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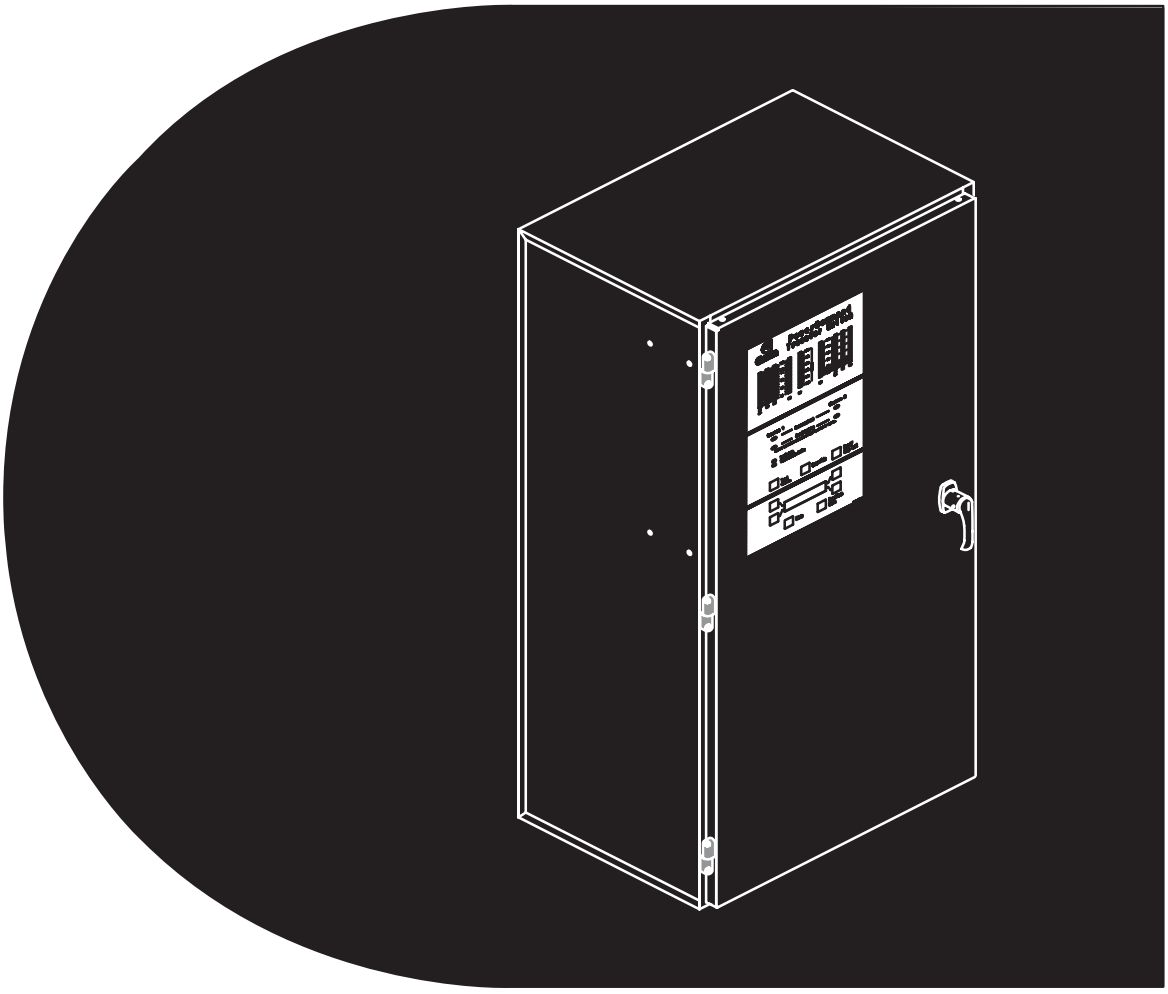
Power Generation

Service Manual

OTPC
Transfer Switch
40 to 1000 Amperes



Printed in U.S.A.

962–0516A 10-2002

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⚠WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Safety Precautions

This manual includes the following symbols to indicate potentially dangerous conditions. Read the manual carefully and know when these conditions exist. Then take the necessary steps to protect personnel and the equipment.

⚠ DANGER ***This symbol warns of immediate hazards that will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice that can result in severe personal injury or death.***

⚠ CAUTION ***This symbol refers to a hazard or unsafe practice that can result in personal injury or product or property damage.***

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

High voltage in transfer switch components presents serious shock hazards that can result in severe personal injury or death. Read and follow these suggestions.

Keep the transfer switch cabinet closed and locked. Make sure only authorized personnel have the cabinet and operational keys.

Due to the serious shock hazard from high voltages within the cabinet, all service and adjustments to the transfer switch must be performed only by an electrician or authorized service representative.

UTILITY-TO-GENSET OR GENSET-TO-GENSET APPLICATIONS

If the cabinet must be opened for any reason:

1. Move the operation selector switch on the generator set to Stop.
2. Disconnect the battery charger.
3. Disconnect the starting batteries of the generator set or sets (remove the ground [–] lead first).
4. Remove AC power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

UTILITY-TO-UTILITY APPLICATIONS

If the cabinet must be opened for any reason, remove AC power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

GENERAL PRECAUTIONS

Place rubber insulative mats on dry wood platforms over metal or concrete floors when working on any electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling any electrical equipment.

Jewelry is a good conductor of electricity and should be removed when working on the electrical equipment.

Wear safety glasses whenever servicing the transfer switch and and do not smoke near the batteries.

Do not work on this equipment when mentally or physically fatigued, or after consuming alcohol or any drug that makes the operation of equipment unsafe.

⚠WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

1. Introduction

ABOUT THIS MANUAL

This manual contains service procedures for an OTPC automatic transfer switch (ATS). This is an open transition (OT) transfer switch with PowerCommand® Control (PC). With an open transition switch there is never a time when both sources are supplying power to the load.

Refer to the schematic and wiring diagram package that was shipped with the ATS for specific information about its configuration.

Use normal and necessary safety precautions before starting any service procedure. Identify all hazards by referring to the Safety Precautions and observe all warnings and cautions within the manual. Whenever you are troubleshooting, remember that the generator set, ATS, and utility power source are all interdependent.

TRANSFER SWITCH APPLICATIONS

Transfer switches are an essential part of a building's standby or emergency power system. Power Source 1 (Normal), commonly the utility line, is backed up by Power Source 2 (Emergency), often a generator set. The transfer switch automatically switches the electrical load from one source to the other.

The load is connected to the common of the ATS (Figure 1-1). Under normal conditions, the load is supplied with power from Source 1 (as illustrated). If Source 1 is interrupted, the load is transferred to Source 2. When Source 1 returns, the load is retransferred to Source 1. The transfer and retransfer of the load are the two most basic functions of a ATS.

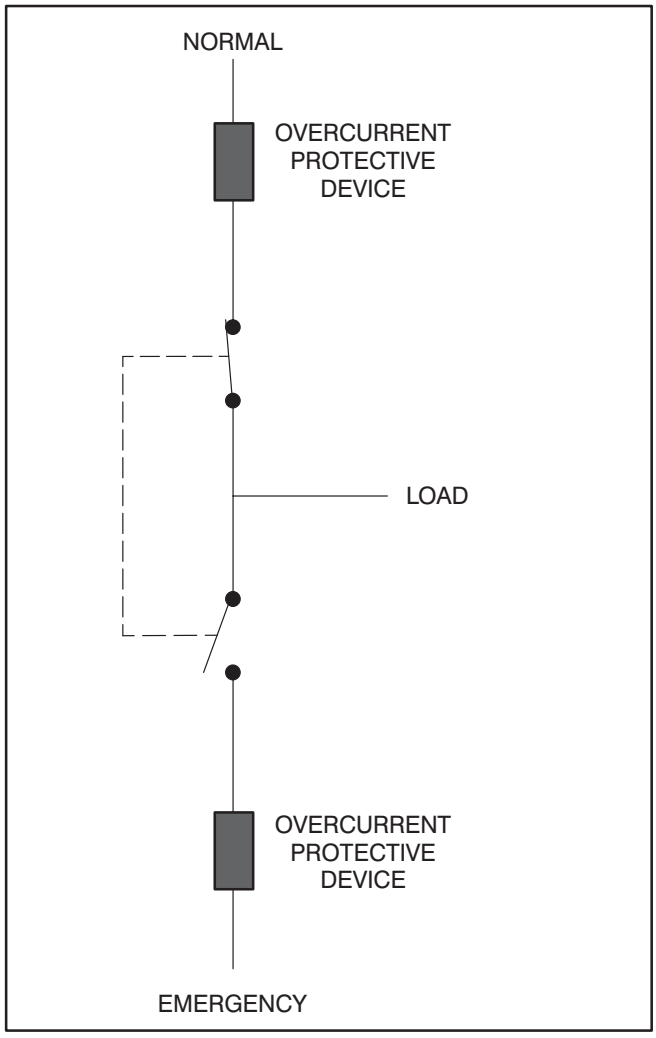

FIGURE 1-1. LOAD TRANSFER SWITCH (TYPICAL FUNCTION)

UTILITY-TO-GENSET CONTROL OPERATION

In utility-to-genset applications, the transfer switch performs the following functions:

1. Sense the interruption of the Source 1 power.
2. Send a start signal to the generator set (Source 2).
3. Transfer the load to the Source 2.
4. Sense the return of Source 1.
5. Retransfer the load to Source 1.
6. Send a stop signal to the generator set.

UTILITY-TO-UTILITY CONTROL OPERATION

In utility-to-utility applications, the transfer switch performs the following functions:

1. Sense the interruption of the Source 1 power.
2. Transfer the load to the Source 2.
3. Sense the return of Source 1.
4. Retransfer the load to Source 1.

Level 2 controllers can control a two-utility configuration for prime power. One utility is designated the preferred source. The control automatically transfers the load between the two utilities and detects alarm conditions. The exercise routine is not available in this configuration.

The operator can select either source as the preferred source. See the Digital Display Menu System section.

GENERATOR-TO-GENERATOR CONTROL

The genset-to-genset control can be set up for two types of applications:

- Prime Power – Two gensets provide all of the power (utility power is not available)
- Dual Standby – Two gensets are used to back up utility power

Note: The Test/Exercise function and Load Shed feature are not available in this configuration.

If one genset fails to operate within the specified range of voltage and frequency, the transfer switch automatically starts and connects the other genset.

Preferred Source Selection

With both prime power and dual standby applications, either genset can be set up to be the preferred source. If the preferred source is changed while one of the gensets is running, the control starts the second genset and transfers the load to it, when it becomes available.

Time Delays

All the time delays are factory set and are adjustable through the front panel display. The factory settings are:

TDNE	10 SEC
TDEN	600 SEC
TDESa	3 SEC
TDECa	600 SEC
TDESb	3 SEC
TDECb	600 SEC

Note: TDESa and TDECa are for the Source 2 genset and TDESb and TDECb are for the Source 1 genset.

Use the Time Delay sub-menus under Setup or the PC Service tool to change the settings.

Prime Power (Plant to Plant) Operation

In prime power applications, utility power is not available. The system includes one transfer switch and two gensets. One genset is always running and supplying power to the load while the other genset is the backup genset. An external power supply is not needed in this application.

Preferred Source Selection – Under normal operation, one genset is designated as the preferred source and supplies power to the load. The second genset is the backup power source. If the preferred genset fails, the backup genset starts and the transfer switch transfers the load to the backup genset.

At any time, the PC Service tool or the Test submenu can be used to designate either genset (Source 1 or Source 2) as the preferred genset. If the preferred genset is changed and the backup genset becomes the preferred genset, the transfer switch transfers the load to the new preferred genset when it becomes available. The unit that is carrying the load is always considered the preferred source.

Automatic Changeover – The transfer switch can be set up to change the preferred source automatically by enabling the changeover timer. The Time Delay sub-menus under Setup or the PC Service tool can be used to enable the changeover timer and specify a changeover delay time period.

The automatic changeover timer automatically changes the preferred source and transfers the load to the new preferred genset after a TDEN time delay. After the transfer is complete, the control initiates a cool-down period (TDEC) on the old preferred genset before shutting it down. The old pre-

ferred genset is now the new backup genset. The changeover timer is now timing for the next changeover and the cycle continues as long as the changeover timer is enabled.

Prime Power Wiring – A permanent start jumper is installed in the transfer switch and is shipped from the factory in the prime power mode. Verify that the jumper (TB3-57 to TB3-59) is installed (see interconnect drawing 630–2108 in Chapter 7).

System Startup – To set up a system for prime power operation:

1. Place the motor disconnect switch in the Off position, and both generator selector switches into the OFF position.
2. Place the transfer switch in the Source 1 position.
3. Place the Off–Manual–Auto selector switch on the Source 1 genset control in the Auto position. The genset will start and supply power to the load (the load will be energized and TDECa may be timing).
4. Use the PC Service tool or the Test sub-menu to set this genset as the preferred source.
5. Wait for TDECa to finish timing.
6. Place the Off–Manual–Auto selector switch on the backup genset (Source 2) control in the Auto position.
7. Place the motor disconnect switch in the Auto position.
8. If desired, use the Time Delay sub-menus under Setup or use the PC Service tool to enable the changeover timer and specify a changeover delay time period.

Testing the System by Turning Off the Preferred Source:

1. With the preferred source genset running and supplying power to the load, place the genset control Off–Manual–Auto selector switch in the Off position. The backup genset should start and run.

   After the voltage and frequency are at acceptable levels, the transfer switch should transfer the load to the backup genset.

2. Place the genset control Off–Manual–Auto selector switch on the preferred genset back in the Auto position. The preferred genset should start and run.

   After the voltage and frequency levels are at acceptable levels, the transfer switch should transfer the load back to the preferred genset.

   After the transfer is complete, the control initiates a cool-down period (TDEC) on the backup genset and it should stop.

Testing the System by Changing the Designated Preferred Source:

1. With the preferred source genset running and supplying power to the load, use the PC Service tool or the Test sub-menu to change the preferred source. The new preferred source should start and run.

   After the voltage and frequency are at acceptable levels, the transfer switch should transfer the load to the new preferred source.

   After the transfer is complete, the control initiates a cool-down period (TDEC) on the old preferred source and it should stop.

2. Use the PC Service tool or the Test sub-menu to change the preferred source back to the original genset. The original genset should start and run.

   After the voltage and frequency levels are at acceptable levels, the transfer switch should transfer the load back to the original genset.

   After the transfer is complete, the control initiates a cool-down period (TDEC) on the backup genset and it should stop.

Dual Stand-By Operation

In dual stand-by applications, utility power is available. The system includes two transfer switches and two gensets. Utility power supplies power to the load and both gensets are backup gensets.

Under normal operation, the utility is supplying power to the load through the lead transfer switch. The lead transfer switch is a utility-to-genset switch. The two gensets are connected to the genset-to-genset transfer switch. The load side of this switch is connected to the genset side of the lead transfer switch.

Upon loss of utility power to the lead transfer switch, a signal is sent to the genset-to-genset transfer

switch to start the preferred genset. When the lead transfer switch senses generator voltage, it transfers the load to that genset. If the preferred genset fails to start, a signal is sent to the backup genset to start. The PC Service tool or the Test sub-menu on the genset-to-genset transfer switch can be used to set the preferred source.

If the Stand-By Start is inactive, upon initial power–up (or reset), or during software initialization, the transfer switch control will not start either genset. When a Stand-By Start command is received from a Master ATS (or other device), the preferred genset immediately starts. If the preferred genset does not start, a time delay engine start (TDES) is initiated and the control starts the backup genset. The load is connected to the genset when it becomes available.

If the preferred genset becomes available while the backup genset is active, a time delay retransfer (TDEN) period is initiated and the load is retransferred back to the preferred genset. A time delay cool-down (TDEC) period is initiated before turning off the backup genset. When the Stand-By Start becomes deactivated, a TDEC period is initiated and the active generator is turned off.

Preferred Source Selection – Under normal operation, one genset is designated as the preferred source and the second genset is designated as the backup power source. If the both the utility power and the preferred genset fails, the backup genset starts and the genset-to-genset transfer switch transfers the load to the backup genset.

At any time, the PC Service tool or the Test sub–menu on the genset-to-genset transfer switch can be used to designate either genset (Source 1 or Source 2) as the preferred genset. If the preferred genset is changed and the backup genset becomes the preferred genset, the transfer switch transfers the load to the new preferred genset if it is needed and when it becomes available.

Alternating Preferred Source – In an attempt to keep the running time equally distributed between both gensets, the control can be set to alternate between the gensets when utility power fails. The selected preferred genset starts with the first power outage. The second power outage starts the backup genset, which now becomes the preferred genset. Upon subsequent outages, the preferred genset alternates.

Only utility outages and tests or exercises initiated at the lead transfer switch result in the gensets being alternated. The designated preferred genset will not change if it fails and the backup genset takes over the load. This alternating preferred source can only be enabled with the PC Service tool. When enabled, a genset can be designated as the preferred source for a maximum of two weeks. Time adjustments can be made in one-hour increments.

Control Voltage – A dual stand-by configuration requires an external 12–24 VDC power supply to keep the genset-to-genset control active. An optional Battery Kit is available, or the genset starting batteries can be used. See drawing 630–2024 for connection details.

Dual Stand-By Wiring – For dual stand-by applications, the jumper (TB3-57 to TB3-59) must be removed (see interconnect drawing 630–2024 in Chapter 7).

System Startup – To set up a system for dual stand-by operation:

1. Place the motor disconnect switch on both transfer switches in the Off position.
2. Connect both transfer switches to the Source 1 side.
3. Make sure the Off–Manual–Auto selector switch on both gensets is in the Off position.
4. Make sure the genset-to-genset transfer switch is being powered by an external DC supply.
5. Press the Lamp Test/Reset button on the genset-to-genset transfer switch. If all of the front panel lights come on, the control is running properly.
6. Use the PC Service tool or the Test sub-menu on the genset-to-genset transfer switch to set the Source 1 genset as the preferred source.
7. Energize utility power to the lead transfer switch. The load is energized and a time delay (TDECa) begins.
8. Wait for TDECa to finish timing.

9. Set the time delay engine start (TDESa) to zero on the lead transfer switch.

10. Set the time delay engine stop (TDECa) to zero on the lead transfer switch.

11. If desired, use the PC Service tool to enable the alternating preferred source.

12. Place the motor disconnect switch in the Auto position on both transfer switches.

Testing the System by Removing Utility Power and Turning Off the Preferred Genset:

1. With the utility supplying power to the load and neither genset running, turn off the utility circuit breaker feeding the load transfer switch. The preferred genset should start and run.

   After the voltage and frequency are at acceptable levels, the lead transfer switch should transfer the load to the preferred genset.

2. Place the Off–Manual–Auto selector of the preferred genset (running) control in the Off position.

   The preferred genset should stop and the backup genset should start and run.

   After the voltage and frequency are at acceptable levels, the genset-to-genset transfer switch should transfer the load to the backup genset.

3. Place the Off–Manual–Auto selector switch on the preferred genset back to the Auto position. The preferred genset should start and run.

   After the voltage and frequency are at acceptable levels, the genset-to-genset transfer switch should transfer the load to the preferred genset. The backup genset should stop after the time delay engine cool-down (TDECa) is completed.

CONTROL LEVELS 1 AND 2

Two controls are available. The type of power source switched and the desired features determine the control levels available. See the Description section for details. The table lists the applications that are available with each control.

TABLE 1-1. AVAILABLE CONTROL LEVELS

Power Sources	Level 1	Level 2
Genset-to-Utility	X	X
Genset-to-Genset		X
Utility-to-Utility		X

MODEL IDENTIFICATION

Identify your model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics and application information are shown on the lower portion of the nameplate. The nameplate is located on the cabinet door.

If it's necessary to contact a dealer or distributor regarding the transfer switch, always give the complete Model, Specification, and Serial number as listed on the nameplate. This information is necessary to properly identify your unit among the many types manufactured.

Refer to the next section for a list of feature/option codes.

The model number is made up of code segments that designate various features or options:

OTPCA 00000 Spec.A
1 2 3 4

1. OTPC - Open Transition PowerCommand® Control.

2. Ampere Rating:
   A = 40, 70, 125
   B = 150, 225, 260
   C = 300, 400, 600
   D = 800, 1000

3. Assigned spec number - issued for each specific combination of accessories, voltages, frequency and standards codes. This number is only repeated for standard product.

4. Specification letter - advances with production modification.

HOW TO OBTAIN SERVICE

When the transfer switch requires servicing, contact your nearest Cummins Power Generation distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

To contact your local CPG distributor in the United States or Canada, call 1-800-888-6626 (this automated service utilizes touch-tone phones only). By selecting Option 1 (press 1), you will be automatically connected to the distributor nearest you.

If you are unable to locate a dealer or distributor, consult the Yellow Pages. Typically, distributors are listed under:

Generators-Electric,
Engines-Gasoline or Engines-Diesel, or
Recreational Vehicles-Equipment,
Parts and Service.

For outside North America, call Cummins Power Generation, 1-763-574-5000, 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday. Or, send a fax to Cummins Power Generation using the fax number 1-763-574-8087.

When contacting your distributor, always supply the complete Model Number and Serial Number as shown on the nameplate.

FEATURE DESCRIPTION	FEATURE OPTION
Poles:	
3 Poles	A028
4 Poles	A029
Application:	
Utility to Genset	A035
Utility to Utility	A036
Genset to Genset	A037
Agency Approvals:	
UL Listing	A046
NFPA 20	A064
Frequency:	
60 Hertz	A044
50 Hertz	A045
Voltage:	
120 VAC	R020
190 VAC	R038
208 VAC	R021
220 VAC	R022
240 VAC	R023
380 VAC	R024
416 VAC	R025
440 VAC	R035
480 VAC	R026
600 VAC	R027
Controls:	
Level 1 Switch Control	C023
Level 2 Switch Control	C024
Control Options:	
Front Panel Security Key	M017
Digital Display	M018
LonWorks Network Com. Module	M020
Load Monitoring	M022
Relay Module	M023

FEATURE DESCRIPTION	FEATURE OPTION
Phase:	
1 Phase, 2-W or 3-W	A041
3 Phase, 3-W or 4-W	A042
Meters:	
Digital Bar Graph Meters	D009
Battery Charges:	
2A, 12/24VDC	K001
10A, 12VDC	K002
10A, 24VDC	K003
Auxiliary Relays:	
24 VDC Coil	L101
Emergency Position	L102
Normal Position	L103
Genset Start	L104
12 VDC Coil	L201
Emergency Position	L202
Normal Position	L203
Genset Start	L204
Miscellaneous:	
Terminal Block – 30 Position	M003
Load Shed – From Emergency	M007
Terminal Block – Battery Chrg Alarms	N002
Power connect – Bus Stabs	N009
Cabinet:	
Type 1	B001
Type 3R	B002
Type 4	B003
Open Construction	B004
Type 12	B010

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2. Component Description

CABINET

The standard cabinet meets the requirements of the National Electrical Manufacturers Association (NEMA) for a UL Type 1 cabinet. This type is designated as a general-purpose, indoor cabinet. The door of a typical utility-to-generator set cabinet is shown in Figure 2-1.

Switch Panel

The switch panel (See Figure 2-1) is a standard feature on all OTPC transfer switches. It contains six indicator lamps and three membrane switches.

***Source 1 Available and Source 2 Available**:* These indicators are lit when the corresponding sources have acceptable output voltage and/or frequency. These indicators can be lit simultaneously.

Source 1 Connected: This indicator is lit when the ATS is in the normal position and Source 1 is supplying power to the load.

Source 2 Connected: This indicator is lit when the ATS is in the emergency position and Source 2 is supplying power to the load.

Not in Auto: For all configurations, the Not in Auto indicator lights when the ATS is not in Auto.

The ATS is not in auto when any of the following signals are active:

1. Motor Disconnect Switch
2. Transfer Inhibit
3. Retransfer Inhibit
4. Load Shed

Test/Exercise Active: The Test/Exercise Active indicator is lit when the ATS has a test or exercise in progress.

Test: For utility-to-genset applications, the Test switch sends a start signal to the generator set designated Source 2 and blinks the Test/Exercise Active indicator. After the start and transfer time delays, Source 2 starts and assumes the load provided that the With Load option is selected. Press the Test switch again to end the test; the Test/Exercise Active indicator goes out and Source 1 resumes as the source of power.

For genset-to-genset applications, there is no test function.

Override: The Override switch terminates most system time delays. The Program Transition, Elevator signal and Engine Cool Down are not affected by this switch. If you press this switch while the Transfer Inhibit input is active, the switch immediately transfers the load. If you press this switch while the Retransfer Inhibit input is active, the switch immediately retransfers the load.

Reset/Lamp Test: The Reset/Lamp Test switch turns on all control panel indicators. This switch also acknowledges events (refer to the Events section).

Security Key Switch Option

The optional security key switch is located on the front panel between the handle and the Control Panel. When it is in the Panel Lock position, it disables the front panel input switches, Test and Override. It also prevents changes to the Digital Display from the setup menus; however, the current values are displayed. Changes can be made when the switch is in the Program position.

Digital Display

The Digital Display is standard on Level 2 controls and optional on Level 1 controls. It contains a 2-line by 20-character digital display module and 6 momentary contact membrane switches. The module displays the menu system. The switches are used to navigate through the menu system.

Each menu indicates the function of the four switches at the sides of the display module. Not all switches are active for each menu. See the Digital Display Menu System section for complete digital display menu details.

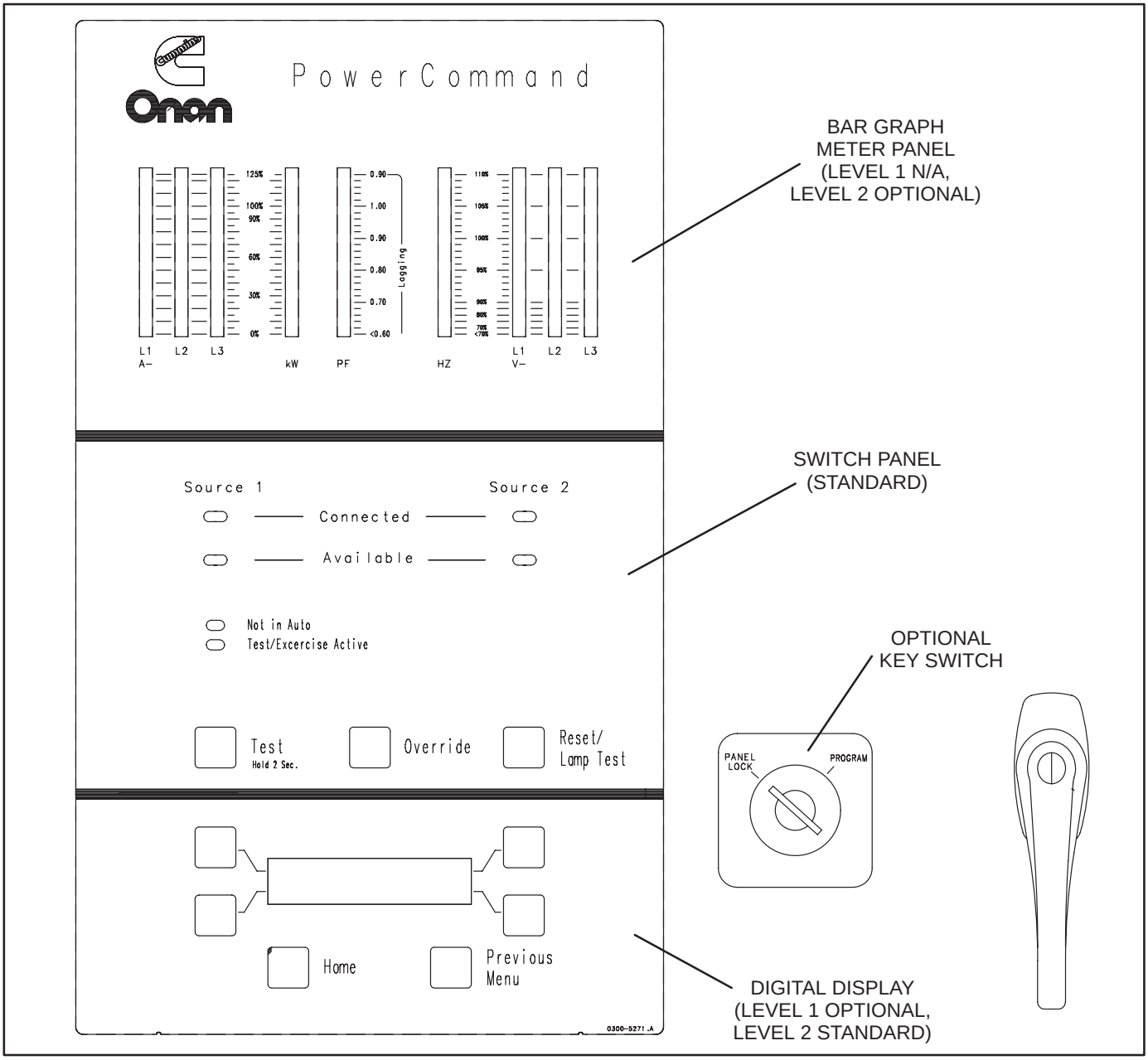


FIGURE 2-1. CABINET WITH OPTIONS

Bar Graph Meter Panel

The Bar Graph Meter Panel is not available on Level 1 controls and is optional on Level 2 controls. This feature includes a three phase AC ammeter, a power meter, a power factor meter, a frequency meter, and a three phase AC voltmeter.

AC Ammeter: The ammeter displays percent of full load currents in amperes (1–125%).

Power Meter: The power meter displays the real power in percent of full load in kilowatts (0–125%).

Power Factor Meter: The power factor meter displays the real power delivered to the load (1.0 – 0.6 lagging) and (1.0 – 0.9 leading).

Frequency Meter: This meter displays the output frequency (percent of nominal frequency), of the power source connected to the load (70–110%).

AC Voltmeter: The voltmeter displays percent of line to neutral voltages of the power source connected to the load (70–110%).

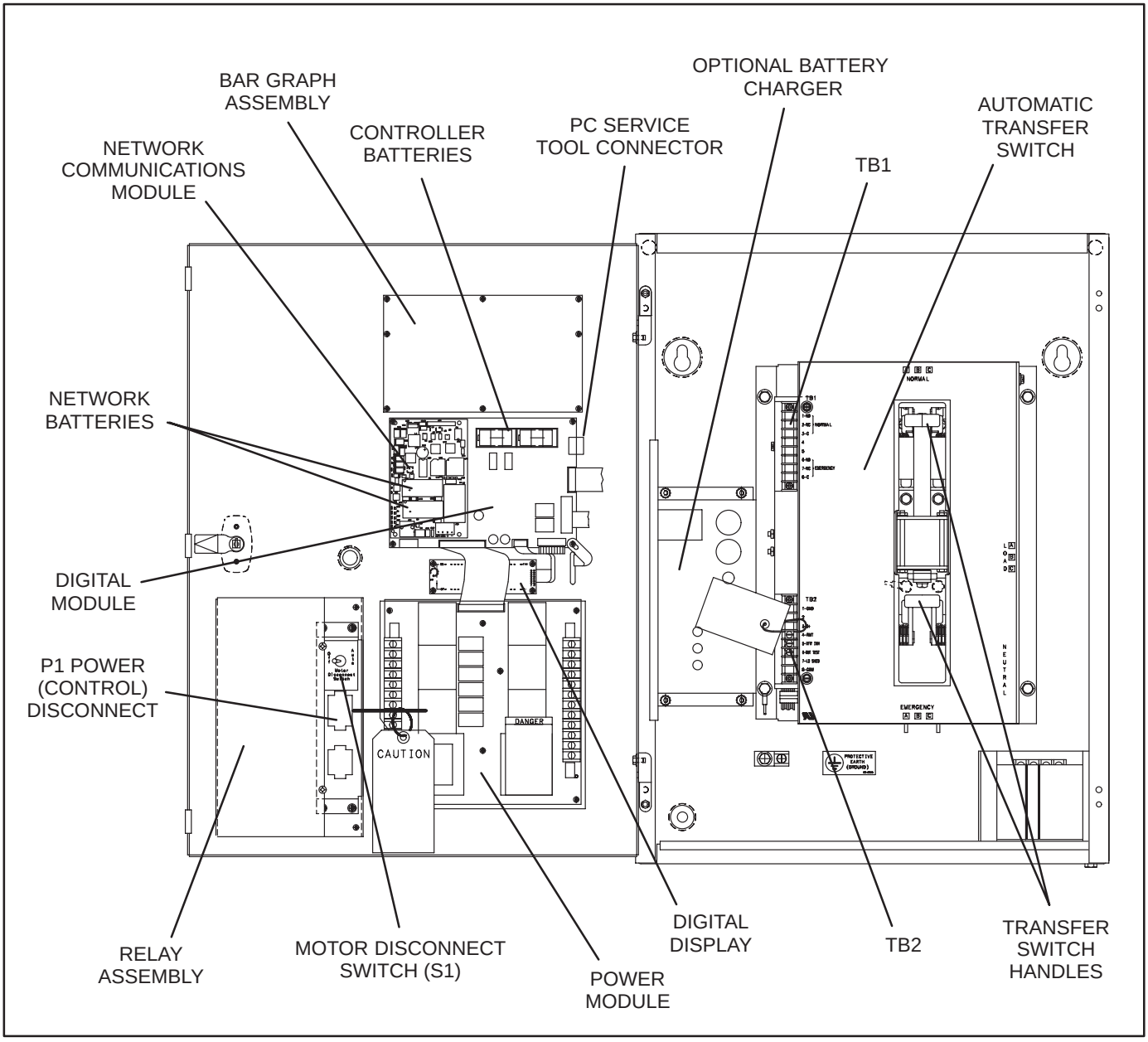


FIGURE 2-2. INTERIOR/COMPONENTS: 40-125 AMP SWITCH

ELECTRONIC CONTROL SYSTEM

This section describes the standard and optional components of the electronic control system.

⚠WARNING ***Improper calibration or adjustment of electronic control modules can cause death, severe personal injury, and equipment or property damage. Calibration and adjustment of these components must be performed by technically qualified personnel only.***

Calibration and adjustment procedures are described in the Installation manual (which is shipped with the ATS).

⚠WARNING ***Accidental actuation of the linear motor could cause severe personal injury. Before making any adjustments, place the Motor Disconnect Switch (Figure 2-2) in the Off position. Return the switch to the Auto position after adjustments are completed.***

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.***

Electronic Control Circuit Modules

The OTPC transfer switch control incorporates a Digital and a Power Module. Two versions of each are available: one for Level 1 controls and one for Level 2 controls. The power modules are available in four different voltage ranges.

Digital Module: The digital modules contain the logic and timing circuits that control transfer switch operation. These modules also contain many of the customer interface circuits (including the genset start signal and network port), the RS-232 communications port for the service tool, and drivers for the control panel indicators, switches, and bar graph meter panel.

Power Module: The power modules contain a power supply for the digital modules, voltage sensing transformers, and relays. These modules also contain the interface circuits for the transfer switch including the position sensing switches and relay drivers.

Programmed Transition

Program Transition introduces a delay (TDPT) during transition of the switch. Programmed transition stops the switch in the neutral position for an adjustable interval of time. In this position, the load is not connected to either Source 1 or 2. This delay allows residual current from inductive loads to decay to an acceptable level before transfer is completed.

The parameters are adjustable. The length of time that the ATS is in the neutral position can be adjusted from 0 to 60 seconds in 1 second increments. The default value is 0 seconds. The proper adjustment is a function of the load. This feature is enabled by default. The values are set with PC service tool or the digital display.

Transfer Times

The controller senses and records the time it takes for the ATS to break from one source and reconnect to the other source. (Transfer times are not recorded if Programmed Transition delay is in use.)

Test With or Without Load

The operator can test the ATS, generator, and power system automatically. The operator can transfer the load during the test or to only test the generator. Both hardware means (switch input) and software means (PowerCommand network) input can activate an automatic test sequence.

Programmable Generator Exerciser

Programmable generator exercises and exercise exceptions are generally programmed to be recurring. They can be programmed from the PC service tool or the digital display when it is available.

Level 1 controllers include two programmable generator exercises and two programmable exercise exceptions. While all events can be set using the PC service tool, only one exercise and one exercise exception can be set with the digital display.

Level 2 controllers include eight programmable generator exercises and eight programmable exercise exceptions. While all events can be set using the PC service tool, only two exercises and two exercise exceptions can be set with the digital display.

All controllers have a push-button switch on the digital module that enables and disables the exerciser

clock. See the Digital Display Menu System section for details on setting the clock. The Real-Time clock must be set before exercise programs are entered.

For utility-to-genset configurations, the exerciser clock initiates genset start and run cycles at specified intervals for specified durations. The exerciser is not used in utility-to-utility or genset-to-genset configurations (see Generator-to-Generator Control Mode).

Two-Wire Starting

The starting circuit is a basic supervisory function of the electronic control. Water-cooled generator sets use a two-wire start control.

Although the logic is more involved, the two-wire starting circuit can be thought of as a single pole, single throw switch. A closed switch starts the generator set. An open switch stops the generator.

NOTE: Three-wire starting is not available on OTPC transfer switches.

Remote Test Transfer

The ATS may be wired with a remote test switch. Closure of a set of contacts across the remote test transfer inputs causes the ATS to sense a (simulated) utility power failure and send a start/run signal to the generator set. The load is transferred to Source 2 when Source 2 becomes available. (Refer to the Installation manual.)

Real-Time Clock

All controllers have a real-time clock that keeps track of the time and date. This clock is year 2000 compliant. The controller uses the real-time clock to time and date stamp all events.

The clock is not set at the factory. To set the clock, use the digital display or PC Service tool.

Voltage Imbalance Sensor

Three phase Level 2 controllers include a voltage imbalance sensor for both Source 1 and Source 2. This feature informs the operator when there is significant voltage imbalance between the phases of Source 1 or Source 2. This feature is used for equipment protection.

A voltage imbalance is typically caused by severe single phase loading. The sensor indicates a failure when the maximum deviation from the average voltage is greater than a user-specified value between 2 and 10 % (drop-out) of the average voltage in 1% increments. The pickup value is fixed at 10% of the drop-out. The time delay for the imbalance sensor drop-out is adjustable (2–20 seconds).

The operator can enable this sensor. See the Digital Display Menu System section. This sensor is inactive for single phase systems and indicates no failures. To prevent nuisance faults, the setting can be increased up to 10 % of the nominal voltage.

Phase Rotation Sensor

Three phase Level 2 controllers include a phase rotation sensor. This feature monitors the phase rotation of the source opposite from the connected source. When the alternate source is out of phase rotation with the connected source, transfer is inhibited. This generally occurs on new installations or after storm damage or generator rewiring. This feature protects against equipment damage by preventing transfer to a source that is out of phase. This feature is required in fire pump applications.

⚠ CAUTION ***Level 1 controls do not support three-phase sensing on Source 2. Do not select the three-phase option for the Source 2 Sensing adjustment with Level 1 controls, even if the system is three phase. This setting will prevent Source 2 from becoming available.***

Both voltage sources have to be applied in order to check phase rotation. Generally, a power source may become out of phase rotation in new installations, after a storm, or when there is generator rewiring.

This feature is enabled by default. To disable it, see the Digital Display Menu System section.

Loss of Single Phase Sensor

Three phase Level 2 controllers include a loss of single phase sensor. This feature initiates a transfer from a source that has lost a single phase and prevents a transfer to a source that has lost a single phase. This is generally caused by a single phase to line ground or open. The controller indicates a fault when the relative phase angle between any line-to-line phase angle drops to less than 90°. This feature

is mainly used to protect three phase devices, such as motors.

The operator can enable this sensor. See the Digital Display Menu System section. This sensor is inactive for single phase systems and indicates no failures.

Generator-to-Generator Control Mode

Level 2 controllers can control a two-generator configuration for either dual standby or prime power. One generator is designated the preferred source. The control automatically transfers the load between the two generators and detects generator alarm conditions. This configuration requires the optional Battery Kit when used in dual standby mode.

The operator can select the preferred source (Source 1 or Source 2) in the genset-to-genset mode. The preferred source selection is made at the digital display (under Test).

A separate changeover timer automatically transfers loads between the two generators. The changeover timer is set from the digital display or the PC Service tool. The exerciser clock is not available in this configuration.

Utility-to-Utility Control Mode

Level 2 controllers can control a two-utility configuration for prime power. One utility is designated the preferred source. The control automatically transfers the load between the two utilities and detects alarm conditions. The exerciser clock is not available in this configuration.

The operator can select either source as the preferred source. See the Digital Display Menu System section.

ELECTRONIC CONTROL OPTIONS

Auxiliary Relays Option

Connections to the auxiliary relays are made directly to the relay terminals. Figure 2-3 shows the location of the Auxiliary Relays on the options panel. The terminals accept wire sizes from one number 12 AWG wire to two number 18 AWG wires. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).

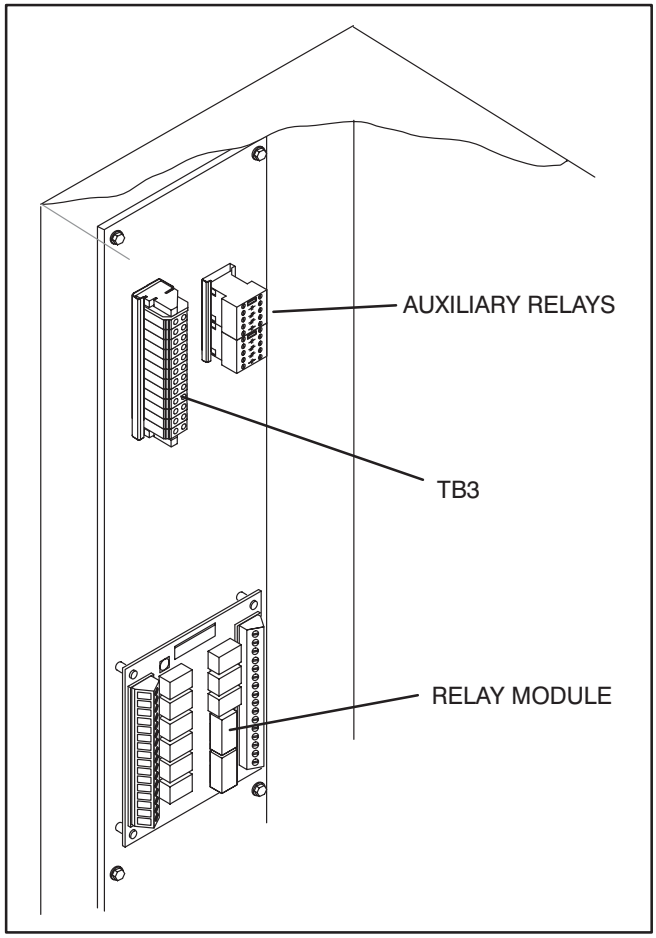


FIGURE 2-3. CONTROL WIRING CONNECTIONS

There are two types of auxiliary relay coils (12 VDC and 24 VDC). The relay options are:

- Installed, not wired
- Emergency relay
- Normal relay
- Genset run relay

All relays have two normally open and two normally closed contacts that are rated for 6 amperes at 600 VAC (Figure 2-4).

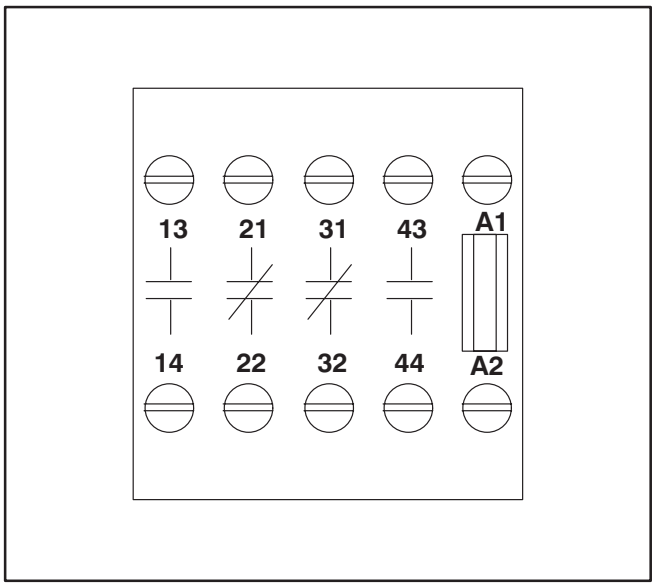


FIGURE 2-4. AUXILIARY RELAY TERMINALS

Relay Module Option

The Relay Module provides nine sets of form C contacts and two sets of normally open contacts that are rated for 2 Amps at 30 VDC or 0.60 Amps at 120 VAC. Two sets of form C contacts and one set of normally open contacts is reserved for future use. Connections to these relays are made at J14 and J15 on the Relay Module. The Relay Module is located on the left inside wall of the transfer switch enclosure. See Figure 2-3 for location in the enclosure and Figure 2-5 for details. See Table 2-1 for relay module connections.

The Source 1 and Source 2 Connected relays are energized when their respective power sources are available, ready to produce power, and connected to the load.

The Source 1 and Source 2 Available relays are energized when their respective power sources are producing power.

The Test/Exercise relay is energized when the system is in test or exercise mode.

The Elevator Pre-Transfer relay is energized during the elevator signal time delay. The relay contacts are used to provide a warning that a transfer or retransfer is about to occur.

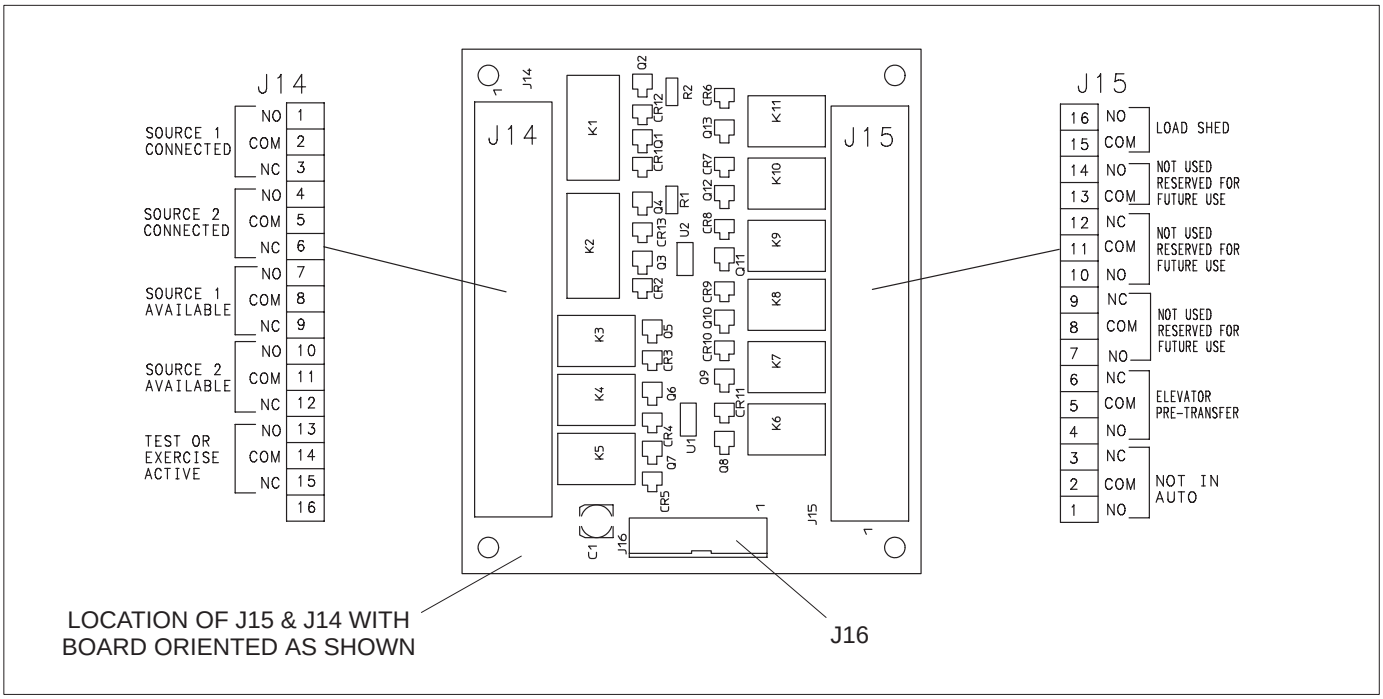


FIGURE 2-5. OPTIONAL RELAY MODULE

TABLE 2-1. RELAY MODULE CONTACTS

Relay	NO	COM	NC
Source 1 Connected	J14-1	J14-2	J14-3
Source 2 Connected	J14-4	J14-5	J14-6
Source 1 Available	J14-7	J14-8	J14-9
Source 2 Available	J14–10	J14-11	J14-12
Test/Exercise Active	J14-13	J14-14	J14-15
ATS Not-In-Auto	J15-1	J15-2	J15-3
Elevator Pre-Transfer	J15-4	J15-5	J15-6
Not Used	J15-7	J15-8	J15-9
Not Used	J15-10	J15-11	J15-12
Not Used	J15-13	J15-14	X
Load Shed	J15-15	J15-16	X

The ATS Not-In-Auto relay is energized when any one of the following is active:

- Motor Disconnect Switch in OFF position.
- Transfer Inhibit
- Retransfer Inhibit
- Load Shed
- P12 is disconnected from Power Module

The Load Shed relay is active when the transfer switch has been commanded to disconnect the load from Power Source 2.

Use number 22 to number 12 AWG wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).

Battery Charger Option

The transfer switch may be equipped with a battery charger used for charging either lead acid or NiCad genset starting and control batteries. These chargers are current limiting and supply automatic constant voltages.

When the battery approaches the full charge preset voltage, the charging current automatically tapers to zero amperes or to a steady-state load on the battery.

The battery charger may be a 10- or 2-amp supply with an output of 12 or 24 volts. Ten amp chargers contain alarm LEDs that indicate AC Power Failure, and Low or High Battery Voltage faults. Optional wiring harness brings signals out to the terminal block for easy customer connections.

Float Voltage Adjustments for:

	12 volt	24 volt
Lead Acid Batteries	13.2 volts	26.4 volts
NiCad Batteries	14 volts	28 volts

Battery Charger Alarm Contacts Option

The optional 10-ampere battery charger can include three sets of form C relay contacts, as an additional option.

Under normal operating conditions, the Low Bat and AC Fail relays are energized and the High Bat relay is de-energized. In response to a Low Bat or AC Fail condition, the appropriate normally energized relay (Low Bat or AC Fail) drops out. In response to a High Bat condition, the normally de-energized High Bat relay is energized.

The contacts are rated for 4 amperes at 120 VAC or 30 VDC. Connections to these contacts are made at terminals 41-42-43 (AC failure), 44-45-46 (high battery voltage), and 47-48-49 (low battery voltage) of TB3 (Figure 2-6). See Figure 2-3 for the location of TB3 on the option panel.

Use number 22 to number 12 AWG wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).

The Level-1 and Level-2 Digital Modules have an input dedicated to monitor the AC Line failure on the battery charger. This input is located at J27-23 and activated when grounded. (As of this printing, this input is only available at J27-23.)

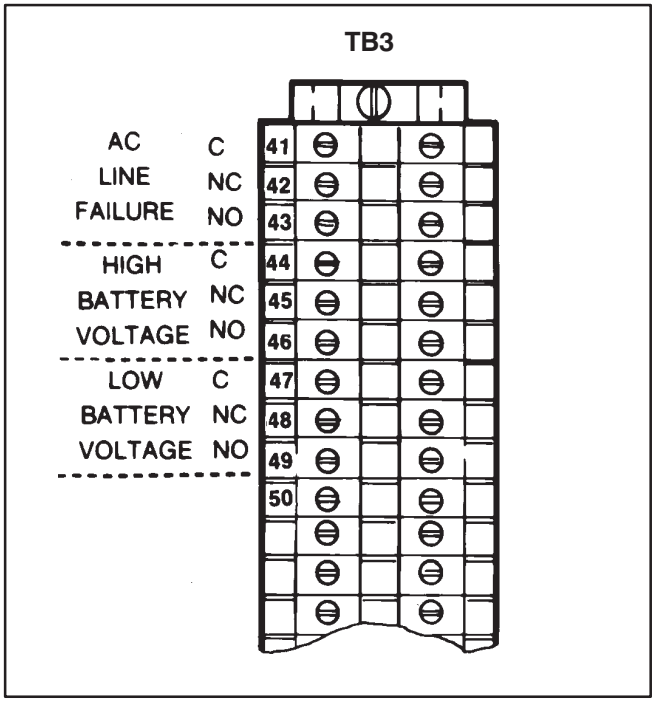


FIGURE 2-6. BATTERY CHARGER ALARM CONTACTS

Load Current and Power Sensor Option

Three-phase Level-2 controllers can include a load current and power sensor (Current Module). The control senses the four load currents (three line currents and the neutral current), three load voltages, and three power factor angles. The control calculates the real load power and the apparent load power.

The load current sensing feature is active on Level-2 controllers when the Current Module is installed and connected to the Digital Module.

The control issues a warning when the neutral current exceeds a user specified value between 100 and 150% of the rated current during a specified time period between 10 and 60 seconds. See the Digital Display Menu System section.

The warning threshold (100 – 150%) and time delay (10 – 60 sec) are only set with the PC Service tool.

Load Shed Option

The load shed option removes the load from the emergency power source by driving the transfer switch to the neutral position. When the signal contacts open the load is transferred back to the emergency source. The load immediately transfers to the preferred source when it is re-established.

The load shed relay (K4) is mounted on the control plate (see Figure 2-7). Signals to K4 are received from the relay module at J15 and J16.

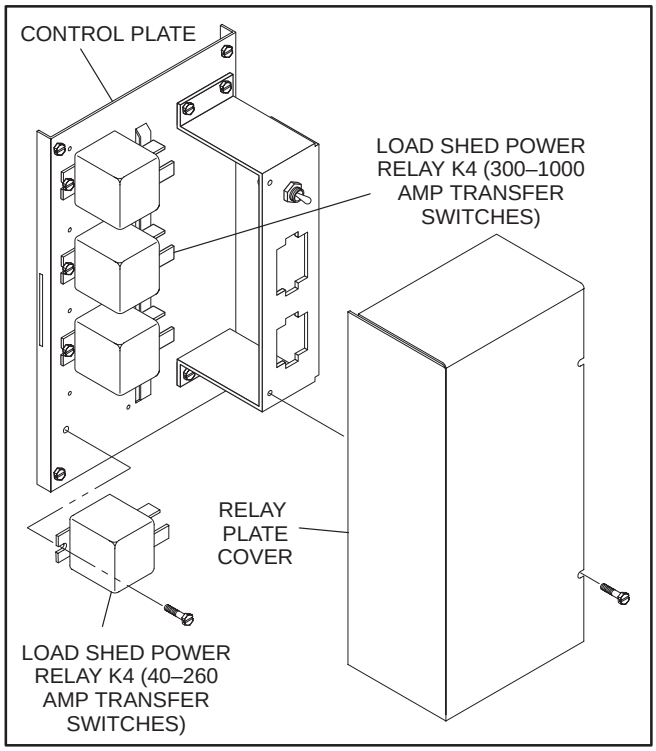


FIGURE 2-7. LOAD SHED RELAY MOUNTING

PowerCommand® Network Interface Module Option

Provides connection to the PowerCommand network. LonWorks compatible for integration into customer monitoring strategy. Refer to the Network Installation and Operator's Manual (900–0366 for TP-78 networks or 900–0529 for FT-10 networks) for network details.

The Network Interface Module is only enabled with the PC Service tool.

TRANSFER SWITCH ASSEMBLY

The ATS (Figure 2-2) opens and closes the contacts that transfer the load between Source 1 and Source 2. The switch is mechanically interlocked to prevent simultaneous closing to both power sources. The main parts of the switch discussed here are the contact assemblies, linear actuator, Motor Disconnect switch, and auxiliary contacts.

Contact Assemblies

The switch has either three or four poles. Three pole ATSs are provided with a neutral bar. The contact assemblies make and break the current flow. When closed to either Source 1 or Source 2, the contacts are mechanically held. A mechanical interlock prevents closing to both power sources at the same time.

Linear Actuator

The linear actuator is a linear induction motor that moves the contact assemblies between the contacts of Source 1 and Source 2. Linear actuator operation is initiated automatically by the ATS. Manual operation of the switch is also possible. Refer to Manual Operation.

Capacitor(s)

Either one or two capacitors (refer to Section 4) provide the phase shift necessary to drive the linear motor. If the capacitor is faulty, the linear motor does not operate.

Auxiliary Switches

Six auxiliary switches are configured to respond to the position of the transfer switch. When the transfer switch is in the Source 1 (Normal) position, switches S3, S4, and S5 are actuated. When the transfer switch is in the Source 2 (Emergency) position, switches S7, S8, and S9 are actuated. Refer to Section 2 and to the schematic and wiring diagram package for more information on the functions of the individual switches.

The schematic and wiring diagram package is shipped with the ATS. Contact your distributor if you do not have a set of drawings. Refer to Section 4 for a description of auxiliary switch maintenance procedures.

Auxiliary Contacts

Auxiliary contacts are provided on the Source 1 and Source 2 sides of the transfer switch. They are actuated by operation of the switch during transfer and retransfer. The Source 1 auxiliary contact switch is actuated when the transfer switch is in the Source 1 position. The Source 2 auxiliary contact switch is actuated when the transfer switch is in the Source 2 position. The contacts are wired to terminal block TB1.

The auxiliary contacts have current ratings of 10 amperes at 250 VAC.

