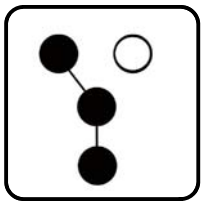
Service

Automatic Transfer Switches



Models:

KEP

Power Switching Device:
Molded Case Circuit Breakers (MCCB) or Switches
Insulated Case Circuit Breakers (ICCB) or Switches

100 to 4000 Amperes

Electrical Controls:

Decision-Maker® MPAC 1500

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

KOHLER® Power Systems

TP-6922 4/16a

Table of Contents

Table of Contents, continued

Notes

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***.

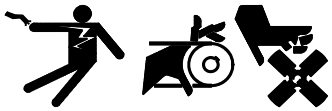
NOTICE

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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Hazardous Voltage/ Moving Parts

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.

WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

WARNING

Hazardous voltage.
Backfeed to the utility system can cause severe injury, death, or property damage.

Before energizing the transfer switch, verify that both the normal and emergency contacts are not left in the closed position.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

This equipment must be installed and serviced by qualified electrical personnel.

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

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

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

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.

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. Turn off 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (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.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

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.

Notice

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.

Notes

This manual provides service information for Kohler® Model KEP Service Entrance rated transfer switches equipped with the Decision-Maker® MPAC 1500 controller. See Figure 1.

This manual includes troubleshooting, repair, and maintenance procedures for the transfer switches and electrical controls.

The information included in this manual is intended solely for use by trained and qualified service personnel of authorized service distributors/dealers.

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.

The equipment service requirements are very important to safe and efficient operation. Inspect parts often and perform required service at the prescribed intervals to keep equipment in top condition.

Figure 1 Model KEP Service Entrance ATS (ICCB type shown)

List of Related Materials

Figure 2 lists the part numbers for related literature. Separate operation and installation manuals contain operation and installation information not provided in this manual. Refer to the parts catalog for instructions to obtain replacement parts.

Document	Document Part Number
Specification Sheet, Model KEP ATS (Service Disconnect to Emergency)	G11-133
Specification Sheet, Model KEP ATS (Service Disconnect to OFF)	G11-141
Specification Sheet, Decision-Maker® MPAC 1500 Controller	G11-128
Operation and Installation Manual, Mode KEP ATS	TP-6946
Operation Manual, Decision-Maker® MPAC 1500 Controller	TP-6883
Operation Manual, Modbus Protocol	TP-6113
Operation Manual, SiteTech Software	TP-6701
Parts Catalog, Transfer Switch	TP-6433
Wiring Diagram Manual, Models KEP ATS	TP-6919

Figure 2 Related Materials

Service Assistance

For professional advice on generator set 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 KOHLERPower.com.
- Look at the labels and decals 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 Netherlands B.V.
Kristallaan 1
4761 ZC Zevenbergen
The Netherlands
Phone: (31) 168 331630
Fax: (31) 168 331631

Asia Pacific
Power Systems Asia Pacific Regional Office
Singapore, Republic of Singapore
Phone: (65) 6264-6422
Fax: (65) 6264-6455

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

1.1 Service Disconnect Position

Model KEP Service Entrance rated transfer switches are configured with the service disconnect position set to either Emergency or OFF. The service disconnect position is factory set on the Decision-Maker® MPAC 1500 controller. Units that are factory-configured to use the OFF position are identified on the service disconnect switch decal, shown in Figure 1-1. Units that do not have the Service Disconnect to OFF label shown in Figure 1-1 use the Emergency position.

The two styles require different procedures to disconnect power during maintenance or service.

1.1.1 Service Disconnect to Emergency

When the service disconnect switch is moved to the SERVICE DISCONNECT position, the transfer switch signals the generator set to start and transfers to the Emergency source. **See Section 1.2 for service disconnect procedures for transfer switches with the service disconnect to Emergency position.**

Controllers with MPAC firmware versions earlier than 1.10 use the Service Disconnect to Emergency position. The service disconnect position is not displayed on controllers with firmware versions earlier than 1.10.

1.1.2 Service Disconnect to OFF

When the service disconnect switch is moved to the SERVICE DISCONNECT position, the utility breaker opens. Utility power is disconnected and the ATS is in the OFF position. **See Section 1.3 for service disconnect procedures for transfer switches with the service disconnect to OFF position.**

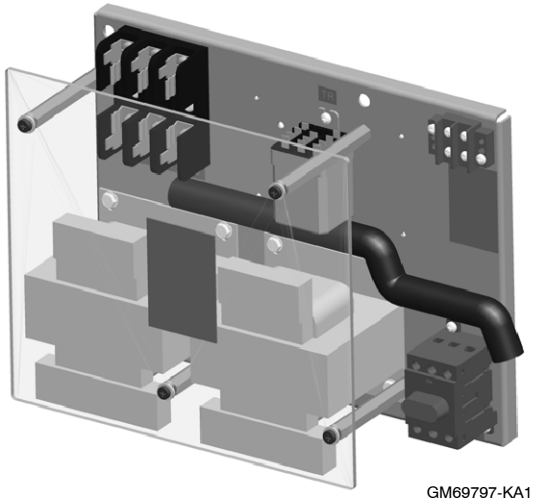
Controllers with MPAC firmware version 1.10 or higher are factory set with the Service Disconnect to OFF position. The position can be seen in the View System Setup screen on the controller. See the controller operation manual for instructions to view the system setup, if necessary.

NOTICE:
SERVICE DISCONNECT TRANSFERS TO OFF, REMOVING POWER FROM THE LOAD. POWER WILL NOT BE RESTORED UNTIL THE SWITCH IS RETURNED TO AUTO.

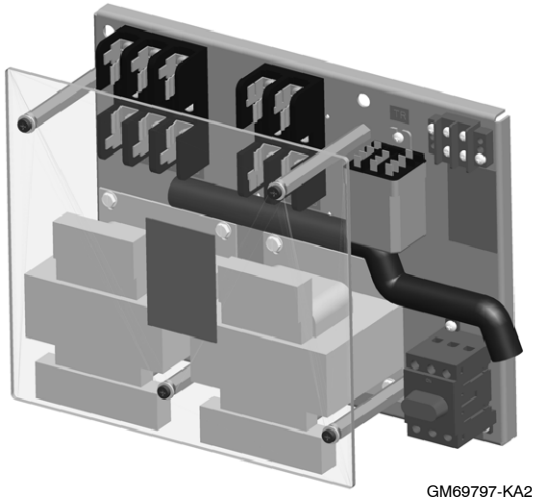
GM99262

Figure 1-1 Service Disconnect to OFF Label

Original Transformer Assemblies (Service Disconnect to EMERGENCY only)

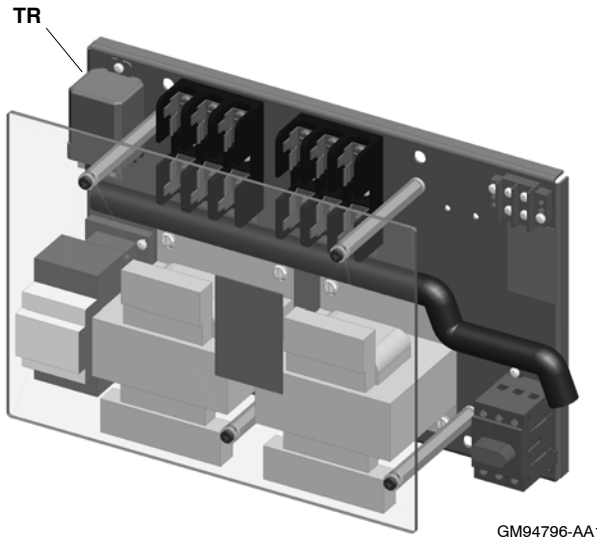


GM69797-KA1
(MCCB)

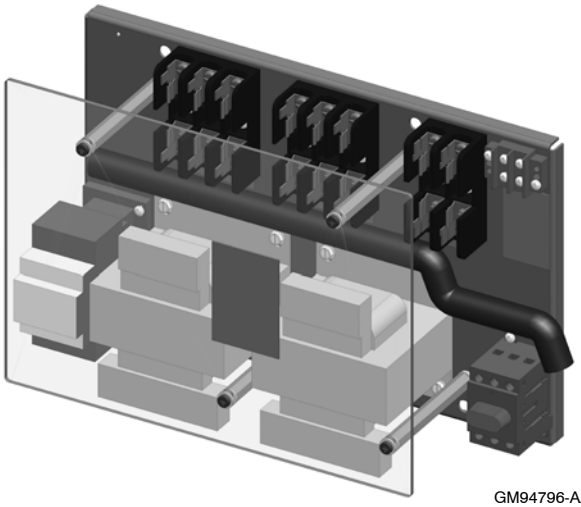


GM69797-KA2
(ICCB)

Revised Transformer Assemblies (Service Disconnect to OFF *)



GM94796-AA1
(MCCB)



GM94796-AA2
(ICCB)

* Transfer switches equipped with transformer assembly GM94796-AA1 or GM94796-AA2 can be reconfigured to use the Service Disconnect to Emergency position, if necessary. See Section 8 for instructions.

Figure 1-2 Transformer Assemblies

1.1.3 Transformer Assemblies

Service disconnect to OFF units are equipped with revised transformer assemblies and controller firmware version 1.10. See Figure 1-2 for illustrations of original and revised transformer assemblies.

Orignal Transformer Assemblies

Transfer switches equipped with an original transformer assembly GM69797-KA1 or GM69797-KA2 **must** use the **Service Disconnect to Emergency** position only. The transformer kit number is not printed on the nameplate.

If the controller is replaced or the controller firmware is upgraded on a unit that has the original transformer assembly, it will be necessary to change the service disconnect position on the controller back to Emergency as described in Section 8.

Revised Transformer Assemblies

Transfer switches equipped with revised transformer kit number GM94796-AA1 (for MCCB models) or GM94796-AA2 (for ICCB models) are factory set to use the **Service Disconnect to OFF** position. Kit number GM94796-AA1 or GM94796-AA2 will appear in the accessories section of the transfer switch nameplate and the transfer switch door will have the service disconnect label shown in Figure 1-1.

The nameplate is located on the controller cover on the inside of the enclosure door. See Figure 5-5 in Section 5.5 of this manual for an illustration of the ATS nameplate, if necessary.

Transfer switches equipped with revised transformer assemblies can be converted to use the Service Disconnect to Emergency position, if necessary. See Section 8.

1.2 Service Disconnect to Emergency Operation

Note: This section describes service disconnect and reconnect procedures for transfer switches that use the Service Disconnect to Emergency position. Go to Section 1.3 for transfer switches that use the Service Disconnect to OFF position.

The two-position service disconnect switch disconnects the normal source from the load, transfers to emergency, and inhibits further transfer.

The service disconnect switch and utility disconnected lamp are located on the enclosure door. See Figure 1-3 for the typical service disconnect switch location.

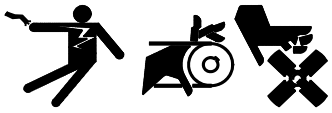
When the switch is in the SERVICE DISCONNECT position, the controller display shows SERVICE DISCONNECT and the utility disconnected lamp on the enclosure door illuminates.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ WARNING



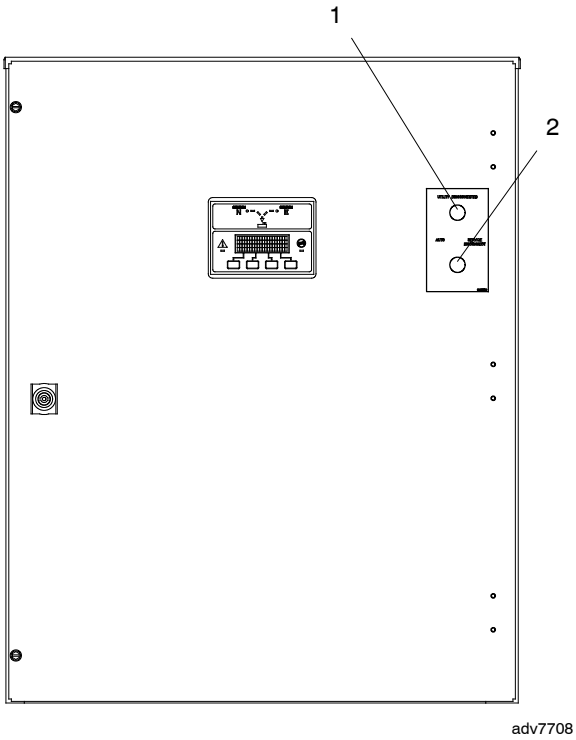
Accidental starting.
Can cause severe injury or death.

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.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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.

Important notes about service disconnect to Emergency operation:

- **On service entrance transfer switches, the line side lugs are active at all times.**
- Service disconnect transfers to the emergency source, disconnecting the load from the utility source ONLY.
- **The engine start signal is activated.** The operator must open the generator set circuit breaker and/or disable the generator set to remove power from the load.
- Further transfer is inhibited after transfer to emergency.
- Moving the switch to the SERVICE DISCONNECT position during a test or exercise sequence ends the test or exercise sequence.
- **Controller power is not disconnected.** The service disconnect procedure does not remove power from the controller. To remove the controller for maintenance or service, perform the service disconnect procedure and then see Section 1.4 for instructions to use the control circuit isolation switch to remove power from the controller.



1. Utility disconnected lamp
2. Service disconnect switch

Figure 1-3 Service Disconnect Switch Location (typical)

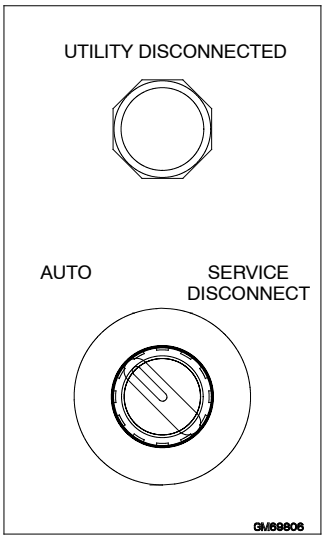


Figure 1-4 Service Disconnect Switch and Light

1.2.1 Service Disconnect Procedure, Service Disconnect to Emergency

The service disconnect switch has two positions: AUTO and SERVICE DISCONNECT. Follow the procedures in this section carefully and observe the safety precautions when performing a service disconnect before maintenance or service. Watch the LED indicators on the ATS controller to check the ATS position and source status during the procedures.

1. Move the service disconnect control switch located on the door of the transfer switch to the SERVICE DISCONNECT position.

2. The engine start contacts close, signaling the generator set to start.

3. When the emergency source is available, the ATS transfers to the emergency source.

   Note: The generator set is now providing power to the load.

4. Check that the utility breaker is open and the Utility Disconnected light is illuminated.

5. Disconnect emergency power from the load by opening the generator set circuit breaker and disabling the generator set as follows:

   a. Turn the generator set off by moving the generator set master switch to the OFF/RESET position or pressing the OFF button on the generator set controller.

   b. Disconnect power to the battery charger.

   c. Remove the battery cables, negative (–) lead first.

6. The Utility Disconnected light will turn off at this point.

7. Use a voltmeter to verify that power is disconnected before servicing connected equipment.

8. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized change in operating condition and verify transfer switch door is locked closed. If the door is not locked, turn and remove the door key.

1.2.2 Service Reconnect Procedure, Service Disconnect to Emergency

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Close and lock the transfer switch enclosure door before connecting power sources.

Service reconnect procedure with Normal source available

Do not return the generator set to service until after the ATS transfers the load to the normal source, as described in the procedure below.

1. Close the breaker between the generator and the emergency side of ATS.

2. Remove the padlock from the service disconnect control switch and move the service disconnect switch to the AUTO position.

3. Reset faults on the controller, if necessary.

4. The ATS will transfer to normal source and open the engine start contacts.

5. Verify that the ATS controller display shows normal source available and ATS in normal position. The Utility Disconnected light on the door should be off.

6. Return the generator set to service:

   a. Reconnect the battery cables, negative lead last.

   b. Reconnect power to the battery charger.

   c. Put the generator set back into auto mode by moving the generator set master switch to the AUTO position or pressing the AUTO button on the generator set controller.

Service reconnect procedure when Normal source is NOT available

Manually operate the ATS to the Normal position before returning the generator set to service, as described in the procedure below.

1. Verify that the generator set master switch is in the OFF position.

2. Open the ATS enclosure and manually transfer the ATS to utility. (Open the emergency breaker and close the utility breaker. See Section 2.2 for instructions, if necessary.) Then close and secure the enclosure door.

3. Return the generator set to service:

   a. Reconnect the battery cables, negative lead last.

   b. Reconnect power to the battery charger.

   c. Put the generator set back into auto mode by moving the generator set master switch to the AUTO position or pressing the AUTO button on the generator set controller.

4. When the generator source is available, the ATS transfers to emergency.

5. Remove the padlock from the service disconnect control switch and move the service disconnect switch to the AUTO position.

6. Reset faults on the controller, if necessary.

7. Verify that the ATS controller display shows emergency source available and ATS in emergency position. The Utility Disconnected light on the door should be off.

1.3 Service Disconnect to OFF Operation

Note: This section describes service disconnect and reconnect procedures for transfer switches that use the Service Disconnect to OFF position. Go to Section 1.2 for transfer switches that use the Service Disconnect to Emergency position.

The two-position service disconnect switch disconnects the source from the load, by transferring to the OFF position, and inhibits further transfer.

The service disconnect switch and utility disconnected lamp are located on the enclosure door. See Figure 1-5 for the typical service disconnect switch location. See Figure 1-6 for the service disconnect switch decal.

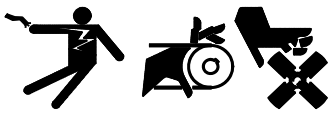
When the switch is in the SERVICE DISCONNECT position, the controller display shows SERVICE DISCONNECTED and the utility disconnected lamp on the enclosure door illuminates if either source is available.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ WARNING



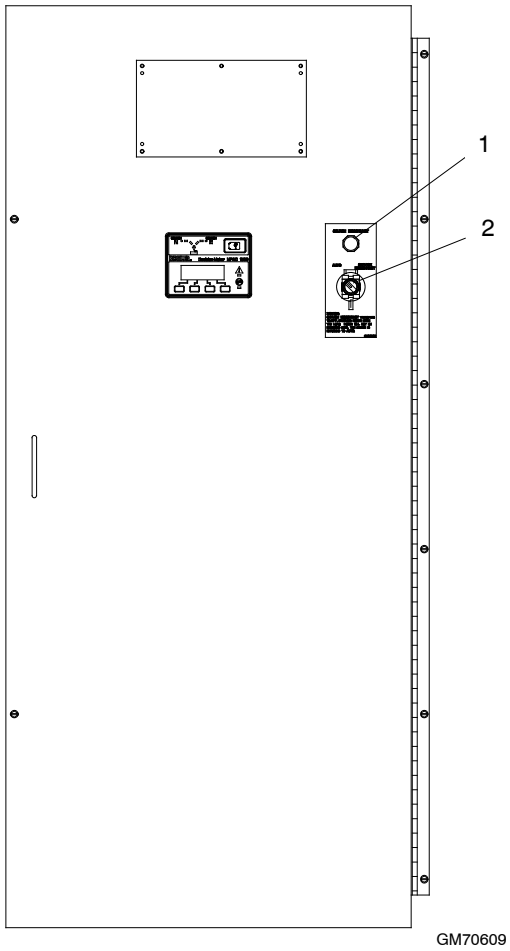
Accidental starting.
Can cause severe injury or death.

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.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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.

Important notes about service disconnect to OFF operation:

- **On service entrance transfer switches, the utility line side lugs are active at all times.** The service disconnect procedure removes power from the load, but utility power is still present at the transfer switch lugs whenever the utility source is available.
- Service disconnect transfers to the OFF position, disconnecting the load from the source when a source is available.
- Service disconnect transfers to OFF immediately, ignoring all time delays.
- The generator engine start signal is *not* activated by the service disconnect to OFF procedure.
- Further transfer is inhibited after transfer to OFF.
- Moving the switch to the SERVICE DISCONNECT position during a test or exercise sequence ends the test or exercise sequence.
- **Controller power is not disconnected.** The service disconnect procedure does not remove power from the controller. To remove power from the controller for maintenance or service, perform the service disconnect procedure and then see Section 1.4 for instructions to use the control circuit isolation switch to remove power from the controller.



1. Utility disconnected lamp
2. Service disconnect switch

Figure 1-5 Service Disconnect Switch Location (typical)

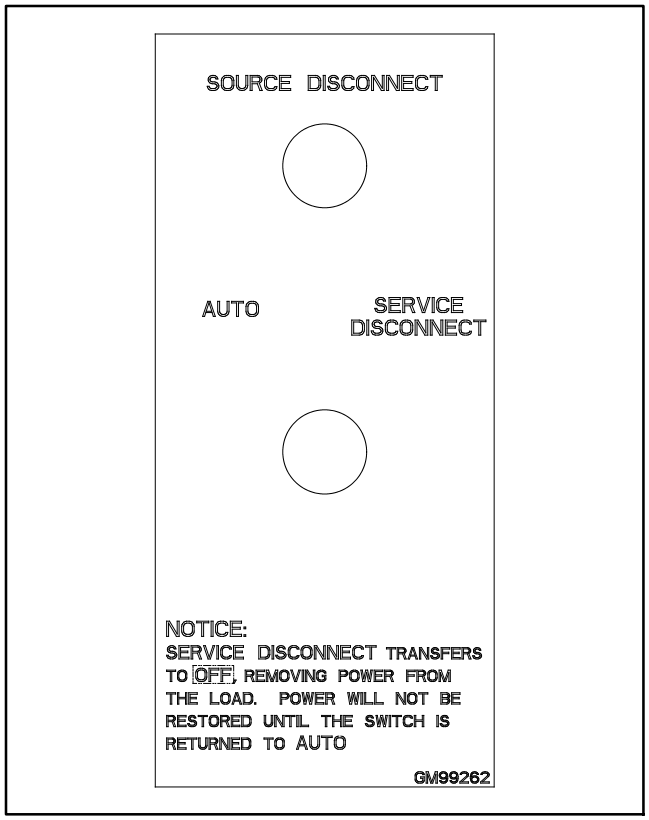


Figure 1-6 Service Disconnect to OFF Decal

1.3.1 Service Disconnect Procedure, Service Disconnect to OFF

The service disconnect switch has two positions: AUTO and SERVICE DISCONNECT. Follow the procedures in this section carefully and observe the safety precautions when performing a service disconnect before maintenance or service. Watch the LED indicators on the ATS controller to check the ATS position and source status during the procedures.

Transfer Switch in NORMAL

Use this procedure if utility power is connected and the transfer switch is in the Normal position.

1. Move the service disconnect control switch located on the door of the transfer switch to the SERVICE DISCONNECT position.

2. Check that the utility (normal) breaker is open and the Utility Disconnected light is illuminated.

3. If the utility breaker is NOT open, manually operate it to the NEUTRAL (MCCB) or TEST (ICCB) position. See Section 2.2 for manual operation instructions.

   Note: The service disconnect procedure removes power from the load, but utility power is still present at the transfer switch normal side lugs whenever the utility source is available.

4. The Utility Disconnected light will stay on as long as utility power is present at the normal source lugs. The controller display shows SERVICE DISCONNECTED and the NOT IN AUTO LED flashes.

5. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized change in operating condition and verify transfer switch door is locked closed. If the door is not locked, turn and remove the door key.

6. Use a voltmeter to verify that power is disconnected from the load before servicing connected equipment.

Transfer Switch in EMERGENCY

Use this procedure if the transfer switch is in the Emergency position.

1. Move the service disconnect control switch located on the door of the transfer switch to the SERVICE DISCONNECT position.

2. The engine start signal is maintained briefly to allow the emergency breaker to open. The engine start signal is then removed.

3. Wait for the generator set to shut down. The generator set may continue to run for several minutes to cool the engine.

4. The Utility Disconnected light turns on if there is utility power to the normal side transfer switch lugs.

5. Check that the emergency breaker is open. If the emergency breaker is NOT open, manually operate it to the NEUTRAL (MCCB) or TEST (ICCB) position. See Section 2.2 for manual operation instructions.

   Note: The service disconnect procedure removes power from the load, but utility power is still present at the transfer switch normal side lugs whenever the utility source is available.

6. If there is no power to the normal (utility) side lugs on the transfer switch, there is no power to the controller or to the Utility Disconnected light.

   - The Utility Disconnected light will not turn on.
   - The controller display goes dark and the controller LEDs turn off.
   - If an External Battery Supply Module (EBSM) (also known as Battery Option Board, BOB) is installed, the generator set battery will continue to supply DC power to the controller. The controller display shows SERVICE DISCONNECTED and the NOT IN AUTO LED flashes.

7. Attach a safety lockout padlock to the service disconnect control switch to prevent unauthorized operation of the switch, and verify that the transfer switch door is closed and locked. If the door is not locked, turn and remove the door key.

8. Use a voltmeter to verify that power is disconnected from the load before servicing connected equipment.

1.3.2 Service Reconnect Procedure, Service Disconnect to OFF

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Close and lock the transfer switch enclosure door before connecting power sources.

Service reconnect procedure with Normal source available

1. Remove the padlock from the service disconnect control switch and move the service disconnect switch to the AUTO position.

2. Reset faults on the controller, if necessary.

3. The ATS will transfer to normal source.

4. Verify that the ATS controller display shows normal source available and ATS in normal position. The Utility Disconnected light on the door should be off.

Service reconnect procedure when Normal source is NOT available

1. Remove the padlock from the service disconnect control switch and move the service disconnect switch to the AUTO position.

   The ATS sends a start signal to the generator.

2. Reset faults on the controller, if necessary.

3. Start the generator. When the generator source is available, the ATS transfers to emergency.

4. Verify that the ATS controller display shows emergency source available and ATS in emergency position. The Utility Disconnected light on the door should be off.

1.4 Control Circuit Isolation Switch

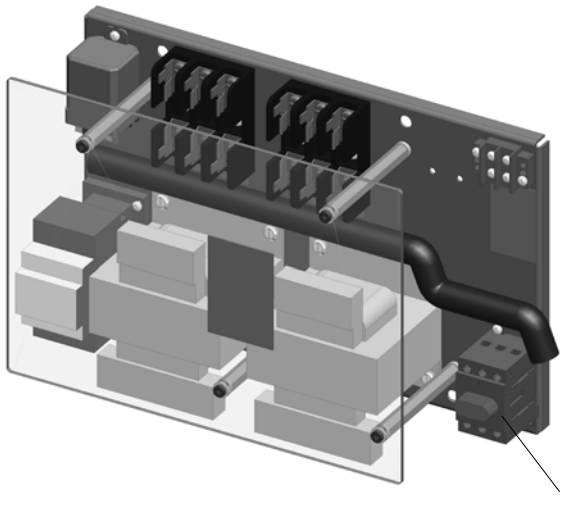
The two-position control circuit isolation switch removes utility power from the ATS controller assembly.

Perform the service disconnect procedure explained in Section 1.2 or 1.3 before operating the control circuit isolation switch. Review the notes and precautions in Section 1.2 or 1.3 before proceeding.

See Figure 1-7 for switch positions. The control circuit isolation switch is mounted on the transformer assembly. See Figure 1-8. The location of the transformer assembly varies with ATS model and enclosure size. See Figure 1-9 and Figure 1-10 for typical locations.

Switch Position	Utility Power to Controller
ON	Connected
OFF	Disconnected

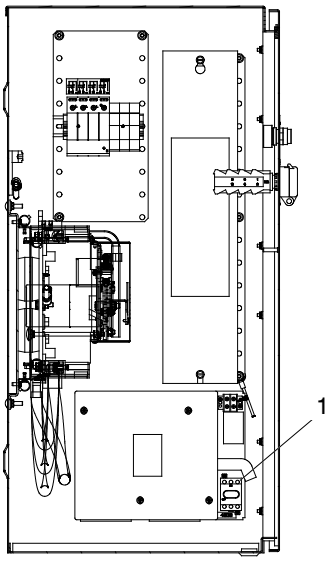
Figure 1-7 Control Circuit Isolation Switch Positions



1. Control circuit isolation switch

GM69797

Figure 1-8 Control Circuit Isolation Switch Location on a Typical Transformer Assembly

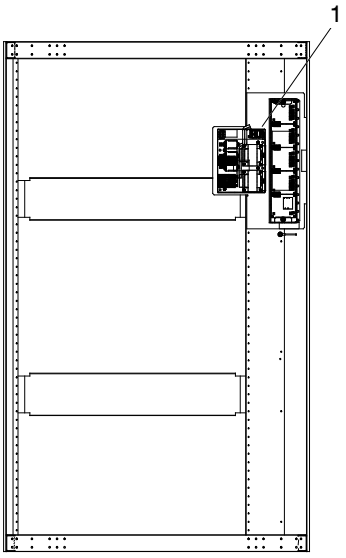


Right Side View

ADV-8612

1. Control circuit isolation switch (on transformer assembly)

Figure 1-9 Control Circuit Isolation Switch Location, MCCB Models (typical)



Right Side View

ADV-8618

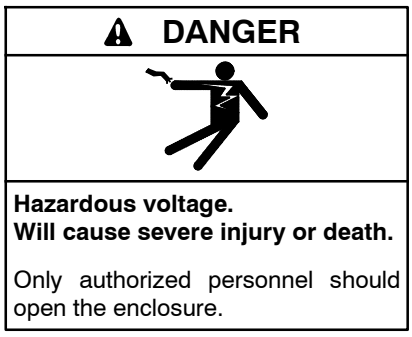
1. Control circuit isolation switch (on transformer assembly)

Figure 1-10 Control Circuit Isolation Switch Location, ICCB Models (typical)

1.4.1 Control Circuit Isolation and Reconnection for Service Disconnect to Emergency Units

Note: This section describes control circuit isolation and reconnection procedures for transfer switches that use the Service Disconnect to Emergency position. Go to Section 1.4.2 for transfer switches that use the Service Disconnect to OFF position.

Control Circuit Isolation Procedure



Note: Review the precautions and notes in Section 1.2 before proceeding. **On service entrance transfer switches, the line side lugs are active at all times.**

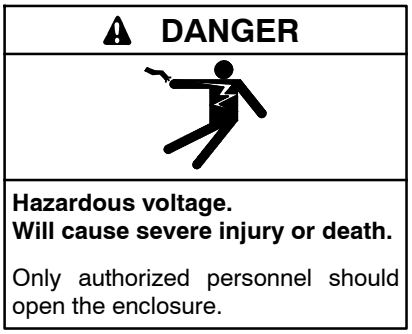
1. Perform the service disconnect procedure in Section 1.2.

   Note: There is still power to the controller assembly after the service disconnect procedure is completed.

2. Open the enclosure door and move the control circuit isolation switch to the OFF position.

3. Use a voltmeter to verify that there is no power to the ATS controller assembly before removing the controller.

Control Circuit Reconnect Procedure (with normal source available)



Note: Review the precautions and notes in Section 1.2 before proceeding. **On service entrance transfer switches, the line side lugs are active at all times.**

Do not return the generator set to service until instructed to do so in the procedure below.

1. Close the breaker between generator and emergency side of ATS (if present).

2. Move the control circuit isolation switch to the ON position.

3. Move the service disconnect switch to the auto position.

4. The ATS will transfer to normal source and open engine start contacts.

5. Verify that the ATS controller display shows normal source available and ATS in normal position. The Utility Disconnected light on the door should be off.

6. Return the generator set to service:

   a. Reconnect the battery cables, negative lead last.

   b. Reconnect power to the battery charger.

   c. Put the generator set back into auto mode by moving the generator set master switch to the AUTO position or pressing the AUTO button on the generator set controller.

Control Circuit Reconnect Procedure (when normal source is NOT available)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Note: Review the precautions and notes in Section 1.2 before proceeding. **On service entrance transfer switches, the line side lugs are active at all times.**

Do not return the generator set to service until instructed to do so in the procedure below.

1. Open the ATS enclosure and manually transfer to utility (IF GENERATOR WAS TURNED OFF).
2. Close the breaker between generator and emergency side of ATS (if present).
3. Move the control circuit isolation switch to the ON position.
4. Move the service disconnect switch to the AUTO position.
5. Return the generator set to service:
   a. Reconnect the battery cables, negative lead last.
   b. Reconnect power to the battery charger.
   c. Move the generator set master switch to the AUTO position.
6. The engine start contacts will close because Normal is not available. Generator set will start.
7. When the generator source is available, the ATS transfers to emergency.
8. Verify that the ATS controller display shows emergency source available and ATS in emergency position. The service disconnect light on the door should be off.

1.4.2 Control Circuit Isolation and Reconnect for Service Disconnect to OFF Units

Note: This section describes control circuit isolation and reconnection procedures for transfer switches that use the Service Disconnect to OFF position. Go to Section 1.4.1 for transfer switches that use the Service Disconnect to Emergency position.

Control Circuit Isolation Procedure

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

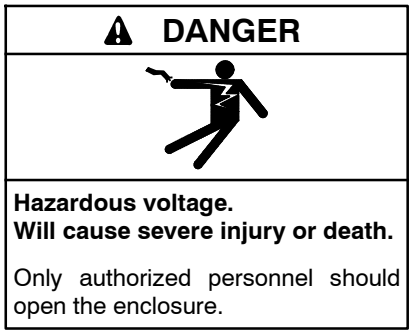
Note: Review the precautions and notes in Section 1.3 before proceeding. **On service entrance transfer switches, the line side lugs are active at all times.**

1. Perform the service disconnect procedure in Section 1.3.1.

   Note: There is still power to the controller assembly after the service disconnect procedure is completed.

2. Open the enclosure door and move the control circuit isolation switch to the OFF position.
3. Use a voltmeter to verify that there is no power to the ATS controller assembly before removing the controller.

Control Circuit Reconnect Procedure (with normal source available)

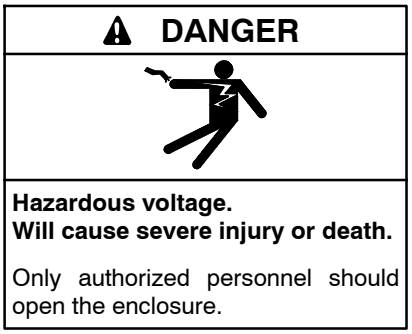


Note: Review the precautions and notes in Section 1.3 before proceeding. **On service entrance transfer switches, the line side lugs are active at all times.**

Do not return the generator set to service until instructed to do so in the procedure below.

1. Move the control circuit isolation switch to the ON position.
2. Move the service disconnect switch to the auto position.
3. The ATS will transfer to normal source.
4. Verify that the ATS controller display shows normal source available and ATS in normal position. The Utility Disconnected light on the door should be off.

Control Circuit Reconnect Procedure (when normal source is NOT available)



Note: Review the precautions and notes in Section 1.3 before proceeding. **On service entrance transfer switches, the line side lugs are active at all times.**

Do not return the generator set to service until instructed to do so in the procedure below.

1. Move the control circuit isolation switch to the ON position.
2. Move the service disconnect switch to the AUTO position.
3. The engine start contacts will close because Normal is not available. Generator set will start.
4. When the generator source is available, the ATS transfers to emergency.
5. Verify that the ATS controller display shows emergency source available and ATS in emergency position. The service disconnect light on the door should be off.

Notes

This section explains the transfer switch operation and controller sequence of operation.

2.1 Transfer Switch Operation

2.1.1 Normal Operation

Under normal conditions, the load is energized from the utility supply through the closed utility transfer power switching device. If the utility power fails, the generator will start and the load will be reenergized via the closed generator transfer power switching device. Refer to Section 3 for the sequence of operation.

In the normal operating mode, the service disconnect switch must be in the AUTO position. See Section 1 for service disconnect instructions.

2.1.2 Overcurrent Trip

If the utility source power switching circuit breaker trips open due to an overcurrent condition, the ATS controller will initiate an engine start signal and initiate transfer of the load to the generator supply. A Source1 breaker trip fault will be displayed on the ATS controller. The utility source will be locked out and the load will remain on the generator supply until the fault is manually reset.

If the emergency source power switching circuit breaker trips open due to an overcurrent condition, the load is transferred to the utility supply. A Source2 breaker trip fault will be displayed on the ATS controller. The generator source will be locked out and the load will remain on the utility supply until the fault is manually reset.

If the emergency source power switching circuit breaker trips open during a loaded test or exercise sequence, the load is transferred to normal and the test or exercise sequence ends.

Note: Contact your local distributor/dealer to identify and correct the cause of the overcurrent condition before resetting the fault.

Press the RESET button on the breaker to reset the breaker on ICCB models. Then check the controller display for fault messages. See the ATS controller operation manual for instructions to reset the fault. See the List of Related Materials in the Introduction section for the manual part number.

MCCB type breakers will automatically reset when the controller fault is reset and the transfer switch controller initiates transfer to the other source.

2.2 Manual Operation

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ WARNING

Hazardous voltage.
Backfeed to the utility system can cause severe injury, death, or property damage.

Before energizing the transfer switch, verify that both the normal and emergency contacts are not left in the closed position.

Note: On service entrance transfer switches, the line side lugs are powered at all times. The service disconnect procedure does **not** disconnect Utility power from the normal source lugs on the transfer switch.

Some service procedures require manual operation of the transfer switch. Perform the service disconnect procedure described in Section 1 before manually operating the transfer switch.

A power switching device in normal and serviceable condition operates smoothly without binding. Do not place the transfer switch into service if the power switching device does not operate smoothly; contact an authorized distributor/dealer for service.

Note: Refer to Figure 2-1 through Figure 2-3 for identification of transfer switch mechanism style supplied with the transfer switch.

2.2.1 Manual Operation Procedure, 100–1200A MCCB Models

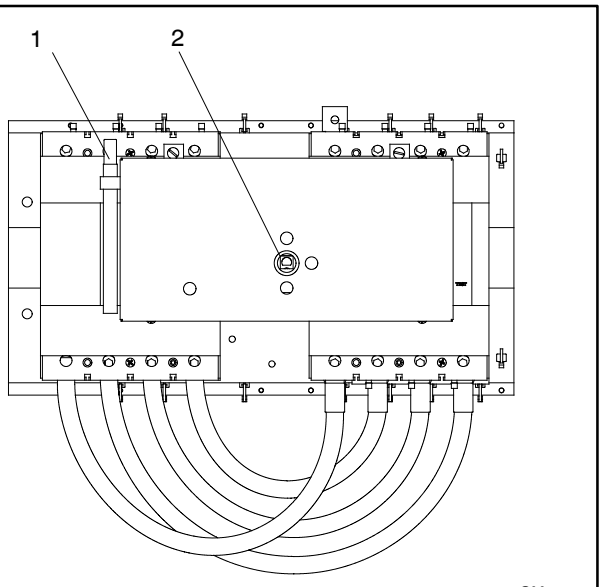
Manually operate the transfer switch mechanism, depending on mechanism type, as described below.

100–800 Amp Units:

See Figure 2-1. Insert the operating handle into the front of the transfer mechanism and turn the operating handle until the position indication on the mechanism clearly shows the desired position: generator, neutral, or utility.

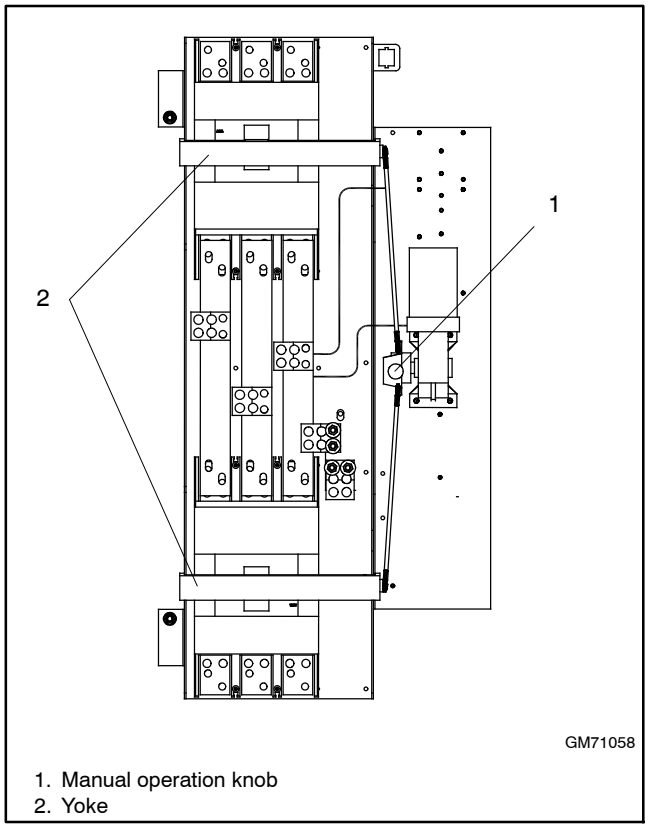
1000 and 1200 Amp Units:

See Figure 2-2. Pull the manual release knob on the mechanism, releasing the motor drive rod from the motor drive arm. Move the knob and yoke to the marked position.



1. Manual operation handle storage location
2. Insert handle here to operate manually

Figure 2-1 100–800 Amp MCCB Manual Operation (250 Amp model shown)



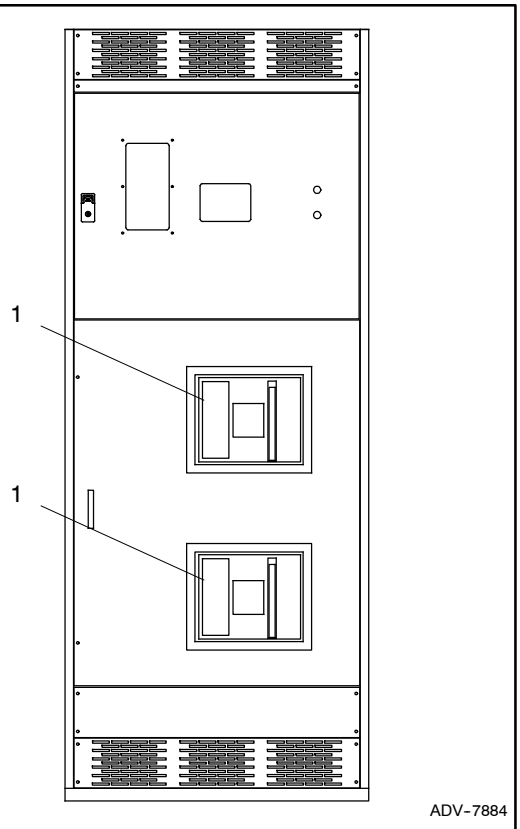
1. Manual operation knob
2. Yoke

Figure 2-2 1000–1200 Amp MCCB Manual Operation

2.2.2 Manual Operation Procedure, 800–4000 A ICCB Models

See Figure 2-3. Manually operate the power switching units as follows: Push the breaker's TEST pushbutton. The breaker should then open. Press the reset button to reset the breaker.

Repeat for the other power switching unit.



