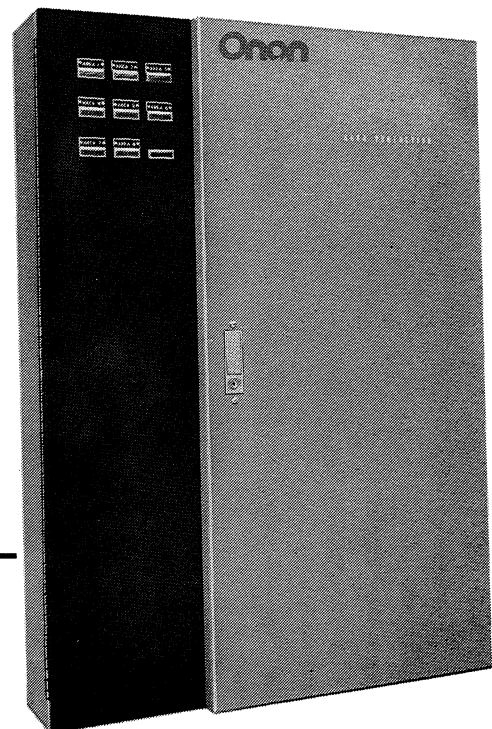


**Onan**

# **Operator's Manual Area Protection Monitor**



# Safety Precautions

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

**⚠ DANGER** *This symbol warns of immediate hazards which will result in severe personal injury or death.*

**⚠ WARNING** *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

**⚠ CAUTION** *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

The Area Protection Monitor contains components which present a serious shock hazard. To minimize this hazard, do the following:

- Keep the Area Protection Monitor cabinet closed and locked. Allow only authorized personnel access to the cabinet.

- Before servicing or maintaining the Area Protection Monitor, disable its power supply (circuit from terminals TB3-7 and TB3-8) and open the circuit breakers to the monitored loads (circuits from TB2 terminal blocks). Disable the generator set (by disconnecting the starting battery, negative lead first) if emergency power is not required during servicing.
- Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when working on any electrical equipment.
- Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when servicing the Area Protection Monitor.
- Do not wear jewelry when working on the Monitor. Jewelry conducts electricity readily.
- Do not work on electrical equipment when mentally or physically fatigued, or after using alcohol or any drug that makes operation of equipment unsafe.

**⚠ WARNING** *To avoid possible personal injury or equipment damage, a qualified electrician or an authorized Onan service representative must install and service the Area Protection Monitor.*

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# General Information

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## OPERATOR'S MANUAL

This operator's manual provides installation, description and operation information for the Onan Area Protection Monitor. A troubleshooting guide is also included. Operators should become familiar with this manual prior to operating the Area Protection Monitor. Failure to follow the proper procedures may result in unsatisfactory operation, equipment damage, and personal injury.

## AREA PROTECTION MONITOR APPLICATION

An automatic transfer switch responds to general power outages involving the utility service entrance, but cannot respond to outages in branch circuits after the distribution panel. The Area Protection Monitor detects power outages of important load circuits branching from the normal source distribution panel, and opens a circuit to an automatic transfer switch to access standby power. Solid-state voltage sensors within the Monitor verify load circuit voltage, deenergizing a relay during low- or no-voltage conditions.

