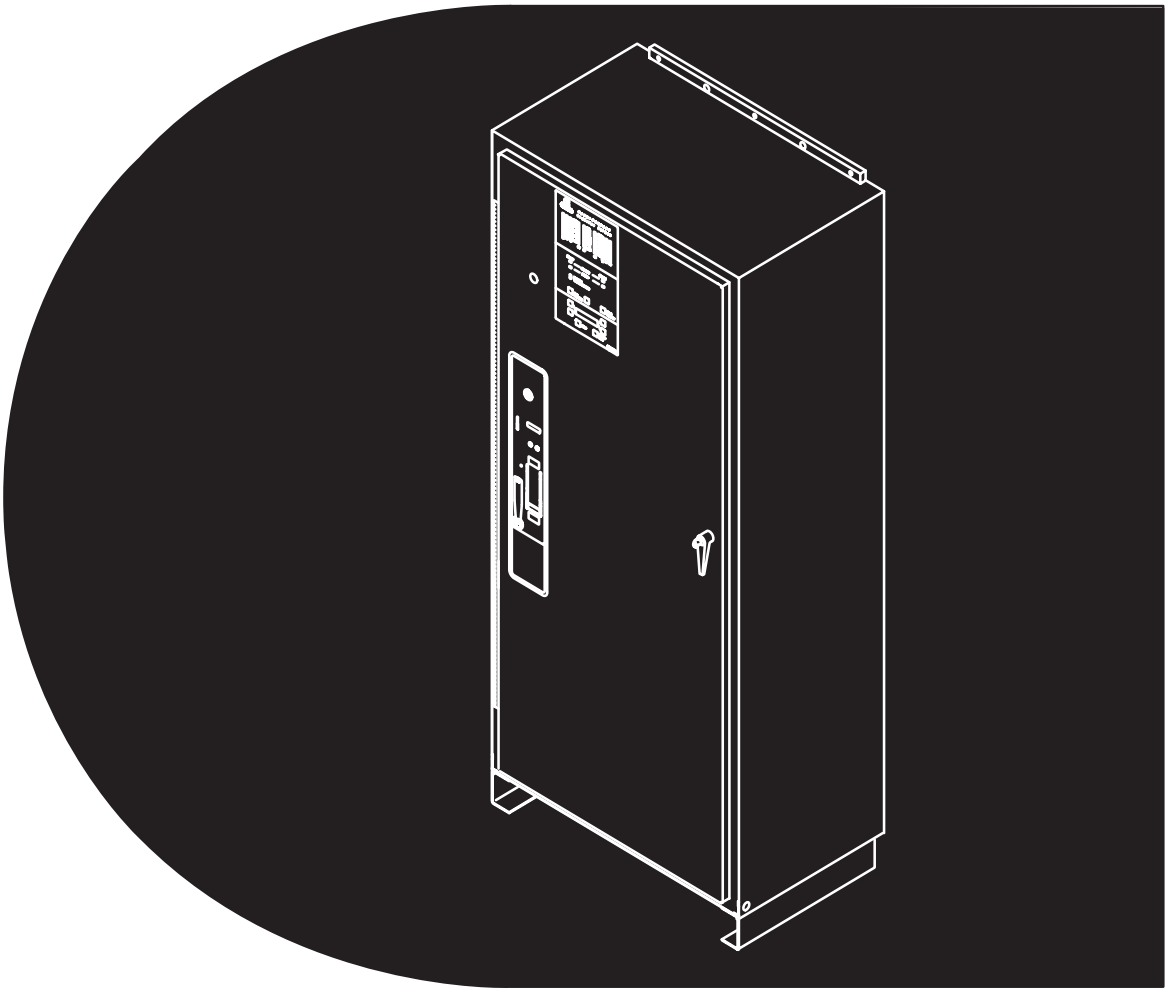
Power Generation

Operator's Manual

BTPC

Bypass Isolation Transfer Switch

150 to 3000 Amperes



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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.

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.

OTPC-2

1. Introduction

OPERATOR'S MANUAL

This Operator's Manual provides information necessary for operation of the transfer switch, and includes models produced under the Cummins®/Onan® and Cummins Power Generation (CPG) brand names.

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The switch transfers power sources either by 1) standard open transition mode or, 2) programmed transition mode. With an open transition switch there is never a time when both sources are supplying power to the load.

The Programmed Transition feature causes the transfer switch to pause in the neutral position, between switched positions, to allow transient currents from the load to diminish before transferring the load to the other source.

The BTPC is a bypass isolation transfer switch with PowerCommand® Control (PC). The BTPC can be used in either utility-to-genset or utility-to-utility control applications.

BTPC BYPASS-ISOLATION TRANSFER SWITCH

The transfer switch combines an automatic transfer switch, a manual bypass switch and a drawout isolation mechanism in one unit.

Bypass Switch Function

The bypass switch allows the operator to manually connect the load to the available power source, bypassing the automatic transfer switch (Figure1-1). When bypassed, the automatic transfer switch can be isolated for testing, maintenance, service or replacement without causing a power interruption.

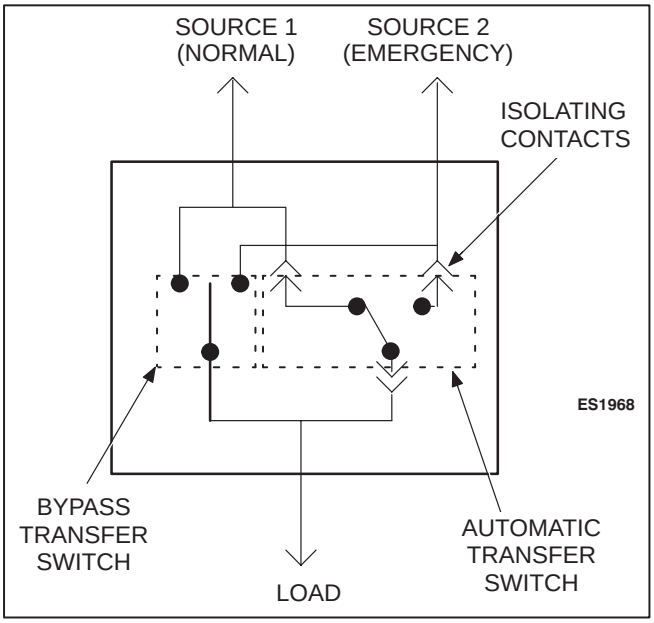


FIGURE 1-1. BT TRANSFER SWITCH (TYPICAL FUNCTION)

Drawout Isolation Mechanism

The drawout isolation mechanism allows the transfer switch to be withdrawn for testing or service. The transfer switch is mounted on rails and is connected to the load, power sources, and controls through isolation contacts. Turning a drawout cranking handle moves the automatic transfer switch either along a rail or on rollers then engages and disengages the isolation contacts without disconnecting power or control cables.

On 1200–3000 Amp switches a control cable (P12) must be disconnected before removing the switch.

TRANSFER SWITCH FUNCTION

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 transfer switch (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 transfer switch.

Automatic transfer switches, capable of automatic operation without operator intervention, perform the basic function of transferring the load to the available source. The controller monitors each source for allowable voltage and frequency range. Transfer switches may interact with any LONMARK™ device such as a:

- Genset
- Master Controller
- Annunciator Panel
- Circuit Breaker

UTILITY-TO-GENSET OPERATION

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

1. Senses the interruption of the Source 1 power.
2. Sends a start signal to the generator set (Source 2).
3. Transfers the load to the Source 2 power.
4. Senses the return of Source 1.
5. Retransfers the load to Source 1.
6. Sends a stop signal to the generator set.

UTILITY-TO-UTILITY OPERATION

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

1. Senses the interruption of the Source 1 power.
2. Transfers the load to the Source 2 power.
3. Senses the return of Source 1.
4. Retransfers the load to Source 1.

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 sub-menu 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 preferred 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.

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 en-

abled, a genset can be designated as the preferred source for a maximum of two weeks. Time adjustments can be made in one-hour increments.

MODEL IDENTIFICATION

Identify your model by referring either to the Model and Specification number as shown on the nameplate, or via the LONWORKS network. Electrical characteristics are shown on the lower portion of the nameplate, which is located on the cabinet door.

If it is 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.

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

BTPCB 00000 Spec. A
1 2 3 4

1. BTPC – Bypass Transition PowerCommand Control.

2. Ampere Rating:
   B = 150–260
   C = 300–400
   D = 600–1000
   E = 1200
   F = 1600
   G = 2000
   H = 3000

3. Assigned spec number – issued for each specific combination of accessories, voltages, frequency and standards codes.

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.

2. Description

This section describes the standard and optional control features as well as the control cabinet and bypass transfer switch.

CABINET

The standard cabinet meets the requirements of the National Electrical Manufacturers Association (NEMA) for a UL Type 1 cabinet. Cabinets are available in NEMA types 1, 3R, 4 and 12. The various types are designated as general-purpose, indoor or outdoor cabinets.

CONTROL PANEL

The panel features are divided into three groups: Bar Graph Meters, Switch Panel and Digital Display. Bar Graph Meters are optional equipment.

Bar Graph Meter Panel

The Bar Graph Meter Panel (optional) includes a three phase AC ammeter, a power meter, a power factor meter, a frequency meter, and a three phase AC voltmeter.

AC Ammeter (A–): The ammeter displays the percentage of full load current in amperes (1–125%).

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

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

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

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

SWITCH PANEL

The switch panel (Figure 2-1) contains six indicator lamps and three membrane pushbuttons.

Indicators

Source 1 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 transfer switch is in the normal position and Source 1 is supplying power to the load.

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

Not in Auto*:* This indicator lights when the transfer switch is not in the Automatic mode of operation and when any of the following signals are active:

- Motor Disconnect Switch is Off
- Transfer Inhibit
- Retransfer Inhibit
- Load Shed
- Bypass switch is connected

Test/Exercise Active*:* The Test/Exercise Active indicator is lit when the transfer switch when a test or exercise routine is active.

Pushbuttons

Test Switch*:* For utility-to-genset applications, the Test switch sends a start signal to the generator set designated Source 2 and flashes the Test/Exercise Active indicator. After the start and transfer time delays, Source 2 starts and assumes the load provided the With Load option is enabled. 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.

Override Switch*:* The Override switch terminates most system time delays. Program Transition, Elevator signal and Engine Cool Down are not affected by this switch. Pressing this switch while the Transfer or Retransfer Inhibit inputs are active, immediately transfers or retransfers the load.

Reset/Lamp Test Switch*:* The Reset/Lamp Test switch turns on all control panel indicators. This

switch also acknowledges events (refer to *Section 5: Events*). Pressing this pushbutton will “wake up” the display panel if it is in a sleep mode.

Digital Display

The Digital Display contains a 2-line by 20-character digital display module and 6 momentary contact membrane buttons. The module displays the menu system. The buttons are used to navigate through the menu system.

Each menu indicates the function of the four buttons at the sides of the display module. Not all buttons are active for each menu. Refer to *Section 4: Digital Display Menu System* for complete digital display menu details.

Sleep Mode: After a period of screen inactivity (35 minutes), the digital display goes blank. Screen inactivity is when there is no user interaction with the menu system and when there are no events. The digital display is reactivated when an event occurs or when an operator touches one of the menu buttons.

In order to conserve controller battery power, the loss of utility power also causes the digital display to go blank. The digital display is reactivated when a second power source becomes available.

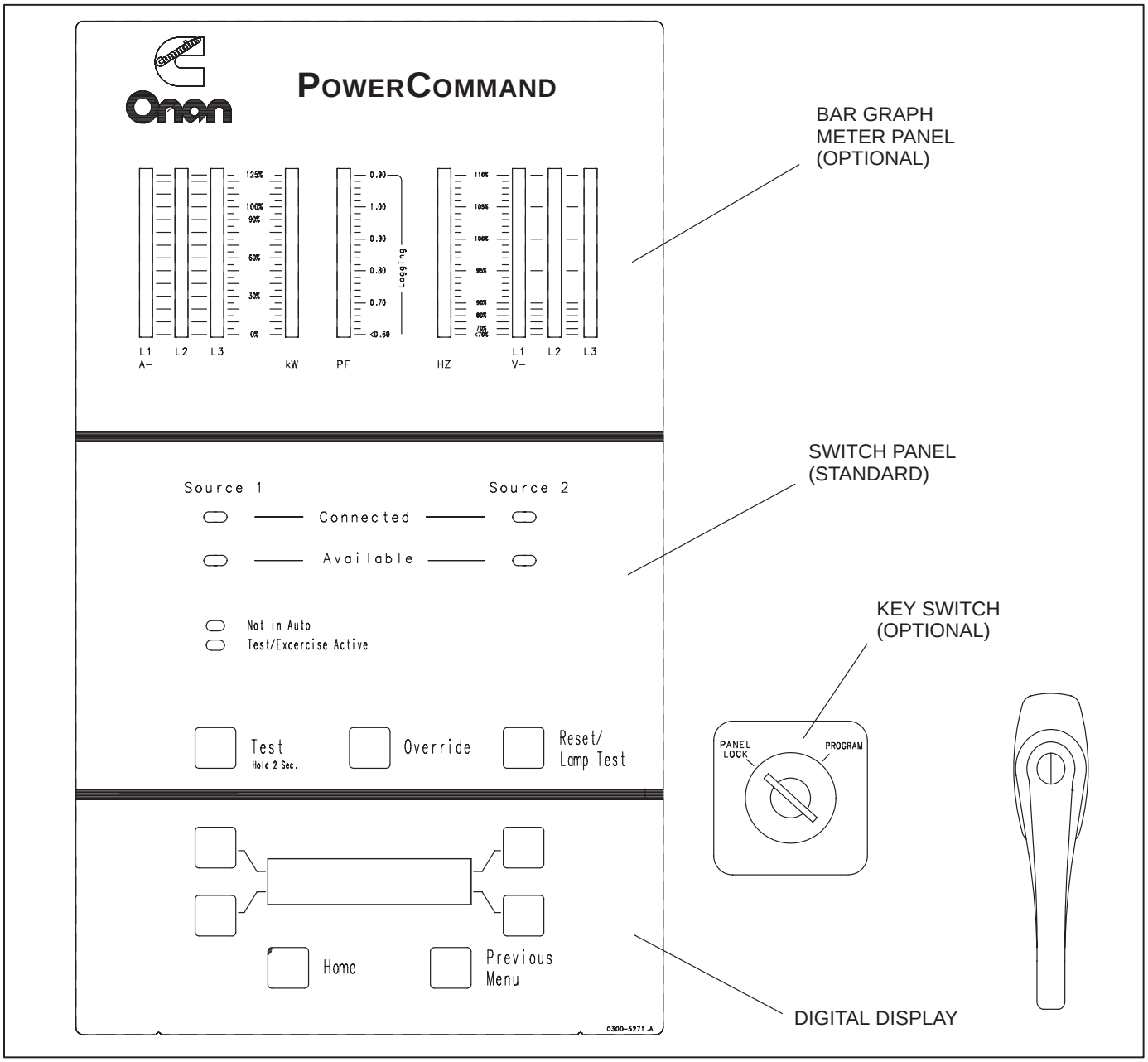


FIGURE 2-1. CABINET WITH OPTIONS

BYPASS SWITCH

The bypass switch, located behind (or below) the automatic transfer switch, is used to open and close the contacts connecting the load to the Normal or Emergency power source. The manually operated bypass switch is mechanically interlocked to prevent simultaneous closing to a dead source or to both power sources at the same time. Operation of the bypass switch is accomplished with the Bypass Switch Handle and the Source Select switch.

Contact Assemblies

Like the automatic transfer switch, the bypass switch has either three or four poles. Three pole transfer switches are provided with a neutral bar. The contact assemblies are manually actuated to connect the load to one of the two power sources, bypassing the automatic transfer switch. When closed to either the Normal or the Emergency power source, the contacts are mechanically held.

Auxiliary Contacts

Auxiliary contacts are provided on the Normal and Emergency sides of the bypass switch. The Normal side auxiliary contact switch is actuated when the bypass switch is in the Normal position. The Emergency side auxiliary contact switch is actuated when the bypass switch is in the Emergency position. The auxiliary contacts have current ratings of 10 amperes at 250 VAC and are wired to terminal block TB1.

BYPASS SWITCH CONTROLS

Indicators (150–1000 Amp Units)

The **Drawout Position indicator** shows which position the automatic transfer switch is in. The drawout mechanism can be latched in one of three positions: Connected, Test, and Isolated (Figure 2-2 and page 2-5).

The **Bypass to Normal and Bypass to Emergency** position indicators show the position of the bypass switch contacts.

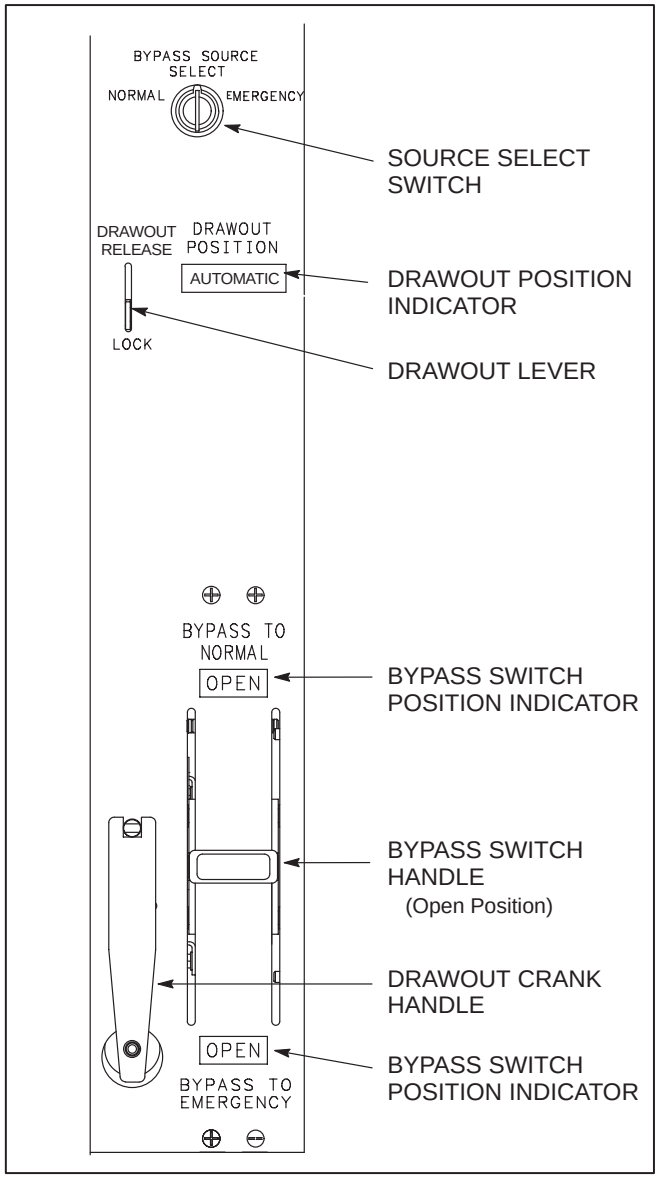


FIGURE 2-2. 150–1000 AMP BYPASS PANEL

When the Bypass switch handle is in the Bypass to Normal position, the bypass switch contacts connect the load to the Normal source and the word “Closed” is shown in the Bypass to Normal indicator slot. When the Bypass switch handle is in the Bypass to Emergency position, the bypass switch contacts connect the load to the Emergency source and the word “Closed” is shown in the Bypass to Emergency indicator slot. In both cases, the word “Open” is shown in the opposite indicator slot.

When the Bypass switch handle is in the center position, the bypass switch contacts are disconnected from both sources and the word “Open” is shown in both indicator slots.

Bypass Handle and Select Switch

The **Source Select Switch** is a spring loaded, three-position switch used to select the source to bypass. Prior to operating the Manual Bypass handle, this switch must be turned to the source the bypass contacts will connect to.

The **Bypass Switch Handle** is used in conjunction with the *Source Select Switch*. The Source Select switch controls an interlock device, which prevents the bypass switch from connecting the load to a dead source or to both sources at the same time. Before operating the Bypass Switch Handle, the Source Select Switch must be turned to the source the load will be connected to. Mechanical and electrical interlocks control the bypass operation.

Bypassing to the Same Source: If the automatic transfer switch is already connected to the source to be bypassed, the operator can turn and hold the Source Select switch then move the Bypass Switch Handle, closing the bypass contacts to that same source, without interrupting the load.

Bypassing to the Opposite Source: If the automatic transfer switch is NOT already connected to the source to be bypassed, interlocks force the following conditions to be met:

1. The bypass operation is permitted only when the selected source is available. When bypassing to the Emergency source, for example, it is necessary to first check that the Source 2 Available lamp is lit. (Refer to *Section 3: Operation*.)

2. As the bypass switch handle is moved to the opposite source, electrical and mechanical interlocks force the automatic transfer switch to the neutral position in a break-before-make action. This operation causes a brief power interruption. (Refer to *Section 3: Operation*.)

Indicators (1200–3000 Amp Units)

There are five indicator lamps for the bypass switch.

NOTE: Bypass mechanism and indicators on 1600–3000 amp switches in Nema 3, 4 or 12 cabinets are not visible from the outer door.

- Bypass to Normal (Source 1)
- Bypass to Emergency (Source 2)
- ATS in Test
- ATS Isolated
- ATS Inhibit

The **Bypass Normal** (Source 1) lamp is lit whenever the bypass switch is connecting (bypassing) Source 1 (Normal) to the load.

The **Bypass Emergency** (Source 2) lamp is lit whenever the bypass switch is connecting (bypassing) Source 2 (Emergency) to the load.

The **ATS in Test** lamp is lit whenever the automatic transfer switch is in the Test position.

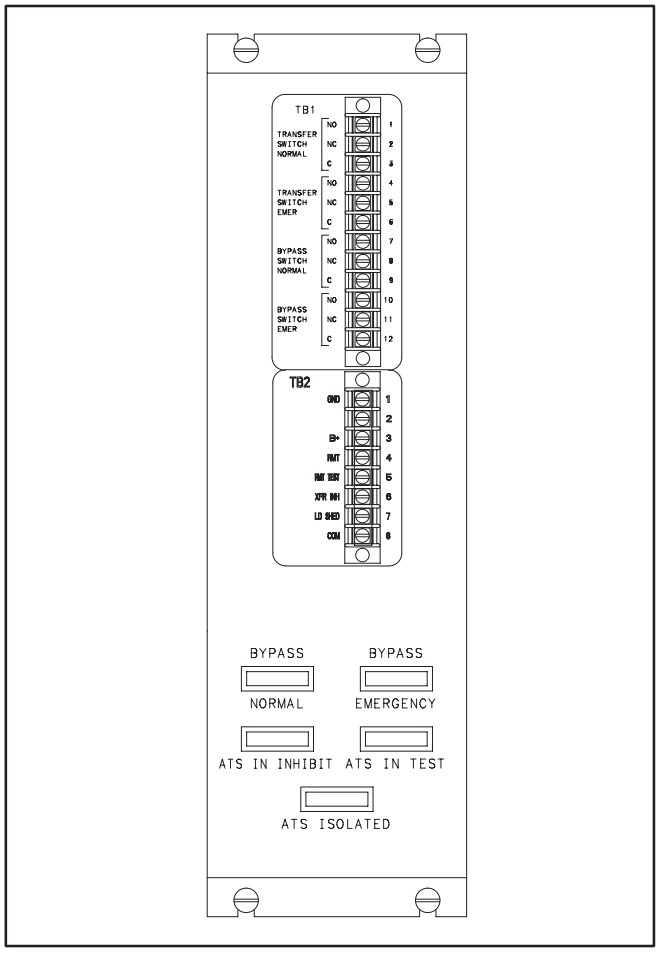


FIGURE 2-3. 1200–3000 AMP INDICATORS

The **ATS Isolated** lamp is lit whenever the transfer switch is Isolated from either source and the bypass switch is connected.

The **ATS Inhibit** lamp is lit whenever the automatic transfer switch is disabled by the limit switches and interlocks that respond to the operation of the bypass switch and the drawout/isolation mechanism.

DRAWOUT-ISOLATION MECHANISM

The drawout-isolation mechanism allows the automatic transfer switch to be isolated for testing or service. Three sets of primary isolation contacts (Normal source, Emergency source, and Load) connect the switching contacts to the terminal lugs. A set of secondary isolation contacts connects the automatic transfer switch controls to the available power source.

Drawout Cranking Handle

The drawout cranking handle is used to isolate and reconnect the automatic transfer switch. The cranking handle turns a gear drive that moves the transfer switch along a mechanically guided path. **The cranking handle will operate only when power is available, and when the bypass switch is connected to one of the sources.** The operator must activate the drawout lever and push in on the crank handle to deactivate the cranking interlocks.

The **Drawout Position Indicator** shows the position the automatic transfer switch is in. The drawout mechanism can be stopped in one of three positions: Automatic, Test, and Isolate.

In the *Automatic* position, both the primary and the secondary isolation contacts are closed. The automatic transfer switch is in its normal operating position.

In the *Test* position, the primary isolation contacts are open and the secondary isolation contacts are closed. The load-supplying contacts of the automatic transfer switch are out of service, but the controller and linear actuator are powered and fully operational. In this position, the controller, linear actuator, and contact mechanisms can be tested.

In the *Isolate* position, both the primary and the secondary isolation contacts are open. On 1200–3000 Amp switches, connector J12/P12 must be disconnected. The transfer switch mechanism is completely isolated from both the power and control circuits and can be removed for service.

⚠WARNING ***Improper removal of the automatic transfer switch can cause severe personal injury or death. Removal of the automatic transfer switch must only be performed by trained and experienced personnel, following the procedures provided in the service manual.***

AUTOMATIC TRANSFER SWITCH

The automatic transfer switch (Figure 2-4) opens and closes the contacts that transfer the load between the two power sources (1 and 2). The switch is mechanically interlocked to prevent simultaneous closing to both power sources. The main parts of the transfer switch discussed here are the contact assemblies, linear actuator, the auxiliary contacts, and the Motor Disconnect switch equipped on 1200–3000 Amp switches only.