1. Trip (Test) and reset pushbuttons

Figure 2-3 ICCB Manual Operation

2.3 Controller Power-up/Reset Sequence

Following is an explanation of the sequence of operation when power is initially applied to the controller or a controller reset occurs.

1. Controller self test is executed.
2. System parameters are downloaded from nonvolatile memory.
3. Contactor position and source availability are determined.
4. If neither source is acceptable, the contactor does not change position.
5. If both sources are available, the controller immediately transfers the contactor to the preferred source.
6. If only one source is available, the controller immediately transfers the contactor to that source, executing only the off-position and load control time delays.

   If the available source is the preferred source, and the contactor is in the standby position, the contactor transfers to preferred, the engine cooldown time delay runs, and then the engine start contacts open.

   If the available source is the preferred source and the contactor is already in the preferred position, the engine start contacts open immediately, bypassing the engine cooldown time delay.

2.4 Sequence of Operation, Service Entrance Models

Service entrance models operate in programmed-transition mode, with a pause in the off position during transfer. The time in the off position is set through the off-to-standby and off-to-preferred time delays. If the OFF time delay is shorter than the time required for the circuit breaker to open, the transfer time will be controlled by the circuit breaker operation time.

The operation sequence can be affected by faults such as a tripped breaker or failure of the generator set engine to start.

2.4.1 Preferred Source Loss and Return, Service Entrance Models

Preferred Source Fails

1. Load control contacts open.
2. Engine start time delay expires.
3. The generator is signaled to start (engine start contacts close).
4. The generator starts and the standby source becomes available.
5. Preferred-to-standby time delay expires.
6. Source 1 circuit breaker opens.
7. Off-to-standby time delay expires.
8. Source 2 circuit breaker closes.
9. Post-transfer load control time delays expire.
10. Load control contacts close.

Preferred Source Returns

1. Pre-transfer load control time delays expire.
2. Load control contacts open.
3. Standby-to-preferred time delay expires.
4. Source 2 circuit breaker opens.
5. Off-to-preferred time delay expires.
6. Source 1 circuit breaker closes.
7. Post-transfer load control sequences and engine cooldown time delay expire.
8. Load control contacts close.
9. The generator is signaled to stop (engine start contacts open).

2.4.2 Exerciser Operation, Service Entrance Models

Unloaded Exercise

The unloaded exercise sequence is the same as for standard transition. See Section 6.6.3.

Loaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The engine start contacts close, signaling the generator set to start.
3. The generator starts and the standby source becomes available.
4. Pre-transfer load control time delays expire.
5. Load control contacts open.
6. Preferred-to-standby time delay expires.
7. Source 1 circuit breaker opens.
8. Off-to-standby time delay expires.
9. Source 2 circuit breaker closes.
10. Post-transfer load control time delays expire.
11. Load control contacts close.

Emergency Source Fails (Normal Source is available)

1. Immediate failure to acquire standby alarm.
2. Exerciser is deactivated.
3. Load control contacts open.
4. Source 2 circuit breaker opens.
5. Off-to-preferred time delay expires.
6. Source 1 circuit breaker closes.
7. Post-transfer load control time delays expire and load control contacts close.
8. Engine cooldown time delay expires and engine start contacts open.

Loaded Exercise Sequence Ends

1. Pre-transfer load control sequences run.
2. Load control contacts open.
3. Source 2 circuit breaker opens.
4. Off-to-preferred time delay expires.
5. Source 1 circuit breaker closes.
6. Post-transfer load control time delays expire and load control contacts close.
7. Engine cooldown time delay expires.
8. The engine start contacts open, signaling the generator to stop.

2.4.3 Test Sequence, Service Entrance Models

Unloaded Test Function is Initiated

1. The generator set is signaled to start.
2. The generator starts and the standby source becomes available.
3. The load bank control is activated.

Unloaded Test Function is Ended

1. The load bank control is deactivated.
2. Engine cooldown time delay expires.
3. The generator is signaled to stop.

Loaded Test Sequence is Initiated (Loaded)

1. The engine start contacts close, signaling the generator set to start.
2. The generator starts and the standby source becomes available.
3. Pre-transfer load control time delays expire and load control contacts open.
4. Preferred-to-standby time delay expires.
5. Source 1 circuit breaker opens.
6. Off-to-standby time delay expires.
7. Source 2 circuit breaker closes.
8. Post-transfer load control time delays expire and load control contacts close.

Emergency Source Fails (Normal Source is available)

1. Test function is deactivated.
2. Immediate failure to acquire standby alarm.
3. Load control contacts open.
4. Source 2 circuit breaker opens.
5. Off-to-preferred time delay expires.
6. Source 1 circuit breaker closes.
7. Post-transfer load control sequences and engine cooldown time delay expire.
8. Load control contacts close.
9. Engine start contacts open.

Loaded Test Sequence is Ended

1. Standby-to-preferred time delay and pre-transfer load control sequences run.
2. Load control contacts open.
3. Source 2 circuit breaker opens.
4. Off-to-preferred time delay expires.
5. Source 1 circuit breaker closes.
6. Post-transfer load control sequences and engine cooldown time delay expire.
7. Load control contacts close.
8. The engine start contacts open, signaling the generator to stop.

2.5 Operation Diagrams

This section contains descriptions and diagrams of the power switching device operation. For complete diagrams, refer to the schematic diagrams provided with the transfer switch.

The ATS controller monitors the connected source and detects source failure, either a complete loss of the source or a source parameter that is outside the acceptable range. The controller starts the engine start time delay. If power is restored before the time delay ends, the controller resets the time delay and continues to monitor the source. If the source failure persists and the time delay ends, the controller closes the engine start contacts to signal the Source E generator set to start.

When Source 2 (or the standby source) becomes available, the controller starts the preferred-to-standby time delay (if not set to zero). When the time delay ends, relay K2 in the controller closes, applying power to the circuit breaker motor operator to open the Source 1 circuit breaker.

Note: Controller relays K1 and K2 and programmed transition interface board (PTIB) relays K1' and K2' are energized for only 250 milliseconds to initiate transfer.

Service entrance models stop in the OFF position for a programmed length of time during transfer. On MCCB models, the K2 relay closes after the Off time delay, applying power to the circuit breaker motor operator and closing the Source 2 circuit breaker. On ICCB models, the transfer-to-OFF sequence is controlled by the K1' and K2' relays on the programmed-transition interface board (PTIB).

The motor operator power circuits vary for MCCB and ICCB models. The following sections illustrate the transfer sequence for the different models.

When Source N (or the preferred source) is restored, the controller starts the standby-to-preferred time delay. When the time delay ends, the controller's K1 (NR) relay closes, applying power to the circuit breaker motor operator and initiating transfer back to Source N (or the preferred source).

The controller K1 and K2 relays and the PTIB relays are replaceable.

Note: Always check all wiring and connections before replacing parts.

Figure 2-4 explains the notation used in the solenoid operation diagrams in Figure 2-5 through Figure 2-8.

Legend:

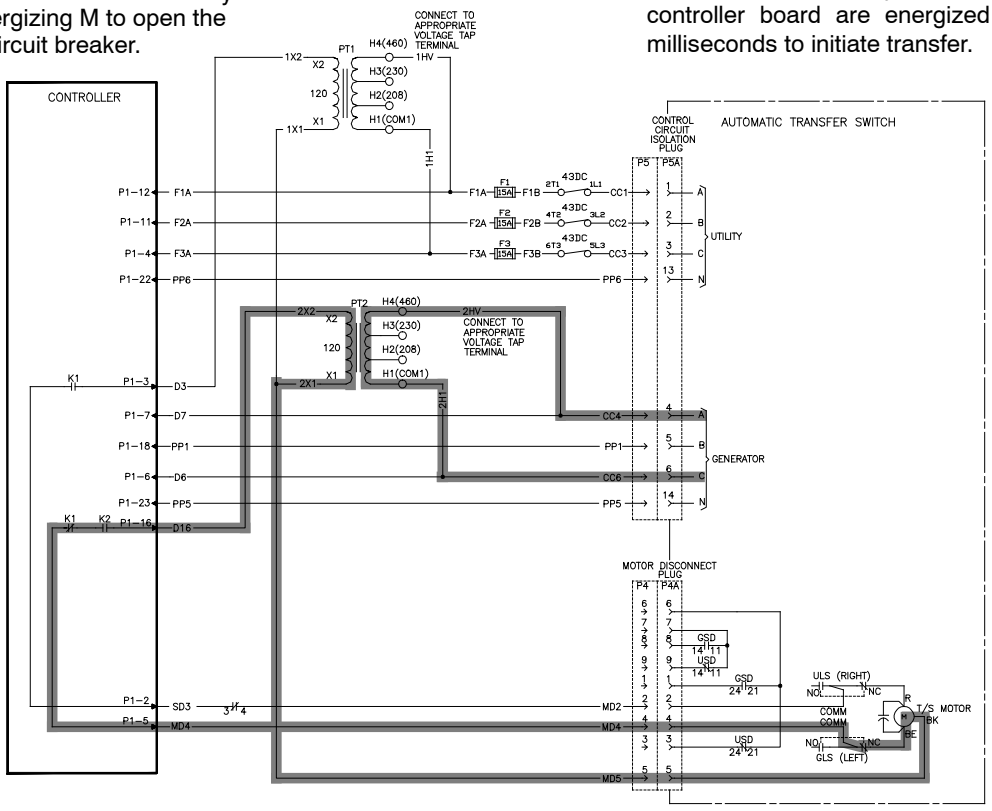
K1, K2	Controller relays. Energized for 250 milliseconds to initiate transfer.
K1', K2'	Programmed-transition interface board (PTIB) relays Energized for 250 milliseconds to initiate transfer.
M	Circuit breaker motor operator, MCCB models
UBC	Utility Breaker Close Motor Operator, ICCB Models
UBO	Utility Breaker Open Motor Operator, ICCB Models
GBC	Generator Breaker Close Motor Operator, ICCB Models
GBO	Generator Breaker Open Motor Operator, ICCB Models

Power through the coil circuit.

Figure 2-4 Legend for Solenoid Operation Diagrams

Transfer, Normal to Off:
Utility source is lost. Controller relay K2 closes, energizing M to open the utility source circuit breaker.

Note: The K1 and K2 relays on the MPAC 1500 controller board are energized for only 250 milliseconds to initiate transfer.



Transfer, Off to Emergency:
After the Off time delay, controller relay K2 closes, energizing M to close the generator circuit breaker.

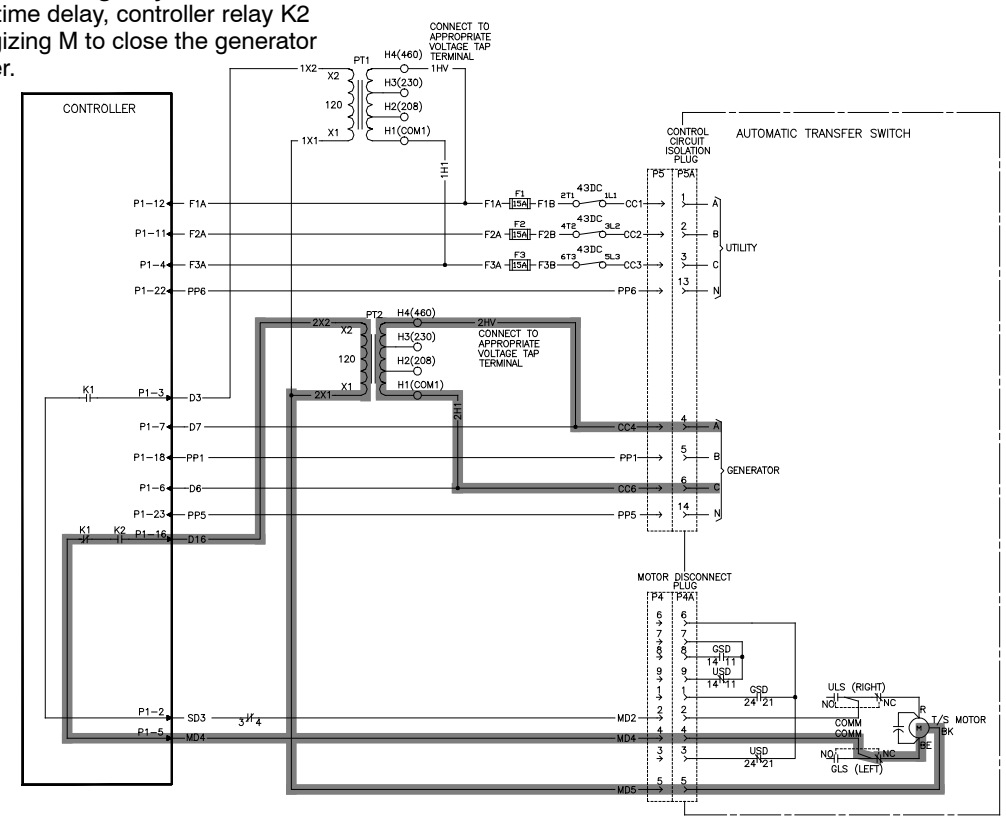


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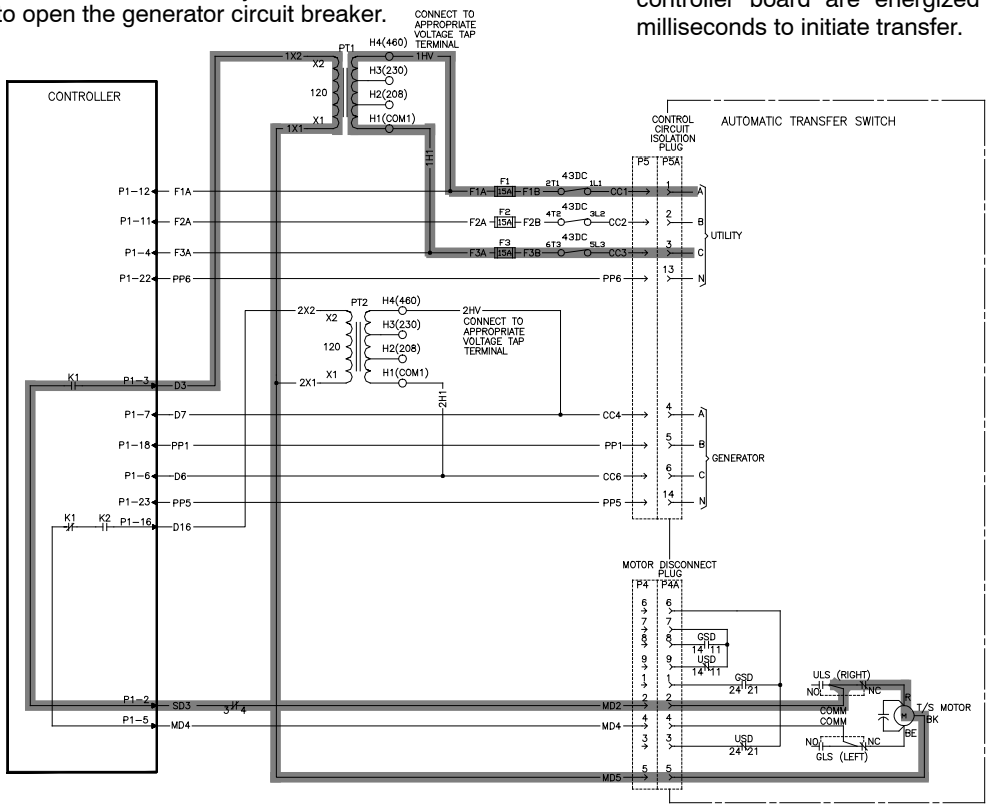
Figure 2-5 MCCB Transfer from Normal to Emergency

Transfer, Emergency to Off:
Utility source returns. Controller relay K1 closes, energizing M to open the generator circuit breaker.

Note: The K1 and K2 relays on the MPAC 1500 controller board are energized for only 250 milliseconds to initiate transfer.



Transfer, Off to Utility:
Controller relay K1 closes, energizing M to close the utility circuit breaker.

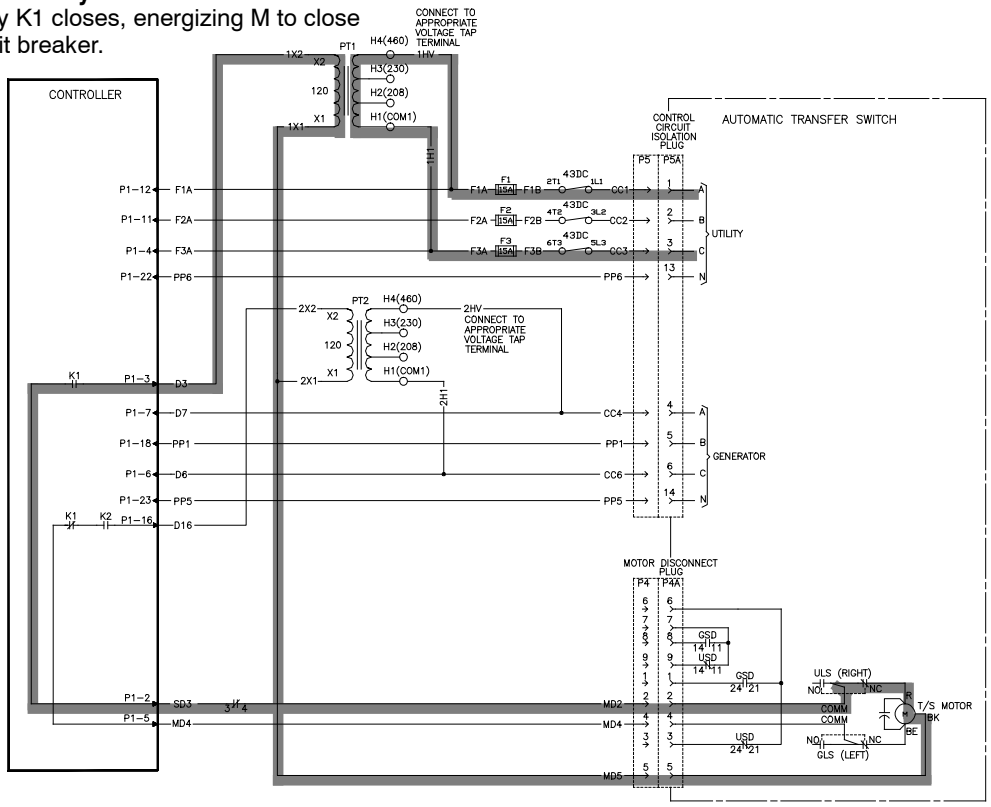


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Figure 2-6 MCCB Transfer from Emergency to Normal

Transfer, Normal to Off:
Utility source is lost. Controller relay K2 closes, energizing the UBO motor operator to open the utility breaker.

Note: Controller relays K1 and K2 and PTIB relays K1' and K2' are energized for only 250 milliseconds to initiate transfer.

Transfer, Off to Emergency:
PTIB relay K2' closes, energizing the GBC motor operator to close the generator breaker.

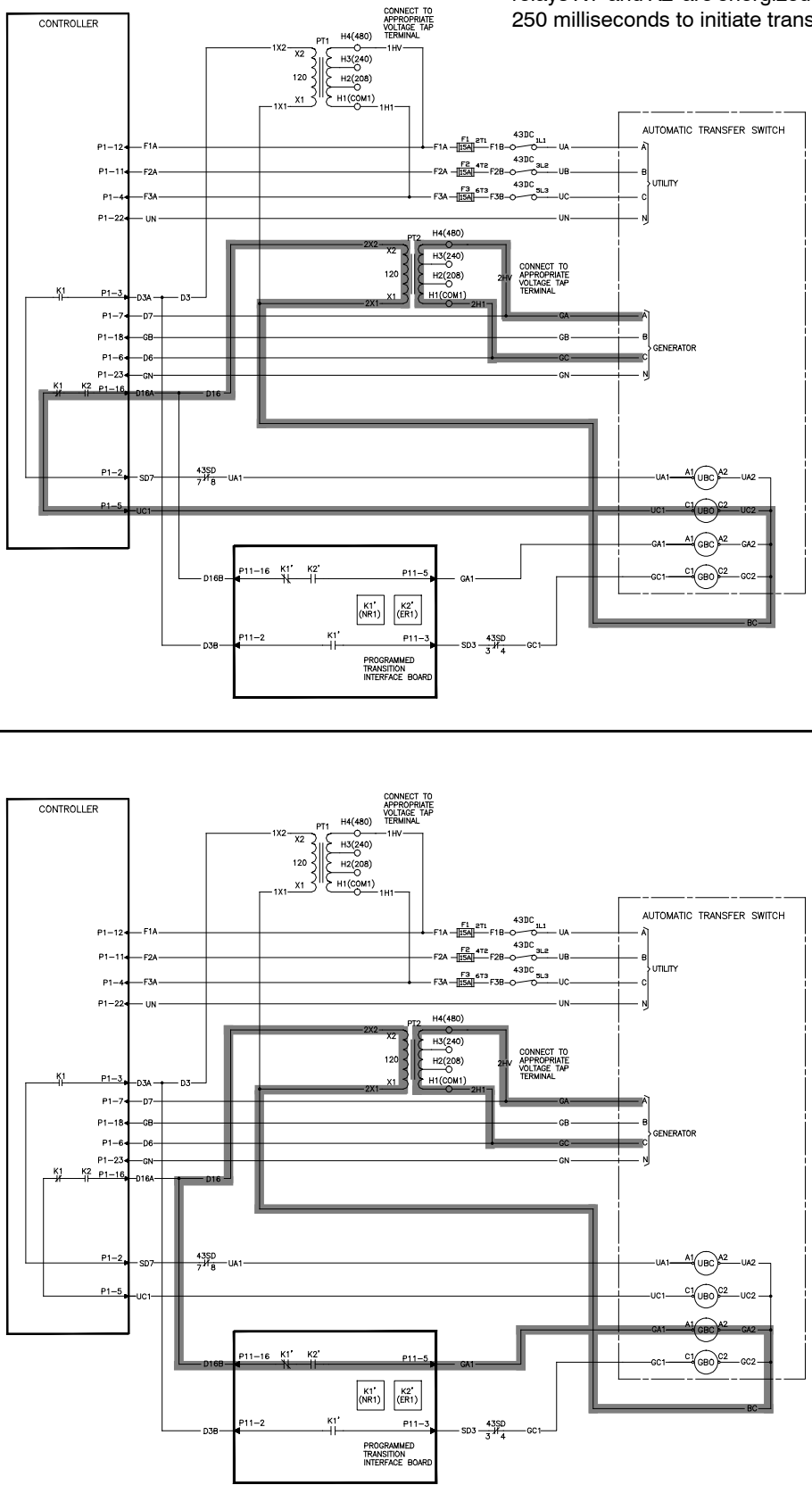
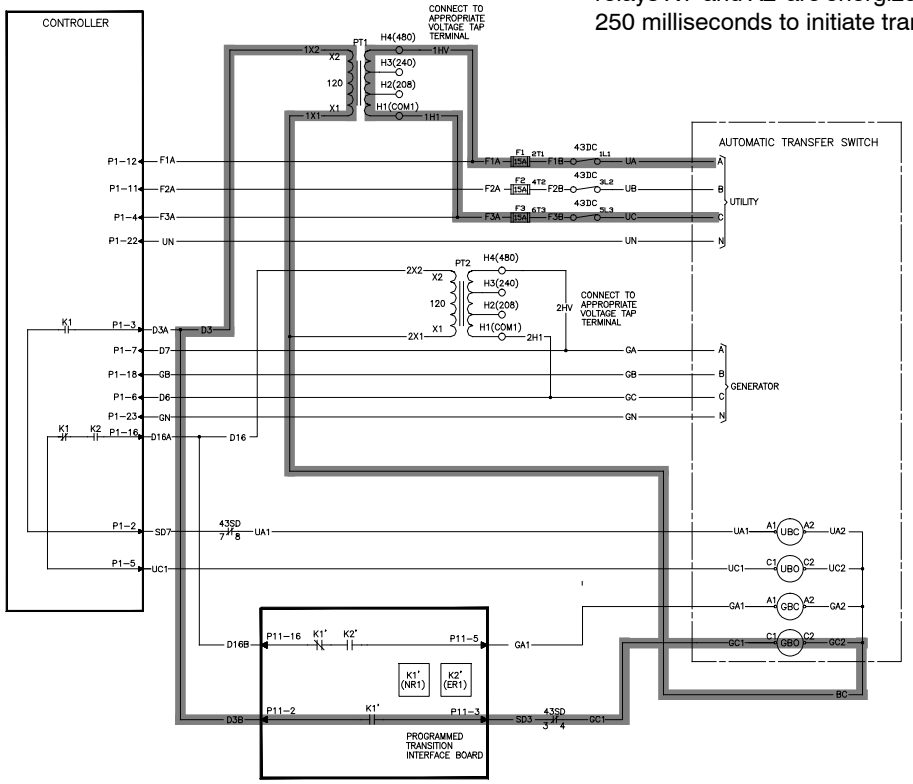


Figure 2-7 ICCB Transfer from Normal to Emergency

Transfer, Emergency to Off:
Utility power returns. PTIB relay K1' closes, energizing the GBO motor operator to open the generator breaker.

Note: Controller relays K1 and K2 and PTIB relays K1' and K2' are energized for only 250 milliseconds to initiate transfer.



Transfer, Off to Normal:
Controller relay K1 closes, energizing the UBC motor operator to close the utility breaker.

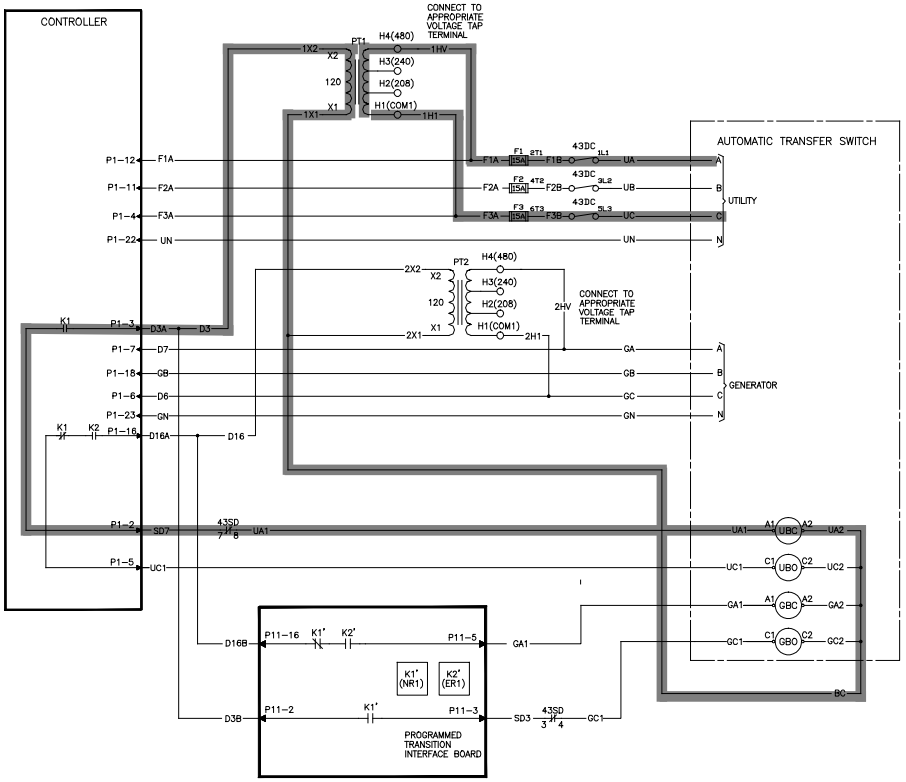


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Figure 2-8 ICCB Transfer from Emergency to Normal

3.1 Introduction

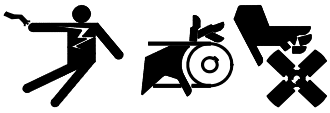
Regular preventive maintenance ensures safe and reliable operation and extends the life of the transfer switch. Preventive maintenance includes periodic testing, cleaning, inspecting, and replacing of worn or missing components. Section 3.5 contains a service schedule of recommended maintenance tasks.

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.

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.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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.

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)

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.

3.2 General Inspection

External Inspection. Inspect the transfer switch weekly.

- Look for any signs of vibration, leakage, excessive noise, high temperature, contamination, or deterioration.
- Remove accumulations of dirt, dust, and other contaminants from the transfer switch's exterior with a vacuum cleaner or by wiping with a dry cloth or brush. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and damage the switch.*
- Replace any worn, missing, or broken external components with manufacturer-recommended replacement parts. Contact a local authorized distributor/dealer for part information and ordering.
- Tighten loose external hardware.

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

3.3 Internal Inspections and Maintenance

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (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.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Note: On service entrance transfer switches, the line side lugs are powered at all times.

3.3.1 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.*

Checking and Tightening Connections. Loose connections on the power circuits can lead to overheating or explosion. Tighten all lugs to the torque values on the label on the switch. See Figure 3-1 for a typical label.

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.

Tighten engine start, input/output, and auxiliary connections to the torque indicated on the decals affixed to the unit.

Part Replacement and Tightening. Replace worn, missing, broken, deteriorated, or corroded internal components with manufacturer-recommended replacement parts. Contact a local authorized distributor/dealer for part information and part ordering. Tighten loose internal 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.

TIGHTENING TORQUE VALUES
FOR
DUAL RATED (AL–CU) SCREW CONNECTORS

AWG. OR CIRCULAR MILL SIZE	TIGHTENING TORQUE IN INCH POUNDS	
	SCREW DRIVER	WRENCH
14 12 10 8	35 35 35 40	75 75 75 75
6 4	45 45	110 110
2 1	50 50	150 150
1/0 2/0	50 50	180 180
3/0 4/0		250 250
250 350		325 325
500 600 700 750		375 375 375 375
800 1000		500 500

297556

Figure 3-1 Typical Torque Label

Signs of Overheating. Replace components damaged by overheating and locate the cause of the overheating. Overheating could be caused by loose power connections, overloading, or a short circuit in the system. After tightening the power terminals, perform a millivolt drop test to locate areas with high contact resistance. See Section 3.4.3. Check the line circuit breakers in the system to be sure that they do not allow the load to exceed the switch rating. Use the controller troubleshooting and schematics to locate a control circuit short.

Wire Repair or Replacement. Replace wiring when there is any doubt about its condition, or when there is extensive damage or deterioration. If the damaged or deteriorated wires are part of a wiring harness, replace the entire wiring harness.

Power Circuit Wiring. Have damage to line voltage and power circuit wiring evaluated and repaired or replaced by a qualified electrician.

Control Circuit Leads. Repair minor damage to leads in low power and control circuits operating up to 250 volts. Carefully splice and insulate the connections. Tape minor control circuit wire insulation cuts or abrasions. Repair moderately damaged leads, where conductors are cut or insulation is damaged over sections shorter than about 100 mm (4 in.) or less than about 25% of the length of the wire, by cutting out the damaged section and splicing in wire of the same type. Use UL-listed insulated (250-volt minimum) connectors and follow the connector manufacturer's instructions. Fabricate new leads using the same type of wire and UL-listed insulated (250-volt minimum) connectors and follow the connector manufacturer's instructions.

3.3.2 Mechanical Interlocks and Linkages

- Verify that mechanical interlocking is correct (i.e. one power switching device must be well open before the other closes).

- Check that the operating linkages are not damaged or bent, and that all bearing points operate freely.

- **1000–1200 Amp Molded-Case Switching Devices:** Verify that all limit switch linkages are correctly adjusted to provide full travel of the power switching device toggles *without* exerting unnecessary forces associated with excessive travel. Check that power switching devices travel far enough to reset any internal trip unit.

  Note: It is more important for the toggle to go fully in the off direction than in the on direction.

3.3.3 Lubrication

Maintain the transfer switch lubrication. If the transfer switch is subject to extremely dusty or abnormal operating conditions, relubricate movements and linkages yearly as described below.

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.

100-800 Amp Molded Case Switching Devices

- Confirm that the yoke operates freely on the yoke pivot bushings. Should lubrication be required, apply medium weight (SAE 20) oil sparingly at these points.
- The motor and gearbox are permanently lubricated and should not require attention under normal operating circumstances.

1000-1200 Amp Molded-Case Switching Devices

- Ensure that the manual handle moves freely on the hub when the lock pin is disengaged. If lubrication is necessary, apply medium weight (SAE 20) oil sparingly.
- Yoke pivot bearings and rod ends are permanently lubricated and do not require maintenance.
- The motor and gearbox are permanently lubricated and should not require attention under normal operating circumstances.

3.4 Testing

Periodic testing is important in any transfer switch application. It helps to ensure that the generator set will start and the transfer switch mechanisms and control circuits will operate when needed.

3.4.1 Weekly Generator Set Exercise

Use the plant exerciser to start and run the generator set once a week to maximize the reliability of the emergency power system. See the transfer switch operation and installation manual for additional information about the exerciser.

3.4.2 Monthly Automatic Operation Test

Test the transfer switch's automatic control system monthly by running a loaded or auto-load test. See Section 6.5.4 or the transfer switch operation and installation manual for the test procedure. Verify that the expected sequence of operations occurs as the switch transfers the load to the emergency source when a normal source failure occurs or is simulated. After the switch transfers the load to the emergency source, end the test and verify that the expected sequence of operations occurs as the transfer switch retransfers to the available normal source and signals the generator set to shut down after a cooldown period.

3.4.3 Other Tests

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (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.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Note: On service entrance transfer switches, the line side lugs are powered at all times.

Every Three Years

Test the wire insulation. Use the following procedure to check for insulation breakdown and replace any faulty components.

Note: Do not perform dielectric testing on the equipment with control components in the circuit.

Wire Insulation Breakdown Test Procedure

1. Disconnect all power sources by performing the service disconnect procedure. See Section 1 for instructions. Disconnect the load from the transfer switch by opening circuit breakers or switches leading from the transfer switch. Disconnect the transfer switch wiring harness from the controller at connector P1.

2. Disconnect the controller components by using the control circuit isolation procedure. See Section 1.4 for instructions.

3. Use a hi-pot tester or meggar to check the insulation resistance phase-to-phase and phase-to-neutral, and phase-to-ground if neutral and ground are isolated. For a hi-pot tester, the maximum potential is 500 VAC and the maximum test time is 1 second.

4. Verify that the measured insulation resistance exceeds 1.24 megohms (MΩ).

5. If the hi-pot tester indicates wire insulation breakdown or if the measured resistance is less than 1.24 MΩ, isolate the leakage current using an instrument designed for this purpose. Replace the faulty components.

   Note: You may need to disconnect power conductors from the lugs to isolate the problem. If you disconnect the power conductors, see the transfer switch operation and installation manual for reconnection instructions.

Every Five Years

Check the normal and emergency source setpoint calibration according to the procedures in Section 5.5, System Settings.

3.5 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, or Replace	Clean	Test	Interval
Electrical System							
Check for signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor.	3.3	X	X				Y
Manually operate the power switching device and lubricate, if necessary. *	3.3.3		D	D			Y
Check wiring insulation for deterioration, cuts, or abrasion. Repair or replace wiring to regain the properties of the original wiring.	3.3	X					Y
		D	D	D			Y
Check the transfer switch's main power switching mechanisms' mechanical operation and integrity.	3.3	D	D			D	Y
Tighten control and power wiring connections to specifications.	3.3		D	D			Y
Test wire and cable insulation for electrical breakdown.	3.4.3					D	Every 3 Years
Check calibration of voltage-sensing circuitry and setpoints, and recalibrate circuitry as necessary.	3.4.3		D			D	Every 5 Years
Control System							
Exercise the generator set without load.	3.4.1, O/M					X	W
Test the transfer switch's automatic control system.	O/M	X				X	M
Test all LED indicators, time delays, and remote control systems for operation.	O/M	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.*	3.2	X			X		M
Check that all external hardware is in place, tightened, and not badly worn.	3.2	X	X	X			M
Inspect the inside of the transfer switch for any signs of vibration, leakage, noise, high temperature, contamination, moisture, or deterioration. Check for metal discoloration, melted plastic, or a burning odor.*	3.3	X					M
		D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn.	3.3	X					M
		D	D				Y

***** Service more frequently if the ATS operates in extremely dusty or dirty areas.

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, or 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. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and cause damage.*
Test: May require tools, equipment, or training available only through an authorized distributor/dealer.

Symbols used in the chart:

O/I/M=See the transfer switch controller operation manual.
X= The transfer switch operator can perform these tasks.
D=An authorized distributor/dealer must perform these tasks.
W=Weekly
M=Monthly
Q=Quarterly
S=Semiannually (every six months)
Y=Yearly (annually)

4.1 Connection

Kohler® SiteTech® software can be used with Decision-Maker® MPAC controllers to check the transfer switch status, change adjustable controller settings, and update the application code on the controller. SiteTech software is available to Kohler authorized distributor and dealers.

The controller must have power to communicate with SiteTech. Use a USB cable to connect a laptop computer to the the MPAC controller's USB port. The cable should have a male mini-B connector on one end for the controller and the appropriate connector for your computer's USB port on the other end. The USB port is located on the front of the controller. See Figure 4-1 for the USB port location on the controller. It is not necessary to open the ATS enclosure to connect your computer.

4.2 Using SiteTech

Start the SiteTech program. The Kohler SiteTech icon and then a screen similar to the one shown in Figure 4-2 appear. The program takes a few moments to read the data from the controller.

The following tabs appear in the blue field near the top of the screen.

- Parameters. View and adjust transfer switch settings from this view. See Section 4.5 for a list of parameters that can be viewed and adjusted using SiteTech.
- Common Alarms. View and adjust events assigned to common alarms 1 and 2.
- Time-Based Load Control. See the controller operation manual for information about load control settings.
- Current-Based Load Control. See the controller operation manual for information about load control settings.
- Exercise Setup. View and adjust the exercise schedule.
- Prog Inputs. View and adjust programmable inputs on the controller and optional input/output modules.
- Prog Outputs. View and adjust programmable outputs on the controller and optional input/output modules.

4.2.1 Changing Settings

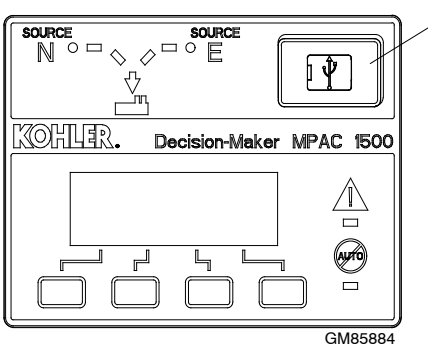
Not all settings are adjustable. Settings that cannot be changed have a gray background. Scroll up and down to see the parameter groups. Click on the down arrow next to each group to reveal the individual settings in that group.

Type in the new value for the setting. New settings appear in bold on the screen. New settings for more than one parameter can be entered. Then click Apply Changes near the top of the screen. If the setting is accepted by the controller, the new setting appears in normal (non-bold) text. If the setting is not accepted, the old setting reappears in the cell. Refer to the controller operation manual for default settings and adjustment ranges.

See TP-6701, SiteTech Software Operation Manual, for more detailed instructions.

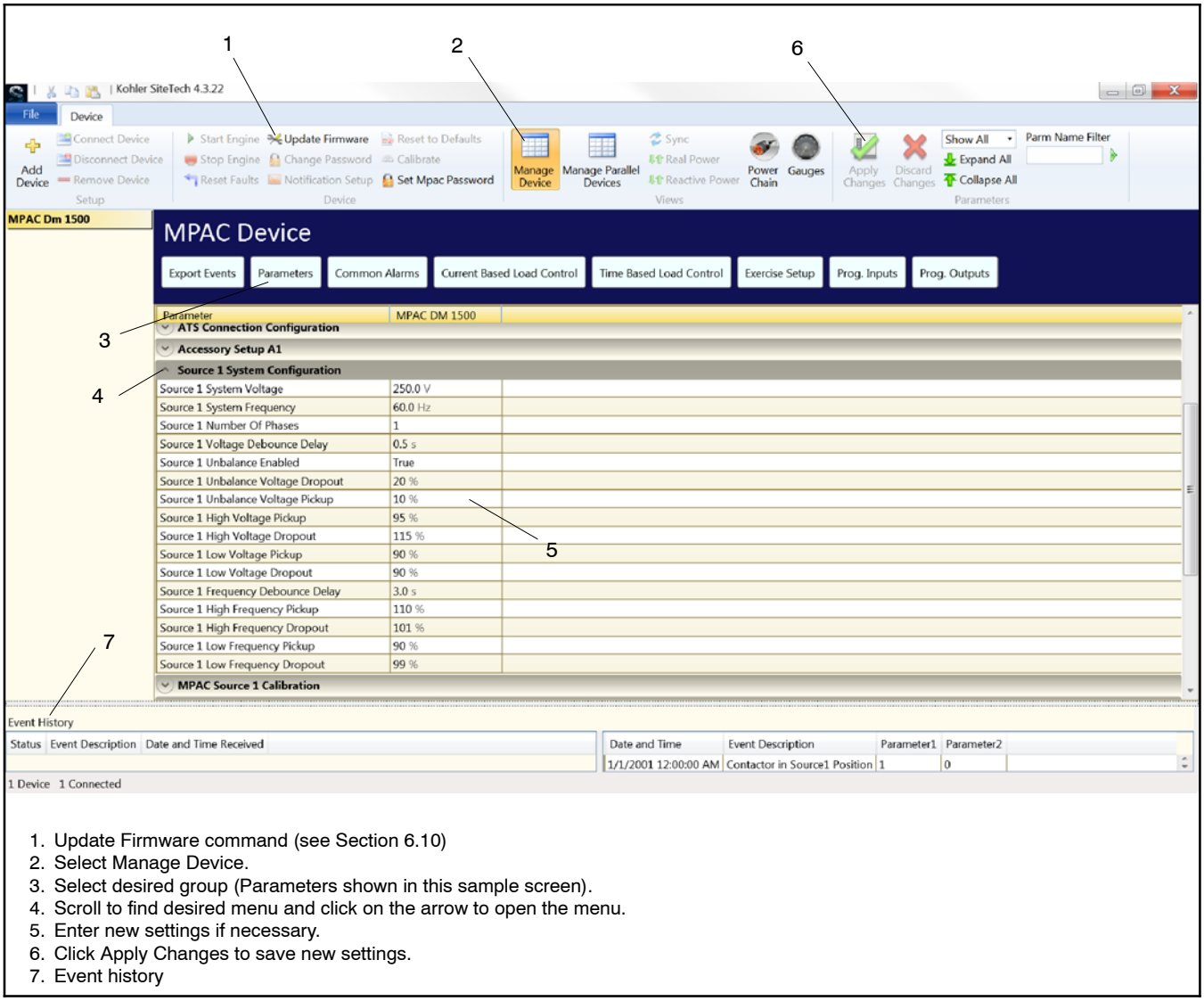
4.2.2 Update Firmware

See Section 6.10 for instructions to update the controller firmware.



