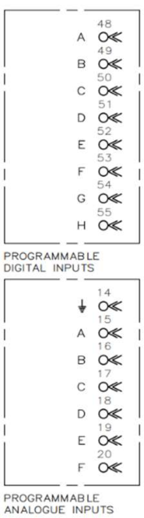
The front panel LEDs will stay illumined while the given status is true except for the Alarm LED, which will flash if there is an alarm that is present. See SECTION 4.5 for more information on alarms and how to clear them.

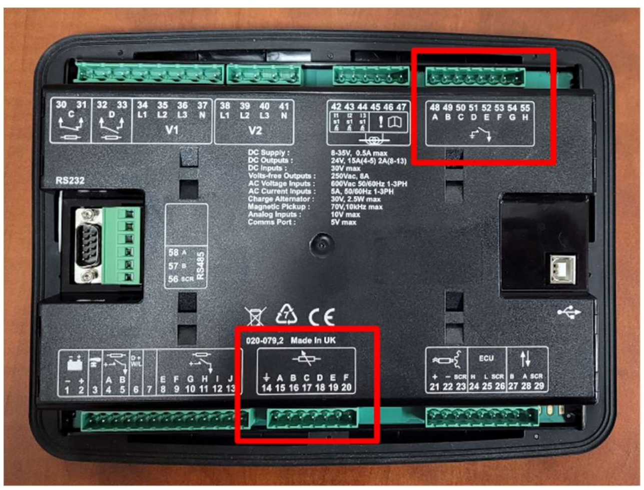
3.2. CONTROLLER INPUT CONNECTIONS

The TSC 7320 is provided from the factory with 14 programmable inputs with default settings per table shown below. 8 of the inputs are digital inputs, and the other 6 are analogue inputs that can also be programmed to be more digital inputs. Refer to the TSC 7320 Manual for further information on programming changes as required.

NOTE: All control wiring required for any remote input connection must be made directly to the door mounted TSC 7320 as per drawing below. All input wire cabling that may be installed must be suitably routed and protected across the door hinge to prevent possible mechanical damage upon door opening and/or door closing. Switch Control Unit internal PCB is shown in the following diagram:

WARNING: Do not apply any voltage across the input terminal and DC common as this will cause damage to the TS 7320 controller. Connect only a dry (i.e. voltage-free) contact.





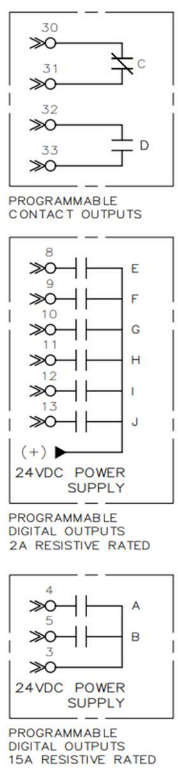
Inputs	Pin No.	Descriptions
DIGITAL INPUT A	48	GENERATOR BREAKER FEEDBACK
DIGITAL INPUT B	49	MAINS BREAKER FEEDBACK
DIGITAL INPUT C	50	NOT MAPPED
DIGITAL INPUT D	51	MANUAL OPERATION
DIGITAL INPUT E	52	OPEN TRANSITION WITH NEUTRAL DELAY
DIGITAL INPUT F	53	SERVICE DISCONNECT REQUEST
DIGITAL INPUT G	54	REMOTE OFF LOAD TEST
DIGITAL INPUT H	55	REMOTE ON LOAD TEST
GROUND	14	480V 3PH 4W CONFIGURATION
ANALOGUE INPUT A	15	120/240V 1PH 3W CONFIGURATION
ANALOGUE INPUT B	16	208V 3PH 4W CONFIGURATION
ANALOGUE INPUT C	17	240V 3PH 4W CONFIGURATION
ANALOGUE INPUT D	18	600V 3PH 4W CONFIGURATION
ANALOGUE INPUT E	19	110V 1PH 2W CONFIGURATION
ANALOGUE INPUT F	20	NOT MAPPED

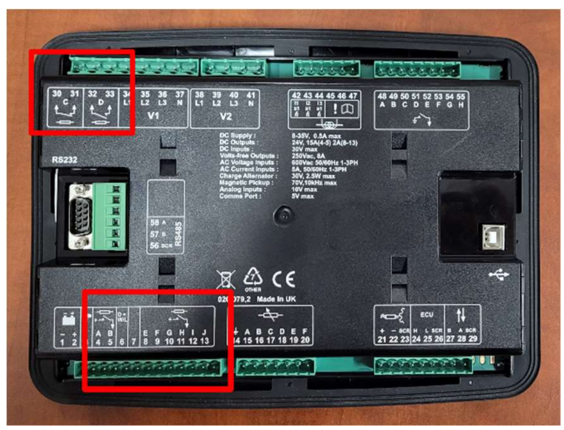
3.3. CONTROLLER OUTPUT CONNECTIONS

The TSC 7320 is provided from the factory with 8 programmable digital outputs and 2 programmable dry contact outputs with default settings per the table shown below. Refer to the TSC 7320 Manual for further information on programming changes as required. The Digital outputs are rated 2A @ 24VDC resistive. Dry output contacts are rated at 8 amps @ 250Vac resistive. One of the dry contacts are normally closed and the other contact is normally open.

NOTE: All control wiring required for any programmable output connections must be made directly to the door mounted TSC 7320 controller as per drawing below. All output wire cabling that may be installed must be suitably routed and protected across the door hinge to prevent possible mechanical damage upon door opening and/or door closing.

WARNING: Do not apply any voltage across the output contacts as this will cause damage to the TSC 7320 controller. Connect a load in series with applicable voltage/current as specified.





Outputs	Pin No.	Rating (Resistive)	Descriptions
DC OUTPUT A	4	15A @ 24VDC	ATS ON SOURCE 1 (PWR FROM PIN 3)
DC OUTPUT B	5	15A @ 24VDC	ATS ON SOURCE 2 (PWR FROM PIN 3)
DC OUTPUT E	8	2A @ 24VDC	TRANFER TO GENERATOR
DC OUTPUT F	9	2A @ 24VDC	TRANFER TO UTILITY
DC OUTPUT G	10	2A @ 24VDC	TRANSFER TO NEUTRAL
DC OUTPUT H	11	2A @ 24VDC	CLOSED TRANSITION MODE
DC OUTPUT I	12	2A @ 24VDC	FAIL TO TRANSFER
DC OUTPUT J	13	2A @ 24VDC	ATS NOT IN AUTO MODE
RELAY OUTPUT C	30 31	8A @ 250VAC	ENGINE START CONTACTS
RELAY OUTPUT D	32 33	8A @ 250VAC	LOAD DISCONNECT CONTACTS