Motor Disconnect Switch

The Motor Disconnect toggle switch, on the Relay Assembly, enables and disables the linear actuator. This switch is only accessible from inside the enclosure. The Not In Auto LED on the front panel indicates the state of this switch. It is lit when the switch is in the Off position. (Other ATS conditions also light this indicator: See the description of the Not in Auto indicator in the Cabinet section.) Place the switch in the Auto position to enable the linear actuator. Place the switch in the Off position to disable the linear actuator.

REMOVING AND REPLACING ELECTRONIC CONTROL COMPONENTS

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Disconnect connector J1/P1 before working on the electronic control system.***

Disconnecting J1/P1 removes all power to the door.

Be sure to remove all power before replacing electronic control modules and components. This includes removing one of the two Lithium batteries from the digital display module. The battery can be replaced after replacing or adding new components. No special tools are required to remove and replace control system components. Be sure to use all of the hardware when remounting components.

3. Operation

FUNCTIONAL PROGRAMS

Programmed Transition

Program Transition introduces a delay (TDPT) during transition of the switch. Programmed transition stops the switch in the neutral position for an adjustable interval of time. In this position, the load is not connected to either Source 1 or 2. This delay allows residual current from inductive loads to decay to an acceptable level before transfer is completed.

The parameters are adjustable. The length of time that the ATS is in the neutral position can be adjusted from 0 to 60 seconds in 1 second increments. The default value is 0 seconds. The proper adjustment is a function of the load. This feature is enabled by default. The values are set with PC service tool or the digital display.

Transfer Times

The controller senses and records the time it takes for the transfer switch to break from one source and reconnect to the other source. (Transfer times are not recorded if Programmed Transition delay is in use.)

Generator Exercise

Programmable generator exercises and exercise exceptions are generally programmed to be recurring. They can be programmed from the PC service tool or the digital display when it is available.

Level 1 controllers include two programmable generator exercises and two programmable exercise exceptions. While all events can be set using the PC service tool, only one exercise and one exercise exception can be set with the digital display.

Level 2 controllers include eight programmable generator exercises and eight programmable exercise exceptions. While all events can be set using the PC service tool, only two exercises and two exercise exceptions can be set with the digital display.

Run the generator set for at least 30 minutes once each week, with at least 50 percent load (if possible).

If Source 1 has an interruption while the genset is exercising without load, the ATS transfers the load to the genset.

All controllers have a push-button switch on the digital module that enables and disables the exerciser clock (Figure 5-1). The Real-Time clock must be set before exercise programs are entered.

For utility-to-genset configurations, the exercise routine initiates genset start and run cycles at specified intervals for specified durations. The exercise routine is not used in utility-to-utility or genset-to-genset configurations (see *Control Modes – Generator-to-Generator*).

Refer to *Section 4: Digital Display Menu System*, for details on setting the clock and programming the exercise routines.

Test With or Without Load

The operator can test the ATS, generator, and power system automatically. The operator can either transfer the load during the test or test the generator only. Both hardware means (switch panel) and software means (PowerCommand network) input can activate an automatic test sequence.

Testing the system with or without the load is setup using PowerCommand or the PC service tool.

To test using the Test Button:

1. Press and hold the button for at least 2 seconds. The Test Exercise LED will begin flashing and the test sequence will begin.

2. Press the Test button again to deactivate the test. The Test/Exercise LED will flash once and the test end sequence will begin.

   NOTE: The Test button does not function unless the Front Panel Security Switch is in the Program position.

To Test using PowerCommand or InPower software, refer to the documentation supplied with those packages.

Transfer/Re-Transfer Inhibits

Transfer Inhibit setup is used to control load transfer to gensets. When activated, load transfer will not take place unless the Override button is pressed. When Transfer or Re-transfer Inhibit is enabled, the Not In Auto LED and event displays on the front panel.

Re-transfer inhibit is used to prevent the controller from automatically re-transferring the load back to Source 1. Some operators prefer to manually transfer the load, using the Override button, once they are satisfied Source 1 is stable.

NOTE: If Source 2 fails, the Re-transfer inhibit is ignored.

Transfer inhibits are setup using the PC Service tool and a remote switch inside the cabinet connected to TB2.

Real-Time Clock

All controllers have a real-time clock that keeps track of the time and date. This clock is year 2000 compliant. The controller uses the real-time clock to time and date stamp all events, and records accumulated Run-time for each power source.

NOTE: The clock is not set at the factory. To set the clock, use the digital display or PC Service tool.

If the Lithium batteries on the Digital Board go completely dead, the clock will need to be reset.

POWERCOMMAND TIME DELAYS

Start Time Delay (TDES-A, and TDES-B)

This brief time delay prevents the generator set from starting during short power interruptions. Timing starts at the Source 1 power interruption. If the duration of interruption exceeds the delay time, the control system starts the generator. This delay is adjustable from 0 to 15 seconds in 1 second increments on Level-1 controls and from 0 to 120 seconds in 1 second increments on Level-2 controls. The default value is 3 seconds for both. The value is set using the PC service tool or the digital display when it is available.

For genset-to-genset applications, TDES-A is the start time delay to start Source 2 genset and TDES-B is the start time delay to start Source 1 genset.

For utility-to-utility applications, TDES-A and TDES-B are not available.

Stop Time Delay (TDEC-A, and TDEC-B)

This delay maintains availability of the genset for immediate reconnection in the event the normal source fails shortly after retransfer. It also allows gradual genset cool-down by running unloaded. The delay is adjustable from 0 to 30 minutes in 1 minute increments. The default value is 10 minutes. It begins timing when the load has retransferred to Source 1. At the end of the delay, the stop signal is sent to the generator set. The value can be set using the PC service tool or the digital display when it is available.

For genset-to-genset applications, TDEC-A is the stop time delay to stop Source 2 genset and TDEC-B is the stop time delay to stop Source 1 genset.

For utility-to-utility applications, TDEC-A and TDEC-B are not available.

Transfer Time Delay (TDNE)

This brief time delay allows the generator set to stabilize before the load is applied. This delay begins when Source 2 (typically the generator) voltage and frequency reach the settings of the control. After the delay, the ATS transfers the load to Source 2. It has an adjustable range of 0 to 120 seconds in 1 second increments. The default value is 10 seconds. The value is set using the PC service tool or the digital display when it is available.

TDNE is the delay from preferred source to backup source in utility-to-utility applications.

Retransfer Time Delay (TDEN)

This delay allows the Source 1 to stabilize before retransfer. Delay begins the moment Source 1 line voltage and frequency return to specified values. After the delay, the ATS retransfers the load to Source 1. It has an adjustable range of 0 to 30 min-

utes in 1 minute increments. The default value is 10 minutes. The value is set using the PC service tool or the digital display when it is available.

TDEN is the delay from backup source to preferred source in utility-to-utility applications.

Programmed Transition (TDPT)

This delay introduces a pause during transfer to allow residual voltage from inductive loads to decay to an acceptable level. The load is not connected to either source during this time while voltage is transferred to a neutral position. The adjustable range is 0 to 60 seconds. The time delay begins before transfer, when both Sources are available. The default value is 0. The value can be set using the PC service tool or the digital display when it is available.

Elevator Time Delay (TDEL)

Used in elevator applications, this delay sets a time to wait for an elevator pre-transfer signal. This signal allows the elevator to come to a complete stop before the switch transfers. The adjustable range is 0 to 60 seconds. The time delay begins when a transfer or retransfer signal signal has been sent to the relays. The default value is 0. The value can be set using the PC service tool or the digital display when it is available.

POWERCOMMAND SENSORS

Under-Voltage Sensing

All controls include under-voltage sensors for Source 1 and Source 2. When a sensor detects a low voltage condition over a specified time period, it initiates a transfer. When the source voltage returns to an acceptable value again, the sensor initiates a retransfer.

These parameters are adjustable. The under-voltage sensing range for a falling voltage (drop-out) is 75 to 98% of the pick-up voltage setting. The default value is 90%. The pick-up range for a rising voltage is 85 to 100% of the nominal voltage setpoint. The default value is 90%. The adjustable range for the time delay period is 0.1 to 1.0 seconds in 0.1 second increments. The default delay time is 0.5 second. These values are set with the PC service tool or the digital display. See Figure 3-1 for an example using the default values.

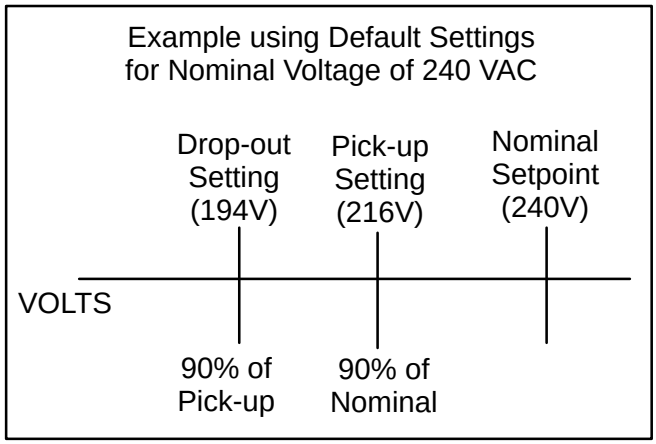


FIGURE 3-1. UNDER-VOLTAGE SENSING

Over-Voltage Sensing

All controls include over-voltage sensors for Source 1 and Source 2 that can be disabled and not used. When a sensor detects a high voltage condition over a specified time period (delay), it initiates a transfer. When the source voltage falls to an acceptable value again, the sensor initiates a retransfer.

These parameters are adjustable. The over-voltage sensing range (drop-out) for a rising voltage is 105 to 135% of the nominal voltage setpoint. The default value is 110%. The pick-up range for a falling voltage is 95 to 100% of the drop-out setting. The default value is 95%. The adjustable range for the delay time period is 0.5 to 120.0 seconds in 1 second intervals. The default delay time is 3.0 seconds. The over-voltage sensing feature is enabled by default. These values are set with the PC service tool or the digital display. See Figure 3-2 for an example using the default values. This feature can also be disabled.

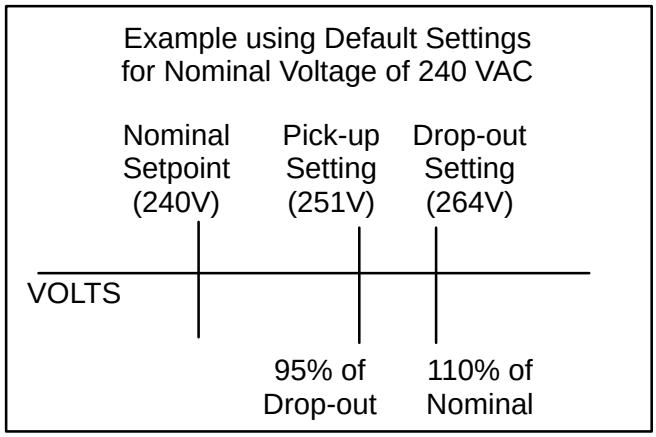


FIGURE 3-2. OVER-VOLTAGE SENSING

Frequency Sensing

All controls include frequency sensors for Source 1 and Source 2 that can be disabled and not used. When a sensor detects a high or low frequency condition over a specified delay time period, it initiates a transfer. When the frequency returns to an acceptable value again, the sensor initiates a retransfer.

These parameters are adjustable. The nominal frequency can be set between 45.0 and 60.0 Hz in 0.1 Hz increments. The default frequency is 60 Hz. The acceptable frequency bandwidth (pick-up) is ±5 to ±20% of the nominal frequency setpoint. The default value is 10%. The drop-out frequency is 1 to 5% beyond the pick-up. The default value is 1%. The range for the delay time period is 0.1 to 15 seconds. The default delay time is 1.0 second. The frequency sensing feature is enabled by default. See Figure 3-3 for an example using the default values. These values are set with the PC service tool or the digital display. This feature can also be disabled.

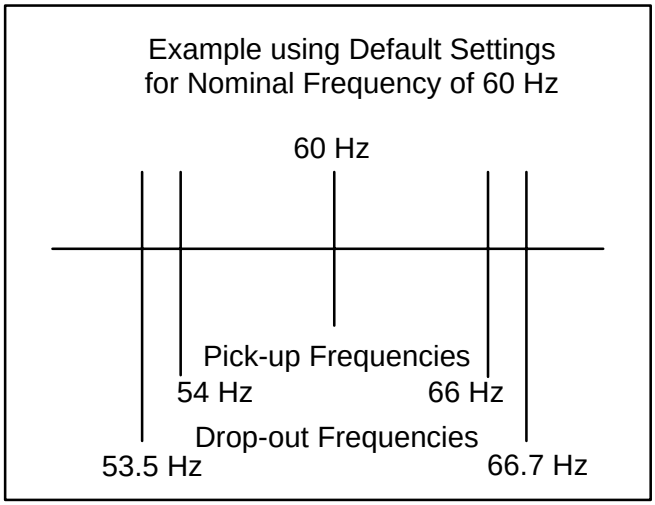


FIGURE 3-3. FREQUENCY SETTING

Voltage Imbalance Sensor

Three phase Level-2 controllers include a voltage imbalance sensor for both Source 1 and Source 2. The sensor indicates a failure when the maximum deviation from the average voltage is greater than a user specified value between 2 and 10% (dropout) of the average voltage in 1% increments. The pick-up value is fixed at 10% of the dropout. The operator can disable this sensor. The default time delay is 10 seconds and is adjustable between 2 and 20 seconds. The dropout sensor default value is 5% and is adjustable between 2 and 10%. This sensor is inactive for single phase systems and indicates no failures. These values are set using the PC service tool or from the digital display when it is available. This feature is disabled at the factory but can be enabled using the PC Service tool or the digital display Setup sub-menus.

Phase Rotation Sensor

Three phase Level 2 controllers include a phase rotation sensor. The sensor indicates a failure when Source 1 and Source 2 do not have the same phase rotation. Both voltage sources have to be applied in order to check phase rotation. The default time delay is 100 msec. and is not adjustable. This sensor is inactive for single phase systems and indicates no failures. The operator can disable this sensor using the PC Service tool or from the digital display Setup sub-menus.

Loss of Single Phase Sensor

Three phase Level 2 controllers include a loss of single phase sensor. Typical balanced three-phase voltage sources have relative phase angles of 120° ±2°. If a single phase is lost and the system loads are highly inductive, the line voltage may stay within acceptable limits. During these failures, the phase angle information will quickly drop. The sensor can detect the loss of a single phase from either source. The controller indicates a fault when the relative phase angle between any line-to-line phase angle drops to less than 90 degrees. This sensor is inactive for single phase systems and indicates no failures. The operator can disable this sensor using the PC service tool or the digital display when it is available. This feature is disabled at the factory but can be enabled using the PC Service tool or the digital display Setup sub-menus.

EVENTS

Functions and failures of the transfer switch are recorded in the software within the Events program. The program retains up to 50 events and can be displayed on the digital display or from the PC service tool. Events are displayed in chronological order beginning with the most recent first. Controllers display both a time and date stamp on each event. Below is a list of events that are stored.

Normal Events

- Source 1 (or 2) Connected
- Source 1 (or 2) Available
- Emergency Start A (or B)
- Start Type A (or B)
- Time Delay Start A (or B)
- Time Delay Normal-Emergency TDNE
- Time Delay Emergency-Normal TDEN
- Time Delay Engine Cool-Down Active TDED
- Time Delay Programmed Transition Active TDPT
- Transfer Pending TDEL
- Time Delay Engine Cool-Down TDEC-B
- Test In Progress
- Exercise in Progress
- In-Phase Transfer In Progress
- Source 1 (or 2) Under Voltage Failure
- Source 1 (or 2) Over Voltage Failure
- Source 1 (or 2) Under/Over Frequency Failure
- Source 1 (or 2) Loss of Phase Failure
- Source 1 (or 2) Voltage Imbalance Failure
- Phase Rotation Failure
- Not In Auto: ATS Motor Disconnected
- Not In Auto: Load Shed
- Not In Auto: Transfer Inhibit
- Not In Auto: Re-Transfer Inhibit
- Not In Auto: Bypassed to Source 1 (or 2)
- Not In Auto: Common Output
- Service Tool Connected
- Network WInk
- Generator A (or B) Common Alarm
- Controller Loss of Power
- Neutral Current Warning (high)
- Preferred Source 1 (or 2)

Fault Codes

- Controller Checksum Error
- Low Controller Battery
- ATS Fail to Close: Transfer
- ATS Fail to Close: Re-Transfer
- ATS Fail to Charge
- Battery Charger Malfunction
- Network Battery Low
- Network Communications Error
- ATS Common Alarm (Network Only)

Handling Fault Code displays are explained in *Section 5: Troubleshooting.* Fault codes will remain on the display until the HOME button is pressed.

OPERATION

Automatic Operation

The utility-to-genset ATS is set for automatic operation by placing control switches in the positions given below. The generator set must also be set for automatic operation.

Refer to section 5, 6, or 7 if applicable.

Motor Disconnect switch:
Auto position.

Operation selector switch (engine control):
Remote position.

Manual Operation

The transfer switch has operator handles for manually transferring the load. Manual Operation must be performed under **NO-LOAD CONDITIONS ONLY.** Use the following procedure:

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents shock hazards that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts with body, tools, jewelry, hair, clothes, etc.***

⚠WARNING ***Manual operation of the transfer switch under load presents a shock hazard that can cause severe personal injury or death. Do not attempt to operate switch manually when under load. Follow the "Safety Related Work Practices" listed in NFPA 70E.***

1. Open the cabinet door of the ATS.
2. Move the Motor Disconnect switch to the Off position.
3. **Transfer - from Source 1 (Normal) to Source 2 (Emergency) power source:**

A. Pull the upper manual operator handle down.

B. Push the lower manual operator handle down.

4. **Retransfer - from Source 2 to Source 1:**

   A. Pull the lower manual operator handle up.

   B. Push the upper manual operator handle up.

5. Before moving the Motor Disconnect switch back to the Auto position, remember the ATS transfers the load to the active power source (if both power sources are available, it transfers the load to Source 1).

   ⚠WARNING ***Automatic transfer switch operation results in rapid movement of the manual operator handles and presents a hazard of severe personal injury. Keep hands clear of handles when switching back to automatic operation.***

6. Move the Motor Disconnect switch to the Auto position.

7. Close the cabinet door.

Generator Set Start Test

1. Set the Test With/Without Load variable to the Without Load value.

   The Test With/Without Load variable must be set to the Without Load value in order to test without load.

2. Press the Test switch. The generator set should start and run.

3. At the end of the test period, press the Test switch again. The generator stops.

4. In anticipation of scheduled or automatic generator set exercise, set the With/Without Load variable to the desired value. Refer to Operator's manual.

With-Load Standby System Test

1. Set the Test With/Without Load variable to the With Load value.

   The Test With/Without Load variable must be set to the With Load value in order to test with load.

2. Press the Test switch. The generator set should start and assume the load after the transfer time delay.

3. At the end of the test period, press the Test switch again if you want to retransfer load back to Source 1 after the retransfer time delay. To bypass the retransfer time delay and cause immediate load retransfer, press the Override switch. The generator stops after the stop time delay.

4. In anticipation of scheduled or automatic generator set exercise, set the With/Without Load variable to the desired value. Refer to the Operator's manual.

PLANNED MAINTENANCE

Performing the annual planned maintenance procedures increases reliability of the transfer switch. The following procedures must only be done by technically qualified personnel. If repair or component replacement is necessary, call your dealer or distributor.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. All corrective service procedures must be done only by technically qualified personnel.***

⚠WARNING ***The transfer switch presents a shock hazard that can cause severe personal injury or death unless all AC power is removed. Be sure to set the genset operation selector switch to Stop, disconnect AC line power, disconnect the battery charger from its AC power source, and disconnect the starting battery (negative [–] lead first) before servicing.***

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.***

1. **Disconnect All Sources of AC Power:**

   A. Disconnect both AC power sources from the transfer switch before continuing. Turn the generator set operation selector switch to Stop. (The selector switch is located on the generator set control panel.)

   B. ***If there is an external battery charger, disconnect it from its AC power source.*** Then disconnect the set starting battery (negative [–] lead first).

2. **Clean**

   A. Thoroughly dust and vacuum all controls, meters, switching mechanism components, interior buswork, and connecting lugs.

   B. Close the cabinet door and wash **exterior** surfaces with a damp sponge (mild detergent and water). ***Do not allow water to enter the cabinet, especially at meters, lamps, and switches.***

3. **Inspect**

   A. Check buswork and supporting hardware for carbon tracking, cracks, corrosion, or any other types of deterioration. If replacement is necessary, call your dealer or distributor.

   B. Check stationary and movable contacts. If contact replacement is necessary, see section 5.

   C. Check system hardware for loose connections. Tighten as indicated in step 4.

   D. Check all control wiring and power cables (especially wiring between or near hinged door) for signs of wear or deterioration.

   E. Check all control wiring and power cables for loose connections. Tighten as indicated in step 4.

   F. Check the cabinet interior for loose hardware. Tighten as indicated in step 4.

4. **Perform Routine Maintenance**

   A. Tighten buswork, control wiring, power cables, and system hardware, as necessary. Hardware torque values are given in section 5. Retorque all cable lug connections. Lug torque requirements are listed in Table 3-1.

   B. Service or replace the batteries (3V lithium) in the Digital Module and the Network Module (if applicable. Replace batteries every two years. See Figure 2-2.

5. **Connect AC Power and Check Operation**

   A. Connect the set starting battery (negative [–] lead last). Connect the normal AC power source, enable the backup power source. If applicable, connect power to the battery charger.

   B. Verify proper operation of the battery charger.

   C. Test system operation as described in this section. Close and lock the cabinet door.

TABLE 3-1. LUG TIGHTENING REQUIREMENTS

Set Screw Socket Size (Across Flats)	Minimum torque for Proper Operation
3/16 inch	80 In-lbs (9 N-m)
1/4 inch	200 In-lbs (23 N-m)
5/16 inch	275 In-lbs (31 N-m)
3/8 inch	375 In-lbs (43 N-m)
1/2 inch	500 In-lbs (57 N-m)
9/16 inch	600 In-lbs (68 N-m)

4. Digital Display Menu System

This section describes the Digital Display Menu System and navigation through the menus. The menus display status information, events, and set-up menus. Setup menus contained parameters with adjustable values. The descriptions in this section include ranges for the parameters and default values. The Digital Display is an option with level-1 controls and is standard with level-2 controls.

The Digital Display Menu System is a 2-line by 20-character graphical display screen and six buttons. The screen or menu displays status information, parameters, events and messages. The buttons change screens and parameters. Two buttons have names: Home and Previous Menu. These buttons are used for navigation. Messages include navigational indicators for the other four buttons.

MAIN MENUS

The main menu system consists of three top-level menus that list vertical menus (or sub-menus). The sub-menus display status information. This information cannot be changed in the main menus. The main menus contain eight sub-menus including the Setup Menus.

SETUP MENUS

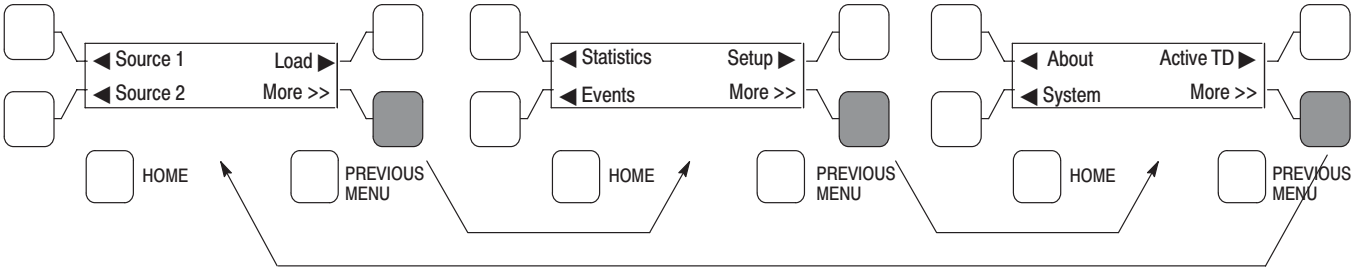
Before you can navigate and change setup parameters, you must enter a password; however, you can bypass the password and examine but not change parameters. When parameters are changed in any setup menu, you are prompted to either save the changes or restore the old values.

NAVIGATION

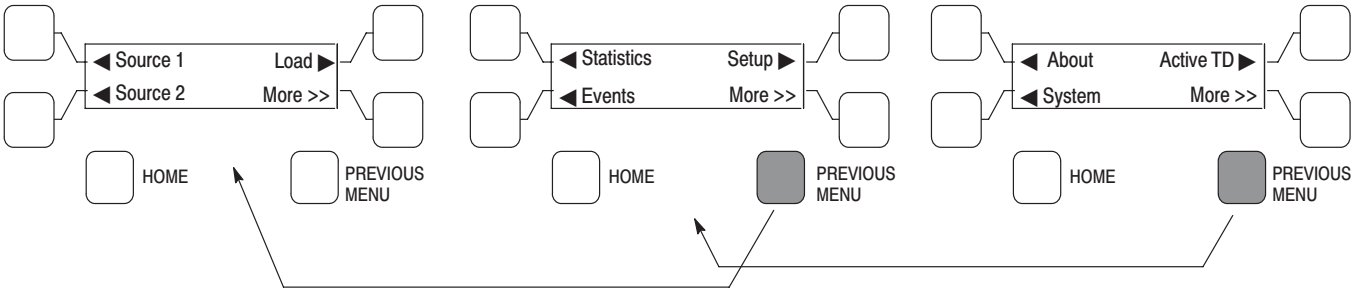
Refer to Figures 4-28 through 4-30 at the end of this section for an over view of menu navigation. These illustrations can also be used to locate a submenu and determine how to access it.

MAIM MENU NAVIGATION

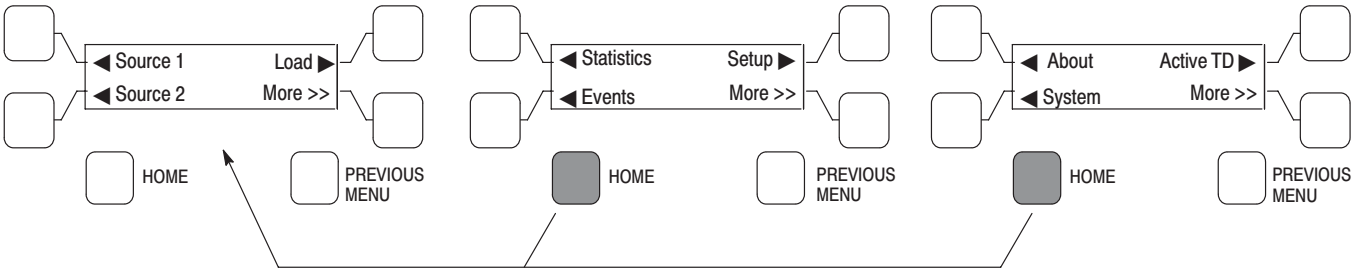
Using the MORE button



Using the PREVIOUS MENU button



Using the HOME button

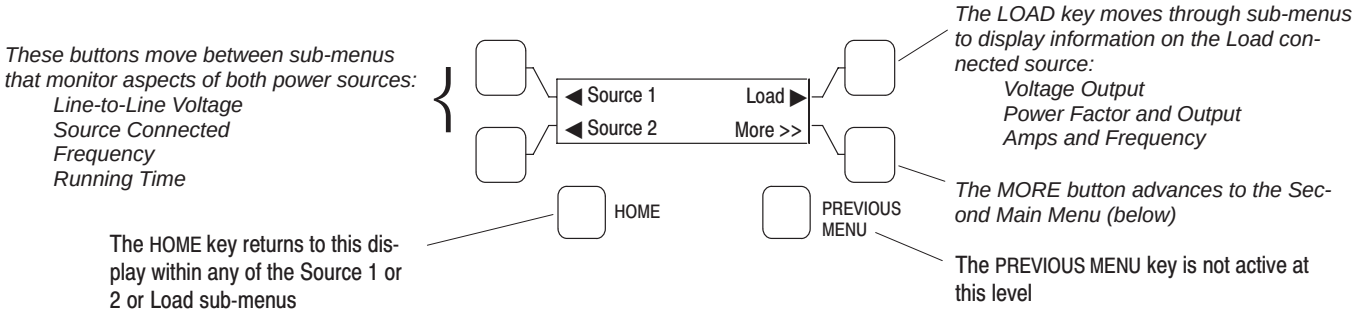


NOTE: The Active TD feature was not available in early versions of software.

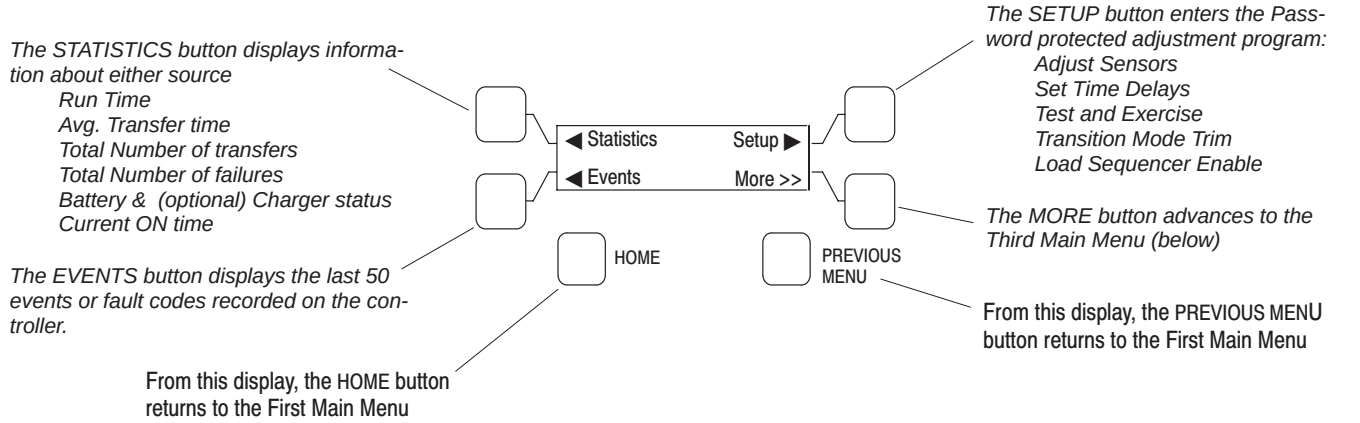
FIGURE 4-1. NAVIGATION

MAIM MENU DESCRIPTIONS

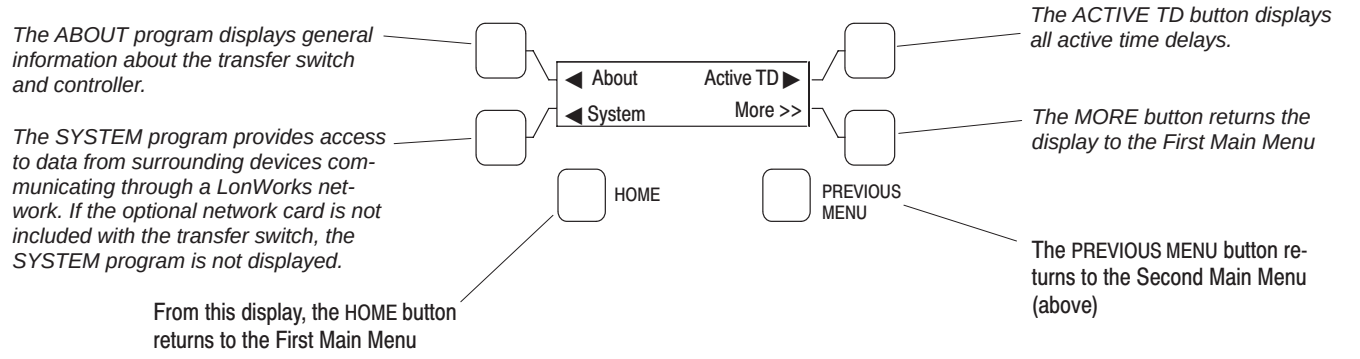
FIRST MAIN MENU



SECOND MAIN MENU



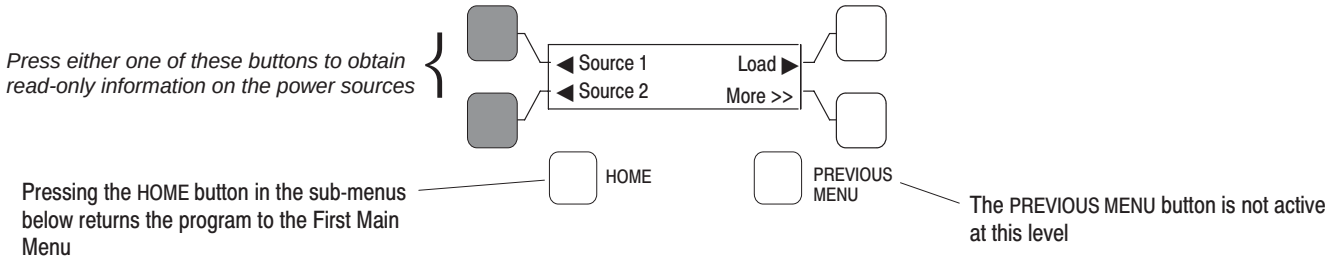
THIRD MAIN MENU



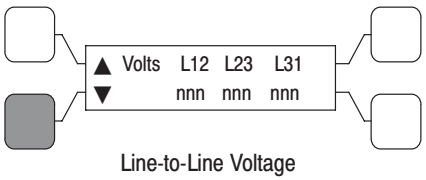
NOTE: The Active TD feature was not available in early versions of software.

FIGURE 4-2. MAIN MENUS

FIRST MAIN MENU – Source 1 and Source 2 Sub-Menus



Use the ▲▼ buttons on left to navigate through these screens



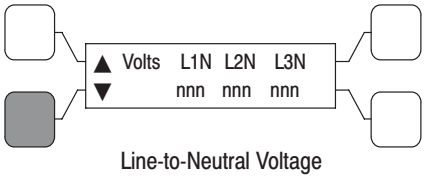
Line-to-Line Voltage

This screen displays line-to-line voltages for either Source 1 or Source 2 for three phase, two phase or single phase configurations.

If the voltage is measured at 10 volts or less, the display reads 0.

On Level 1 Controllers, only one voltage will be displayed at L12.

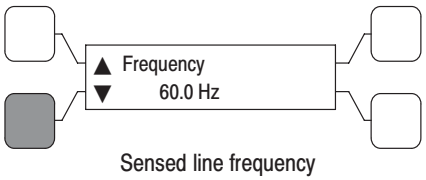
On Level 2 Controllers, if the Source is two phase, the display will read voltages at L12 and L31.



Line-to-Neutral Voltage

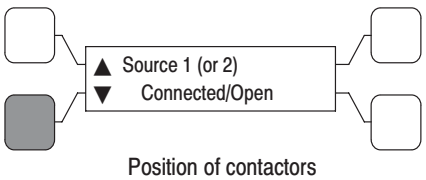
This screen displays Line to Neutral voltage measurements for three phase, two phase or single phase configurations. (Numbers do not display if system has no neutral)

This screen does not display with Level 1 controllers.



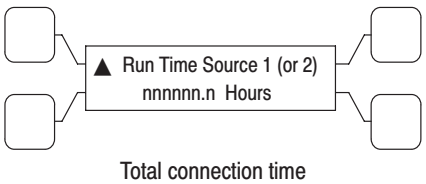
Sensed line frequency

This screen displays the sensed line frequency for Source 1 or 2.



Position of contactors

This screen displays the position of contactors for either Source 1 or 2.



Total connection time

This screen displays the total time the transfer switch has been connected to either Source 1 or 2.

FIGURE 4-3. SOURCE 1 AND 2 SUB-MENUS

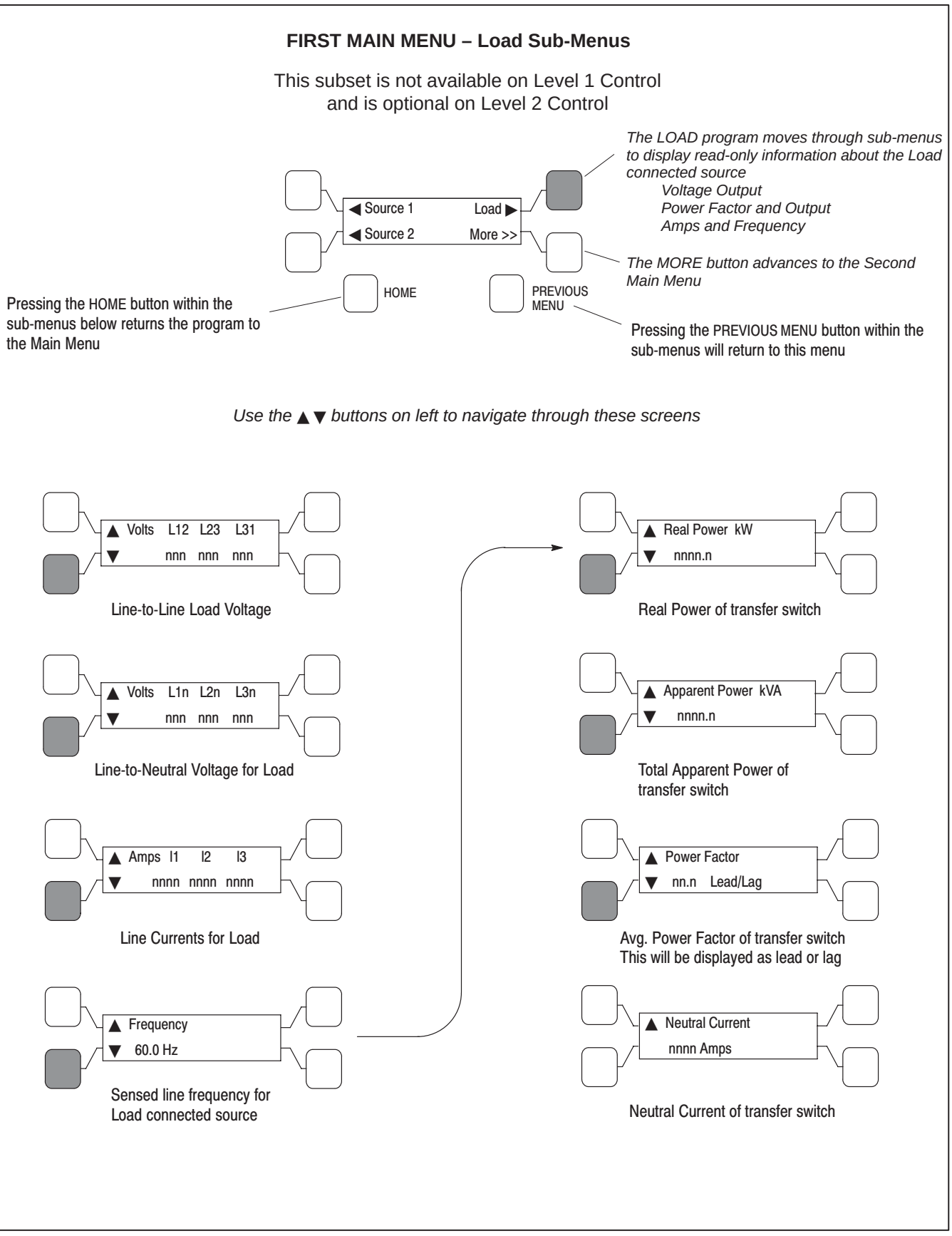
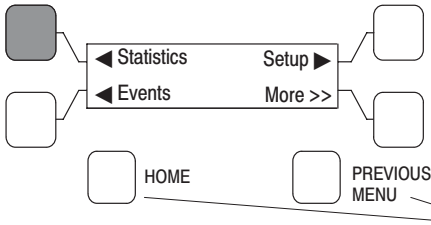


FIGURE 4-4. LOAD SUB-MENUS

SECOND MAIN MENU – Statistics Sub-Menus

The STATISTICS program displays read-only information about either source:

- *Run Time*
- *Avg. Transfer time*
- *Total Number of transfers*
- *Total Number of failures*
- *Battery & (optional) Charger status*
- *Current ON time*



From this display, the PREVIOUS MENU and HOME buttons return the program to the First Main Menu

Use the ▲▼ buttons on left to navigate through these screens

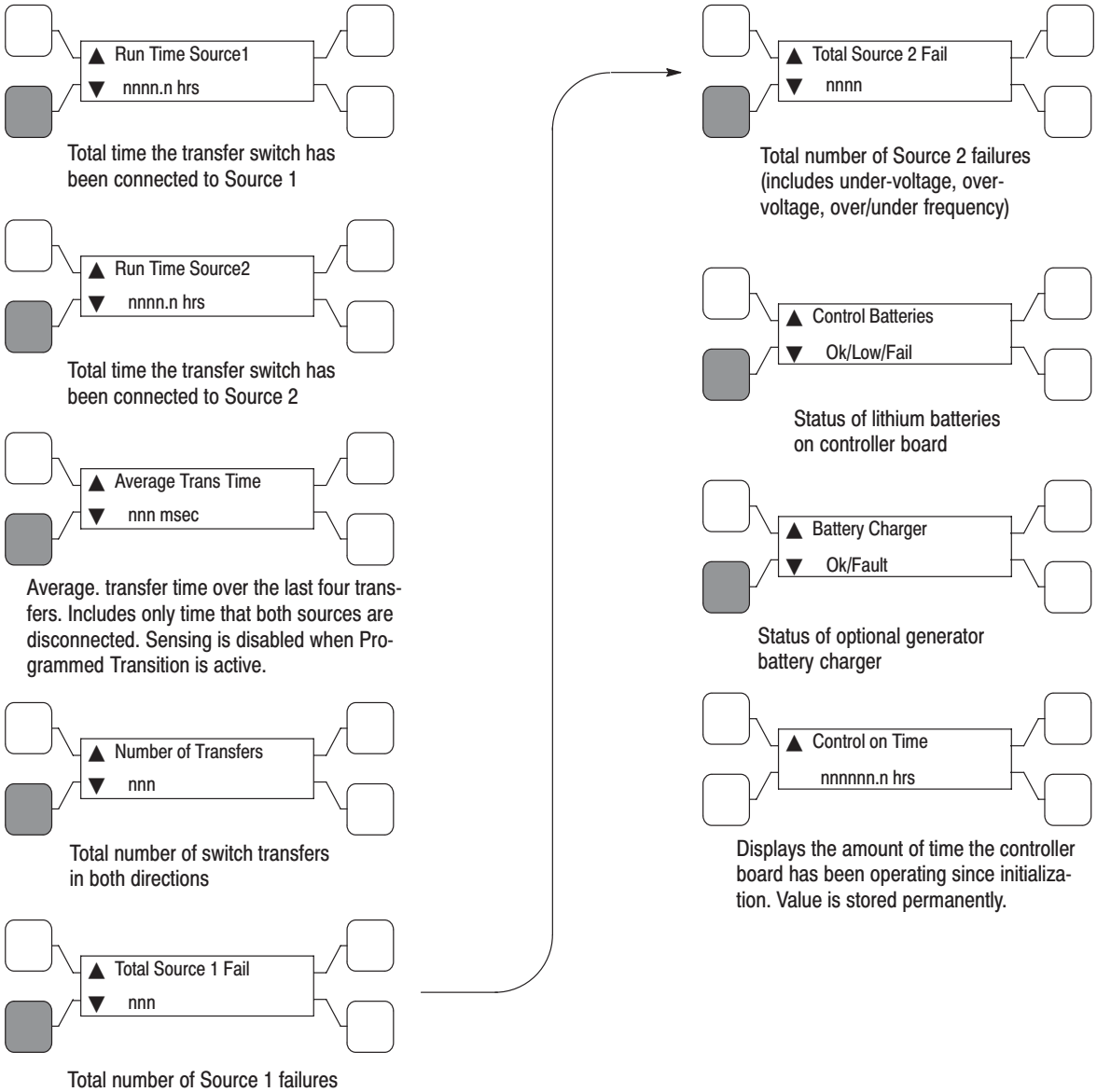
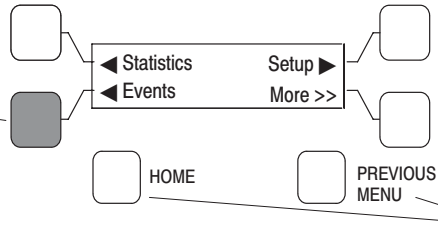


FIGURE 4-5. STATISTICS SUB-MENUS

SECOND MAIN MENU – Events Sub-Menus

The EVENTS program displays information about either source. The controller stores and records the last fifty "events" in chronological order, beginning with the most recent event. The date and time are listed with each event.

The Events program include Fault codes, active time delays or significant power system changes.



From this display, the PREVIOUS MENU button and HOME button returns program to the First Main Menu.

Within the sub-menus, press the PREVIOUS MENU button anytime to return to this menu.

Use the ▲▼ buttons on left to navigate through these screens

Sample Events

⁎ Indicates Event is currently active

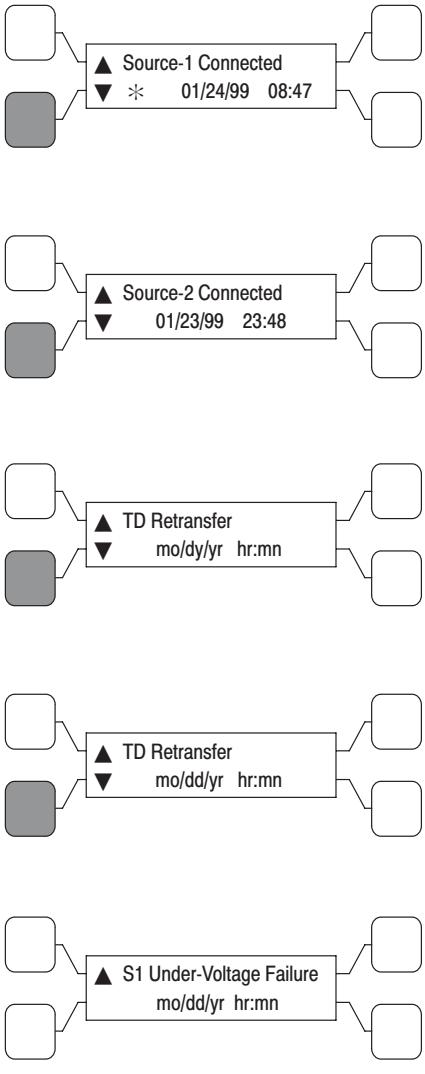
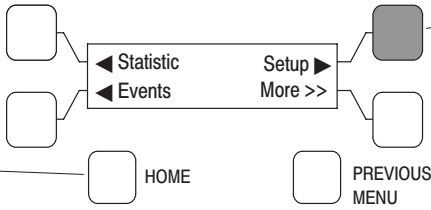


FIGURE 4-6. EVENTS SUB-MENUS

SECOND MAIN MENU – Setup Sub-Menus

Password



The SETUP button enters the Password protected adjustment programs to:

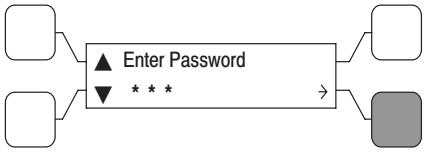
Adjust Sensors
Set Time Delays
Test and Exercise
Exercise Exceptions
Transition Mode Trim
Load Sequencer Enable

From this display, the PREVIOUS MENU button and HOME button returns program to the Main Menu.

The MORE button advances to the Third Main Menu.

Entering the Password Program

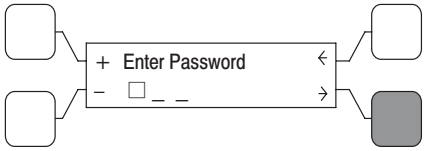
Press the Setup button to access the setup password menu.



The password is 574.

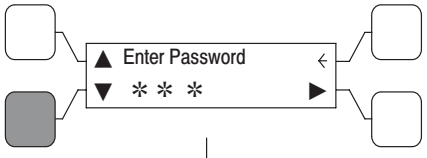
Use the + and – buttons to select numbers.

Use the › button to move the cursor to the next field.



Note: Entering the password is required to change setup parameters. The setup menus can be viewed **(read-only)** by pressing the › button three times without pressing either the + or – buttons to select numbers.

When the password is set, press the ▶ button to enter the setup program.



The Setup program is now accessed. This is the first Setup Menu screen.

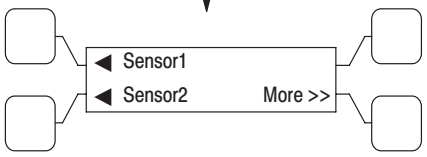
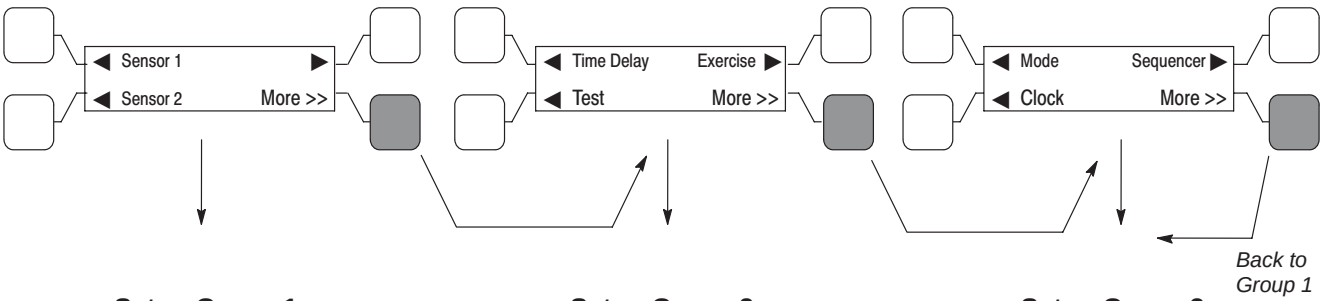


FIGURE 4-7. PASSWORD SUB-MENUS

Setup Menu Navigation and Description



Setup Group 1

This group allows programming the operational parameters of the switch for Source 1 and Source 2.

The *Sensor Sub-Menus* are used for setting the:

- Phase Type
- Nominal Voltage
- Undervoltage Settings
- Overvoltage Settings
- Time Delays
- Frequency Settings
- Imbalance Settings
- Phase Loss
- Phase Rotation

See Figures 4-10 and 4-11 for Sensor Sub-menus.

Setup Group 2

The *Time Delay* sub-menus allow programming time for the:

- Engine Start
- Power Source 1 to Source 2
- Power Source 2 to Source 1
- Engine Cooldown
- Programmed Transition
- Elevator Pre-Transfer
- Genset to Genset Engine Controls

Refer to Figure 4-12 for Time Delay sub-menus.

Test sub-menus allow programming the front panel test switch to test the source with or without a load. If the configuration is genset to genset, Source 1 or 2 is selectable. See Figure 4-14.

Exerciser sub-menus allows programming an exercise routine for Power Source 2 and are available only on utility-to-genset controls. If Level 2 control is installed, a second exercise program can be setup. See Figure 4-15 or 4-17 for Exercise sub-menus. *Exercise* sub-menus also allow for adding and deleting exercise exceptions. See Figure 4-19 for Exercise sub-menus. Up to 8 routines and exceptions can be programmed using the PC service tool.

NOTE: Exercise exception sub-menus were not available on early versions of software.

Setup Group 3

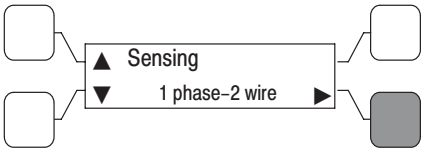
The *Mode* sub-menu allows programming the type of transition the switch uses. See Figure 4-21.

The *Clock* sub-menus program the time and date, as well as daylight savings time. See Figure 4-22.

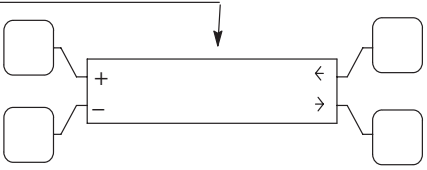
Load *Sequencer* is a software feature, available only with LonWorks NetWork Communication Module. This program allows the user to send a predetermined sequence of event announcements in a timed, sequential order to turn the load off and on. See FIgure 4-23.

FIGURE 4-8. SETUP DESCRIPTION

Changing Setup Parameters



When this button is pressed within any sub-menu, a cursor appears in the location of the editable field. In most cases, there is only one field to edit.



Use the + and – buttons to select numerical values or to toggle through a list of selections.

Default values are shown in parenthesis.

Use the › button to move the cursor to the next field.

When entering numerical values, the – button lowers the value to it's lowest range, then begins again at the top end of the range. The + button increases the value to its highest range, then begins again at the low end of the range.

If changes are made, press the › button to enter the new value and return to the previous menu.

Changing any data within the setup sub-menus will invoke a SAVE/RESTORE screen when exiting the Setup Sub-menu Groups.

If the PREVIOUS MENU button is pressed during an editing session, the data will not be changed.

If the HOME button is pressed during an editing session, the SAVE/RESTORE screen is invoked.

Saving or Restoring Setup Parameters

Changing any parameters within the Setup sub-menus invokes this screen when exiting the Setup sub-menu groups.

Use the Restore button to delete any setup parameter changes that were made during the current session. The program reverts to data from the previous session and does not save any changes.

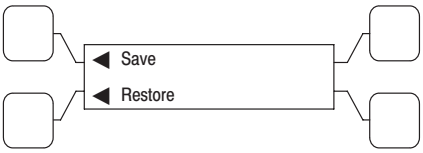


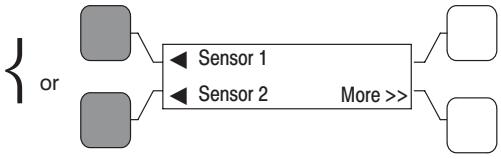
FIGURE 4-9. CHANGING SETUP PARAMETERS

Setup – *Group 1*

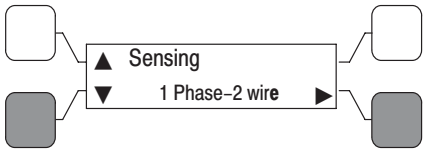
Sensor 1 & Sensor 2 Sub-Menus

Sensor 1 and Sensor 2 sub-menus are identical except:

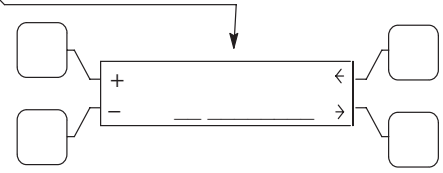
S1 refers to Source 1
S2 refers to Source 2



For 2-wire system, select:
1 phase–2 wire
For a single phase - 3 wire system, select: 1 phase–3 wire
For a 3 phase system, select:
3 phase



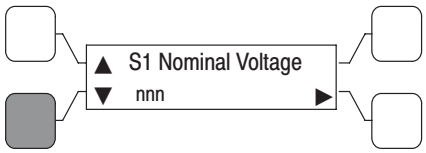
When this button is pressed in any sub-menu, a cursor appears in the location of the editable field. In most cases, there is only one field to edit.



System Voltage for Source 1 or 2

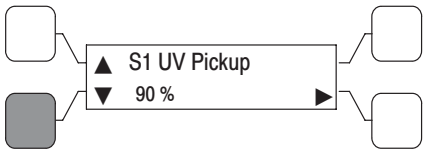
Enter the system voltage between 110 and 600 VAC

Note: Level 1 Controls are Line-to-Line Voltages and Level 2 Controls are Line-to-Neutral Voltages.



Under-Voltage Sensor Pick-Up

Enter a number between 85 and 100% of the nominal voltage (90%)



Use the + and – buttons to select numerical values or to toggle through a list of selections.

Default values are shown in parenthesis)

When entering numerical values, the – button lowers the value to its lowest range, then begins again at the top end of the range. The + button increases the value to its highest range, then begins again at the low end of the range.

Use the → button to move the cursor to the next field.

If changes are made, press the → button to enter the new value and return to the previous menu.

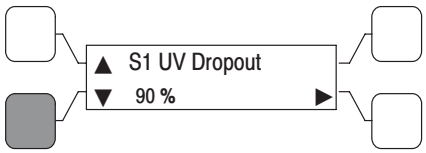
Changing any data within the setup sub-menus will invoke a SAVE/RESTORE screen when exiting the Setup Sub-menu Groups.

If the PREVIOUS MENU button is pressed during an editing session, the data will not be changed.

If the HOME button is pressed during an editing session, the SAVE/RESTORE screen is invoked.

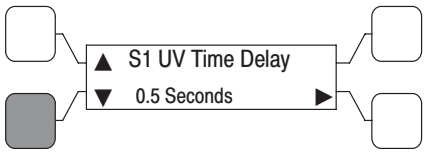
Under-Voltage Sensor Drop-Out Voltage

Enter a number between 75 and 98% of the under-voltage pick-up percentage (90%)



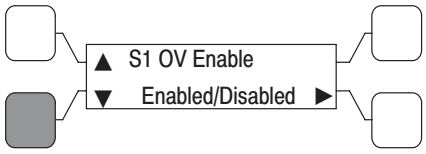
Under-Voltage Drop-Out Time Delay

Enter a time between 0.0 and 1.0 seconds (0.5)



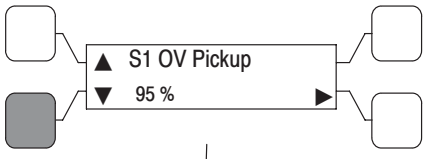
Over-Voltage Sensing Enable

Choose Enabled or Disabled (Enabled)



Over-Voltage Pick-Up
This adjusts the over-voltage pick-up as a percentage of the over-voltage drop-out

Enter a number between 95 and 99% (95%)



Note: Default values are in parenthesis.