1. USB port (behind cover)

Figure 4-1 Decision-Maker® MPAC Controllers



1. Update Firmware command (see Section 6.10)
2. Select Manage Device.
3. Select desired group (Parameters shown in this sample screen).
4. Scroll to find desired menu and click on the arrow to open the menu.
5. Enter new settings if necessary.
6. Click Apply Changes to save new settings.
7. Event history

Figure 4-2 Sample SiteTech Screen for Decision-Maker® MPAC Controllers

4.3 Exporting and Importing Parameter Settings

SiteTech software allows the generator set installer or service technician to save the device settings in a file and use that file to reload those settings later.

After the device has been installed and set up for the application, save the settings to a file on the computer. Setting files are saved as spreadsheets with the file extension .xls. Give the file a suitable name that identifies the specific device, and store it in a secure location.

Note: Saving the settings to a file is strongly recommended.

Saving the device settings to a file immediately after system startup creates a file that can be used to restore the device to the desired settings in the event of a system problem. The file can also be used to quickly set up a new controller if the device must be replaced in the future.

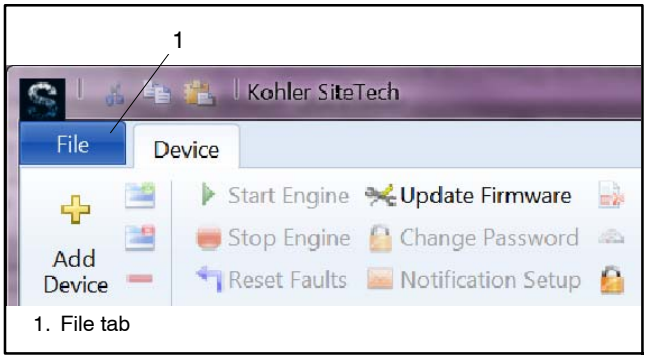
The settings and events are saved in a spreadsheet file that can be opened using Microsoft® Excel software. Open the file to view the settings and events, if desired. Some settings can be modified in the file using Excel. See Section 4.3.2 for important information about editing the file.

4.3.1 Export Parameters

The Export command saves the parameter settings to a spreadsheet file.

File Export Procedure

1. Click on the *File* tab in the upper left corner of the screen to open the file import and export commands screen. See Figure 4-3 and Figure 4-4.



1. File tab

Figure 4-3 Click the File Tab

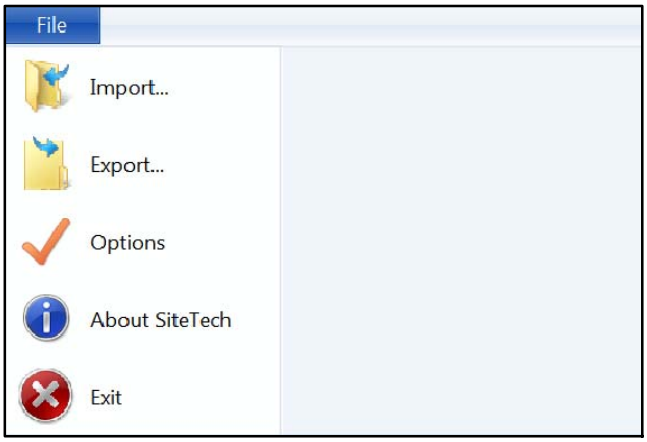


Figure 4-4 Import and Export Commands

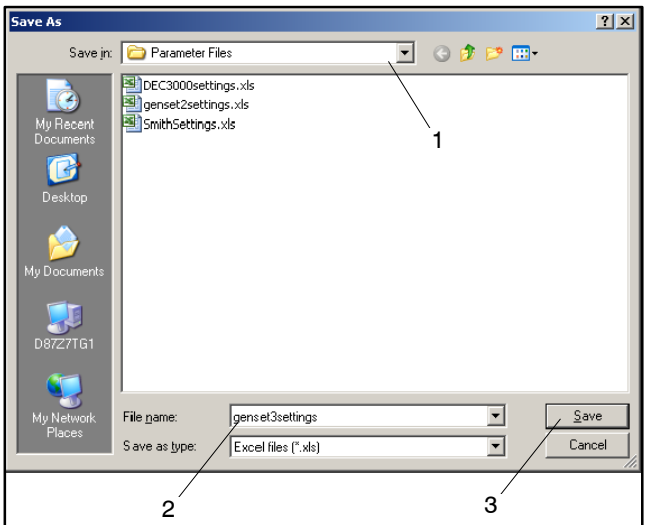
2. Click on Export. The Save As dialog window will open. See Figure 4-5.

3. The default location to save the file is shown at the top of the dialog box. Use the down arrow to select a different file location on the PC, if necessary.

4. In the File Name box, type in a suitable name for the file. Use a name that clearly identifies the device for future reference.

5. Click Save to save the file to the selected directory on the PC. The settings and events will be saved in a spreadsheet file that can be viewed on a PC, edited, and used to import the settings to another device.

Note: When more than one device is connected, the file export command will export all the settings for each device into the spreadsheet.



1. File will be saved to this location on the PC. Use the down arrow to change the location, if necessary.
2. Type in a suitable file name.
3. Click Save.

Figure 4-5 Save As Dialog Box for File Export

4.3.2 Editing Parameter Files

The parameter files created by the Export command can be opened using Excel software and reviewed for service or troubleshooting purposes. Some parameter settings can be changed in the Excel file and then reloaded onto the device using the Import Parameters command.

Note: Do not modify any settings that are not labeled "Write" in the Access column of the spreadsheet.

Only settings that are labeled "Write" in the Access column *and* have simple numerical values or True or False in the last column of the spreadsheet should be modified. See Figure 4-6. Change only the values shown in the device column of the spreadsheet.

Use this feature with caution. Be sure that the new values are within the acceptable range for each parameter. Refer to the documentation provided with the controller or device for default settings and adjustment ranges.

Access	Value	Sample Values	Change Allowed in Spreadsheet?
Write	Simple numerical values	0 57.5	YES
Write	True or False	True False	YES
Write	Numbers in parentheses	(0)	NO
Write	Mixed text and numbers	Off(0) 12 V (12)	NO
Read	Any	—	NO
Locked	Any	—	NO

Figure 4-6 Parameter Changes Allowed in Spreadsheet

4.3.3 Import Parameters

The Import command allows the operator to import device settings from a file. Use setting files created by the Export command in SiteTech. (See Section 4.3.1.) Setting files are saved as spreadsheets with the file extension .xls. Parameters not included in the files are not changed.

Use the Import Parameters command to set up more than one controller to the same settings, or to import the device settings to a new controller after the controller has been replaced.

The parameter file can contain settings for more than one device. Select the device you want to use as the source device and then select the target device. SiteTech may select the connected device as the target device for you. See Figure 4-7 and Figure 4-8.

File Import Procedure

1. Click on the File tab in the upper left corner of the screen to reveal the file import and export commands. See Figure 4-4.

2. Click on Import. A dialog window will open. See Figure 4-7.

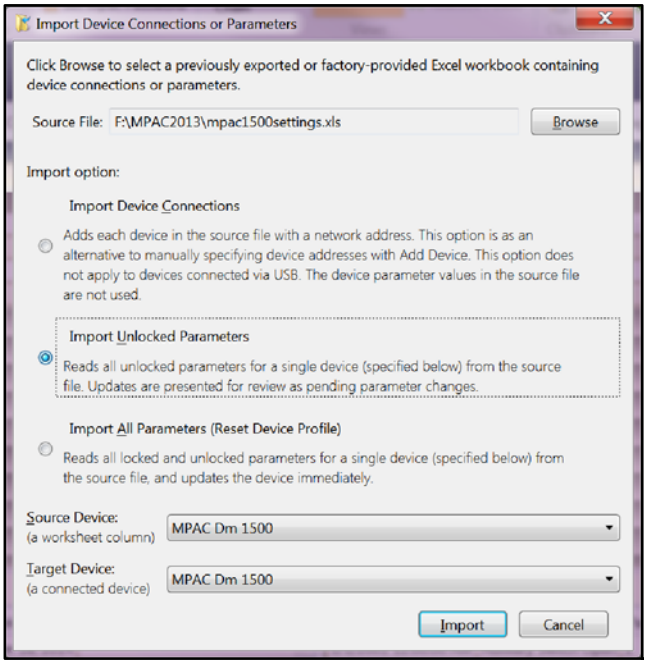
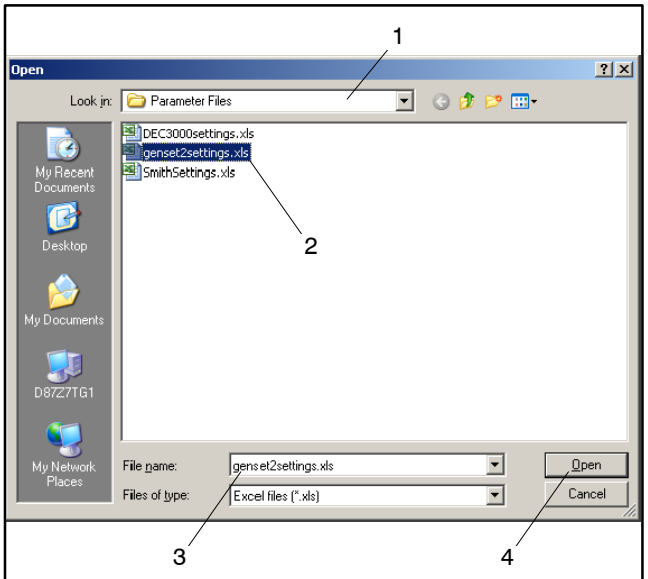


Figure 4-7 Import Parameters Window

3. Click on the Browse button. A window will open. See Figure 4-8.



1. File location. Click down arrow to change, if necessary.
2. Select the desired file from the list.
3. Name of selected parameter file should appear here.
4. Click Open.

Figure 4-8 Open Dialog Box for File Import

4. The default location to find the file is shown at the top of the dialog box. Use the down arrow to select a different file location on the PC, if necessary.
5. Click on the name of the file to select it. Check that the selected file name appears in the File Name box near the bottom of the window.
6. Click Open.
7. The selected file now appears in the Source File box. See Figure 4-7.
8. Click on Import Unlocked Parameters. See Figure 4-7.
9. Check that the Source Device and the Target Device windows both show MPAC Dm 1500.
10. Click the Import button to load the new parameters onto the controller. See Figure 4-7.
11. New settings will appear in bold face on the SiteTech screen. Click on Apply Changes to load the new settings onto the device. Click Discard Changes if you decide not to load the new settings onto the device.

4.4 Export Events

The Export Events button creates a text file of time- and date-stamped events. Click on Export Events and save the file to a location of your choice on your computer.

4.5 Parameters

The following table lists the parameters that are available using a personal computer and Kohler SiteTech software. The parameters are divided into groups as shown. The access column indicates which parameters can be adjusted using SiteTech. Parameters marked “Write” can be adjusted; parameters marked “Read” are for monitoring only and cannot be adjusted using SiteTech.

See Section 4.1 for instructions to connect a computer to the controller’s USB port and Section 4.2 for an illustration of a sample screen from SiteTech. See TP-6701, SiteTech Software Operation Manual, for more detailed instructions to use the software.

For adjustable parameters and time delays, see the applicable controller operation manual for default settings and adjustment ranges.

Digital Inputs A1 and A2 and Digital Outputs A1 and A2 are on the MPAC 1500 controller. Other inputs and outputs are for the optional accessory boards.

Group	Parameter	Access	Units
Identity	Vendor	Read	
	Product	Read	
	Firmware Version	Read	
	Sub MPAC Firmware Version	Read	
ATS Metering Summary	MPAC ATS Contactor Position	Read	
	Key Switch Press Status	Read	
	Preferred Source	Read	
	Preferred Source Available	Read	
	Standby Source Available	Read	
	Exercise In Progress	Read	
	In Phase Monitor Active	Read	
	Load Control In Progress	Read	
	Peak Shave In Progress	Read	
	Loaded Test Occurring	Read	
	Unloaded Test Occurring	Read	
	Auto Loaded Test Occurring	Read	
	Synchronous Check Occurring	Read	
	User Forcing To Off	Read	
	Dip Switch Status	Read	
	Closed Transition In Phase Delta	Read	degrees
ATS Information	ATS Serial Number	Write	
	Controller Serial Number	Write	
	Contactor Serial Number	Write	
	Fpga Firmware Version	Read	
	ATS Designation	Write	
	ATS Load	Write	
	ATS Branch	Write	
	ATS Location	Write	
Source 1 Metering	MPAC Source 1 Rotation Actual	Read	
	Source 1 Voltage L1-L2	Read	V
	Source 1 Voltage L2-L3	Read	V
	Source 1 Voltage L3-L1	Read	V
	Source 1 Voltage L1-N	Read	V
	Source 1 Voltage L2-N	Read	V
	Source 1 Voltage L3-N	Read	V
	Source 1 Frequency	Read	Hz
Source 2 Metering	MPAC Source 2 Rotation Actual	Read	
	Source 2 Voltage L1-L2	Read	V
	Source 2 Voltage L2-L3	Read	V
	Source 2 Voltage L3-L1	Read	V
	Source 2 Voltage L1-N	Read	V
	Source 2 Voltage L2-N	Read	V
	Source 2 Voltage L3-N	Read	V
	Source 2 Frequency	Read	Hz

Group	Parameter	Access	Units
ATS Load Metering	Load Current L1	Read	A
	Load Current L2	Read	A
	Load Current L3	Read	A
ATS Load Metering Calibration	Calibration Factor Load Current L1	Write	
	Calibration Factor Load Current L2	Write	
	Calibration Factor Load Current L3	Write	
ATS Run Time	ATS Controller Clock Date Time	Write	
	ATS Total Hours Of Operation	Read	h
	ATS Total Hours Not In Preferred	Read	h
	ATS Total Hours In Standby	Read	h
	ATS Total Switch Transfers	Read	
	ATS Total Failure To Transfers	Read	
	ATS Total Loss Of Preferred Transfers	Read	
	Transfer Time Source 1 To Source 2	Read	ms
	Transfer Time Source 2 To Source 1	Read	ms
	MPAC ATS Date Of Last Maintenance	Write	
	ATS Hours Of Operation Since Maintenance	Read	h
	ATS Hours Not In Preferred Since Maintenance	Read	h
	ATS Hours In Standby Since Maintenance	Read	h
	ATS Switch Transfers Since Maintenance	Read	
	ATS Failure To Transfers Since Maintenance	Read	
	ATS Loss Of Preferred Transfers Since Maintenance	Read	
	Last Outage Date Time	Read	
	Last Outage Duration	Read	h
	System Start Date	Write	
	Daylight Saving Adjust Enabled	Write	
	Move Forward Date Day Of Week	Write	
	Move Forward Date Week Of Month	Write	
	Move Forward Date Month Of Year	Write	
	Move Backward Day Of Week	Write	
	Move Backward Week Of Month	Write	
	Move Backward Month Of Year	Write	
	Closed Transition Dual Source Connected Time	Read	ms
	Source 1 To Open Time	Read	ms
	Source 1 To Close Time	Read	ms
	Source 2 To Open Time	Read	ms
	Source 2 To Close Time	Read	ms
ATS Connection Configuration	MPAC ATS Phase Rotation Setting	Write	
	ATS Contactor Rating	Write	A
	Fail To Synchronize Enabled	Write	
	Manual Transfer Mode	Write	
	Transition Mode	Write	
	Mode Of Operation	Write	
	Manual Transfer Switch Position	Write	
	Closed Programmed Transition Override Mode	Write	
	Synchronous Voltage Phase Angle	Write	degrees
	Synchronous Voltage Differential	Write	%
	Synchronous Frequency Differential	Write	Hz
	Service Entrance Configuration	Write	
	Save Configuration Parameters	Write	
	MPAC Dm ATS Preferred Source	Write	
	Service Disconnect Position	Write	Off or Source E

Group	Parameter	Access	Units
Accessory Setup A1	Accessory Setup A1 Extended Engine Start Timer Enabled	Write	
	Accessory Setup A1 Inphase Monitor Enabled	Write	
	Accessory Setup A1 Remote Test Loaded	Write	
	Accessory Setup A1 Commit To Transfer	Write	
	Accessory Setup A1 Peak Shave Retransfer Delay Bypass	Write	
	Accessory Setup A1 Three Source Simultaneous Engine Start Mode	Write	
	Accessory Setup A1 Three Source Preferred Source Toggle	Write	
	Accessory Setup A1 Inphase Monitor Transfer Angle	Write	
Source 1 System Configuration	Source 1 System Voltage	Write	V
	Source 1 System Frequency	Write	Hz
	Source 1 Number Of Phases	Write	
	Source 1 Voltage Debounce Delay	Write	s
	Source 1 Unbalance Enabled	Write	
	Source 1 Unbalance Voltage Dropout	Write	%
	Source 1 Unbalance Voltage Pickup	Write	%
	Source 1 High Voltage Pickup	Write	%
	Source 1 High Voltage Dropout	Write	%
	Source 1 Low Voltage Pickup	Write	%
	Source 1 Low Voltage Dropout	Write	%
	Source 1 Frequency Debounce Delay	Write	s
	Source 1 High Frequency Pickup	Write	%
	Source 1 High Frequency Dropout	Write	%
	Source 1 Low Frequency Pickup	Write	%
	Source 1 Low Frequency Dropout	Write	%
MPAC Source 1 Calibration	MPAC Source 1 Calibration Factor Voltage L1-L2	Write	V
	MPAC Source 1 Calibration Factor Voltage L2-L3	Write	V
	MPAC Source 1 Calibration Factor Voltage L3-L1	Write	V
	MPAC Source 1 Calibration Factor Voltage L1-N	Write	V
	MPAC Source 1 Calibration Factor Voltage L2-N	Write	V
	MPAC Source 1 Calibration Factor Voltage L3-N	Write	V
Source 2 System Configuration	Source 2 System Voltage	Write	V
	Source 2 System Frequency	Write	Hz
	Source 2 Number Of Phases	Write	
	Source 2 Voltage Debounce Delay	Write	s
	Source 2 Unbalance Enabled	Write	
	Source 2 Unbalance Voltage Dropout	Write	%
	Source 2 Unbalance Voltage Pickup	Write	%
	Source 2 High Voltage Pickup	Write	%
	Source 2 High Voltage Dropout	Write	%
	Source 2 Low Voltage Pickup	Write	%
	Source 2 Low Voltage Dropout	Write	%
	Source 2 Frequency Debounce Delay	Write	s
	Source 2 High Frequency Pickup	Write	%
	Source 2 High Frequency Dropout	Write	%
	Source 2 Low Frequency Pickup	Write	%
	Source 2 Low Frequency Dropout	Write	%
MPAC Source 2 Calibration	MPAC Source 2 Calibration Factor Voltage L1-L2	Write	V
	MPAC Source 2 Calibration Factor Voltage L2-L3	Write	V
	MPAC Source 2 Calibration Factor Voltage L3-L1	Write	V
	MPAC Source 2 Calibration Factor Voltage L1-N	Write	V
	MPAC Source 2 Calibration Factor Voltage L2-N	Write	V
	MPAC Source 2 Calibration Factor Voltage L3-N	Write	V

Group	Parameter	Access	Units
ATS Delays	ATS Transfer From Preferred Delay	Write	s
	ATS Transfer From Standby Delay	Write	s
	ATS Transfer Off To Preferred Delay	Write	s
	ATS Transfer Off To Standby Delay	Write	s
	ATS Source 2 Engine Start Delay	Write	s
	ATS Source 2 Engine Cool Down Delay	Write	s
	ATS Fail To Acquire Standby Delay	Write	s
	ATS Fail To Acquire Preferred Delay	Write	s
	ATS Source 2 Extended Engine Start Delay	Write	s
	ATS Source 1 Extended Engine Start Delay	Write	s
	ATS Source 1 Engine Start Delay	Write	s
	ATS Source 1 Engine Cool Down Delay	Write	s
	ATS Fail To Synchronize Delay	Write	s
	Active Time Delay	Read	
	Active Delay Time Remaining	Read	s
	Active Delay Time Delay Preset	Read	s
ATS Prime Power	Source 1 Prime Power Duration	Write	h
	Source 2 Prime Power Duration	Write	h
	Source 1 Prime Powerevent Countdown	Read	min
	Source 2 Prime Powerevent Countdown	Read	min
	Prime Power Start Stop	Write	
ATS Timed Load Control	Timed Disconnect LCR 1 From Source 1	Write	s
	Timed Disconnect LCR 2 From Source 1	Write	s
	Timed Disconnect LCR 3 From Source 1	Write	s
	Timed Disconnect LCR 4 From Source 1	Write	s
	Timed Disconnect LCR 5 From Source 1	Write	s
	Timed Disconnect LCR 6 From Source 1	Write	s
	Timed Disconnect LCR 7 From Source 1	Write	s
	Timed Disconnect LCR 8 From Source 1	Write	s
	Timed Disconnect LCR 9 From Source 1	Write	s
	Timed Connect LCR 1 From Source 2	Write	s
	Timed Connect LCR 2 From Source 2	Write	s
	Timed Connect LCR 3 From Source 2	Write	s
	Timed Connect LCR 4 From Source 2	Write	s
	Timed Connect LCR 5 From Source 2	Write	s
	Timed Connect LCR 6 From Source 2	Write	s
	Timed Connect LCR 7 From Source 2	Write	s
	Timed Connect LCR 8 From Source 2	Write	s
	Timed Connect LCR 9 From Source 2	Write	s
	Timed Disconnect LCR 1 From Source 2	Write	s
	Timed Disconnect LCR 2 From Source 2	Write	s
	Timed Disconnect LCR 3 From Source 2	Write	s
	Timed Disconnect LCR 4 From Source 2	Write	s
	Timed Disconnect LCR 5 From Source 2	Write	s
	Timed Disconnect LCR 6 From Source 2	Write	s
	Timed Disconnect LCR 7 From Source 2	Write	s
	Timed Disconnect LCR 8 From Source 2	Write	s
	Timed Disconnect LCR 9 From Source 2	Write	s
	Timed Connect LCR 1 From Source 1	Write	s
	Timed Connect LCR 2 From Source 1	Write	s
	Timed Connect LCR 3 From Source 1	Write	s
	Timed Connect LCR 4 From Source 1	Write	s
	Timed Connect LCR 5 From Source 1	Write	s
	Timed Connect LCR 6 From Source 1	Write	s
	Timed Connect LCR 7 From Source 1	Write	s
	Timed Connect LCR 8 From Source 1	Write	s
	Timed Connect LCR 9 From Source 1	Write	s
	Number Of Source 1 Timed LCRs	Write	
	Number Of Source 2 Timed LCRs	Write	

Group	Parameter	Access	Units
ATS Current Based Load Control	Source 1 Load Control Mode	Write	
	Source 2 Load Control Mode	Write	
	Source 1 Add Load Amperage	Write	A
	Source 1 Remove Load Amperage	Write	A
	Source 2 Add Load Amperage	Write	A
	Source 2 Remove Load Amperage	Write	A
	Source 1 Current Based LCR 1 Enabled	Write	
	Source 1 Current Based LCR 2 Enabled	Write	
	Source 1 Current Based LCR 3 Enabled	Write	
	Source 1 Current Based LCR 4 Enabled	Write	
	Source 1 Current Based LCR 5 Enabled	Write	
	Source 1 Current Based LCR 6 Enabled	Write	
	Source 1 Current Based LCR 7 Enabled	Write	
	Source 1 Current Based LCR 8 Enabled	Write	
	Source 1 Current Based LCR 9 Enabled	Write	
	Source 1 Current Based LCR 1 Add Priority	Write	
	Source 1 Current Based LCR 2 Add Priority	Write	
	Source 1 Current Based LCR 3 Add Priority	Write	
	Source 1 Current Based LCR 4 Add Priority	Write	
	Source 1 Current Based LCR 5 Add Priority	Write	
	Source 1 Current Based LCR 6 Add Priority	Write	
	Source 1 Current Based LCR 7 Add Priority	Write	
	Source 1 Current Based LCR 8 Add Priority	Write	
	Source 1 Current Based LCR 9 Add Priority	Write	
	Source 1 Current Based LCR 1 Remove Priority	Write	
	Source 1 Current Based LCR 2 Remove Priority	Write	
	Source 1 Current Based LCR 3 Remove Priority	Write	
	Source 1 Current Based LCR 4 Remove Priority	Write	
	Source 1 Current Based LCR 5 Remove Priority	Write	
	Source 1 Current Based LCR 6 Remove Priority	Write	
	Source 1 Current Based LCR 7 Remove Priority	Write	
	Source 1 Current Based LCR 8 Remove Priority	Write	
	Source 1 Current Based LCR 9 Remove Priority	Write	
	Current Based Add LCR 1 To Source 1 Time Delay	Write	s
	Current Based Add LCR 2 To Source 1 Time Delay	Write	s
	Current Based Add LCR 3 To Source 1 Time Delay	Write	s
	Current Based Add LCR 4 To Source 1 Time Delay	Write	s
	Current Based Add LCR 5 To Source 1 Time Delay	Write	s
	Current Based Add LCR 6 To Source 1 Time Delay	Write	s
	Current Based Add LCR 7 To Source 1 Time Delay	Write	s
	Current Based Add LCR 8 To Source 1 Time Delay	Write	s
	Current Based Add LCR 9 To Source 1 Time Delay	Write	s
	Current Based Remove LCR 1 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 2 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 3 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 4 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 5 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 6 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 7 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 8 From Source 1 Time Delay	Write	s
	Current Based Remove LCR 9 From Source 1 Time Delay	Write	s
	Source 2 Current Based LCR 1 Enabled	Write	
	Source 2 Current Based LCR 2 Enabled	Write	
	Source 2 Current Based LCR 3 Enabled	Write	
	Source 2 Current Based LCR 4 Enabled	Write	
	Source 2 Current Based LCR 5 Enabled	Write	
	Source 2 Current Based LCR 6 Enabled	Write	
	Source 2 Current Based LCR 7 Enabled	Write	
	Source 2 Current Based LCR 8 Enabled	Write	

Group	Parameter	Access	Units
ATS Current Based Load Control, Continued	Source 2 Current Based LCR 9 Enabled	Write	
	Source 2 Current Based LCR 1 Add Priority	Write	
	Source 2 Current Based LCR 2 Add Priority	Write	
	Source 2 Current Based LCR 3 Add Priority	Write	
	Source 2 Current Based LCR 4 Add Priority	Write	
	Source 2 Current Based LCR 5 Add Priority	Write	
	Source 2 Current Based LCR 6 Add Priority	Write	
	Source 2 Current Based LCR 7 Add Priority	Write	
	Source 2 Current Based LCR 8 Add Priority	Write	
	Source 2 Current Based LCR 9 Add Priority	Write	
	Source 2 Current Based LCR 1 Remove Priority	Write	
	Source 2 Current Based LCR 2 Remove Priority	Write	
	Source 2 Current Based LCR 3 Remove Priority	Write	
	Source 2 Current Based LCR 4 Remove Priority	Write	
	Source 2 Current Based LCR 5 Remove Priority	Write	
	Source 2 Current Based LCR 6 Remove Priority	Write	
	Source 2 Current Based LCR 7 Remove Priority	Write	
	Source 2 Current Based LCR 8 Remove Priority	Write	
	Source 2 Current Based LCR 9 Remove Priority	Write	
	Current Based Add LCR 1 To Source 2 Time Delay	Write	s
	Current Based Add LCR 2 To Source 2 Time Delay	Write	s
	Current Based Add LCR 3 To Source 2 Time Delay	Write	s
	Current Based Add LCR 4 To Source 2 Time Delay	Write	s
	Current Based Add LCR 5 To Source 2 Time Delay	Write	s
	Current Based Add LCR 6 To Source 2 Time Delay	Write	s
	Current Based Add LCR 7 To Source 2 Time Delay	Write	s
	Current Based Add LCR 8 To Source 2 Time Delay	Write	s
	Current Based Add LCR 9 To Source 2 Time Delay	Write	s
	Current Based Remove LCR 1 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 2 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 3 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 4 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 5 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 6 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 7 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 8 From Source 2 Time Delay	Write	s
	Current Based Remove LCR 9 From Source 2 Time Delay	Write	s
Modbus	Modbus Enabled	Write	
	MPAC Modbus Baud Rate	Write	b/s
	Modbus Slave Address	Write	
	Modbus Parity	Read	
	Modbus Stop Bits	Read	
Network Configuration	DHCP Enabled	Write	
	Static IP Address	Write	
	Static Subnet Mask	Write	
	Static Default Gateway	Write	
	DHCP Server	Write	
	Modbus TCP Unit Id	Write	
	Modbus TCP Server Enabled	Write	
Network Status	MAC Address	Read	
Digital Input Output Descriptions	Software Controlled Output 1 Description	Write	
	Software Controlled Output 2 Description	Write	
	Software Controlled Output 3 Description	Write	
	Software Controlled Output 4 Description	Write	
	Remote Monitored Input 1 Description	Write	
	Remote Monitored Input 2 Description	Write	
	Remote Monitored Input 3 Description	Write	
	Remote Monitored Input 4 Description	Write	

Group	Parameter	Access	Units
Installed Boards	Expansion Board 1	Read	
	Expansion Board 2	Read	
	Expansion Board 3	Read	
	Expansion Board 4	Read	
	Alarm Board	Read	
	Battery Option Board Installed	Read	
MPAC Dm Digital Input Output Status	Main Logic Board User Outputs	Read	
	Main Logic Board User Inputs	Read	
	Expansion Board 1 User Outputs	Read	
	Expansion Board 2 User Outputs	Read	
	Expansion Board 3 User Outputs	Read	
	Expansion Board 4 User Outputs	Read	
	Expansion Board 1 User Inputs	Read	
	Expansion Board 2 User Inputs	Read	
	Expansion Board 3 User Inputs	Read	
	Expansion Board 4 User Inputs	Read	
	Software Controlled User Outputs	Write	
	Software Controlled User Outputs Assigned	Read	
	Remote Monitoring User Inputs	Read	
	Remote Monitoring User Inputs Assigned	Read	
	Main Logic Board Hardware Outputs	Read	
MPAC 1500 Digital Input A1	MPAC 1500 Digital Input A1 Event	Write	
MPAC 1500 Digital Input A2	MPAC 1500 Digital Input A2 Event	Write	
MPAC 1500 Digital Input B1	MPAC 1500 Digital Input B1 Event	Write	
MPAC 1500 Digital Input B2	MPAC 1500 Digital Input B2 Event	Write	
MPAC 1500 Digital Input C1	MPAC 1500 Digital Input C1 Event	Write	
MPAC 1500 Digital Input C2	MPAC 1500 Digital Input C2 Event	Write	
MPAC 1500 Digital Input D1	MPAC 1500 Digital Input D1 Event	Write	
MPAC 1500 Digital Input D2	MPAC 1500 Digital Input D2 Event	Write	
MPAC 1500 Digital Input E1	MPAC 1500 Digital Input E1 Event	Write	
MPAC 1500 Digital Input E2	MPAC 1500 Digital Input E2 Event	Write	
MPAC 1500 Digital Output A1	MPAC 1500 Digital Output A1 Event	Write	
MPAC 1500 Digital Output A2	MPAC 1500 Digital Output A2 Event	Write	
MPAC 1500 Digital Output B1	MPAC 1500 Digital Output B1 Event	Write	
MPAC 1500 Digital Output B2	MPAC 1500 Digital Output B2 Event	Write	
MPAC 1500 Digital Output B3	MPAC 1500 Digital Output B3 Event	Write	
MPAC 1500 Digital Output B4	MPAC 1500 Digital Output B4 Event	Write	
MPAC 1500 Digital Output B5	MPAC 1500 Digital Output B5 Event	Write	
MPAC 1500 Digital Output B6	MPAC 1500 Digital Output B6 Event	Write	
MPAC 1500 Digital Output C1	MPAC 1500 Digital Output C1 Event	Write	
MPAC 1500 Digital Output C2	MPAC 1500 Digital Output C2 Event	Write	

Group	Parameter	Access	Units
MPAC 1500 Digital Output C3	MPAC 1500 Digital Output C3 Event	Write	
MPAC 1500 Digital Output C4	MPAC 1500 Digital Output C4 Event	Write	
MPAC 1500 Digital Output C5	MPAC 1500 Digital Output C5 Event	Write	
MPAC 1500 Digital Output C6	MPAC 1500 Digital Output C6 Event	Write	
MPAC 1500 Digital Output D1	MPAC 1500 Digital Output D1 Event	Write	
MPAC 1500 Digital Output D2	MPAC 1500 Digital Output D2 Event	Write	
MPAC 1500 Digital Output D3	MPAC 1500 Digital Output D3 Event	Write	
MPAC 1500 Digital Output D4	MPAC 1500 Digital Output D4 Event	Write	
MPAC 1500 Digital Output D5	MPAC 1500 Digital Output D5 Event	Write	
MPAC 1500 Digital Output D6	MPAC 1500 Digital Output D6 Event	Write	
MPAC 1500 Digital Output E1	MPAC 1500 Digital Output E1 Event	Write	
MPAC 1500 Digital Output E2	MPAC 1500 Digital Output E2 Event	Write	
MPAC 1500 Digital Output E3	MPAC 1500 Digital Output E3 Event	Write	
MPAC 1500 Digital Output E4	MPAC 1500 Digital Output E4 Event	Write	
MPAC 1500 Digital Output E5	MPAC 1500 Digital Output E5 Event	Write	
MPAC 1500 Digital Output E6	MPAC 1500 Digital Output E6 Event	Write	
MPAC 1500 Common Alarm A1	MPAC 1500 Common Alarm A1 Common Alarm	Read	
	MPAC 1500 Common Alarm A1 Alarm Audible	Write	
	MPAC 1500 Common Alarm A1 Assigned To Common Alarm 2	Write	
	MPAC 1500 Common Alarm A1 Assigned To Common Alarm 1	Write	
The parameters shown above for Common Alarm A1 are available for Common Alarms A2 –A64.			
Exerciser Summary	Enabled	Read	
	Loaded	Read	
	Interval	Read	
	Repeat Rate	Read	
	Start Date	Read	
	Start Time	Read	
	Event Run Duration	Read	
	Running	Read	
	Source	Read	
MPAC Dm Exerciser Scheduler A1	MPAC Dm Exerciser Scheduler A1 Enabled	Write	
	MPAC Dm Exerciser Scheduler A1 Loaded	Write	
	MPAC Dm Exerciser Scheduler A1 Interval	Write	
	MPAC Dm Exerciser Scheduler A1 Repeat Rate	Write	
	MPAC Dm Exerciser Scheduler A1 Start Date	Write	
	MPAC Dm Exerciser Scheduler A1 Start Time	Write	
	MPAC Dm Exerciser Scheduler A1 Event Run Duration	Write	min
	MPAC Dm Exerciser Scheduler A1 Running	Read	
	MPAC Dm Exerciser Scheduler A1 Source	Read	
The parameters shown above for Exerciser Scheduler A1 are available for Exerciser Scheduler A2 –A21.			

4.6 Calibration

SiteTech can be used to adjust the controller calibration. Refer to Sections 5.4.2 and 6.12 for instructions to measure the voltage and current (if equipped with the current sensing accessory) and check the controller calibration.

Voltage Calibration

Voltage calibration parameters appear in the MPAC Source 1 Calibration and MPAC Source 2 Calibration groups in SiteTech. Note that there are separate settings for line-to-line and line-to-neutral voltages on all phases.

If the voltage measured at the ATS source lugs does not match the voltage shown on the controller display, enter the actual measured voltage into the corresponding voltage calibration parameter. For example, enter the measured line-to-neutral voltage into MPAC Source 1 Calibration Factor Voltage L1-N. Then click on Apply Changes.

Current Calibration

Current calibration is also possible for transfer switches equipped with the current sensing accessory. Current calibration factors appear in the ATS Load Metering group.

If the current measured at the ATS does not match the current displayed on the controller, enter the measured current value (in amps) into the corresponding Calibration Factor Load Current L1, L2, or L3 setting in SiteTech. For example, enter the amps measured on line 1 into Calibration Factor Load Current L1. Then click on Apply Changes.

4.7 Action Commands

The MPAC Dm Manual Command allows you to start and stop a remote test, end a time delay, or perform other manual operations using SiteTech. See Figure 4-9.

Select one command from the drop down list so that only one box is checked. Then click on Apply Changes to activate the command. If you use the manual command to start a remote test and then want to stop it, make sure to click on the Start command again to deselect it, and click on the End Remote Test command. Then Apply Changes to stop the test.

Make sure that only one box is checked before clicking on Apply Changes.

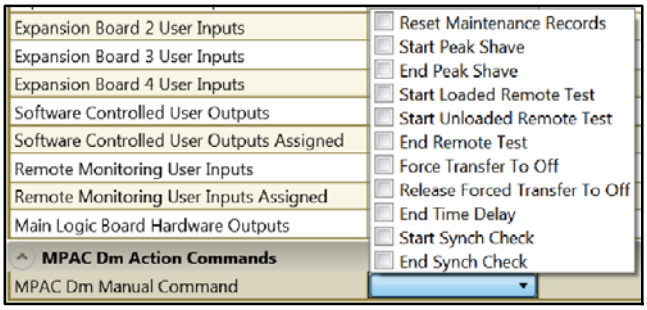
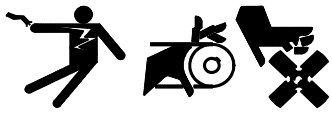


Figure 4-9 Manual Commands

5.1 Precautions

⚠ 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.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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.

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)

5.2 Initial Checks

When troubleshooting a problem, check the following things first.

- Check the Service Required LED and the transfer switch controller display for fault or warning indications. If a fault or warning is indicated, proceed to Section 5.10.
- Disconnect power to the transfer switch and check for loose connections. Check the source lugs, controller harnesses, and generator set engine start connection.
- Check the event history log. The log lists the 100 most recent transfer switch events, including transfers and DIP switch setting changes as well as faults and alarms. See Section 5.3 for instructions to view the event history log.
- Check the system settings and time delays. See Section 5.5, System Settings. Verify that the settings are correct and appropriate for the application.

Read and follow all safety precautions in this manual and on labels on the switch. Only trained and qualified personnel should service the transfer switch and connected equipment.

Refer to the wiring diagrams provided with the switch or the wiring diagram manual when troubleshooting the transfer switch and controller.

5.3 View Event History

When troubleshooting, check the event history for faults, transfer attempts, or other events leading to the current condition. The history lists the 100 most recent transfer switch events, including transfers and DIP switch setting changes as well as faults and alarms.

From the main screen, step to View Event History and display recent events as shown in Figure 5-1. Possible event descriptions are listed in Figure 5-2.

A personal computer connected to the controller's USB port and Kohler SiteTech software can also be used to view the event history. See Section 4 and/or the SiteTech Software Operation manual.

If a fault condition or alarm is displayed, proceed to Section 5.10.

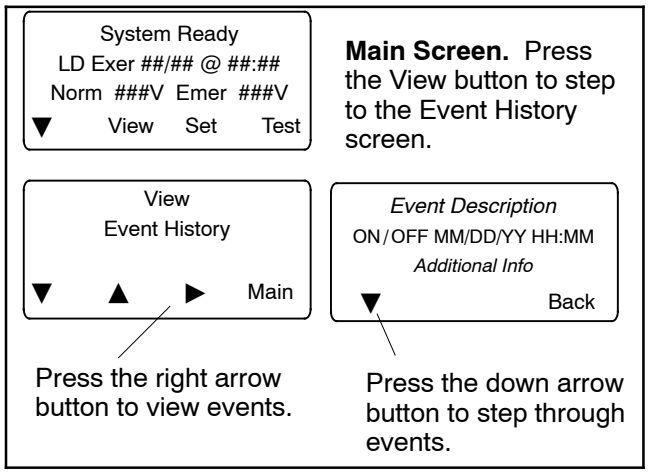


Figure 5-1 Viewing Event History

Event Descriptions	
End Time Delay Btn	Inhibit Transfer
Test Btn	Rem End Time Delay
Exercise Btn	Remote Test Start/Stop
Lamp Test	Low Battery Input
Service Req'd Reset	Remote Common Alarm
Maint DIP Switch	Bypass Contactor Dis
Pwd DIP Switch	3 Src System Disable
Auto/Manual Switch	Service disconnect
Prime Power Start/Stop	Over Frequency
New Module	Under Frequency
Contactor in Off	Phase Loss
Contactor in Src N	Phase Rotation Error
Contactor in Src E	Over Voltage L1-L2
External Battery Low	Over Voltage L2-L3
Exerciser Active	Over Voltage L3-L1
Fail to Acquire Pref	Under Voltage L1-L2
Fail to Acquire Stby	Under Voltage L2-L3
Fail to Sync	Under Voltage L3-L1
Fail to Transfer	Voltage Imbalance
I/O Module Lost Comm	Auto Loaded Test Timeout
Aux Switch Fault	Exerciser Loaded Change
Aux Switch Open	Test Loaded Changed
Fail to Open Source 1	1 Week Exercise Chg
Fail to Close Source 1	Exerciser disabled Chg
Fail to Open Source 2	Pref Source Changed
Fail to Close Source 2	Default Params Loaded
Source 1 Breaker Trip	MODBUS Forced to OFF
Source 2 Beaker Trip	MODBUS Peak Shave
Forced Trans to Off	MODBUS System Test
Peak Shave Mode	

Figure 5-2 Events

5.4 System Power

DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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)

5.4.1 Verify Power to ATS

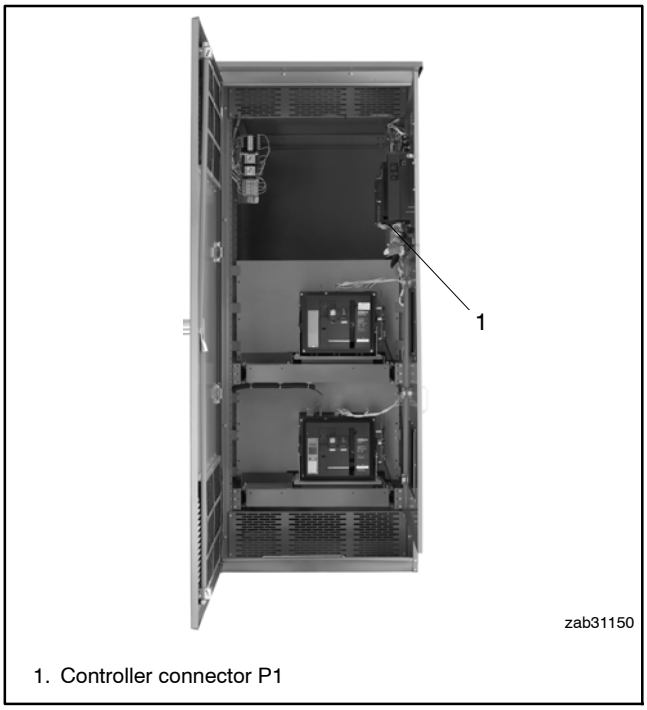
If the transfer switch display is off, check for power to the transfer switch. If the utility source is not available, check for emergency power. Follow the voltage check procedure in Section 5.4.2, Voltage, Frequency, and Phase Rotation Checks, to check voltage at the Source N (normal) or Source E (emergency) lugs.

