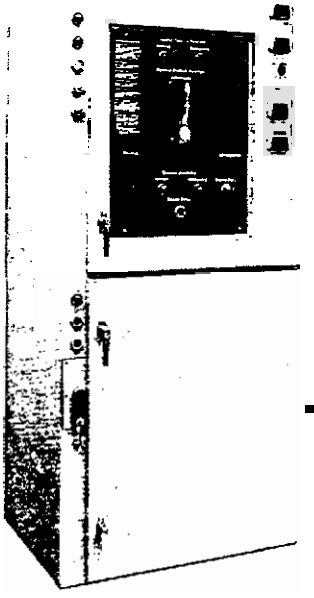
McGRAW-EDISON

Onan

Operators Manual

BT
Transfer Switch



Utility-to-Utility
Automatic Control

962-0111
(SPEC A)
6-83
Printed in U.S.A.

Power Generation

Safety Precautions

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

WARNING ***Onan uses this symbol throughout the text to warn of possible injury or death.***

CAUTION ***This symbol is used to warn of possible equipment damage.***

The BT transfer switch has components with high voltages which present serious shock hazards. For this reason, read the following suggestions:

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

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

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

Do not work on this equipment when mentally or physically fatigued.

Do not open the transfer switch cabinet unless qualified to service the transfer switch and related systems. High voltage components within the cabinet present a serious electrical shock hazard. For this reason, only a qualified service person such as an electrician or an Onan service representative should open the cabinet for servicing.

The automatic transfer switch may be isolated for service or testing without disconnecting the load from the power source. Follow the bypass/isolation procedures covered in other sections of this manual. When servicing other components within the switch cabinet, always remove Source 1 and Source 2 AC power. When adjustment procedures require that AC power be connected, use extreme caution to avoid touching exposed terminals which might carry high voltage currents.

Table of Contents

Introduction

ABOUT THIS MANUAL

This manual provides information for installing and operating the Onan BT bypass-isolation transfer switch. A troubleshooting guide is also included which describes the corrective procedures the operator can follow if a malfunction occurs. Study this manual carefully and observe all warnings and cautions. The operator should become familiar with all operation procedures that apply to the BT switch. This will protect the operator and the equipment and help ensure proper switch operation.

BT BYPASS-ISOLATION TRANSFER SWITCH

The BT bypass-isolation transfer switch combines an automatic transfer switch, manual bypass switch, and drawout isolation mechanism into a single unit. The result is a unique package that allows a greater degree of protection from power interruptions. The following sections explain how each of these mechanisms function.

Transfer Switch Function

A transfer switch is an essential part of a standby or emergency power system. The primary utility power source is backed up by an alternate utility power source. The transfer switch connects the load to one of the two power sources.

Under normal conditions, the load is supplied with power from the primary source as diagramed in Figure 1. If the primary power source is interrupted, the load is transferred to the alternate power source. When the primary power source is restored, the load is retransferred to the primary power source. The transfer and retransfer of the load between two separate power sources is the most basic function of the transfer switch.

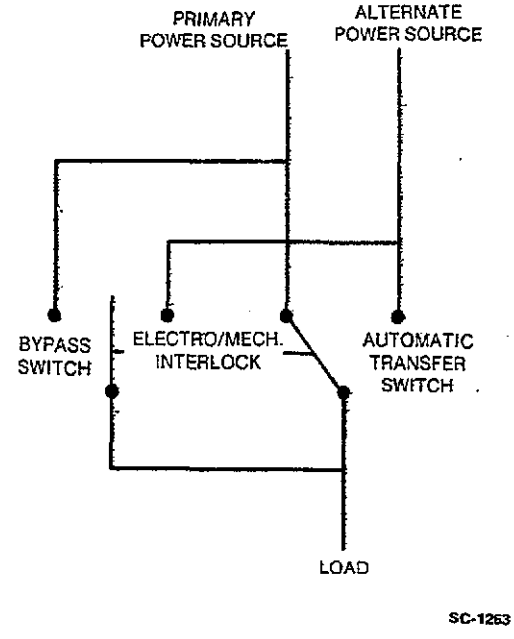


FIGURE 1. BT TRANSFER SWITCH

Automatic Operation: To insure a rapid response to a power interruption, the transfer switch is designed for automatic operation. This is an important feature in installations where essential services are provided. The automatic transfer switch eliminates the need for operator involvement and greatly reduces the response time by automatically performing all of the following functions:

- Senses the interruption of the primary power source
- Transfers the load to the alternate power source
- Senses when the primary power source is restored
- Retransfers the load to the primary power source

Bypass Switch Function

To provide an extra measure of protection, a manual bypass switch is incorporated with the automatic transfer switch. The bypass switch allows the operator to manually connect the load to the available power source (see Figure 1) and bypass the automatic transfer switch. The automatic transfer switch can then be serviced or even removed without causing a power interruption. This gives a greater measure of protection than is provided by the automatic transfer switch alone.

Drawout Isolation Mechanism

The drawout isolation mechanism allows the automatic transfer switch to be easily withdrawn for testing or service. The transfer switch is mounted on rails and connected to the load and power source through special isolation contacts. Turning an external crank handle withdraws the transfer switch to permit testing or service. If necessary, the switch can be lifted from its rails and removed from the cabinet.

MODEL IDENTIFICATION

Identify your model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics are shown on the lower portion of the nameplate. It is located inside the cabinet door on the control box cover.

If it is necessary to contact a dealer or the factory regarding the transfer switch, always give the complete Model, Spec, and Serial number as listed on the nameplate. Also give the number(s) of any options that may be listed on a label below the nameplate. This information is necessary to properly identify your unit among the many types manufactured.

A typical model number with explanation is given below.

BT	B	B	A	400	-	4X	U	/	31	01	E
1	2	3	4	5		6	7		8	9	10

1. Basic model series.
   BT indicates BT Bypass transfer switch series.
2. Number of switched conductor poles.
   B-indicates 3-pole.
3. Basic control group.
   B—indicates utility standby to utility.
4. Enclosure type.
   A-indicates general purpose NEMA 1.
5. Ampere rating.
6. Voltage code and frequency
   4X or 54X (50 Hz) = 277/480, 3-phase, 4-wire.
7. Agency Certification.
   U-Underwriters' Laboratories, Inc.
8. Control option group number.
9. Meter option group number.
10. Specification letter; advances with production modification.