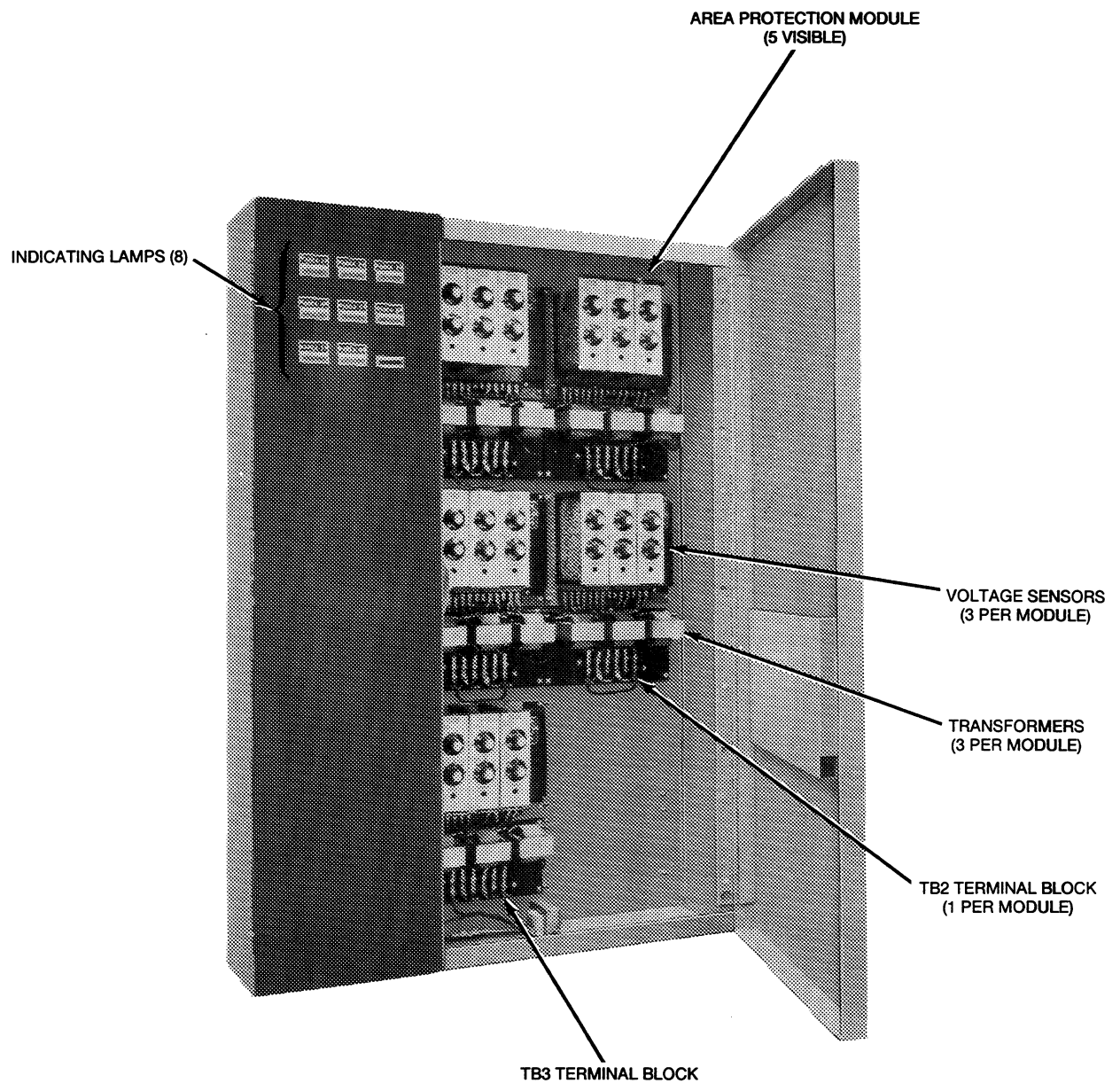
The Area Protection Monitor is enclosed in a general-purpose indoor cabinet with a locking door. This cabinet conforms to NEMA 1 construction standards: it is designed for wall mounting, and has knockouts for electrical connections. Indicating lamps on the front of the cabinet show which areas do not have normal power.

A fully equipped Area Protection Monitor contains nine monitor modules: each module handles either these single-phase loads, or one three-phase load. The three-phase Area Protection Monitor monitors as many as 9 load circuits: the single-phase Area Protection Monitor monitors as many as 27 load circuits. Figure 1 illustrates a three-phase unit with eight modules.