If utility power is not available and the emergency generator set is not running, check that the generator set master switch is in the AUTO position. Verify that the generator set runs when the master switch is moved to the RUN position. If the engine does not start, troubleshoot the generator set as described in the generator set documentation. Otherwise, check the engine start circuit. See Section 6.7.

Note: Perform the service disconnect and control circuit isolation procedures before disconnecting or reconnecting the controller harness. See Section 1 for instructions.

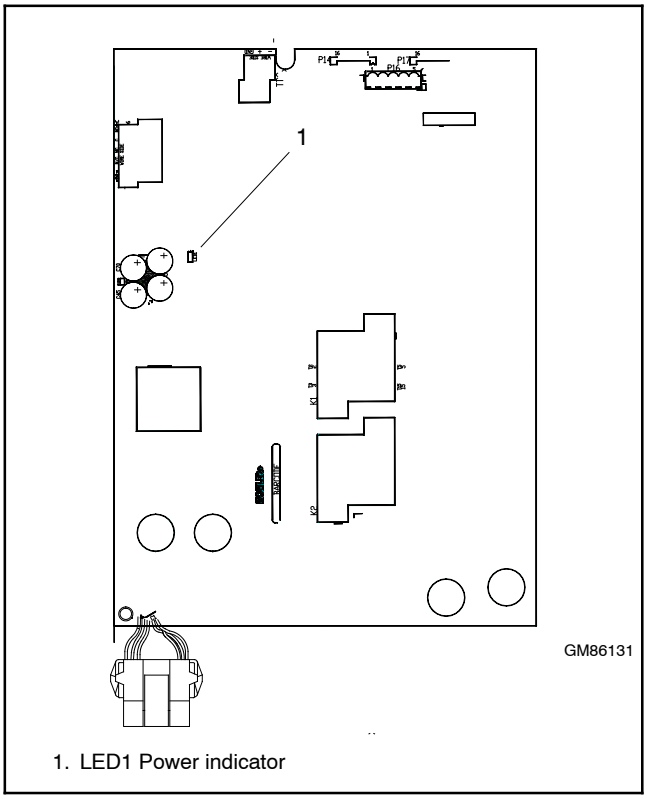
If the utility source is available but the transfer switch display is off, check for open source circuit breakers or switches. Verify that the transfer switch wiring harness is connected to the controller. See Figure 5-3.

An LED on the controller circuit board lights to indicate power to the controller. See Figure 5-4.



1. Controller connector P1

Figure 5-3 Transfer Switch Harness Connection to Control Board, Typical



1. LED1 Power indicator

Figure 5-4 LED1 Power Indicator on Controller Circuit Board

5.4.2 Source Voltage, Frequency, and Phase Rotation Checks

The voltage, frequency, and phase rotation 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 ratings of the utility source, transfer switch, and generator set, and verify that the ratings are all the same.

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.

Note: Source N is the source connected to the normal side of the transfer switch. Source E is the source connected to the emergency side of the transfer switch.

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

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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, Frequency, and Phase Rotation Measurement Procedure

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

1. Perform the service disconnect procedure described in Section 1.3 for service disconnect to OFF units or Section 1.2 for service disconnect to Emergency units.
2. Perform the control circuit isolation procedure described in Section 1.4 to remove power from the controller.
3. If Source N is a generator set, start the generator by moving the generator set master switch to the RUN position or pressing the RUN button on the generator controller.
4. 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!* The transfer switch has multi-tap voltage capability at the voltage transformers. See the transfer switch Installation/Operation Manual for instructions to change the transfer switch voltage configuration, if necessary.

   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, change the transfer switch voltage setting or follow the generator set manufacturer's instructions to adjust the generator set. See the transfer switch Installation/Operation Manual for instructions to change the transfer switch voltage configuration, if necessary.

5. Use a phase rotation meter to check the phase rotation at the Source N (normal) terminals. Rewire the transfer switch Source N terminals to obtain the correct phase sequence 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 Set Sources screen to change the phase rotation setting on the controller. See the controller operation manual for instructions.

6. If the source is a generator set, stop the generator set by moving the master switch to the OFF position.

7. Disconnect Source N by opening upstream circuit breakers or switches.
8. Manually operate the transfer switch to position N.
9. Repeat steps 3 through 6 for Source E. Then proceed to step 10.
10. Disconnect both sources to the transfer switch by opening the circuit breakers or switches.
11. 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 power is connected.

12. Close and lock the transfer switch enclosure door.
13. Reconnect both power sources by closing the circuit breakers or switches.
14. 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.

5.5 System Settings

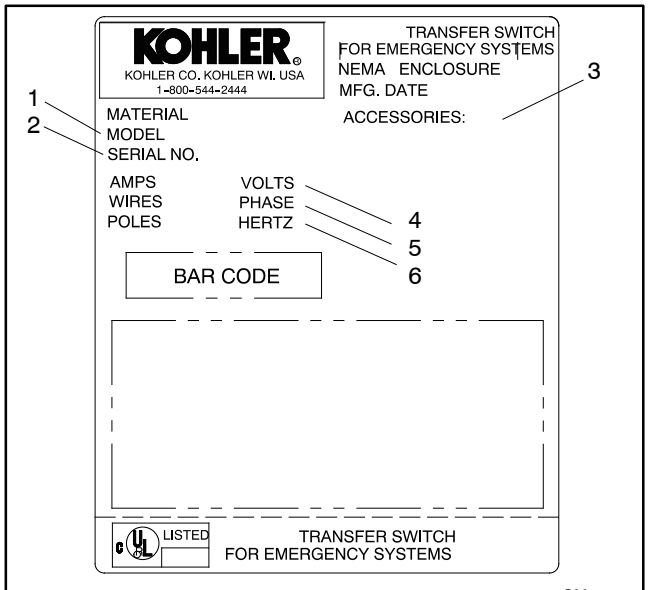
If the ATS does not recognize the source, check that the source voltage and frequency settings on the controller match the actual source parameters. Compare the controller settings to the ratings on the ATS nameplate and to the measured source parameters.

5.5.1 Controller Source Settings

Check the controller's source voltage, frequency, and phase settings. See the controller operation manual for instructions.

Check the controller settings and compare them to the voltage rating, frequency rating, and number of phases shown on the ATS nameplate. The nameplate is attached to the cover of the controller assembly, which is mounted on the inside of the transfer switch door. See Figure 5-5 for an illustration of the nameplate.

Note: The system voltage and frequency shown on the ATS nameplate must match the Source N and Source E voltage and frequency settings. Do not enter settings that do not match the nameplate ratings of the ATS.



1. Model designation
2. Serial number
3. Factory-installed accessory numbers
4. Voltage rating
5. Frequency rating
6. Number of phases (single or three)

Figure 5-5 Typical Transfer Switch Nameplate

Use the procedure in Section 5.4.2 to measure the source voltage, frequency, and phase rotation, and compare the measured values to the controller settings. Follow the instructions in the controller operation manual to change the controller settings if they do not match the measured source parameters.

5.5.2 Voltage and Frequency Pickup and Dropout Settings

Figure 5-6 illustrates the relative values of the voltage pickup and dropout settings. Typical frequency pickup and dropout settings relate to the nominal source frequency in a similar way.

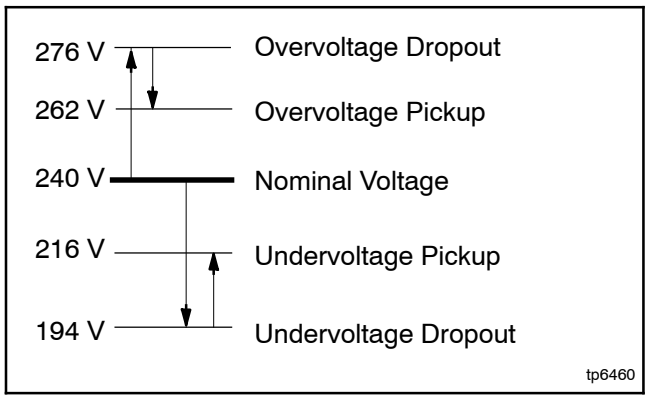


Figure 5-6 Relationship Between Voltage Pickup and Dropout Settings (default settings for 240-volt system shown)

If the source voltage rises above the overvoltage dropout setting or falls below the undervoltage dropout setting for a time longer than the debounce time, the controller will consider the source as failed. The source voltage must return to a level within the range of the pickup values for the controller to recognize the source as restored.

Choose pickup and dropout settings that allow a tolerable variation in the source parameters to prevent nuisance transfers caused by small changes in the source voltage and frequency.

Voltage and Frequency Sensing		
Parameter	**Default**	**Adjustment Range**
Undervoltage dropout	90% of pickup	75%–98%
Undervoltage pickup	90% of nominal	85%–100%
Overvoltage dropout *	115% of nominal*	106%–135%
Overvoltage pickup	95% of dropout	95%–100%
Voltage dropout time	0.5 sec.	0.1–9.9 sec.
Unbalance enable	Disable	Enable/Disable
Unbalance dropout	20%	5%–20%
Unbalance pickup	10%	3%–18%
* 690 volts, maximum. Default = 110% for 600 volt applications.		

Figure 5-7 Voltage Settings

Parameter	**Default**	**Adjustment Range**
Underfrequency dropout	99% of pickup	95%–99%
Underfrequency pickup	90% of nominal	80%–95%
Overfrequency dropout	101% of pickup	101%–115%
Overfrequency pickup	110% of nominal	105%–120%
Frequency dropout time	3 sec.	0.1–15 sec.

Figure 5-8 Frequency Settings

5.6 Time Delays

Check the time delays when troubleshooting problems with transfer switch operation.

Use the View Time Delays screen to check the settings for the adjustable time delays. Figure 5-9 shows the factory settings and adjustment ranges for the adjustable time delays. See the Operation Manual for more information.

Observe the controller's display to identify which time delay is executing at any given time. Initiate a test and observe as each programmed time delay executes. Compare the operation to the test sequence illustrated in the flowcharts in Figure 6-10 or Figure 6-9.

Time Delay Description	Description/Note	Default Time	Adjustment Range †
Engine Start, Source S2	Source S2 – Util/Gen and Gen/Gen modes	3 sec	0–6 sec*
Engine Start, Source S1	Source S1 – Use for Gen/Gen mode	3 sec	
Engine Cooldown, Source S2	Source S2 – Util/Gen and Gen/Gen modes	5 min	0–60 min
Engine Cooldown, Source S1	Source S1 – Gen/Gen mode	5 min	
Fail to Acquire Pref	If the preferred source does not reach acceptable voltage and stabilize within the allowed time, the Fail to Acquire Preferred Source fault is activated.	1 min	
Fail to Acquire Stby	If the standby source does not reach acceptable voltage and stabilize within the allowed time, the Fail to Acquire Standby Source fault is activated.	1 min	
Transfer (Xfr) Pref>Stby	Transfer delay, preferred to standby	3 sec	
Transfer (Xfr) Stby>Pref	Transfer delay, standby to preferred	15 min	
Transfer (Xfr) Off>Stby	Time in the OFF position (Preferred to Standby for programmed transition models only)	1 sec	1 sec–60 min
Transfer (Xfr) OFF>Pref	Time in the OFF position (Standby to Preferred for programmed transition models only)	1 sec	
In-Phase Xfr Fail (found in the Set Sources menu)	For in-phase monitoring: the time allowed for the two sources to come into synchronization within specified phase angle before a Fail to Sync fault is activated.	60 sec	10 sec–15 min
Load # Disc N>E	Disconnect load before-transfer to standby source. Used for time-based and current-based load control.	0 sec	0–60 min
Load # Rec N>E	Reconnect load after-transfer to standby source. Used for time-based load control.	0 sec	
Load # Disc E>N	Disconnect load before-transfer to preferred source. Used for time-based and current-based load control.	0 sec	
Load # Rec E>N	Reconnect load after-transfer to preferred source. Used for time-based load control.	0 sec	
Load # Add Source1/Source2	For current-based load control.	0 sec	
Load # Remove Srce1/Srce2	For current-based load control.		

* The optional external battery module allows extended engine start time delays from 0–60 min.

† Adjustable in 1 second increments.

Figure 5-9 Time Delays

5.7 Reset Data

Be sure to read and understand the information in this section before resetting.

5.7.1 Reset Maintenance Records

Reset the maintenance records after transfer switch service to update the last maintenance date and totals since reset that are displayed in the maintenance records screen.

5.7.2 Reset Event History

Resetting the event history clears the events from the event history log.

5.7.3 Reset Default Parameters

Resetting to the default parameters will reset **all** parameters, **including the system voltage and frequency**, to a factory default setting. The default system voltage and frequency settings may not match the settings for your application.

The transfer switch will not operate correctly if the system voltage and frequency do not match the sources. Use the Set Sources screen to set the system voltage and frequency after resetting to the default parameters. See the controller operation manual for instructions.

5.7.4 Reset and Disable Test Password

Reset the Test password to return the test password to the default, 0000.

Disable the test password to allow the user to start a test without entering a password.

Note: Disable the test password only during service unless the transfer switch is installed in a secure location.

5.7.5 Reset Data Procedure

Use the Reset Data menus to set records or parameters back to factory default settings. See Figure 5-10.

1. Use the black arrow buttons to step to the desired screen. See the following sections for information about each reset screen.
2. Press the open up arrow button to toggle Yes or No until Yes is displayed.
3. Press Save to reset the displayed records to the factory defaults. Pressing Back exits the screen without resetting.

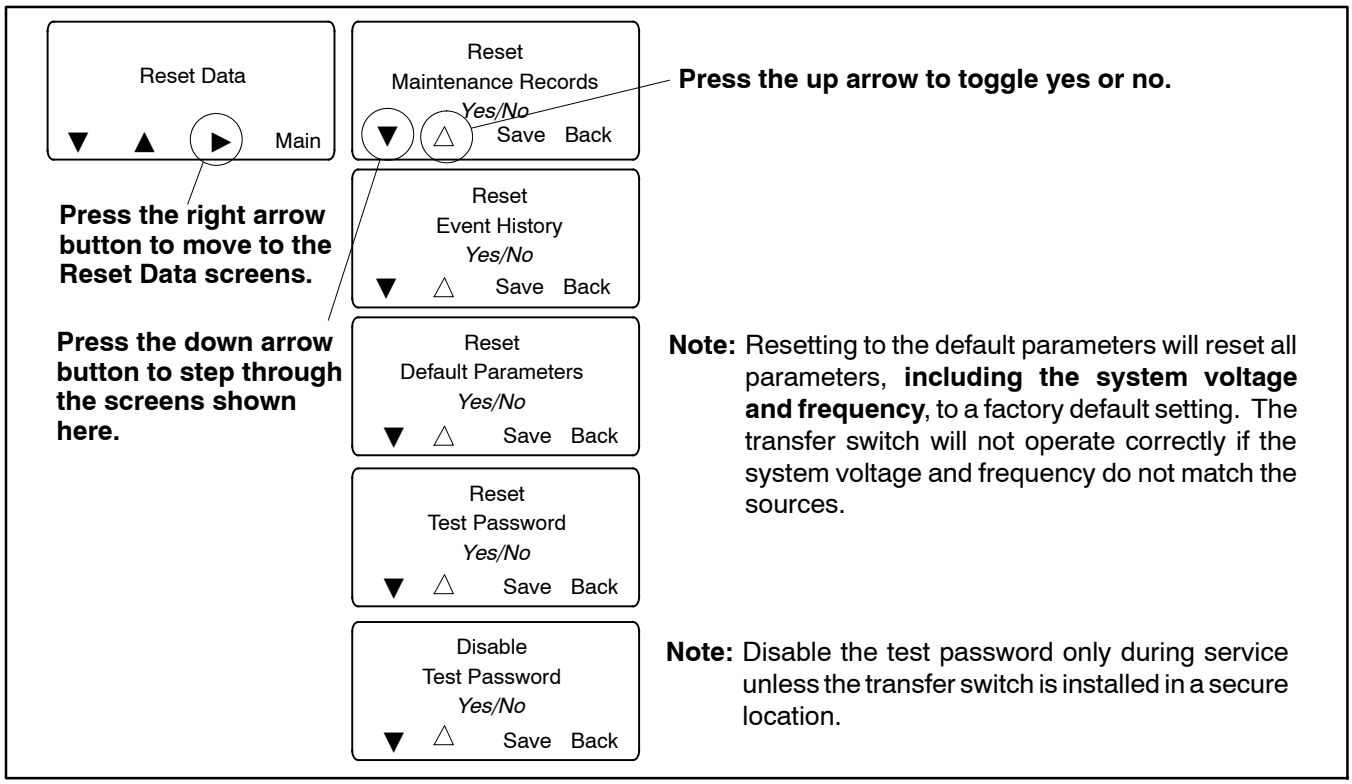


Figure 5-10 Reset Data

5.8 Warnings and Faults

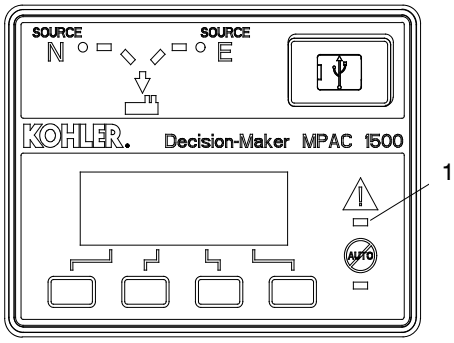
When a fault exists, the System Alert indicator lights, a designated output and the common fault output are turned on, and an appropriate message is displayed to indicate the fault. See Figure 5-11 for the location of the System Alert indicator.

ATS warnings and faults are shown in Figure 5-12. There are three types of warning/fault conditions:

Warning. Warnings automatically reset with a source availability change or a transfer request.

Fault Requiring Manual Reset. Under these conditions, normal ATS operation is halted. Active modes are turned off. If the contactor is in the preferred source position, the engine cooldown time delay executes and the engine start contacts open, allowing the generator set to shut down. See Section 5.8.1 for instructions to reset faults.

Self Resetting Faults. Under these conditions, active modes are turned off. If the contactor is in the preferred source position, the engine cooldown time delay executes and the engine start contacts open, allowing the generator set to shut down. When the fault condition is corrected, the fault is automatically cleared from the controller and normal ATS operation continues.



1. System Alert LED

GM85884

Figure 5-11 Fault Indication

Condition	Type	Description
Failure to Acquire Standby Source	Warning	The source voltage did not reach the acceptable range within a set time (see Time Delays). For example, the standby source generator set did not start.
Failure to Acquire Preferred Source	Warning	
IPM Synching (In-Phase Monitor Synching)	Warning (status)	The two sources did not come into phase within the Fail to Synchronize time delay. **Note:** If the sources do become in phase, the warning is automatically cleared and normal ATS operation continues.
External Battery Low	Warning	The voltage of the battery connected to the external battery supply module (EBSM) is low.
Failure to Transfer	Warning	The signal to transfer is sent to the contactor and the main shaft auxiliary switch fails to indicate a complete ATS position change. The controller will attempt to transfer the unit three times before the fault is indicated.
Auxiliary Switch Fault	Manual Reset Fault	The main shaft auxiliary switches indicate that the ATS is in more than one position, or the position changed when no signal was sent to initiate the change.
Auxiliary Switch Open	Manual Reset Fault	The main shaft auxiliary switches indicate that the ATS is in neither position (all inputs are open).
Src N (or Src E) Rotation Err	Self-Resetting Fault	The detected phase rotation of one or both sources does not match the preselected setting.
I/O Module Lost Comm	Self-Resetting Fault	An I/O device has stopped communicating or does not have a correct address specified. Fault resets if communication is reestablished.
Module Status Change	Self-Resetting Fault	An accessory module has been disconnected OR a new module is detected. See Section 5.8.2 to reset.
Module Status Conflict	Self-Resetting Fault	An accessory module has been replaced with a different type of module. See Section 5.8.3 to correct.
External Fault (Remote Common Alarm)	Self-Resetting Fault	The input contact assigned to the remote common alarm input function is closed.

Figure 5-12 Warnings and Faults

5.8.1 Fault Reset

To clear a fault or warning condition and reset the System Alert LED, go to the Main screen and press the down arrow button to open the Reset screen. See Figure 5-11 and Figure 5-13. Then press the button labelled Reset. A fault reset does not change the controller settings.

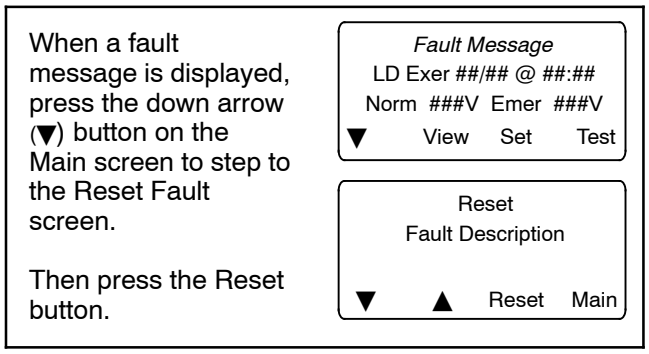


Figure 5-13 Fault Reset

5.8.2 Module Status Change

If the Module Status Change message appears on the controller display, first verify that the cable from the controller to the accessory module assembly is not loose or disconnected.

The Module Status Change message automatically clears if the fault condition is corrected (self-resetting fault).

Module Connection (new or reconnected module)

Installing or reconnecting one or more accessory modules triggers the Module Status Change message.

1. If the ATS display shows Module Status Change, press the Reset button. See Figure 5-14.

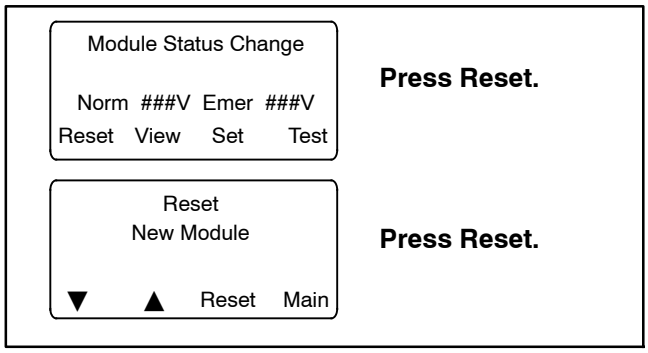


Figure 5-14 Screens after Module Connection

2. The ATS display will show Reset New Module. Press the Reset button from that screen. The controller recognizes the module type(s).

3. Navigate to the Set Input/Outputs>Set Aux I/O screen to check that the controller has recognized the connected modules. See Figure 5-15.

See the transfer switch operation/installation manual for instructions to assign programmable inputs and outputs to I/O modules or assign functions to the audible alarm for an Alarm Module.

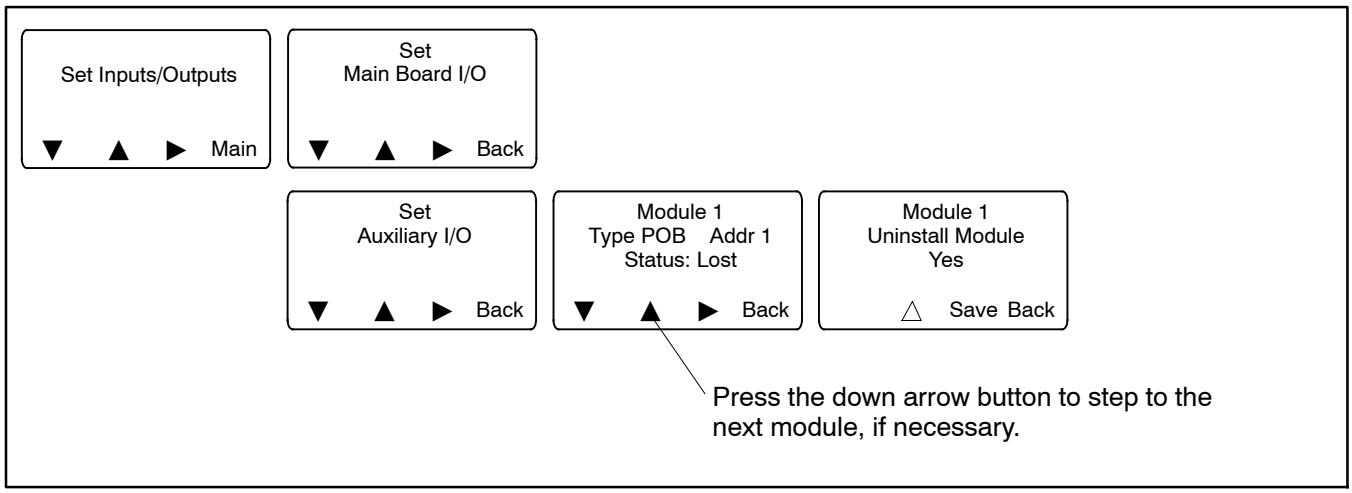


Figure 5-15 Uninstall Module

Disconnected Module

If one or more accessory modules are disconnected from the controller, the message Module Status Change appears. See Figure 5-16. Pressing the Reset button displays the message Check Module Setup to Clear Fault.

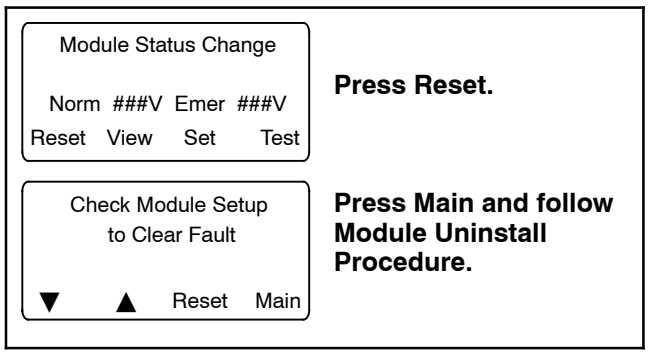


Figure 5-16 Screens after Module Disconnection

When modules are physically disconnected from the transfer switch, they must be uninstalled through the controller keypad. Use the following procedure to uninstall modules after disconnection.

Module Uninstall Procedure

1. If the ATS display shows Module Status Change, press the button labelled Reset.
2. If the ATS display shows Check Module Setup to Clear Fault,, press Main to return to the main screen.
3. Press Set to enter setup mode.
4. Enter the setup password.
5. Press the down arrow to step to the Set Inputs/Outputs screen. See Figure 5-15.
6. Navigate to the Set Auxiliary I/O screen. See Figure 5-15. Press the right arrow button to see the status of module 1. Press the down arrow to step to the next module, if necessary, until the screen shows Status: Lost.
7. Press the right arrow button to move to the Uninstall Module screen. Verify that the screen says Uninstall Module Yes. (Press the open arrow button to toggle no/yes, if necessary.)
8. When Yes is displayed, press Save to uninstall the module.
9. Repeat the uninstall procedure for additional modules, if necessary.

Other Module Status Change Conditions

A Module Status Change message that cannot be cleared as described above may indicate a failure of the controller's real-time clock. Carefully follow the procedures above to attempt to reset the fault. If the fault cannot be reset, replace the controller. See Section 6.11.

5.8.3 Module Status Conflict

The message Module Status Conflict appears if one type of module is replaced with another type of module that has the same address. Follow the procedure below to resolve the conflict.

Procedure to Clear a Module Status Conflict

1. Disconnect power to the transfer switch.

   Note: Do not disconnect modules with the power connected. Connecting or disconnecting modules when the power is connected will damage the ATS controller.

2. Disconnect the module.
3. Close the enclosure door and reconnect power to the ATS. The display will show Module Status Change.
4. Press the button labelled Reset. The display will show Check Module Setup to Clear Fault.
5. Follow the procedure in Section 5.8.2 to uninstall the module through the ATS controller keypad.
6. Disconnect power to the ATS.
7. Connect the new module.
8. Close the enclosure door and reconnect power to the ATS. The display will show Module Status Change. See Figure 5-14.
9. Press the button labeled Reset to display Reset New Module. Press the reset button from that screen. The controller will now recognize the new module type.
10. Navigate to the Set Auxiliary I/O screen to check the status and settings for the new module. See Figure 5-15. Press the right arrow button to see the status of module 1. Press the down arrow to step to the next module, if necessary,

See the transfer switch operation/installation manual for instructions to assign programmable inputs and outputs to I/O modules or assign functions to the audible alarm for an Alarm Module.

5.9 Common Alarms

Any of the functions listed in Figure 5-17 can be assigned to Common Alarms 1 and 2. Common alarms 1 and 2 can then be assigned to output functions which activate when any of the conditions assigned to the common alarm are present. Common Alarms 1 and 2 can also be set to sound the alarm horn on the optional Alarm Module.

Functions that can be Assigned to Common Alarms	
Preferred Source Available	Source 2 Over Frequency
Standby Source Available	Source 2 Under Frequency
Contactor in Preferred	Failure to Acquire Standby *
Contactor in Standby Position	Failure to Acquire Preferred *
Contactor in OFF Position	Fail to Transfer *
Contactor in Source1 Position	Module Communication Loss *
Contactor in Source2 Position	Auxiliary Switch Fault *
Not in Automatic Mode	Auxiliary Switch Open *
ATS Load Control is active	Software Controlled RDO #1 is Active
Standby Battery Low *†	Software Controlled RDO #2 is Active
Exerciser is Active	Software Controlled RDO #3 is Active
Test Mode is Active	Software Controlled RDO #4 is Active
Peak Shave Mode is Active	Remote Common Alarm Input *
Non-Emergency Transfer is Active (Peak Shave/ Exerciser/Test) †	User Input #1 is Active
Load Bank Control is On	User Input #2 is Active
In-phase Monitor Waiting for Synchronization	User Input #3 is Active
Source 1 Under Voltage	User Input #4 is Active
Source 1 Over Voltage	System Ready
Source 1 Phase Imbalance	Critical Service Required
Source 1 Loss of Phase	Non-Critical Service Required
Source 1 Phase Rotation Error *	Source 1 is Available
Source 1 Over Frequency	Source 2 is Available
Source 1 Under Frequency	Supervised Transfer Waiting
Source 2 Under Voltage	Audible Alarm
Source 2 Over Voltage	Assigned to Common Alarm 2
Source 2 Phase Imbalance	Assigned to Common Alarm 1
Source 2 Loss of Phase	
Source 2 Phase Rotation Error *	
* Assigned to Critical Service Required † Assigned to Non-Critical Service Required	

Figure 5-17 Common Alarm Functions

If the common alarm is activated, the specific condition that triggered the alarm will be shown on the ATS controller display screen. Check the display to identify the problem and then refer to the troubleshooting tables in Sections 5.10 and 5.11.

Use the View Common Alarms screen to identify which functions have been assigned to each common alarm. See the operation and installation manual for instructions to check the view screens and to change the settings, if necessary.

Selected functions as noted in Figure 5-17 are grouped into the Critical Service Required and Non-Critical Service Required functions. The Critical Service Required and Non-Critical Service Required functions can be assigned to activate the alarm horn on the optional Alarm Module. If any of the conditions included in the Critical Service Required or Non-Critical Service Required function occurs, the alarm horn will sound. The message on the ATS display will identify which condition (for example, Fail to Acquire Standby) triggered the alarm and caused the horn to sound.

5.10 Events and Faults Troubleshooting Table

The following tables list the faults and alarms that may be shown on the controller's display screen or listed in the event history log. The tables also list the possible causes for each problem and suggested procedures to identify and correct the source of the problem.

The event history log also lists transfers and other normal events not shown in these tables.

The event history can also be viewed in SiteTech™ software. See Section 4 and/or the SiteTech Software Operation Manual for instructions.

Fault or Event Message	Possible Cause	Check	See Section
Overfrequency, Underfrequency	Frequency settings	Check that the system frequency setting matches the actual source frequency (50 or 60 Hz).	5.5
		Check the over/underfrequency pickup and dropout settings. See Section 5.5.2 and the Setup Program Operation Manual.	5.5
		Check that the frequency debounce setting is long enough to prevent nuisance faults caused by brief frequency variations.	5.5
	Source availability, stability	Check that the source frequency matches the nominal system frequency and stays within the range of the pickup and dropout settings.	5.4.2 5.5
	Source connections	Check for loose connections. Check wiring.	W/D
Overvoltage, Undervoltage	Voltage settings	Check that the system voltage setting matches the actual source voltage.	5.4.2 5.5
		Check the over/undervoltage pickup and dropout settings.	5.5 5.5.2
		Check that the voltage debounce setting is long enough to prevent nuisance faults caused by brief voltage dips or spikes.	5.5
	Source availability, stability	Check that the source voltage matches the nominal system voltage and stays within the range of the pickup and dropout settings.	5.4.2 5.5
	Source connections	Check for loose connections. Check wiring.	W/D
	Calibration error	Check the ATS calibration.	6.12
Loss of Phase	Single/three phase setting does not match source	Check that the controller single/three phase setting matches the source.	5.5
	One phase of the source has been lost	Check that all phases of the source are available.	5.4.2
	Source connections	Check for loose connections.	
Source Rotation Error	Phase rotation setting (ABC or BAC) does not match source	Check that the controller phase rotation setting matches the source phase rotation (ABC or BAC). Check the source connections to the transfer switch and verify that A,B, and C are connected to the appropriate lugs. Change the controller phase rotation setting or rewire the source connections if necessary.	5.5
Source1 or Source2 Breaker Trip	An overcurrent condition has tripped the circuit breaker.	Check the load for short circuits or malfunctioning equipment. Identify the cause of the overcurrent condition before resetting the fault. ICCB breakers require manual reset.	ATS O/I/M
	Controller cannot determine the transfer switch position	Check wiring and connections to position limit switches. See the schematic drawing for connections.	W/D
		Test the position limit switch operation. Replace limit switch if necessary.	
		Transfer switch in intermediate position. Manually operate the transfer switch. See the ATS Operation/Installation Manual for manual operation instructions and safety precautions.	ATS O/I/M

Fault or Event Message	Possible Cause	Check	See Section
Failure to Transfer	Transfer switch mechanism problem	See Section 5.11, Troubleshooting.	5.11
Failure to Acquire Standby	Generator set did not start	See Failure to Start Generator Set, below.	
	Open circuit breaker	Check and close ATS source and generator set circuit breakers.	—
	ATS does not recognize the standby source	Check source voltage, frequency, phase rotation settings and compare to actual values.	5.4.2 5.5
		Check for loose source connections. Check the labels on the switch for tightening torques.	3.3
		Check for open switch or circuit breaker to the source.	—
		Check ATS calibration.	6.12
		Check voltage sensing. See Figure 5-19, Voltage Sensing Troubleshooting flowchart.	5.13
Failure to Acquire Preferred	Open circuit breaker	Check and close ATS source and generator set circuit breakers.	
	ATS does not recognize the source	Check source voltage, frequency, phase rotation settings and compare to actual values.	5.4.2 5.5
		Check for loose source connections. Check the labels on the switch for tightening torques.	3.3
		Check for open switch or circuit breaker.	—
		Check ATS calibration.	6.12
		Check voltage sensing. See Figure 5-19, Voltage Sensing Troubleshooting flowchart.	5.13
External Battery Low	Low generator set engine starting battery voltage	Check battery connections and voltage. Charge or replace battery if voltage is low.	Generator set manuals
Module Status Change	A new accessory module is detected	Press the reset button to open Reset New Module screen. Then press Reset again.	5.8.2
	A module has been disconnected	Check connections from the controller to the I/O module assembly and at the top of each I/O module. Verify that the module is securely installed. If a module has been removed, go to Set Inputs/Outputs screen and uninstall the module.	5.8.2
	Communication to an installed I/O module has been lost	Check I/O module connections.	5.8.2
	Real-time clock failure on controller board	If the procedures in Section 5.8.2 fail to clear the error message, replace the controller.	5.8.2 6.11
Module Status Conflict	One type of module was replaced with another type of module that has the same address	Follow the procedure in Section 5.8.3 to uninstall the old module and then install the new module.	5.8.3
External Fault	Fault condition in customer-supplied equipment connected to external input	Identify and correct the cause of the fault condition.	Manuals for connected equipment
	Loose or faulty connection	Check connection to external input.	ATS OIM

5.11 Troubleshooting Table

The following table lists potential problems with possible causes and suggested remedies. Section numbers in the last column refer to other sections of this manual.

Also see Section 5.13, MPAC Controller Troubleshooting Flowcharts.

Always follow the safety precautions at the beginning of this manual when troubleshooting and servicing the transfer switch.

Problem	Possible Cause	Check	See Section
No LEDs illuminated and/or display is blank	No power to the transfer switch	Check that source switches or circuit breakers between the sources and the transfer switch are closed.	—
		Verify that at least one source is available. Check for utility or gen set voltage to the ATS.	5.4.2
		Check source connections to the normal and emergency lugs on the ATS.	
	No power to the controller	Check that the transfer switch harness is connected to the controller.	Figure 5-3
		Check the harness for loose connections or broken leads (continuity check).	W/D
	One or more faulty LEDs	Press the Lamp Test button to check the operation of all LEDs. Replace the controller if one or more LEDs do not light during the lamp test. If no LEDs light during the lamp test, troubleshoot power and connections to the controller as described above.	6.1.2 6.11 6.4
	See Figure 5-20, Blank Display Troubleshooting.		5.13
Strange characters on controller display or controller lockup	See Figure 5-23, Troubleshooting Display Errors or Controller Lockup.		5.13
Source available LED off when Source is available	Malfunctioning LED	Press the Lamp Test button to check the operation of all LEDs. Replace the controller if one or more LEDs do not light. If no LEDs light, troubleshoot power and connections to the controller.	6.1.2
	Source settings do not match actual source parameters	Check the source voltage, frequency, and phase rotation settings. See the ATS Operation Manual for instructions.	5.5
	Incorrect ATS meter calibration	Check calibration.	6.12
Position LED not lit	Transfer switch in intermediate position	Manually operate the transfer switch and check the position LED operation.	TOC
	LEDs not functioning	See *No LEDs illuminated* in this table.	—
O/I/M= ATS Operation and Installation Manual; O/M = Controller Operation Manual; W/D = Wiring Diagrams			

Problem	Possible Cause	Check	See Section
Generator set engine runs when it should not	ATS does not recognize the Normal source	Is the normal (utility source available? Check the normal source available LED on the ATS controller. If not lit, check for utility voltage to the transfer switch normal lugs. Check source connections to the transfer switch.	5.5
		Check that the ATS settings for voltage, frequency, and phase rotation are correct for the normal source. Check the transfer switch voltage calibration.	O/M
	Utility Power Switching Device has opened due to an over current condition.	Identify and correct the cause of the overcurrent condition. Then manually reset the power switching unit.	Breaker instructions
	ATS not in the expected position	Check the ATS position LEDs to verify that the ATS is in the normal position. Check the position of the preferred source selector switch, if equipped. If the preferred source selector switch is set to Emergency, the ATS will remain in the emergency position and generator set will run, even if the utility source is available.	6.1
	Exerciser is running	Check the controller display for Exerciser Active message. Press the END button to end an exercise run, if necessary. A remote switch may be signalling an exercise run. Check for remote exercise inputs.	O/M
	Test sequence is running	Check the controller display for indication that a test sequence is active. Press the END TEST button to end a test sequence, if necessary. A remote switch may be signalling a test run. Check for remote test inputs.	O/M
	Engine cooldown time delay operating	Check for Engine Cooldown message on the controller display. Press End Delay button to end the cooldown delay, if necessary. Check the ATS controller engine cooldown time delay setting.	5.6 O/M
		Check the generator set controller for operation of a separate engine cooldown cycle.	Generator O/M
	Engine start connection closed	Check the wiring and connections to the engine start contacts on the ATS and the generator set. Check for shorts or incorrect connections.	ATS O/I/M W/D
		Test the engine start contact operation. Disconnect the engine start leads. If the engine stops, the display shows System Ready, and the Normal source is available, check for continuity between pins 8 and 9 of the P1 plug. If there is continuity, the start relay is being held closed when it should be open. Replace the controller.	6.7
	Generator set not in AUTO	Put the generator set into automatic (AUTO) mode. Wait for the generator set engine cooldown delay, if necessary.	Generator set manuals
	Other generator set problem	Disconnect the engine start leads from the ATS. If the engine continues to run, troubleshoot the generator set.	
O/I/M= ATS Operation and Installation Manual; O/M = Controller Operation Manual; W/D = Wiring Diagrams			

Problem	Possible Cause	Check	See Section
Generator set engine does not start	Engine start time delay is running	Check the controller display to see if the engine start time delay is active. Wait for the engine start time delay to expire. Press End Delay button to end the delay early, if necessary.	5.6
		See the ATS controller Operation Manual for instructions to change the engine start time delay setting, if necessary.	O/M
	Loose engine start connection	Check for loose engine start connection on the ATS and the generator set. Tighten connections and/or replace wiring if necessary.	ATS O/I/M Generator manuals
	No engine start signal from the ATS	Follow the procedure in Section 6.7 to test the engine start contact operation.	6.7
	Generator set master switch not in the AUTO position	Check that the generator set is in AUTO. Refer to the generator manuals for instructions, if necessary.	Generator set manuals
	Generator set problem	If the ATS is sending an engine start signal and the the generator set is in AUTO, troubleshoot the generator set for failure to start. Refer to the generator set and engine manuals for instructions.	
Exerciser does not start generator set	Exerciser not set	Use View Exercise Setup screen to check exerciser settings. See the ATS controller operation manual for instructions to check and change the exerciser settings.	O/M
	Check that exercise run duration is not set to zero	Use View Exercise Setup screen to check exerciser settings. See the ATS controller operation manual for instructions to check and change the exerciser settings.	O/M
	Loose or open engine start connection	Check the wiring and connections to the engine start terminals on the ATS and the generator set. Engine start terminal locations vary with transfer switch model and size. See the ATS installation manual or ADV drawing for the engine start terminal location, if necessary.	ATS O/I/M
	Engine start problem	Follow the procedure in Section 6.7 to test the engine start operation. Also see *Generator set engine does not start* in this table.	6.7
Exerciser does not run regularly or at all	Exerciser not set	Use View Exercise Setup screen to check exerciser settings.	O/M
	Maintenance DIP switch SW1B closed	Check for Maintenance Mode message on controller display.	—
		Check the maintenance DIP switch setting.	6.8
	Exercise interval different than expected	Use View Exercise Setup screen to check exerciser settings.	O/M
O/I/M= ATS Operation and Installation Manual; O/M = Controller Operation Manual; W/D = Wiring Diagrams			

Problem	Possible Cause	Check	See Section
Failure to transfer	Alternate source is not available	Check that the source available LED on the ATS controller is lit. Check the source connections to the ATS normal and/or emergency lugs. Check that circuit breakers and/or switches between the source and ATS are closed. Check source voltage and frequency. See Section 5.4.2 for instructions. Check that the ATS settings for voltage, frequency, and phase rotation are correct for the both sources. Check the transfer switch voltage calibration. See Section 6.12 for instructions.	3.3 5.4.2 5.5
	AC voltage sensing is incorrect	Perform troubleshooting procedures in Figure 5-19.	5.13
	Unloaded exercise selected	Use View Exercise Setup screen to check exerciser settings.	O/M
	Unloaded test sequence selected	Press the End Test button, wait for the test sequence to stop, and then select a Loaded or Auto Loaded test sequence. For remote tests, check the Remote Test loaded/ unloaded setting. See the ATS Operation Manual for instructions.	ATS O/M
	Pre-transfer time delays operating	Check controller display for time delay indication. See the operation manual for information on time delays during normal operation.	ATS O/I/M
		Check the time delay settings on the ATS controller.	5.6
	Maintenance DIP switch enabled	Check DIP switch setting.	6.8
	Connected source available	Check the Source Available LEDs. if the normal or preferred source is available the ATS will not transfer automatically.	6.1
	Preferred source selection set to emergency and emergency source is available	Check the preferred source selection and the Source Available LEDs.	—
	Supervised transfer control switch (optional) in manual position	Check the position of the supervised transfer control switch, if equipped. Move the switch to the TRANSFER or AUTO position, as appropriate for the application.	ATS O/I/M
	Programmed-transition interface board (PTIB) malfunction.	Check the connections and relays on the PTIB.	6.9
	Controller or controller connection problem.	Perform the troubleshooting procedures in the Transfer Troubleshooting flowchart in Figure 5-21 and Figure 5-22.	5.13
	Harness is disconnected from the control circuit isolation switch.	Disconnect power by performing the Service Disconnect and Control Circuit isolation procedures in Section 1. Then connect the harness.	1
O/I/M= ATS Operation and Installation Manual; O/M = Controller Operation Manual; W/D = Wiring Diagrams			

5.12 Power Switching Device Troubleshooting

5.12.1 MCCB Circuit Breakers

Transfer switches with MCCB breakers use the ABB circuit breakers shown in Figure 5-18. Refer to the circuit breaker manufacturer's documentation provided with the transfer switch for more information.

