Front Matter

Abstract
This manual contains information and instructions for installing, operating and maintaining the CHB 302-2 Medium Intensity Obstruction Lighting System.

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Applicable Specifications
CHB302W and CHB302WS meet FAA L-865.
CHB302R meets FAA L-864.
CHB302D meets FAA L-864 and L-865.

Disclaimer
While every effort has been made to ensure that the information in this manual is complete, accurate and up-to-date, Cooper Crouse-Hinds assumes no liability for damages resulting from any errors or omissions in this manual, or from the use of the information contained herein. Cooper Crouse-Hinds reserves the right to revise this manual without obligation to notify any person or organization of the revision.
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Warranty
Cooper Crouse-Hinds warrants all components, under normal operating conditions, for 2 years.

Parts Replacement
The use of parts or components, in this equipment, not manufactured or supplied by Cooper Crouse-Hinds voids the warranty and invalidates the third party testing laboratory certification which ensures compliance with FAA Advisory Circulars 150/5345-43E, 150/5345-51 and 150/4345-53B. The certification is valid as long as the system is maintained in accordance with FAA guidelines (FR doc. 04-13718 filed 6-16-04).

Personnel Hazard Warning

Dangerous Voltages
Dangerous line voltages reside in certain locations in this equipment. Also, this equipment may generate dangerous voltages. Although FTCA has incorporated every practical safety precaution, exercise extreme caution at all times when you expose circuits and components, and when you operate, maintain, or service this equipment.

Avoid Touching Live Circuits
Avoid touching any component or any part of the circuitry while the equipment is operating. Do not change components or make adjustments inside the equipment with power on.

Dangerous Voltages Can Persist with Power Disconnected
Under certain conditions, dangerous voltages can be present because capacitors can retain charges even after the power has been disconnected.

Protect yourself — always turn off the input (primary) power and wait for one minute for storage capacitors to drain their charge. Then check between the red and blue wires on the flashhead terminal block with a voltmeter for any residual charge before touching any circuit element or component.

Do Not Depend on Interlocks
Never depend on interlocks alone to remove unsafe voltages. Always check circuits with a voltmeter. Under no circumstances remove or alter any safety interlock switch.
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Section 1 – Introduction and Operation

System
CHB 302-2 omni-directional Medium Intensity Lights are available in two models:

1. The CHB 302-2 consists of an FH 308 Flashhead and PC 302-2 Power Converter. The power converter uses a 2904411 Timing and Trigger Board. This white light operates at 40 flashes per minute at two intensity levels for day and night use. The CHC 140 System Controller controls this light.

2. The CHB 302-2S consists of an FH 308 Flashhead and PC 302-2S Power Converter. The power converter uses a 2904410 Timing and Trigger Board. This white light operates at 40 flashes per minute at two intensity levels for day and night use. The CHC 121 System Controller controls this light.

The CHB 302-2 lights are intended primarily as Antenna Obstruction Lights (AOL) for lighting masts or protuberances on a supporting structure.

Description
The lights are two-part units consisting of a flashhead and power converter in separate outdoor enclosures. An electrical cable connects these two units, which may be separated in a normal installation by up to 500 hundred feet. If greater separation is required, consult Cooper Crouse-Hinds Customer Service at 1-866-764-5454.

The flashhead is usually mounted at the tip of a mast or antenna. The power converter supplying energy to the flashhead is normally mounted at the base of the mast or antenna.

These lights contain circuitry for two flash intensity levels for white lights and switch from one intensity level to the other in response to a signal from the System Controller. This same signal also synchronizes the flashing of all other lights in the system, however, if the System Controller should be disconnected or fail, the lights continue to flash at full intensity. Simultaneous flashing with the other lights usually continues even without the System Controller.

To monitor the entire system, the System Controller receives status signals from all lights in the system. These signals travel through two-wire shielded conductors.

Specifications
Physical:

Power Converter:

(H x W x Depth, Wgt)
21 x 17 x 9.5 in., 64 lbs.
533.2 x 432 x 241 mm., 29 kg.

Flashhead:

(H x Diam, Wgt)
17 x 18.25 in., 17 lbs.
430.5 x 463 mm., 34.8 kg.

Performance Characteristics:
Application: L-865/L-864

Flash Intensity and Rate:

FH 308
Full intensity (white) 20,000 ± 25% CD
Low intensity (white) 2,000 ± 25% CD
Rate: 40 flashes per minute

**Beam Spread:**
- Horizontal: 360° (omnidirectional)
- Vertical: 5°

**Electrical (factory wired for nameplate voltage):**
- AC voltage 120/208/240/480 VAC, 60 Hz
- 230 VAC 50 Hz
- Volt-Amperes 250 VA peak; 175 VA avg.
- CHB 302-2/302-2S Day - 130 Watts
- Night - 75 Watts

**Aerodynamic Wind Area:**
- Flashhead .93 sq. ft.; .0864 sq. m.
- Power Converter 2.5 sq. ft.; .23 sq. m.

**Environmental:**
- FAA Advisory Circular 150/5345-43 compliance

**Control and Monitoring:**
- ElectroFlash System Controller

**Power Converter Operation**

This equipment operates automatically, but operation can be modified for special situations by methods later described. The center of operations for each light is the Timing and Trigger Board (PCB1) located in the power converter. PCB1 contains indicator lights useful for troubleshooting or checking the operation of the light's power converter.

The pattern of lights is determined by the light’s height on the structure (the tier), and its location or compass point around the structure: Beacon 1 is northerly; Beacon 2 is easterly; Beacon 3 is southerly; and Beacon 4 is westerly. Convention designates the lowest tier of lights on a structure as Tier 1, the next Tier 2, and so on.