WARNING

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

Installation

CHOOSING THE LOCATION

The following factors should be considered when selecting a location for the transfer switch.

- Standard enclosure is a NEMA Type 1 cabinet and requires an indoor location.
- Cabinet doors are front opening and require a specified amount of clearance (Table 1) to open fully.
- Power cables should only enter the cabinet in the areas specified in the outline drawing.
- A separate conduit is required for control system wiring between remote accessories and transfer switch control.
- There must be a switch and fuses or circuit breaker in the commercial line power before the transfer switch
- Make provisions for lighting and convenience receptacles allow for servicing.
- Select a flat and level mounting surface that is vibration-free. Avoid hot, moist, or dusty locations.

The approximate cabinet dimensions are given in Table 1. Refer to the outline drawing for exact dimensions.

TABLE 1
APPROXIMATE CABINET DIMENSIONS

Switch Amp Rating	Height (H)	Width (W)	Depth W/Door - Closed (D)	Depth W/Door - Open
400	90 IN. (2286 mm)	32.75 IN. (832 mm)	26 IN. (660 mm)	54.5 IN. (1385 mm)
800	90 IN. (2286 mm)	48 IN. (1219 mm)	33.12 IN. (841 mm)	59.12 IN. (1502 mm)
1000	90 IN. (2286 mm)	48 IN. (1219 mm)	33.12 IN. (841 mm)	59.12 IN. (1502 mm)

MOUNTING REQUIREMENTS

Place the shipping box so the cabinet is standing upright and then carefully open and remove the shipping box. Check the entire unit for completeness and general condition. All transfer switches are shipped complete, properly packed, and in working condition when delivered to the transportation company. Any claim for loss or damage in transit should be filed promptly against the transportation company making the delivery.

Two steel rails (see Figure 2) are attached to the bottom of the cabinet for mounting purposes. Use 3/8 inch mounting studs to anchor the cabinet to the floor. Refer to the outline drawing for the correct spacing. When the mounting studs are properly spaced, a large flat washer will overlap the mounting rail. Use six mounting studs to secure the 400 Amp model. Use eight mounting studs to secure the 800 and 1000 Amp models.

Hoist the cabinet into position using appropriate lifting equipment. The four eyebolts at the top of the cabinet may be used as attachment points for the lifting equipment.

WARNING ***Transfer switch cabinet is heavy and can cause serious injury if dropped. Keep hands and feet clear while lifting cabinet.***

Place a flat washer and nut on each stud and tighten securely. The floor must be flat or the cabinet may be distorted when the mounting nuts are tightened.

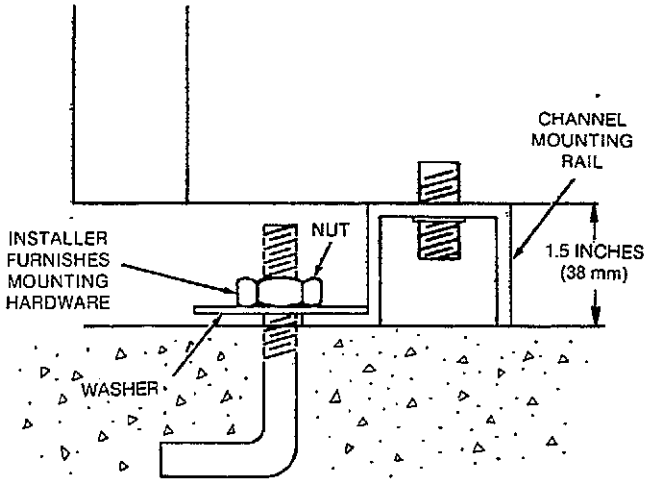


FIGURE 2. MOUNTING HARDWARE

WIRING RECOMMENDATIONS

Wiring must be performed only by qualified personal. Make all wiring openings ***only*** in the area specified in the outline drawing. Run control wiring in separate conduit from the AC power cables to avoid inducing currents that could cause problems within the control.

CAUTION ***Use extreme care to keep drill chips and fillings out of the relays, contacts, and other parts of the automatic transfer switch when mounting or connecting conduit. Also, screwdrivers should be used carefully to prevent damage to the resistors, coils, and contacts.***

Power Source and Load Connections

Use wires of sufficient size to carry the rated current to connect the power supply cables to the transfer switch and the transfer switch to the load. Make connections to the transfer switch terminals as shown in Figures 3 and 4. The lug terminals for 400 Ampere switches will accept two copper or aluminum conductors ranging in size from #2 to 500 MCM. The lug terminals for 800 and 1000 Ampere switches will accept four copper or aluminum conductors ranging in size from #2 to 600 MCM.

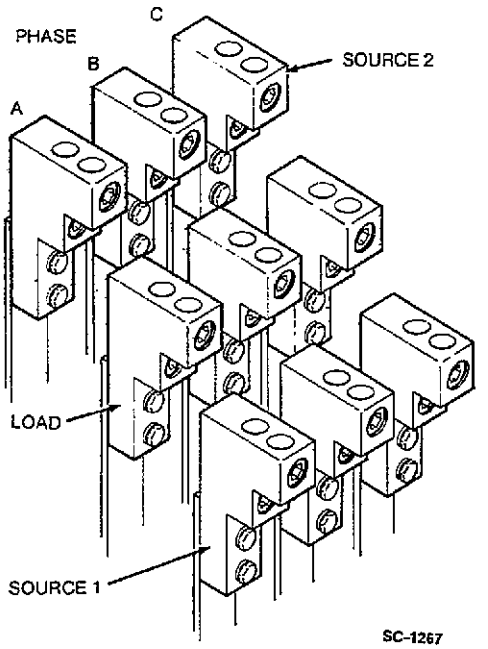


FIGURE 3. TERMINAL LUGS FOR 400 AMP TRANSFER SWITCH

It is recommended that the primary power source be connected to the Source 1 terminals and the alternate power source be connected to the Source 2 terminals. Match the Source 1 phase rotation to the Source 2 phase rotation when making connections.