Continued on next page

FIGURE 4-10. SETUP GROUP 1 – SENSOR SUB-MENUS

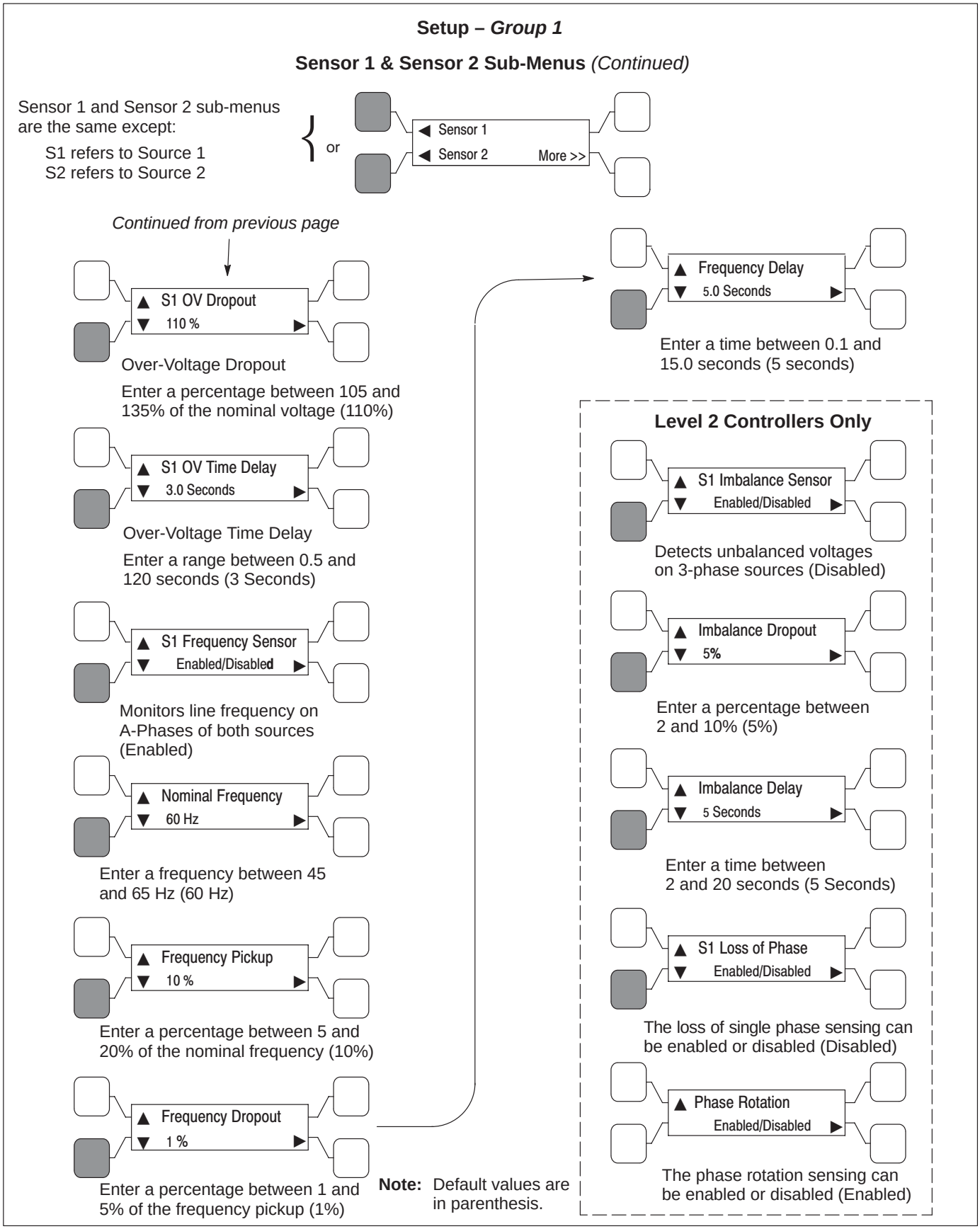
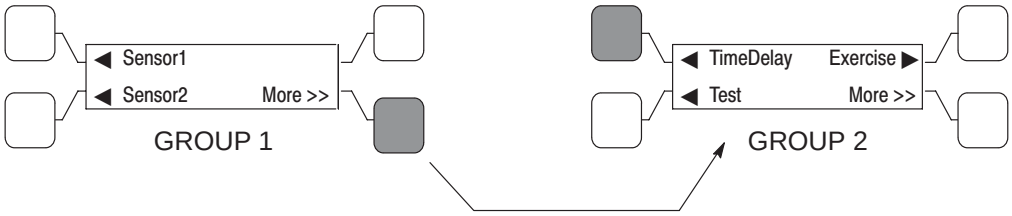


FIGURE 4-11. SETUP GROUP 1 – SENSOR SUB-MENUS (Continued)

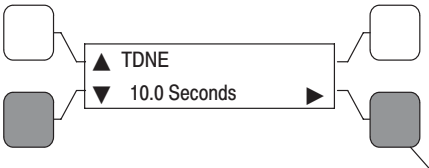
Setup – *Group 2*

Time Delay Sub-Menus

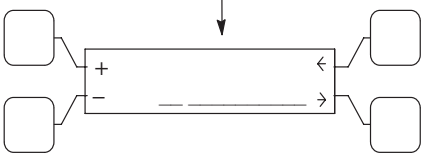


In a Normal to Emergency transfer this function allows Source 2 to stabilize before the load is applied.

Enter a time from 0 to 120 seconds (10 seconds). See Note 2.

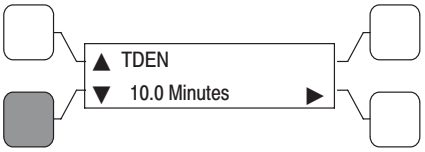


When this button is pressed in any sub-menu, a cursor appears in the location of the editable field. In most cases, there is only one field to edit.



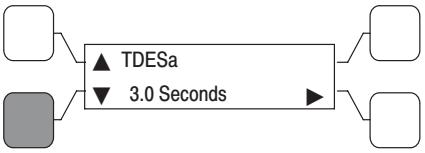
In a Emergency to Normal transfer this allows Source 1 to stabilize before re-transfer.

Enter a time from 0 to 30 minutes (10 minutes). See Note 2.



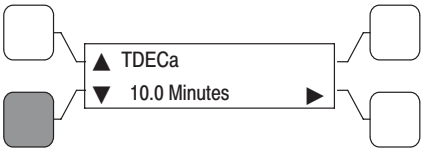
Sets the time delay for Engine Start on genset (a) used in a utility-generator and generator-generator mode. Prevents nuisance genset starting during brief power interruptions. This menu does not appear in utility-to-utility installations.

Enter a range from 0 to 120 seconds (3.0 seconds). See Note 2.



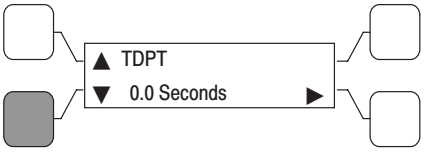
Sets the time delay for Engine Cool-down following a re-transfer. This menu does not appear in utility-to-utility installations.

Enter a time from 0 to 30 minutes (10 minutes).



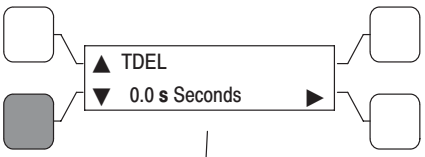
Sets the time delay for Programmed Transition setting of 0.0 disables the program.

Enter a time from 0 to 60 seconds (0 seconds).



Sets the time delay to wait for an elevator pre-transfer signal.

Enter a time from 0 to 60 seconds (0 seconds).



Continued on next page

Use the + and – buttons to select numerical values or to toggle through a list of selections.

Default values are shown in parenthesis.

Use the → button to move the cursor to the next field.

When entering numerical values, the – button lowers the value to its lowest range, then begins again at the top end of the range. The + button increases the value to its highest range, then begins again at the low end of the range.

If changes are made, press the → button to enter the new value and return to the previous menu.

Changing any data within the setup sub-menus will invoke a SAVE/RESTORE screen when exiting the Setup Sub-menu Groups.

If the PREVIOUS MENU button is pressed during an editing session, the data will not be changed.

If the HOME button is pressed during an editing session, the SAVE/RESTORE screen is invoked.

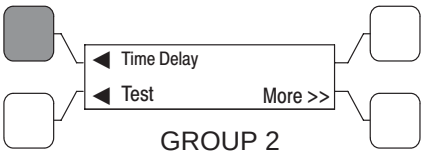
Note: Default values are in parenthesis.

Note 2: On early versions of software, the sequence of the first three menus were as follows: TDESa, TDNE, and TDEN.

FIGURE 4-12. SETUP GROUP 2 – TIME DELAY SUB-MENUS

Setup – *Group 2*

Time Delay Sub-Menus *(Continued)*



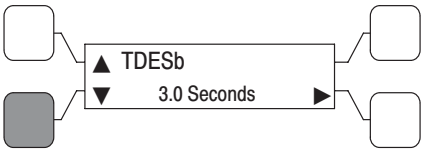
This group is used only in Genset to Genset applications

Continued from previous page

Level 2 Controller Only

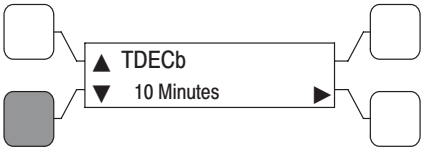
Sets the Engine Start time delay to for genset (b).

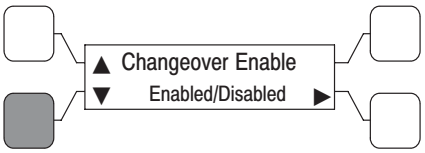
Enter a time from 0 to 120 seconds (3 seconds)



Sets the time delay for Engine Cooldown to begin.

Enter a time of 0 to 30 minutes (10 minutes)





If Changeover Enabled is enabled, this menu sets the amount of time a single generator can be run before switching to the other generator.

Enter a time from 1 to 336.0 hours (24 hrs)

Note: Default values are in parenthesis.

FIGURE 4-13. SETUP GROUP 2 – TIME DELAY SUB-MENUS (Continued)

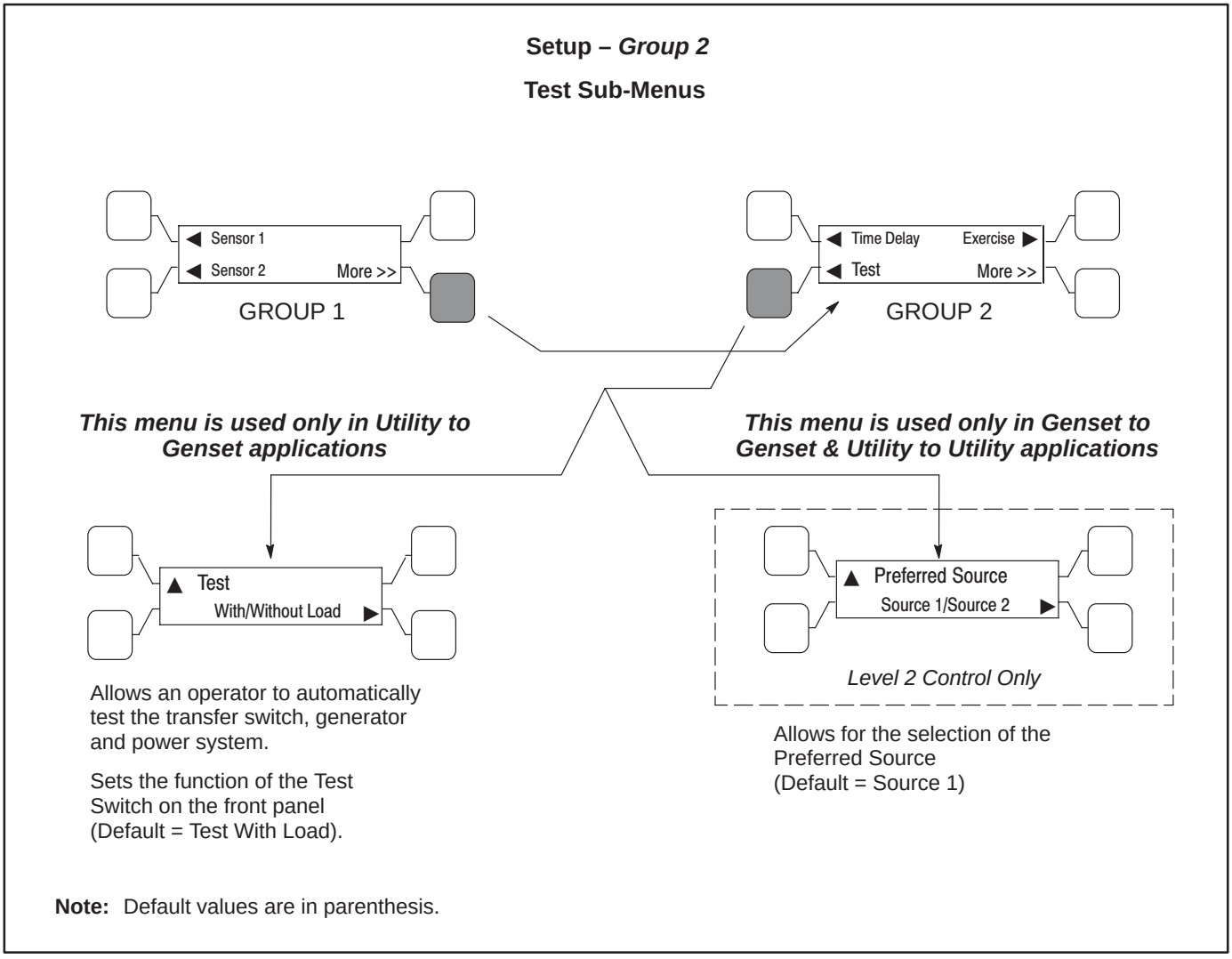
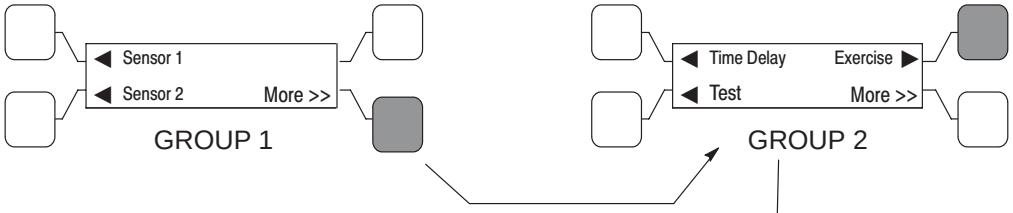


FIGURE 4-14. SETUP GROUP 2 – TEST SUB-MENUS

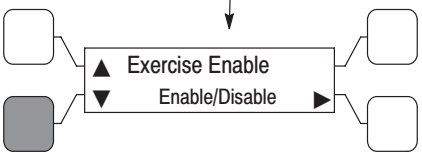
Setup – *Group 2*

Exerciser Sub-Menus – Software Versions Prior to 1.5.190

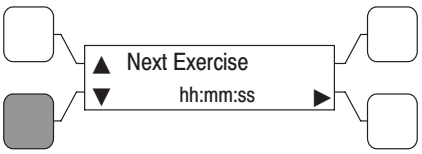
These sub-menus are available only in Utility-to-Genset applications.



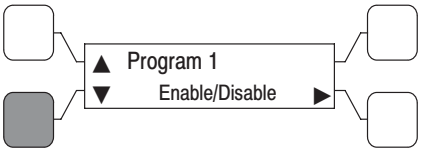
Enables or disables all the functions of exercising the generator(s)



Displays the Time remaining until the next exercise cycle. This display is readable only when the exerciser is Enabled (May not be displayed in Software Version 1.0)

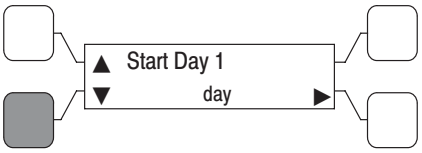


This screen allows disabling Exercise Program 1 only



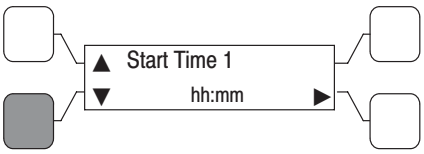
The first of four programming sub-menus for the Exerciser cycle. Sets the day an Exercise cycle will occur

Select a day between Sunday=0 and Saturday=6



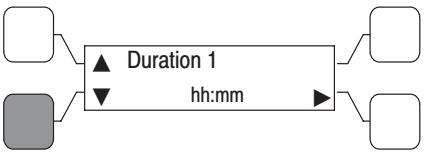
Sets a Time for the exercise cycle to begin

Enter a time within a 24 hour period: hh = 0 – 23, mm = 0 – 59.



Sets the length of Time the exercise cycle will run

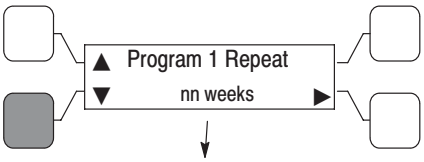
Enter a time within a 24 hour period: hh = 0 – 23, mm = 0 – 59.



Sets an Interval the exercise cycle will repeat

Enter a cycle between 0 and 52 weeks

Typical values are 1 or 2



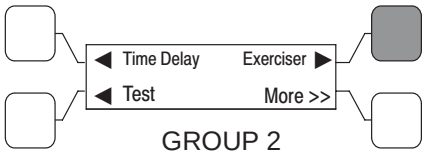
Only one program is available for Level 1 Controllers

Continued on next page

FIGURE 4-15. SETUP GROUP 2 – EXERCISER SUB-MENUS (SOFTWARE VERSIONS PRIOR TO 1.5.190)

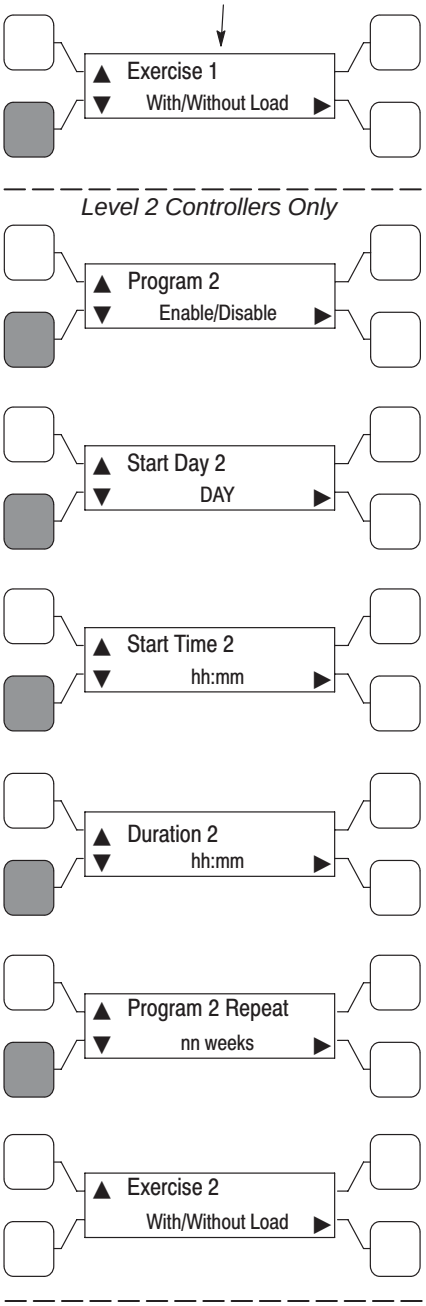
Setup – *Group 2*

Exercise Sub-Menus – Software Versions Prior to 1.5.190 *(Continued)*



Level 2 Controllers allow for two exercise programs to be setup from the Setup menu screen. Six additional programs and eight exceptions can be setup using the PC Service Tool.

Continued from previous page



Enables or disables exercising the generator(s) with or without a load

This screen allows disabling Exercise Program 2 only

Sets the day of the second exercise cycle.

Enter a day between Sunday = 0 and Saturday = 6.

Sets the time the second exercise cycle will begin

Enter a time within a 24 hour period: hh = 0 – 23, mm = 0 – 59.

Sets a time limit the second exercise cycle will run

Enter a time within a 24 hour period: hh = 0 – 23, mm = 0 – 59.

Sets an Interval the second exercise cycle will repeat

Enter a range from 0 to 52 weeks. Typical values are 1 or 2.

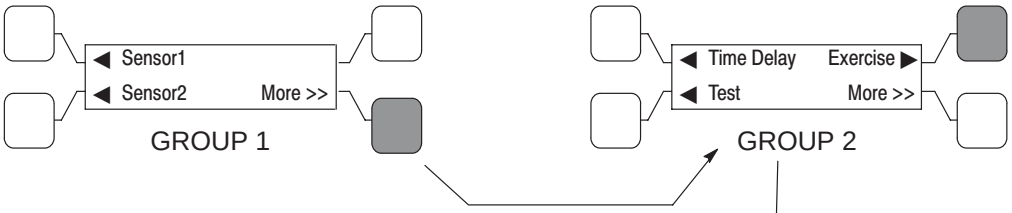
Enables or disables the second exercise program to run the generator(s) with or without a load

FIGURE 4-16. SETUP GROUP 2 – EXERCISER SUB-MENUS(SOFTWARE VERSIONS PRIOR TO 1.5.190) (Continued)

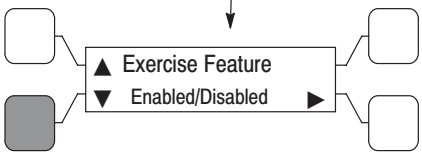
Setup – *Group 2*

Exercise Sub-Menus – Starting with Software Version 1.5.190

These sub-menus are available only in Utility-to-Genset applications.

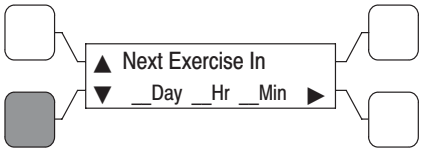


Enables or disables all the functions of exercising the generator(s). (Default = Disabled)

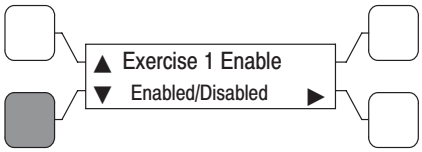


Note: Instead of "Exercise Feature," this menu is titled "Exercise Enable" in some early versions of software. This menu is no longer included with current software.

Displays the Time remaining until the next exercise cycle. If no exercises are enabled, the message "No Next Exercise" is displayed.

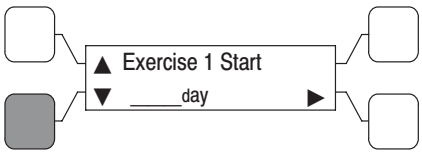


This screen allows disabling Exercise 1 only. (Default = Disabled)



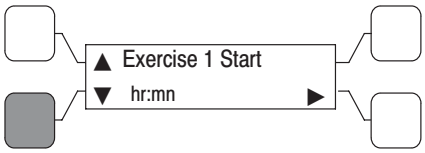
The first of four programming sub-menus for the Exercise cycle. Sets the day an Exercise cycle will occur

Select a day between Sunday and Saturday. (Default = Sunday)



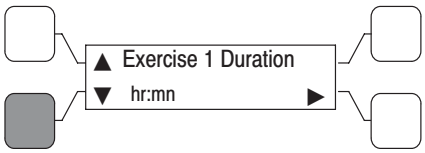
Sets a Time for the exercise cycle to begin.

Enter a time within a 24 hour period: hr = 0–23, mn = 0–59. (Default = 00:00)



Sets the length of Time the exercise cycle will run.

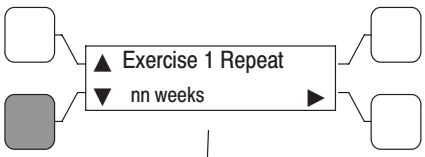
Enter a time within a 24 hour period: hr = 0–23, mn = 0–59. (Default = 00:00)



Sets an Interval the exercise cycle will repeat.

Enter a cycle between 0 and 52 weeks.

Typical values are 1 or 2. (Default = 0 weeks)



Note: Only one exercise is available for Level 1 Controllers

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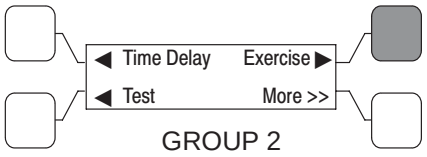
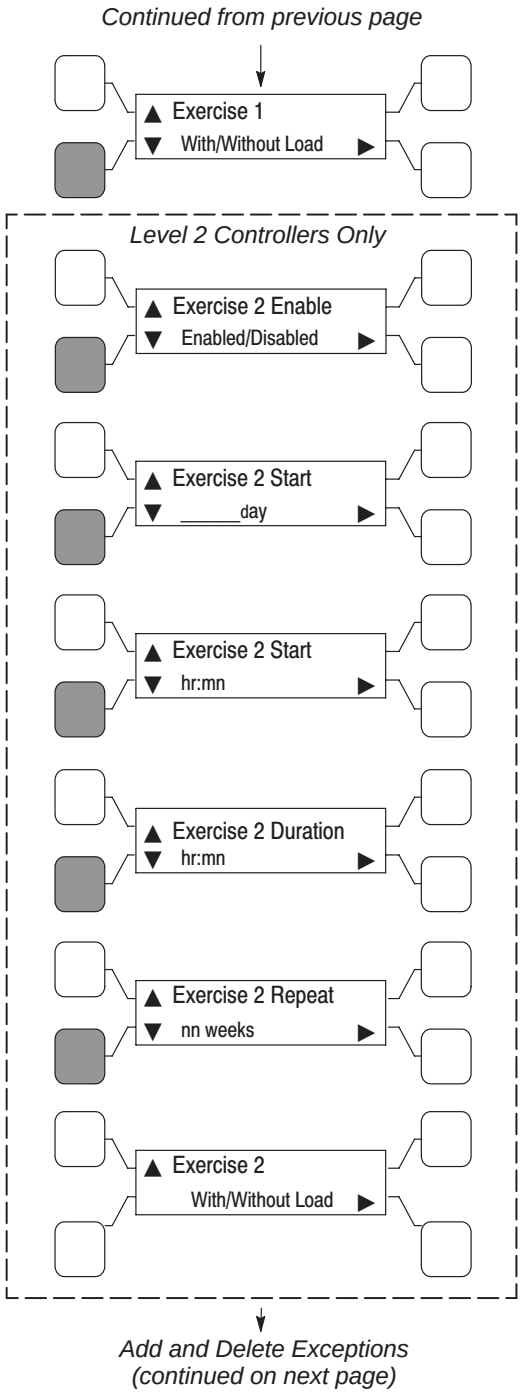
FIGURE 4-17. SETUP GROUP 2 – EXERCISE SUB-MENUS (STARTING WITH SOFTWARE VERSION 1.5.190)

Setup – *Group 2*

Exercise Sub-Menus – Starting with Software Version 1.5.190 *(Continued)*



Level 2 Controllers allow for two exercise programs to be setup from the Setup menu screen. Six additional programs and eight exceptions can be setup using the PC Service Tool.



Enables or disables the first exercise program to run the generator(s) with or without a load. (Default = Without Load)

This screen allows disabling Exercise 2 only. (Default = Disabled)

Sets the day of the second exercise cycle.

Enter a day between Sunday and Saturday. (Default = Sunday)

Sets the time the second exercise cycle will begin.

Enter a time within a 24 hour period: hr = 0–23, mn = 0–59. (Default = 00:00)

Sets a time limit the second exercise cycle will run.

Enter a time within a 24 hour period: hr = 0–23, mn = 0–59. (Default = 00:00)

Sets an Interval the second exercise cycle will repeat.

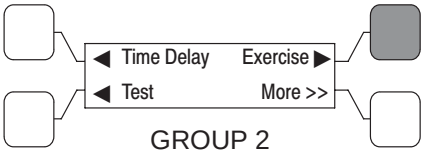
Enter a range from 0 to 52 weeks. Typical values are 1 or 2. (Default = 0 weeks)

Enables or disables the second exercise program to run the generator(s) with or without a load. (Default = Without Load)

FIGURE 4-18. SETUP GROUP 2 – EXERCISE SUB-MENUS (STARTING WITH SOFTWARE VERSION 1.5.190) (Continued)

Setup – *Group 2*

Exercise Exceptions Sub-Menus



Level 2 Controllers allow for adding and deleting exceptions to the two exercise programs setup from the Setup menu screen.

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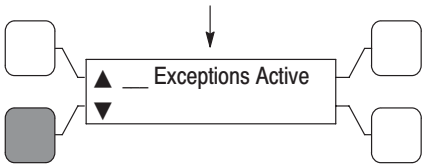
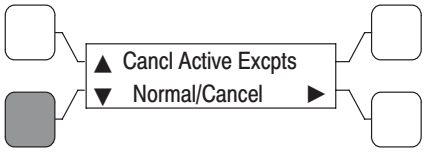
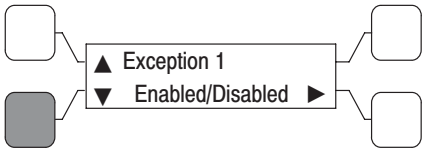
Indicates the number of active exercise exceptions. If there are no active exceptions, the message “No Exceptions Active” is displayed.



This screen allows canceling all exceptions. (Default = Normal)

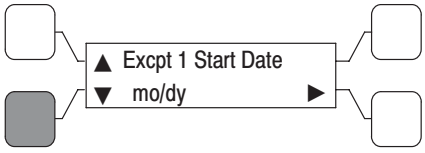


This screen allows enabling/disabling Exception 1 only. (Default = Disabled)



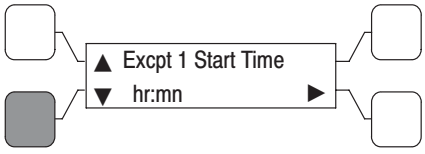
Sets the month and day for Exception 1.

Enter a starting date that the exercise will not run: mo = 1–12, dy = 1–31.



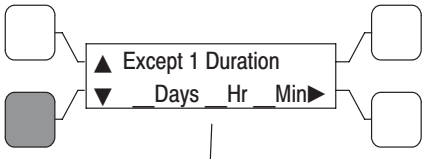
Sets a time of day for Exception 1.

Enter a starting time of day that the exercise will not run: hr = 0–23, mn = 0–59.



Sets the Time period that Exception 1 will override an Exercise.

Enter a time: dy = 1–31, hr = 0–23, mn = 0–59.

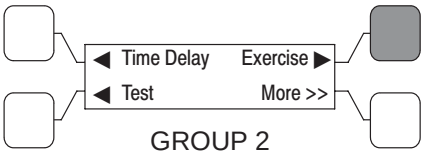


Continued on next page

FIGURE 4-19. SETUP GROUP 2 – EXERCISE EXCEPTIONS SUB-MENUS

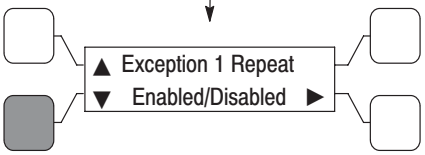
Setup – *Group 2*

Exercise Exceptions Sub-Menus *(Continued)*



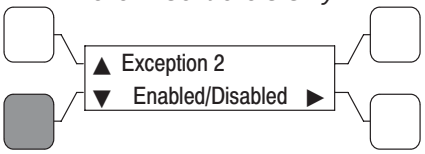
Continued from previous page

This screen allows enabling/disabling Exception 1 repeating. (Default = Disabled)



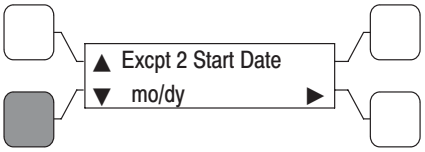
Level 2 Controllers Only

This screen allows enabling/disabling Exception 2 only. (Default = Disabled)



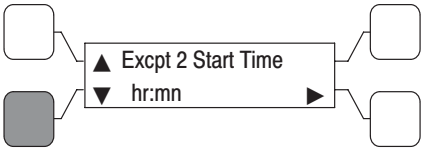
Sets the month and day for Exception 2.

Enter a starting date that the exercise will not run: mo = 1–12, dy = 1–31.



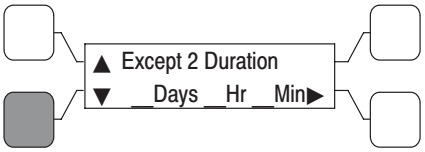
Sets a time of day for Exception 2.

Enter a starting time of day that the exercise will not run: hr = 0–23, mn = 0–59.



Sets the Time period that Exception 2 will override an Exercise.

Enter a time: dy = 1–31, hr = 0–23, mn = 0–59.



This screen allows enabling/disabling Exception 2 repeating. (Default = Disabled)

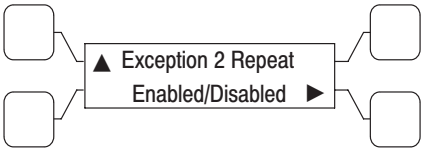


FIGURE 4-20. SETUP GROUP 2 – EXERCISE EXCEPTIONS SUB-MENUS (Continued)

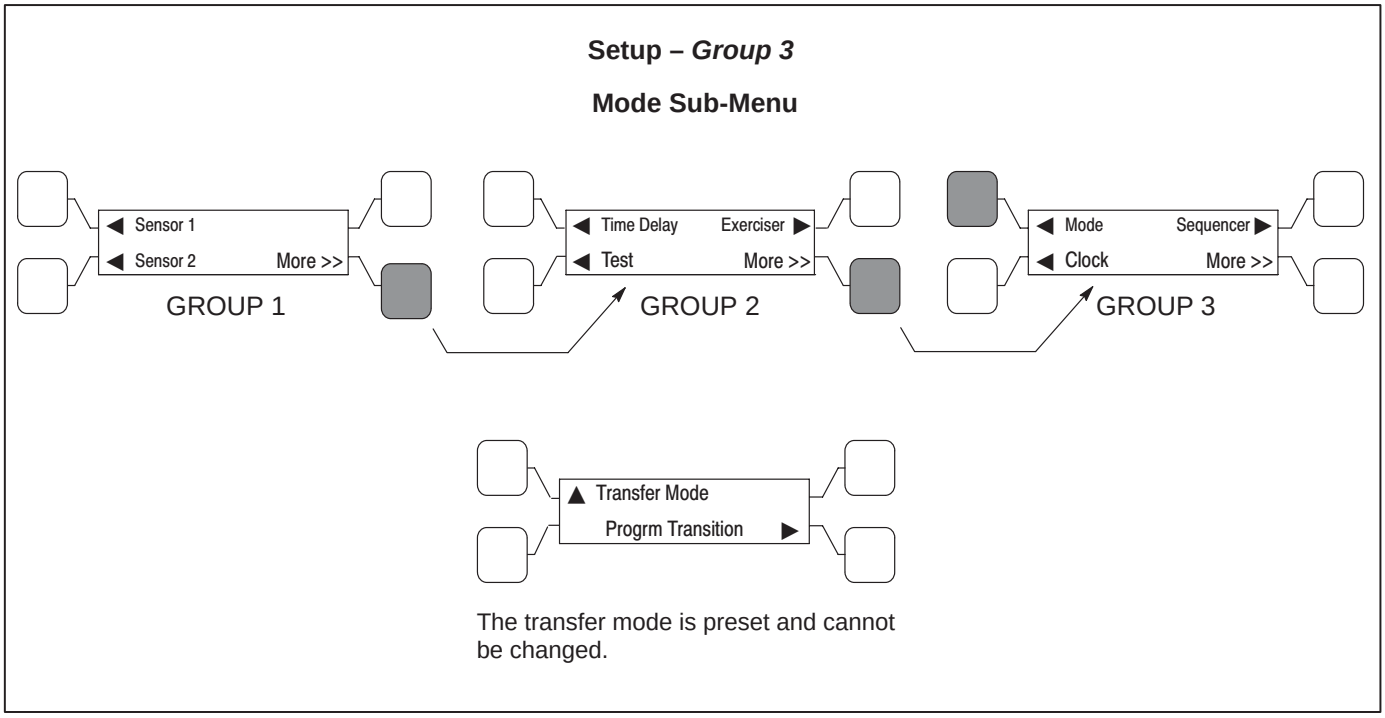
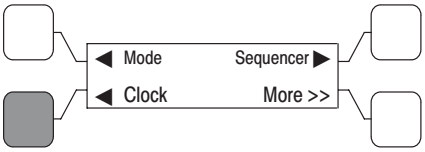


FIGURE 4-21. SETUP GROUP 3 – MODE SUB-MENU

Setup – *Group 3*

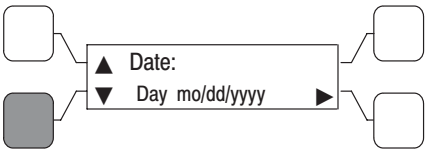
Clock Sub-Menus



The Clock sub-menus allow the user to set the actual date and-time, as well as select the Daylight Saving Time option.

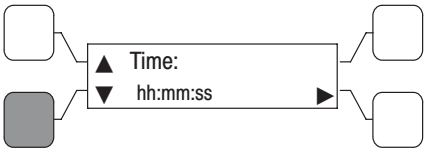
Sets the actual day and date.

Enter a month between Jan = 1 and Dec = 12, date between 1 and 31, and year between 1 and 9999.



Sets the actual time of day.

Enter the actual time within a 24 hour period Enter a time within a 24 hour period: hh = 0 – 23, mm = 0 – 59, ss = 0 – 59.



Activates the Daylight Savings time option. Selecting Enabled automatically updates the clock +/– one hour on the appropriate days. (Default = Disabled)

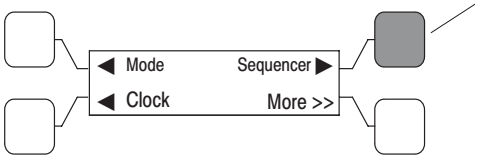
Note: The Daylight Savings Time program is set for North America. If you are anywhere outside of North America, the time should be changed manually.

- The first Sunday in April – moves the time forward one hour.
- The last Sunday in October – moves the time back one hour.

FIGURE 4-22. SETUP GROUP 3 – CLOCK SUB-MENUS

Setup – *Group 3*

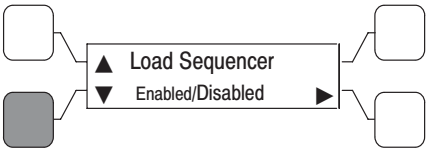
Sequencer Sub-Menus



The Sequencer sub-menus are a software only feature allowing the user to send a predetermined sequence of network event announcements. The announcements are sent in a timed, sequential order and are used to turn ATS loads off and on.

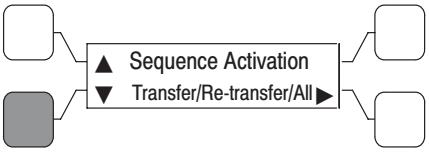
Sequencer is available only with the Network Communication Module. The module must be installed and enabled before these screens are displayed.

When Enabled, allows event announcements to be sent to the transfer switch.



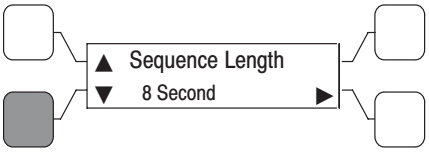
Sets activation for certain operational modes.

Choose Transfer, Re-transfer or All



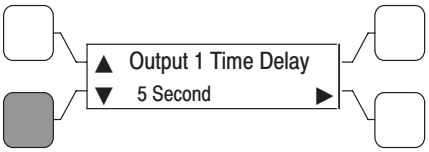
The control can activate a maximum of 8 relay output signals.

Enter the number of relay output signals desired to activate: 1 thru 8



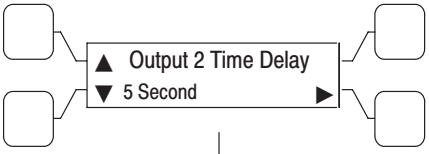
When Load Sequencer is triggered, the controller deactivates all remote relay output signals. Starting with Relay 1, the controller counts down the specified time delay, then activates Relay 1.

Enter a time from 0 to 60 seconds.



If the Sequence Length is greater than 1, the control counts down the specified Relay 2 time delay, then activates the Relay 2 signal.

Enter a time from 0 to 60 seconds.



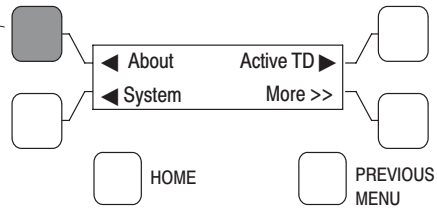
The process repeats until all relay signals have been sequenced. The maximum time delay for all 8 signals is 8 minutes.

Menus continue through Output 8, depending on the number of Sequence Lengths specified.

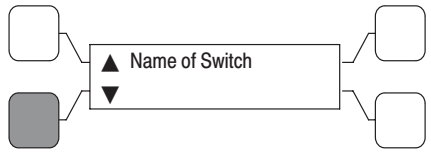
FIGURE 4-23. SETUP GROUP 3 – SEQUENCER SUB-MENUS

THIRD MAIN MENU – About Sub-Menus

The About sub-menus contain read-only information about the transfer switch and controller.

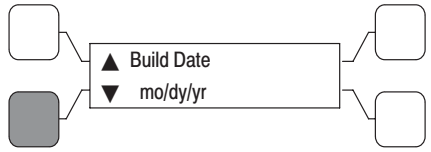


Displays the name of the switch as defined in the Event Handling Requirement.

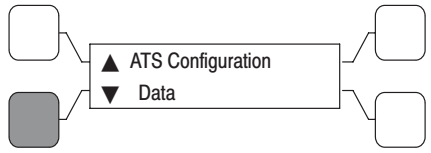


Displays the current firmware version of the controller.

Displays the manufacturing date of the controller.

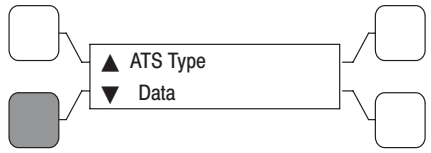


Displays the configuration of the controller. Changes are made by service personnel using the PC Service tool.



Data
Test Mode
Util–Gen
Utility–Utility
Genset–Genset
Unknown

Displays the mode of operation the control is using. Adjustments can be made by service personnel using the PC Service Tool.



Data
OT = Open Transition
BT = Bypass Transition
Unknown

Displays the ATS board level (1 or 2).

NOTE: This menu was not included in early versions of software.

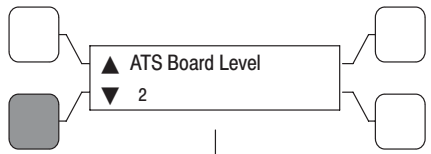


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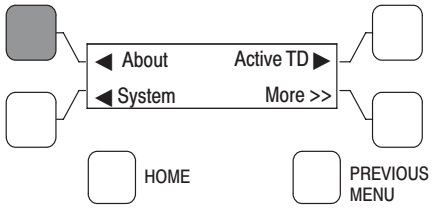
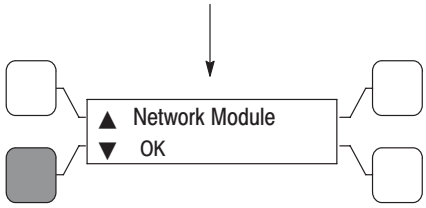
FIGURE 4-24. THIRD MAIN MENU – ABOUT SUB-MENUS

THIRD MAIN MENU – About Sub-Menus *(continued)*



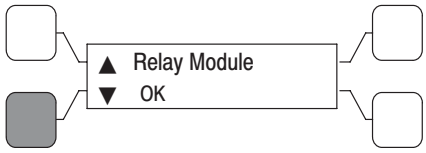
Continued from previous page

This screen indicates if a Network Communications Module is installed and enabled.



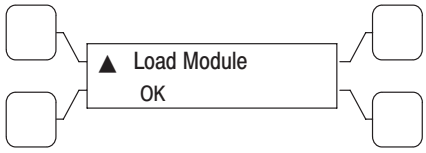
Hardware Detected	Software Enabled	Data
True	True	OK
False	True	Not Installed
True	False	Not Enabled
False	False	Not Available

This screen indicates if the Relay Module hardware is installed.



This screen indicates if the Load Current Module hardware is installed.

This feature is not available on Level 1 controllers

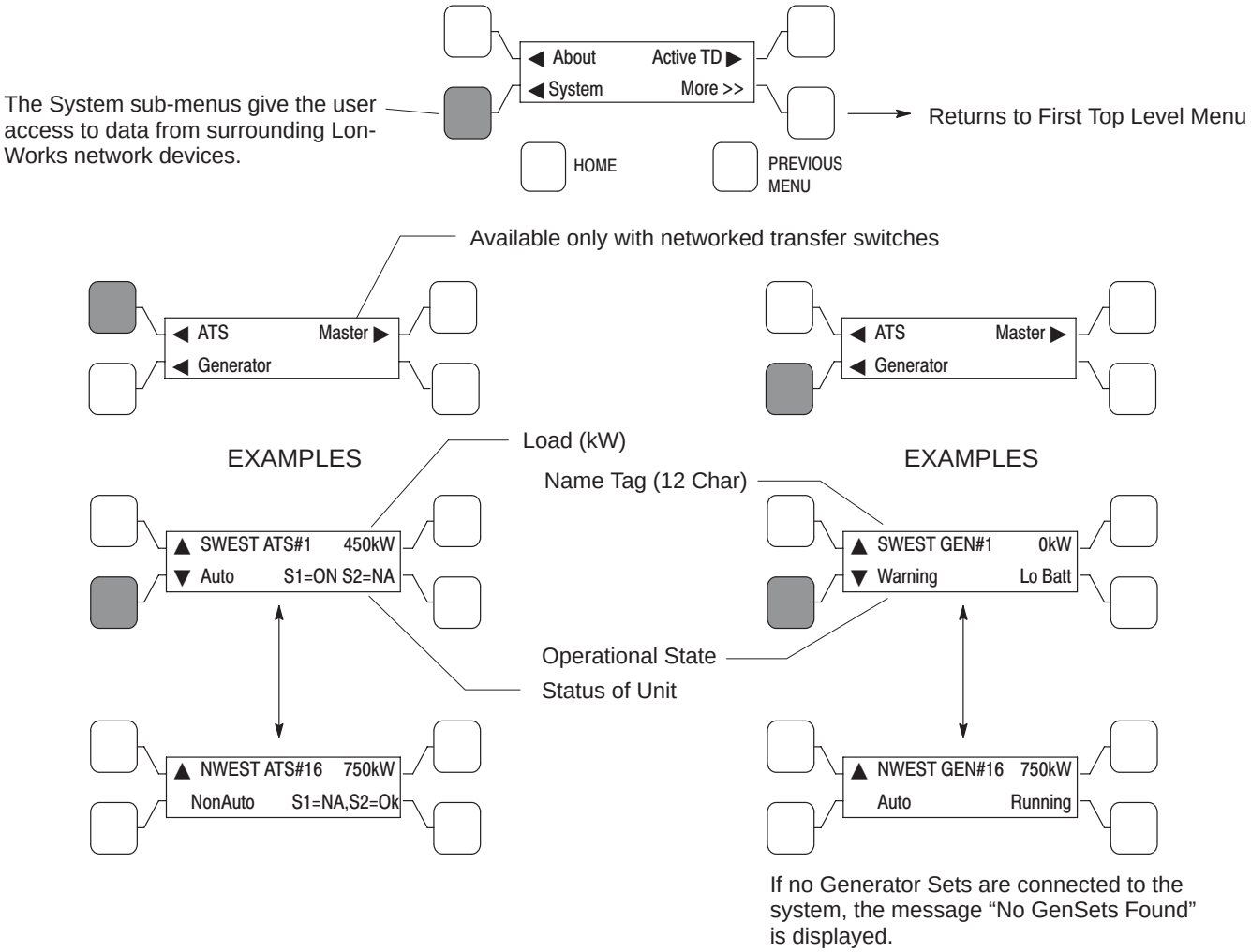


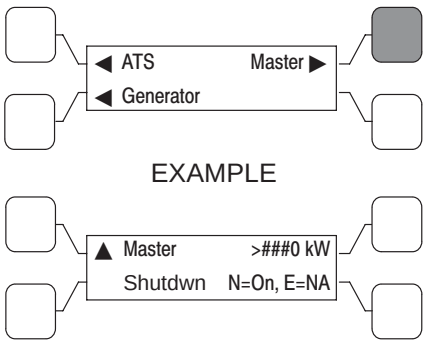
Data
OK
Not Installed

FIGURE 4-25. THIRD MAIN MENU – ABOUT SUB-MENUS (Continued)

THIRD MAIN MENU – System Sub-Menus

These sub-menus are available only with the Network Communication Module.
The status of up to 32 devices can be viewed at the ATS.





The Master Control menu displays information on:

1. Power (kW)
2. Master Control Status
   (Non Auto, Ready, Norm Fail, Test)
3. Voltage Source Status
   ([N=Source1, E=Source2], On, OK, or NA).

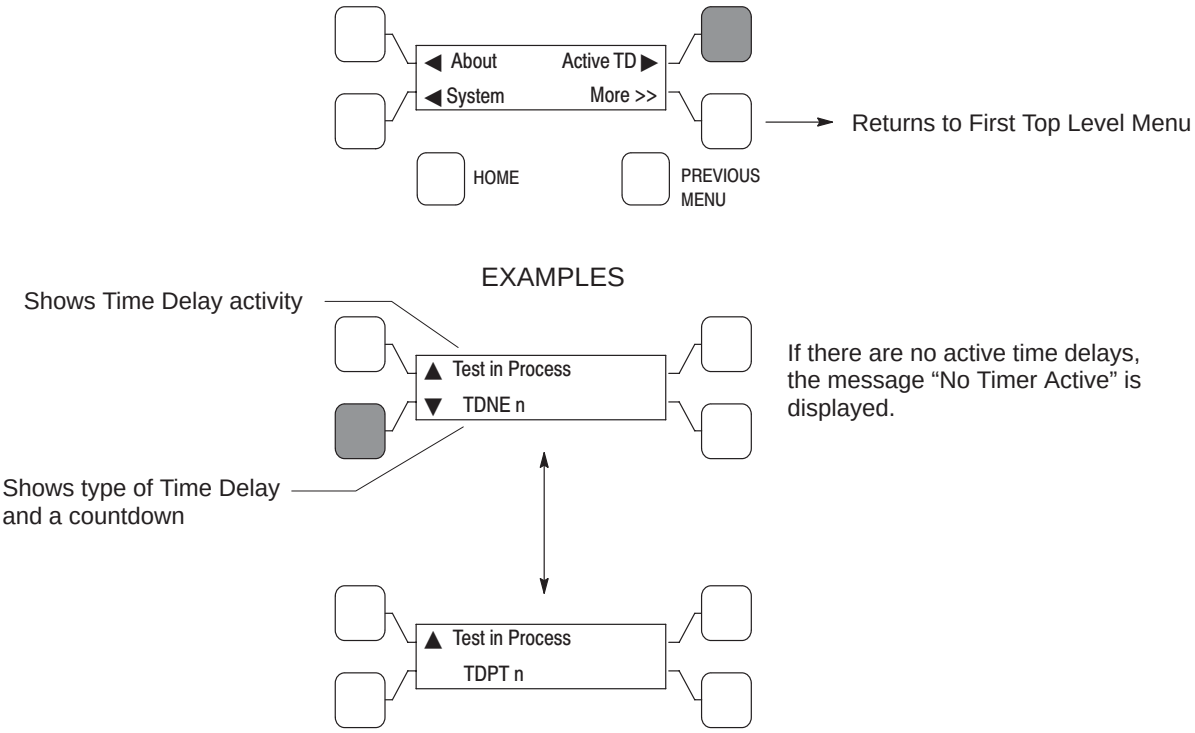
If a Master Control is not connected to the system, the message “No Master Control” is displayed.

NOTE: The Master Control menu is not available in early versions of software.

FIGURE 4-26. THIRD MAIN MENU – SYSTEM SUB-MENUS

THIRD MAIN MENU – Active TD Sub-Menus

These sub-menus are available only when there are active time delays.



NOTE: Active TD menus were not available on early versions of software.