3.4. ATS OPERATION MODE DESCRIPTIONS

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 to the load.
STOP MODE 	ATS will immediately start transferring to utility and stay there. The ATS will not automatically operate during a utility power failure	Outputs momentarily energize to move ATS mechanism to the Utility position. If the mechanism is moved away from Utility, the controller will automatically move it back to Utility.	Output is disabled - engine will not start during a utility power failure[1] Engine will stop if it was previously running
TEST MODE 	ATS will not automatically operate during a utility power failure, and The ATS will transfer to utility if there is a gen power failure. ATS cannot be operated manually as the controller will keep the breaker on utility.	Outputs momentarily energize to move ATS mechanism to the Utility position. If the mechanism is moved away from Utility, the controller will automatically move it back to Utility.	Output is enabled but engine will not start during a utility power failure[1]. Engine will continue to run unless there is a fault.
MANUAL 	ATS will not automatically operate during a utility power failure, and The ATS will transfer to utility if there is a gen power failure. ATS cannot be operated manually as the controller will keep the breaker on utility.	Outputs momentarily energize to move ATS mechanism to the Utility position. If the mechanism is moved away from Utility, the controller will automatically move it back to Utility.	Output is enabled but engine will not start during a utility power failure[1]. Engine will continue to run unless there is a fault.
SERVICE DISCONNECT ***(Service Entrance Only-US Market ATS)***	ATS transfers to neutral position to disconnect power to the load. ATS will not automatically operate during a utility power failure. Note: When the Service Disconnect signal is removed, the transfer switch will immediately return to the utility, and the controller will remain in STOP mode. When required, put the controller back in Auto mode.	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
EXERCISE 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
MANUAL OFF LOAD TEST	When OFF LOAD TEST mode is manually initiated, engine will start and run, but the ATS will not transfer to the generator. When OFF LOAD TEST mode is terminated, engine will stop	Outputs do not change state **even if** utility or generator supply fails	Output automatically closes to start engine during the OFF LOAD test mode. Output automatically opens when test mode is terminated
EXERCISE OFF LOAD TEST	When OFF LOAD TEST mode is initiated, engine will start and run, but the ATS will not transfer to the generator. 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
EXERCISE SCHEDULE	When an EXERCISE SCHEDULE occurs, the ATS will perform an 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 7320 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.

3.5. AUTOMATIC SEQUENCE OF OPERATION

3.5.1. OPEN TRANSITION TRANSFER (NEUTRAL DELAY)

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

NOTE: Time delays indicated below are factory default settings only. Refer to TSC 7320 manual for alternate time delay settings available on the TSC 7320 Controller	
UTILITY POWER FAIL	When voltage drops on any phase of the utility supply below 85% of rated voltage, a generator start sequence will be initiated
GEN START	The generator will start following expiry of the 2 second Gen Start timer
GEN WARMUP	A generator warmup period will be initiated once the generator starts running, and will not transfer until the timer expires, or a fault occurs
TRANSFER TO GEN	The load will transfer to the generator supply following expiry of the 2 second Gen Warmup timer
UTILITY POWER RETURN	When utility power is restored to above 90% rated voltage on all phases, a utility return timer sequence will be initiated
TRANSFER AWAY FROM GENERATOR	The load will transfer away from the generator supply following expiry of the 300 second utility return timer
TRANSFER TO UTILITY	Once the load transfers off of the generator supply, the load will re-transfer back onto the utility supply following expiry of the 3 second neutral delay timer
GEN COOLDOWN	The generator will automatically stop following expiry of the 300 second cooldown timer.

3.5.2. 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 7320 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.

3.5.3. 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 7320 is configured to provide additional logic for this application. When the TSC 7320 controller receives an input signal for Closed Transition Transfer Mode, the TSC 7320 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.

3.5.3.1. 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 7320'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 7320 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 7320 output contacts to enable transfer to the neutral position.

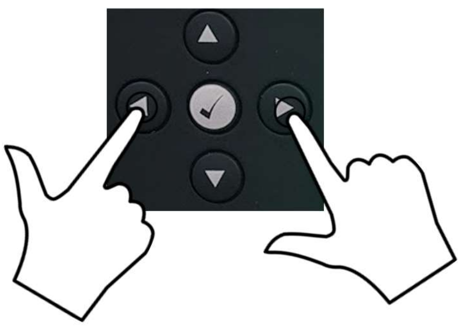
NOTE
The controller will stay in Stop mode after moving the service disconnect switch back to the Energized position. To resume normal operation the user must press the auto mode button when done.

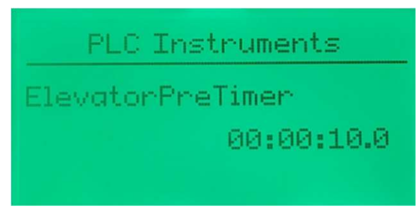
3.6. DISPLAY PAGE DESCRIPTIONS

The TSC 7320 controller monitors the ATS and displays various information which is visible on the front Display or front panel LEDs. Navigating to different screens is controlled by a four navigation buttons, and a center checkmark button. The display has pre-programmed display pages which are selected manually, and are organized into the following main menu pages in software:

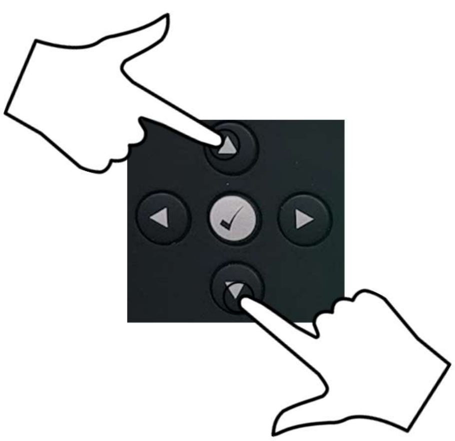
Status – Engine – Generator – Mains – Alarms – Event Log – Communications – Schedule – PLC Instruments – About

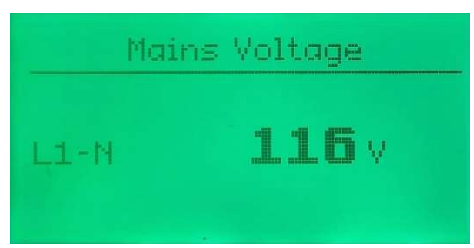
The display pages above can be continuously cycled through left or right:





Each of the headers listed above contain subpages with more information relating to the chosen header, like voltage, frequency, and current readings.



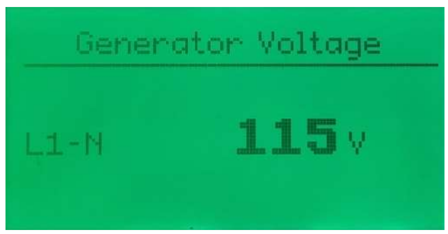


3.6.1. STATUS PAGE

The Status Page is utilized as a summary control and monitoring screen for the ATS. This screen provides information on the ATS current status, Generator status, timers with remaining duration, and system alarms. More information on voltage, frequency and current are displayed on other pages.

3.6.1. GENERATOR PAGE

The generator page and subpages display the voltage, frequency, current, wattage, current electrical configuration, and the Synchroscope page.

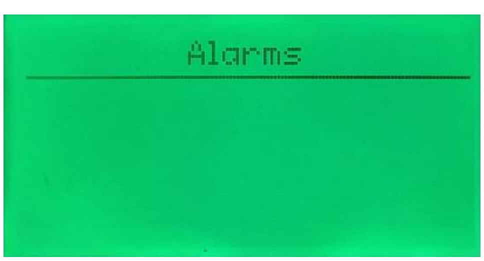


3.6.2. MAINS PAGE

The Mains page and subpages display the voltage, frequency, current, wattage, and the current electrical configuration.

3.6.3. ALARMS PAGE

The TSC 7320 alarms page displays available alarms and will remain blank if there are no alarms present. If there is more then one alarm, the up and down navigation keys can be used to cycle bewteen them.



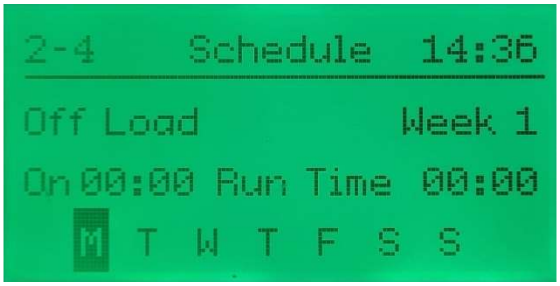
3.6.4. EVENTS LOG PAGE

The events log page shows time/date stamped information as to when events have occurred. The controller stores up to 250 events before the information is cleared automatically.