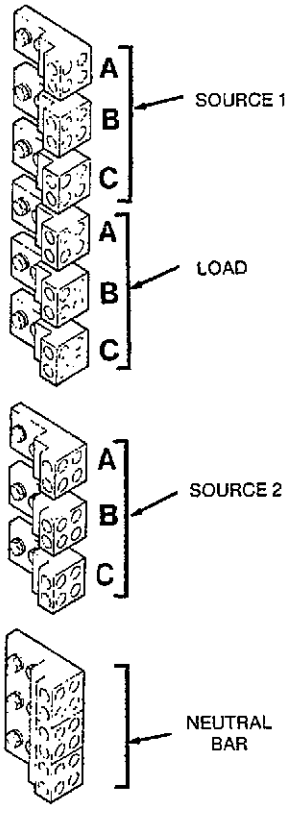


FIGURE 4. TERMINAL LUGS FOR 800 AND 1000 AMP SWITCHES

For transfer switches with the optional AC Ammeter, route each of the load wires through one of the three current transformers as shown in Figure 5. The wire must pass once (1 primary turn) through the current transformer for proper meter operation.

A neutral bar is provided for connecting the neutral wire if used.

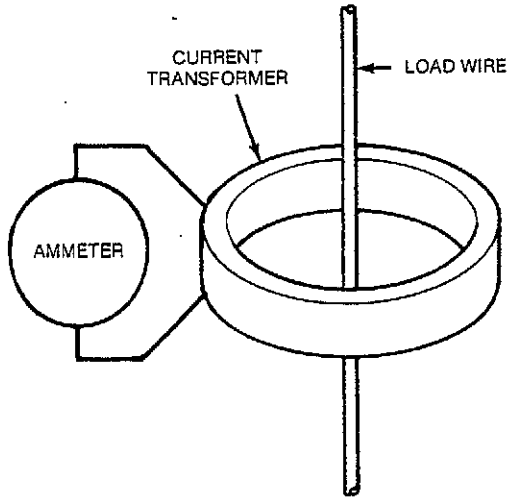


FIGURE 5. CURRENT TRANSFORMER

Control Connections

Route all control wires in a separate conduit from the load wires to avoid induced currents.

Primary Source Failure Signal: A power failure of the primary source closes a set of relay contacts that can be used for a signal circuit external to the transfer switch. Make connections to terminals 6 and 7 on TB1 (see Figure 6). The contacts are rated 10 amps at 28 VDC/120 VAC, 6 amps at 240 VAC, or 3 amps at 480/600 VAC.

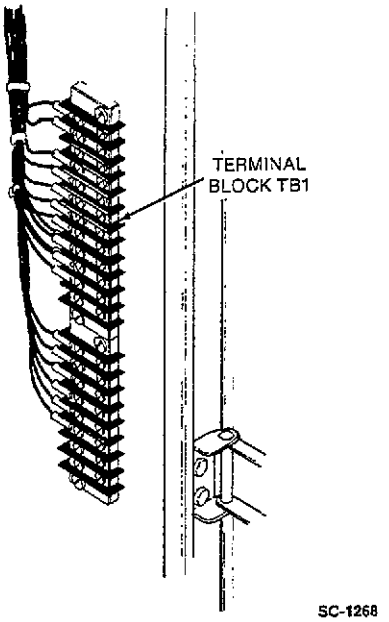


FIGURE 6. TERMINAL BLOCK TB1

Auxiliary Contacts (if used): Auxiliary contacts are located on the normal and emergency sides of the transfer switch for external alarm or control circuitry. Connections for auxiliary contacts can be made on terminal block TB1 terminals 13 through 18. The contacts have ratings of 10 amperes at 480 VAC. The list below shows the position (open or closed) of the auxiliary contacts when the transfer switch is in the center position. Moving the transfer switch to the Source 1 or Source 2 side only affects the auxiliary contacts on that side.

NORMAL AUXILIARY CONTACT	EMERGENCY AUXILIARY CONTACT
TB1-13 — N/O	TB1-16 — N/O
TB1-14 — N/C	TB1-17 — N/C
TB1-15 — COM	TB1-18 — COM

Cleaning Cabinet

After mounting and wiring of cabinet are completed, clean the interior with a vacuum cleaner to remove any chips, filings, or dirt from the cabinet interior and components.

ADJUSTMENTS

Make the adjustments described in the following sections as required.

Programmed Transition (If Equipped)

The programmed transition time delay is attached to the plastic shield (see Figure 7) that covers the transfer switch. It is normally set by the factory for a two second delay.

Depending on the model, the programmed transition either has a time delay range of 0.5 to 5.0 seconds, 1.5 to 15 seconds, or 5 to 50 seconds (three timers are available). To adjust, turn the knob clockwise to increase the delay and counterclockwise to decrease the delay. The time increments are marked on the knob.

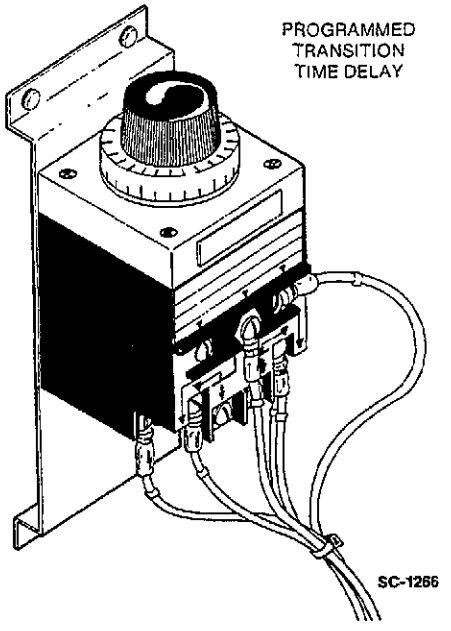


FIGURE 7. PROGRAMMED TRANSITION

Switch Positions

Set all switches as described in the following sections.

Primary Source Select Switch: Move the Primary Source Select Switch to the preferred source as desired (Source 1 or Source 2).

Bypass Switch: Move the Bypass switch handle on the front of the cabinet to AUTOMATIC.

AC Power Connection

Connect AC line power to the automatic transfer switch by closing the service entrance switch or main circuit breaker. The green and red source available lights on the cabinet front should light.

