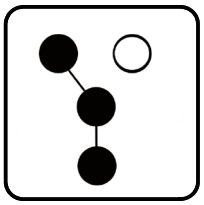
Operation

Automatic Transfer Switches



Controls:
Decision-Maker® MPAC 750

Transfer Switch Model:
KSS

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
Power Systems

TP-6865 4/14

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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***.

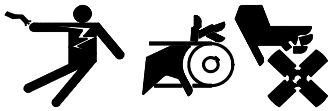
NOTICE

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 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.

(Decision-Maker® 3000 and 6000 Generator Set 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.

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before servicing. Install the barrier after adjustments, maintenance, or servicing.

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.
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.

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.

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

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

Heavy Equipment

⚠ WARNING

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

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

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

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

This manual provides operation instructions for Kohler® Decision-Maker® MPAC 750 automatic transfer switch controls and related accessories.

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.

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

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

List of Related Materials

A separate transfer switch installation manual provided with the unit contains instructions for transfer switch installation and manual operation procedures.

Literature Item	Part Number
Specification Sheet, MPAC 750 Controller	G11-126
Specification Sheet, Model KSS/KSP	G11-130
Installation Manual, Model KSS/KSP	TP-6834
Operation Manual, Modbus Protocol	TP-6113

Service Assistance

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

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

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Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka
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Bangalore, India
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(91) 80 3366231
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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 Introduction

This section contains operation instructions, including:

- User interface panel, with pushbuttons and LED indicators
- Warnings and faults
- Test
- Exercise
- Controller Reset

1.2 Source Names

Throughout this manual, the sources are referred to using the following names:

- Source N
- Source E
- Preferred Source
- Standby Source

Source N is connected to the Normal side of the transfer switch. Source E is connected to the Emergency side of the transfer switch. In most applications, Source N is the utility source, and Source E is the standby generator set. The engine start contacts are associated with Source E.

The Preferred Source is the source that will be used if both sources are available. With the MPAC 750 controller, the preferred source is Source N. The standby source is Source E.

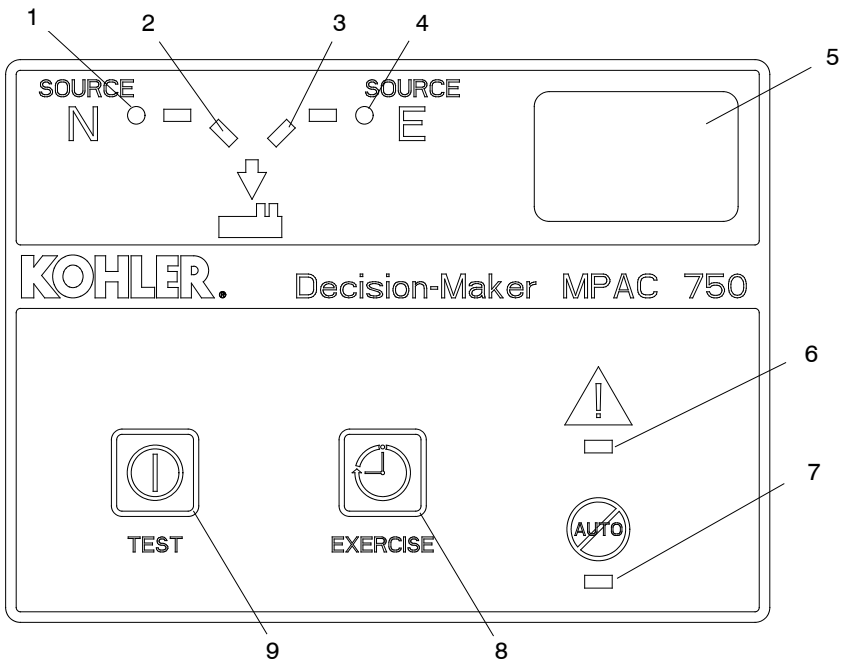
1.3 User Interface Panel

The user interface panel is located on the transfer switch door. Figure 1-1 shows the user interface pushbuttons and LED indicators.

1.3.1 Pushbuttons

The user interface panel has two pushbuttons:

- Test (see Section 1.4)
- Exercise (see Section 1.6)



1. Source N Available LED
2. Source N Position LED
3. Source E Position LED
4. Source E Available LED
5. USB port location
6. System Alert LED
7. Not in Auto LED
8. Exercise button
9. Test button

Figure 1-1 User Interface Panel

1.3.2 LED Indicators

LEDs on the user interface indicate contactor position, source availability, faults, and other conditions. The table in Figure 1-2 describes the functions of the LED indicators. Source N is connected to the normal side of the ATS and is typically the utility source. Source E is connected to the emergency side of the ATS and is typically the generator set.

The Source E Available and Source E Position LEDs also indicate test and exercise runs as described in Figure 1-3. See Sections 1.4 and 1.6 for more information.

See Section 1.7 for more information about warnings and faults.

Some programmable inputs will trigger the LEDs to light or flash. See Section 3.6.

LED Indicator	Condition
Source N Available, Green	Source N is available.
Source E Available, Red	Source E is available.
Position N, Green	Contactor is in Normal position.
Position E, 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 1.7.
	Input active: Low Battery Voltage or Remote Common Alarm. See Section 3.6.
Not in Auto, Red	ATS is not set for automatic operation.
	Flashes for manual transfer waiting.
	Inhibit Transfer input is active. See Section 3.6.

Figure 1-2 User Interface LED Indicators

Condition	Source E Available (RED)	Source E Position (RED)
Unloaded Test	Flash 1sec/1sec	OFF
Loaded Test	Flash 1sec/1sec	Flash 1sec/1sec
Unloaded Exercise	Flash 0.5 sec/2 sec	OFF
Loaded Exercise	Flash 0.5 sec/2 sec	Flash 0.5 sec/2 sec

Figure 1-3 Test and Exercise Indication

1.4 Test

Use the Test button to:

- Start and run the generator set (unloaded test).
- Simulate a Source N failure, resulting in a transfer to Source E (loaded test).

If the emergency source is lost during a system test, the test is terminated. If the contactor is in the standby position, it transfers immediately to the preferred position.

For remote test information, also see Section 3.6.1.

1.4.1 Unloaded System Test

Press and hold the Test button for 3–5 seconds to start an unloaded test. The generator set will start without waiting for the engine start time delay. The load is not transferred to the generator set. The generator runs until the test is ended.

During an unloaded test, the Source E available LED flashes, 1 second on and 1 second off.

Press and hold the Test pushbutton for about 2 seconds to end the test. Time delays will execute as programmed when the test is ended. The Source E available LED lights during the time delays. The generator set shuts down.

If the normal source fails during the test, the contactor transfers to the emergency source. The ATS then monitors the sources and operates automatically when the normal source returns.

1.4.2 Loaded System Test

A loaded test simulates a failure of source N. Press and hold the Test button for 6 seconds or longer to start a loaded test. The generator set will start without waiting for the engine start time delay. The ATS then transfers the load to the generator set.

Since the loaded test transfer will be between two live sources, the in-phase monitor feature will be activated if it is enabled.

During a loaded test, the Source E available and Source E position LEDs flash, 1 second on and 1 second off.

Press and hold the Test pushbutton for about 2 seconds to end the test. The retransfer sequence operates as though Source N has been restored after a failure. The load is transferred back to source N. All time delays are executed and an in-phase transfer will occur if enabled. The Source E LEDs light during the time delays. The generator set shuts down.

If Source E is lost during the test and Source N is available, the transfer switch will immediately transfer to the Source N position, bypassing all time delays. If source N is lost during a loaded test with the contactor in the standby position, the test will continue to run.

1.5 Automatic Operation Test

Check the transfer switch's automatic control system immediately after the voltage check. Review the operation instructions in Section 1 before proceeding.

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

Follow the procedure below to start a loaded test. Verify that the ATS starts the generator set and transfers the load to the emergency source, executing all time delays that are set up to operate during a loss of the normal source. End the test and verify that the transfer switch transfers the load back to the normal source and removes the engine start signal, executing all appropriate programmed time delays. Refer to Section 2.2.3 for a more detailed description of the test sequence of operation.

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

Automatic Operation Test Procedure

1. Check the controller LED indicators to verify that the Source N Position and Source N Available indicators are lit.

2. Verify that the generator set master switch is in the AUTO position.

3. Press and hold the Test button for 6 seconds or longer to start a loaded test.

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

5. 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-standby transfer time delay, verify that the Source N Position LED turns off and the Source E Position LED lights, indicating that the switch has transferred the load to Source E.

6. Press and hold the Test pushbutton for about 2 seconds to end the test.

7. Verify that the switch transfers the load back to Source N. After the standby-to-preferred time delay, verify that the Source E Position LED goes out and the Source N Position LED lights, indicating that the switch has transferred the load to Source N.

8. 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.

1.6 Exercise

Set the exerciser after the ATS is installed. The exercise automatically runs the generator set for 20 minutes each week.

If a system test is active when the exercise is scheduled to occur, the exercise is skipped. A preferred-source failure during an exerciser period causes the exercise to be terminated and normal ATS operation to resume.

1.6.1 Exercise Schedule

Pressing the exercise button to start a loaded or unloaded exercise as described in the following sections sets the exercise time and day. The system will exercise at the same time and day each week.

To change the schedule, simply start a new exercise on the desired day and time.

To start and stop the generator set without changing the exercise schedule, use the Test button. See Section 1.4 for instructions.

1.6.2 Unloaded Exercise

An unloaded exercise starts and runs the generator set for 20 minutes without transferring the load. Press and hold the exercise button for 3–5 seconds to start an unloaded exercise. During an unloaded exercise, the Source E available LED flashes, 0.5 seconds on and 2 seconds off.