FIGURE 4-27. THIRD MAIN MENU – ACTIVE TD SUB-MENUS

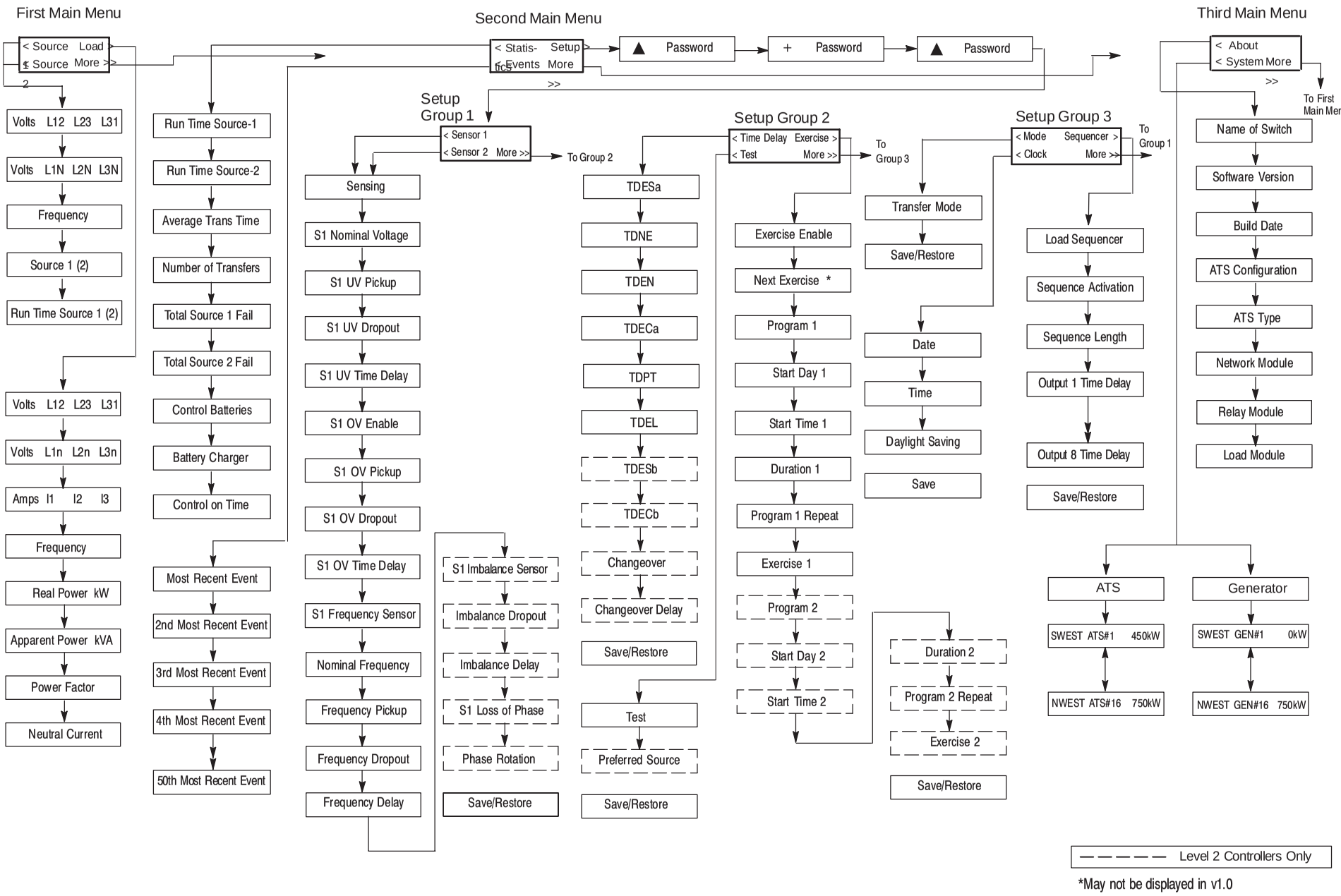


FIGURE 4-28. MENU SYSTEM MAP – PRIOR TO SOFTWARE VERSION 1.5.190

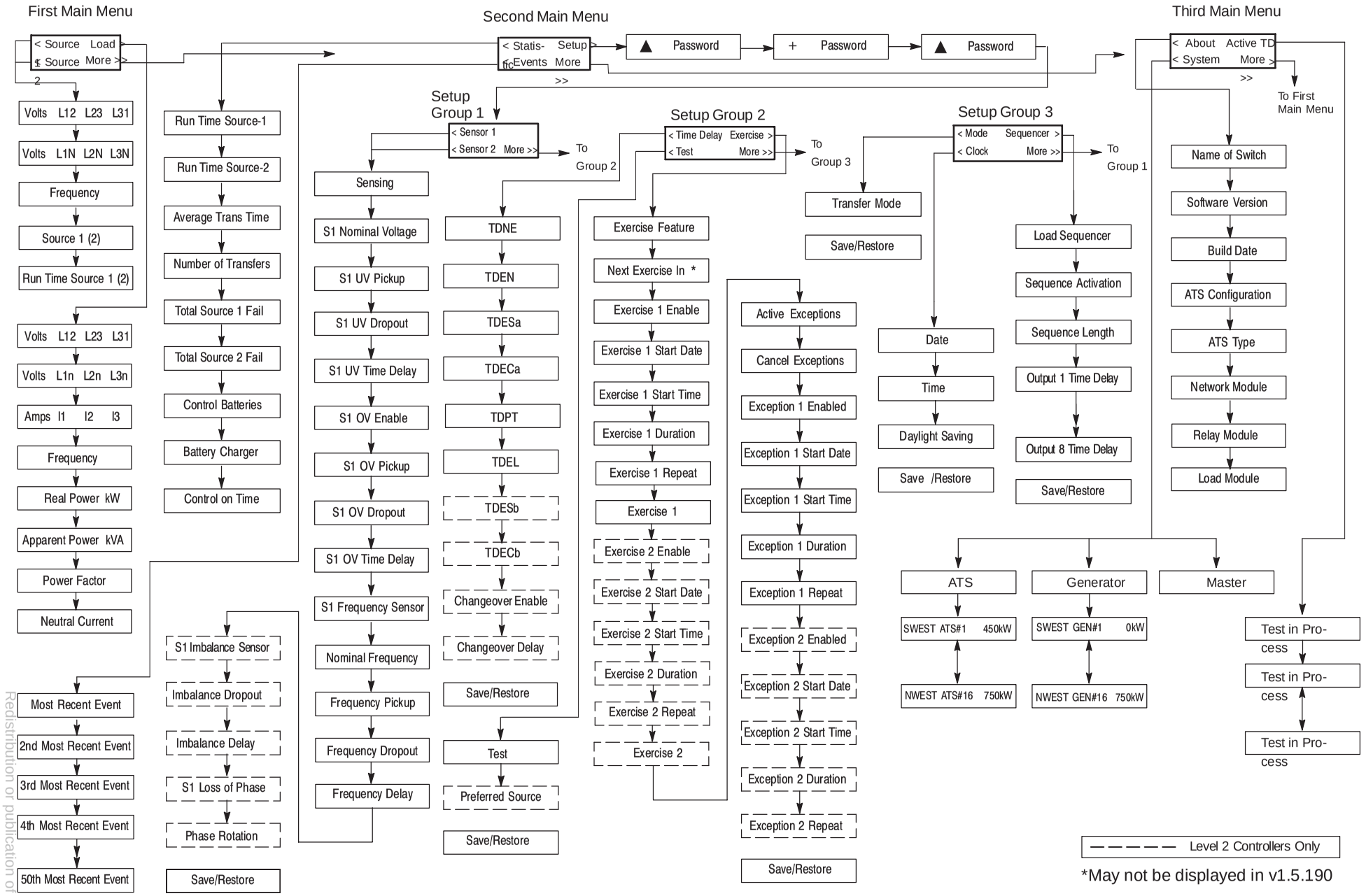


FIGURE 4-29. MENU SYSTEM MAP – STARTING WITH SOFTWARE VERSION 1.5.190

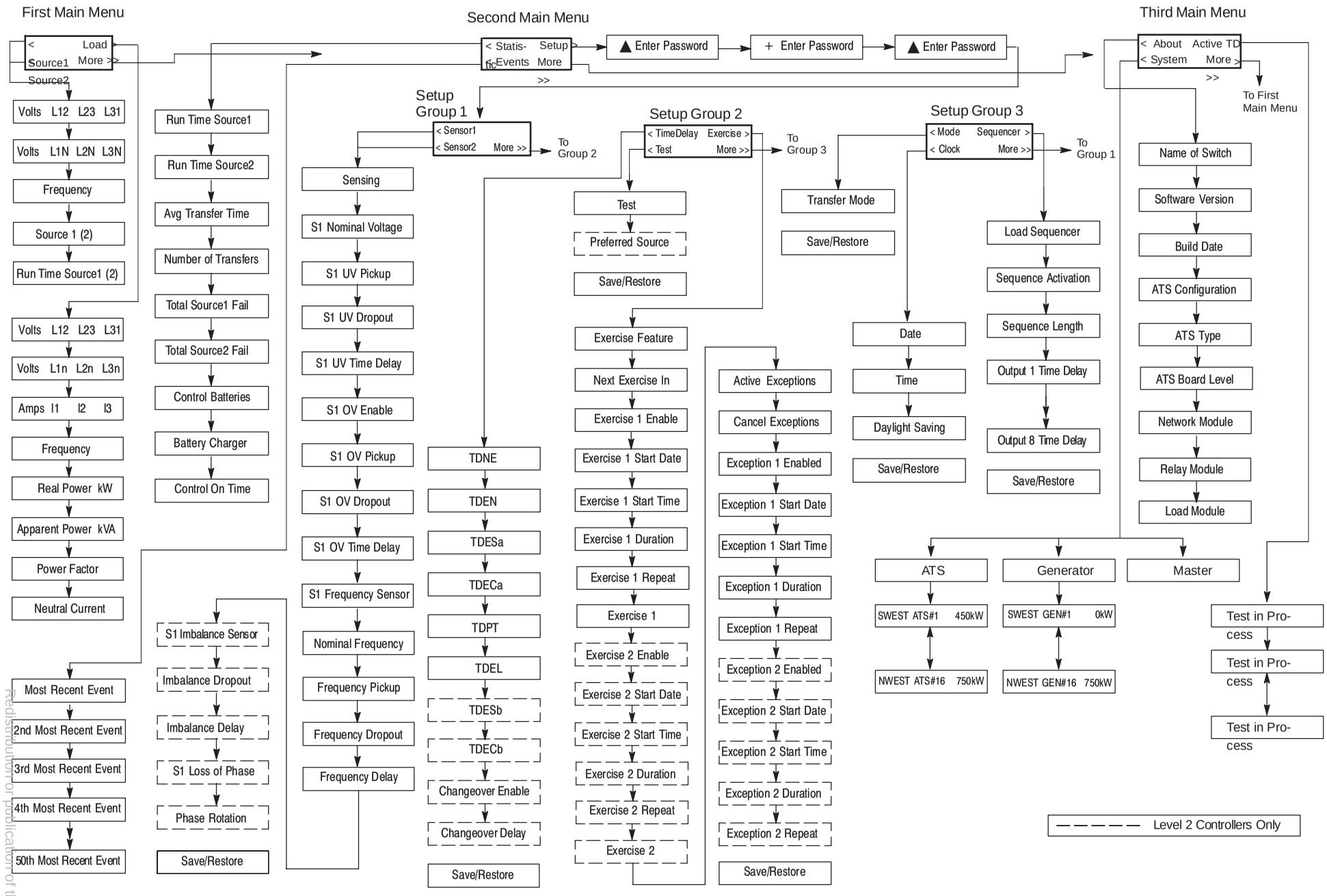


FIGURE 4-30. MENU SYSTEM MAP – STARTING WITH SOFTWARE VERSION 1.8.204

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5. Troubleshooting

This section describes a typical transfer switch Sequence of Events, followed by a description of the Control LED indicators and two troubleshooting procedures.

The first troubleshooting procedure uses fault codes from the controls diagnostics. The second procedure uses conditional schematics and symptoms to diagnose all possible problems, including those not covered by the fault codes.

INPOWER SERVICE TOOL

The InPower™ service tool can be used to test the transfer switch with functions, including Remote Test, Transfer Inhibit, Retransfer Inhibit etc. InPower, when used improperly, can cause symptoms like warnings and shutdowns that appear to be a defective control. When these problems occur, always verify that a Test feature was not left enabled with InPower. Always disable test features before disconnecting InPower.

ABOUT NETWORK APPLICATIONS AND CUSTOMER INPUTS

In applications with networks and remote customer inputs, the genset may start unexpectedly or fail to crank as a result of these inputs. These symptoms may appear to be caused by the transfer switch control. Verify that the remote input is not causing the symptom or isolate the control from these inputs before troubleshooting the control.

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts with body, tools, jewelry, hair, clothes, etc. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

DIGITAL MODULE

The digital module contains the logic and timing circuits that control transfer switch operation. This module also contains many of the customer interface circuits (including the genset start signal and network port), the RS-232 communications port for the service tool, and drivers for the control panel indicators, switches, and meters.

Two versions of this module are provided: one for Level 1 controls and one for Level 2 controls.

TROUBLESHOOTING **PAGE**

POWER MODULE

The power modules contain a power supply for the digital modules, voltage sensing transformers, and relays. These modules also contain the interface circuits for the transfer switch including the position sensing switches and relay drivers.

Two versions of this module are provided: one for Level 1 controls and one for Level 2 controls. The power modules are available in four different voltage ranges.

CONTROL LED INDICATORS AND SWITCH

LED Indicators

The digital module located on the inside of the switch enclosure door contains ten LED indicators. The indicators provide some information about the current control status. These indicators may be helpful in troubleshooting the transfer switch when the Digital Display is not available. See Figure 5-1 and Table 5-1.

Exerciser Enable/Disable Switch

The Exerciser Enable/Disable switch (Figure 5-1) enables the control to exercise the genset during future scheduled exercise periods and lights the Exerciser Enabled indicator or disables the scheduled exercise period and turns the indicator off. The operator can also enable and disable the exerciser from the Digital Display, when it is available or from the PC Service Tool.

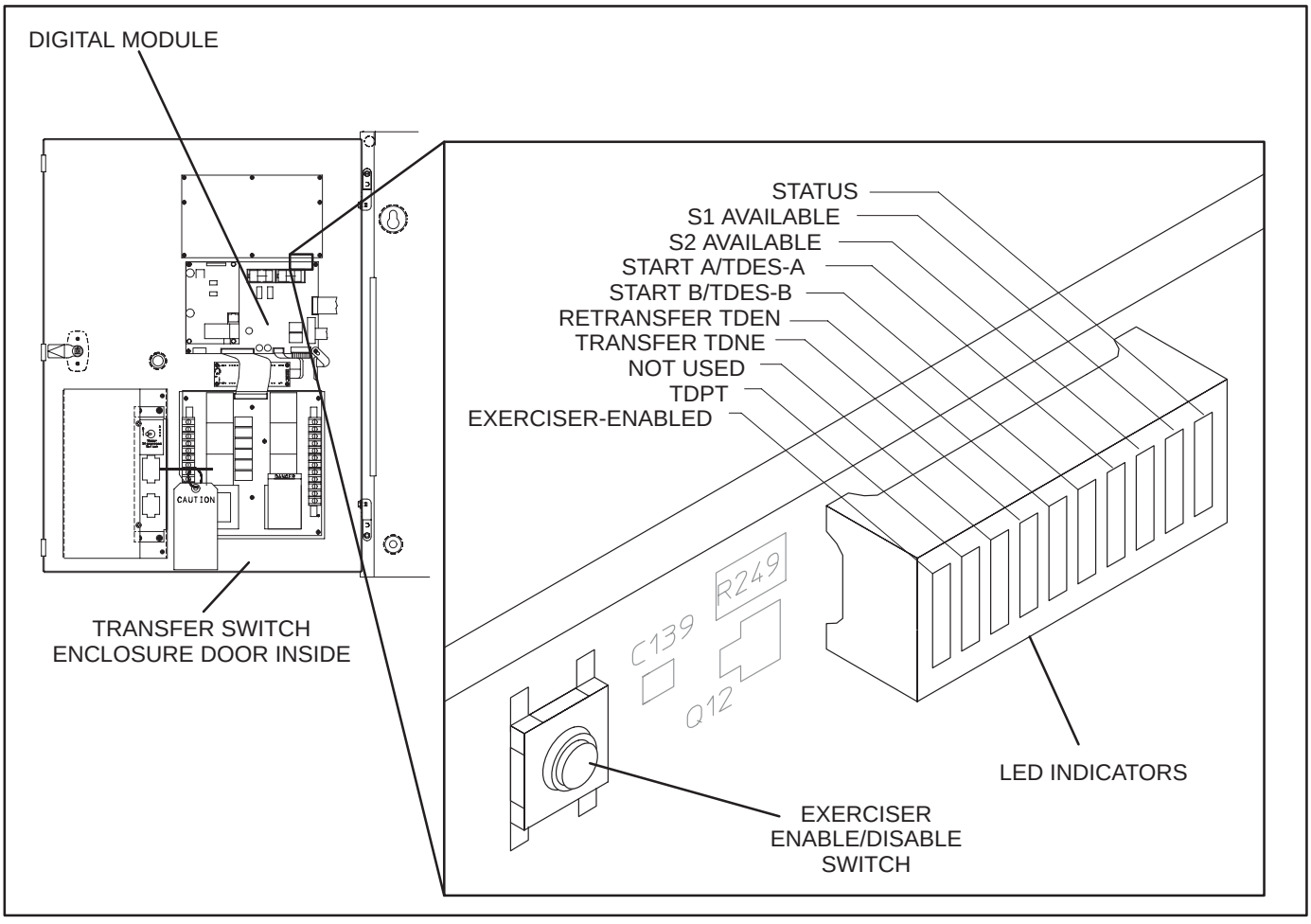

FIGURE 5-1. LED LOCATION ON DIGITAL MODULE (SHOWN ON THE 40 TO 125 AMP SWITCH)

TABLE 5-1. DIGITAL MODULE LED INDICATORS

Indicator	Definition
Status	Blinks at 1/2 Hz rate when the controller has power and the program is running without error. This indicator flashes the event code of an active event until the event is acknowledged with the Reset switch on the front panel. This indicator is sometimes referred to as the heart beat because it blinks constantly when the controller does not have an active event. (Refer to Table 4-2.)
S1 Available	Lights when Power Source 1 has acceptable voltage and frequency limits. This indicator lights when the Source 1 Available indicator on the control panel lights.
S2 Available	Lights when Power Source 2 has acceptable voltage and frequency limits. This indicator lights when the Source 2 Available indicator on the control panel lights.
Start A/TDES-A	1. Lights constantly when the control has commanded Source 2 to start 2. Blinks at 1/2 Hz rate during the time delay to engine start (TDESa)
Start B/TDES-B	This indicator is only used for genset-to-genset applications when Source 1 is a generator not a utility. 1. Lights constantly when the control has commanded Source 1 to start 2. Blinks at 1/2 Hz rate during the time delay to engine start (TDESb)
Retransfer/TDEN	1. Lights when the control energizes the Retransfer relay 2. Blinks at 1/2 Hz rate during the time delay to retransfer (TDEN)
Transfer/TDNE	1. Lights when the control energizes the Transfer relay 2. Blinks at 1/2 Hz rate during the time delay to transfer (TDNE)
TDPT	Time Delay Programmed Transition Blinks at 1/2 Hz rate during the programmed transition time delay
Exerciser Enabled	Lights when the Exerciser clock is enabled and blinks during an exercise period. The small switch next to the indicator enables and disables the exerciser. The operator can also enable and disable the exerciser from the Digital Display when it is available.

SEQUENCE OF EVENTS

The control executes a prescribed sequence of events for all transfer switch operations. See Figure 4-1. The operations for a typical loss of main power and a return of that main power are:

Transfer from Source 1 to Source 2

This sequence of events includes a programmed transition and begins with Source 1 supplying power to the load. The Source 1 Available and Source 1 Connected indicators are lit. The sequence ends with Source 2 (generator) assuming the load.

1. Source 1 fails. The control senses that Source 1 voltage and frequency are not within the specified limits with the under-voltage, over-voltage, frequency, phase rotation, or loss of phase sensors.
2. Source 1 Available indicator goes out.
3. The control initiates a TDES (time delay, engine start) that delays engine start up for Source 2.
4. If TDES expires without a return to acceptable Source 1 power, the control starts the genset. The control issues a Start signal by de-energizing relay K10. The Start A/TDES-A indicator is on steady.
5. As soon as the control senses that the generator (Source 2) output is within the specified voltage and frequency limits, it initiates a TDNE (time delay, Source 1 to Source 2 transfer) to

give the genset time to stabilize. The Source 2 Available indicator lights, and the Transfer/ TDNE indicator begins blinking.

6. When TDNE expires, the control energizes the Transfer relay which energizes relay K2. The switch starts moving toward the neutral position. Switch S5 opens interrupting current through the switch motor so that the switch stops in the neutral position. The Source 1 Connected indicator goes out.

7. The control verifies that the switch has moved to the neutral position.

8. The control initiates a TDPT (time delay, programmed transition) so that residual voltage from an inductive load can decay. The TDPT indicator starts blinking.

   If this is not a programmed transition, TDPT equals 0 seconds.

9. When TDPT expires, the control energizes the Programmed Transition relay which energizes relay K3. The TDPT indicator stops blinking. The switch starts moving toward the Source 2 position. Switch S8 opens interrupting current through the switch motor so that the switch stops in the Source 2 position. The generator assumes the load. The Source 2 Connected indicator lights.

Transfer from Source 2 to Source 1

This sequence of events includes a programmed transition and begins with Source 2 (generator) supplying power to the load. The Source 2 Connected and Source 2 Available indicators are lit. The sequence ends with Source 1 assuming the load and the generator cooling down.

1. Source 1 is restored.

2. The control senses when Source 1 output is within the specified voltage and frequency limits. The Source 1 Available indicator lights when Source 1 power is within the specified limits.

3. The control initiates a TDEN (time delay, Source 2 to Source 1) to give Source 1 time to stabilize. The Retransfer/TDEN indicator starts blinking.

4. When TDEN expires, the control energizes the Retransfer relay which energizes relay K1. The switch starts moving toward the neutral position. Switch S9 opens interrupting current through the switch motor so that the switch stops in the neutral position. The Source 2 Connected indicator goes out and the Source 2 Available indicator remains lit.

5. The control verifies that the switch has moved to the neutral position.

6. The control initiates TDPT so that residual voltage from an inductive load can decay. The TDPT indicator starts blinking.

   If this is not a programmed transition, TDPT equals 0 seconds.

7. When TDPT expires, the control energizes the Programmed Transition relay which energizes relay K3. The TDPT indicator stops blinking. The switch starts moving toward the Source 1 position. Switch S4 opens interrupting the current through the switch motor so that the switch stops in the Source 1 position. Source 1 (utility) assumes the load. The Source 1 Connected indicator lights.

8. The control initiates a TDEC (time delay, engine cool–down) so that the engine can cool down under no load conditions.

9. When TDEC expires, the control turns the engine off. The Source 2 Available indicator goes out.

TROUBLESHOOTING USING FAULT CODES

The Digital Display shows two types of events: fault events and non-fault events. The last 50 active or inactive events, both fault and non-fault events (refer to the *Events* section of the *Operator's Manual*), can be viewed with the Digital Display. You can also read all events in the event history file by using the PC Service Tool.

Fault Events

Fault events should be considered alarms for the ATS operator. They indicate that the ATS is not operating correctly. Table 5-2 lists the fault codes and fault message and Table 5-3 gives corrective actions for each fault code.

TABLE 5-2. FAULT CODES AND MESSAGES

343	Controller Checksum Error
441	Low Controller Battery
1113	ATS Fail to Close: Transfer
1114	ATS Fail to Close: Retransfer
597	Battery Charger Malfunction
477	Network Battery Low
1468	Network Communications Error

Fault Flash-Out

The control flashes an active fault code on the Digital Module Status indicator until it is acknowledged with the Reset switch on the front panel. The control flashes each digit of the fault code with a pause between digits and a longer pause between repetitions.

The control moves acknowledged events to the event history file (refer to *Events* section). This file can hold a maximum of 50 fault and non-fault events. The digital display and the PC Service Tool can read the contents of the Event history file.

The controller displays the fault message on the Digital Display with an asterisk indicator. You must press the Reset button on the control panel to acknowledge a fault and clear the display.

Faults can be viewed on transfer switches, without the digital display by observing the status LED on the digital module (see Figure 5-1).

Troubleshooting Warnings

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts with body, tools, jewelry, hair, clothes, etc. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

TABLE 5-3. TROUBLESHOOTING

⚠WARNING ***Some ATS service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of electricity and machinery hazards should perform service. See Safety Precautions.***

CONTROLLER CHECKSUM ERROR (343)

The checksum of the Flash EPROM does not match the checksum stored in the controller

Corrective Action:

1. Reset the control by removing power (including the batteries). If checksum error is repeated on power up, replace the Digital Module.

LOW CONTROLLER BATTERY (441)

Low Lithium battery voltage

Corrective Action:

1. Replace controller batteries. (See Figure 2-2.)
2. Press the Reset button on the front panel.
3. Reset real-time clock. (See Figure 4-22.)

ATS FAIL TO CLOSE: TRANSFER (1113)

A transfer between Source 1 and Neutral failed or the allotted transfer time was exceeded.

Corrective Action:

1. Press the Reset button on the front panel.
2. Refer to the fault definitions following this table.
3. Refer to Table 5-5.

ATS FAILED TO CLOSE: RETRANSFER (1114)

A transfer between Source 2 and Neutral failed or the allotted retransfer time was exceeded.

Corrective Action:

1. Press the Reset button on the front panel.
2. Refer to the fault definitions following this table.
3. Refer to Table 5-6.

BATTERY CHARGER MALFUNCTION (597)

The battery charger status signal indicates a fault condition.

Corrective Action:

1. Press the Reset button on the front panel.
2. Check the battery charger fuse(s). Replace, if necessary, with fuses of the correct rating. Fuse current ratings are shown on the charger faceplate.
3. Refer to the fault definitions following this table.

TABLE 5-3. TROUBLESHOOTING (CONTINUED)

WARNING ***Some ATS service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of electricity and machinery hazards should perform service. See Safety Precautions.***

NETWORK BATTERY LOW (477)

The Network Control Module (NCM) indicates that the network battery voltage is low.

Corrective Action:

1. Replace the Network Module batteries.
2. Press the Reset button on the front panel.

NETWORK COMMUNICATIONS ERROR (1468)

The Network Control Module (NCM) indicates that a network communications error has occurred.

Corrective Action:

1.Press the Reset button on the front panel.

FAULT EVENT DEFINITIONS

Controller Checksum Error

The controller checks the Flash EPROM checksum after each microprocessor reset. The checksum is stored in nonvolatile EEPROM. If a checksum error fault occurs, the controller still attempts a normal boot-up sequence.

The controller Fault Flash-out subsystem flashes this fault on the Status indicator until the fault is acknowledged (reset). Reset the control by removing power (including the batteries). If checksum error is repeated on power up, replace the Digital Module.

Low Controller Battery

The controller monitors the voltage of the Lithium batteries that supply power to the controller. If the battery voltage drops to 5.2 VDC, the controller sets the fault status to active.

The controller Fault Flash-out subsystem flashes this fault until the fault is acknowledged (reset).

ATS Fail to Close: Re-Transfer

The controller first verifies that the transfer switch moved from Source 2 to Neutral within the time limit defined in the Fail to Close Time Delay. The controller also verifies that the transfer switch moved from Neutral to Source 1 within the time limit defined in the Fail to Close Time Delay. The controller will automatically retry to close the switch every 30 seconds.

If the Fail to Close time limit is exceeded, the controller changes the fault status to active. The fault remains active until the Reset button is pressed.

ATS Fail to Close: Transfer

The controller first verifies that the transfer switch moved from Source 1 to Neutral within the time limit defined in the Fail to Close Time Delay. The controller also verifies that the transfer switch moved from Neutral to Source 1 within the time limit defined in the Fail to Close Time Delay. The controller will automatically retry to close the switch every 30 seconds.

If the Fail to Close time limit is exceeded, the controller changes the fault status to active. The fault remains active until the Reset button is pressed.

Battery Charger Malfunction

The controller monitors the status of the optional battery charger. If the Battery Charger Fault input is active, this event is active.

The controller Fault Flash-out subsystem flashes this fault until the fault is acknowledged (reset).

Network Battery Low

This event is detected by the optional Network Communications Module (NCM) and is communicated to the controller. If the battery voltage drops, the controller sets the fault status to active.

The controller Fault Flash-out subsystem flashes this fault on the Status indicator until the fault is acknowledged (reset).

Network Communications Error

This event is detected by the Network Communications Module (NCM) and is communicated to the transfer switch controller. This indicates that the device is no longer communicating with other devices on the network.

The controller Fault Flash-out subsystem flashes this fault until the fault is acknowledged (reset).

TROUBLESHOOTING WITH SYMPTOMS

Use the troubleshooting guide to help diagnose transfer switch problems. It is divided into sections based on the symptom. Common problems are listed with their possible causes. Refer to the corrective action column for the appropriate test or adjustment procedure. The section page number in the right column lists the location of the test or adjustment procedure in the manual.

Conditional schematics are used to highlight the circuit that is energized during the sequence of the events. These conditional schematics are for a typical transfer switch with options. Always refer to the schematic and wiring diagram package that was shipped with the transfer switch for specific information about its configuration. Be aware that relays are pulsed and the controller automatically retrys to close the switch every 30 seconds.

Make a thorough inspection of the transfer switch wiring to make sure that good wire harness and ground connections are made. Correct wiring problems before performing any test or replacing any components.

Troubleshooting Warnings

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts with body, tools, jewelry, hair, clothes, etc. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically qualified personnel.***

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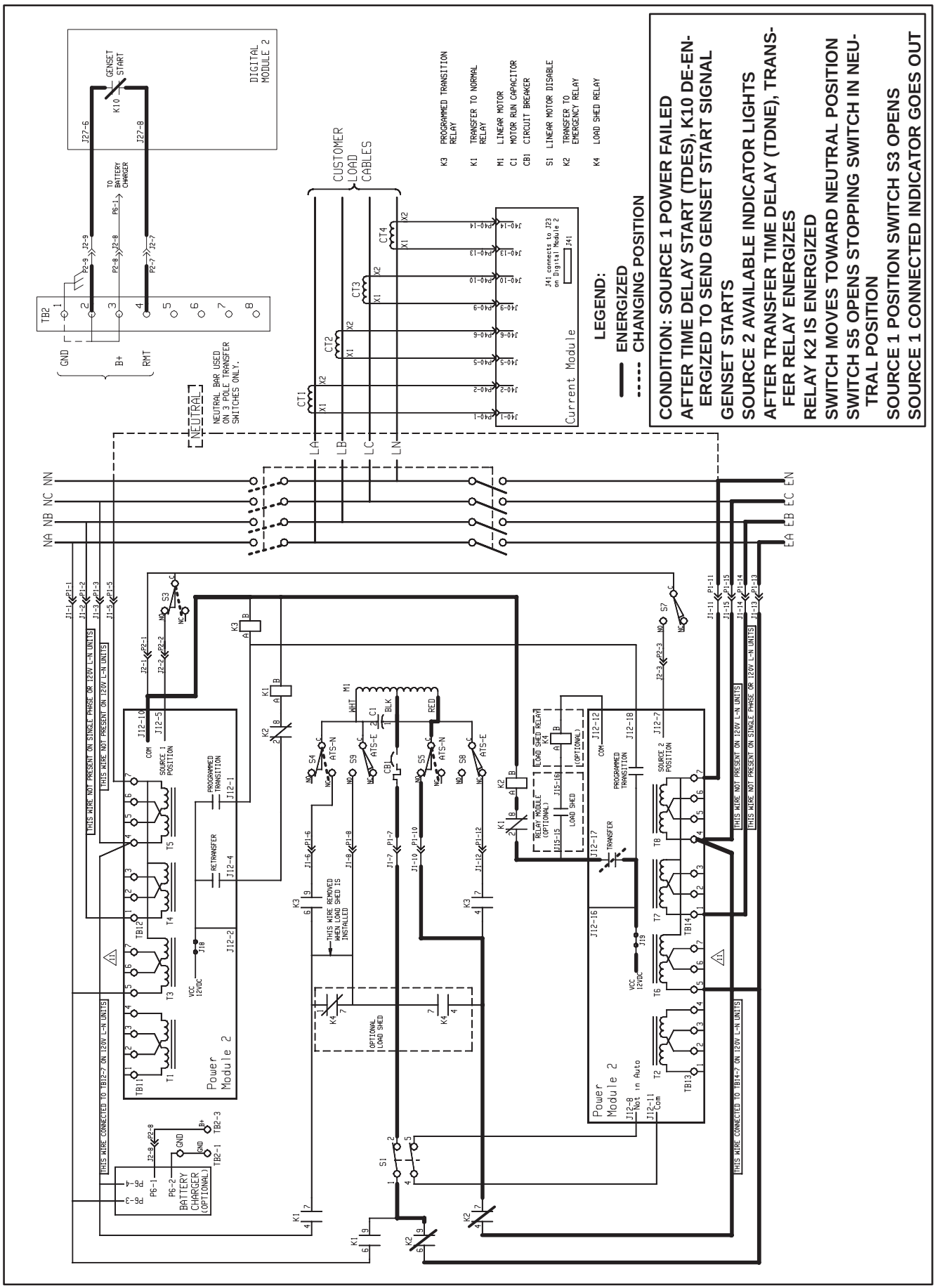

FIGURE 5-2. TYPICAL CONDITIONAL SCHEMATIC – LOSS OF SOURCE 1 POWER OCCURS, TRANSFER FROM SOURCE 1 TO NEUTRAL

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 5-4. SOURCE 1 POWER FAILS, BUT GENSET DOES NOT START

Trouble	Possible Cause	Corrective Action	Section-Page
Start/TDES mode	1. Engine Start time delay active.	1. Wait for Engine Start time delay to expire.	3-2
Start/TDES mode	1. Selector Switch on genset not in Auto position.	1. Set selector switch to Auto position	
Genset cranks but does not start.	1. Genset problem.	1. Check fuel system. Refer to genset service manual.	
Genset does not crank.	1. Wiring, Battery, or Genset problem	1a. Start genset at genset control. If it starts, check wiring of TB2 per the wiring diagram (See Wiring Diagram Section). Check the wiring between the transfer switch and the genset. If it is OK, go to next possible cause – *No genset start signal*. 1b. If it does not crank, check batteries and cable connections. 1c. If it cranks but does not start at the genset control, check fuel system and refer to genset service manual.	
Start/TDES indicator OFF	1. No genset start signal.	1. Check for start signal by labeling and removing the remote start wiring from the genset at TB2-2 and TB2-4. Attach an ohmmeter between TB2-2 and TB2-4. Press and hold the Test button for 2 seconds. After the TDES has expired, the resistance should change from infinity to 0 ohms. If the start signal is not present, and the wiring between TB2-2 and J27-6 and between TB2-4 and J27-8 is good, the Digital module is defective.	

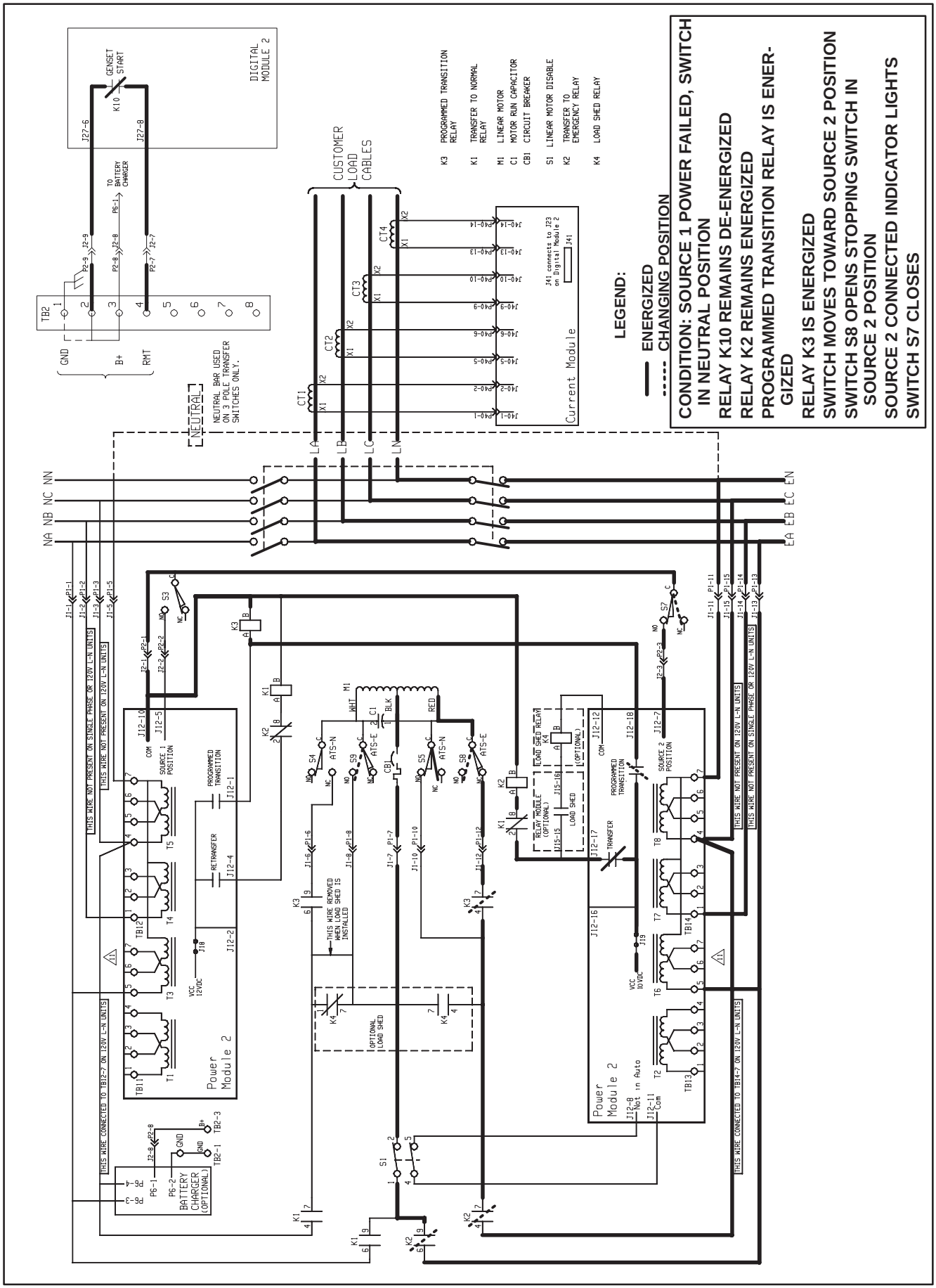

FIGURE 5-3. TYPICAL CONDITIONAL SCHEMATIC – SOURCE 2 AVAILABLE – TRANSFER FROM NEUTRAL TO SOURCE 2

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 5-5. GENERATOR SET STARTS, BUT DOES NOT ASSUME LOAD

Trouble	Possible Cause	Corrective Action	Section-Page
Not in Auto indicator is ON*.	1a. Motor Disconnect switch S1 OFF.	1a. Move Motor Disconnect switch to AUTO.	
		1b. J12 disconnected or defective wiring.	
	2. Transfer Inhibit input active.	2. Remove Transfer Inhibit signal.	
	3. Load Shed input active.	3. Remove Load Shed signal.	
Source 2 Available indicator is OFF.	1. Bad connection at P1.	1. Check P1 connection.	
	2. Genset output voltage not acceptable or Source 2 voltage settings wrong.	2a. Measure genset output voltage.	
		2b. Verify voltage settings in control with digital display or service tool.	
		2c. Improper phase rotation (Level 2 only).	
	3. Defective Power module.	3a. Verify Source 2 voltage input to Power module.	6-3, 6-4
		3b. Verify Power module transformer output.	6-3, 6-4
	4. Defective Digital module.	4. Replace Digital module.	6-5
	5. Voltage Imbalance Failure	5. Check voltage imbalance settings.	
Source 2 Available indicator is ON, TDNE indicator blinking.	1. Transfer time delay active.	1. Wait for Transfer time delay to expire.	
Source 2 Available and TDNE indicators ON, Switch remains in Source 1 position. (Fault 1113)	1. No Transfer signal.	1a. Check Transfer Relay: 10 VDC at J12-17 indicates active Transfer signal.	
		1b. Check relay K2, K2 should be momentarily energized.	
		1c. Check cable between Digital Module and Power Module.	
		1d. Check Digital Module Source 2 voltage input to Power Module and Power Module transformer voltage output.	6-3
Source 2 Available and TDNE indicators ON, Switch in neutral position (Fault 1113)	1. No Programmed Transition signal.	1a. Check Programmed Transition Relay: J12-18 indicates an active Programmed Transition signal.	
		1b. Check relay K3, K3 should be momentarily energized.	
		1c. Check cable between Digital Module and Power Module.	
		1d. Check Digital Module and switch	

*** With motor disconnect switch OFF, Digital Module will send Genset Start signal after 20 second delay.**

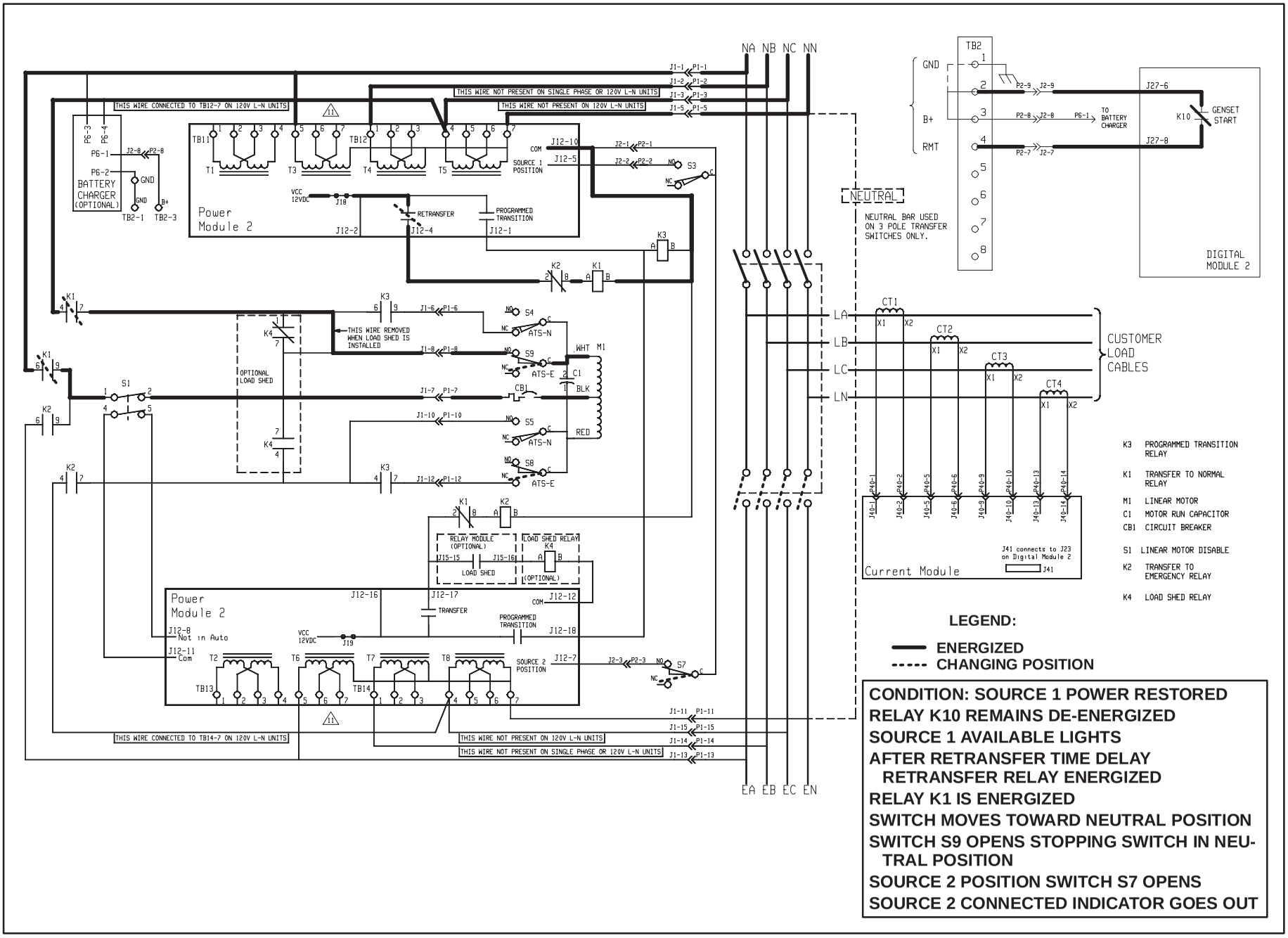

FIGURE 5-4. TYPICAL CONDITIONAL SCHEMATIC – SOURCE 1 RETURNS – RETRANSFER FROM SOURCE 2 TO NEUTRAL

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 5-6. TRANSFER SWITCH DOES NOT RETRANSFER WHEN SOURCE 1 POWER IS RESTORED AFTER A POWER FAILURE OR ON INITIAL INSTALLATION

Trouble	Possible Cause	Corrective Action	Section-Page
Not in Auto indicator is ON.	1. Motor Disconnect switch OFF. 2. Retransfer Inhibit input active.	1a. Move Motor Disconnect switch to AUTO. 1b. J12 disconnected or defective wiring. 2. Remove Retransfer Inhibit signal	
Source 1 Available indicator ON, TDEN indicator blinking	1. Time delay to retransfer (TDEN) has not expired.	1. Wait for TDEN to expire.	
Source 1 Available and TDEN indicators ON, switch remains in Source 2 position (FAULT 1114)	1. No Retransfer signal. 2. Switch problem	1a. Check Retransfer relay: 10 VDC at J12-4 indicates an active retransfer signal. 1b. Check Relay K1, K1 should be momentarily energized. 1c. Check cable between Digital Module and Power Module. 1d. Check Digital Module and switch. 1e. Wait for five seconds to one minute to make sure the motor saver timer is not activated. 2. Check switch and switch wiring	
Source 1 Available and TDEN indicators ON, switch in neutral position (Fault 1114)	1. No Programmed Transition signal.	1a. Check Programmed Transition relay: 10 VDC at J12-1 indicates an active programmed transition signal. 1b. Check Relay K3, K3 should be momentarily energized. 1c. Check cable between Digital Module and Power Module. 1d. Check Digital Module and switch. 1e. Wait for five seconds to one minute to make sure the motor saver timer is not activated.	
Source 1 Available indicator OFF	1. Source 1 voltage not within specified limits. 2. Bad connection at connector P1. 3. Source 1 voltage settings wrong. 4. Defective Digital Module or Power Module.	1. Measure Source 1 voltage. 2. Check for continuity through P1. 3. Verify voltage settings with digital display or service tool 4. Replace Digital Module or Power Module.	
Source 1 Available indicator ON, Test/Exercise Active indicator lit	1. Test or Exercise with load active.	1. Wait for Test or Exercise to complete or press Test again to end test.	

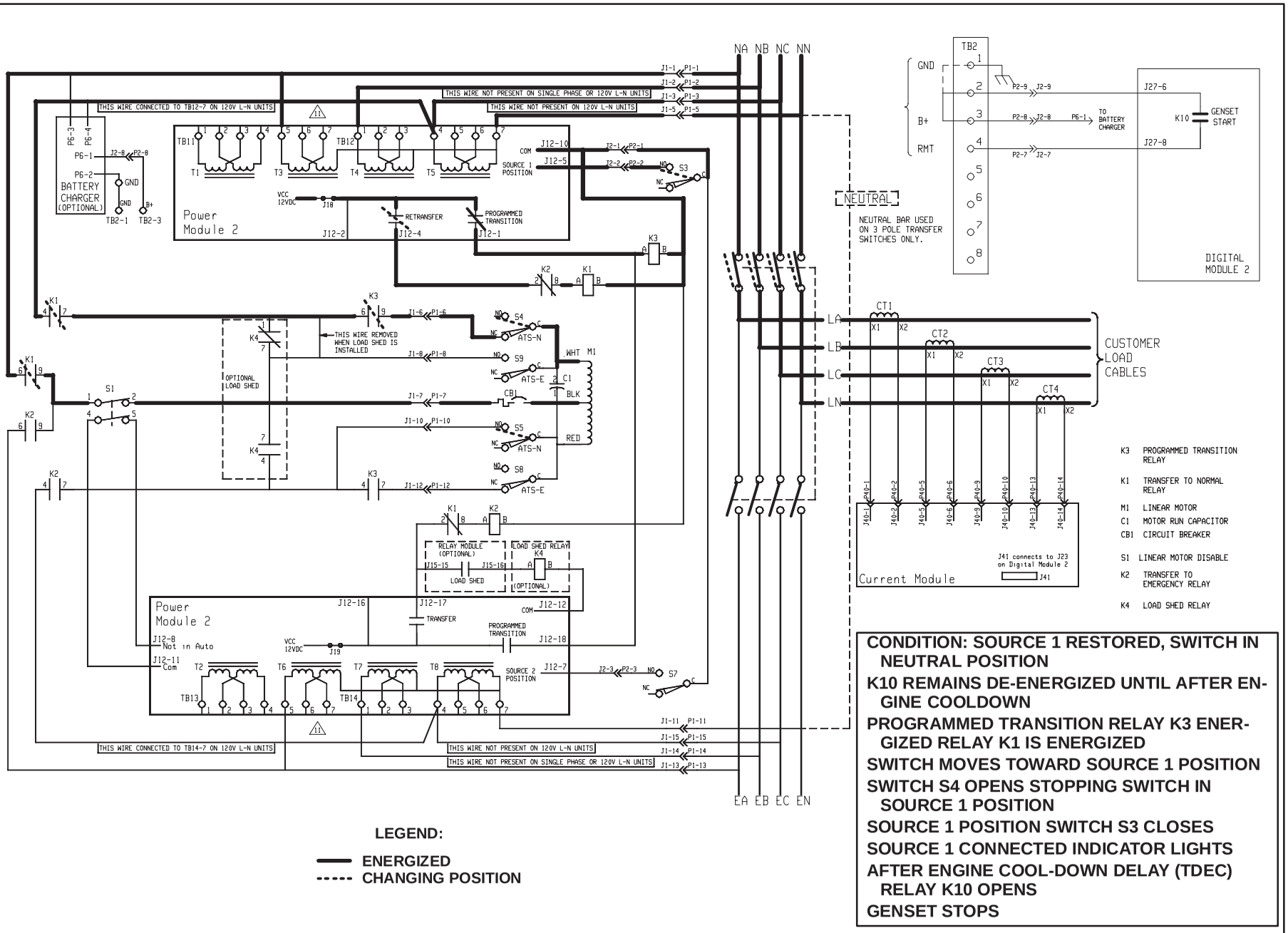

FIGURE 5-5. TYPICAL CONDITIONAL SCHEMATIC – SOURCE 1 AVAILABLE – TRANSFER FROM NEUTRAL TO SOURCE 1

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 5-7. GENERATOR SET CONTINUES TO RUN AFTER RETRANSFER OF LOAD TO SOURCE 1

Trouble	Possible Cause	Corrective Action	Section-Page
Source 2 Available indicator ON.	1. Time Delay Engine Cool-down (TDEC) still active.	1. Wait for TDEC to expire.	
Test/Exercise Indicator ON.	1. Exercise program active. 2. Test in progress.	1. Check Exercise setup. 2. Check Test switch and Test switch circuit.	
TDES-A/Start A Indicator ON	1. RMT signal still active. 2. No network start signal.	1. Measure voltage between TB2-2 and TB2-4. Zero VDC indicates an active RMT signal that holds the genset ON. 2. Restart the network.	

TABLE 5-8. GENERATOR SET STARTS DURING NORMAL POWER SERVICE

Trouble	Possible Cause	Corrective Action	Section-Page
Genset starts during normal power service.	1. Selector switch on genset not set on Remote.	1. Set selector switch to Remote.	
	2. Exercise period set on exerciser clock.	2. Refer to exerciser clock programming instructions.	
	3. Remote test customer input.	3. Check for remote test input at J4-5.	
	4. Test switch defective on front panel.	4. Remove ribbon cable, if genset stops test switch is defective.	6-1
	5. Momentary voltage dip from normal source.	5. Check undervoltage settings, adjust if needed.	
	6. Power Module no longer sensing Source 1 voltage.	6a. Verify Source 1 voltage input to Power Module.	6-3, 6-4
		6b. Verify Power Module transformer output.	6-3, 6-4
		6c. Check the Event History Log to find out if the number of Source 1 failures (such as over/under voltage, momentary spike that caused the over/under voltage timer to time out, phase rotation, or phase imbalance) is intermittent on the Power Module.	
	7. Network input for remote start.	7. Remove network remote start input.	
	8. Voltage imbalance failure.	8. Check voltage imbalance settings.	
	9. Test input active from PC Service tool.	9. Cycle power on control or remove test input with PC Service tool.	

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TABLE 5-9. GENERATOR SET DOES NOT EXERCISE OR EXERCISES BUT DOES NOT TRANSFER LOAD

Trouble	Possible Cause	Corrective Action	Section-Page
Genset does not exercise.	1. Motor disconnect switch not in Auto.	1. Set motor disconnect switch to Auto.	
	2. Selector switch on genset not set on Remote.	2. Set selector switch to Remote.	
	3. Exerciser program not enabled.	3. Check control LED (Figure 4-1). Use Digital Display if equipped or PC Service tool to program. **NOTE:** Some software versions include an exercise feature enable/disable function. This function must be enabled before any individual exercise periods can be enabled.	
	4. Exercise period not programmed.	4. Refer to exerciser clock programming instructions.	
	5. Exception program set to prevent exercise.	5a. Check exerciser exception program settings either with the digital display or the PC Service tool. 5b. If desired, cancel all exercise exceptions either with the digital display or the PC Service tool.	
	6. Genset cranks but does not start.	6. Genset fuel system or other genset problem, refer to genset service manual.	
	7. No start signal from transfer switch when exercise clock is in program mode or remote start signal present.	7. Check for start signal by labeling and removing the remote start wiring from the genset at TB2-2 and TB2-4. Attach an ohmmeter between TB2-2 and TB2-4. Press and hold the Test button for 2 seconds. After the TDES has expired, the resistance should change from infinity to 0 ohms. If the start signal is not present, and the wiring between TB2-2 and J27-6 and between TB2-4 and J27-8 is good, the Digital module is defective.	
Genset exercises at wrong time.	1. Real-time clock not set.	1. Check or change program with Digital Display if equipped or the PC Service tool. Check to see if more than one exercise is scheduled at the same time.	
Genset exercises but does not assume load.	1. Control programmed to exercise without load.	1. Check or change program with Digital Display if equipped or PC Service tool.	
	2. Transfer Inhibit active.	2. Remove Transfer Inhibit signal.	

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TABLE 5-10. TRANSFER SWITCHES WITH DIGITAL DISPLAY

Trouble	Possible Cause	Corrective Action	Section-Page
Front panel display not working.	1. Feature not enabled.	1. Enable this feature using the PC Service tool.	
	2. In sleep mode.	2a. Press any button to wake up display. If display does not wake up, check status light (Figure 4-1). If status light flashing, check touch panel. 2b. Defective connector between Digital Module and Digital Display.	6-1
	3. Status light on continuous/status light not blinking (Digital Display locked up).	3a. Reset control by removing J1 connector and batteries from Digital Module. Reinstall batteries and reconnect J1. Reprogram real-time clock.	
	4. Status light off (no power to Digital Module).	4a. No power to Digital Module. Remove J12 from Power Module (to eliminate short that could load down the Power Module). Check for 10 VDC at J18 or J19 (measure between J18 & J12-13 or J19 & J12-13). If 10 VDC is present – defective Digital Module. If 10 VDC is not present – defective Power Module. 4b. Make sure line voltage is present.	6-3

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components. The following procedures are to be performed only by technically trained and experienced personnel.***

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TABLE 5-11. TRANSFER SWITCHES WITH BAR GRAPH

Trouble	Possible Cause	Corrective Action	Section-Page
Bar Graph – no display	1. Feature not enabled.	1. Requires PC Service tool. The feature must be enabled and saved using InPower. Then the control must be repowered. Check ribbon cable connector.	
Bar Graph display inaccurate.	1. CTs mis-wired, CTs reversed, open wire on CTs.	1a. Check CT wiring installation and correctly wire CTs. 1b. Make sure the shorting bar on the CT terminal block is properly installed.	6-45
	2. Requires calibration.	2. For minor adjustment use the PC Service tool.	
The bar graph will not illuminate when the transfer switch is in the neutral position; only the bottom frequency LED will be lit.			

TABLE 5-12. TRANSFER SWITCHES WITH KEY SWITCH

Trouble	Possible Cause	Corrective Action	Section-Page
Unable to activate Front Panel input switches (Test and Override)	1. Key switch in Panel Lock position. 2. Key switch defective or mis-wired.	1. Turn key to Program position. 2. Check key switch wiring per Installation drawing and key switch contacts for proper operation.	
Unable to change setup parameters. (Parameters can only be read).	1. Key switch in Panel Lock position. 2. Key switch defective or mis-wired.	1. Turn key to Program position. 2. Check key switch wiring per Installation drawing and key switch contacts for proper operation.	

6. Transfer Switch Service

GENERAL

This section provides test procedures for the control panel membrane switches and Power Module and also covers the removal and replacement procedures for the transfer switch assembly.

MEMBRANE SWITCH TEST

All control panels include three membrane switches. Control panels with the digital display include nine membrane switches. This procedure checks the resistance of each membrane switch from a cable connector on the membrane panel.

1. Remove the connector from J25 on the Digital Module circuit board. See Figure 6-1.
2. Press the switch down and measure the resistance between the switch common (pin 10) and each switch. Measure the resistance on the solder points on the connector. The resistance of a closed membrane switch should be in the range of 0 to 200 ohms depending on how hard you press. Figure 6-2 shows membrane switch configuration and Table 6-1 lists the pin connections corresponding to the membrane switches.
3. Attach the connector to J25.
4. Close and lock the enclosure door.

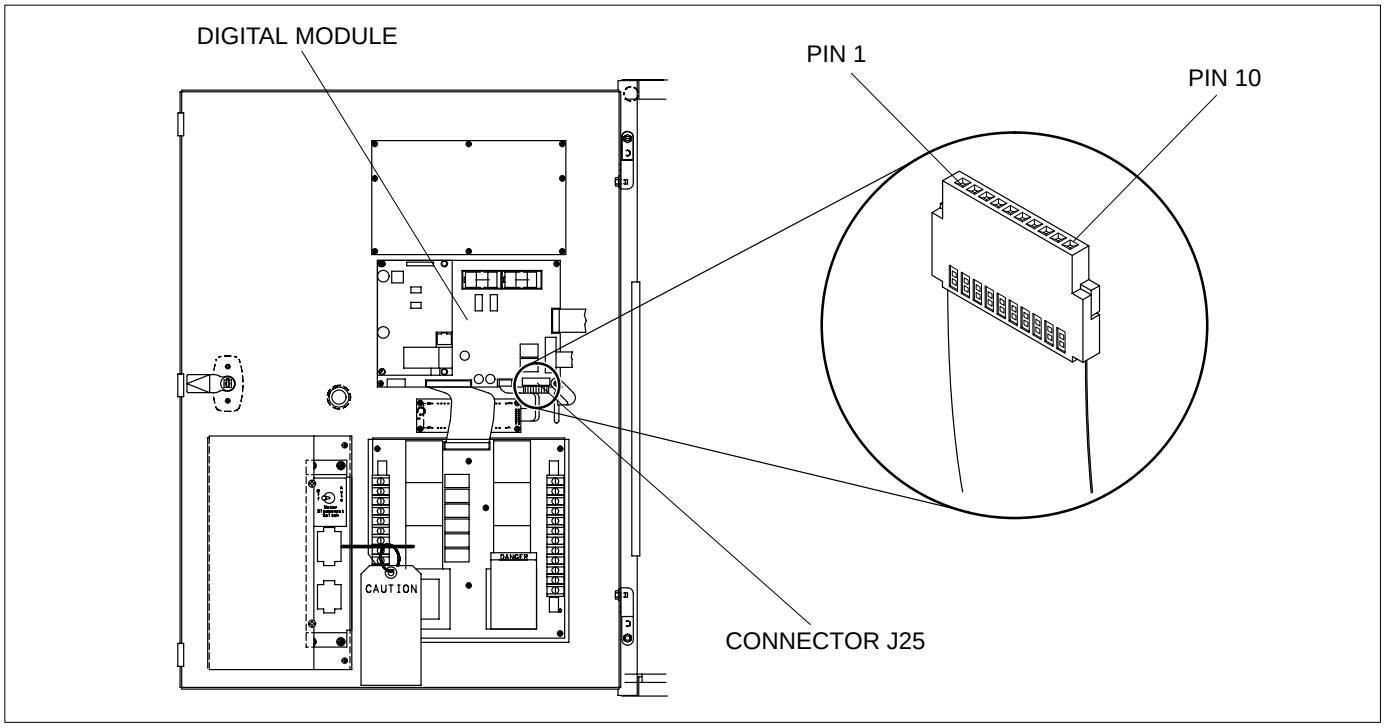


FIGURE 6-1. LOCATION OF CONNECTOR J25

TABLE 6-1. MEMBRANE SWITCH PINS

PIN	SWITCH	SWITCH NAME
1	S1	TEST
2	S2	OVERRIDE
3	S3	RESET/LAMP TEST
4	S4	PREVIOUS MENU
5	S5	HOME
6	S6	▲
7	S7	▼
8	S8	▶
9	S9	◀
10		COMMON

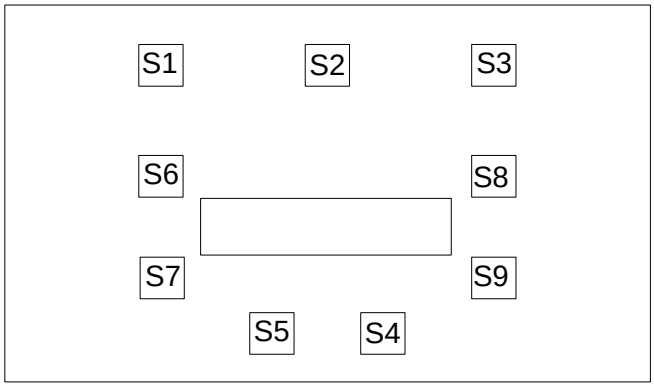


FIGURE 6-2. SWITCH LOCATIONS (AS YOU FACE THE CONTROL PANEL)

POWER MODULE TEST

When a Power Module failure occurs, the most common part to fail is the transformer. Use the following information to determine if a Power Module transformer(s) is causing the error condition.

Power Module 1

Table 6-2 provides the test points and voltage level that should be found at each test point for a good board. Refer to page 7-21 for Power Module 1 wiring diagram.

A wiring break-out tool (34 pin) is required to measure J11 test points. This tool is contained in the Cummins PCC Tool Kit, P/N 3824746.