WARNING ***Connecting AC power to the transfer switch will energize many of the load circuits. To avoid serious personal injury or death from electrical shock, all load circuit wiring must be completely installed.***

ELECTRONIC CONTROL SETTINGS

The adjustments on the electronic modules are factory set and normally do not require field adjustment. If desired, the Pickup, Dropout and Time Delay settings may be adjusted to other than factory settings. However, the calibration (Cal) adjustments should be changed only if the nominal voltage is significantly different than the nameplate rating, or when installing a replacement sensor module.

CAUTION ***Haphazard setting of the module calibration (Cal) adjustments may result in abnormal operation of the transfer switch.***

Complete all installation procedures before making adjustments to the Time Delay Module or the Voltage Sensor Modules. All adjustments are made by inserting a screwdriver through the small openings in the module panel.

WARNING ***High voltages are present within the control cabinet which might cause serious personal injury or death. Proceed with care!***

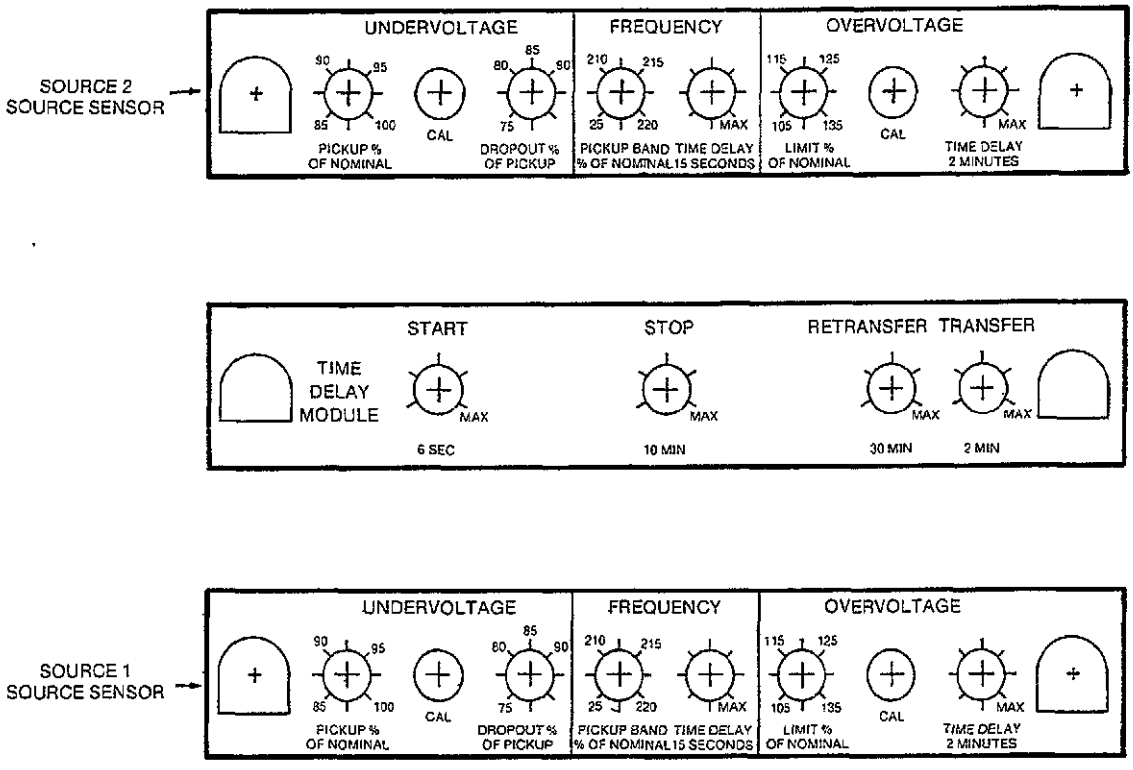
Time Delay Module

The time delay module controls the following functions:

- Transfer time delay
- Retransfer time delay

The Start and Stop time delays are not required with utility to utility transfer switches. Turn the Start and Stop potentiometers fully counterclockwise to their minimum settings.

If other than factory setting is desired, align the slot on the potentiometer to the desired markings on the module panel. See Figure 8. Range of adjustments and factory settings are as follows:



ES 1408

FIGURE 8. TIME DELAY MODULE AND VOLTAGE SENSORS

DELAY	ADJUSTMENT	FACTORY SETTING
Transfer	0-120 seconds	2 seconds
Retransfer	0-32 seconds	15 minutes

Voltage Sensor Modules

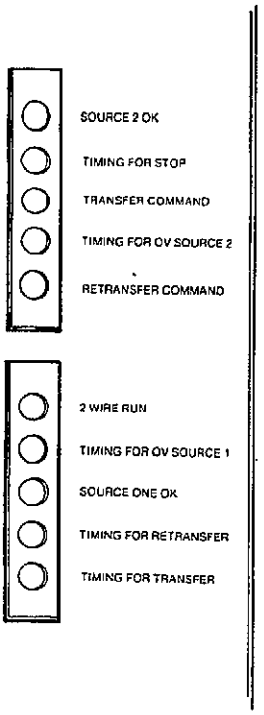
A separate voltage sensor (see Figure 8) is used for each power source. The voltage sensor above the time delay module is for the Source 2 power source and the sensor below the time delay module is for the Source 1 power source.

Undervoltage Sensor: The standard voltage sensor modules monitor Source 1 and Source 2 power sources for an undervoltage condition. The undervoltage range of adjustment is shown below. If other than factory setting is desired, align the slot on the potentiometer to the desired markings on the module panel.

FUNCTION	ADJUSTMENT RANGE	FACTORY SETTING
Dropout	75% to 98%	85%
Pickup	85% to 100%	95%

A separate voltage sensor is used for each power source. Calibrate the undervoltage sensor using the following procedure.

1. To calibrate the Source 1 undervoltage sensor, the green normal source available light should be on.
2. Turn and hold the Source Select switch to Source 1 and move the bypass switch handle to the Source 1 position.
3. Turn the undervoltage pickup and dropout potentiometers on the voltage sensor fully clockwise.
4. Turn the undervoltage calibration (CAL) potentiometer fully clockwise. The Source 1 OK lamp (Source 2 OK for Source 2) should be on (see Figure 9). If the Source OK lamp fails to come on and the voltage sensor has an overvoltage sensing option, turn the overvoltage LIMIT and CAL potentiometers fully clockwise.
5. Turn the CAL potentiometer counterclockwise until the source OK lamp turns off.
6. Slowly turn the CAL potentiometer clockwise until the Source OK lamp just turns on again.
7. The undervoltage sensor is now calibrated. If the overvoltage sensor was adjusted in step 4, then recalibrate it using the overvoltage sensor calibration procedure.
8. Reset the Pickup and Dropout potentiometers to the factory settings or to the desired settings.