1.6.3 Loaded Exercise

A loaded exercise starts the generator set and transfers the load from the normal source to Source E. Press and hold the Exercise button for 6 seconds or longer to start a loaded exercise. During a loaded exercise, the Source E available and Source E position LEDs flash, 0.5 seconds on and 2 seconds off. After 20 minutes, the load transfers back to the normal source and the generator set shuts down.

1.6.4 Stopping an Exercise

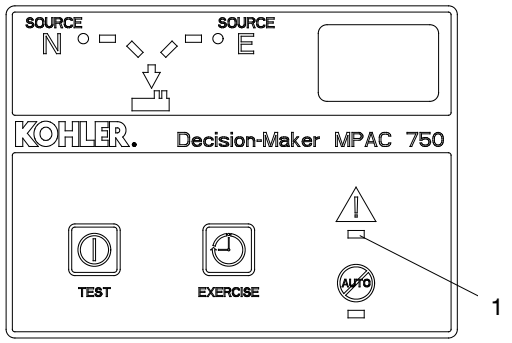
If it is necessary to stop an exercise while it is running, press and hold the exercise button for 2 seconds. Stopping an exercise does not affect the weekly exercise schedule.

1.6.5 Optional Programmable Exerciser

A programmable exercise timer is available. The optional exerciser allows scheduling of additional loaded or unloaded exercises. See Section 6.4 for more information.

1.7 Warnings and Faults

When a fault exists, the System Alert indicator LED turns on and the related output is activated. If the output is assigned to the common fault, the common fault output is also activated. See Figure 1-4 for the location of the System Alert indicator.



1. System Alert LED GM46892

Figure 1-4 Fault Indication

ATS warnings and faults are shown in Figure 1-5. 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 Source N position, the engine cooldown time delay executes and the engine start contacts open, allowing the generator set to shut down. See Section 1.7.1 for instructions to reset faults.

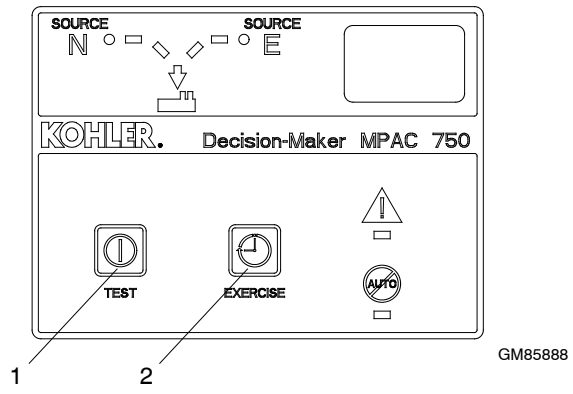
Self Resetting Faults. Under these conditions, active modes are turned off. If the contactor is in the Source N position, the engine cooldown time delay executes and the engine start contacts open, allowing the generator set to shut down. When the fault condition is corrected, the fault is automatically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

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 Source E generator set did not start.
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 come into phase after the time delay expires, the warning is automatically cleared and normal ATS operation continues.
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.
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.
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).
External Fault	Self-Resetting Fault	The external input dedicated to this condition is closed.

Figure 1-5 Warnings and Faults

1.7.1 Fault Reset

To clear a fault or warning condition and reset the System Alert LED, press the Test and Exercise buttons at the same time and hold for 2 seconds. See Figure 1-6.



1. Test button
2. Exercise button

Press and hold the Test and Exercise buttons for 2 seconds to clear a fault condition.

Figure 1-6 Fault Reset

1.8 Controller Reset

1.8.1 Reboot

To reboot the controller processor while retaining all parameter settings, press the Test and Exercise buttons at the same time and hold for 15 seconds.

1.8.2 Reset to Default Settings

A personal computer with Kohler® SiteTech™ software can be used to reset the controller to factory defaults, if necessary. SiteTech software is only available to Kohler authorized distributors or dealers.

Note: 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 SiteTech software to set the system voltage and frequency after resetting to the default parameters.

Check the system operation to verify the settings after resetting.

2.1 Controller Power-up/Reset

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.

2.2 Sequence of Operation

The Sequence of Operation describes the transfer switch normal operation. The MPAC 750 controller operates using standard transition only (no programmed- or closed-transition operation).

Operation can be affected by faults such as the normal or emergency contacts failing to open or close when signaled to do so.

2.2.1 Source N Loss and Return

Following is an explanation of the transfer switch sequence of operation when Source N failure is detected.

Source N Fails

1. Engine start time delay expires.
2. The generator is signaled to start.
3. The generator starts and Source E becomes available.
4. Preferred-to-standby time delay expires.
5. Contactor transfers to Source E.

Source N Returns

1. Standby-to-preferred time delay expires.
2. Contactor transfers to Source N.
3. Engine cooldown time delay expires.
4. The engine start contacts open, signaling the generator to stop.

2.2.2 Exerciser Operation

Unloaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The generator is signaled to start.
3. The generator starts and Source E becomes available.

Unloaded Exercise Sequence Ends

1. Engine cooldown time delay expires.
2. The engine start contacts open, signaling the generator to stop.

Loaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The generator is signaled to start.
3. The generator starts and Source E becomes available.
4. Preferred-to-standby time delay and pre-transfer load control sequences run.
5. Contactor transfers to Source E.

Source E Fails (Source N is available)

1. Exerciser is deactivated.
2. Contactor immediately transfers to Source N.
3. Immediate failure to acquire standby alarm.
4. Engine cooldown time delay expires.
5. Engine start contacts open.

Loaded Exercise Sequence Ends

1. Contactor transfers to preferred.
2. Engine cooldown time delay expires.
3. The engine start contacts open, signaling the generator to stop.

2.2.3 Test Sequence

Unloaded Test Function is Initiated

1. The generator set is signaled to start.
2. The generator starts and Source E becomes available.

Unloaded Test Function is Ended

1. Engine cooldown time delay expires.
2. The generator is signaled to stop.

Loaded Test Function is Initiated

1. The generator is signaled to start (engine start contacts close).
2. The generator starts and Source E becomes available.
3. Preferred-to-standby time delay expires.
4. Contactor transfers to Source E.

Source E Fails (Source N is available)

1. Test function is deactivated.
2. Contactor immediately transfers to Source N.
3. Immediate failure to acquire standby alarm.
4. Engine cooldown time delay expires.
5. Engine start contacts open.

Loaded Test Function is Ended

1. Standby-to-preferred time delay sequence runs.
2. Contactor transfers to Source N.
3. Engine cooldown time delay expires.
4. The engine start contacts open, signaling the generator to stop.

3.1 Introduction

The Decision-Maker® MPAC 750 controller is factory set for your transfer switch. This section lists factory settings and adjustment ranges.

If necessary, some settings can be changed using a personal computer and Kohler® SiteTech® software or over Modbus®. SiteTech software is only available to Kohler authorized distributors and dealers.

Use a USB cable with a male mini-B connector to connect the controller to a laptop computer. The USB connector is located on the front of the controller. See Figure 1-1.

Using Modbus

Commercially available programs can be used to read and change some settings over Modbus. For other Modbus applications, the Modbus master must be programmed to read the Modbus registers. Modbus registers are published in TP-6113, Modbus Protocol Operation Manual. A system designer trained in the application of Modbus protocol must write and thoroughly test the program before implementation.

3.2 System Setup

The transfer switch is factory-set with default settings for time delays and other parameters. See Section 1 for the default settings. Settings can be adjusted, if necessary using a personal computer and Kohler® SiteTech™ software or over Modbus. SiteTech software is available to Kohler authorized distributors and dealers.

Note: Use caution when changing transfer switch settings. The source voltage and frequency settings must match the values shown on the transfer switch nameplate.

3.3 System Parameters

The transfer switch is factory-set for the transfer switch model and rating. System parameters should not require adjustment.

The system parameter factory settings are shown in Figure 3-1. Note that some settings are not adjustable.

System Parameter	Factory Setting
Transition type, standard	See the ATS nameplate
Single/three phase	
Operating voltage	
Operating frequency (50 or 60 Hz)	
Rated current	
Transfer mode (automatic or non-automatic)*	
Phase rotation*	ABC
Commit to transfer*	No
Operating mode*	Utility-to-Generator
In-phase monitor	Disabled
In-phase monitor transfer angle	5°
* Not adjustable.	

Figure 3-1 System Parameters

3.3.1 Transition Type, Standard

The MPAC 750 controller is only available for standard-transition model transfer switches. Standard-transition models (also referred to as open transition) use a break-before-make transfer that does not require source synchronization for transfer between available sources.

Note: The transition type is determined by the ATS model. Do not change the transition type.

3.3.2 Commit to Transfer: No

This setting is factory set to No and is not adjustable. If the preferred source returns returns during the transfer-to-standby time delay, the transfer sequence is cancelled and the load is not transferred to the standby source.

3.3.3 In-Phase Monitor

The in-phase monitor can be enabled or disabled for standard-transition models. The in-phase monitor operates prior to transfer when both sources are available. Transfer is inhibited while both sources are greater than 2 cycles apart. If the connected source falls below the undervoltage dropout setting, the in-phase monitor terminates and allows transfer.

The synchronism window has a default value of 5° and is adjustable from 15° to 5° before synchronism only. Settings can be changed using a personal computer and Kohler SiteTech software or over Modbus. Contact your distributor or dealer for service.

The In-Phase Monitor Sync Output is activated if the sources do not synchronize within 60 seconds.