Contact Assemblies

The automatic transfer switch has either three or four poles. Three pole transfer switches are provided with a neutral bar. The contact assemblies make and break the current flow. When closed to either the Normal or the Emergency power source (1 or 2), the contacts are mechanically held. Electrical and mechanical interlocks prevent them from closing the load to a dead source or to both power sources at the same time.

The power contacts are rated at 600 VAC. They are made of a long-life silver alloy which resists burning and pitting, and feature separate arcing surfaces.

Linear Actuator

The linear actuator is the solenoid that moves the contact assemblies between the Normal (Source 1) power and the Emergency (Source 2) power. Linear actuator operation is initiated automatically with automatic transfer switches.

Motor Disconnect Switch (150–1000 Amp Switches)

Moving the Drawout Lever to the Release position disables the linear actuator. The Not In Auto indicator on the front panel will light and the display indicates a Motor Disconnect event.

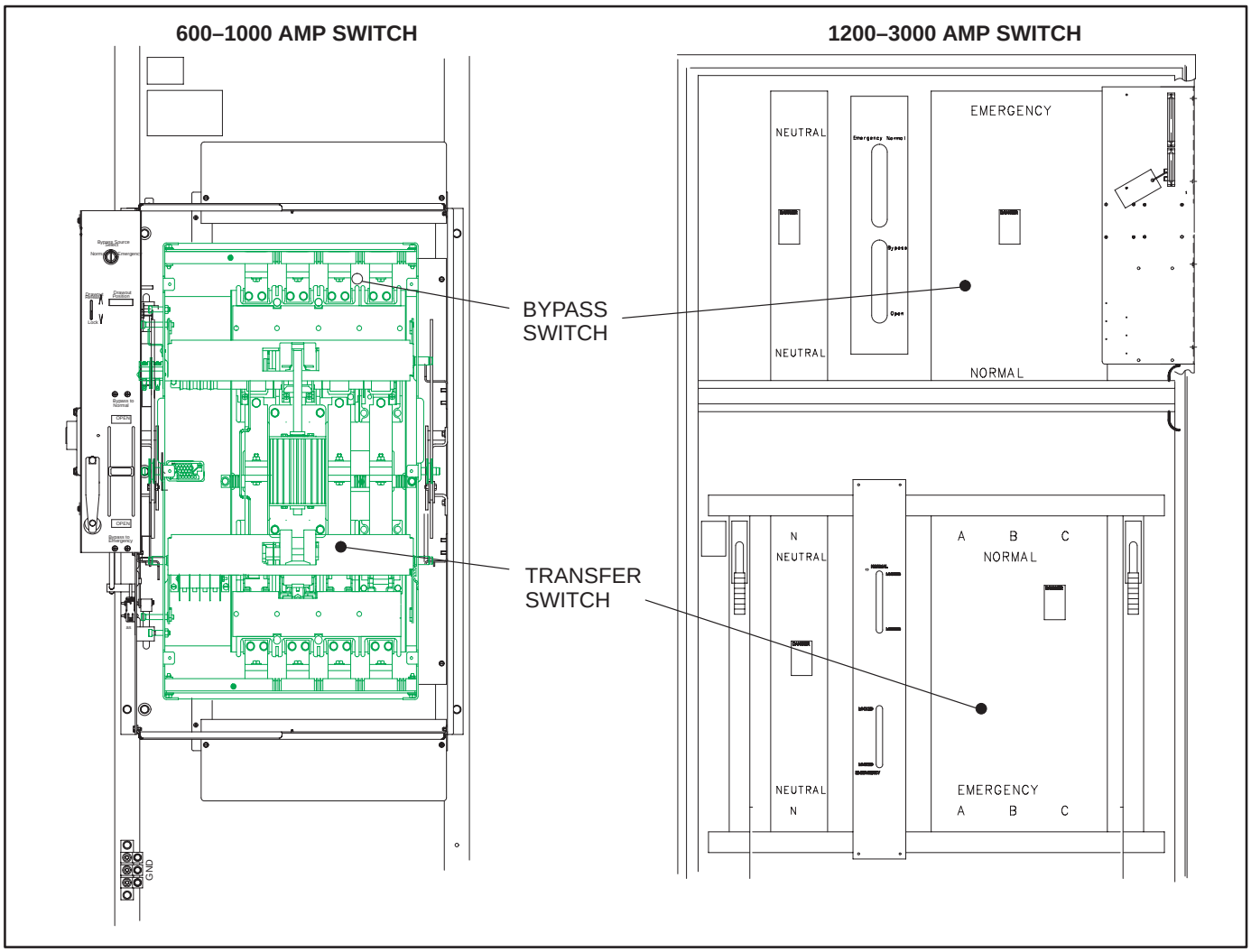


FIGURE 2-4. TRANSFER SWITCHES

Motor Disconnect Switch (1200–3000 Amp Switches)

The Motor Disconnect toggle switch, on the accessory control plate, enables and disables the linear actuator (Figure 2-5).

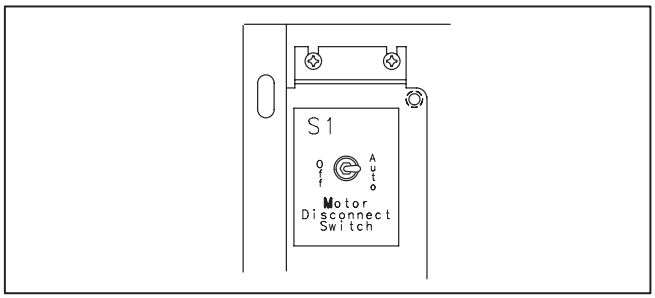


FIGURE 2-5. MOTOR DISCONNECT SWITCH

Placing the switch in the Auto position enables the linear actuator. Placing the switch in the Off position disables the linear actuator. When placed in the Off position, the Not In Auto indicator on the front panel will light and the display indicates a Motor Disconnect event.

Auxiliary Contacts

Auxiliary contacts are provided on the Normal and Emergency sides of the transfer switch. They are actuated by operation of the transfer switch during transfer and retransfer. The Normal side (Source 1) auxiliary contact switch is actuated when the transfer switch is in the Normal position. The Emergency side (Source 2) auxiliary contact switch is actuated when the transfer switch is in the Emergency position. The auxiliary contacts have current ratings of 10 amperes at 250 VAC. The contacts are wired to terminal block TB1.

ELECTRONIC CONTROL SYSTEM

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

Before Making Adjustments

⚠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.***

NOTE: When making adjustments, do not operate the linear motor more then once every two minutes.

All calibration and adjustment procedures are described in the Installation manual (shipped with the transfer switch) and in the Service manual (available through your distributor).

⚠WARNING ***Accidental actuation of the linear motor could cause severe personal injury. Before making any adjustments, disable the linear actuator.***

⚠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. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform and wear safety glasses.***

Electronic Control Circuit Modules

The BTPC transfer switch control incorporates a Digital and a Power Module. Power modules are available in four different voltage ranges. The digital module has two 3-volt batteries to power the real-time clock when no source voltage is available. Replace these batteries every two years.

Digital Module: The digital module contains the logic and timing circuits that control transfer switch operation. These modules also contain many 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.

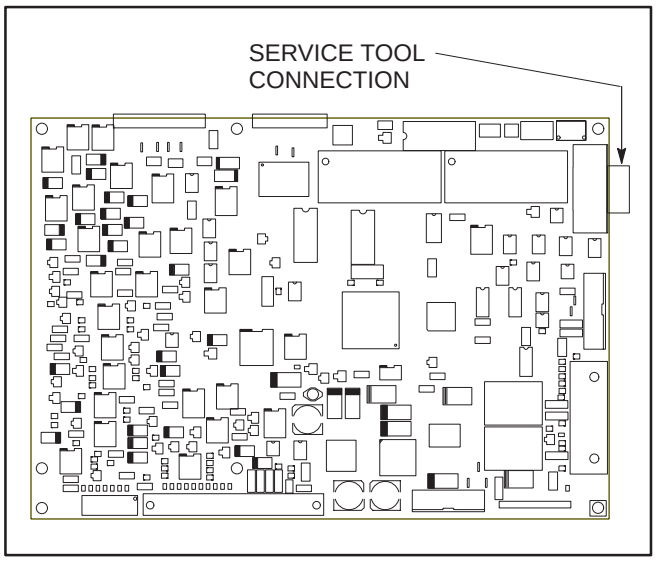


FIGURE 2-6. DIGITAL MODULE

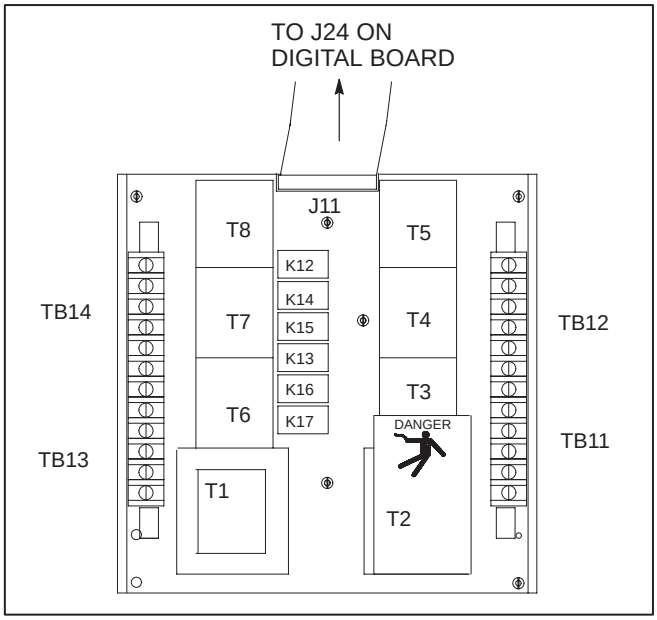


FIGURE 2-7. POWER MODULE

Power Module:

The power module supplies power to the digital module, and contains voltage sensing transformers, and relays. These modules also hold interface circuits for the transfer switch including position sensing switches and relay drivers. 12 VDC rectification and regulation circuits on this module are powered by both sources through transformers T1 and T2.

The power module contains eight transformers. Each source (1 and 2) use three transformers. Source 1 and 2 voltages are sensed by transformers T1 and T2. Both sources are connected A:N, B:N and C:N except for 120 volt switches.

Connect 120 volt switches A:N for 2-wire, and AN:CN for 3 wire single phase systems. The other transformers are used to power the 12 VDC supply on the module. One transformer is connected to Source 1 and the other Source 2 (Figure 2-7).

Power modules contain six pilot relays defined as:

- K12 Neutral to Source 1
- K13 Source 2 to Neutral
- K14 Neutral to Source 2
- K15 Source1 to Neutral
- K16 Closed Transition Normal to Emergency
- K17 Closed Transition Emergency to Normal.

Control Plate

The Control Plate contains two transformers; one for Emergency supply and one for Normal supply (Figure 2-8).

On *150–1000 Amp* switches, relays K1 through K6 control the opening and closing of various switches.

- K1 Transfer to Normal
- K2 Transfer to Emergency
- K3 Programmed Transition
- K4 Optional Load Shed
- K5 Bypass to Normal
- K6 Bypass to Emergency

1200–3000 Switches

Three bridge rectifiers control voltage to the transfer and bypass switch. Relays K1 thru K4 send signals to activate the transfer switch contact actuator. The Auto/Test signals are controlled by Relay K5 to the transfer switch. An optional relay, (K6) may be added for the Load Shed feature.

The Motor Disconnect switch S1 interrupts signals from K2–K4 disabling the linear actuator.

Connectors P1, P10 and P3 are the interface and power sources for the cabinet door, the bypass switch and the transfer switch.

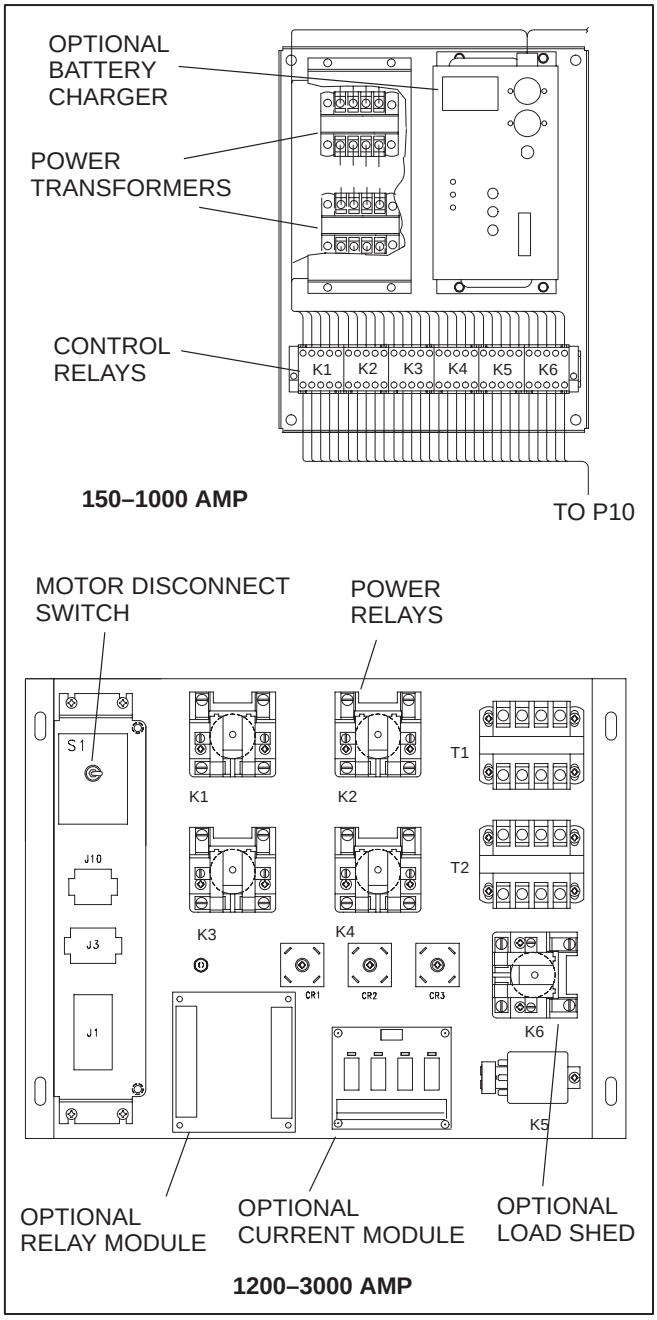


FIGURE 2-8. CONTROL PLATE

Time Delays

Start Time Delay (TDES-A): This brief time delay prevents the generator set from starting during short power interruptions. The delay is adjustable from 0 to 120 seconds in 1 second increments. The default value is 3 seconds. Timing begins at the Source 1 power interruption. If the duration of interruption exceeds the delay time, the control system starts the generator. The value is set with the PC service tool or the digital display.

Stop Time Delay (TDEC-A): This delay is adjustable from 0 to 30 minutes in 1 minute increments. The default value is 10 minutes. It begins timing when the load is retransferred to Source 1. At the end of the delay, the stop signal is sent to the generator set. During this time delay, the generator set cools down without load before stopping. The value is set with the PC service tool or the digital display.

Transfer Time Delay (TDNE): This brief time delay allows the generator set to stabilize before the load is applied. This delay begins when the Source 2 (typically the generator) voltage and frequency reaches the settings of the control. After the delay, the transfer switch 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 with the PC service tool or the digital display.

Retransfer Time Delay (TDEN): This delay allows Source 1 to stabilize before retransfer. The delay begins the moment Source 1 line voltage and frequency return to specified values. After the delay, the transfer switch can retransfer the load to Source 1. It has an adjustable range of 0 to 30 minutes in 1 minute increments. The default value is 10 minutes. The value is set with the PC service tool or the digital display.

Programmed Transition (TDPT): Program Transition introduces a delay 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.

Parameters are adjustable. The length of time that the transfer switch 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. The values are set with PC service tool or the digital display.

Elevator Transfer 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.

System Sensors

Under-Voltage Sensing: All controls include 3-phase 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 2-9 for an example using the default values.

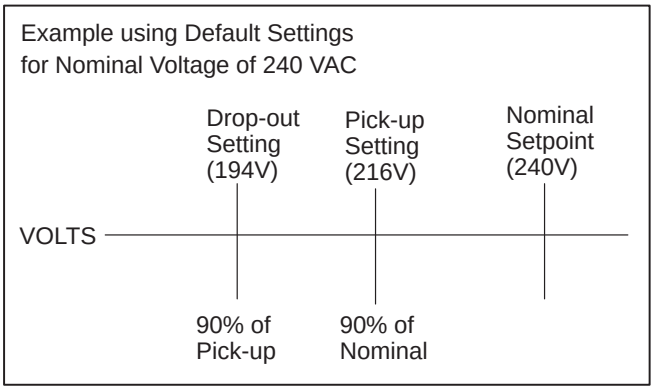


FIGURE 2-9. UNDER-VOLTAGE SENSING

***Over-Voltage Sensing*:** All controls include 3-phase 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 2-10 for an example using the default values. This feature can also be disabled.

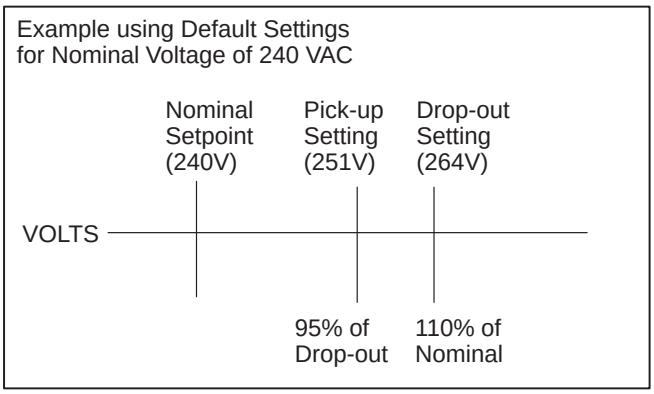


FIGURE 2-10. OVER-VOLTAGE SENSING

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. These values are set with the PC service tool or the digital display. See Figure 2-11 for an example using the default values. This feature can also be disabled.

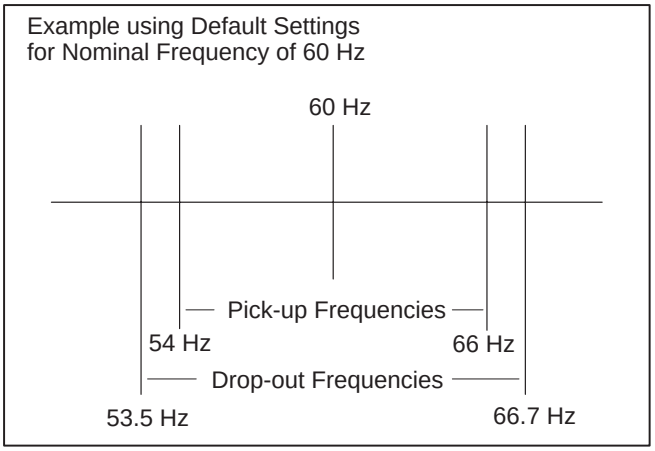


FIGURE 2-11. FREQUENCY SETTING

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).

This sensor can be enabled using the PC Service tool or the digital display Setup sub-menus. 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. It can be disabled using the PC Service tool or the digital display Setup sub-menus.

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.

This sensor can be enabled using the PC Service tool or the digital display Setup sub-menus. This sensor is inactive for single phase systems and indicates no failures.

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.

Three-wire starting is not available on BTPC transfer switches.

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.)

Testing With or Without Load

The transfer switch, generator, and power system can be tested automatically. The operator can activate a test by pressing the Test pushbutton, using a remote switch, or via software commands (network input).

The Test function can be programmed to test only the genset start command or test with a load transfer. By default, the genset will warm-up prior to a transfer. The load transfers to the genset when genset power becomes available (acceptable).

Generator Exercise Programs

Controllers include eight programmable generator events and eight programmable exceptions. These events are generally programmed to be recurring. They can be programmed from the PC service tool or the digital display. (Requires the PC service tool to program exercise programs 3 through 8 and all exceptions.)

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

For utility-to-genset configurations, the exercise clock initiates genset start and run cycles at specified intervals for specified durations. This feature is not used in utility-to-utility applications.

NOTE: Exercise and Test routines are not used in *Utility-to-Utility* configurations. For *Genset-to Genset* configurations, Test and Exercise are not available from the ATS. These functions should be initiated by a master ATS or other device in the power system.

Real-Time Clock

All controllers have a real-time clock that keeps track of the time and date. 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.

CONTROL OPTIONS

Relay (Signal) Module

The Relay Signal Module contains 11 Form-C relay contacts including the Elevator Pre-Transfer Delay. Additional signal relay contacts may be used with other applications.

In *1200–3000 Amp* switches, an additional 30 position terminal block is supplied with the module; TB3.

The *Source 1* or *Source 2 Connected* relays are energized when the respective power source is producing power and connected to the load.

The *Source 1* or *Source 2 Available* relays are energized when their respective power sources are available and within the acceptable limits of the voltage sensors.

The *Test/Exercise* relay is energized when the system is in a test or exercise routine.

The *Load Shed* relay (optional) is energized when the transfer switch is signaled to shed load from emergency. Connections at J15-15 and J15-16 are input from load shed to the control. This contact is used by the load shed circuit and is not available for customer use.

The *Elevator Pre-Transfer* signal delays transfer (or retransfer) gives warning to an elevator control that a transfer (or retransfer) is about to occur.

The *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 on the Power Module (1200–3000 Amp switches)
- The switch is bypassed

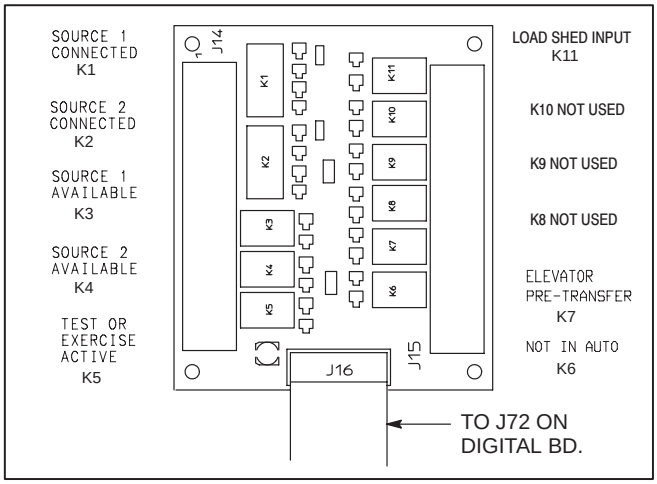


FIGURE 2-12. RELAY MODULE

Load Monitoring

Controllers can include a load current and power sensor (Current Module) and current transformers installed on the load lines. The control senses the all the load currents (including 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 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.

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

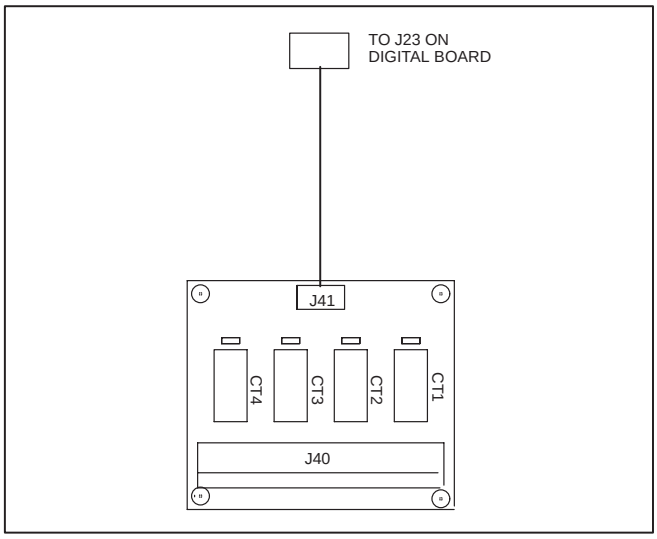


FIGURE 2-13. CURRENT MODULE

⚠ CAUTION ***To avoid system faults, false alarms and fault messages, do not remove P40 from the Current Module while the CTs are energized unless the secondaries are shorted. Refer to the Service Manual.***

Remote Test Transfer

The transfer switch may be wired with a remote test switch. Closure of a set of contacts across the remote test inputs causes the transfer switch 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. (See Testing With or Without Load on page 2-12.)

Auxiliary Relays

DC auxiliary relays provide contacts for energizing external alarms, remote indicators, and control equipment such as louver motors and water pumps. (Figure 2-14.) Relays are 4-pole, 12 or 24 VAC.

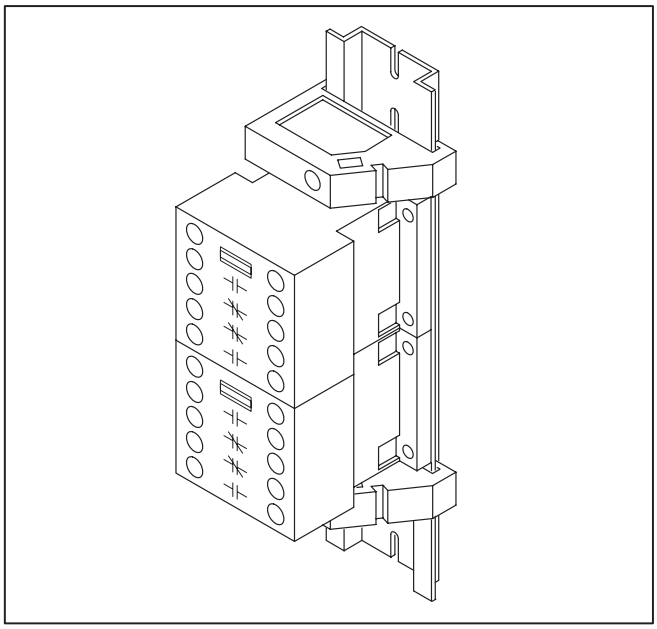


FIGURE 2-14. AUXILIARY RELAYS

Float Battery Charger

A float-charge battery charger (Figure 2-15) regulates its charge voltage to continuously charge without damage to the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

Two chargers are available. One battery charger is rated for 10 amperes at 12 or 24 VDC. The other battery charger is rated for 2 amperes at 12 or 24 VDC.

