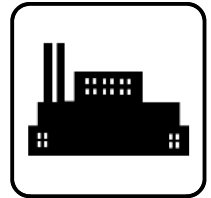


Operation and Installation

Transfer Switches



Models:

KDT/KMT/KDP/KMP

Power Switching Device:

Open-Transition 40 to 600 Amps

Programmed-Transition 100-600 Amps

Electrical Controls:

MPAC 1000™

KOHLER®

POWER SYSTEMS

9001
KOHLER
POWER SYSTEMS
NATIONALLY REGISTERED

TP-6225 6/04a

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Transfer Switch Identification Numbers

Record the product identification numbers from the transfer switch nameplate.

Model Designation _____
Serial Number _____

Accessory Number	Accessory Description
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Table of Contents

Product Identification Information	Inside front cover
Safety Precautions and Instructions	I
Introduction	i
Related Materials	i
Warranty Registration	i
Service Assistance	ii
Section 1 Product Description	1
1.1 Purpose	1
1.2 Nameplate	1
1.3 Model Code	2
Section 2 Installation	3
2.1 Introduction	3
2.2 Receipt of Unit	3
2.2.1 Inspection	3
2.2.2 Storage	3
2.2.3 Lifting	3
2.2.4 Unpacking	4
2.3 Mechanical Installation	4
2.4 Manual Operation Check	5
2.4.1 Manual Operation Procedure, Open-Transition Switches	5
2.4.2 Manual Operation Procedure, Programmed-Transition Switches	6
2.5 Electrical Wiring	7
2.5.1 AC Power Connections	8
2.5.2 Engine Start Connection	9
2.5.3 Auxiliary Contacts	9
2.5.4 Controller Ground	11
2.6 Final Equipment Inspection	11
2.7 Warranty Registration	11
Section 3 Setup and Test	13
3.1 Introduction	13
3.2 Controller	13
3.2.1 User Interface Panel	13
3.2.2 Controller Reset	15
3.2.3 DIP Switches	15
3.2.4 Controller Inputs and Outputs	16
3.2.5 Communications Connections	18
3.3 Programmed-Transition Interface Board (PTIB)	18
3.4 System Settings and Time Delays	19
3.4.1 System Parameters	19
3.4.2 Time Delays	19
3.5 Generator Set Preparation	19
3.6 Functional Test	20
3.6.1 Manual Operation Test	20
3.6.2 Voltage Check	20
3.6.3 Automatic Operation Test	21
3.7 Exerciser Setup	23

Table of Contents, continued

Section 4 Operation	25
4.1 Introduction	25
4.2 Sequence of Operation	25
4.2.1 Automatic Operation	25
4.2.2 System Test	27
4.2.3 Exerciser	29
4.2.4 Peak Shave/Area Protection Operation Sequence	32
4.2.5 Pre- and Post-Transfer Load Control Sequence	33
4.3 Source Availability	34
4.3.1 Startup	34
4.3.2 Example	34
4.3.3 Selected Pickup and Dropout Values	35
4.4 Faults	36
4.4.1 Service Required LED	36
4.4.2 Auxiliary Switch Faults	36
4.4.3 Failure to Acquire Standby Source	36
4.4.4 Failure to Transfer	36
4.4.5 Phase Rotation Faults	36
4.5 Controller Power Supply	36
Section 5 Scheduled Maintenance	37
5.1 Introduction	37
5.2 Testing	38
5.2.1 Weekly Generator Set Exercise	38
5.2.2 Monthly Automatic Control System Test	38
5.3 Inspection and Service	39
5.3.1 General Inspection	39
5.3.2 Other Inspections and Service	39
5.4 Service Schedule	40
Section 6 Accessories	41
6.1 Introduction	41
6.2 Battery Charger	41
6.2.1 Battery Charger Connection	43
6.2.2 Battery Charger Operation	45
6.2.3 Battery Charger Troubleshooting	46
6.2.4 Battery Charger Specifications	47
6.3 Chicago Alarm	47
6.4 Control Switches	47
6.4.1 Preferred Source Switch	48
6.4.2 Supervised Transfer Control Switch	50
6.5 External Battery Supply Module	51
6.5.1 EBSM Description	51
6.5.2 Requirements	51
6.5.3 External Battery Supply Module Diagnostic LEDs	52
6.5.4 Connections and Setup for Systems with Extended Time Delays	52
6.5.5 Connections and Setup for Three-Source Systems	54
6.5.6 Assigning the Programmable Inputs and Outputs	57
6.5.7 Installing the I/O Module Cover	58
6.6 In-Phase Monitor	59
6.7 Programmable Inputs and Outputs	59
6.7.1 Programmable Input/Output (I/O) Modules	60
6.7.2 I/O Module Connection	61
6.7.3 I/O Module Address	62
6.7.4 I/O Module Faults and Diagnostics	62
6.8 Security Cover	63

Table of Contents, continued

6.9	Setup Program	63
6.9.1	Setup Program Features	63
6.9.2	System Requirements	63
6.10	Surveyor Program	64
6.10.1	Surveyor Program Features	64
6.10.2	Hardware Requirements	65
6.10.3	Other Requirements	65
Appendix A	Abbreviations	A-67

Safety Precautions and Instructions

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that **will cause severe personal injury, death, or substantial property damage.**

WARNING

Warning indicates the presence of a hazard that **can cause severe personal injury, death, or substantial property damage.**

CAUTION

Caution indicates the presence of a hazard that **will or can cause minor personal injury or property damage.**

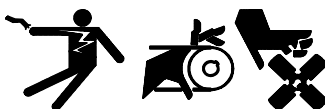
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set.
Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery

WARNING



Sulfuric acid in batteries.
Can cause severe injury or death.

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

WARNING



Explosion.
Can cause severe injury or death.
Relays in the battery charger cause arcs or sparks.

Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

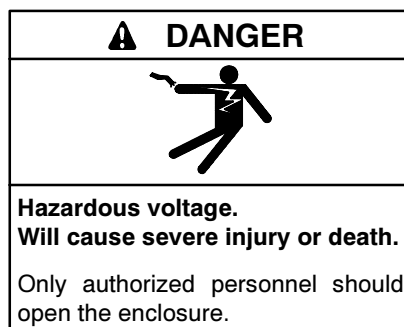
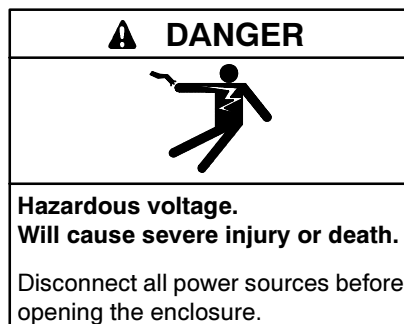
Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Hazardous Voltage/ Electrical Shock



Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocutation is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Installing accessories to the transformer assembly. Hazardous voltage can cause severe injury or death. To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to the transformer assembly primary terminals on microprocessor logic models. Terminals are at line voltage.

Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent electrical shock deenergize the normal power source before making any line or auxiliary connections.

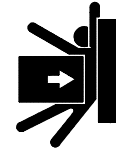
Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Servicing the transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect the transfer switch controls at the inline connector to deenergize the circuit boards and logic circuitry but allow the transfer switch to continue to supply power to the load. Disconnect all power sources to accessories that are mounted within the enclosure but are not wired through the controls and deenergized by inline connector separation. Test circuits with a voltmeter to verify that they are deenergized before servicing.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. *(600 volts and under)*

Heavy Equipment

⚠ WARNING



Unbalanced weight. Improper lifting can cause severe injury or death and equipment damage.

Use adequate lifting capacity. Never leave the transfer switch standing upright unless it is securely bolted in place or stabilized.

Moving Parts

⚠ WARNING



Airborne particles. Can cause severe injury or blindness.

Wear protective goggles and clothing when using power tools, hand tools, or compressed air.

Notice

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings, and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

NOTICE

Improper operator handle usage. Use the manual operator handle on the transfer switch for maintenance purposes only. Return the transfer switch to the normal position. Remove the manual operator handle, if used, and store it in the place provided on the transfer switch when service is completed.

NOTICE

Foreign material contamination. Cover the transfer switch during installation to keep dirt, grit, metal drill chips, and other debris out of the components. Cover the solenoid mechanism during installation. After installation, use the manual operating handle to cycle the contactor to verify that it operates freely. Do not use a screwdriver to force the contactor mechanism.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

This manual provides operation and installation instructions for Kohler® Model KDT/KMT and KDP/KMP automatic transfer switches with MPAC 1000™ electrical controls.

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Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this literature and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect parts often and perform required service at the prescribed intervals. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

x:in:002:002

Related Materials

This manual includes operation and installation information for Model KDT/KMT and KDP/KMP open-transition and programmed-transition transfer switches. Check the transfer switch model number on the transfer switch nameplate and verify that it matches the models shown on the front cover of this manual before proceeding with installation.

Refer to the ATS specification sheets for ratings and specifications. Separate manuals cover service and parts information. See Figure 1. Contact an authorized distributor/dealer for literature.

Document	Document Part Number
Specification Sheet, Model KDT/KMT ATS	G11-89
Specification Sheet, Model KDP/KMP Programmed-Transition ATS	G11-96
MPAC™ Setup Program Operation Manual	TP-6135
Parts Catalog	TP-6158
Wiring Diagram Manual	TP-6169

Figure 1 Related Literature

Warranty Registration

The transfer switch seller must complete a Startup Notification Form and submit it to the manufacturer within 60 days of the initial startup date. The Startup Notification Form covers all equipment in the power system. Power systems not registered within 60 days of startup are automatically registered using the manufacturer's ship date as the startup date.

Service Assistance

For professional advice on generator power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric
- Visit the Kohler Power Systems website at KohlerPowerSystems.com
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product
- Call toll free in the US and Canada 1-800-544-2444
- Outside the US and Canada, call the nearest regional office

Headquarters Europe, Middle East, Africa (EMEA)

Kohler Power Systems
ZI Senia 122
12, rue des Hauts Flouviars
94517 Thiais Cedex
France
Phone: (33) 1 41 735500
Fax: (33) 1 41 735501

Asia Pacific

Power Systems Asia Pacific Regional Office
Singapore, Republic of Singapore
Phone: (65) 264-6422
Fax: (65) 264-6455

China

North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka

India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea

North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America

Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

Section 1 Product Description

1.1 Purpose

An automatic transfer switch (ATS) transfers electrical loads from a normal (preferred) source of electrical power to an emergency (standby) source when the normal source falls outside the acceptable electrical parameters.

When the normal (preferred) source fails, the ATS signals the emergency (standby) source generator set to start. When the emergency (standby) source reaches acceptable levels and stabilizes, the ATS transfers the load from the normal (preferred) source to the emergency (standby) source. The ATS continuously monitors the normal (preferred) source and transfers the load back when the normal (preferred) source returns and stabilizes. After transferring the load back to the normal (preferred) source, the ATS removes the generator start signal, allowing the generator set to shut down.

Figure 1-1 shows a typical installation block diagram.

1.2 Nameplate

A nameplate attached to the controller cover on the inside of the enclosure door includes a model designation, a serial number, ratings, and other information about the transfer switch. See Figure 1-2.

Copy the model designation, serial number, and accessory information from the nameplate to the spaces provided in the Product Identification Information section inside the front cover of this manual for use when requesting service or parts. Copy the model designation into the spaces in Section 1.3 and use the accompanying chart to interpret the model designation.

The serial number is also shown on a label inside the transfer switch enclosure.

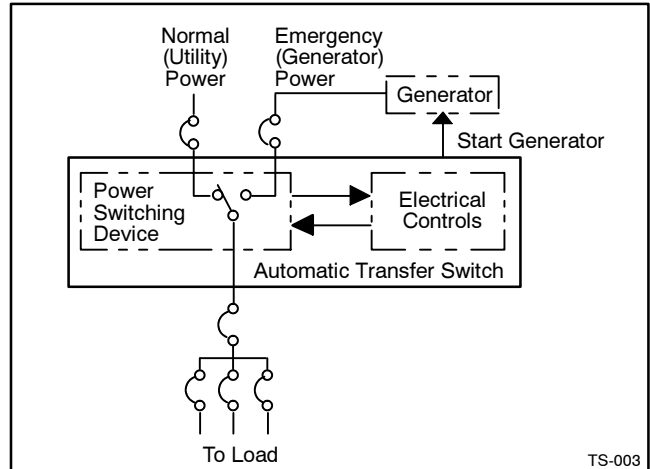


Figure 1-1 Typical ATS Block Diagram

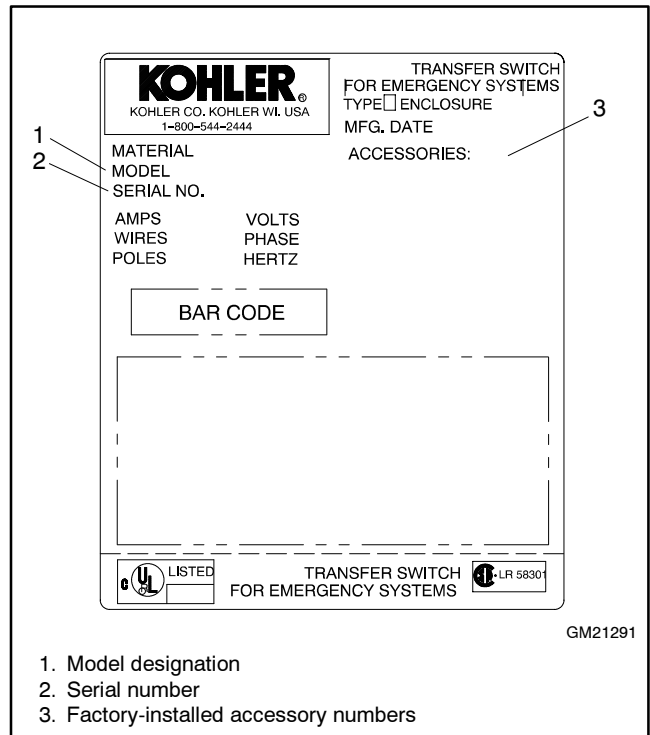
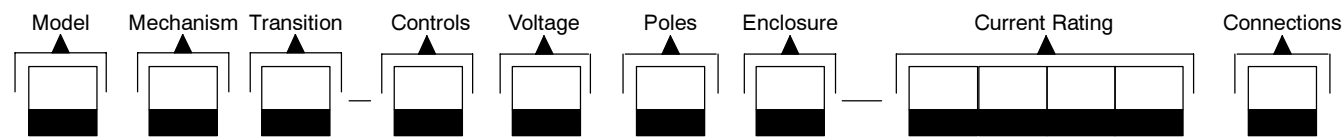


Figure 1-2 Typical Transfer Switch Nameplate

1.3 Model Code

Record the transfer switch model designation in the boxes below. The transfer switch model designation defines characteristics and ratings as explained in the accompanying chart.



Kohler® Model Designation Key

This chart explains the Kohler® transfer switch model designation system. The sample model designation shown is for a Model K series-rated transfer switch that uses an open-transition contactor with MPAC 1000™ electrical controls rated at 480 volts/60 Hz, 3 poles, 4 wires, and solid neutral in a NEMA 1 enclosure with a current rating of 225 amperes. Not all possible combinations are available.

SAMPLE MODEL DESIGNATION

KDT-AMTA-0225S

Model

K: Model K Transfer Switch

Mechanism

D: Series-Rated, Automatic

M: Series-Rated, Non-Automatic

Transition

T: Open-Transition

P: Programmed-Transition

Electrical Controls

A: MPAC 1000™ (Microprocessor ATS Controls)

Voltage/Frequency

C: 208 Volts/60 Hz

G: 380 Volts/50 Hz

K: 440 Volts/60 Hz

D: 220 Volts/50 Hz

H: 400 Volts/50 Hz

M: 480 Volts/60 Hz

F: 240 Volts/60 Hz

J: 416 Volts/50 Hz

Number of Poles/Wires

N: 2-pole, 3-wire, solid neutral

T: 3-pole, 4-wire, solid neutral

V: 4-pole, 4-wire, switched neutral

Enclosure

A: NEMA 1†

C: NEMA 3R

F: NEMA 4X

B: NEMA 12

D: NEMA 4

G: Open unit

† Standard

Current Rating: Numbers indicate the current rating of the switch in amperes:

0040

0150

0225

0400

0080

0200

0260

0600

0100

Power Connections

S: Standard

2.1 Introduction

Note: Have the equipment installed only by trained and qualified personnel. Verify that the installation complies with applicable codes and standards.

Kohler® transfer switches are shipped factory-wired, factory-tested, and ready for installation. Installation includes the following steps:

- Unpack and inspect the transfer switch upon receipt.
- Verify that the transfer switch voltage and frequency ratings match the voltages and frequencies of the sources.
- Mount the transfer switch.
- Check the manual operation.
- Wire the normal power source (utility), emergency power source (generator set), and load circuits.
- Connect the generator set engine start leads.
- Connect accessories, if provided.
- Connect and initialize the electrical controls, as required.
- Check voltages and operation.

Protect the switch against damage before and during installation.

Note: A protective device such as a molded-case circuit breaker or fused disconnect switch **MUST** be installed on both sources of incoming power for circuit protection and use as a disconnect device.

The functional tests in Section 3.6 are a necessary part of the installation. Be sure to perform the functional tests, which include voltage checks and operation tests, before putting the transfer switch into service.

2.2 Receipt of Unit

2.2.1 Inspection

At the time of delivery, inspect the packaging and the transfer switch for signs of shipping damage. Unpack the transfer switch as soon as possible and inspect the exterior and interior for shipping damage. If damage and/or rough handling is evident, immediately file a damage claim with the transportation company.

2.2.2 Storage


Store the transfer switch in its protective packing until final installation. Protect the transfer switch at all times from moisture, construction grit, and metal chips. Avoid storage in low-temperature and high-humidity areas where moisture could condense on the unit. See Figure 2-1 for acceptable storage temperatures.

Item	Specification
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Operating Temperature	-20°C to 70°C (-4°F to 158°F)
Humidity	5% to 95% noncondensing
Altitude	0 to 3050 m (10000 ft.) without derating

Figure 2-1 Environmental Specifications

2.2.3 Lifting

⚠ WARNING



Unbalanced weight. Improper lifting can cause severe injury or death and equipment damage.

Use adequate lifting capacity.
Never leave the transfer switch standing upright unless it is securely bolted in place or stabilized.

See Figure 2-2 or Figure 2-3 or the dimensional drawing for the weight of the transfer switch. Use a spreader bar to lift the transfer switch. Attach the bar only to the enclosure's mounting holes or lifting brackets; do not lift the unit any other way. Close and latch the enclosure door before moving the unit.

Amps	Weight kg (lb.)		
	2-Pole	3-Pole	4-Pole
40-225	28 (62)	30 (65)	31 (68)
260-400	52 (115)	56 (123)	59 (131)
600	179 (395)	183 (403)	186 (410)

Figure 2-2 Transfer Switch Weights, Open-Transition Models, NEMA Type 1 and 3R Enclosures

Amps	Weight kg (lb.)		
	2-Pole	3-Pole	4-Pole
100-200	52 (115)	56 (123)	59 (131)
400	52 (115)	56 (123)	59 (131)
600	179 (395)	183 (403)	186 (410)

Figure 2-3 Transfer Switch Weights, Programmed-Transition Models, NEMA Type 1 and 3R Enclosures

2.2.4 Unpacking

Allow the equipment to warm to room temperature for at least 24 hours before unpacking to prevent condensation on the electrical apparatus. Use care when unpacking to avoid damaging transfer switch components. Remove dirt and packing material that may have accumulated in the transfer switch or any of its components.

Note: Do not use compressed air to clean the switch. Cleaning with compressed air can cause debris to lodge in the components and damage the switch.

2.3 Mechanical Installation

NOTICE

Foreign material contamination. Cover the transfer switch during installation to keep dirt, grit, metal drill chips, and other debris out of the components. Cover the solenoid mechanism during installation. After installation, use the manual operating handle to cycle the contactor to verify that it operates freely. Do not use a screwdriver to force the contactor mechanism.

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

Check the system voltage and frequency. Compare the voltage and frequency shown on the transfer switch nameplate to the source voltage and frequency. Do not install the transfer switch if the system voltage and frequency are different from the nominal normal (utility) source voltage and frequency or the nominal emergency source voltage and frequency shown on the generator set nameplate.

Plan the installation. Use the dimensions given on the enclosure dimension (ADV) drawings. Select a mounting site that complies with local electrical code restrictions for the enclosure type. Mount the transfer switch as close to the load and power sources as

possible. Allow adequate space to fully open the enclosure and to service the switch. Provide cable bending space and clearance to live metal parts.

Prepare the foundation. Ensure that the supporting foundation for the enclosure is level and straight. For bottom cable entry, if used, install conduit stubs in the foundation. Refer to the enclosure dimension drawing for the conduit stub locations. When pouring a concrete floor, use interlocking conduit spacer caps or a wood or metal template to maintain proper conduit alignment.

Install the ATS. For easy access during installation and wiring, remove the front door of the enclosure. Open the door and disconnect the cable plug that connects the front door components to the internal components. Disconnect the grounding wire between the door and the enclosure. Squeeze the release pins on each hinge together and remove the door. See Figure 2-4. Set the door out of the way to protect the controls. Cover the internal components of the transfer switch mechanism to keep debris out of the components.

Vertically mount 40- through 400-amp transfer switches to a wall or other rigid vertical supporting structure. Use the template on the shipping carton to locate the mounting holes in the wall. Level the template before marking and drilling the holes. Clearance holes through the back of each enclosure are provided for mounting. Use shims to plumb the enclosure. Verify that the door hinges are vertical to avoid distortion of the enclosure or door. Vacuum any debris out of the enclosure.

Bolt 600-amp automatic transfer switches directly to floor mounting pads. Shim the enclosure so that the enclosure is plumb.

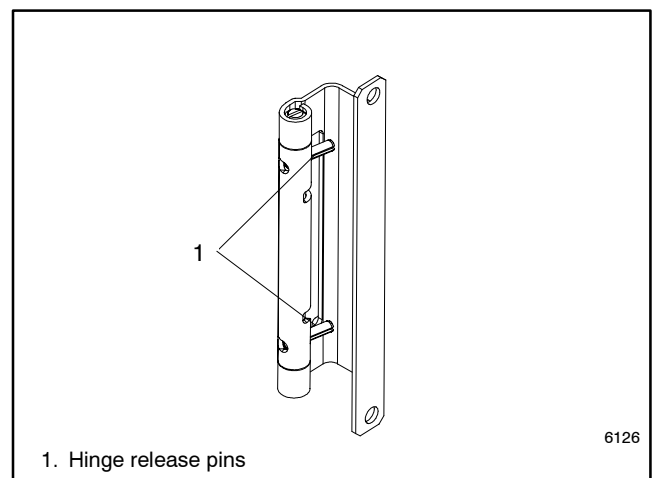
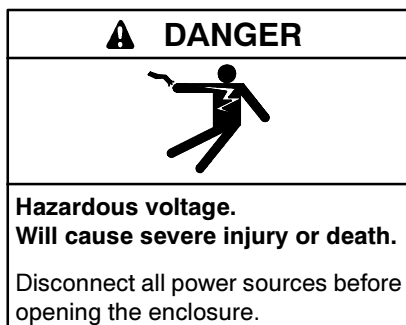


Figure 2-4 Hinge Release Pins

2.4 Manual Operation Check



NOTICE

Improper operator handle usage. Use the manual operator handle on the transfer switch for maintenance purposes only. Return the transfer switch to the normal position. Remove the manual operator handle, if used, and store it in the place provided on the transfer switch when service is completed.

A manual operation handle is provided with the transfer switch *for maintenance purposes only*. Use the manual operation handle to check the manual operation before energizing the transfer switch. Use the following manual operation procedures to verify that the contactor operates smoothly without binding.

Note: A contactor in normal and serviceable condition operates smoothly without binding. Do not place the transfer switch into service if the contactor does not operate smoothly; contact an authorized distributor/dealer to service the contactor.

2.4.1 Manual Operation Procedure, Open-Transition Switches

Note: Never use the manual operation handle to transfer the load with the power connected. Disconnect both power sources before manually operating the switch.

1. Remove the maintenance handle from the clips on the right side of the transfer switch frame. See Figure 2-6.
2. Insert the maintenance handle into the hole in the shaft on the left side of the operator.
3. Move the maintenance handle up or down as shown to manually operate the transfer switch. It should operate smoothly without any binding. If it

does not, check for shipping damage or construction debris.

4. Return the transfer switch to the Normal position.
5. Remove the maintenance handle and store it on the frame in the clips provided.

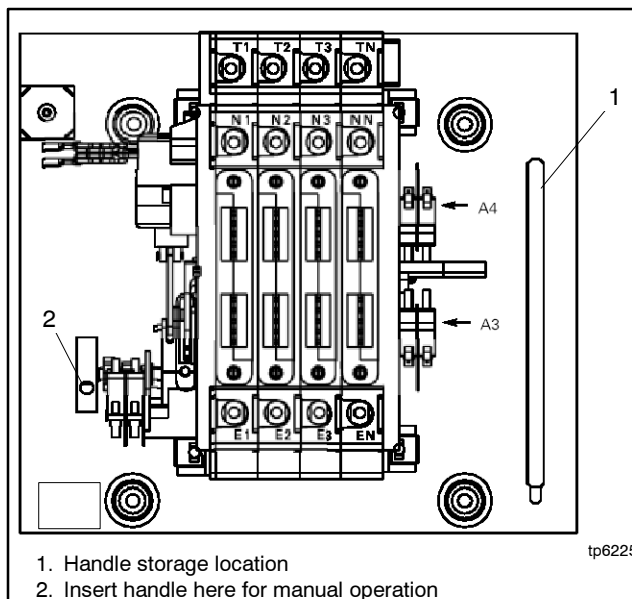


Figure 2-5 Manual Operation Handle, 40-260 Amp Model KDT/KMT Open-Transition Switches

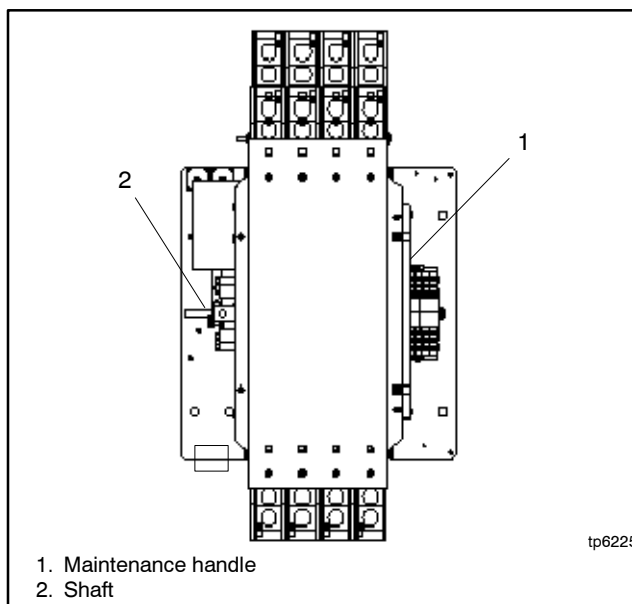


Figure 2-6 Manual Operation Handle, 400-600 Amp Model KDT/KMT Open-Transition Switches

2.4.2 Manual Operation Procedure, Programmed-Transition Switches

Note: Never use the manual operation handle to transfer the load with the power connected. Disconnect both power sources before manually operating the switch.