3.6.5. SCHEDULE PAGE

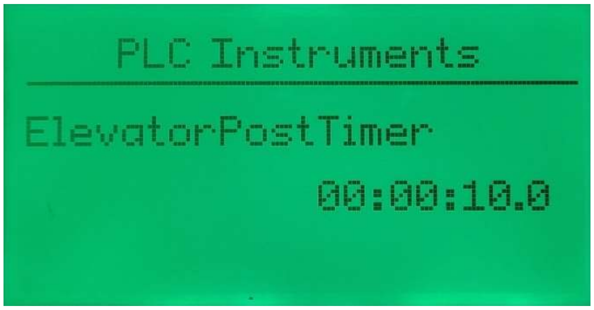
The schedule page shows information about the different exercise tests, when they will run, and for how long. There are two different banks of schedules, and eight individual schedules each (sixteen total). Use the up and down buttons to cycle between all the schedules. By default, the schedules are blank. For more information on how to change the schedule, see SECTION 5.4.1.

Note: the schedules only run when the controller is in auto mode.



3.6.6. PLC INSTRUMENTATION PAGE

The PLC Instruments page shows several different transfer switch settings, and their respective values. To change these values, please refer to SECTION 5.1.1.



3.6.7. CURRENT METERING PAGE

The current metering page is a subpage within the generator section, and it displays the measured current as report from the CT's for each of the lines.

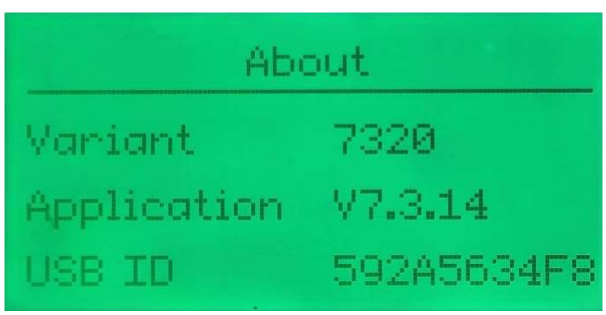
NOTE: Load CT 's must be supplied with the ATS to provide current and power data.

3.6.8. SYNCHROSCOPE PAGE

The Synchroscope page is a subpage in the generator section and displays the voltage difference and slip frequency difference between two available sources. This page will also popup when changing sources on an ATS that is equipped with closed transition or fast open transition in-sync transfer capability. This page will display the phase angle difference, voltage difference and slip frequency difference between two available sources.

3.6.9. ABOUT PAGE

The about page can be used to identify the firmware version of the controller, and the software version.



4. OPERATING INSTRUCTIONS

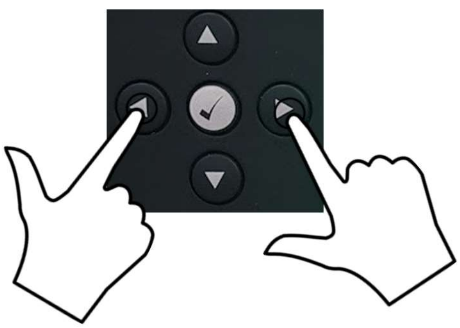
4.1. DISPLAY SCREEN NAVIGATION

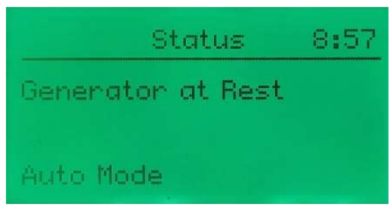
The TSC 7320 controller has pre-programmed display pages which are selected manually using the buttons on the front of the controller, by pushing the left and right navigation buttons.

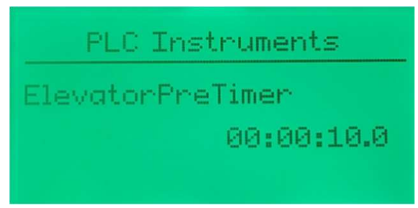
The display pages are organized into the following order and can be continuously cycled through:

Status – Engine – Generator – Mains – Alarms – Event Log – Communications – Schedule – PLC Instruments – About

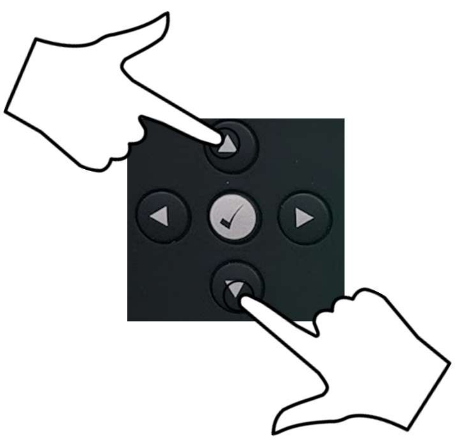
The display pages above can be continuously cycled through left or right:

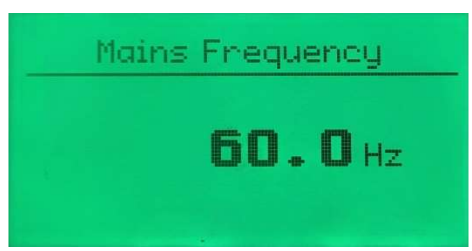






Each of the headers listed above contain subpages with more information relating to the chosen header, like voltage, frequency, and current readings.





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

To initiate an ATS On Load Test, press the test button on the TSC 7320 controller to enter test mode.

Next, press the gen start button (green), and the controller will start the generator and once it reaches the nominal voltage and frequency, the switch will be transferred to the generator and take over the load.

To stop the on-load test and return to normal, press the auto button, and the controller will start a utility return delay timer, and transfer back to the utility when the timer expires. The generator will continue to run until the cooling expires, and then it will turn off the generator.

Note :

Pushing the red stop button will initiate a return to Utility request followed by an engine stop. If the utility is available, the ATS will transfer to utility and stop the engine ignoring any countdown timers. If the Utility is not available, the controller will turn off the generator, and generate a Mains Fail to Close Alarm.

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

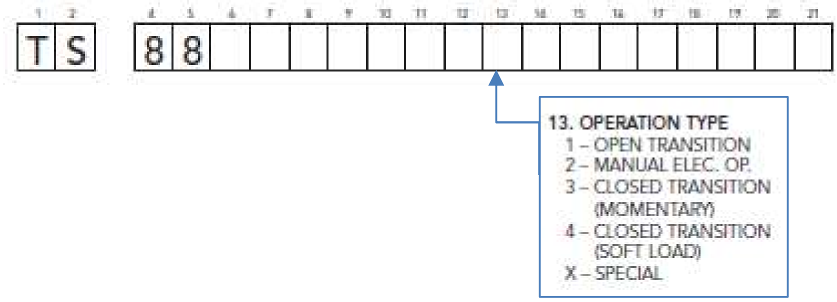
To initiate an ATS off load test, press the manual button on the TSC 7320 controller to enter manual mode.

Next, press the gen start button (green), and the controller will start the generator, but the switch will NOT transfer to generator, even if the source is healthy.