Single-phase Area Protection Monitors are available in 120 VAC, 240 VAC, and 277 VAC versions, with capacities ranging from 3 areas (3 lamps) to 27 areas (27 lamps).

Three-phase Area Protection Monitors are available in 208 VAC, 240 VAC, 480 VAC and 600 VAC versions, with capacities ranging from 1 area (1 lamp) to 9 areas (9 lamps).

**The Area Protection Monitor cannot be used in conjunction with the Onan OT III Transfer Switch. The Monitor opens relay contacts to remotely actuate a transfer switch, but the OT III requires a relay closing for remote actuation.**



MONITOR SHOWN: THREE-PHASE, EIGHT AREA, EIGHT-LAMP VERSION

FIGURE 1. AREA PROTECTION MONITOR CABINET (OPEN)

## MOUNTING

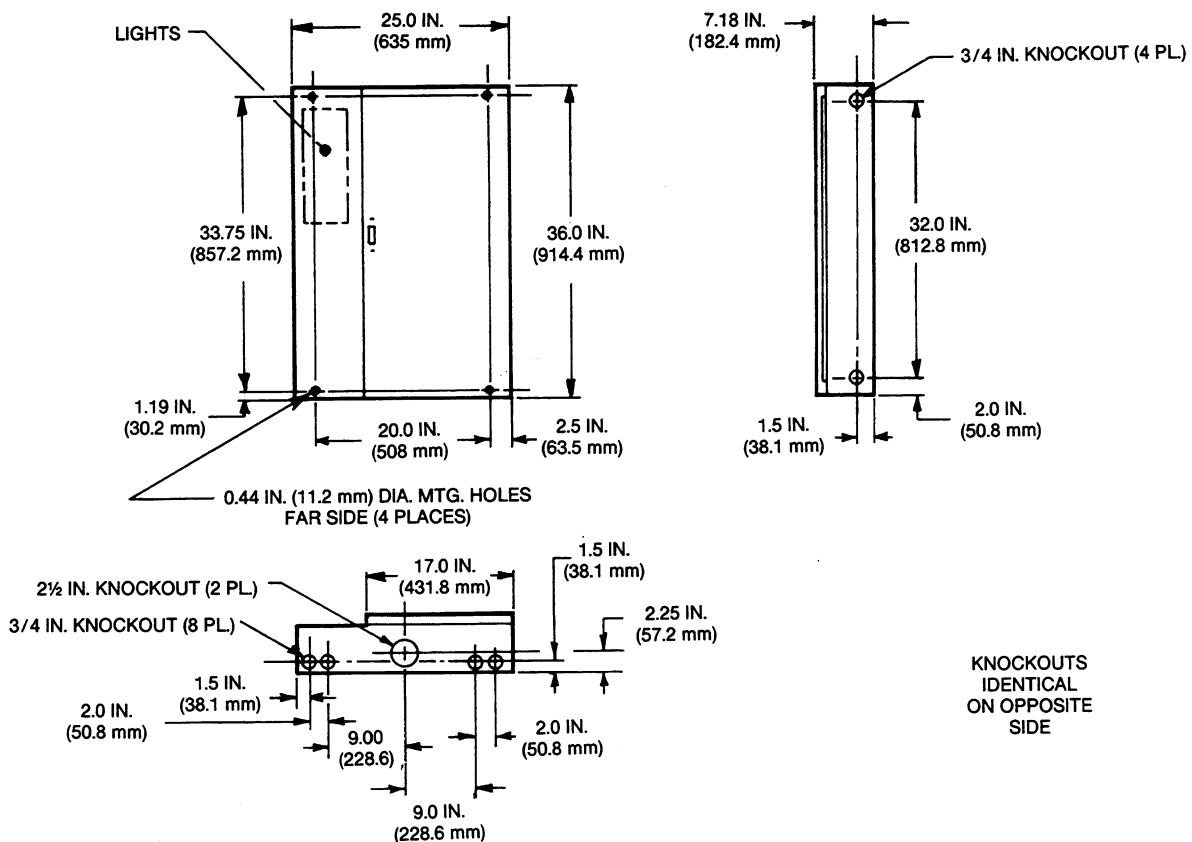
**Mount the Area Protection Monitor on a surface which is vibration-free and convenient for wiring. Avoid hot, moist or dusty locations.**