1. Check the contactor position, indicated by the A and B position indicators. See Figure 2-7. One position indicator will display ON to indicate the source position. If both indicators display OFF, the transfer switch is in the OFF position.
 2. If the transfer switch is not in the OFF position, use a screwdriver or other tool to push the TRIP button. See Figure 2-7. Check that both position indicators display OFF.
 3. Slide the manual operating handle (provided with the switch) over the shaft on the left side of the switch. See Figure 2-7.
 4. Move the switch to the A (Source 1) or B (Source 2) position as follows:
 - a. To move the switch to position A (Source 1), move the manual operation handle up and then release the handle. Verify that the A position indicator displays ON.
 - b. To move the switch to position B (Source 2), use a screwdriver or other tool to push the SELECT button. Hold the SELECT button in and move the manual operation handle up and then release the handle. Verify that the B position indicator displays ON.
- Note:** Always move the manual operation handle UP and then release it.
5. Remove the manual operation handle and store it in a convenient location.

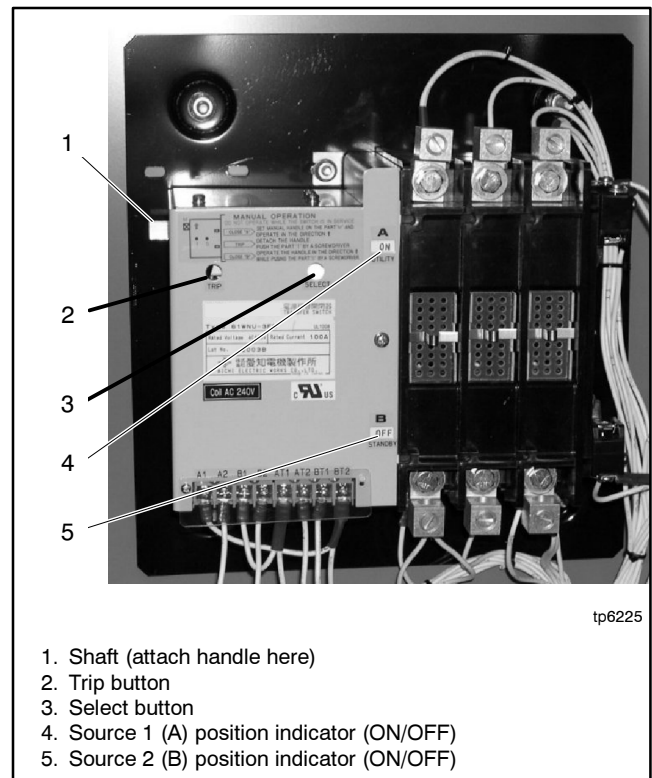


Figure 2-7 Manual Operation, Model KDP/KMP Programmed- Transition Switches (handle not shown)

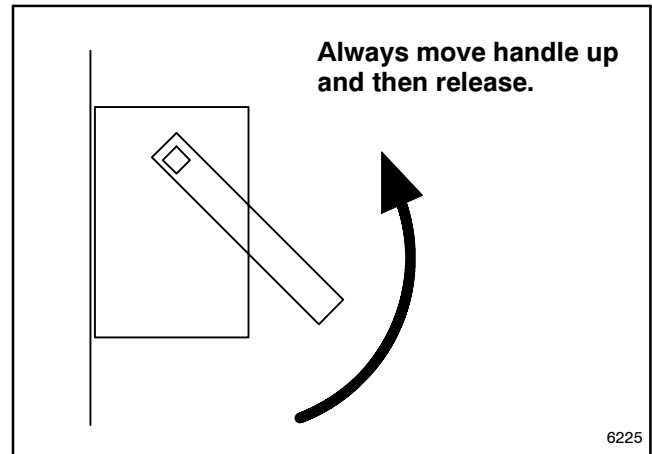


Figure 2-8 Manual Operating Handle, Model KDP/KMP Programmed- Transition Switches

2.5 Electrical Wiring

The transfer switch is factory-wired and tested. Field installation includes connecting the sources, loads, generator start circuit(s), and auxiliary circuits, if used.

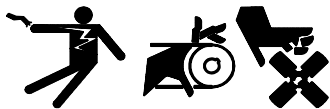
Note: An approved protective device such as a molded-case circuit breaker or fused disconnect switch **MUST** be installed on both sources of incoming power for circuit protection and use as a disconnect device. For approved circuit breakers, see specification sheet G11-89 for model KDT/KMT switches or G11-96 for model KDP/KMP switches.

Refer to the wiring diagrams provided with the transfer switch. Observe all applicable national, state, and local electrical codes during installation.

Install DC, control, and communication system wiring in metal conduit separate from AC power wiring.

Note: Do not connect the wiring harness to the controller until instructed to do so in the voltage check procedure, Section 3.6.2.

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

DANGER



Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent electrical shock deenergize the normal power source before making any line or auxiliary connections.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

NOTICE

Foreign material contamination. Cover the transfer switch during installation to keep dirt, grit, metal drill chips, and other debris out of the components. Cover the solenoid mechanism during installation. After installation, use the manual operating handle to cycle the contactor to verify that it operates freely. Do not use a screwdriver to force the contactor mechanism.

2.5.1 AC Power Connections

Determine the cable size. Refer to Figure 2-9 for open-transition switches or Figure 2-10 for programmed-transition switches to determine the size and number of conductors that can be used. Make sure the lugs provided are suitable for use with the cables being installed. Watertight conduit hubs may be required for outdoor use.

Drill the entry holes. Cover the internal components of the ATS to protect them from metal chips and construction grit. Then drill entry holes for the conductors at the locations shown on the enclosure drawings. Remove debris from the enclosure with a vacuum cleaner.

Note: Do not use compressed air to clean the switch. Cleaning with compressed air can cause debris to lodge in the components and damage the switch.

Install and test the power conductors. Leave sufficient slack in the conductors to reach all of the power connecting lugs on the power switching device. Test the power conductors after pulling them into position and before they are connected to verify that they are not defective and that they were not damaged during installation.

Connect the cables. Be careful when stripping insulation from the cables; avoid nicking or ringing the conductor. Clean cables with a wire brush to remove surface oxides before connecting them to the terminals. Apply joint compound to the connections of any aluminum conductors.

Refer to the wiring diagram provided with the switch. The connection points on the contactor are labeled Normal, Emergency, and Load. Be sure to follow the phase markings (A, B, C, and N). For single-phase systems, connect to A and C.

Note: Connect the source and load phases as indicated by the markings and drawings to prevent short circuits and to prevent phase-sensitive load devices from malfunctioning or operating in reverse.

On models equipped with the optional preferred source switch, connect source A to the normal side and source B to the emergency side of the contactor.

Verify that all connections are consistent with drawings before tightening the lugs. Tighten all lug connections to the torque values shown in Figure 2-11. Carefully wipe off any excess joint compound after tightening the terminal lugs.

UL-Listed Solderless Screw-Type Terminals for External Power Connections		
Normal, Emergency, and Load Terminals		
Switch Rating, Amps	Cables per Pole	Range of Wire Sizes, Copper or Aluminum
40-150	1	#8 to 3/0 AWG
200-225	1	#6 AWG to 250 MCM
260	1	#6 AWG to 350 MCM
400	1	#4 AWG to 600 MCM
	2	#6 AWG to 250 MCM
600	2	#2 AWG to 600 MCM

Figure 2-9 Cable Sizes, Open-Transition Models KDT/KMT

UL-Listed Solderless Screw-Type Terminals for External Power Connections		
Normal, Emergency, and Load Terminals		
Switch Rating (Amps)	Cables per Pole	Range of Wire Sizes, Copper or Aluminum
100	1	#14 to 1/0 AWG
200	1	#6 AWG to 250 MCM
400	2	#1/0 AWG to 250 MCM
	1	#4 AWG to 600 MCM
600	2	#2 AWG to 600 MCM

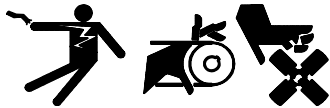
Figure 2-10 Cable Sizes, Programmed-Transition Models KDP/KMP

Socket Size Across Flats, inches	Bolt Torque	Bolt Torque
	Nm	Ft. lbs.
1/8	5	4
5/32	11	8
3/16	14	10
7/32	16	12
1/4	23	17
5/16	31	23
3/8	42	31
1/2	57	42
9/16	68	50

Figure 2-11 Tightening Torque for Lugs

2.5.2 Engine Start Connection

⚠ WARNING



**Accidental starting.
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Prevent the generator set from starting by moving the generator set master switch to the OFF position; disconnecting power to the generator engine start battery charger, if installed; and disconnecting all generator engine start battery cables, negative (-) leads first.

Figure 2-12 shows the engine start contact rating. Connect the generator set remote starting circuit to the engine start terminals located on the transfer switch contactor assembly. See Figure 2-13 through Figure 2-17 for the locations of the engine start terminals, which are labeled on the unit with a red decal. Refer to the generator set installation manual for wire size specifications.

Engine Start Contact Rating
2 amps @ 30 VDC/250 VAC.

Figure 2-12 Engine Start Contacts

2.5.3 Auxiliary Contacts

Connect the auxiliary contacts to customer-supplied alarms, remote indicators, or other devices. Auxiliary contacts provide contacts that close when the transfer switch is in the Normal position and contacts that close when the transfer switch is in the Emergency position. Each contact is rated 15 amps at 250 VAC.

Each transfer switch is equipped with one set of auxiliary contacts for normal position and one set for emergency position indication. Additional sets of auxiliary contacts are available for the model KDP/KMP switches. Figure 2-13 through Figure 2-17 show the locations of the auxiliary contacts for different models. Refer to the schematic diagram provided with the transfer switch to identify which auxiliary contacts are closed on Normal and which are closed on Emergency.

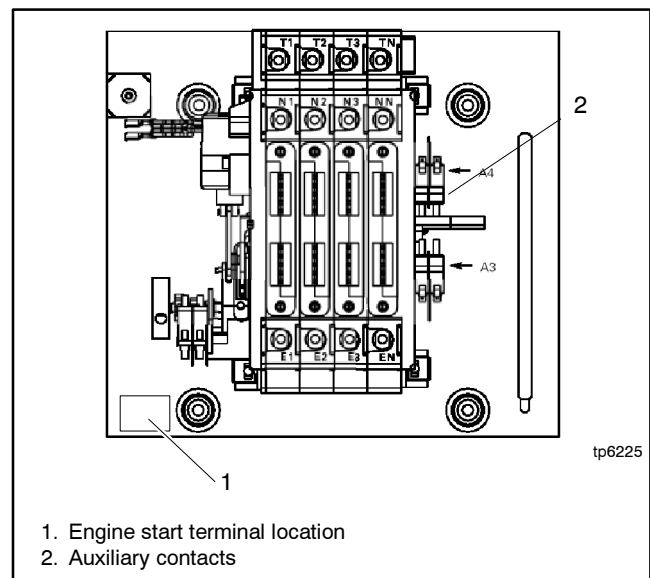


Figure 2-13 Engine Start and Auxiliary Contact Locations, 40–225 Amp Model KDT/KMT Open-Transition Switches

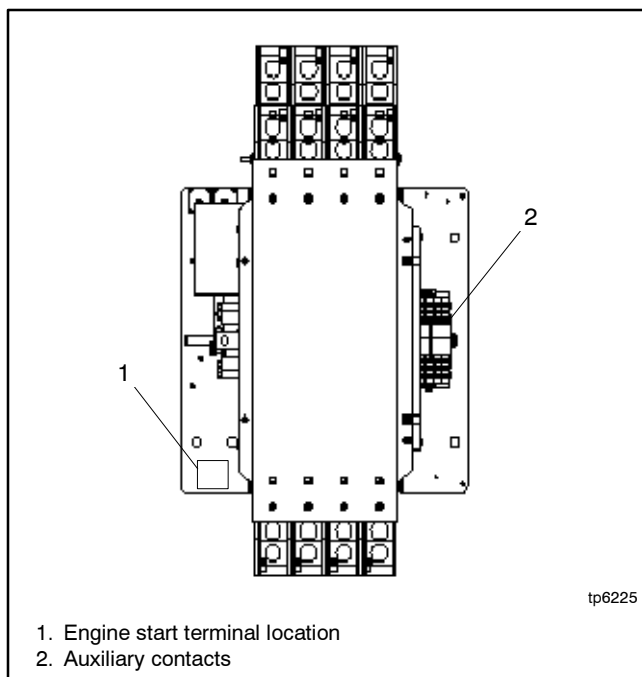


Figure 2-14 Engine Start and Auxiliary Contact Locations, 400-600 Amp Model KDT/KMT Open-Transition Switches

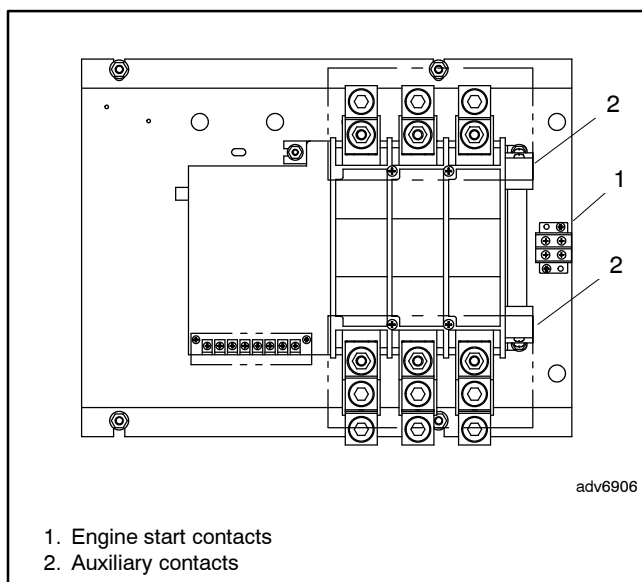


Figure 2-15 Engine Start and Auxiliary Contact Locations, 100-200 Amp Model KDP/KMP Programmed-Transition Switches

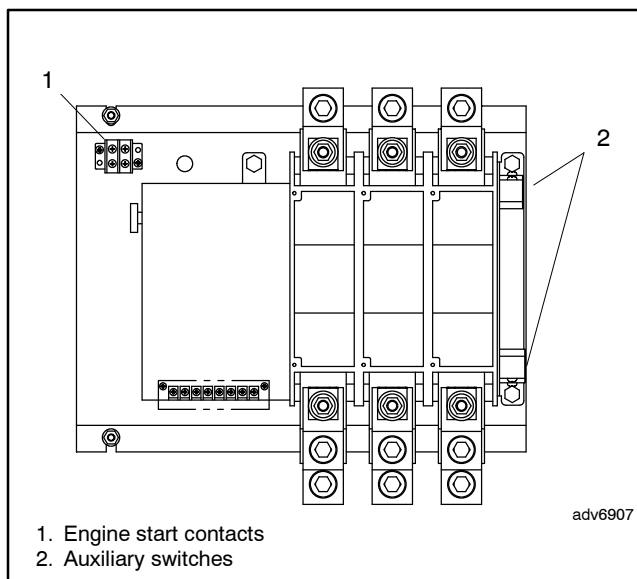


Figure 2-16 Engine Start and Auxiliary Contact Locations, 400 Amp Model KDP/KMP Programmed-Transition Switches

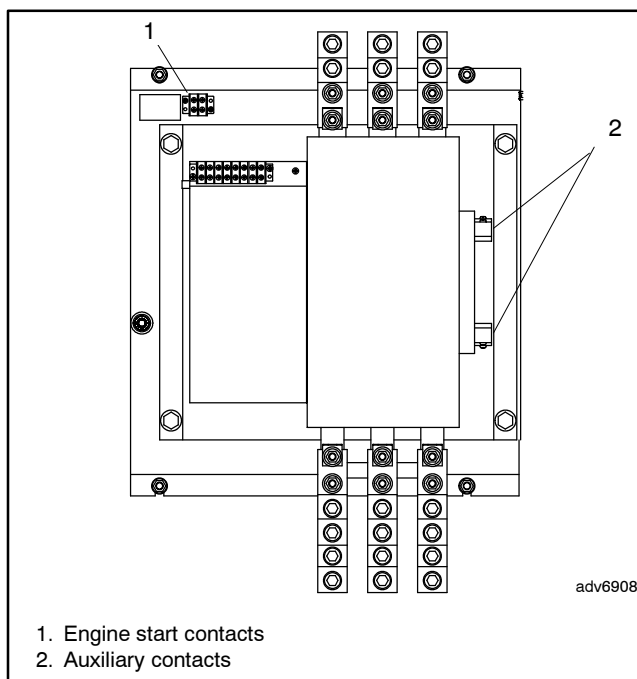


Figure 2-17 Engine Start and Auxiliary Contact Locations, 600 Amp Model KDP/KMP Programmed-Transition Switches

2.5.4 Controller Ground

Verify that the controller's grounding wire is connected from the controller's lower left mounting stud to the enclosure.

Note: Do not connect the controller harness to the power switching device until instructed to do so in the voltage check procedure, Section 3.6.2. Disconnect the power before connecting or disconnecting the controller harness.

2.6 Final Equipment Inspection

Perform the following inspections before energizing the transfer switch:

1. Use a vacuum to remove any debris from the transfer switch.
2. Verify that all source and load connections are correct and that the phase rotations of the sources match.
3. Check the engine start connections.
4. Check the lug torque values at the power connections. Torque values are listed in Figure 2-11.
5. Check that all covers and barriers are installed and properly fastened.

2.7 Warranty Registration

The transfer switch seller must complete a Startup Notification Form and submit it to the manufacturer within 60 days of the initial startup date. The Startup Notification Form covers all equipment in the power system. Power systems not registered within 60 days of startup are automatically registered using the manufacturer's ship date as the startup date.

Notes

3.1 Introduction

This section explains the setup and test of the transfer switch. Follow the instructions in this section after completing the physical installation described in the previous section.

Note: Be sure to perform the functional tests explained in Section 3.6 before putting the transfer switch into operation.

The instructions in this section explain how to set up the system to operate using factory default settings. This section includes:

- User interface panel pushbuttons and LED indicators
- DIP switch functions and settings
- Main logic board input and output connections and default settings
- Communications connections
- Factory default settings for voltage, frequency, and time delay functions
- Functional tests
- Exerciser setup
- Warranty registration

The transfer switch is designed to be set up and operated using the factory settings for time delays, voltage and frequency pickup and dropout, and other system parameters. To view and change the system settings, a personal computer running the MPAC-1000™ Setup Program is required. See TP-6135, Software Operation Manual, for instructions to use the Setup Program.

3.2 Controller

3.2.1 User Interface Panel

The user interface panel is located on the transfer switch door. Figure 3-1 shows the user interface pushbuttons and LED indicators. The LEDs light steadily or flash to indicate different ATS conditions. The tables in Figure 3-2 and Figure 3-3 describe the functions of the pushbuttons and LED indicators. Refer to the appropriate section for more details about functions listed in Figure 3-3 and Figure 3-2; see the Table of Contents.

Figure 3-4 lists the fault conditions that cause the Service Required LED to light or flash. Steady illumination indicates that maintenance is needed; flashing indicates that service is required immediately. Reset the controller after correcting the fault; see 3.2.2.

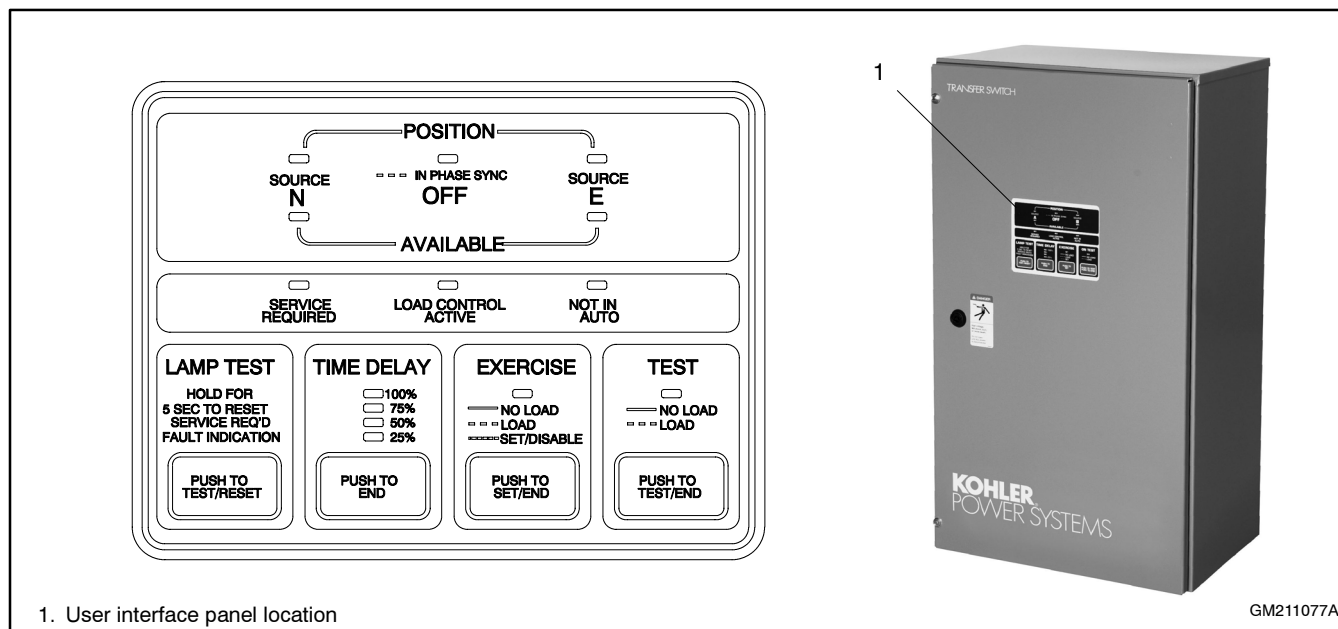


Figure 3-1 User Interface Panel

LED Indicator	Color	LED Illumination		
		Steady	Slow Flash	Rapid Flash
Exercise	Amber	Unloaded exercise is running.	Loaded exercise is running.	When exercise button is pressed and held, rapid flashing indicates the exercise has been started and set. Rapid flashing at any other time indicates that the exerciser is inhibited by the DIP switch setting.
Load Control Active	Amber	Pre/post-transfer load control or peak shave functions are operating.	—	—
Not in Auto	Red	—	—	ATS is not set for automatic operation or a load shed (forced transfer to OFF) sequence is active.
Position N	Red	Contactors is in Normal position.	—	—
Position E	Red	Contactors is in Emergency position.	—	—
Position Off/ In-Phase Sync	Amber	Contactors is in Off position (programmed-transition models only).	—	In-phase monitor is operating (open-transition models only).
Service Required	Red	Fault. Non-emergency is maintenance required.	—	Fault. Immediate maintenance is required.
Source N Available	Green	Source N is available.	—	—
Source E Available	Green	Source E is available.	—	—
Test	Red	Unloaded test is running.	Loaded test is running.	—
Time Delay LED Bar	Amber	LEDs step down to indicate time remaining in an active time delay or exercise period.	—	—

Figure 3-2 User Interface LED Indicators

Pushbutton	Description
Exercise	Start and stop an exercise and set the exercise time.
Lamp Test	Test LEDs or reset the Service Required LED.
Test	Start and stop a test.
Time Delay	End an active time delay. (Does not end the exercise active or programmed-transition time delays.)

Figure 3-3 User Interface Pushbuttons

Service Required LED Illumination	Fault (See Section 4.3)
Flashing	Auxiliary Switch Fault
	Auxiliary Switch Open
	Failure to Acquire Standby Source
	Failure to Transfer
	I/O Module Communications Lost
	I/O Module Not Installed
	I/O Module Not Found
	Phase Rotation Fault
	Remote Common Fault
Steady	External Low Battery

Figure 3-4 Service Required LED

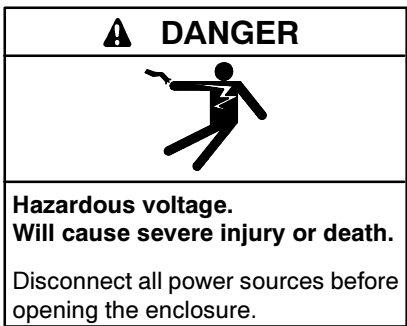
3.2.2 Controller Reset

Reset the controller to clear the Service Required LED after correcting a fault condition. The controller can be reset without disconnecting power. Use the following procedure.

Controller Reset Procedure

1. Hold the Lamp Test button until the LEDs flash. Do not release the button.
2. Continue to hold the Lamp Test button in and press the End Time Delay button. The LEDs will flash when the controller resets.

3.2.3 DIP Switches



Before opening the transfer switch enclosure to check or change the DIP switch settings, open the circuit breakers to disconnect the power to the transfer switch.

DIP switches on the main logic board control the test and exercise functions. A maintenance DIP switch inhibits transfer during ATS service. The factory settings for the DIP switches are shown in Figure 3-6.

The DIP switches are located on the controller's main logic board on the inside of the enclosure door. The DIP switches and the PC connector can be accessed

without removing the controller's plastic cover. Figure 3-5 shows the locations of the DIP switches.

A decal on the logic assembly housing shows the DIP switch positions and settings (see Figure 3-6). Check the DIP switch settings and adjust if necessary for the application.

Note: Changing the position of the 1 week/2 week exercise DIP switch after the exerciser has been set does not change the time of the *next* scheduled exercise. The new DIP switch setting becomes effective *after* the next scheduled exercise. See Section 4.2.3 for more information about the exerciser.

Close and lock the enclosure door before energizing the transfer switch.