**NOTE**

Please note that lights are referred to as beacons for programming purposes only.

The AOL unit always occupies the highest point on any structure and is programmed as Beacon 2 of that tier. Figure 1-2 shows PCB1 for the AOL. A typical installation is shown in Figure 1-1.

The System Controller and PCB1 (2904411) govern all the functions for operation of the CHB302-2. PCB1 (2904410) governs all functions of the CHB302-2S. Signals from all lights on the structure travel over the same pair of wires. PCB1 programming allows a System Controller to distinguish its signal from other lights for monitoring and control purposes.

PCB1 has nine light emitting diode (LED) indicators, and one clear neon indicator that you can use to monitor equipment operations during checkout and troubleshooting. To monitor operation, observe the specified LEDs. The essential features on PCB1 for troubleshooting are shown in Figure 1-2 and Figure 1-3.

**Flash Modes: Night, Day, Catenary, and 60/50Hz Operation**

A Photoelectric Control (PEC) connected to the System Controller detects lighting conditions. As they change, the System Controller sends an intensity signal to all lights on the structure.

**Night**

At night, the PC 302-2 or -2S switches to Night Mode operation to operate the
flashhead at the night intensity of 2,000 ± 25% candellas.

**Twilight**
At twilight, the PC 302-2 or -2S switches to Twilight Mode operation to operate the flashhead at the day intensity of 20,000 ± 25% ECD.

**Day**
In daylight, the PC 302-2 or -2S switches to Day Mode operation to operate the flashhead at the day intensity of 20,000 ± 25% ECD.

**Catenary**
Beacons flashing in a distinct pattern to alert air traffic of catenary wires is called Catenary Mode. The FAA requires the flash sequence for catenary lighting to be middle-top-bottom with a flash rate of 60 fpm. A maximum of three tiers are supported in catenary mode. You select Catenary Mode operation with the handheld terminal (p/n 1903776). See section 5. Catenary Mode operation is usually set up by the factory for your installation.

**60/50Hz**
PCB1 operates from either a 60Hz or a 50Hz power source.

**Manual Operation**

**Mode Control (PCB1-2904411)**
Table 1-1 explains how to force the light to operate continuously at a fixed flash intensity (mode), useful for troubleshooting the light to check its operation at all flash intensities. The handheld terminal (p/n 1903776) may also be used.

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Test Point</th>
<th>Procedure: Connect a jumper between Test Point 5 (TP5) labelled TEST and the indicated Test Point.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY (High)</td>
<td>TP6</td>
<td>TP6 forces: PC 302-2 day mode; daylight intensity</td>
</tr>
<tr>
<td>NITE (Low)</td>
<td>TP4</td>
<td>TP4 forces: PC 302-2 night mode</td>
</tr>
<tr>
<td>LTV</td>
<td>-</td>
<td>Factory use only. Causes continuous triggering. Do not use.</td>
</tr>
</tbody>
</table>

**Mode Control (PCB1-2904410)**
Table 1-1 explains how to force the Beacon to operate continuously at a fixed flash intensity (mode), useful for troubleshooting the Beacon to check its operation at all flash intensities. The handheld terminal (p/n 1903776) may also be used…

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Test Point</th>
<th>Procedure: Connect a jumper between Test Point 5 (TP5) labelled TEST and the indicated Test Point.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY (High)</td>
<td>TP6-DAY</td>
<td>TP6 forces: PC 302-2S day mode.</td>
</tr>
<tr>
<td>TWI (High)</td>
<td>TP5-TWI</td>
<td>TP5 forces: PC 302-2S day mode.</td>
</tr>
<tr>
<td>NITE (Low)</td>
<td>TP4-NITE</td>
<td>TP4 forces: PC 302-2S night mode.</td>
</tr>
<tr>
<td>LTV</td>
<td>-</td>
<td>Factory use only. Causes continuous triggering. Do not use.</td>
</tr>
</tbody>
</table>
Figure 1-1 Typical CHB302-2 Structure Installation
**PCB1 (2904411) Functions**

**Setting Up PCB1 (2904411)**

Programming is done with the handheld terminal, see section 5. Upon your order, the factory sets up the desired operation. However, you can change some operations in the field by using the handheld terminal (p/n 1903776). Also, Figure 1-2 is useful for monitoring the equipment's operation.

**Indicator LEDs and Lamps (2904411)**

Nine indicator LEDs and one neon lamp on (PCB1) indicate equipment operation. A name on PCB1 adjacent to the lamp identifies each LED. Figure 1-2 shows the location of these lamps. Table 1-3 lists the LEDs and lamp on PCB1 (2904411) and indicates their functions.