SC 1282

FIGURE 9. CONTROL LAMPS

9. To calibrate the Source 2 undervoltage sensor, Source 2 voltage must be available. Verify that the Source 2 available lamp is on.
10. Follow steps 3 through 8 to calibrate the Source 2 source undervoltage sensor.
11. Move the bypass switch handle to the automatic position.

Overvoltage Sensor: The optional overvoltage sensor detects when the source voltage has exceeded the overvoltage limit.

If other than factory setting is desired, align the slot on the potentiometer to the desired markings on the module panel. See Figure 8. Range of adjustments and factory settings are shown below.

FUNCTION	ADJUSTMENT RANGE	FACTORY SETTING
Limit	105 to 135%	110%
Time Delay	0 to 2 minutes	5 seconds

The overvoltage pickup point is fixed at 5 percent below the Limit setting. The adjustable dropout Time Delay overrides momentary overshoots in voltage.

If necessary, the Overvoltage sensor may be calibrated as follows:

If the Undervoltage sensor has not been calibrated, do so before proceeding.

1. To calibrate the Source 1 overvoltage snesor, the green Source 1 available light should be on. On voltage sensors with the frequency sensing option, the source frequency must be within the limits set by the FREQUENCY PICK-UP BAND Potentiometer.
2. Turn and hold the Source Select switch to Source 1 and move the bypass switch handle to the Source 1 position.
3. Turn the overvoltage LIMIT and TIME DELAY potentiometers on the voltage sensor fully clockwise.
4. Turn the overvoltage calibration (CAL) potentiometer fully clockwise. The Source 1 OK lamp (Source 2 OK for Source 2) should be on (see Figure 9).
5. Turn the CAL potentiometer counterclockwise until the Source OK lamp turns off.
6. Slowly turn the CAL potentiometer clockwise until the Source OK lamp just turns on again.
7. Reset the OVERVOLTAGE LIMIT and TIME DELAY potentiometers to the factory settings or to the desired settings.
8. To calibrate the Source 2 overvoltage sensor, Source 2 voltage must be available. Verify that the Source 2 Available lamp is on.
9. Follow steps 3 through 7 to calibrate the Source 2 overvoltage sensor.
10. Move the bypass switch handle to the automatic position.

Frequency Sensor: The optional frequency sensor detects when the source frequency is within an acceptable band. This band is centered about the nominal system frequency (50 or 60 hertz).

If other than factory setting is desired, align the slot on the potentiometer to the desired markings on the module panel. See Figure 8. Range of adjustments and factory settings are shown below.

FUNCTION	ADJUSTMENT RANGE	FACTORY SETTING
Pickup Band	±4 to ±20%	±10%
Time Delay	0 to 15 seconds	5 Seconds

The dropout bandwidth is always 2.5% wider (on each end) than the pickup bandwidth.

The adjustable dropout Time Delay allows the control to ignore momentary dips or rises in frequency.

CHECKOUT PROCEDURES

The following sections cover several checkout procedures for verifying that the transfer switch is operational.

Transfer Switch Test

Make the following test with a load applied to verify that the complete system (switch and control) is operational. A momentary interruption in power will occur when the load is transferred during testing.

1. Verify that the bypass switch handle is in the AUTOMATIC position.

2. Disconnect Source 1 from the transfer switch. The load should transfer to Source 2 after the transfer time delay elapses. The green Source 1 Available light should be OUT and the red Source 2 Available and Source 2 Transfer Switch Position lights should be ON.
3. Place the Primary Source Select switch in the Source 2 position. The Alternate Source Failure light should go ON.
4. Reconnect Source 1 power to the transfer switch. The Source 1 Available light should go on and the Alternate Source Failure light should go OUT.
5. Disconnect Source 2 from the transfer switch. The load should retransfer to Source 1 after the retransfer time delay elapses. The red Source 2 Available light should be OUT and the green Source 1 Available and Source 1 Transfer Switch Position lights should be ON.
6. Place the Primary Source Select Switch in the Source 1 position and verify the Alternate Source Failure light is ON. Reconnect Source 2 to the transfer switch. The Alternate Source Failure light should go OUT.

Bypass Switch Test

Make the following tests to verify that the bypass switch and interlock system is operational. Begin test with the load supplied by the Source 1 power source Note that some tests will result in momentary power interruptions.

Same Source Bypass Test:

1. Turn the Source Select switch to Source 1 and move the bypass switch handle to the Source 1 position.
2. Turn the key operated Drawout Release switch and hold against the tension of the spring return. Turn the drawout crank handle counterclockwise until the amber test light comes on and then release the Drawout Release switch.
3. If the bypass switch is operational, no power interruption should occur. The green Source 1 Bypassed light should be ON.
4. Turn the key operated Drawout Release switch and hold against the tension of the spring return. Turn the drawout crank handle clockwise until the limit of rotation is reached.
5. Release the Drawout Release switch and push the Reset switch. The green Transfer-Switch-Position light should be *ON*.
6. Move bypass switch handle to the automatic position.
7. Turn the Primary Source Select switch to Source 2. The load should transfer to Source 2 after the transfer time delay elapses.
8. Turn the Source Select switch to Source 2 and move the bypass switch handle to the Source 2 position.
9. Turn the key operated Drawout Release switch and hold against the tension of the spring return. Turn the drawout crank handle counterclockwise until the amber test light comes on and then release the Drawout Release switch.
10. If the bypass switch is operational, no power interruption should occur. The green Source 2 Bypassed light should be *ON*.
11. Turn the key operated Drawout Release switch and hold against the tension of the spring return. Turn the drawout crank handle clockwise until the limit of rotation is reached.
12. Release the Drawout Release switch and push the Reset switch. The red Source 2 Transfer Switch Position light should be *ON*.
13. Move bypass switch handle to the automatic position and turn the Primary Source Select switch to Source 1.