1. Carefully remove the crating from around the Area Protection Monitor.
2. Install the two top mounting bolts (included) in the wall. The top mounting holes are “key” holes, which enable easier mounting: Figure 2 shows their position.
3. Open the cabinet door.

4. Remove the left front panel screws and swing the panel open.
5. Lift the cabinet and suspend it from the two mounting bolts in the wall.

**⚠ WARNING** *Lifting and mounting the cabinet can cause severe personal injury. Have sufficient manpower available to assist in lifting the cabinet.*

6. Tighten the top mounting bolts.
7. Install the bottom two mounting bolts and tighten.



### FIGURE 2. CABINET DIMENSIONS

## WIRING

Onan strongly recommends that cabinet wiring be performed in the following sequence. Figure 2 shows the cabinet knockouts.

**CAUTION** *The resistors, coils, and contacts of the Area Protection Monitor and the automatic transfer switch are easily damaged. Use screwdrivers and other tools carefully when mounting these components. Use extreme care to keep drill chips and filings out of the Monitor and the transfer switch when mounting or connecting conduit.*

1. Remove AC line power from the automatic transfer switch and the Area Protection Monitor. Stop the generator set and remove the negative lead from the cranking battery to prevent starting.

**WARNING** *The transfer switch presents a possible shock hazard while the cabinet is being wired. Make certain that the generator set is disabled and that all AC voltage is removed from the automatic transfer switch.*

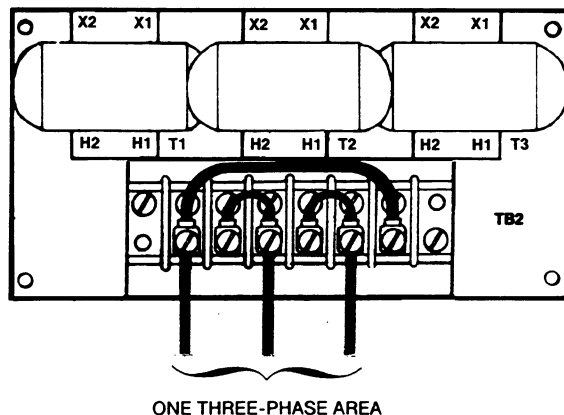
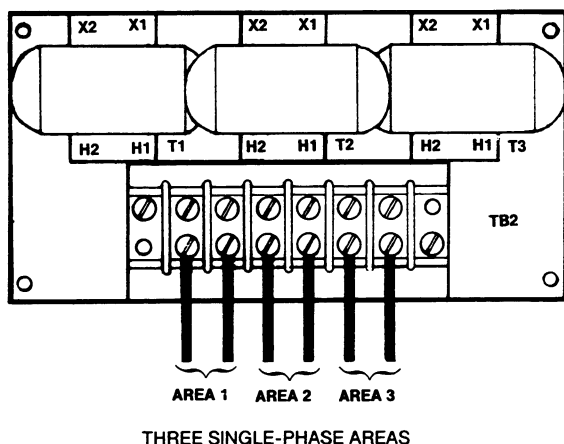
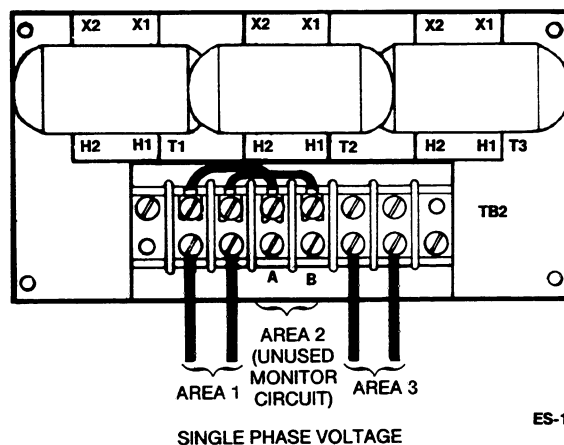