5.12.2 ICCB Circuit Breakers

Transfer switches with ICCB breakers use Square D type NW circuit breakers. Refer to the circuit breaker manufacturer's documentation for more information.

ABB Frame	Amps	Trip Unit	Type	Trip Unit Function
Ts3	100	Non-interchangeable	Bimetal/Electromagnet	Thermal/Magnetic
Ts3	150	Non-interchangeable	Bimetal/Electromagnet	Thermal/Magnetic
Ts3	200	Non-interchangeable	Bimetal/Electromagnet	Thermal/Magnetic
T4	250	PR221	Electronic	LS/I
T5	400	PR221	Electronic	LS/I
T6	600	PR221	Electronic	LS/I
T6	800	PR221	Electronic	LS/I
S7	1000	PR212	Electronic	LSIG
S7	1200	PR212	Electronic	LSIG

Figure 5-18 ABB Circuit Breakers

5.12.3 Troubleshooting Table

Problem	Probable Causes	Corrective Actions
The power switching device cannot be opened locally.	Open pushbutton locked.	Remove the locking.
	Faulty mechanism or main circuits bonded.	Contact service department.
The power switching device cannot be manually closed.	Power switching device closing on short-circuit.	Clear the fault. Check power switching device condition before putting back into operation.
	Fault trip indicator on power switching device button not reset (service entrance type ATS).	Reset fault trip indicator-button.
	Power switching device not fully connected (drawout type only).	Connect power switching device fully.
	Antipumping function.	Move transfer mode switch to the manual position, then back to the auto position to cycle the control signal.
	Power switching device not charged.	Check the geared motor power supply is greater than 85% nominal voltage. Check the power supply circuit. Attempt a manual recharging. Replace the geared motor if necessary. (Contact service department).
	Closing coil is continuously supplied.	Move transfer mode switch to the manual position, then back to the auto position to cycle the control signal.
	Power switching device locked in *open* position.	Remove the locking.
	Power switching device interlocked.	Check whether this refusal to close is not normal.
The power switching device does not recharge electrically.	Charge motor supply voltage too low (less than 85% nominal voltage).	Apply a voltage greater than 85% nominal voltage. Check the charge motor electrical circuit. Attempt to recharge manually. If problem continues, mechanism is faulty. Contact service department. If okay, motor is faulty. Replace it.

5.13 MPAC Controller Troubleshooting Flowcharts

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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)

Problems with the MPAC controller can often be traced to incorrect controller settings, faulty wiring, or a bad circuit board. Use the troubleshooting flowcharts in this section to diagnose problems and identify the parts that require service or replacement. If the controller circuit board fails, replace the controller.

Use the troubleshooting flowcharts in Figure 5-19 through Figure 5-23 to diagnose and correct the following problems on the MPAC controller.

- Incorrect voltage sensing
- Blank display
- Slow or no transfer to utility
- Strange characters on display or controller lockup

Refer to the operation/installation manual and wiring diagrams provided with the transfer switch during the procedure. See Figure 5-24 for an illustration of the controller circuit board and contactor connection.

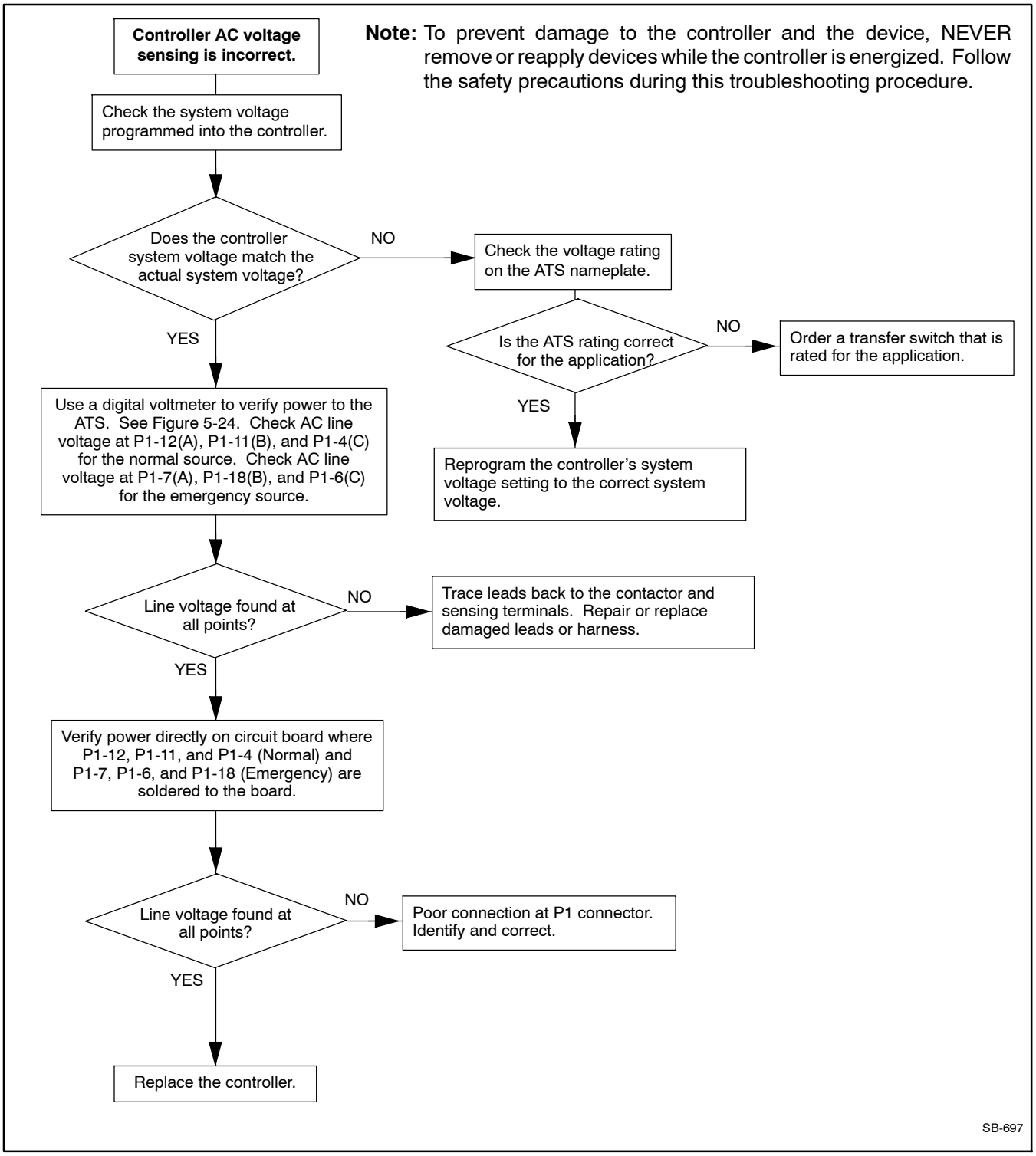


Figure 5-19 Voltage Sensing Troubleshooting

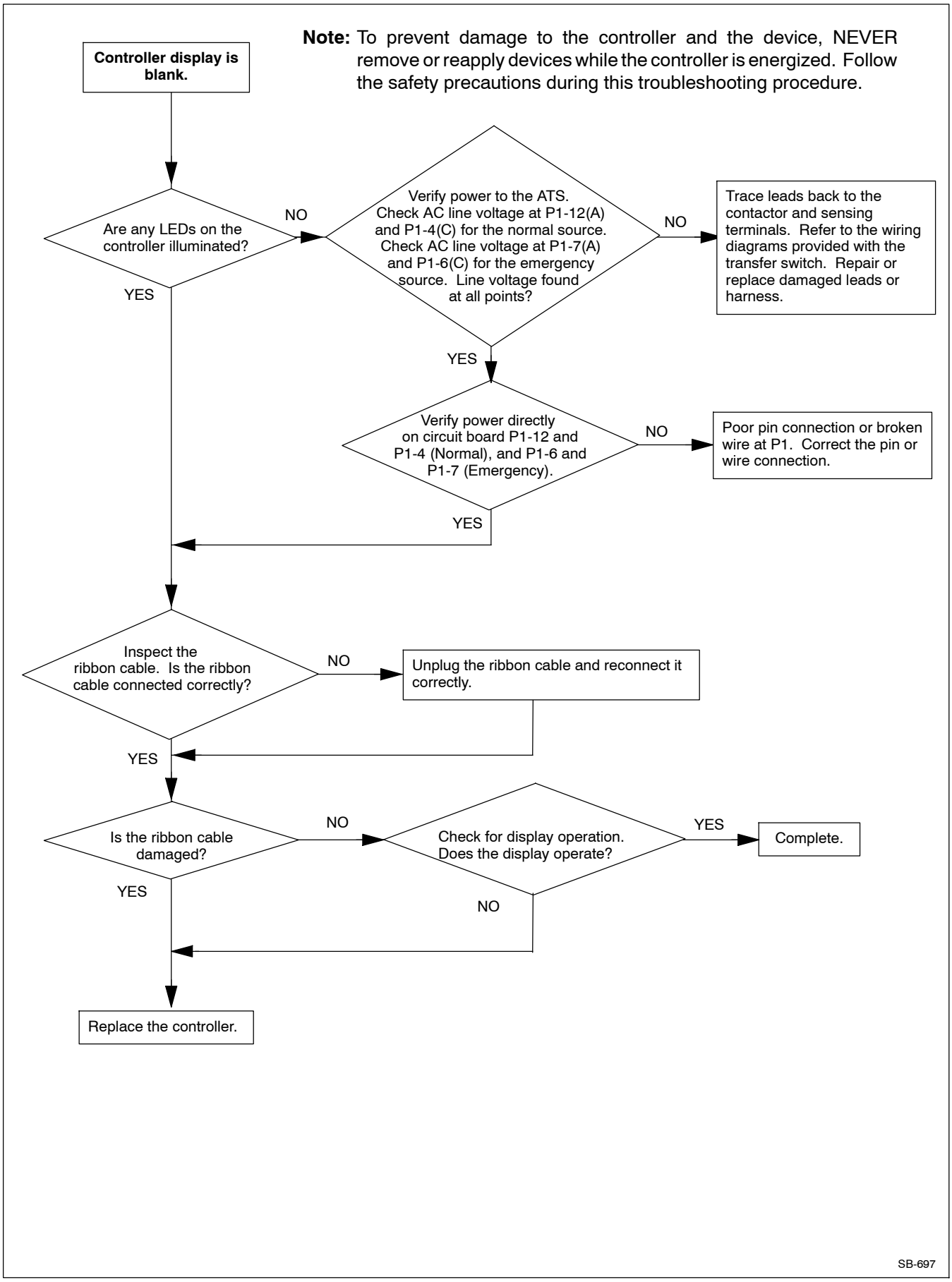


Figure 5-20 Blank Display Troubleshooting

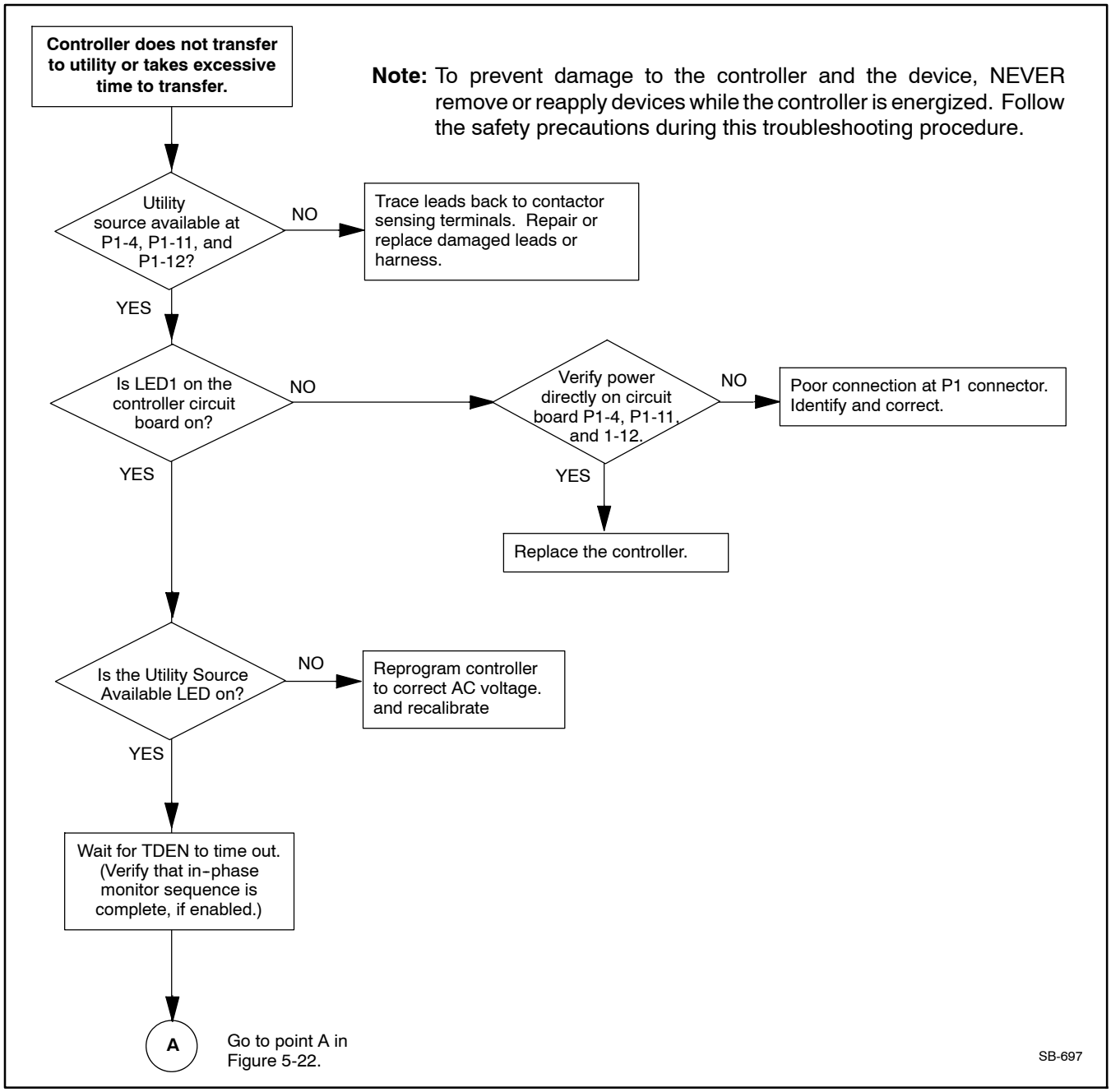


Figure 5-21 Transfer Troubleshooting, Part 1

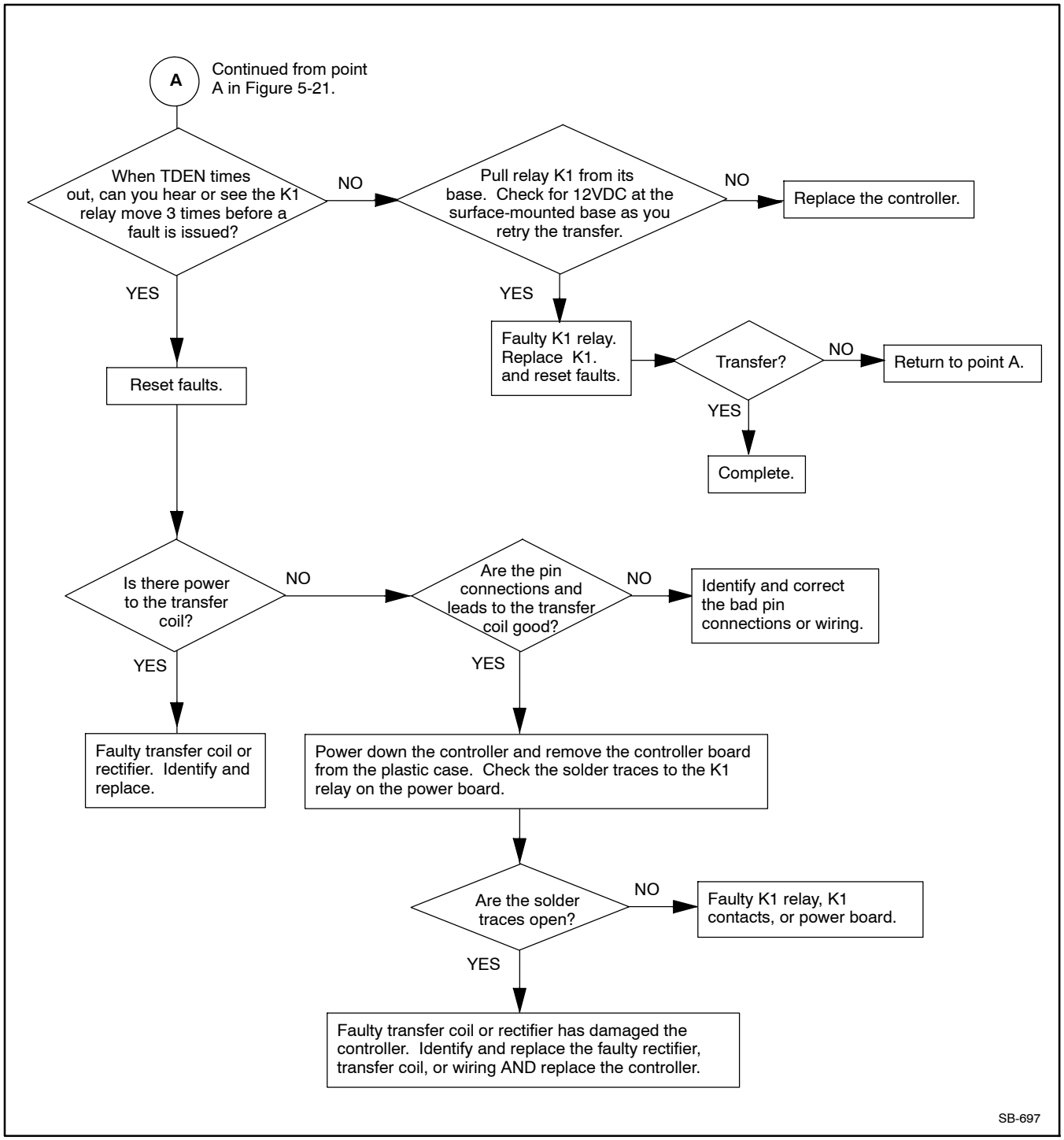


Figure 5-22 Transfer Troubleshooting, Part 2

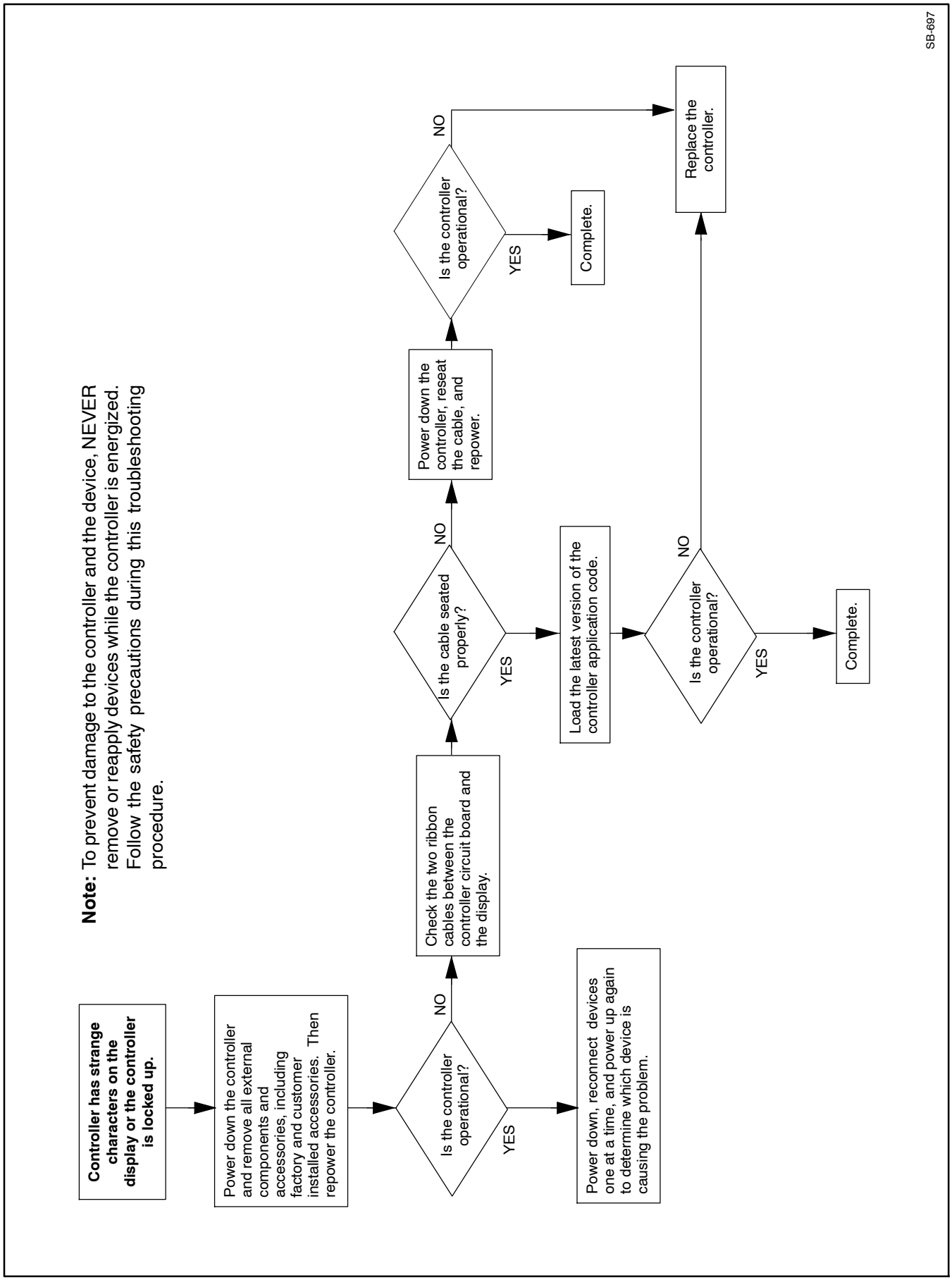


Figure 5-23 Troubleshooting Display Errors or Controller Lockup

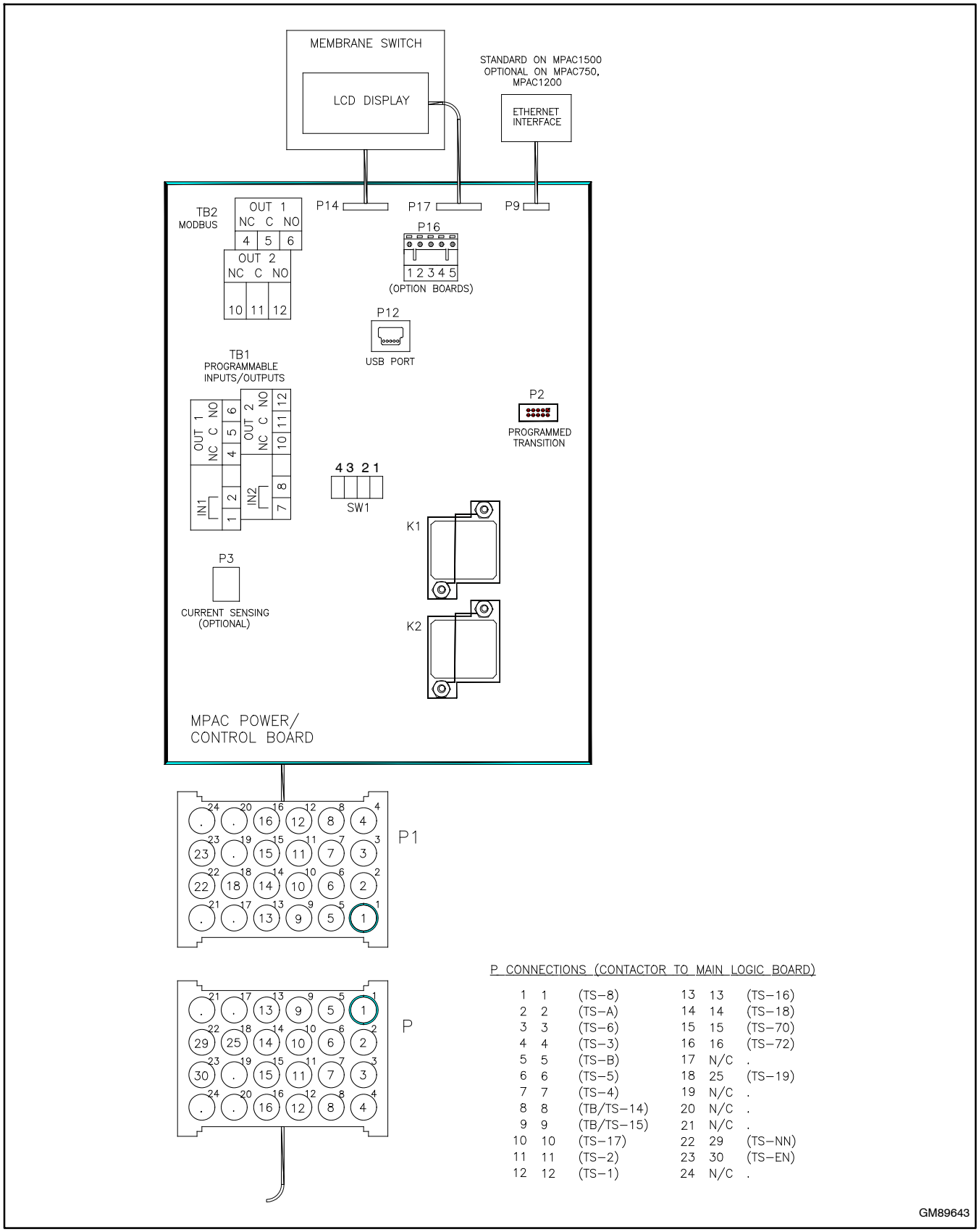


Figure 5-24 MPAC Controller Circuit Board and P1/P Connections

6.1 User Interface Panel

The user interface panel is located on the transfer switch door. Figure 6-2 shows the user interface panel for the the Decision-Maker® 1500 controller.

6.1.1 Display

The four-line display on the Decision-Maker® MPAC 1500 controller indicates transfer switch status and setup, including the following:

- System status
- Faults and warnings
- Active time delays
- Source voltages
- Source frequency (Hz)
- Current (amps)
- Source setup information
- Time and date
- Time and date of next scheduled exercise

The display also identifies the pushbutton functions, which can change from screen-to-screen.

6.1.2 Lamp Test

To test the LEDs on the controller's user interface, go to the Main screen. Press the down arrow button once, then press the Lamp Test button and verify that all 6 LEDs on the user interface illuminate. See Figure 6-1.

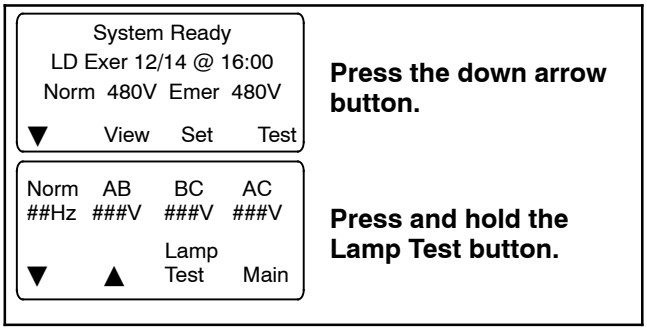
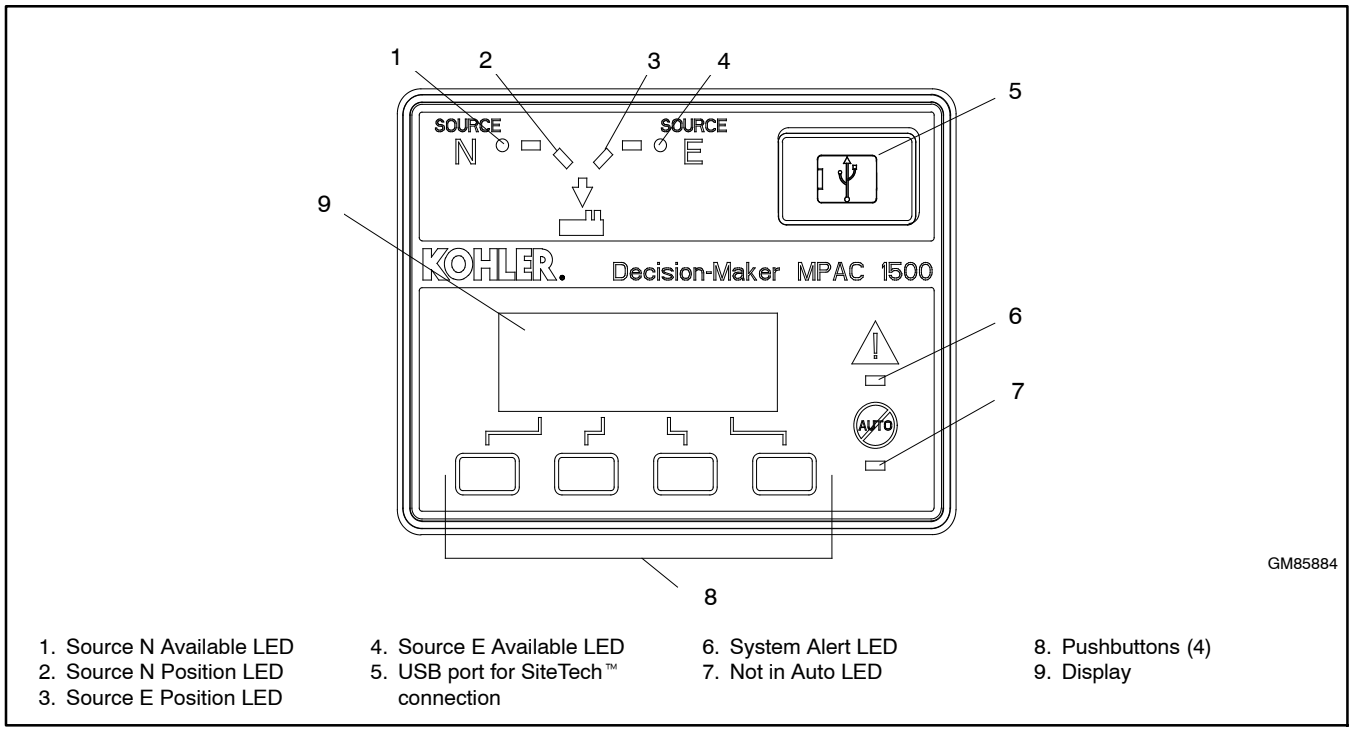


Figure 6-1 Lamp Test



1. Source N Available LED
2. Source N Position LED
3. Source E Position LED
4. Source E Available LED
5. USB port for SiteTech™ connection
6. System Alert LED
7. Not in Auto LED
8. Pushbuttons (4)
9. Display

Figure 6-2 User Interface Panel, Decision-Maker® MPAC 1500 Controller

6.1.3 LED Indicators

LEDs on the user interface indicate contactor position, source availability, faults, and other conditions. Figure 6-3 describes the functions of the LED indicators. See Section 5.8 for more information about warnings and faults.

LED Indicator	Condition
Source N Available, Green	Source N is available.
Source E Available, Red	Source E is available.
Position A, Green	Contactor is in Normal position.
Position B, Red	Contactor is in Emergency position.
System Alert, Red	Fault. Identify and correct the cause of the fault condition, then reset faults at the controller. See Section 5.8.
	Input active: Low Battery Voltage or Remote Common Alarm.
Not in Auto, Red	ATS is not set for automatic operation or a load shed (forced transfer to OFF) sequence is active.
	Flashes for manual transfer waiting.
	Input active: Inhibit Transfer or Forced Transfer to OFF.

Figure 6-3 User Interface LED Indicators

6.1.4 Pushbuttons

The controller user interface panel has four pushbuttons below the display. Pushbutton functions are shown above each button in the last line of the display and can change from screen-to-screen.

The pushbutton functions are defined in Figure 6-4. See the controller operation manual for instructions to use the pushbuttons to navigate the controller menus and change settings.

▼	Down arrow (closed). Step down to the next screen or scroll through a list.
▲	Up arrow (closed). Step back to the previous screen.
▶	Right arrow (closed). Move to the next submenu.
△	Up arrow (open). Increases the selected numerical value.
▽	Down arrow (open). Decreases the selected numerical value.
▷	Right arrow (open). Steps to the next digit in a selected numerical value.
Back	Steps back to the previous screen or submenu.
End Delay	Ends the current time delay.
End Test	Ends an active test sequence. See Section 6.5.
OK	Enters the displayed numerical value (password or setting).
Main	Returns to the main screen.
Next	Steps to the next parameter in an item with multiple settings (for example, in Exerciser Setup).
Reset	Reset the fault condition shown on the display, or reset an accessory module after connection.
Save	Saves settings shown on the display.
Set	From the main screen, moves to the first setup screen.
Start	From the Test screen, starts the test sequence.
Test	From the main screen, moves to the test sequence screens.
View	From the main screen, moves to the first view screen.

Figure 6-4 MPAC 1500 Pushbutton Functions

6.2 Controller Parts

These controller parts are replaceable:

- Relays K1 and K2
- Programmed-transition interface board (PTIB)
- Ethernet communication board
- Ribbon cables for PTIB and Ethernet boards
- Controller assembly, which includes the controller circuit board with contactor connector P1, K1 and K2 relays, plastic housing, and user interface with ribbon cable.

These controller parts are NOT replaceable:

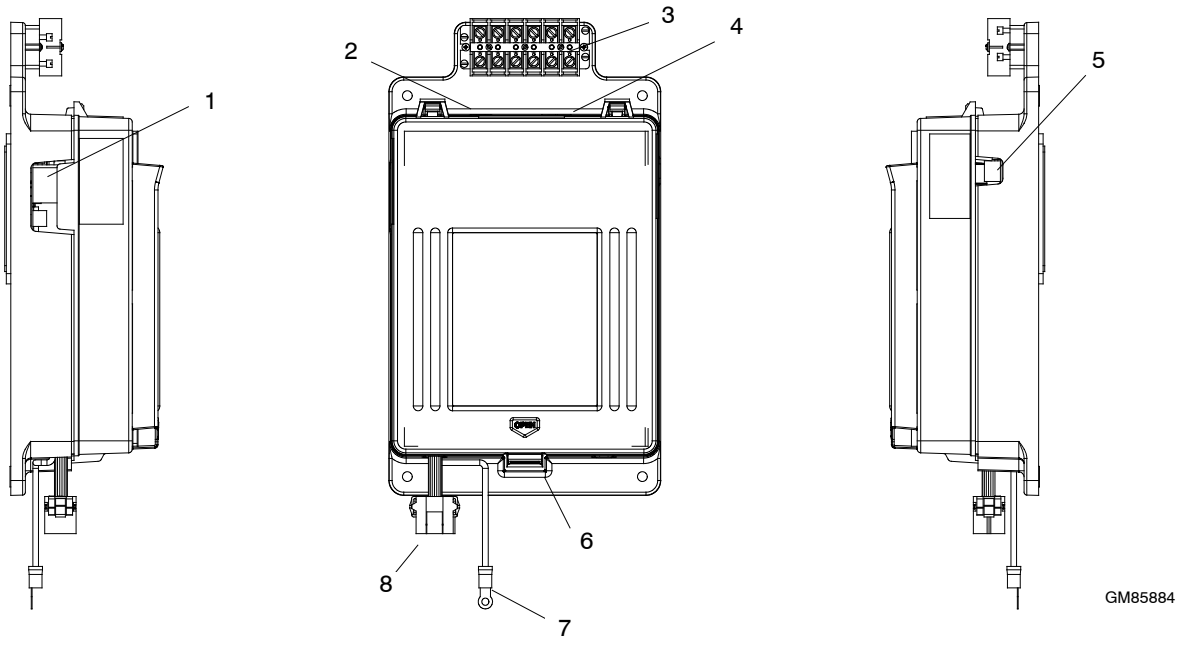
- Controller circuit board
- User interface

If the troubleshooting procedures find that the controller circuit board or user interface assembly is damaged or has failed, replace the controller assembly.

Please refer to the Parts Catalog or Kohler Power Plus online parts system for replacement part numbers.

6.3 Controller Connections

The locations of the controller connections are shown in Figure 6-5. Refer to the wiring diagrams provided with the transfer switch for connection details.

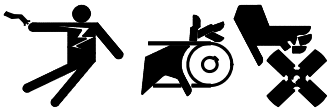


1. Standard input/output connection
2. RS-485 connection TB2
3. Connection for optional current sensing kit
4. Optional I/O module connection P16
5. Access openings to optional RJ-45 connector
6. Latch
7. Ground wire
8. Contactor harness connection

Figure 6-5 Controller Connections

6.4 Controller 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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)

6.4.1 Disconnecting Power

When it is necessary to disconnect power to the transfer switch or ATS controller, follow the service disconnect and control circuit isolation procedures in Section 1.

- **On service entrance transfer switches, the line side lugs are active at all times, even after the service disconnect procedure has been completed.**

- The service disconnect procedure does not remove power from the controller. To remove the controller for maintenance or service, perform the service disconnect procedure and then see Section 1.4 for instructions to use the control circuit isolation switch to remove power from the controller.

6.4.2 Controller Power Supply

The controller converts AC line voltage to DC voltage. Line voltage or DC voltage from an external battery connected through an External Battery Supply Module (EBSM) will cause LED1 on the controller's power board to light. See Figure 6-6 for the LED location.

- If the Normal or Emergency source is available but the controller display is dark, check LED1 on the controller circuit board. See Figure 6-6. LED1 lights when voltage is available for the controller.

Note: Disconnect power to the controller before disconnecting the I/O module assembly at P16.

- If the transfer switch is equipped with an EBSM, disconnect power to the controller. Then disconnect the I/O module assembly at connector P16 on the controller to remove the external battery supply. Then check LED1 with the Normal or Emergency source available.

- If LED1 lights but the controller display is dark, check the two ribbon cables between the controller circuit board and the display to make sure that they are seated properly. If not, reseat the cables. If the display remains dark, replace the controller.

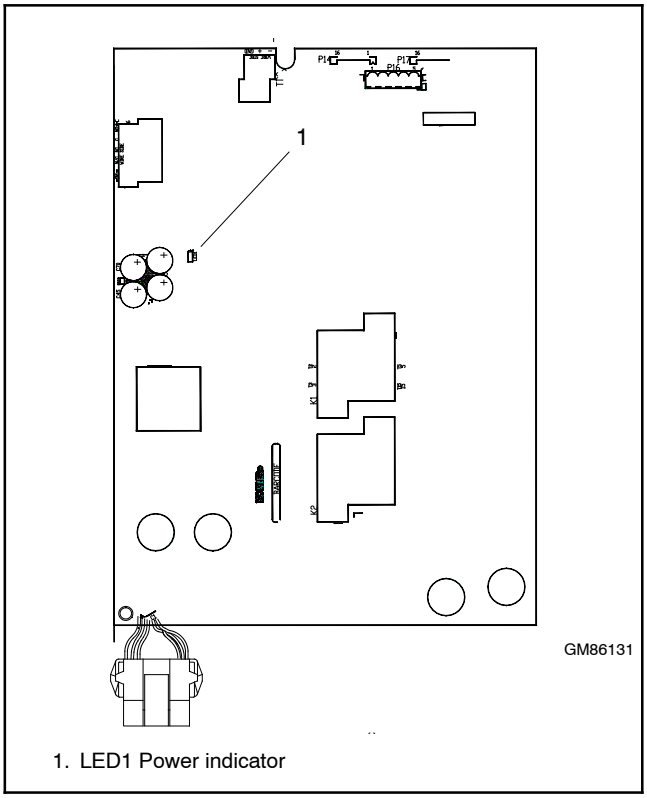
- If LED1 does not light when the Normal or Emergency source is available, check for line voltage to the controller using the following procedure.

Check for Line Voltage to the Controller

1. Disconnect power to the transfer switch by opening circuit breakers or switches.
2. Disconnect the transfer switch wiring harness from the controller at the 24-pin connector.
3. Reapply power to the transfer switch.
4. Check for voltage across the wiring harness pins. Observe all Safety Precautions when checking the voltage.
   a. If Source N is available, check for line voltage across pins 4 and 12 of the transfer switch wiring harness connector.
   b. If Source E is powering the transfer switch, check for line voltage across pins 6 and 7 of the connector.

If there is no power to the pins checked in step 4, check the wiring harness continuity. Replace the harness if faulty or damaged.

If there is power to the pins checked in step 4 but LED1 on the power board does not light when power is connected, replace the controller.



1. LED1 Power indicator

Figure 6-6 LED1 Location on MPAC Controller Circuit Board

6.5 System Test

Use the system test feature to:

- Start and run the generator set, or
- Simulate a preferred source failure, resulting in a transfer to the standby source.