Dead Source Bypass Test:

1. Disconnect Source 2 power from the transfer switch.
2. Turn the Source Select switch to the Source 2 side and attempt to move the bypass handle to the Source 2 side. The interlock mechanism should prevent the load from transferrring to a dead source.
3. Reconnect Source 2 power to the transfer switch.
4. Turn the Primary Source Select switch to Source 2. The load should transfer to Source 2 after the transfer time delay elapses.
5. Disconnect Source 1 power from the transfer switch.
6. Turn the Source Select switch to Source 1 and attempt to move the bypass switch handle to the Source 1 side. The interlock mechanism should prevent the load from transferring to a dead source.
7. Reconnect Source 1 power to the transfer switch and turn the Primary Source Select switch to Source 1.

Opposite Source Bypass Test:

1. Verify that the Source 2 Available light is *ON* and the Primary Source Select switch is turned to Source 1.
2. Turn the Source Select switch to Source 2 and move the bypass switch handle to Source 2. A momentary load interruption will occur during transfer.
3. Verify that the red Source 2 Bypassed light is *ON* and then press the Reset button.
4. Turn the Primary Source Select switch to Source 2.
5. Turn the Source Select switch to Source 1 and move the bypass switch handle to Source 1. A momentary load interruption will occur during retransfer.
6. Press the Reset switch and turn the Primary Source Select switch to Source 1.
7. Move bypass switch handle to the *AUTOMATIC* position.

Description

GENERAL

This section describes the standard and optional items or features of the automatic transfer switch, bypass switch, cabinet, and control.

INDICATOR LAMPS

Six indicator lamps are used to show power source availability, transfer switch position, and bypass switch position. Refer to Figure 10 for the location of each lamp.

Source 1 Available (Green): Indicates that the Source 1 power source is available.

Source 2 Available (Red): Indicates that the Source 2 power source is available.

Transfer Switch Position-Source 1 (Green): Indicates automatic transfer switch is in the Source 1 position.

Transfer Switch Position-Source 2 (Red): Indicates automatic transfer switch is in the Source 2 position.

Source 1 Bypassed (Green): Indicates the bypass switch is in the Source 1 position.

Source 2 Bypassed (Red): Indicates the bypass switch is in the Source 2 position.

A single amber indicator light is used to indicate when the transfer switch has been drawn out to the test position.

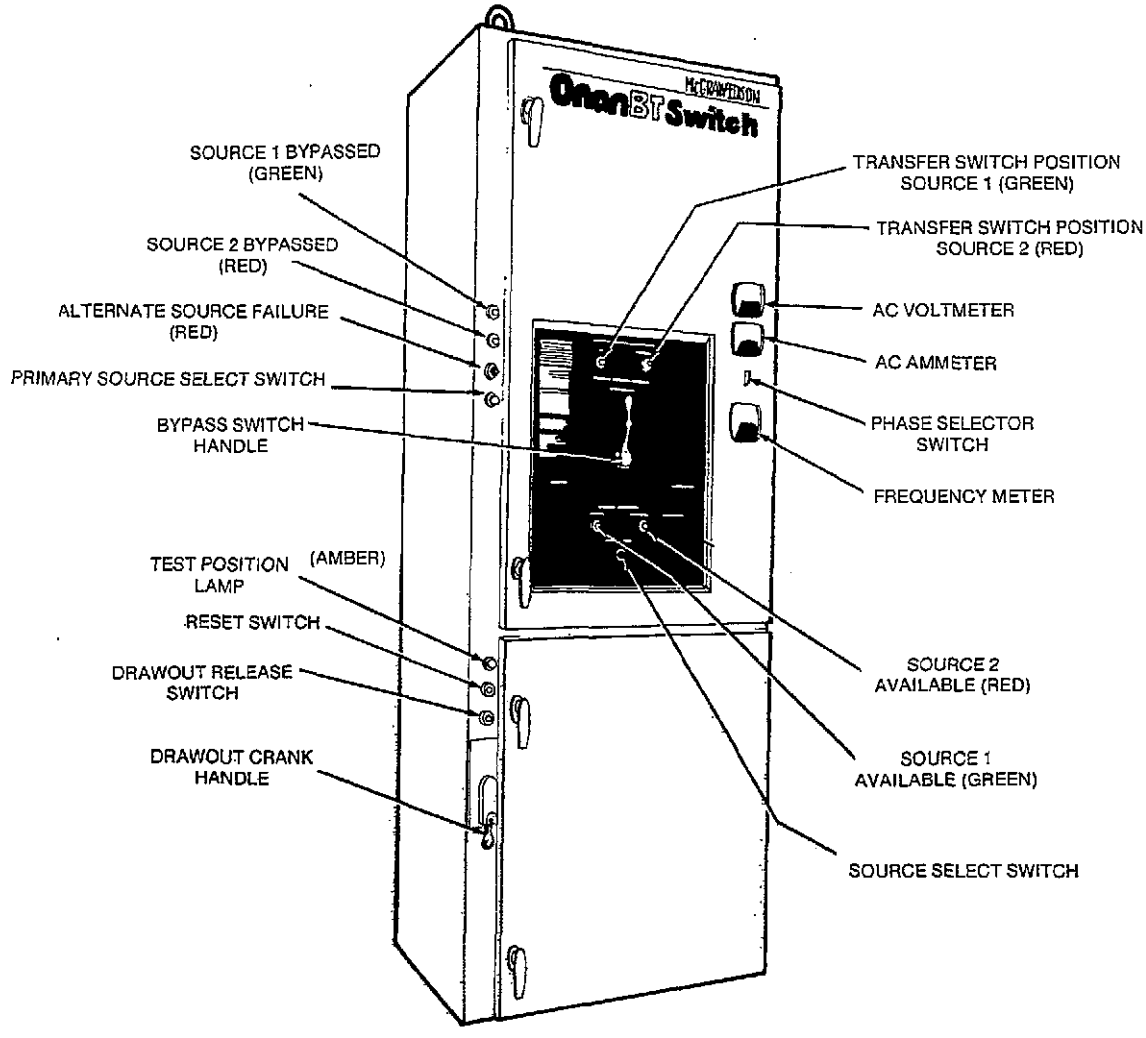


FIGURE 10. 400 AMP BT TRANSFER SWITCH

METERS

Onan has meter options as operating indicators of the power sources. These include an AC voltmeter, AC ammeter, and frequency meter.