FIGURE 3. CONNECTIONS FOR MONITORING LOADS

2a. **Load monitor connections:** Connect wires from each TB2 terminal block (Figure 3) to the designated loads.

2b. **Single-phase monitoring:** If all TB2 terminals are not used, jumper the unused terminals to the corresponding TB2 terminals. For example, if area 2 terminals are not used, as shown in Figure 4, jumper them to the area 1 or area 3 terminals.

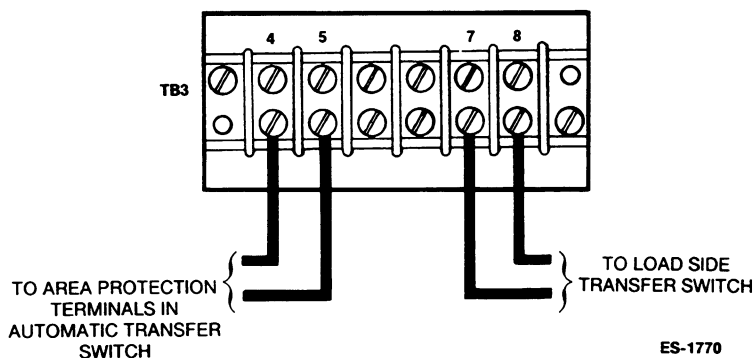


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FIGURE 4. CONNECTIONS FOR USING TWO AREAS OF SINGLE-PHASE MODULE

2c. **Three-phase monitoring:** If a module circuit from the TB2 terminal blocks is not being used, remove the K1 relay from that module and jumper TB1-4 to TB1-5. If an additional area is to be monitored later, remove the jumper between TB1-4 and TB1-5 and return relay K1 to its original position.

3. Attach a wire terminal TB3-4 and a wire to terminal TB3-5 (Figure 5). Connect these wires to the area protection terminals (or "Remote Test Switch" terminals) of the normally-closed circuit in the automatic transfer switch. This connection provides a signal to the automatic transfer switch.



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FIGURE 5. CONNECTIONS TO TERMINAL BLOCK TB3