A password is required to activate the system test, ensuring that only authorized personnel can start a test. Pressing the Test pushbutton signals the controller to initiate the system test sequence.

To check the source voltage and frequency while a test is running, press the Main button. Press the Test button to return to the test sequence screens.

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

During a system test, if the emergency source becomes unavailable based on its preset operating parameters, the fail to acquire standby signal is indicated immediately, and the test is terminated. If the contactor is in the standby position, it transfers immediately to the preferred position.

Faults such as failure to acquire the standby source or failure to transfer will affect the test sequence. Refer to the troubleshooting tables and flowcharts in Section 5 for instructions to diagnose and correct faults.

Load control time delay settings may affect the test sequences.

Check the preferred source selection. 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.

Test Procedure

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

1. Check the controller LED indicators to verify that the Position N and Source N Available indicators are lit.
2. Verify that the generator set is in AUTO.
3. Refer to Figure 6-7. From the main screen, press the Test button. Enter the test password when prompted and press OK.
4. Press the down arrow button until the desired type of test is displayed. The different tests are described in sections 6.5.1 through 6.5.3.
5. Press the Start button.
6. Verify that the generator set starts and the Source E Available LED lights.
7. Observe the controller LEDs and display during the test. Verify that the the system operates as described in the following sections.
8. Press the End Test button.

   Note: An Auto Load test will end automatically after the set time.

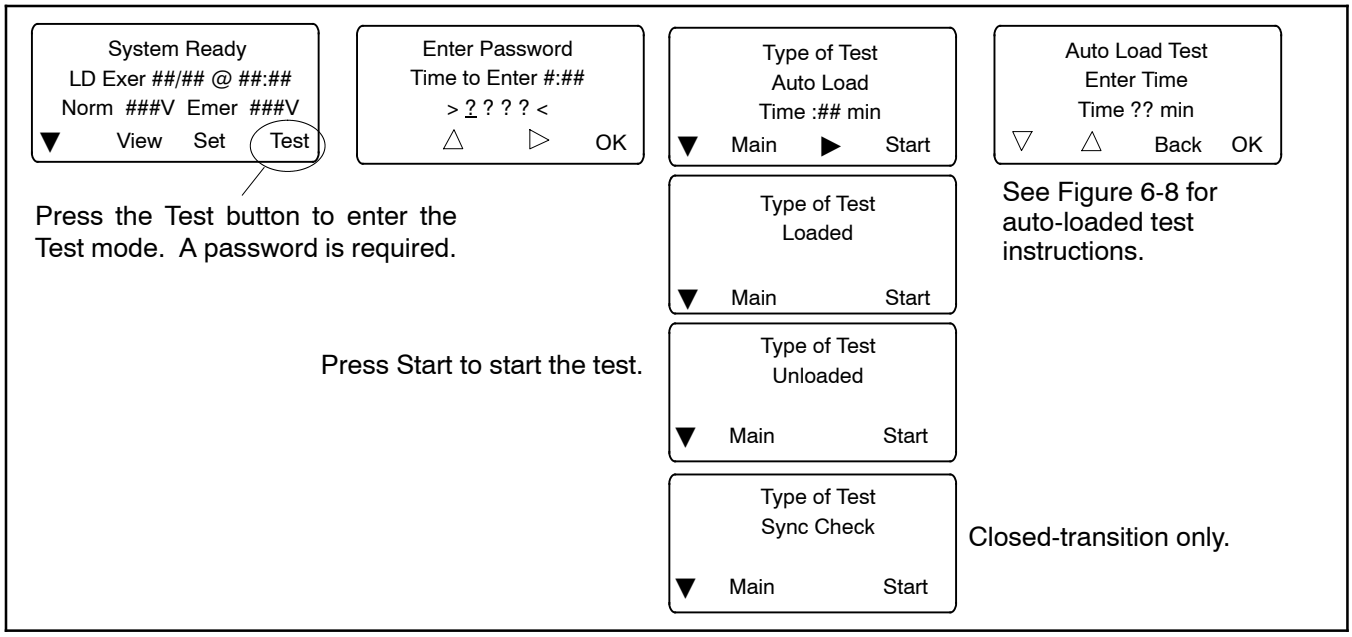
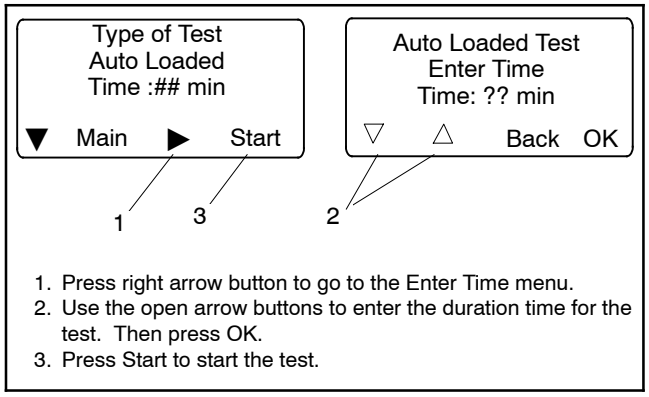


Figure 6-7 Test Screens

6.5.1 Auto-Loaded Test

An Auto-Loaded test executes for a set length of time and then ends automatically. The auto-loaded test time setting determines how long after the transfer to standby to terminate the test and transfer back to the preferred source. The time is defaulted to 30 minutes and can be adjusted from 1 minute to 60 minutes.

Press the End Test pushbutton to end a Loaded or Unloaded test early. Time delays will execute as programmed after the end test button is pressed. Pressing the End Delay button will end the currently displayed time delay.



1. Press right arrow button to go to the Enter Time menu.
2. Use the open arrow buttons to enter the duration time for the test. Then press OK.
3. Press Start to start the test.

Figure 6-8 Auto Loaded Test Menus

6.5.2 Loaded Test

A loaded test simulates a preferred source failure, except that the engine start time delay is bypassed. The generator set is signaled to start immediately upon test activation. Load control signals are issued prior to transfer with their associated time delays. Since the loaded test transfer will be between two live sources, the in-phase monitor will be activated if it is enabled.

If the preferred source is lost during a loaded test with the contactor in the standby position, the test will continue to be active, even on restoration of preferred. If the standby source is lost and the preferred source is available, the test will be terminated, and the transfer switch will immediately transfer to the preferred source position, bypassing all time delays except the off-position requirements in a programmed-transition system.

When a loaded test is terminated normally, the retransfer sequence operates as though the preferred source has been restored after a failure. All time delays will be executed and an in-phase transfer will occur if enabled.

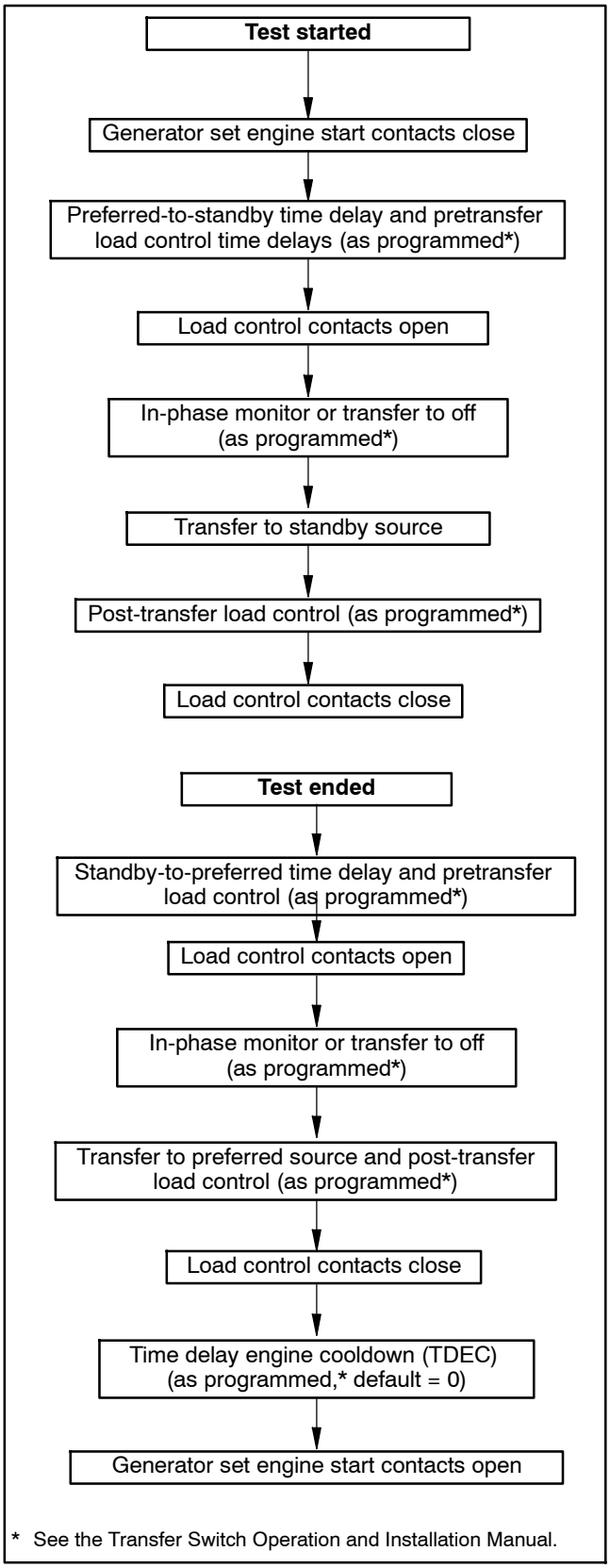


Figure 6-9 Loaded Test Sequence

6.5.3 Unloaded Test

When an unloaded test is initiated, the controller immediately signals the generator to start, without waiting for time delay engine start to timeout. The contactor does not change position during an unloaded test, but if the normal source should fail, the contactor will transfer to the emergency source. See Figure 6-10 for the test sequence.

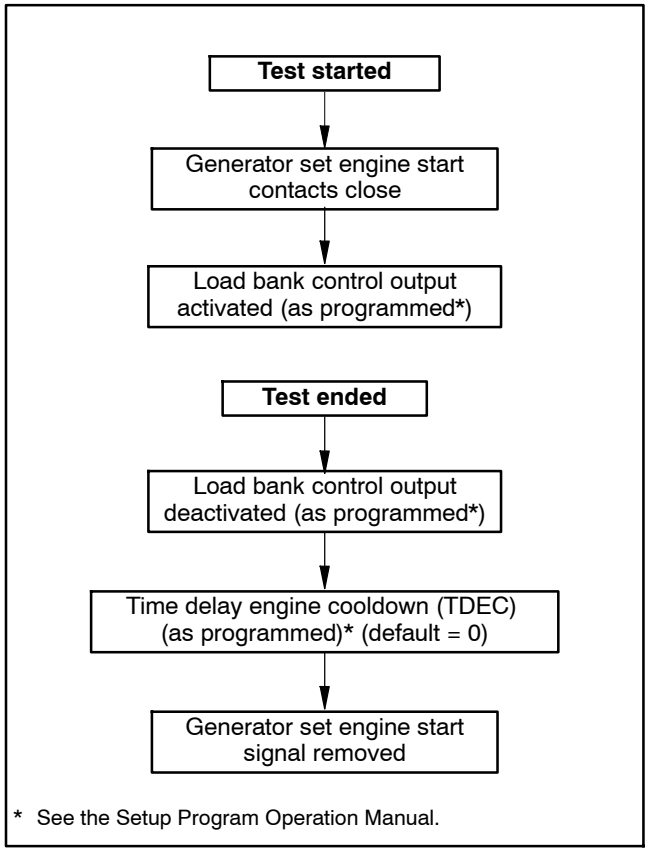


Figure 6-10 Unloaded Test Sequence

6.5.4 Automatic Operation Test

Use the following procedure to check the transfer switch operation. Watch the LEDs on the controller's user interface as the time delays run and Source E becomes available when the generator set starts. For a loaded test, watch the position LEDs to verify that the ATS transfers the load.

The test sequence simulates a loss of the normal source, starts the generator set, and transfers the load to the emergency source (loaded test), executing all time delays that are set up to operate during a loss of the normal source. Pressing the End Delay button during the test sequence ends the time delay shown on the screen.

Press the End Test button to end the test sequence. The transfer switch transfers the load back to the normal source and removes the engine start signal, executing all programmed time delays.

Refer to Figure 6-10 and Figure 6-9 for flowcharts showing the test sequence of operation without and with load. Load control time delay settings may affect the operation sequences.

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

Check the preferred source selection. 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.

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. Verify that the generator set is in AUTO.

3. Refer to Figure 6-7. From the main screen, press the Test button. Enter the test password when prompted and press OK.

4. Press the down arrow button to display Type of Test, Loaded.

5. Press the Start button.

6. Verify that the generator set starts and the Source E Available LED lights.

7. Verify that the switch transfers the load to Source E. Observe the controller LEDs and display as the time delays execute and the load is transferred.

   After the preferred-to-off time delay, verify that the Position N LED turns off. 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.

8. Press the End Test button.

9. Verify that the switch transfers the load back to Source N.

   After the standby-to-off time delay, verify that the Position E LED goes out. 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.

10. After the engine cooldown time delay expires, the engine start signal is removed. Verify that the generator set stops.

    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.

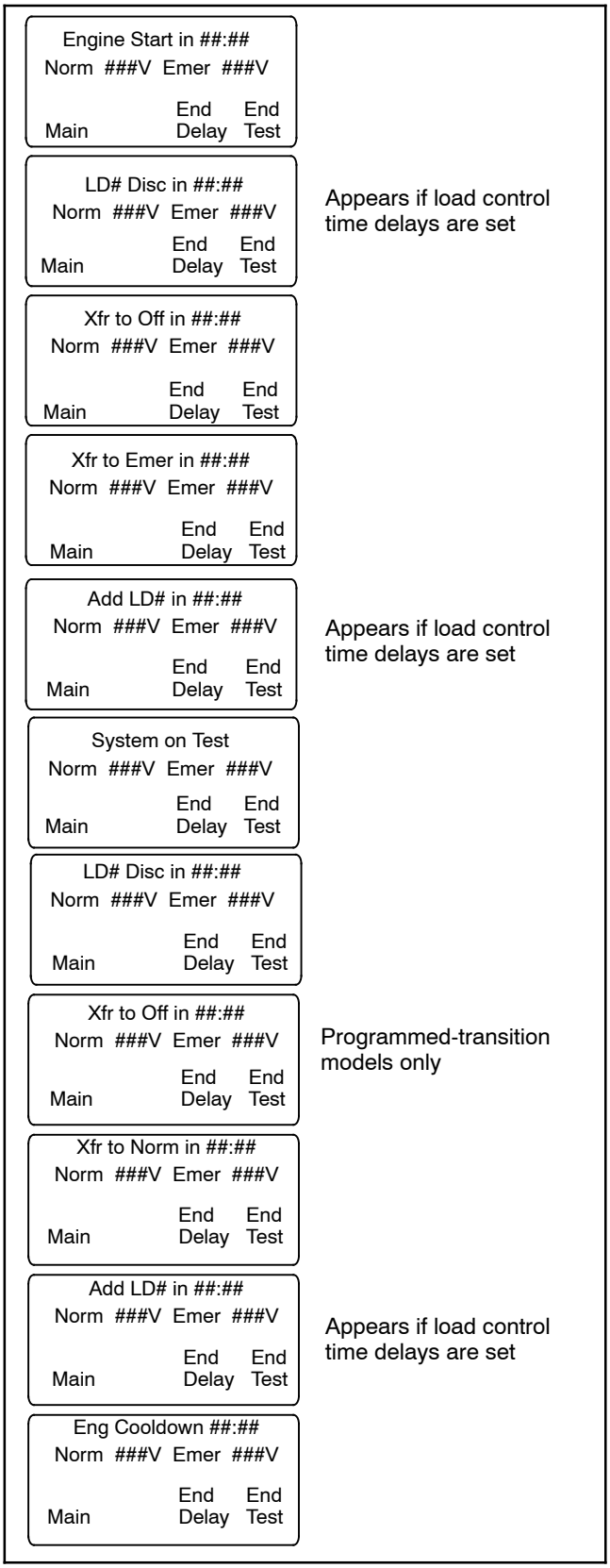


Figure 6-11 Test Sequence Screens

6.6 Exercise

6.6.1 Exercise Scheduling

Schedule exercise runs through the Set Exercise screen. See the transfer switch operation and installation manual for instructions. To run the generator set at a time other than a scheduled exercise sequence, use the Test function. See Section 6.5 for instructions.

When a scheduled exercise is running, the screens shown in Figure 6-12 appear. Press Main to return to the main screen, if desired.

6.6.2 Stopping an Exercise

Press the End button to end the exercise sequence before the scheduled stop time, if necessary.

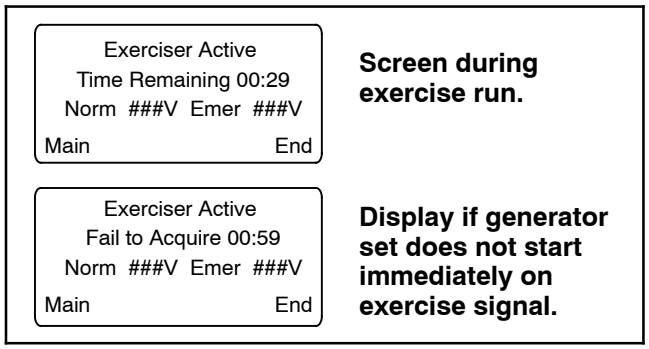


Figure 6-12 Exercise Sequence Screens

6.6.3 Exerciser Sequence

Figure 6-13 and Figure 6-14 illustrate the unloaded and loaded exercise sequences.

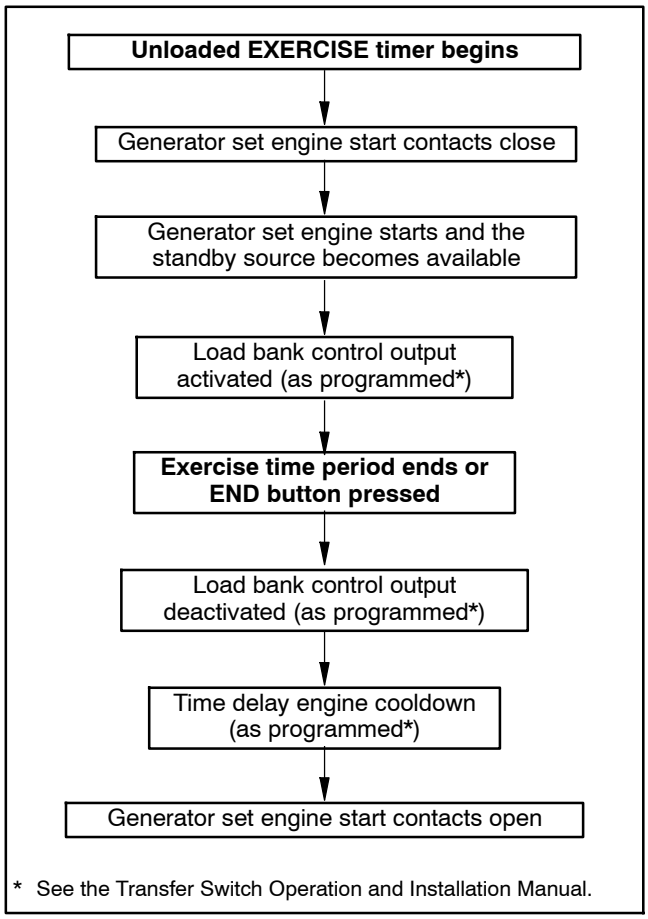


Figure 6-13 Unloaded Exercise Sequence

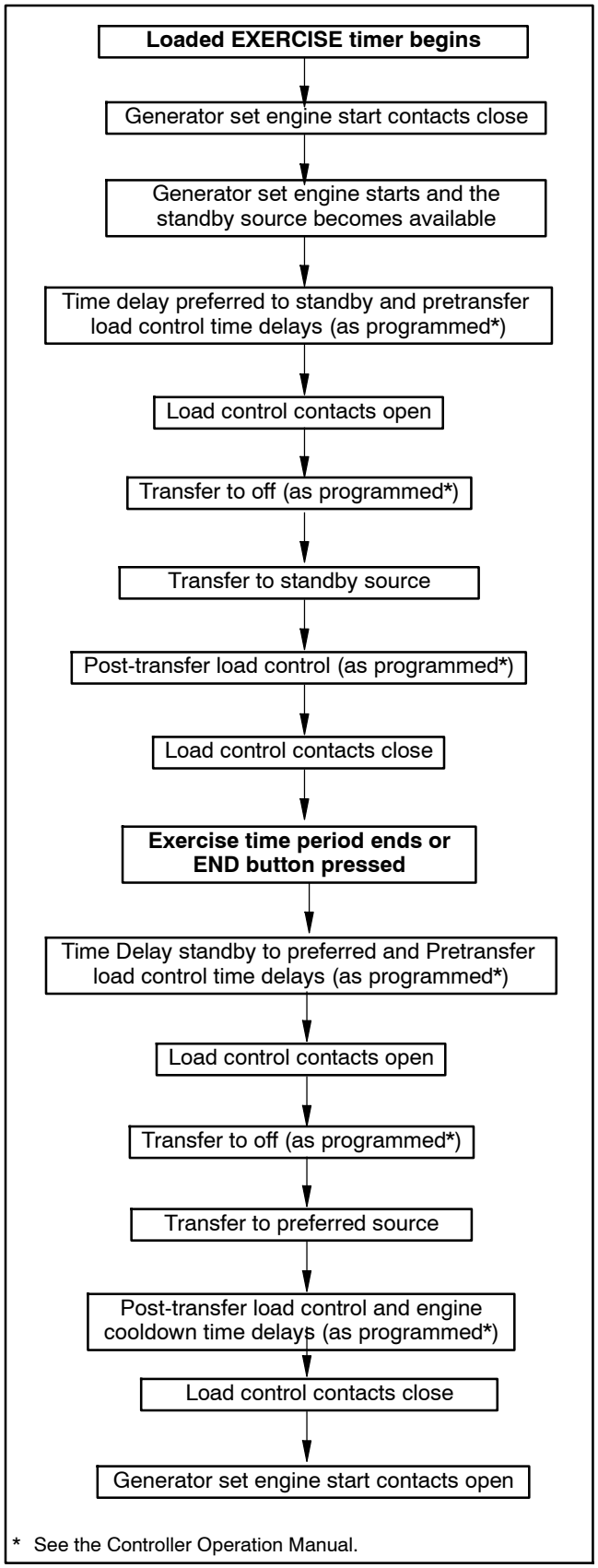


Figure 6-14 Loaded Exercise Sequence

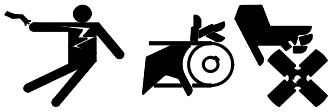
6.7 Engine Start Troubleshooting

The engine start contacts should close when the Normal source is lost and when the ATS controller starts a test or exercise sequence. The engine start contacts are labeled with a decal. Check the operation/installation manual or the dimension drawing for the contact location, if necessary.

Use the following procedure to check for continuity across the engine start contacts when the Normal source is disconnected and during a test sequence. Allow time for the engine start and engine cooldown time delays during the test. Refer to the operation manual for the applicable time delays.

Be sure to read and follow the safety precautions when performing the test procedure.

⚠ 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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)

Engine Start Test Procedure

Start with the transfer switch in the Source N position.

1. Connect an ohmmeter or test lamp across the engine start contacts at one of the following locations:

   a. Pins 8 and 9 of connector J1 (the transfer switch harness-to-controller connection). See Figure 6-15.

   b. The engine start contacts on the transfer switch contactor or field-connection terminal block. See the decal on the transfer switch or the transfer switch operation and installation manual for the engine start contact location.

   c. The generator set engine start leads. See the generator set documentation for engine start lead identification and location.

2. Disconnect Normal power from the transfer switch and verify that the engine start contacts close.

3. Reconnect Normal power to the transfer switch and verify that the engine start contacts open after applicable time delays.

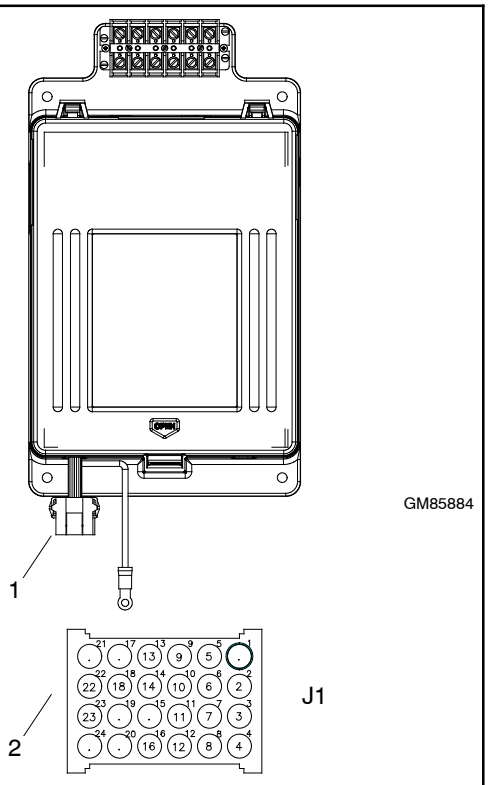
4. If the engine start contacts do not operate as indicated in steps 2 and 3 when power is disconnected and reconnected, replace the ATS controller's power board. See Section 6.11.

5. Press the Test button to initiate a test sequence and verify that the engine start contacts close.

6. Press the End button to end the test. Verify that the engine start contacts open after the engine cooldown time delay (which may be set to zero).

7. If the ATS engine start contacts do not close during the Test Procedure, replace the ATS controller. See Section 6.11.

If the generator set engine does not start, check the engine start connections to the generator set. Verify that the generator set master switch is in the AUTO position. Troubleshoot the generator set if the engine start connections are good but the engine does not start.

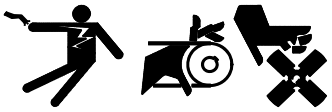


1. Transfer switch harness connection, P1
2. Connector J1 pin numbering

Figure 6-15 Transfer Switch Harness-to-Controller Connection

6.8 Controller DIP Switches

⚠ 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

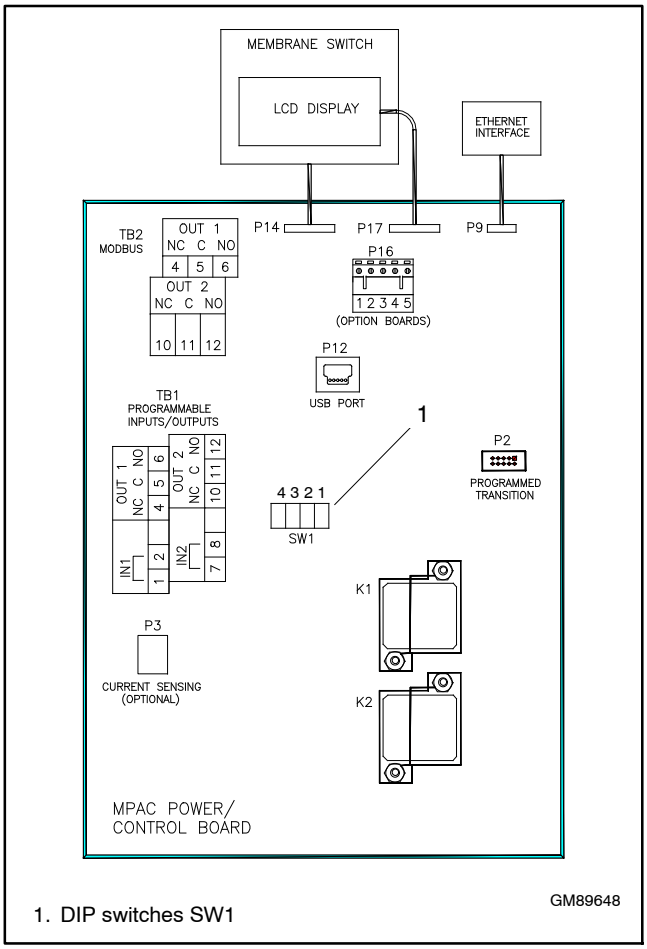
(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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.



1. DIP switches SW1

GM89648

Figure 6-16 DIP Switch Location (cover removed)

Perform the service disconnect and control circuit isolation procedures described in Section 1 before adjusting the DIP switches on the controller's circuit board.

DIP switches on the controller's circuit board can be used during maintenance and service. The DIP switches are located on the controller's circuit board on the inside of the enclosure door. Figure 6-16 shows the location of the switches on the controller circuit board. Notice that the DIP switches are numbered in this order: 4 3 2 1.

SW1-1, Password Disable. Closing the password disable DIP switch SW1-1 disables the setup password and resets it to the factory defaults. When the switch is closed, system setup and programming is allowed without the need to enter a password.

Note: Disable the setup password only during service unless the transfer switch is installed in a secure location.

Closing and then reopening DIP switch SW1-1 resets the password to the default value, 0000.

The test password is not affected by this DIP switch. Use the Reset Data screen to disable the test password.

SW1-2, Maintenance. The maintenance DIP switch inhibits transfer during ATS service. When this switch is in the closed position, contactor functions are disabled. The Not in Auto LED flashes red and the message Maintenance Mode is indicated on the LCD screen. In addition, a programmable digital output is turned on and an entry in the event log indicates that the maintenance mode has been activated. System monitoring and setup are allowed while in maintenance mode.

SW1-3 and SW1-4. Switch 3 is for factory use only. Switch 4 is not used.

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

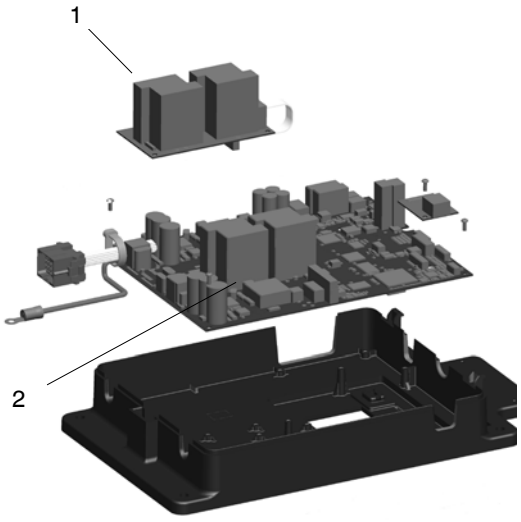
6.9 Programmed-Transition Interface Board

The programmed-transition interface board (PTIB) is used on Model KEP transfer switches with insulated case switches (ICSW) and/or insulated case circuit breakers (ICCB). The PTIB is not used on Model KEP transfer switches with molded case switches (MCSW) and/or molded case circuit breakers (MCCB)

The PTIB is installed on the controller as shown in Figure 6-17. The PTIB contains two replaceable 10-amp relays, K1 (NR1) and K2 (ER1). See Figure 6-18.

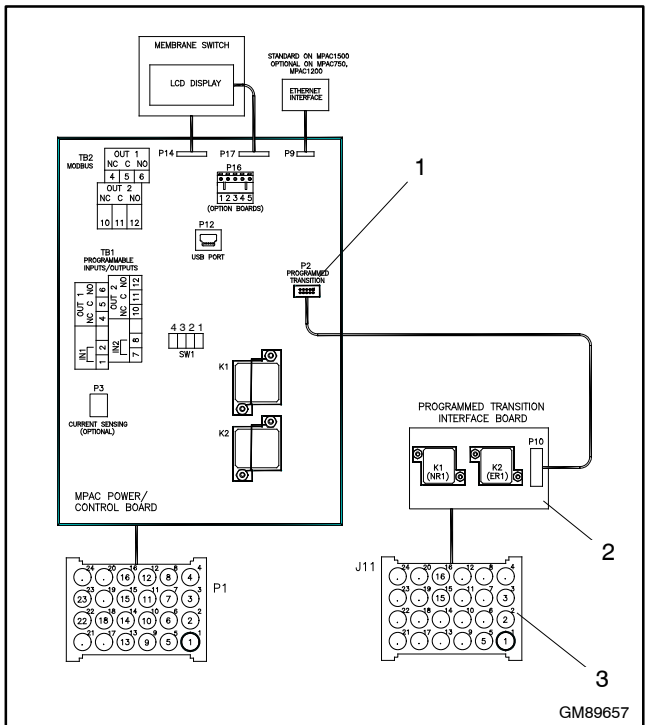
Refer to the operation sequence diagrams in Section 2.5 and to the schematic diagram provided with the transfer switch to troubleshoot the relays. If the transfer switch stops in the OFF position and does not transfer after the Off time delay, check the following on the PTIB:

- Check the contactor connection at J11.
- Check the ribbon cable connection from the PTIB to the controller circuit board.
- Check that relays K1 and K2 are properly seated.
- Replace relays K1 and/or K2 if they are damaged.
- Replace the PTIB board if necessary.



1. PTIB
2. Location above controller circuit board

Figure 6-17 Programmed-Transition Interface Board Location



1. PTIB connection to controller circuit board
2. Programmed-transition interface board (PTIB) with K1 and K2 relays
3. Contactor connection J11

Figure 6-18 PTIB Relays and Connections

6.10 Controller Application Program

The manufacturer may release new versions of the controller application code. The new code can be downloaded from TechTools and loaded onto the controller using Kohler SiteTech software.

Program Loader software is *not* used for loading code onto the Decision-Maker® MPAC controllers.

To download the latest version of the controller application code:

1. On your computer, go to Kohler TechTools.
2. Click on Software and then ATS Controllers.
3. Click on the ATS controller and then click on the link to download the latest software version. The file name will be of the form MpacDmAppV###.zip, where V### indicates the version number.

   Note: All three Decision-Maker® MPAC controllers use the same application code file.

4. Save the file onto your laptop computer.
5. Connect the computer to the ATS controller using a USB cable. See Figure 4-1 and Section 4 if necessary. Start Kohler SiteTech software.
6. If updating firmware from version 1.04 to 1.10 or higher, check and write down the setting for programmable output 1. You may need to reset this parameter later, as described in Section 8.2.
7. Select Update Firmware near the top of the screen. See Figure 6-19.
8. In the Update Firmware dialog box, click on Browse and navigate to the location of the firmware file on your computer. Click on the firmware zip file and click Open.

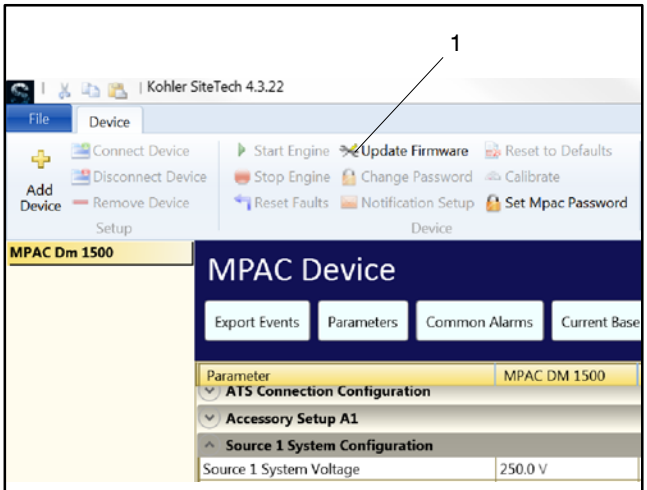
   Note: Select the entire zip file. Do not attempt to load individual files contained within the zip file.

9. Click on the Update Firmware button in the dialog box to start loading the new firmware onto the controller.
10. SiteTech will indicate that the firmware was successfully updated. Close the program and disconnect the computer from the controller.

See the SiteTech Operation Manual, TP-6701, for more information, if necessary.

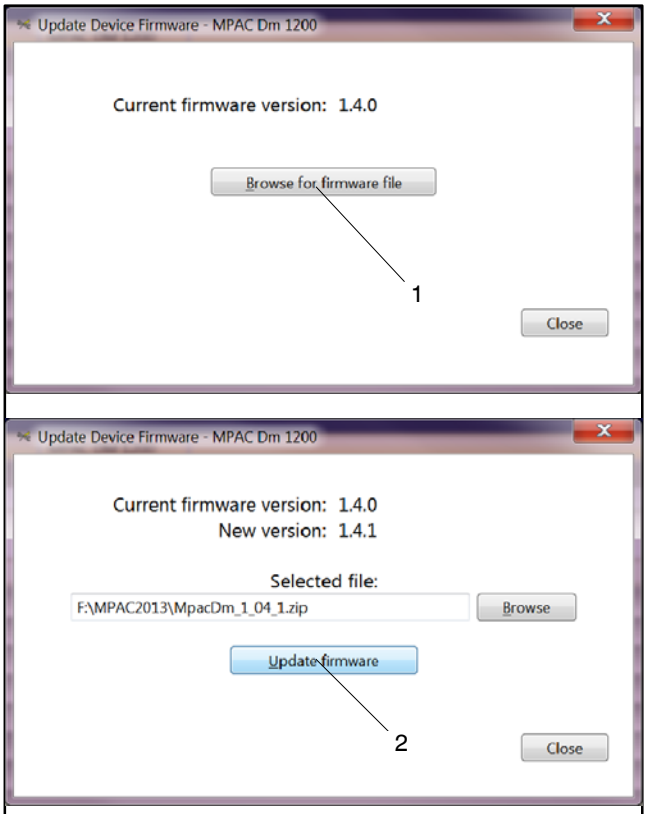
Loading new code does not change the system settings, *except as noted in Section 8.2*. After loading a new version of code, check the system settings, input/output assignments, time delays, and other parameters to verify that they are correct for the application.

After loading new code, run a loaded test to verify that the system operates correctly. See Section 6.5, System Test.



1. Update Firmware

Figure 6-19 SiteTech Update Firmware Command



1. Click and find the firmware file stored on your computer.
2. Click to start loading the new firmware onto the controller.

Figure 6-20 Firmware Update Dialog Boxes

6.11 Controller Replacement

Always check for open switches or circuit breakers, loose connections, or faulty wiring before replacing any parts. Replace the controller only if the troubleshooting and test procedures in this manual indicate conclusively that the controller is damaged or inoperative.

The entire controller and plastic housing can be obtained as a complete assembly.

Note: Save the old controller's plastic cover, which includes the transfer switch nameplate, for use with the new controller.

6.11.1 Controller Parameter Settings

New controllers are shipped with the factory default settings for the system settings, including voltage, frequency, number of phases, phase rotation, and other user-adjustable settings. After installation, the system parameters must be set for the application.

If the old controller is operable, it may be possible to save the parameter file before removing the controller from the transfer switch. The parameter file contains the system parameter settings, including system setup, source setup, time delays, input and output assignments, and communications settings. The configuration file can be loaded onto the new controller after it is installed. Use a personal computer with Kohler SiteTech software to export and import controller files. See the SiteTech Software Operation Manual for instructions.

Note: Operation problems can be caused by incorrect controller settings. Do not load the old parameter file onto the new controller unless you are certain that all the settings in the file are correct.

If the parameter settings file is not available, use the controller user interface or SiteTech software to check and adjust the system settings for the application. Refer to the controller Operation Manual or the SiteTech Software Operation Manual for instructions.

6.11.2 Circuit Board and Electronic Component Handling

Improper removal, installation, transportation, storage, or service can damage sensitive electronic components. Observe the following guidelines to prevent damage when working with circuit boards or electronic components.

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.

Circuit Board and Electronic Component Handling

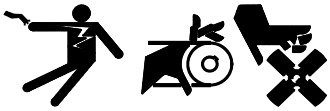
- Keep circuit boards or electronic components inside the antistatic, cushioned factory packaging until installation.
- Store circuit boards or electronic components in a clean environment away from moisture, vibration, static electricity, corrosive chemicals, and solvents.
- Disconnect all power sources before removing or installing circuit boards or electronic components.
- Wear an approved, grounded, antistatic wrist strap when handling circuit boards or electronic components.
- Carefully hold the circuit board by its edges and not by any of its components or electrical contacts.
- Do not drop the circuit board or electronic components.
- Do not bend the circuit board, electronic components, or electronic component leads.
- Do not strike the circuit board or electronic components using or against a hard object.
- Clean dusty or dirty circuit boards with a vacuum cleaner or soft, dry brush.
- Never attempt circuit board repairs, adjustments, or modifications other than replacing plug-in service parts or performing manufacturer-approved installation or service procedures.

6.11.3 Replacement Procedure

Before removing the old controller, refer to Section 6.11.1. It may be possible to download the system settings from the controller to a file that can later be loaded onto the new controller for more efficient system setup.

Perform the service disconnect and control circuit isolation procedures described in Section 1 before starting to disconnect the controller. Observe the following safety precautions to avoid injury or equipment damage.

⚠ 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.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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.

Controller Replacement Procedure

1. Perform the Service Disconnect and Control Circuit Isolation procedures described in Section 1 to remove power from the controller.

Note: There is power coming into the normal source lugs at all times, even after the service disconnect procedure has been completed.

2. Disconnect the transfer switch harness at the P1 connector at the bottom of the controller. See Figure 6-21.

3. Disconnect the controller ground wire at the ring terminal on the enclosure door.

4. Disconnect the accessory module assembly at connector P16 at the top of the controller, if connected.

5. Remove the plastic cover from the old controller and save it to install on the new controller assembly.

   Note: The cover includes the transfer switch nameplate, which must remain with the transfer switch.

   To remove the cover, depress the latch at the bottom of the cover. Swing the cover open on its hinges and lift it off.

6. Label and then disconnect any input and output leads connected to terminal strip TB1 on the controller. See Figure 6-22.

7. Label and then disconnect the RS-485 communication cable from terminal strip TB2 on the controller (if connected). See Figure 6-22.

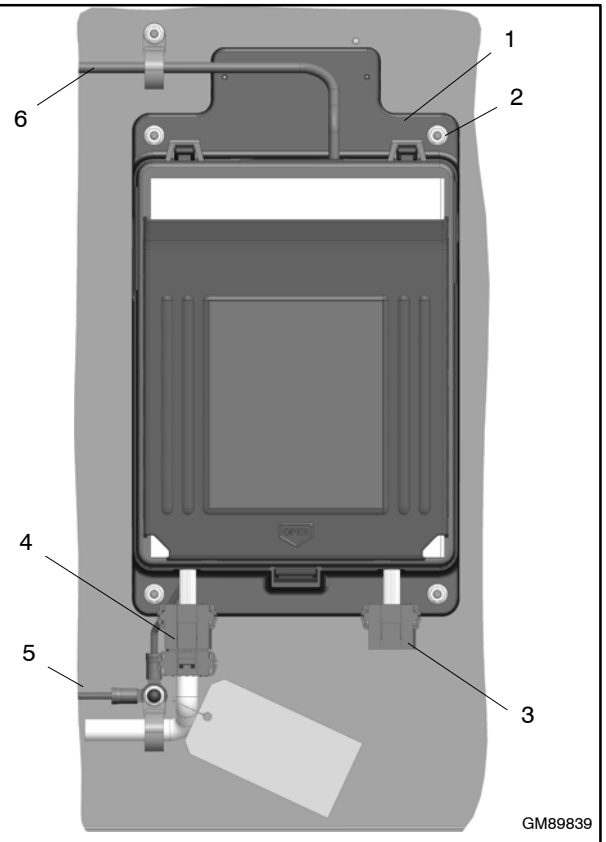
8. Disconnect any other communications connections to the ethernet port or the USB port. See Figure 6-22 for connector identification.