<table>
<thead>
<tr>
<th>LED/Lamp</th>
<th>Name</th>
<th>Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARM</td>
<td>I 1</td>
<td>Red</td>
<td>On — Main Alarm, follows main alarm relay.</td>
</tr>
<tr>
<td>SYNC</td>
<td>I 2</td>
<td>Grn</td>
<td>On — Valid sync signal was received on the CONTROL terminal (Pin 6).</td>
</tr>
<tr>
<td>CONF</td>
<td>I 3</td>
<td>Grn</td>
<td>On — Flash confirmation signal is present on the MONITOR terminal (Pin 5).</td>
</tr>
<tr>
<td>NITE</td>
<td>I 4</td>
<td>Grn</td>
<td>On — NITE mode is active. The PC 302-2 operates at night intensity.</td>
</tr>
<tr>
<td>TWI</td>
<td>I 5</td>
<td>Grn</td>
<td>On — TWILIGHT mode is active. <strong>TWILIGHT MODE is the same as DAY MODE for a PC 302-2. It operates at daylight intensity.</strong></td>
</tr>
<tr>
<td>DAY</td>
<td>I 6</td>
<td>Grn</td>
<td>On — DAY mode is active. PC 302-2 operates the flashhead at daylight intensity.</td>
</tr>
<tr>
<td>I 7</td>
<td>Red</td>
<td></td>
<td>Photocell Alarm</td>
</tr>
<tr>
<td>I 8</td>
<td>Red</td>
<td></td>
<td>Intensity Alarm.</td>
</tr>
<tr>
<td>NEON Lamp</td>
<td>I 9</td>
<td>Clear</td>
<td>On — 120 VAC trigger voltage is present. This lamp may flicker.</td>
</tr>
<tr>
<td>CONTROL</td>
<td>I 10</td>
<td>Grn</td>
<td>Flashes on and off when communications is active.</td>
</tr>
</tbody>
</table>
Figure 1-2 PCB1 Timing and Trigger Board (2904411)

**PC 302-2 System Checkout**

You must operate the System Controller in Day Mode or Night Mode to observe the LED lamps on PCB1 and observe the flashhead as described next:

**Day/Twilight Operation**

Switch the System Controller to Day Mode. Observe the LED lamps on the PCB1 as follows:

1. SYNC LED I 2 blinks.
2. CONF LED I 3 blinks.
3. DAY LED I 4 is on. The PC 302-2 light operates at daylight intensity (20,000 candelas).
4. TWI LED I 5 is off.
5. NITE LED I 6 is off.
6. NEON LAMP I 9 is on.
7. Switch the System Controller back to AUTO.
### Night Operation

Switch the System Controller to Night Mode. Observe the LED lamps on the PCB1 as follows:

1. SYNC LED I 2 blinks.
2. CONF LED I 3 blinks.
3. DAY LED I 4 is off.
4. TWI LED I 5 is off.
5. NITE LED I 6 is on. The PC 302-2 light operates at night intensity (2,000 candelas).
6. NEON LAMP I 9 is on.
7. Switch the System Controller back to AUTO.

If any responses are not as indicated, see Troubleshooting in Section 3.

### PCB1 (2904410) Functions

#### Setting Up PCB1 (2904410)

Beacon positions are programmed with the handheld terminal see section 5.

#### Indicator LEDs and Lamps (2904410)

Nine indicator LEDs and one neon lamp on PCB1 indicate operation. A name adjacent to the indicator identifies it. The neon lamp has no name. Figure 1-3 shows PCB1 with LED and lamp locations. Table 1-4 lists the functions of the LEDs and neon lamp on the board.

### Table 1-4 PCB1 (24990xx) LEDs and Lamps

<table>
<thead>
<tr>
<th>LED/Lamp</th>
<th>Name</th>
<th>Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARM I 1</td>
<td>Red</td>
<td>On</td>
<td>— Alarm present.</td>
</tr>
<tr>
<td>SYNC I 2</td>
<td>Grn</td>
<td>On</td>
<td>— valid sync signal received from the System Controller (once every 6 seconds).</td>
</tr>
<tr>
<td>CONF I 3</td>
<td>Grn</td>
<td>On</td>
<td>— power converter flash sensing circuit issued a flash confirmation signal.</td>
</tr>
<tr>
<td>NITE I 4</td>
<td>Grn</td>
<td>On</td>
<td>— current operating mode is night mode.</td>
</tr>
<tr>
<td>TWI I 5</td>
<td>Grn</td>
<td>On</td>
<td>— current operating mode is twilight mode.</td>
</tr>
<tr>
<td>DAY I 6</td>
<td>Grn</td>
<td>On</td>
<td>— current operating mode is day mode.</td>
</tr>
<tr>
<td>NEON Lamp (Trigger) I 9</td>
<td>Clear</td>
<td>On — 120 VDC trigger voltage at PCB1. Lamp may flicker while triggering flashtube.</td>
<td></td>
</tr>
<tr>
<td>CONTROL I 10</td>
<td>Grn</td>
<td>Flashes on and off when communications is active.</td>
<td></td>
</tr>
</tbody>
</table>

Replacement circuit boards may require programming for beacon position on the structure. Use the handheld terminal (p/n 1903776) see section 5. Consult Cooper Crouse-Hinds before changing programming, and follow their direction.

**CAUTION**

The factory programs PCB1 boards for operation and position, and they have different part numbers. Boards are programmed differently and thus are not interchangeable between all lights on a structure.
To operate and observe the PC 302-2S you must operate the System Controller in Day Mode, Twilight Mode, or Night Mode to observe the LED lamps on PCB1 and observe the flashhead as described next:

**Day Operation**

- **NOTE**
  - The CHB 302-2S operates its white flashhead at daylight intensity.

Switch the System Controller to day mode operation. During daylight hours, some LED lamps on PCB1 may be difficult to observe. Observe the following LEDs on the PCB1.

1. I 6 DAY is on. On indicates that current operation is day mode.
2. I 5 TWI is off.
3. I 4 NITE is off.
4. I 2 SYNC flashes each time a valid sync signal is received from the System Controller.
5. I 3 CONF blinks on. On indicates that PCB1 issued a flash confirmation signal because the flash was good.
6. I 1 ALARM is off. On indicates that an alarm is present in PCB1. This usually
indicates a flash failure but it may indicate other failures.

7. NEON I 9 is on. On indicates that trigger voltage is present on PCB1.

**Twilight Operation**

**NOTE**

For twilight System Controller commands, the CHB 302-2S operates in daylight intensity.

