THOMSON TECHNOLOGY
A Subsidiary of Regal-Beloit Corporation
POWER & CONTROL

TSC 800

TRANSFER SWITCH CONTROLLER

(WITH REMOTE COMMUNICATION OPTION)

INSTALLATION, OPERATING & SERVICE MANUAL

Software Version 1.7

PM049 REV 6 02/04/04

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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.

Software Version

1.7 02/04/01	Revised Transfer Fail Features and functionality
1.6 98/12/15	Added Remote Communication
1.5 n/a	Unreleased version
1.4 98/06/15	Updated Transfer Fail operation
1.3 98/01/19	Updated default under/over frequency setpoints, transfer fail programmability, minor logic revisions
1.2 97/10/10	Changed Transfer Switch fail timer to 30 seconds
1.1 97/01/30	Upgraded Frequency setting range
1.0 96/06/30	Original version

Operating & Service Manual Version

Rev 6 02/04/15	Changes for Version 1.7 TSC 800 Software
Rev 5 00/07/31	Added Four Position Test Switch Information
Rev 4 00/03/01	General revisions
Rev 3 99/02/12	Added Multi-tap information.
Rev 2 98/12/01	Added Remote Communication features per version 1.6 TSC 800 Software
Rev 1 98/01/21	General Revisions for upgraded TSC 800 software
Rev 0 97/06/04	Original release

Contact Thomson Technology, to obtain applicable instruction manuals. Soft copy of most current version is available at www.thomsontechnology.com.

2. INSTALLATION

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 Technology as required. **Note:** Factory installations of TTI 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 800 controller will require reprogramming as well.

CAUTION!!!
All installation and/or service work performed must be done by qualified personnel only. Failure to do so may cause personal injury or death.

2.3. MOUNTING LOCATION/INSTALLATION

The TSC 800 transfer controller is designed for mounting directly onto a transfer switch door. Considerations should be given for the following:

The controller should be installed in a dirt free, dry location away from extreme heat sources.

The LCD window should be installed at an optimum height for operator viewing.

Adequate space should be provided around the rear of the TSC 800 circuit board for control wiring.

Verify that the intended AC voltage input to the controller does not exceed the maximum allowable level on the control panel door as per the applicable control panels certification standard.

The TSC 800 controller can be installed onto a door of a transfer switch using two different methods:

- The first method requires a special door cutout for the LCD display and LED's as shown in FIGURE 5. This mounting method requires the Lexan faceplate to be mounted directly onto the door of the transfer switch enclosure via its adhesive tape on the rear of the Lexan. The controller must be disassembled to mount on the door, then re-assembled.
- The second method of controller mounting requires a factory supplied adapter faceplate as shown in FIGURE 6. This method only requires a simple large rectangular hole to be cut out of the door as shown in FIGURE 6(a). The controller is then inserted into this hole and the faceplate is mounted on top of the door with studs as supplied with the faceplate. Note: #8-32 AWG nuts will be required to attach the faceplate to the door.

2.4. AC VOLTAGE SENSING INPUT

The TSC 800 can accept direct AC voltage sensing inputs on the generator and utility supplies from 120-600Vac (nominal). **Note:** Direct input voltage sensing can only be used when the system utilizes a 3 phase, 4 wire distribution system which has the neutral conductor *solidly* grounded. For 3 phase, 3 wire systems (i.e. no neutral) or high voltage systems, potential transformers must be used. Refer to FIGURES 1-4 for voltage sensing connections.

2.5. AC CONTROL POWER INPUT

The TSC 800 is factory supplied for either 115Vac or 230Vac (nominal) control power input voltage. Independent AC control power is required from both utility and generator supplies. AC control power is utilized for internal TSC 800 control circuits and external control device loads. The TSC 800 requires approximately 12VA AC power for internal control circuits. The maximum external load is limited by output contact ratings (i.e. 10A resistive, 120VAC). Total AC control power requirements for each supply must be determined by adding both internal and external load requirements.

2.6. FOUR POSITION TEST SWITCH INPUTS (FTS4)

The function of the Four Position Test Switch Input is to allow operators to select various operating scenarios for test or maintenance purposes, inaddition to the use of the faceplate mounted pushbuttons.

NOTE: When an external FTS4 switch is used, the TSC 800 operation as selected from the faceplate pushbuttons will be overridden.

OFF: Disables the engine start output from the transfer switch. If the primary source is available, and within normal limits, the TSC 800 will initiate a transfer to the primary source. The transfer switch will not automatically transfer to the secondary (alternate) source should the primary source fail.

AUTO: All automatic functions are enabled.

ENGINE START: (No load test) An engine start signal will be initiated and will remain on until the FTS4 is placed in another position. The engine will start if the engine's auto start controller is in the "Auto" mode. If the primary source fails in this mode, and the secondary source is within parameters, the TSC 800 will initiate a transfer to the secondary source.

TEST: (Full load test) A primary source failure is simulated and an engine start signal will be initiated. When the secondary source is within normal limits, the TSC 800 will initiate a transfer to the secondary source. The system will remain in this state until the FTS4 is placed in another position or the secondary supply fails. Upon a secondary supply failure, if the primary supply is available, the TSC 800 will initiate a transfer to the primary supply.

2.7. OUTPUTS

The TSC 800 provides the following types of output circuits:

Engine Start Contact	Isolated Form C contact (10A, 120VAC Resistive)
Programmable Output Contact	Isolated Form C contact (10A, 120VAC Resistive)
Transfer to Utility Output	120VAC[1], 10A (Resistive) powered output contact
Transfer to Generator output	120VAC[1], 10A (Resistive) powered output contact
Pre/post-transfer to utility	120VAC[1], 3A (Resistive) powered output contact
Pre/post-transfer to generator	120VAC[1], 3A (Resistive) powered output contact
Load on utility	120VAC[1], 3A (Resistive) powered output contact
Load on generator	120VAC[1], 3A (Resistive) powered output contact

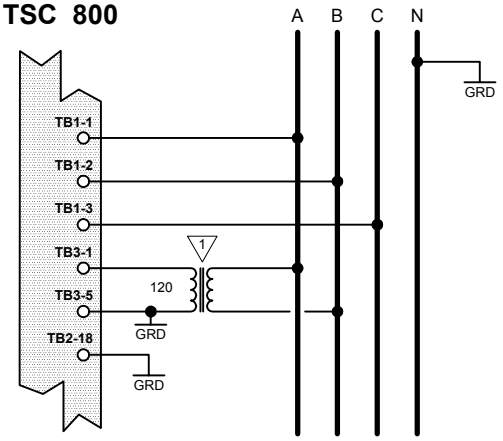
[1] **Note:** Output voltage is dependent upon AC control power input voltage (i.e. 120VAC or 230VAC nominal).

Interposing relays are required between the TSC 800 outputs and the end device if loads exceed the output current rating.

Transient suppression devices are required for all inductive devices sharing wiring or if physically located near the transfer switch controller.

For AC operated relays or solenoids, use a suitably rated metal oxide varistor (MOV) or capacitor/resistor suppressor.

TSC 800



VOLTAGE INPUTS

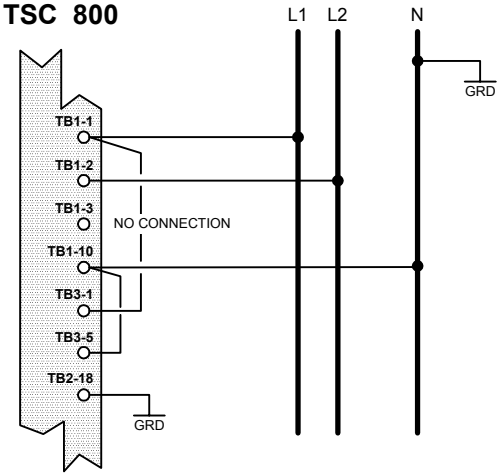
600VAC L-L, 347VAC L-N
480VAC L-L, 277VAC L-N
380VAC L-L, 220VAC L-N
208VAC L-L, 120VAC L-N

1 PT REQUIRED FOR TRANSFER SWITCH MECHANISM POWER (MUST BE SIZED TO SUIT POWER REQUIREMENTS).

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

NOTE: UTILITY VOLTAGE SENSING AND CONTROL POWER SHOWN ONLY.

TSC 800



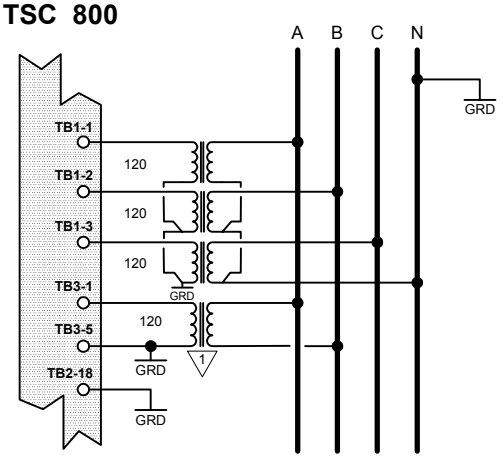
VOLTAGE INPUTS

240VAC L-L, 120VAC L-N

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

NOTE: UTILITY VOLTAGE SENSING SHOWN ONLY.

TSC 800



SECONDARY PT VOLTAGE

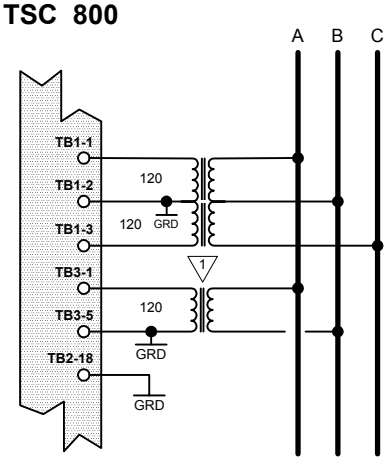
208VAC L-L, 120VAC L-N
120VAC L-L, 69VAC L-N

1 PT REQUIRED FOR TRANSFER SWITCH MECHANISM POWER (MUST BE SIZED TO SUIT POWER REQUIREMENTS).

FIG:3
3Ø, 4W WYE PT's

NOTE: UTILITY VOLTAGE SENSING SHOWN ONLY.

TSC 800



SECONDARY PT VOLTAGE

120VAC L-L [NO NEUTRAL]

NOTE: ØB IS GROUNDED

1 PT REQUIRED FOR TRANSFER SWITCH MECHANISM POWER (MUST BE SIZED TO SUIT POWER REQUIREMENTS).

FIG:4
3Ø, 3W DELTA PT's

NOTE: UTILITY VOLTAGE SENSING SHOWN ONLY.

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2.8. EXTERNAL PANEL CONTROL WIRING

As a minimum, all control wiring shall conform to the local regulatory authority on electrical installations. Specific wire sizes for typical circuits (of distances up to 100ft (30m)[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)

[1] For distances exceeding 100 ft. (30m) consult Thomson Technology

2.9. 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.

2.9.1. Remote start contact wires (2 #14 AWG (2.5mm^2)) should be run in a separate conduit.

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

2.9.3. 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.

2.9.4. The remote start contact must be voltage free (i.e. dry contact). The use of a “powered” contact will damage the transfer controller.

2.10. COMMMUNICATION CABLE

Communication cable wiring from the controller’s com 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, 8 conductor 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 TTI factory.

2.11. FACEPLATE MOUNTING DIMENSIONS

Refer to FIGURE 5 for the TSC 800 faceplate mounting dimension information.