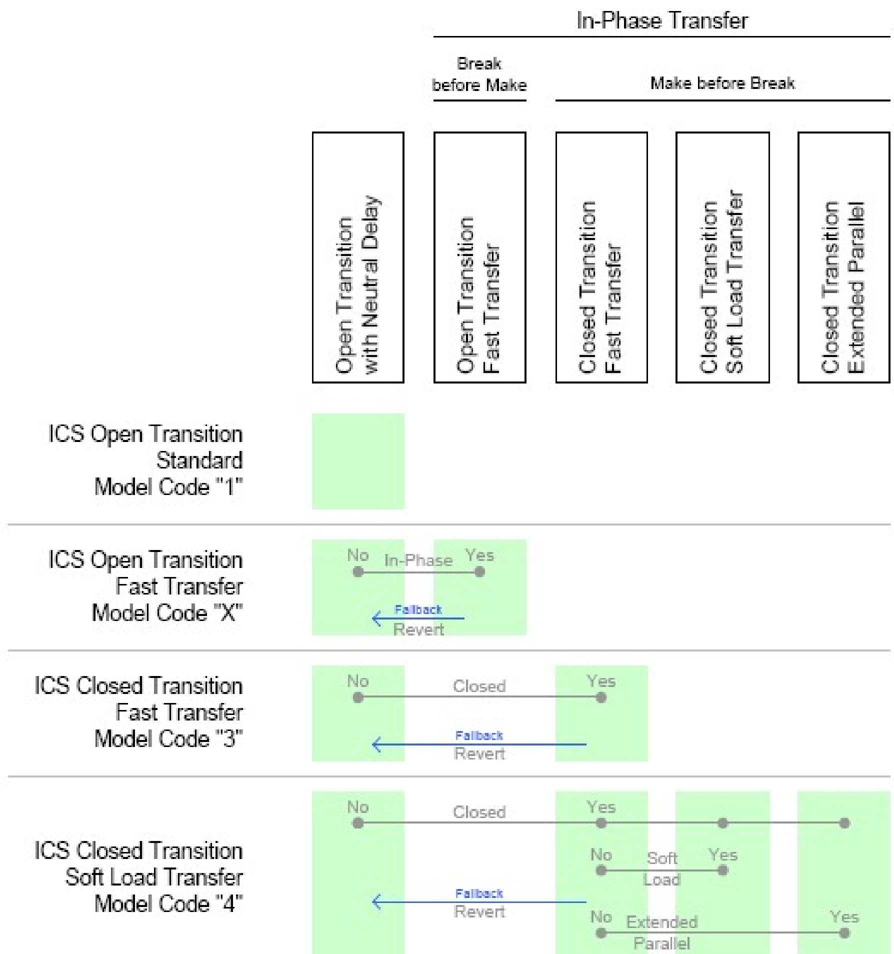
To stop the off-load test and return to normal, press the STOP button, and the controller will turn off the generator. If the Auto mode button is pushed, the controller will start a countdown timer and then turn off the generator.

4.4. 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:



4.4.1. 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 the wire connecting the controllers input E (PIN 52) to the DC negative terminals is removed. see SECTION 5.6.1 for more information

4.4.2. CLOSED TRANSITION REANSFER (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 using an External Switch. The external switch has two positions and will allows the user to select between closed transition operation, and open transition operation.

Note: changing the position of the switch will affect the following and subsequent transfers.

4.5. TRANSFER FAIL ALARM RESET

Should a Transfer Fail Alarm occur, the Alarm LED will start flashing. The transfer switch is pre-programmed as Force Transfer, so 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. The alarms can be silenced by pressing the Alarm mute button.

To determine which transfer alarm condition has been triggered, navigate to the Alarms page using the left and right navigation buttons. If multiple alarms have been generated, use the up and down arrows to cycle between alarms. Once the specific alarm condition has been determined and the necessary corrective action has been implemented, the alarm can be reset by pressing and holding the Alarm mute button for 5 seconds.

4.6. SERVICE DISCONNECT MODE

For transfer switches equipped with the Service Entrance Mode option, the TSC 7320 is configured to provide additional logic for the application. When the TSC 7320 controller receives an input signal from the door mounted Service Disconnect switch to transfer to the neutral position, the TSC 7320 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 7320 are disconnected and the engine start signal is disabled. When the Service Disconnect switch is returned to the Energized position, the TSC 7320 control outputs are re-connected and will change state to cause the ATS mechanism to transfer back to the Utility position.

NOTE
The controller will stay in Stop mode after moving the service disconnect switch back to the Energized position. To resume normal operation the user must press the auto mode button when done

4.7. PHASE SEQUENCE PROTECTION ALARM RESET

The TSC 7320 is programmed to generate an alarm if it detects a rotated phase sequence (not A-B-C). The ATS will not transfer to that source until the sequence has been fixed, and the alarm has been cleared.

5. PROGRAMMING INSTRUCTIONS

5.1. PASSWORD SECURITY DESCRIPTION/LOGIN

There are two different areas to change the controller settings, one of the requires entering a pin to change the settings, and the other are does not require a pin.

5.1.1. NON-RESTRICTED SETTINGS

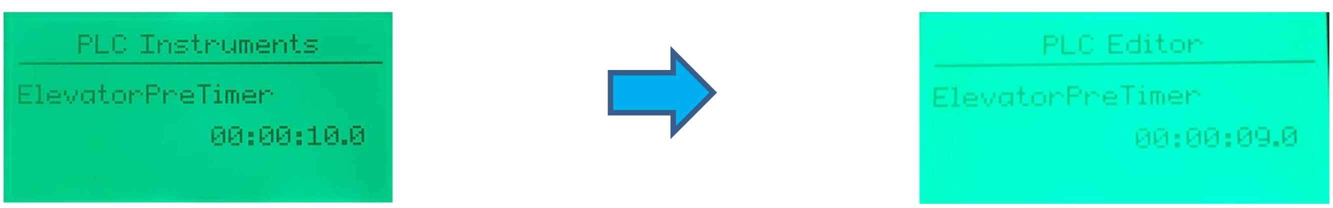
The following settings can be changed in the non-restricted area:

Enable Elevator Timers - Elevator pre-timer - Elevator post-timer - Neutral delay timer

With the transfer switch energized, follow the procedure below to access the above settings:

- Enter “STOP” mode, by pressing the red button in the lower left corner of the controller

- Use the left or right navigation keys to find the “PLC Instrumentation Page”
- Use the up or down navigation keys to find the setting to be adjusted
- Press and hold the center checkmark button until the header changes to “PLC Editor”
- The setting will now begin to flash. Use the up or down buttons to change the value
- When the desired value is set, press the center checkmark to save the timer and exit
- If more settings need to be adjusted, repeat the above procedure.
- Exiting the editor will automatically return the controller to auto mode.

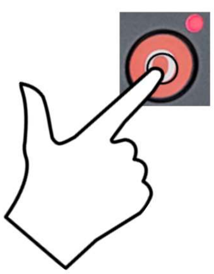


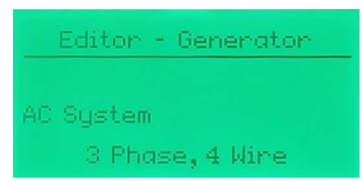
5.1.2. RESTRICTED SETTINGS

To prevent un-authorized access, all the other transfer switch settings can only be changed in the restricted area.

With the transfer switch energized, follow the procedure below to login to the TSC 7320 controller:

- Enter “STOP” mode, by pressing the red button in the lower left corner of the controller.
- Press the stop button AND the center checkmark button at the same time.
- The screen’s header will read “Editor” and the screen will ask for a 4-digit pin number.
- Use the navigation buttons to enter the default PIN “1 1 1 1”. The up and down buttons will change the value, and the left and right buttons will let the user cycle between the 4 digits.
- Press the center checkmark button to confirm and login to the restricted area.
- The left or right navigation keys can now be used to cycle between different groups of settings, and the up and down buttons can be used to cycle between the settings for that group
- Find the desired setting, press the center checkmark button and the value will start to flash
- Use the up and down buttons to change the value, and the center checkmark button to confirm
- Find and change all settings as desired
- To exit the editor mode, hold the center checkmark button for 5 seconds while not editing





5.2. SYSTEM TIME/DATE ADJUSTMENT

To adjust the TSC 7320 controller's internal time clock, follow the detailed procedure below.