TABLE 6-2. POWER MODULE 1 (300-5148)

INPUT	OUTPUT	TERMINAL**
Source 1	NA 3 VDC	J11 – 1
	NB 3 VDC	J11 – 3
	NC 3 VDC	J11 – 5
	10 VDC*	J18, J19
Source 2	EA/EC 3 VDC	J11 – 7
	10 VDC*	J18, J19
CR3, CR4, CR5	20-30 VDC	J11 – 29

*** Use only one source when checking for regulated DC.**

**** Use J12-13 for DC ground.**

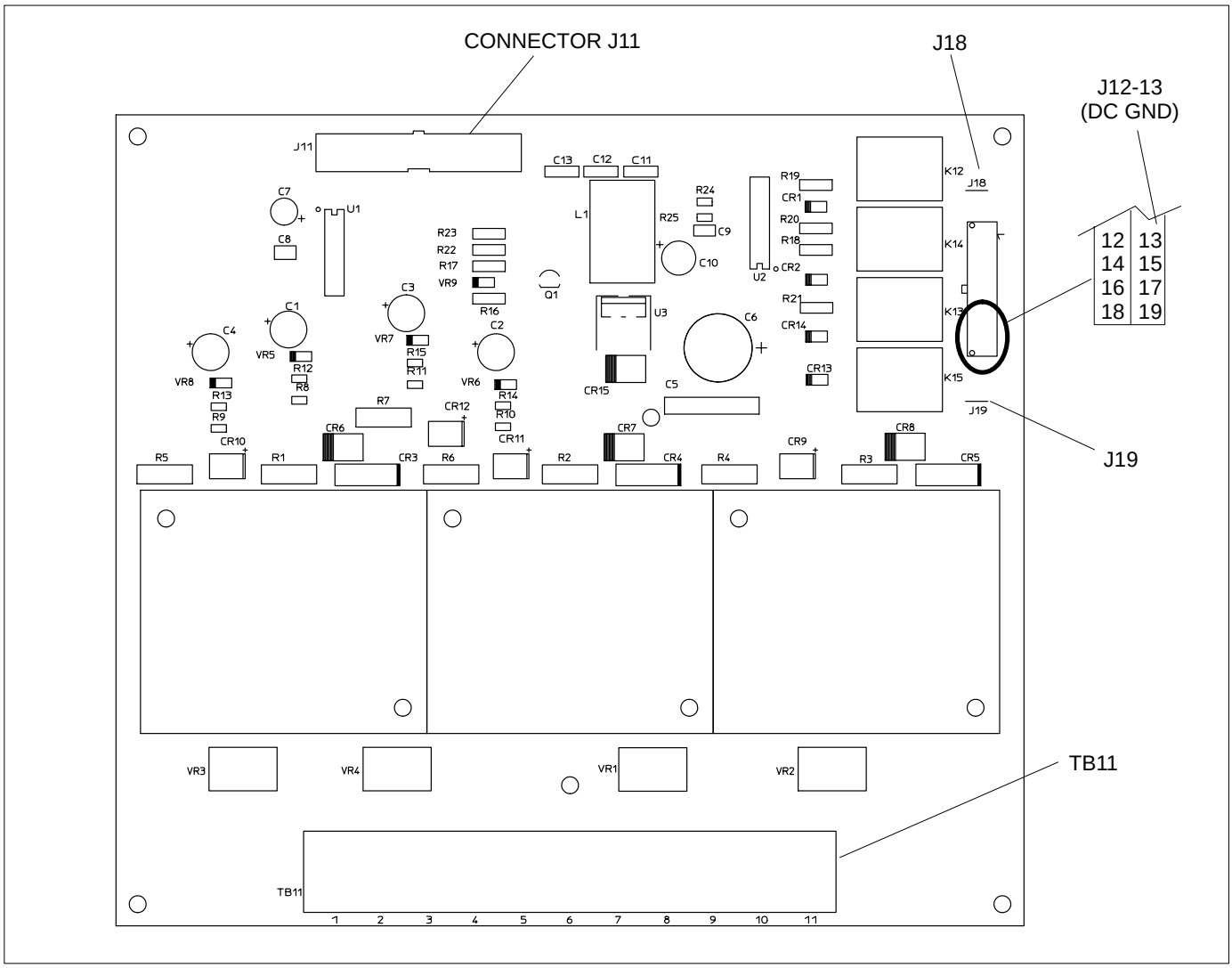


FIGURE 6-3. POWER MODULE 1 PCB COMPONENT LOCATIONS

Power Module 2

Table 6-3 provides the test points and voltage level that should be found at each test point for a good board. Refer to page 6-26 for Power Module 2 wiring diagram and test point locations.

A wiring break-out tool (34 pin) is required to measure J11 test points. This tool is contained in the Cummins PCC Tool Kit, P/N 3824746.

TABLE 6-3. POWER MODULE 2 (300-5149)

INPUT	OUTPUT	TERMINAL**
Source 1	NA 18 VAC	J11 – 1 & 2
	NB 18 VAC	J11 – 3 & 4
	NC 18 VAC	J11 – 5 & 6
	10 VDC*	J18, J19
Source 2	EA 18 VAC	J11 – 7 & 8
	EB 18 VAC	J11 – 9 & 10
	EC 18 VAC	J11 – 11 & 12
	10 VDC*	J18, J19
CR1, CR4	20-30 VDC	J11 – 29

*** Use only one source when checking for regulated DC.**

**** Use J12-13 for DC ground.**

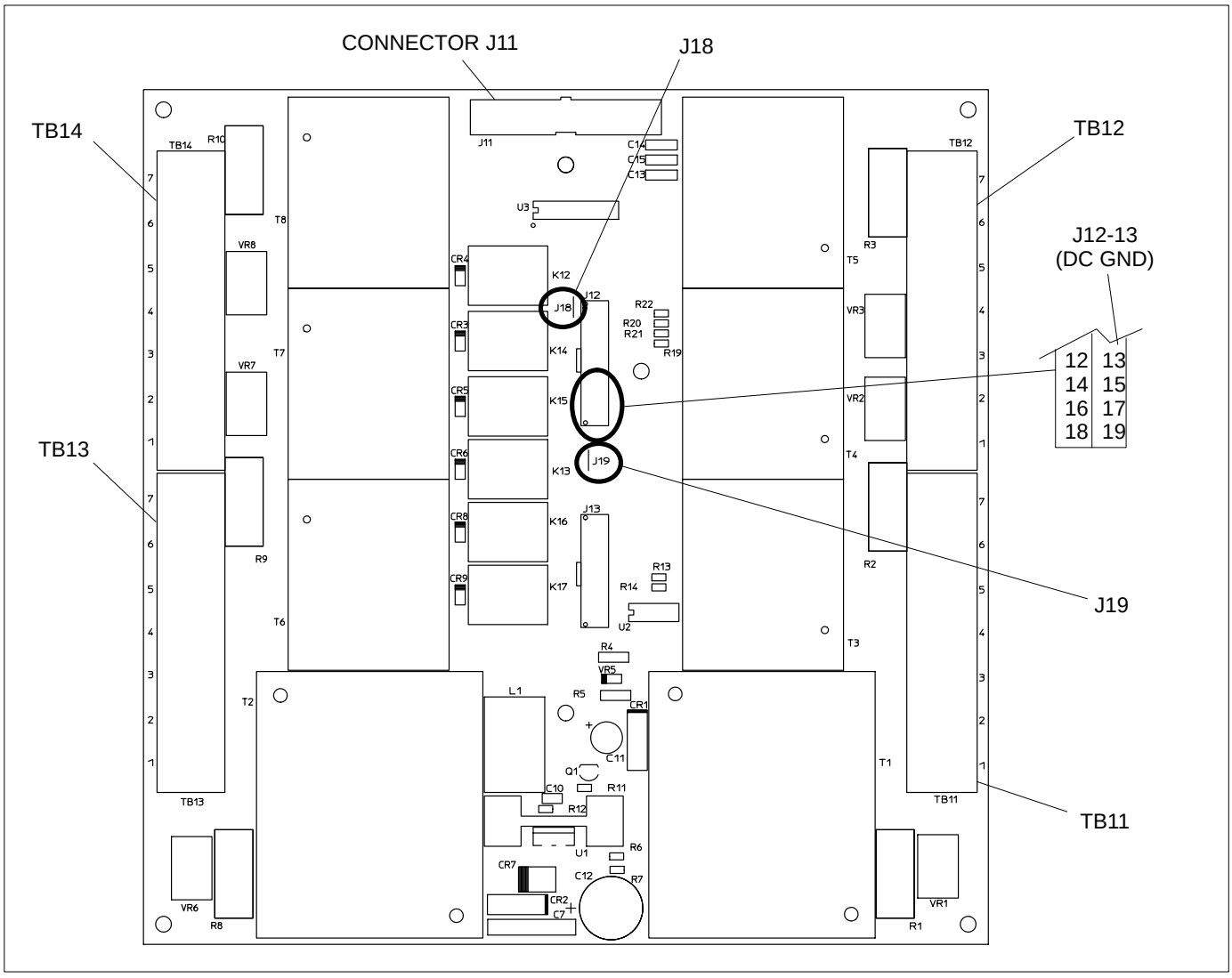


FIGURE 6-4. POWER MODULE 1 PCB COMPONENT LOCATIONS

DIGITAL BOARD REPLACEMENT

This procedure describes the replacement of 300–5146 and 300–5147–01, 02, and 03 digital boards on automatic transfer switches.

Digital Board	ATS Description
300–5146	Level 1 Control
300–5147–01	Level 2 Control with Open Transition
300–5147–02	Level 2 Control with Momentary Closed Transition
300–5147–03	Level 2 Control with Extended Paralleling

The InPower™ service tool is required to set up the replacement digital board. The setup can be automated with a capture file. If a good capture file is not available, individual parameters need to be set up for the application.

⚠WARNING ***AC power within the cabinet and the inside of the cabinet door presents a shock hazards that can result in severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Remove power to the door by disconnecting connector J1/P1 before working on the electronic control system. All service and adjustments to the transfer switch must be performed by trained and experienced personnel only.***

1. Place the motor disconnect switch in the “Off” position.
2. Disconnect connector P1.
3. Remove the old digital board and install the new one.
4. Connect connector P1.

Initial Calibration

Use InPower to perform an initial calibration on the replacement digital board. Select the calibration settings and features to match the transfer switch nameplate values.

For the changes to take effect, remove all power from the digital board, including the batteries. This will update the “Restore Factory Settings” to the values written to the digital board during the initial calibration.

Setup with a Capture File

If you have a capture file from the original board when it was working properly, use InPower™ to write the capture file to the replacement board. All your settings should be updated automatically on the new board. Review all the settings before placing the motor disconnect switch in the “On” position.

NOTE: The use of a capture file updates the “Real Time Clock” with settings from the old data. After writing the capture file, update each of the Real Time Clock settings.

Setup Without a Capture File

Use InPower to set up the parameters listed in Table 6-4.

After the Setup is Completed

After the board setup is complete, place the motor disconnect switch back in the “On” position.

InPower is a trademark of Cummins Inc.
LonWorks is a registered trademark of Echelon Corp.

TABLE 6-4. SETUP PARAMETERS (SHEET 1 OF 2)

Adjustments Folder:

Controller Mode Folder:

Configuration Menu:

Default: Offline
This setting must to be changed to one of the following for proper operation.
(The control will not function if left offline)
Utility to Generator: (Level 1 and Level 2 boards)
Utility to Utility: (Level 2 boards only)
Generator to Generator: (Level 2 boards only)

Switch Mechanism Type Menu:

Zenith:	Default setting
	Ok if used on a Zenith switch OTPC / BTPC (1200 Amp through 3000 Amp)
Onan OT3:	*Use this setting for all OTPC / BTPC switches between 40 and 1000 amps.*
PLTH-S:	PLTH, PLTS, PLTO
Onan New:	OHPC and CHPC

Select the "Save Adjustments" icon to save your changes.

Current Adjustment Folder:

Nominal Current: Default: 125 amps
Must be set to nameplate rating.

Feature Enable Folder:

Refer to nameplate for system features.

Alphanumeric Display	Default: Enabled (Always enabled)
Bargraph Meter (Level 2 control only)	Default: Disabled (Feature Code D009)
Load Shed	Default: Disabled (Feature Code M007)
Lonworks Communications	Default: Disabled (Feature Code M020)
Exerciser Enable	Default: Disabled (must be enabled to use the exercise function)

Select the "Save Adjustments" icon to save your changes.

Nominal Current Folder:

Must be set to nameplate rating Default: 125 Amps

Select the "Save Adjustments" icon to save your changes.

Nominal Frequency Folder:

Must be set to nameplate rating Default: 60 Hertz

Select the "Save Adjustments" icon to save your changes.

Nominal Voltage Folder:

Must be set to nameplate rating Default: 120 Volts AC

Note:
On a Level 2 board this is the line-to-neutral voltage of the system voltage.
On a Level 1 board this is the line-to-line voltage of the system voltage.
240V Delta configurations must be set to 139 Volts AC.

Select the "Save Adjustments" icon to save your changes.

TABLE 6-4. SETUP PARAMETERS (SHEET 2 OF 2)

Adjustments Folder (continued):	
Source 1 and Source 2 Sensing Folders:	
Source 1 or Source 2 sensing	Default: 3 Phase (see the Caution on the following page)
Source 1 or 2 over voltage sensing	Default: Enabled
Source 1 or 2 frequency sensing	Default: Enabled
Source 1 or 2 voltage imbalance sensing	Default: Disabled (See Note)
Source 1 or 2 loss of phase sensing	Default: Disabled (See Note)
Phase rotation sensing	Default: Enabled (See Note)
Note: Before changing this setting, review the feature description on the following page.	
Select the "Save Adjustments" icon to save your changes.	
Voltage Adjustment Folder:	
Connection type	Default: Wye (Must be set to match application)
Select the "Save Adjustments" icon to save your changes.	
Calendar / Clock Settings:	
Real Time Clock Folder:	
Must be set Select month, day of month, year, hour (24 hour format), minute Enable or disable daylight savings time Date format (North American or International)	
Select the "Save Adjustments" icon to save your changes.	
Exerciser Clock – To be set only if an exercise is desired:	
Feature Enable Folder:	
Exerciser enable	
Exerciser Clock Folder:	
Enable Program 1 Set exercise start day of week Set exercise start time (24-hour format) Set exercise duration (HR:MN format) Enter repeat interval of exercise Example: 0 = exercise once, 1 = weekly, 2 = every two weeks, 52 = once every 52 weeks Exercise with / without load	
Select the "Save Adjustments" icon to save your changes.	
Note: The Reset Exerciser Repeat Count feature, in the Controller Mode folder, can be used to change a repeat interval. Switch the setting from "False" to "True" for the new interval to take effect. The setting will automatically switch back to "False" again.	
Test Folder:	
Setup Folder:	
Test: With / Without Load	Default: Without Load
Select the "Save Adjustments" icon to save your changes.	

SWITCH ASSEMBLY REMOVAL/REPLACEMENT PROCEDURE

There are four separate switch assemblies. Each assembly corresponds to a particular current range. The four current range groups are: 40-70-100-125 amperes, 150-225-250-260 amperes, 300-400-600 amperes, and 800-1000 amperes.

For servicing purposes, each transfer switch assembly can be separated into the following components:

- **Linear Actuator**
- **Block and Crossbar Assembly**
- **Auxiliary Switches**

A separate section covers the removal and replacement procedures for each major component within a particular range.

DISCONNECT AC POWER

Before beginning any service procedure:

- If a generator set provides Source 2 (Emergency) power, turn the operation selector switch to Stop. (The selector switch is located on the generator set control panel.)
- **Disconnect all sources of AC power from the transfer switch.**
- If there is an external battery charger, disconnect it from its AC power source. Then disconnect the set starting battery negative [–] cable.

⚠WARNING ***The transfer switch presents a shock hazard that can cause severe personal injury or death unless all AC power is removed. Disconnect all sources of AC power to the transfer switch before servicing. Be sure to set the generator set operation selector switch to Stop, disconnect the battery charger from its AC power source, and disconnect the starting battery negative [–] cable.***

RECONNECTING AC POWER (WHEN FINISHED)

After all service procedures are completed:

- If Source 2 (Emergency) is a generator, connect the negative (–) battery cable to the starting battery. If applicable, connect the battery charger to its AC power source.
- Reconnect Source 1 (Normal) Source 2 (Emergency).
- Set the operation selector switch on the genset to in the Remote position.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.***

LINEAR ACTUATOR REMOVAL AND REPLACEMENT (40 TO 125 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the linear actuator for 40- to 125-ampere switches.

Removing Actuator

1. Open the transfer switch cabinet door.

2. Loosen and remove the four machine screws (with flat washers) that secure the plastic switch cover to the switch base, and lift it off.

3. Separate the actuator lead wires from the rest of the wiring harness. Remove wire ties as required.

4. Pry the capacitor(s) loose from the bracket. Remove the end cap and disconnect the red and white actuator leads from the capacitor and the black lead from circuit breaker. Note the lead connections to the capacitor terminals.

5. Remove the socket head capscrews and lock washers that secure the actuator to the block assemblies (Figure 6-6). Note the ground wire connection to the lower left capscrew.

6. Disengage the actuator rod from the switch handle and remove the actuator from the block assembly.

7. Remove one of the hex head capscrews and lock washers that secure the rod end assembly to the actuator rod.

8. Remove the rod end assembly from the actuator rod (Figure 6-5) and slide the rod out of the actuator.

Replacing Actuator

1. Insert the actuator rod into the replacement actuator motor from the side opposite the ground brush (Figure 6-5). Install the rod end assembly and tighten the capscrew to 70-75 in-lbs (7.9-8.5 N•m).

2. Position the actuator motor on the block assemblies so the load wires are at the bottom, and fit the rod assembly into the handle of the closed switch assembly.

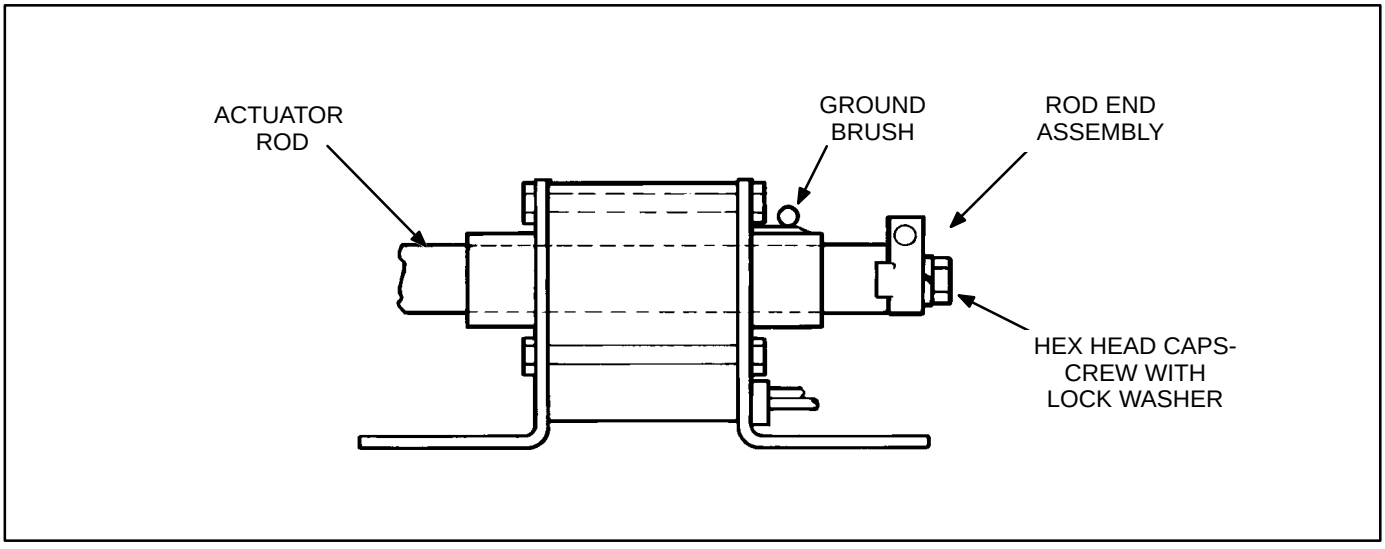
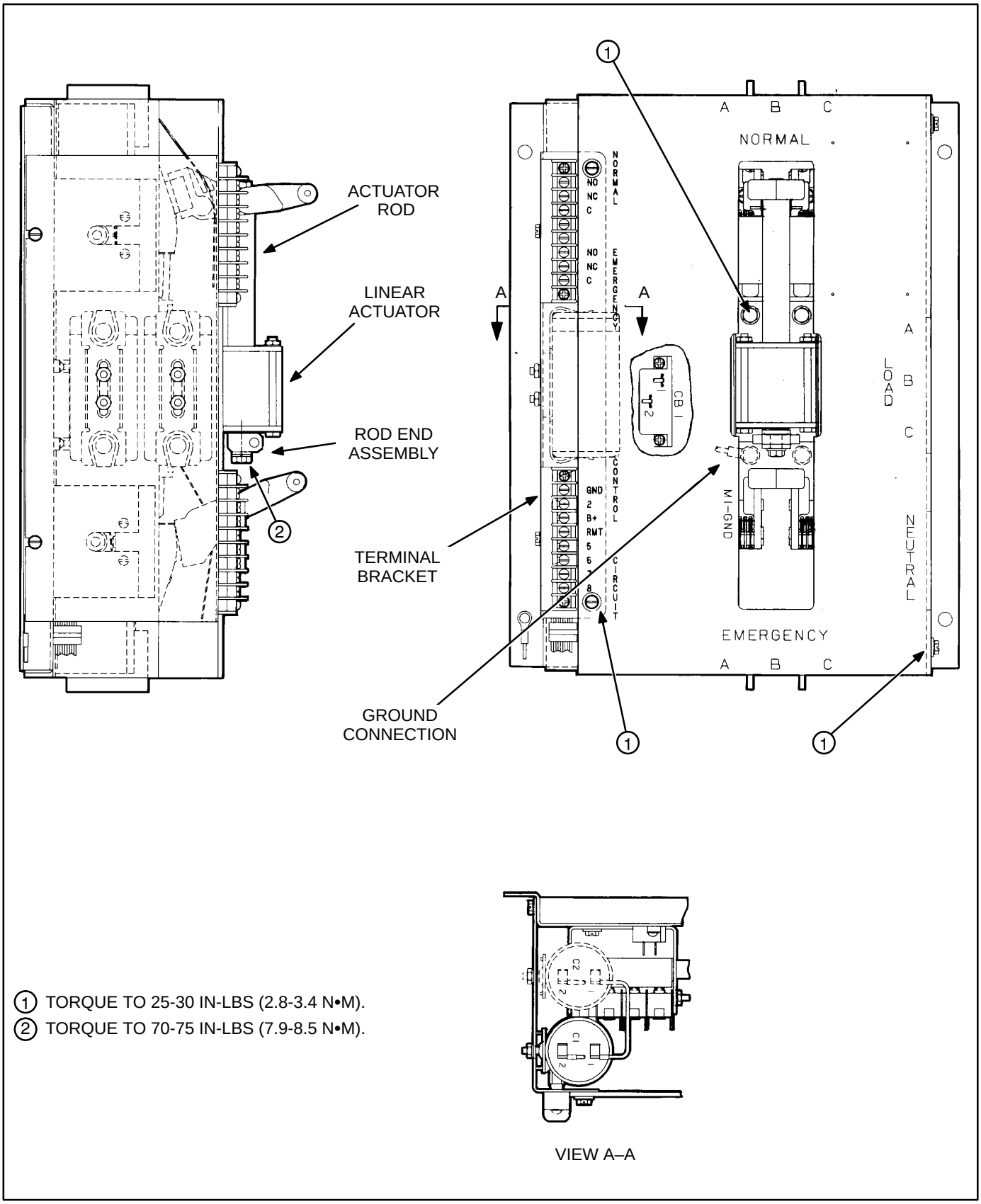


FIGURE 6-5. LINEAR ACTUATOR (40 TO 125 AMPERES)



① TORQUE TO 25-30 IN-LBS (2.8-3.4 N•M).
② TORQUE TO 70-75 IN-LBS (7.9-8.5 N•M).

FIGURE 6-6. TRANSFER SWITCH COVER (40 TO125 AMPERES)

3. Secure the actuator motor to the block assemblies using socket head capscrews (4) and lock washers (4). Be sure to reconnect the ground wire to the lower left screw (Figure 6-6). Tighten capscrews to 25-30 in-lbs (2.8-3.4 N•m).

   ⚠CAUTION ***Do not overtighten screws or the switch can be damaged.***

4. Connect the black actuator lead wire to the circuit breaker, and connect the red and white actuator lead wires to the following capacitor terminals:

   Red Lead Wire - Connect to capacitor C1, Terminal 1.

   White Lead Wire - If one capacitor, connect to capacitor C1, Terminal 2. If two capacitors, connect to capacitor C2, Terminal 2.

   Transfer switches for voltage ranges 347, 380/416, 440/480 and 480 use two capacitors (C1 and C2) wired together in series. A single jumper wire is placed between terminal 2 on C1 and Terminal 1 on C2.

5. Replace the capacitor end cap(s) and install the capacitor(s) in the bracket(s). Use wire ties to hold actuator lead wires in place.

6. Check transfer switch operation and alignment of the actuator rod by manually opening and closing both the Source 1 (Normal) and Source 2 (Emergency) switch assemblies.

7. Place the plastic switch cover in position and secure with machine screws (4) and flat washers (4). Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

8. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

9. Test the switch for proper operation and close the cabinet.

BLOCK AND CROSS-BAR ASSEMBLY REMOVAL AND REPLACEMENT (40 TO 125 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the block and crossbar assemblies for 40- to 125-ampere switches.

Removing the Block and Cross-Bar Assembly (Normal or Emergency)

1. Remove the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 40 to 125 ampere switches. Follow steps 1-6 in the Removing Actuator section.

2. Remove the round head machine screws and flat washers that secure the interlock bar to the interlock arms (see Figure 6-7) and remove the interlock bar.

3. Disconnect the control wiring leads from the jumper bus bars.

4. Remove the hex head machine screws, ring terminals, flat washers, lock washers, and nuts that secure the jumper bus bars (see Figure 6-7) to the load bus bars.

5. Remove the hex head machine screws and spring washers that secure the jumper bus bars to the block assemblies, and lift off the jumper bus bars.

6. Remove the control wiring leads from the power source terminals (Figure 6-8).

7. Loosen the lug terminal screws and remove the power source supply wires from the lug terminals.

8. Remove the two round head machine screws, lock washers, and flat washers that secure the

block assembly to the base; and carefully remove the assembly.

⚠CAUTION ***Use care when removing the block and cross-bar assembly from the base. Carefully disengage the cross bar from the auxiliary switch lever to avoid cracking the switch lever.***

Replacing the Block and Cross-Bar Assembly

1. Clean all current-carrying surfaces with a wire brush.

2. Hold the block assembly in position on the base and check the alignment of the auxiliary switch lever. When the main switch contacts are closed, the auxiliary switch lever must be aligned vertically, as shown in Figure 6-7. Move the auxiliary switch lever as required to get correct alignment.

3. Secure the block assembly to the base with round head machine screws (2), lock washers (2), and flat washers (2). Tighten the screws to 25-30 in-lbs(2.8-3.4 N•m).

4. Install the power source supply wires and securely tighten the lug terminals.

5. Connect the control wiring leads to the corresponding power source terminals. Control wires are marked NORM A,B,C or EMER A,B,C for identification.

6. Apply a thin coat of joint compound between the mating surfaces of the jumper bus bars, braided strap connector, and load bus bars.

7. Install the jumper bus bars and secure to the switch assemblies with hex head machine screws and spring washers. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

8. Secure the jumper bus bars to each load bus bar using a hex head machine screw, ring terminal, flat washer, lock washer, and nut. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

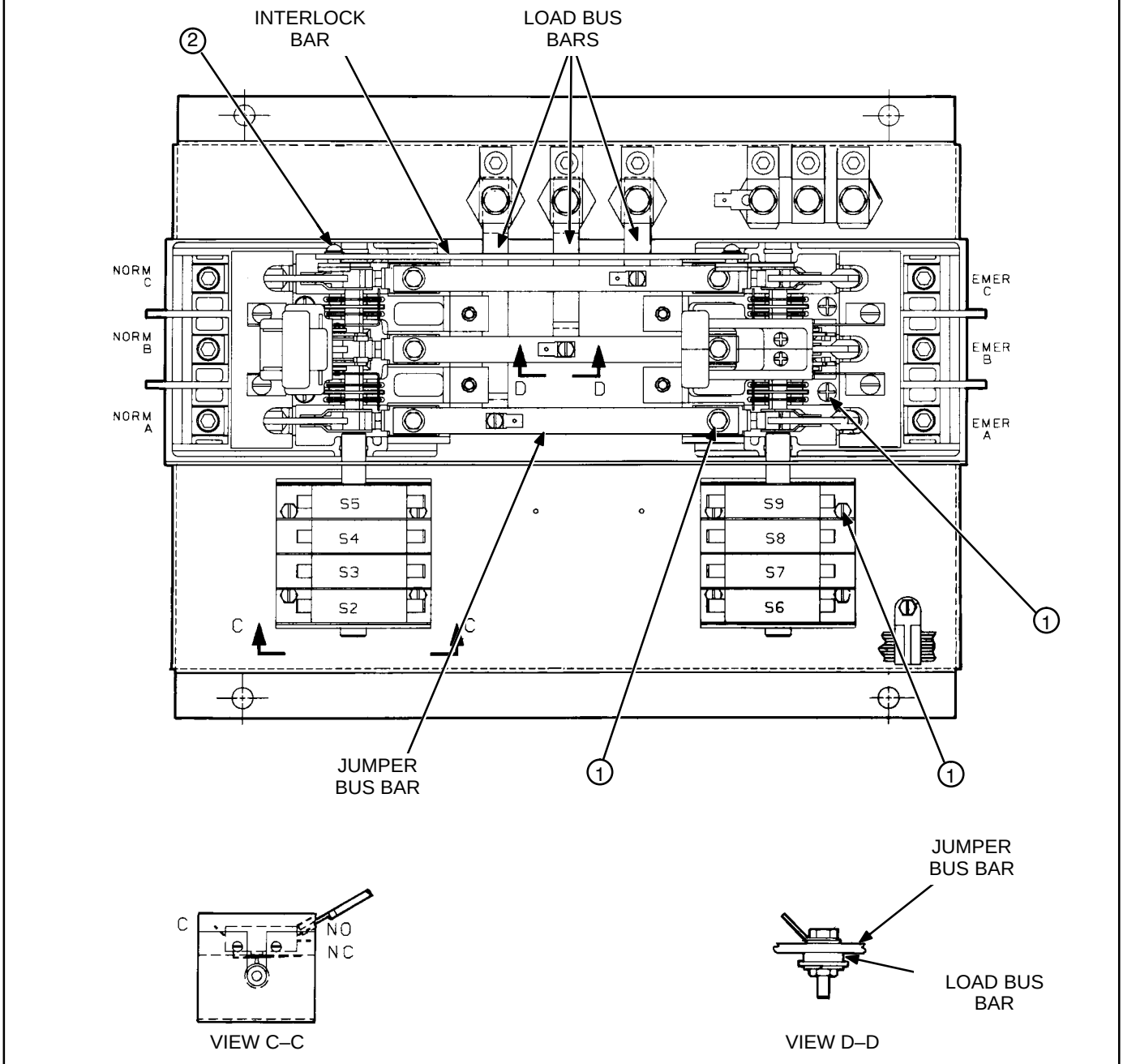
9. Connect the control wiring leads to the corresponding jumper bus bar terminal. Control wires are marked LOAD A,B,C.

10. Apply thread sealant (blue Loctite 242, Onan part number 518-0309) to the threads of the interlock bar machine screws. Install the interlock bar and secure to each interlock arm with a round head machine screw and flat washer. Tighten to 15-20 in-lbs (1.7-2.3 N•m) torque.

11. Attempt to close both sides of the transfer switch. The interlock assembly must hold one side open so that only one side closes at a time.

12. Replace the linear actuator as described in *Linear Actuator Removal And Replacement* section for 40- to 125-ampere switches. Follow steps 2 through 8 in the *Replacing Actuator* section. Apply a thin coat of lubricant (Onan part number 524-0157) to the slot in the handle.

13. Test the switch for proper operation and close the cabinet.



(1) TORQUE TO 25-30 IN-LBS (2.8-3.4 N•M).
(2) TORQUE TO 15-20 IN-LBS (1.7-2.3 N•M).

FIGURE 6-7. SWITCH ASSEMBLY (40 TO 125 AMPERES)

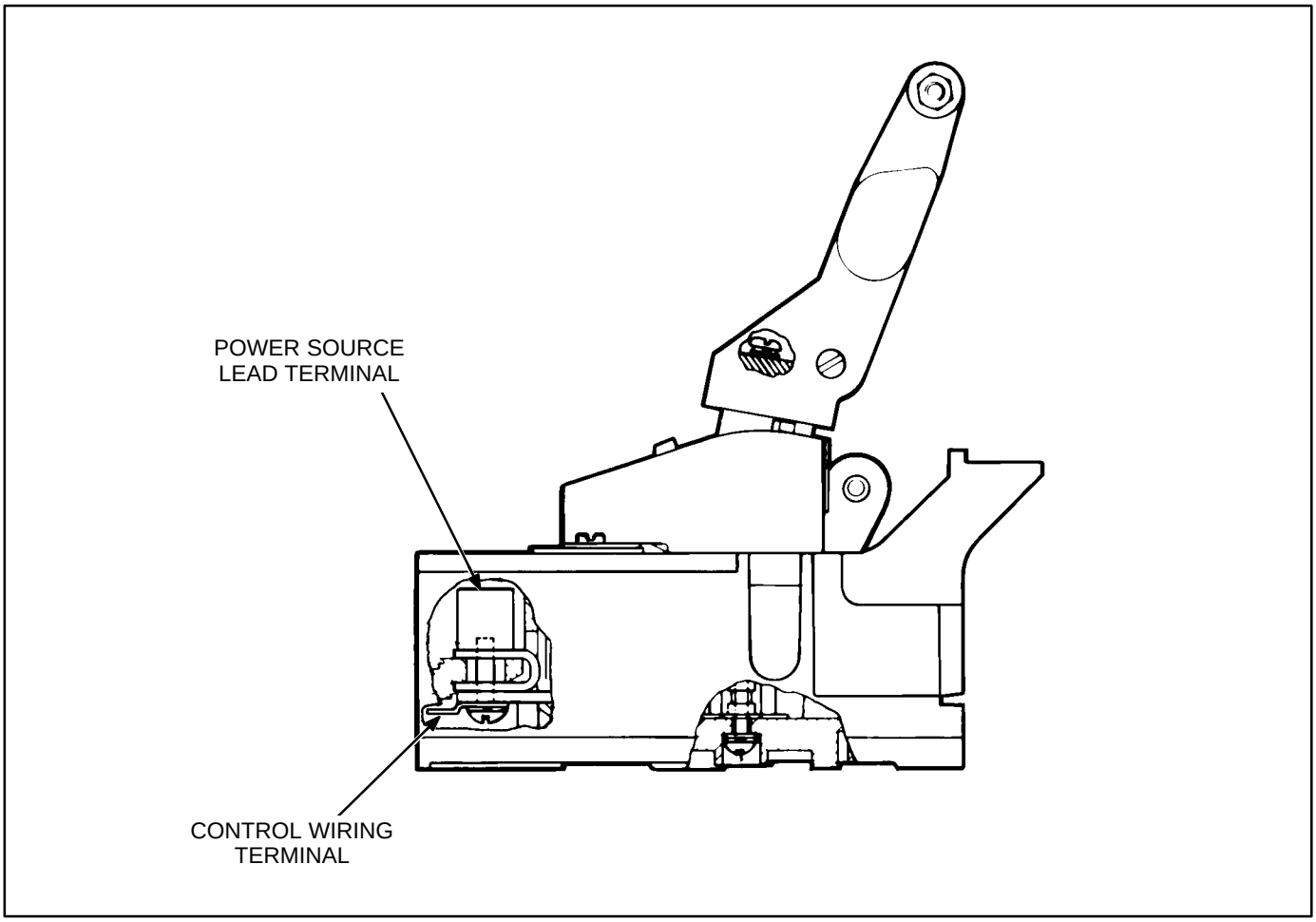


FIGURE 6-8. CONTROL WIRING TERMINALS (40 TO 125 AMPERES)

AUXILIARY SWITCH REMOVAL AND REPLACEMENT (40 TO 125 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first)..

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the auxiliary switch for 40- to 125-ampere switches.

Removing Auxiliary Switch Assembly

1. Open the transfer switch cabinet door.

2. Loosen and remove the four machine screws (with flat washers) that secure the plastic switch cover to the switch base, and lift it off.

3. Loosen the two machine screws that secure the terminal bracket to the base. Move the terminal bracket to allow access to the auxiliary switches.

4. Remove the control wiring leads from the auxiliary switch terminals (Figure 6-9).

5. Remove the hex head machine screws that secure the auxiliary switch assembly bracket to the base.

6. Disengage the auxiliary switch lever from the transfer switch crossbar and lift out the auxiliary switch assembly.

   ⚠CAUTION ***Use care when disengaging the switch lever from the crossbar to avoid cracking the switch lever.***

7. Remove the hex head machine screws and nuts that secure the auxiliary switches to the bracket (Figure 6-9); and lift out the four switches, insulating barriers, and switch lever.

Replacing Auxiliary Switch Assembly

1. Place the auxiliary switch lever in the bracket as shown in Figure 6-9. Note that the end of the lever with the octagonal hole must engage the transfer switch cross bar when the auxiliary switch assembly is installed.

2. Install the auxiliary switches (4) and insulating barriers (5) in the bracket, and secure with hex head machine screws (2) and nuts (2).Tighten to 10-15 in-lbs (1.1-1.7 N•m) torque. Note that each switch must be assembled so the side with two terminals (Figure 6-9) is facing inward, toward the other auxiliary switch.

3. Manually close the contacts that will be coupled to the auxiliary switch lever.

4. Hold the auxiliary switch assembly in position on the base and check the alignment of the auxiliary switch lever. When the transfer switch is closed, the auxiliary switch must be aligned as shown in Figure 6-9. Move the auxiliary lever as required to get the correct alignment.

5. Secure the bracket to the base using the hex head machine screws and tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

6. Install control wiring leads on the corresponding switch terminals. Leads are marked with terminal numbers (S2/N0, S7/NC, S9/C, etc..) for identification. Refer to Figure 6-9 for identification of the auxiliary switch terminals.

7. Place the terminal bracket in position on the base and secure it with hex head machine screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m).

8. Place the plastic switch cover in position and secure with machine screws (4) and flat washers (4). Tighten to 25-30 in-lbs (2.8-3.4 N•m).

9. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

10. Test the switch for proper operation and close the cabinet.

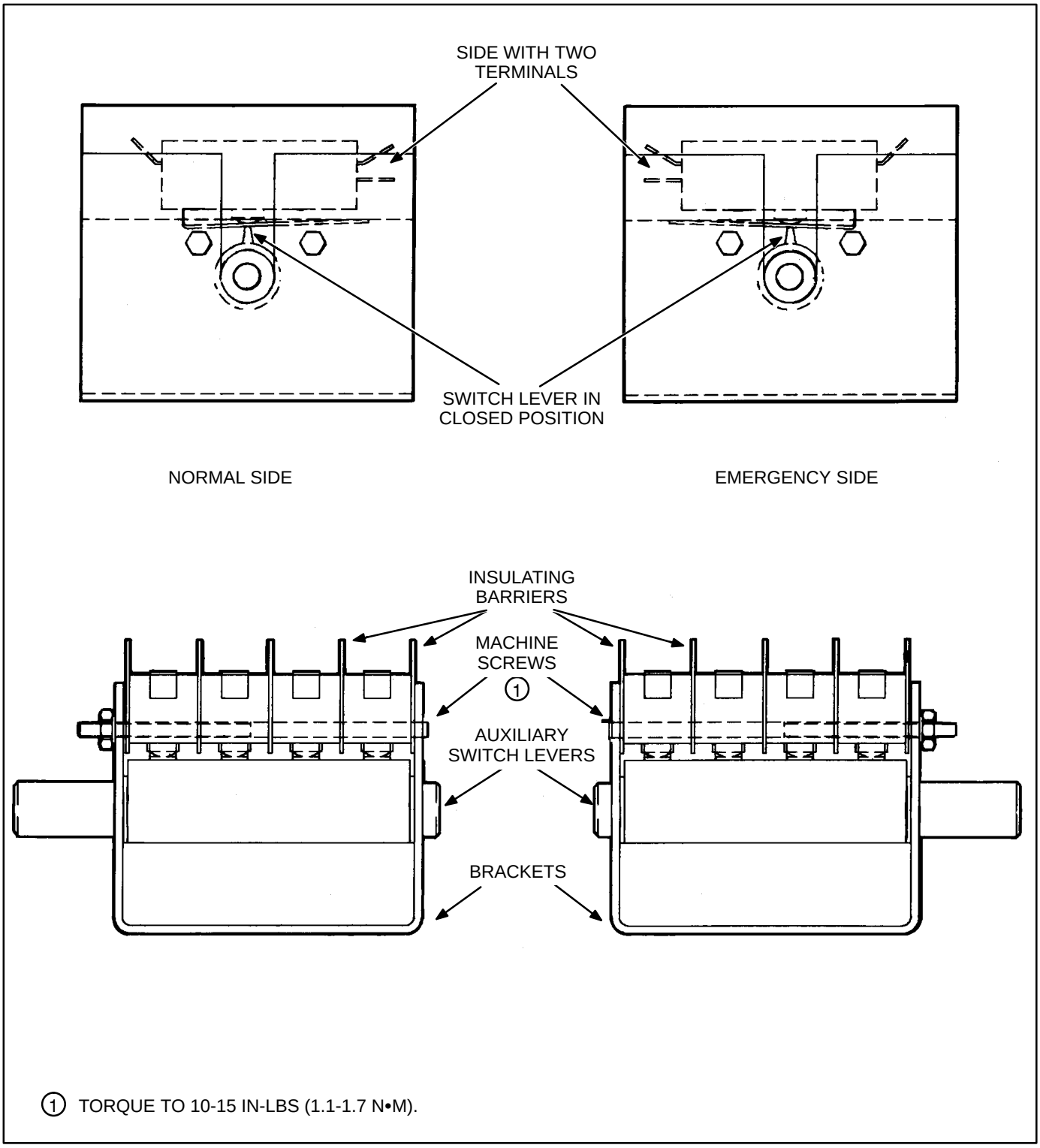


FIGURE 6-9. AUXILIARY SWITCHES (40 TO 125 AMPERES)

LINEAR ACTUATOR REMOVAL AND REPLACEMENT (150 TO 260 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the linear actuator for 150- to 260-ampere switches.

Removing Actuator

1. Open the transfer switch cabinet door.

2. Loosen and remove the two self-locking nuts and two machine screws (with flat washers) that secure the plastic switch cover to the switch base, and lift off the cover. (Figure 6-10)

3. Separate the actuator lead wires from the rest of the wiring harness; remove wire ties as required.

4. Pry the capacitor(s) loose from the bracket. Remove the end cap and disconnect the red and white actuator lead wires from the capacitor terminals.

5. Disconnect the black actuator wire from the circuit breaker and disconnect the ground wire from the end of the actuator.

6. Remove the hex head capscrews, flat washers, and lock washers that secure the actuator to the switch assemblies (Figure 6-10), and lift out the spacers (4) and barriers (2).

7. Disengage the actuator rod from the switch handle and remove the actuator from the switch assembly.

8. Remove one of the hex head capscrews and lock washers that secure the rod end assembly to the end of the actuator rod.

9. Remove the rod end assembly from the actuator rod (Figure 6-10) and slide the rod out of the actuator motor.

Replacing Actuator

1. Insert the actuator rod into the replacement actuator motor (Figure 6-11). Hold the actuator ground brush up slightly to allow passage of the actuator rod. Install the rod end assembly and tighten capscrew to 70-75 in-lbs (7.9-8.5 N•m).

2. Hold the actuator motor in position over the switch assemblies so the lead wires are at the bottom, and fit the rod assembly into the handle of the closed switch assembly.

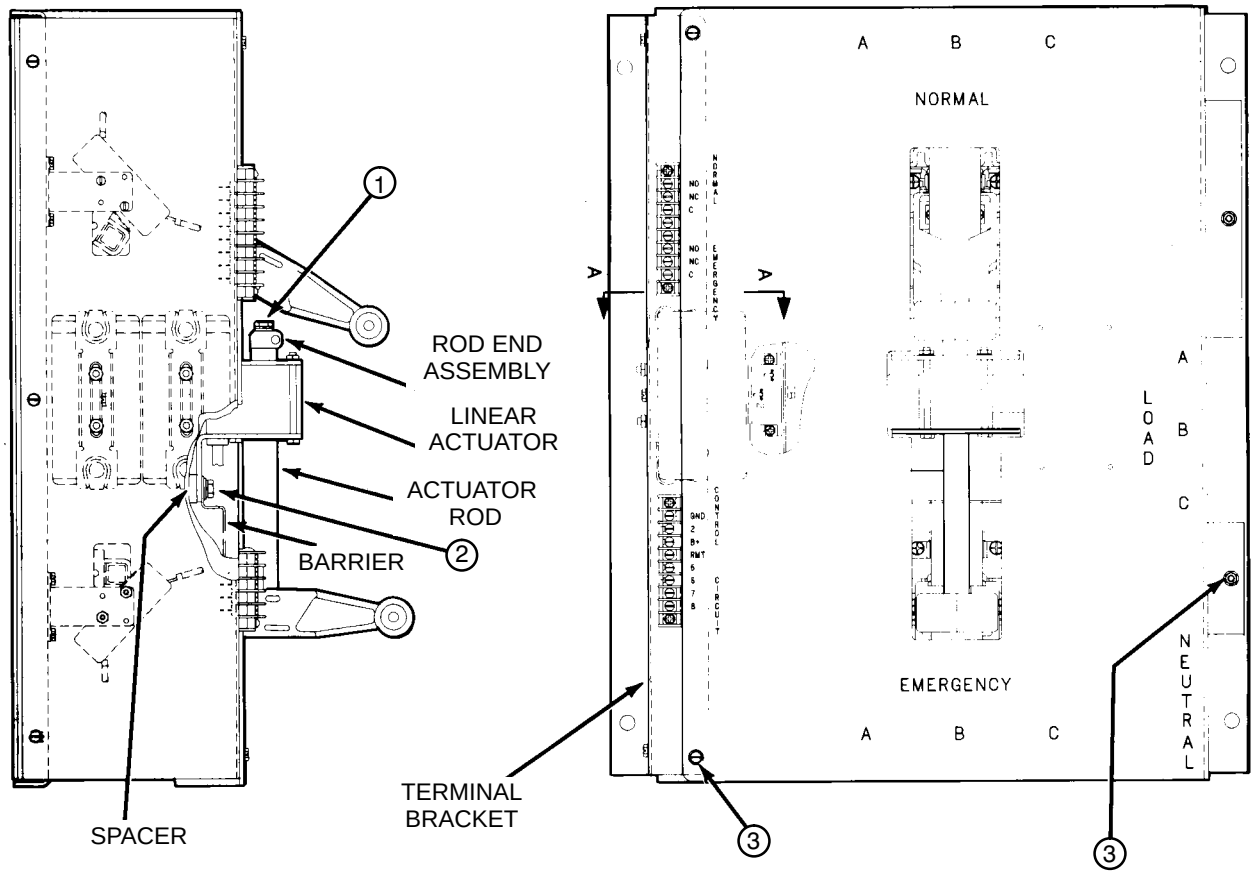
3. Secure the actuator motor to the switch assemblies using hex head capscrews (4), lock washers (4), flat washers (4), barriers (2), and spacers (4). Tighten the capscrews to 25-27 in-lbs (2.8-3.0 N•m).

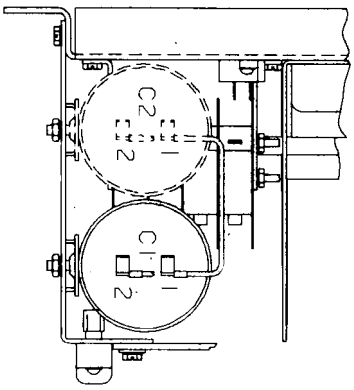
4. Connect the black actuator lead wire to the circuit breaker, and the red and white actuator lead wires to the following capacitor terminals:

Red Lead	• Capacitor C1, Terminal 1
White Lead	• One capacitor, Capacitor C1, Terminal 2.
	• Two capacitors, Capacitor C2, Terminal 2.

Transfer switches for voltage ranges 347, 380/416, and 440/480 use two capacitors (C1 and C2) wired together in series. A single jumper wire is placed between terminal 2 on C1 and terminal 1 on C2.

5. Replace the capacitor end cap(s) and install the capacitor(s) in the bracket(s).





VIEW A–A

① TORQUE TO 70-75 IN-LBS (7.9-8.5 N•M).
② TORQUE TO 25-27 IN-LBS (2.8-3.0 N•M).
③ TORQUE TO 25-30 IN-LBS (2.8-3.4 N-M).

FIGURE 6-10. TRANSFER SWITCH COVER (150 TO 260 AMPERES)

6. Connect the ground wire to the end of the actuator. Use wire ties to hold the actuator lead wires in place with the wiring harness.

7. Check operation of the transfer switch and alignment of the actuator rod by manually opening and closing both the Normal and Emergency switch assemblies.

8. Place the plastic switch cover in position and secure with machine screws (2), flat washers (2), and self-locking nuts (2). Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

9. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

10. Test the switch for proper operation and close the cabinet.

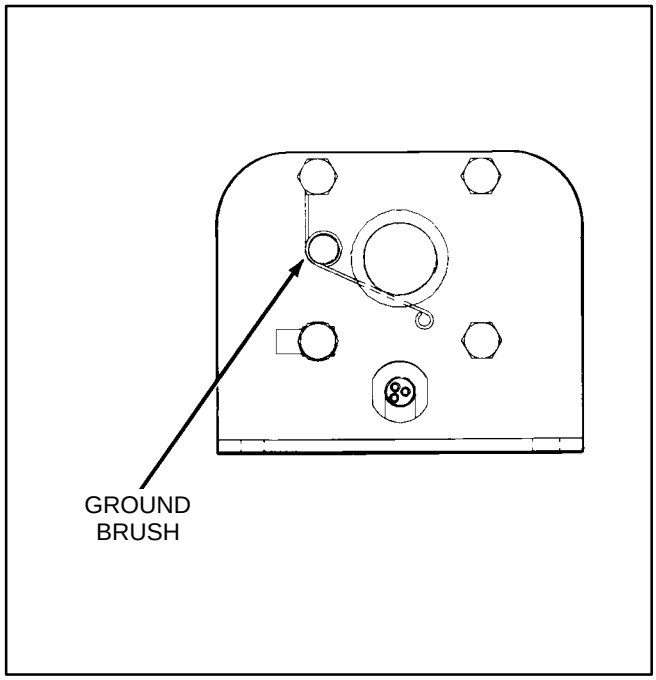


FIGURE 6-11. LINEAR ACTUATOR (150 TO 260 AMPERES)

BLOCK AND CROSS-BAR ASSEMBLY REMOVAL AND REPLACEMENT (150 TO 260 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the block and cross-bar assemblies for 150- to 260-ampere switches.

Removing the Block and Cross-Bar Assembly (Normal or Emergency)

1. Loosen the lug terminal screws and remove the power source supply wires from the lug terminals.

2. Remove the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 150- to 260-ampere switches. Follow steps 1 through 7 in the Removing Actuator section.

3. Remove the hex head capscrews, lock washers, and flat washers that secure the interlock bar to the interlock arms (Figures 6-12 and 6-13), and remove the interlock bar.

4. Remove the round head machine screws and mounting plate that secure the handle assembly to the switch assembly, and lift off the handle assembly.

5. Disconnect the control wiring leads from the jumper bus bars.

6. Remove the hex head capscrews and spring washers that secure the A, B, and C jumper bus bars to the block and cross-bar assemblies. Remove the two Phillips head screws and the two hex head capscrews that secure the load lug support block. Carefully remove the jumper bus bar/load bus bar/load lug support block assembly.

7. Remove the control wiring leads from the power source terminals.

8. **On 4-pole switches (Figure 6-13):** Before the block and cross-bar assembly can be removed, the neutral block assembly must be loosened and pivoted slightly out of the way.

   A. Remove the two machine screws that secure the arc chute cover. Remove the cover and the arc chute.

   B. Remove the hex head capscrew, terminal ring, spring washer, and load lug that secure the neutral jumper bus bar. Remove the neutral jumper bus bar.

   C. Remove the two Phillips screws and the spacer that secure the source lug side of the neutral block.

   D. Pivot the neutral block slightly away from the block and cross-bar assembly.

   ⚠CAUTION ***Use care when removing the block and cross-bar assembly from the base. Carefully disengage the cross-bar from the auxiliary switch assembly to avoid cracking the switches.***

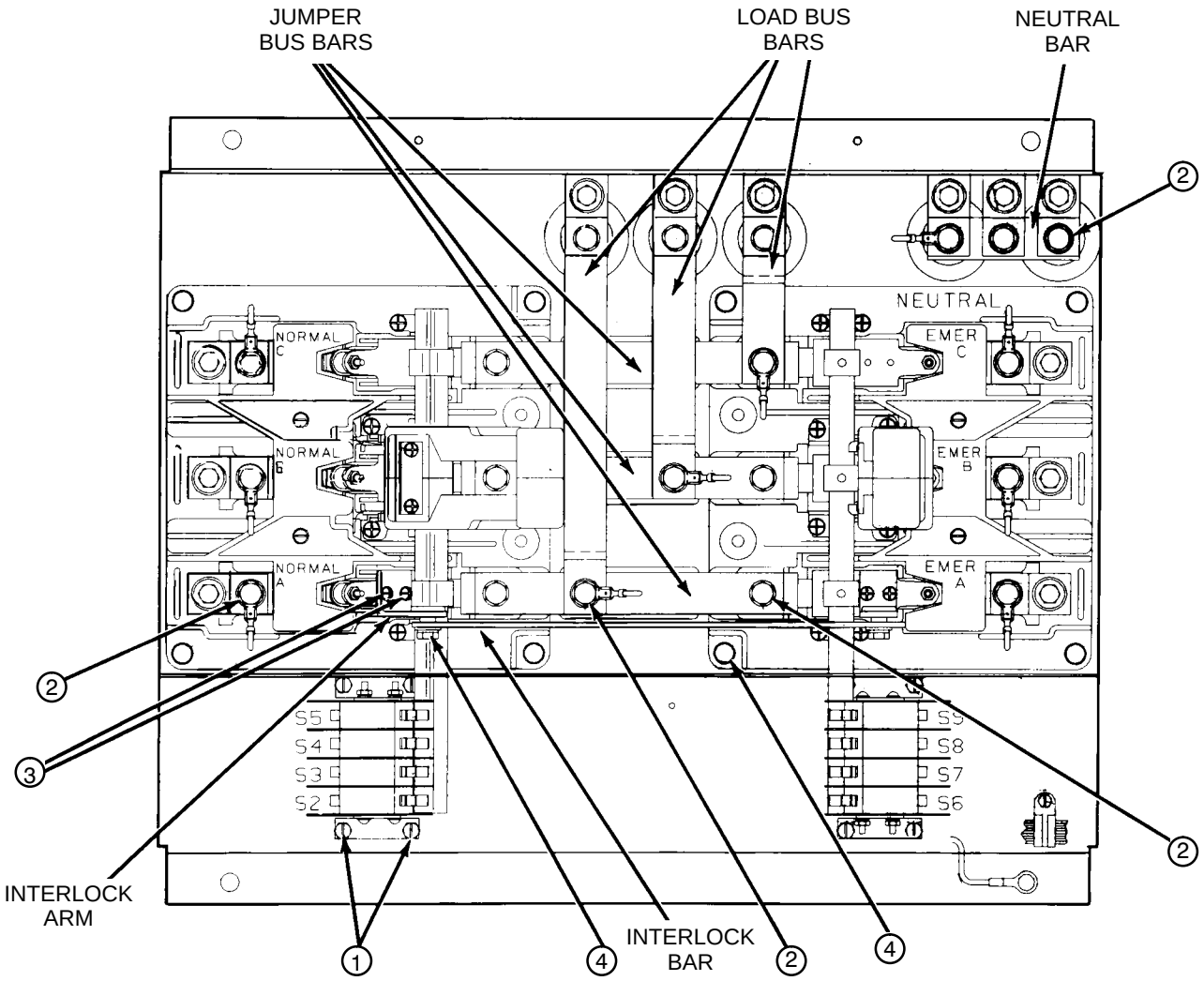
9. Remove the remaining hex head capscrews that secure the block and cross-bar assembly to the base, and carefully remove the assembly.

10. Remove the two threaded hex spacers from the back of each block assembly and save for reuse.

11. **On 4-pole switches (Figure 6-13):** With a screwdriver, dig the glue out of the cavity in the base of the neutral block. Remove the machine screw that secures the neutral block, and remove the neutral block.