Switch the System Controller to twilight mode operation. Observe the following LEDs on PCB1.

1. I 6 DAY is on. On indicates daylight mode operation
   1. I 5 TWI is off.
2. I 4 NITE is off.
3. I 2 SYNC flashes each time a valid sync signal is received from the System Controller.
4. I 3 CONF flashes on. On indicates that PCB1 issued a flash confirmation signal because the flash was good.
5. I 1 ALARM is off. Off indicates that no alarms are present in the board. (An on condition usually indicates a flash failure but it may indicate other failures.)
6. NEON I 9 is on. On indicates that trigger voltage is present on PCB1.

**Night Operation**

**NOTE**

The CHB 302-2S operates the white flashhead at night intensity.

Switch the System Controller to night mode operation.

Observe the following LEDs on the PCB1.

1. I 6 DAY is off.
2. I 5 TWI is off.
Section 2 — Mounting, Outline, and Installation

Unpacking
Inspect shipping cartons for signs of damage before opening them. Check package contents against the packing list and inspect each item for visible damage. Report damage claims promptly to the freight handler.

Tools
Although no special tools are necessary, the following hand tools are suggested for installation:

- Phillips®-head screwdriver, #2
- 9- or 12-inch (# 2 - 3/16”), flat-blade screwdriver
- 9- or 12-inch (# 3 - 5/16”), flat-blade screwdriver
- Medium, slip joint pliers
- Set of combination wrenches
- Long-nose pliers
- 8-in. adjustable wrench
- Assorted nut-driver handles (1/4”, 5/16”, 3/8”)
- Universal terminal crimper
- Digital multi-meter

Access
WARNING
Read the warning on Page iii now. Disconnect primary power before opening enclosures.

Power Converter
Latches secure the cover. When you release these, you can swing open the cover for internal access.

Flashhead
You may pivot the lens open by disengaging two quick-release latches. Be careful that the rim of the lens clears nearby objects during opening and closing. Normally, the flashhead contains no interlock. Turn off primary power before opening the flashhead. Wait one minute for storage capacitors to drain down. Open the flashhead and use a voltmeter to ascertain that no high voltage exists between the red and the blue wires. Look for these wires on the ceramic terminal posts.

Mounting

Power Converter
Mounting and package dimensions for the power converter are shown in Figure 2-2. Cooper Crouse-Hinds does not furnish mounting hardware unless you order it as part of an installation kit. Use the following guidelines:

- Ensure that adequate space surrounds the equipment for access during installation, maintenance and servicing.
- Allow space for air flow around the power converter.
- Use a bonding strap and bond the case to the site grounding system.

Flashhead
Mounting dimensions for the flashhead are shown in Figure 2-1. The flashhead must be protected from lightning strikes. The flashhead may be mounted to painted or unpainted surfaces. One of the legs in the base of the flashhead contains a built-in electrical ground connection. Use the
following guidelines for mounting the flashhead; use:

- • A lightning rod extended above the flashhead to protect it when it is mounted at the uppermost part of the structure. Avoid locating the rod where it would prevent tilting the lens open or interfere with access by maintenance or service personnel.
- • A bonding strap when mounting the flashhead. Fasten the bonding strap to the flashhead with the mounting bolt that goes through the leg containing the ground connection.

**Leveling**

Flashheads must be level for correct vertical beam alignment. Two leveling vials—aligned with the mounting feet—are permanently attached to the flashhead. Typically, the mounting surface for the flashhead is level and no adjustments are required. When the flashhead is level, both leveling vials show centered bubbles. Use the following guidelines:

- If adjustment is necessary, raise the appropriate mounting foot with shims or washers. Raising one foot by 1/16 inch (1.6 mm) tilts the beam about 1/2 degree.
- Take extreme care to ensure that all four feet rest snugly against a firm mounting surface before tightening the mounting bolts. Failure to do so could result in serious damage to the base when you tighten the bolts.

**Installation**

This manual may not contain all the information about installation wiring required for your installation.

**NOTE**

If installation drawings prepared specifically for your site disagree with information provided in this manual, the installation drawings should take precedence. Consult any site-specific installation wiring diagram supplied with your equipment.

**Note:** wiring diagrams define only minimum requirements recommended for satisfactory equipment operation. It is the responsibility of the installer to comply with all applicable electrical codes.

You can find conduit and other distribution wiring details on electrical installation diagrams provided by others. Installation instructions concerning red light marker fixtures are not part of this manual.

All installation wiring should have an insulation rating of 600 volts. Size the power service wiring to satisfy the load demand of the red light system (if present) and the power converters. Read the notes on the installation wiring diagrams supplied both in this manual and with the equipment.

**Power Converter Wiring**

Consult the installation wiring drawings. For service wiring, consider the voltage, length of the wire run, and the total load (number of lights). Assume a load of 175 volt-amperes per light, and do not permit the line voltage to drop by more than 5% caused by wire resistance. Also assume a load of 175 volt-amperes per light to determine the appropriate slow-acting fuse ratings at the power distribution panel. Use a value of 250 volt-amperes per light to
determine fast-acting fuse ratings at the power distribution panel.

The operating voltage and frequency is imprinted on a label inside the power converter near the fuse block. Two internal fuses are sized according to the operating voltage. When Line 2 is neutral, the factory replaces Fuse F2 with a jumper wire.