- With the TSC 7320 powered on, navigate to the restricted area of the settings, and login
- Find the page with the "Editor - Display" heading. If the date and time is not listed, the up or down navigation button may need to be pressed to show the setting

- Press the center checkmark button and the seconds setting will start to flash. Use the up or down navigation keys to change the value of the flashing setting, and the left and right keys to change which part of the date and time is being edited.

- Change all parts of the time and date to match the desired values and press the center checkmark to save the changes.

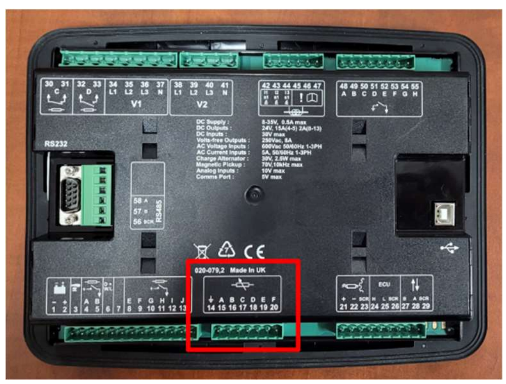
Once the correct time and date is entered, hold the center checkmark to exit the editor mode.

5.3. VOLTAGE CHANGE PROCEDURE

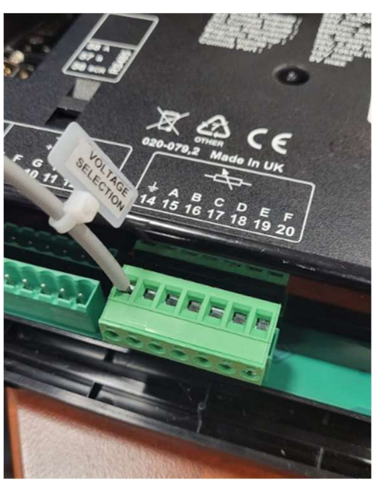
To change system voltage on the TSC 7320 controller, the transfer switch can be energized or de-energized to change the system voltage. If the transfer switch is energized, please ensure the mechanism is in the utility position, and place the controller in “Stop” mode by pushing the red button in the lower left corner. It is recommended to de-energize the transfer switch to mitigate any hazardous conditions. Always proceed with caution and follow the steps below to change the voltage.

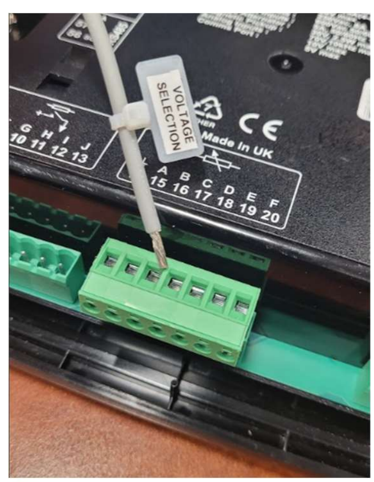
NOTE
1. The following instructions detail re-programming the TSC 7320 controller only. Additional procedures are required to change the voltage sensing transformer taps inside the ATS. Refer to separate ATS model instructions
2. All system voltage changes are ONLY done via connecting a designated wire to a different terminal on the TSC 7320 controller. All alarm values are ONLY changed via software programming.

1. **<u>Locating the PIN:</u>** First find PINs 14 to 20 on the backside of the TSC 7320 controller. There will be a wire connected to PIN 14, and that wire will have a label specifying it is the voltage selection wire.



2. **<u>Removing the wire</u>**: Using a small flat head screwdriver, loosen the terminal screw for PIN 14, and remove the voltage selection wire out of PIN 14.

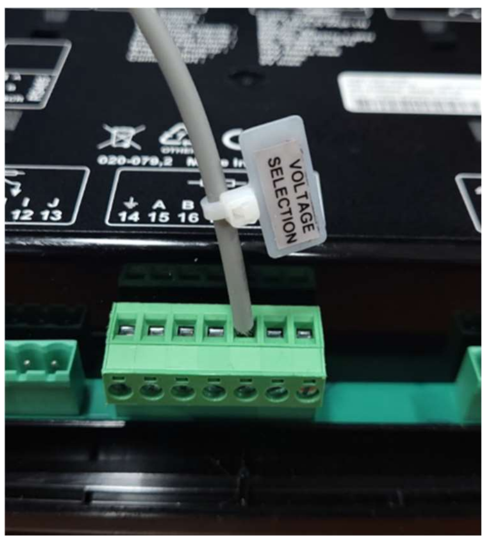




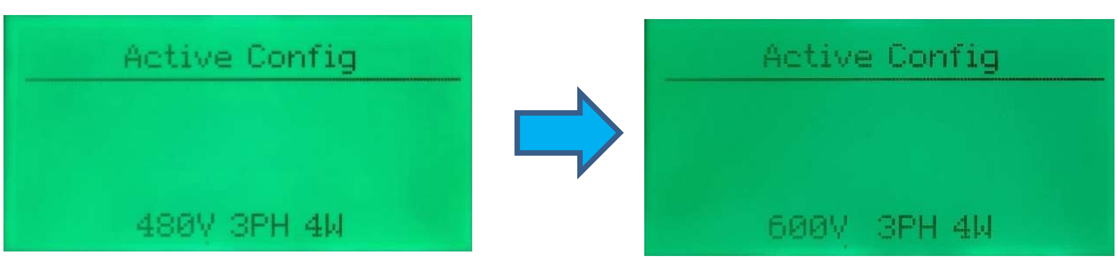
3. Choosing voltage configuration: There are 5 separate inputs that dictate the different configurations, and they are listed in the table below. Select one of the options below based on the ATS requirements.

Inputs	Pin No.	Descriptions
GROUND	14	480V 3PH 4W CONFIGURATION
ANALOGUE INPUT A	15	120/240V 1PH 3W CONFIGURATION
ANALOGUE INPUT B	16	208V 3PH 4W CONFIGURATION
ANALOGUE INPUT C	17	240V 3PH 4W CONFIGURATION
ANALOGUE INPUT D	18	600V 3PH 4W CONFIGURATION
ANALOGUE INPUT E	19	110V 1PH 2W CONFIGURATION

4. **Inserting the wire:** Insert the voltage selection wire into the desired terminal and tighten the screw on the terminal. The terminals are rated for 4.5in-lbs of torque, do NOT over tighten the terminal screw. The photo below shows the 600V 3PH 4W configuration.



5. **Checking config:** If the panel is not energized, turn on the power and energize the transfer switch. After the controller boots-up, use the left or right navigation keys to find the "Mains" page, and use the up and down navigation keys to find the "Active Config" page. If the controller is properly registering the changed input, the screen should display the desired configuration, and NOT the default 480V configuration. In this case, the 600V configuration has been selected.



6. **Complete:** The voltage change procedure is now complete. If the voltage settings need to be adjusted from their default values, please refer to SECTION 5.1 of this document for further details on entering the restricted area of the settings, and how to change values.

5.4. EXERCISE TIMER SETUP

The TSC 7320 controller has a built-in calendar based programmable exercise timer. The exercise timer has two banks that can be programmed on either weekly or monthly period. Each of the banks has 8 schedules within them that can be set to a specific week, day, and time. For a given schedule, the type of test and duration can be inputted. The exercise timer utilizes an internal real-time clock for referencing all timing functions. The controller's real-time clock utilizes a battery back-up power source to retain correct time/date settings during short duration utility power failures.