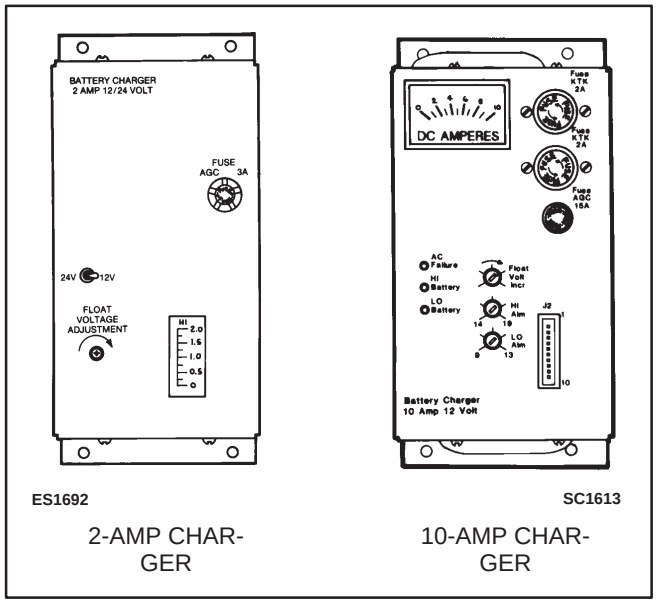
The 2-ampere battery charger has an ammeter to indicate charging current and a fuse to protect the battery charger circuit.

The 10-ampere battery charger has three fuses (two on the AC input and one on the DC output), three fault display LEDs, and an ammeter for indication of charging current.

On the 10-ampere charger, three sets of (form C) alarm contacts (corresponding to the three fault

LEDs) are also available. Using an optional alarm contact harness, these contacts can be wired by the installer to activate other audible or visual alarms.

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.



2-AMP CHARGER

10-AMP CHARGER

FIGURE 2-15. BATTERY CHARGER

Load Shed

The Load Shed module is used to disconnect the load from an available Power Source 2 in order to reduce the power consumed from that source. When the load shed function is initiated, the transfer switch is moved to the neutral position and the Not In Auto indicator lights.

When the load shed feature is active and power on Source-1 returns, the control immediately retransfers to Source-1.

If the load shed signal is removed before Source-1 returns, the switch transfers back to Source-2.

Load Shed is enabled or disabled using the PC Service Tool or the digital display. The relay module must be installed with a load shed module. Load shed includes power relay K4 on 150–1000 Amp switches and K6 on 1200–3000 Amp switches, mounted to the control plate. Figure 2-8 shows the location of these relays.

PowerCommand® Network Interface Module

This option interfaces the transfer switch to the PowerCommand network. It allows for remote monitoring of the transfer switch. Some commands can be sent from the remote location. Interfacing is accomplished through LONWORKS software. Refer to the *Network Installation and Operator's Manual* (900-0366) for network details.

The Network Interface Module is only enabled with the PC Service tool and is mounted to the digital board.

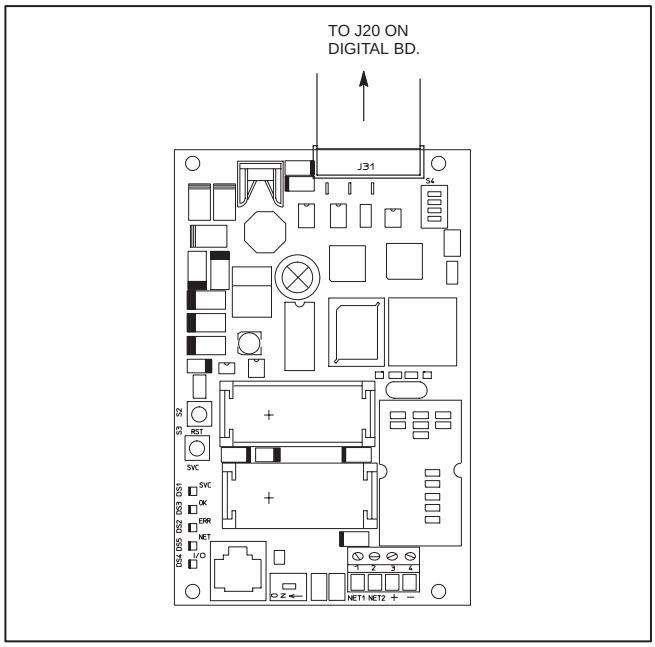


FIGURE 2-16. NETWORK MODULE

Security Key Switch

The optional security key switch is located on the front panel between the handle and the Control Panel (Figure 2-1). When in the Panel Lock position, it disables the front panel input switches, Test and Override. It also prevents changes being made to the setup menus using the Digital Display; however, values can be viewed, but not changed. Modifications can be made when the switch is in the Program position.

3. Operation

AUTOMATIC OPERATION

During normal automatic operation the transfer switch indicators and components will be in the following positions.

150–1000 Amp Switches

- **Drawout Position Indicator:** On Bypass switch panel in AUTOMATIC position (Figure 3-2).
- **Bypass Switch Handle:** Center position. Both bypass switch position indicators should read OPEN (Figure 3-2).
- **Source Selector Switch:** NORMAL for Source 1 power, EMERGENCY for Source 2 power (Figure 3-2).
- **Front Panel Indicator:** The Source 1 or Source 2 Connected indicator is lit (Figure 3-1).
- **Operation selector switch (engine control):** Remote position.

1200–3000 Amp Switches

- **Drawout Position Indicator:** On transfer switch – AUTO position.
- **Manual Bypass mechanism:** Lower position (OPEN). Neither the Bypass Normal nor the Bypass Emergency indicator lamps are illuminated.
- **Motor Disconnect toggle switch:** Place in AUTO position.
- **Bypass Selector Switch:** Place in OFF position.
- **Front Panel Indicator:** The Source 1 or Source 2 Connected indicator is lit.
- **Operation selector switch (engine control):** Remote position.

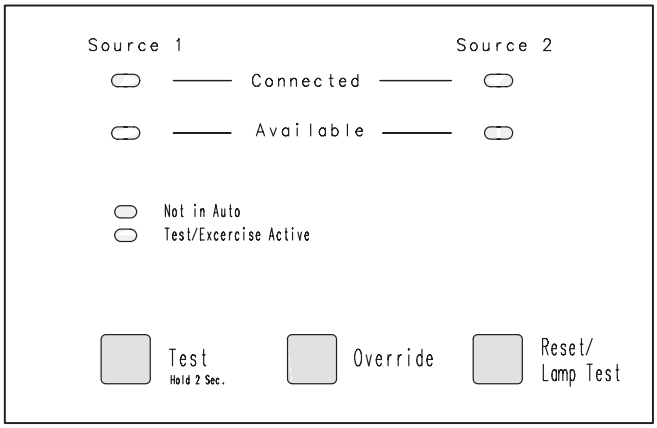


FIGURE 3-1. SWITCH PANEL

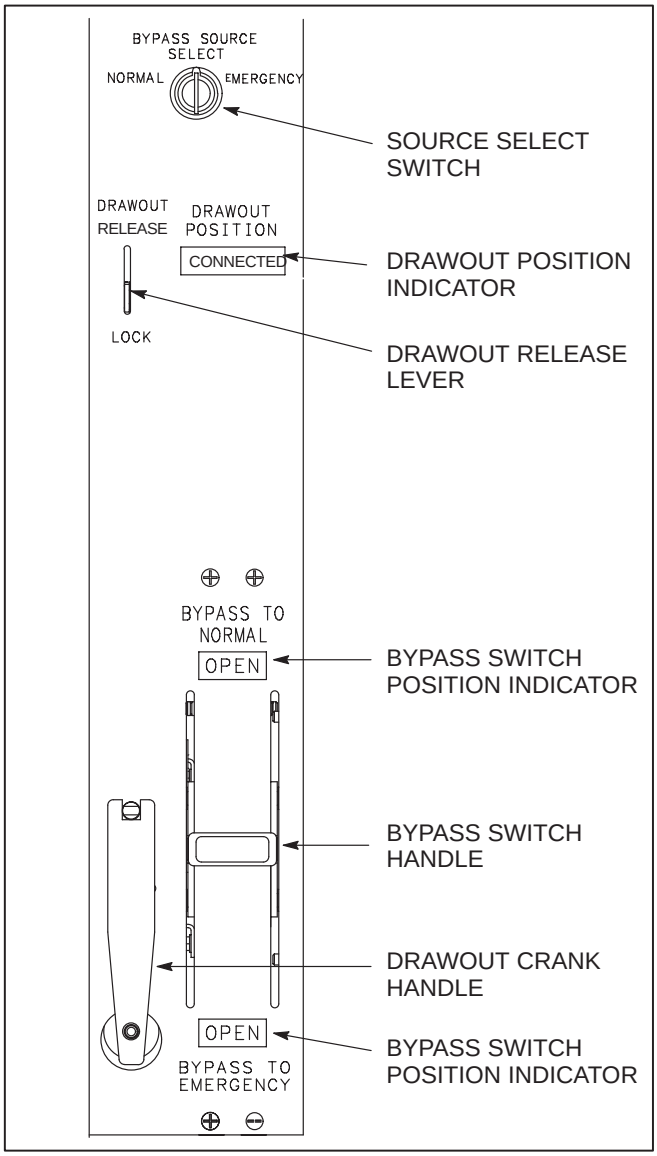


FIGURE 3-2. 150–1000 AMP BYPASS PANEL

BYPASSING THE TRANSFER SWITCH

Bypassing Load to Source 1

150–1000 Amp Switches

The transfer switch should be in the Normal position and Source 1 power must be available.

1. Turn and hold the Bypass Source Select switch in the Normal position (Figure 3-2).
2. Move the bypass switch handle up to the Bypass to Normal position
3. Make sure the bypass switch position indicator reads CLOSED at the upper indicator.
4. Release the Bypass Source Select switch.

   The transfer switch is bypassed. The digital display reads “Bypassed to S1”, and the Not In Auto LED is on.

1200–3000 Amp Switches

NOTE: The load can only be bypassed to the same source that the automatic transfer switch is connected to. Interlocks prevent the operator from bypassing the load to the opposite source or to a dead source.

The transfer switch door must be opened if the cabinet is a NEMA 3, 4, or 12.

⚠WARNING ***Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

Whenever bypassing the transfer switch, always make sure that both the transfer switch and the Bypass Source Select switch are in the same position.

The transfer switch should be in the Normal position and Source 1 power must be available.

1. Turn the Source Selector Switch to the Normal position (Figure 3-3).
2. Insert the manual Bypass Handle and move the mechanism up to the Bypass position.

   The transfer switch is bypassed and the digital display reads “Bypassed to S1”. The Not in Auto LED is on. The Bypass/Normal indicator and the ATS Inhibit indicator, inside the cabinet, are on.

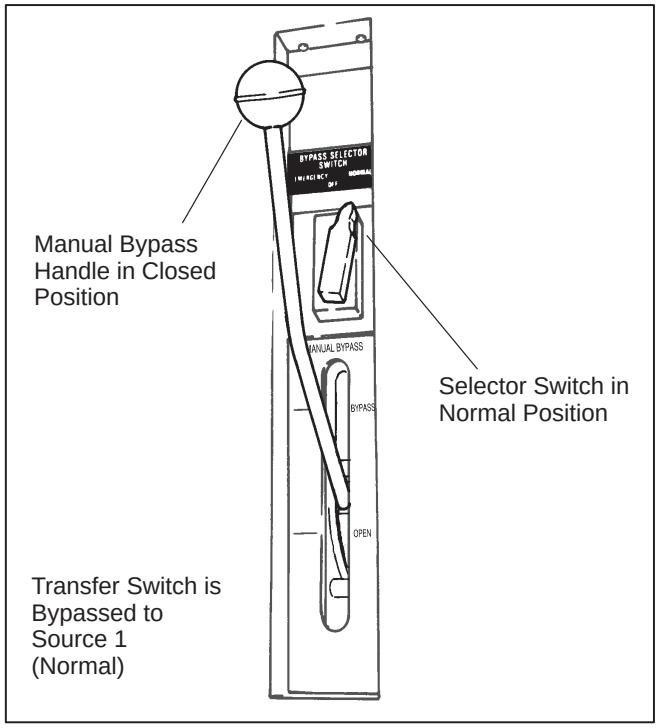


FIGURE 3-3. MANUAL BYPASS OPERATION 1200–3000 AMP SWITCHES

Bypassing Load to Source 2

Transfer Load to Source 2

The software variable **Test–With/Test Without Load** must be set to the With Load value.

1. To activate the switch panel, turn the key switch on the front panel to PROGRAM.
2. To transfer to Source 2, first, start the genset by pressing and holding the *Test* button on the front switch panel for 2 seconds (Figure 3-1). The Test/Exercise LED is on.

   After the Engine Start time delay, and Source 2 output is acceptable, the brief Normal to Emergency time delay begins. The Source 2 Available lamp is lit and the linear motor energizes and drives the transfer switch contact mechanism to Source 2.

   The Source 2 Connected indicator on the switch panel will light.

   NOTE: If the Program Transition feature is active, additional delays and sensor checks must occur before a transfer command is issued.

   If the ATS is closed to Source 1, this operation will cause a brief power interruption while switching to Source 2.

150–1000 Amp Switches

1. Turn and hold the Bypass Source Select switch in the Emergency position.

2. Move the bypass switch handle down to the Bypass to Emergency indictor.

3. Make sure the bypass switch indicator reads CLOSED at the lower indicator.

4. Release the Bypass Source Select switch.

   The transfer switch is bypassed to Source 2. The digital display reads “Bypassed to S2” and the Not In Auto LED is on.

1200–3000 Amp Switches

NOTE: The load can only be bypassed to the same source that the automatic transfer switch is connected to. Interlocks prevent the operator from bypassing the load to the opposite source or to a dead source.

The transfer switch door must be opened if the cabinet is a NEMA 3, 4, or 12.

⚠WARNING ***Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

1. Turn the Source Selector Switch to the Emergency position.

2. Insert the Manual Bypass handle and move the mechanism up to the Bypass position.

   The transfer switch is bypassed and the digital display reads “Bypassed to S2”. The Not in Auto LED is on. The Bypass/Emergency indicator and the ATS Inhibit indicator, inside the cabinet, are on.

ISOLATING THE TRANSFER SWITCH

150–1000 Amp Switches

To isolate the automatic transfer switch for servicing, the operator must manually bypass the load to either the Normal source or to the Emergency source, and then crank the transfer switch out to the Isolated position.

1. Bypass the transfer switch to either available Source.

2. Extend the drawout cranking handle from the storage position (Figure 3-2).

3. Lift and hold the Drawout Release Lever up. Turn the cranking handle counterclockwise until the ATS travels past the TEST position, then release the Drawout Release Lever. (Push in on the cranking handle to deactivate the cranking interlocks.)

4. Continue cranking the handle until the Drawout Release drops and the cranking handle locks. The Drawout Position Indicator slot reads ISOLATED.

   As the transfer switch is being drawn out, mechanical interlocks force the switch to the neutral position.

5. Return the handle to the stored position.

1200–3000 Amp Switches

To isolate the automatic transfer switch for servicing, the operator must manually bypass the load to either the Normal source or to the Emergency source, and then crank the transfer switch out to the Isolated position.

The load can only be bypassed to the <u>same</u> source that the automatic transfer switch is connected to. Interlocks prevent the operator from bypassing the load to the opposite source or to a dead source.

1. Bypass the transfer switch to either available Source.

2. To access the transfer switch and handle, open the cabinet door (Nema 3, 4, and 12 cabinets).

   ⚠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. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

3. Move the Motor Disconnect toggle switch (Figure 3-4) to the Off position to disable the linear actuator.

NOTE: The cranking handle operates only when power is available, and when the bypass switch is connected to one of the sources.

4. Locate the drawout cranking handle and insert it into cranking mechanism. While pressing in on the cranking handle, rotate the drawout handle (Figures 3-5 and 3-6) counterclockwise to move the transfer switch out.

   Check that the transfer switch position pointer is aligned with the word ISOLATE (Figures 3-7 and 3-8). Check that the ATS Isolated and ATS Inhibit lamps are on.

5. Return the handle to its storage place.

6. Disconnect connector J12/P12 from the transfer switch before removing the switch from the enclosure.

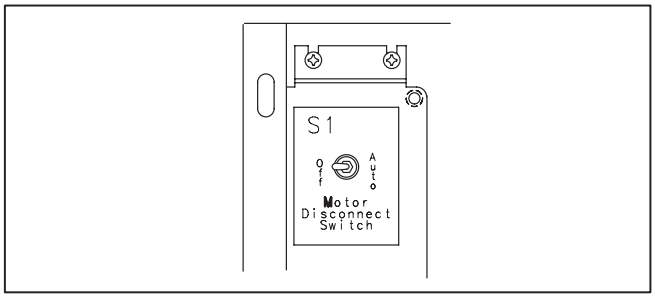


FIGURE 3-4. MOTOR DISCONNECT SWITCH

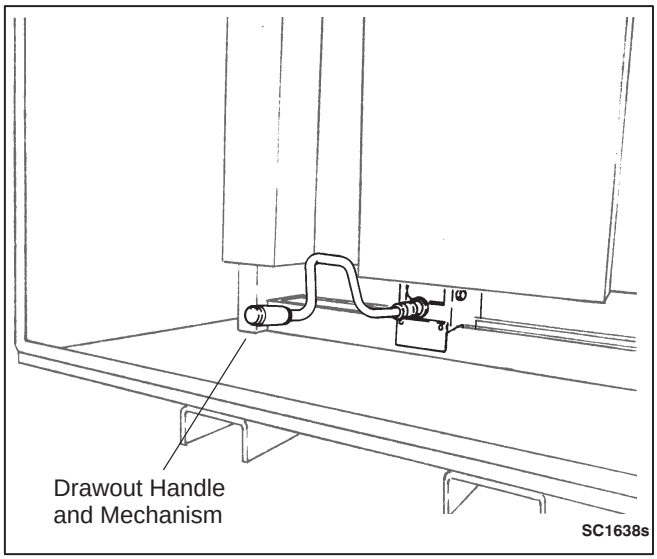


FIGURE 3-5. 1200 AMP DRAWOUT MECHANISM

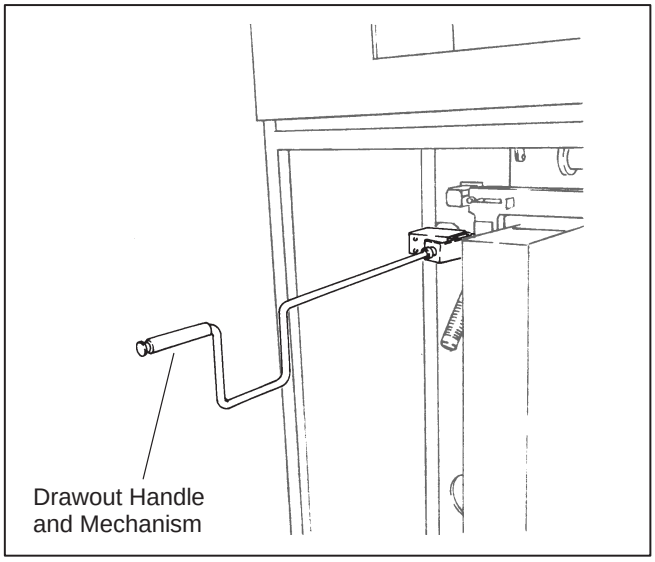


FIGURE 3-6. 1600–3000 DRAWOUT MECHANISM

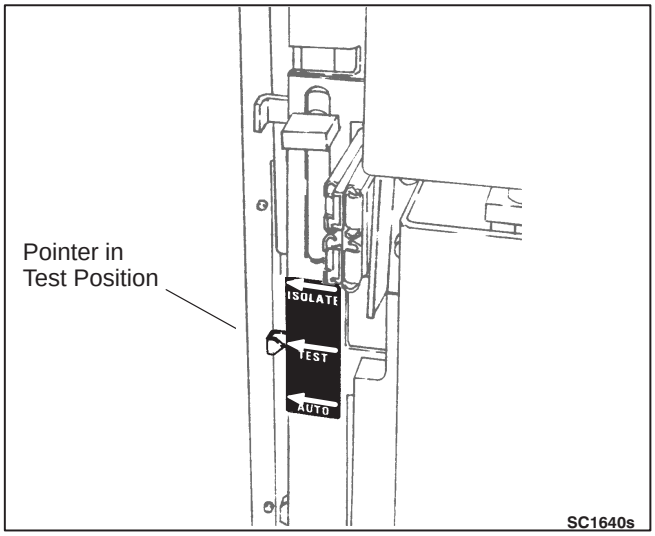


FIGURE 3-7. 1200 AMP DRAWOUT POSITION POINTER

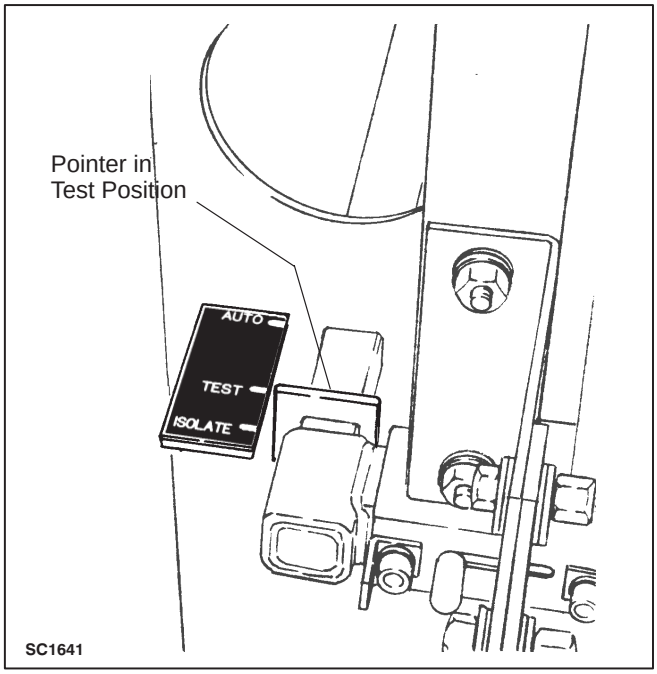


FIGURE 3-8. 1600–3000 AMP DRAWOUT POSITION POINTER

WARNING ***Improper removal of the automatic transfer switch can cause severe personal injury or death. Removal of the automatic transfer switch must only be performed by trained and experienced personnel, following the procedures provided in the Service manual.***

RECONNECTING THE TRANSFER SWITCH

The manual bypass switch must be in the Normal or Emergency position in order to reconnect the transfer switch. If not done already, connect the bypass switch using one of the procedures described previously. If the bypass switch is connected to Normal there will not be a power interruption when reconnecting the transfer switch. If the bypass switch is connected to Emergency there will be a brief power interruption when reconnecting the transfer switch.

150–1000 Amp Switches

Load is Bypassed to the Normal Source

1. Make sure the transfer switch is on the rails and pushed all the way into the frame.
2. Lift the rail extensions and close the cabinet door.
3. Extend the drawout cranking handle from the stored position. Lift and hold the Drawout Lever.
4. Rotate the drawout cranking handle clockwise to move the transfer switch to the TEST position. Release the Drawout Lever after the transfer switch travels past the TEST position indicator.

   As the transfer switch is being cranked back to the connected position, mechanical interlocks force the switch to the neutral position.
5. Keep turning the cranking handle clockwise until the Drawout Lever drops, locking the cranking handle.

   The transfer switch will automatically return to the Normal position, provided the programmed transition time delay (TDPT) has expired, and normal power is available.
6. The Drawout Position Indicator should read CONNECTED.
7. Return the cranking handle to storage.
8. After the transfer switch has returned to the Normal source, move the bypass switch handle to the center position.
9. Check that the word OPEN is shown in both the Bypass to Normal and the Bypass to Emergency indicator slots.
10. Check the “Not in Auto” LED on the front panel is off.

Load is Bypassed to the Emergency Source (Source 2)

There will be a brief power interruption when reconnecting the transfer switch when the load is bypassed to Emergency. There are two methods to return the transfer switch to automatic operation depending if the Normal source is available.

Method 1 (Normal Source Is Available)

1. Make sure the transfer switch is on the rails and pushed all the way into the frame.
2. Lift the rail extensions and close the cabinet door.
3. Extend the drawout cranking handle from the stored position. Lift and hold the Drawout Lever.

4. Rotate the drawout cranking handle clockwise to move the transfer switch to the TEST position. Release the Drawout Lever after the transfer switch travels past the TEST position indicator.

   As the transfer switch is being cranked back to the connected position, mechanical interlocks force the switch to the neutral position.

5. Keep turning the cranking handle clockwise until the Drawout Lever drops, locking the cranking handle.

   Because normal power is available the control will try to transfer the transfer switch to Normal. Since the bypass switch is connected to Emergency, the automatic transfer switch will not automatically transfer. Relays K1 and K3 on the control plate will energize every 8 seconds. This is normal operation that protects the circuitry.

6. The Drawout Position Indicator should read CONNECTED.

7. Return the cranking handle to storage.

   ⚠CAUTION ***The next operation causes a brief power interruption. Move the bypass switch handle to the center position. After the programmed transition time delay (TDPT) the automatic transfer switch transfers to Normal.***

8. Check that the word OPEN is shown in both the Bypass to Normal and the Bypass to Emergency indicator slots.

9. Check the “Not in Auto” LED on the front panel is off.

Method 2 (Normal Source is Not Available)

1. Make sure the transfer switch is on the rails and pushed all the way into the frame.

2. Lift the rail extensions and close the cabinet door.

3. Extend the drawout cranking handle from the stored position. Lift and hold the Drawout Lever.

4. Rotate the drawout cranking handle clockwise to move the transfer switch to the TEST position. Release the Drawout Lever after the transfer switch travels past the TEST position indicator.

   As the transfer switch is being cranked back to the connected position, mechanical interlocks force the switch to the neutral position.

5. Keep turning the cranking handle clockwise until the Drawout Lever drops, locking the cranking handle.

   The transfer switch will automatically return to the Emergency position, provided the programmed transition time delay (TDPT) has expired, and Emergency power is available.