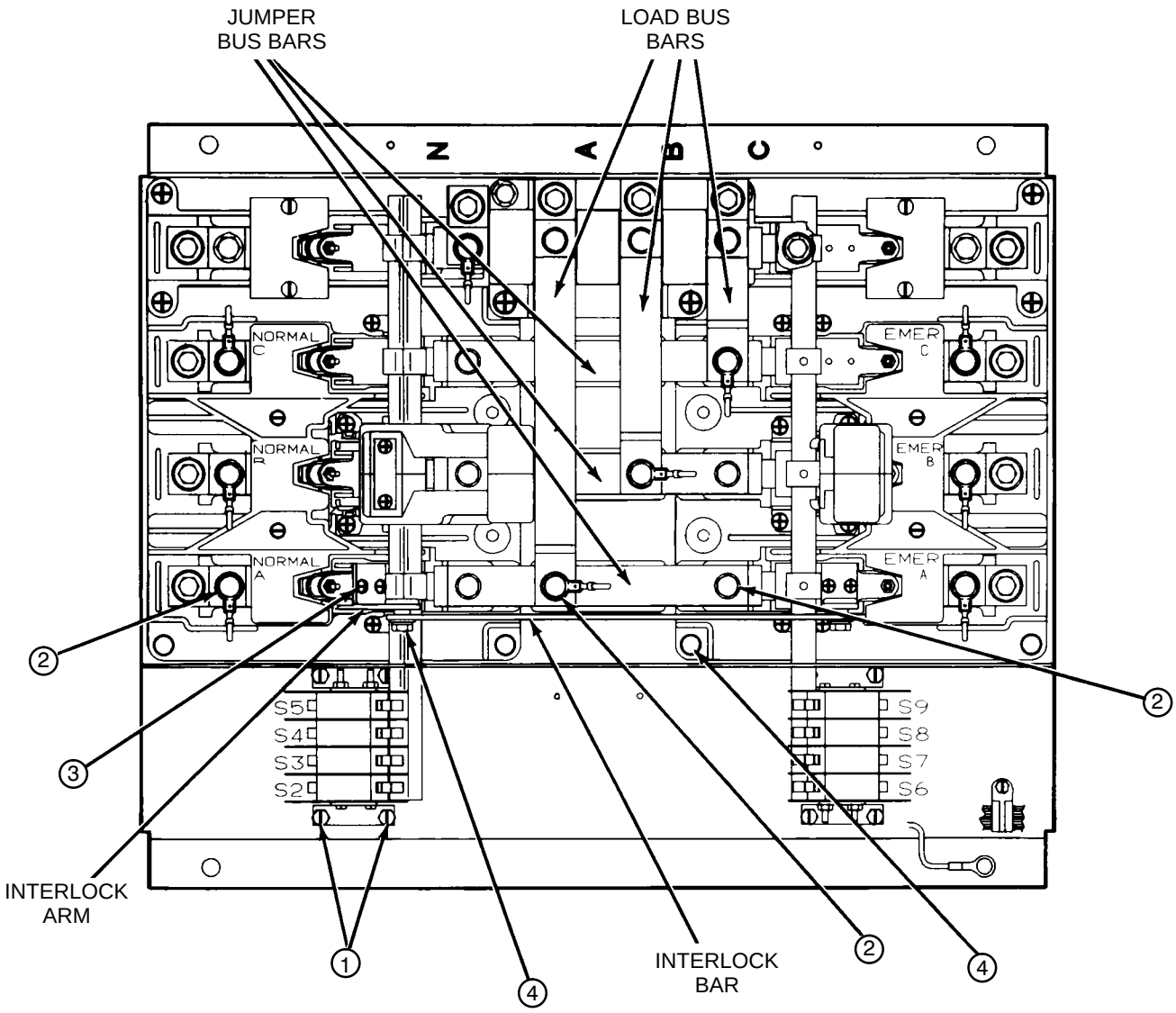
12. Remove the two round head machine screws that secure the interlock arm to the block and cross-bar assemblies, and lift off the interlock arm.

13. Remove the hex head capscrews, ring terminals, spring washers, and lug terminals from the block and cross-bar assembly.



① TORQUE TO 25-30 IN-LBS (2.8-3.4 N•M).
② TORQUE TO 10-12 FT-LBS (13.6-16.3 N•M).
③ TORQUE TO 15-20 IN-LBS (1.7-2.3 N•M).
④ TORQUE TO 70-75 IN-LBS (7.9-8.5 N•M).

FIGURE 6-12. 3-POLE SWITCH ASSEMBLY (150 TO 260 AMPERES)



1. TORQUE TO 25-30 IN-LBS (2.8-3.4 N•M).
2. TORQUE TO 10-12 FT-LBS (13.6-16.3 N•M).
3. TORQUE TO 15-20 IN-LBS (1.7-2.3 N•M).
4. TORQUE TO 70-75 IN-LBS (7.9-8.5 N•M).

FIGURE 6-13. 4-POLE SWITCH ASSEMBLY (150 TO 260 AMPERES)

Replacing Block and Cross-Bar Assembly

1. Install the lug terminals on the block and cross-bar assembly and secure with hex head capscrews, ring terminals, and spring washers. Tighten to 10-12 ft-lbs (13.6-16.3 N•m).

2. Install the interlock arm and secure with the two round head capscrews. Tighten the screws to 15-20 in-lbs (1.7-2.3 N•m) torque.

3. Install the two threaded hex spacers in the back of the block and cross-bar assembly.

4. **On 4-pole switches (Figure 6-13):** Secure the neutral block with the machine screw that was removed from the center hole. Tighten to 70-75 in-lbs (7.9-8.5 N•m). Fill the cavity in the block with adhesive silicone to completely cover the screw head. Pivot the neutral block to permit placement of the block and cross-bar assembly.

5. Secure the block and cross-bar assembly to the base with the hex head capscrews. Tighten to 70-75 in-lbs (7.9-8.5 N•m) torque.

6. **On 4-pole switches (Figure 4-9):**

   A. Pivot the neutral block back to its correct position.

   B. Secure the neutral block with the two Phillips screws and the spacer. Tighten to 70-75 in-lbs (7.9-8.5 N•m) torque.

   C. Secure the neutral jumper bus bar with the hex head capscrew, terminal ring, spring washer, and load lug. Tighten to 10-12 ft-lbs (13.6-16.3 N•m) torque.

   D. Position the neutral block arc chute and cover. Secure the arc chute cover with the two machine screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

7. Connect the control wiring leads to the corresponding power source terminals. Control wires are marked NORM A,B,C,N or EMER A,B,C,N for identification.

8. Clean the current-carrying surfaces of the jumper bus bars and load bus bars with a wire brush.

9. Install the A, B, and C jumper bus bar/load bus bar/load lug support block assembly. Secure to the block and cross-bar assemblies with hex head capscrews and spring washers. Tighten to 10-12 ft-lbs (13.6-16.3 N•m) torque. Secure the load lug support block with the four screws. Tighten to 70-75 in-lbs (7.9-8.5 N•m) torque.

10. Connect the control wiring leads to the corresponding jumper bus bar terminals. Control wires are marked LOAD A, B, C, N.

11. Place the handle assembly in position on the block and cross-bar assembly and secure with the two machine screws and mounting plate. Tighten to 15-20 in-lbs (1.7-2.3 N•m) torque. Apply a thin coat of lubricant (Onan part number 524-0157) to the slot in the handle.

12. Apply thread sealant (blue Loctite 242, Onan part number 518-0309) to the threads of the interlock bar capscrews. Install the interlock bar and secure to each interlock arm with a hex head capscrew, lock washer, and flat washer. Tighten to 70-75 in-lbs (7.9-8.5 N•m) torque.

13. Attempt to close both sides of the transfer switch. The interlock assembly must hold one side open so that only one side closes at a time.

14. Replace the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 150- to 260-ampere switches. Follow steps 2 through 9 in the *Replacing Actuator* section.

15. Install the power source supply wires and securely tighten the lug terminals to the torque value specified on the plastic cover.

16. Test the switch for proper operation and close the cabinet.

AUXILIARY SWITCH REMOVAL AND REPLACEMENT (150 TO 260 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the auxiliary switch assembly for 150- to 260-ampere switches.

Removing Auxiliary Switch Assembly

1. After disconnecting all sources of AC power, open the transfer switch cabinet door.
2. Loosen and remove the two self-locking nuts and the two machine screws (with flat washers) that secure the plastic switch cover to the switch base, and lift off the cover.
3. Remove the three machine screws that secure the terminal bracket (Figure 6-10) to the base. Move the terminal bracket to allow access to the auxiliary switches.
4. Remove the control wiring leads from the auxiliary switch terminals (Figure 6-14).
5. Remove the hex head machine screws that secure the auxiliary switch assembly bracket to the base.
6. Lift out the auxiliary switch assembly.
7. Remove the hex head capscrews and nuts that secure the auxiliary switches to the brackets (Figure 6-14), and lift out the four auxiliary switches and insulating barriers.

Replacing Auxiliary Switch Assembly

1. Install the insulating barriers (5) and auxiliary switches (4) in the brackets and secure with hex head machine screws (2) and nuts (2). Tighten to 10-15 in-lbs (1.1-1.7 N•m). Note that each switch must be assembled so the side with two terminals faces inward (Figure 6-14) when the auxiliary switch assembly is installed on the base.
2. Hold the auxiliary switch assembly in position on the base (the side with two terminals must face inward) and secure the bracket to the base using the hex head machine screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.
3. Install the control wiring leads on the corresponding switch terminals.Leads are marked with the terminal numbers (S2/NO, S5/NC, S7/C, etc..) for identification. Refer to Figures 6-12, 6-13, and 6-14 for identification of auxiliary switch terminals.
4. Place the terminal bracket in position on the base and secure it with the hex head machine screws.Tighten to 25-30 in-lbs (2.8-3.4 N•m).
5. Place the plastic switch cover in position and secure with machine screws, flat washers, and self-locking nuts. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.
6. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).
7. Test the switch for proper operation and close the cabinet.

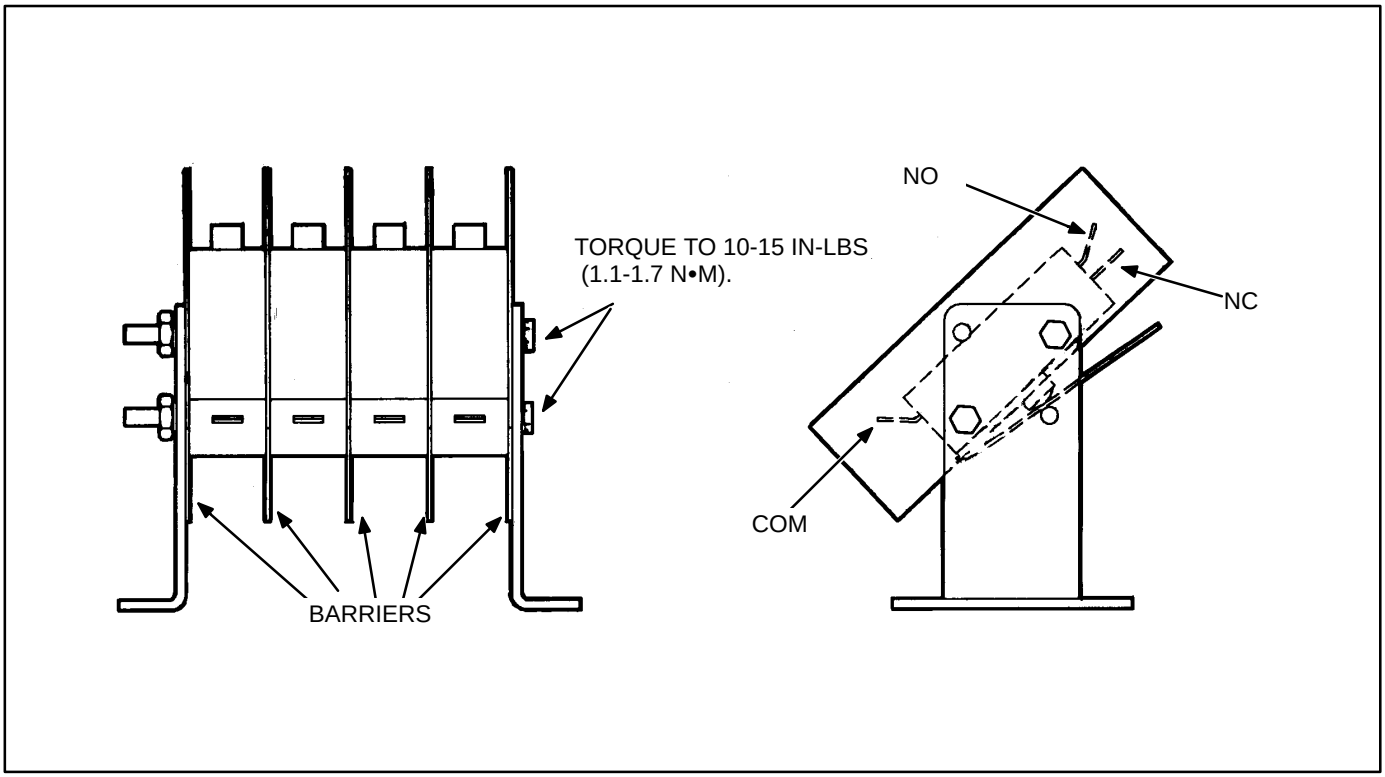


FIGURE 6-14. AUXILIARY SWITCH (150 TO 260 AMPERES)

LINEAR ACTUATOR REMOVAL AND REPLACEMENT (300 TO 600 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the linear actuator for 300- to 600-ampere switches.

Removing Actuator

1. Open the transfer switch cabinet door.
2. Loosen and remove the four machine screws that secure the plastic switch cover to the transfer switch, and lift off the cover (Figure 6-15).
3. Separate the actuator lead wires from the rest of the wiring harness; remove wire ties as required.
4. Pry the capacitor(s) loose from the bracket. Remove the end cap and disconnect the red and white actuator lead wires from the capacitor terminals.
5. Disconnect the black actuator lead from the circuit breaker and the ground wire from the end of the actuator.
6. Remove the hex head capscrews, flat washers, and lock washers that secure the actuator to the switch assemblies (Figure 6-15).
7. Disengage the actuator rod from the switch handle and remove the actuator from the switch assembly.
8. Remove one of the hex head capscrews and lock washers that secure the rod end assembly to the end of the actuator rod.
9. Remove the rod end assembly (Figure 6-15) and slide the actuator rod out of the actuator motor.

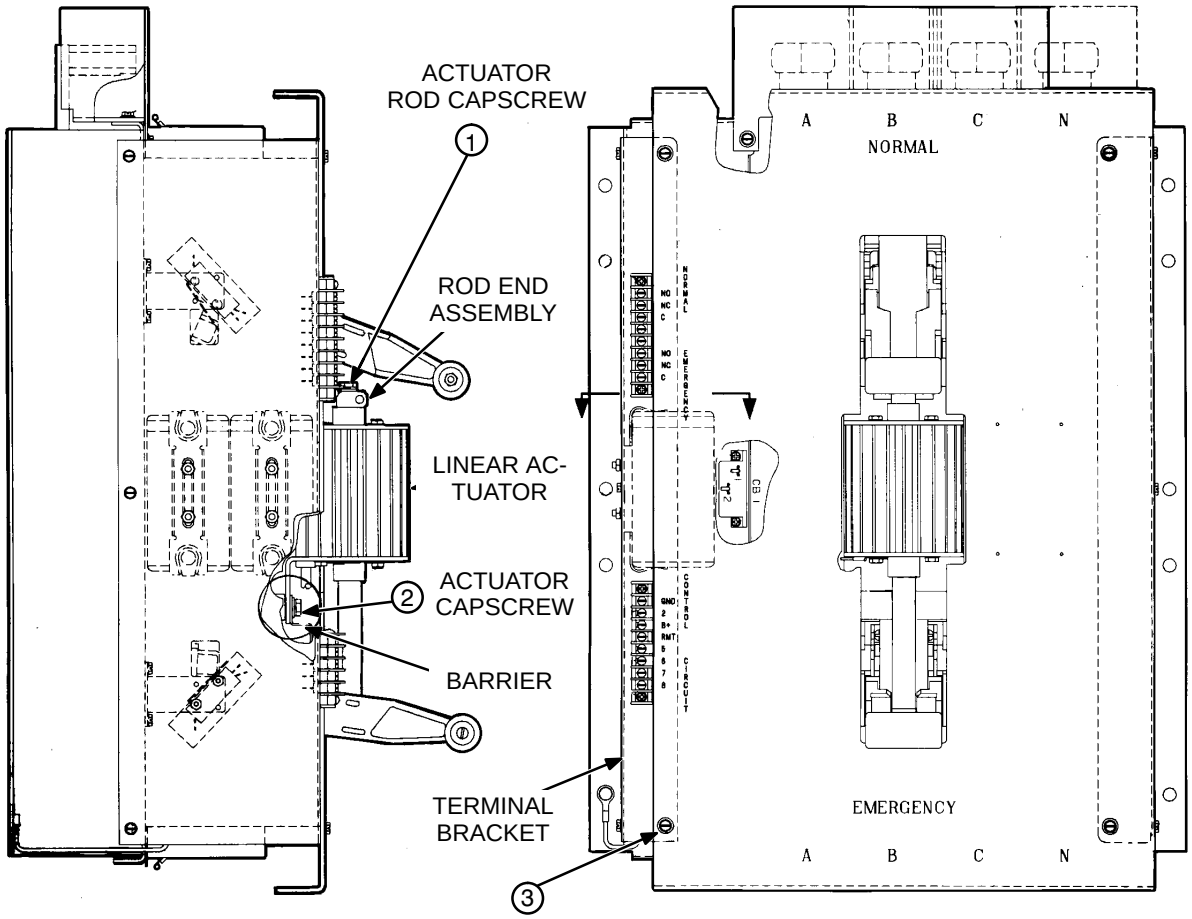
Replacing Actuator

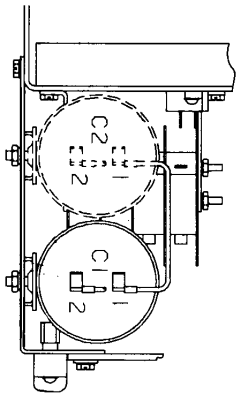
1. Insert the actuator rod into the replacement actuator motor (Figure 6-16). Hold the actuator ground brush up slightly to allow passage of the actuator rod. Install the rod end assembly and tighten capscrew to 70-75 in-lbs(7.9-8.5 N•m).
2. Hold the actuator motor in position over the switch assemblies so the lead wires are at the bottom and fit the rod assembly into the handle of the closed switch assembly.
3. Secure actuator motor to switch assemblies using hex head capscrews (4), lock washers (4), flat washers (8), and spacers (4). Tighten capscrews to 25-27 in-lbs (2.8-3.0 N•m).
4. Connect the black actuator lead wire to the circuit breaker, and the red and white actuator lead wires to the following capacitor terminals:

Red Lead	• Capacitor C1, Terminal 1
White Lead	• One capacitor, Capacitor C1, Terminal 2.
	• Two capacitors, Capacitor C2, Terminal 2.

Transfer switches for voltage ranges 347, 380/416, and 440/480 use two capacitors (C1 and C2) wired together in series. A single jumper wire is placed between terminal 2 on C1 and terminal 1 on C2.

5. Replace the capacitor end cap(s) and install the capacitor(s) in the bracket(s).
6. Connect the ground wire to the end of the actuator. Use wire ties to hold actuator lead wires in place with the rest of the wiring harness.





VIEW A–A

1. TORQUE TO 70-75 IN-LBS (7.9-8.5 N•M).
2. TORQUE TO 25-27 IN-LBS (2.8-3.0 N•M).
3. TORQUE TO 25-30 IN-LBS (2.8-3.4 N•M).

FIGURE 6-15. TRANSFER SWITCH COVER (300 TO 600 AMPERES)

7. Check the operation of the transfer switch and the alignment of the Actuator rod by manually opening and closing both the Normal and Emergency switch assemblies.

8. Install the plastic switch cover on the switch with the four screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m).

9. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

10. Test the switch for proper operation and close the cabinet.

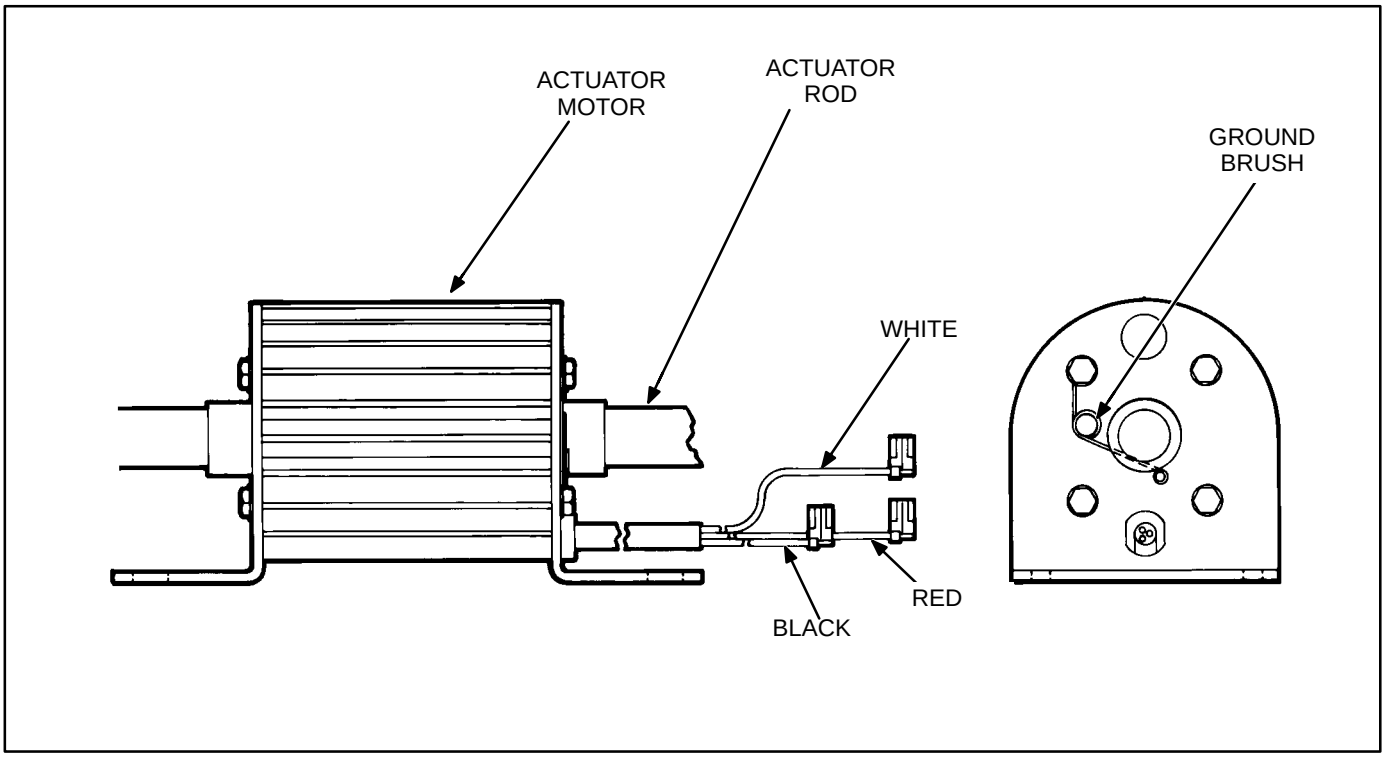


FIGURE 6-16. LINEAR ACTUATOR (300 TO 600 AMPERES)

BLOCK AND CROSS-BAR ASSEMBLY REMOVAL AND REPLACEMENT (300 TO 600 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the block and cross-bar assemblies for the 300- to 600-ampere switches.

Removing the Block and Cross-bar Assembly (Normal or Emergency)

1. Remove the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 300- to 600-ampere switches.

2. Remove the hex head capscrews, lock washers, and flat washers that secure the interlock bar to the interlock arm (Figures 6-17 and 6-18), and remove the interlock bar.

3. Disconnect the control wiring leads from the jumper bus bars.

4. Remove the round head shoulder screws and lock washers that secure the handle assembly to the block and cross-bar assembly, and lift off the handle assembly.

5. Remove the control wiring leads from the power source terminals.

6. Remove the lug terminal screws and the power supply wires from the lug terminals. Remove the lug mounting screws and then remove the solder-less lugs from the switch assemblies.

7. Remove the hex head capscrews, ring terminals, spring washers, flat washers, lock washers, and nuts that secure the jumper bus bars to the load bus bars.

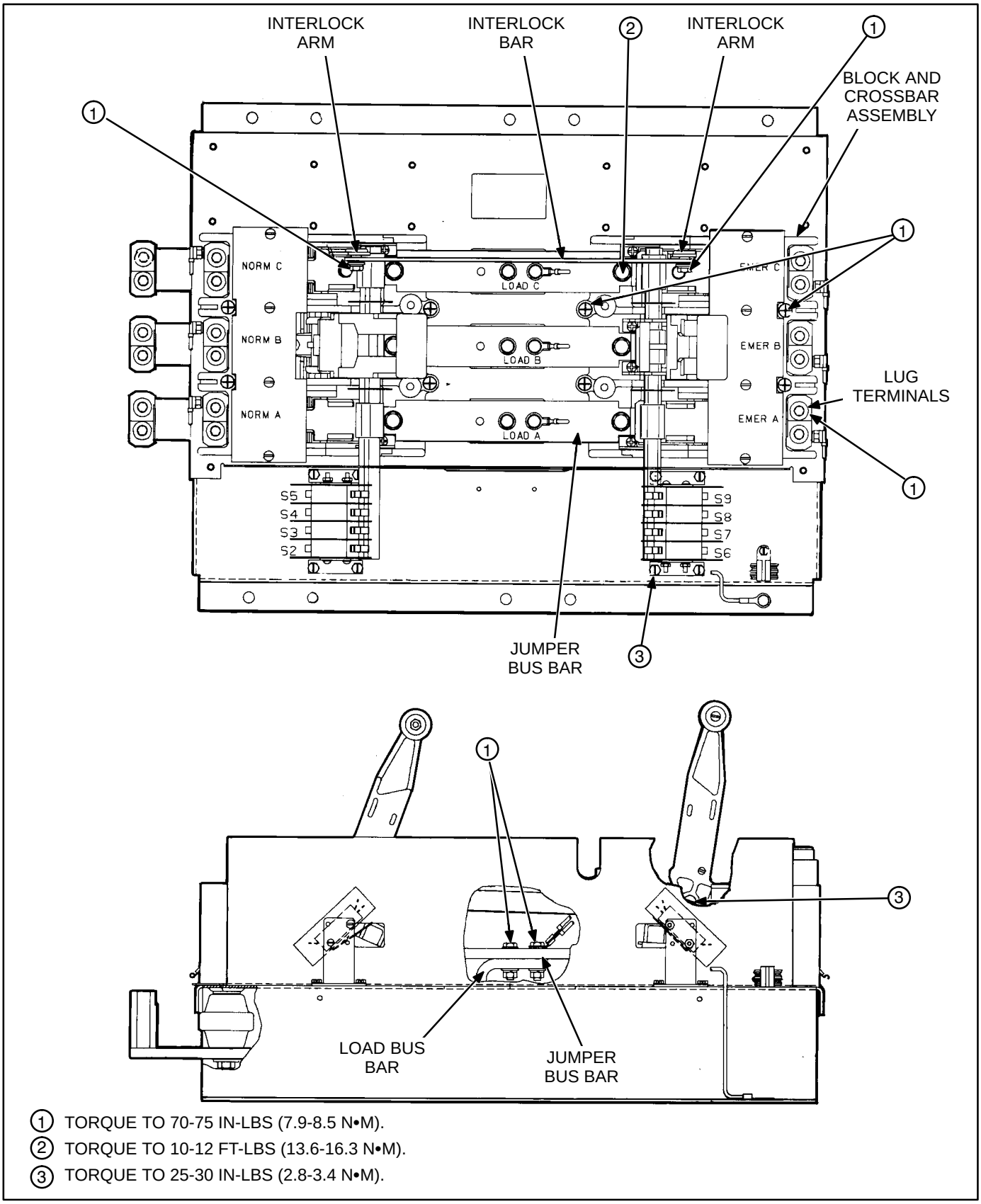
8. Remove the hex head capscrews and spring washers that secure the jumper bus bars to the block assemblies, and lift off the jumper bus bars.

9. Remove the four screws, lock washers, and flat washers that secure the block and cross-bar assembly to the base. **On 4-pole switches,** remove the screw that secures the small bearing bracket to the neutral block (Figure 6-18). Remove the block and cross-bar assembly. Save the bearing bracket and screw for reuse.

   ⚠CAUTION ***Use care when removing the block and cross-bar assembly from the base. Carefully disengage the crossbar from the auxiliary switch assembly to avoid cracking the switches.***

10. **On 4-pole switches (Figure 6-18):** Remove the four screws that secure the block and contact assembly to the base, and lift off the block and contact assembly.

11. Remove hex head capscrew and lock washer that secure the interlock arm assembly to the block assembly and lift off the interlock arm.



(1) TORQUE TO 70-75 IN-LBS (7.9-8.5 N•M).
(2) TORQUE TO 10-12 FT-LBS (13.6-16.3 N•M).
(3) TORQUE TO 25-30 IN-LBS (2.8-3.4 N•M).

FIGURE 6-17. 3-POLE SWITCH ASSEMBLY (300 TO 600 AMPERES)

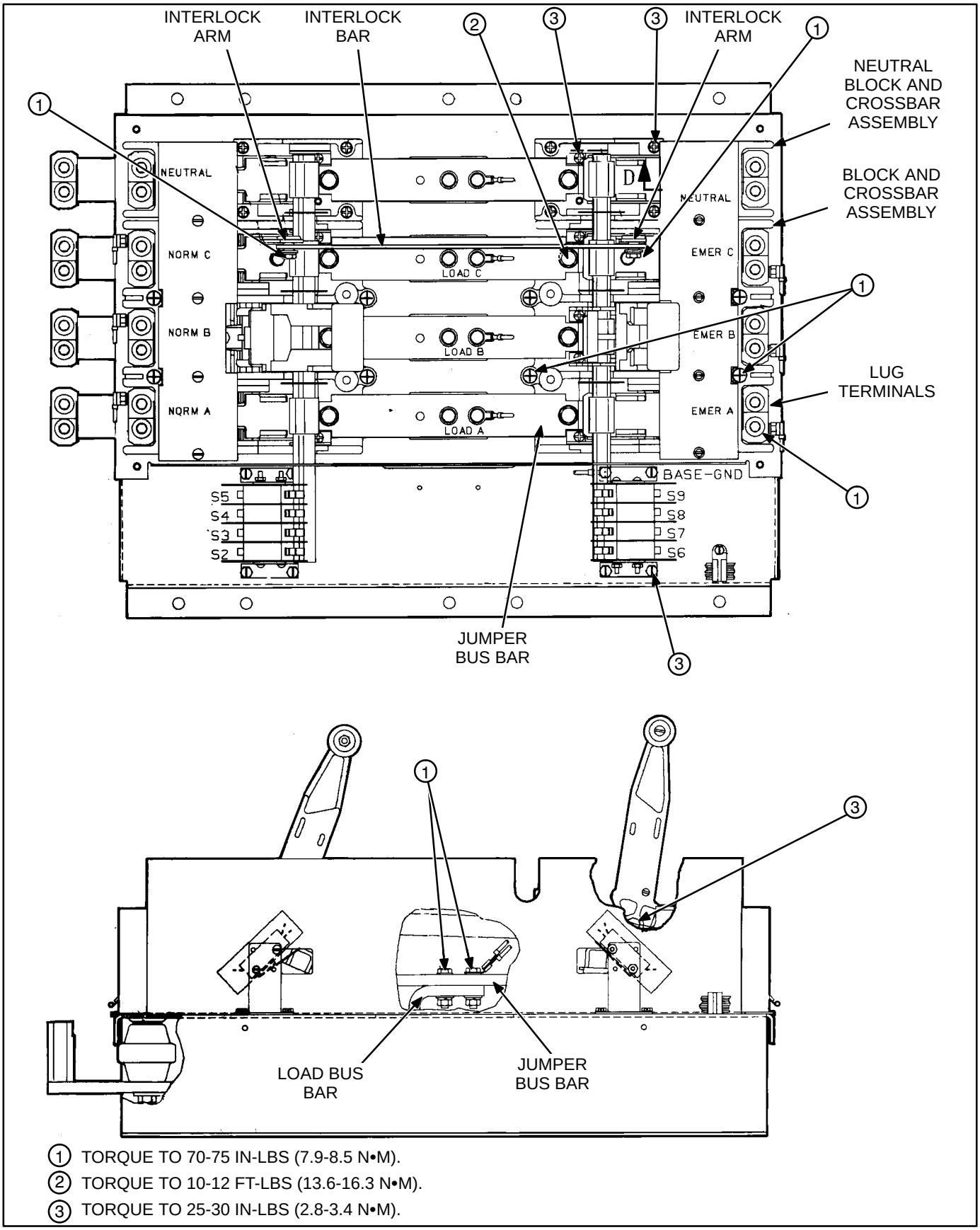


FIGURE 6-18. 4-POLE SWITCH ASSEMBLY (300 TO 600 AMPERES)

Replacing the Block and Cross-bar Assembly (Normal or Emergency)

1. Install interlock arm on block assembly using capscrew and lock washer (Figures 6-17 and 6-18). Torque to 70-75 in-lbs (7.9-8.5 N•m).

2. **On 4-pole switches (Figure 6-17):** Secure the block and contact assembly to the base using the four screws removed in step 10 above. Tighten the screws to 25-30 in-lbs (2.8-3.4 N•m). Place the bearing bracket (removed in step 9) in position on the end of the cross-bar assembly.

3. Install the block and cross-bar assembly on the transfer switch base (with screws, lock washers, and flat washers), carefully engaging auxiliary switches. Tighten to 70-75 in-lbs (7.9-8.5 N•m). On 4-pole switches, tighten the bearing bracket screw to 25-30 in-lbs (2.8-3.4 N•m).

4. Clean the current-carrying surfaces of the block assembly and the lug terminals with a wire brush. Install the lug terminals with the round head screws and lock washers. Tighten to 70-75 in-lbs (7.9-8.5 N•m).

5. Secure the jumper bus bars to the block assembly with the capscrews and spring washers. Make sure the mating surfaces have a coating of electrical joint compound. Tighten the capscrews 10-12 ft-lbs (13.6-16.3 N•m).

6. Secure the load bus bars to the jumper bus bars with the capscrews, lock washers, flat washers, spring washers, ring terminals, and nuts (Figures 6-17 and 6-18). Be sure to apply a thin coat of electrical joint compound between the current-carrying surfaces. Tighten to 70-75 in-lbs (7.9-8.5 N•m).

7. Install the actuator handle on the block assembly with the shoulder screws and lock washers. Tighten to 25-30 in-lbs (2.8-3.4 N•m). Apply a thin coat of lubricant (Onan part number 524-0157) to the slot in the handle.

8. Connect the power source supply wires to the lug terminals. Tighten the lug terminals to the torque value silkscreened on the transfer switch cover.

9. Connect the control wiring leads to the power source terminals. Control wires are marked NORM A, B, C or EMER A, B, C.

10. Connect the control wiring leads to the jumper bus bars. Control wires are marked LOAD A, B, C for identification.

11. Apply thread sealant (blue Loctite 242, Onan part number 518-0309) to the threads of the interlock bar capscrews. Install the interlock bar and secure to each interlock arm with a hex head capscrew, lock washer, and flat washer. Tighten to 70-75 in-lbs (7.9-8.5 N•m).

12. Attempt to close both sides of the transfer switch. The interlock assembly must hold one side open so that only one side closes at at time.

13. Replace the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 300- to 600-ampere switches. Follow steps 2 through 9 in the *Replacing Actuator* section.

14. Test the switch for proper operation and close the cabinet.

AUXILIARY SWITCH REMOVAL AND REPLACEMENT (300 TO 600 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the auxiliary switch assembly for 300- to 600-ampere switches.

Removing Auxiliary Switch Assembly

1. After disconnecting all sources of AC power, open the transfer switch cabinet door.
2. Loosen and remove the four machine screws that secure the plastic switch cover to the transfer switch, and lift off the cover.
3. Loosen and remove the four machine screws that secure the terminal bracket (Figure 6-15) to the base. Move the terminal bracket to allow access to the base.
4. Remove the control wiring leads from the auxiliary switch terminals (Figure 6-19).
5. Close the transfer switch to the side you are working on and remove the hex head machine screws that secure the auxiliary switch assembly bracket to the base.
6. Lift out the auxiliary switch assembly.
7. Remove the hex head machine screws and nuts that secure the auxiliary switches to the bracket (Figure 6-19) and lift out the auxiliary switches and insulating barriers.

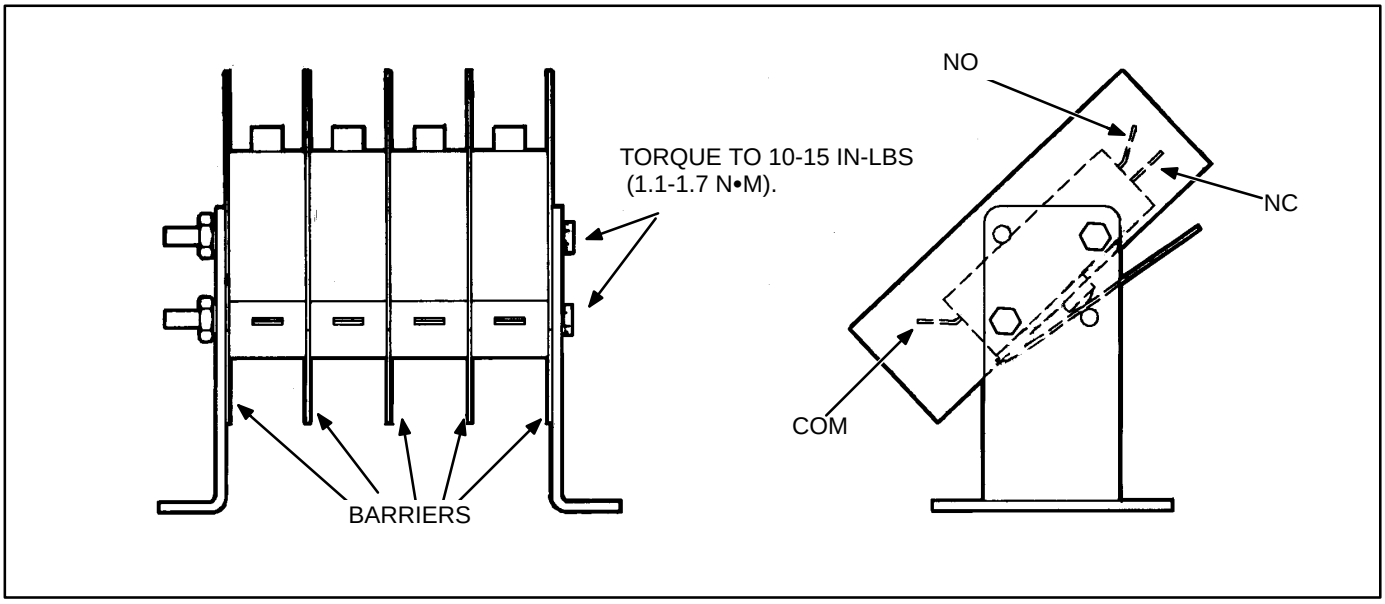


FIGURE 6-19. AUXILIARY SWITCH (300 TO 600 AMPERES)

Replacing Auxiliary Switch Assembly

1. Install the insulating barriers (5) and auxiliary switches (4) in the brackets, and secure with hex head machine screws (2) and nuts (2). Tighten to 10-15 in-lbs (1.1-1.7 N•m). Note that each switch must be assembled so the side with two terminals faces inward (Figures 6-17, 6-18, and 6-19) when the auxiliary switch assembly is installed on the base.

2. Hold the auxiliary switch assembly in position on the base (the side with two terminals must face inward) and secure the bracket to the base with the hex head machine screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m).

3. Install the control wiring leads on the corresponding switch terminals. Leads are marked with the terminal numbers (S2/N0, S5/NC, S7/C, etc..) for identification. Refer to Figures 6-17, 6-18, and 6-19 for identification of the auxiliary switch terminals.

4. Place the terminal bracket in position on the base and secure it with the hex head machine screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m).

5. Place the plastic cover in position and secure with the hex head screws and flat washers. Tighten to 25-30 in-lbs (2.8-3.4 N•m).

6. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

7. Test the transfer switch for proper operation and close the cabinet.

LINEAR ACTUATOR REMOVAL AND REPLACEMENT (800 AND 1000 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the linear actuator for 800- and 1000-ampere switches.

Removing Actuator

1. Open the transfer switch cabinet door.

2. Remove a hex head capscrew, flat washer, and lock washer that secures one of the rod end assemblies to the end of the actuator rod.

3. Remove the rod end assembly (Figure 6-20) and slide the actuator rod out of the actuator motor.

4. Loosen and remove the twelve machine screws (with flat washers) that secure the three plastic switch covers to the switch base, and lift off the switch covers (Figure 6-20).

5. Separate the actuator lead wires from the rest of the wiring harness; remove the wire ties as required.

6. Pry the capacitors loose from the brackets. Remove the end cap and disconnect the red and white actuator lead wires from the capacitor terminals.

7. Disconnect the black actuator lead wire from the circuit breaker and the ground wire from the end of the actuator.

8. Remove the hex head capscrews, flat washers, and lock washers that secure the actuator to the switch assemblies (Figure 6-20) and lift out the spacers and actuator motor.

Replacing Actuator

1. Hold the actuator motor and spacers (4) in position over the switch assemblies with the lead wires at the bottom.

2. Secure the actuator motor to the switch assemblies using hex head capscrews (4), lock washers (4), and flat washers (4). Tighten the capscrews to 70-75 in-lbs (7.9-8.5 N•m).

3. Connect the black actuator lead wire to the circuit breaker, and the red and white actuator lead wires to the following capacitor terminals:

Red Lead	• Capacitor C1, Terminal 1
White Lead	• One capacitor, Capacitor C1, Terminal 2.
	• Two capacitors, Capacitor C2, Terminal 2.

White Lead Wire - Connect to capacitor C2 - Terminal 2.

Transfer switches for voltage ranges 347, 380/416, and 440/480 use two capacitors (C1 and C2) wired together in series. A single jumper wire is placed between terminal 2 on C1 and terminal 1 on C2.

Transfer switches for voltage ranges 115, 190/200, 208, and 220/240 use two capacitors (C1 and C2) wired in parallel. Two jumper wires are used. One is placed between terminal 1 on C1 and terminal 1 on C2. The other is placed between terminal 2 on C1 and terminal 2 on C2.

4. Replace the capacitor end cap(s) and install the capacitor(s) in the bracket(s).

5. Connect ground wire to the end of the actuator. Use wire ties to hold the actuator lead wires in place with the rest of the wiring harness.

6. Place the plastic switch covers in position and secure with machine screws and flat washers. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

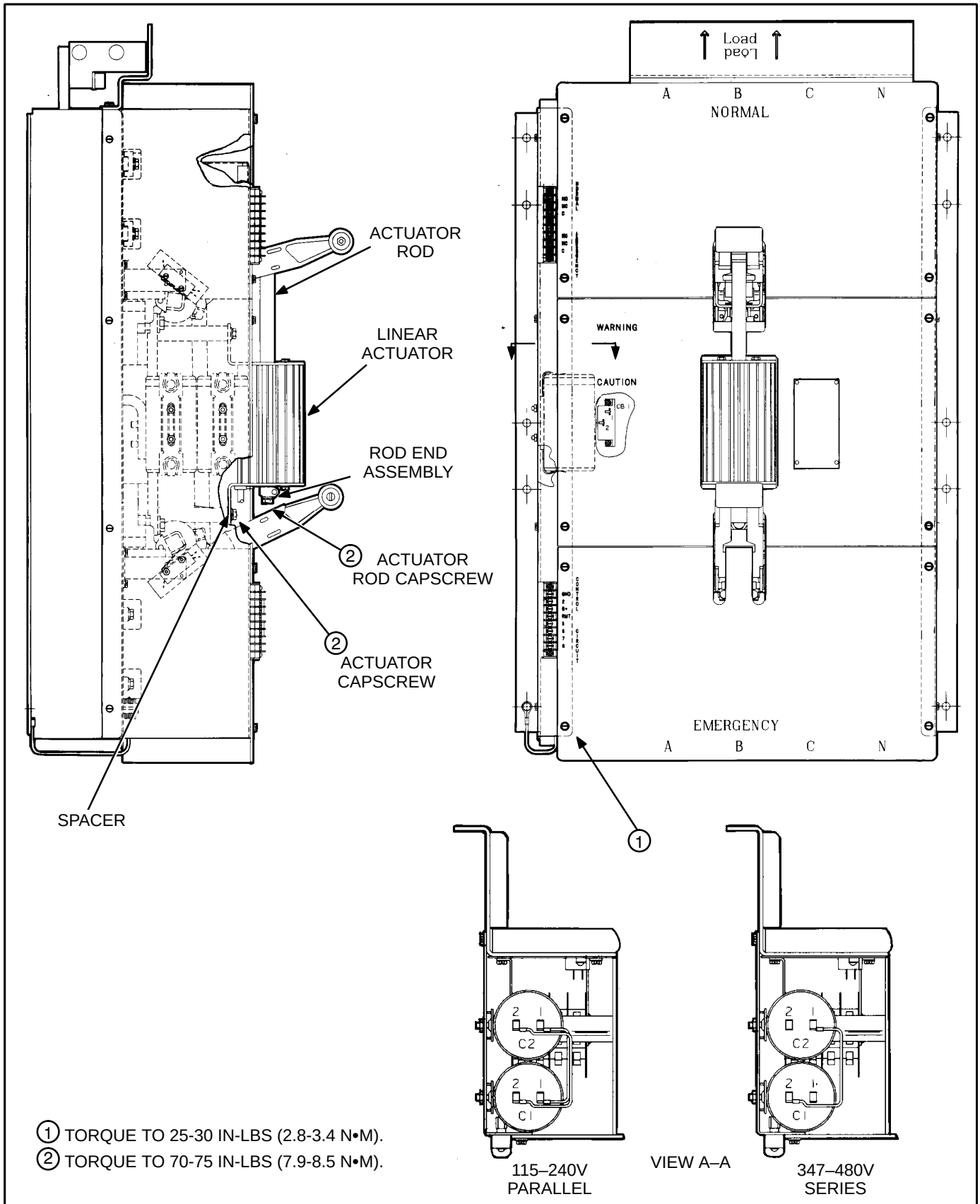


FIGURE 6-20. TRANSFER SWITCH COVER (800 - 1000 AMPERES)

7. Insert the actuator rod into the replacement actuator motor (Figure 6-21). Hold the actuator ground brush up slightly to allow passage of the actuator rod.

8. Secure the rod end assembly to the actuator rod with the hex head capscrew, flat washer, and lock washer. Tighten the capscrew to 70-75 in-lbs (7.9-8.5 N•m). Fit rod assembly into the handle of the closed switch assembly.

9. Check the operation of the transfer switch and the alignment of the actuator rod by manually opening and closing both the Normal and Emergency switch assemblies.

10. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

11. Test the switch for proper operation and close the cabinet.

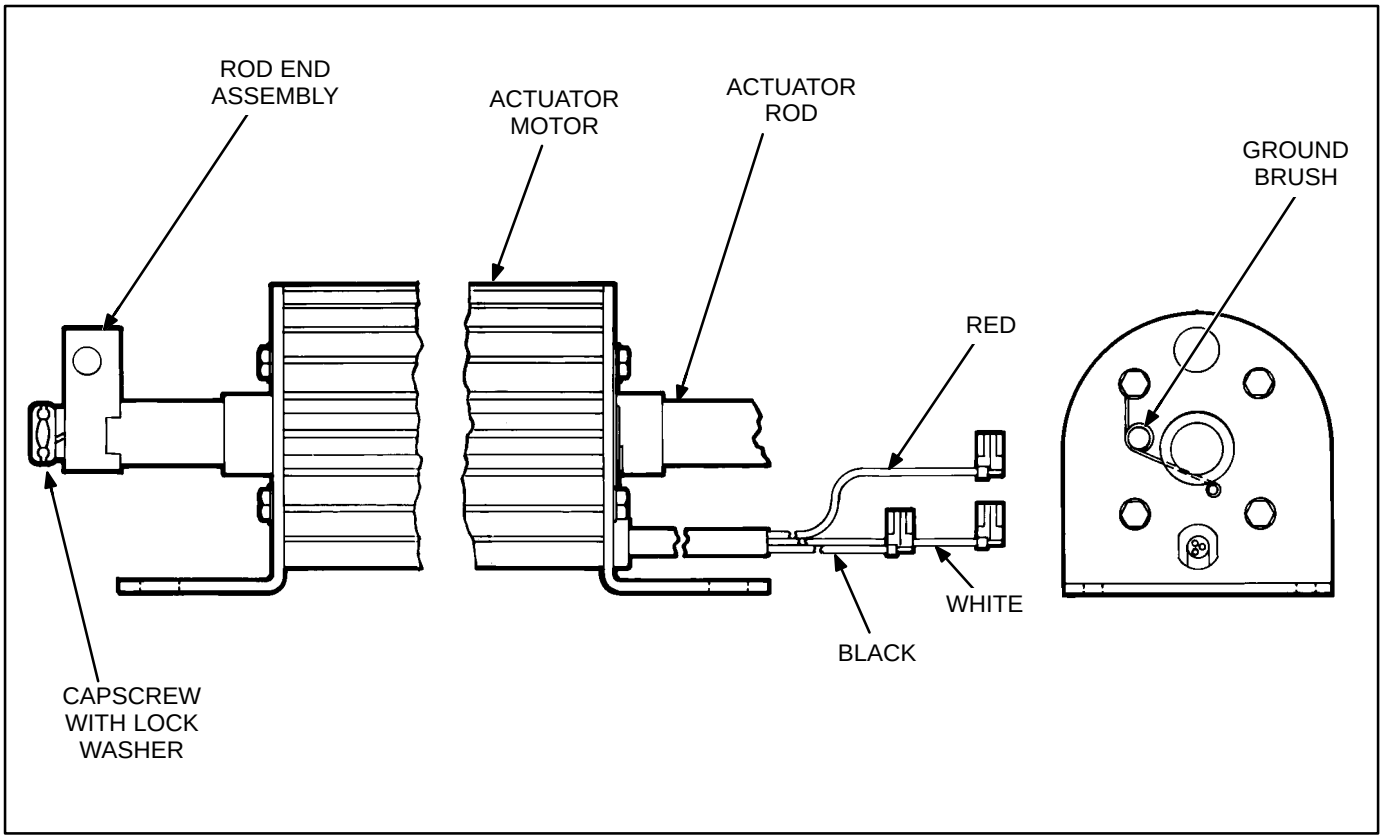


FIGURE 6-21. LINEAR ACTUATOR (800 - 1000 AMPERES)

BLOCK AND CROSS-BAR ASSEMBLY REMOVAL AND REPLACEMENT (800 AND 1000 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the block and cross-bar assemblies for 800- and 1000-ampere switches.

Removing the Block and Cross-bar Assembly (Normal or Emergency)

1. Remove the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 800- and 1000-ampere switches.
2. Lift the arc chute covers off the arc chutes.
3. Remove the hex head capscrews, lock washers, and flat washers that secure the interlock bar to the interlock arm (Figures 6-22 and 6-23); and remove the interlock bar.
4. Disconnect the control wiring leads from the jumper bus bars.
5. Remove hex head capscrews, ring terminals and spring washers that secure jumper bus bars (Figures 6-22 and 6-23) to load bus bars.
6. Remove hex head capscrews, spring washers, and bushings that secure the jumper bus bars to the switch assemblies. Lift off the jumper bus bars. (The neutral pole on the 4-pole switches does not have a bushing at this connection.)
7. Remove the control wiring leads from the power source terminals.
8. Loosen lug terminal screws and remove power source supply wires from the lug terminals.
9. With a screwdriver, dig the glue out of the insulator cups that cover and insulate the block assembly mounting screws.
10. Remove hex head capscrews and flat washers that secure the block assemblies (Figures 6-22 and 6-23) to the base, and lift off the block assemblies (note where spacers are used).

    - On 3-pole switches, the A-phase block on the Normal side and C-phase block on the Emergency side have a spacer under their outer mounting tabs. On 4-pole switches, the A-phase block on the Normal side and neutral block on the Emergency side have this spacer. Make certain that you install new block assemblies with the spacers in their original positions.

    - The block assemblies are not identical. The A- and C-phase blocks, and the neutral block on 4-pole switches, are different from the B-phase block. Refer to parts manual and part numbers stamped on replacement block assemblies to make certain that you install new block assemblies in their correct positions.

11. Remove round machine screws, lock washers, and flat washers that secure arc chutes (Figures 6-22 and 6-23) to block assemblies; and lift out arc chutes, barriers, and spacers. Discard arc chute barriers and spacers.
12. Remove the Allen head capscrews and lug terminals from the block assemblies.
13. Remove the hex head capscrews and flat washers that secure the cross-bar assembly to the base, and lift off the cross-bar assembly.

    ⚠CAUTION ***Use care when removing the block and cross-bar assembly from the base. Carefully disengage the crossbar from the auxiliary switch assembly to avoid cracking the switch.***

14. Remove shoulder screws and self-locking nuts that secure the two halves of the handle assembly together. Remove the shoulder screws and lock washers that secure the handle assembly to the block and cross-bar assembly. Slide the two halves of the handle apart and remove them.
15. Remove the two round head machine screws that secure the interlock arm to the cross-bar assembly, and lift of the interlock arm.

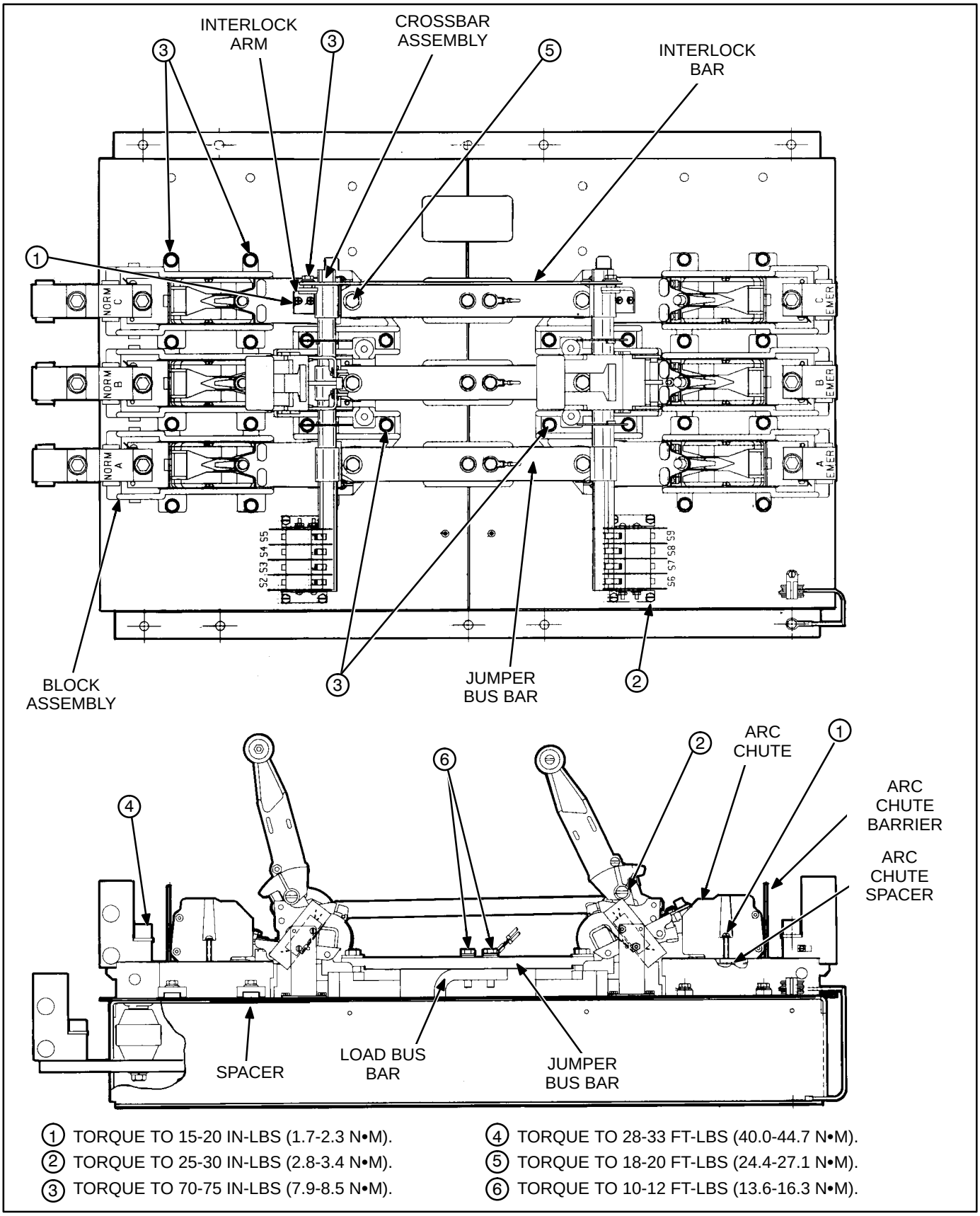


FIGURE 6-22. 3-POLE SWITCH ASSEMBLY (800 - 1000 AMPERES)

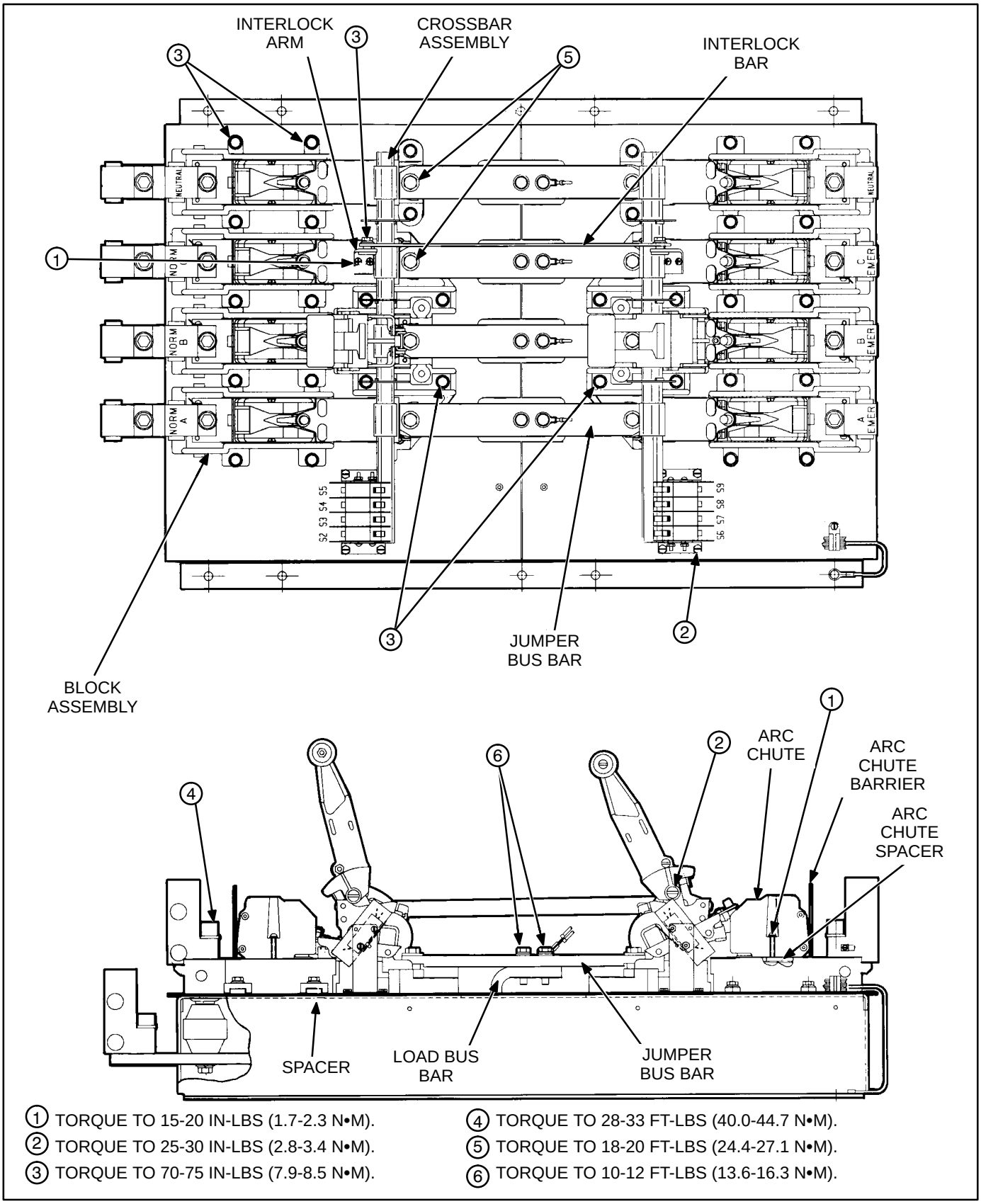


FIGURE 6-23. 4-POLE SWITCH ASSEMBLY (800 - 1000 AMPERES)

Replacing the Block and Cross-bar Assembly (Normal or Emergency)

1. Install the interlock arm on the cross-bar assembly and secure with the round head machine screws. Tighten the screws to 15-20 in-lbs (1.7-2.3 N•m) torque.