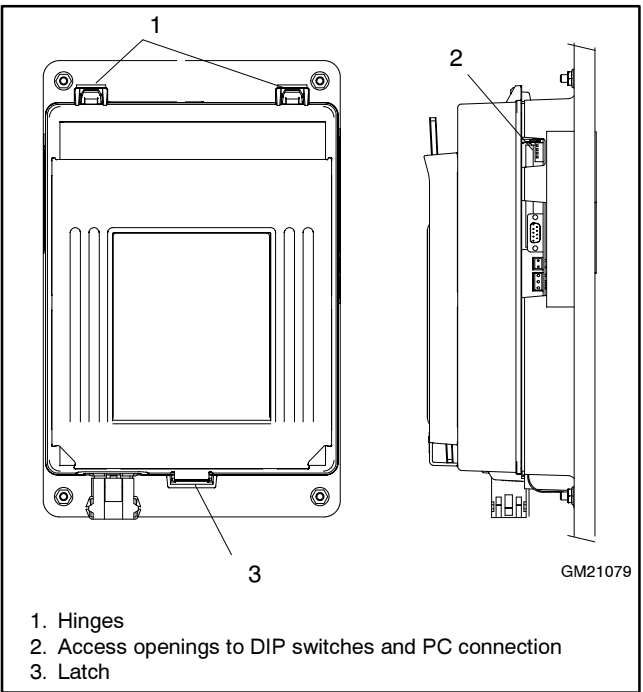


Figure 3-5 DIP Switch Location

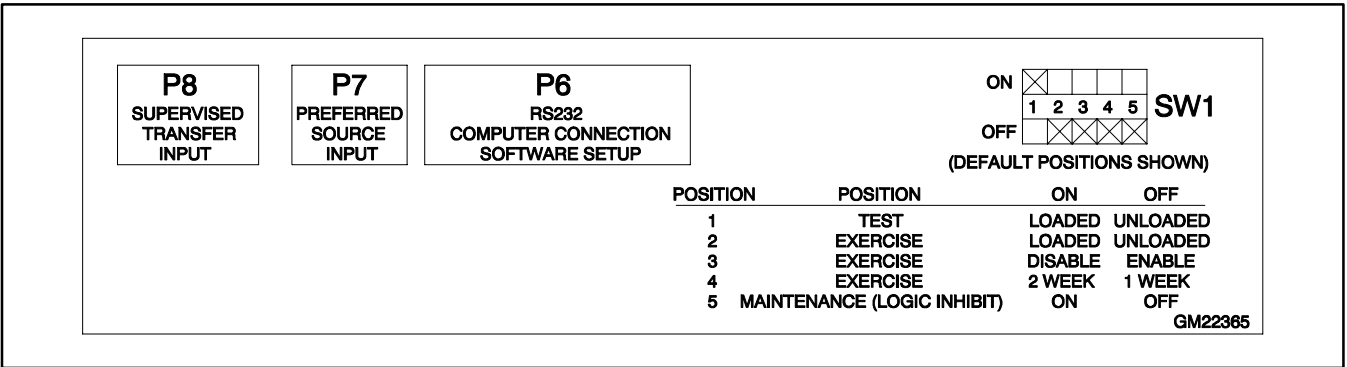
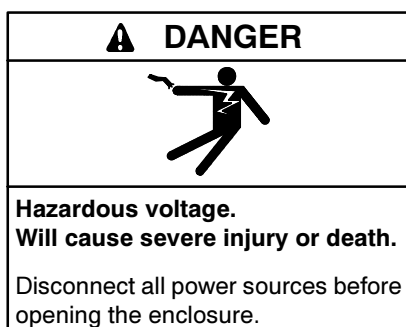


Figure 3-6 Logic Assembly Decal Showing DIP Switch Settings

3.2.4 Controller Inputs and Outputs



The controller main logic board's inputs and outputs are factory-assigned to the functions shown in Figure 3-7.

Pre-Transfer Load Control Output. Assigned to normally-closed terminals TB1-1 and TB1-2. The load control output operates only during the transfer sequence between two live sources. When the output is activated, the contact opens for the programmed length of time before transfer (default setting=3 seconds) to allow controlled disconnection of selected loads. The contact closes at the time of transfer (default post-transfer time delay setting=0). The contact will not open unless an acceptable source is available.

See Section 4.2.5 for more information about the pre-transfer and post-transfer load control signal operation sequence. The pre- and post-transfer time delays can be adjusted using the optional setup program.

Load Bank Control Output. Assigned to terminals TB1-3-TB1-5 (programmable). The load bank control output can be used to apply a load to the generator set during the exercise. The load bank control output closes or opens a contact that can be used to signal the load bank controller to operate. If the Normal source is lost during an exercise period, the load bank control output opens the contact to remove the load bank and allow the transfer of the building load to the emergency source.

Peak Shave/Area Protection Input. Assigned to terminals TB1-6 and TB1-7 (programmable input #1). Closing the contact signals the ATS to start the generator set and transfer to the standby source, ignoring the Time Delay Engine Start and Standby-to-Preferred time delays. The system attempts to transfer to the preferred source when the input is removed (contact opened). An override feature returns the ATS to the Normal source if the Emergency source fails and the Normal source is available.

TB1 Input/Output	Factory Setting
Non-programmable output	Pre-transfer load control
Programmable output	Load bank control output
Programmable input #1	Peak shave/Area protection input
Programmable input #2	End time delay input

Figure 3-7 Terminal Strip Input and Output Factory Settings

End Time Delay Input. Assigned to terminals TB1-8 and TB1-9 (programmable input #2). Closing the contact ends an active time delay. The signal ends only the time delay that is active at the time the signal is applied. Repeated signals are required to end additional time delays. Does not end the programmed-transition time delays or an exerciser run.

Other Inputs and Outputs. Other input and output functions can be assigned to the programmable TB1 terminals. Refer to Section 6 for lists of available programmable inputs and outputs. Use the Setup Program to change the input and output assignments if necessary.

Connections. Connect input and output leads to the controller terminal strip on the main logic board (MLB). Figure 3-8 shows the location of the terminal strip. To gain access to the terminal strip, open the plastic housing by pushing up on the latch on the bottom of the cover and swinging the cover up and out. See Figure 3-5. The cover is hinged at the top. Lift the cover off the hinges to remove it completely, if necessary. Refer to the label on the plastic housing or Figure 3-9 for the connections. Use #12-24 AWG wire and tighten the connections to 0.5 Nm (4.4 in. lbs.).

The controller board terminal strip has two programmable inputs. Each input has a signal and a return connection. Connect inputs to terminals 6 and 7 or 8 and 9 on terminal strip TB1. Record the connections on the label provided. Use the setup program to assign the input functions if they are different from the default assignments shown in Figure 3-7.

The main logic board has one programmable output, which is factory-assigned to the load bank control output function. Connect to terminals 3 and 4 or 3 and 5 on terminal strip TB1. Use the setup program to assign the output function if it is different from the default assignment.

Note: Always replace the cover before energizing the transfer switch controls.

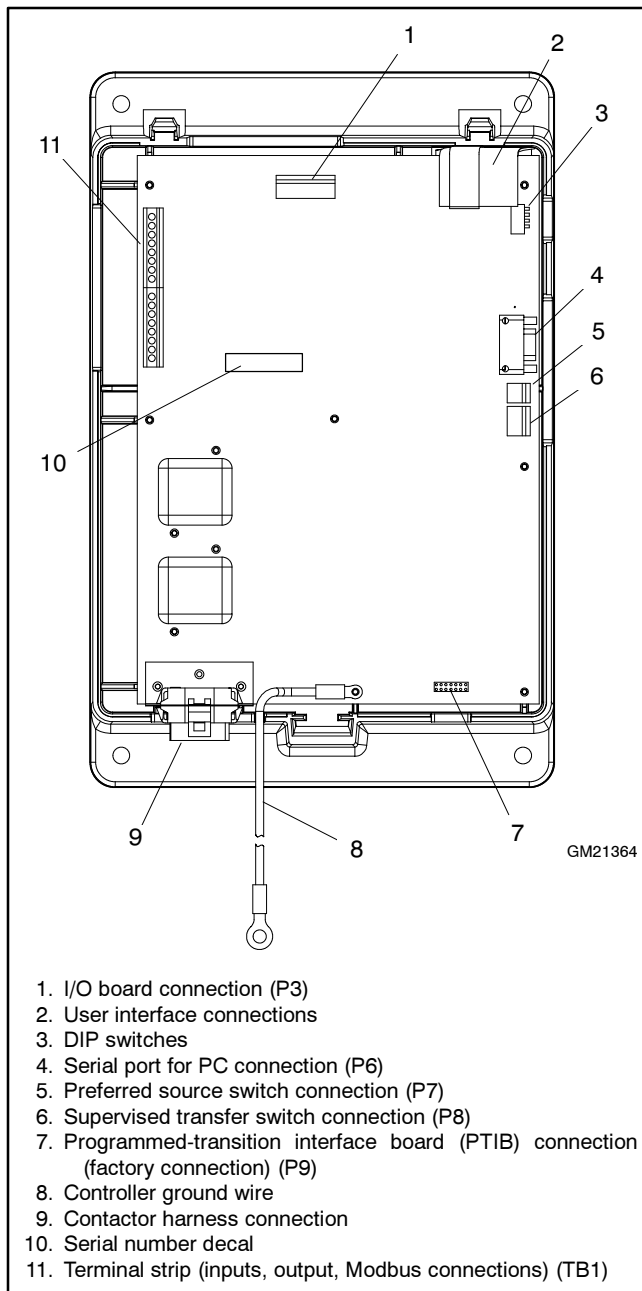


Figure 3-8 Controller Board Component Locations

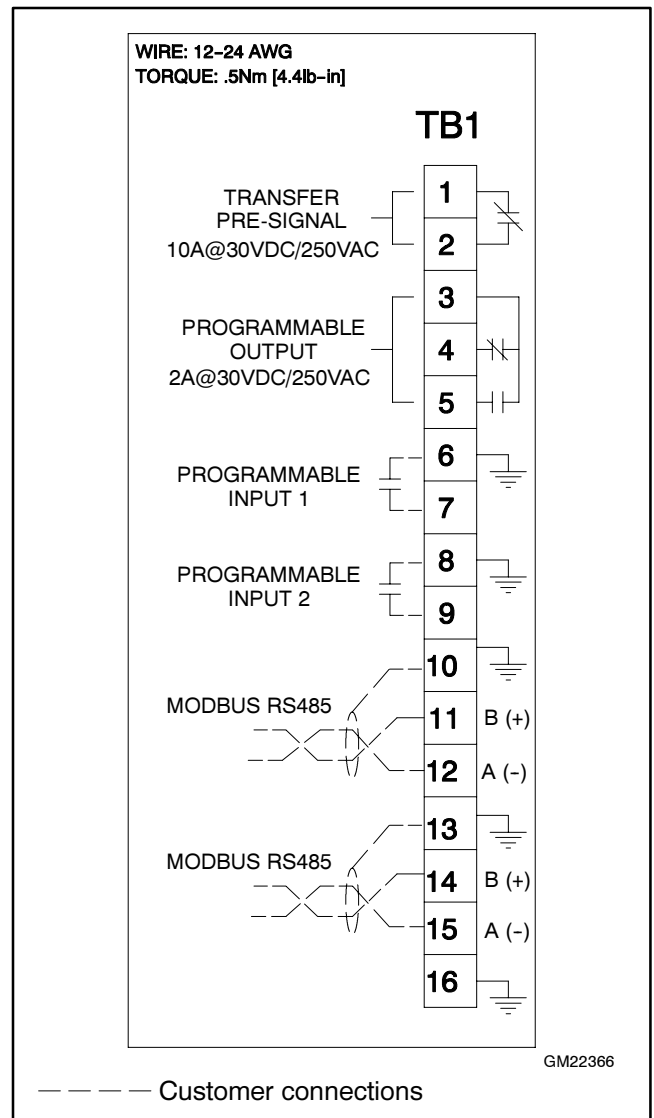


Figure 3-9 Terminal Strip TB1 Connections

3.2.5 Communications Connections

The controller has two communications connections.

Serial Port. For connection to a personal computer to run the Setup Program software. This is a non-isolated RS-232 port with a connection speed of 57.6 kbps.

Modbus® Network Interface (MNI). For connection to building management systems, programmable logic controls, etc. This is a non-isolated RS-485 port with connection speeds of 9.6 kbps and 19.2 kbps. Use RTU (remote terminal unit) protocol for communication through this port.

Connect the Modbus input and output to the terminals shown in Figure 3-9. Use #12-24 AWG twisted-pair wire; Belden cable #9841 or equivalent is recommended. Connect the shield to ground as shown in Figure 3-9. Tighten the connections to 0.5 Nm (4.4 in. lbs.).

Note: Contact Kohler Co. for information about the Modbus® communication protocol.

3.3 Programmed-Transition Interface Board (PTIB)

Model KDP/KMP programmed-transition transfer switches use a programmed-transition interface board (PTIB). The PTIB is mounted on the inside of the enclosure door.

The PTIB is factory-wired and requires no additional wiring in the field. Verify that the PTIB wiring harness is connected to the main logic board. See Figure 3-10 for the PTIB connector location.

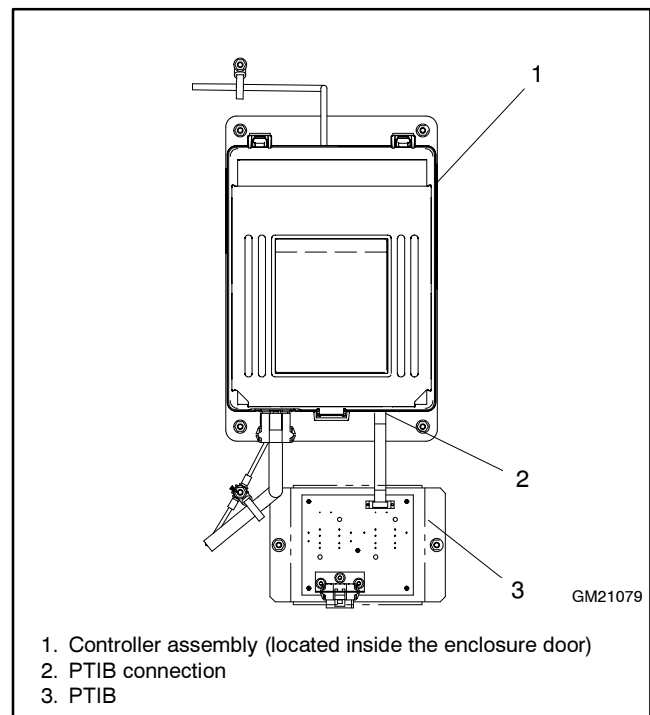


Figure 3-10 Programmed-Transition Interface Board (PTIB)

3.4 System Settings and Time Delays

The system can be operated using the factory settings listed in the following sections.

Use the Setup Program to change the controller time delays, pickup and dropout settings, inputs, outputs, and options if necessary.

3.4.1 System Parameters

The system parameter factory settings are shown in Figure 3-11. The controller voltage and frequency sensing are factory-set to the default values shown in Figure 3-12. The voltage and frequency time delays prevent nuisance transfers caused by brief spikes and dips in the power supply.

System Parameter	Factory Setting
Open or programmed transition	Set to order
Single/three phase	Set to order
Operating voltage	Set to order
Operating frequency (50 or 60 Hz)	Set to order
Phase rotation	ABC
Commit to transfer (yes or no)	No
Rated current	Set to order
Operating mode: Generator-to-Generator, Utility-to-Generator, or Utility-to-Utility	Utility-to-Generator
In-phase monitor	Disabled
In-phase monitor transfer angle	0
Transfer mode (automatic or non-automatic)*	Set to order
* The transfer mode (automatic or non-automatic) cannot be changed in the field.	

Figure 3-11 System Parameters

Voltage and Frequency Sensing	
Parameter	Default
Undervoltage pickup	90% of nominal
Undervoltage dropout	90% of pickup
Overvoltage dropout	115% of nominal
Overvoltage pickup	95% of dropout
Voltage debounce time	0.5 sec.
Underfrequency pickup	90% of nominal
Underfrequency dropout	99% of pickup
Overfrequency dropout	101% of pickup
Overfrequency pickup	110% of nominal
Frequency debounce time	3 sec.

Figure 3-12 Factory Settings, Voltage and Frequency

3.4.2 Time Delays

The factory settings for the time delays are shown in Figure 3-13.

The pre-transfer time delays operate only when both sources are available. These delays allow time to disconnect selected loads before transfer. The load control LED on the user interface lights when the pre-transfer signal is active. The pre-transfer and post-transfer time delays overlap the preferred-to-standby and standby-to-preferred transfer time delays.

Adjustable Time Delays	
Time Delay	Default
Engine start	3 sec.
Preferred to standby	1 sec.
Standby to preferred	15 min.
Off to standby (programmed-transition only)	1 sec.
Off to preferred (programmed-transition only)	1 sec.
Failure to acquire standby source	1 min.
Pretransfer to standby signal	3 sec.
Pretransfer to preferred signal	3 sec.
Post-transfer to standby signal	0 sec.
Post-transfer to preferred signal	0 sec.
Engine cooldown	0 min.
In-phase monitor synch	30 sec.

Figure 3-13 Factory Settings, Time Delays

3.5 Generator Set Preparation

Disconnect all power sources to the transfer switch by opening upstream circuit breakers or switches to the transfer switch.

Prepare the generator set for operation. Check the items specified by the generator set installation or operation checklist or manual.

Move the generator set master switch to the OFF position; reconnect the generator engine start battery cables, negative (-) leads last; and reconnect power to the generator engine start battery chargers, if installed.

3.6 Functional Test

The functional test includes three checks:

- Manual Operation Test
- Voltage Checks
- Automatic Operation Test

Note: Perform these checks in the order presented to avoid damaging the ATS.

Read all instructions on the labels affixed to the automatic transfer switch.

3.6.1 Manual Operation Test

If you have not already done so, test the contactor manual operation before proceeding to the voltage check and electrical operation test.

Note: Disable the generator set and disconnect the power by opening the circuit breakers or switches for both sources before manually operating the transfer switch.

Follow the instructions in Section 2.4 to check the transfer switch manual operation.

A contactor in normal and serviceable condition transfers smoothly without binding when operated manually. Do not place the transfer switch into service if the contactor does not operate smoothly without binding; contact an authorized distributor/dealer to service the contactor.

Note: Do not reconnect the power sources at this time. Proceed to the voltage check procedure described in the following section.

3.6.2 Voltage Check

The voltage, frequency, and phasing of the transfer switch and the power sources must be the same to avoid damage to loads and the transfer switch. Compare the voltage and frequency specifications of the utility source, transfer switch, and generator set, and verify that the specifications are all the same.

Use the voltage check procedure explained in this section to verify that the voltages and phasing of all power sources are compatible with the transfer switch before connecting the power switching device and controller wire harnesses together.

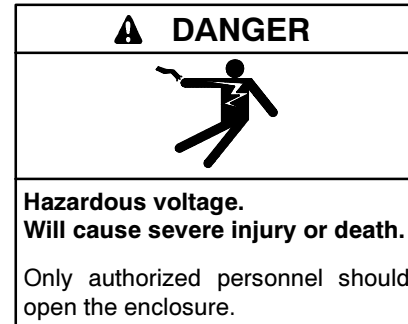
Read and understand all instructions on installation drawings and labels on the switch. Note any optional

accessories that have been furnished with the switch and review their operation.

Source N is the source connected to the normal side of the contactor. Source E is the source connected to the emergency side of the contactor.

The voltage check procedure requires the following equipment:

- A digital voltmeter (DVM) with electrically insulated probes capable of measuring the rated voltage and frequency
- A phase rotation meter



Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. (600 volts and under)

Voltage Check Procedure

Note: Perform voltage checks in the order given to avoid damaging the transfer switch.

1. Verify that the generator set master switch is in the OFF position and both power sources are disconnected from the transfer switch.
2. Disconnect the power switching device and controller wiring harnesses at the inline disconnect plug, if they are connected.
3. Manually operate the transfer switch to position E. See Section 2.4.
4. If Source N is a generator set, move the generator set master switch to the RUN position. The generator set should start.
5. Close the Source N circuit breaker or switch.

6. Use a voltmeter to check the Source N (normal) phase-to-phase and phase-to-neutral (if applicable) terminal voltages and frequency.
 - a. If Source N is the utility and the measured input does not match the voltage and frequency shown on the transfer switch nameplate, **STOP!** Do not proceed further in installation because the transfer switch is not designed for the application—call your distributor/dealer to order the correct transfer switch.
 - b. If Source N is a generator set and the generator set output voltage and frequency do not match the nominal system voltage and frequency shown on the transfer switch nameplate, follow the manufacturer's instructions to adjust the generator set. The automatic transfer switch will only function with the rated system voltage and frequency specified on the nameplate.
7. Use a phase rotation meter to check the phase rotation at the Source N (normal) terminals. Rewire the transfer switch Source N terminals to make the phase sequence match the load if necessary.

Note: The default setting for the phase rotation on the controller is ABC. If the application uses a phase rotation of CBA, use the Setup Program to change the phase rotation setting on the controller.
8. If the source is a generator set, stop the generator set by moving the master switch to the OFF position.
9. Disconnect Source N by opening upstream circuit breakers or switches.
10. Manually operate the transfer switch to position N.
11. Repeat steps 4 through 8 for Source E. Then proceed to step 17.
12. Disconnect both sources to the transfer switch by opening the circuit breakers or switches.
13. Connect the power switching device and controller wiring harnesses together at the inline disconnect plug.

Note: Do not connect or disconnect the controller wiring harness when the power is connected.
14. Check the DIP switch settings. Verify that the TEST DIP switch is in the loaded position before proceeding with the next test.
15. Close and lock the transfer switch enclosure door.

16. Reconnect both power sources by closing the circuit breakers or switches.
17. Move the generator set master switch to the AUTO position.

Note: If the engine cooldown time delay setting is not set to zero (default setting), the generator set may start and run until the Time Delay Engine Cooldown (TDEC) ends.

18. Proceed to the automatic operation test.

3.6.3 Automatic Operation Test

Check the transfer switch's automatic control system immediately after the voltage check. The test sequence simulates a loss of the normal source, starts the generator set, and transfers the load to the emergency source, executing all time delays that are set up to operate during a loss of the normal source. When the test is ended in step 7 of the procedure, the transfer switch transfers the load back to the normal source and removes the engine start signal, executing all appropriate programmed time delays.

Refer to Section 4.2.2 for a description of the test sequence of operation.

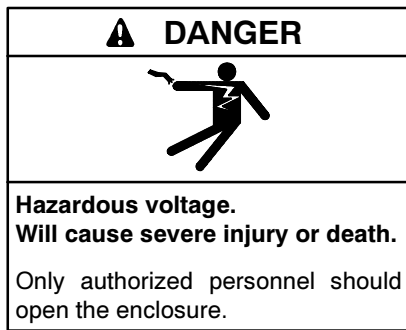
Note: If the standby source fails during a test, the ATS will immediately attempt to transfer to the preferred source.

Optional Switches. If the ATS is equipped with a preferred source switch, check the switch position before proceeding with the automatic operation test. The test procedure assumes that Source N is the preferred source.

If the transfer switch is equipped with a supervised transfer switch, verify that it is set to the Auto position.

See Section 6.4 for more information about optional switches.

Note: Close and lock the enclosure door before starting the test procedure.



Automatic Operation Test Procedure

1. Check the controller LED indicators to verify that the Position N and Source N Available indicators are lit.
2. Press the lamp test button and check that all controller LEDs illuminate.
3. Verify that the generator set master switch is in the AUTO position.
4. Press the TEST button on the controller to start the test. The TEST LED flashes to indicate that the ATS controller is set up to transfer the load during the test.
5. Verify that the generator set starts after the engine start delay times out. Check that the Source E Available LED lights.
6. Verify that the switch transfers the load to Source E.
 - a. Open-Transition Model KDT/KMT Switches: After the preferred-to-standby time delay, verify that the Position N LED goes out and the

Position E LED lights, indicating that the switch has transferred the load to Source E.

- b. Programmed-Transition Model KDP/KMP Switches: After the preferred-to-off time delay, verify that the Position N LED goes out and the Position OFF LED lights. After the off-to-standby time delay, check that the Position E LED lights, indicating that the switch has transferred the load to Source E.
7. Push the Test button to end the test.
8. Verify that the switch transfers the load back to Source N.
 - a. Open-Transition Model KDT/KMT Switches: After the standby-to-preferred time delay, verify that the Position E LED goes out and the Position N LED lights, indicating that the switch has transferred the load to Source N.
 - b. Programmed-Transition Model KDP/KMP Switches: After the standby-to-off time delay, verify that the Position E LED goes out and the Position OFF LED lights. After the off-to-preferred time delay, check that the Position N LED lights, indicating that the switch has transferred the load to Source N.

Note: The generator set may have an engine cooldown time delay that causes the generator set engine to run after the transfer switch engine start signal is removed.

This completes the functional test. Proceed to the next section to activate the exerciser.

3.7 Exerciser Setup

Set the exerciser period (every week or every 2 weeks) and load condition by using DIP switches on the controller circuit board. The factory settings for the exerciser are shown in Figure 3-14.

The exerciser clock must be set after installation. Pressing the exercise button activates the exerciser, starts an exercise run, and sets the time and date of the next exercise run.

Setting the Exerciser

1. Press and hold the Exercise button for approximately 3 seconds until it flashes.
2. The generator set will start and run for 30 minutes. Press and hold the exercise button again to end the exercise period early, if desired.

Note: Pressing the end time delay button does *not* end an exercise run.

The exercise time is set to the time that the button is pushed. The default setting for the exerciser run duration is 30 minutes. The time delay LEDs show the time remaining in the exercise run.

Use the Setup Program to change the exerciser run duration, if desired. See Section 4.2.3 for more information about the exerciser.

Exerciser Parameter	Factory Setting
1 week/2 week exercise (DIP switch)	1 week
Disable/enable exercise (DIP switch)	Enable
Load/no load exercise (DIP switch)	No load
Run duration	30 minutes

Figure 3-14 Exerciser Factory Settings

The exerciser can be set without starting the generator set, if necessary. Use the following procedure.

Setting the Exerciser (without starting the generator set)

1. Move the disable/enable exercise DIP switch to the DISABLE position and close the enclosure door. The Exercise LED flashes rapidly to indicate that the exerciser is disabled.
2. Press and hold the exercise button until the Exercise LED goes out for approximately 3 seconds and then starts to flash again.
3. Move the disable/enable exercise DIP switch back to the ENABLE position.
4. Close and lock the enclosure door.
5. Verify that the EXERCISE LED is not flashing.

The exerciser time is set to the time that the button is pushed. The exerciser will run in one or two weeks according to the 1 week/2 week DIP switch position.

Notes

4.1 Introduction

This section contains descriptions and flowcharts for typical transfer switch operating sequences. This section also describes faults and provides other information related to the controller operation.

On systems not equipped with the preferred source selector switch, the preferred source is the source connected to the Normal side of the power switching device. The source connected to the Emergency side of the contactor is the standby source.

4.2 Sequence of Operation

4.2.1 Automatic Operation

Typical ATS operation in utility-to-generator set mode is divided into two sequences:

- **Failure of the Normal (preferred) power source** and the resulting load transfer to the Emergency (standby) source.
- **Restoration of the preferred power source** and the resulting load transfer back to the preferred source.

Events such as the failure of the generator set to start can change the sequence of operation.

If the emergency source fails and the normal source is not available, the transfer switch controller powers down until one of the sources returns.

Figure 4-1 illustrates the transfer sequence when the normal source fails, and Figure 4-2 illustrates the sequence when it returns. Figure 4-3 shows the operation of the user interface LEDs during loss and restoration of the normal source.