3.4 Voltage Pickup and Dropout Settings

The controller senses the voltage on both sources with an accuracy of ±0.5%. A source is considered available when its voltage is within the range of dropout settings. If the voltage of the active source is outside the acceptable range for a length of time longer than the debounce time, the system attempts to transfer the load to the alternate source. The debounce time prevents nuisance transfers caused by brief voltage spikes and dips.

See Figure 3-2 for default settings and adjustment ranges.

Settings	Default Setting	Adjustment Range †
Under voltage dropout	90% of pickup	75% to 98% of Pickup
Under voltage pickup	90% of nominal	85% to 100% of Nominal
Over voltage dropout	115%	106% to 135% of Nominal
Over voltage pickup	95% of dropout	95 to 100% of Dropout
Debounce time	0.5 seconds	0.1 to 9.9 seconds
† Settings can be changed using a PC with SiteTech software or over Modbus.		

Figure 3-2 Normal Source Pickup and Dropout Settings

3.5 Time Delays

The factory settings and adjustment ranges for the time delays are shown in Figure 3-3.

The engine start time delay and transfer time delays can prevent nuisance transfers caused by brief voltage dips or surges.

The engine cooldown time delay holds the engine start contacts closed for a designated time after transfer to allow the generator set to run without load before shutting down.

If the standby source does not reach acceptable voltage and stabilize within the allowed time, the Fail to Acquire Standby Source fault is activated.

Time Delay Description	Factory Setting	Adjustment Range †
Engine Start	3 sec	0–6 sec
Engine Cooldown	5 min.	0–60 min
Transfer, preferred to standby	3 sec	
Transfer, standby to preferred	15 min	
Fail to Acquire Stby	1 min	
Fail to Synch	1 min	NA
† PC with SiteTech software required.		

Figure 3-3 Time Delay Settings

3.6 Programmable Inputs and Outputs

The controller includes connections for two programmable inputs and two programmable outputs. Inputs and outputs are unassigned until the installer assigns a function to the I/O.

The programmable inputs and outputs can be assigned to the functions shown in Figure 3-4 and Figure 3-5. Programmable inputs and outputs can be assigned in two ways:

- Using a PC with Kohler® SiteTech™ software. SiteTech software is available only to Kohler authorized distributors and dealers.
- Over Modbus; see TP-6113, Modbus Protocol Manual, for Modbus registers.

Programmable input functions correspond to the connections to the transfer switch controller. Do not change the programmable input assignments without verifying the input connections to the transfer switch.

See the transfer switch installation manual for connection information for controller inputs and outputs.

3.6.1 Input Functions

Available input functions are shown in Figure 3-4. Some inputs will trigger an indicator LED on the user interface and/or display a message on the LCD screen when they are activated.

All of the inputs may be assigned to either one or both of the common alarms.

Remote Test Input. Activating the input starts a test, and deactivating the input stops the test. Tests follow the sequence described in Sections 1.4 and 2.2.3.

If a local test is already running, activating the remote test input will stop the local test. A remote test can be stopped locally, if necessary, by pressing and holding the TEST button on the controller for about 2 seconds.

The default type for a remote test is “unloaded.” To change the remote test type, use a computer and Kohler® SiteTech™ Software to set the Remote Test Loaded parameter. Alternatively, set the remote test type over Modbus.

The optional programmable exerciser uses the remote test input. See the instructions provided with the exerciser for more information.

Programmable Inputs	⚠ LED	⊘ LED
Inhibit Transfer (maintenance mode)	None	Flashing
Remote Common Alarm	Steady	None
Remote Test	None	None

Figure 3-4 Available Programmable Inputs

3.6.2 Output Functions

Output functions are shown in Figure 3-5. Information about selected output functions is shown below. Refer to the section number shown in Figure 3-5 for more information about the output function.

Programmable Output	Type	See Section
Aux Switch Fault	Fault	1.7
Aux Switch Open	Fault	1.7
Common Alarm Active (1 and 2)	Fault	3.7
Contactor in Preferred Position	Monitor	—
Contactor in Source E Position	Monitor	—
Contactor in Source N Position	Monitor	—
Contactor in Standby Position	Monitor	—
Exerciser Active	Monitor	2.2.2
Fail to Acquire Standby	Fault	1.7
Fail to Transfer	Fault	1.7
In-Phase Monitor Sync	Control	3.3.3
Not in Auto	Monitor	1.3.2
Source E (Phase) Rotation Error	Fault	—
Source N (Phase) Rotation Error	Fault	—
Test Mode Active	Monitor	1.4

Figure 3-5 Available Programmable Outputs

3.7 Common Alarms

Functions can be assigned to two alarm groups. The groups can then be assigned to programmable outputs, if desired. Any function assigned to the Common Alarm triggers the Common Alarm programmable output. See Section 3.6, Programmable Inputs and Outputs, for more information about programmable outputs.

Use Kohler® SiteTech™ software or Modbus to assign events to the controller's common alarm groups. See Figure 3-6 for a list of functions that can be assigned to the common alarm.

Alarm Descriptions
Auxiliary Switch Fault
Auxiliary Switch Open
Contactor in Preferred
Contactor in Source E Position
Contactor in Source N Position
Contactor in Standby Position
Exerciser Active
Fail to Acquire Standby Source
Fail to Transfer
In Phase Monitor Synching
Not in Auto
Remote Common Alarm
Source E Available
Source N Available
Source N Rotation Error
Source E Rotation Error
System Ready
Test Mode Active

Figure 3-6 Alarm Descriptions

3.8 Communications

Use a personal computer with Kohler SiteTech software or Modbus to set the communication parameters for serial or Ethernet connections. See Section 4, Communications, for instructions.

4.1 Introduction

The Decision-Maker® MPAC 750 controller is equipped with a USB port and a Modbus port with an RS-485 connector. An optional Ethernet accessory board is available.

Kohler authorized distributors and dealers can use a personal (laptop) computer with Kohler® SiteTech™ software to view and adjust controller parameters, view event history, import and export parameter files, and update controller firmware. See TP-6701, SiteTech Software Operation manual, for instructions.

Controller settings can also be viewed and adjusted using Modbus. The Modbus registers are available in the Modbus Protocol Manual, TP-6113.

The controller can send encapsulated Modbus messages over the network connection. Only one Modbus address can be assigned to the controller, regardless of the communication port or protocol being used.

Note: Modbus® applications require a Modbus software driver written by a trained and qualified systems programmer.

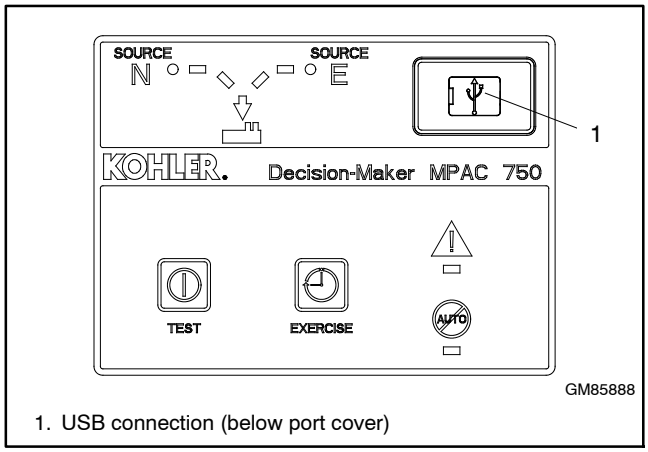
4.2 Connections

4.2.1 USB Port SiteTech Connection

A personal computer and Kohler SiteTech software can be used for changing controller settings. Use a USB cable to connect the controller to a personal computer.

See Figure 4-1 for the USB port location on the front of the controller assembly. Remove the small port cover and use a USB cable with a mini-B connector to connect the controller's USB port to the computer.

See TP-6701, SiteTech Software Operation Manual, for instructions to use the software.



1. USB connection (below port cover)

Figure 4-1 USB Connection (for SiteTech)

4.2.2 Modbus Connection

See Figure 4-2 and Figure 4-3 for the RS-485 Modbus connector location. The Modbus port on the controller circuit board is Port 0.

Use serial connections to TB2 on the controller board to connect the transfer switch to a personal computer for system monitoring, the optional remote annunciator, or a Modbus network. See Figure 4-5.

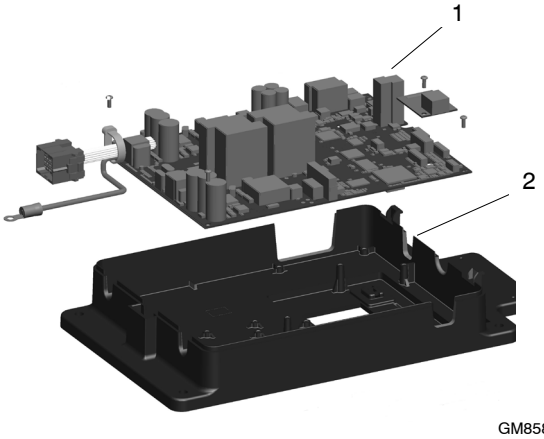
A 121 ohm terminating resistor is recommended on the last device in a network. If there is only one device, a terminating resistor may be required depending on the cable distance and communication speed. Long cables and high speeds will increase the need for a terminating resistor.

The serial port is an isolated RS-485 port with connection speeds of 9.6, 19.2, and 57.6 kbps. Use shielded twisted-pair cable to connect to the RS-485 connectors on controller terminal strip TB2 for serial connections. For connection to a PC, use a USB to RS-485 converter.

Connect the Modbus input and output to the terminals shown in Figure 4-4. Use #12-24 AWG shielded, twisted-pair wire. Belden cable #9841 or equivalent is recommended. Connect one end of the shield to ground. Leave the other end of the shield disconnected. Tighten the connections to 0.5 Nm (4.4 in. lb.).