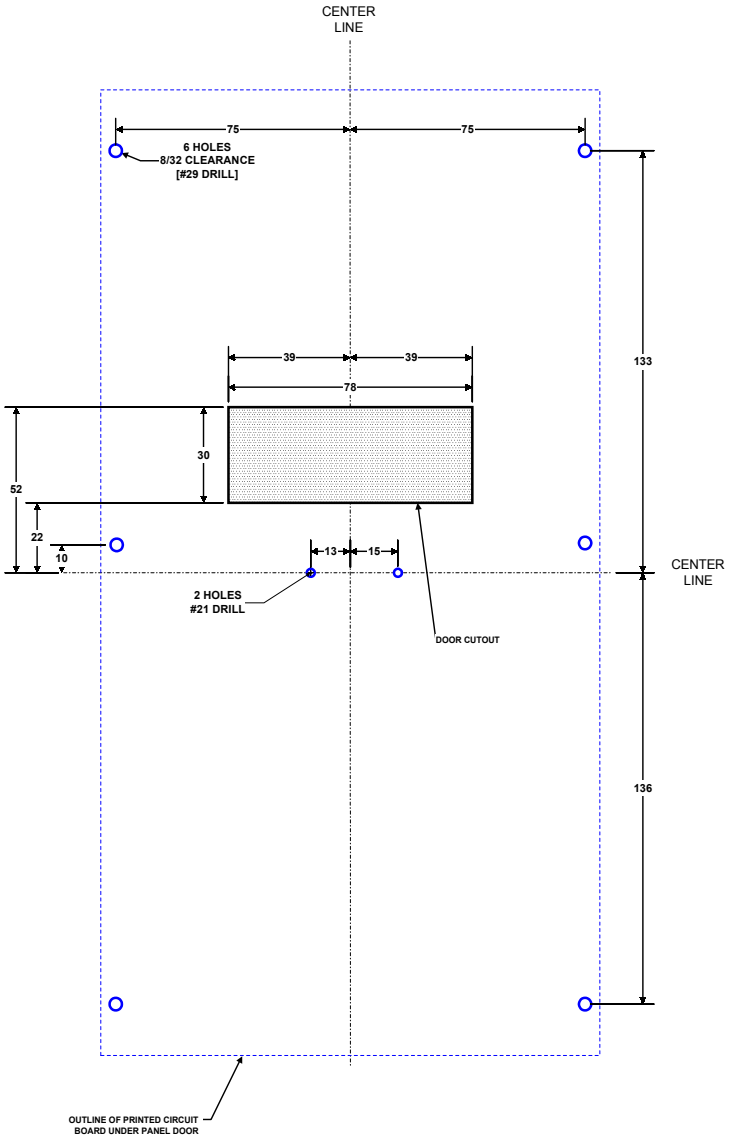

FIGURE 5

REFER TO:
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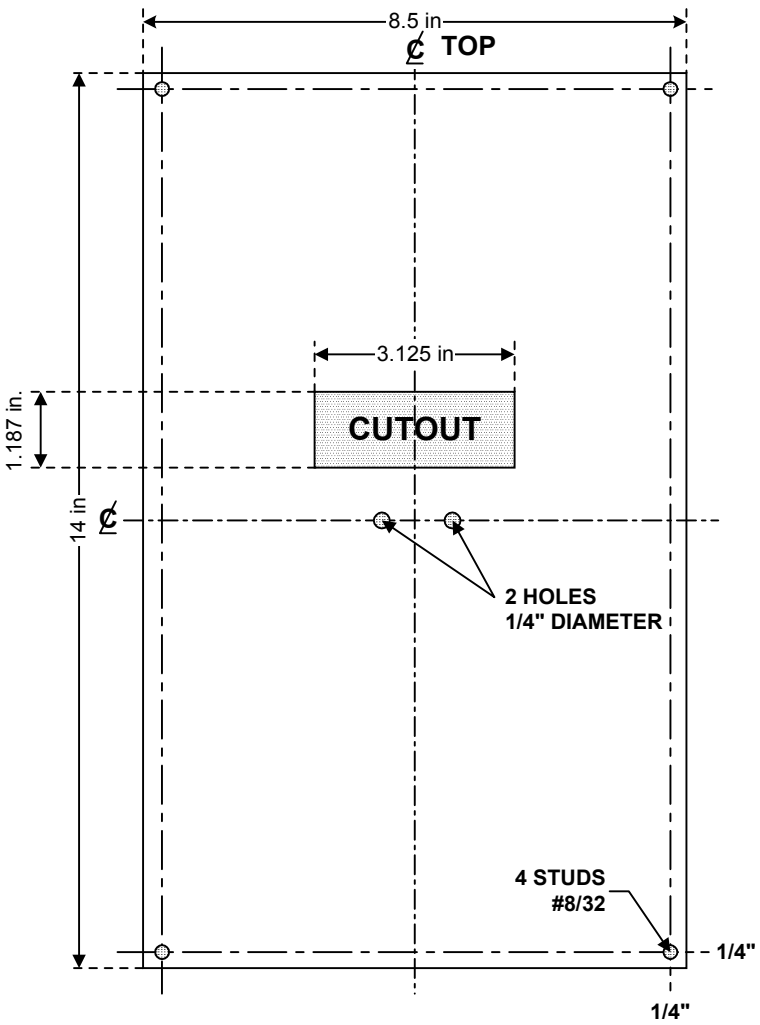

FIGURE 6: ADAPTER FACEPLATE

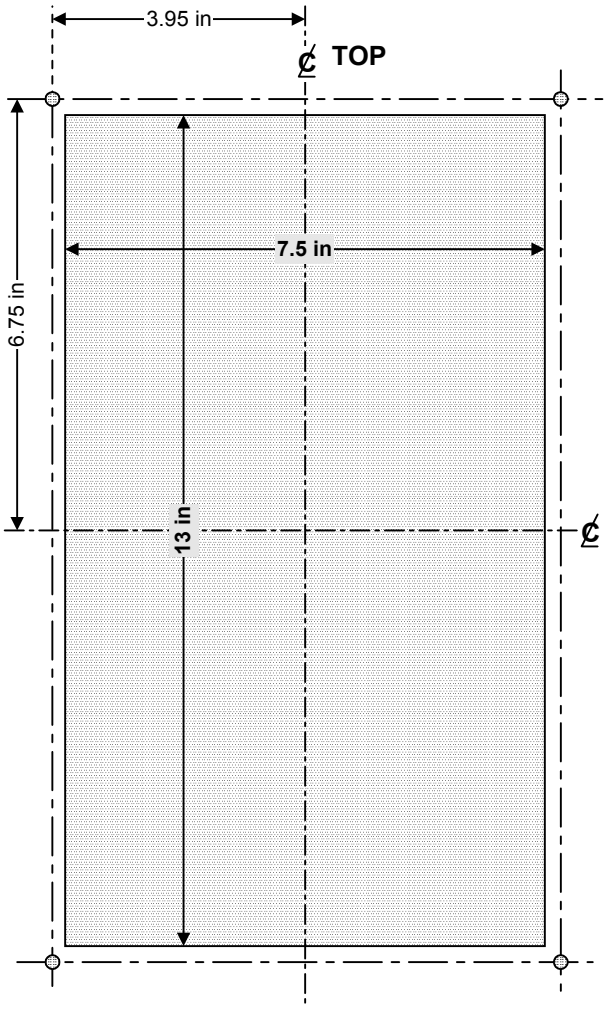

FIGURE 6(a):
DOOR CUTOUT FOR ADAPTER FACEPLATE

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2.12. DIELECTRIC TESTING

Do not perform any high voltage dielectric testing on the transfer switch with the TSC 800 controller connected into the circuit as serious damage will occur to the controller. All AC control fuses or control circuit isolation plugs connected to the TSC 800 must be removed if high voltage dielectric testing is performed on the transfer switch.

3. DESCRIPTION

The TSC 800 controller utilizes microprocessor-based design technology which provides high accuracy for all voltage sensing and timing functions. The **TSC 800** is factory configured to control all the operational functions and display features of the automatic transfer switch. All standard and optional control features of the **TSC 800** are fully programmable from the front panel LCD display and are security password protected. The LCD display screen prompts are in plain English, providing a user-friendly operator interface with many display options available. The microprocessor design provides many standard features which were previously only available as add-on optional features.

The TSC 800 controller consists of two parts; a Lexan faceplate which is mounted externally on the transfer switch door, and a printed circuit board (PCB) which is mounted inside the transfer switch door.

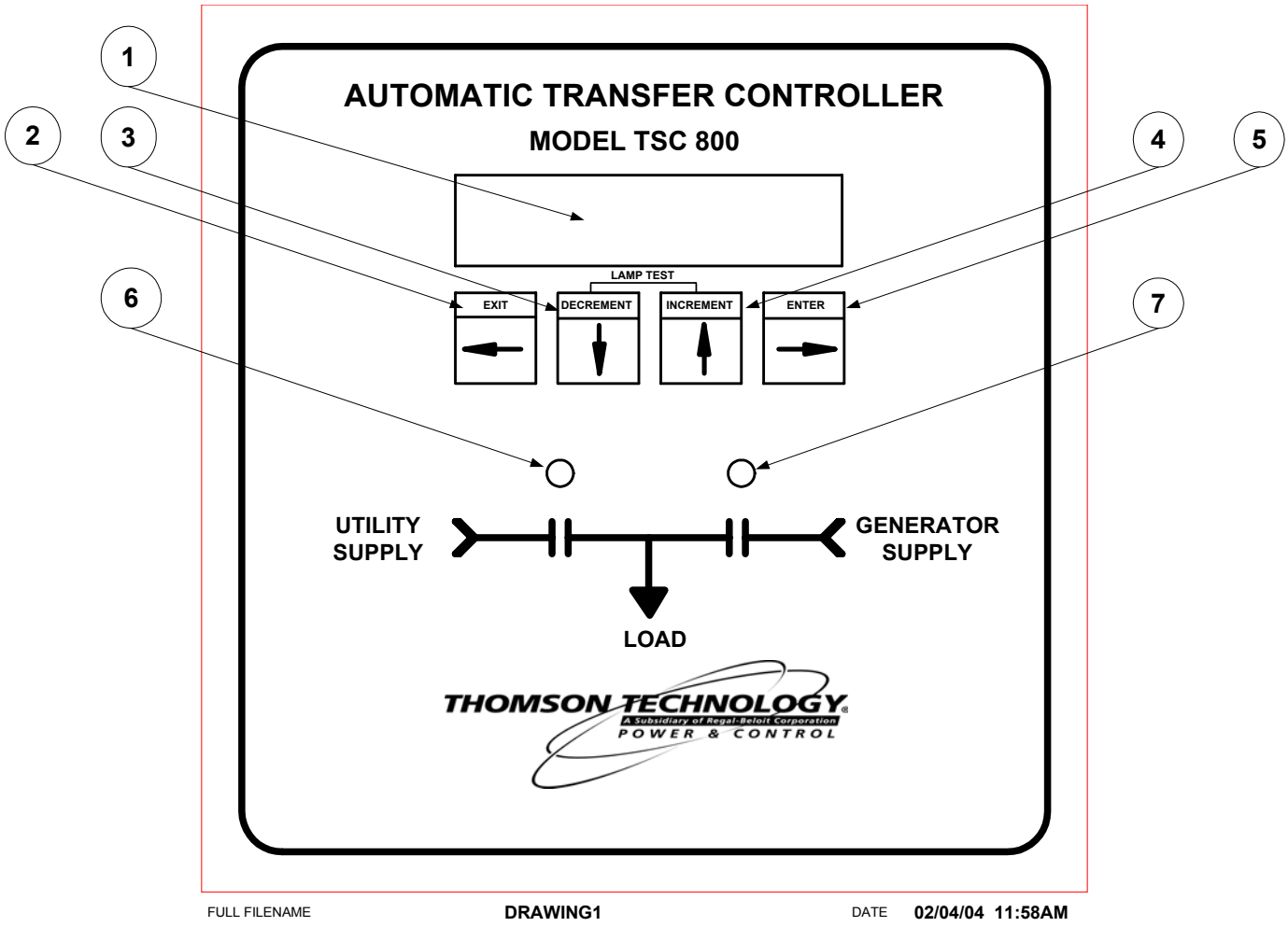

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FIGURE 7

3.1. LEXAN FACEPLATE

The Lexan faceplate is shown as in FIGURE 7. The Lexan pushbuttons are connected to the main PCB via plug-in ribbon cable. The main features of the Lexan faceplate are described as follows with reference to FIGURE 7.