AC Voltmeter: The voltmeter measures line-to-line voltage of both power sources. For three phase voltages, a selector switch is included.

AC Ammeter: The ammeter measures the load current. For three phase systems, a selector switch is included.

Frequency Meter: The frequency meter measures the frequency of both power sources in hertz.

SWITCHES

The following sections explain the purpose and function of the various switches on the cabinet. Refer to Figure 10 for location.

Bypass Switch and Source Select Switch

The Bypass switch is used in conjunction with the Source Select switch. The Source Select switch controls an interlock device. The interlock prevents the bypass switch from connecting the load to a dead source or to both sources at the same time. To operate the Bypass switch, the Source Select switch must first be turned to the source that will be connected to the load. This releases the interlock and makes it possible to turn the Bypass switch handle.

Drawout Release Switch and Reset Switch

The Drawout Release switch is used when the transfer switch is to be drawn out for testing or service. Turning the key operated Drawout Release switch causes the transfer switch to go to the center position and releases the drawout crank handle. When testing or service is complete, turning the Drawout Release Switch allows the transfer switch to be reconnected. After reconnection, pushing the Reset switch returns the transfer switch to the same position as the bypass switch.

Additional Switches

Primary Source Select Switch: Selects which power source (Source 1 or Source 2) will be the preferred or primary power source. When the primary source is not available, the control will signal for the load to transfer to the alternate power source.

Phase Selector Switch: Selects the phase for AC voltmeter and AC ammeter reading.

CONTROL SYSTEM

The control system operates as the overall supervisor for the transfer switch. The following sections cover the various functions of the control.

Time Delays

Transfer Time Delay: The transfer time delay begins the moment the primary power source fails. At the end of the transfer delay, the transfer switch is allowed to operate, transferring the load to the alternate power source. This brief delay (factory setting of two seconds) prevents the load from transferring because of a momentary dip in voltage. It has a time range adjustable from zero to two minutes.

Retransfer Time Delay: The retransfer time delay begins timing the moment the primary power source voltage and frequency return. At the end of the delay, the transfer switch is allowed to retransfer the load to the primary source. This delay (factory setting of 15 minutes) allows the primary power source to stabilize before retransfer. It has a time range adjustable from zero to thirty-two minutes.

Voltage Sensing

Undervoltage Sensing: If the monitored source voltage falls to the drop-out point, a signal is made to transfer load to the other power source. The sensors are set to pick up at 95 percent of the nominal voltage and drop out at 85 percent of the pickup setting. The pickup setting is adjustable from 85 to 100 percent of the nominal voltage, and the drop-out setting is adjustable from 75 to 98 percent of the pickup setting.

If you want to connect load to the primary power source, for example, the primary source voltage would have to be 95 percent of the nominal voltage. Once connected, the voltage sensor would not signal for a drop of load unless the primary voltage fell below 85 percent of the pickup setting.

Frequency Sensing: Optional frequency sensing for the Source 1 and Source 2 power source detects when frequency is within an adjustable bandwidth (±4 to ±20%). If the frequency goes above or below the bandwidth, the automatic transfer switch will initiate transfer of the load to the other source. An adjustable dropout time delay allows the control to ignore momentary dips or rises in frequency.

Overvoltage Sensing: Optional overvoltage sensing of all lines is available along with undervoltage and frequency sensing.

The overvoltage sensing limit is adjustable from 105 to 135 percent of the nominal voltage, and is factory set at 110 percent. The overvoltage pickup point is fixed at 5 percent below the limit setting. An adjustable time delay overrides momentary overshoots in voltage.

Programmed Transition (Optional)

Programmed transition is an optional feature of BT transfer switches. Programmed transition is the capability of the transfer switch to assume a mid-transition position, for an adjustable interval of time, when the load is neither connected to the Source 1 power source nor to the Source 2 power source. This feature allows residual voltages in a motor load to decay to an acceptable level before transition is completed. The length of time that the transfer switch is in the midposition can be adjusted from 0.5 to 5 seconds, 1.5 to 15 seconds, or 5 to 50 seconds, depending on the timer option. The proper adjustment is a function of the motor and its connected load.

TRANSFER SWITCH

The transfer switch does the work of opening and closing the contacts that transfer the load between Source 1 and Source 2 power. The transfer switch is a set of multipole, single throw, electromechanical switches, that are mechanically interlocked to prevent simultaneous closing to both power sources. The principal parts of the transfer switch discussed here are the contact assemblies, linear actuator, auxiliary contacts, and isolation mechanism.

Contact Assemblies

The contact assemblies actually make and break the current flow. When closed to either Source 1 or Source 2 power source, these contacts are mechanically held. A mechanical interlock prevents the contact assemblies from closing to both power sources at the same time.

Series BT transfer switches are multipole switches which open and close more than one current path, or pole, with a common switching means.

Linear Actuator

The linear actuator moves the contact assemblies from the Source 1 power source to the Source 2 power source and back again as required. The linear actuator is a linear induction motor that acts upon an actuator rod, which moves the contact assemblies. Operation of the linear actuator is electrical and is initiated automatically with automatic transfer switches.

Auxiliary Contacts

Auxiliary contacts are provided on both the Source 1 and Source 2 side of the transfer switch. They are actuated by the operation of the transfer switch during transfer and retransfer. The auxiliary contacts have current ratings of 10 amperes at 480 VAC.

ISOLATION MECHANISM

The drawout-isolation mechanism allows the transfer switch to be isolated for testing or service. The transfer switch is mounted on rails and may be drawn out by turning an external crank handle. A special set of isolation contacts permits the transfer switch to be disconnected from the AC circuitry as required.

When the transfer switch is drawn out to the test position, the load and power sources are disconnected from the transfer switch. However, the transfer switch control continues to receive AC power from whatever source is supplying the load. This permits the operator to test the various control functions such as the time delays, voltage sensors, etc.

When the transfer switch is fully drawn out, the transfer switch and control are fully isolated from the load and all power sources. If necessary, the cabinet can be opened and the complete transfer switch assembly can be lifted from the rails for service.

A key operated interlock limits operation of the drawout-isolation mechanism to authorized personnel. No load break will occur when the transfer switch is drawn out if the bypass switch is set correctly (see bypass switch description).