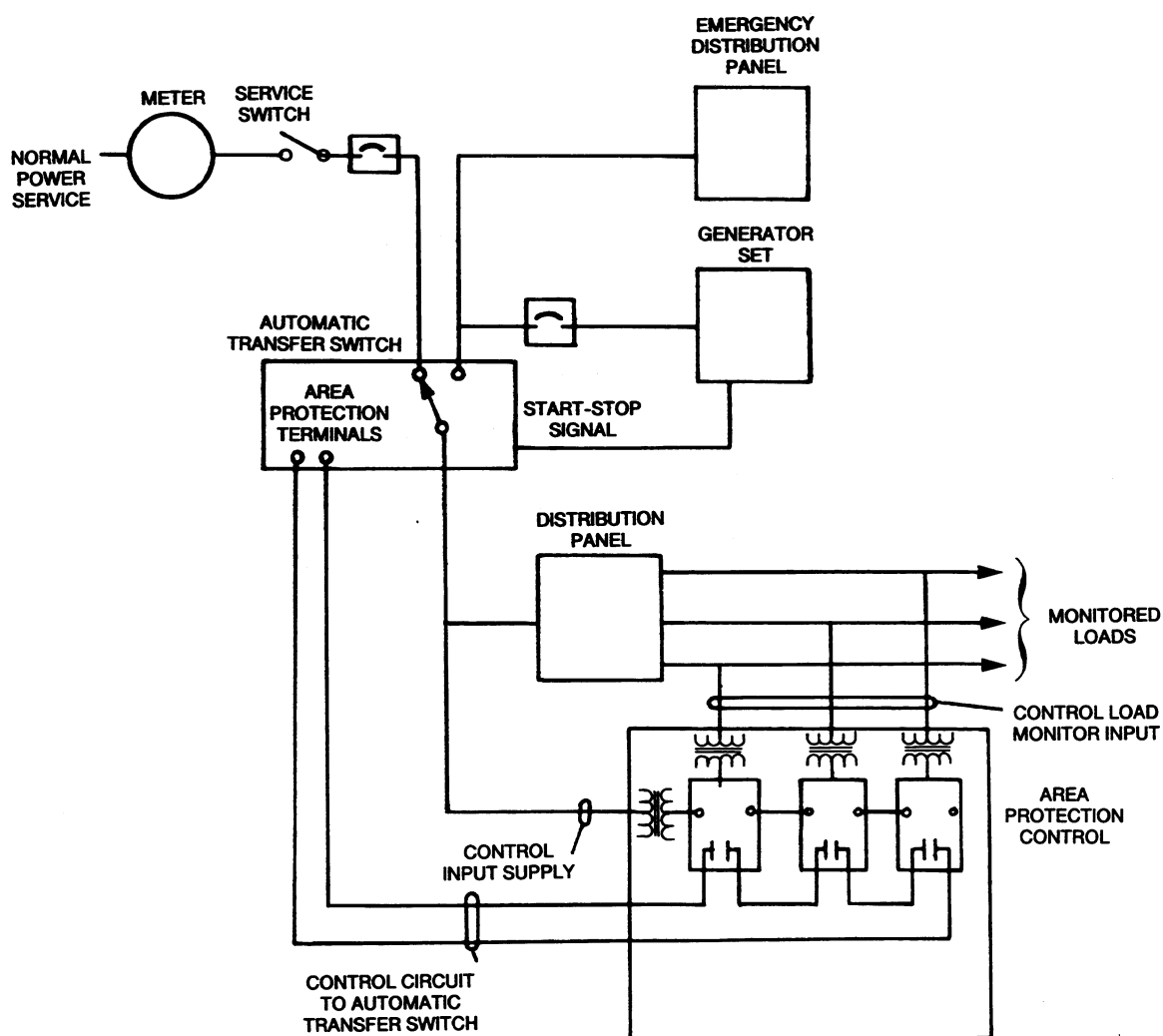
4. Attach a wire to terminal TB3-7 and a wire to terminal TB3-8 (Figure 5) in the cabinet. Connect these wires to the load side of the transfer switch. This connection provides the Area Protection Monitor AC input supply.
5. Check the voltage sensor settings. See the *Operation* section of this manual for a description, and the *Adjustments* section of this manual for the adjustment procedure.
6. Close and secure the left cabinet panel.
7. Restore AC line voltage to the automatic transfer switch. Make certain the generator set is ready for operation.
8. Close the monitor cabinet door.



# Operation

The line voltage sensors on each monitor module are adjustable for pickup and dropout voltages. When the line voltage of an area falls to a dropout level, a K1 relay on its attached monitor module deenergizes. This opens

the protection circuit to TB3-4 and TB3-5, and also breaks a connection to the automatic transfer switch. The transfer switch signals the generator set to start and supply power to the emergency load. Figure 6 illustrates a typical Area Protection Monitor application.



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FIGURE 6. TYPICAL AREA PROTECTION APPLICATION

When line voltage is restored to all monitored loads, the voltage sensors energize their K1 relays to close the area protection circuit to the automatic transfer switch. The transfer switch signals the generator set to stop after power is restored to all monitored loads.