① LCD viewing window. The LCD display is mounted on the main PCB which is visible from the lexan faceplate.

② EXIT push-button. The EXIT function is used to scroll backwards through the status menus or programming prompts to the previous item. The EXIT function is used to "exit" the programming menu by holding this button down for approximately 2 seconds while in the programming mode.

③ DECREMENT push-button. The DECREMENT function is used to change a programming value while in the programming mode. When this push-button is held down, the displayed value will be "decremented" to a lower value as desired. Note: The longer the push-button is held down, the faster the value will be decremented.

④ INCREMENT push-button. The INCREMENT function is used to change a programming value while in the programming mode. When this push-button is held down, the displayed value will be "incremented" to a higher value as desired. Note: The longer the push-button is held down, the faster the value will be incremented.

⑤ ENTER push-button. The ENTER function is used to scroll forwards through the status menus or programming prompts to the next item. The ENTER function is used to "enter" a programming or test mode as well as accepting changed programming values. **Note:** In the programming mode, the longer the ENTER push-button is held down, the faster the next menu prompt will appear.

⑥ Load on Utility supply LED light viewing window

⑦ Load on Generator supply LED light viewing window

3.1.1. LAMP TEST

A lamp test feature is provided to test all LED lights as well as the LCD display. To activate the lamp test feature, simultaneously push the INCREMENT and DECREMENT push-buttons. All LED's and LCD display should illuminate for approximately 2 seconds then return to their original status.

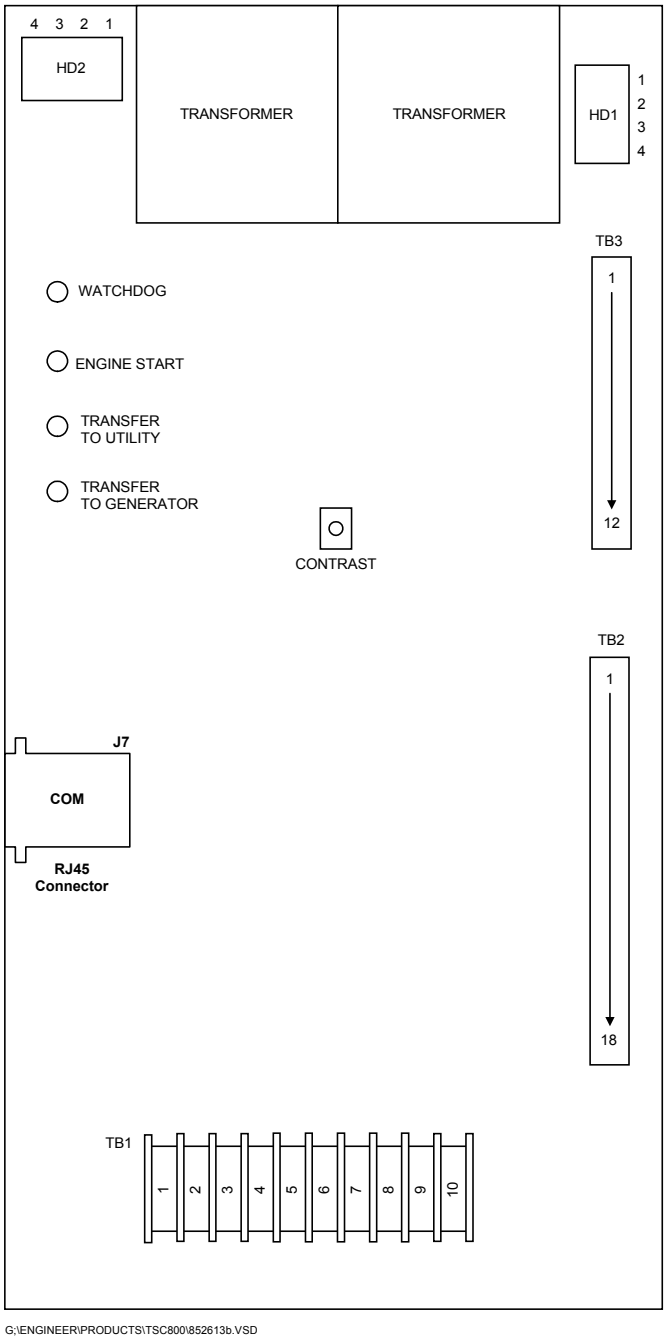

FIGURE 8

3.2. PRINTED CIRCUIT BOARD

The printed circuit board (PCB) is shown in FIGURE 8. The PCB contains the following user interface items:

3.2.1. VOLTAGE SELECTION

The voltage selection is made via two connector plugs which are located on the PCB and are identified as HD1 and HD2. A different plug assembly is required for a voltage change.

The TSC 800 is factory configured for a specific power supply voltage input as designated by voltage header plugs labeled as follows:

115V - designates a 115V power supply input voltage

230V - designates a 230V power supply input voltage

3.2.2. TERMINAL BLOCKS

Three terminal blocks are located on the PCB as follows:

TB1 high voltage sensing terminal block (120-600VAC)

WARNING

Voltage sensing circuits are capable of lethal voltages while energized. Standard safety procedures should be followed and be performed by qualified personnel only. Failure to do so may cause personnel injury and/or death.

TB2 transfer control terminal block for output contacts and low voltage inputs

TB3 transfer control terminal block for 115/230v input and output circuits

3.2.3. DIAGNOSTIC LED'S

The TSC 800 controller provides four diagnostic LED lights which are mounted on the rear of the printed circuit board as per FIGURE 8. Their functions are described as follows:

WATCHDOG — This LED flashes on and off at irregular intervals which indicates that the microprocessor is functioning normally.

TRANSFER TO UTILITY — This LED is illuminated whenever the TSC 800 is initiating a Transfer to Utility signal.

TRANSFER TO GEN — This LED is illuminated whenever the TSC 800 is initiating a Transfer to Generator signal.

ENGINE START — This LED is illuminated whenever the TSC 800 is initiating a Engine Start signal.

Note: All LED's will be illuminated whenever a lamp test function is performed.

3.2.4. COMMUNICATION PORT

A communication port is provided to interconnect to a remote communication system for remote monitoring and control of the transfer switch. Refer to section 3 for additional information.

3.2.5. CONTRAST ADJUSTMENT

A contrast adjustment potentiometer is located on the PCB and is factory set for ambient temperatures of 15° to 30° Celsius. For different ambient temperatures, consult the factory for adjustment procedures.

4. REMOTE COMMUNICATION OPTION

The TSC 800 transfer switch controller is available with an optional remote communication feature. The remote communication feature allows a TSC 800 controller to be monitored and controlled from a remote location via serial communication link to a personal computer (PC). PC's may be connected locally via serial communication cable to the TSC 800 or remotely via modem and telephone systems. Remote communication can be via customer supplied equipment or with an external communication interface module (CIM) as manufactured by Thomson Technology

NOTE:

The CIM module may be located in the engine control panel provided the maximum distance between the CIM and TSC 800 controller is not exceeded as per the following information. Refer to the installation section of this manual for further information.

The CIM module utilizes an internal modem and contains Modbus™ protocol to interface with different remote monitoring software programs. Refer to separate literature for detailed information on the CIM module. The TSC 800 remote communication option must be ordered and be factory enabled prior to shipment. The communication feature cannot be user enabled once shipped from the factory.

The TSC 800 communication port utilizes a RS422 data transmission signal which is directly interconnected to the CIM module via 8 conductor, shielded cable with plug-in RJ45 connectors. Refer to FIGURES 9 & 10 for detailed information on direct connected or remote connected PC applications with CIM module.

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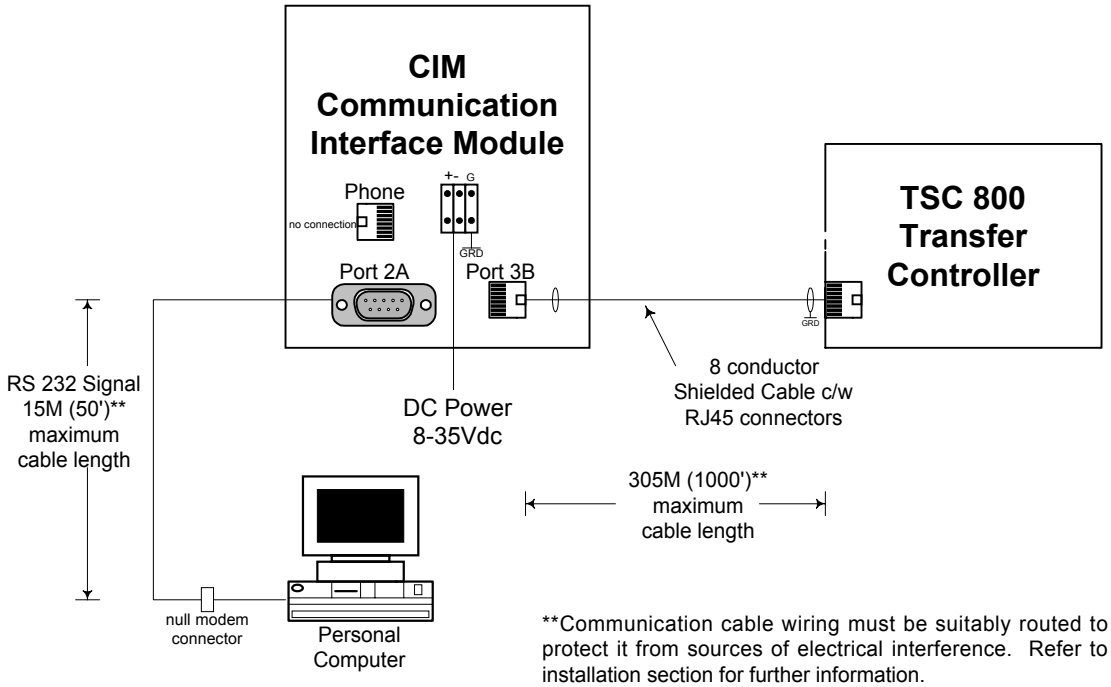

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FIGURE #9 TSC 800 WITH CIM MODULE & DIRECT CONNECTED PC (RS232)