6. The Drawout Position Indicator should read CONNECTED.

7. Return the cranking handle to storage.

8. After the transfer switch has returned to the Emergency source, move the bypass switch handle to the center position.

9. Check that the word OPEN is shown in both the Bypass to Normal and the Bypass to Emergency indicator slots.

10. Check the “Not in Auto” LED on the front panel is off.

    ⚠CAUTION ***When Normal power returns, the automatic transfer switch will follow standard operating procedures and transfer back to Normal after all the applicable time delays have expired. This operation will cause a brief power interruption.***

1200–3000 Amp Switches

1. Position the transfer switch to the same power source as the bypass switch is connected to. See Manual Operation on the next page.

2. Reconnect harness P12/J12.

3. Locate the cranking handle and insert it into the cranking mechanism. Rotate the handle clockwise moving the switch to the Test position.

4. Check that the automatic transfer switch position pointer is aligned with the word TEST Check that the **ATS in Test** lamp is lit and the **ATS Inhibit** lamp is not lit.

5. Keep turning the drawout cranking handle clockwise to move the automatic transfer switch back to the AUTO position.

6. Make sure the automatic transfer switch position pointer is aligned with the word AUTO. Return the drawout cranking handle to its stored position.

7. Move the Motor Disconnect toggle switch (located on the control plate) to the AUTO position to enable the linear actuators.

8. Move the Manual Bypass handle down to the OPEN position.

9. Make sure the **ATS Inhibit, Bypass Source 1** and **Bypass Source 2** indicator lamps are **not** lit. Return the manual bypass handle to its stored position.

   After the automatic transfer switch is returned to the Auto position, the Motor Disconnect toggle switch is moved to the Auto position, and the bypass switch is moved to the open (disconnected) position, the automatic transfer switch will respond to transfer/retransfer signals from the controller.

10. Close and lock the cabinet door.

MANUAL OPERATION
1200–3000 Amp Switches

The transfer switch has operator handles that are intended for maintenance use only. Manual operation must be performed by qualified personnel under **NO-LOAD CONDITIONS ONLY**.

⚠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 it is under load. Follow the "Safety Related Work Practices" listed in NFPA 70E.***

On standard transfer switches, there are two manual operator slots—one for the Normal (Source 1) contacts and one for the Emergency (Source 2) contacts.

A manual operating handle is provided with the transfer switch. The handle is a straight steel rod or tube, with a knob or hand grip on one end.

The transfer switch and the bypass switch must be connected to the same source to isolate and reconnect the transfer switch.

Manual Transfer to Source 2

If you determine that Source 2 is available but the transfer switch does not automatically transfer (refer to the *Troubleshooting* section), perform this procedure to manually transfer to Source 2.

1. Bypass and isolate the automatic transfer switch to the available source as described in this section.

2. Make sure the Motor Disconnect switch is in the OFF 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. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

3. Insert the transfer switch handle in the slot for the Normal contacts and open the Normal contacts by pulling the handle downward.

   ⚠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 it is under load.***

4. Then, insert the handle in the slot for the Emergency contacts and close the Emergency contacts by pulling the handle downward (Figure 3-9).

   Be certain to push the handle all the way to the LOCK position. A distinct over-center locking action can be felt.

5. Return handle to the storage position.

   ⚠WARNING ***Automatic transfer switch operation results in rapid movement of the manual operator mechanism and presents a hazard of severe personal injury if the operator handle is engaged in the mechanism. Remove the handle and place it in its storage position.***

6. Reconnect the transfer switch to the AUTO position.

7. Move the Motor Disconnect switch to the AUTO position, and close the cabinet door.

8. If the transfer switch is not functioning correctly, call your dealer or distributor immediately.

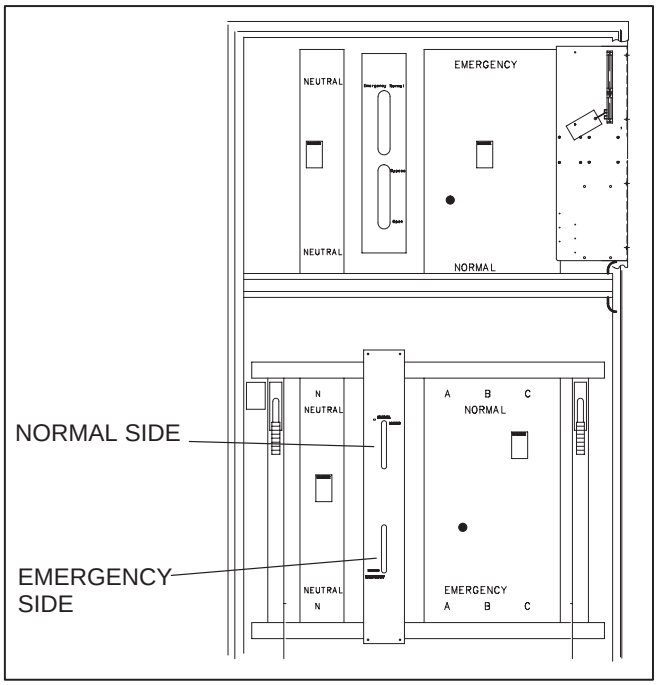


FIGURE 3-9. MANUAL TRANSFER SWITCH SLOTS

Manual Transfer to Source 1

1. Bypass and isolate the automatic transfer switch as described in this section.

2. Make sure the Motor Disconnect switch is in the OFF 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. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

3. Insert the handle in the slot for the Emergency contacts and open the Emergency contacts by pulling the handle upward.

4. Insert the handle in the slot for the Normal contacts and close the Normal contacts by pulling the handle upward.

   Be certain to push the handle all the way to the LOCK position. A distinct over-center locking action can be felt. Return the handle to its storage position.

5. Return handle to the storage position.

   ⚠WARNING ***Automatic transfer switch operation results in rapid movement of the manual operator mechanism and presents a hazard of severe personal injury if the operator handle is engaged in the mechanism. Remove the handle and place it in its storage position.***

6. Reconnect the transfer switch to the AUTO position.

7. Move the Motor Disconnect switch to the AUTO position, and close the cabinet door.

8. If the transfer switch is not functioning correctly, call your dealer or distributor immediately.

SYSTEM TESTING

Generator Set Start Test

This routine tests the start circuits of the PowerCommand control and starts the generator set. The linear actuators and contact mechanisms are not tested and there is no transfer of load to the Emergency source (Source 2).

1. Place the key switch in the PROGRAM position.

2. Set the software **Test–With/Test Without Load** variable to the Without Load value.

3. Start the genset by pressing and holding the *Test* button on the front panel for 2 seconds (Figure 3-1).

4. After the Engine Start time delay, the generator starts and the Source 2 Available lamp is lit.

   NOTE: Pressing the *Override* button on the front panel will cancel any time delays except for Programmed Transition, Engine Cool-down and Elevator signal.

5. To end the test routine, press the Test button again to stop the generator.

6. Reset the **Test–With/Without Load** variable to the desired value for regularly scheduled exercise routines. Refer to *Generator Set Exercise* below.

With Load Standby Test

The software variable **Test–With/Test Without Load** must be set to the With Load value. This operation causes a brief power interruption while switching to Source 2.

1. Activate the switch panel by turning the key switch on the front panel to PROGRAM.

2. Start the genset by pressing and holding the *Test* button on the front panel for 2 seconds (Figure 3-1).

3. After the Engine Start time delay, and Source 2 output is acceptable, the brief Normal to Emergency time delay begins. The Source 2 Available lamp is lit and the linear actuator energizes and drives the transfer switch contact mechanism to neutral or Source 2.

   NOTE: If the Programmed Transition feature is active, additional delays and sensor checks must occur before a transfer command is issued.

4. To end the test routine, press the Test button again. The controller issues a retransfer time delay.

   At the end of the TDEN time delay, the load retransfers from Source 2 to Source 1. The controller issues a engine cool-down time delay and turns off the generator. The Test/Exercise LED is turned off.

5. Reset the **Test–With/Without Load** variable to the desired value for regularly scheduled exercise routines.

NOTE: Time delays for Engine Start and Engine Cool-down are not used in Utility-to-Utility configurations.

Non-Load Break Transfer Switch Test 150–1000 Amp Switches

When the transfer switch is in the Test position, the load-supplying contacts of the automatic transfer switch are out of service, but the PowerCommand control and the linear actuator are powered and fully operational. In this position, the control, the linear actuator, and the contact mechanisms can be tested while the load remains connected to Source 1.

1. Turn and hold the Bypass Source Select switch in the Normal position and move the bypass switch handle to the Normal position. Check that the word CLOSED is shown in the Bypass to Normal Indicator slot and release the Bypass Source Select switch (Figure 3-2).

   ⚠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 whenever the cabinet door is open. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

2. Lift the Drawout Release lever and turn the drawout cranking handle counterclockwise to move the automatic transfer switch to the TEST position.

3. After three rotations of the cranking handle, release the Drawout Release lever. When the

transfer switch reaches the TEST position, the Drawout Release lever engages, locking the transfer switch in the Test position.

4. As the automatic transfer switch is being drawn out, mechanical interlocks force the switch to the neutral position. Check that the word TEST appears in the Drawout Position Indicator slot. Return the drawout cranking handle to its stored position.

5. Select the software variable **Test–With/Test Without Load** to the With Load value.

   NOTE: With Load variable must be selected in order to test the linear actuator and the contact mechanisms. Because the automatic transfer switch is bypassed and isolated from the load, there will NOT be an actual transfer of load.

6. Press and hold the TEST pushbutton on the front panel.

   The generator set will start and run. After the transfer time delay, the linear actuator will drive the contact mechanism to the Emergency side. Because the automatic transfer switch is bypassed and isolated from the load, there is NO transfer of load to the Emergency source and NO interruption of power to the load.

7. Press the Test pushbutton to end the test routine. After the retransfer time delay, the linear actuator will drive the contact mechanism back to the Normal side.

   To avoid the retransfer time delay, press the OVERRIDE pushbutton (the switch returns to Normal). The generator will stop after the cooldown time delay.

8. Lift the Drawout Release lever and turn the drawout cranking handle clockwise to move the automatic transfer switch back to the Automatic position.

9. After three rotations of the cranking handle, release the Drawout Lock. As the automatic transfer switch is being cranked back to the Automatic position, mechanical interlocks force the switch to the neutral position.

10. Check that the word AUTOMATIC appears in the Drawout Position indicator slot and return the drawout cranking handle to its stored position.

11. After the automatic transfer switch has returned to the Normal position, move the bypass switch handle to the center position. Check that the word OPEN is shown in both the Bypass to Normal and the Bypass to Emergency indicator slots.

12. Reset the **Test–With/Without Load** variable to the desired value for regularly scheduled exercise routines. Refer to *Generator Set Exercise* below.

After the automatic transfer switch is returned to the Automatic position and the Drawout Release lever is released, the switch will respond to transfer/retransfer signals from the PowerCommand control. In this procedure, the switch returns to the Normal position, provided the retransfer time delay has expired.

Had the bypass switch been placed in the Emergency position, electrical and mechanical interlocks would prevent the automatic transfer switch from retransferring to the Normal source.

Non-Load Break Transfer Switch Test 1200–3000 Amp Switches

⚠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. Do not wear long hair, damp clothing, or jewelry. Use insulated tools, stand on a dry rubber mat or wood platform.***

The software variable **Test–With/Test Without Load** must be set to the With Load value in order to test the linear actuators and the contact mechanisms. Because the automatic transfer switch is bypassed and isolated from the load, there will NOT be an actual With Load test.

1. Insert the Manual Bypass handle into the bypass drive mechanism.

2. Turn the Bypass Selector switch to the Normal position and move the Manual Bypass handle up (Figure 3-3).

   Check that the **Bypass Normal** and **ATS Inhibit** lamps are lit.

3. Push in and rotate the drawout cranking handle (Figures 3-5 and 3-6) counterclockwise to

move the automatic transfer switch to the TEST position.

Check that the automatic transfer switch position pointer is aligned with the word Test (Figures 3-7and 3-8).

Check that the **ATS in Test** lamp is lit. and that the **ATS Inhibit** lamp is not lit.

4. Return the drawout cranking handle to its stored position.

   In the Test position, the load-supplying contacts of the automatic transfer switch are out of service, but the PowerCommand control and the linear actuators are powered and fully operational. In this position, the control, the linear actuators, and the contact mechanisms can be tested.

   NOTE: The cranking handle operates only when power is available. The bypass switch must be connected to one of the sources.

5. Make sure the **Test–With/Without Load** variable is set to With Load.

6. Move the Motor Disconnect toggle switch (located on the control plate) to the AUTO position to enable the automatic transfer switch linear actuators. Close the cabinet door.

7. Press and hold the TEST button on the front panel.

   The generator set will start and run. After the transfer time delay, the linear actuators will drive the contact mechanism to the Emergency side. Because the automatic transfer switch is bypassed and isolated from the load, there is NO transfer of load to the Emergency source and NO interruption of power to the load.

8. At the end of the test routine and time delays, the linear actuators will drive the contact mechanism back to the Normal side.

   To avoid any retransfer time delays, press the Override button. The generator will stop after the stop time delay.

9. Move the Motor Disconnect toggle switch (located on the control plate) to the OFF position to disable the automatic transfer switch linear actuators.

10. Move the automatic transfer switch back to the Auto position by rotating the drawout cranking handle clockwise. The **ATS Inhibit** lamp will light.

11. Make sure the position pointer is aligned with the word AUTO. Return the drawout cranking handle to its stored position.

12. Move the Motor Disconnect toggle switch to the AUTO position. Close the cabinet door.

13. Move the Manual Bypass handle down. Check that the **ATS Inhibit, Bypass Normal** and the **Bypass Emergency** indicator lamps are **not** lit.

14. Return the Manual Bypass handle to its stored position.

    After the automatic transfer switch is returned to the Auto position, the Motor Disconnect toggle switch is moved to the Auto position, and the bypass switch is moved to the open (disconnected) position, the automatic transfer switch will respond to transfer/retransfer signals from the PowerCommand control.

15. Reset the **Test–With/Without Load** variable to the desired value for regularly scheduled exercise routines. Refer to *Generator Set Exercise* below.

GENERATOR SET EXERCISE

Run the generator for at least 30 minutes once each week with at least 50 percent load (if possible). If exercise routines are not desired, use the switch, as described below, to test the generator set each week.

Exercise routines can be programmed for specified exercise periods and are used to exercise the generator set automatically with or without load. If Source 1 has an interruption while the generator set is exercising without load, the automatic transfer switch transfers the load to the generator set. The Digital Display can set parameters for two exercise periods, and the PC Service Tool can set parameters for eight exercise periods and eight exceptions.

All controllers have a switch to enable or disable pre-set exercise routines. The pushbutton is located on the Digital Module above the batteries next to the LED light bar display. This button is used by service personnel to disable unexpected transfers while servicing the switch.

If a power failure occurs during the exercise routine, the controller overrides the routine and transfers the load.

TRANSFER SWITCH MAINTENANCE

Performing the annual planned maintenance procedures increases reliability of the transfer switch.

The following procedures must be performed only by trained and experienced personnel, according to procedures in the Service manual (150-1000 Amp Switches: 962-0518 and 1200-3000 Amp Switches: 962-0519). If repair or component replacement is necessary, call your dealer or distributor.

Transfer switches generally do not require maintenance, but they do require regular care and testing to make sure they operate properly upon a power failure; such as starting the generator set and reliably transferring power to the alternate power source.

Power System Functional Tests

Emergency power systems are required to be tested on a regular basis, and the transfer switch is required to be tested at least once per month per NFPA 110: 6–4.5.

Weekly Inspection

Inspect the entire emergency power system, including the transfer switch, to verify all indicating lamps are functional, the control switches are in the proper (automatic operation) position, and there are no obvious indications of overheating or faulty operation.

Monthly Testing

In order to meet certain codes and standards, generator sets are required to be operated at 30% or more of rated load on a regular basis. Every month test the entire emergency power system using the transfer switch to initiate a exercise sequence.

In a standard exercise routine, the transfer switch should; signal the generator set to start, monitor the genset as it starts, and transfer load to the genset. After the genset test, the transfer switch should transfer the load back to normal service and shutdown the genset after a cool-down period. Methods to test the transfer switch can be: 1) manual operation of the Test switch on the transfer switch cabinet, 2) the automatic programmed Exercise routine, or 3) other building management systems.

The test verifies: 1) the generator set will start and carry the load, 2) the transfer switch is able to detect a power failure, 3) mechanically connect to the alternate power source, and 4) reconnect to the normal power source.

Annual Maintenance and Testing

Because a transfer switch serves critical loads 24 hours a day both NFPA110 and NFPA 70B regulations require annual inspection and maintenance of automatic transfer switches. The inspection is intended to detect overheating contacts or connections that could be from overloads, wear in contact assemblies, or loose cable terminations. If these conditions remain uncorrected, the transfer switch can overheat and completely fail, resulting in total power loss to critical loads in a facility for extended periods of time. Replacement of the transfer switch is difficult when catastrophic failures occur because the transfer switch is always energized in the building's electrical system.

Clean and Inspect the Switch

Keeping the switch clean helps to prevent dangerous or damaging ground fault conditions. Disconnect power to the transfer switch from both the utility source and the generator source. The sources will be locked out and tagged for safety. Vacuum and clean the switch cabinet to remove all dirt and debris from the enclosure. Exterior surfaces of the switch can be cleaned as long as care is taken to prevent liquid from entering external switches or the interior of the cabinet.

It is necessary to the monitor transfer switch condition because they are operated under load many more times than other distribution circuit devices. Inspect the transfer switch for carbon tracking, cracks, corrosion, or any other type of deterioration. Remove covers over the contact mechanisms and contacts and inspect for abnormal wear or degradation. Some contact wear is normal. Make corrections and repairs when required.

Most transfer switches require no lubrication, but if required, lubricate according to the Service manual.

After the transfer switch is cleaned and reassembled, check all the power and control connections for deterioration. Re-torque lug connections ac-

cording to the Torque Table in the *Section 1* of the *Service Manual*. Particularly, check for wear on wires routed across doors, and wiring connected to moving parts.

Annual Testing

After cleaning and inspecting the switch, a full power failure test is recommended. In the monthly test, a power failure is typically simulated by manipulation of the control circuits in the transfer switch or controller. Each year, physically open the normal power supply to the facility. Verify all critical support equipment is connected to generator power, and that the generator starts and runs critical loads. The generator set and power transfer system must function exactly as if an actual power failure has occurred.

Thermography

A thermographic or infrared examination of transfer switches is a valuable resource to monitor transfer switch condition and loading. Thermal evaluations can detect overheating due to not only failure or deterioration of components, but also overloading or the effects of non-linear loads in the distribution system.

In general, thermographic evaluation is most useful when historical data is available for use in comparing current test data to samples of previous performance. Comparison of current performance to other contacts of identical or similar design, with similar load levels, or between contacts of a single device often identify contacts needing further inspection or repair.

If historical data is not available, then test data can be evaluated based on maximum allowable temperatures allowed by UL standards. On transfer switches rated 400 amps and lower, the contact and lug assembly should not exceed 50°C (122°F) over ambient with full load on the switch. On transfer switches 400 amps and over, the contact and lug assembly should not exceed 60°C (140°F) over ambient. The bus bar and connecting straps may operate at temperatures up to 60°C over ambient at full load.

Thermographic evaluation does not take the place of the required yearly inspection and maintenance, but can highlight problems between service intervals, or indicate the certain need for repairs such as contact replacement which are not commonly required. Advance notice of the need to repair these components can prevent wasted time and unnecessary down time.

Planned Maintenance Schedule

⚠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 trained and experienced personnel, according to procedures in the Service manual (150-1000 Amp Switches: 962-0518 and 1200-3000 Amp Switches: 962-0519).***

⚠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.***

TABLE 3-1. PLANNED MAINTENANCE

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, the procedures are described in the Service manual (for 150-1000 Amp switches: 962-0518 and for 1200-3000 Amp switches: 962-0519).

   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 4 of the Service manual (for 150-1000 Amp switches: 962-0518 and for 1200-3000 Amp switches: 962-0519). Retorque all cable lug connections. Lug torque requirements are listed in section 1 of the Service manual.

   B. Replace the batteries (3V lithium) in the Digital Module and the Network Module (if applicable) every two years. See Figures 2-6 and 2-16.

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

   A. Connect the genset 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.

4. Digital Display Menu System

This section describes the Digital Display Menu System and illustrates navigation through the menus. The menus display status information, events, and setup menus. Setup menus contain parameters with adjustable values. Descriptions in this section include ranges for the parameters and default values. The system menus can also be accessed with the InPower Service Tool.

DIGITAL DISPLAY

The Digital Display Menu System is a 2-line by 20-character graphical display screen and six push-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

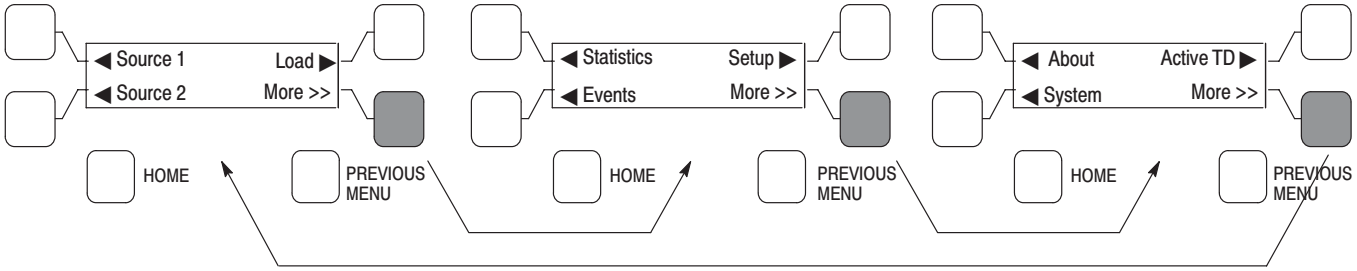
Before you can navigate and change setup parameters, you must enter a password and unlock the key switch on the front panel. However, you can bypass the password and examine, but not change, any parameter. After parameters are changed in any setup menu, you are prompted to either save the changes or to restore the old value. Setting and navigating through the password menus is described in Figure 4-7.

NAVIGATION

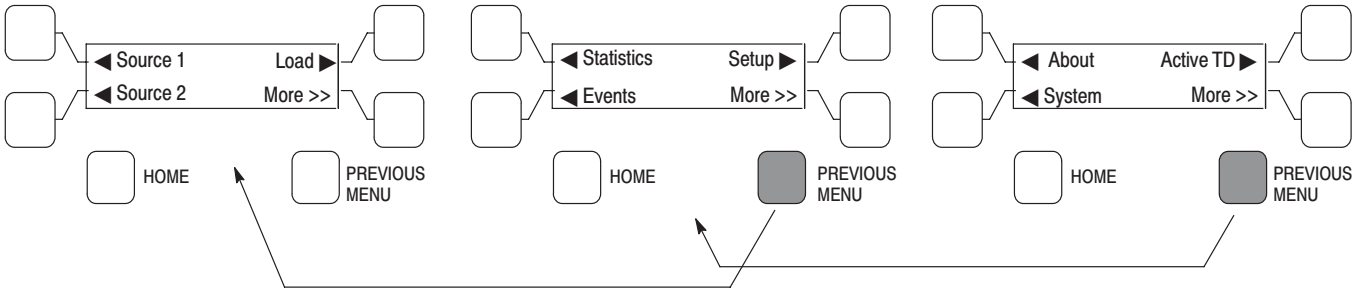
Refer to Figures 4-28 through 4-30 at the end of this section for an overview of menu navigation. This illustration can be used to locate a submenu and determine how to access it.

MAIN MENU NAVIGATION

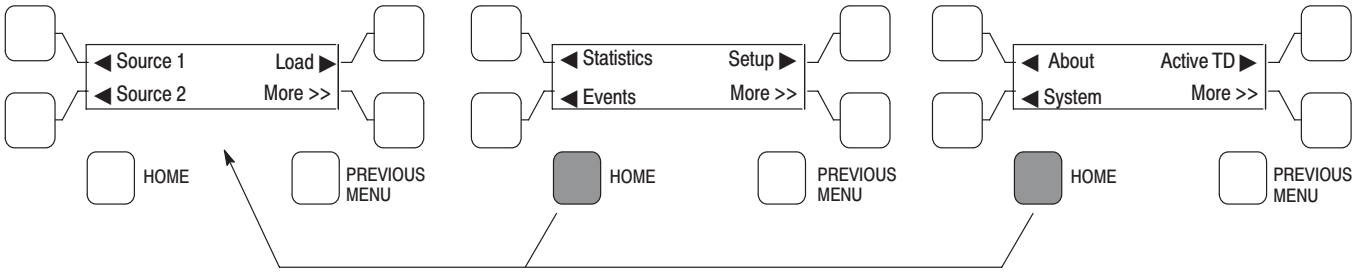
Using the MORE button



Using the PREVIOUS MENU button



Using the HOME button

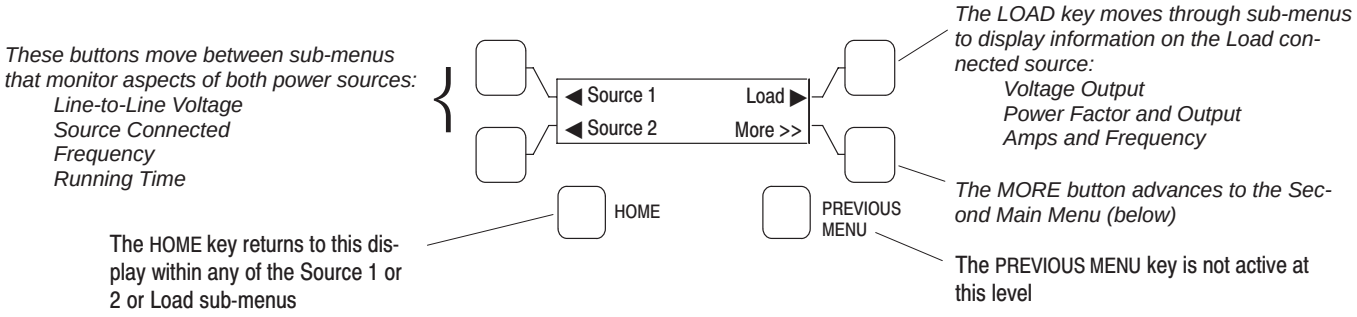


NOTE: The Active TD feature was not available in early versions of software.