9. Disconnect the current sensing accessory at connector P3, if equipped.

10. Support the controller assembly and remove four nuts at the corners.

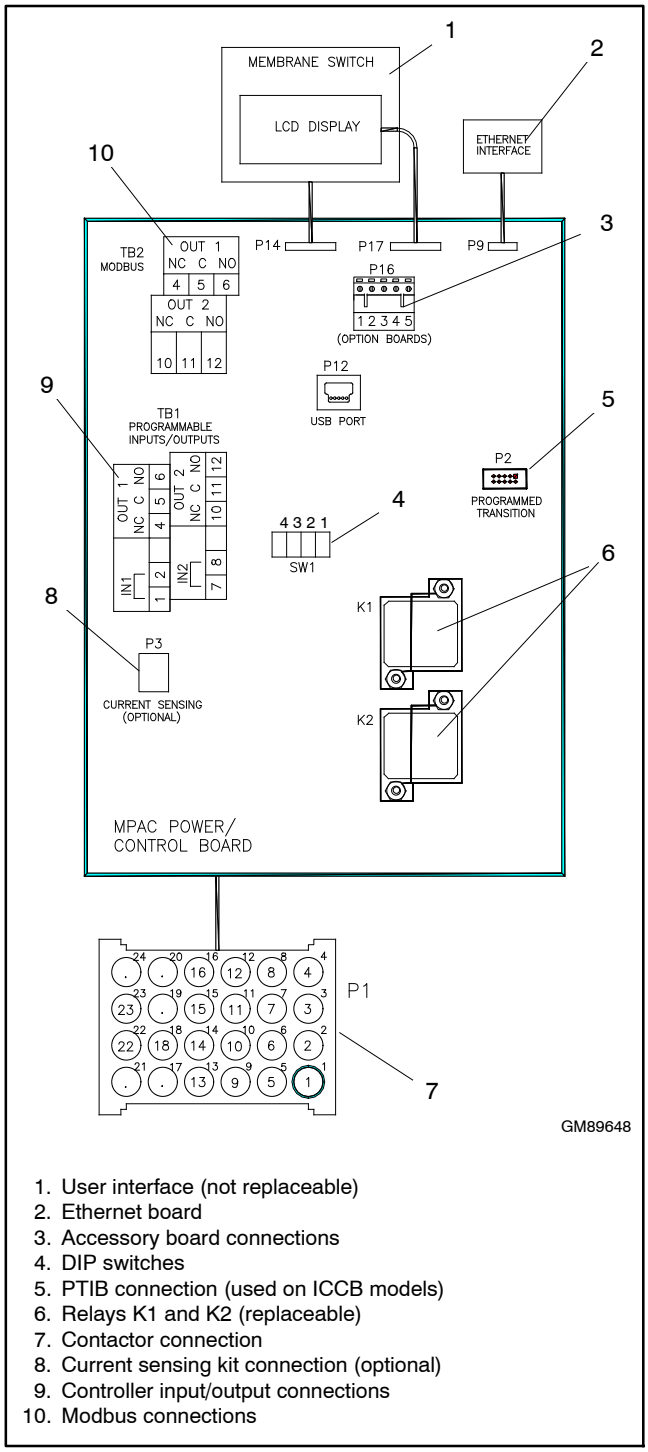
11. Carefully remove the entire controller assembly, including the user interface panel, which is part of the assembly.

12. Replace the entire assembly with a new controller. Secure the four nuts at the corners and tighten them to no more than 6.8 Nm (5 ft. lb. or 60 in. lb.) torque.



1. Controller assembly mounted inside enclosure door
2. Controller mounting screws, qty. 4
3. PTIB connector P2 (programmed and closed-transition only)
4. Contactor connector P1
5. Ground lead
6. Programmable input/output harness (optional)

Figure 6-21 Controller Assembly



1. User interface (not replaceable)
2. Ethernet board
3. Accessory board connections
4. DIP switches
5. PTIB connection (used on ICCB models)
6. Relays K1 and K2 (replaceable)
7. Contactor connection
8. Current sensing kit connection (optional)
9. Controller input/output connections
10. Modbus connections

Figure 6-22 Controller Connections

Reconnect the controller assembly.

13. Connect the controller ground lead to the terminal on the enclosure door. See Figure 6-21.

14. The programmed-transition interface board (PTIB) is included on controllers for KEP models that use insulated case switches (ICSW) and/or insulated case circuit breakers (ICCB). Verify that the PTIB is installed and connected to P2 on the controller. See Figure 6-22 and Section 6.9.

15. Connect the I/O leads to terminal strip TB1, using the labels attached in step 6 to connect the leads to the appropriate terminals. See Figure 6-22.

16. Connect RS-485 communication cable, if used, to terminal strip TB2, using the labels attached in step 7 to connect the leads to the appropriate terminals. See Figure 6-22.

17. Connect the accessory module assembly (if equipped) at connector P16.

18. Reconnect any other items that were disconnected from the controller. See Figure 6-22 for connector identification.

19. Connect the transfer switch harness to the connector on bottom of the controller.

20. Check the controller's DIP switch settings and adjust them if necessary. See Section 6.8, Controller DIP Switches.

21. Close and lock the transfer switch enclosure door.

22. Perform the Control Circuit Reconnect and Service Reconnect procedures described in Section 1.

    Note: Power to the controller is required in order to check and adjust the controller settings. If all the power sources are generator sets, reconnect the normal source generator set engine starting battery and put the generator set into automatic mode.

Set up the new controller.

23. If the parameter settings file for the transfer switch was downloaded from the old controller, load it onto the new controller using SiteTech See Section 6.11.1. See Section 4.3 and the SiteTech Software Operation Manual for instructions to import the file, if necessary.

24. If the configuration settings file cannot be loaded through the USB port, check and adjust the system settings for the application. Use the controller user interface or a personal computer and Kohler SiteTech software to check and adjust the controller settings. Refer to the transfer switch operation and installation manual for setup instructions.

Note: Contactor and ATS serial numbers can only be entered through Modbus using Monitor III or a customer-supplied Modbus driver and the distributor-level password.

Check settings and verify operation.

25. Check the system settings and adjust them, if necessary. Check the system voltage, frequency, number of phases, phase rotation, time delays, and other user-adjustable settings. Refer to the transfer switch operation and installation manual for instructions.

26. Reconnect the emergency source generator set engine starting battery, negative (–) lead last.

27. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.

28. From the main screen, press the down arrow button and then press the LAMP TEST button to verify that all LEDs light.

29. Run a loaded test to check the system operation. See Section 6.5, System Test.

30. Measure the source voltages, frequency, and phase rotation using the procedure in Section 5.4.2.

31. If the voltage readings shown on the controller do not match the voltage measured at the source lugs, calibrate the controller. See Section 6.12.

6.12 Calibration

DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

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)

The transfer switch voltage and current sensing (if equipped) are calibrated at the factory. If voltage recalibration is necessary, refer to Section 5.4.2 for instructions to check the voltages, and then use the Calibration menu to enter the measured values. See Figure 6-23.

The current sensing accessory is required in order for the transfer switch to measure and display the current values. See the controller Operation Manual for information about the current sensing accessory. Use a clamp-on current sensing meter to measure the current and enter the measured values through the Setup Menu–Calibration shown below.

For three-phase models, the voltage and current for all phases will appear and can be calibrated.

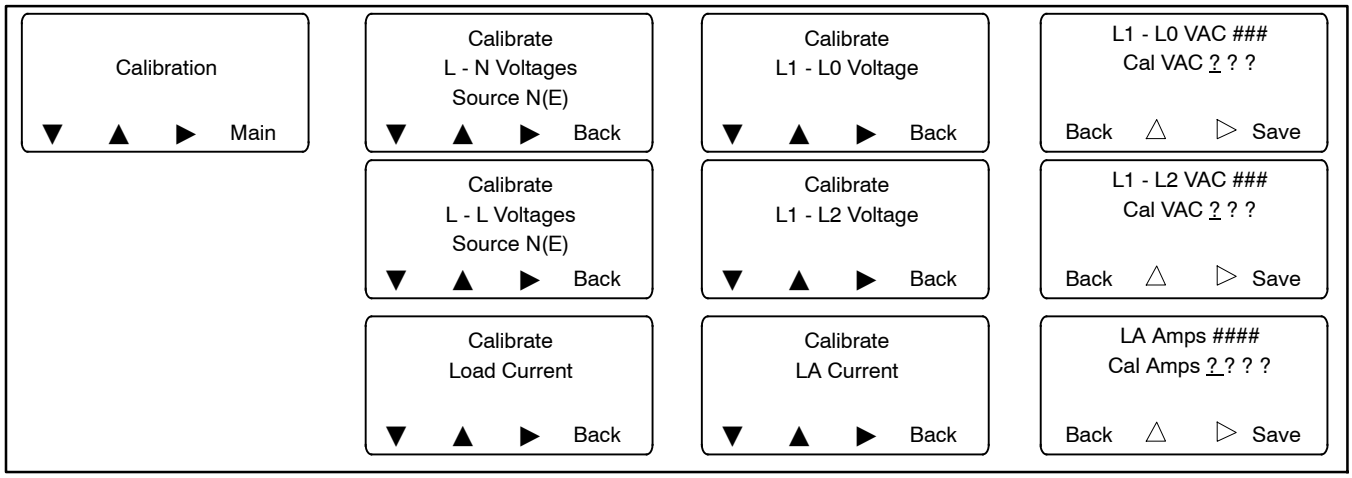
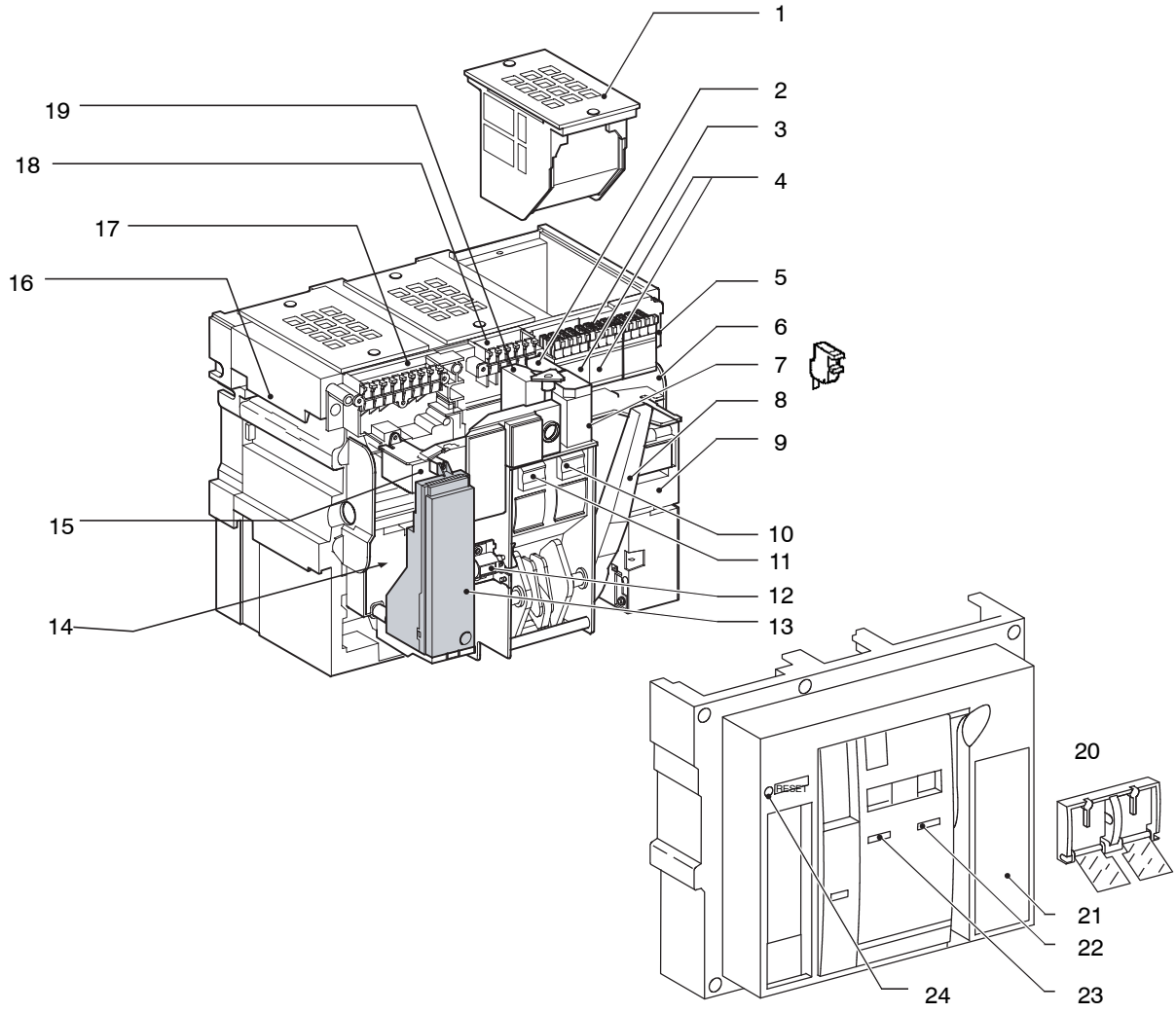


Figure 6-23 Calibration



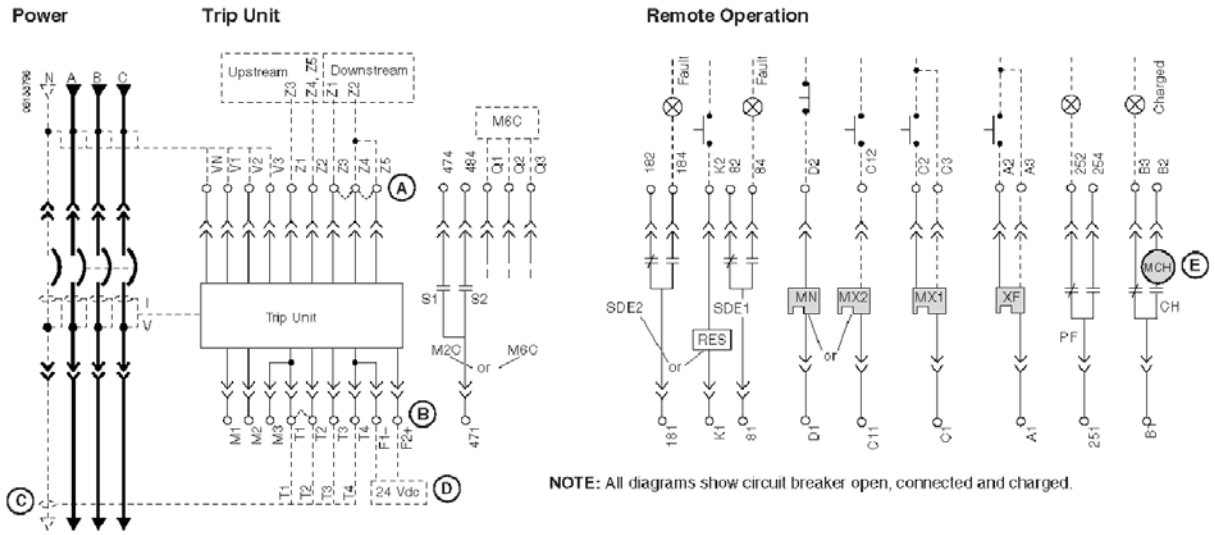
1. Arc chamber
2. Shunt trip (MX1)
3. Auxiliary contact connection
4. Two (2) blocks of four additional switches (OF) or combined connected/closed switches (EF)
5. Block of four form C auxiliary contacts (OF)
6. Shunt close (XF)
7. Ready to close contact (PF)
8. Charging handle
9. Spring charging motor (MCH)
10. Closing pushbutton
11. Opening pushbutton
12. Operation counter
13. Trip unit
14. Overcurrent Trip Switch (SDE1)
15. Overcurrent trip switch (SDE2) or electric reset
16. Lifting tab
17. Trip unit connection to overcurrent trip switch
18. Auxiliary control connection
19. Shunt trip (MX2) or undervoltage trip device (MN)
20. Open/close pushbutton cover (lockable with padlock
21. Faceplate
22. Charged/discharged indicator
23. Open/close indicator
24. Push to reset on fault trip

tp6738

Figure 7-1 ICCB Power Switching Device

Wiring Diagrams

Wiring Diagrams for Masterpact NW Circuit Breakers



A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
C—For proper wiring of neutral CT, refer to Instruction Bulletin 48041-082-01 shipped with it.
D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
E—When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Push-In Type Terminals

Cell Switches		
CD3	CD2	CD1
834	824	814
832	822	812
831	821	811

or

CE6	CE5	CE4
364	354	344
362	352	342
361	351	341

Trip Unit											Cell Switches			Remote Operation				
COM		UC1		UC2		UC3	UC4	M2C/M6C	SDE2/RES	SDE1	CE3	CE2	CE1	MN/MX2	MX1	XF	PF	MCH
E6	E5	Z5	M1	M2	M3	F2+	V3	484/Q3	184/K2	84	334	324	314	D2/C12	C2	A2	254	B2
E3	E4	Z3	Z4	T3	T4	VN	V2	474/Q2	182	82	332	322	312	C13	C3	A3	252	B3
E1	E2	Z1	Z2	T1	T2	F1−	V1	471/Q1	181/K1	81	331	321	311	D1/C11	C1	A1	251	B1

Figure 7-2 Wiring Diagrams NW Breakers

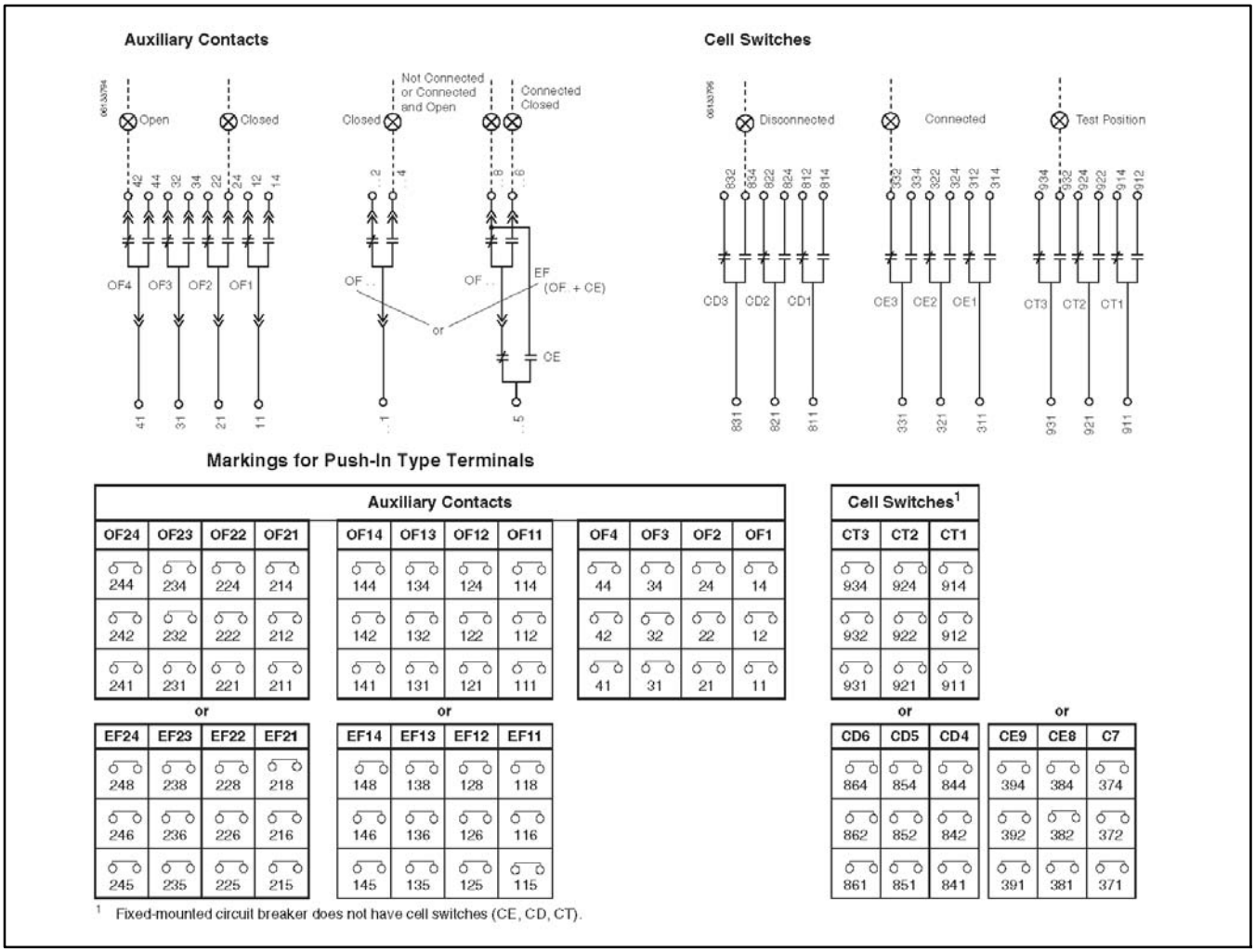
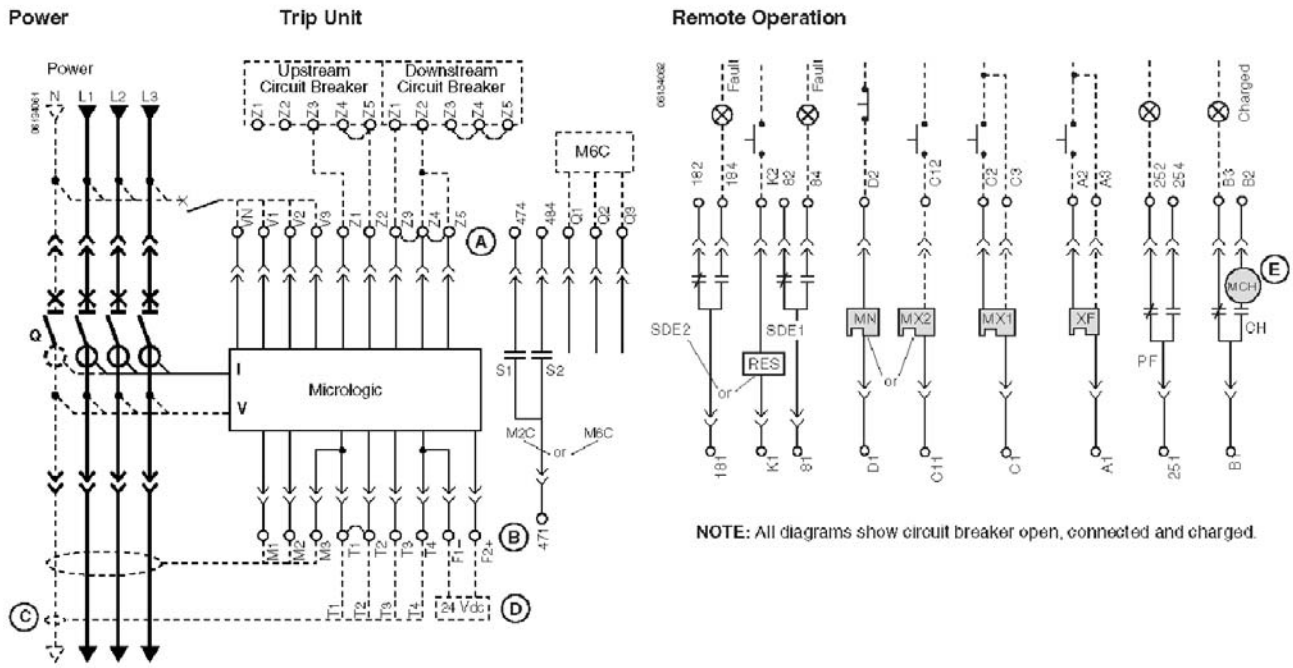


Figure 7-3 Wiring Diagrams, NT and NW circuit breakers

Wiring Diagrams

Markings for Push-In Type Terminals



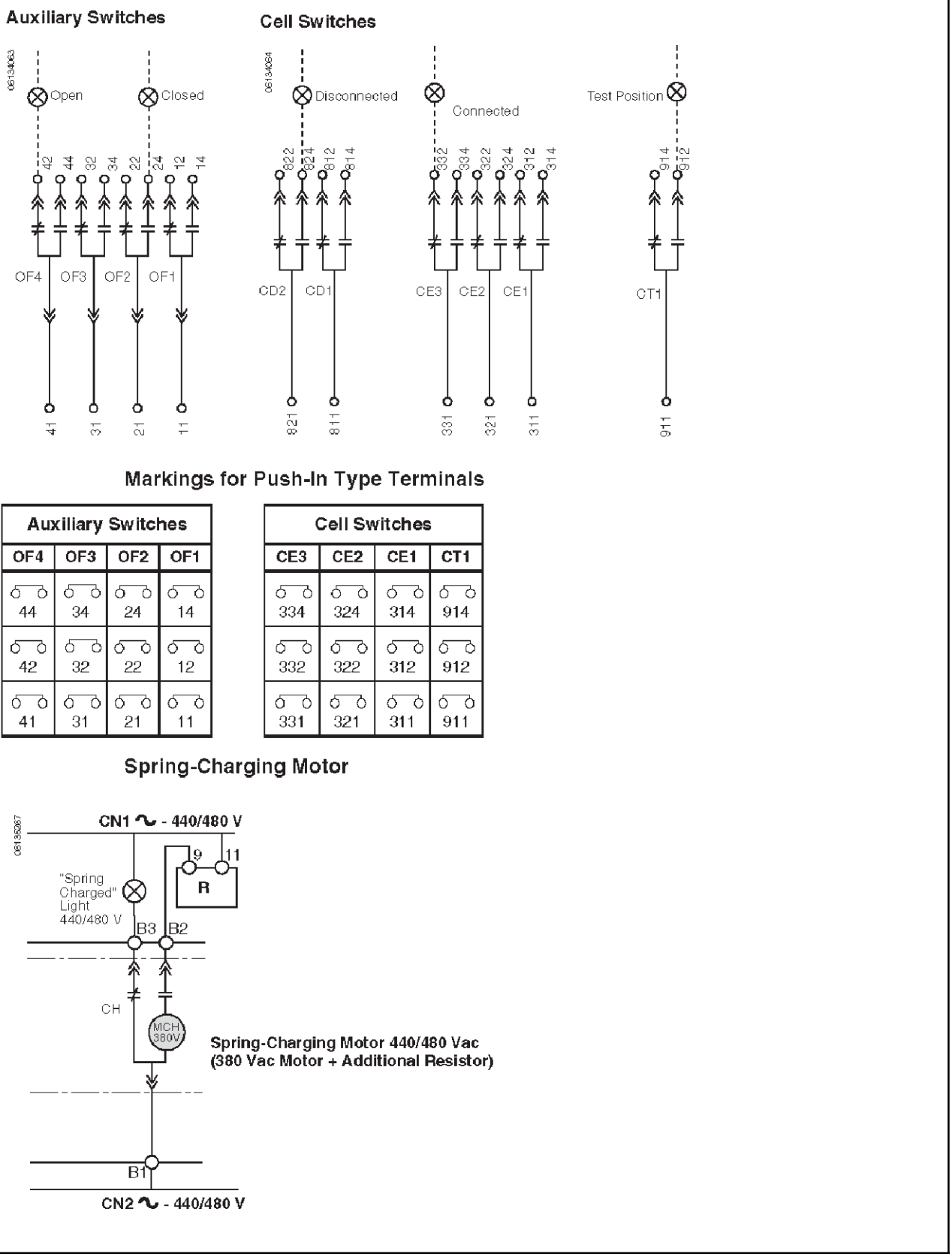
A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
C—For proper wiring of neutral CT, refer to Instrucion Bulletin 48041-082-01 shipped with it.
D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
E—When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Push-In Type Terminals

Cell Switches		Trip Unit						
CD2	CD1	COM	UC1	UC2	UC3	UC4 / M2C / M6C	SDE2 / RES	SDE1
824	814	E5 E6	Z5 M1	M2 M3	F2+	V3 / 484 / Q3	184 / K2	84
822	812	E3 E4	Z3 Z4	T3 T4	VN	V2 / 474 / Q2	182	82
821	811	E1 E2	Z1 Z2	T1 T2	F1–	V1 / 471 / Q1	181 / K1	81

Remote Operation				
MN / MX2	MX1	XF	PF	MCH
D2 / C12	C2	A2	254	B2
C13	C3	A3	252	B3
D1/C11	C1	A1	251	B1

Figure 7-4 Wiring Diagram NT Breaker for 800 A and 1200 A 3- and 4-Pole ICCB Models



Markings for Push-In Type Terminals

Auxiliary Switches			
OF4	OF3	OF2	OF1
44	34	24	14
42	32	22	12
41	31	21	11

Cell Switches			
CE3	CE2	CE1	CT1
334	324	314	914
332	322	312	912
331	321	311	911

Spring-Charging Motor

Figure 7-5 Electrical Diagram

Additional Wiring Information

Alarm Contacts (OF1, OF2, OF3 and OF4 are standard equipment)

OF4 OF3 OF2 OF1	Open/Closed Circuit Breaker or Switch Position Contacts	OF24: Open/Closed Circuit Breaker or Switch Position Contact or EF24: Combined Connected and Closed Contact
		OF23 or EF23
		OF22 or EF22
		OF21 or EF21
		OF14 or EF14
		OF13 or EF13
		OF12 or EF12
		OF22 or EF22
		OF11 or EF11

Cradle Contacts

CD3 CD2 CD1	Disconnected Position Contacts	CE3 CE2 CE1	Connected Position Contacts	CT3 CT2 CT1	Test Position Contacts
or				or	
CE6 CE5 CE4	Connected Position Contacts			CE9 CE8 CE7	Connected Position Contacts
				or	
				CD6 CD5 CD4	Disconnected Position Contacts

Trip Unit

Basic	A	P	H		
	X	X	X	Com:	E1–E6 Communication
	X	X	X		Z1–Z5 Logical Selectivity
	X	X	X		Z1 = ZSI OUT
	X	X	X	UC1:	Z2 = ZSI OUT Source; Z3 = ZSI IN Source
	X	X	X		Z4 = ZSI IN Short-Time Delay
	X	X	X		Z5 = ZSI IN Ground Fault
	X	X	X	UC3:	F2+, F1– 24 Vdc External Power Supply
		X	X		External Neutral VN Plug
		X	X	UC4	External Phase Voltage Sensing
		X	X	M2C	Two Programmable Contacts (internal relay)
		X	X	or M6C	Six Programmable Contacts (for connection to external M6C module)

Remote Operation

SDE2 or RES	Electrical Fault Alarm Contact Remote Reset
SDE1	Electrical Fault Alarm Contact (standard)
MN or MX2	Undervoltage Trip Device Additional Shunt Trip
MX1	Shunt Trip (standard or networked)
XF	Shunt Close (standard or networked)
PF	Ready-to-Close Contact
MCH	Spring-Charging Motor

NOTE: When communication version of the MX1 or XF coils are used, terminals (C3, A3) must be connected to line even if the communications module is not installed.

The bypass circuit through terminal C2/A2 is only momentary duty for 0.5 sec. For continuous duty, use the communications command.

Figure 7-6 Additional Wiring Information for ICCB Breakers

8.1 Introduction

The service disconnect operation for Model KEP service entrance rated automatic transfer switches equipped with the Decision-Maker® MPAC 1500 controller has changed. When the transfer switch is put into service disconnect mode:

- The original design transfers to Emergency and signals the generator set to start.
- The new design transfers to the OFF position. Both sources are disconnected and the generator set is NOT signalled to start.

The new style switches are identified by the decal shown in Figure 8-1, located near the service disconnect switch on the outside of the enclosure door.

The new design uses controller firmware version 1.10 (or higher) and new transformer assemblies. See Figure 8-2 for illustrations of original and new transformer assemblies.

If the transfer switch is equipped with the new transformer assembly, kit number GM94796-AA1 or GM94796-AA2 will appear in the accessories section of the transfer switch nameplate. The nameplate is located on the controller cover on the inside of the enclosure door. Transfer switches equipped with an original transformer assembly GM69797-KA1 or GM69797-KA2 do not have the transformer kit number printed on the nameplate.

NOTICE:
SERVICE DISCONNECT TRANSFERS TO OFF, REMOVING POWER FROM THE LOAD. POWER WILL NOT BE RESTORED UNTIL THE SWITCH IS RETURNED TO AUTO.

Figure 8-1 Service Disconnect to OFF Decal

Orignal Transformer Assemblies

Transfer switches equipped with an original transformer assembly GM69797-KA1 or GM69797-KA2 **must** use the **Service Disconnect to Emergency** position only. The transformer kit number is not printed on the nameplate.

If the controller is replaced or the controller firmware is upgraded on a unit that has the original transformer assembly, it will be necessary to change the service disconnect position on the controller back to Emergency as described in Section 8.2.1.

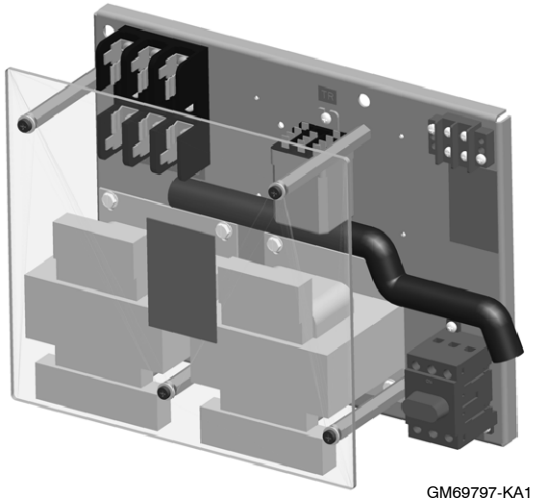
Revised Transformer Assemblies

Transfer switches equipped with revised transformer kit number GM94796-AA1 (for MCCB models) or GM94796-AA2 (for ICCB models) are factory set to use the **Service Disconnect to OFF** position. Kit number GM94796-AA1 or GM94796-AA2 will appear in the accessories section of the transfer switch nameplate and the transfer switch door will have the service disconnect label shown in Figure 8-1.

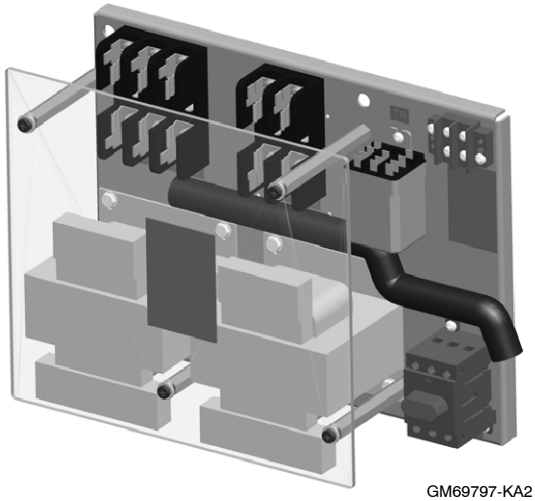
The nameplate is located on the controller cover on the inside of the enclosure door. The nameplate is located on the controller cover on the inside of the enclosure door.

Transfer switches equipped with revised transformer assemblies can be converted to use the Service Disconnect to Emergency position, if necessary. Follow the instructions in Section 8.2.

Original Transformer Assemblies (Service Disconnect to EMERGENCY only) :

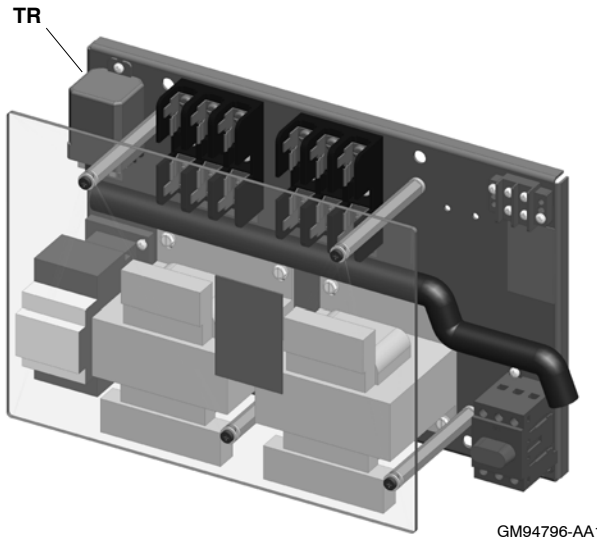


GM69797-KA1
(MCCB)

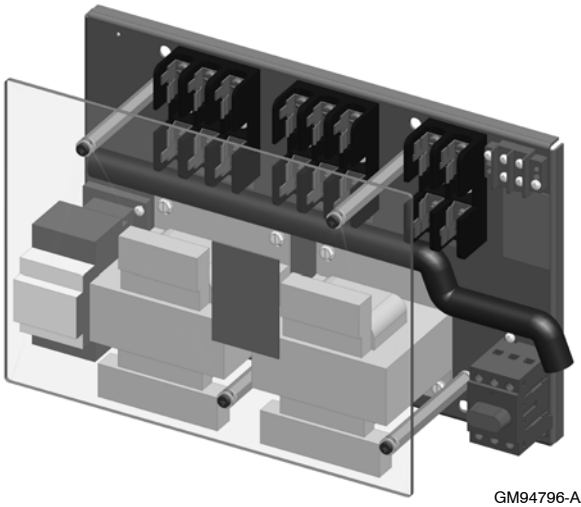


GM69797-KA2
(ICCB)

Revised Transformer Assemblies (Service Disconnect to OFF *):



GM94796-AA1
(MCCB)



GM94796-AA2
(ICCB)

* Transfer switches equipped with transformer assembly GM94796-AA1 or GM94796-AA2 can be reconfigured to use the Service Disconnect to Emergency position, if necessary.

Figure 8-2 Transformer Assemblies

8.2 Changing the Service Disconnect Position

In some applications, it may be necessary to change the service disconnect position on the transfer switch.

Example 1: If you update the controller firmware or replace the controller on a unit that is equipped with an original transformer assembly, GM69797-KA1 or GM69797-KA2, you will need to change the service disconnect position setting on the controller back to Emergency. Use Kohler® SiteTech™ software to change the service disconnect position setting on the controller. You may also need to re-assign programmable output #1.

Example 2: If you install a transfer switch equipped with a new transformer assembly in an application that requires the original service disconnect to emergency position, you will need to convert the transfer switch. This could be the case when an older service-entrance rated transfer switch is being replaced, or in any application that was designed to use the service disconnect to emergency operation. Conversion includes changing the service disconnect position setting on the controller and changing some connections inside the ATS.

Updating Firmware or Replacing the Controller

Before updating the firmware or replacing the controller, check the setting for programable output #1. If output 1 is used for customer-provided equipment, you will need to reset it after firmware upgrade or controller replacement. Firmware version 1.10 sets the service disconnect position to OFF and sets programmable output #1 to Service Disconnect Gen Cntrl. If the service disconnect position is changed to Emergency, then the programmable output setting can be changed. Use SiteTech software to change the output setting as needed for the application.

If the controller firmware is updated or the controller is replaced, check the transformer assembly installed on the transfer switch and compare the illustrations Figure 8-2. If the transfer switch is equipped with an original transformer assembly (GM69797-KA1 or GM69797-KA2), you will need to change the service disconnect position setting on the controller. Use Kohler® SiteTech™ software to change the Service Disconnect position setting on the controller to Source E and assign programmable output #1 to its original setting, if used. See the procedure in Section 8.2.1.

Converting a New ATS to the Service Disconnect to Emergency Position

In some applications, the transfer switch may be required to operate using the original Service Disconnect to Emergency behavior. Transfer switches using the new transformer assemblies and the Service Disconnect to OFF position can be converted in the field to the original behavior. The following changes are required:

1. Use a laptop computer with Kohler® SiteTech™ software to change the Service Disconnect position setting from OFF to Source E. See the procedure in Section 8.2.1.

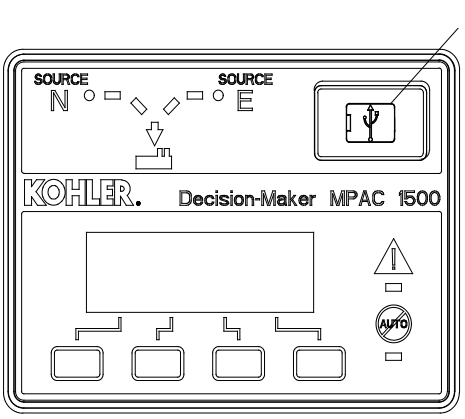
   Note: The distributor level password is required.

2. Disconnect the engine start bypass circuit using the instructions that are given in this section. See the procedure in Section 8.2.2.