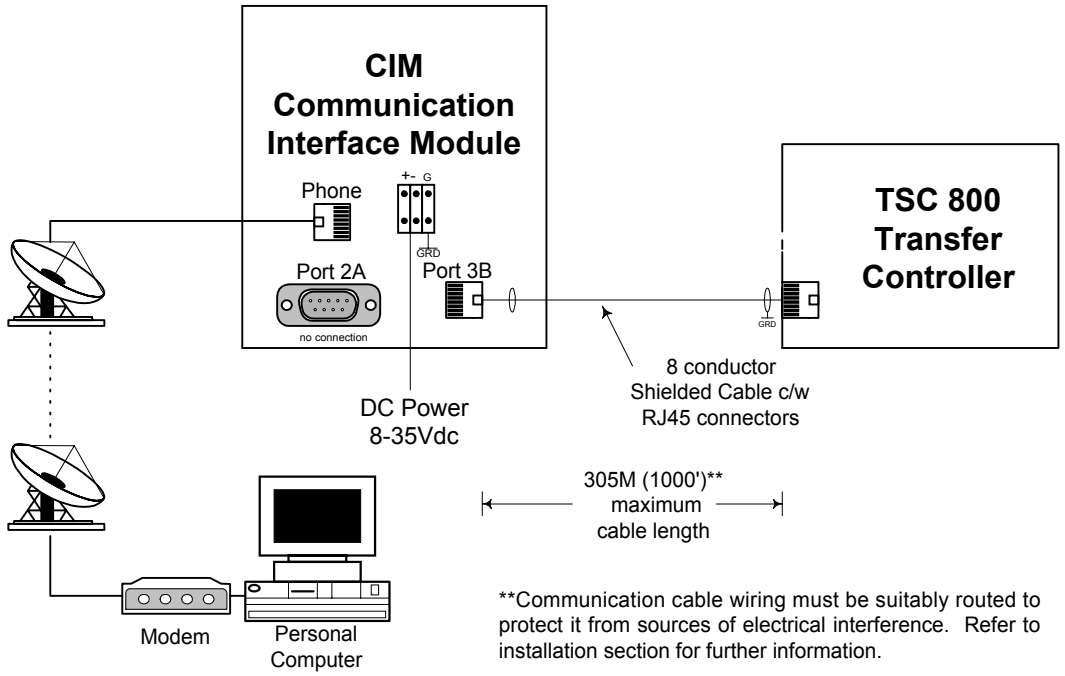

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FIGURE #10 TSC 800 WITH CIM MODULE & REMOTE CONNECTED PC

The TSC 800 RS422 communication port allows multiple TSC 800 controllers to be directly interconnected together to form a single network system. Up to 10 TSC 800 controllers may be interconnected to a single CIM module.

> **NOTE**:
> TSC 800 controllers and MEC 20 engine/generator controllers may be interconnected together via the same communication network provided the maximum number of controllers and interconnection distances are not exceeded. For additional information, refer to associated product instruction manuals.

Each TSC 800 controller is programmed with an unique communication node address number for the remote communication system to reference. The network system may be connected to a local PC or to a remote PC via telephone system and CIM module. Refer to FIGURE #11 for a typical TSC 800 network system with CIM module.

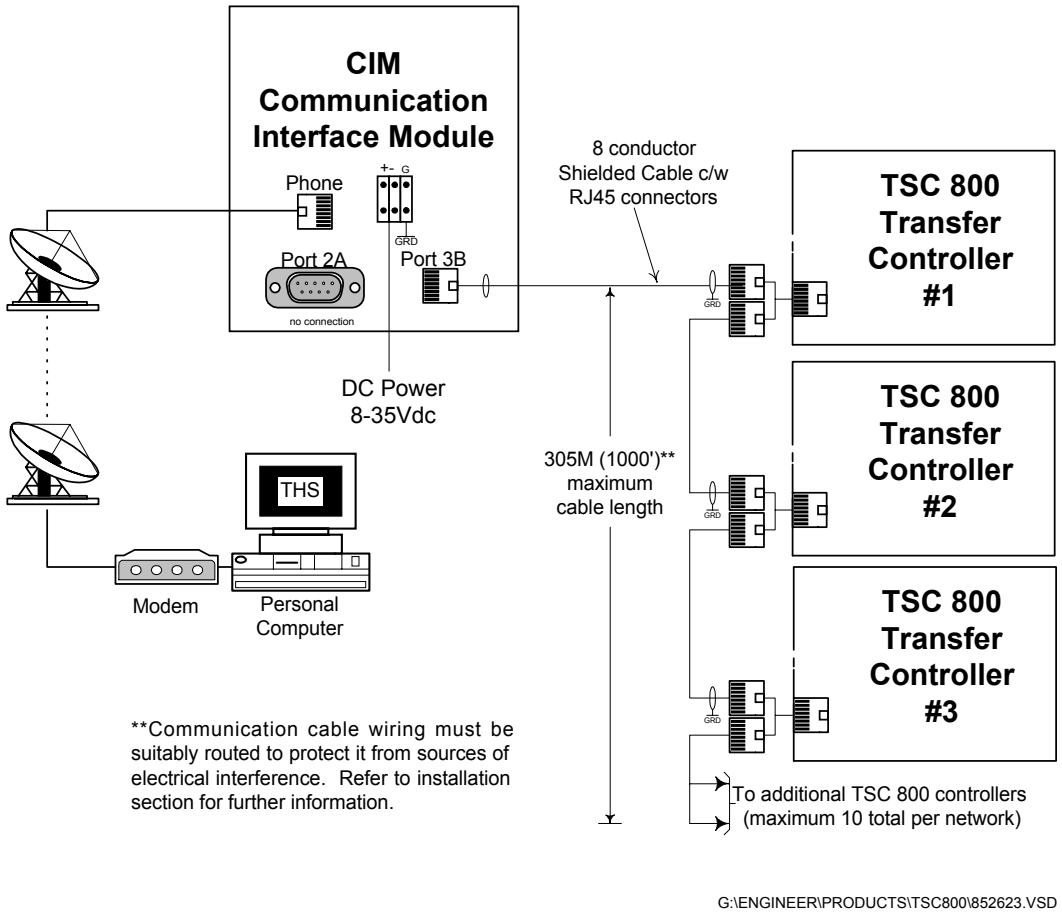
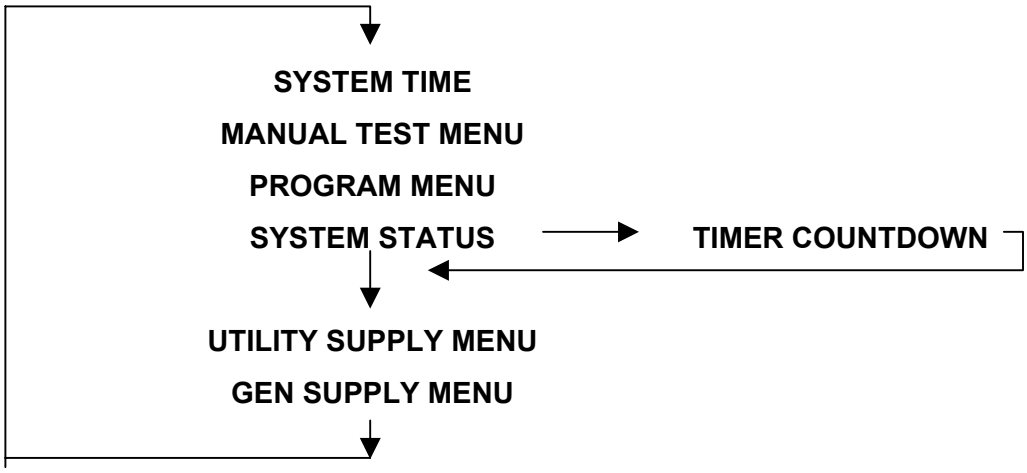


FIGURE #11 NETWORKED TSC 800 INTERCONNECTION DIAGRAM

5. TSC 800 DISPLAY MENUS

The TSC 800 contains a Liquid Crystal Display (LCD) which is visible on the front faceplate. The LCD has preprogrammed display menus which may be selected by pressing the *ENTER* or *EXIT* push-buttons in succession until the desired menu is displayed. The display menu types and order in which they are programmed are as follows:



5.1. SYSTEM TIME MENU

The system time menu is used to show current system time. The TSC 800 controller uses its internal time clock to reference when an automatic exercising operation (if pre-programmed) is to occur. To change the system time, refer to the "time clock adjustment" section of this manual.

LCD DISPLAY

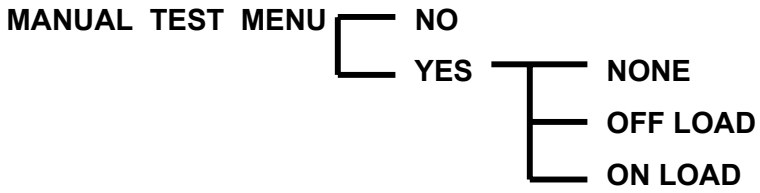
① Displays the day of the week

② Displays the current time in hours (24-hour clock): hour: min: seconds

5.2. MANUAL TEST MENU

The Manual Test Menu may be selected to initiate a specific type of generator testing operation.

The test sub-menus are organized as follows:



LCD DISPLAY

① Displays two messages which may be toggled between *YES* or *NO* by pressing the *INCREMENT* push-button. Their functions are described as follows:

- **NO** Testing operation menu is disabled when NO is displayed.
- **YES** Testing operation menu is enabled when YES is displayed and entered.

The following Test Mode options are provided:

NONE Testing operation is disabled when the NONE prompt is selected. To terminate a previously-set testing mode, select NONE and enter.

OFF LOAD When OFF LOAD prompt is selected and entered, the generator will immediately start and operate off load and will not permit a load transfer. **Note:** If the utility supply fails during this test mode, the generator will transfer on load. The generator will remain running until a different test mode is selected and entered.

ON LOAD When the ON LOAD prompt is selected and entered, the generator will immediately start and transfer on load. The generator will remain on load until a different test mode is selected and entered.

5.3. TSC 800 PROGRAM MENU

The programming menu is used to access the TSC 800's programmable functions such as time delays, voltage/frequency setpoints, calibration and time clock adjustments.

Access to the programming sub-menus can only be obtained with a security password number. The sub menus are organized as follows:

LCD DISPLAY

PROGRAM MENU NO①	

① Displays two messages which may be toggled between YES or NO by pressing the *INCREMENT* push-button. Their functions are described as follows:

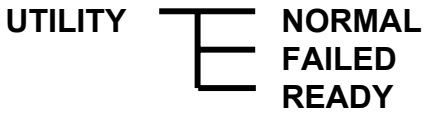
- **NO** Programming sub-menus are disabled when NO is displayed.
- **YES** Programming sub-menus are enabled when YES is displayed.

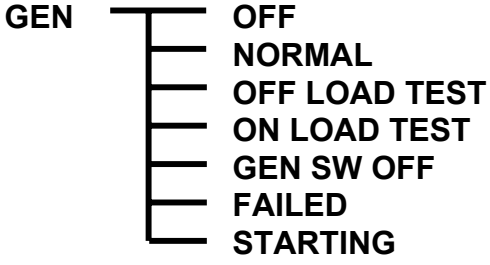
5.4. SYSTEM STATUS MENU

The system status menu provides the operator with information as to current status of both the utility and generator supplies.

NOTE:
The system status menu screen may be momentarily replaced with a time delay countdown screen when a transfer sequence is initiated. The display will automatically return to the previous menu following expiry of the timing sequence.

The system status sub-menus are organized as follows:





LCD DISPLAY

UTIL	**NORMAL**①
GEN	**OFF**②

① Displays utility supply status conditions. There are three status conditions:

NORMAL Load is on the utility supply and the utility's voltage and frequency is normal.

FAILED Utility supply voltage and/or frequency is outside the nominal programmed limits(i.e. failed condition).

READY Load is on the generator supply and the utility supply is ready to transfer. This is a temporary condition due to either a test mode being selected or during a utility return time delay.

② Displays generator supply status conditions. There are seven status conditions as follows:

OFF Load is on the utility supply and the generator is off, ready to start upon utility failure condition.