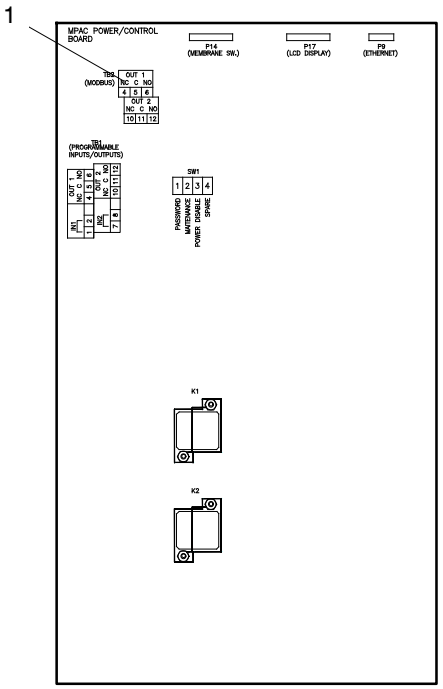
Use Modbus® RTU (remote terminal unit) protocol for communication over the serial port. The Modbus registers are available in the Modbus Protocol Manual, TP-6113.

Note: Modbus® applications require a Modbus software driver written by a trained and qualified systems programmer.



1. RS-485 Modbus connections
2. Access opening for RS-485 cables

Figure 4-2 Modbus Connections (controller cover removed for illustration only)



1. Modbus communication RS-485 connector

Figure 4-3 Modbus Connector on the Controller Circuit Board

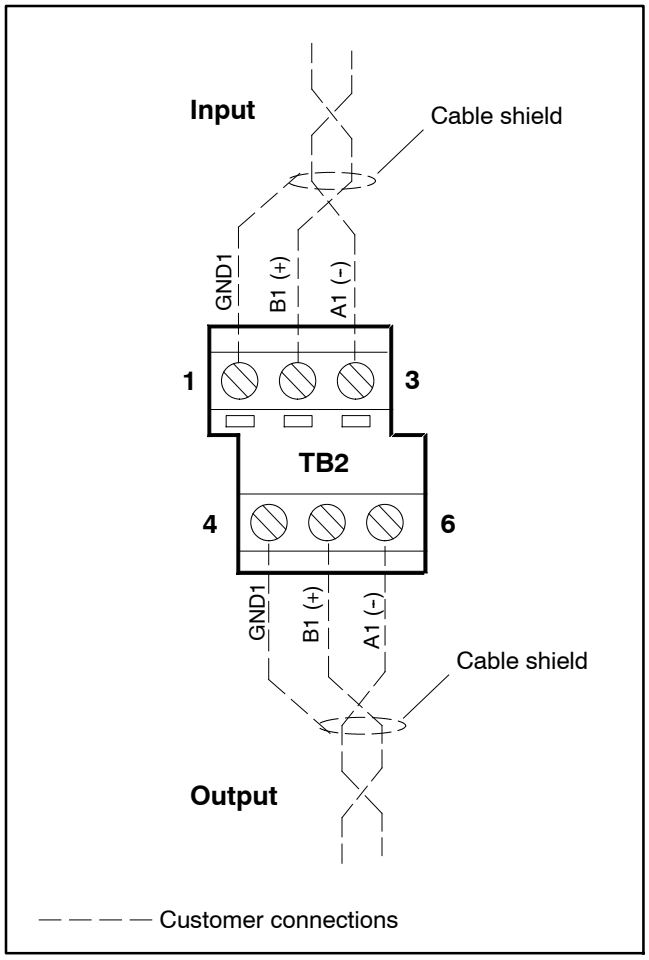
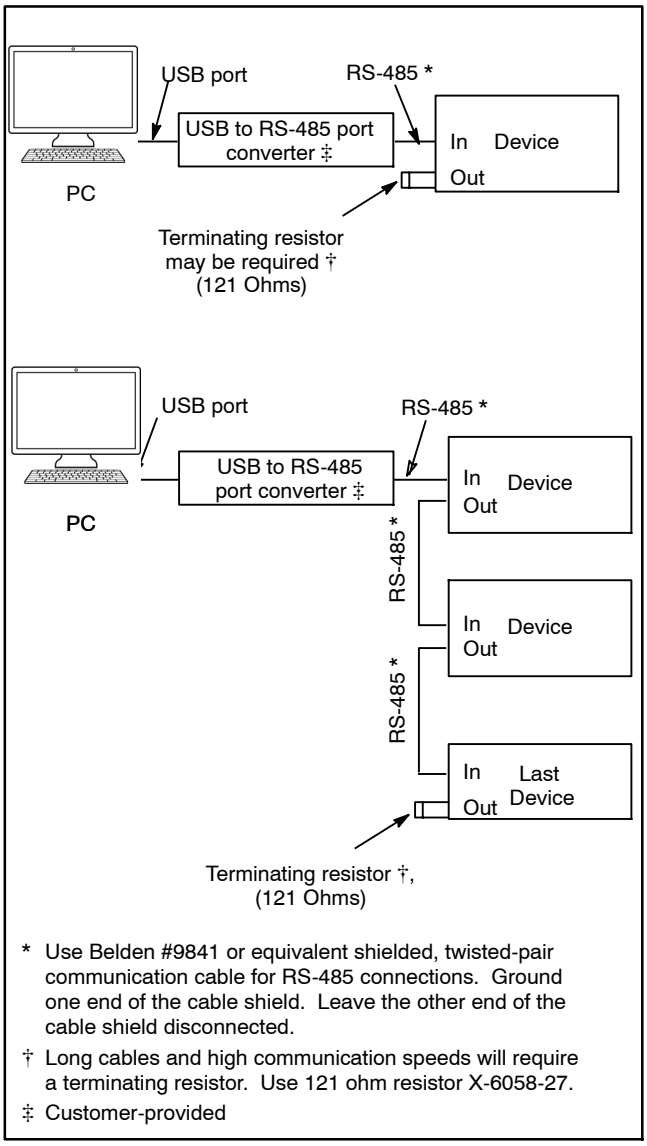


Figure 4-4 Modbus RS-485 Connections



* Use Belden #9841 or equivalent shielded, twisted-pair communication cable for RS-485 connections. Ground one end of the cable shield. Leave the other end of the cable shield disconnected.

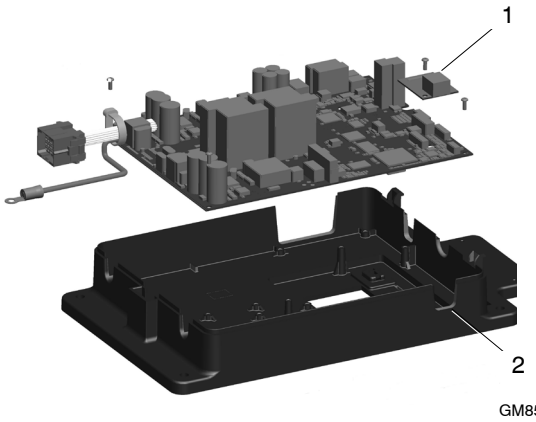
† Long cables and high communication speeds will require a terminating resistor. Use 121 ohm resistor X-6058-27.

‡ Customer-provided

Figure 4-5 Serial Connections

4.2.3 Ethernet Connection (Optional)

The Ethernet communication accessory board is required for connection to the Ethernet. The Ethernet communication board is an optional accessory for the MPAC 750 controller. The communication board connects to the controller board as shown in Figure 4-6.



1. Ethernet communication board with RJ-45 connector
2. Access opening for Ethernet cable

Figure 4-6 Ethernet Board (controller cover removed for illustration only)

The Ethernet communication accessory board allows the transfer switch to be connected to a building's Ethernet network to communicate with personal computers connected to the same subnet.

Note: For an ethernet connection, obtain an IP address and subnet mask number from the local system administrator.

Ethernet Port. The ethernet port is a standard RJ-45 jack. See Figure 4-6 for the location of the Ethernet port. Use Category 5e or better cable to connect the controller to the building's network.

Use the Setup menus or a personal computer connected to the controller's USB port and Kohler SiteTech software to set the communication parameters. The Ethernet communication board may have a default IP address assigned at the factory for test purposes. See Figure 4-7. **Change the IP address to an address owned by the user.** See Section 3.8 for instructions to set the communication parameters.

The transfer switch controller does not operate as a Modbus-to-Ethernet converter for other devices in a network. For multiple device networks connected to the personal computer through the Ethernet, use a Modbus-to-Ethernet converter for the other devices in the network. See Figure 4-8 and instruction sheet TT-1405, provided with the converter, for connection instructions.

The controller can communicate with up to five (5) simultaneous TCP/IP (ethernet) connections. These five connections do not include the RS-485 serial port. In the extreme case, five users may be communicating with the controller via TCP/IP network connections and another may be communicating through the serial port, for a total of six (6) communication channels. As the controller is asked to communicate with more and more outside devices, the communication will slow down.