3. Change connections for correct operation of the Service Disconnected lamp. See the procedure in Section 8.2.3.

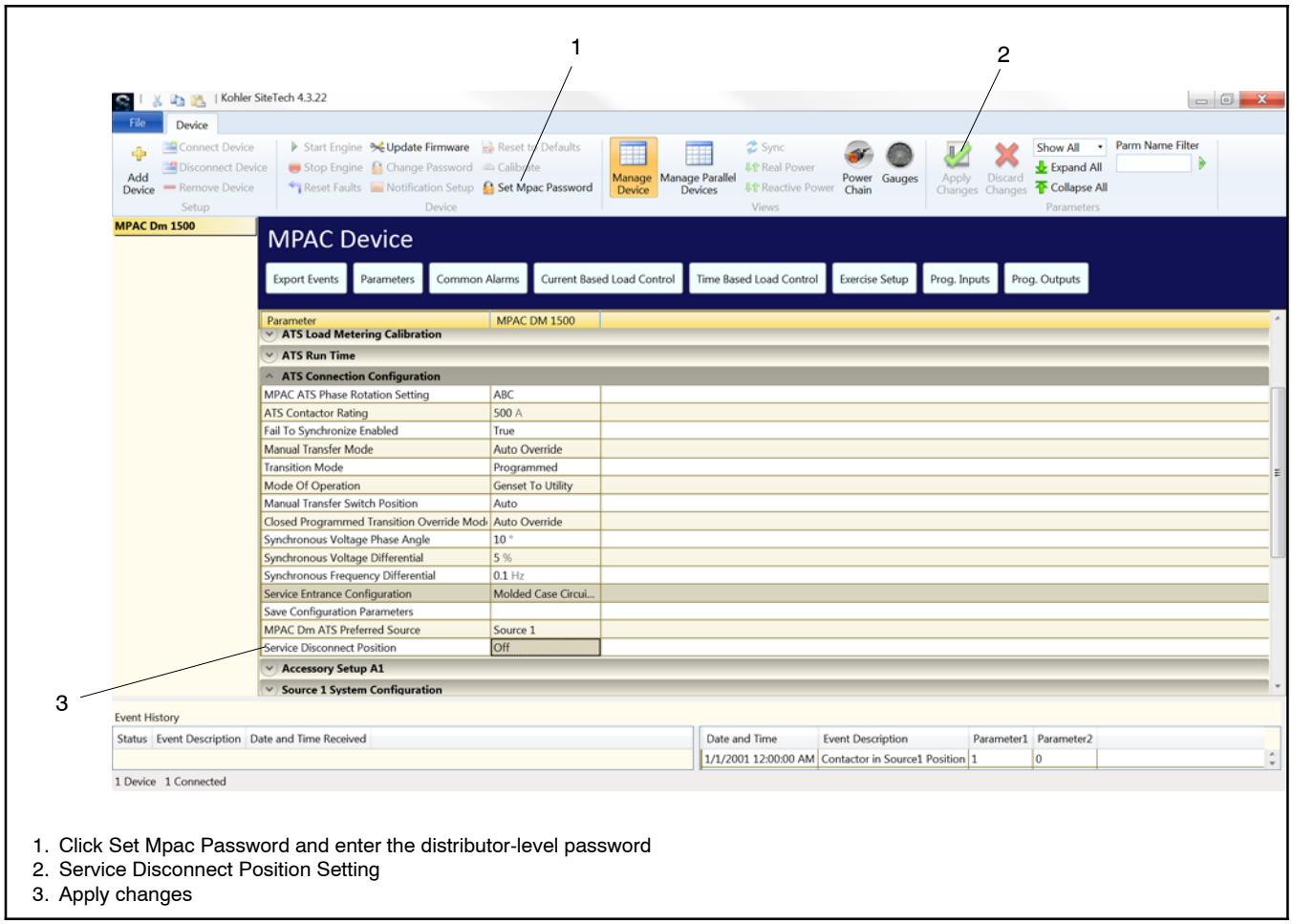
8.2.1 Procedure to Change the Service Disconnect Position Setting on the Controller

1. Use a USB cable to connect your laptop PC to the MPAC controller. See Figure 8-3.
2. Start SiteTech™ and wait for it to connect to the MPAC controller.
3. Click on Set Mpac Password and enter the distributor password. Obtain the password from the Kohler Power Systems Generator Service Department.
4. Find the Service Disconnect Position setting in the ATS Connection Configuration group. See Figure 8-4.
5. Change the Service Disconnect Position setting to Source E.
6. Check the programmable output settings and re-assign programmable output #1 to the original setting, if used.
7. Apply changes to save the new setting.



1. USB connection (below port cover)

Figure 8-3 USB Connection for SiteTech



1. Click Set Mpac Password and enter the distributor-level password
2. Service Disconnect Position Setting
3. Apply changes

Figure 8-4 Service Disconnect Position Setting in SiteTech

8.2.2 Procedure to Disconnect the Engine Start Bypass Circuit

Transfer switches using the new transformer assemblies include an engine start bypass circuit that prevents the ATS from sending an engine start signal to the generator when it is placed in the Service Disconnect position. If it is necessary to configure the ATS to operate in the Service Disconnect to Emergency position, this bypass circuit must be disconnected from the controller's input connection.

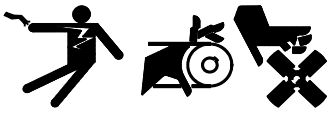
After performing this procedure, programmable output #1 is available for customer use, if needed. Programmable output #1 has been factory-set to Service Disconnect Generator Control. Be sure to reset the output to the appropriate event if connecting it to customer equipment.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ 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.

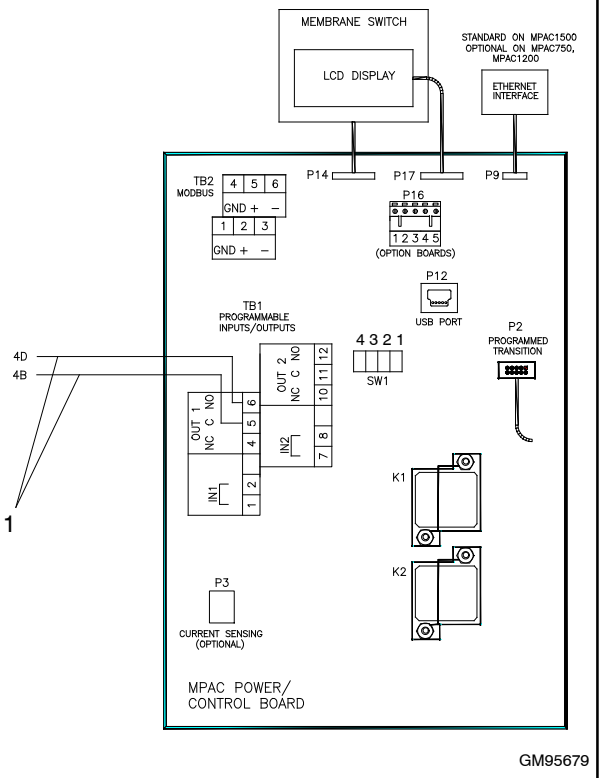
Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to 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.

See Figure 8-5 and follow these instructions.

1. Prevent the generator set from starting:
   a. Press the OFF button on the generator controller.
   b. Disconnect power to the generator engine starting battery charger, if installed.
   c. Disconnect all generator engine start battery cables, negative (-) leads first.
2. Follow the instructions in Section 1.3 of this manual to perform the service disconnect procedure and Section 1.4 to perform the control circuit isolation procedure.
3. Open the ATS enclosure door and find the programmable output connections to TB1 on the back of the Decision-Maker® MPAC 1500 controller.
4. Engine start bypass circuit leads 4B and 4D are connected to programmable output #1, terminals TB1-5 and TB1-6 on the controller's main logic circuit board. Disconnect leads 4B and 4D from the controller.
5. Connect leads 4B and 4D together and tape securely.

6. Use cable ties to secure the leads out of the way.

7. Continue to Section 8.2.3 to change the connections for the Service Disconnected Lamp.



1. Engine start bypass circuit leads 4B and 4D connected to TB1 on the controller's main circuit board.

Figure 8-5 Engine Start Bypass Circuit Connection

8.2.3 Connection Changes for Service Disconnected Lamp Operation

If a transfer switch with the new transformer assembly is converted to use the Service Disconnect to Emergency position, change the connections described in this section for correct operation of the Service Disconnected lamp. Follow the instructions in the procedure for MCCB or ICCB models as applicable to your unit.

Procedure for MCCB Models

1. Prevent the generator set from starting:

   a. Press the OFF button on the generator controller.

   b. Disconnect power to the generator engine starting battery charger, if installed.

   c. Disconnect all generator engine start battery cables, negative (–) leads first.

2. Follow the instructions in Section 1.3 of this manual to perform the service disconnect procedure and Section 1.4 to perform the control circuit isolation procedure.

3. At the TR relay on the transformer panel, disconnect lead DL2 from terminal 3 and connect it to terminal 6. See Figure 8-6.

4. Find the quick-connect QCON1 in lead USD, located between connectors P3 and P4. See Figure 8-7. Disconnect leads USD and USD1 at the quick–connect and tape the ends.

5. Reconnect power to the control circuit. Follow the instructions in Section 1.4.2.

6. Perform the service reconnect procedure described in Section 1.2.2.

7. Use Kohler® SiteTech™ software to change the service disconnect position setting to Emergency. See the procedure in Section 8.2.1.

8. Return the generator set to service:

   a. Reconnect the battery cables, negative lead last.

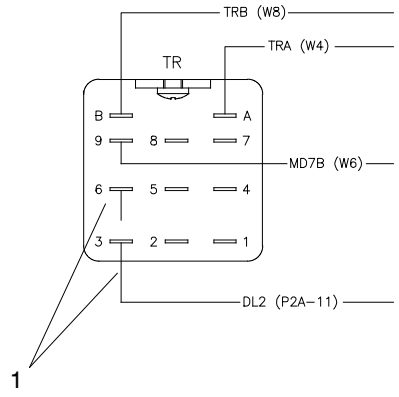
   b. Reconnect power to the battery charger.

   c. Put the generator set back into auto mode by moving the generator set master switch to the AUTO position or pressing the AUTO button on the generator set controller.

9. On the transfer switch enclosure door, change the service disconnect switch decal to show that the ATS now uses the Service Disconnect to Emergency position. Use a permanent marker or apply a new label over the existing decal that says:

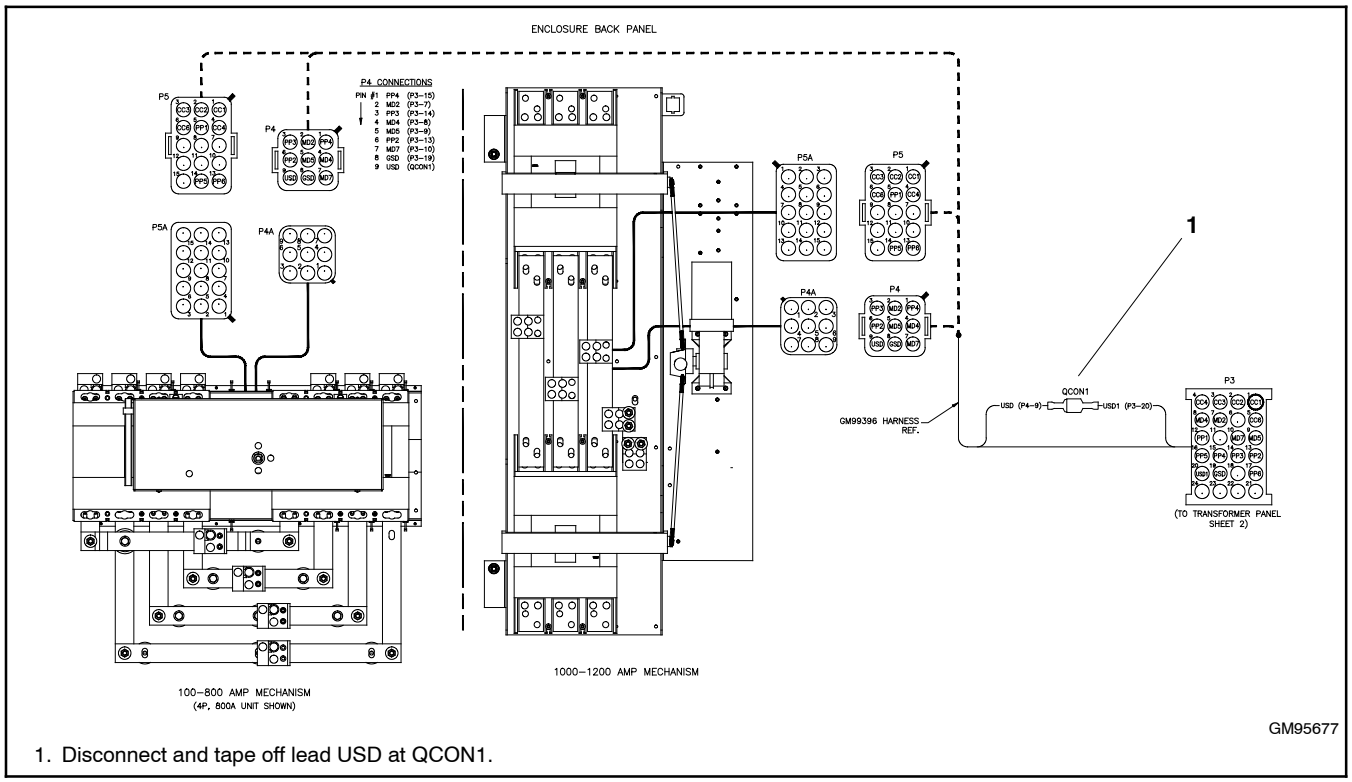
Service Disconnect transfers to EMERGENCY source and starts the generator set.

10. Test the system operation.



1. Disconnect lead DL2 from terminal 3 and connect to terminal 6.

Figure 8-6 Lead DL2 Reconnection on the Transformer Panel, MCCB Models



1. Disconnect and tape off lead USD at QCON1.

Figure 8-7 Disconnect QCON1, MCCB Models

Procedure for ICCB Models

1. Prevent the generator set from starting:

   a. Press the OFF button on the generator controller.

   b. Disconnect power to the generator engine starting battery charger, if installed.

   c. Disconnect all generator engine start battery cables, negative (–) leads first.

2. Follow the instructions in Section 1.3 of this manual to perform the service disconnect procedure and Section 1.4 to perform the control circuit isolation procedure.

3. See Figure 8-8. At the generator (emergency) circuit breaker inside the transfer switch, find lead G-22, which is connected to terminal 22 on the circuit breaker auxiliary contact terminal block. Disconnect lead G-22 and reconnect it to terminal 24.

4. At the utility (normal) circuit breaker, disconnect leads G-21 and U-21 from the circuit breaker auxiliary contact terminal block. Crimp leads G-21 and U-21 together.

5. Reconnect power to the control circuit. Follow the instructions in Section 1.4.2.

6. Perform the service reconnect procedure described in Section 1.2.2.

7. Use Kohler® SiteTech™ software to change the service disconnect position setting to Emergency. See the procedure in Section 8.2.1.

8. Return the generator set to service:

   a. Reconnect the battery cables, negative lead last.

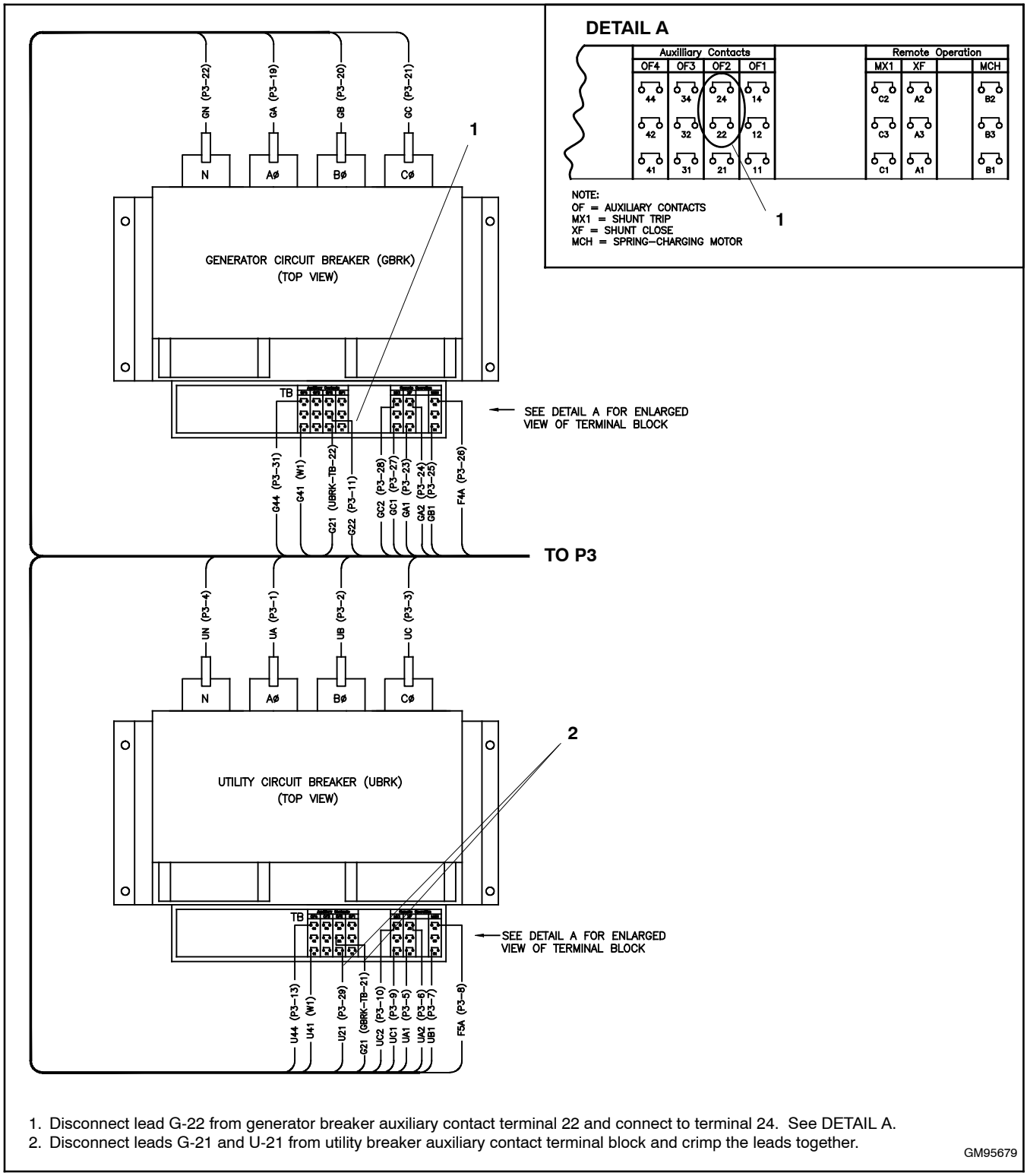
   b. Reconnect power to the battery charger.

   c. Put the generator set back into auto mode by moving the generator set master switch to the AUTO position or pressing the AUTO button on the generator set controller.

9. On the transfer switch enclosure door, change the service disconnect switch decal to show that the ATS now uses the Service Disconnect to Emergency position. Use a permanent marker or apply a new label over the existing decal that says:

Service Disconnect transfers to EMERGENCY source and starts the generator set.

10. Test the system operation.



1. Disconnect lead G-22 from generator breaker auxiliary contact terminal 22 and connect to terminal 24. See DETAIL A.
2. Disconnect leads G-21 and U-21 from utility breaker auxiliary contact terminal block and crimp the leads together.

GM95679

Figure 8-8 Reconnection of Leads G21, G22, and U21, ICCB Models

Notes

Appendix A Abbreviations

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

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
APU	Auxiliary Power Unit
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CAT5	Category 5 (network cable)
CB	circuit breaker
CC	crank cycle
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E^2PROM, EEPROM	electrically-erasable programmable read-only memory
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
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 temp., high engine temp.
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)
IBC	International Building Code
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_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	internet protocol
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
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
kWth	kilowatt-thermal
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
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
$m^3/hr.$	cubic meters per hour
$m^3/min.$	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
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
ms	millisecond
m/sec.	meters per second
mtg.	mounting
MTU	Motoren-und Turbinen-Union
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., ∅	phase
PHC	Phillips® head Crimptite® (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
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
RO	read only
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTDs	Resistance Temperature Detectors
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SMTP	simple mail transfer protocol
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SMS	short message service
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TB	terminal block
TCP	transmission control protocol
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
THD	total harmonic distortion
TIF	telephone influence factor
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UIF	user interface
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
URL	uniform resource locator (web address)
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
WO	write only
w/o	without
wt.	weight
xfmr	transformer

Appendix B Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spiralock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix C, General Torque Specifications, and other torque specifications in the service literature.

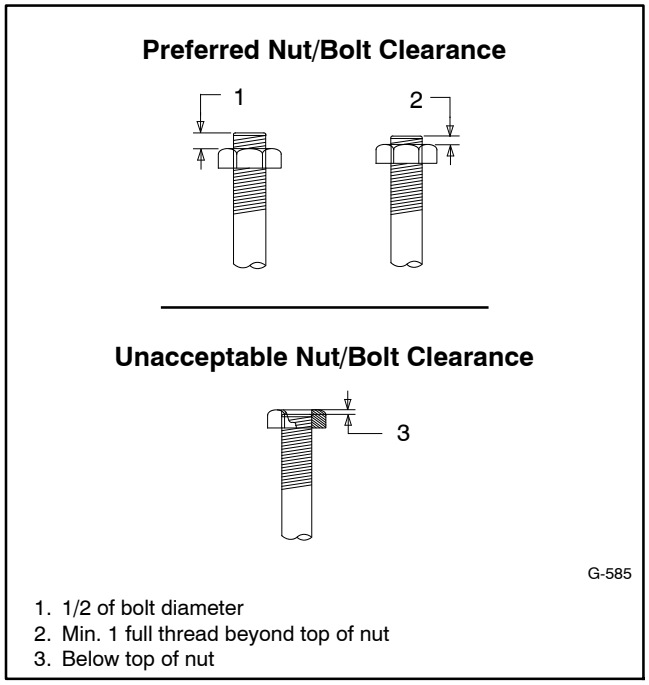


Figure 1 Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

   For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spiralock nut. See Figure 2.
3. Follow these SAE washer rules after determining exit hole type:
   a. Always use a washer between hardware and a slot.
   b. Always use a washer under a nut (see 2 above for exception).
   c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.

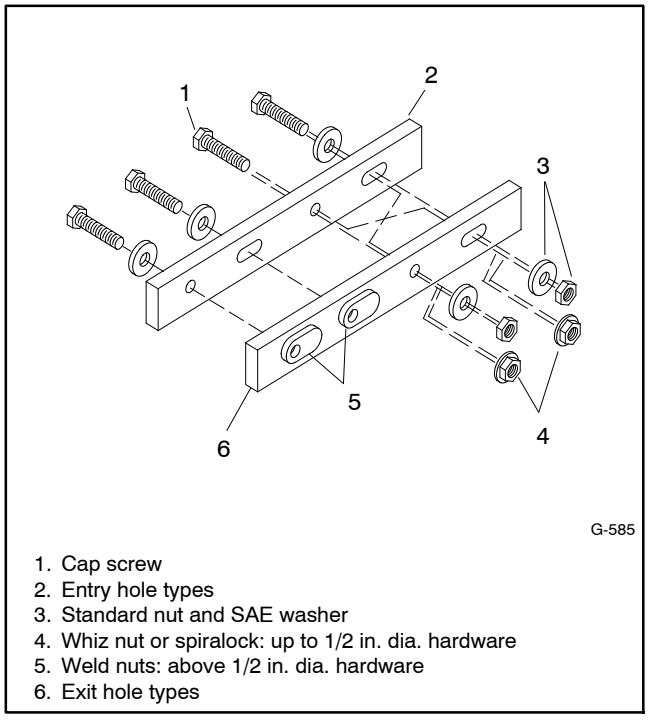


Figure 2 Acceptable Hardware Combinations

Appendix C General Torque Specifications

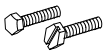
American Standard Fasteners Torque Specifications								
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
1/4-20	Nm (in. lb.)	6.8	(60)	10.8	(96)	14.9	(132)	
1/4-28	Nm (in. lb.)	8.1	(72)	12.2	(108)	16.3	(144)	
5/16-18	Nm (in. lb.)	13.6	(120)	21.7	(192)	29.8	(264)	
5/16-24	Nm (in. lb.)	14.9	(132)	23.1	(204)	32.5	(288)	
3/8-16	Nm (ft. lb.)	24.0	(18)	38.0	(28)	53.0	(39)	
3/8-24	Nm (ft. lb.)	27.0	(20)	42.0	(31)	60.0	(44)	
7/16-14	Nm (ft. lb.)	39.0	(29)	60.0	(44)	85.0	(63)	
7/16-20	Nm (ft. lb.)	43.0	(32)	68.0	(50)	95.0	(70)	
1/2-13	Nm (ft. lb.)	60.0	(44)	92.0	(68)	130.0	(96)	
1/2-20	Nm (ft. lb.)	66.0	(49)	103.0	(76)	146.0	(108)	
9/16-12	Nm (ft. lb.)	81.0	(60)	133.0	(98)	187.0	(138)	
9/16-18	Nm (ft. lb.)	91.0	(67)	148.0	(109)	209.0	(154)	
5/8-11	Nm (ft. lb.)	113.0	(83)	183.0	(135)	259.0	(191)	
5/8-18	Nm (ft. lb.)	128.0	(94)	208.0	(153)	293.0	(216)	
3/4-10	Nm (ft. lb.)	199.0	(147)	325.0	(240)	458.0	(338)	
3/4-16	Nm (ft. lb.)	222.0	(164)	363.0	(268)	513.0	(378)	
1-8	Nm (ft. lb.)	259.0	(191)	721.0	(532)	1109.0	(818)	
1-12	Nm (ft. lb.)	283.0	(209)	789.0	(582)	1214.0	(895)	

Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.)								
Size (mm)	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 5.8 or 8.8
	Grade 5.8		Grade 8.8		Grade 10.9		
M6 x 1.00	6.2	(4.6)	9.5	(7)	13.6	(10)	See Note 3
M8 x 1.25	15.0	(11)	23.0	(17)	33.0	(24)	
M8 x 1.00	16.0	(11)	24.0	(18)	34.0	(25)	
M10 x 1.50	30.0	(22)	45.0	(34)	65.0	(48)	
M10 x 1.25	31.0	(23)	47.0	(35)	68.0	(50)	
M12 x 1.75	53.0	(39)	80.0	(59)	115.0	(85)	
M12 x 1.50	56.0	(41)	85.0	(63)	122.0	(90)	
M14 x 2.00	83.0	(61)	126.0	(93)	180.0	(133)	
M14 x 1.50	87.0	(64)	133.0	(98)	190.0	(140)	
M16 x 2.00	127.0	(94)	194.0	(143)	278.0	(205)	
M16 x 1.50	132.0	(97)	201.0	(148)	287.0	(212)	
M18 x 2.50	179.0	(132)	273.0	(201)	390.0	(288)	
M18 x 1.50	189.0	(140)	289.0	(213)	413.0	(305)	

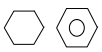
Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have either two diameters of thread engagement or a 30% or more reduction in the torque to prevent stripped threads.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 90% of the yield strength and a friction coefficient of 0.125.

Appendix D Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

American Standard (Screws, Bolts, Studs, and Nuts)

1/4-20 x 1

- Length In Inches (Screws and Bolts)
- Threads Per Inch
- Major Thread Diameter In Fractional Inches Or Screw Number Size

Metric (Screws, Bolts, Studs, and Nuts)

M8-1.25 x 20

- Length In Millimeters (Screws and Bolts)
- Distance Between Threads In Millimeters
- Major Thread Diameter In Millimeters

Plain Washers

9/32 x 5/8 x 1/16

- Thickness
- External Dimension
- Internal Dimension

Lock Washers

5/8

- Internal Dimension

Appendix E Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions
Hex Head Bolts (Grade 5)	
X-465-17	1/4-20 x .38
X-465-6	1/4-20 x .50
X-465-2	1/4-20 x .62
X-465-16	1/4-20 x .75
X-465-18	1/4-20 x .88
X-465-7	1/4-20 x 1.00
X-465-8	1/4-20 x 1.25
X-465-9	1/4-20 x 1.50
X-465-10	1/4-20 x 1.75
X-465-11	1/4-20 x 2.00
X-465-12	1/4-20 x 2.25
X-465-14	1/4-20 x 2.75
X-465-21	1/4-20 x 5.00
X-465-25	1/4-28 x .38
X-465-20	1/4-28 x 1.00
X-125-33	5/16-18 x .50
X-125-23	5/16-18 x .62
X-125-3	5/16-18 x .75
X-125-31	5/16-18 x .88
X-125-5	5/16-18 x 1.00
X-125-24	5/16-18 x 1.25
X-125-34	5/16-18 x 1.50
X-125-25	5/16-18 x 1.75
X-125-26	5/16-18 x 2.00
230578	5/16-18 x 2.25
X-125-29	5/16-18 x 2.50
X-125-27	5/16-18 x 2.75
X-125-28	5/16-18 x 3.00
X-125-22	5/16-18 x 4.50
X-125-32	5/16-18 x 5.00
X-125-35	5/16-18 x 5.50
X-125-36	5/16-18 x 6.00
X-125-40	5/16-18 x 6.50
X-125-43	5/16-24 x 1.75
X-125-44	5/16-24 x 2.50
X-125-30	5/16-24 x .75
X-125-39	5/16-24 x 2.00
X-125-38	5/16-24 x 2.75
X-6238-2	3/8-16 x .62
X-6238-10	3/8-16 x .75
X-6238-3	3/8-16 x .88
X-6238-11	3/8-16 x 1.00
X-6238-4	3/8-16 x 1.25
X-6238-5	3/8-16 x 1.50
X-6238-1	3/8-16 x 1.75
X-6238-6	3/8-16 x 2.00
X-6238-17	3/8-16 x 2.25
X-6238-7	3/8-16 x 2.50
X-6238-8	3/8-16 x 2.75
X-6238-9	3/8-16 x 3.00
X-6238-19	3/8-16 x 3.25
X-6238-12	3/8-16 x 3.50
X-6238-20	3/8-16 x 3.75
X-6238-13	3/8-16 x 4.50
X-6238-18	3/8-16 x 5.50
X-6238-25	3/8-16 x 6.50

Part No.	Dimensions
Hex Head Bolts, cont.	
X-6238-14	3/8-24 x .75
X-6238-16	3/8-24 x 1.25
X-6238-21	3/8-24 x 4.00
X-6238-22	3/8-24 x 4.50
X-6024-5	7/16-14 x .75
X-6024-2	7/16-14 x 1.00
X-6024-8	7/16-14 x 1.25
X-6024-3	7/16-14 x 1.50
X-6024-4	7/16-14 x 2.00
X-6024-11	7/16-14 x 2.75
X-6024-12	7/16-14 x 6.50
X-129-15	1/2-13 x .75
X-129-17	1/2-13 x 1.00
X-129-18	1/2-13 x 1.25
X-129-19	1/2-13 x 1.50
X-129-20	1/2-13 x 1.75
X-129-21	1/2-13 x 2.00
X-129-22	1/2-13 x 2.25
X-129-23	1/2-13 x 2.50
X-129-24	1/2-13 x 2.75
X-129-25	1/2-13 x 3.00
X-129-27	1/2-13 x 3.50
X-129-29	1/2-13 x 4.00
X-129-30	1/2-13 x 4.50
X-463-9	1/2-13 x 5.50
X-129-44	1/2-13 x 6.00
X-129-51	1/2-20 x .75
X-129-45	1/2-20 x 1.25
X-129-52	1/2-20 x 1.50
X-6021-3	5/8-11 x 1.00
X-6021-4	5/8-11 x 1.25
X-6021-2	5/8-11 x 1.50
X-6021-1	5/8-11 x 1.75
273049	5/8-11 x 2.00
X-6021-5	5/8-11 x 2.25
X-6021-6	5/8-11 x 2.50
X-6021-7	5/8-11 x 2.75
X-6021-12	5/8-11 x 3.75
X-6021-11	5/8-11 x 4.50
X-6021-10	5/8-11 x 6.00
X-6021-9	5/8-18 x 2.50
X-6239-1	3/4-10 x 1.00
X-6239-8	3/4-10 x 1.25
X-6239-2	3/4-10 x 1.50
X-6239-3	3/4-10 x 2.00
X-6239-4	3/4-10 x 2.50
X-6239-5	3/4-10 x 3.00
X-6239-6	3/4-10 x 3.50
X-792-1	1-8 x 2.25
X-792-5	1-8 x 3.00
X-792-8	1-8 x 5.00

Part No.	Dimensions	Type
Hex Nuts		
X-6009-1	1-8	Standard
X-6210-3	6-32	Whiz
X-6210-4	8-32	Whiz
X-6210-5	10-24	Whiz
X-6210-1	10-32	Whiz
X-6210-2	1/4-20	Spiralock
X-6210-6	1/4-28	Spiralock
X-6210-7	5/16-18	Spiralock
X-6210-8	5/16-24	Spiralock
X-6210-9	3/8-16	Spiralock
X-6210-10	3/8-24	Spiralock
X-6210-11	7/16-14	Spiralock
X-6210-12	1/2-13	Spiralock
X-6210-15	7/16-20	Spiralock
X-6210-14	1/2-20	Spiralock
X-85-3	5/8-11	Standard
X-88-12	3/4-10	Standard
X-89-2	1/2-20	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

Metric

Hex head bolts are hardness grade 8.8 unless noted.

Hex Head Bolts (Partial Thread)

Part No.	Dimensions
M931-05055-60	M5-0.80 x 55
M931-06040-60	M6-1.00 x 40
M931-06055-60	M6-1.00 x 55
M931-06060-60	M6-1.00 x 60
M931-06060-SS	M6-1.00 x 60
M931-06070-60	M6-1.00 x 70
M931-06070-SS	M6-1.00 x 70
M931-06075-60	M6-1.00 x 75
M931-06090-60	M6-1.00 x 90
M931-06145-60	M6-1.00 x 145
M931-06150-60	M6-1.00 x 150
M931-08035-60	M8-1.25 x 35
M931-08040-60	M8-1.25 x 40
M931-08045-60	M8-1.25 x 45
M931-08050-60	M8-1.25 x 50
M931-08055-60	M8-1.25 x 55
M931-08055-82	M8-1.25 x 55*
M931-08060-60	M8-1.25 x 60
M931-08070-60	M8-1.25 x 70
M931-08070-82	M8-1.25 x 70*
M931-08075-60	M8-1.25 x 75
M931-08080-60	M8-1.25 x 80
M931-08090-60	M8-1.25 x 90
M931-08095-60	M8-1.25 x 95
M931-08100-60	M8-1.25 x 100
M931-08110-60	M8-1.25 x 110
M931-08120-60	M8-1.25 x 120
M931-08130-60	M8-1.25 x 130
M931-08140-60	M8-1.25 x 140
M931-08150-60	M8-1.25 x 150
M931-08200-60	M8-1.25 x 200
M931-10040-82	M10-1.25 x 40*
M931-10040-60	M10-1.50 x 40
M931-10045-60	M10-1.50 x 45
M931-10050-60	M10-1.50 x 50
M931-10050-82	M10-1.25 x 50*
M931-10055-60	M10-1.50 x 55
M931-10060-60	M10-1.50 x 60
M931-10065-60	M10-1.50 x 65
M931-10070-60	M10-1.50 x 70
M931-10080-60	M10-1.50 x 80
M931-10080-82	M10-1.25 x 80*
M931-10090-60	M10-1.50 x 90
M931-10090-82	M10-1.50 x 90*
M931-10100-60	M10-1.50 x 100
M931-10110-60	M10-1.50 x 110
M931-10120-60	M10-1.50 x 120
M931-10130-60	M10-1.50 x 130
M931-10140-60	M10-1.50 x 140
M931-10180-60	M10-1.50 x 180
M931-10235-60	M10-1.50 x 235
M931-10260-60	M10-1.50 x 260
M960-10330-60	M10-1.25 x 330
M931-12045-60	M12-1.75 x 45
M960-12050-60	M12-1.25 x 50
M960-12050-82	M12-1.25 x 50*
M931-12050-60	M12-1.75 x 50
M931-12050-82	M12-1.75 x 50*
M931-12055-60	M12-1.75 x 55
M931-12060-60	M12-1.75 x 60
M931-12060-82	M12-1.75 x 60*
M931-12065-60	M12-1.75 x 65
M931-12075-60	M12-1.75 x 75
M931-12080-60	M12-1.75 x 80
M931-12090-60	M12-1.75 x 90
M931-12100-60	M12-1.75 x 100
M931-12110-60	M12-1.75 x 110

Hex Head Bolts (Partial Thread), continued

Part No.	Dimensions
M960-16090-60	M16-1.50 x 90
M931-16090-60	M16-2.00 x 90
M931-16100-60	M16-2.00 x 100
M931-16100-82	M16-2.00 x 100*
M931-16120-60	M16-2.00 x 120
M931-16150-60	M16-2.00 x 150
M931-20065-60	M20-2.50 x 65
M931-20090-60	M20-2.50 x 90
M931-20100-60	M20-2.50 x 100
M931-20120-60	M20-2.50 x 120
M931-20140-60	M20-2.50 x 140
M931-20160-60	M20-2.50 x 160
M931-22090-60	M22-2.50 x 90
M931-22120-60	M22-2.50 x 120
M931-22160-60	M22-2.50 x 160
M931-24090-60	M24-3.00 x 90
M931-24120-60	M24-3.00 x 120
M931-24160-60	M24-3.00 x 160
M931-24200-60	M24-3.00 x 200

Hex Head Bolts (Full Thread)

Part No.	Dimensions
M933-04006-60	M4-0.70 x 6
M933-05030-60	M5-0.80 x 30
M933-05035-60	M5-0.80 x 35
M933-05050-60	M5-0.80 x 50
M933-06010-60	M6-1.00 x 10
M933-06012-60	M6-1.00 x 12
M933-06014-60	M6-1.00 x 14
M933-06016-60	M6-1.00 x 16
M933-06020-60	M6-1.00 x 20
M933-06025-60	M6-1.00 x 25
M933-06030-60	M6-1.00 x 30
M933-06040-60	M6-1.00 x 40
M933-06050-60	M6-1.00 x 50
M933-07025-60	M7-1.00 x 25
M933-08010-60	M8-1.25 x 10
M933-08012-60	M8-1.25 x 12
M933-08016-60	M8-1.25 x 16
M933-08020-60	M8-1.25 x 20
M933-08025-60	M8-1.25 x 25
M933-08030-60	M8-1.25 x 30
M933-08030-82	M8-1.25 x 30*
M933-10012-60	M10-1.50 x 12
M961-10020-60	M10-1.25 x 20
M933-10020-60	M10-1.50 x 20
M933-10025-60	M10-1.50 x 25
M961-10025-60	M10-1.25 x 25
M933-10025-82	M10-1.50 x 25*
M961-10030-60	M10-1.25 x 30
M933-10030-60	M10-1.50 x 30
M933-10030-82	M10-1.50 x 30*
M961-10035-60	M10-1.25 x 35
M933-10035-60	M10-1.50 x 35
M933-10035-82	M10-1.50 x 35*
M961-10040-60	M10-1.25 x 40

Hex Head Bolts (Full Thread), continued

Part No.	Dimensions
M933-12016-60	M12-1.75 x 16
M933-12020-60	M12-1.75 x 20
M961-12020-60F	M12-1.50 x 20
M933-12025-60	M12-1.75 x 25
M933-12025-82	M12-1.75 x 25*
M961-12030-60	M12-1.25 x 30
M933-12030-82	M12-1.75 x 30*
M961-12030-82F	M12-1.50 x 30*
M933-12030-60	M12-1.75 x 30
M933-12035-60	M12-1.75 x 35
M961-12040-82	M12-1.25 x 40*
M933-12040-60	M12-1.75 x 40
M933-12040-82	M12-1.75 x 40*
M961-14025-60	M14-1.50 x 25
M933-14025-60	M14-2.00 x 25
M961-14050-82	M14-1.50 x 50*
M961-16025-60	M16-1.50 x 25
M933-16025-60	M16-2.00 x 25
M961-16030-82	M16-1.50 x 30*
M933-16030-82	M16-2.00 x 30*
M933-16035-60	M16-2.00 x 35
M961-16040-60	M16-1.50 x 40
M933-16040-60	M16-2.00 x 40
M961-16045-82	M16-1.50 x 45*
M933-16045-82	M16-2.00 x 45*
M933-16050-60	M16-2.00 x 50
M933-16050-82	M16-2.00 x 50*
M933-16060-60	M16-2.00 x 60
M933-16070-60	M16-2.00 x 70
M933-18035-60	M18-2.50 x 35
M933-18050-60	M18-2.50 x 50
M933-18060-60	M18-2.50 x 60
M933-20050-60	M20-2.50 x 50
M933-20055-60	M20-2.50 x 55
M933-24060-60	M24-3.00 x 60
M933-24065-60	M24-3.00 x 65
M933-24070-60	M24-3.00 x 70

Pan Head Machine Screws

M7985A-03010-20	M3-0.50 x 10
M7985A-03012-20	M3-0.50 x 12
M7985A-04010-20	M4-0.70 x 10
M7985A-04016-20	M4-0.70 x 16
M7985A-04020-20	M4-0.70 x 20
M7985A-04050-20	M4-0.70 x 50
M7985A-04100-20	M4-0.70 x 100
M7985A-05010-20	M5-0.80 x 10
M7985A-05012-20	M5-0.80 x 12
M7985A-05016-20	M5-0.80 x 16
M7985A-05020-20	M5-0.80 x 20
M7985A-05025-20	M5-0.80 x 25
M7985A-05030-20	M5-0.80 x 30
M7985A-05080-20	M5-0.80 x 80
M7985A-05100-20	M5-0.80 x 100
M7985A-06100-20	M6-1.00 x 100

Flat Head Machine Screws

M965A-04012-SS	M4-0.70 x 12
M965A-05012-SS	M5-0.80 x 12
M965A-05016-20	M5-0.80 x 16
M965A-06012-20	M6-1.00 x 12

* This metric hex bolt's hardness is grade 10.9.

Metric, continued

Hex Nuts

Part No.	Dimensions	Type
M934-03-50	M3-0.50	Standard
M934-04-50	M4-0.70	Standard
M934-04-B	M4-0.70	Brass
M934-05-50	M5-0.80	Standard
M934-06-60	M6-1.00	Standard
M934-06-64	M6-1.00	Std. (green)
M6923-06-80	M6-1.00	Spiralock
M982-06-80	M6-1.00	Elastic Stop
M934-08-60	M8-1.25	Standard
M6923-08-80	M8-1.25	Spiralock
M982-08-80	M8-1.25	Elastic Stop
M934-10-60	M10-1.50	Standard
M934-10-60F	M10-1.25	Standard
M6923-10-80	M10-1.50	Spiralock
M6923-10-62	M10-1.50	Spiralock†
M982-10-80	M10-1.50	Elastic Stop
M934-12-60	M12-1.75	Standard
M934-12-60F	M12-1.25	Standard
M6923-12-80	M12-1.75	Spiralock
M982-12-80	M12-1.75	Elastic Stop
M982-14-60	M14-2.00	Elastic Stop
M6923-16-80	M16-2.00	Spiralock
M982-16-80	M16-2.00	Elastic Stop
M934-18-80	M18-2.5	Standard
M982-18-60	M18-2.50	Elastic Stop
M934-20-80	M20-2.50	Standard
M982-20-80	M20-2.50	Elastic Stop
M934-22-60	M22-2.50	Standard
M934-24-80	M24-3.00	Standard
M982-24-60	M24-3.00	Elastic Stop
M934-30-80	M30-3.50	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
M125A-03-80	3.2	7.0	0.5	M3
M125A-04-80	4.3	9.0	0.8	M4
M125A-05-80	5.3	10.0	1.0	M5
M125A-06-80	6.4	12.0	1.6	M6
M125A-08-80	8.4	16.0	1.6	M8
M125A-10-80	10.5	20.0	2.0	M10
M125A-12-80	13.0	24.0	2.5	M12
M125A-14-80	15.0	28.0	2.5	M14
M125A-16-80	17.0	30.0	3.0	M16
M125A-18-80	19.0	34.0	3.0	M18
M125A-20-80	21.0	37.0	3.0	M20
M125A-24-80	25.0	44.0	4.0	M24

† This metric hex nut's hardness is grade 8.

Notes

Notes

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