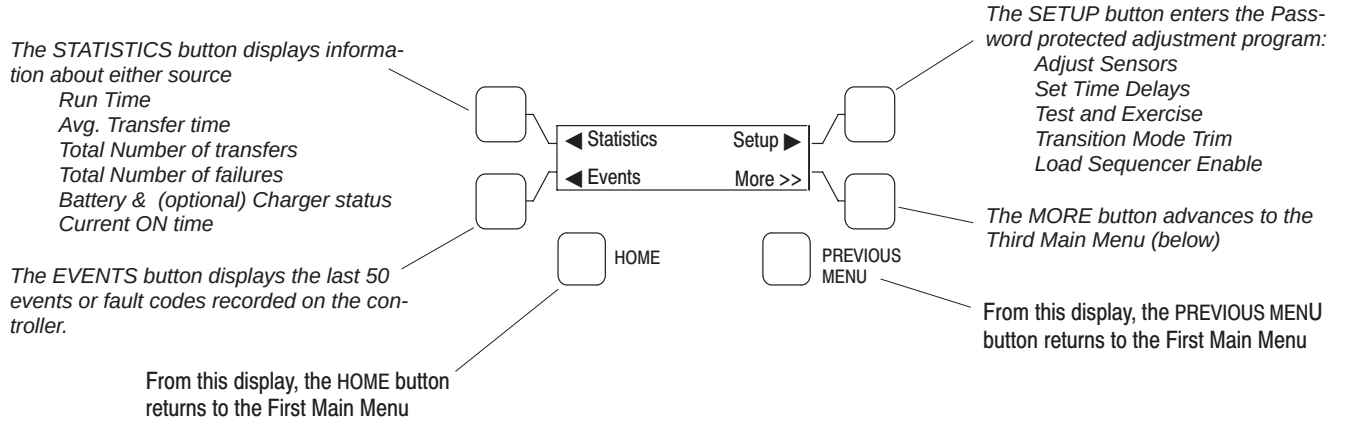
FIGURE 4-1. NAVIGATION

MAIN MENU DESCRIPTIONS

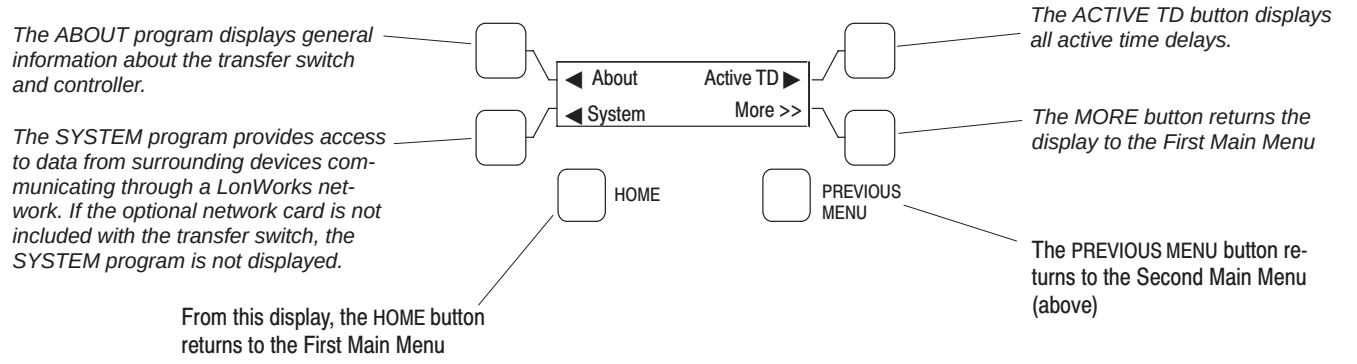
FIRST MAIN MENU



SECOND MAIN MENU



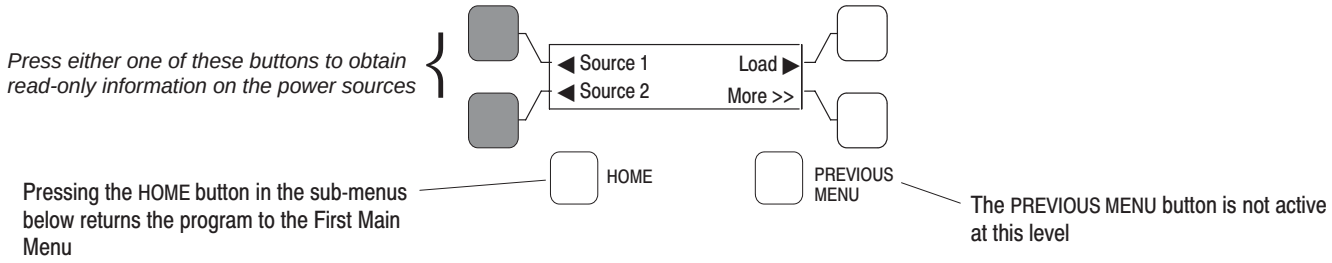
THIRD MAIN MENU



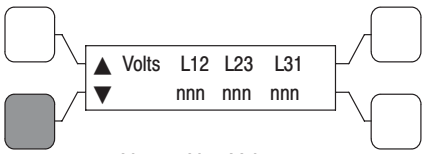
NOTE: The Active TD feature was not available in early versions of software.

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

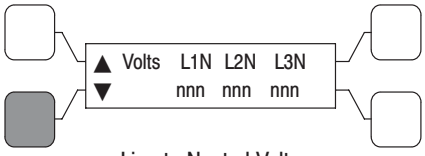


Line-to-Line Voltage

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

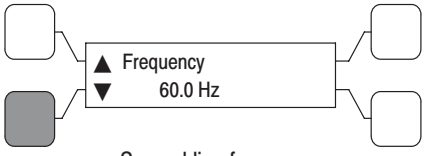
If the voltage is measured at 10 volts or less, the display reads 0.

If the Source is two phase, the display will read voltages at L12 and L31.



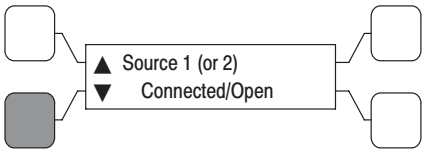
Line-to-Neutral Voltage

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)



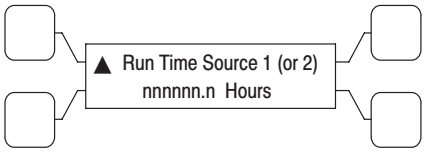
Sensed line frequency

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.



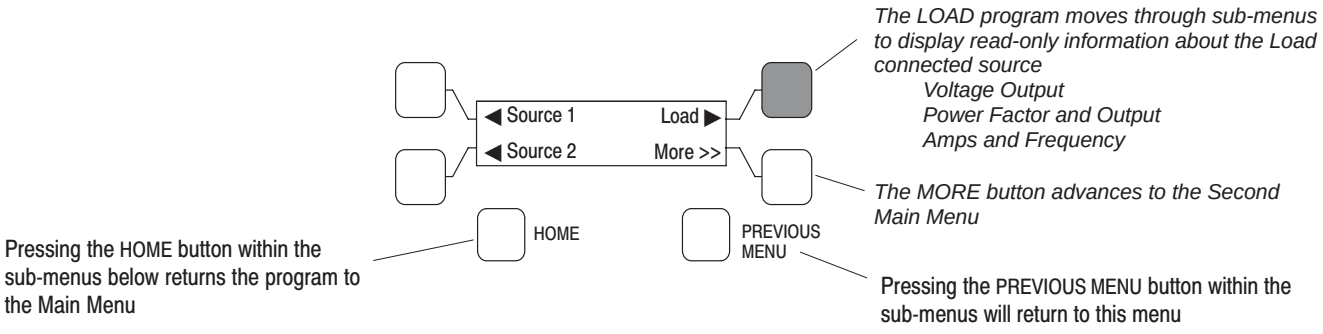
Total connection time

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

FIRST MAIN MENU – Load Sub-Menus

This subset is optional on Level 2 Controls



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

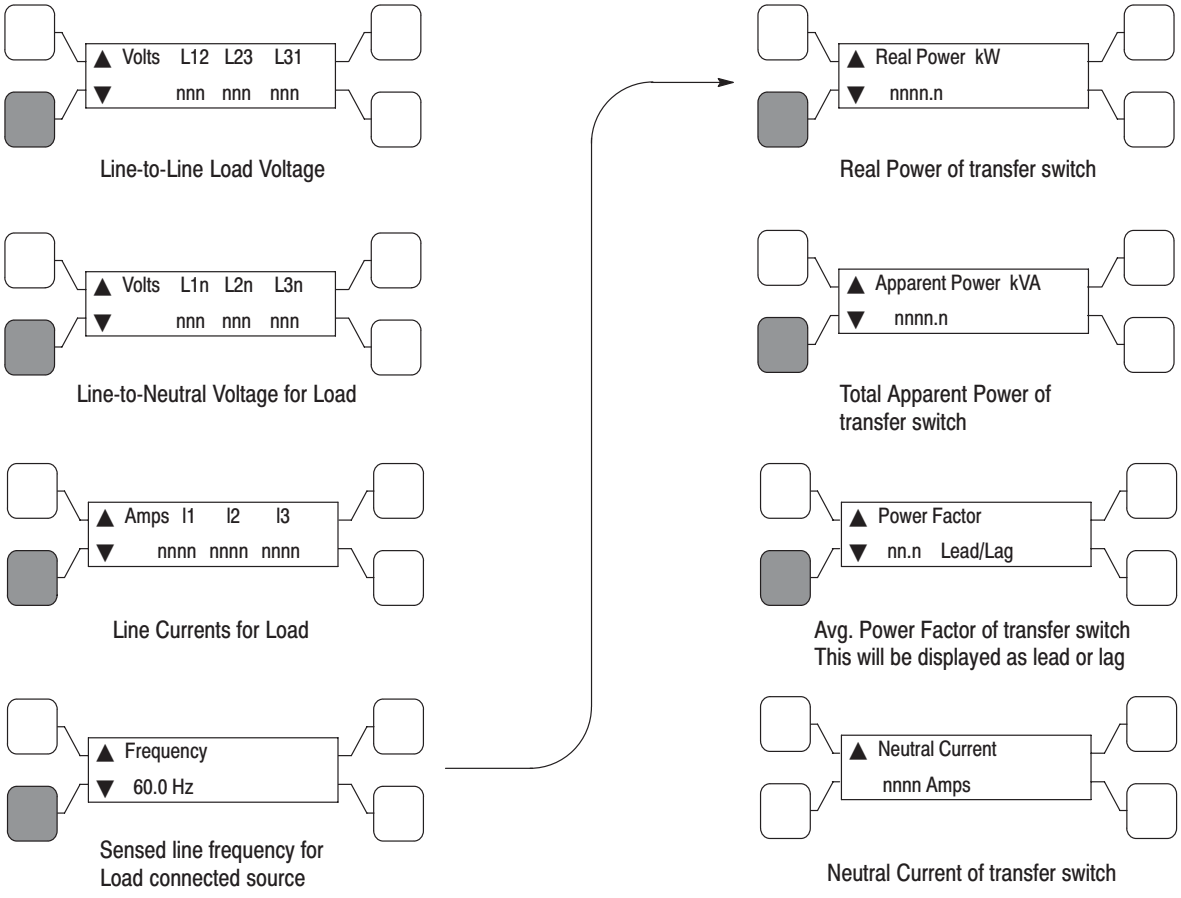
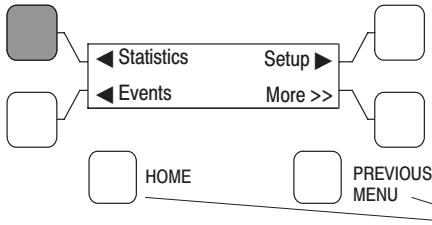


FIGURE 4-4. LOAD SUB-MENUS

SECOND MAIN MENU – Statistics Sub-Menus

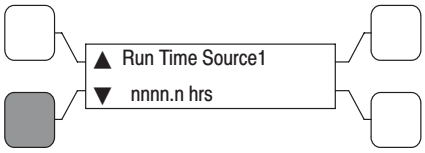
The STATISTICS program displays read-only information about either source:

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

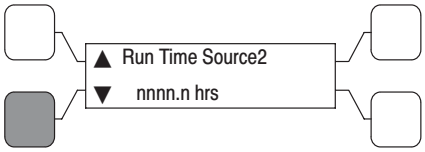


From this display, the PREVIOUS MENU and HOME buttons return the program to the First Main Menu

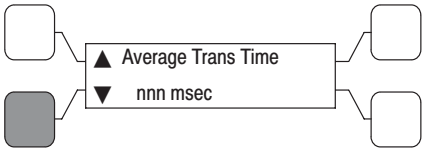
Use the ▲▼ buttons on left to navigate through these screens



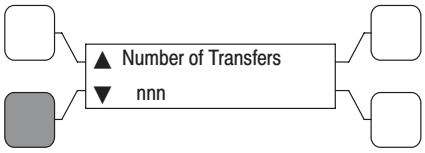
Total time the transfer switch has been connected to Source 1



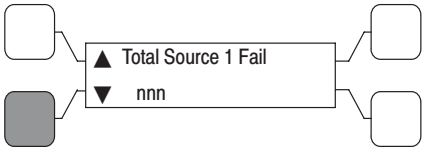
Total time the transfer switch has been connected to Source 2



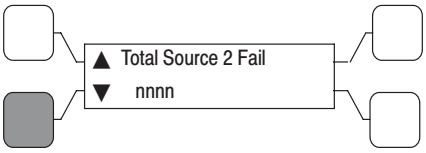
Average. transfer time over the last four transfers. Includes only time that both sources are disconnected. Sensing is disabled when Programmed Transition is active.



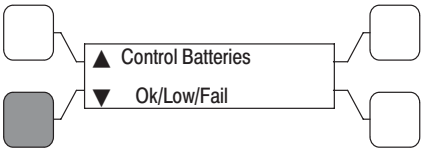
Total number of switch transfers in both directions



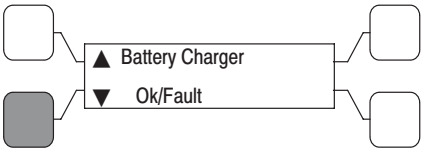
Total number of Source 1 failures



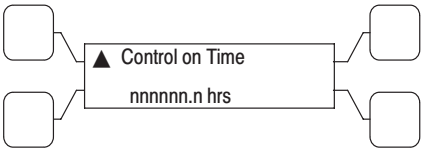
Total number of Source 2 failures (includes under-voltage, over-voltage, over/under frequency)



Status of lithium batteries on controller board



Status of optional generator battery charger



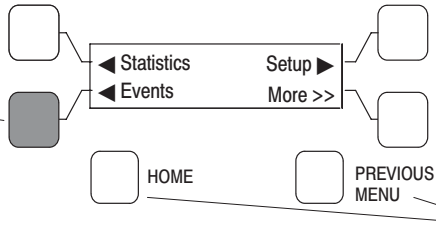
Displays the amount of time the controller board has been operating since initialization. Value is stored permanently.

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

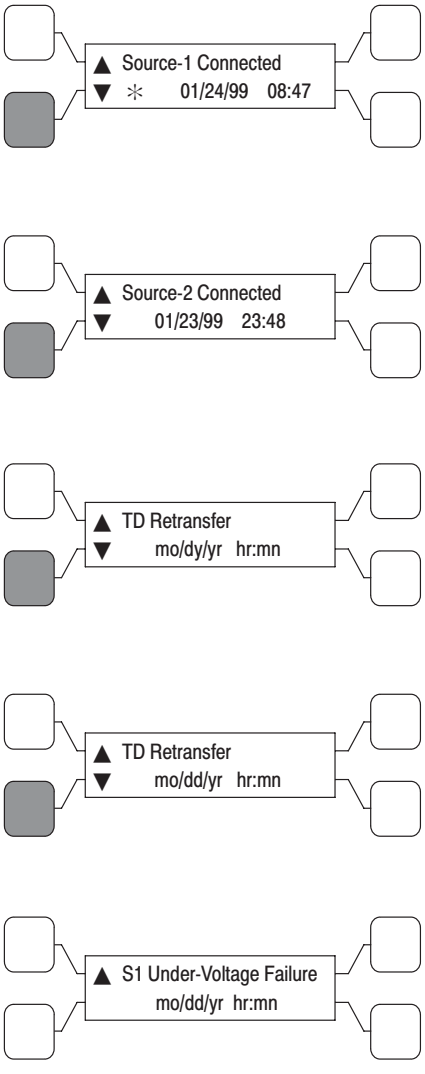
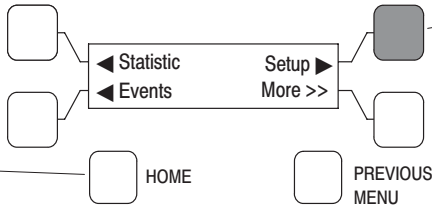


FIGURE 4-6. EVENTS SUB-MENUS

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.

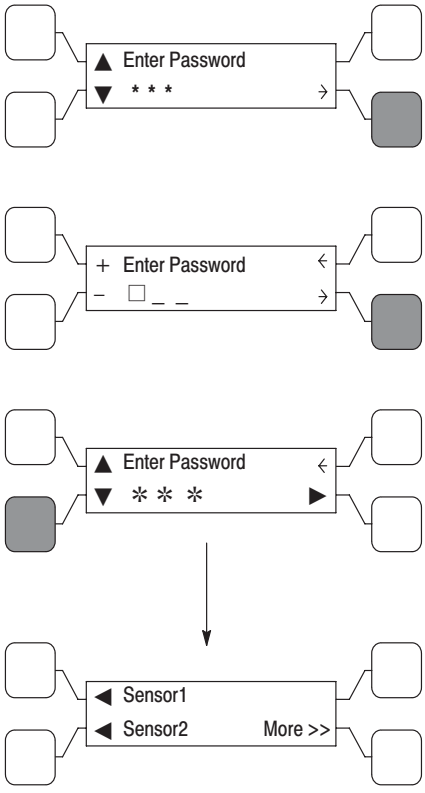
The password is 574.

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.

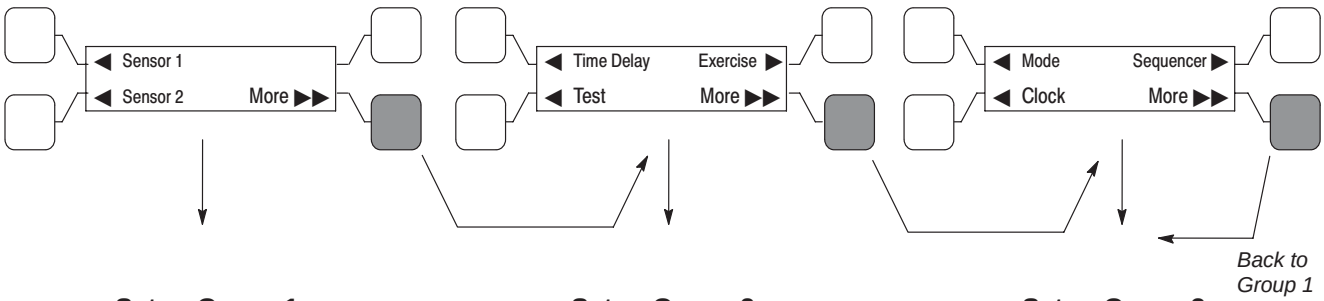
When the password is set, press the ▶ button to enter the setup program.



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 routines for Power Source 2 and are available only on utility-to-genset controls. Only two exercises can be setup using the Digital Display. 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 Exceptions sub-menus. Up to 8 routines and exceptions can be programmed using the PC service tool.

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

Setup Group 3

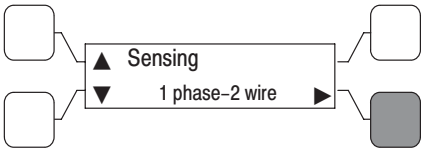
The *Mode* sub-menu allows programming the type of transition the switch uses. See Figure 4-21.

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

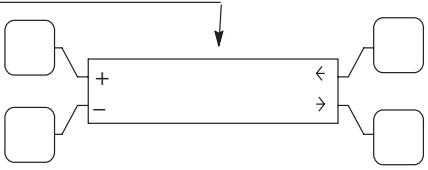
Load *Sequencer* is a software feature, available only with LonWorks NetWork Communication Module. This program allows the user to send a predetermined sequence of event announcements in a timed, sequential order to turn the load off and on. See FIgure 4-23.

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.

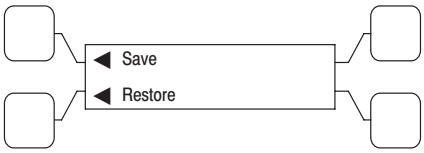


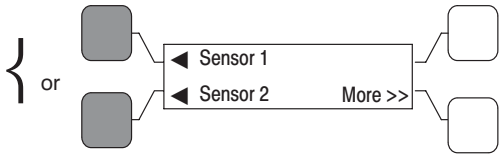
FIGURE 4-9. CHANGING SETUP PARAMETERS

Setup – *Group 1*

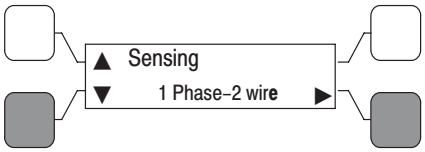
Sensor 1 & Sensor 2 Sub-Menus

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

S1 refers to Source 1
S2 refers to Source 2



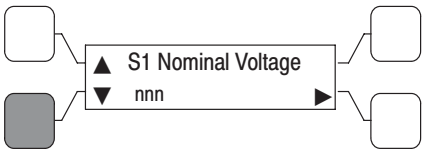
For 2-wire system, select:
1 phase–2 wire
For a single phase - 3 wire system, select: 1 phase–3 wire
For a 3 phase system, select:
3 phase



System Voltage for Source 1 or 2

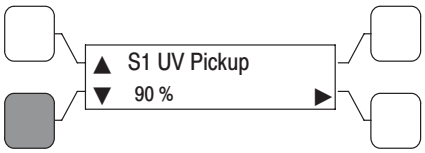
Enter the system voltage between 110 and 600 VAC

Note: Line-to-Neutral Voltages are shown.



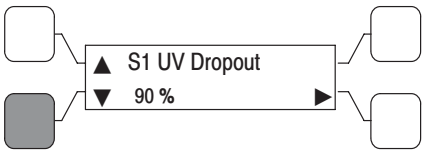
Under-Voltage Sensor Pick-Up

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



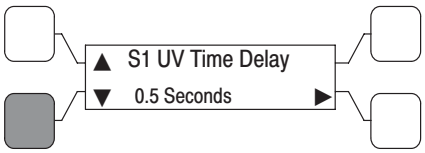
Under-Voltage Sensor Drop-Out Voltage

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



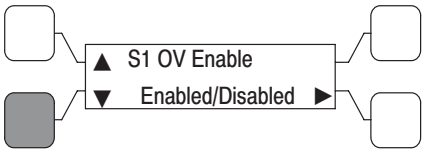
Under-Voltage Drop-Out Time Delay

Enter a time between 0.0 and 1.0 seconds (0.5)



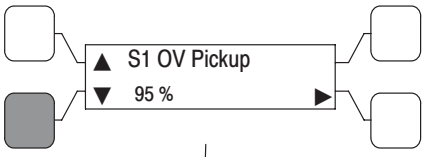
Over-Voltage Sensing Enable

Choose Enabled or Disabled (Enabled)



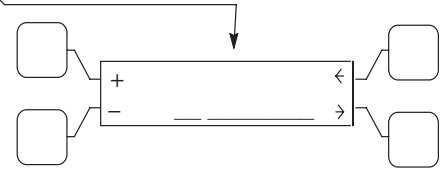
Over-Voltage Pick-Up
This adjusts the over-voltage pick-up as a percentage of the over-voltage drop-out

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



Continued on next page

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.



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

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.

Note: Default values are in parenthesis.