Time Delays. Time delays before load transfer prevent nuisance transfers during brief power interruptions. The voltage and frequency debounce time delays prevent nuisance transfers caused by brief spikes and dips in the power supply. See Section 3.4 for the default settings for the time delays and debounce times.

Loss of Phase. If the system detects a loss of phase in the connected source, the ATS checks the other source

to determine if it is acceptable and transfer to it. The system considers a phase lost if the source phase angle is greater than the load phase angle. The controller logs loss of phase events in the event history.

Programmed-Transition Switches. Programmed transition switches provide an OFF position during transfer between two sources. The adjustable time off period allows residual voltages in the load circuits to decay before connecting to the second source. During the off period, the ATS main contacts are open and neither source powers the load.

The off-to-standby and off-to-preferred time delays control the length of the off period for programmed-transition switches. The time delays are factory-set to the defaults shown in Figure 3-13. The time delays can be changed using the optional Setup Program.

The End Time Delay Button and Remote Bypass command do not override the off-to-standby and off-to-preferred time delays.

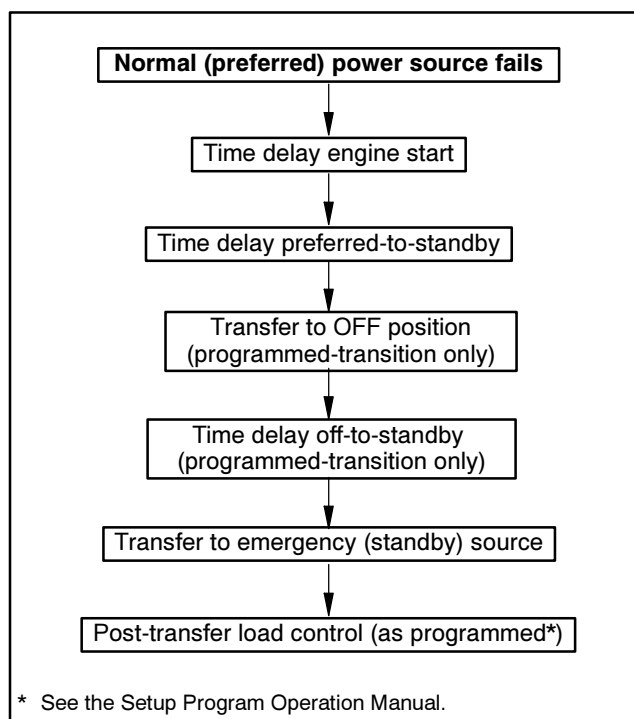


Figure 4-1 ATS Sequence of Operation, Transfer to Emergency (standby source)

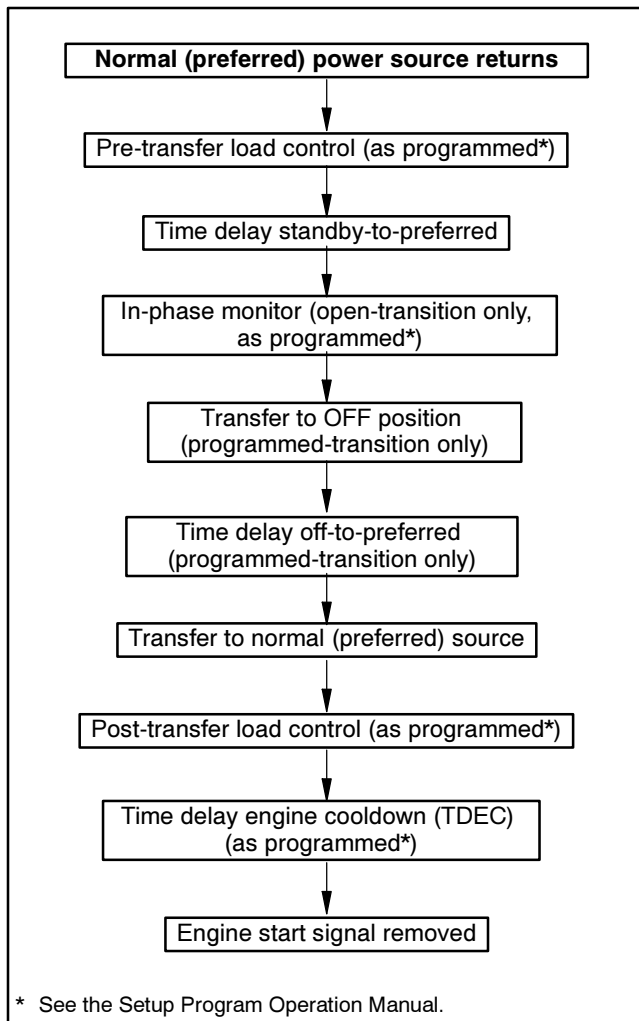


Figure 4-2 ATS Sequence of Operation, Return to Normal (preferred source)

Loss of Normal Source	LED Indicators					
	N Available	N Position	OFF Position	E Available	E Position	Load Control
Engine Start Time Delay						
Preferred-to-Standby Time Delay		X		X		
Post-transfer to Standby Load Control				X	X	X
Standby-to-Preferred Time Delay	X			X	X	
Pre-transfer to Preferred Load Control	X			X	X	X
Off-to-Preferred Time Delay (programmed-transition only)	X		X	X		
Post-transfer to Preferred Load Control	X	X		X		X
Engine Cooldown Time Delay (Default = 0)	X	X		X		

Figure 4-3 User Interface LED Indicators During Loss of Normal Source

4.2.2 System Test

A system test simulates a preferred source failure and performs the transfer sequence. Press and release the test button to start the test. Press and release the test button again to end the test. The test sequence does not start if the ATS is in the standby position.

A test sequence can also be started or ended through the setup software. See the Setup Program Operation manual.

The Test LED flashes to indicate a loaded test or lights steadily to indicate a test without load. Use the test DIP switch to select loaded or unloaded tests. See Section 3.2.3 for DIP switch locations and settings.

Figure 4-4 and Figure 4-5 illustrate the following test sequences. Figure 4-6 shows the operation of the user interface LEDs during the test sequence.

Test without Load. The test without load sequence starts the generator set but does not transfer the load. The generator set continues to run until the test button is pushed again.

Test with Load. The test with load sequence simulates a preferred source failure and activates the pre- and post-transfer load control sequences as programmed. Refer to Section 4.2.5 for additional information about pre-transfer time delays.

The test remains active until the test button is pushed again or until a remote test signal is received. If the standby source fails during a test cycle, the system immediately transfers back to the preferred source if it is acceptable.

The test sequence executes all time delays that are set up to operate during a normal sequence of operation. Press the End Time Delay button to shorten the time delays while they are running, if desired. (The End Time Delay button does not end programmed-transition time delays.)

At the start of the test, the ATS simulates a preferred source failure and signals the generator set to start. When the standby source is available and the time delay preferred-to-standby expires, the ATS transfers the load if the test DIP switch is set for a loaded test.

When the test button is pressed again, the ATS transfers the load back to the preferred source, if available, after the standby-to-preferred time delay. The ATS removes the generator engine start signal after the related time delays expire. (The generator set may continue to run if the generator set controller provides an additional engine cooldown time delay.)

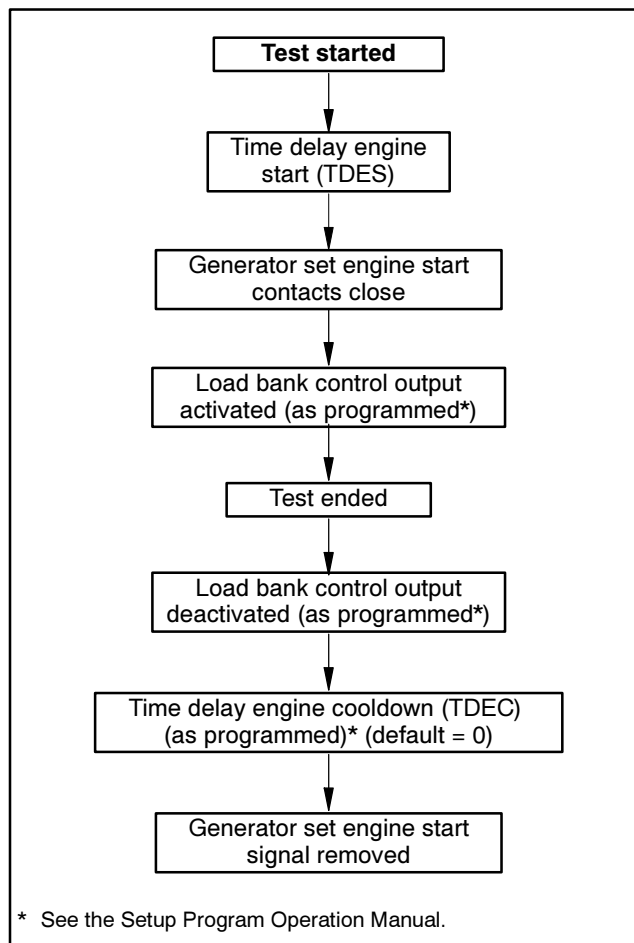


Figure 4-4 Test Without Load Sequence

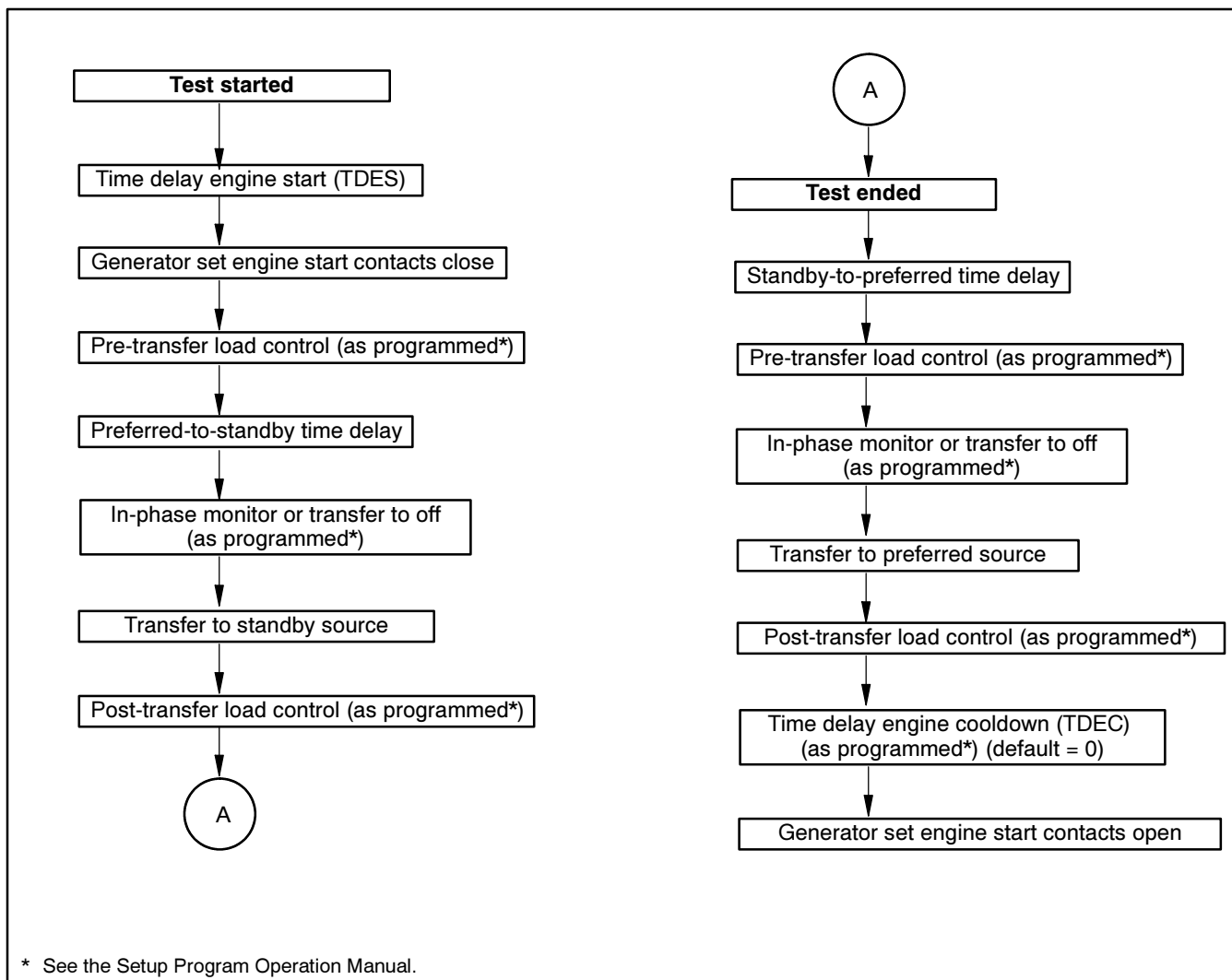


Figure 4-5 Test with Load Sequence

System Test	N Available	N Position	OFF Position	E Available	E Position	Load Control	Test (flashing)
Engine Start Time Delay	X	X					X
Preferred-to-Standby Time Delay	X	X		X			X
Pre-transfer to Standby Load Control	X	X		X		X	X
Off-to-Standby Time Delay (programmed-transition only)	X		X	X			X
Post-transfer to Standby Load Control	X			X	X	X	X
Pre-transfer to Preferred Load Control	X			X	X	X	X
Off-to-Preferred Time Delay (programmed-transition only)	X		X	X			X
Post-transfer to Preferred Load Control	X	X		X		X	X
Engine Cooldown Time Delay (Default = 0)	X	X		X			X

Figure 4-6 User Interface LED Indicators During a Loaded Test

4.2.3 Exerciser

Activate the exerciser after ATS installation by pressing and holding the exercise button until the exercise LED flashes quickly. See Figure 3-1 for the location of the Exercise button and LED on the user interface panel.

Press the Exercise button while the exercise is running to end the exercise early, if desired.

Figure 4-7 shows the exerciser factory default settings. The exercise mode is set through the Setup Software. All other settings in Figure 4-7 are set through DIP switches on the controller's main logic board. See Section 3.2.3.

Figure 4-8 describes the exercise LED operation.

Exerciser Parameter	Factory Setting
1 week/2 week exercise	1 week
Disable/enable exercise	Enable
Load/no load exercise	No load
Run duration	30 minutes
Exercise mode	Switch Input

Figure 4-7 Exerciser Factory Settings

Exerciser LED	Indicates
Steady Illumination	Unloaded exercise active.
Slow Flash (1 Hz)	Loaded exercise active
Rapid Flash (4 Hz)	When exercise button is pressed and held, rapid flashing indicates the exercise has been started and set. Rapid flashing at any other time indicates that the exercise is inhibited by the DIP switch setting.

Figure 4-8 Exerciser LED Indicator

Loaded/Unloaded Exercise. A DIP switch on the controller circuit board allows the selection of loaded or unloaded exercise runs. (See Section 3.2.3 for DIP switch locations.) Selecting unloaded exercise allows the ATS to start and run the generator set without transferring the building load.

The exercise LED flashes to indicate a loaded exercise. The exercise sequence starts the generator set engine immediately and activates the pre-transfer load control sequence. The in-phase monitor or programmed-transition time delays operate if programmed. The post-transfer load control sequence operates as programmed after the load is transferred. See Figure 4-9 and Figure 4-10 for the exerciser sequences of operation. Figure 4-11 shows the operation of the user interface LEDs during the exercise run. Refer to Section 4.2.5 for additional information about pre-transfer time delays.

Exercise Mode. The exerciser is factory-set to operate in switch input mode, which uses the Exercise button on the user interface to start, stop, and set the exerciser, and the 1 week/2 week DIP switch to determine the exercise schedule.

Calendar modes with and without override are also available. The Setup Program software is required to select and set up the exerciser calendar modes. See the Setup Program Operation manual.

The calendar mode overrides the exercise button on the user interface. Pressing the exercise button when the exerciser is set for calendar mode will not start an exercise or set the exercise time.

Calendar mode with override allows the starting and setting of the exerciser by pressing the exercise button. Pressing the exercise button while in calendar mode with override resets the exerciser to the switch input mode.

Exercise Schedule. The exercise repeats at the same time each week or every two weeks, depending on the 1 Week/2 Week DIP switch position. See Section 3.2.3 for the DIP switch location.

Note: The exerciser clock is accurate to within 1 minute per month.

Pressing the exercise button starts the exercise and sets the time for the *next* exercise according to the position of the 1 week/2 week DIP switch. Changing the 1 week/2 week DIP switch position does not change the time of the *next* exercise because it has already been scheduled. The new DIP switch setting becomes effective *after* the next scheduled exercise.

The system skips the exercise period if it is scheduled to start when the ATS is running under the following conditions:

- The ATS is running a test cycle initiated by the Test button on the user interface.
- The ATS is running on the standby source because the preferred source is not available.
- The ATS is running on the standby source because of a peak shave/area protection command.

Exercise Duration. The default (factory) setting for the run duration is 30 minutes. If the generator set fails during an exercise period, the switch immediately transfers back to the preferred source (if acceptable). Use the Setup Program to change the run duration, if desired.

Load Bank Control. The load bank control output can be used to apply a load to the generator set during the exercise. The load bank control output provides a contact closure that can be used to signal the load bank controller to operate. If the Normal source is lost during an exercise period, the load bank control output contact opens to remove the load bank and allow the transfer of the building load to the emergency source. See Section 3.2.4 for the load bank control output connection.

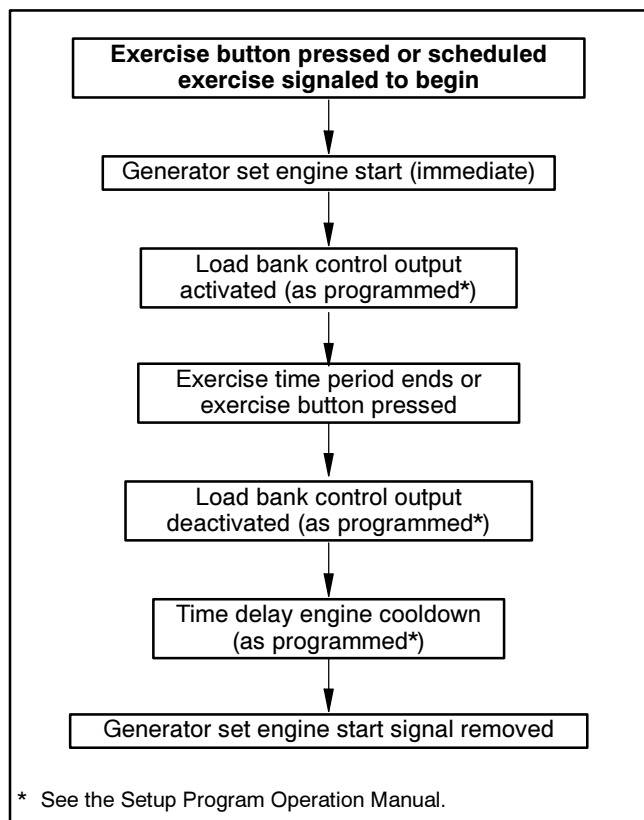


Figure 4-9 Exercise without Load Sequence

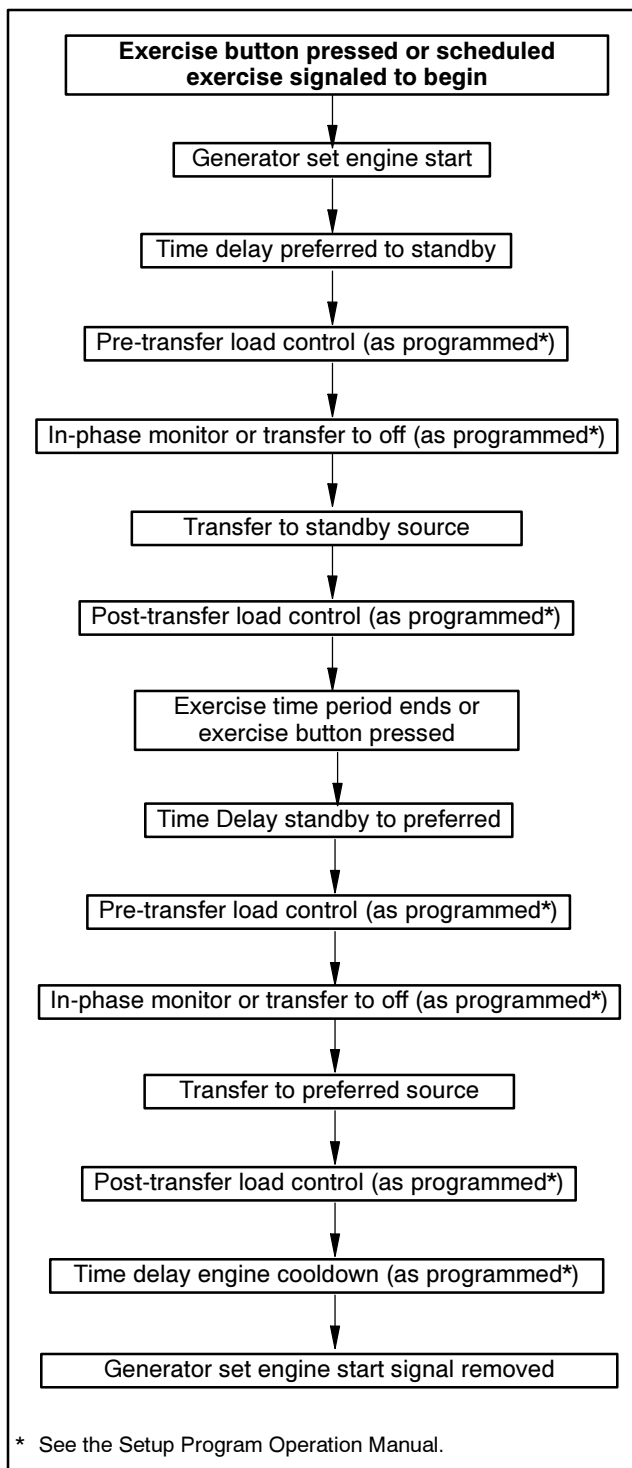


Figure 4-10 Exercise with Load Sequence

Loaded Exercise	LED Indicators						
	N Available	N Position	OFF Position	E Available	E Position	Load Control	Exercise (flashing)
Preferred-to-Standby Time Delay	X	X		X			X
Pre-Transfer to Standby Load Control	X	X		X		X	X
Off-to-Standby Time Delay (programmed-transition only)	X		X	X			X
In-Phase Synch (as programmed; N/A for programmed-transition models.)	X		X (flashing)	X			X
Post-Transfer to Standby Load Control	X			X	X	X	X
Pre-Transfer to Preferred Load Control	X			X	X	X	X
Off-to-Preferred Time Delay (programmed-transition only)	X		X	X			X
Post-Transfer to Preferred Load Control	X	X		X		X	X
Engine Cooldown Time Delay (Default = 0)	X	X		X			X

Figure 4-11 User Interface LED Indicators During a Loaded Exercise

4.2.4 Peak Shave/Area Protection Operation Sequence

The peak shave input (contact closure) signals the transfer switch to start the generator set and transfer to the standby source. The engine start (TDES) time delay is ignored.

When the peak shave input is removed (contact open), the system transfers back to preferred (if available) and removes the generator engine start signal. The default setting ignores the standby-to-preferred time delay when transferring back to preferred.

Note: The setup software can be set to bypass or execute the standby-to-preferred time delay during the peak shave sequence. See the Setup Program Operation Manual.

See Figure 4-12 for the sequence of operation.

See Section 3.2.4 for input connection information.

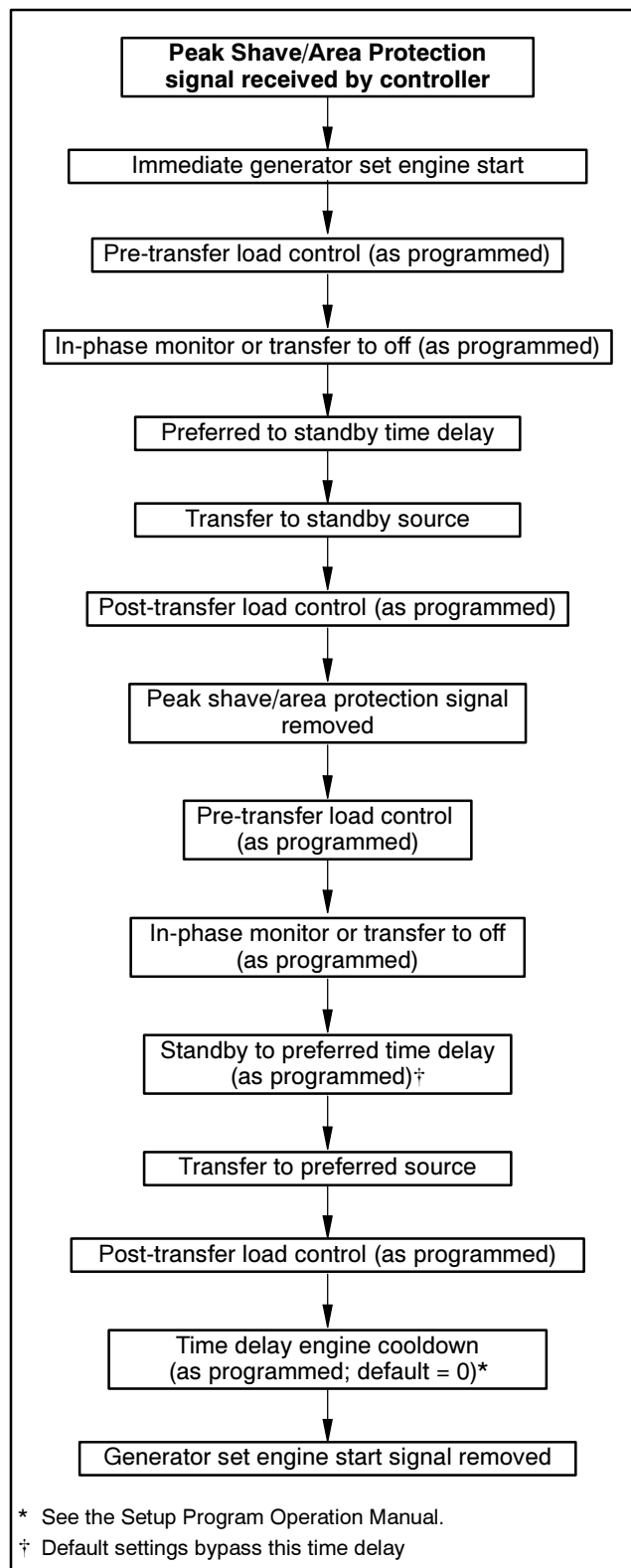


Figure 4-12 Peak Shave/Area Protection Sequence

4.2.5 Pre- and Post-Transfer Load Control Sequence

The pre-transfer and post-transfer load control time delays operate during transfer between two live sources, such as during a loaded test sequence or a loaded exercise. The load control LED lights when the pre- and post-transfer signals are active.

The pre-transfer load control time delays overlap the preferred-to-standby and standby-to-preferred time delays. The longer delay determines the time delay before transfer.