The following chart gives the voltage sensor adjustment ranges in percentages. For adjustments, see the *Adjustments* section.

#### ADJUSTABLE VOLTAGE SENSORS

Generator Set Starts (line drop-out voltage)	Generator Set Stops (line pick-up voltage)
5% to 20% below pickup voltage setting	75% to 100% of normal voltage

#### Indicator Lamps

Lamps on the left cabinet panel indicate which monitored load circuit is open. A step-down transformer supplies 24 volts to operate the lamps. The left cabinet panel can accommodate as few as three or as many as 27 zone indicator lamps.

# Adjustments

**⚠ WARNING** *High voltages within the cabinet and rear side of the cabinet door present a shock hazard which may cause severe personal injury or death. Use care when opening the cabinet door: do not touch or allow any tool to touch any wires, plates or contacts unless you have positive knowledge that power has been removed from the Area Protection Monitor and from the load monitoring circuits.*

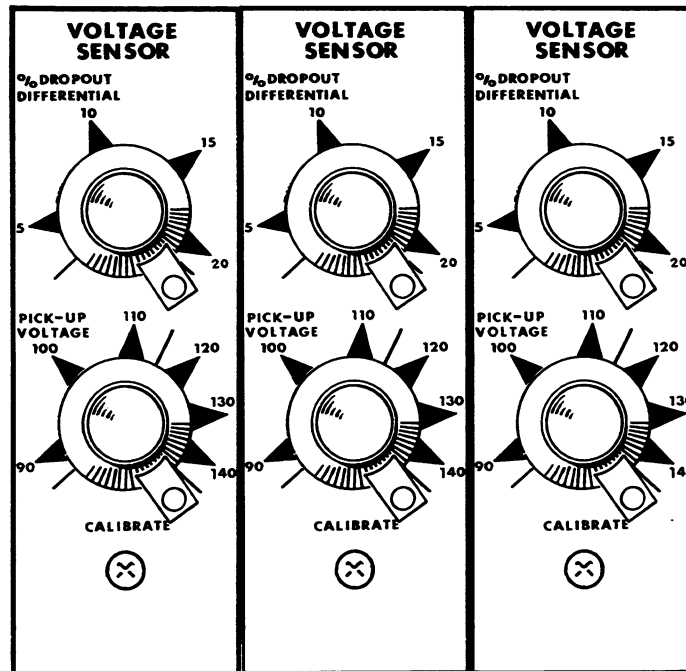
## VOLTAGE SENSORS

Voltage sensor settings (Figure 7) range from 90 to 140 volts for a nominal 120-volt system. For higher-voltage systems, the "PICKUP VOLTAGE" knob readings are multiplied by the following factors.

VOLTAGE	MULTIPLYING FACTOR
120	.0
208	1.73
240	2.0
480	4.0
600	5.0

1. Turn the "PICKUP VOLTAGE" knob to the desired pickup voltage (voltage at which the load is transferred from the generator set to commercial power). Unless there is equipment which may be damaged by slight voltage changes, a pickup voltage setting of 90% of the nominal voltage should be satisfactory. For example, 90% of 120 volts (120-volt system) yields 108 volts as the knob setting.
2. Turn the "%DROP-OUT DIFFERENTIAL" knob to the desired deviation below the pickup voltage. This setting signifies the voltage at which the load is transferred from commercial power to the generator set. A setting of 15% is often satisfactory. For example, 15% of 108 volts (pickup voltage from Step 1) is 16 volts. The dropout voltage is then the pickup voltage minus the differential voltage (108 - 16 = 92 volts).

**⚠ CAUTION** *Incorrect or haphazard adjustment of voltage sensor controls may result in abnormal operation of the Area Protection Monitor. Use extreme care when adjusting these controls.*



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FIGURE 7. VOLTAGE SENSORS

# Troubleshooting

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This troubleshooting section discusses three common situations. Find the section which corresponds most closely to your problem, read the steps and answer the questions. Then proceed to the step whose number is listed under your answer; "YES" or "NO". Refer to the Area Protection Monitor wiring diagram during these procedures.