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

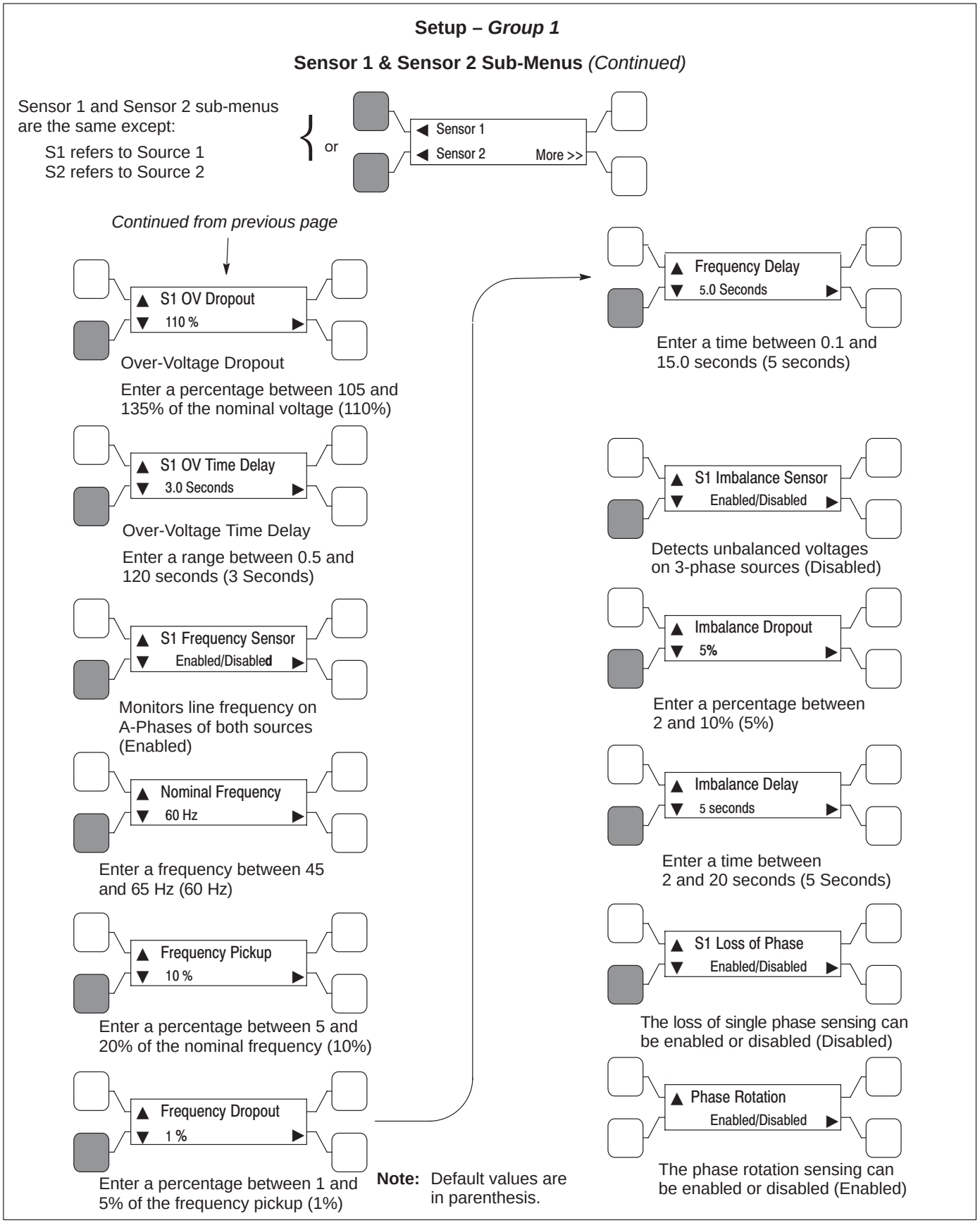
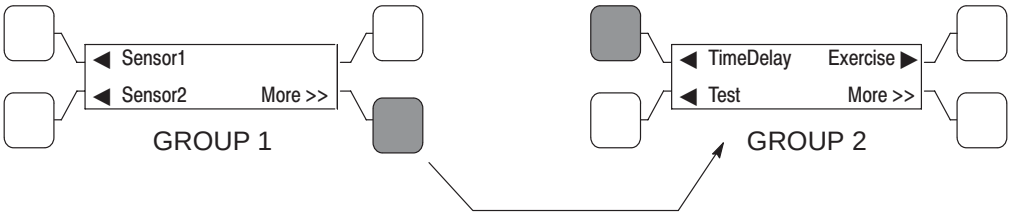


FIGURE 4-11. SETUP GROUP 1 – SENSOR SUB-MENUS (Continued)

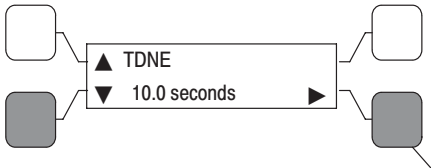
Setup – *Group 2*

Time Delay Sub-Menus

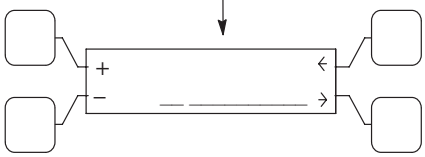


In a Normal to Emergency transfer this function allows Source 2 to stabilize before the load is applied.

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.

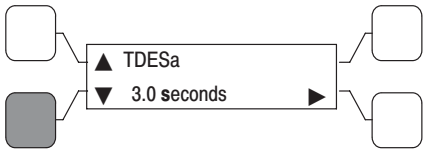


In a Emergency to Normal transfer this allows Source 1 to stabilize before re-transfer.

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

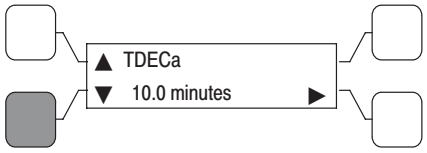
Sets the time delay for Engine Start on genset (a) used in a utility-generator and generator-generator mode. Prevents nuisance genset starting during brief power interruptions. This menu does not appear in utility-to-utility installations.

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



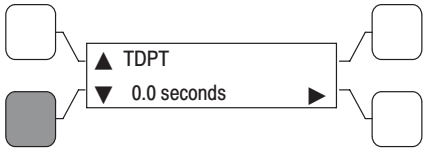
Sets the time delay for Engine Cool-down following a re-transfer. This menu does not appear in utility-to-utility installations.

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



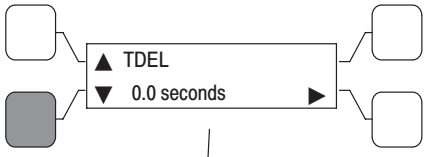
Sets the time delay for Programmed Transition setting of 0.0 disables the program.

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.

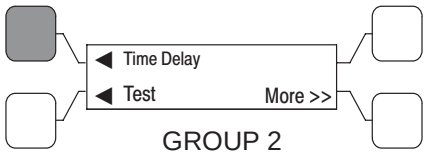
Note: Default values are in parenthesis.

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)*

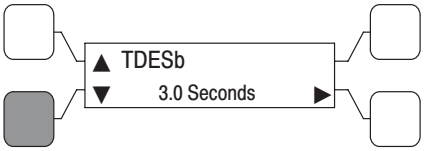


This group is used only in Genset to Genset applications

Continued from previous page

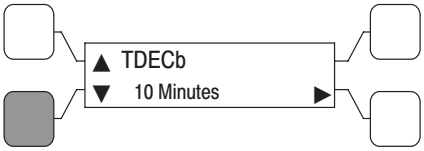
Sets the Engine Start time delay to for genset (b).

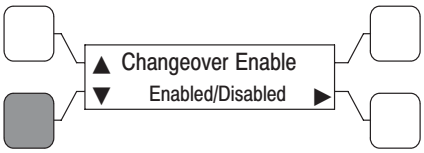
Enter a time from 0 to 120 seconds (3 Seconds)



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 Hours)

Note: Default values are in parenthesis.

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

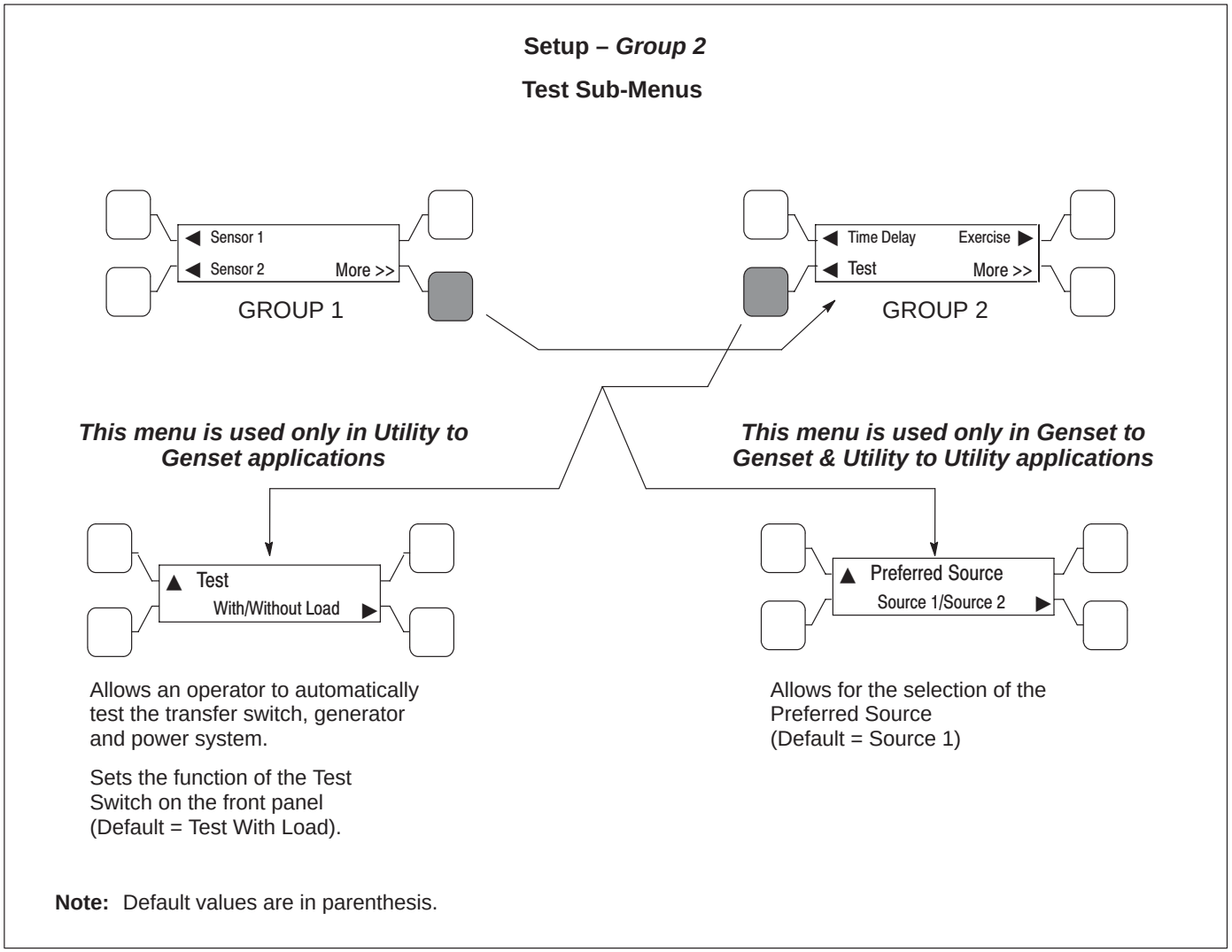
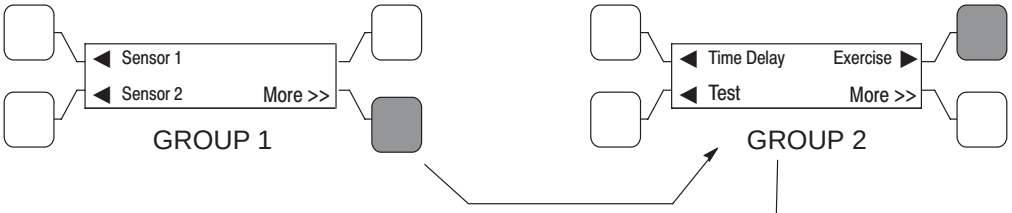


FIGURE 4-14. SETUP GROUP 2 – TEST SUB-MENUS

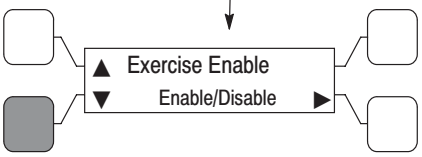
Setup – *Group 2*

Exerciser Sub-Menus – Software Versions Prior to 1.5.190

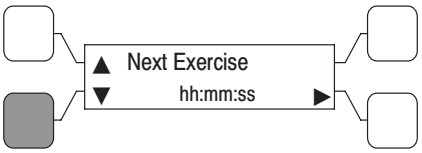
These sub-menus are available only in Utility-to-Genset applications.



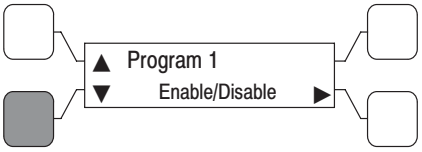
Enables or disables all the functions of exercising the generator(s)



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)

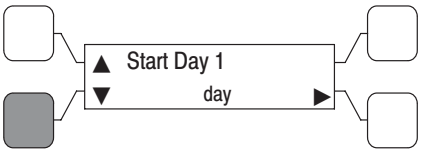


This screen allows disabling Exercise Program 1 only



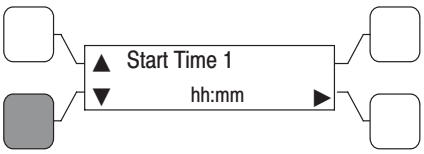
The first of four programming sub-menus for the Exerciser cycle. Sets the day an Exercise cycle will occur

Select a day between Sunday=0 and Saturday=6



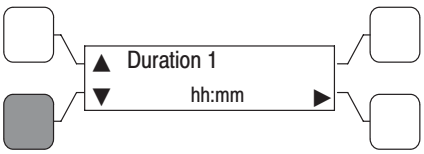
Sets a Time for the exercise cycle to begin

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



Sets the length of Time the exercise cycle will run

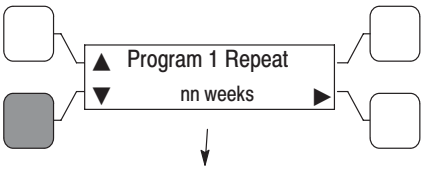
Enter a time within a 24 hour period: hh = 0 – 23, mm = 0 – 59.



Sets an Interval the exercise cycle will repeat

Enter a cycle between 0 and 52 weeks

Typical values are 1 or 2

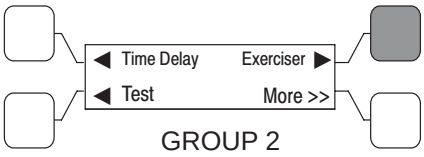


Continued on next page

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

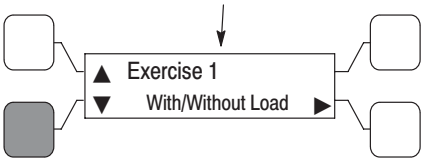
Setup – *Group 2*

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

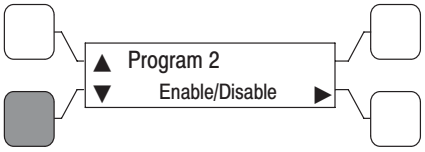


Level 2 Controls allow for two exercise programs to be setup from the Setup menu screen. Six additional programs and eight exceptions can be setup using the PC Service Tool.

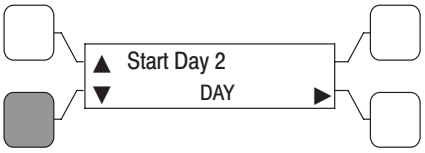
Continued from previous page



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

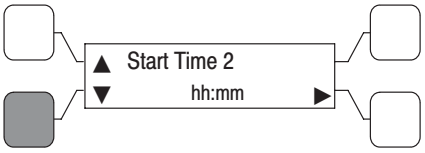


This screen allows disabling Exercise Program 2 only



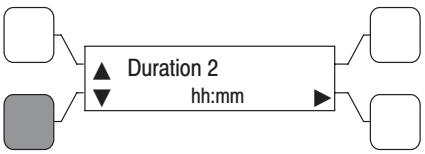
Sets the day of the second exercise cycle.

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.

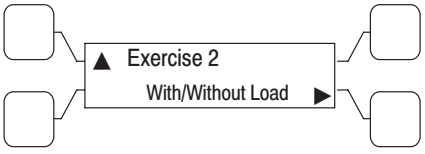


Sets a time limit the second exercise cycle will run

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.



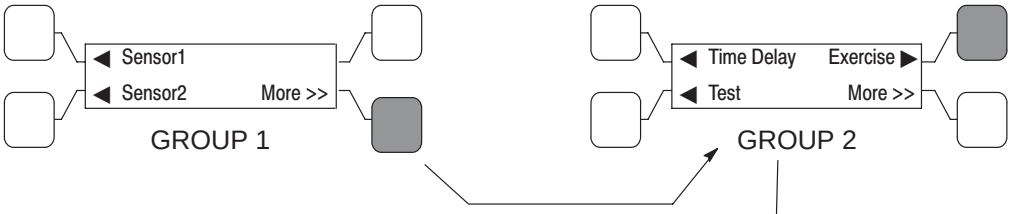
Enables or disables the second exercise program to run the generator(s) with or without a load

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

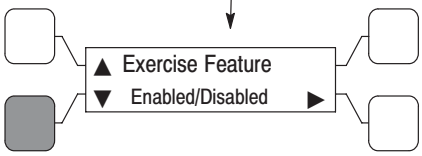
Setup – *Group 2*

Exerciser Sub-Menus – Starting with Software Version 1.5.190

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

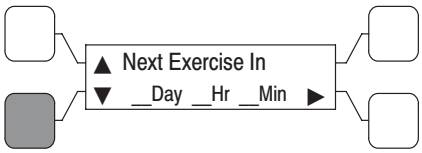


Enables or disables all the functions of exercising the generator(s). (Default = Disabled)

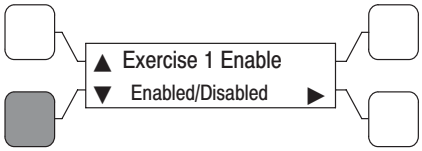


Note: Instead of "Exercise Feature," this menu is titled "Exercise Enable" in some early versions of software. This menu is no longer included with current software.

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

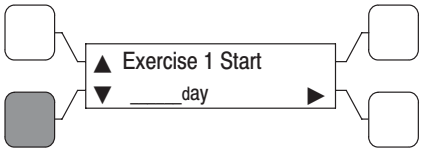


This screen allows disabling Exercise 1 only. (Default = Disabled)



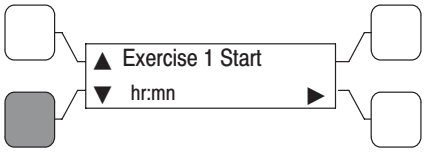
The first of four programming sub-menus for the Exercise cycle. Sets the day an Exercise cycle will occur

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



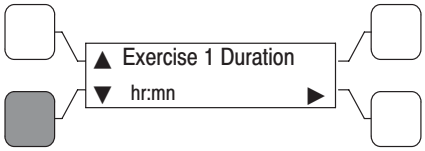
Sets a Time for the exercise cycle to begin.

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)

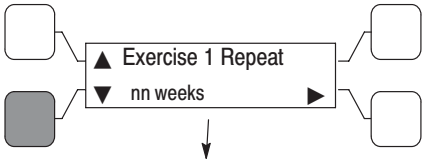


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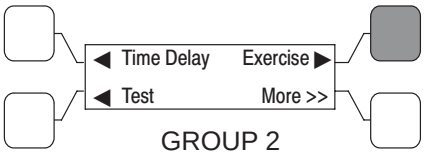
FIGURE 4-17. SETUP GROUP 2 – EXERCISER SUB-MENUS (STARTING WITH SOFTWARE VERSION 1.5.190)

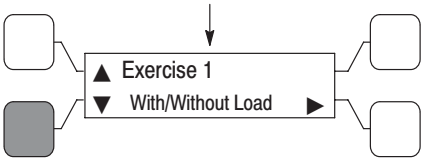
Setup – *Group 2*

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

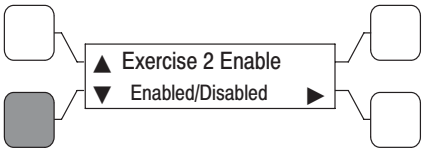


Level 2 Controls allow for two exercise programs to be setup from the Setup menu screen. Six additional programs and eight exceptions can be setup using the PC Service Tool.

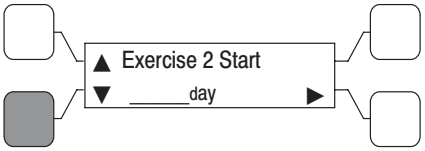
Continued from previous page



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

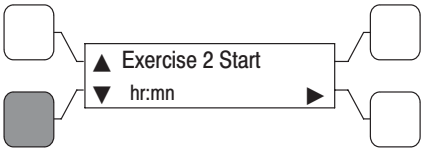


This screen allows disabling Exercise 2 only. (Default = Disabled)



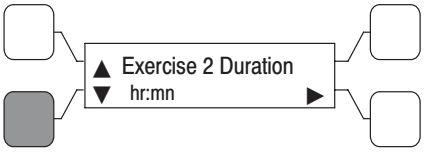
Sets the day of the second exercise cycle.

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



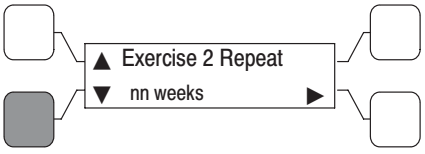
Sets the time the second exercise cycle will begin.

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



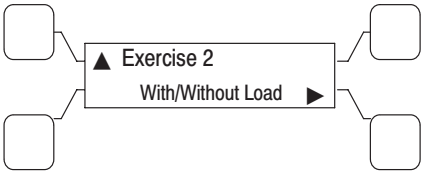
Sets a time limit the second exercise cycle will run.

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)



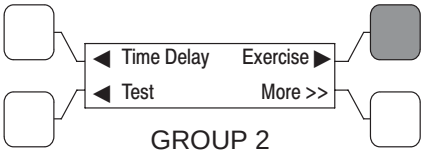
Enables or disables the second exercise program to run the generator(s) with or without a load. (Default = Without Load)

Add and Delete Exceptions
(continued on next page)

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

Setup – *Group 2*

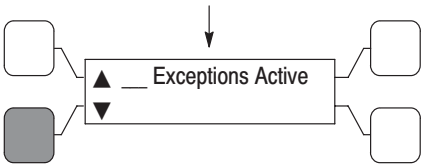
Exercise Exceptions Sub-Menus



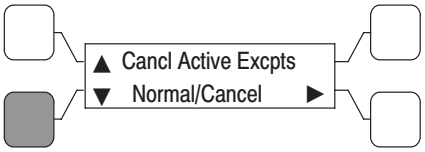
Level 2 Controls allow for adding and deleting exceptions to the two exercise programs setup from the Setup menu screen.

Continued from previous page

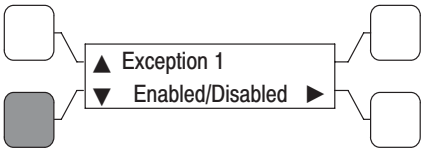
Indicates the number of active exercise exceptions. If there are no active exceptions, the message “No Exceptions Active” is displayed.



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

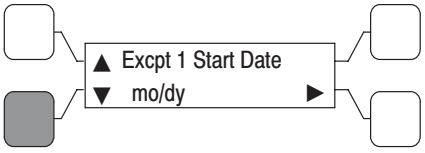


This screen allows enabling/disabling Exception 1 only. (Default = Disabled)



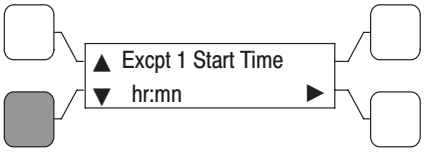
Sets the month and day for Exception 1.

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



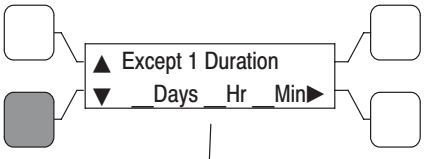
Sets a time of day for Exception 1.

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.

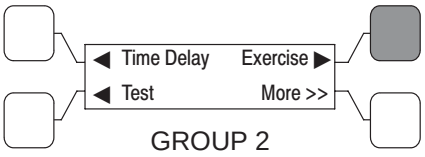


Continued on next page

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

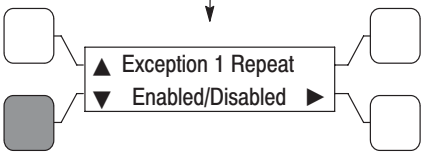
Setup – *Group 2*

Exercise Exceptions Sub-Menus *(Continued)*

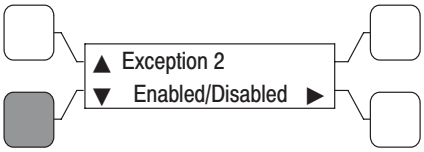


Continued from previous page

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

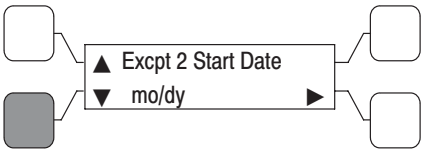


This screen allows enabling/disabling Exception 2 only. (Default = Disabled)



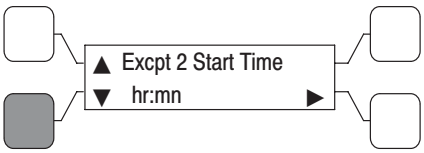
Sets the month and day for Exception 2.

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



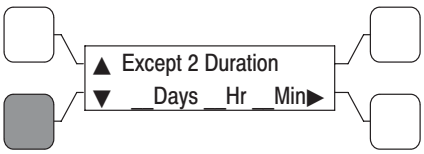
Sets a time of day for Exception 2.