The timelines in Figure 4-13 illustrate the pre-transfer time delay sequence using the default settings. (The default settings for the post-transfer signals are equal to zero.) The default setting for the preferred-to-standby time delay is 1 second, and the default setting for the pre-transfer time delay is three seconds. The time delay before transfer is equal to the longer time delay, which is 3 seconds. When transferring back to the preferred source, the standby-to-preferred time delay is 15 minutes. The pre-transfer signal operates during the final 3 seconds before transfer to the preferred source. The total time delay before transfer back to preferred (using the default settings) is 15 minutes.

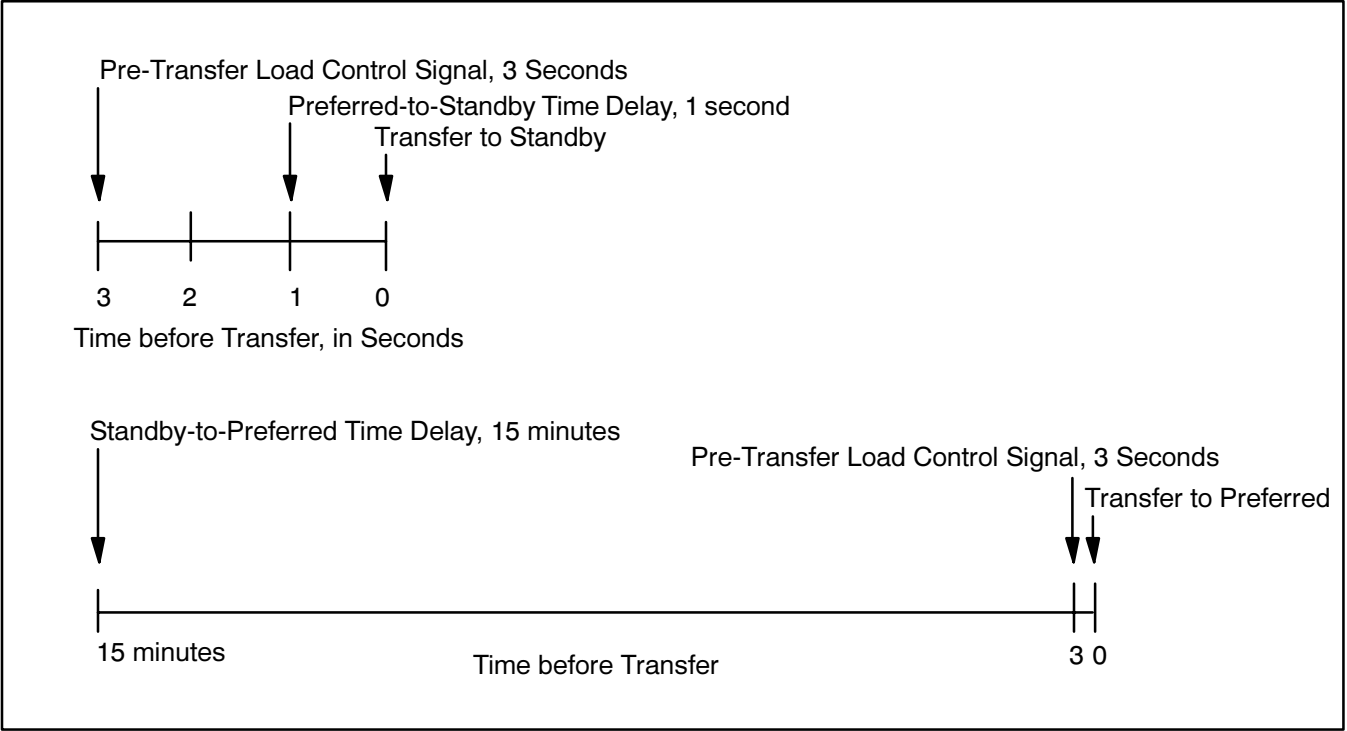


Figure 4-13 Pre-Transfer Time Delay Operation (default settings)

4.3 Source Availability

This section explains how the transfer switch controller defines the acceptable voltage range for the source.

At startup, the transfer switch considers the source voltages acceptable only if they are within the range of the undervoltage and overvoltage pickup values. The same conditions apply at initial startup and each time the source returns after a power outage. When the source has been recognized as available, the voltage may rise or fall within the wider range of dropout values and still be considered acceptable. See Figure 4-14 for an illustration of the default settings and acceptable voltages for a 600-volt system.

4.3.1 Startup

If the transfer switch controller does not recognize the source at startup, compare the measured voltages to the undervoltage and overvoltage pickup values. Measure the voltage on all phases.

If any of the measured voltages on any phase are outside the pickup value, use the Setup Program to change the pickup settings so that the ATS will recognize the source. The Setup Program's Voltage Setpoints screen allows adjustment of the settings for overvoltage and undervoltage pickup and dropout. Refer to the Setup Program Operation and Installation Manual for instructions to use the program.

Note: The maximum overvoltage dropout setting on a 600 VAC system is 115% (690 VAC). The maximum on all other system voltages is 135%.

4.3.2 Example

Here is an example for a 600 volt system with default settings. The voltage settings are illustrated in Figure 4-14. At initial startup and each time the source returns after a power outage, the phase voltages must be between the undervoltage pickup value (540 VAC) and the overvoltage pickup value (627 VAC). If the values are within this range at startup, the controller recognizes the source as acceptable. After the controller has recognized the sources, the voltage may increase past the 627 VAC barrier all the way up to 660 VAC before dropping out. After reaching 660 VAC, the source will not be considered acceptable again until all phases are below the 627 VAC threshold.

However, if the measured voltage on any phase is 628 VAC or higher at startup, the controller will not consider the source as available. Use the Setup Program to set the overvoltage pickup to 96% or higher so that the controller accepts the source at startup.

The same values apply if there is an outage. When the source returns the voltages must be within the 540 VAC to 627 VAC range unless the pickup values have been adjusted.

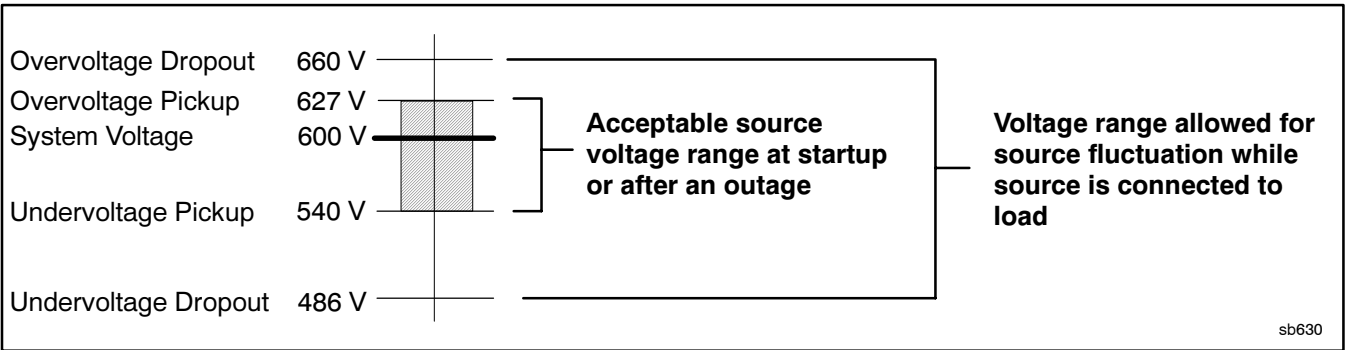


Figure 4-14 Example Voltages, 600 Volt System with Factory Default Settings

4.3.3 Selected Pickup and Dropout Values

For reference, the overvoltage pickup values corresponding to different system voltages have been calculated for the default overvoltage dropout setting (115%) and are listed in Figure 4-15.

Notice that the overvoltage pickup values are calculated as a percentage of the dropout setting. Changing the overvoltage dropout setting affects the overvoltage pickup setting.

System Voltage	Overvoltage Dropout at Default = 115% of System Voltage*	Overvoltage Pickup (Range 95–100% of Dropout, Default = 95%)	
		%	Value
208	239	95 *	227
		96	230
		97	232
		98	234
		99	237
240	276	95 *	262
		96	265
		97	268
		98	270
		99	273
380	437	95 *	415
		96	420
		97	424
		98	428
		99	433
480	552	95 *	524
		96	530
		97	535
		98	541
		99	546
600	690†	95 *	656
		96	662
		97	669
		98	676
		99	683

* Default setting of 115% shown. Overvoltage dropout can be set to 105–135% of system voltage. Different dropout settings will result in different pickup values.

† Maximum voltage 690 VAC, or 115% of system voltage at 600 VAC

Figure 4-15 Selected Overvoltage Pickup and Dropout Values

Undervoltage pickup values are calculated as a percentage of system voltage. The undervoltage dropout is then calculated as a percentage of the pickup value. For reference, selected undervoltage pickup and dropout values are listed in Figure 4-16.

System Voltage	Undervoltage Pickup (Range 85–100% of System Voltage, Default = 90%)		Undervoltage Dropout Value at Default = 90% of Pickup *
	%	Value	
208	85	177	160
	90 *	187	168
	95	198	178
	98	204	184
	100	208	187
240	85	204	184
	90 *	216	194
	95	228	205
	98	235	212
	100	240	216
380	85	323	291
	90 *	342	308
	95	361	325
	98	372	335
	100	380	342
480	85	408	367
	90 *	432	389
	95	456	410
	98	470	423
	100	480	432
600	85	510	459
	90 *	540	486
	95	570	513
	98	588	529
	100	600	540

* Default setting = 90% of pickup setting. Undervoltage dropout can be set to 75–98% of the pickup value.

Figure 4-16 Selected Undervoltage Pickup and Dropout Values

4.4 Faults

4.4.1 Service Required LED

The following faults cause the Service Required LED to flash, indicating that immediate service is required:

- Auxiliary switch fault
- Auxiliary switch open
- Failure to acquire standby source
- Failure to transfer
- Phase rotation fault
- Input/output module faults (see Section 6.7.1)

Find and correct the cause of the fault before trying to reset the controller. The cause of the fault may be shown by the other LEDs on the user interface; check the Source Available, Position, Load Control, Time Delay, Exercise, and Test LEDs to diagnose the cause of the faults. If the LEDs do not reveal the cause of the fault condition, connect a PC to the controller and use the Setup Program to view the event history. The event history lists fault conditions and transfers. See the software operation manual for more information and instructions.

After correcting the fault condition, press the Lamp Test button for approximately 5 seconds until the LEDs flash twice to clear the Service Required LED.

4.4.2 Auxiliary Switch Faults

An Auxiliary Switch Fault occurs if the controller cannot determine the contactor switch position. The Service Required LED flashes.

The fault clears when the controller can detect the switch position. Depress the Lamp Test button until the LEDs flash to clear the Service Required LED.

4.4.3 Failure to Acquire Standby Source

A fault occurs if the unit attempts to start the generator set but the standby source does not appear after the Acquire Standby Source to Failure time delay. The Service Required LED illuminates. Some conditions that may cause this fault are failure of the generator set to start, no voltage output from the generator, or an error in sensing the voltage output from the generator set.

The fault clears when the system acquires a standby source. Depress the Lamp Test button until the LEDs flash to clear the Service Required LED.

4.4.4 Failure to Transfer

If the unit fails to transfer on command, the controller waits 1 second and then initiates another 200 msec attempt to transfer. If the in-phase monitor is operating, the system waits 1 second and then begins monitoring the source phases in preparation for transfer. When the sources are in phase, the system attempts to transfer. After three unsuccessful attempts to transfer, the system stops attempting to transfer and generates a fault. The Service Required LED illuminates.

The fault clears when the contactor transfers successfully. Depress the Lamp Test button until the LEDs flash to clear the Service Required LED.

4.4.5 Phase Rotation Faults

A fault occurs if the phase rotation of the source voltage does not match the system's phase rotation direction setting (ABC or CBA). The unit will not transfer to a source if the source's phase rotation does not match the system setting. If the system detects a phase rotation fault in the connected source, it attempts to transfer to an alternate source that has the correct phase rotation. The controller logs phase rotation faults in the event history.

If the system detects phase rotation faults on both sources, the Service Required LED lights. The system does not transfer from the connected source.

4.5 Controller Power Supply

The controller's time, date, and all controller settings, including time delays, system parameters, pickups and dropout settings, and input/output assignments, are maintained by a controller battery during power outages.

The controller is powered by the sources connected to the transfer switch. The "dark time" is that period of time when neither source is available. During the dark time, capacitors maintain the controller power for about 15 seconds. The capacitors require approximately one hour to completely recharge after a power loss.

An optional external battery supply module (EBSM) can provide power to the controller for extended periods of time. Use the EBSM to allow extended engine start time delays of up to 60 minutes or to power the second ATS controller in a three-source system. See Section 6.5, External Battery Supply Module.

5.1 Introduction


Regular preventive maintenance ensures safe and reliable operation and extends the life of the transfer switch. Preventive maintenance includes periodic testing, cleaning, inspection, and replacement of worn or missing components. Section 5.4 contains a service schedule for recommended maintenance tasks.

A local authorized distributor/dealer can provide complete preventive maintenance and service to keep the transfer switch in top condition. Unless otherwise specified, have maintenance or service performed by an authorized distributor/dealer in accordance with all applicable codes and standards. See the Service Assistance section in this manual for how to locate a local distributor/dealer.

Keep records of all maintenance or service.

Replace all barriers and close and lock the enclosure door after maintenance or service and before reapplying power.

⚠ WARNING




Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.


⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Grounding the transfer switch. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the transfer switch and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

NOTICE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings, and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

5.2 Testing

5.2.1 Weekly Generator Set Exercise

Use the exerciser or a manual test to start and run the generator set under load once a week to maximize the reliability of the emergency power system. Press the Test button on the controller front panel to start and end the test. The Test LED flashes during a test with load or lights steadily during a test without load. Use the DIP switch to set the system for a loaded test or use a load bank and the load bank control output to run loaded without transferring the building load. See Sections 4.2.2 and 4.2.3 for more information about the exercise and test functions.

5.2.2 Monthly Automatic Control System Test

Test the transfer switch's automatic control system monthly. See Section 3.6.3 for the test procedure.

- Verify that the expected sequence of operations occurs as the switch transfers the load to the emergency source when a preferred source failure occurs or is simulated.
- Observe the indicator LEDs included on the transfer switch to check their operation.
- Watch and listen for signs of excessive noise or vibration during operation.
- After the switch transfers the load to the standby source, end the test and verify that the expected sequence of operations occurs as the transfer switch retransfers to the preferred source and signals the generator set to shut down after a cooldown period.
- On programmed-transition units, verify that the time delay in the OFF position functions during transfer to the standby source and transfer back to the preferred source.

5.3 Inspection and Service

Contact an authorized distributor/dealer to inspect and service the transfer switch annually and also when any wear, damage, deterioration, or malfunction of the transfer switch or its components is evident or suspected.

5.3.1 General Inspection

External Inspection. Keep the transfer switch clean and in good condition by performing a weekly general external inspection of the transfer switch for any evidence of vibration, leakage, excessive temperature, contamination, or deterioration. Remove accumulations of dirt, dust, and other contaminants from the transfer switch's external components or enclosure with a vacuum cleaner or by wiping with a dry cloth or brush.

Tighten loose external hardware. Replace any worn, missing, or broken external components with manufacturer-recommended replacement parts. Contact a local authorized distributor/dealer for specific part information and ordering.

Internal Inspection. Have an authorized distributor/dealer perform an annual inspection of the transfer switch. Inspect the switch more frequently if it is located in a dusty or dirty area or when any condition noticed during an external inspection may have affected internal components. Disconnect all power sources, open the transfer switch enclosure, and inspect internal components. Look for:

- Accumulations of dirt, dust, moisture, or other contaminants
- Signs of corrosion
- Worn, missing, or broken components
- Loose hardware

- Wire or cable insulation deterioration, cuts, or abrasions
- Signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor
- Other evidence of wear, damage, deterioration, or malfunction of the transfer switch or its components

Cleaning. Use a vacuum cleaner or a dry cloth or brush to remove contaminants from internal components. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and damage the switch.*

Lubrication. Maintain the transfer switch lubrication. If the transfer switch is subject to extremely dusty or abnormal operating conditions, relubricate all movements and linkages yearly. Relubricate the solenoid operator if the TS coil is replaced. Do not use oil; order the lubrication kit shown in the Parts Catalog.

Disconnect power and manually operate the transfer switch mechanism to verify that it operates smoothly without binding. If lubricating the outer mechanism of the transfer switch does not eliminate binding, replace the transfer switch assembly.

Periodically oil the enclosure door locks and screws.

5.3.2 Other Inspections and Service

Have an authorized distributor/dealer perform scheduled maintenance, service, and other maintenance that ensures the safe and reliable operation of the transfer switch. See Section 5.4, Service Schedule, for the recommended maintenance items and service intervals.

Have an authorized distributor/dealer repair or replace damaged or worn internal components with manufacturer-recommended replacement parts.

5.4 Service Schedule

Follow the service schedule below for the recommended service intervals. The transfer switch operator can perform tasks marked by an X. Have an authorized distributor/dealer inspect the switch annually and perform all service marked by a D.

System Component or Procedure	See Section	Visually Inspect	Check	Adjust, Repair, Replace	Clean	Test	Frequency
ELECTRICAL SYSTEM							
Check for signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor.	5.3.1	X	X				Y
Check the contactor's external operating mechanism for cleanliness; clean and relubricate if dirty *	5.3.1	X			D (clean and lube)		Y
Inspect wiring insulation for deterioration, cuts, or abrasion. Repair or replace deteriorated or damaged wiring.	5.3.1	X	D	D			Y
Tighten control and power wiring connections to specifications.	2.5		D			D	Y
Check the transfer switch's main power switching contacts' condition; clean or replace the main contacts or replace the contactor assembly as necessary.	5.3.1	D		D	D		Y
Perform a millivolt drop test to check for high contact resistances on power circuits. Tighten connections, clean main contacts, or adjust or replace main contacts or transfer switch assembly to eliminate high contact resistances.	S/M		D	D	D	D	Y
Test wire and cable insulation for electrical breakdown.	S/M					D	Every 3 Years
Check calibration of voltage-sensing circuitry and setpoints, and recalibrate circuitry as necessary.	S/M		D			D	Every 5 Years
CONTROL SYSTEM							
Test the transfer switch's automatic control system.	5.2.2 3.6.3	X				X	M
Test all indicators (LEDs) and all remote control systems for operation.	3.2	D	D	D		D	Y
GENERAL EQUIPMENT CONDITION							
Inspect the outside of the transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration. *	5.3.1	X			X		M
Check that all external hardware is in place, tightened, and not badly worn.	5.3.1	X	X	X			M
Inspect the inside of transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration. *	5.3.2	D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn.	5.3.2	X	D	D			Y
* Service more frequently if the transfer switch is operated in dusty or dirty areas. Do not use compressed air to clean the transfer switch.							
See Section: Read these sections carefully for additional information before attempting maintenance or service. Visually Inspect: Examine these items visually. Check: Requires physical contact with or movement of system components, or the use of nonvisual indications. Adjust, Repair, Replace: Includes tightening hardware and lubricating the mechanism. May require replacement of components depending upon the severity of the problem. Clean: Remove accumulations of dirt and contaminants from external transfer switch's components or enclosure with a vacuum cleaner or by wiping with a dry cloth or brush. <i>Do not use compressed air to clean the switch because it can cause debris to lodge in the components and cause damage.</i> Test: May require tools, equipment, or training available only through an authorized distributor/dealer.							
Symbols used in the chart: X=The transfer switch operator can perform these tasks. D=An authorized distributor/dealer must perform these tasks. S/M=ATS Service Manual W=Weekly M=Monthly Q=Quarterly S=Semiannually (every six months) Y=Yearly (annually)							

6.1 Introduction

This following transfer switch accessories are available:

- Battery charger
- Chicago alarm
- Control switches:
 - Preferred source switch
 - Supervised transfer switch
- External battery supply module (EBSM)
- In-phase monitor
- Programmable inputs and outputs:
 - Main logic board terminal strip
 - Input/output modules
- Security cover
- Setup Program software

Refer to the dimension drawings provided with the transfer switch for accessory locations.

Refer to the instructions provided with many of the accessory kits for more detailed operation instructions.

6.2 Battery Charger

The GM22502 is a 3-stage electronic battery charger designed for 12 or 24 VDC systems. It is designed to be used for lead acid batteries (flooded cell or AGM types) and gel cell batteries. The sealed and potted design is rainproof, lightweight, silent, and completely automatic. The charger contains internal, self-resetting short-circuit protection for the outputs and fuses for reversed-polarity protection.

The battery charger produces 12 VDC at 6 Amps or 24 VDC at 3 Amps. Red and green LEDs indicate that the unit is recharging or maintaining the battery.

Figure 6-1 shows the battery charger. Refer to the transfer switch dimension drawing for the location of the battery charger.

⚠ WARNING



**Sulfuric acid in batteries.
Can cause severe injury or death.**

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

⚠ WARNING



**Explosion.
Can cause severe injury or death.
Relays in the battery charger
cause arcs or sparks.**

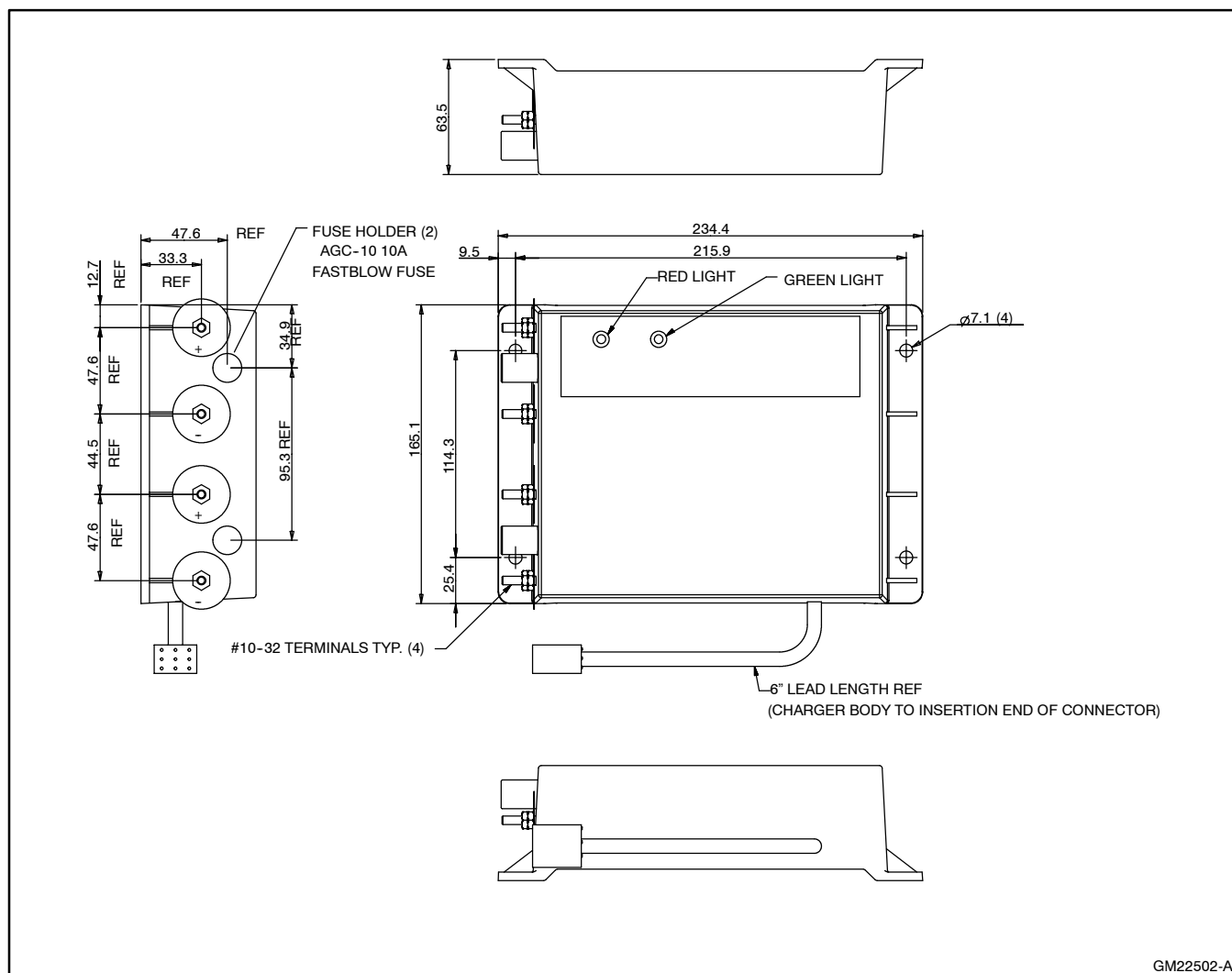
Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.



GM22502-A

Figure 6-1 Battery Charger

6.2.1 Battery Charger Connection

The battery charger is powered by the load side of the transfer switch contactor through a factory-installed wiring harness with a 9-pin inline connector. Verify that the power to the ATS is disconnected before connecting or disconnecting the 9-pin connector to the battery charger.

Ring terminals for battery charger connections are included with the battery charger.

The installing technician must supply the cable with terminals between the battery charger and the battery. Figure 6-3 provides details regarding cable length and gauge. Use red cable for battery positive (+) and black cable for battery negative (-).

Use the following procedure to connect the battery charger.

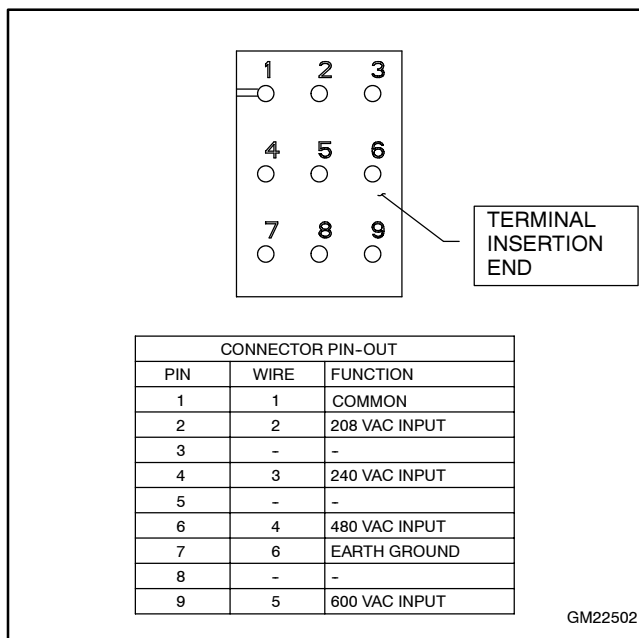
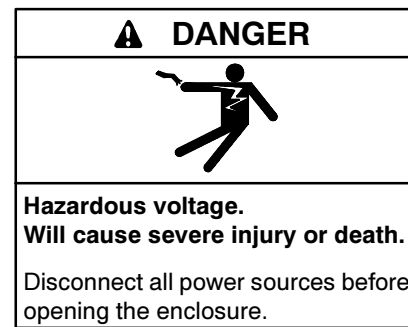


Figure 6-2 Battery Charger Power Connection

Maximum Distance	Wire Size	Battery Charger Terminal Size	Eyelet Terminal Part No.
4.5 m (15 ft.)	12 AWG	No. 10	X-283-11
7.5 m (25 ft.)	10 AWG		

Figure 6-3 Battery Cable and Terminal Specifications

Battery Charger Connection Procedure



Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

1. Verify that power to the ATS is disconnected (switches or circuit breakers to the ATS are open).
2. Verify that the inline connector to the battery charger is disconnected.
3. Clean the battery terminals and check the battery according to the battery manufacturer's instructions.
4. Determine the length of cable needed to connect the battery to the battery charger and refer to Figure 6-3 for the required wire size. The distances shown are the one-way distances from the charger to the battery.