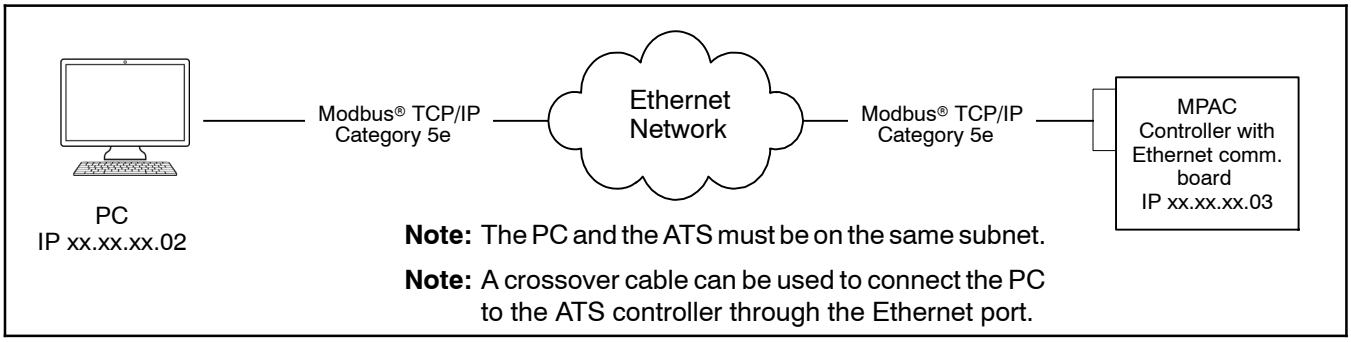


Figure 4-7 Remote Network (Ethernet) Connection

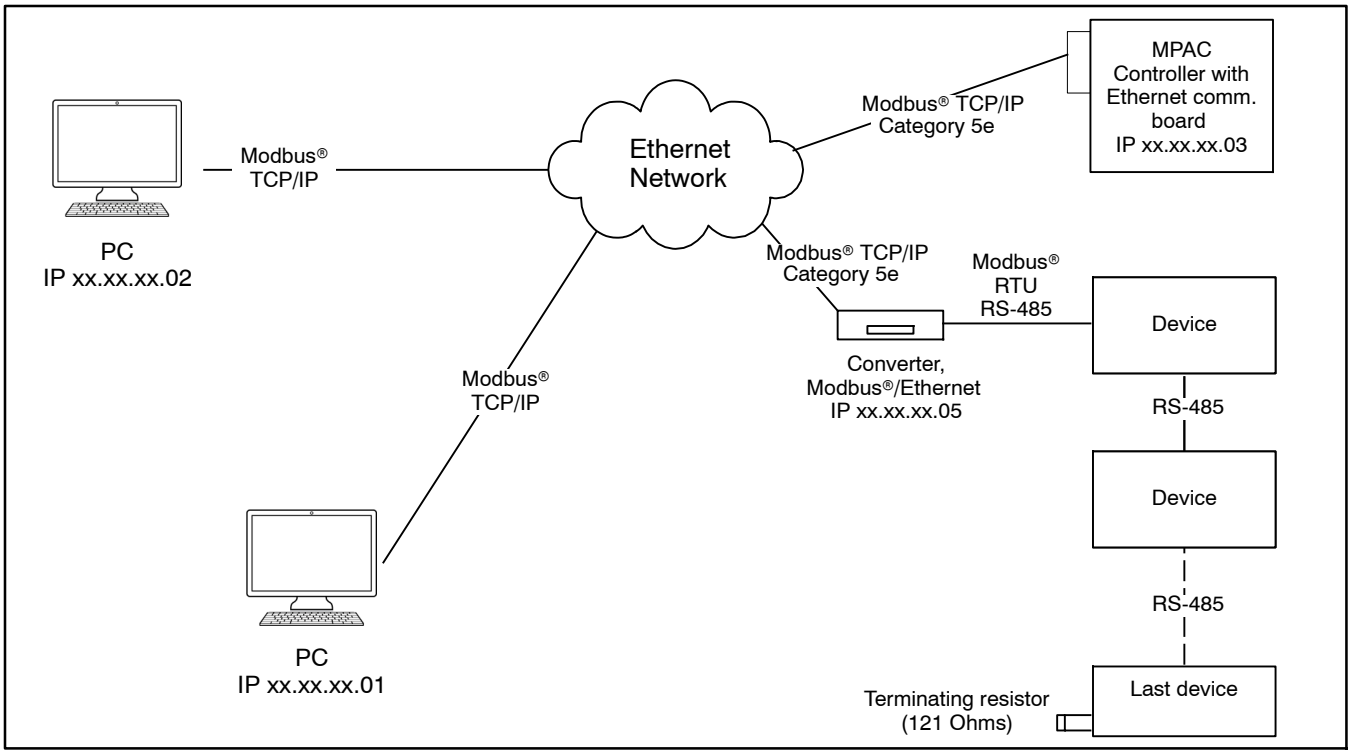


Figure 4-8 Ethernet Connections to Multiple-Device Network

4.3 Communications Setup

Use a personal computer with Kohler® SiteTech™ software connected to the USB port to set the communication parameters for serial or Ethernet connections. For serial communications, the controller uses Modbus® communication protocol.

4.3.1 Modbus Serial Communication Setup

Set the following communication parameters for serial communication. Also see Figure 4-9 for a summary of these settings.

Note: Modbus® applications require a Modbus software driver written by a trained and qualified systems programmer.

Modbus Enabled. Set to True to allow Modbus communication.

Modbus Baud Rate. Required for serial connections. The baud rate must match the baud rate of the connected PC.

Modbus Slave Addr. Assign a unique address between 001 and 247 to the serial port.

4.3.2 Network Communication Setup

Work with your local network administrator to set the following communication parameters for Ethernet communication.

See Figure 4-9 for a summary of the following settings.

DHCP Enabled. Factory set to False. Setting this parameter to True enables dynamic host configuration protocol (DHCP), which allows a DHCP server to automatically assign a dynamic IP address, subnet mask, and default gateway to the MPAC controller. Work with your local network administrator to determine whether DHCP is required.

Static IP Address. The transfer switch may have a default IP address assigned at the factory. **Change the IP address to a static IP address owned by the user.** Obtain an IP address, subnet mask, and default gateway information from the local network administrator.

Static Subnet Mask. Obtain subnet mask information from the local network administrator. All devices that communicate with each other on the same local network must use the same subnet mask.

Static Default Gateway. Obtain gateway information from the local network administrator.

DHCP Server. Displayed for information only. Provide this value to the network administrator if there are problems with DHCP.

Modbus TCP Unit ID. The unit ID is required for Modbus over TCP communication. The unit ID for TCP communication is analogous to the Modbus address for serial communication through the RS-485 ports. The factory default setting is 2.

Modbus TCP Server Enabled. Enable (set to True) to enable TCP if the transfer switch is connected to a network for TCP/IP communication (for example, ethernet communication).

MAC address. The MAC hardware address is factory-set. It can be seen in the View>Communications Setup screens but not viewed or changed in the setup menus.

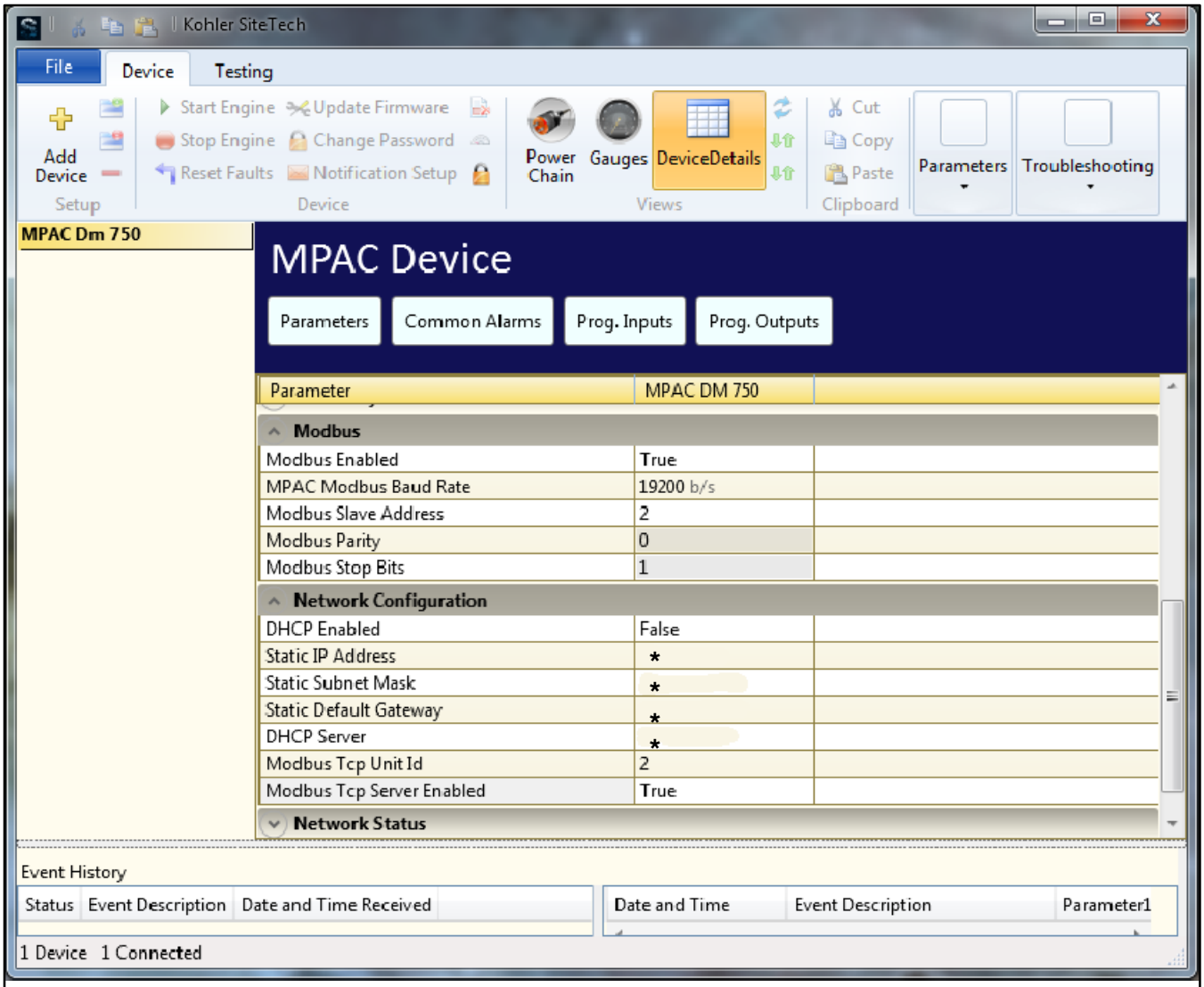
4.3.3 Setup Using SiteTech

Use a USB cable, male USB A to male USB mini-B, to connect the MPAC controller to a personal computer. Then use Kohler SiteTech software to set the communication parameters for serial or Ethernet connections. See Figure 4-10 and TP-6701, SiteTech Software Operation Manual.