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)

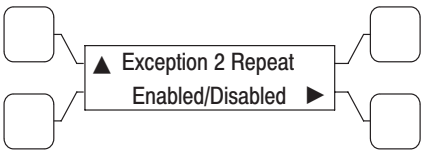


FIGURE 4-20. SETUP GROUP 2 – EXERCISE EXCEPTIONS SUB-MENUS (Continued)

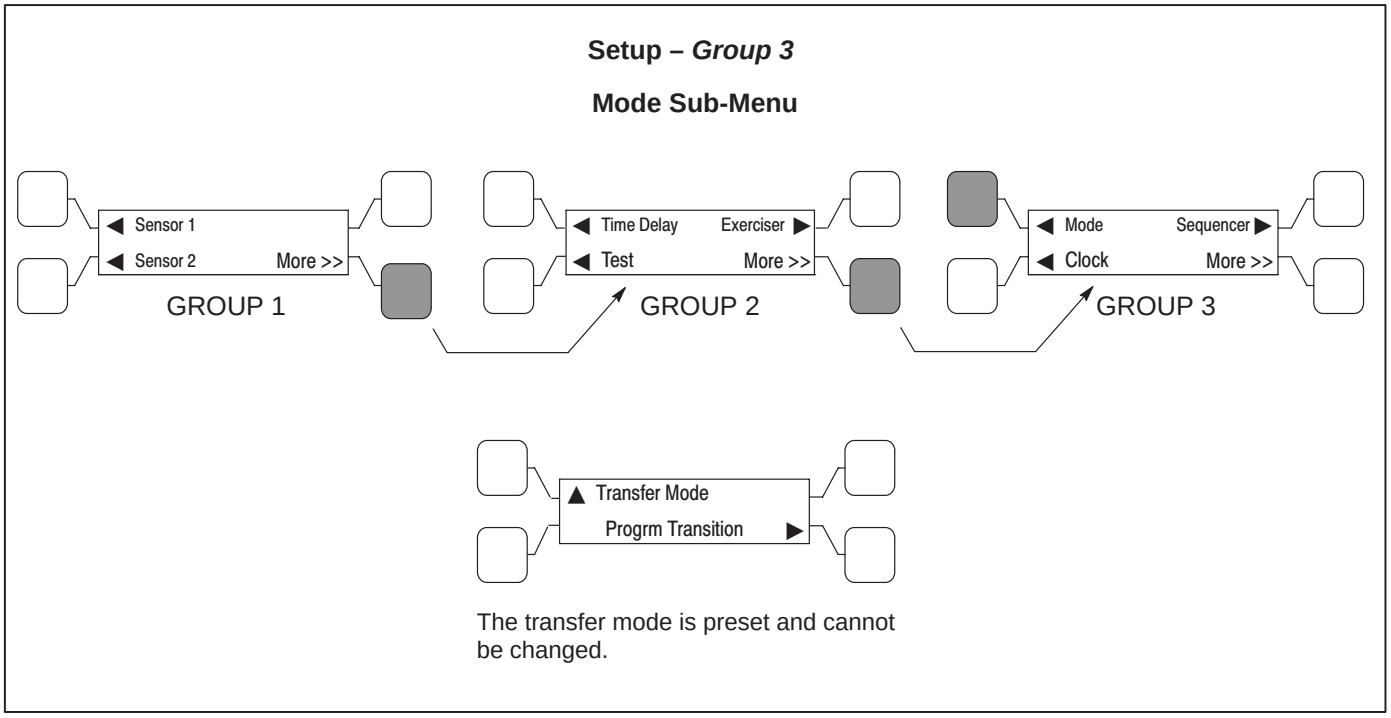
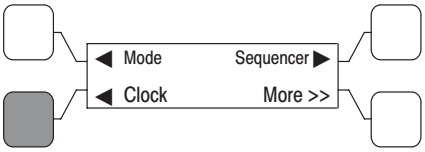


FIGURE 4-21. SETUP GROUP 3 – MODE SUB-MENU

Setup – *Group 3*

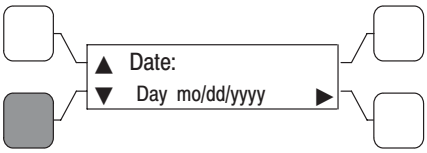
Clock Sub-Menus



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

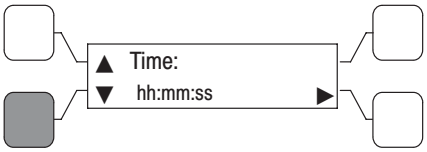
Sets the actual day and date.

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)

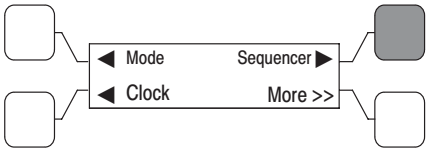
Note: The Daylight Savings Time program is set for North America. If you are anywhere outside of North America, the time should be changed manually.

- 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*

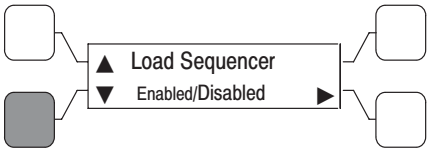
Sequencer Sub-Menus



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.

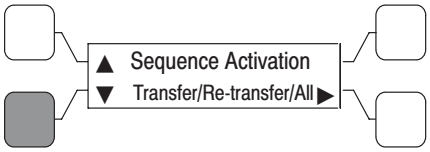
Sequencer is available only with the Network Communication Module. The module must be installed and enabled before these screens are displayed.

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



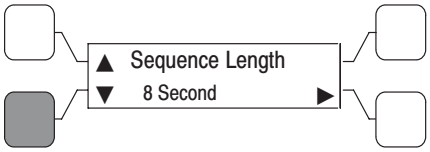
Sets activation for certain operational modes.

Choose Transfer, Re-transfer or All



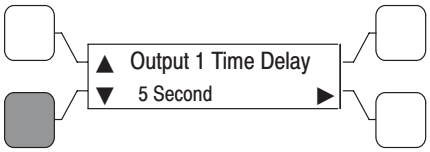
The control can activate a maximum of 8 relay output signals.

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



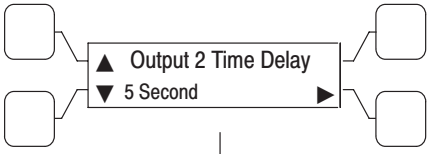
When Load Sequencer is triggered, the controller deactivates all remote relay output signals. Starting with Relay 1, the controller counts down the specified time delay, then activates Relay 1.

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.



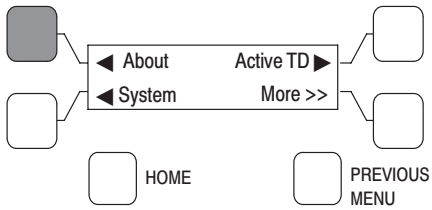
Menus continue through Output 8, depending on the number of Sequence Lengths specified.

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

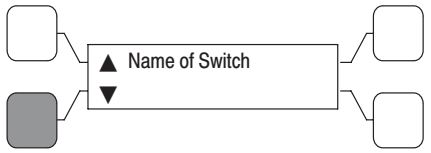
FIGURE 4-23. SETUP GROUP 3 – SEQUENCER SUB-MENUS

THIRD MAIN MENU – About Sub-Menus

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

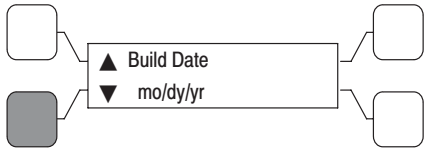


Displays the name of the switch as defined in the Event Handling Requirement.

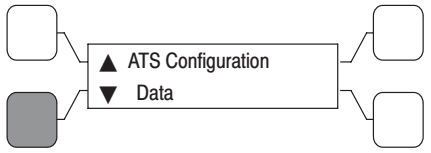


Displays the current firmware version of the controller.

Displays the manufacturing date of the controller.

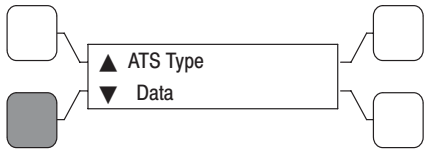


Displays the configuration of the controller. Changes are made by service personnel using the PC Service tool.



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.

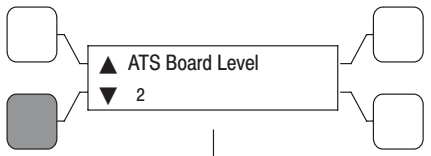


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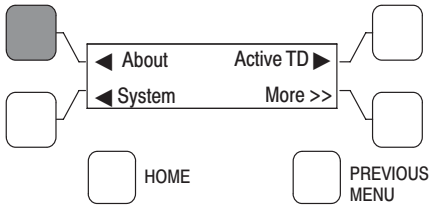
FIGURE 4-24. THIRD MAIN MENU – ABOUT SUB-MENUS

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



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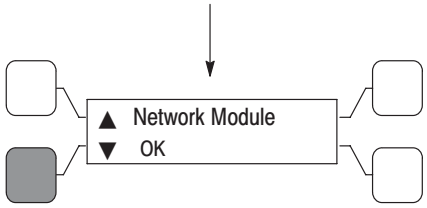
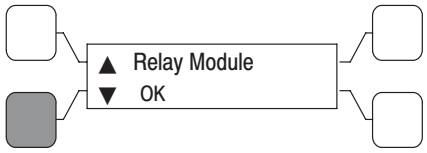
This screen indicates if a Network Communications Module is installed and enabled.

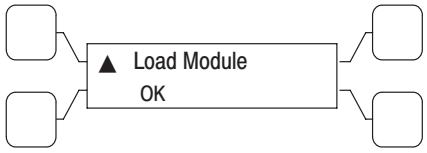


Hardware Detected	Software Enabled	Data
True	True	OK
False	True	Not Installed
True	False	Not Enabled
False	False	Not Available

This screen indicates if the Relay Module hardware is installed.



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

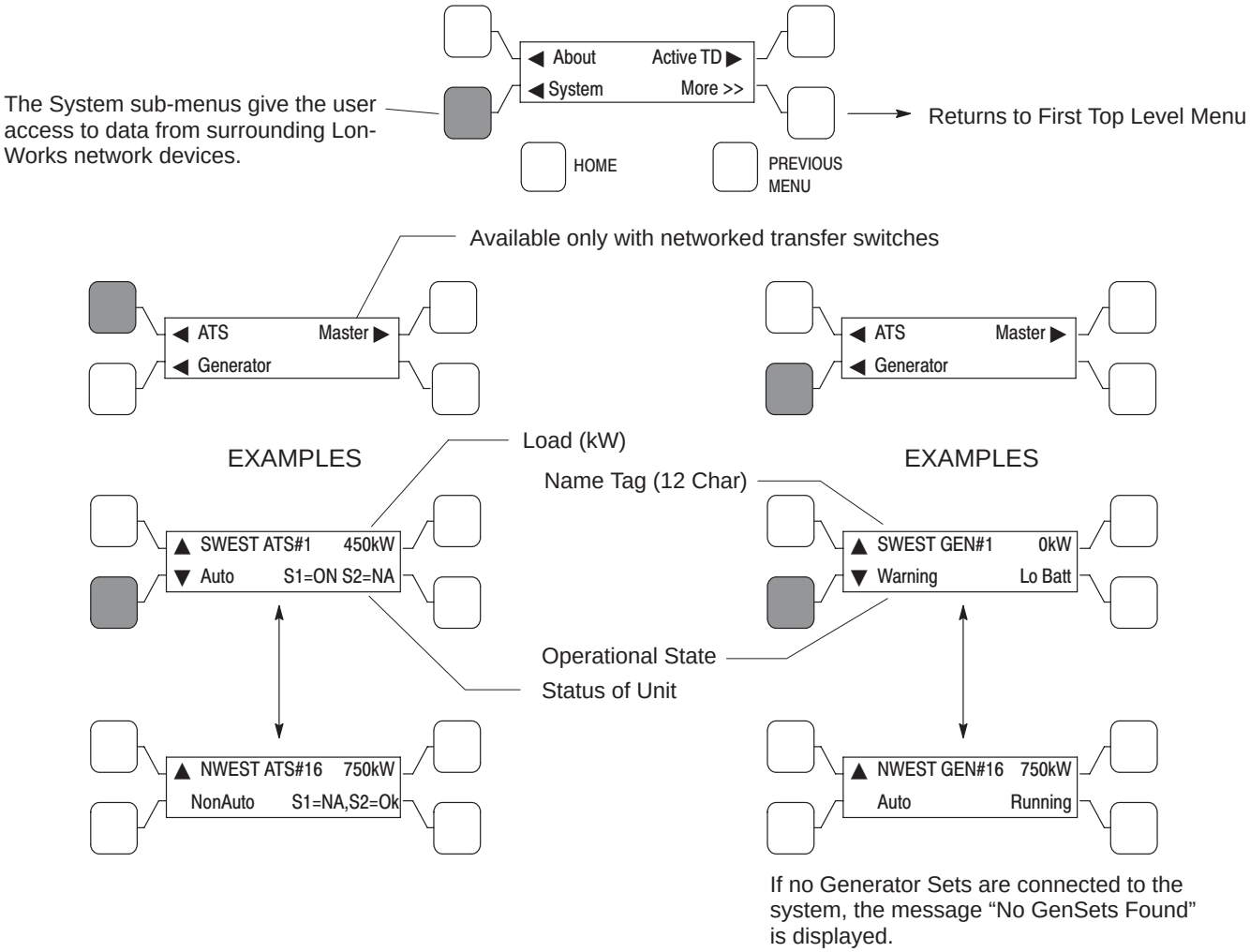


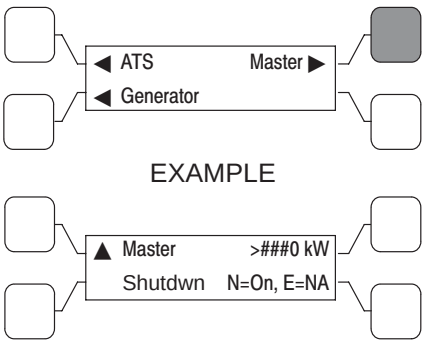
Data
OK
Not Installed

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).

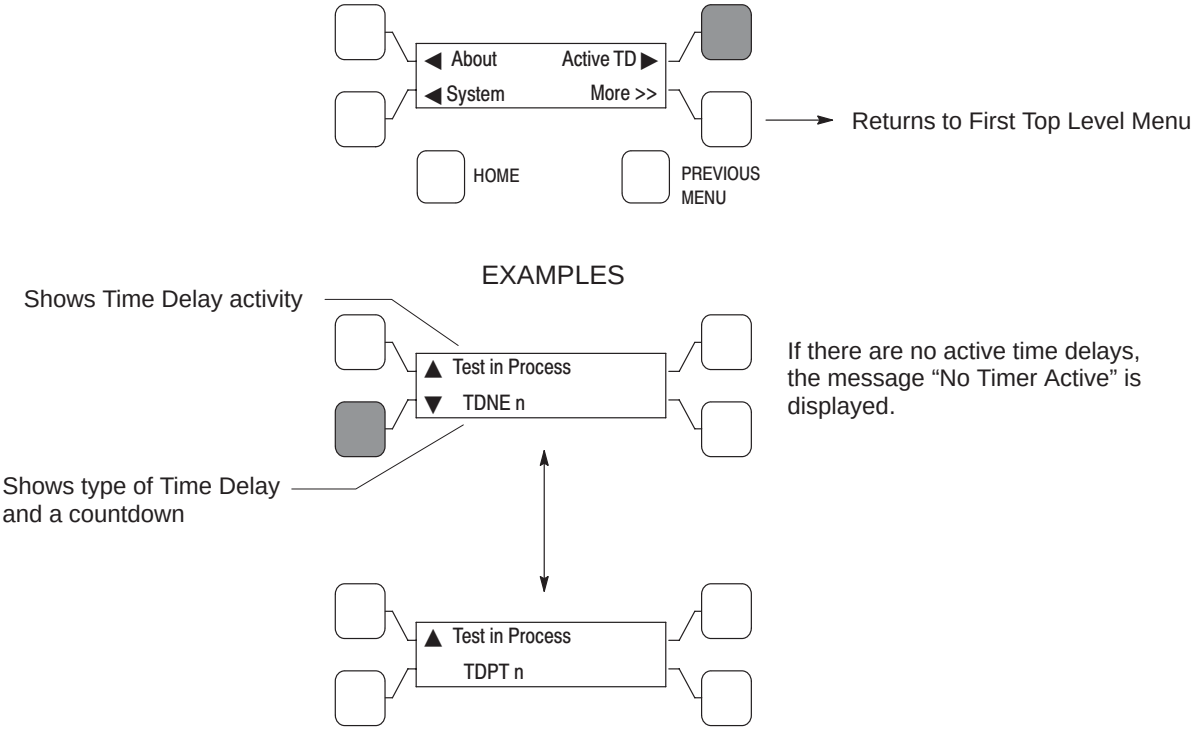
If a Master Control is not connected to the system, the message “No Master Control” is displayed.

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

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

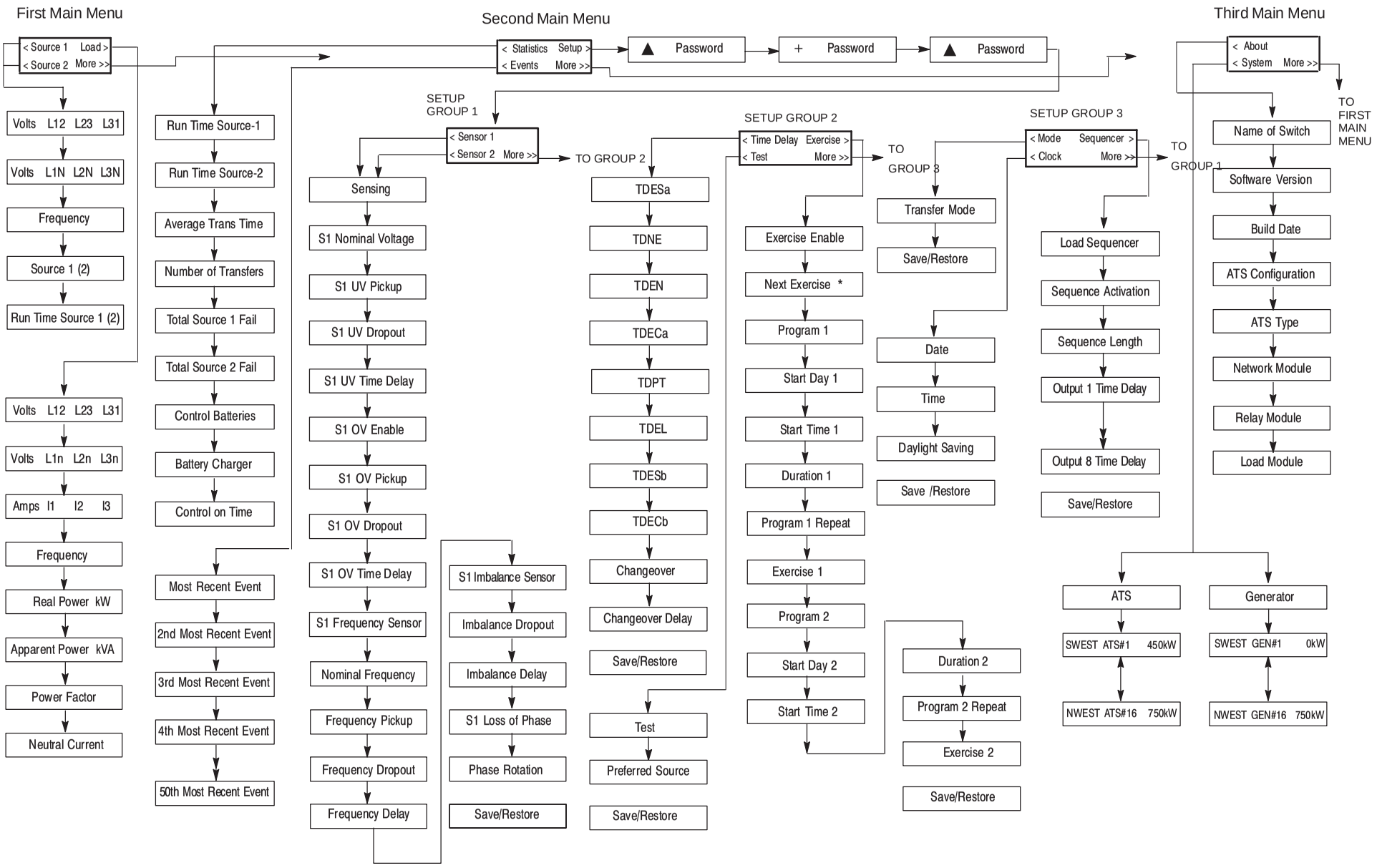
THIRD MAIN MENU – Active TD Sub-Menus

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



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

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



*MAY NOT BE DISPLAYED .

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

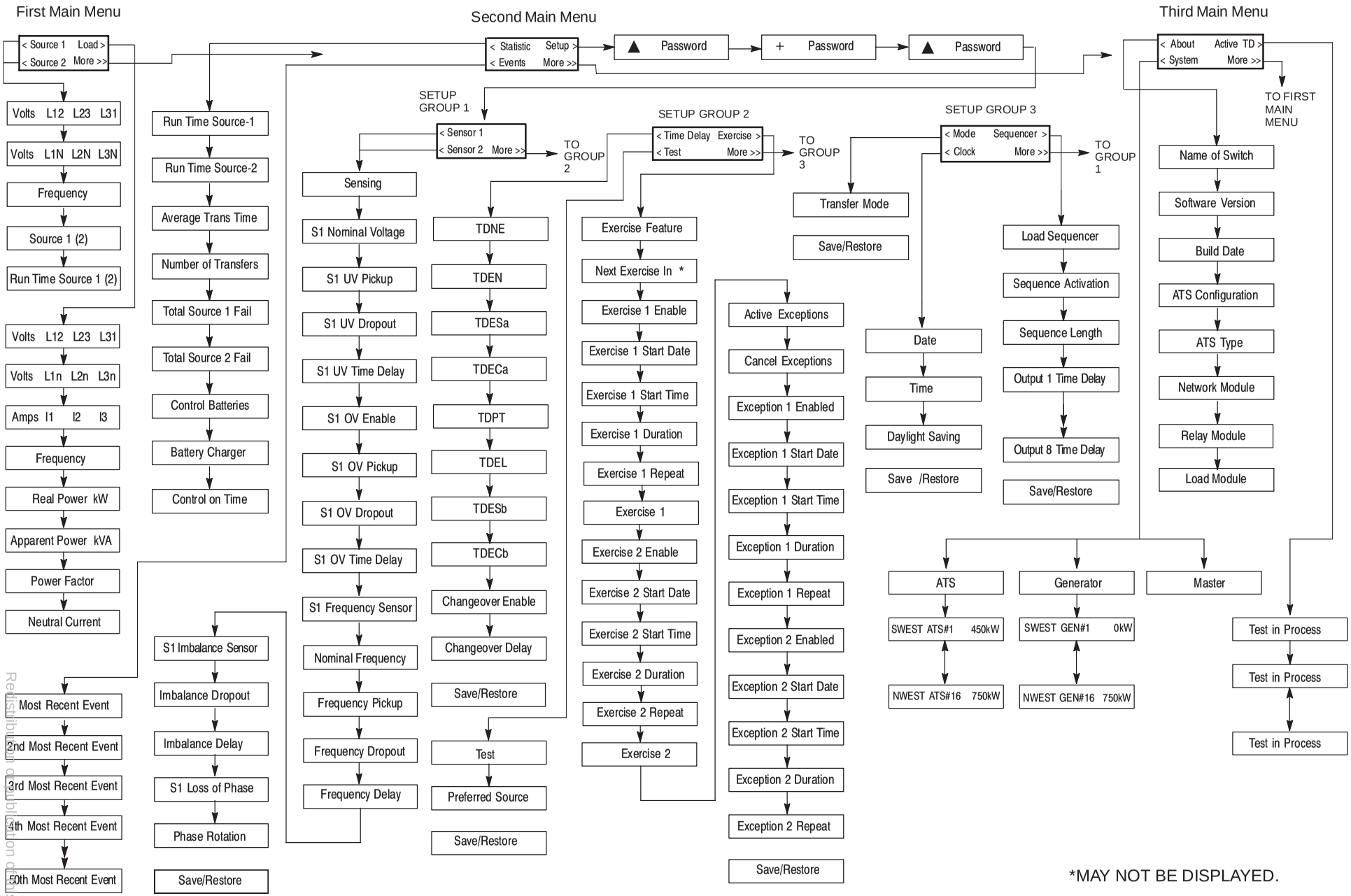


FIGURE 4-29. MENU SYSTEM MAP – STARTING WITH SOFTWARE VERSION 1.5.190

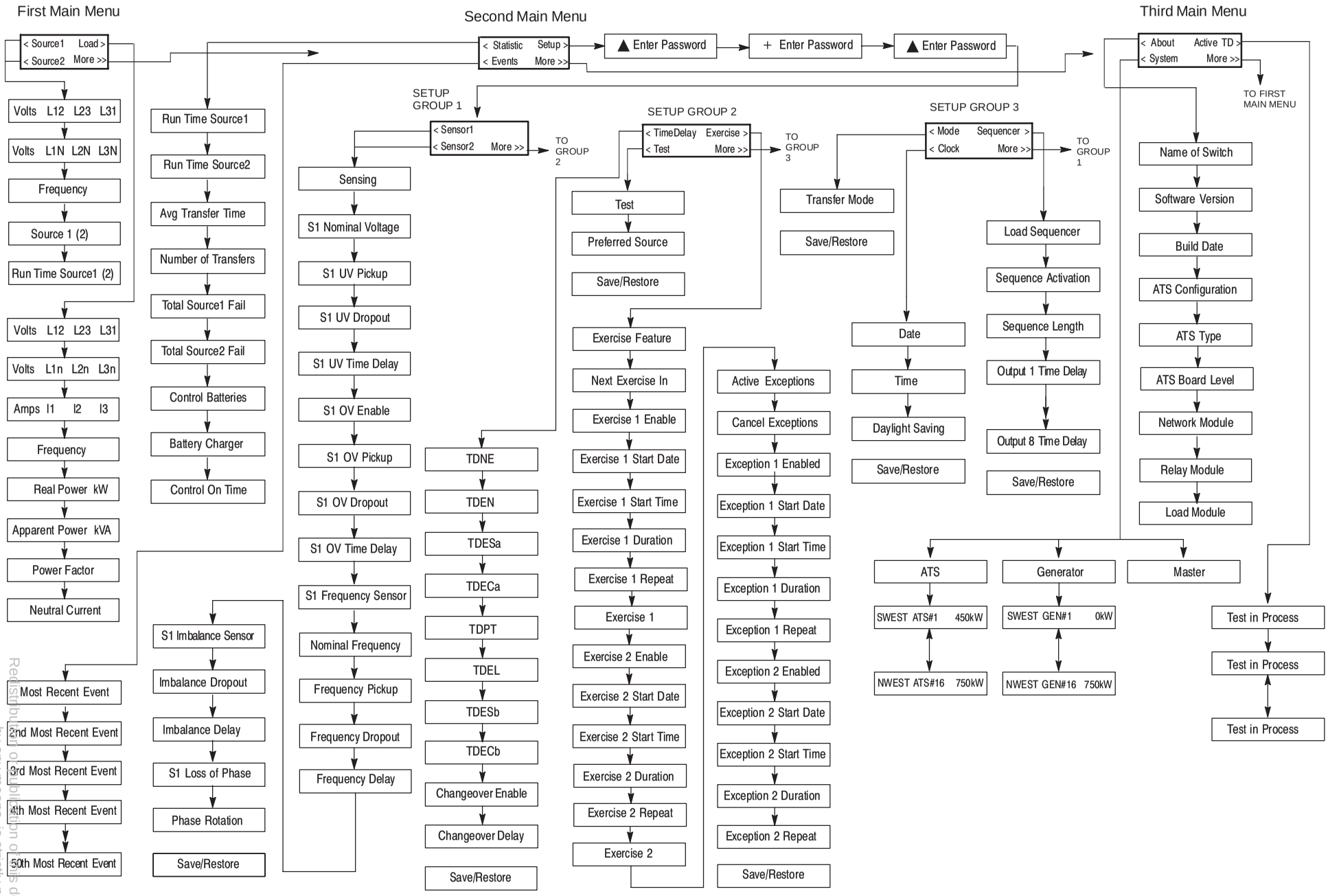


FIGURE 4-30. MENU SYSTEM MAP – STARTING WITH SOFTWARE VERSION 1.8.204

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5. Events

This section describes the Events feature and contains a list of all non-fault events. Events can be displayed on the PC service tool and on transfer switches that are equipped with the Digital Display.