2. Apply a thin coat of lubricant (Onan part number 524-0157) to the slot in the handle. Place the handle assembly in position on the switch assembly and secure with the shoulder screws, lock washers, and locknuts. Tighten to 25-30 in-lbs (2.8-3.4 N•m).

3. Secure the cross-bar assembly to the base with the hex head capscrews (4), lock washers (4), and flat washers (4). Tighten to 70-75 in-lbs (7.9-8.5 N•m) torque.

4. Apply a thin coat of glyptol between the arc chute spacers and the arc chute barrier. Place the arc chute spacers (2), arc chute barrier, and arc chute in position on each block assembly; and secure with round head machine screws (2), lock washers (2) and flat washers (2). Tighten to 15-20 in-lbs (1.7-2.3 N•m) torque.

5. Apply a thin coat of electrical joint compound between the mating surfaces of the block assembly and the lug terminals. Install the lug terminals on the block assemblies and secure with the Allen head capscrews. Tighten to 28-33 ft-lbs (40.0-44.7 N•m) torque.

6. Place each block assembly in position on the base and secure with the hex head capscrews and flat washers. Refer to Figures 4-18 and 4-19 to determine where the spacers are required. Tighten the capscrews to 70-75 in-lbs (7.9-8.5 N•m) torque.

    - On 3-pole switches, the A-phase block on the Normal side and the C-phase block on the Emergency side have a spacer under their outer mounting tabs. On 4-pole switches, the A-phase block on the Normal side and the neutral block on the Emergency side have this spacer. Make certain that you install new block assemblies with the spacers in their original positions.

    - The block assemblies are not identical. The A- and C-phase blocks, and the neutral block on 4-pole switches, are different than the B-phase block. Refer to the parts manual and the part numbers stamped on the replacement block assemblies to make certain that you install new block assemblies in their correct positions.

7. Fill the insulator cups that cover and insulate the block assembly mounting screws with adhesive silicone to completely cover the washers and screw heads.

8. Install the power source supply wires and securely tighten the lug terminals to 10-12 ft-lbs (13.6-16.3 N•m) torque.

9. Connect the control wiring leads to the power source terminals. Control wires are marked NORM A,B,C or EMER A,B,C for identification.

10. Apply a thin coat of electric joint compound between the mating surfaces of the jumper bus bars, the braided strap connectors, and load bus bars.

11. Install the jumper bus bars and secure to the switch assemblies with hex head capscrews, spring washers, and bushings. (The neutral pole on 4-pole switches does not have a bushing at this connection.) Tighten to 18-20 ft-lbs (24.4-27.1 N•m) torque.

12. Secure the jumper bus bars to the load bus bars with hex head capscrews, ring terminals, and spring washers. Tighten to 10-12 ft-lbs (13.6-16.3 N•m) torque.

13. Connect the control wiring leads to the jumper bus bars. Control wires are marked LOAD A,B,C for identification.

14. Apply thread sealant (blue Loctite 242, Onan part number 518-0309 is recommended) to the threads of the interlock bar capscrews. Install the interlock bar and secure to each interlock arm with a hex head capscrew, lock washer, and flat washer. Tighten to 70-75 in-lbs (7.9-8.5 N•m).

15. Place the arc chute covers in position over the arc chutes.

16. Attempt to close both sides of the transfer switch. The interlock assembly must hold one side open so that only one side closes at at time.

17. Replace the linear actuator as described in the *Linear Actuator Removal and Replacement* section for 800- and 1000-ampere switches. Follow steps 2 through 10 in the *Replacing Actuator* section.

18. Test the switch for proper operation and close the cabinet.

AUXILIARY SWITCH REMOVAL AND REPLACEMENT (800 AND 1000 AMPERES)

If Source 2 is a genset, set the operation selector switch on the generator control panel to Stop. **Disconnect both Source 1 and Source 2 from the transfer switch**. If there is an external battery charger, disconnect it from AC power. Then disconnect the genset starting battery (negative [–] lead first).

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer switch before servicing.***

The following procedures cover the removal and replacement of the auxiliary switch assembly for 800- and 1000-ampere switches.

Removing Auxiliary Switch Assembly

1. Open the transfer switch cabinet door.

2. Remove the hex head capscrew, flat washer, and lock washer that secures one of the rod end assemblies to the end of the actuator rod.

3. Remove rod end assembly (Figure 6-20) and slide the actuator rod out of the actuator motor.

4. Loosen and remove the twelve machine screws (with flat washers) that secure the three plastic switch covers to the switch base, and lift off the switch covers (Figure 6-20).

5. Remove the hex head machine screws that secure the terminal bracket to the base. Move the bracket to the side to allow access to the auxiliary switch terminals.

6. Remove the control wiring leads from the auxiliary switch terminals (Figure 6-24).

7. Close the transfer switch to the side you are working on and remove the hex head machine screws that secure auxiliary switch assembly brackets to the base. Lift out the auxiliary switch assembly.

8. Remove round head machine screws, flat washers, and nuts that secure the auxiliary switches to bracket (Figure 6-24); and lift out the auxiliary switches and insulating barriers.

Replacing Auxiliary Switch Assembly

1. Install the insulating barriers and auxiliary switches in the brackets and secure with hex head capscrews (2) and nuts (2). Note that each switch must be assembled so the side with two terminals faces inward (Figure 6-24) when the auxiliary switch assembly is installed.

2. Install the auxiliary switch assembly on the base and secure the bracket to the base using the hex head machine screws. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

3. Install control wiring leads on switch terminals. The leads are marked with the terminal numbers (S2/N0, S5/NC, S7/C, etc..) for identification. Refer to figures 6-22, 6-23, and 6-24 for identification of the auxiliary switch terminals.

4. Place terminal bracket in position on base and secure it with the hex head machine screws (4). Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

5. Place the plastic covers in position and secure them with machine screws and flat washers. Tighten to 25-30 in-lbs (2.8-3.4 N•m) torque.

6. Insert the actuator rod into the replacement actuator motor. Hold the actuator ground brush up slightly to allow passage of the actuator rod.

7. Secure the rod end assembly to the actuator rod with the hex head capscrew, flat washer, and lock washer. Tighten capscrew to 70-75 in-lbs (7.9-8.5 N•m). Fit the rod assembly into the handle of the closed switch assembly.

8. If Source 2 is a genset, connect the starting battery (negative [–] lead last). If applicable, connect the battery charger to AC power. **Reconnect Source 1 and Source 2.** Set the operation selector switch to Auto (or Remote).

9. Test the transfer switch for proper operation and close the cabinet.

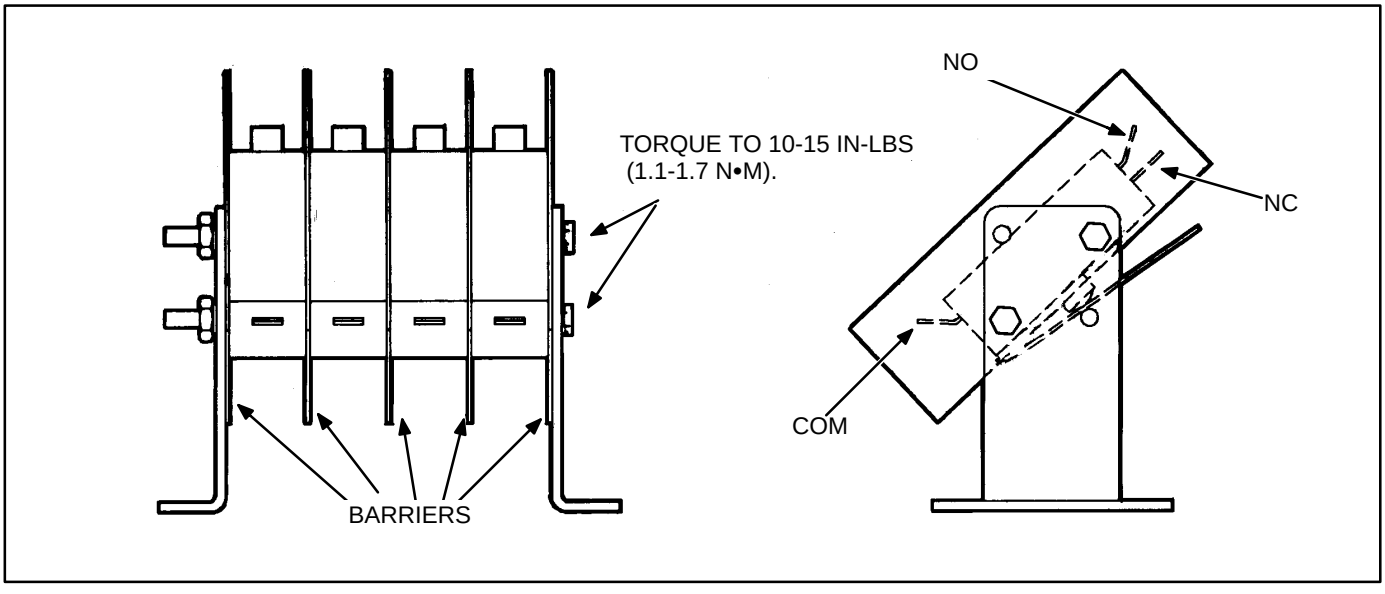


FIGURE 6-24. AUXILIARY SWITCH (800 - 1000 AMPERES)

MIS-WIRED CURRENT TRANSFORMERS

If a current transformer (CT) is installed backwards, you will get erroneous readings (unusual power factor and negative kilowatts).

The shorting bar in terminal block TB4 is removed when the transfer switch is installed. To correct CT wiring without removing power to the transfer switch, the shorting bar must be reinstalled (see Figure 6-25).

⚠CAUTION ***Do not disconnect the current module while the current transformers are energized unless the secondaries are shorted.***

To correct CT mis-wiring,

1. If Source 2 is a genset, set the operation selector switch on the generator control panel to STOP.

2. Open the transfer switch cabinet door.

   ⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.***

3. Remove the protective cover from TB4.

4. Attach the shorting bar to the center of TB4, making sure to tighten each screw.

5. Verify which CT is mis-wired. Reverse the jumper wires on the current module for the mis-wired CT. Do not remove any CT wires from TB4.

6. Once all wiring is properly secured, remove the shorting bar.

7. Reinstall the protective cover on TB4.

8. If Source 2 is a genset, set the operation selector switch on the generator control panel to ON.

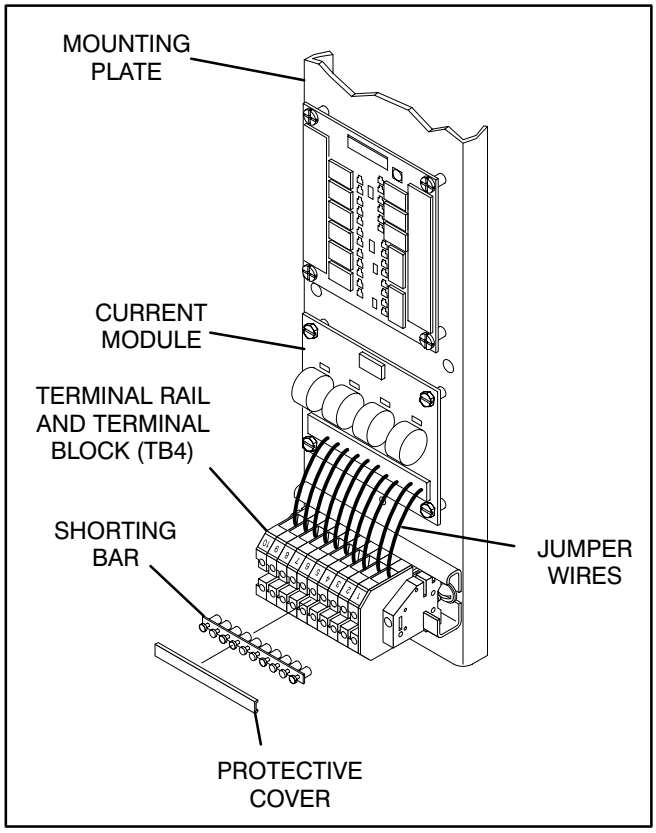


FIGURE 6-25. SHORTING BAR INSTALLATION

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7. Schematics

TABLE 7-1. POWER MODULE 1 AND 2

J12 (POWER MODULES 1 AND 2)		J13 (POWER MODULE 2)
PIN #	**DESCRIPTION**	**DESCRIPTION**
1	N/O close normal	CT N/O contact normal
2	Common voltage feed (not used)	CT N/O contact normal
3		
4	N/O open emergency	
5	Transfer switch S1 (normal) position sensor (gnd)	
6		
7	Transfer switch S2 (Emergency) position sensor (gnd)	
8	Motor disconnect switch input (gnd)	
9		
10	Loop ground for motor disconnect switch	
11	Loop ground for normal/emergency transfer switch position indicators	Bypass switch S1 (normal) position sensor (gnd)
12	Common ground for all control relays	Bypass switch S2 (emergency) position sensor (gnd)
13	Loop ground for normal/emergency bypass position indicators	
14		
15		CT N/O contact emergency
16	Common voltage feed (not used)	CT N/O contact emergency
17	N/O open normal	
18	N/O close emergency	

TABLE 7-2. POWER MODULE 1 & 2 AC POWER CONNECTIONS

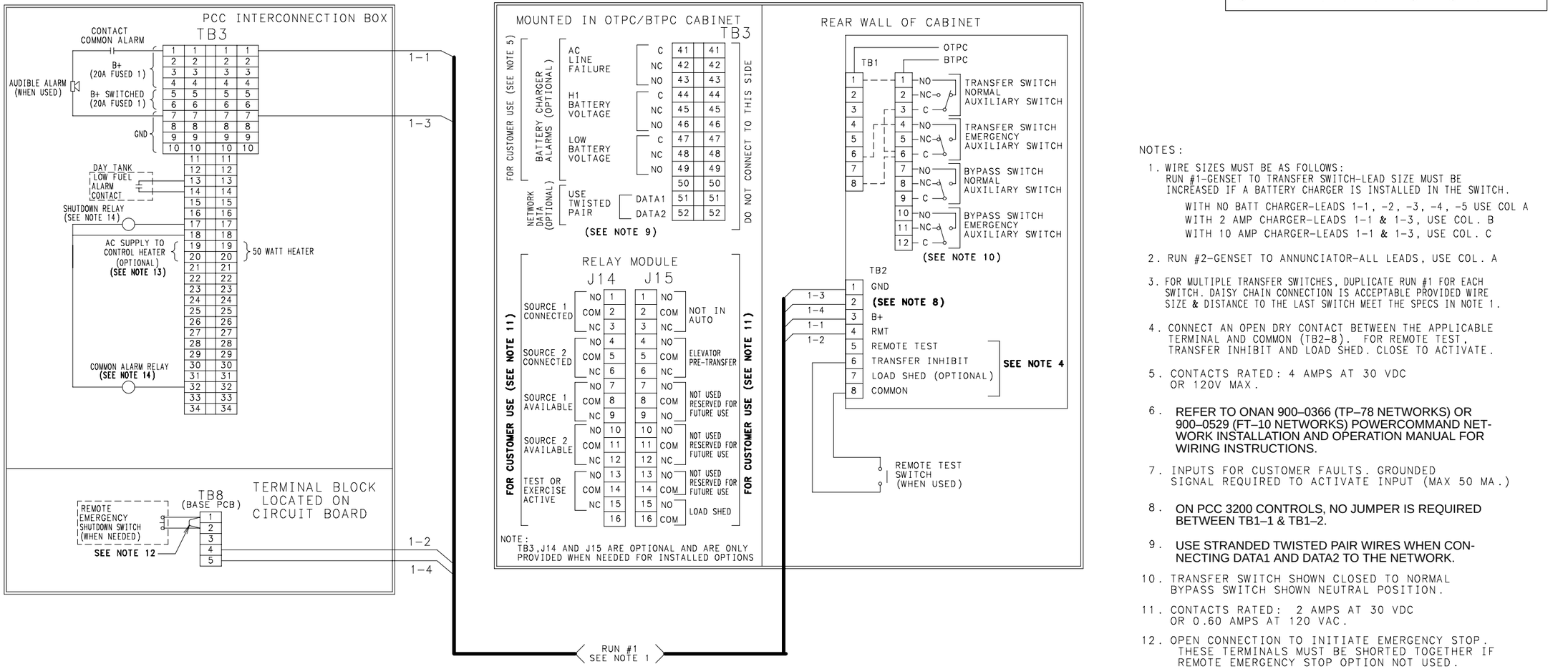
POWER MODULE #1		POWER MODULE #2	
TB#	**LINE CONNECTIONS**	**TB#**	**LINE CONNECTIONS**
TB11-1	“A” Phase	TB11-5	“A” Phase
TB11-4	“B” Phase	TB12-1	“B” Phase
TB11-7	“C” Phase	TB12-4	“C” Phase
TB#	**GENERATOR CONNECTIONS**	**TB#**	**GENERATOR CONNECTIONS**
TB11-8	“A” Phase	TB13-5	“A” Phase
TB11-11	“C” Phase	TB14-1	“B” Phase
		TB14-4	“C” Phase

TABLE 7-3. DIGITAL MODULE LEVEL 1 AND 2

J27 (DIGITAL MODULE LEVEL 1)		J27 (DIGITAL MODULE LEVEL 2)
PIN #	**DESCRIPTION**	**DESCRIPTION**
1	Retransfer inhibit (grounded input)	Retransfer inhibit (grounded input)
2	Remote engine start (gnd) not used	Remote engine start (gnd) not used
3	Remote test (grounded input)	Remote test (grounded input)
4	Transfer inhibit (grounded input)	Transfer inhibit (grounded input)
5	Panel lock (grounded input)	Panel lock (grounded input)
6	Engine start #1 relay common	Engine start #1 relay common
7	Test #1 start (gnd) not used	Test #1 start (gnd)
8	Engine start #1 relay N/C	Engine start #1 relay N/C
9	Generator #1 alarm (gnd) not used	Generator #1 alarm (gnd)
10	Engine start #1 relay N/O not used	Engine start #1 relay N/O
11	Terminal block common ground	Terminal block common ground
12	Ground	Ground
13	Load shed (grounded input)	Load shed (grounded input)
14		Test #2 start (gnd)
15		Synch enable
16		Engine start #2 common
17		Generator #2 alarm (gnd)
18		Engine start #2 relay N/C
19		Standby start
20		Engine start #2 relay N/O
21	B+ input	B+ input
22	Ground	Ground
23	Battery charge input	Battery charge input
24	Not used	Not used

ONAN/CUMMINS GENERATOR SET WITH PCC 3200 CONTROL

OTPC & BTPC UTILITY TO GENSET



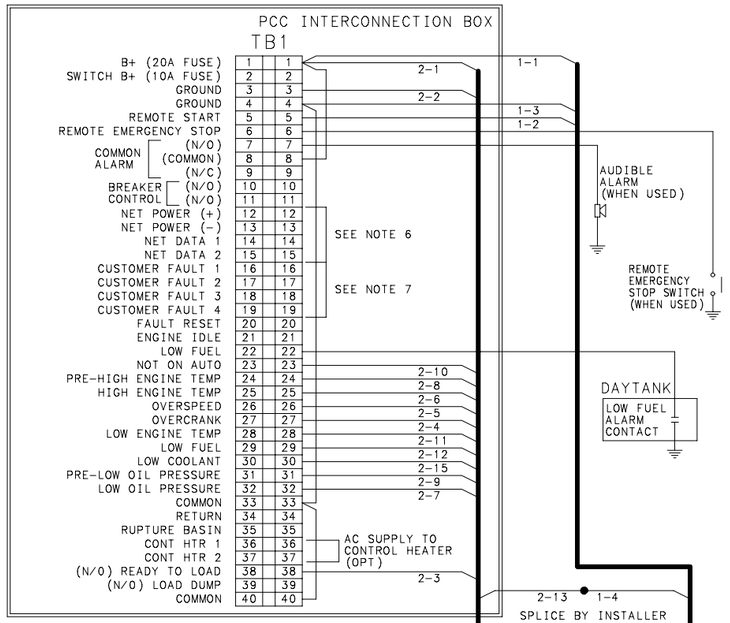
WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

NOTES:

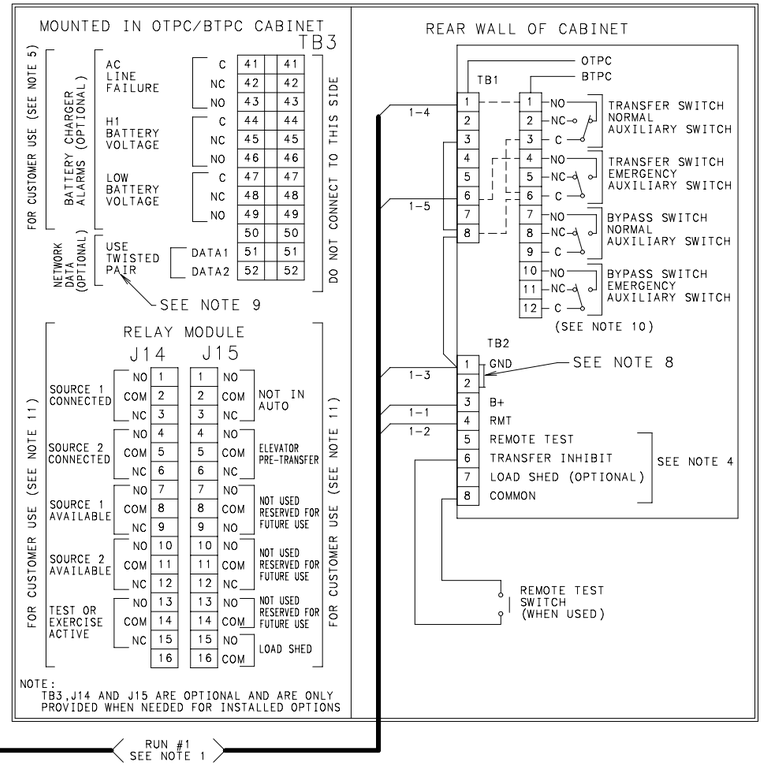
1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-1, -2, -3, -4, -5 USE COL A
   WITH 2 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. B
   WITH 10 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. C
2. RUN #2-GENSET TO ANNUNCIATOR-ALL LEADS, USE COL. A
3. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
4. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
5. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
6. REFER TO ONAN 900–0366 (TP–78 NETWORKS) OR 900–0529 (FT–10 NETWORKS) POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL FOR WIRING INSTRUCTIONS.
7. INPUTS FOR CUSTOMER FAULTS. GROUNDED SIGNAL REQUIRED TO ACTIVATE INPUT (MAX 50 MA.)
8. ON PCC 3200 CONTROLS, NO JUMPER IS REQUIRED BETWEEN TB1–1 & TB1–2.
9. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
10. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN NEUTRAL POSITION.
11. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.
12. OPEN CONNECTION TO INITIATE EMERGENCY STOP. THESE TERMINALS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP OPTION NOT USED.
    THE JUMPER SHOWN BETWEEN TB8–1 AND TB8–2 IS NOT SUPPLIED WITH UNIT.
13. 120VAC OR 240VAC AT 50W.
14. CUSTOMER SUPPLIED EITHER 12 OR 24VDC RELAYS OUTPUT SIGNAL 20ma @ 24VDC MAX.

TYPICAL INTERCONNECTION DIAGRAM (SHEET 1 OF 6)

ONAN/CUMMINS GENERATOR SET WITH PCC 3100 CONTROL



OTPC & BTPC UTILITY TO GENSET



WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

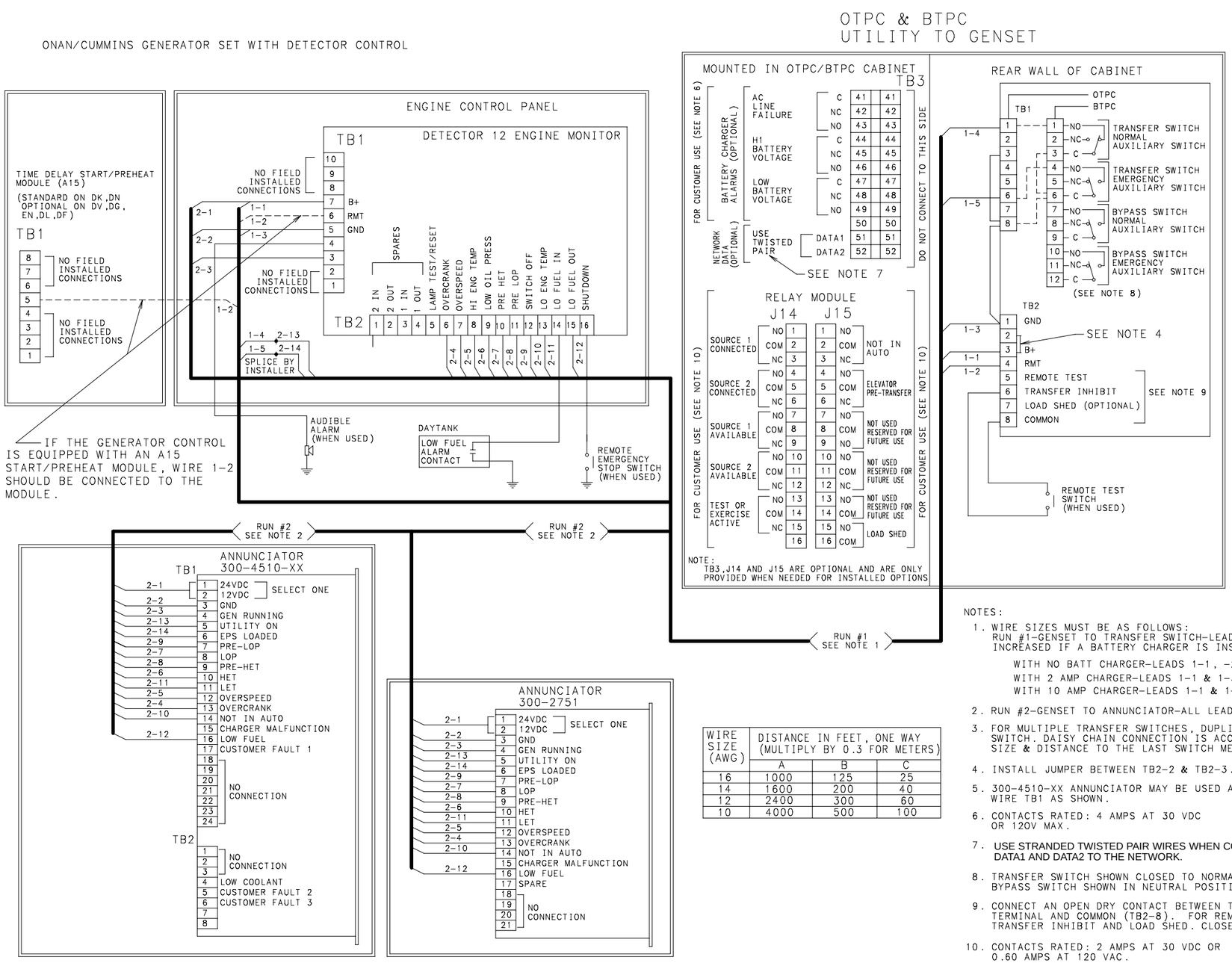
NOTES:

1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1–GENSET TO TRANSFER SWITCH–LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER–LEADS 1–1, –2, –3, –4, –5 USE COL A.
   WITH 2 AMP CHARGER–LEADS 1–1 & 1–3, USE COL. B
   WITH 10 AMP CHARGER–LEADS 1–1 & 1–3, USE COL. C
2. RUN #2–GENSET TO ANNUNCIATOR–ALL LEADS, USE COL. A
3. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
4. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2–8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
5. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
6. REFER TO ONAN 900–0366 (TP–78 NETWORKS) OR 900–0529 (FT–10 NETWORKS) POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL FOR WIRING INSTRUCTIONS.
7. INPUTS FOR CUSTOMER FAULTS. GROUNDED SIGNAL REQUIRED TO ACTIVATE INPUT (MAX 50 MA.)
8. INSTALL JUMPER BETWEEN TB1–1 & TB1–2 FOR SETS WITH PCC 3100 CONTROL.
9. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
10. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN NEUTRAL POSITION.
11. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.

T S S S T T
S T T
S T T T S T
T T S
S T T T S S T

N 63 1 4 S 2 6
R DM S R
M 22

TYPICAL INTERCONNECTION DIAGRAM (SHEET 2 OF 6)



WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

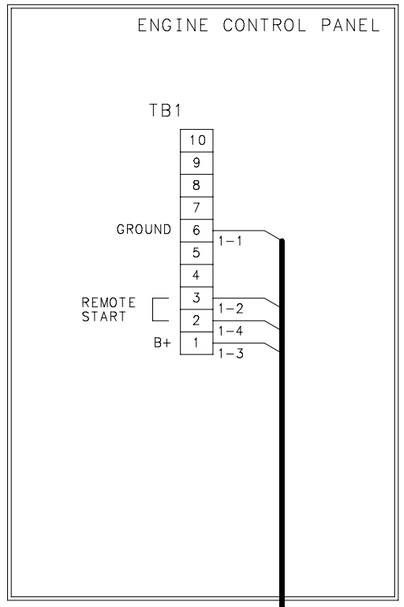
NOTES:

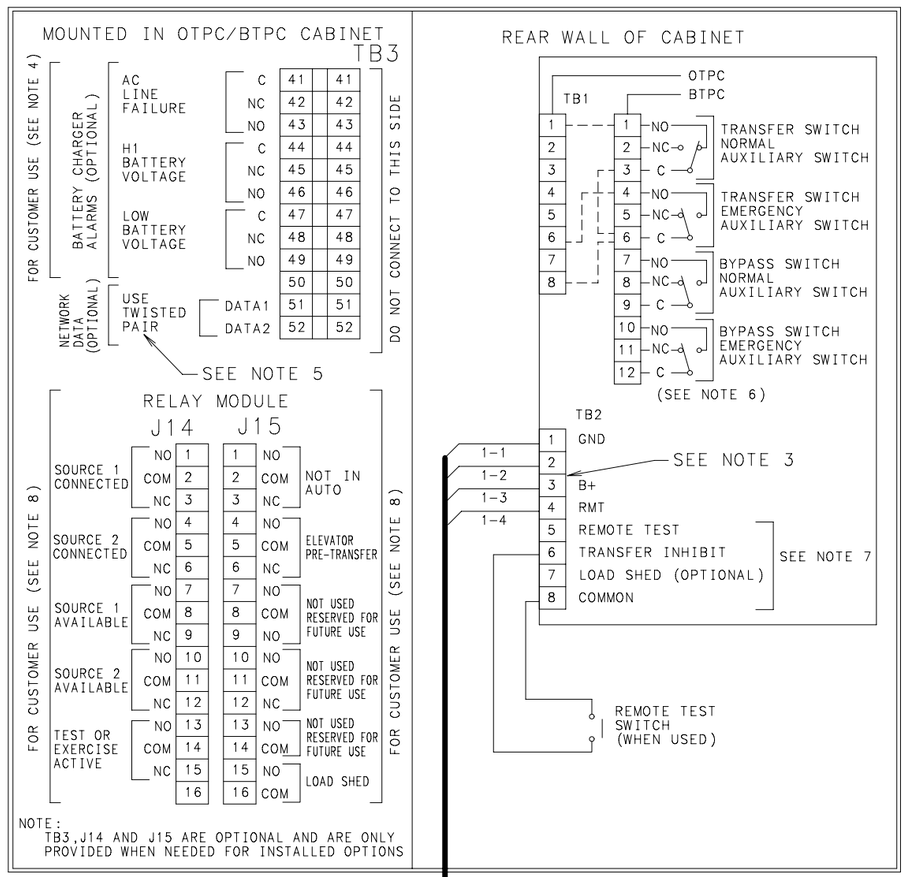
1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-1, -2, -3, -4, -5 USE COL. A
   WITH 2 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. B
   WITH 10 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. C
2. RUN #2-GENSET TO ANNUNCIATOR-ALL LEADS, USE COL. A
3. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
4. INSTALL JUMPER BETWEEN TB2-2 & TB2-3.
5. 300-4510-XX ANNUNCIATOR MAY BE USED ALSO. WIRE TB1 AS SHOWN.
6. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
7. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
8. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN IN NEUTRAL POSITION.
9. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
10. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.

TYPICAL INTERCONNECTION DIAGRAM (SHEET 3 OF 6)

OTPC & BTPC
UTILITY TO GENSET

ONAN/CUMMINS GENERATOR SET
SERIES GGDB ALL SPECS, GN SPEC B, DN SPEC B WITH TWO WIRE CONTROL





WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

NOTES:

1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-2, -4 USE COL. A
   WITH 2 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. B
   WITH 10 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. C
2. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
3. DO NOT INSTALL JUMPER BETWEEN TB2-2 & TB2-3 OR BETWEEN TB2-2 & TB2-1.
4. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
5. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
6. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN IN NEUTRAL POSITION.
7. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
8. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.

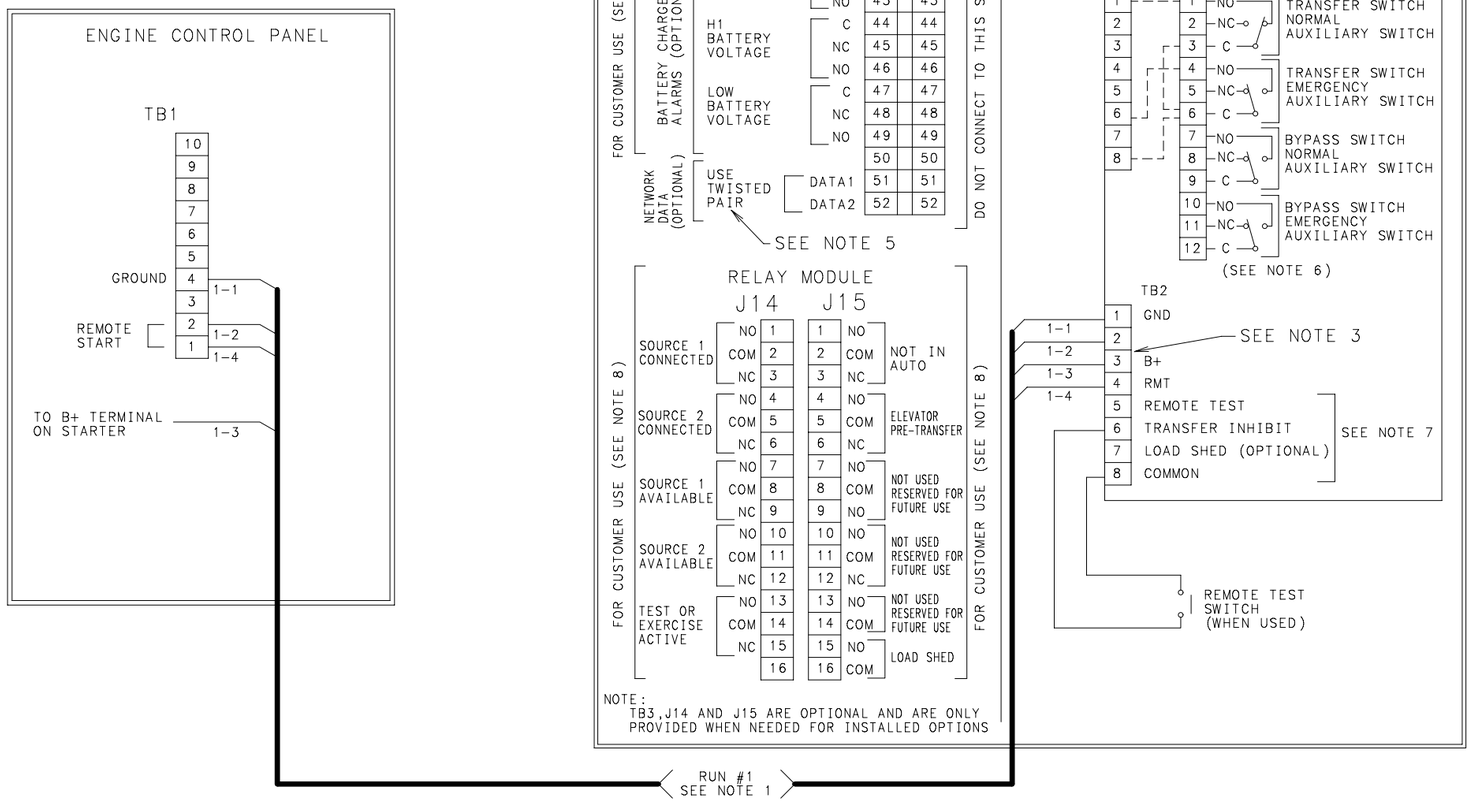
N 63 1 4 S 4 6
R D M S R
M 22

TYPICAL LEVEL 2 INTERCONNECTION DIAGRAM (SHEET 4 OF 6)

OTPC & BTPC
UTILITY TO GENSET

ONAN/CUMMINS GENERATOR SET

SERIES GN SPEC A,DN SPEC A WITH TWO WIRE CONTROL



WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

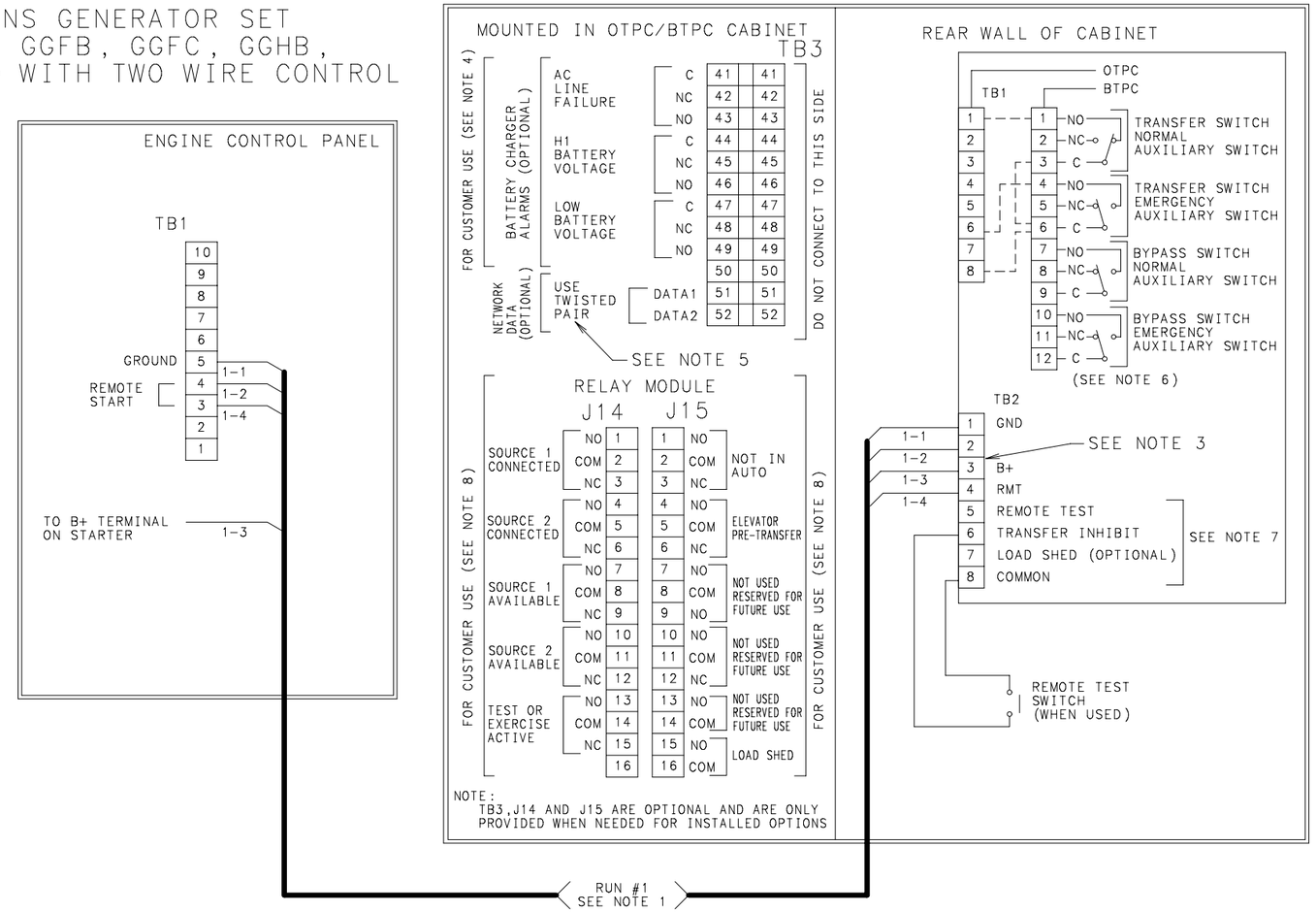
NOTES:

1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-2, -4 USE COL. A
   WITH 2 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. B
   WITH 10 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. C
2. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
3. DO NOT INSTALL JUMPER BETWEEN TB2-2 & TB2-3 OR BETWEEN TB2-2 & TB2-1.
4. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
5. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
6. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN IN NEUTRAL POSITION.
7. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
8. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.

TYPICAL INTERCONNECTION DIAGRAM (SHEET 5 OF 6)

ONAN/CUMMINS GENERATOR SET SERIES DG, GGFB, GGFC, GGHB, GGHC, GGHD WITH TWO WIRE CONTROL

OTPC & BTPC UTILITY TO GENSET



WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4000	500	100

NOTES:

1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-2, -4, USE COL. A
   WITH 2 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. B
   WITH 10 AMP CHARGER-LEADS 1-1 & 1-3, USE COL. C
2. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
3. DO NOT INSTALL JUMPER BETWEEN TB2-2 & TB2-3 OR BETWEEN TB2-2 & TB2-1.
4. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
5. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
6. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN IN NEUTRAL POSITION.
7. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
8. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.

N 63 1 4 S 6 6
R D M S R
M 22

TYPICAL INTERCONNECTION DIAGRAM (SHEET 6 OF 6)

CUSTOMER CONNECTIONS

AUXILIARY CONTACTS

MOUNTED ON FRONT OF TRANSFER SWITCH. AVAILABLE ON ALL UNITS.

TRANSFER SWITCH NORMAL AUXILIARY SWITCH: NO, NC, COM

TB1: 1 NO — S2 — C; 2 NC; 3 COM — ATS-N

TRANSFER SWITCH EMERGENCY AUXILIARY SWITCH: NO, NC, COM

TB1: 6 NO — S6 — C; 7 NC; 8 COM — ATS-E

FOR CUSTOMER USE

TRANSFER SWITCH AUXILIARY CONTACTS RATED: 10 AMPS, 250 VAC

UTILITY TO GENERATOR

TO ENGINE GENERATOR CONTROL

REFER TO THE INTERCONNECTION DRAWING FOR PROPER INSTALLATION OF WIRING AND IF NEEDED, JUMPER LOCATION, BETWEEN THE GENSET CONTROL AND TRANSFER SWITCH.

ON PARALLELING SYSTEMS. REFER TO SYSTEM INTERCONNECTION DRAWING FOR CORRECT WIRING.

TB2: 1 GND; 2 (P2-9 » J2-9); 3 B+ (P2-8 » J2-8, P6-1 » TO BATTERY CHARGER); 4 RMT (P2-7 » J2-7)

J27-6 — K10 — GENSET START — J27-8

FOR CUSTOMER USE

TO USE REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED CONNECT AN OPEN CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). CLOSE THE CONTACT TO ACTIVATE THE FUNCTION. NOTE THAT LOAD SHED IS OPTIONAL AND MUST BE INSTALLED IN ORDER TO USE.

TB2: 5 REMOTE TEST (P2-6 » J2-6) — J27-3 REMOTE TEST

TB2: 6 XFER INHIBIT (P2-5 » J2-5) — J27-4 TRANSFER INHIBIT

TB2: 7 LOAD SHED (OPTIONAL) (P2-4 » J2-4) — J27-13 LOAD SHED

TB2: 8 COMMON (P2-10 » J2-10) — J27-12 COMMON

DIGITAL MODULE 2

UTILITY TO UTILITY

TB2: 1 (P2-9 » J2-9); 2; 3 (P2-8 » J2-8, P6-1 » TO BATTERY CHARGER); 4 (P2-7 » J2-7)

J27-6 — K10 — GENSET START — J27-8

FOR CUSTOMER USE

TO USE REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED CONNECT AN OPEN CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). CLOSE THE CONTACT TO ACTIVATE THE FUNCTION. NOTE THAT LOAD SHED IS OPTIONAL AND MUST BE INSTALLED IN ORDER TO USE.

TB2: 5 REMOTE TEST (P2-6 » J2-6) — J27-3 REMOTE TEST

TB2: 6 XFER INHIBIT (P2-5 » J2-5) — J27-4 TRANSFER INHIBIT

TB2: 7 LOAD SHED (OPTIONAL) (P2-4 » J2-4) — J27-13 LOAD SHED

TB2: 8 COMMON (P2-10 » J2-10) — J27-12 COMMON

DIGITAL MODULE 2

OPTIONAL: RELAY MODULE

CONTACTS RATED: 2 AMPS AT 30 VDC, 0.60 AMPS AT 120VAC

RELAY MODULE

SOURCE 1 CONNECTED (2)	J14-1 NO	K1	K11	J15-16 NO — LOAD SHED (7)
	J14-2 COM	K1		J15-15 COM
	J14-3 NC	K1	K10	J15-14 NO — FAILED TO CLOSE (10)
SOURCE 2 CONNECTED (2)	J14-4 NO	K2		J15-13 COM
	J14-5 COM	K2	K9	J15-12 NC — NOT USED. RESERVED FOR FUTURE USE.
	J14-6 NC	K2		J15-11 COM
SOURCE 1 AVAILABLE (3)	J14-7 NO	K3	K9	J15-10 NO
	J14-8 COM	K3	K8	J15-9 NC — NOT USED. RESERVED FOR FUTURE USE.
	J14-9 NC	K3		J15-8 COM
SOURCE 2 AVAILABLE (3)	J14-10 NO	K4	K8	J15-7 NO
	J14-11 COM	K4	K7	J15-6 NC — ELEVATOR PRE-TRANSFER (6)
	J14-12 NC	K4		J15-5 COM
TEST OR EXERCISE ACTIVE (4)	J14-13 NO	K5	K7	J15-4 NO
	J14-14 COM	K5	K6	J15-3 NC — NOT IN AUTO (5)
	J14-15 NC	K5		J15-2 COM
	J14-16		K6	J15-1 NO

OPTIONAL: 10 AMP BATTERY CHARGER ALARMS

CONTACTS RATED: 4 AMPS AT 30 VDC OR 120VAC MAX

TB3 — 10 AMP BATTERY CHARGER ALARMS J2-1

AC LINE FAILURE SIGNAL (2)	COM	41	J2-1
	NC	42	J2-2 K1
	NO	43	J2-4 K1
HI BATTERY VOLTAGE SIGNAL (8)	COM	44	J2-5
	NC	45	J2-7 K2
	NO	46	J2-6 K2
LO BATTERY VOLTAGE SIGNAL (9)	COM	47	J2-9
	NC	48	J2-10 K3
	NO	49	J2-8 K3

50

OPTIONAL: NETWORK MODULE

USE TWISTED PAIR

NETWORK DATA: DATA 1 — 51 — J30-1 DATA 1; DATA 2 — 52 — J30-1 DATA 2

NETWORK MODULE

OPTIONAL: RETRANSFER INHIBIT

CONNECT A JUMPER OR A CLOSED CONTACT BETWEEN TB3-53 AND TB3-54 TO INHIBIT RETRANSFER.

RETRANSFER INHIBIT: 53, 54 — J27-1 RETRANSFER INHIBIT

DIGITAL MODULE

T S S S T T
S T T
S T T T S T
T T S
S T T T S S T

NOTES:

1. TB1 AND TB2 ARE MOUNTED ON THE FRONT OF THE TRANSFER SWITCH. TB3 IS MOUNTED ON THE LEFT INSIDE PANEL OF THE ENCLOSURE.
2. SHOWN WITH SOURCE NOT CONNECTED.
3. SHOWN WITH SOURCE NOT AVAILABLE.
4. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING TEST OR EXERCISE PERIOD.
5. SHOWN WITH CONTROL IN AUTOMATIC MODE. CONTACTS CHANGE STATE WHEN CONTROL IS NOT IN AUTO.
6. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE FOR AN ADJUSTABLE TIME BEFORE LOAD TRANSFER OCCURS.
7. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING LOAD SHED.
8. SHOWN UNDER NORMAL BATTERY VOLTAGE CONDITION. CONTACTS TRANSFER UNDER A HIGH BATTERY VOLTAGE CONDITION.
9. SHOWN UNDER A LOW BATTERY VOLTAGE CONDITION.
10. SEE SHEET 2.
11. SEE SHEET 2.
12. SEE SHEET 2.
13. SEE SHEET 4.
14. SEE SHEET 4.
15. SEE SHEET 5.
16. SEE SHEET 5.
17. SEE SHEET 5.

(D2) 18. SHOWN NOT ACTIVE, CONTACT CHANGES STATE DURING A FAILED TO TRANSFER OR FAILED TO RETRANSFER EVENT.

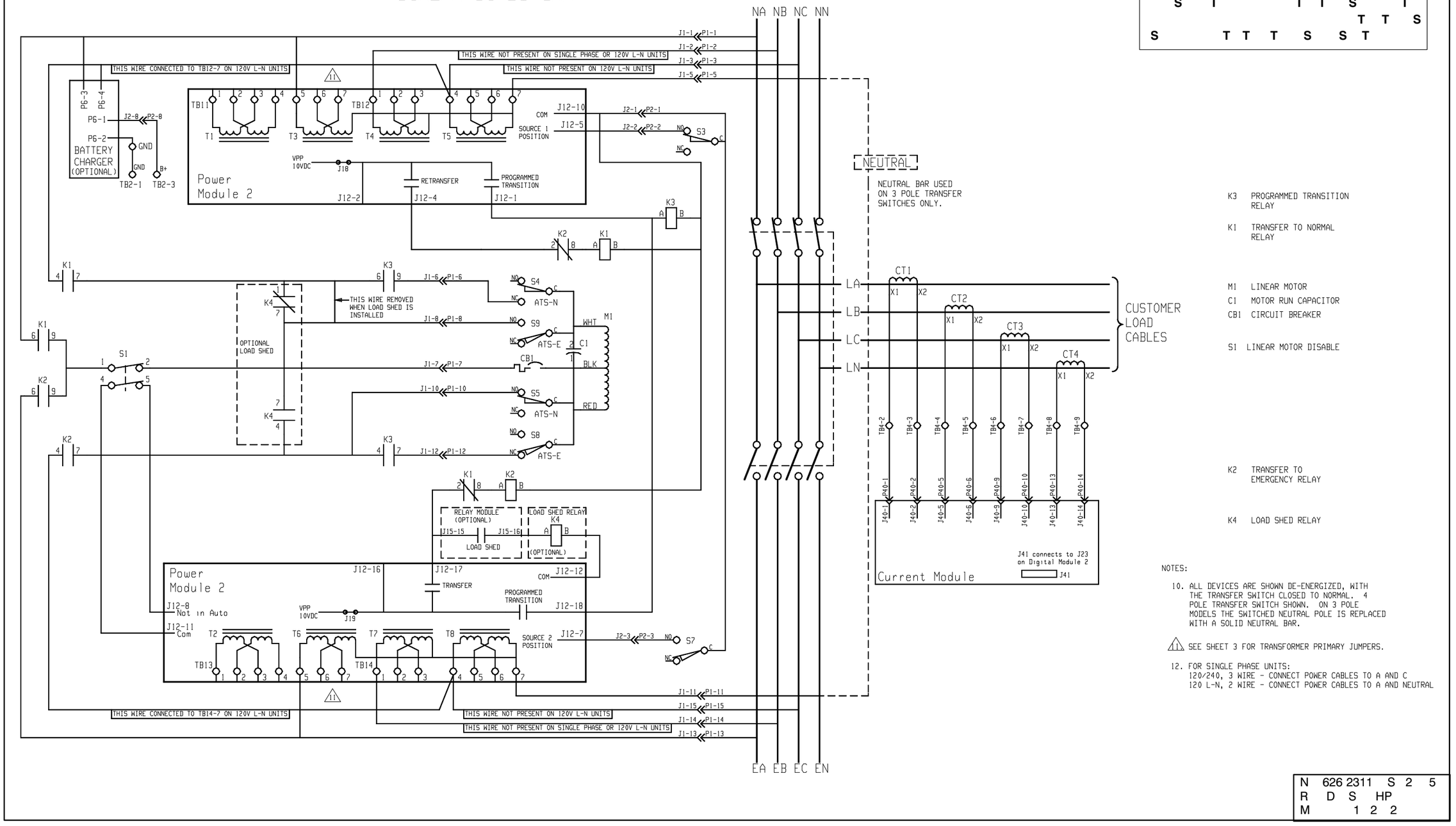
LEVEL 2 CONTROL
DISPLAY MODULE
3 AND 4 POLE
40-600 AMP
120 VOLT 1 PHASE L-N
240 VOLT 1 PHASE
190 VOLT 3 PHASE
208 VOLT 3 PHASE
220 VOLT 3 PHASE
240 VOLT 3 PHASE
380 VOLT 3 PHASE
415 VOLT 3 PHASE
440 VOLT 3 PHASE
480 VOLT 3 PHASE

OPTIONS:
NETWORK MODULE
LOAD SHED
RELAY MODULE
BAR GRAPH
LOAD CURRENT MODULE
BATTERY CHARGER
BATTERY CHARGER ALARMS
RETRANSFER INHIBIT

N 626 2311 S 1 5
R D S HP
M 1 2 2

TYPICAL LEVEL 2 WIRING DIAGRAM (SHEET 1 OF 5)

SCHEMATIC DIAGRAM



NOTES:

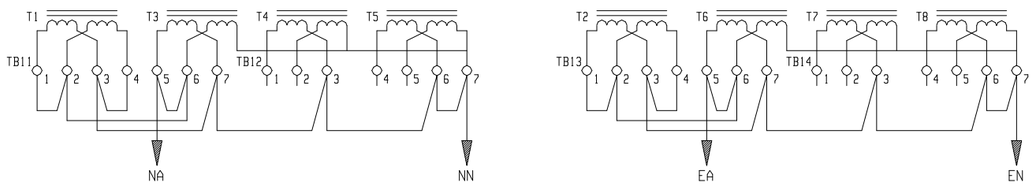
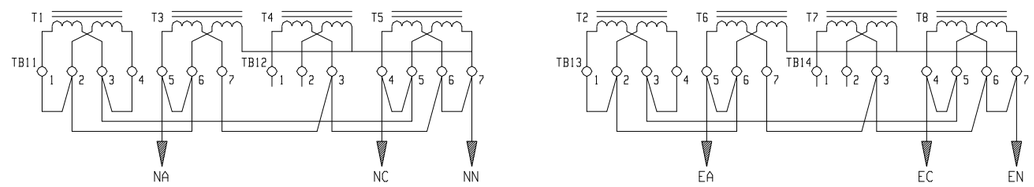
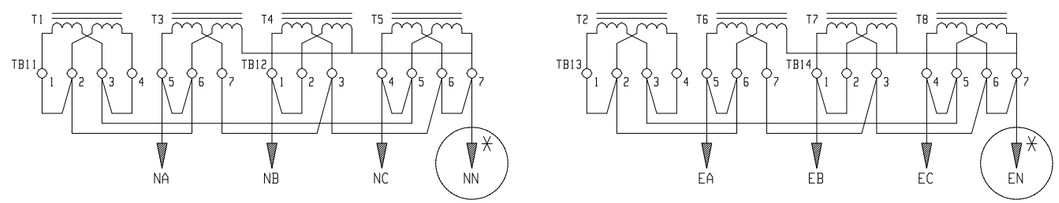
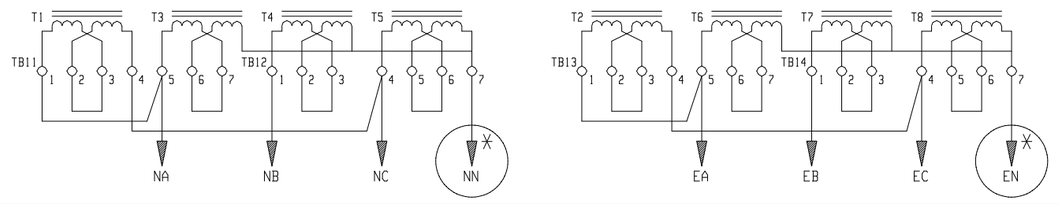
10. ALL DEVICES ARE SHOWN DE-ENERGIZED, WITH THE TRANSFER SWITCH CLOSED TO NORMAL. 4 POLE TRANSFER SWITCH SHOWN. ON 3 POLE MODELS THE SWITCHED NEUTRAL POLE IS REPLACED WITH A SOLID NEUTRAL BAR.