SiteTech software is available only to Kohler authorized distributor and dealers.

Setting	Range	Default	Notes
Modbus Enabled	True or False	True	Enable for network communication through the ethernet port.
Modbus Baud Rate	9600, 19200, 57600	19200	Baud rate in bits per second for serial communication between the controller and a personal computer's COM port.
Modbus Slave Address	001-247	0	Address for the RS-485 serial port (on the controller board).
Modbus Parity	Read only	None	Not adjustable.
Modbus Stop Bits	Read only	1	Not adjustable.
DHCP Enabled	True or False	False	Dynamic host communication protocol. Enable if required; check with your local network administrator.
Static IP Address	See notes.	*	Obtain from your local network administrator. Every device on the network must have a unique IP address.
Static Subnet Mask	See notes.	*	Obtain from your local network administrator. All devices that communicate with each other on the same local network must use the same subnet mask.
Static Default Gateway	See notes.	*	Obtain from your local network administrator.
DHCP Server	Read only	—	Displayed for information only.
Modbus TCP Unit ID	001-247	002	The unit ID is required for Modbus over TCP communication.
Modbus TCP Server Enabled	True or False	True	Enable (set to True) to enable TCP/IP communication (for example, Ethernet communication).
MAC Address	Not Adjustable	Factory-set	Hardware address, entered at the factory. Not adjustable.
* Do not use the factory settings for IP address, subnet mask, or default gateway. Obtain these settings from your local network administrator.			

Figure 4-9 Communication Parameters



* Obtain from the local network administrator

Figure 4-10 Communications Parameters in Kohler SiteTech Software

4.4 Event History and Parameter Files

The event history and parameter setting files can be exported to a personal computer (PC) using Kohler® SiteTech™ software. Use a USB cable to connect the PC to the controller.

The event history files can be opened with spreadsheet software. Event history files have filenames of the form presentyymmdd.his, where yymmdd (year, month, day) is the date of the file as read from the controller.

- Event history files are updated periodically by the controller.
- Use a personal computer with Kohler SiteTech software to save the event history to a file. See TP-6701, SiteTech Software Operation Manual, for instructions.
- Use a spreadsheet program to open the file on the computer.

The resulting file includes the events with time and date formatted into spreadsheet columns.

Parameter settings can be loaded onto the MPAC controller from a saved file. This can be useful for service or controller replacement. See the SiteTech Operation Manual for instructions to export and import files.

4.5 Controller Firmware Updates

Kohler may release updated versions of the controller firmware. A personal (laptop) computer connected to the USB port and Kohler® SiteTech™ software are required for updating the firmware on the controller. Have an authorized distributor/dealer load an updated version of the controller firmware, if necessary. See TP-6701 for instructions to update the firmware.

Notes

5.1 Introduction

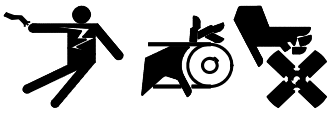
Regular preventive maintenance ensures safe and reliable operation and extends the life of the transfer switch. Preventive maintenance includes periodic testing, cleaning, inspection, and replacement of worn or missing components. Section 5.4 contains a service schedule for recommended maintenance tasks.

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

Keep records of all maintenance or service.

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

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

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.

⚠ 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.

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.

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.

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

NOTICE

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

5.2 Testing

5.2.1 Weekly Generator Set Exercise

Use the exerciser to start and run the generator set under load once a week to maximize the reliability of the emergency power system. See Section 1.6 for instructions to program the exerciser.

5.2.2 Monthly Automatic Control System Test

Test the transfer switch's automatic control system monthly. See Section 1.5 for the test procedure.

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

5.3 Inspection and Service

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

5.3.1 General Inspection

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

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

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

Internal Inspection. Disconnect all power sources, open the transfer switch enclosure door, and inspect internal components monthly or when any condition noticed during an external inspection may have affected internal components.

Contact an authorized distributor/dealer to inspect and service the transfer switch if any of the following conditions are found inside the transfer switch.

- 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 abrasion
- 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.

If the application does not allow a power interruption for the time required for the internal inspection, have an authorized distributor/dealer perform the internal inspection.

5.3.2 SPD Inspection

On transfer switches equipped with optional surge protective devices (SPDs), check the following items every two months:

- SPD status indicators
- Condition of SPD connecting leads

5.3.3 Other Inspections and Service

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

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

5.4 Service Schedule

Follow the service schedule below for the recommended service intervals. Have all service performed by an authorized distributor/dealer except for activities designated by an X, which may be performed by the switch operator.

System Component or Procedure	See Section	Visually Inspect	Check	Adjust, Repair, Replace	Clean	Test	Frequency
Electrical System							
Check for signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor	5.3.1	X	X				Y
Check the contactor's external operating mechanism for cleanliness; clean and relubricate if dirty *	5.3.1	X			D (clean and lube)		Y
Inspect wiring insulation for deterioration, cuts, or abrasion. Repair or replace deteriorated or damaged wiring	5.3.1	X	D	D			Y
Tighten control and power wiring connections to specifications	2		D			D	Y
Check the transfer switch's main power switching contacts' condition; clean or replace the main contacts or replace the contactor assembly as necessary	S/M	D		D	D		Y
Control System							
Exercise the generator set under load	5.2.1					X	W
Test the transfer switch's automatic control system	5.2.2 1.5	X				X	M
General Equipment Condition							
Inspect the outside of the transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration *	5.3.1	X			X		M
Check that all external hardware is in place, tightened, and not badly worn	5.3.1	X	X	X			M
Inspect the inside of transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration*	5.3.3	D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn	5.3.3	X	D	D			Y
SPD Modules (if equipped)							
Check status indicators	6.6	X		D			Every 2 months
Check condition of connecting leads	6.6	X		D			

* Service more frequently if the transfer switch is operated in 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, 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:

X= The transfer switch operator can perform these tasks.
D=An authorized distributor/dealer must perform these tasks.
S/M = Service Manual. An authorized distributor/dealer must perform these tasks.

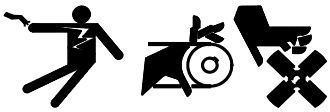
W=Weekly
M=Monthly
Q=Quarterly
S=Semiannually (every six months)
Y=Yearly (annually)

6.1 Introduction

This section describes the hardware options that are available for transfer switches equipped with Decision-Maker® MPAC 750 controls.

6.2 Controller Disconnect Switch

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

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

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

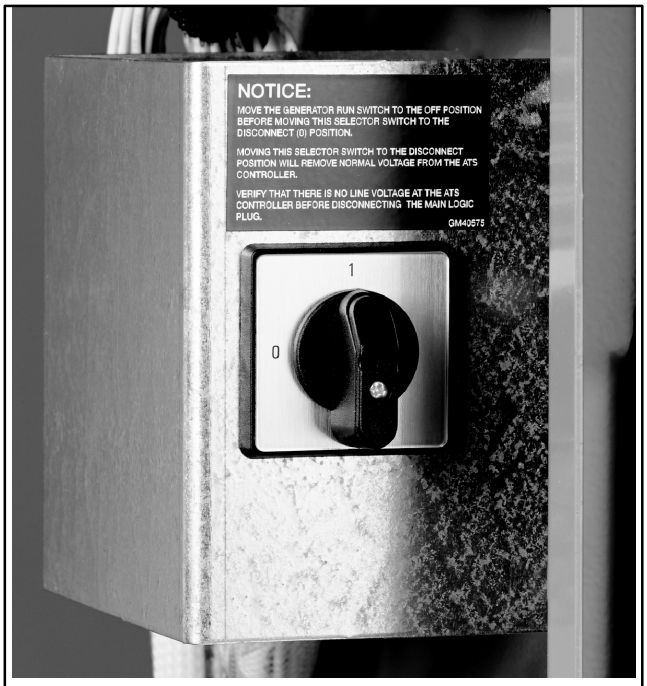
Only authorized personnel should open the enclosure.

The controller disconnect switch allows disconnection of the power to the controller during maintenance and service. See Figure 6-1.

Note: Disable the generator set before using the controller disconnect switch to disconnect power to the ATS controls.

Disconnecting power to the controls can cause the ATS to signal the generator set to start. Prevent the generator set from starting by moving the generator set master switch to OFF and disconnecting the battery charger and battery. Refer to the generator set operation manual for specific instructions.

The switch has two positions, auto (I) and disconnect (0). Move the controller disconnect switch to the 0 position to disconnect power to the ATS controller. After maintenance or service, move the switch to the I position to reconnect power. Follow the instructions in the generator set documentation to reenable the generator set.