Note: Use the recommended wire size to prevent overcharging the battery. Route AC and DC wiring in separate conduits.
5. Remove the boots and ring terminals from the battery charger posts.
6. Slide a red boot onto the red cable and a black boot onto the black cable. Attach ring terminals and use a crimping tool to crimp the ring terminals tightly.
7. Determine whether the generator set electrical system uses 12 or 24 volts. This information is shown on the generator set nameplate.

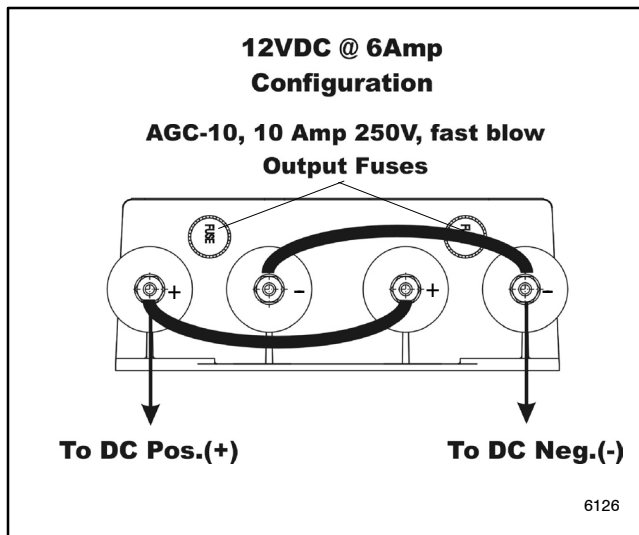


Figure 6-4 12-Volt Battery Charger Connections

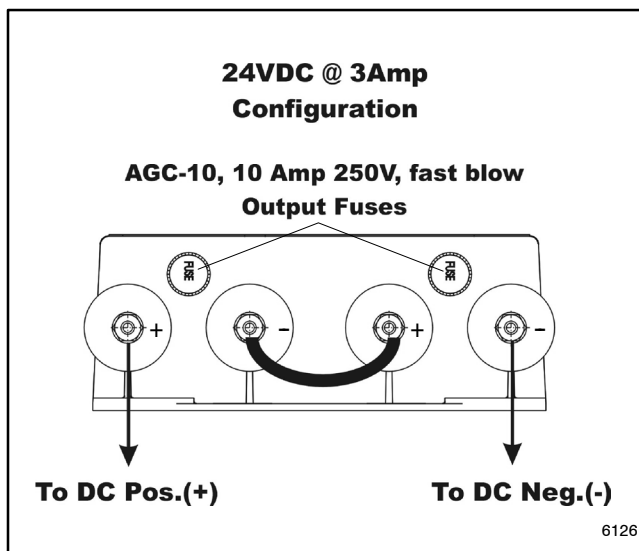


Figure 6-5 24-Volt Battery Charger Connections

8. Connect the jumpers as shown in Figure 6-4 for a 12-volt system or Figure 6-5 for a 24-volt system, reconnecting the jumper lead for 24-volt systems as shown. Place the jumper lead terminal between the two flat washers on the battery charger terminal.

Note: Battery chargers are configured for 12-volt systems at the factory. For 24-volt systems, reconnect the jumper lead as shown in Figure 6-5 and discard the second jumper lead.

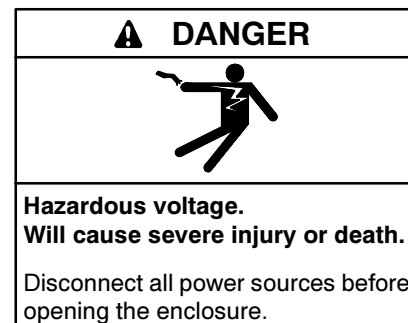
9. Connect the battery cables as shown in Figure 6-4 for 12 VDC systems or Figure 6-5 for 24 VDC systems.

Note: The positive (POS, P, +) battery post usually has a larger diameter than the negative (NEG, N, -) post.

- a. Connect the red POSITIVE terminal of the battery charger to the positive post of the battery.
- b. Connect the black NEGATIVE terminal of the battery charger to the negative post of the battery.

10. Slide the boots over the battery charger posts.
11. Connect the in-line connectors on the battery charger power cord.
12. Connect the charger to the battery according to the generator set or battery manufacturer's instructions, watching the polarity (+/-) of the connections.
13. Close the enclosure door and reconnect power to the transfer switch after the charger connections are complete.
14. Use a voltmeter to check the voltage at the battery and compare the readings to Figure 6-7 or Figure 6-8 to verify charger operation.

Battery Charger Disconnection Procedure



1. Before opening the transfer switch enclosure, disconnect power to the transfer switch by opening switches or circuit breakers to the transfer switch.
2. Disconnect the AC power cord at the in-line connector.
3. Remove the black (NEGATIVE) lead from the the battery terminal first.
4. Remove the red (POSITIVE) lead from the battery terminal.

Note: If it is not possible to disconnect power to the ATS during generator set service, disconnect the battery charger cables at the battery, negative lead first as described in steps 3 and 4 above. Insulate each lead by heavily taping the end.

6.2.2 Battery Charger Operation

Red and green LEDs on the charger indicate the charge rate. Refer to Figure 6-6 for a description of the LED

indicator operation. Figure 6-7 and Figure 6-8 show the 3-stage charging method for 12 VDC and 24 VDC configurations.

LED Indicators		Battery Charger Operating Condition
Red	Green	
On	Off	<p>The battery is discharged and the charger is recharging at the BULK rate (stage 1). This charging rate is 6 Amps at 12 VDC or 3 Amps at 24 VDC. The measured voltage (with the battery charger on) is 11.8 to 14 Volts in 12 VDC mode or 23.6 to 28 VDC 24 VDC mode.</p> <p>If the red LED stays on for more than 24 hours, refer to Problem 1 in the troubleshooting section in this manual.</p>
On	On	<p>The battery charger is charging at an ABSORPTION rate of between 1.5 and 5 Amps (stage 2). This mode of charging gradually “tops off” your battery, and reduces harmful sulfating. While both LED’s are on, the voltage measured (with the battery charger on) should be approx. 14.0 to 14.5 VDC in 12 VDC mode or 28.0 to 29.0 in 24 VDC mode.</p> <p>If both LED’s stay on longer than 24 hours, refer to Problem 2 in the troubleshooting section in this manual.</p>
Off	On	<p>The battery charger is charging at a FLOAT or MAINTENANCE rate of less than 1.5 Amps, (stage 3). The battery is now 90% charged and ready for use. This “float” charging current will gradually decrease to as low as 0.1 Amps as the battery reaches 100% charge. The float rate maintains the battery at full charge without overcharging.</p> <p>If the green LED stays on when your battery is known to be low, refer to Problem 3 in the troubleshooting section in this manual.</p>

Figure 6-6 BatteryCharger Operation

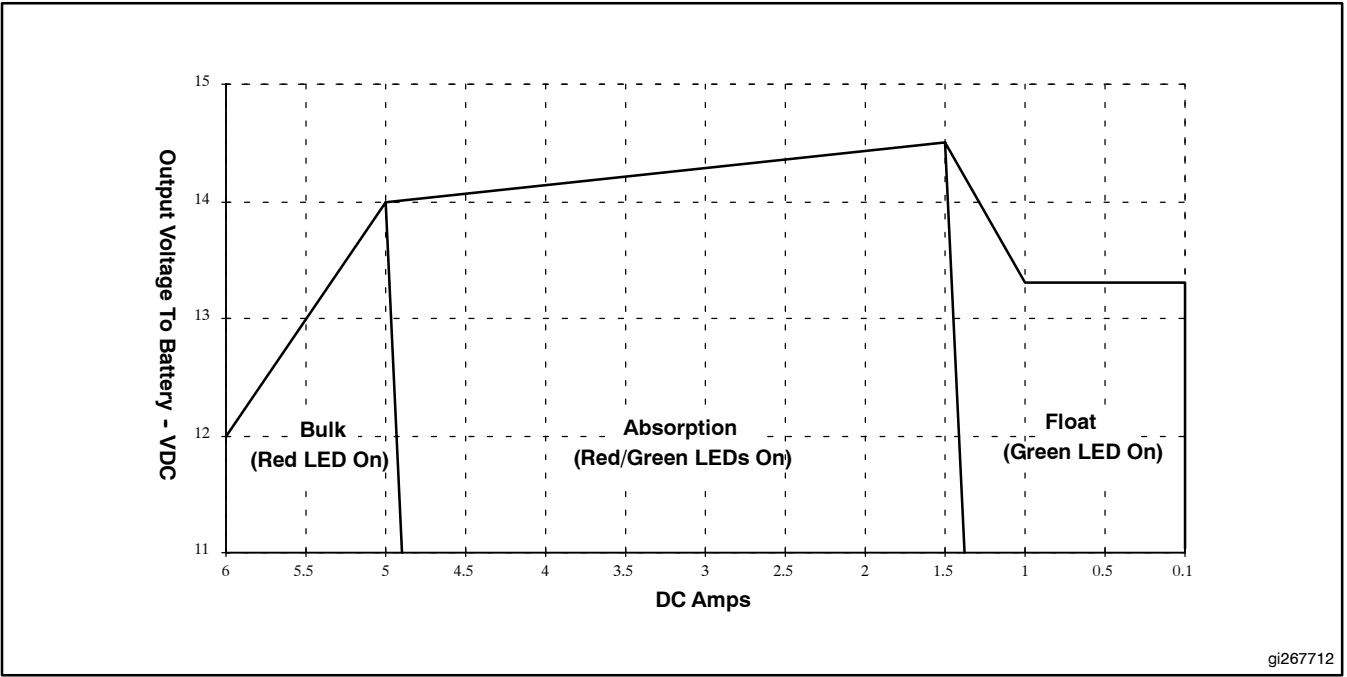


Figure 6-7 Charging Method, 12 VDC, 6 A Configuration

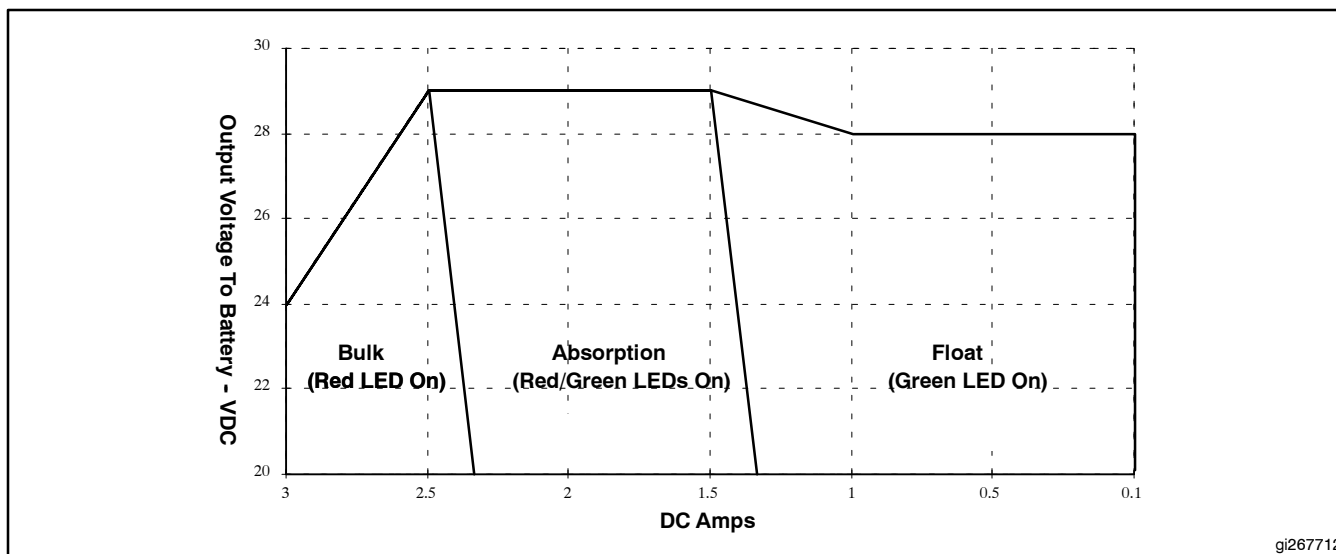


Figure 6-8 Charging Method, 24 VDC 3 A Configuration

6.2.3 Battery Charger Troubleshooting

Problem	Cause	Solution
Red LED stays on for more than 24 hours.	One or more defective or damaged cells.	Load test the battery and replace if necessary.
	Battery charger has reduced its output voltage below the normal level due to a DC overload or a DC short.	Remove the source of the overload or short. Disconnect the battery charger's black (NEGATIVE) ring terminal from the battery. Reapply AC power and the green LED only should now light.
	On-board DC systems are drawing more current than the charger can replace.	Turn off excessive DC equipment while charging.
The red and green LEDs stay on for more than 24 hours.	On-board DC systems are drawing between 1.5 – 5 A.	Turn off excessive DC equipment while charging.
	One or more defective or damaged cells.	Load test the battery and replace if necessary.
	Extremely low AC voltage at the battery charger.	Reduce the length of the power cord or increase the power cord wire size.
Green LED stays on when the battery is known to be low.	Open DC output fuse.	Replace the AGC-10 fuse.
	Faulty or contaminated terminal connections.	Clean and tighten or repair all terminal connections.
	One or more defective or damaged cells.	Load test the battery and replace if necessary.
Neither of the LEDs turn on when the AC power is applied.	No AC power available at the battery charger.	Connect AC power or reset the AC breaker on the main panel.
	Component failure.	Return battery charger to an authorized distributor/dealer.

Figure 6-9 Battery Charger Troubleshooting

6.2.4 Battery Charger Specifications

Figure 6-10 lists the battery charger specifications.

Output	
Charging	12 Volts DC (min.) at 6 Amps 24 Volts DC (min.) at 3 Amps
Maintaining	13.30 Volts DC at 0.1 Amps
Input	
Rated AC Voltage	208 VAC, AC connector pin 2 240 VAC, AC connector pin 4 480 VAC, AC connector pin 6 600VAC, AC connector pin 9
Current Draw	@ 50/ 60 Hz, 0.7 Amps Maximum
Maximum Recommended Battery Size	
Recharging	150 Amp-Hours
Maintenance only	300 Amp-Hours
Physical Dimensions	
Height	3.5 in. (8.9 cm.)
Width	6.4 in. (16.3 cm.)
Depth	2.1 in. (5.3 cm.)
Weight	3.5 lb. (1.6 kg)

Figure 6-10 Battery Charger Specifications

6.3 Chicago Alarm

The Chicago Alarm Accessory Kit provides an alarm that sounds to indicate that the transfer switch is in the Emergency position. Install this kit to comply with the alarm requirement in Article 700 of the Chicago City Code.

The kit is designed for indoor installation only. Follow the instructions provided with the kit to install the alarm box on a wall or other rigid mounting surface and make the necessary electrical connections.

The alarm horn sounds and the red ATS in Emergency lamp illuminates whenever the transfer switch is in the Emergency position. Push the Alarm Silence button to stop the alarm horn, if desired. The amber Alarm Silence lamp illuminates when the button is pressed. Both lamps then remain illuminated until the ATS transfers back to the Normal position.

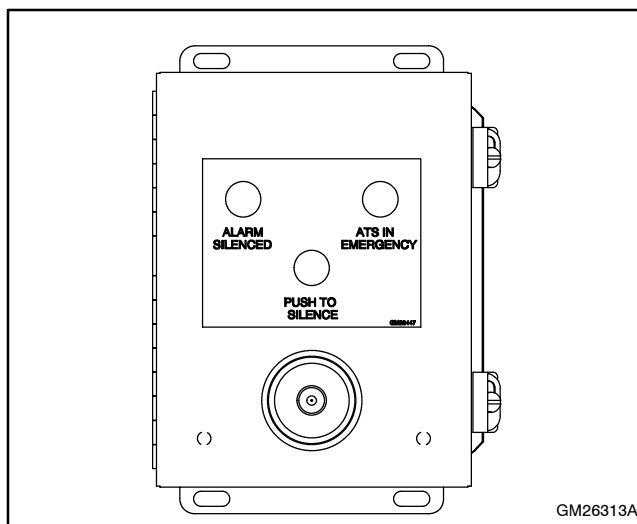


Figure 6-11 Chicago Alarm Box

6.4 Control Switches

Two control switches are available: the preferred source switch and the supervised transfer control switch. The switches are mounted on the enclosure door. See Figure 6-12 for typical switch locations.

Note: Factory-installed switches are factory-wired and require no additional wiring in the field.

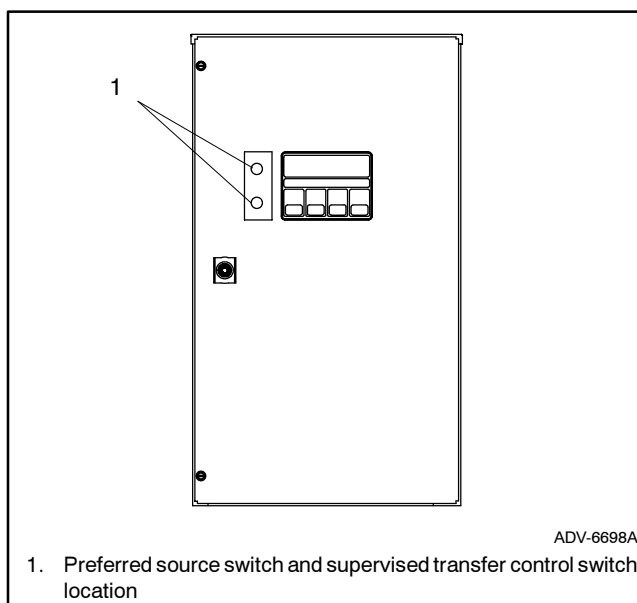


Figure 6-12 Control Switch Locations

6.4.1 Preferred Source Switch

The two-position, key-operated preferred source selector switch allows selection of either power source as the preferred source. The key can be removed with the switch in either position, locking the switch into the selected position. The preferred source selection cannot be changed remotely through software or the Modbus® connection. Figure 6-13 shows the preferred source selector switch.

The transfer switch seeks and transfers to the preferred source whenever it is available. Source N is always the source connected to the Normal side of the transfer switch, and Source E is always connected to the Emergency side. Generator engine start relays are assigned to the the source (Source N or Source E). The engine start relays do not change when the preferred source switch position changes. This prevents the need to change the wiring of the engine start relay(s) when the preferred source changes.

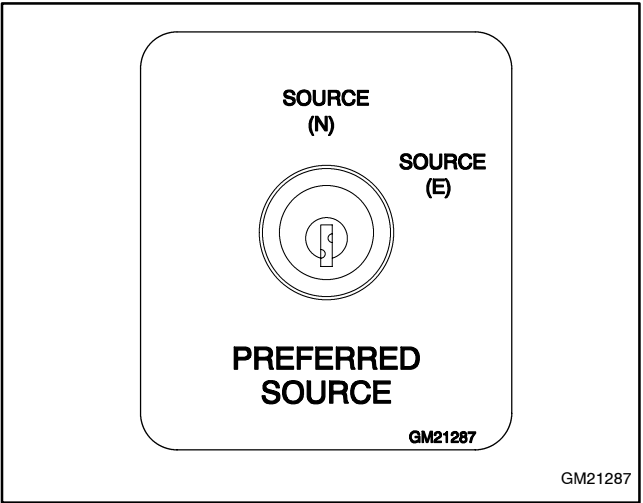


Figure 6-13 Preferred Source Selector Switch

Operating Modes. The transfer switch is factory-set for the generator set-to-utility mode of operation. This mode uses one generator set, which is connected to the Emergency side of the contactor (Source E), and one engine start relay. The engine start relay connections are located on the contactor on 30–400 amp units, and on the customer-connection terminal block on larger units (see Section 2.5.2). The engine start contact is

assigned to the connected generator set and does not change assignment when the preferred source switch position is changed. In this mode, if the preferred source switch is set to Source E, then the system operates the generator set indefinitely, transferring to utility power only if the generator set fails.

Use the setup program to change the mode to generator set-generator set or utility-utility if necessary. The generator set-generator set mode uses two generator sets and requires the assignment of a second engine start output. Use the setup program to assign one of the main logic board terminal strip or I/O module outputs to Start Source N Generator, and connect the engine start leads for the Source N generator set to the corresponding terminals on the terminal strip or I/O module terminals. See Sections 3.2.4 and 6.7.2. The programmed engine start output remains tied to the Source N generator set regardless of the position of the preferred source switch.

The utility-utility mode is designed to use utility power for both Source N and Source E. This mode does not use the engine start outputs.

Time Delays and Source Parameters. Engine start relays and time delays, source voltage and frequency trip points, and load shed time delays are assigned to the source (N or E). They do not change assignment when the preferred source switch position is changed.

Note: Source N is always connected to the Normal side of the transfer switch, and Source E is always connected to the Emergency side.

Other time delays are assigned to the source function (preferred or standby). System parameters that are assigned to the function automatically change source when the preferred source selection changes.

Figure 6-14 shows which parameters are assigned to the source and which are assigned to the function. The last two columns of the table show the effect of the preferred source selector switch position on each parameter or time delay.

Item	Assignment	Preferred Source Switch Position	
		N	E
Source N generator engine start relay	Source	N	N
Source E generator engine start relay	Source	E	E
Source N engine start time delay	Source	N	N
Source E engine start time delay	Source	E	E
Source N engine cooldown time delay	Source	N	N
Source E engine cooldown time delay	Source	E	E
Source N voltage and frequency trip points	Source	N	N
Source E voltage and frequency trip points	Source	E	E
Source N load shed time delays	Source	N	N
Source E load shed time delays	Source	E	E
In-phase monitor synch	Source	E	E
Preferred-to-standby time delay	Function	N to E	E to N
Standby-to-preferred time delay	Function	E to N	N to E
Failure to acquire standby source	Function	E	N
Pretransfer to preferred signal	Function	N	E
Pretransfer to standby signal	Function	E	N
Post-transfer to preferred signal	Function	N	E
Post-transfer to standby signal	Function	E	N
Off-to-standby time delay (programmed-transition only)	Function	Off to E	Off to N
Off-to-preferred time delay (programmed-transition only)	Function	Off to N	Off to E

Figure 6-14 Preferred Source Selection Effect on System Parameters and Time Delays

6.4.2 Supervised Transfer Control Switch

The supervised transfer control switch (AUTO/MANUAL/TRANSFER switch) is a three-position, key-operated switch that allows manual control of load transfers. The switch has maintained AUTO and MANUAL positions and a momentary TRANSFER position. The key can be removed in either the AUTO or MANUAL position. The key cannot be removed when the switch is in the TRANSFER position. Figure 6-15 shows the switch.

The manual mode allows the system to run on the standby source indefinitely, even if the preferred source is available. In manual mode, the controller is inhibited from initiating a transfer sequence until the keyswitch is turned to the TRANSFER position.

It is not necessary to hold the switch in the TRANSFER position during the transfer sequence. Turn the switch to TRANSFER and release it to initiate transfer. The transfer sequence will proceed after the switch returns to the MANUAL position, executing all programmed time delays and transferring the load to the other source if it is available.

Automatic and Non-Automatic Transfer Switches.

The switch operation differs for automatic and non-automatic switches. An automatic transfer switch transfers automatically to an available source if the connected source is lost. A non-automatic transfer switch does not transfer automatically, even if the connected source is lost. Figure 6-16 summarizes the switch operation.

Note: Transfer switches are built and UL-labeled as automatic or non-automatic by the factory and

cannot be converted in the field. The supervised transfer control switch cannot be removed from non-automatic switches in the field.

Test and Peak Shave Operation. When the supervised transfer control switch on an *automatic* system is in the MANUAL position, pressing the Test button or sending a peak shave command causes transfer to the standby source. However, ending the test or removing the peak shave signal will *not* cause a transfer back to the preferred source. Move the supervised transfer control switch to the TRANSFER position to initiate transfer back to the preferred source.

Test and peak shave signals are ignored by *non-automatic* systems when the supervised transfer control switch is in the MANUAL position.

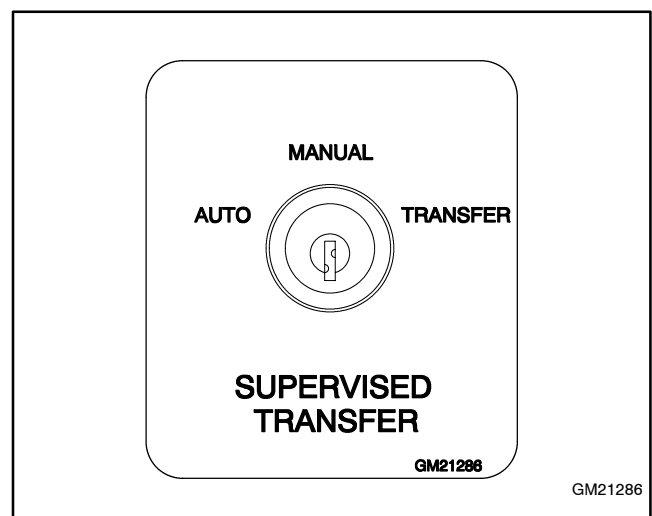


Figure 6-15 Supervised Transfer Control Switch

Switch Position	Operation, Automatic Switches	Operation, Non-Automatic Switches
AUTO	<ul style="list-style-type: none"> Automatically transfers to the standby source, when available, if the preferred source is lost Transfers back to the preferred source when it becomes available 	
MANUAL	<ul style="list-style-type: none"> Automatically transfers to an available source if the connected source is lost Does not automatically transfer back to preferred when both sources are available 	<ul style="list-style-type: none"> Enables the Not-in-Auto indicator Transfers only when the switch is manually moved to the TRANSFER position: <ul style="list-style-type: none"> Does not automatically transfer to an available source when the connected source is lost Does not automatically transfer back to preferred when both sources are available
TRANSFER	<ul style="list-style-type: none"> Can use to transfer when the switch is in the MANUAL position and both sources are available Initiates transfer sequence to the other source, if available, including all programmed time delays Operates pre- and post-transfer load control time delays if both sources are available 	<ul style="list-style-type: none"> Must use for all transfers when the switch is in the MANUAL position Initiates transfer sequence to the other source, if available, including all programmed time delays Operates pre- and post-transfer load control time delays if both sources are available

Figure 6-16 Supervised Transfer Control Switch Operation

the I/O module before installing the external battery supply module. A maximum of three I/O modules can be installed with the EBSM.