NORMAL The generator is running due to a failed utility supply.

OFF LOAD TEST The generator is running off load due to manually initiated test mode via the front-panel push-buttons or exercise timer mode.

ON LOAD TEST The generator is running on load due to a manually initiated test mode via the front panel push-buttons or an automatic test mode as programmed in the time clock exercising menu.

GEN SW OFF The four position test switch has been set to the OFF position, disabling generator starting and transferring operation.

FAILED Generator is signaled to operate, however its voltage and/or frequency is outside the nominal programmed limits (i.e. failed condition).

STARTING Engine start signal has been initiated, and the TSC 800 sensors are waiting for generator voltage to build up.

5.5. TIMER COUNTDOWN MENUS

Timer countdown menus are automatically displayed when a specific time delay function occurs during a transfer sequence. When a time delay begins, the LCD display will indicate the time delay function name (e.g. GEN. START DELAY) and the current time remaining in the countdown sequence. When the timing function is complete, the LCD display will automatically change to either the next timing sequence countdown display or return to the original system status screen menu.

LCD DISPLAY

GEN START
DELAY① 45 SEC②

① Displays specific time delay function currently in operation

② Displays current time in seconds or minutes that are left in the specific timing sequence.

NOTE:

During a timer countdown sequence, a different display menu may be selected by pressing the *ENTER* push-button.

The following timer countdown screens are provided:

GEN START DELAY	**XX SEC.**
GEN WARMUP DELAY	**XX SEC.**
GEN COOLING DELAY	**XX SEC.**
UTILITY RETURN DELAY	**XX MIN.**
PRE-TRANSFER DELAY	**XX SEC.**
NEUTRAL DELAY	**XX SEC.**
POST-TRANSFER DELAY	**XX SEC.**

5.6. UTILITY SUPPLY MENU

The utility supply menu allows the operator to view the utility supply voltage and frequency values.

LCD DISPLAY

```
UTIL      60.0 HZ①
600②  600③  600④
```

① Displays utility supply frequency in hertz (HZ). The frequency is displayed with a resolution of 1/10 of a hertz.

② Displays utility supply voltage as follows:

- 3-phase system: LINE TO LINE VOLTAGE--Phases A to B
- 1-phase system: LINE TO LINE VOLTAGE--Phases L1 to L2

③ Displays utility supply voltage as follows:

- 3-phase system: LINE TO LINE VOLTAGE--Phases B to C
- 1-phase system: LINE TO NEUTRAL VOLTAGE--Phases L1-N

④ Displays utility supply voltage as follows:

- 3-phase system: LINE TO LINE VOLTAGE--Phases C-A
- 1-phase system: LINE TO NEUTRAL VOLTAGE--Phases L2-N

5.7. GENERATOR SUPPLY MENU

The generator supply menu allows the operator to view the generator supply voltage and frequency values.

LCD DISPLAY

```
GEN       60.0 HZ①
600②  600③  600④
```

① Displays generator supply frequency in hertz (HZ). The frequency is displayed with a resolution of 1/10 of a hertz.

② Displays generator supply voltage as follows:

- 3-phase system: LINE TO LINE VOLTAGE--Phases A to B
- 1-phase system: LINE TO LINE VOLTAGE--Phases L1 to L2

③ Displays generator supply voltage as follows:

- 3-phase system: LINE TO LINE VOLTAGE--Phases B to C
- 1-phase system: LINE TO NEUTRAL VOLTAGE--Phases L1-N

④ Displays generator supply voltage as follows:

- 3-phase system: LINE TO LINE VOLTAGE--Phases C-A
- 1-phase system: LINE TO NEUTRAL VOLTAGE--Phases L2-N

6. OPERATING INSTRUCTIONS

To operate the TSC 800 controller and associated transfer switch using the front faceplate push-buttons, refer to the following detailed operating instruction sub-section descriptions.

6.1. DISPLAY MENUS

The TSC 800 will display the last selected menu when normal utility or generator power is energized. To view another display menu, press the *ENTER* push-button to scroll to the next available menu. Keep pressing the ENTER push-button to view the complete list of display menu types. Note that the menu list will automatically loop back to the first menu item when the end of the list is reached.

6.2. TESTING INSTRUCTIONS

To perform a testing operation on the transfer switch using the front faceplate push-buttons, follow the procedure listed below.

To Initiate the Test Mode:

- Using the *ENTER* push-button, scroll to the **MANUAL TEST MENU**.
- Using the *INCREMENT* push-button, select the **YES** message and press the *ENTER* push-button.
- Using the *INCREMENT* push-button, select the **ON LOAD** or **OFF LOAD** test option as required.
- Press the *ENTER* push-button.

To Exit the Test Mode:

- Using the *ENTER* push-button, scroll to the **MANUAL TEST MENU.**
- Using the *INCREMENT* push-button, select the **YES** message and press the *ENTER* push-button.
- Using the *INCREMENT* push-button, select the **NONE** test option.
- Press the *ENTER* push-button.

6.3. TIME CLOCK ADJUSTMENT

To adjust the TSC 800 controllers internal time clock, follow the detailed procedure below. Note normal utility or generator power must be energized to enable adjustment.

- Using the *ENTER* push-button, scroll to the **PROGRAM MENU**.
- Using the *INCREMENT* push-button, select the **YES** message and press the *ENTER* push-button.
- Press the *ENTER* push-button when the **PASSWORD** message is displayed.
- Using the *INCREMENT* push-button, select the current ***day*** of the week message and press the *ENTER push*-button.
- Using the *INCREMENT* push-button, select the current ***hour*** of the day (i.e. 24 hour clock) and press the *ENTER push*-button.
- Using the *INCREMENT* push-button, select the current ***minute*** of the day (i.e. 60 minute) and press the *ENTER push*-button.
- Press the EXIT push-button and hold for 2 seconds to exit the time clock adjustment mode.

7. PROGRAMMING INSTRUCTIONS

Access to the programmable parameters of the **TSC 800** Transfer Controller is via a security password number. Three levels of security passwords are provided as described below:

READ ONLY MODE

User can view the programmable parameters only and cannot change any values. The Factory default number for the read-only level is one (1).

READ / WRITE MODE

User can view and modify any programming parameter as required. The Factory default number for the read/write level is two (2).

MASTER READ / WRITE MODE

User can view/modify any programming parameter as well as view/modify the security password level numbers. Consult TTI factory for master password number if required.

To enter the programming mode, follow the procedure as shown:

PROGRAM MENU
YES

Select the Program Menu by scrolling through the display menus using the ENTER push-button. When displayed, use the INCREMENT push-button to select the YES prompt and push the ENTER button .

PASSWORD
0

Use the INCREMENT or DECREMENT push-buttons to ramp the displayed number up or down to the desired password access number. Press the ENTER push-button when the correct number is displayed.

NOTE:

If an invalid number is entered, programming access will be limited to time clock adjustment only. To exit the programming mode, press the EXIT push-button and hold for two seconds until the display changes.

When the programming mode is accessed, the programming parameters will be displayed in the same order as the Programming Sheet. To skip over parameters that do not require changes, push and hold the ENTER push-button until the desired function is displayed. The EXIT push-button may be used to scroll backwards through the programming parameter loop.

To change a programmed parameter, use the INCREMENT or DECREMENT push-buttons to scroll through the available options or to adjust a value up or down to the desired number. When the desired option or number is displayed, press the ENTER push-button to accept the new value.

NOTE:

If the programming mode is terminated before the last change had been entered, the programming parameter will remain unchanged.

To exit the programming mode, press the EXIT push-button and hold for two seconds until the display changes.

7.1. EXERCISE TIMER

The TSC 800 controller has a built-in exercise timer which is programmable for a single occurrence, weekly exercise time period. The timer is fully programmable for 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 800's internal time clock for referencing all timing functions. The time clock has a 10 minute power reserve feature to retain correct time settings during short duration utility power failures. Note: During any On-Load exercise test mode, the transfer switch will automatically re-transfer back to the utility supply if the generator set fails. To program the exercise timer prompts refer to the following descriptions:

7.1.1. AUTO TEST START DAY

Select the day of the week (e.g. Monday, Tuesday, etc.) that the generator set is to be started to begin its exercise period.

7.1.2. AUTO TEST START HOUR

Select the hour of the day (i.e. 0-23 hour) that the generator set is to be started to begin its exercise period.

7.1.3. AUTO TEST START MINUTE

Select the minute of the day (i.e. 0-59 minutes) that the generator set is to be started to begin its exercise period.

7.1.4. AUTO TEST STOP DAY

Select the day of the week (e.g. Monday, Tuesday, etc.) that the generator set is to be stopped following its exercise period.

7.1.5. AUTO TEST STOP HOUR

Select the hour of the day (i.e. 0-23 hour) that the generator set is to be stopped following its exercise period.

7.1.6. AUTO TEST STOP MINUTE

Select the minute of the day (i.e. 0 to 59 minutes) that the generator set is to be stopped following its exercise period.

7.1.7. AUTO TEST MODE

Select type of test mode desired. Three test modes are available as follows:

7.1.7.1. NONE: The exercise test mode is de-activated.

7.1.7.2. OFF LOAD: The generator set will be started during the exercise period but no transfer will occur. Note: the generator will transfer on load if the utility supply fails during the test period.

7.1.7.3. ON LOAD: The generator will be started and will transfer on load. Note: During the On-Load exercise test mode, the transfer switch will automatically re-transfer back to the utility supply if the generator set fails.

7.2. SYSTEM CONFIGURATION

The TSC 800 controller provides a flexible control system to allow specific operation for a wide range of power distribution types. To program the system configuration, refer to the following descriptions:

7.2.1. NODE ADDRESS

Set to unique controller address (1-255) for use with network connected TSC 800 controllers.

Note: This programming feature is only active when the remote communication option is enabled. Default setting for single TSC 800 applications is 1.

7.2.2. SYSTEM VOLTAGE

Set to nominal system voltage as expressed in “phase to phase” voltage.(i.e. a 347/600 volt system would be entered as “600”. The programmable range of values is 120V-15,000V.

7.2.3. VOLTAGE SENSING RATIO

For direct voltage sensing wiring connections from 208 to 600 volts, enter a ratio of “1:1”. When potential transformers are utilized for voltage sensing, enter the transformer ratio.(e.g. when using a 600:120 transformer, enter a ratio of “5:1”.

7.2.4. SYSTEM FREQUENCY

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

7.2.5. SYSTEM PHASES

Set to match the power distribution system used on the automatic transfer switch (i.e. either 1 phase or 3 phase system).

7.3. VOLTAGE SENSING

The TSC 800 controller provides 3-phase overvoltage and undervoltage 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. To program the voltage sensing features, refer to the following descriptions:

7.3.1. UTILITY UNDERVOLTAGE SENSOR PICKUP

Set to the desired utility undervoltage setpoint at which the internal voltage sensor *picks up* (i.e. the sensor energizes to a normal state when the utility voltage is above the setpoint). The setting is entered based on a phase to phase voltage value within a range of 70% to 100% of nominal system voltage. Note: The difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.2. UTILITY UNDERVOLTAGE SENSOR DROPOUT

Set to the desired utility undervoltage setpoint at which the internal voltage sensor *drops out* (i.e. the sensor de-energizes to an abnormal state when the utility voltage is below the setpoint). The setting is entered based on a phase to phase voltage value within a range of 70% to 100% of nominal system voltage. Note: The difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.3. UTILITY UNDERVOLTAGE SENSOR TIME DELAY (DROPOUT)

Select the desired utility undervoltage time delay setting. The setting is entered in seconds within a range of 0 to 10 seconds. If no delay is required, set this time delay to zero.