A voltage sensor bypass module (part #300-1343) is available to replace a possibly malfunctioning voltage sensor for troubleshooting procedures.

## **⚠ WARNING**

***Service and troubleshooting procedures present a shock hazard. To minimize this hazard, disable the Monitor power supply, disable all load monitor circuits, and disable the generator set before troubleshooting or servicing the Area Protection Monitor. (If troubleshooting or service instructions require that the Monitor be powered, use extreme caution.)***

To disable the Monitor power supply, remove the connections to terminals TB3-7 and TB3-8.

To disable the generator set, disconnect the starting battery (negative [-] lead first).

## Troubleshooting Chart

**⚠ WARNING** *Troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel should perform service procedures. Review the safety precautions on the inside front cover of this manual.*

A. Generator set supplies power to emergency load during normal power.	YES	NO
1a. Is an indicator lamp on the Monitor front panel lit?	6A	2A
2a. Jumper across the terminals connecting the Monitor to the automatic transfer switch. Is the emergency load transferred to the normal power service?	4A	3A
3a. See the transfer switch manual.	—	—
4a. Jumper TB3-4 to TB3-5 in the Monitor. Is the emergency load transferred to the normal power service?	7A	5A
5a. Check for an open in the circuit between the Monitor and the transfer switch.	—	—
6a. Jumper TB1-4 to TB1-5 of the module whose indicator lamp is lit. Is the load transferred to normal power service?	8A	—
7a. Jumper TB1-4 to TB1-5 on all modules. Is the emergency load transferred to the normal power service?	8A	—
8a. Record pickup voltage settings with a small pencil mark on the voltage sensor(s) in question. Set the pickup voltage knobs to 90 or below. Is the load transferred to the normal power source? After this test, return the knobs to their original settings.	9A	10A
9a. Check the output voltage of the transformer(s) on the affected module.	—	—
10a. Remove the voltage sensor from the module, and replace it with a voltage sensor bypass module. Is the load transferred to the normal power source? (Repeat this procedure for all voltage sensors on a three-phase module).	11A	12A
11a. Replace the plug-in voltage sensor module.	—	—
12a. Replace the respective 24 VDC relay.	—	—

## Troubleshooting Chart (continued)



**WARNING** *Troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel should perform service procedures. Review the safety precautions on the inside front cover of this manual.*

<b>B. Power outage of monitored load occurs, and the generator set does not start and supply emergency power.</b>	<b>YES</b>	<b>NO</b>
1b. Are the generator set and automatic transfer switch set for automatic operation?	2B	—
2b. Is the jumper removed between the area protection terminals of automatic transfer switch?	3B	—
3b. On the area protection control module whose indicator lamp is lit, remove the respective 24 VDC relay. Does the generator set start and assume the emergency load?	5B	4B
4b. Check the circuit between the Monitor and the transfer switch.	—	—
5b. On the module whose 24 VDC relay was removed, jumper TB1-4 to TB1-5. Does the generator set stop (after time delays, if any)?	6B	—
6b. Replace the 24 VDC relay on the affected module.	—	—
<b>C. Normal power is restored after a power outage. The generator set continues to supply the emergency load.</b>	<b>YES</b>	<b>NO</b>
1c. Is an indicator lamp lit on any of the modules?	5C	2C
2c. Jumper TB3-4 to TB3-5. Is the load transferred to normal power service?	4C	3C
3c. Refer to the transfer switch manual.	—	—
4c. Jumper TB1-4 to TB1-5 of each module until the load is retransferred to normal power service. Then replace the appropriate relay on the module.	—	—
5c. Jumper TB1-4 to TB1-5 of the module whose indicator lamp is lit. Is the load retransferred to normal power service?	7A	—



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