I = Connect
0 = Disconnect

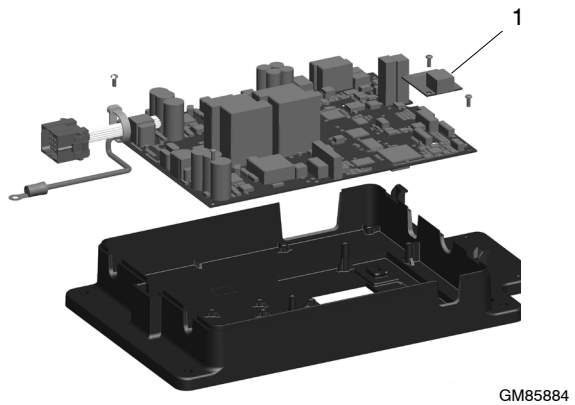
Figure 6-1 Controller Disconnect Switch

6.3 Ethernet Board

Ethernet communication is provided by an optional circuit board that connects to the MPAC controller board. See Figure 6-2. The Ethernet board includes an RJ-45 connector for an Ethernet cable.

The Ethernet board may have a default IP address assigned at the factory for test purposes. **Change the IP address to an address owned by the user.** Use Kohler SiteTech software to assign a new IP address and port number.

See Section 4.2.3 for more information about Ethernet communications.



1. Ethernet communication board with RJ-45 connector

Figure 6-2 Ethernet Communication Board

6.4 Programmable Exerciser

The optional programmable exerciser is a 7-day timer that allows programming of up to 8 on/off events per day. See Figure 6-3. Use the exercise timer to program weekly loaded or unloaded exercise periods in addition to the exercise time set through the ATS controller. The timer is installed inside the ATS enclosure.

Programmable exerciser features include:

- Seven-day programmable timer allows scheduling up to 56 on/off events.
- LCD display indicates day, time, program/run modes, on/off status, and skip cycle status.
- Skip next cycle button.
- 5-year lithium backup battery.

The programmable exerciser uses the Remote Test input. See Section 3.6.1. If necessary, a remote test started by the programmable exerciser can be stopped locally by pressing and holding the TEST button on the MPAC 750 controller for about two seconds.

Refer to the instruction sheet provided with the exerciser for installation, connection, loaded/unloaded selection, and programming instructions. A personal computer and Kohler® SiteTech™ software are required to set up the remote exerciser. SiteTech software is available to Kohler-authorized distributors and dealers.

Figure 6-3 Programmable Exerciser

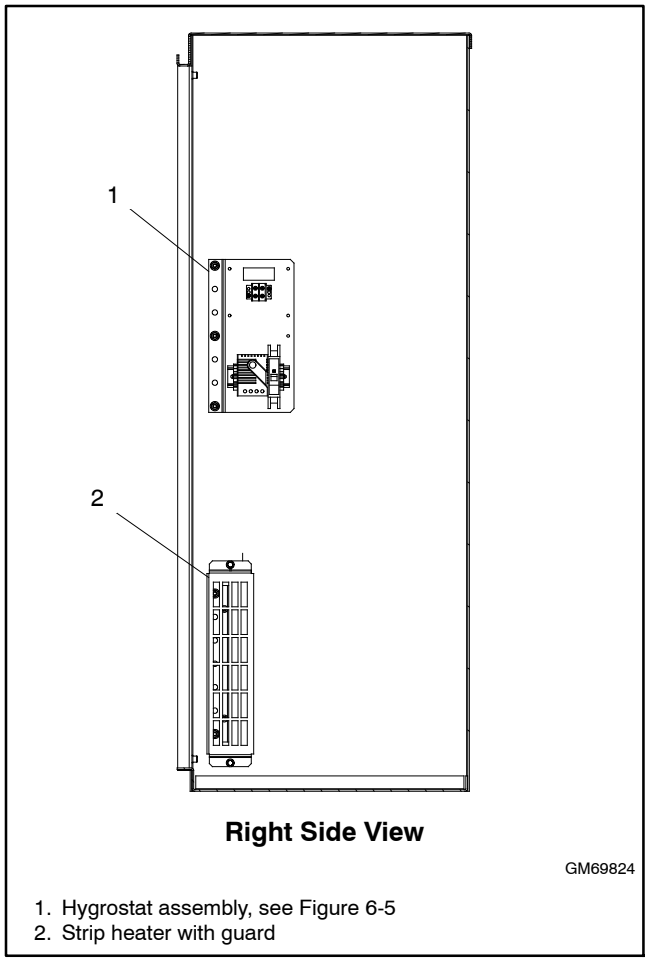
6.5 Heater

An anti-condensation heater kit is available. The strip heater is controlled by a hygrostat to raise the temperature inside the enclosure above the dew point to prevent condensation. Figure 6-4 shows typical locations of the heater kit components inside the enclosure.

The installer must connect 120 VAC power to the terminal block near the hygrostat. See Figure 6-5 and Figure 6-6. The heater and hygrostat are connected to power through a 15-amp circuit breaker.

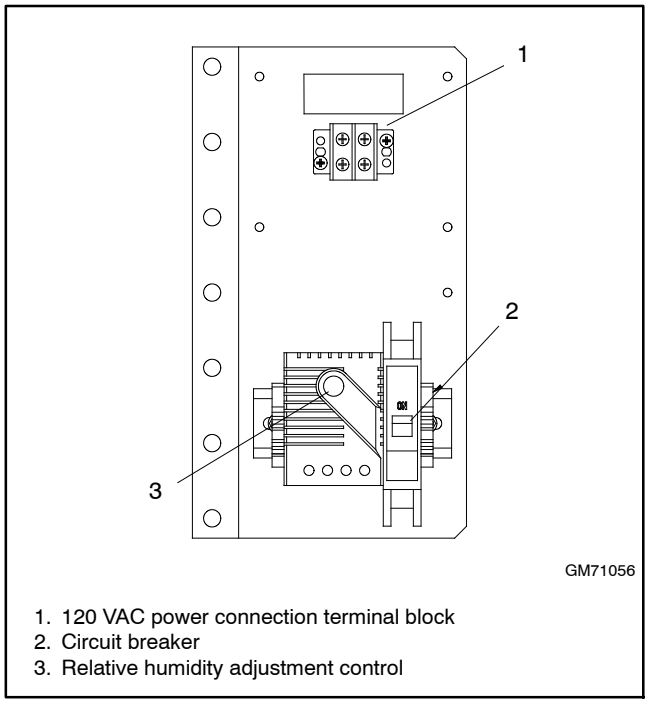
The relative humidity setting on the hygrostat is adjustable from 35% to 95%. A setting of 65% is recommended.

Because of space limitations in the smaller enclosures, 40–225 Amp Model KSS transfer switches can include either an enclosure heater or a surge protection device (SPD), but not both.



1. Hygrostat assembly, see Figure 6-5
2. Strip heater with guard

Figure 6-4 Heater Location, Typical



1. 120 VAC power connection terminal block
2. Circuit breaker
3. Relative humidity adjustment control

Figure 6-5 Hygrostat Assembly, Typical

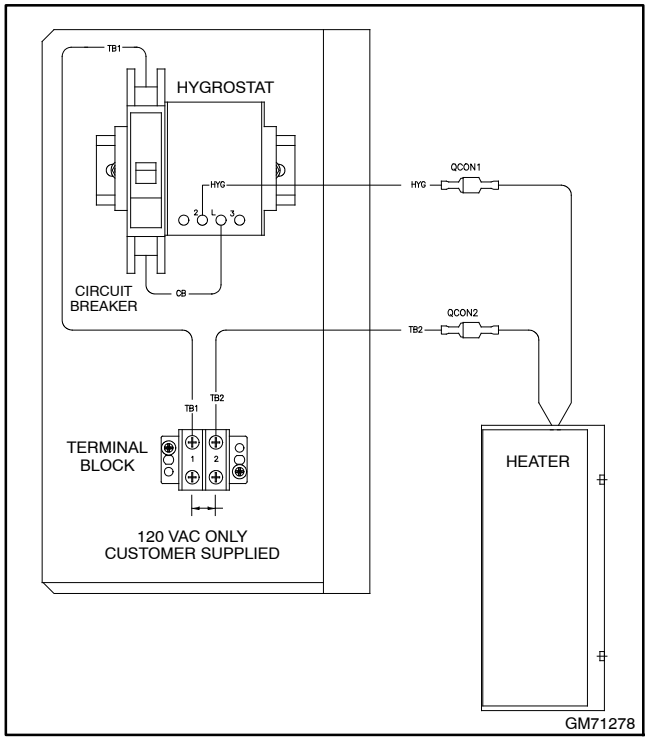
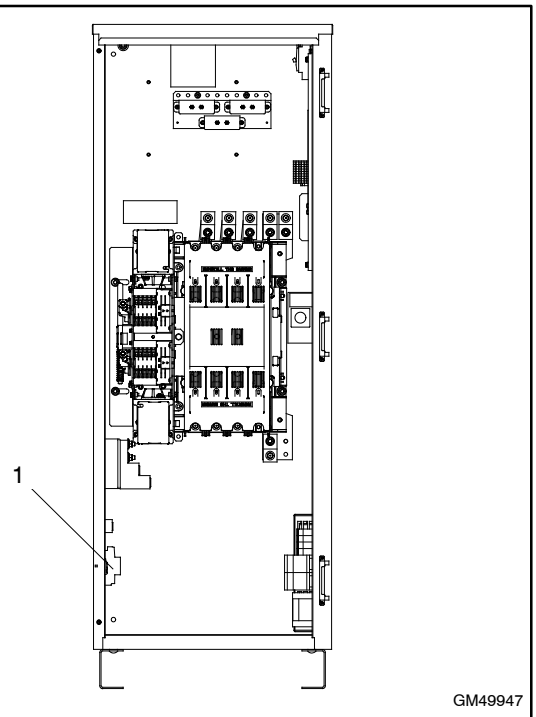


Figure 6-6 Heater Connections

6.6 Surge Protection (SPD)

A surge protection device (SPD) is available for the transfer switch. Installed on the Normal source side, the SPD protects the system from voltage surges, preventing damage to household loads. The SPD resets automatically. See Figure 6-7 for the typical SPD assembly location inside the ATS enclosure. See Figure 6-8 for SPD specifications.