A personal computer running the Setup Program is required to configure the inputs and outputs for all systems using the external battery supply module. **Setup Program version 1.3.0 or higher is required for setting up three-source systems. Setup Program version 1.6.1 or higher is required to set up extended engine start time delays.** Refer to the Setup Program Operation Manual to set up the I/O circuit board communications and to define the I/O circuit board inputs and outputs.

For a three-source system, verify that your ATS controller uses **main logic software version 1.21 or higher** by using the Setup Program to view the System Information data window. Refer to the Setup Program Operation Manual for instructions. Contact the factory for the latest version of the main logic software if the controller does not have version 1.21 or higher. Use the Program Loader to load the latest version of the software onto the controller. See TT-1285 for Program Loader instructions.

Use a **battery charger** to maintain the battery(ies) connected to the EBSM. The ATS controller draws 800 mAmps during normal operation. Optional I/O modules can increase the current draw to a maximum of 1.5 amps.

6.5.3 External Battery Supply Module Diagnostic LEDs

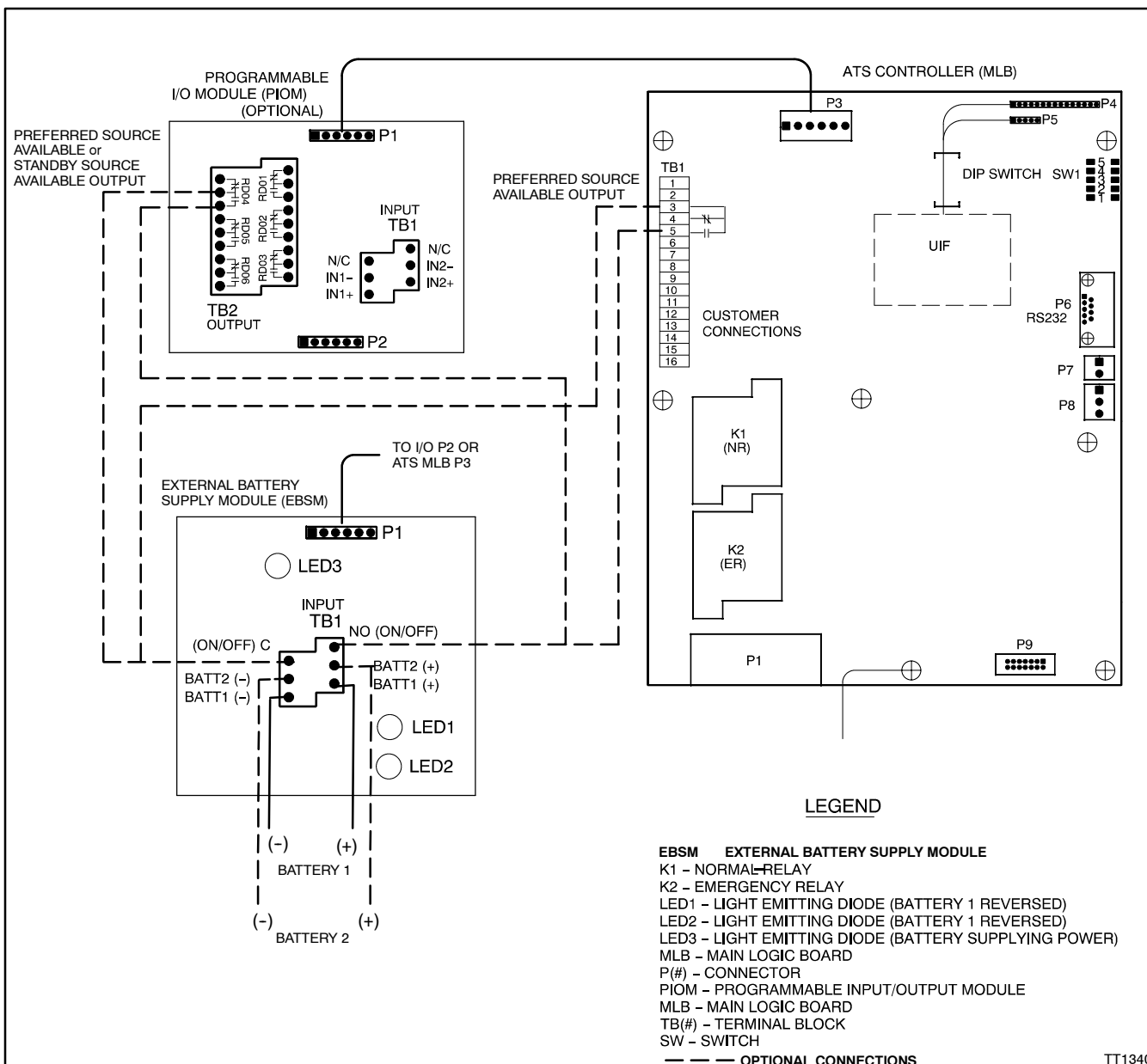
The EBSM includes three LED indicators:

- LEDs 1 and 2 illuminate if the battery polarity is reversed. Reverse the battery connections at EBSM TB1 if the corresponding LED lights.
- LED3 illuminates when the EBSM is on, supplying power to the ATS controller.

6.5.4 Connections and Setup for Systems with Extended Time Delays

Use wire sizes from #14 AWG to #20 AWG for EBSM and I/O module connections. See Figure 6-19 for connections during the following steps.

1. Optional connections prevent the EBSM from running continuously when a source is available. Connect the normally open (NO) side of one (or two) available programmable output(s) from the ATS controller's main logic board or a programmable I/O module to the terminals labelled ON/OFF on TB1 on the EBSM. See Figure 6-19. Set the programmable output(s) to Preferred Source Available (and Emergency Source Available) in step 4.
 2. Connect the battery power.
 - a. Connect the battery cables for the first battery to TB1 on the EBSM. Connect the positive battery cable to the terminal labelled BATT 1 (+) and connect the negative cable to BATT 1 (-).
 - b. For a 24-volt, 2-battery system, connect the second battery to the terminals labelled BATT 2 (+) and BATT 2 (-).
 3. Check that LEDs 1 and 2 are not illuminated. The LEDs illuminate if the battery polarity is reversed. If either LED1 or LED2 is illuminated, reverse the polarity of the corresponding battery connections to EBSM TB1. The input is reverse-polarity protected.
- Note:** LED1 corresponds to Battery 2 and LED2 corresponds to Battery 1.
4. Use the Setup Program to set the programmable output(s), if used. Proceed to step 6.5.6 for instructions to assign the outputs.



TT1340

External Battery Supply Module (EBSM) Operation

The EBSM uses up to two battery inputs (9-36 VDC) and provides a 12 VDC output that powers the ATS controller. This is required when the engine start time delay is extended beyond 15 seconds. This is the amount of time that the controller can maintain power without an available source.

The EBSM is connected by snapping it to an existing I/O module or through harness P3 to the controller when an I/O module is not used.

The EBSM will provide power to the controller continuously unless the ON/OFF input on the EBSM is enabled. The ON/OFF input on TB1 of the EBSM can be connected to the normally open contact of a programmable output from the ATS controller's main logic board or from a programmable I/O module to turn the EBSM OFF when a source is available.

Figure 6-19 Connections for Extended Time Delays

6.5.5 Connections and Setup for Three-Source Systems

See Figure 6-20 and Figure 6-21 for connections during the following steps.

1. Connect the power sources to the transfer switches as described below. Refer to the transfer switch Operation/Installation manual or specification sheet for cable sizes. See Figure 6-20 for connections.
 - a. Connect the utility power source to the normal side of ATS1.
 - b. Connect the load to the load side of ATS1.
 - c. Connect the emergency side of ATS1 to the load side of ATS2.
 - d. Connect generator set 1 to the normal side of ATS2.
 - e. Connect generator set 2 to the emergency side of ATS2.
2. Three-source systems require the following input/output connections to control the engine start commands for generator sets 1 and 2. Observe the polarity of all connections shown in Figure 6-21. Use wire sizes from #14 AWG to #20 AWG for EBSM and I/O module connections.
 - a. Connect the ATS2 engine start contacts to the engine start circuit on generator set 2 (G2).

Note: The ATS engine start contacts are located on the contactor (on 30–400 amp models) or on the field-connection terminal block (on 600–4000 amp models) and are labeled with a red decal.

- b. Connect the ATS1 main logic board programmable output terminals TB1-3 and TB1-5 to ATS2 main logic board programmable input 1 terminals TB1-6 and TB1-7 as shown in Figure 6-21. This I/O connection will be set to “Three-Source System Disable.”

- c. Connect ATS2 main logic board programmable output terminals TB1-3 and TB1-4 to the engine start connection on generator set 1 (G1). The ATS1 programmable output will be set to “Start Source N Generator.”
 - d. Optional. Connect the normally open side of any available output on the I/O module on ATS2 to the ON/OFF terminals on external battery supply module terminal strip TB1. The ATS2 I/O module output will be set to “Preferred Source Available.” (This optional connection turns off the EBSM when source G1 is available.)
 - e. Optional. Connect the normally open side of any available output on the I/O module on ATS2 to the ON/OFF terminals on external battery supply module terminal strip TB1. The ATS2 I/O module output will be set to “Standby Source Available.” (This optional connection turns off the EBSM when source G2 is available.)
3. Connect battery power. Connect the battery cables for the first battery to TB1 on the EBSM. Connect the positive battery cable to the terminal labelled BATT 1 (+) and connect the negative cable to BATT 1 (-).

For a 24-volt, 2-battery system, connect the second battery to the terminals labelled BATT 2 (+) and BATT 2 (-).

Check that LEDs 1 and 2 are not illuminated. The LEDs illuminate if the battery polarity is reversed. If either LED is illuminated, reverse the polarity of the corresponding battery connections to EBSM TB1.

Note: LED1 corresponds to Battery 2 and LED2 corresponds to Battery 1.

4. Use the Setup Program to assign inputs and outputs. See step 6.5.6 for instructions.

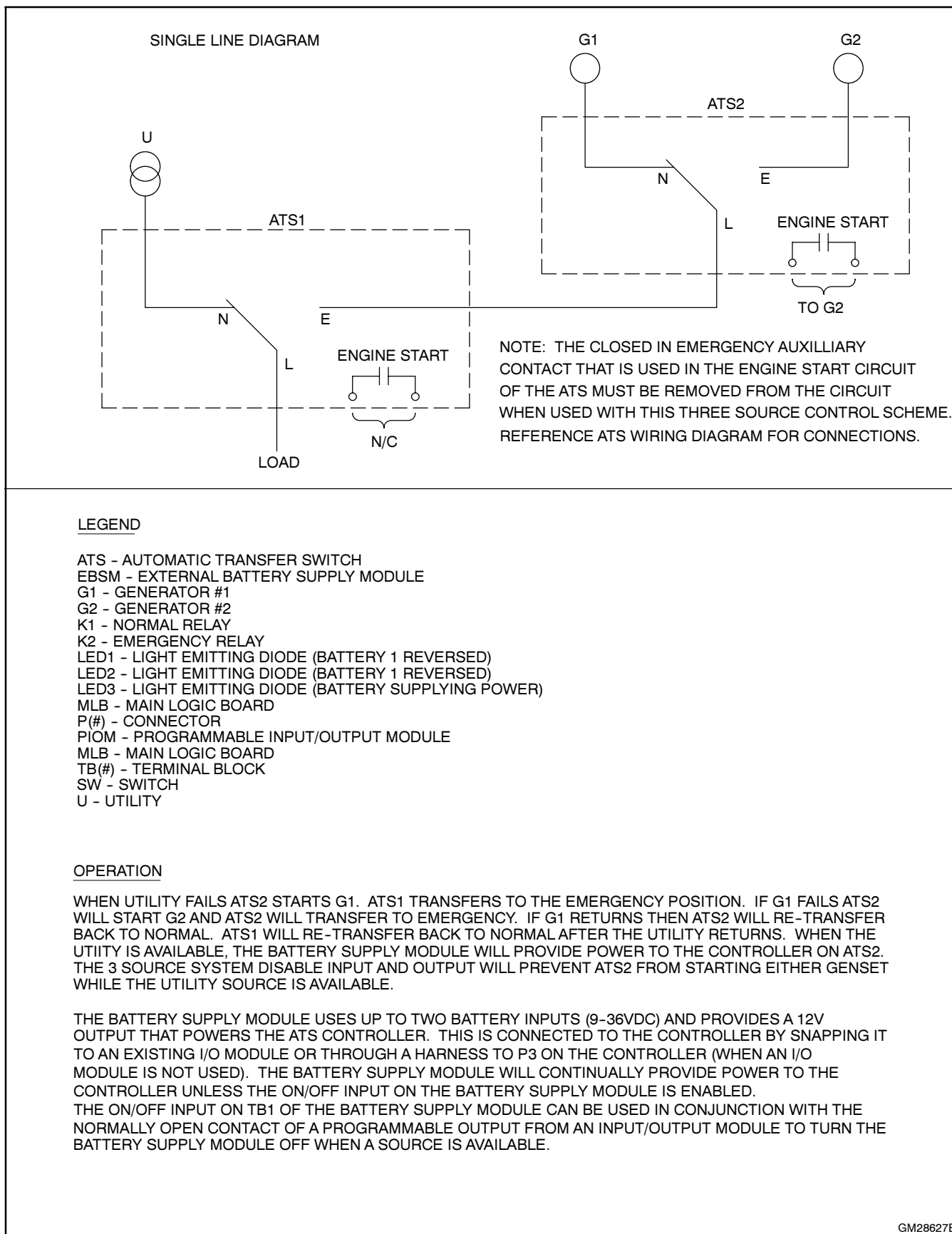


Figure 6-20 Three-Source System Transfer Switch and Source Connections

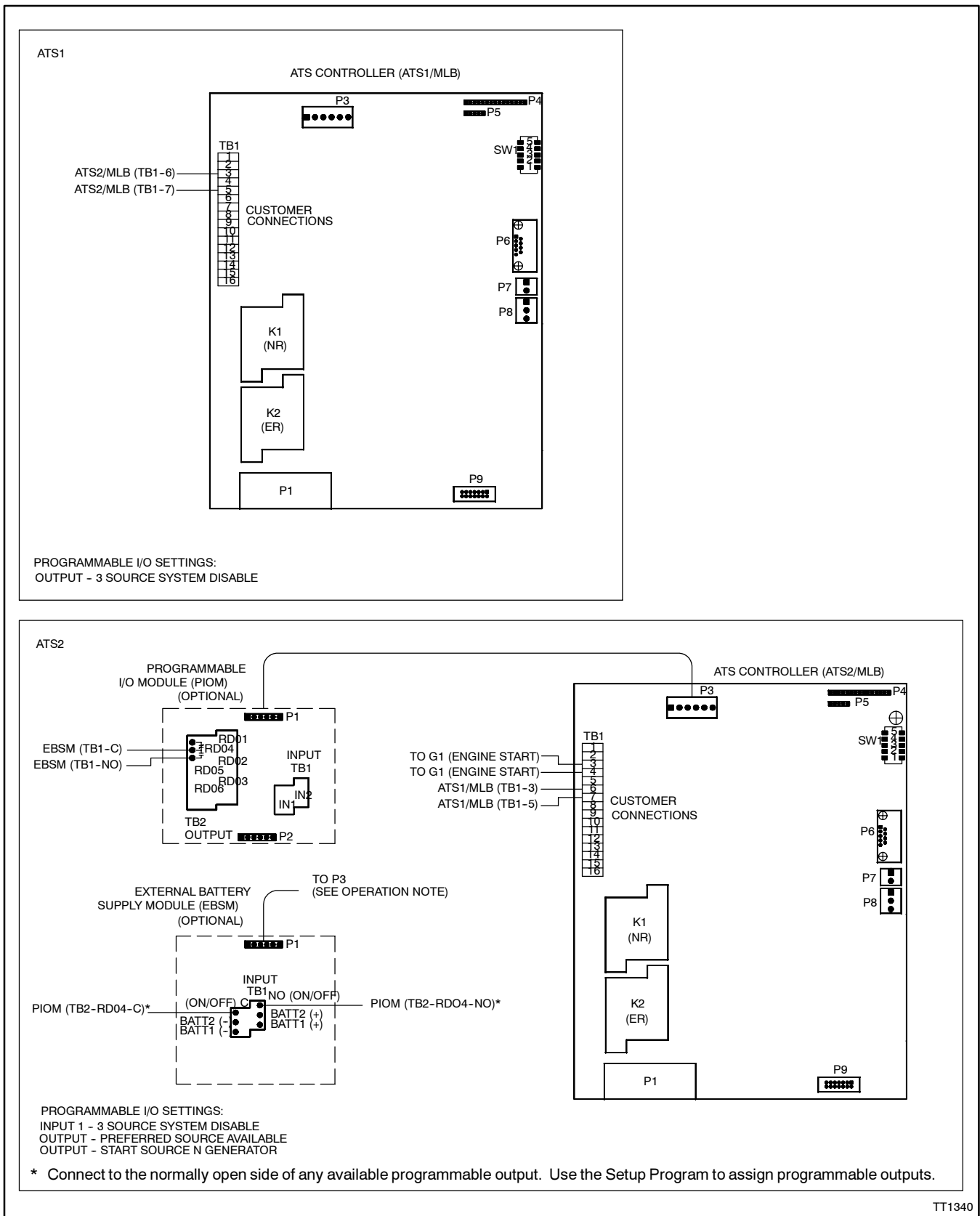


Figure 6-21 Input and Output Connections for Three-Source Systems

6.5.6 Assigning the Programmable Inputs and Outputs

Note: The Setup Program is required for assigning programmable inputs and outputs. See the Setup Program Operation and Installation Manual for more information about the Setup Program during the following steps.

Note: For extended time delays, programmable outputs need to be assigned only if the optional connections described in Section 6.5.4 are used.

1. Connect a personal computer (PC) to the ATS controller. See the Setup Program Operation and Installation Manual for instructions to connect the PC. Follow the instructions in the manual to install the Setup Program on the PC, if necessary.
2. Start the Setup Program.
3. Select Connection>Connect to establish communication with the transfer switch controller.
4. Select Window>New Window to bring up the list of data windows.
5. Select Programmable Input/Output from the list and click OK to create the Programmable I/O data window on the PC's screen. See Figure 6-22. Then choose Window>Setup or double-click on the Programmable I/O window to bring up the setup screen shown in Figure 6-23.
6. To determine the required input and output assignments, refer to step 4 for extended time delays or step 4 for three-source systems.

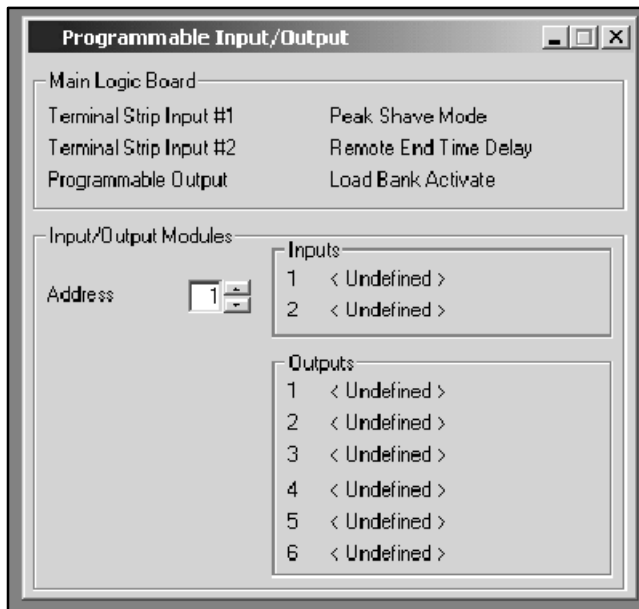


Figure 6-22 Programmable Input/Output Display

7. Identify the location of the input or output connection to be assigned: one of the input or output connections on the main logic board terminal strip TB1 or one of the programmable I/O modules. See Figure 6-23.

Note: For I/O modules, be sure to select the module address on the left side of the setup window before assigning the input/output. See Figure 6-23.

8. For **extended time delays**, assign the following outputs, if used.

Note: These are optional connections.

- a. Set the programmable output connected to the EBSM to Preferred Source Available, if used.
 - b. If two programmable outputs are connected to the EBSM ON/OFF terminals, set the second output to Standby Source Available.
9. For **three-source systems**, assign the following inputs and outputs.
 - a. Assign the ATS1 programmable output connected in step b. to "Three-Source System Disable."
 10. Click OK to save the input/output assignment(s) and close the setup window.

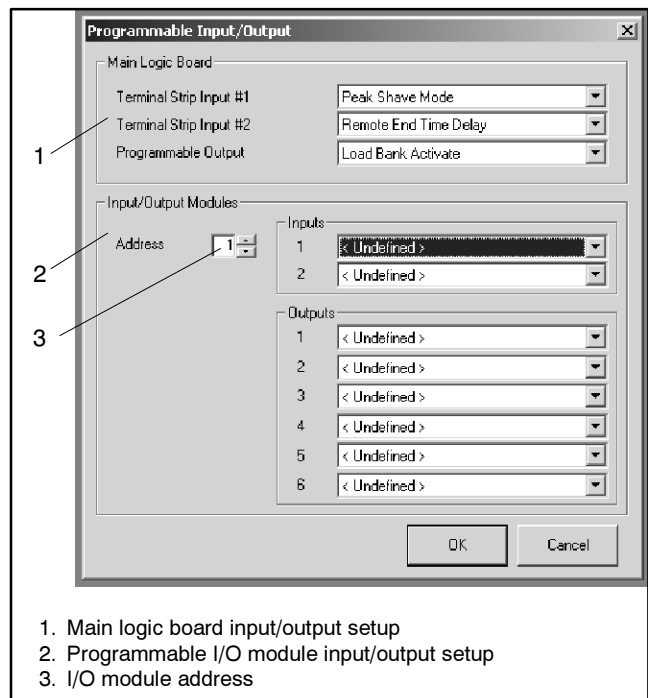


Figure 6-23 Programmable Input/Output Setup Window

11. For three-source systems, connect the PC to ATS2 and assign the following inputs and outputs for the second transfer switch.
 - a. Assign ATS2 main logic board programmable input 1 to “Three-Source System Disable.”
 - b. Assign the ATS2 main logic board programmable output connected in step c. to “Start Source N Generator.”
 - c. Optional. Assign the ATS2 I/O module output connected in Section 6.5.5 to “Preferred Source Available.”
 - d. Optional. Assign the ATS2 I/O module output connected in Section 6.5.5 to “Emergency Source Available.”
12. Click OK to save the input/output assignment(s) and close the setup window.
13. Follow the instructions in the Setup Program Operation and Installation Manual to exit the program and disconnect the PC.

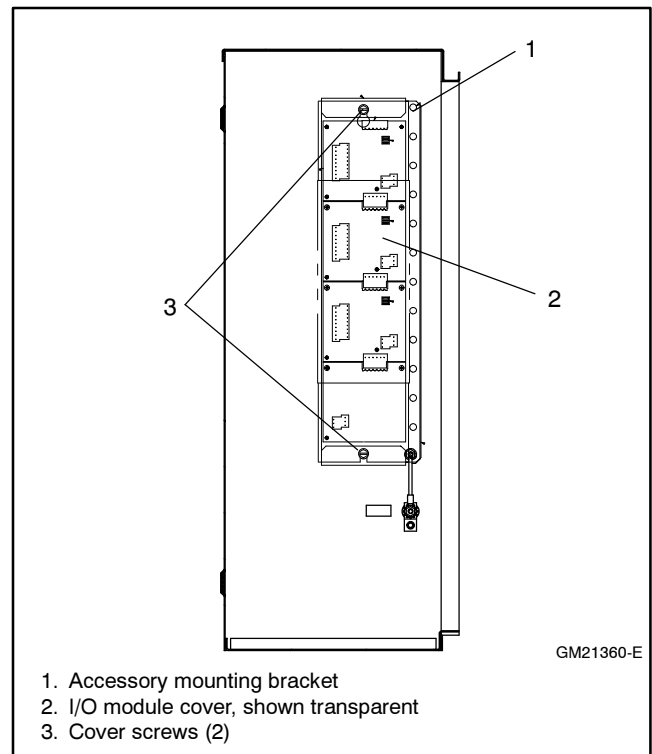


Figure 6-24 Installing I/O Module Cover

6.5.7 Installing the I/O Module Cover

1. Use cable ties as necessary to secure and protect all input/output and external battery supply module wiring.
2. Install the I/O module cover using the two 1/4-20 cover screws. See Figure 6-24.
3. Record the input and output connections on the decal. See Figure 6-25.
4. Write “External Battery Supply Module” in the space on the decal that corresponds to the board location (i.e., Address 1,2,3, or 4).
5. With surfaces clean and dry, attach the decal to the I/O module cover.

Note: The decal may be shipped already attached to the I/O module cover.

INPUT/OUTPUT MODULE ASSIGNMENTS

ADDRESS 1

INPUT 1 (TB1-IN1) _____

INPUT 2 (TB1-IN2) _____

OUTPUT 1 (TB2-RD01) _____

OUTPUT 2 (TB2-RD02) _____

OUTPUT 3 (TB2-RD03) _____

OUTPUT 4 (TB2-RD04) _____

OUTPUT 5 (TB2-RD05) _____

OUTPUT 6 (TB2-RD06) _____

ADDRESS 2

INPUT 1 (TB1-IN1) _____

INPUT 2 (TB1-IN2) _____

OUTPUT 1 (TB2-RD01) _____

OUTPUT 2 (TB2-RD02) _____

OUTPUT 3 (TB2-RD03) _____

OUTPUT 4 (TB2-RD04) _____

OUTPUT 5 (TB2-RD05) _____

OUTPUT 6 (TB2-RD06) _____

ADDRESS 3

INPUT 1 (TB1-IN1) _____

INPUT 2 (TB1-IN2) _____

OUTPUT 1 (TB2-RD01) _____

OUTPUT 2 (TB2-RD02) _____

OUTPUT 3 (TB2-RD03) _____

OUTPUT 4 (TB2-RD04) _____

OUTPUT 5 (TB2-RD05) _____

OUTPUT 6 (TB2-RD06) _____

ADDRESS 4

INPUT 1 (TB1-IN1) _____

INPUT 2 (TB1-IN2) _____

OUTPUT 1 (TB2-RD01) _____

OUTPUT 2 (TB2-RD02) _____

OUTPUT 3 (TB2-RD03) _____

OUTPUT 4 (TB2-RD04) _____

OUTPUT 5 (TB2-RD05) _____

OUTPUT 6 (TB2-RD06) _____

SW1 SETTINGS			
ADDRESS	SW1-1	SW1-2	SW1-3
1	C	C	C
2	C	C	O
3	C	O	C
4	C	O	O

THIS SIDE DOWN - OPEN

THIS SIDE DOWN - CLOSED

GM23621

GM23621-

Figure 6-25 Decal for Input and Output Assignments

6.6 In-Phase Monitor

Transfer switches are shipped with the in-phase monitor disabled. The factory settings are shown in Figure 6-26. Use the Setup Program to enable the in-phase monitor and adjust the settings, if necessary. Refer to the Setup Program Operation Manual.