⚠11 SEE SHEET 3 FOR TRANSFORMER PRIMARY JUMPERS.

12. FOR SINGLE PHASE UNITS:
    120/240, 3 WIRE - CONNECT POWER CABLES TO A AND C
    120 L-N, 2 WIRE - CONNECT POWER CABLES TO A AND NEUTRAL

N 626 2311 S 2 5
R D S HP
M 1 2 2

TYPICAL LEVEL 2 WIRING DIAGRAM (SHEET 2 OF 5)

LINE TO LINE VOLTAGE	POWER MODULE 2 FACTORY TRANSFORMER CONNECTIONS
120 VAC L-N 2 WIRE	
240 VAC 1 PHASE 3 WIRE	
190-240 VAC 3 PHASE 4 WIRE	
380-480 VAC 3 PHASE 4 WIRE	

SEE 0626-2312 FOR 600 VOLT CONNECTIONS.

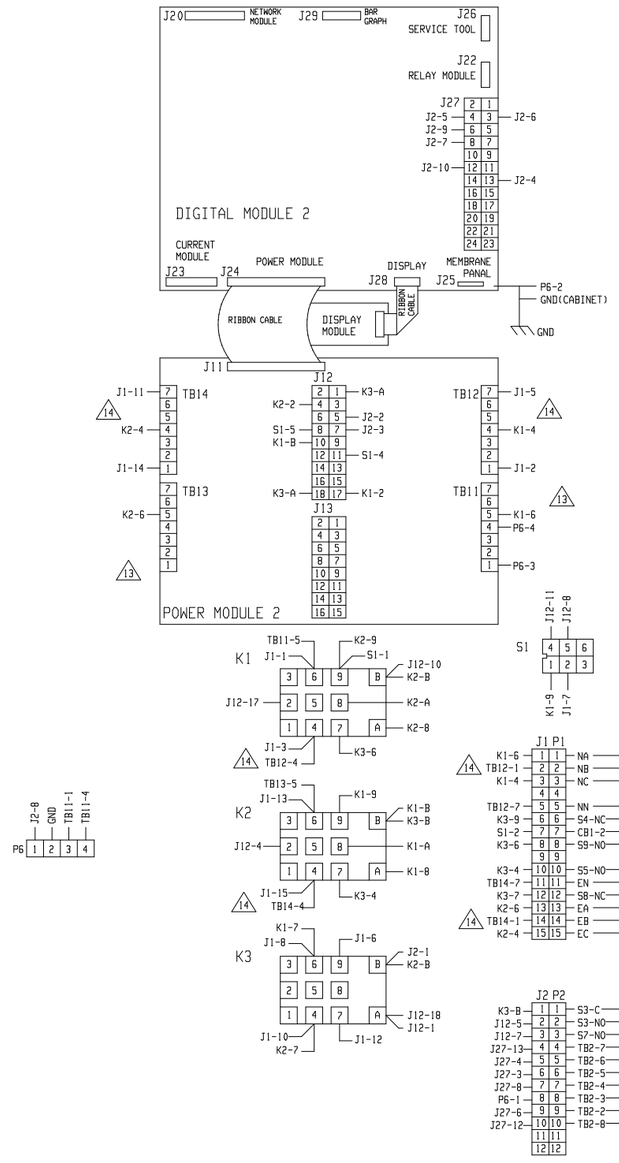
*CONNECTIONS FOR SPECIAL WYE AND DELTA APPLICATIONS	
APPLICATION	POWER MODULE WIRING CHANGES
4-WIRE, 3-PHASE WYE WITH GROUNDED NEUTRAL	NO WIRING CHANGES NECESSARY THIS IS THE FACTORY CONFIGURATION
3-WIRE, 3-PHASE DELTA OR WYE WITH NO NEUTRAL OR UNGROUNDED NEUTRAL	1. DISCONNECT THE NEUTRAL SENSING WIRES FROM TB12-7 & TB14-7 ON THE POWER MODULE.
4-WIRE, 3-PHASE DELTA WITH GROUNDED NEUTRAL OR 3-WIRE, 3 PHASE DELTA WITH A GROUNDED CORNER.	1. DISCONNECT THE NEUTRAL SENSING WIRES FROM TB12-7 & TB14-7 ON THE POWER MODULE.

TYPICAL LEVEL 2 WIRING DIAGRAM (SHEET 3 OF 5)

STANDARD WIRING

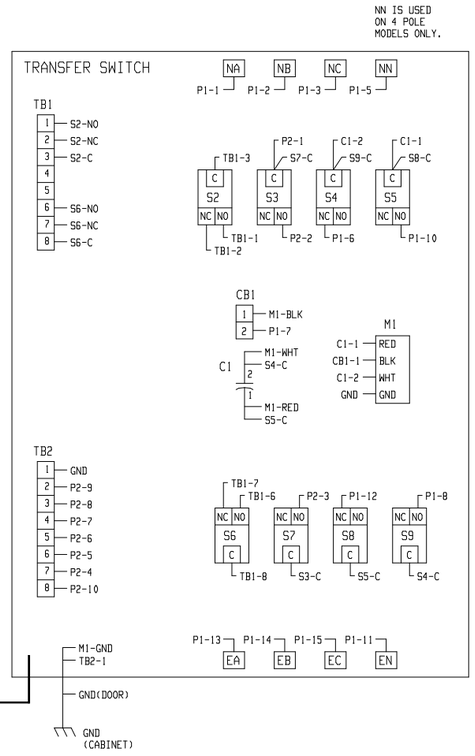
T	S	S				S		T	T														
S			T														T						
		S		T					T	T		S			T								
													T	T		S							
S					T	T		T		S		S	T										

REAR VIEW OF DOOR



LEFT SIDEWALL

REAR WALL OF CABINET



NEUTRAL BAR IS USED ON 3 POLE MODELS ONLY.

NOTES:

13. SEE SHEET 3 FOR TB11, TB12, TB13 AND TB14 JUMPER CONNECTIONS.

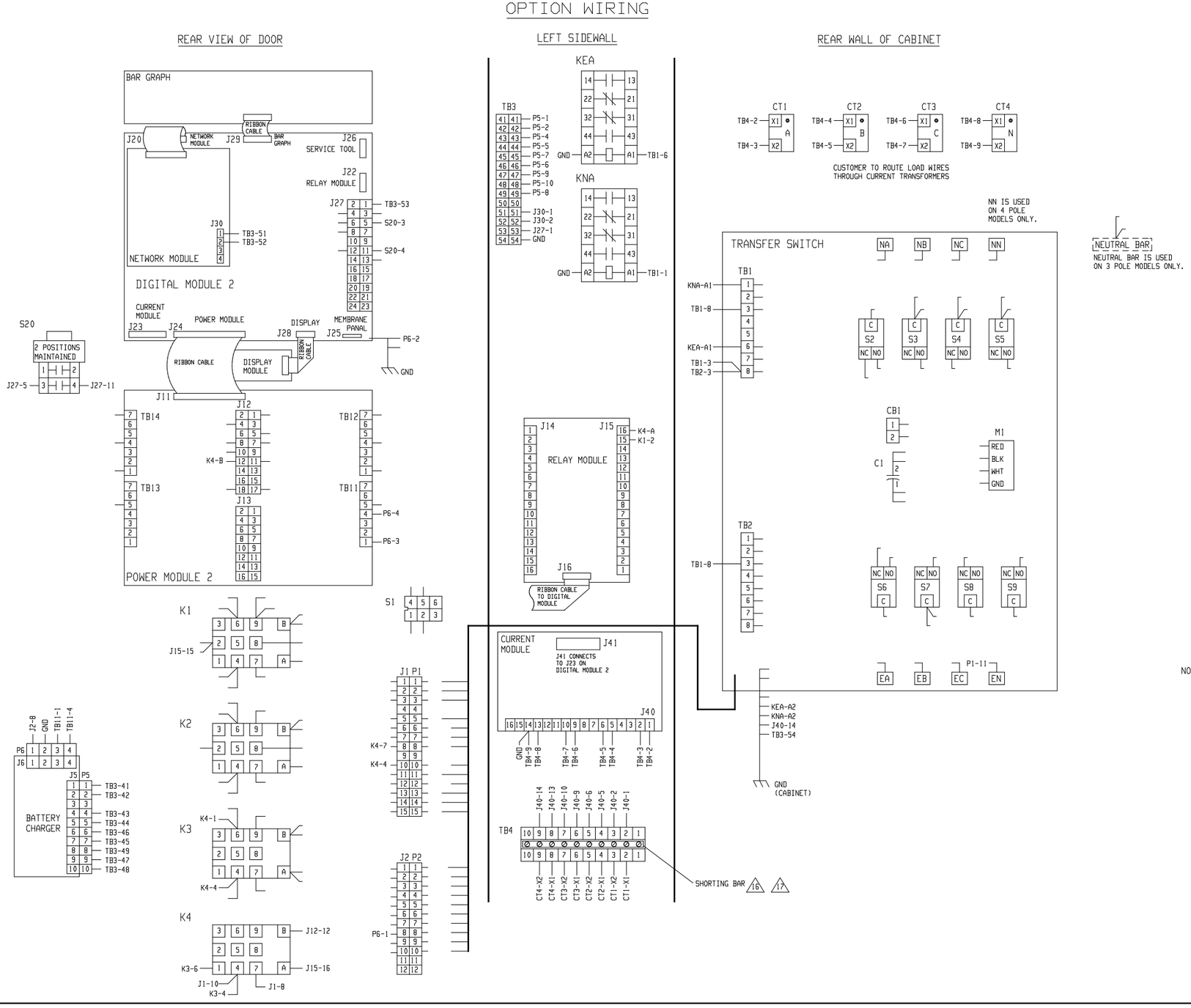
14. ON ALL SINGLE PHASE, 2 OR 3-WIRE UNITS: THE WIRES CONNECTED FROM J1-2 TO TB12-1 AND FROM J1-14 TO TB14-1 ARE NOT PRESENT.

IN ADDITION, ON 120 VOLT L-N, 2-WIRE UNITS: THE WIRES CONNECTED FROM J1-3 TO K1-4 AND FROM J1-15 TO K2-4 ARE NOT PRESENT. THE WIRE CONNECTED FROM K1-4 TO TB12-4 WILL BE CONNECTED FROM K1-4 TO TB12-7 AND THE WIRE CONNECTED FROM K2-4 TO TB14-4 WILL BE CONNECTED FROM K2-4 TO TB14-7.

N		6	2	6	2	3	1	1		S	4		5										
R		D		S			HP																
M					1	2	2																

TYPICAL LEVEL 2 WIRING DIAGRAM (SHEET 4 OF 5)

OPTION WIRING



NOTES:

15. WIRING FOR RELAYS KNA AND KEA IS TYPICAL. POWER CONNECTIONS TO COILS MAY VARY SLIGHTLY DEPENDING ON THE NUMBER OF RELAYS INSTALLED.

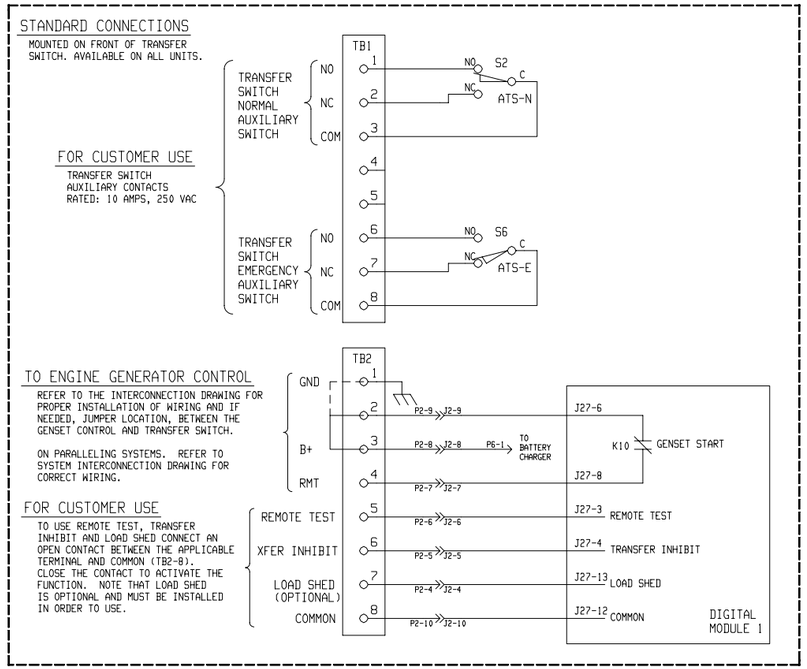
16. CAUTION: DO NOT DISCONNECT THE CURRENT MODULE WHILE THE CURRENT TRANSFORMERS ARE ENERGIZED UNLESS THE SECONDARIES ARE SHORTED. TO SHORT SECONDARIES ATTACH THE SHORTING BAR TO THE CENTER OF TB4 BEING SURE TO TIGHTEN EACH SCREW.

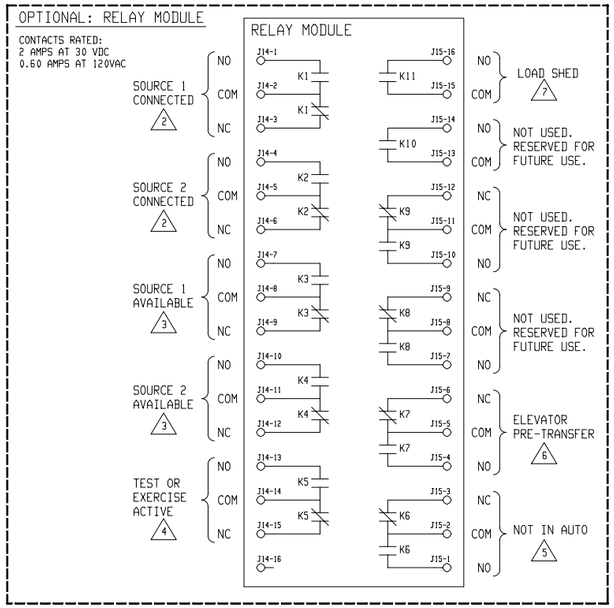
17. THE CURRENT TRANSFORMERS ARE SHORTED DURING SHIPPING. TO ACTIVATE, REMOVE THE SHORTING BAR FROM THE CENTER OF TB4 BY LOOSENING ALL OF THE SCREWS AND LIFTING IT OUT OF THE TERMINAL BLOCK. SAVE FOR REUSE.

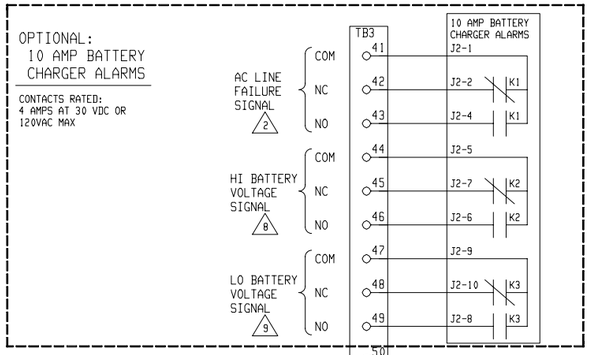
N 626 2311 S 5 5
R D S HP
M 1 2 2

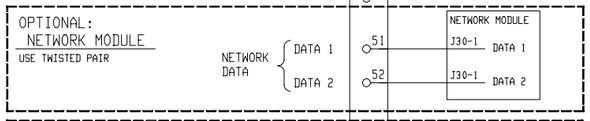
TYPICAL WIRING DIAGRAM (SHEET 5 OF 5)

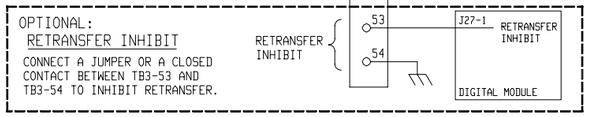
CUSTOMER CONNECTIONS











NOTES:

1. TB1 AND TB2 ARE MOUNTED ON THE FRONT OF THE TRANSFER SWITCH. TB3 IS MOUNTED ON THE LEFT INSIDE PANEL OF THE ENCLOSURE.
2. SHOWN WITH SOURCE NOT CONNECTED.
3. SHOWN WITH SOURCE NOT AVAILABLE.
4. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING TEST OR EXERCISE PERIOD.
5. SHOWN WITH CONTROL IN AUTOMATIC MODE. CONTACTS CHANGE STATE WHEN CONTROL IS NOT IN AUTO.
6. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE FOR AN ADJUSTABLE TIME BEFORE LOAD TRANSFER OCCURS.
7. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING LOAD SHED.
8. SHOWN UNDER NORMAL BATTERY VOLTAGE CONDITION. CONTACTS TRANSFER UNDER A HIGH BATTERY VOLTAGE CONDITION.
9. SHOWN UNDER A LOW BATTERY VOLTAGE CONDITION.
10. SEE SHEET 2.
11. SEE SHEET 2.
12. SEE SHEET 2.
13. SEE SHEET 4.
14. SEE SHEET 4.
15. SEE SHEET 5.

UTILITY TO GENSET
LEVEL 1 CONTROL
3 AND 4 POLE
40-600 AMP
120 VOLT 1 PHASE L-N
240 VOLT 1 PHASE
190 VOLT 3 PHASE
208 VOLT 3 PHASE
220 VOLT 3 PHASE
240 VOLT 3 PHASE
380 VOLT 3 PHASE
415 VOLT 3 PHASE
440 VOLT 3 PHASE
480 VOLT 3 PHASE

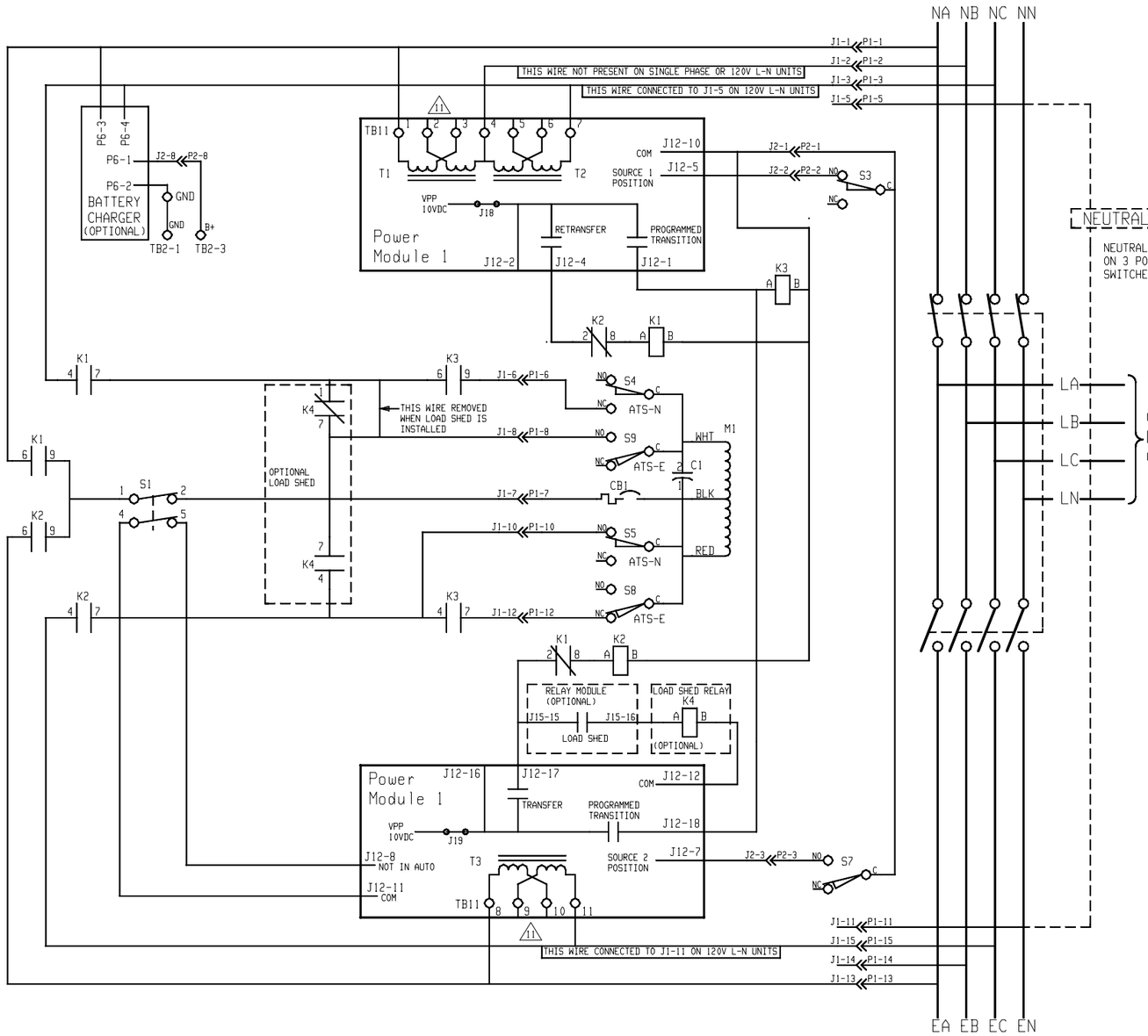
OPTIONS:
DISPLAY MODULE
NETWORK MODULE
LOAD SHED
RELAY MODULE
BATTERY CHARGER
BATTERY CHARGER ALARMS
RETRANSFER INHIBIT

T S S S T T
S T T
S T T T S T
T T S
S T T T S S T

N 626 23 3 S 1 5
R C S HP
M 4 2

TYICAL LEVEL 1 WIRING DIAGRAM (SHEET 1 OF 5)

SCHEMATIC DIAGRAM



NEUTRAL BAR USED ON 3 POLE TRANSFER SWITCHES ONLY.

K3 PROGRAMMED TRANSITION RELAY

K1 TRANSFER TO NORMAL RELAY

M1 LINEAR MOTOR

C1 MOTOR RUN CAPACITOR

CB1 CIRCUIT BREAKER

S1 LINEAR MOTOR DISABLE

K2 TRANSFER TO EMERGENCY RELAY

K4 LOAD SHED RELAY

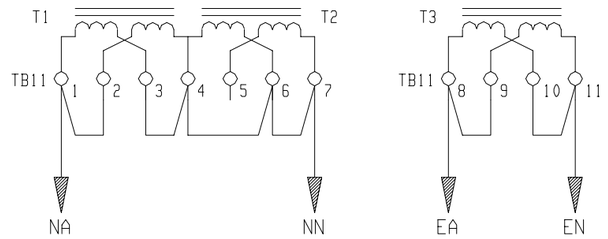
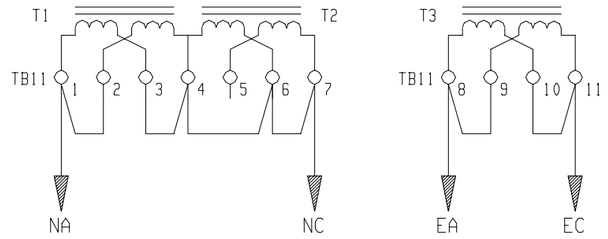
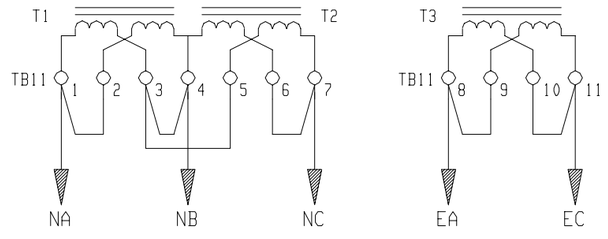
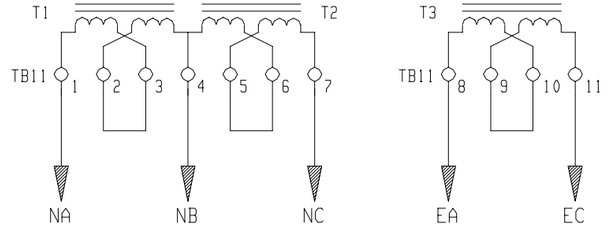
NOTES:

10. ALL DEVICES ARE SHOWN DE-ENERGIZED, WITH THE TRANSFER SWITCH CLOSED TO NORMAL. 4 POLE TRANSFER SWITCH SHOWN. ON 3 POLE MODELS THE SWITCHED NEUTRAL POLE IS REPLACED WITH A SOLID NEUTRAL BAR.

11. SEE SHEET 3 FOR TRANSFORMER PRIMARY JUMPERS.

12. FOR SINGLE PHASE UNITS:
120/240, 3 WIRE - CONNECT POWER CABLES TO A AND C
120 L-N, 2 WIRE - CONNECT POWER CABLES TO A AND NEUTRAL

TYPICAL LEVEL 1 WIRING DIAGRAM (SHEET 2 OF 5)

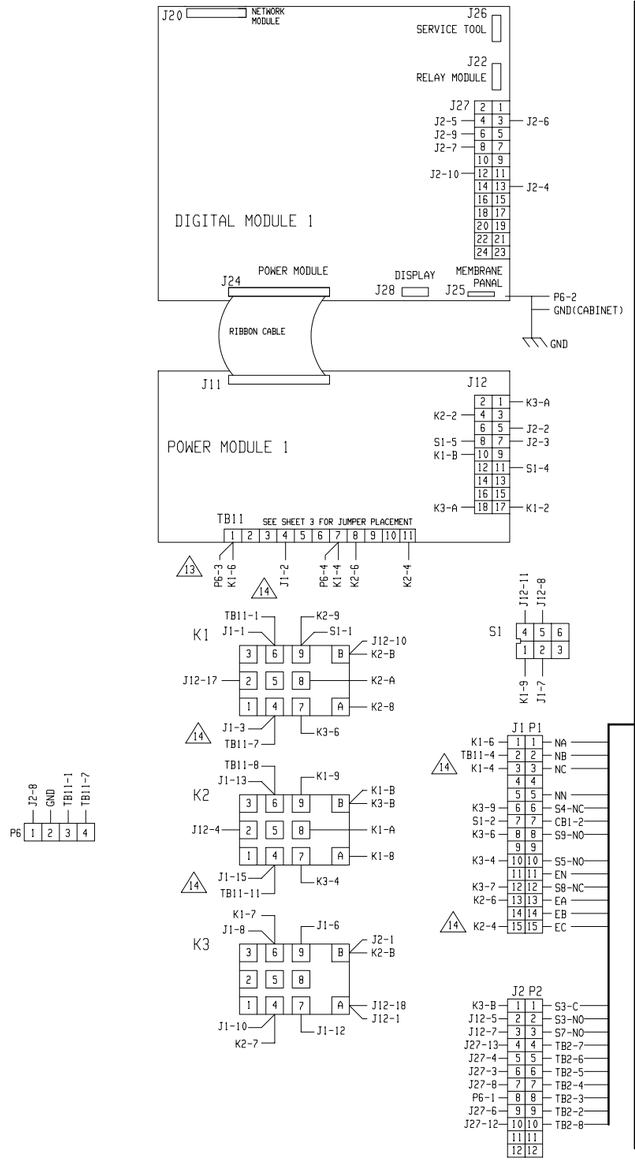
LINE TO LINE VOLTAGE	POWER MODULE 1 TRANSFORMER CONNECTIONS
120 VAC 1 PHASE 2 WIRE	
240 VAC 1 PHASE 3 WIRE	
190-240 VAC 3 PHASE 4 WIRE	
380-480 VAC 3 PHASE 4 WIRE	

TYPICAL LEVEL 1 WIRING DIAGRAM (SHEET 3 OF 5)

STANDARD WIRING

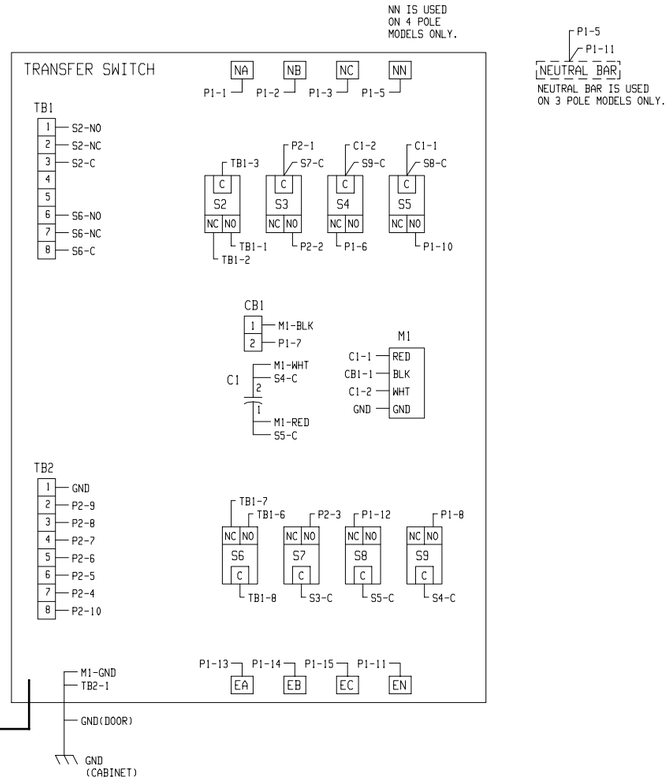
T S S S T T
S T T
S T T T S T
T T S
S T T T S S T

REAR VIEW OF DOOR



LEFT SIDEWALL

REAR WALL OF CABINET



NOTES:

13. SEE SHEET 3 FOR TB11 JUMPER CONNECTIONS.

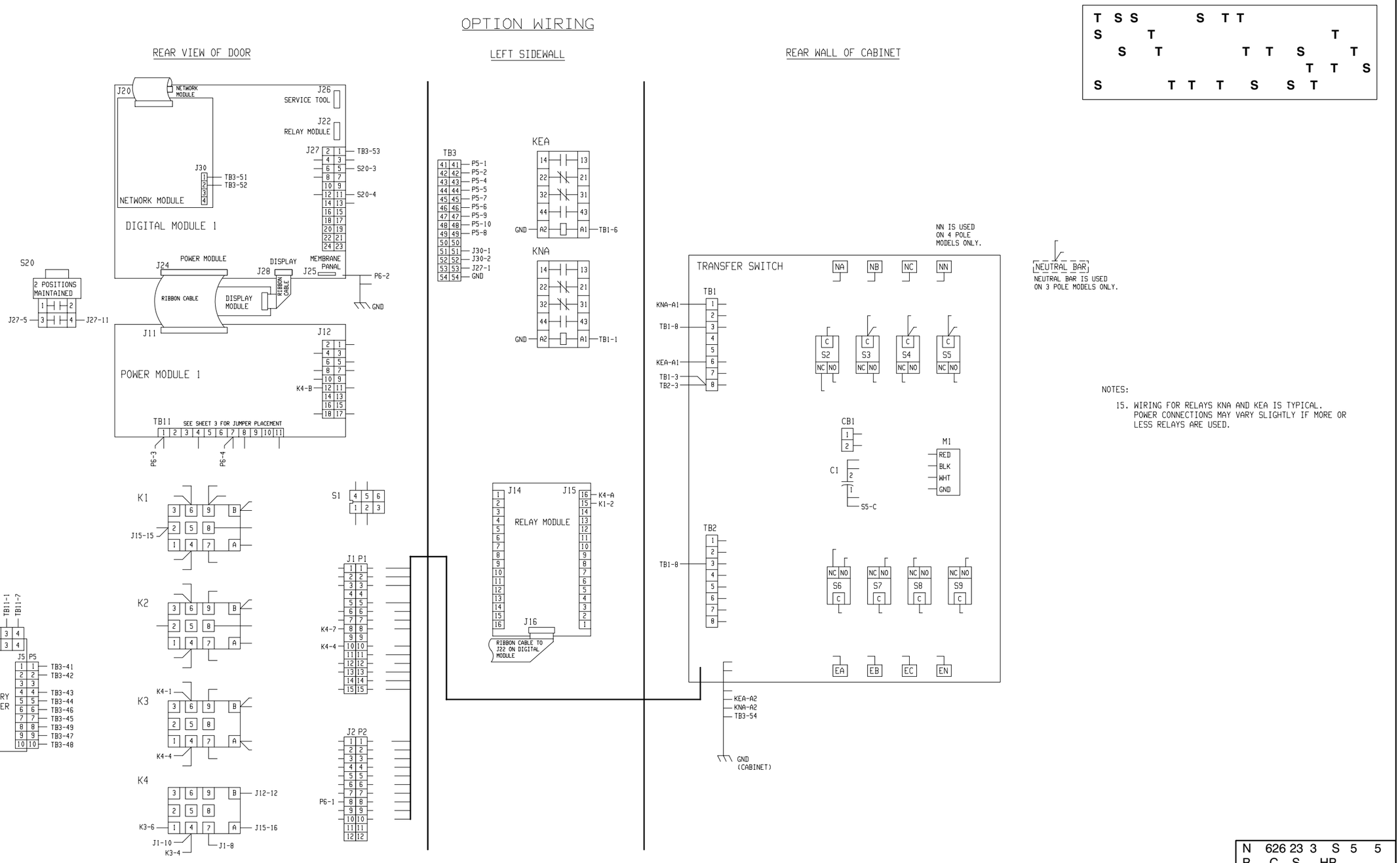
14. ON ALL SINGLE PHASE, 2 OR 3 WIRE UNITS:
THE WIRE CONNECTED FROM J1-2 TO TB11-4 IS NOT PRESENT.

IN ADDITION, ON 120 VOLT L-N, 2 WIRE UNITS:
THE WIRE CONNECTED FROM K1-4 TO J1-3 WILL BE CONNECTED FROM K1-4 TO J1-5 AND
THE WIRE CONNECTED FROM K2-4 TO J1-15 WILL BE CONNECTED FROM K2-4 TO J1-11.

N 626 23 3 S 4 5
R C S HP
M 4 2

TYPICAL LEVEL 1 WIRING DIAGRAM (SHEET 4 OF 5)

OPTION WIRING

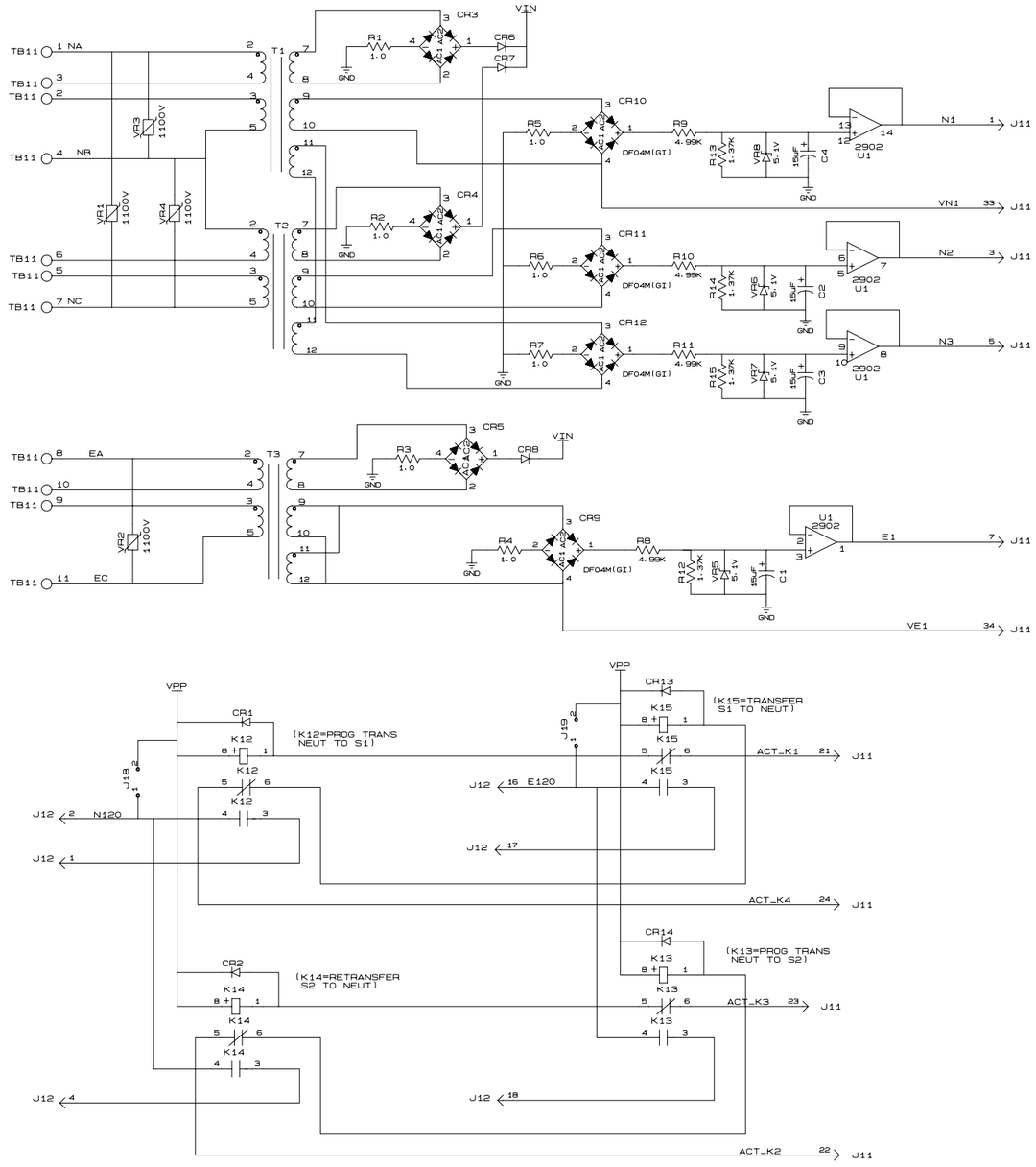


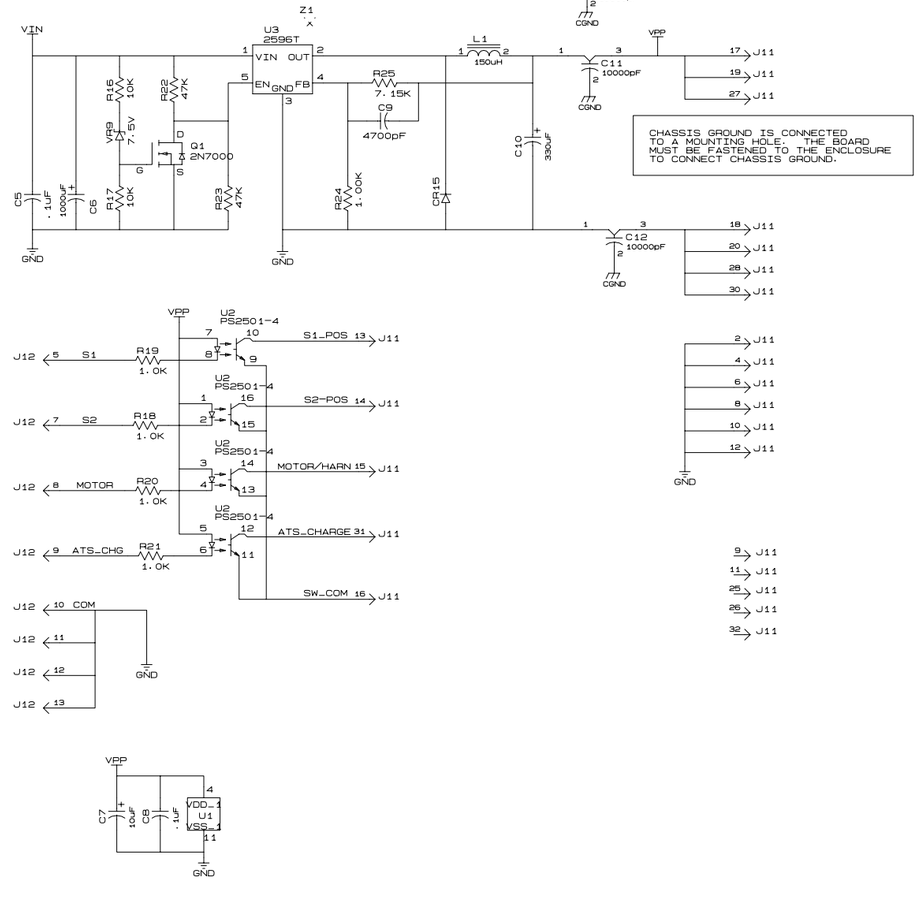
NOTES:

15. WIRING FOR RELAYS KNA AND KEA IS TYPICAL. POWER CONNECTIONS MAY VARY SLIGHTLY IF MORE OR LESS RELAYS ARE USED.

TYPICAL LEVEL 1 WIRING DIAGRAM (SHEET 5 OF 5)

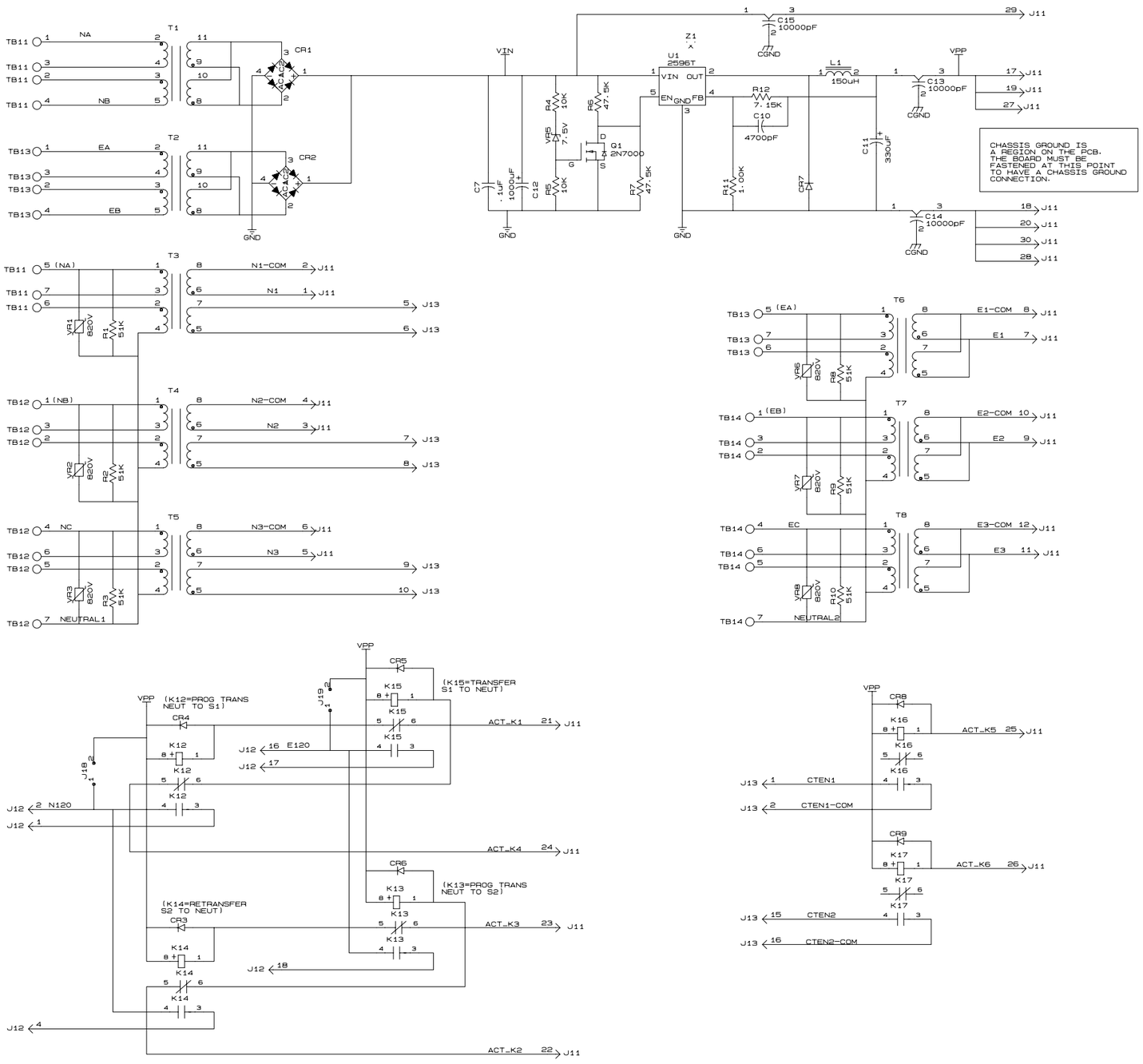
NOTE: REFER TO FIGURE 5-3 FOR PCB COMPONENT LOCATION.





N 3 514 S 1 2
R E S HP
M 32 2

POWER MODULE 1 PCB ASSEMBLY

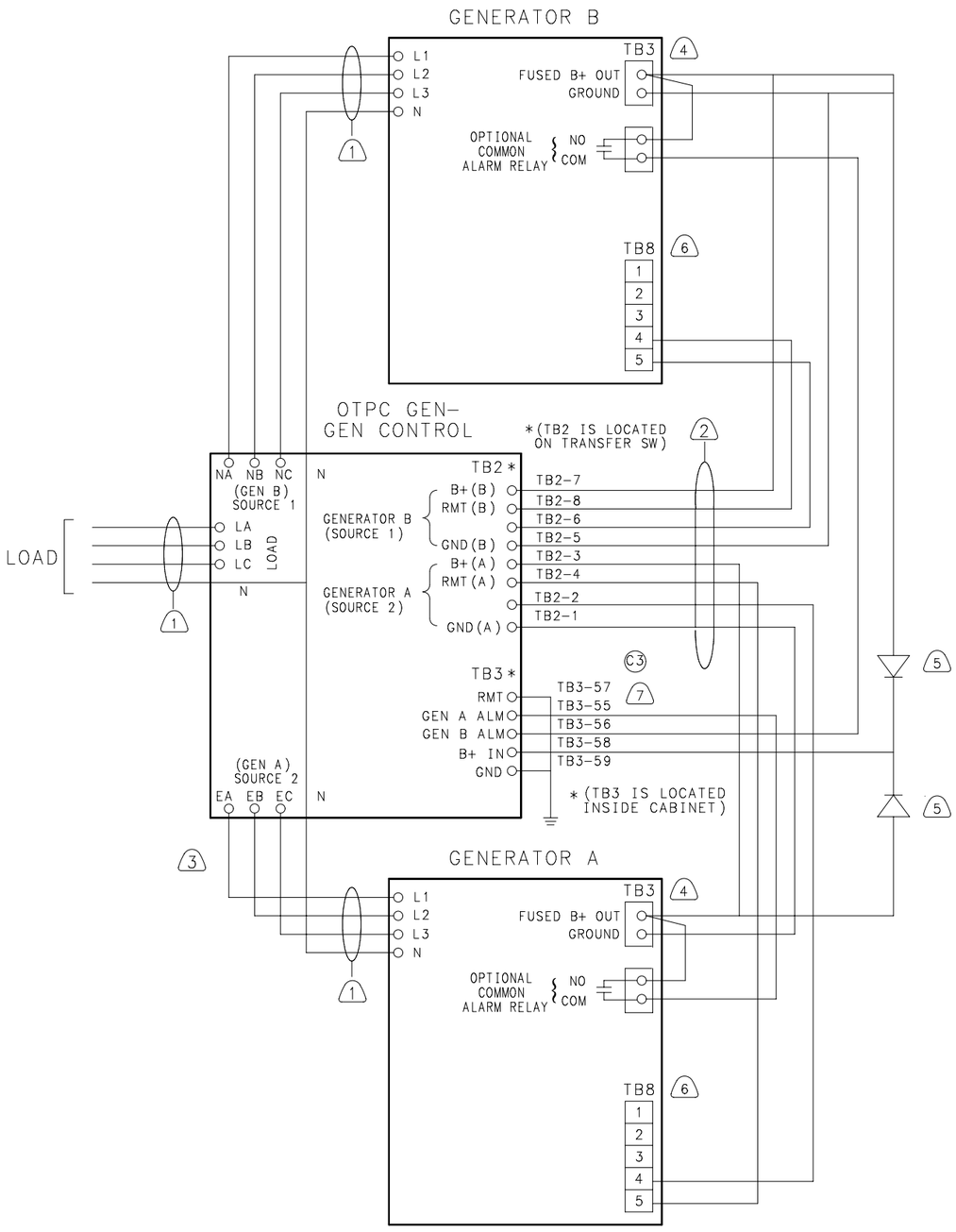


T S S S T T
S T T
S T T T S T
T T S
S T T T S S T

NOTE: REFER TO FIGURE 5-4 FOR PCB COMPONENT LOCATIONs.

N 3 514 S 1 2
R C S HP
M 3 2 2

POWER MODULE 2 PCB ASSEMBLY



T S S S T T
S T T
S T T T S T
T T S
S T T T S S T

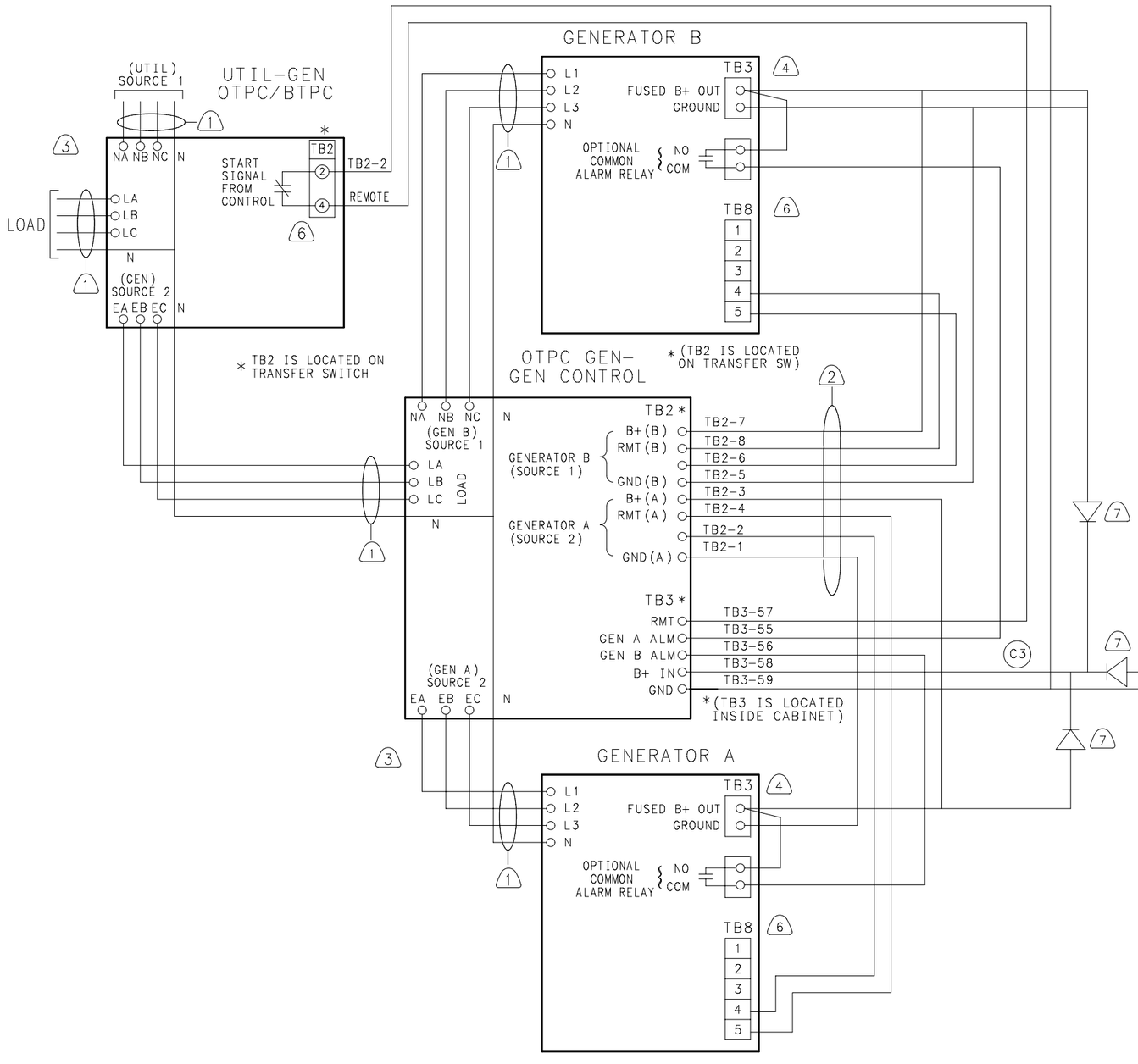
NOTES:

1. CABLES ARE SIZED FOR LOAD & LENGTH OF RUN.
2. USE NO. 16 WIRE FOR DISTANCES UP TO 100 FT.
3. NORMAL SIDE OF OTPC SWITCH IS NA, NB, NC. EMERGENCY SIDE OF OTPC SWITCH IS EA, EB, EC. LOAD SIDE OF OTPC SWITCH IS LA, LB, LC.
4. REFER TO GENERATOR SET WIRING DIAGRAMS FOR PROPER JUMPER SELECTION & TERMINAL NUMBERS FOR SIGNALS.
5. USE 600V/3A RECTIFIER (ONAN NO. 0315-0100 OR SIMILAR). DIODES ONLY NEED TO BE INSTALLED IF NETWORK BOARD IS INSTALLED.
6. TERMINAL BLOCK LOCATED ON CIRCUIT BOARD.
7. FOR DUAL STANDBY OPERATION REFER TO INTERCONNECTION DRAWING 0626-2024.

PLANT TO PLANT
PCC 3200

N 63 21 S 3 3
R C S R
M 52 1

TYPICAL INTERCONNECT DIAGRAM – GENSET TO GENSET, PLANT TO PLANT



NOTES:

1. CABLES ARE SIZED FOR LOAD & LENGTH OF RUN.
2. USE NO. 16 WIRE FOR DISTANCES UP TO 100 FT.
3. NORMAL SIDE OF OTPC SWITCH IS NA, NB, NC. EMERGENCY SIDE OF OTPC SWITCH IS EA, EB, EC. LOAD SIDE OF OTPC SWITCH IS LA, LB, LC.
4. REFER TO GENERATOR SET WIRING DIAGRAMS FOR PROPER JUMPER SELECTION & TERMINAL NUMBERS FOR SIGNALS.
5. BATTERY CHARGER IS AVAILABLE ONLY AS AN ACCESSORY. PART NO. 0300-5330.
6. DRY CONTACT ONLY. REMOVE ALL JUMPERS FROM TB2-2.
7. USE 600V/3A RECTIFIERS (ONAN NO. 0357-0100 OR SIMILAR).
8. GENERATOR SET SHOULD BE EQUIPPED WITH SHUTDOWN OPTION.
9. REMOVE JUMPER BETWEEN TB3-57 & GROUND.
10. FOR PROPER OPERATION OF CONTROL, BATTERY VOLTAGE APPLIED TO TB3-58 MUST BE BETWEEN 13-28VDC

DUAL STANDBY SYSTEM
PCC 3200

TYPICAL INTERCONNECT DIAGRAM
GENSET TO GENSET, DUAL STAND-BY SYSTEM

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