7.3.4. UTILITY OVERVOLTAGE SENSOR PICKUP

Note: This feature is optional and must be factory ordered with the transfer switch. Set to the desired utility overvoltage setpoint at which the internal voltage sensor *picks up* (i.e. the sensor energizes to an abnormal state when the utility voltage is above the setpoint). The setting is entered based on a phase to phase voltage value within a range of 100% to 130% of nominal system voltage. **Note:** The

difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.5. UTILITY OVERVOLTAGE SENSOR DROPOUT

Note: This feature is optional and must be factory ordered with the transfer switch. Set to the desired utility overvoltage setpoint at which the internal voltage sensor *drops out* (i.e. the sensor de-energizes to a normal state when the utility voltage is below the setpoint). The setting is entered based on a phase to phase voltage value within a range of 100% to 130% of nominal system voltage. **Note:** The difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.6. UTILITY OVERVOLTAGE SENSOR TIME DELAY (PICKUP)

Note: This feature is optional and must be factory ordered with the transfer switch. Select the desired utility overvoltage time delay setting. The setting is entered in seconds within a range of 0 to 5 seconds. If no delay is required, set this time delay to zero.

7.3.7. GENERATOR UNDERVOLTAGE SENSOR PICKUP

Set to the desired generator undervoltage setpoint at which the internal voltage sensor *picks up* (i.e. the sensor energizes to a normal state when the generator voltage is above the setpoint). The setting is entered based on a phase to phase voltage value within a range of 70% to 100% of nominal system voltage. **Note**: The difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.8. GENERATOR UNDERVOLTAGE SENSOR DROPOUT

Set to the desired generator undervoltage setpoint at which the internal voltage sensor *drops out* (i.e. the sensor de-energizes to an abnormal state when the generator voltage is below the setpoint). The setting is entered based on a phase to phase voltage value within a range of 70% to 100% of nominal system voltage. **Note**: The difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.9. GENERATOR UNDERVOLTAGE SENSOR TIME DELAY (DROPOUT)

Select the desired generator undervoltage time delay setting. The setting is entered in seconds within a range of 0 to 10 seconds. If no delay is required, set this time delay to zero.

7.3.10. GENERATOR OVERVOLTAGE SENSOR PICKUP

Note: This feature is optional and must be factory ordered with the transfer switch. Set to the desired generator overvoltage setpoint at which the internal voltage sensor *picks up* (i.e. the sensor energizes to an abnormal state when the generator voltage is above the setpoint). The setting is entered based on a phase to phase voltage value within a range of 100% to 130% of nominal system voltage. Note: The difference between the pick up and drop out setting is considered the dead band or hysteresis value.

7.3.11. GENERATOR OVERVOLTAGE SENSOR DROPOUT

Note: This feature is optional and must be factory ordered with the transfer switch. Set to the desired generator overvoltage setpoint at which the internal voltage sensor *drops out* (i.e. the sensor de-energizes to a normal state when the generator voltage is below the setpoint). The setting is entered based on a phase to phase voltage value within a range of 100% to 130% of nominal system voltage. **Note**: The difference between the pickup and dropout setting is considered the dead band or hysteresis value.

7.3.12. GENERATOR OVERVOLTAGE SENSOR TIME DELAY (PICKUP)

Note: This feature is optional and must be factory ordered with the transfer switch. Select the desired generator overvoltage time delay setting. The setting is entered in seconds within a range of 0 to 5 seconds. If no delay is required, set this time delay to zero.

7.4. FREQUENCY SENSING

The **TSC 800** controller 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 frequency sensing features, refer to the following descriptions:

7.4.1. UTILITY UNDERFREQUENCY SENSOR

Note: This feature is optional and must be factory ordered with the transfer switch.

Set to the desired utility underfrequency setpoint at which the internal frequency sensor *drops out* (i.e. the sensor de-energizes to an abnormal state when the utility frequency is below the setpoint). The setting is entered in a frequency value within a range of 40.0 to 60.0 HZ.

7.4.2. UTILITY UNDERFREQUENCY SENSOR TIME DELAY (DROPOUT)

Note: This feature is optional and must be factory ordered with the transfer switch.

Select the desired utility underfrequency time delay setting. The setting is entered in seconds within a range of 0 to 10 seconds. If no delay is required, set this feature to zero.

7.4.3. UTILITY OVERFREQUENCY SENSOR

Note: This feature is optional and must be factory ordered with the transfer switch.

Set to the desired utility overfrequency setpoint at which the internal frequency sensor *picks up* (i.e. the sensor energizes to an abnormal state when the utility frequency is above the setpoint). The setting is entered in a frequency value within a range of 50.0 to 70.0 HZ.

7.4.4. UTILITY OVERFREQUENCY SENSOR TIME DELAY (PICKUP)

Note: This feature is optional and must be factory ordered with the transfer switch.

Select the desired utility overfrequency time delay setting. The setting is entered in seconds within a range of 0 to 5 seconds. If no delay is required, set this time delay to zero.

7.4.5. GENERATOR UNDERFREQUENCY SENSOR

Set to the desired generator underfrequency setpoint at which the internal frequency sensor *drops out* (i.e. the sensor de-energizes to an abnormal state when the generator frequency is below the setpoint). The setting is entered in a frequency value within a range of 40.0 to 60.0 HZ.

7.4.6. GENERATOR UNDERFREQUENCY SENSOR TIME DELAY (DROPOUT)

Select the desired generator underfrequency time delay setting. The setting is entered in seconds within a range of 0 to 10 seconds. If no delay is required, set this time delay to zero.

7.4.7. GENERATOR OVERFREQUENCY SENSOR

Set to the desired generator overfrequency setpoint at which the internal frequency sensor *picks up* (i.e. the sensor energizes to an abnormal state when the generator frequency is above the setpoint). The setting is entered in a frequency value within a range of 50.0 to 70.0 HZ.

7.4.8. GENERATOR OVERFREQUENCY SENSOR TIME DELAY (PICKUP)

Select the desired generator overfrequency time delay setting. The setting is entered in seconds within a range of 0 to 5 seconds. If no delay is required, set this time delay to zero.

7.5. TIME DELAYS

The TSC 800 provides many time delay control functions which are individually programmable as described below.

7.5.1. GENERATOR START DELAY

The generator (i.e. engine) start signal will be initiated following expiry of the start delay timer. Select desired generator start delay time in seconds. The range of setting is 0 to 60 seconds. If no delay is required, set this time delay to zero. **Note**: The output relay is normally energized when the utility power is within limits and de-energizes to start the generator.

7.5.2. GENERATOR WARM UP DELAY

A transfer to the generator supply will be initiated when the voltage and frequency are within limits and upon expiry of the warm up delay timer. Select desired generator warm up delay time in seconds. The range of settings is 0 to 1800 seconds. If no delay is required, set this time delay to zero.

7.5.3. GENERATOR 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 minutes. The range of settings is 0 to 30 minutes. If no delay is required, set this time delay to zero.

7.5.4. UTILITY 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 minutes. The range of settings is 0 to 30 minutes. If no delay is required, set this time delay to zero. **Note**: The utility return delay will be bypassed should the generator fail during the time delay period.

7.5.5. PRE/POST TRANSFER DELAY (LDC)

Note: This feature is optional and must be factory ordered with the transfer switch.

The pre/post transfer delay period will be initiated upon a impending transfer in either direction. The pre/post transfer output relays will momentarily energize (as per the pre-transfer time setting) prior to a load transfer and will stay energized until the post-transfer delay time period expires. Select desired pre- and post-delay time in seconds. The range of settings is 0 to 30 seconds. If no delay is required, set this time delay to zero.

7.5.6. MINIMUM FIND NEUTRAL DELAY

The TSC 800 transfer control logic includes an adjustable time delay feature to compensate for the minimum time that a transfer switch mechanism takes to operate when load sensing voltage is lost due to a power failure. This time delay is set to a time value which is approximately *equal* to the time that the transfer mechanism typically takes to operate from one supply position to the neutral position. This feature is factory set to match the specific transfer switch mechanism as supplied with the unit.

7.5.7. MAXIMUM FIND NEUTRAL DELAY

The TSC 800 transfer control logic includes an adjustable time delay feature to compensate for the maximum time that a transfer switch mechanism takes to operate when load sensing voltage is used to detect the neutral position. This time delay is set to a time value which is *greater than* the typical time that the transfer mechanism typically takes to operate from one supply position to the neutral position. When the TSC 800 controller is supplied from the factory with a TTI transfer mechanism the Maximum Find Neutral Delay will be factory set for correct operation. Note: When the TSC 800 controller is supplied loose without a transfer mechanism, the Maximum Find Neutral Delay function must be user set for correct operation with the appicable transfer mechanism. For applications using electrically held contactors, the Maximum Find Neutral Delay function must typically be set for 0.0 seconds for correct operation.

7.5.8. NEUTRAL DELAY TIMER (NDT)

The neutral delay time period will be initiated once both of the supply breakers are open during a transfer sequence. Select desired neutral delay time in seconds. The range of settings is 0 to 60 seconds. If no delay is required, set

this time delay to zero. **Note**: The neutral delay will be bypassed should the operating power fail for longer than the timer setting.

NOTE: Model TS 890 transfer switches may use NDT timers which are external to the TSC 800 controller. In this case the TSC 800 NDT function is not used and must be set at zero seconds. Refer to TS 890 drawings for further information.

7.5.9. MAXIMUM TRANSFER TIME

The TSC 800 transfer control logic includes an adjustable time delay feature to detect when a transfer switch mechanism fails to operate. This time delay is set to a time value which is *greater than* the typical time that the transfer mechanism typically takes to operate from one supply position to the opposite supply position. This feature is factory set to match the specific transfer switch mechanism as supplied with the unit.

7.5.10. TRANSFER FAIL

The TSC 800 transfer switch controller contains a "TRANSFER SWITCH FAIL" detection feature. This feature is user programmable and allows 3 different functional settings which are described below:

DISABLED: The "TRANSFER SWITCH FAIL" feature is disabled in this mode. The TSC 800 controller will not verify that the transfer mechanism has operated correctly.

HALT TRANSFER: The TSC 800 controller will verify that the transfer switch mechanism has correctly transferred or is in the correct position. If the TSC 800 controller senses an abnormal condition (i.e. load voltage and transfer switch position contacts are not at the normal levels or states) the controller will activate an alarm message to the LCD display. The transferring output signals from the controller will be de-activated and the engine start contact will remain in its last state (before the alarm was activated). The controller has an internal 30 second timer to provide an alarm bypass to enable correct operating sequences. To reset the alarm condition, the "lamp test" function must be activated.

FORCE TRANSFER: The TSC 800 controller will verify that the transfer switch mechanism has correctly transferred or is in the correct position. If the TSC 800 controller senses an abnormal condition (i.e. fail to transfer when initiated, load voltage failure due to a tripped transfer breaker or transfer switch limit switch failure) the controller will activate an alarm message to the LCD display. The transferring output signals from the controller will be enabled and will force

a transfer to the alternate source if available and within nominal limits. The transfer switch will remain on the alternate source indefinitely until the "Transfer Fail" alarm condition is manually reset on the TSC 800 controller. The controller has an internal 30 second timer to provide an alarm bypass to enable correct operating sequences. To reset the alarm condition, the "lamp test" function must be activated

Note**: The TTI factory default setting for the TSC 800 "Transfer Switch Fail" function is **FORCE TRANSFER

7.5.11. TRANSFER LOGIC

Note: This feature is user selectable in TSC 800 software version 1.3 (or greater).