**Flashhead Wiring**

A flashhead cable interconnects the power converter and flashhead. When Cooper Crouse-Hinds Part Number 4634000, or equivalent cable, is used, the two may be separated by a distance up to 600 feet. Consult Customer Service at 1-866-764-5454 when a greater distance is necessary. The cable requires five conductors with 600 volts (minimum) insulation. Two of the conductors must be #10 AWG. The other three may be #16 AWG (minimum; for mechanical strength) if you are cabling together individual wires.

To ensure long-term equipment reliability, use continuous wiring between the power converter and flashhead without intervening junctions or splices.

**Securing the Flashhead Cable**

Use the following procedure for securing the flashhead cable to a skeletal structure:

1. Run the cable along one of the tower legs and wrap one full turn of two-inch Scotchwrap™ #50 tape, or the equivalent, around the cable and tower leg at regular intervals of about 5 feet (1.5 meters).

2. Wrap three full turns of one-inch Scotchwrap Filament #890 tape, or the equivalent, over the Scotchwrap #50 tape.

3. Wrap four full turns of two-inch Scotchwrap #50 tape, or the equivalent, over the Scotchwrap Filament #890 tape.

4. Perform steps 1 through 4 also directly above and below any tower leg flanges that the cable may cross.

**Installation Checklist**

Complete the following steps before applying power:

1. Inspect all equipment for damage.

2. Verify the received equipment against the packing list to ensure completeness.

3. Position and mount each unit allowing adequate clearance for opening the covers. Also, use the following guidelines:
   - Ensure that the case is mounted upright and grounded with a bonding strap from the case leg to the site grounding system.
   - Ensure that only the bottom of the case has drain holes and that they are clear.
   - Ensure that no holes are punched or drilled on the top surface of the case.
   - Ensure that air can flow around the case.
   - Mount the power converter away from radio frequency interference (RFI).

1. Flashhead Mounting:
2. Power Converter Wiring: Examine the installation drawings and use the following guidelines:

- Check for proper incoming service voltage.
- Wire each unit according to the instructions.
- Ensure that all three power converters are on the same main line breaker.
- Check all electrical connections for tightness.
- Check all terminal strip connections for tightness.

3. Flashhead Wiring:

- Protect the top flashhead against lightning strikes.
- Ground the flashhead leg with the ground connection by using a bonding strap to the tower.
- Check the wiring of the flashhead cable to the flashhead.
- Secure the flashhead cable to the tower. Support and tape the cable to prevent its movement by the wind.

After completing all the steps listed above, turn on the power and perform an operational checkout from procedures in Section 3 of this manual.
Figure 2-1 Flashhead Mounting and Outline

Cooper Industries Inc.
Crouse-Hinds Division
PO Box 4999,
Syracuse, New York 13221 • U.S.A.
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NOTES:
1. WEIGHT: 17 LBS (7.7 KG)
2. AERODYNAMIC WIND AREA: .93 FT² (.0864 M²)
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)
4. ACCESS TO THE FLASHHEAD MUST REMAIN UNOBSTRUCTED
5. FLASHHEAD SHOULD HAVE LIGHTNING PROTECTION
Figure 2-2 Power Converter Mounting and Outline
Figure 2-4 Three-phase Wiring Guideline
Figure 2-5 Flashhead Internal Wiring
Section 3 — Maintenance and Troubleshooting

Preventive Maintenance
Carry out the following inspection and cleaning procedures at least once a year:

1. Verify that moisture does not accidentally enter the equipment through gaskets or seals, or collect as condensation.
2. Verify that all drain holes are clear.
3. Check terminal blocks and relays for evidence of corrosion and electrical arcing. Clean or replace any component that shows evidence of high-voltage damage.
4. Check flash tube connections for signs of pitting or arcing. Verify that anode and cathode connections are firmly tightened.
5. Check all electrical connections for tightness and verify the absence of corrosion or electrical arcing.
6. Clean the outside surface of the lens with liquid detergent and water. Wipe it gently with a soft cloth or paper towel.
7. Clean the inside surface of the lens with a professional plastic cleaner. Wipe the lens with cheesecloth only. Do not use regular cloth or paper towels. A lens cleaning kit, PN 8630801, is available. Contact Customer Service at 1-866-764-5454.

Troubleshooting
NOTE
Before proceeding—read the warning on Page iii.

RFI Problems
Presence of radio frequency interference (RFI) can cause a light to flash intermittently, at the wrong rate, or at the wrong intensity. RFI can enter the light by way of any wire to or from the unit. For example:

- RFI on primary power wires could cause errors in flash rate and intensity.
- RFI on the control wire could cause a light to stay at NITE mode. RFI would not normally cause a light to stay at DAY mode.
- RFI on the monitor wire could cause lights and the system controller to malfunction.
- Strong RFI could burn out circuit board components.

While circuits are designed to reject or bypass RFI, complete immunity cannot be guaranteed beforehand. It may be necessary after installation to add external filters or use other methods to reduce RFI entering the equipment. Contact Customer Service for technical assistance to achieve satisfactory operation.

Diagnostic Troubleshooting
The most effective troubleshooting begins with careful observations of operating behavior. This often leads directly to the cause of a problem.

If any LED lamps are not as indicated, try replacing PCB1 for that unit, unless all units have the same or very similar problems. System-wide problems may be caused by an incorrectly operating System Controller or improper system wiring.

Table 3-1 lists some symptoms a malfunctioning light might exhibit. Table 3-2 correlates these symptoms with
component assemblies or conditions that might cause the malfunction.