BYPASS SWITCH

The bypass switch allows the operator to manually connect the load directly to the available power source and bypass the transfer switch. This avoids an interruption in power when the transfer switch is drawn out for testing or service. An interlock system prevents the load from being connected to a dead source or to two sources at the same time.

Bypass Switch Handle

The bypass switch handle has three positions: 1) automatic, 2) Source 1, 3) Source 2. Turning the switch handle to automatic places the bypass switch in the center position and makes the load connection dependent on the position of the automatic transfer switch. The bypass switch must be in this position for automatic transfer switch operation. Turning the switch handle to Source 1 or Source 2 manually connects the load to that source.

Interlock System

The interlock system prevents the operator from connecting the load to a dead source or to two sources at the same time. Before turning the bypass switch handle, the Source-Select switch must be turned to the source that will be connected to the load. If the automatic transfer switch is already connected to the same source, the operator will be able to move the bypass switch handle without load interruption. This operation is called bypassing to the **same** source.

If the automatic transfer switch is not connected to the same source, turning the Source-Select switch to the opposite source will cause a short power interruption. Turning the bypass switch handle to the desired source will restore power. This operation is called bypassing to the **opposite** source.

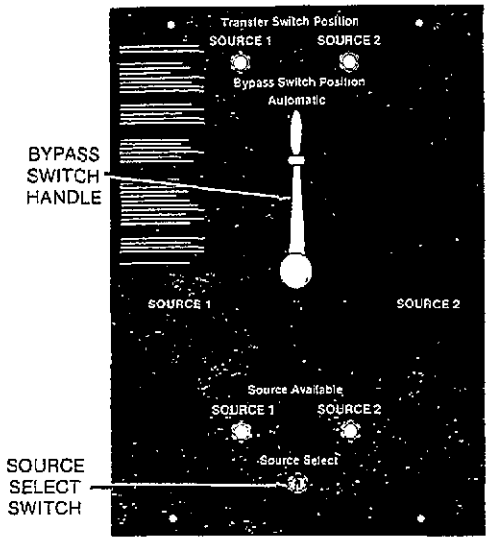
If AC voltage is not present at the source selected, the interlock will prevent the operator from moving the bypass switch handle to that source. This avoids an interruption in power by preventing the operator from bypassing to a **dead** source.

Operation

AUTOMATIC TRANSFER SWITCH OPERATION

For emergency standby service, set the BT transfer switch for automatic operation. Turn the Primary Source Select switch to the preferred power source (Source 1 or Source 2) and place the bypass switch handle in the automatic position. Normally, the transfer switch will be installed with Source 1 as the primary power source. With the controls set as described, the transfer switch will automatically transfer the load to the alternate power source (after the time delays elapse) if the primary power source fails. When the primary power source returns, the load will automatically retransfer from the alternate power source to the primary power source.

If necessary, the load may be kept connected to the alternate power source when the primary source returns by turning the Primary Source Select switch to the alternate (normally Source 2) power source. This will allow the operator to retransfer the load to the primary power source when the interruption in power will not disrupt essential services. To initiate retransfer to the primary source, turn the Primary Source Select switch to the primary source. The load will retransfer to the primary source immediately.



SC-1265-1

FIGURE 11. BYPASS SWITCH

ISOLATING THE TRANSFER SWITCH FOR SERVICE

The operator can manually bypass the load to Source 1 or to Source 2 if it is necessary to isolate the transfer switch for servicing or if the automatic transfer switch malfunctions. Use the following procedures:

1. Turn the Source Select switch (See Figure 11) to the source that will be connected to the load. If bypassing to the opposite source, the power will be momentarily interrupted.
2. While holding the Source Select switch, move the bypass switch handle to the source to be connected to the load.
3. Release the Source Select switch. The load is now bypassed and the automatic transfer switch may be isolated for service without load interruption.
4. Turn the key operated Drawout Release switch and hold against the tension of the return spring. Turn the drawout crank handle counterclockwise to the limit of its rotation.
5. Release the Drawout Release switch. The lower cabinet door may be opened to service the transfer switch as required.

To Reconnect the Transfer Switch:

1. Turn the key operated Drawout Release switch and hold against the tension of the return spring. Turn the drawout crank handle clockwise to the limit of its rotation.
2. Release the Drawout Release switch and then push the Reset button.
3. Move the bypass switch handle to the automatic position to return the transfer switch to automatic operation.

Troubleshooting

TRANSFER SWITCH DOES NOT TRANSFER AUTOMATICALLY

1. Is the bypass switch handle in the *AUTOMATIC* position. Place the bypass switch handle in the *AUTOMATIC* position for automatic transfer switch operation.
2. Has the transfer time delay expired? The factory setting is for 2 seconds.
3. Has the programmed transition (if equipped) time delay expired? The factory setting is for 2 seconds.
4. Is the Alternate Source Failure light on.? Load will not transfer if the alternate power source is not within the voltage and frequency settings of the voltage sensor.
5. Is the transfer switch Test lamp *ON* indicating the automatic transfer switch has been withdrawn for testing? Reconnect transfer switch as covered in the Operation section.
6. If none of the above, contact an authorized Onan service center for assistance.

TRANSFER SWITCH DOES NOT RETRANSFER AUTOMATICALLY

1. Is the bypass switch handle in the *AUTOMATIC* position? Place the bypass switch handle in the *AUTOMATIC* position for automatic transfer switch operation.
2. Has the retransfer time delay expired? The factory setting is for 15 minutes.
3. Has the programmed transition (if equipped) time delay expired? The factory setting is for 2 seconds.
4. Is the Source Available (for the primary source) light on? Load will not retransfer if the primary power source is not within the voltage and frequency settings of the voltage sensor.
5. Is the transfer switch Test lamp *ON* indicating the automatic transfer switch has been withdrawn for testing? Reconnect transfer switch as covered in the Operation Section.
6. If none of the above, contact an authorized Onan service center for assistance.

Onan Corporation
A Subsidiary of
McGraw-Edison Company
1400 73rd Avenue N.E.
Minneapolis, MN 55432

612 574-5000
Telex 29 0476 (U.S.)
Telex 29 0856 (outside U.S.)
TWX 910 576-2833
Cable ONAN

Power Generation