The TSC 800 transfer controller software contains a user selectable function for type of transfer logic required for specific applications. This feature will be factory set for specific type of application and transfer mechanism used and therefore should not require resetting.

Selectable operating logic is as follows:

MAINTAINED: The TSC 800 transfer output signals will stay in the 'MAINTAINED" energized state upon a source failure and will only de-energize when the alternate source becomes available. Note: the transfer output signal will de-energize upon a total loss of source voltage.

DROPOUT: The TSC 800 transfer output signals will "DROPOUT" (or de-energize) when the connected source goes out of normal voltage or frequency limits. The transfer output signal will only re-energize when the connected source returns to normal limits.

7.5.12. PROGRAMMABLE OUTPUT

The TSC 800 transfer controller includes a standard programmable output relay signal. The output relay energizes when one of the following conditions occurs. Note: Only one function may be programmed.

LOAD ON UTILITY	Output energizes when the utility transfer breaker is closed and load voltage is present.
LOAD ON GENERATOR	Output energizes when the generator transfer breaker is closed and load voltage is present.
LOAD SHED	Output energizes when generator is on load and frequency drops below underfrequency setpoint for longer than the time delay setting.

UTILITY SUPPLY NORMAL Output relay energizes when the utility supply is energized and is within voltage and frequency limits.

FAIL TO TRANSFER Output relay energizes when the transfer switch mechanism fails to operate for the given time delay period. Note: This output feature is only activated when the "TRANSFER SWITCH FAIL" feature is set to either "Halt" or "Force" transfer settings. (Refer to programming item 7.5.10 for additional information.)

7.5.13. UTILITY FAIL CALLOUT

When the remote communication option is enabled, this programming prompt will appear. This feature may be enabled or disabled by programming selection.

ENABLED: The controller will initiate a callout signal via the communication port to a remote connected device when a Utility (Source 1) power failure is detected. The callout signal will be reset when the Utility (Source 1) power returns to normal condition.

DISABLED: The controller will not initiate a callout when a Utility (Source 1) power failure is detected.

7.5.14. LOAD ON GENERATOR CALLOUT

When the remote communication option is enabled, this programming prompt will appear. This feature may be enabled or disabled by programming selection.

ENABLED: The controller will initiate a callout signal via the communication port to a remote connected device when the load is connected to the generator supply. The callout signal will be reset when the load transfers back to the utility supply.

DISABLED: The controller will not initiate a callout when the load transfers to the generator supply.

7.5.15. TRANSFER FAIL CALLOUT

When the remote communication option is enabled, this programming prompt will appear. This feature may be enabled or disabled by programming selection.

ENABLED: The controller will initiate a callout signal via the communication port to a remote connected device when the transfer switch fails to operate. The callout signal will only reset when the "Fail to Transfer" alarm is manually reset via local push-buttons or with the remote communication software.

DISABLED: The controller will not initiate a callout when a "Fail to Transfer " alarm condition occurs.

7.5.16. AUTO TEST CALLOUT

When the remote communication option is enabled, this programming prompt will appear. This feature may be enabled or disabled by programming selection.

ENABLED: The controller will initiate a callout signal via the communication port to a remote connected device when a automated test is initiated at the controller via the TSC 800 exercise time clock. The callout signal will reset when the Auto Test condition is terminated.

DISABLED: The controller will not initiate a callout an Auto Test condition is initiated.

7.5.17. MAN TEST CALLOUT

When the remote communication option is enabled, this programming prompt will appear. This feature may be enabled or disabled by programming selection.

ENABLED: The controller will initiate a callout signal via the communication port to a remote connected device when a manual test is initiated at the controller via the TSC 800 push-buttons or external control switch. The callout signal will reset when the Manual Test condition is terminated.

DISABLED: The controller will not initiate a callout a Manual Test condition is initiated.

7.5.18. SWITCH NOT IN AUTO CALLOUT

When the remote communication option is enabled, this programming prompt will appear. This feature may be enabled or disabled by programming selection.

ENABLED: The controller will initiate a callout signal via the communication port to a remote connected device when the TSC 800 controllers' operating mode is "Not In Auto" as locally selected via the four position external control switch. The callout signal will reset when the control switch is returned to the Auto position.

DISABLED: The controller will not initiate a callout if the TSC 800 controller is not in the Auto mode of operation.

7.5.19. BACK LIGHT TIME OUT

The LCD back light function can be programmed so it will automatically turn off after the selected time.

7.6. VOLTAGE SENSING CALIBRATION

Voltage sensing calibration for the utility, generator and load sensors is provided by the TSC 800 software program. All voltage sensing circuits are factory calibrated to specific voltage levels prior to shipment of the transfer switch.

Should field calibration of any voltage sensing circuit be required, the following procedure may be used.

WARNING

Voltage sensing circuits are capable of lethal voltages while energized. Standard safety procedures should be followed and be performed by qualified personnel only. Failure to do so may cause personnel injury and/or death.

7.6.1. GENERAL

7.6.1.1. To access the TSC 800's software programming loop for programming, the program menu must be selected, the YES prompt entered and read/write security password level (or higher) must be entered.

7.6.1.2. Once the programming loop has been accessed, scroll to the voltage calibration screens as shown below.

UTIL AB① ZERO②
99③ 600V④

① Displays the selected supply's phase voltages to be calibrated.

② Displays the type of calibration function, either ZERO or SPAN.

③ Displays the calibration correction factor number (0-255) used to obtain the correct voltage reading. **Note**: To correctly calibrate any of the voltage sensors, the ZERO function must be calibrated before the SPAN function.

④ Displays the actual voltage measurement which will be the same value as shown on the TSC 800 display menus for generator or utility supplies. This voltage reading may be calibrated higher or lower by changing the correction factor number.

NOTE:
To accurately calibrate the TSC 800's voltage sensors, an external test voltage meter is required, with an accuracy of 0.5% or better.

7.6.2. UTILITY VOLTAGE CALIBRATION

To adjust the utility supply voltage sensors, perform the following procedure:

7.6.2.1. ZERO CALIBRATION

7.6.2.1.1. Energize the generator supply to power up the controller and de-energize the utility supply.

7.6.2.1.2. Scroll to the desired utility supply voltage phases with the **ZERO** function selected.

7.6.2.1.3. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed voltage level. Adjust the correction factor number to obtain 0 VAC on the display.

7.6.2.1.4. With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the TSC 800 programming sheet for future reference if required.

7.6.2.1.5. Repeat the above procedure for all remaining phases of the utility supply as required.

7.6.2.2.SPAN CALIBRATION

7.6.2.2.1. Energize the utility supply voltage to the controller at nominal level. The generator supply may be de-energized.

7.6.2.2.2. In the programming mode, scroll to the desired utility supply voltage phases with the **SPAN** function selected.

7.6.2.2.3. Connect an external AC voltmeter of adequate voltage range and accuracy to the TSC 800 controller terminal associated with the voltage phases to be calibrated.

WARNING

Voltage sensing circuits are capable of lethal voltages while energized. Standard safety procedures should be followed and be performed by qualified personnel only. Failure to do so may cause personal injury and/or death.

7.6.2.2.4. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed voltage level on the TSC 800. Adjust the correction factor number to obtain an identical voltage reading as measured with the external AC voltmeter.

7.6.2.2.5. With the correct voltage displayed, press the *ENTER* push-button to accept the correction factor number. Record the correction factor number on the TSC 800 programming sheet for future reference if required.

7.6.2.2.6. Repeat the above procedures for all remaining phases of the utility supply as required.

NOTE:

Once the span calibration setting has been done, do not readjust any zero calibration points as this will cause incorrect voltage readings.

8. TSC 800 PROGRAMMING DATA SHEETS

SUMMARY CONFIGURATION DATA SHEET

WORK ORDER #:		REV.		REV. DATE:	
INITIATED BY:		CUSTOMER:		DEFAULT PROGRAM #:	
DATE:		PROJECT:		TPS VERSION:	

NOTES:

SYSTEM AC INPUTS

SYSTEM AC VOLTS:_____ PHASES:_____ FREQUENCY:_____ CONTROL TYPE:_____

DIGITAL DISPLAY FEATURES

☐ GEN AC VOLTAGE ☐ UTILIY AC VOLTAGE ☐ TIME CLOCK

☐ GEN AC FREQUENCY ☐ UTILITY AC FREQUENCY

STANDARD FEATURES

☐ Level 1 Features

- 3 phase Utility (SRC 1) Undervoltage Sensing
- 3 phase Gen (SRC 2) Undervoltage Sensing
- Generator Underfrequency Sensing
- Generator Start Delay Timer
- Generator Cooldown Timer
- Utility Return Timer
- Generator Warm-up Timer
- Automatic Exercise Timer
- Neutral Delay Timer

☐ Level 2 Features (Level 1 features plus)

- Utility/Gen 3 Phase Overvoltage Sensing
- Utility Overfrequency Sensing

☐ Level 3 Features (Level 1& 2 features plus)

- Dual Source Logic

OPTIONAL FEATURES

☐ Utility/Gen 3 Phase Overvoltage Sensing
☐ Utility Overfrequency Sensing
☐ Load Disconnect Contact
☐ COM Port Enabled

STANDARD PROGRAMMABLE OUTPUTS

OUTPUT NAME	OUTPUT FUNCTION
☐ Programmable Output	☐ Load on Gen
	☐ Load on Utility
	☐ Utility Normal
	☐ Transfer Fail
	☐ Load Shed