5.4.1. ADDING / EDITNG NEW EXERCISE SCHEDULE EVENT

Login to the restricted area of the controller settings, refer to SECTION 5.1.2 for further details. After entering the restricted settings area, use the left or right buttons and navigate to the "Editor – Schedule" page. Here the scheduler can be activated, or deactivated.

The up and down buttons can now be sued to cycle between all the scheduler settings. When viewing a setting, the value can be changed by pushing the center checkmark button, and then using the up and down buttons to change the value. If there is more than one value that can be changed on the specific page, they can be cycled through using the left and right buttons. When done, push the center button to save. Exit by holding the center button for 5 seconds. **Note: a duration of 0 will disable that schedule.**

This controller will perform an On-load test every Saturday at 8:00AM for 30 mins.

5.5. MULTI-STAGE LOAD SHED CONTROL

Load Shed strategies are used when the backup generator is not sized to supply all ATS loads. TSC 7320 monitors the generator output KW to determine when to connect or disconnect non-critical loads to maximize utilization and to prevent the generator from overload and shutdown. The TSC 7320 controller supports up to 5 stages and will energize outputs to control shedding of the loads.

NOTE: Load Shed is only provided for Utility-Generator type applications and requires the Load Power Metering (LPM-DSE) option.

5.6. SYSTEM SETTINGS

NOTE: For specific device settings and ranges, refer to ***SECTION 6*** - Factory Default Programming.

The TSC 7320 controller has a couple options that are controller via the input pins.

5.6.1. OPEN TRANSITION

All panels have a wire connecting the controllers input E (PIN 52) to the DC negative terminals, and that input will make the controller perform an open transition transfer with a neutral delay. If the wire is removed, the controller will perform either fast open transition transfers (if applicable), or closed transition transfers (if applicable).

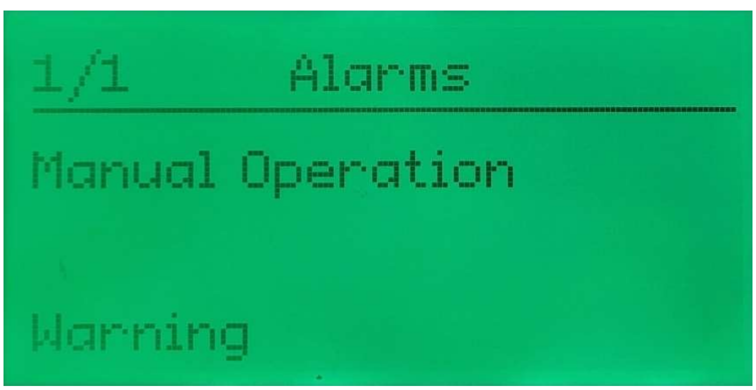
- **Do not remove the wire if the ATS does not support fast open, or closed transition transfers.**

NOTE: if the controller is not able to perform a fast open or closed transition transfer before the 5-minute sync timer expires, it will perform an open transition with a neutral delay.

5.6.2. MANUAL OPERATION

If a wire connects the controllers input D (PIN 51) to the DC negative terminals, that input will put the controller in manual operation mode and will allow the user to manually operate the ATS. If the wire is removed the controller will return to normal operation.

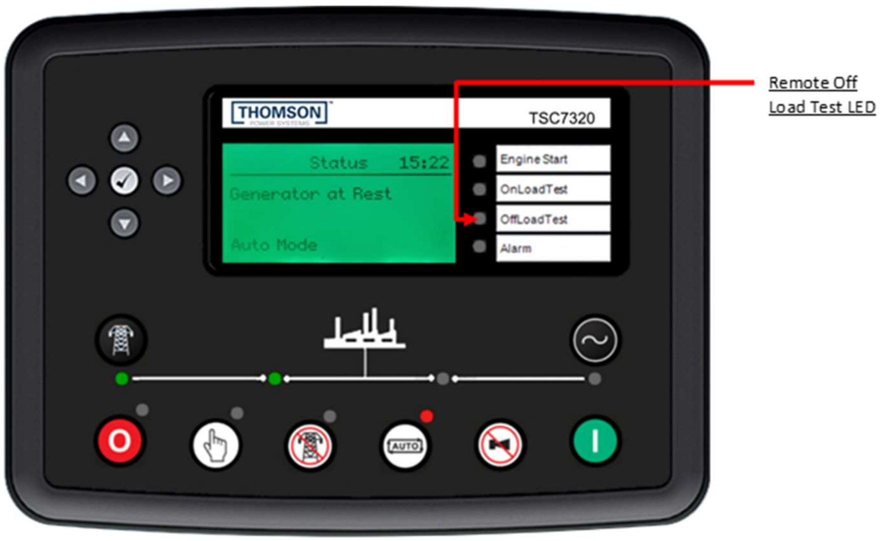
Note: Manual operation is NOT Manual mode. Manual mode is selected ONLY using the button on the front panel. Refer to SECTION 3.4 for more information on the different modes.



5.6.3. REMOTE OFF LOAD TEST

If a wire connects the controllers input G (PIN 54) to the DC negative terminals, that input will tell the controller perform an off load test. The controller will run the off load test until the input is removed. If the wire is removed the controller will return to normal operation.

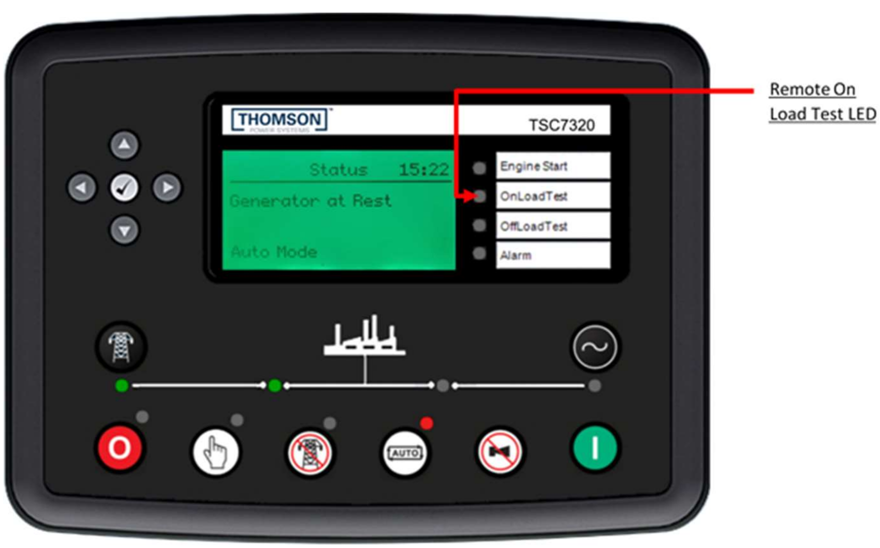
Note: the front panel indicator LED will remain illuminated while the input is activated.



5.6.4. REMOTE ON LOAD TEST

If a wire connects the controllers input H (PIN 55) to the DC negative terminals, that input will tell the controller perform an on load test. The controller will run the on load test until the input is removed. If the wire is removed the controller will return to normal operation.

Note: the front panel indicator LED will remain illuminated while the input is activated.



6. FACTORY DEFAULT PROGRAMMING

The TSC 7320 is factory programmed with default settings as shown as per the following table. NOTE: This table is applicable for firmware version R0. Refer to the TSC 7320 O&M Manual for programming instructions to change any default setting.