Each item in Table 3-2 is weighted to indicate the estimated likelihood that it would be causing the problem. For example, suppose the light does not flash at all but some of its circuits are still functioning; that is, fuses are not blown, relays operate, and so forth. This is symptom C in Table 3-1. Table 3-2 indicates that symptom C behavior would most likely be caused by a defective PCB1 board. The next most likely cause would be a defective rectifier board. The third would be the C1/C2 capacitor bank, and so on.

When a problem has been traced to a specific component, see Subsection Component Testing and Subsection Component Removal and Replacement for further assistance.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Flash Conditions</th>
<th>Code†</th>
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</thead>
<tbody>
<tr>
<td>All circuits are dead</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Primary line fuse repeatedly blows</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Some circuits functioning</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>No confirmation</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>NITE flash fails</td>
<td>OK</td>
<td>No</td>
</tr>
<tr>
<td>NITE too bright - ragged flash</td>
<td>Skips</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Skips</td>
</tr>
<tr>
<td></td>
<td>Skips</td>
<td>Skips</td>
</tr>
<tr>
<td>Resistor on PCB2 burned out</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Inconsistent and erratic flash behavior</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>No FAIL indication</td>
<td>No</td>
<td>No</td>
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† See Table 3-2
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<tr>
<th>Probable Cause</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
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<tbody>
<tr>
<td>DAY capacitor bank</td>
<td></td>
<td></td>
<td></td>
<td>C1/C2</td>
<td>4</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>NITE capacitor</td>
<td></td>
<td></td>
<td>C3</td>
<td></td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
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<td></td>
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<td>Primary Line Fuses</td>
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<td>F1/F2</td>
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<td></td>
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<tr>
<td>Flashtube</td>
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<td></td>
<td>FT101</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
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<tr>
<td>Low Intensity Relay</td>
<td></td>
<td></td>
<td>K2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Burst Choke</td>
<td></td>
<td></td>
<td>L2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
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<tr>
<td>Rectifier Board</td>
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<td></td>
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<td>Timing And Trigger Board</td>
<td></td>
<td></td>
<td>PCB1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<td></td>
<td></td>
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<tr>
<td>Burst Resistor</td>
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<td></td>
<td>R2</td>
<td></td>
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<tr>
<td>Interlock Switch</td>
<td></td>
<td></td>
<td>S1</td>
<td>2</td>
<td></td>
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<tr>
<td>Power Transformer</td>
<td></td>
<td></td>
<td>T1</td>
<td>3</td>
<td>2</td>
<td>5</td>
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<td></td>
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<td>Sense Module</td>
<td></td>
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<td>PCB3</td>
<td>3</td>
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<td>Coupling Transformer</td>
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<td>7</td>
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<td></td>
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<td></td>
<td></td>
<td>3</td>
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<tr>
<td>Suppressor Assembly</td>
<td></td>
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<td>VR1</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1 Blown fuse in one leg of 3-phase power distribution: all beacons on the same phase would be affected.
Note 2 Wrong phase between system controller and light.
Note 3 Trigger potential arcing to chassis.
Note 4 Wrong confirmation programming at light.
Note 5 RF interference
Note 6 Poor connection in discharge circuit between capacitors and flashtube or arcing to chassis.
Component Testing

The following procedures describe how to check most of the unit's major electrical components. Always make resistance measurements with the primary power turned off. However, you must make voltage measurements with power applied. Thus, for your safety, carry out all preliminary steps such as connecting test leads or circuit jumpers, or disconnecting existing circuit connections with the power turned off and storage capacitors discharged.

WARNING

Read the warning on Page iii.

Power Converter

Capacitors

You may test capacitors with an analog ohmmeter capable of measuring one meg-ohm or greater. Use the procedure described below. Resistance measured between the terminals of a fully discharged capacitor is initially zero and increases steadily with time if analog ohmmeter leads are left across the terminals. Eventually, an open circuit condition occurs. The time it takes for the complete transition depends upon the total amount of capacitance. A capacitor, disconnected from other circuitry, is defective if it does not exhibit this behavior. The capacitor must be manually discharged before this measurement can be repeated. This procedure may not detect a failure that occurs only at high voltage.

A bank of capacitors connected in parallel may be checked as a single unit. First disconnect any leads that connect the capacitors to external circuits. Connect the ohmmeter leads to the terminals of any one of the capacitors. If a short circuit is indicated, the individual capacitors must be disconnected and checked separately. A shorted capacitor is indicated if the measured resistance does not rise above zero after several seconds of measurement.

NOTE

Some instruments make incorrect readings near a radiating antenna. Make measurements when the power to the antenna is turned OFF or use a meter known to be unaffected by an RF field.

C1 and C2 Capacitor Banks

Check these capacitor banks as described in Subsection Capacitors. Each bank can be checked as a whole at one time by connecting the meter leads to the terminals of anyone of the individual capacitors in the bank and pressing the armature of the K3 Bleeder Relay.

C3 and C4 Capacitors

Check these capacitors as described in Subsection Capacitors.

K2 — Low Intensity Relay, 24-volt DC Coil

A malfunctioning relay may have faulty contacts, a sticky mechanism or a defective coil. The first two possibilities may be determined by inspection and manually exercising the armature. A defective coil can be confirmed by measuring the resistance.

To measure the resistance of the K2 Relay, first remove the PCB1 timing and trigger board. The resistance from TB4-8 and TB4-9 to TB4-10 or chassis should be approximately 290 ohms.

K3 - Discharge Relay - 120 VAC Coil

The resistance of the K3 Relay coil should be approximately 290 ohms.
**L1 — Burst Choke**
The measured resistance of this choke should be approximately 15 ohms.