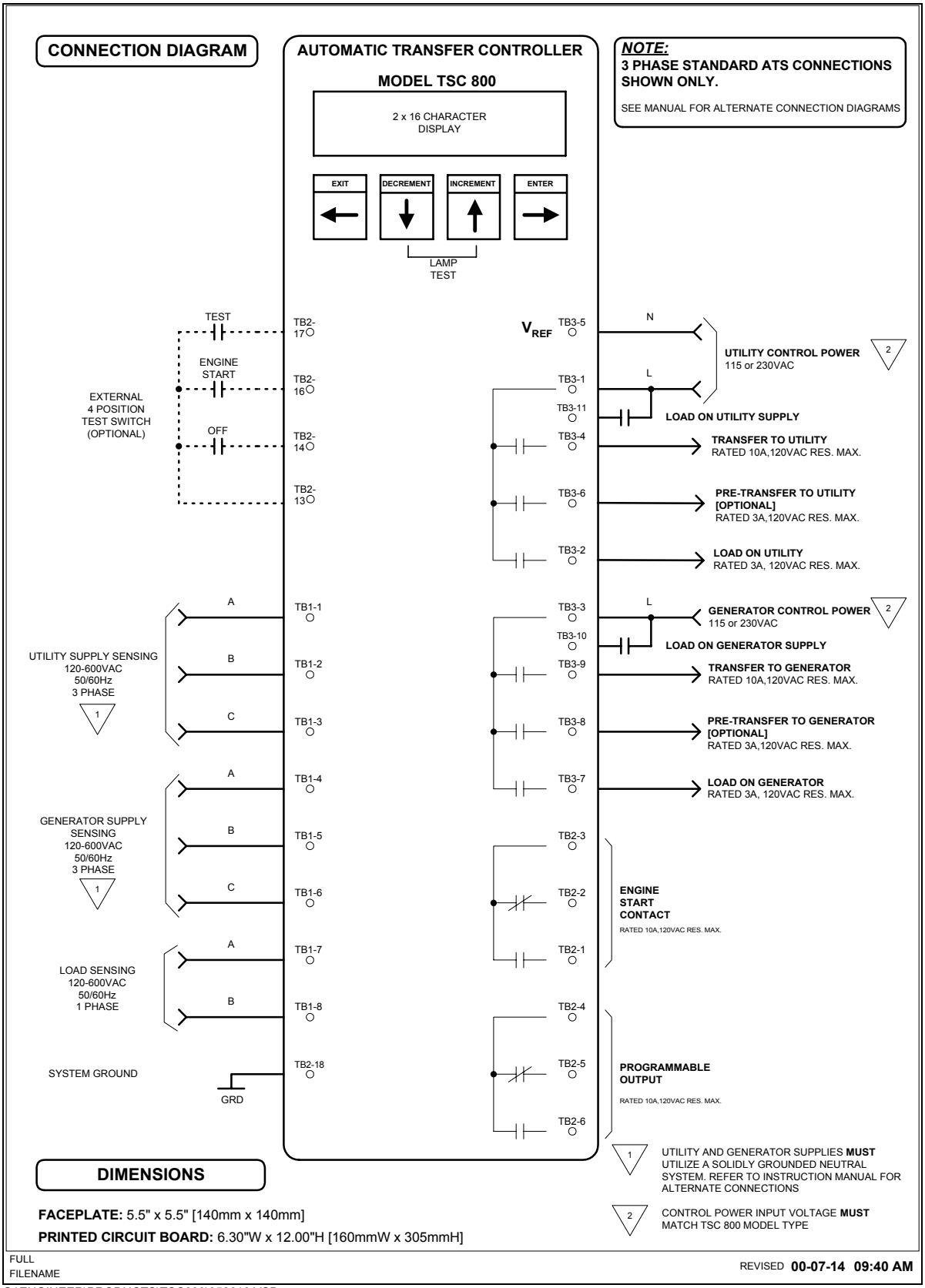
9. MAIN MENU PROGRAMMING SHEET

PARAMETER		VALUE	RANGE LOW		HIGH
CONTROL TYPE	*STD ATS / DUAL SOURCE*				
AUTO TEST START DAY					
AUTO TEST START HOUR					
AUTO TEST START MIN					
AUTO TEST STOP DAY					
AUTO TEST STOPHOUR					
AUTO TEST STOP MIN					
AUTO TEST MODE					
COMMUNICATION OPTION	*toggle enabled/disabled*				
NODE ADRESS	*#*		1		255
SYSTEM VOLTAGE	*[***VAC]*				
VOLTAGE SENSING RATIO	*RATIO*		1		208
SYSTEM FREQUENCY	*[***Hz]*		0		125
SYSTEM PHASES	*TOGGLE 1 OR 3 PHASE*				
UTILITY UNDERVOLTAGE SENSORS PICK UP	*[***VAC]*		0	to	0
UTILITY UNDERVOLTAGE SENSORS DROP OUT	*[***VAC]*		0	to	0
UTILITY UNDERVOLTAGE SENSORS TIME DELAY DROP OUT	*[**SEC]*		0	to	10
UTILITY OVERVOLTAGE SENSORS PICK UP	*[***VAC]*		0	to	0
UTILITY OVERVOLTAGE SENSORS DROP OUT	*[***VAC]*		0	to	0
UTILITY OVERVOLTAGE SENSORS TIME DELAY PICK UP	*[**SEC]*		0	to	5
UTILITY UNDER FREQUENCY SENSORS	*[***Hz]*		48.0	to	60.0
UTILITY UNDER FREQUENCY SENSORS TIME DELAY DROPOUT	*[**SEC]*		0	to	10
UTILITY OVER FREQUENCY SENSORS	*[***Hz]*		50.0	to	70.0
UTILITY OVER FREQUENCY SENSORS TIME DELAY PICK UP	*[**SEC]*		0	to	5
GENERATOR UNDERVOLTAGE SENSORS PICK UP	*[***VAC]*		0	to	0
GENERATOR UNDERVOLTAGE SENSORS DROP OUT	*[***VAC]*		0	to	0
GENERATOR UNDERVOLTAGE SENSORS TIME DELAY DROP OUT	*[**SEC]*		0	to	10
GENERATOR OVERVOLTAGE SENSORS PICK UP	*[***VAC]*		0	to	0
GENERATOR OVERVOLTAGE SENSORS DROP OUT	*[***VAC]*		0	to	0
GENERATOR OVERVOLTAGE SENSORS TIME DELAY PICK UP	*[**SEC]*		0	to	5
GENERATOR UNDER FREQUENCY SENSORS	*[***Hz]*		40.0	to	60.0
GENERATOR UNDER FREQUENCY SENSORS TIME DELAY DROP OUT	*[**SEC]*		0	to	10
GENERATOR OVER FREQUENCY SENSORS	*[***Hz]*		50.0	to	70.0
GENERATOR OVER FREQUENCY SENSORS TIME DELAY PICK UP	*[**SEC]*		0	to	5
GENERATOR START DELAY	*[****SEC]*		0	to	60
GENERATOR WARM-UP DELAY	*[****SEC]*		0	to	1800
GENERATOR COOLDOWN DELAY	*[****MIN]*		0	to	30
UTILITY RETURN DELAY	*[****MIN]*		0	to	30
PRE-TRANSFER DELAY	*[****SEC]*		0	to	30
MIN FIND NEUTRAL DELAY	*[****SEC]*		0.0	to	20.0
MAX FIND NEUTRAL DELAY	*[****SEC]*		0.0	to	20.0
NEUTRAL DELAY	*[****SEC]*		0	to	60
MAX TRANSFER TIME	*[****SEC]*		0	to	30
POST TRANSFER DELAY	*[****SEC]*		0	to	30
TRANSFER FAIL	*toggle disabled/Halt/Force*				
TRANSFER OUTPUT LOGIC	*toggle maintained/dropout*				
PROGRAMMABLE OUTPUT	*A=LD ON UTIL,B= LD ON GEN,C= LD SHED,D= UTIL NORMAL,E=FAIL TO XFER*		A	to	E
UTILITY FAIL CALLOUT	*toggle enabled/disabled*				
LOAD ON GEN CALLOUT	*toggle enabled/disabled*				
TRANSFER FAIL CALLOUT	*toggle enabled/disabled*				
AUTO TEST CALLOUT	*toggle enabled/disabled*				
MAN TEST CALLOUT	*toggle enabled/disabled*				
SWITCH NOT IN AUTO CALLOUT	*toggle enabled/disabled*				
BACKLIGHT	*[****SEC]*		0	to	999

10. CALIBRATION DATA SHEET

UTILITY PHASE A - B ZERO	*[*CORRECTION FACTOR*]*		0	to	255
UTILITY PHASE A - B SPAN	*[*CORRECTION FACTOR*]*		0	to	255
UTILITY PHASE B - C ZERO	*[*CORRECTION FACTOR*]*		0	to	255
UTILITY PHASE B - C SPAN	*[*CORRECTION FACTOR*]*		0	to	255
UTILITY PHASE C - A ZERO	*[*CORRECTION FACTOR*]*		0	to	255
UTILITY PHASE C - A SPAN	*[*CORRECTION FACTOR*]*		0	to	255
GENERATOR PHASE A - B ZERO	*[*CORRECTION FACTOR*]*		0	to	255
GENERATOR PHASE A - B SPAN	*[*CORRECTION FACTOR*]*		0	to	255
GENERATOR PHASE B - C ZERO	*[*CORRECTION FACTOR*]*		0	to	255
GENERATOR PHASE B - C SPAN	*[*CORRECTION FACTOR*]*		0	to	255
GENERATOR PHASE C - A ZERO	*[*CORRECTION FACTOR*]*		0	to	255
GENERATOR PHASE C - A SPAN	*[*CORRECTION FACTOR*]*		0	to	255
LOAD PHASE A - B ZERO	*[*CORRECTION FACTOR*]*		0	to	255
LOAD PHASE A - B SPAN	*[*CORRECTION FACTOR*]*		0	to	255

11. TSC 800 TYPICAL CONNECTION DIAGRAM



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12. TSC 800 SPECIFICATIONS

- POWER SUPPLY:
  - 115 or 230 VAC nominal (+10% -30%)
    - 50/60 Hz
    - 100ma nominal (no external load connected)

- VOLTAGE SENSING:
  - Direct 120-600 VAC nominal, single or three phase
  - 50/60 Hz
  - +/- 0.5% accuracy of setting @ 25°C

- OPERATING TEMPERATURE:
  - 0°C to +50°C

- OUTPUT CONTACTS (Form C, 10A,120/240VAC resistive)
  - Engine start
  - Programmable function (not available with dual source system logic)

- OUTPUT SIGNALS (120/240 VAC resistive load)
  - Transfer to utility 10A
  - Transfer to generator 10A
  - Pre/post-transfer to utility 3A
  - Pre/post-transfer to generator 3A
  - Load on utility 3A
  - Load on generator 3A

13. TROUBLESHOOTING

A number of problems can cause the TSC 800 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!

Symptom	Possible Causes
- Will not re-transfer to utility source upon restoration	- a test mode has been activated (check TSC 800 status LCD display) - utility voltage or frequency is outside the pre-programmed limits (check utility source for adequate voltage & frequency) - a loose control connection - faulty contactor auxiliary contact - defective utility contactor coil - defective TSC 800 controller (verify output signals with circuit board mounted diagnostic LED's) - TSC 800 has "Transfer Fail" alarm activated (if programmed as "Force Transfer). Determine cause of alarm and rectify before TSC 800 is reset
- Will not transfer to generator source upon failure of utility source	- generator set not producing enough voltage/frequency or output circuit breaker open - warm-up time delay function has not timed out yet (verify TSC 800 timer setting) - a loose control connection - faulty contactor auxiliary contact - defective generator contactor coil - defective TSC 800 controller (verify output signals with circuit board mounted diagnostic LED's) - TSC 800 has "Transfer Fail" alarm activated (if programmed as "Force Transfer). Determine cause of alarm and rectify before TSC 800 is reset
- Transfer to generator source without a power failure in the utility source	- a test mode has been activated (check TSC 800 status LCD display) - defective TSC 800 controller (verify output signals with circuit board mounted diagnostic LED's) - loose or broken wire to the utility voltage sensing terminals on the TSC 800 controller - Utility supply voltage is slightly above or below voltage sensing setpoints. Compare TSC 800 program voltage setpoints with actual utility voltage displayed on the controller - Utility Breaker has tripped due to an overcurrent condition (Type B or Service Entrance type ATS) and TSC 800 "Transfer Fail" alarm activated (Note: TSC 800 must be programmed as "Force Transfer for this to occur). Determine cause of alarm and rectify before TSC 800 is

Symptom	Possible Causes
	reset
- Generator does not start up or stop when it should	- verify remote engine control panel is set for automatic mode
- No time delay when there should be	- verify time delay function in the TSC 800 program setting as per programming sheets as supplied with the transfer switch
- power is not available at the load terminals but the utility or generator breaker appears to be closed to a live source	- the breaker's trip unit (service entrance or “Type B” style only) has tripped on a fault on the system and TSC 800 “Transfer Fail” is programmed as “Disabled or Halt Transfer”. Correct the fault, and manually reset the breaker in the transfer switch by moving it off and then on again with the manual operating handle
- Engine runs for no apparent reason	- Verify the TSC 800 has not been set for test operation. If yes, select manual test “NONE”. Refer to section 4.2 for operation details

DEFECTIVE COMPONENTS

Return defective components to Thomson Technology for repair. **Be sure to advise model and serial number of the transfer switch.**

14. NOTES