EVENT TYPES

The controller has two types of events: fault events and non-fault events. All events have the same format within the control software.

A fault event is a situation in which the transfer switch or ATS controller is not operating correctly. Fault events can be in either of two states: active or inactive. Fault events are used in troubleshooting transfer switch problems. See *Troubleshooting, Section 6* for more information on Fault Events.

Active events consist of a text message, a date/time stamp, and an asterisk. Pressing the Reset button on the control panel acknowledges all active events and moves it to the history file. The asterisk indicates the event is currently active.

Event History

The controller displays the last event that occurred on the digital display, until it is acknowledged or another event occurs. If another event occurs before the displayed event is acknowledged, it is displayed and the previous event moves to the history file, unacknowledged. Unacknowledged events are acknowledged when the reset button is pressed.

The control records up to 50 events in the event history file. When the history file is full and a new event occurs, the control adds it to the history file and deletes the oldest event in the history file. The PC service tool and the digital display can display the events. See the Digital Display Menu System section for how to display previous events.

NON-FAULT EVENTS

A non-fault event is a power system fault or a situation in which the power system is not in the normal state. Non-fault events can be in either of two states: active or inactive. Non-fault events provide a chronological history of power system behavior.

The events listed below describe the status of the power system or the ATS, but are not ATS faults. These events are meant to provide a historical log of the power system behavior over time.

Press the Reset button on the control panel to acknowledge the event.

Source 1 Connected

This event is active when the transfer switch is connected to Source 1 (Normal). There is an associated LED output on the front panel, a relay output on the Relay Module, and a Digital Display screen that also indicates Source 1 Connected.

Source 2 Connected

This event is active when the transfer switch is connected to Source 2 (Emergency). There is an associated LED output on the front panel, a relay output on the Relay Module, and a Digital Display screen that also indicates Source 2 Connected.

Source 1 Available

This event is active whenever the Source 1 sensors (over/under voltage, over/under frequency, phase rotation, loss of phase, voltage imbalance) indicate that Source 1 is within acceptable limits. There is an associated LED output on the front panel and a relay output on the Relay Module.

Source 2 Available

This event is active whenever the Source 2 sensors (over/under voltage, over/under frequency, phase rotation, loss of phase, voltage imbalance) indicate that Source 2 is within acceptable limits. There is an associated LED output on the front panel and a relay output on the Relay Module.

Emergency Start A

This event is active whenever the controller requires the genset (Source 2) to start at rated speed—otherwise known as an emergency start. There is also a discrete output called Emergency Start A.

Emergency Start B

This event is active whenever the controller requires the Source 1 generator set to start at rated speed. This event is only used in genset-genset control modes. There is also a discrete output called Emergency Start B.

Test Start A

This event is active whenever the controller performs a Test sequence. The controller also activates the Emergency Start A output in order for the generator to interpret that a Test/Exercise start is called for.

There is also a discrete output called Test Start A that goes to the Start Type input on gensets with PowerCommand 3200 controls.

Time Delay Start A (TDES-A)

This event is active whenever the Time Delay Start A timer is active. This event is inactive whenever the timer expires or is not active. The main control loop activates this output whenever the control requires generator set (A) to start.

The digital display shows this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Time Delay Start B (TDES-B)

This event is active whenever the Time Delay Start B timer is active. This event is inactive whenever the timer expires or is not active. The control activates this output whenever the control requires generator set (B) to start. This event is only present for controllers configured for Genset-to-Genset control mode.

The digital display shows this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Time Delay Source 1 (N)-to-Source 2 (E) (TDNE)

This event is active whenever the Time Delay Source 1 to Source 2 timer is active—also called the time delay transfer. This event is inactive whenever the timer expires or is not active. The control activates this output when the control is counting down to transfer the switch from Source 1 to Source 2.

The digital display displays this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Time Delay Source 2 (E) to Source 1 (N) (TDEN)

This event is active whenever the Time Delay Source 2 to Source 1 timer is active—also called the time delay retransfer. This event is inactive whenever the timer expires or is not active. The control activates this output when the control is counting down to transfer the switch from Source 2 to Source 1.

The digital display shows this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Time Delay Engine Cool-Down (TDECa)

This event is active whenever the Time Delay Engine Cool-down timer is active—also called the time delay stop. This event is inactive whenever the timer expires or is not active. The control activates this output whenever the control is cooling down the generator set.

The digital display shows this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Time Delay Programmed Transition (TDPT)

This event is active whenever the programmed transition timer is active (whenever the control is delaying the transfer switch in the neutral position). This event is inactive whenever the timer expires or is not active.

The digital display shows this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Transfer Pending (TDEL)

Whenever the Elevator Pretransfer output is active, the controller sets this event to active. The control

activates this event whenever a transfer pending signal is needed in the power system—this is typically used as an early warning signal for elevator systems. When the timer expires, the event will go inactive.

The digital display shows this event when it becomes active, in addition, it displays an active countdown, in seconds, of the time delay.

Test In Progress

This event is active whenever a test sequence is active. There is an associated LED output on the front panel and a relay output on the Relay Module.

Exercise in Progress

This event is active whenever an exercise sequence is active. There is an associated LED output on the front panel and a relay output on the Relay Module.

Source 1 Under-Voltage Failure

This event is active when ever Source 1 voltage is less than the acceptable limits, set in the controller.

Source 1 Over-Voltage Failure

This event is active whenever Source 1 voltage is greater than the acceptable limits, set in the controller.

Source 1 Over/Under Frequency Failure

This event‘ is active whenever Source 1 frequency is outside acceptable limits, set in the controller.

Source 1 Voltage Imbalance Failure

This event is active whenever Source 1 voltage is outside acceptable limits set in the controller.

Source 1 Loss of Phase Failure

This event is active whenever Source 1 is missing one or more of its (three–phase) voltage sources.

Source 2 Under-Voltage Failure

This event is active whenever Source 2 voltage is less than the acceptable limits set in the controller.

Source 2 Over-Voltage Failure

This event is active whenever Source 2 voltage is greater than the acceptable limits set in the controller.

Source 2 Over/Under Frequency Failure

This event is activate whenever Source 2 frequency is outside acceptable limits set in the controller.

Source 2 Voltage Imbalance Failure

This event is active whenever Source 2 voltage is outside acceptable limits set in the controller

Source 2 Loss of Phase Failure

This event is active whenever Source 2 is missing one or more of its (three–phase) voltage sources.

Phase Rotation Failure

This event is active whenever Source 1 and Source 2 voltages have different phase sequences.

Not in Auto: ATS Motor Disconnected

This event is active when the Motor Disconnect switch is off. This input causes the controller to enter a non-automatic mode—it does not try to move the transfer switch mechanism.

Not in Auto: Load Shed

This event is active whenever the Load Shed input is active, or the network *nviLoadShedCmd* input is active.

Not in Auto: Transfer Inhibit

This event is active whenever the Transfer Inhibit input is active, or the network *nviTransferInhCmd* input is active.

Not in Auto: Retransfer Inhibit

This event is active whenever the Retransfer Inhibit input is active, or the network *nviReTransferInhCmd* input is active. Even though the Not-in-Auto light is lit, the transfer switch will function correctly.

Not in Auto: Common Output (Network Only)

This event is used to support the multiple Not In Auto conditions. This output has the same value (or status) as the hardware LED output located on the ATS front panel and the Relay Module output.

Whenever any of the Not In Auto events are true—including, Motor Disconnected, Load Shed, Transfer Inhibit, Retransfer Inhibit, Bypassed to Source 1, and Bypassed to Source 2—the control makes this event active.

The Network Annunciator uses this event to indicate the general status of the ATS Not In Auto output.

Not in Auto: ATS Bypassed to Source 1

This event is active when Source 1 is bypassed.

Not in Auto: ATS Bypassed to Source 2

This event is active when Source 2 is bypassed.

Service Tool Connected

This event is active when a PC service tool is connected to the controller. The service tool can provide a chronological service history, which is stored in the control.

Load Sequencer Outputs (1-8)

The Load Sequencer feature consists of eight programmable timers which can control eight different network devices in a timed sequence. These outputs are network accessible only. Each Load Sequencer output is an independent Event Announcement. This is necessary for the Network Control Module (NCM) to receive and transmit event changes.

When these outputs are active, the transfer switch is typically inhibiting another transfer switch from loading the active source. This allows a gentle loading of a transfer switch when performing a transfer or retransfer sequence.

The Event Handler generates an Event Announcement whenever the Load Sequencer outputs (1-8) change state.

Network Wink

The network wink event is active whenever the Network Control Module (NCM) performs a logical write command to the controller. Network wink events are used by network service technicians to identify a particular network device—the technician winks a device in order to identify it from other devices. The controller responds to an active network wink event by placing a Network Wink message on the digital display.

Exercise Sequence

This event is active when the controller performs an Exercise sequence. This event is identical to the Test Start-A event descriptions. However, an exercise event is initiated by the controller itself rather than by an external switch input.

Generator A Common Alarm Input

This event is active when the Generator A Common Alarm input is activated. This input is usually only used in genset-to-genset applications. When this input is active, it indicates that generator A is shutdown (and locked out). This input comes from the genset control and signals the ATS not to attempt starting the generator because it is not available to produce power.

Generator B Common Alarm Input

This event is active when the Generator B Common Alarm input is activated. This input is usually only used in genset-to-genset applications. When this input is active, it indicates that generator B is shutdown (and locked out). This input comes from the genset control and signals the ATS not to attempt starting the generator because it is not available to produce power.

Neutral Current Warning

This event is detected only on switches equipped with the Load Monitoring bargraph. This event is active when the neutral current (amps) exceeds the threshold for neutral current.

Preferred Source 1 (or 2)

This event is active when the preferred source variable changes from either Source 2 to Source 1 or Source 1 to Source 2. The event is inactive when the preferred source is Source 1.

This event is used only in utility-to-utility control modes.

Controller Loss of Power

The controller signals the network card and other devices that the ATS controller is going to shutdown due to a lack of power. This signal triggers a time-delay start or other sequences. After the sequences are complete the controller shuts itself off in order to conserve the back-up batteries. The network card responds by not communicating to the controller.

6. Troubleshooting

The following procedures describe preliminary troubleshooting checks. If the problem persists, call your dealer or distributor.

Fault messages appear on the digital display, and by LED indicators. Ten LED indicators and a small push-button switch located on the Digital Module may help in troubleshooting the transfer switch (Figure 6-1).

CONTROL MODULE LED INDICATORS AND SWITCH

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 cabinet door is open. See Figure 6-1.

Fault Flash-Out

The control flashes an active fault code on the Status LED indicator until it is acknowledged with the Reset switch on the front panel. See Figure 6-1 and Table 6-1. The control flashes each digit of the fault code with a pause between digits and a longer pause between repetitions.

The control moves and stores acknowledged events to an event history file. This file can hold a maximum of 50 fault and non-fault events. Contents of the events history file can be viewed using the digital display or the PC Service Tool.

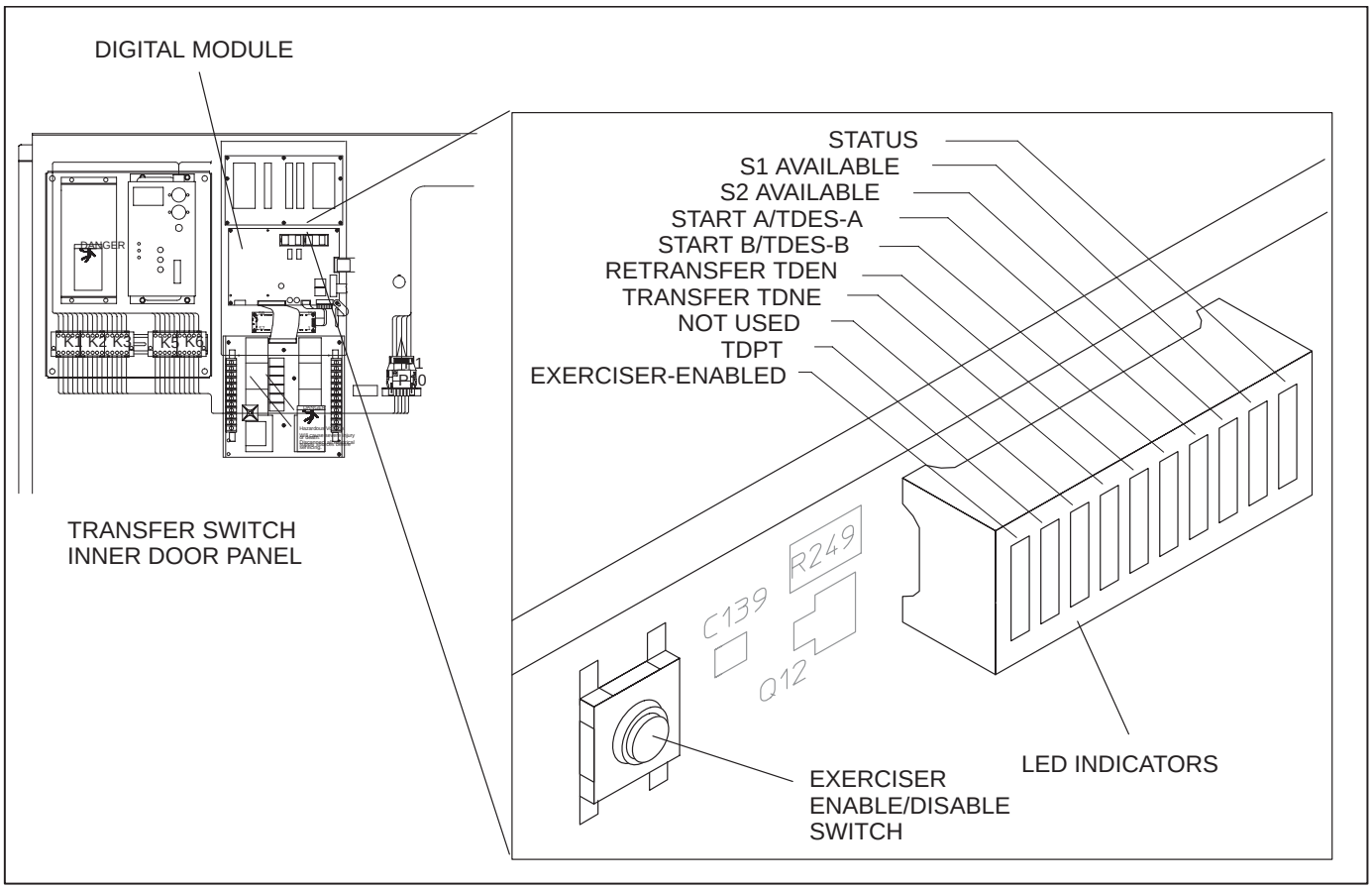

FIGURE 6-1. LED LOCATION ON DIGITAL MODULE (SHOWN ON THE 600–1000 AMP SWITCH)

TABLE 6-1 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 an Exerciser routine 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 exercise routine from the Digital Display when it is available.

Exerciser Enable/Disable Switch

All controllers have a switch to enable or disable pre-set exercise routines. The pushbutton is located on the Digital Module above the batteries next to the LED light bar display. This button is used by service personnel to disable unexpected transfers while servicing the switch.

Override Pushbutton

To override transfer time delays and transfer inhibits, press the Override pushbutton. The controller will not override time delays for Programmed Transition, Elevator Pre-Transfer signals and Engine Cool-down. The Override pushbutton is located on the front of the cabinet. See *Section 2, Description.*

TROUBLESHOOTING TRANSFER SWITCH WITHOUT A DIGITAL DISPLAY

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

When the digital display is not available, diagnosis of problems involves observing system operation.

The "Status" LED indicator shown in Figure 6-1 will continuously flash a fault code when a fault occurs. Table 6-2 lists the fault codes. You should be able to visually count the intermittent pulses on the LED and determine the corresponding numerical code.

If the transfer switch is equipped with a network module, events and fault codes can be viewed using InPower software.

To acknowledge or clear the event or fault, press the Override pushbutton. If you cannot determine the problem, contact Cummins Power Generation Service.

GENERAL TROUBLESHOOTING

Power Outage Occurs, But Generator Set Does Not Start

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door present 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.***

1. The operation selector switch on the generator set control panel should be set at Remote. Check for fault indicators on the generator set control.

2. Start the generator set using its start-stop controls. If it does not crank, check the starting batteries. If it cranks but does not start, check the fuel supply. If the problem persists, call your dealer or distributor.

3. The controller doesn't sense Source 1 has failed. Press the Reset Pushbutton or the Test Pushbutton.

4. Check the Engine Start Time Delay in the Setup menus. It should not be set over 120 seconds.

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

   ⚠WARNING ***Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, arcing equipment, or other possible source of ignition near the fuel system.***

Generator Set Starts During Normal Power Service

1. The operation selector switch on the generator set control panel should be set at Remote.

   ⚠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.***

2. Check the Test/Exerciser Active indicator to see whether it is in an exercise period.

   If the exercise period occurs at unexpected times or for excessive duration, check the Exercise Routines in the Setup Menus. Reprogram if necessary.

3. Momentary voltage dips might cause voltage sensors to initiate generator set starting. Check the parameter settings in the Setup Menus.

4. The switch is sensing an Over- or -Under Voltage condition on Source 1.

5. If the problem persists, call your dealer or distributor.

Generator Set Does Not Exercise

1. The operation selector switch on the generator set control panel should be set at Remote.

2. Check wiring between transfer switch and genset for correct configuration and opens. *(Refer to the Interconnection Diagram supplied with the switch.)*

⚠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.***

3. Check the Test/Exerciser Active indicator to see whether it is in an exercise period.

4. Start the generator set using its start-stop controls. If it does not crank, check the starting batteries. If it cranks but does not start, check the fuel supply. If the problem persists, call your dealer or distributor.

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

⚠WARNING ***Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, arcing switch or equipment, or other possible source of ignition near the fuel system.***

After a Power Failure, Generator Set Starts But Does Not Assume Load

1. Check the Not In Auto lamp on front panel. In this instance, the indicator will be lit if :

   The Transfer Inhibit option is active – press the Override pushbutton.

   The Motor Disconnect switch is in the OFF position (1200–3000 amp units) – open cabinet door and move switch to AUTO.

   The switch is bypassed to Source 1 – manually transfer the bypass switch to Source 2 (see *Operation*).

   The Load Shed option is enabled and will not allow the switch to move. – Disable Load Shed.

⚠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.***

2. Check the output voltage of the power source by observing the voltmeter on the generator set or the optional meters on the transfer switch door.

3. Check the Source 2 Available lamp on the ATS Control Panel. Check the parameter settings in the Setup menus.

4. The Drawout Release lever should be fully locked. Lift the lever and turn the Drawout Crank handle clockwise or counterclockwise to allow the lever to fully drop.

After Power Returns, Transfer Switch Does Not Return to Normal Position

1. The retransfer time delay period may not have expired. Check the Retransfer Timing lamp on the Digital Module.

2. The transfer switch is bypassed to Source 2 – manually transfer the bypass switch to Source 1.

3. The Retransfer Inhibit option is active – press the Override pushbutton.

4. The Load Shed option is active and is moving the load to neutral. Switch should transfer.

5. Open the cabinet door and check the Motor Disconnect switch position. For automatic operation, it must be in the AUTO 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. When the cabinet door is open, use extreme caution to avoid touching electrical contacts with body, tools, jewelry, clothes, hair, etc.***

6. Stop the generator set with the Start/Stop switch. When the generator set stops, the transfer switch transfers the load to Power Source 1, if power ratings are acceptable.

7. If the switch still does not retransfer, manually return the switch to the Source 1 position (see *Operation*). Call your dealer or distributor.

Generator Set Continues to Run After Retransfer of Load to Normal Power

The Engine Cool-Down Time Delay is active. Genset should stop when time delay expires (30 minutes maximum).

If genset continues to run, stop the genset with its Start/Stop switch, and call your dealer or distributor.

Battery Charger Fails To Charge (If Equipped)

Check the battery charger fuse(s). Replace, if necessary, with fuses of the correct rating. Fuse ampere ratings are shown on the charger faceplate.

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

If the fuse is OK, call your dealer or distributor.

Battery Loses Water

The battery charger float voltage could be too high (if equipped with battery charger). Adjust the float setting. Refer to the *Installation Manual*. If the problem continues, call your dealer or distributor.

Battery Loses Charge

Battery charger float voltage could be too low (if equipped with battery charger). Adjust the float setting. Refer to the *Installation Manual*. If the problem continues, call your dealer or distributor.

TROUBLESHOOTING TRANSFER SWITCH WITH THE DIGITAL DISPLAY

The Digital Display shows two types of events: fault events and non-fault events. The last 50 events, both fault and non-fault events, 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 transfer switch operator. They indicate that the transfer switch is not operating correctly. Table 6-2 lists the fault codes and fault message and Table 6-3 gives corrective actions for each fault code.

TABLE 6-2 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
1115	ATS Fail to Charge
477	Network Battery Low
1468	Network Communications Error

The controller displays the fault message on the Digital Display. The flashing asterisk indicates the event or fault code is currently active. Pressing the Reset button on the control panel acknowledges a fault and clears the display.

The LED indicator on the Digital Module will flash out the numerical code on the status LED .

TABLE 6-3 TROUBLESHOOTING

⚠ WARNING ***Some ATS service procedures present hazards that can result in severe personal injury or death. Only qualified 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.
2. Remove and re-install Digital Module batteries (see Figures 2-5 and 2-6).
3. Contact Cummins Power Generation Service if checksum error is repeated on power up.
4. Reset real-time clock (see Figure 4-18).

LOW CONTROLLER BATTERY (441)

Low Lithium battery voltage

Corrective Action:

1. Replace Digital Module batteries. (See Figures 2-5 and 2-6.)
2. Press the Reset button on the front panel.
3. Reset real-time clock (see Figure 4-18).

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. Contact Cummins Power Generation Service.

ATS FAILED TO CLOSE: RETRANSFER (1114)

A transfer between Source 2 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. Contact Cummins/Onan Service.

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.
4. Contact Cummins/Onan Service.

TABLE 6-3 TROUBLESHOOTING (CONTINUED)

⚠ WARNING ***Some ATS service procedures present hazards that can result in severe personal injury or death. Only qualified 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. Press the Reset button on the front panel.
2. Replace the Network Module batteries.
3. Contact Cummins/Onan Service.

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.
2. Contact Cummins/Onan Service.

FAULT CODE DEFINITIONS

Controller Checksum Error

The control 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 control Fault Flash-out system flashes this fault on the Status LED 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 control 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 control Fault Flash-out system flashes this fault on the Status LED Indicator until the fault is acknowledged (reset).

ATS Fail to Close: Re-Transfer

The control 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 control also verifies that the transfer switch moved from Neutral to Source 1 within the time limit defined in the Fail to Close Time Delay.

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

ATS Fail to Close: Transfer

The control 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 control also verifies that the transfer switch moved from Neutral to Source 1 within the time limit defined in the Fail to Close Time Delay.

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

Battery Charger Malfunction

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

The control Fault Flash-out system 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 control. If the battery voltage drops, the control sets the fault status to active.

The control Fault Flash-out system flashes this fault on the Status LED 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 control. This indicates that the device is no longer communicating with other devices on the network.

The control Fault Flash-out system flashes this fault on the Status LED Indicator until the fault is acknowledged (reset).

7. Time Delay Glossary

TIME DELAY	ABBREVIATION	DEFINITION
Start Time Delay	TDES	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. 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 signals the generator set to start. The value is set with the PC service tool or the digital display when it is available.
Stop Time Delay (Cool-down)	TDEC	This delay is adjustable from 0 to 30 minutes in 1 minute increments. The default value is 10 minutes. It begins timing when the load is retransferred to Source 1. At the end of the delay, the stop signal is sent to the generator set. During this time delay, the generator set cools down at no load before stopping. The value is set with the PC service tool or the digital display when it is available.
Transfer Time Delay	TDNE	This delay begins when Source 2 (typically the generator) voltage and frequency reach the settings of the control. After the delay, the transfer switch transfers the load to Source 2. This brief time delay allows the generator set to stabilize before the load is applied. It has an adjustable range of 0 to 120 seconds in 1 second increments. The default value is 10 seconds. The value is set with 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 begins the moment Source 1 line voltage and frequency return to specified values. After the delay, the transfer switch can retransfer the load to Source 1. The delay allows the Power Source 1 to stabilize before retransfer. It has an adjustable range of 0 to 30 minutes in 1 minute increments. The default value is 10 minutes. The value is set with 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 Time Delay	TDPT	This delay is the time that the switch spends in the neutral position, when neither source is connected to the load, during a transfer or a retransfer. It begins when the switch moves to the neutral position and opens the contacts of the switch connected to the load. After the delay the control transfers the load. This time delay allows residual voltage of inductive loads to decay sufficiently before connecting it to another source. It is adjustable 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 value is set with the PC service tool or the digital display when it is available.
Elevator Pretransfer Time Delay	TDEL	The Elevator Pre-Transfer Delay Signal delays transfer (or retransfer) for a specified time to give warning to an elevator control that a transfer (or retransfer) is about to occur. It is adjustable from 0 to 60 seconds in 1 second increments. The default value is 0 seconds. This feature is enabled by default. The value is set with the PC service tool or the digital display when it is available.

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