**PCB1 — Timing and Trigger Board**
Replace this board with one known to be in good condition.

**PCB2 — HV Rectifier Board**
Replace this board with one known to be in good condition.

**PCB3 — Sense Module**
Replace this board with one known to be in good condition.

**R1 — Discharge Resistors**
The measured resistance should be 35 kohms.

**R2A & R2B — Burst Resistors**
The measured resistance should be 750 ohms for each resistor in the PC 301-2 or PC 301-2S.

**T1 — Power Transformer**
To test this transformer, first remove the timing and trigger board (PCB1) and the HV rectifier board (PCB2).

Apply power to the unit and measure secondary winding voltages at the terminals indicated in Table 3-3.

**Table 3-3 T1 Voltages**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Voltage Range Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB4-1 to TB4-9</td>
<td>900 to 1050 VAC</td>
</tr>
<tr>
<td>TB3-1 to TB3-10</td>
<td>110 to 120 VAC</td>
</tr>
<tr>
<td>TB3-2 to TB3-3</td>
<td>22 to 26 VAC</td>
</tr>
<tr>
<td>Across C4</td>
<td>550 to 600 VAC</td>
</tr>
</tbody>
</table>

1 If this AC voltage is substantially below the specified minimum value, check the C4 Tuning Capacitor.

**VR1 — Suppressor Assembly**
To check this component first remove one of its leads from a fuse block terminal. The measured resistance across VR1 on the x100 kohm scale should be infinite.

**Flashhead**

**FT101 — Flashtube**
Visually inspect the flashtube for broken electrodes, cracked glass, and the solder connections of the pins. A darkened envelope does not necessarily mean the light output would be unacceptable. Before concluding that a faulty flashtube is responsible for an inadequate flash, first rule out other possible causes such as weak or absent discharge voltage or triggering pulses.

**T101 — Trigger Transformer**
The measured resistance of the secondary winding (potted assembly) should be approximately 1.5 ohms. Check the ferrite core for cracks. Check the mounting screws for tightness.

**Component Removal and Replacement**
Component location diagrams are provided in Figure 4-1, Figure 4-2 in Section 4 — Recommended Spare and Replaceable Parts. A flashead electrical wiring diagrams is provided in Figure 2-5. Power converter internal wiring diagrams are provided on the Information Card that is supplied with your system. The Card is fastened inside the power converter cover.

Note the location and color of all wires that you disconnect. When you replace the wiring after you replace the components, ensure that the wiring conforms exactly to the wiring diagrams.
The general procedure for removing components is a logical one and is as follows:

1. Obtain access to the component in question:
   a. Disconnect completely or partially the wiring to components first that prevent clear access.
   b. Completely remove or relocate these components.
2. Disconnect the wiring to the component that you want to replace.
3. Remove this component.
4. Replace everything in the reverse order: first the component, then the wiring, then the components that allowed you access. In some cases, you may have to place some wires on the component before you fasten it in place, then replace the remaining wires.

Most components are relatively easy to access for removal. Only those that are more difficult are described.

**Power Converter**

**C1/C2 — Capacitors**

Before removing or replacing a capacitor always make sure it is discharged by checking with a voltmeter directly across the terminals. You may manually discharge a capacitor by placing a resistance (25 watts, 10,000 ohms or greater) between its terminals. Direct shorting may damage the capacitor, while connecting the terminals to the equipment chassis may fail to discharge it.

Remove Fuse F1 for this procedure to prevent accidental application of power if the interlock switch is accidently pressed.

**Removal**

Remove circuit board PCB1 and PCB2 for access to the capacitors.

Loosen two screws at the corners of the circuit boards, loosen the screws holding the boards to their respective terminal blocks, and slide the board to clear the screw heads. Remove the boards from the unit.

The capacitors are mounted in holes in a bracket and held down to the chassis with a bolted washer. Disconnect the wires leading to capacitors. Remove the bolt and washer. Lift the capacitors from their receiving holes.

**Replacement**

Insert the capacitors into their respective receiving holes. Replace the hold-down bolt and washer to secure the capacitors to the chassis. Reconnect the wires to capacitors and verify that wiring agrees with the Information Card. Wires must be replaced exactly as removed. In some instances, a quick-connect wire terminal does not seat properly if it is not placed on the terminal cluster exactly as it was before removal. This is due to interference between the insulation on the wire terminal and the insulation surrounding their terminal cluster on the capacitor. Cooper Crouse-Hinds recommends that you lightly squeeze the quick-connect wire terminals with pliers before reinstalling them over the capacitor terminal blades.

**PCB1 — Timing and Trigger Board**

**Removal**

1. Loosen (but do not remove) the two screws near the corners of the board.
2. Loosen the screws holding the board to its terminal block.
3. Slide the board to the right and lift the board from the chassis.

Replacement
Reverse the removal procedure.

**T1 — Power Transformer**

*Removal*

1. Disconnect wires attached to the transformer and observe how each wire is routed from the harness to its terminal on the transformer.

2. Remove the four screws holding the transformer to the chassis and remove transformer from the chassis.

*Replacement*

1. Reverse the removal procedure.

2. Verify that wiring agrees with the Information Card supplied with the power converter and that you restore wire routing to its original state.

**PCB2 — HV Rectifier Board**

*Removal*

1. Loosen the two screws near the corners of the board.

2. Loosen, but do not remove, the screws holding the HV rectifier board to the terminal block.

3. Slide the circuit board out from under the terminal block screws.

*Replacement*

Reverse the removal procedure.