TSC 7320 FACTORY DEFAULT PROGRAMMING SETTINGS

Function	Description	Range	Factory Default Value	Percentage of nominal
PLC Instruments				
NeutralDelayStp	Neutral Delay Timer	0 - 86400 sec	3 sec	N/A
ElevatorPreTimer	Elevator Pre-park Timer	0 - 86400 sec	0 sec	N/A
ElevatorPostTimer	Elevator Post-park Timer	0 - 86400 sec	3 sec	N/A
Start Timers				
Mains Transient Delay	Engine Start Delay	0 - 30 sec	2 sec	N/A
Warming	Generator Warmup Timer	0 - 3600 sec	1 sec	N/A
Load / Stopping Timers				
Return Delay	Utility Return Timer	0 - 18000 sec	300 sec	N/A
Cooling	Generator Engine Cooldown	0 - 3600 sec	300 sec	N/A
Generator Options				
AC System	AC Electrical Configuration		3PH, 4W	N/A
Generator Voltage and Alarms[1]				
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 409V PhN	234V PhN	84
Under Voltage Pre-Alarm Trip	Under Voltage Pre-Alarm Threshold	51 - 410V PhN	235V PhN	85
Nominal Voltage	Nominal Voltage	53 - 412V PhN	277V PhN	100
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	55 - 414V PhN	319V PhN	115
Over Voltage Shutdown Trip	Over Voltage Shutdown Threshold	96 - 415V PhN	320V PhN	116
Generator Frequency and Alarms[1]				
Under Frequency Pre-Alarm Trip	Under Frequency Pre-Alarm Threshold	0.1 - 74.4 Hz	56.9 Hz	95
Nominal Frequency	Nominal Frequency	0.3 - 74.6 Hz	60.0 Hz	100
Mains Options				
AC System	AC Electrical Configuration		3PH, 4W	N/A
Mains Alarms[1]				
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 412V PhN	234V PhN	84
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	53 - 415V PhN	320V PhN	116
Under Frequency Trip	Under Frequency Alarm Threshold	0.0 - 74.7 Hz	56.9 Hz	95

[1] Alarm threshold values must cascade in value

Alternate Voltage configurations

120/240 V Generator Voltage and Alarms[1] **(L1 - L2)**				
AC System	AC Electrical Configuration		1PH, 3W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 409V PhN	101V PhN	84
Under Voltage Pre-Alarm Trip	Under Voltage Pre-Alarm Threshold	51 - 410V PhN	102V PhN	85
Nominal Voltage	Nominal Voltage	53 - 412V PhN	120V PhN	100
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	55 - 414V PhN	138V PhN	115
Over Voltage Shutdown Trip	Over Voltage Shutdown Threshold	56 - 415V PhN	139V PhN	116
120/240V Mains Alarms[1]				
AC System	AC Electrical Configuration		1PH, 3W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 412V PhN	101V PhN	84
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	53 - 415V PhN	139V PhN	116
208V Generator Voltage and Alarms[1]				
AC System	AC Electrical Configuration		3PH, 4W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 409V PhN	101V PhN	84
Under Voltage Pre-Alarm Trip	Under Voltage Pre-Alarm Threshold	51 - 410V PhN	102V PhN	85
Nominal Voltage	Nominal Voltage	53 - 412V PhN	120V PhN	100
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	55 - 414V PhN	138V PhN	115
Over Voltage Shutdown Trip	Over Voltage Shutdown Threshold	56 - 415V PhN	139V PhN	116
208V Mains Alarms[1]				
AC System	AC Electrical Configuration		3PH, 4W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 412V PhN	101V PhN	84
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	53 - 415V PhN	139V PhN	116
240V Generator Voltage and Alarms[1]				
AC System	AC Electrical Configuration		3PH, 4W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 409V PhN	117V PhN	84
Under Voltage Pre-Alarm Trip	Under Voltage Pre-Alarm Threshold	51 - 410V PhN	118V PhN	85
Nominal Voltage	Nominal Voltage	53 - 412V PhN	139V PhN	100
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	55 - 414V PhN	160V PhN	115
Over Voltage Shutdown Trip	Over Voltage Shutdown Threshold	56 - 415V PhN	161V PhN	116
240V Mains Alarms[1]				
AC System	AC Electrical Configuration		3PH, 4W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 412V PhN	117V PhN	84
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	53 - 415V PhN	161V PhN	116

600V Generator Voltage and Alarms[1]				
AC System	AC Electrical Configuration		3PH, 4W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 409V PhN	294V PhN	85
Under Voltage Pre-Alarm Trip	Under Voltage Pre-Alarm Threshold	51 - 410V PhN	295V PhN	85
Nominal Voltage	Nominal Voltage	53 - 412V PhN	347V PhN	100
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	55 - 414V PhN	399VPhN	115
Over Voltage Shutdown Trip	Over Voltage Shutdown Threshold	56 - 415V PhN	400V PhN	115
600V Mains Alarms[1]				
AC System	AC Electrical Configuration		3PH, 4W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 412V PhN	293V PhN	84
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	53 - 415V PhN	401V PhN	116
110V Generator Voltage and Alarms[1]				
AC System	AC Electrical Configuration		1PH, 2W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 409V PhN	92V PhN	84
Under Voltage Pre-Alarm Trip	Under Voltage Pre-Alarm Threshold	51 - 410V PhN	93V PhN	85
Nominal Voltage	Nominal Voltage	53 - 412V PhN	110V PhN	100
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	55 - 414V PhN	127V PhN	115
Over Voltage Shutdown Trip	Over Voltage Shutdown Threshold	56 - 415V PhN	128V PhN	116
110V Mains Alarms[1]				
AC System	AC Electrical Configuration		1PH, 2W	
Under Voltage Alarm Trip	Under Voltage Alarm Threshold	50 - 412V PhN	92V PhN	84
Over Voltage Alarm Trip	Over Voltage Alarm Threshold	53 - 415V PhN	128V PhN	116

7. TSC 7320 WIRING PIN CONNECTIONS

Pin No.	Pin No.	Rating	Descriptions
POWER	1	8-35VDC, 0.5A MAX	NEGATIVE 24VDC (-VE)
POWER	2	8-35VDC, 0.5A MAX	POSITIVE 24VDC (+VE)
POWER	3	8-35VDC, 0.5A MAX	EMERGENCY STOP
DC OUTPUT	4	15A @ 24VDC	ATS ON SOURCE 1 (PWR FROM PIN 3)
DC OUTPUT	5	15A @ 24VDC	ATS ON SOURCE 2 (PWR FROM PIN 3)
DC OUTPUT	8	2A @ 24VDC	TRANFER TO GENERATOR
DC OUTPUT	9	2A @ 24VDC	TRANFER TO UTILITY
DC OUTPUT	10	2A @ 24VDC	TRANSFER TO NEUTRAL
DC OUTPUT	11	2A @ 24VDC	CLOSED TRANSITION MODE
DC OUTPUT	12	2A @ 24VDC	FAIL TO TRANSFER
DC OUTPUT	13	2A @ 24VDC	ATS NOT IN AUTO MODE
ANALOG INPUT	14	10VDC MAX	480V 3PH 4W CONFIGURATION
ANALOG INPUT	15	10VDC MAX	120/240V 1PH 3W CONFIGURATION
ANALOG INPUT	16	10VDC MAX	208V 3PH 4W CONFIGURATION
ANALOG INPUT	17	10VDC MAX	240V 3PH 4W CONFIGURATION
ANALOG INPUT	18	10VDC MAX	600V 3PH 4W CONFIGURATION
ANALOG INPUT	19	10VDC MAX	110V 1PH 2W CONFIGURATION
ANALOG INPUT	20	10VDC MAX	NOT MAPPED
RELAY OUTPUT	30	8A @ 250VAC	ENGINE START CONTACTS
RELAY OUTPUT	31		
RELAY OUTPUT	32	8A @ 250VAC	LOAD DISCONNECT CONTACTS
RELAY OUTPUT	33		
SENSING	34	0 - 600VAC	GENERATOR VOLTAGE PHASE 1
SENSING	35	0 - 600VAC	GENERATOR VOLTAGE PHASE 2
SENSING	36	0 - 600VAC	GENERATOR VOLTAGE PHASE 3
SENSING	37	0 - 600VAC	GENERATOR VOLTAGE NUETRAL
SENSING	38	0 - 600VAC	MAINS VOLTAGE PHASE 1
SENSING	39	0 - 600VAC	MAINS VOLTAGE PHASE 2
SENSING	40	0 - 600VAC	MAINS VOLTAGE PHASE 3
SENSING	41	0 - 600VAC	MAINS VOLTAGE NUETRAL
CURRENT SENSING	42	0 - 5A	CURRENT TRANSFORMER, L1
CURRENT SENSING	43	0 - 5A	CURRENT TRANSFORMER, L2
CURRENT SENSING	44	0 - 5A	CURRENT TRANSFORMER, L3
CURRENT SENSING	45	0 - 5A	CURRENT TRANSFORMER, COMMON
CURRENT SENSING	46	0 - 5A	CURRENT TRANSFORMER, NEUTRAL
DC INPUT	48	30VDC MAX	GENERATOR BREAKER FEEDBACK
DC INPUT	49	30VDC MAX	MAINS BREAKER FEEDBACK
DC INPUT	50	30VDC MAX	NOT MAPPED
DC INPUT	51	30VDC MAX	MANUAL OPERATION
DC INPUT	52	30VDC MAX	OPEN TRANSITION WITH NEUTRAL DELAY
DC INPUT	53	30VDC MAX	SERVICE DISCONNECT REQUEST
DC INPUT	54	30VDC MAX	REMOTE OFF LOAD TEST
DC INPUT	55	30VDC MAX	REMOTE ON LOAD TEST