Note: The in-phase monitor is not available on programmed transition switches.

The in-phase monitor operates when both sources are available, such as when transferring from the standby back to the preferred source. The in-phase monitor assures that transfer occurs when the two sources are in phase. The phase angle measuring accuracy is $\pm 5^{\circ}$.

The in-phase monitor does not operate when one source is lost.

The OFF position LED on the user interface panel flashes at 2 Hz when the in-phase monitor is operating.

Synchronization Output. The synchronization output provides a contact closure that can be used to signal some generator set controllers to synchronize the two sources by adjusting the engine speed of a generator set equipped with a variable-speed governor. See the generator set operation manual. The system activates the output after the synch output time delay. See Figure 6-26.

Parameter	Factory setting
Enable/disable	Disable
Phase angle, degrees	0
Synch output time delay, seconds	30

Figure 6-26 In-Phase Monitor Factory Settings

6.7 Programmable Inputs and Outputs

Programmable inputs and outputs are available through the controller main logic board terminal strip and through optional input/output (I/O) modules. Programmable monitoring, control, and fault detection outputs are available through the terminal strip on the controller or through the programmable input/output (I/O) modules.

The main logic board inputs and outputs are factory-assigned to the functions listed in Section 3.2.4. The I/O modules are shipped with the input and output assignments undefined. The Setup Program is required to change the main logic board terminal strip input and output assignments and also to set up and assign inputs and outputs to the optional I/O modules. The table in Figure 6-27 lists the available inputs. Figure 6-28 lists the available programmable outputs.

See TP-6135, Setup Program Operation and Installation Manual, for more information about programmable inputs and outputs.

Programmable Inputs
Low Battery Voltage
Peak Shave Mode
Inhibit Transfer
Remote End Time Delay
Remote Test
Forced Transfer to OFF (programmed-transition models only; requires load shed accessory)
Remote Common Alarm
3 Source System Disable
Bypass Contactor Disable (factory-set; do not change)

Figure 6-27 Programmable Inputs

Programmable Output	Type
Preferred Source Available	Monitor
Standby Source Available	Monitor
Contactor in Preferred Position	Monitor
Contactor in Standby Position	Monitor
Contactor in OFF position	Monitor
Contactor in Source N Position	Monitor
Contactor in Source E Position	Monitor
Not in Auto	Monitor
Load Control Active	Monitor
Low Battery on Standby Source	Monitor
Exerciser Started	Monitor
Test Mode Active	Monitor
Peak Shave Active	Monitor
Non-Emergency Transfer	Monitor
Load Bank Activate	Control
Start Source N Generator	Control
Start Source E Generator	Control
In Phase Monitor Waiting for Synch	Control
Common Alarm	Fault
Source N Undervoltage	Fault
Source N Overvoltage	Fault
Source N Loss of Phase	Fault
Source N Phase Rotation Error	Fault
Source N Overfrequency	Fault
Source N Underfrequency	Fault
Source E Undervoltage	Fault
Source E Overvoltage	Fault
Source E Loss of Phase	Fault
Source E Phase Rotation Error	Fault
Source E Overfrequency	Fault
Source E Underfrequency	Fault
Failure to Acquire Standby	Fault
Failure to Transfer	Fault
Auxiliary Switch Fault	Fault
Auxiliary Switch Open	Fault
I/O Module Comms Lost	Fault
I/O Module Not Found	Fault
I/O Module Not Installed	Fault
Load Control Output 0-8	Control
Modbus® Controlled RDO #1	Control
Modbus®-Controlled RDO #2	Control
Modbus®-Controlled RDO #3	Control
Modbus®-Controlled RDO #4	Control
3 Source System Disable	Control

Figure 6-28 Available Programmable Outputs

6.7.1 Programmable Input/Output (I/O) Modules

Programmable Input/Output (I/O) modules provide two inputs and six outputs, numbered 1–6, for controller communications. Up to four modules can be connected to the controller.

The I/O modules are covered by a protective cover. See Figure 6-29. Figure 6-30 and Figure 6-31 show typical I/O module locations.

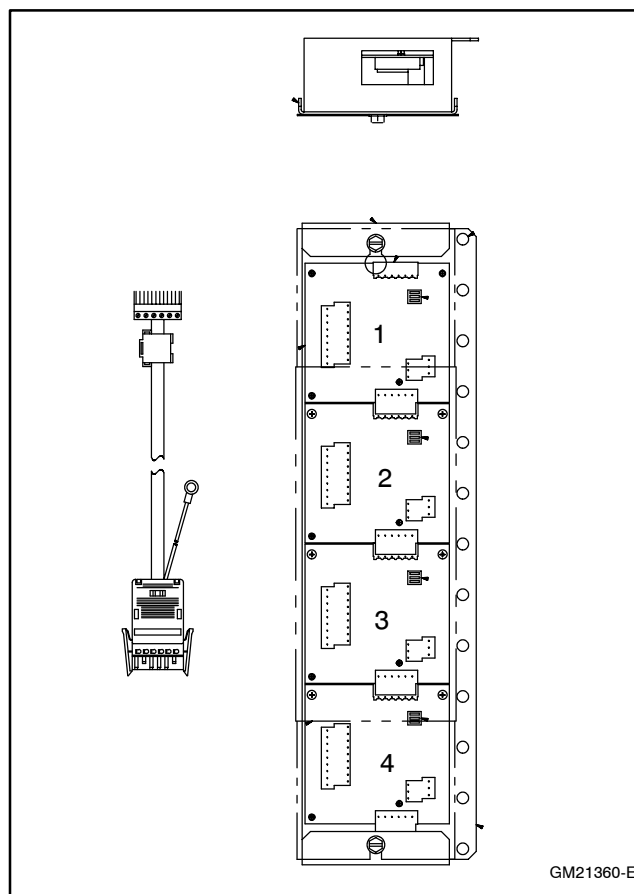


Figure 6-29 Input/Output Modules and Harness
(cover is shown transparent to show detail)

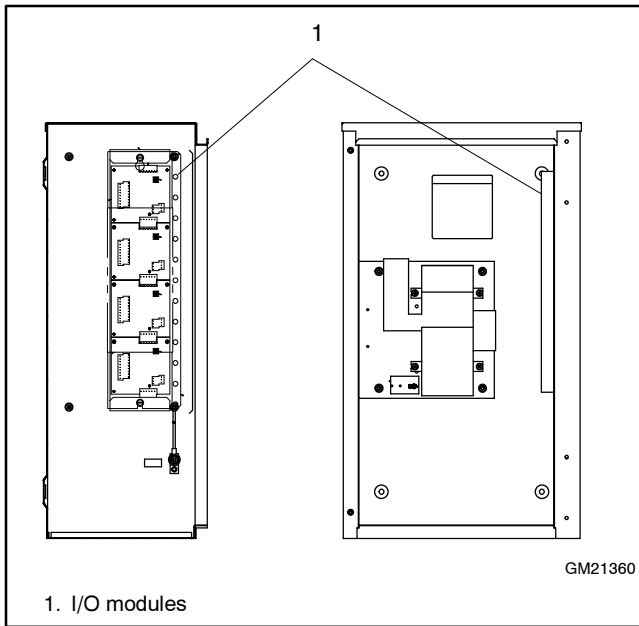


Figure 6-30 Typical I/O Module Locations (welded enclosures)

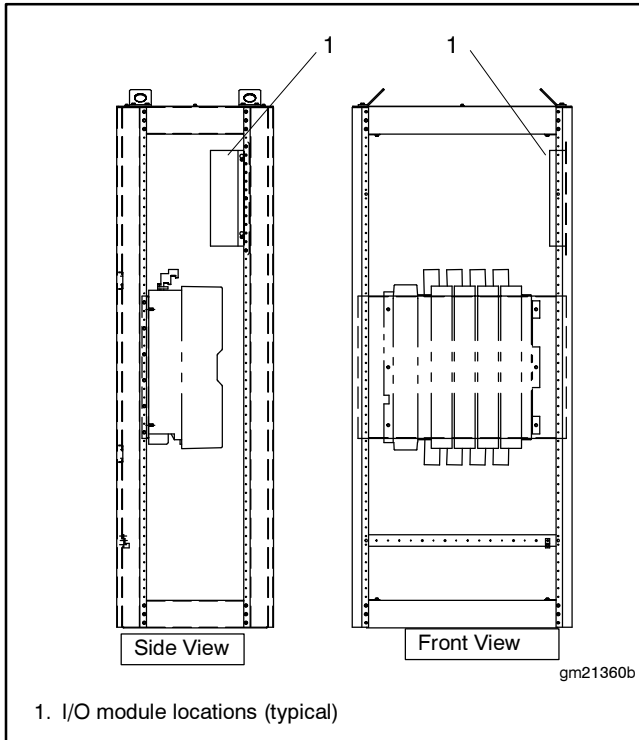


Figure 6-31 Typical I/O Module Locations (framework enclosures)

6.7.2 I/O Module Connection

Optional input/output (I/O) modules are connected to the controller by a factory-installed harness. Figure 6-32 shows the controller connection.

The input and output ratings are shown in Figure 6-33. Figure 6-34 shows an I/O module with its input and output terminal blocks and address DIP switches.

Each I/O Module requires a unique address. Factory-installed I/O module addresses are set at the factory.

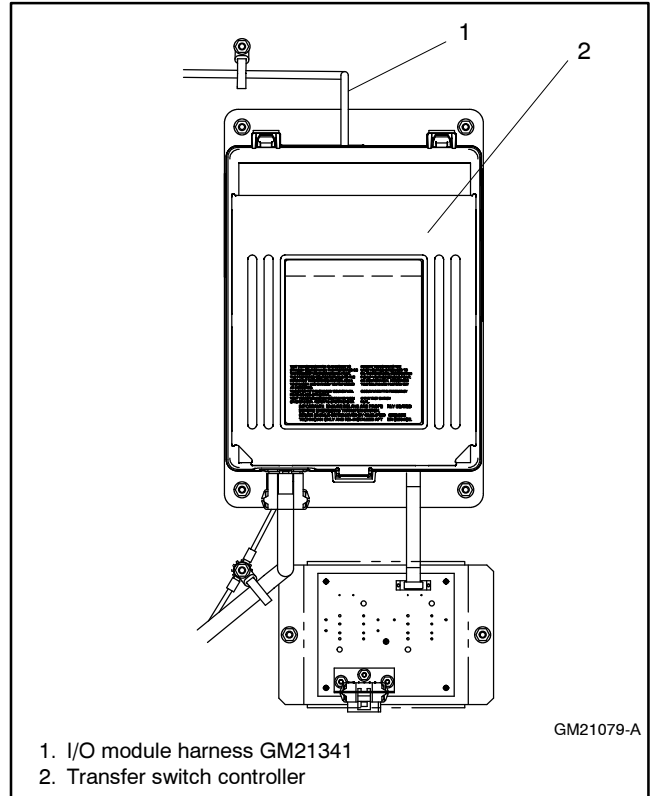


Figure 6-32 I/O Circuit Board Module Harness Connection to Transfer Switch Controller

I/O Module Item	Rating
Input	16 mA @12 VDC
Output	2 A @ 250 VAC

Figure 6-33 I/O Module Ratings

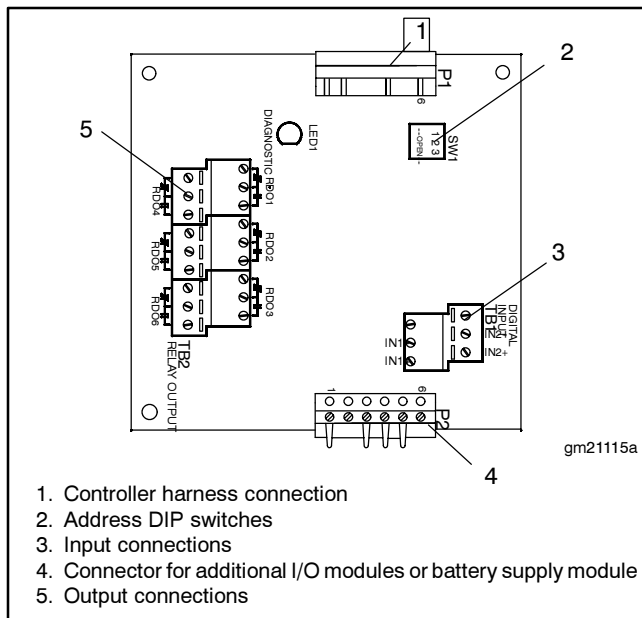


Figure 6-34 I/O Module Input and Output Connections

I/O Module Connection Procedure

1. Disconnect power to the transfer switch before connecting to the I/O modules.
2. Remove the I/O module cover and connect devices to the I/O module input terminals on terminal block TB1 or output terminals on terminal block TB2. See Figure 6-34 for the terminal block locations. The output connections on the I/O module are labelled RDO (relay driver output) 1 through 6. Use wire sizes within the specifications in Figure 6-35 for the input and output connections.
3. Tighten the connections to 0.5 Nm (4.4 in. lb.).
4. Record the connections on the label on the cover and replace the cover.
5. Use the Setup Program to set up the I/O board communications and to define the I/O board inputs and outputs. Refer to the Setup Program Operation Manual for instructions.

Component	Number of Wires	Wire Size Range	Tightening Torque
Controller terminal strip I/O terminals	1	#12-24 AWG	0.5 Nm (4.4 in. lb.)
I/O board terminals	1	#14-26 AWG	

Figure 6-35 Input and Output Connection Specifications

6.7.3 I/O Module Address

Each I/O Module requires a unique address. Factory-installed I/O module addresses are set at the factory.

To check the I/O module addresses, compare the DIP switch settings with Figure 6-36, starting with the module connected to the controller harness. Figure 6-34 shows the address DIP switch location on the I/O module. Push down the end of the DIP switch near the OPEN label to open the switch, or push down the other end to close it. See Figure 6-37.

I/O Module Number	Address DIP Switches		
	1	2	3
1	Closed	Closed	Closed
2	Closed	Closed	Open
3	Closed	Open	Closed
4	Closed	Open	Open

Figure 6-36 I/O Module Address DIP Switches

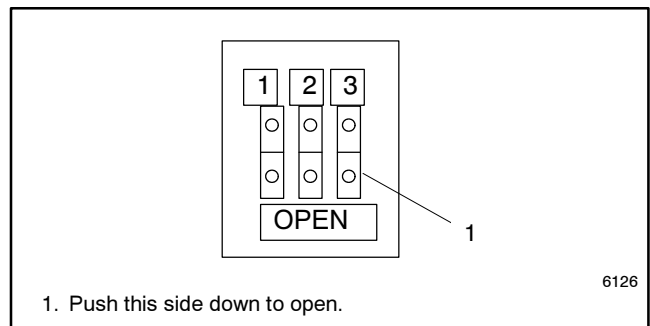


Figure 6-37 I/O Module Address DIP Switches

6.7.4 I/O Module Faults and Diagnostics

When power is applied to the system, the controller attempts to initiate communication with each connected I/O board. The following faults may occur on powerup if the I/O modules are not correctly installed, addressed, or configured in the setup software. Check the LED on each I/O module for diagnostic information in the case of a fault.

Diagnostic LED. Each I/O module has a diagnostic LED that lights or flashes to indicate the I/O board status as described in the table in Figure 6-38.

I/O Module Not Found. If the system does not detect an I/O module at an expected address, the Service Required LED flashes and the software logs the message, "I/O Module Not Found." Check that the number of I/O modules installed matches the number expected by the setup program. Check that the I/O modules are connected and the address DIP switches are set correctly. Check the diagnostic LED to verify that

the module is receiving power and communicating with the controller.

I/O Module Not Installed. If the software detects an I/O module that is connected but not expected by the setup program, the Service Required LED flashes and the software logs the message, "I/O Module Not Installed." The system ignores the board if it does not find the setup definition. Check that the number of I/O modules expected in the Setup Program matches the number of modules installed on the transfer switch. Check that the I/O module address DIP switches are set correctly. Check the diagnostic LED.

I/O Module Communications Lost. If communication to an I/O module that was previously installed and working is lost, the Service Required LED flashes and the software logs the message "I/O Module Communications Lost." Check the I/O module connections and diagnostic LED.

I/O board Status	Diagnostic LED
Unpowered	Off
Operating correctly	On, Steady
Power but no communication with control board	Quick Flash (2 Hz)
No defined program at I/O module address	Slow Flash (0.5 Hz)

Figure 6-38 I/O Module Diagnostic LED

6.8 Security Cover

The gasketed, hinged security cover prevents unauthorized access to the transfer switch controls and protects the user interface from harsh environmental conditions. Use a customer-supplied padlock to lock the cover.

The cover is available with or without a window for NEMA 1 enclosures. NEMA 3R enclosures include a windowless cover as standard equipment.

6.9 Setup Program

The MPAC Setup Program allows the use of a personal computer to view and adjust system parameters, voltage and frequency pickup and dropout settings, time delays, input and output functions, and other system parameters. The program is required for field-adjustment of any transfer switch settings or system parameters. The software also includes a time-stamped event log that is useful for system diagnostics and troubleshooting.

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The Setup Program Operation and Installation Manual, provided with the software, gives detailed software installation and operation instructions.

6.9.1 Setup Program Features

The MPAC Setup Program allows viewing and adjustment of the system parameters of a transfer switch equipped with the MPAC-1000™ programmable transfer switch controller. Use the software to:

- View and adjust:
 - Source parameters
 - Time delays
 - Voltage and frequency trip points
 - Exerciser settings
 - Date and time
 - Other settings
- View:
 - System status
 - DIP switch settings
 - Event history
 - Maintenance records
- Start and stop a system test, exercise, or peak shave sequence
- Transfer to the OFF position (programmed-transition models only)
- Assign programmable inputs and outputs
- Toggle Modbus®-controlled relay outputs

6.9.2 System Requirements

The minimum system requirements to run the Setup Program are:

- 133MHz or higher Intel® Pentium®-compatible CPU
- 32 MB RAM
- CD-ROM drive and 75 MB hard drive space available for installation
- 800 x 600 dpi or better color monitor
- Microsoft Windows® 95, Windows® 98, Windows NT® 4.0, Windows® 2000*, or Windows XP® operating system with Internet Explorer version 4.0 or higher
- Serial port configured as COM 1-16
- Null-modem cable (included with the software kit)

Refer to the Setup Program Operation Manual for more information.

6.10 Surveyor Program

The MPAC Surveyor Program allows the use of a personal computer to monitor the transfer switch status and view and adjust selected transfer switch settings. The Surveyor program requires connection through the ATS controller's Modbus® RS-485 terminals. The ATS controller can be connected directly to the PC through a local connection or using modems for remote communication.

The Surveyor Program allows remote monitoring of up to 247 automatic transfer switches equipped with the programmable ATS controller. The program also allows remote adjustment of selected settings, including time delays, voltage and frequency trip points, and exerciser settings.

The Surveyor software kits include the software CD-ROM, a dongle (or hardware key), an RS-232 to RS-485 converter, and a Surveyor Program Software Manual. The Software Manual gives detailed connection, installation and operation instructions.

The hardware key, or dongle, included with the Surveyor Software kit must be installed on the PC in order to run the program. Only the hardware keys included with the software kits will allow operation of the Surveyor software. Keys obtained from any other source will not work. Two versions of the hardware key are available: a USB-port version and a parallel-port version. The parallel-port version allows the connection of another device (a printer, for example) to the PC's parallel port, if necessary. Choose the software kit with the appropriate type of key for your PC.

Remote connections require a PC modem and a device modem. The PC to External Modem kits include a PC modem, 25-pin to 9-pin converter, and cable to connect the modem to your personal computer. The PC to external modem kit is not required if the PC has an internal modem.

The Device Modem kits include a device modem, null converter, and 25-pin to 9-pin converter for connection to the transfer switch or transfer switch network. Use one device modem kit for all remote connections, 50 or 60 Hz to suit the application. Use the RS-232 to RS-485 converter, included in the Surveyor software kit, with the device modem. Refer to the detailed connection diagrams in the instructions provided with the modem kit.

Note: The device modem is configured differently than the PC modem. A device modem must be connected to the ATS or ATS network for remote communications.

6.10.1 Surveyor Program Features

The ATS Surveyor Program allows viewing and adjustment of selected settings for transfer switches equipped with the MPAC-1000™ programmable transfer switch controller. Use the software to:

- View and adjust:
 - Time delays
 - Voltage and frequency trip points
 - Exerciser settings
 - Date and time
 - Common alarms
 - Load control time delays
- View:
 - Source parameters
 - System status
 - Active time delays
 - DIP switch settings
 - Event history
 - Maintenance records
- Start and stop a system test, exercise, or peak shave sequence
- Transfer to the OFF position (programmed-transition models only)
- Assign programmable inputs and outputs
- Toggle Modbus®-controlled relay outputs

The Surveyor Program allows the user to view but not adjust some parameters, including the following:

- Source parameters (system voltage, frequency, number of phases or phase rotation)
- System start date
- Contactor and controller serial numbers
- Historical records
- Supervised transfer mode
- Extended engine start time delay enable/disable

The items listed above can only be changed using the Setup Program running on a PC connected to the ATS controller's RS-232 port.

The Surveyor Program cannot be used to view or adjust the transfer switch's communication settings, i.e. the network address or the network interface baud rate. Use the Setup Program to view and adjust ATS communication settings.

6.10.2 Hardware Requirements

The following hardware items are required for device connection and communication:

- Hardware key (also called a dongle; included with the software kit)
- RS-232 to RS-485 converter (included with software kit)
- Shielded #12-24 AWG twisted pair cable, Belden #9841 or equivalent, for the RS-485 connections (customer-provided)
- PC modem and device modem if remote connections are used (kits that include the modem and the necessary cables, adapters, and converters are available from the factory)
- USB-to-serial converter *only if* your PC has a USB port rather than a serial port (customer-provided; the Belkin USB Serial Adapter is one example)

6.10.3 Other Requirements

The Setup Program is required in order to configure the transfer switch communication settings at the time of installation.

The ATS controller must use version 1.21 or higher of the ATS controller application software in order to communicate with the Surveyor Program. Check the software version number in the System Information data window in the Setup Program; see the software manual for instructions. An authorized distributor/dealer can load the latest version of application software onto the ATS controller.

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere	cont.	continued
ABDC	after bottom dead center	CPVC	chlorinated polyvinyl chloride
AC	alternating current	crit.	critical
A/D	analog to digital	CRT	cathode ray tube
ADC	analog to digital converter	CSA	Canadian Standards Association
adj.	adjust, adjustment	CT	current transformer
ADV	advertising dimensional drawing	Cu	copper
AHWT	anticipatory high water temperature	cu. in.	cubic inch
AISI	American Iron and Steel Institute	cw.	clockwise
ALOP	anticipatory low oil pressure	CWC	city water-cooled
alt.	alternator	cyl.	cylinder
Al	aluminum	D/A	digital to analog
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	DAC	digital to analog converter
AO	anticipatory only	dB	decibel
API	American Petroleum Institute	dBA	decibel (A weighted)
approx.	approximate, approximately	DC	direct current
AR	as required, as requested	DCR	direct current resistance
AS	as supplied, as stated, as suggested	deg., °	degree
ASE	American Society of Engineers	dept.	department
ASME	American Society of Mechanical Engineers	dia.	diameter
assy.	assembly	DI/EO	dual inlet/end outlet
ASTM	American Society for Testing Materials	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)
ATDC	after top dead center	DIP	dual inline package
ATS	automatic transfer switch	DPDT	double-pole, double-throw
auto.	automatic	DPST	double-pole, single-throw
aux.	auxiliary	DS	disconnect switch
A/V	audiovisual	DVR	digital voltage regulator
avg.	average	E, emer.	emergency (power source)
AVR	automatic voltage regulator	EDI	electronic data interchange
AWG	American Wire Gauge	EFR	emergency frequency relay
AWM	appliance wiring material	e.g.	for example (<i>exempli gratia</i>)
bat.	battery	EG	electronic governor
BBDC	before bottom dead center	EGSA	Electrical Generating Systems Association
BC	battery charger, battery charging	EIA	Electronic Industries Association
BCA	battery charging alternator	EI/EO	end inlet/end outlet
BCI	Battery Council International	EMI	electromagnetic interference
BDC	before dead center	emiss.	emission
BHP	brake horsepower	eng.	engine
blk.	black (paint color), block (engine)	EPA	Environmental Protection Agency
blk. htr.	block heater	EPS	emergency power system
BMEP	brake mean effective pressure	ER	emergency relay
bps	bits per second	ES	engineering special, engineered special
br.	brass	ESD	electrostatic discharge
BTDC	before top dead center	est.	estimated
Btu	British thermal unit	E-Stop	emergency stop
Btu/min.	British thermal units per minute	etc.	et cetera (and so forth)
C	Celsius, centigrade	exh.	exhaust
cal.	calorie	ext.	external
CARB	California Air Resources Board	F	Fahrenheit, female
CB	circuit breaker	fglass.	fiberglass
cc	cubic centimeter	FHM	flat head machine (screw)
CCA	cold cranking amps	fl. oz.	fluid ounce
ccw.	counterclockwise	flex.	flexible
CEC	Canadian Electrical Code	freq.	frequency
cfh	cubic feet per hour	FS	full scale
cfm	cubic feet per minute	ft.	foot, feet
CG	center of gravity	ft. lbs.	foot pounds (torque)
CID	cubic inch displacement	ft./min.	feet per minute
CL	centerline	g	gram
cm	centimeter	ga.	gauge (meters, wire size)
CMOS	complementary metal oxide substrate (semiconductor)	gal.	gallon
cogen.	cogeneration	gen.	generator
COM	communications (port)	genset	generator set
conn.	connection	GFI	ground fault interrupter

GND, ⊕	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temperature
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H ₂ O	inches of water
in. Hg	inches of mercury
in. lbs.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2 ¹⁰ bytes)
kg	kilogram
kg/cm ²	kilograms per square centimeter
kgm	kilogram-meter
kg/m ³	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft ³	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode

Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L _{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10 ⁶ when used with SI units), male
m ³	cubic meter
m ³ /min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2 ²⁰ bytes)
MCM	one thousand circular mils
MCCB	molded-case circuit breaker
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce

p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., Ø	phase
PHC	Phillips head crimp (screw)
PHH	Phillips hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent-magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	<i>Système international d'unités</i> , International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number

SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec, specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

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