Because of space limitations in the smaller enclosures, 40–225 Amp Model KSS transfer switches can include either an enclosure heater or a surge protection device(SPD), but not both.



1. SPD assembly is typically located on the side of the enclosure. Location varies for different models.

Figure 6-7 SPD Location, Typical

SPD Specifications								
Nominal Voltage (V ±15%)	Max. Discharge Current (kA)	Phase	Poles	UL VPR 3rd Ed (L-N/N-G/L-G) (kV)	Limiting Voltage, (L-N/N-G/L-G) (kV)		Short Circuit Withstand Current (kA)	Maximum Continuous Operating Voltage (VAC)
					at 3kAmps	at 10kAmp		
120/240	40	Split	3	0.6 / 1.2 / 0.7	0.6 / 0.4 / 0.6	0.8 / 0.7 / 0.8	200	175 / 350
120/208	40	Wye	4	0.6 / 1.2 / 0.7	0.6 / 0.4 / 0.6	0.8 / 0.7 / 0.8	200	175 / 350
277/480	40	Wye	4	1.0 / 1.2 / 1.1	1.0 / 0.4 / 1.0	1.2 / 0.7 / 1.2	200	320 / 460
120/240	40	HLD	4	1.0 / 1.2 / 1.1	1.0 / 0.4 / 1.0	1.2 / 0.7 / 1.2	200	320 / 460
347/600	40	Wye	4	1.3 / 1.2 / 1.4	1.3 / 0.4 / 1.3	1.5 / 0.7 / 1.5	200	440 / 880

Figure 6-8 SPD Specifications

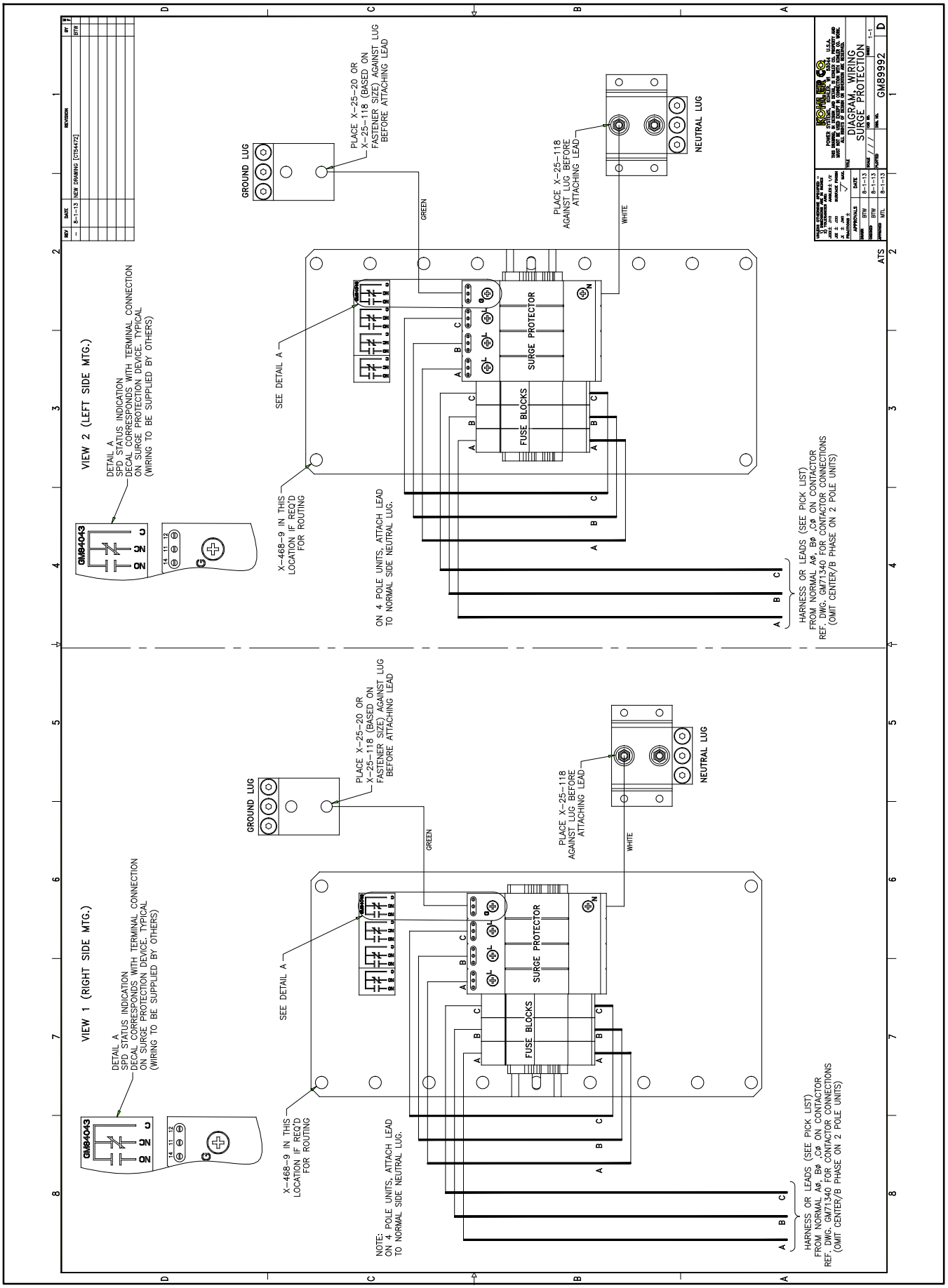
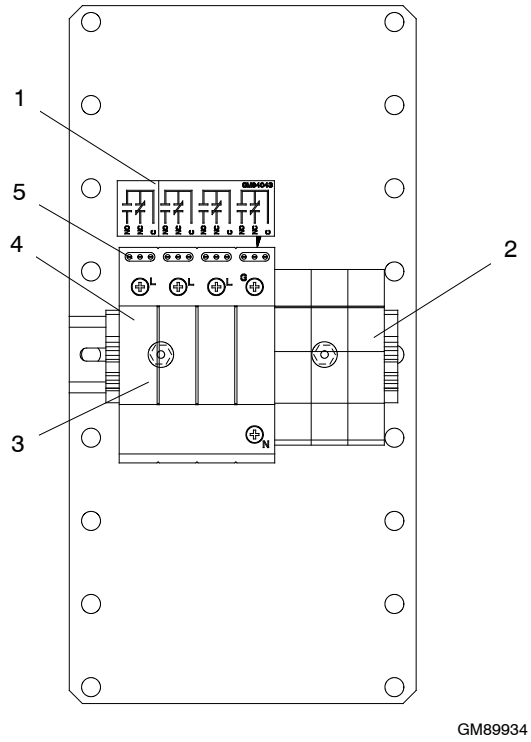


Figure 6-9 SPD Wiring Diagram, GM89992

6.6.1 SPD Status Indicators

A status indicator on each Surge Protection Device (SPD) module indicates the SPD condition. See Figure 6-10. A green indicator shows that the SPD is providing protection. When the status indicator is red, the SPD no longer provides protection. Replace the SPD cartridge. See Section 6.6.3 for replacement instructions.



1. Decal, remote status indicator wiring
2. Fuse blocks
3. Surge suppressors
4. SPD status indicator location
5. Remote status indicator connections

Figure 6-10 SPD Assembly, Typical

6.6.2 SPD Remote Status Indicator

A customer-supplied indicator for the SPD can be connected to provide remote indication when the SPD needs to be replaced. The contact changes state when the SPD module needs replacement.

Connect customer-provided indicators or alarms to the normally open (NO) or normally closed (NC) auxiliary contact terminals on terminal block TB1. See Figure 6-11 for the contact rating and Figure 6-10 for the terminal block location. See the decal on the SPD assembly or the transfer switch wiring diagram for connections.

SPD Remote Status Indication	Specification
Contact rating	1 A @ 250 VAC
Wire Size	16 AWG

Figure 6-11 Remote Status Indicator Contact Specifications

6.6.3 SPD Replacement

Replace the module when the SPD indicator turns red. Follow the replacement procedure in this section.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

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

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.

SPD Replacement Procedure

Note: The cartridges are keyed for the phases or the neutral. Be sure to obtain the correct service part for each cartridge. See the transfer switch parts catalog for service part numbers.

1. Disable the generator set to prevent starting as follows:
   a. Move the generator set master switch to the OFF position.
   b. Disconnect power to the battery charger.
   c. Disconnect the generator set engine starting battery, negative (–) lead first.
2. Disconnect power to the transfer switch: Open the normal and emergency source circuit breakers upstream of the transfer switch.
3. Remove the enclosure's inner panel , if equipped.
4. Open the fuse holder.
5. Remove the cartridge by pulling straight out.
6. Replace the SPD cartridge with the appropriate service part.
7. Close the fuse holder.
8. Replace the enclosure's inner panel, if equipped.
9. Reconnect power to the transfer switch by closing the normal and emergency source circuit breakers.
10. Check the SPD status indicators.
11. Reconnect the generator set engine starting battery, negative (–) lead last.
12. Reconnect power to the battery charger.
13. Close and lock the ATS enclosure door.
14. Move the generator set master switch to the AUTO position.

6.7 User Interface Cover

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

NEMA 3R enclosures include a cover as standard equipment.

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

Notes

Notes

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