8. TROUBLESHOOTING

Several problems can cause the TSC 7320 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.

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 (mains transient) delay period in TSC 7320 has not yet expired.	Verify TSC 7320 time delay setting
	A Load Test mode has been activated locally or remotely	Check TSC 7320 load test LED status indicators
	An Exercise Test mode has been activated by the TSC 7320 scheduler	Check TSC 7320 status screen for Exercise Test is active
	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 7320 settings for under/over voltage, voltage phase balance and under/over frequency
	TSC 7320 has incorrect utility voltage or frequency settings for the ATS.	Re-Program TSC 7320 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 7320 Utility & Generator Voltage Pages. If power cabling has non-matching phase rotation, reverse power conductors on one phase on one of the supplies
	TSC 7320 utility voltage sensing connection plug (38,39,40,41) is unplugged	Verify all TSC 7320 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 7320 has “Transfer Fail” alarm activated.	Determine cause of alarm and rectify before resting the alarm on TSC 7320
	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 - 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
	Defective TSC 7320 controller	Verify TSC 7320 has 24VDC control power applied to the battery power input (1,2), then press and hold the lamp test button, and ensure all 12 LED lights on the front panel light up If defective, return to Thomson Power systems using RMA process

Will not re-transfer to utility source upon restoration (cont'd)	Faulty Generator power switching device auxiliary switch	Verify Generator side auxiliary switch (G-AUX) n/c contact is closed and is low resistance when Generator switching device is open. Verify TSC 7320 Digital input for Gen Power Switching Device is Open has been activated
	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 7320 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 7320 Settings for under/over voltage, voltage phase balance and under/over frequency
	TSC 7320 has incorrect generator voltage or frequency settings for the ATS.	Re-Program TSC 7320 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 7320 Utility & Generator Voltage Pages. If power cabling has non-matching phase rotation, reverse power conductors on one phase on one of the supplies
	TSC 7320 Generator voltage sensing connection plug (34,35,36,37) is unplugged	Verify all TSC 7320 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 7320 has "Transfer Fail" alarm activated.	Determine cause of alarm and rectify before resetting the alarm at TSC 7320
	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
Will not transfer to generator source upon failure of utility source (con't)	A loose control wire connection	Check all wiring connections in the ATS
	Defective TSC 7320 controller	Verify TSC 7320 has 24VDC control power applied to the battery power input (1,2), then press and hold the lamp test button, and ensure all 12 LED lights on the front panel light up If defective, return to Thomson Power systems using RMA process

	Faulty Utility power switching device auxiliary switch	Verify Utility side auxiliary switch (U-AUX) n/c contact is closed and is low resistance when Utility switching device is open. Verify TSC 7320 Digital input for Utility Power Switching Device is Open has been activated
Transfer to generator source without a power failure in the utility source	A Load Test mode has been activated locally or remotely	Check TSC 7320 load test LED status indicators
	An Exercise Test mode has been activated by the TSC 7320 scheduler	Check TSC 7320 status screen for Exercise Test is active
	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 7320 settings for under/over voltage, voltage phase balance and under/over frequency
	TSC 7320 has incorrect utility voltage or frequency settings for the ATS.	Re-Program TSC 7320 with correct settings as required for voltage or frequency.
	Utility power switching device has tripped open due to an over current condition and TSC 7320 “Mains Breaker Tripped” alarm is displayed.	Determine cause of alarm and rectify before TSC 7320 is reset.
	A loose control wire connection	Check all wiring connections in the ATS
	Defective TSC 7320 controller	Verify TSC 7320 has 24VDC control power applied to the battery power input (1,2), then press and hold the lamp test button, and ensure all 12 LED lights on the front panel light up 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
	TSC 7320 Engine start contact connection plug (30,31) is unplugged	Verify all TSC 7320 connectors are fully inserted
	Defective TSC 7320 controller	Verify TSC 7320 has 24VDC control power applied to the battery power input (1,2), then press and hold the lamp test button, and ensure all 12 LED lights on the front panel light up If defective, return 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 Engine control panel.
No time delay when there should be	Incorrect TSC 7320 time delay setting	Verify TSC 7320 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 manually 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.	Power switching device aux contact failure. Contact Thomson Power system for adjustment procedure or replacement of aux contacts
The transfer switch has completed a transfer, but the motor has overheated and the internal thermal protector has opened	Aux contact failure or improper adjustment	Contact Thomson Power system for adjustment procedure or replacement of aux contacts
TS 7320 Display is not showing any system information	Defective TS 7320 controller	Verify TSC 7320 has 24VDC control power applied to the battery power input (1,2), then press and hold the lamp test button, and ensure all 12 LED lights on the front panel light up If defective, return to Thomson Power systems using RMA process
	TSC 7320 controller is not powered from 24Vdc aux supply	The TSC 7320 controller needs 24Vdc aux power all the time. Verify Low power buffer module provides proper 24Vdc supply to TSC 7320 controller.

Service procedures must be undertaken by **qualified personnel only.**

NOTE

There are no user serviceable components located on the TSC 7320 printed circuit board. If the TSC 7320 controller is 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.

9. 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**

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

Component Description	Thomson Power Systems Part Number	Comments
TSC 7320 Controller Service Replacement	TSC7320SR	Must change the controller settings via the front panel prior to use. Refer to TSC 7320 Instruction Manual.
Power switching device aux contacts 1 n/o, 1 n/c (all ATS Models)	Contact service for the required parts	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

Component Description	Thomson Power Systems Part Number	Comments
120VAC 10A Auxiliary Plug-in Relay, 11 pin square	006161	Must ensure coil voltage is correct
24VDC 10A Auxiliary Plug-in Relay, 11 pin square (UX/GX)	004095	Must ensure coil voltage is correct
120VAC Auxiliary Plug-in Timer, 11 pin round	001515	Must ensure coil voltage is correct
100VA Control Transformer	009997	Change PT tabs to match panel voltage before installing

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

10. 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.

11. NOTES

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