**T3 — Coupling Transformer**

*Removal*

1. Remove the two blue wires from the primary (small number of turns) of the Coupling Transformer.

2. Remove the two blue wires from the secondary of T3 (large number of turns) to TB2-4 and TB2-5.

3. Remove the two 4-40 x 2" Phillips head screws holding the transformer assembly to the bracket. Note the orientation of the molded secondary winding with respect to fixed features on the bracket, because it must be reinstalled with this same orientation.

4. Remove the outer half of the core and lift off the molded secondary winding. The seven turns of the primary winding remain hanging in place.

5. Remove the inner half of the core, taking care not to uncoil any turns of the primary winding.

*Replacement*

1. Reassemble the primary and secondary windings over the two halves of the core. Attach the core to the bracket using the two long screws.

2. Reattach the electrical wires. Verify that wiring is in accordance with the Information Card supplied with the power converter.

**PCB3 — Sense Module**

*Removal*

1. Disconnect the wire on TB2-1 that passes through the PCB3 coil on the PCB3 board.
2. Pull this wire through the coil to remove it from the coil. Note its direction through the coil.

3. Disconnect the two wires on the small terminal block (TB1) on PCB3 (small screwdriver needed).

4. Remove the two Phillips-head screws that hold PCB3 to the base plate. Note that there are spacers on these screws under the board.

5. Lift out PCB3.

Replacement
Reverse the removal procedure.

All Other Power Unit Components
All other components are mounted in the base or attached to the side walls of the power unit. They are attached by Phillips-head screws. You may need a short screwdriver for some removals.

Removal
1. Carefully note the position and color of wires on the connectors to the component you want to remove.

2. Remove the wires either fastened by screws or connector plugs (this depends on the component you are removing).

3. Remove the screws that hold the component to the chassis.

Replacement
Replace components in the reverse order of removal. That is:

1. Attach the component with its mounting screws.

2. Reattach the connecting wires by using the plugs or hold-down screws.

Flashhead

FT101 — Flashtube

Removal
Loosen the three screws (on screw lugs)—this enables you to disengage the flashtube. Carefully lift the flashtube upward from the assembly.

Replacement
Align the pins on the flashtube base with the clamps of the terminal screw lugs, making sure that the red dot on the flashtube base coincides with the red dot marked on the bracket directly under it. Then carefully insert the flashtube and settle it into place, making sure the ceramic base is resting directly on the tops of the screw lugs. Secure the flashhead by tightening the three screws on the screw lugs.

T101 — Trigger Transformer

Removal
1. At the trigger wire post adjacent to the flashtube, remove the large diameter wire coming from the trigger transformer.

2. At one of the smaller, side-mounted ceramic posts, remove the small wire to the trigger transformer. Do not disconnect the primary winding wires (seven turns of insulated wire).

3. Remove the two 4-40 x 2" phillips head screws holding the transformer assembly to the bracket. Note the orientation of the molded secondary winding with respect to fixed features on the bracket, because it must be reinstalled with this same orientation.
4. Remove the outer half of the core and lift off the molded secondary winding. The seven turns of the primary winding remain hanging in place.

5. Remove the inner half of the core, taking care not to uncoil any turns of the primary winding.

Replacement

1. Reassemble the primary and secondary windings over the two halves of the core. Attach the core to the bracket using the two long screws.

2. Reattach the electrical wires. Verify that wiring agrees with the Information Card supplied with the power converter.

T102 — Coupling Transformer

Removal and replacement are similar to the procedure for the trigger transformer (T101) in Subsection T101 — Trigger Transformer.

Storage

Equipment should be stored indoors when not in use. Circuit board, when not installed in the equipment, should be kept in antistatic bags or containers.
Section 4 — Recommended Spare and Replaceable Part

Customer Service
Customer Service: 1-866-764-5454
Telephone: 315-477-7000
FAX: 315-477-5590
Shipping and Receiving:
Cooper Crouse-Hinds
PO Box 4999, Wolf & 7th North Streets
Syracuse, NY 13221
Internet Address:
http:\www.crouse-hinds.com

Ordering Parts
To order parts, contact Customer Service at 1-866-764-5454.

Power Converter Parts
Table 4-1 lists the major replaceable parts for the power converter.

Flashhead Parts
Table 4-2 lists the part numbers for the major replaceable parts for the flashhead. The flashtube mounting plate assembly (PN 8812401) is listed here because, if available at a site, you can use it to isolate a malfunction in the flashhead or the flashhead cable without first climbing the mast.

Returning Equipment
If it is necessary to return equipment, contact Customer Service (see the following section) for a Return Material Authorization (RMA) number.

Repackaging
Return the equipment in a container that provides maximum protection during shipping and handling. If the original cartons and packaging material are no longer available, package the power converter and flashhead separately as described in the following subsections.

Power Converter
Package and ship the power converter in an upright position; that is, with the feet downward. Pad the power converter so that the feet cannot penetrate the box during shipment. Box each power converter separately using a double thickness cardboard container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

Flashhead
Package and ship the flashhead in an upright position. Box each flashhead separately and use adequate padding. Attach the flashhead base to a plate measuring 20 inches square (e.g., 3/8" plywood). Use a double thickness cardboard (or wood) container that is 20 inches square by about 26 inches high (inside dimensions). Use soft packing or a cardboard collar around the lens to prevent tipping inside the container. Do not drop. Use appropriate warning labels on the outside of the container.
### Table 4-1 Power Converter Major Replaceable Parts

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
<th>Part Number Reference</th>
</tr>
</thead>
<tbody>
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<td>Capacitor, 70 MFD, main bank</td>
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</tr>
<tr>
<td>6-1</td>
<td>Capacitor, 1 mfd, burst (PC 302-1R)</td>
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<td>Capacitor, 2 mfd, burst (PC 302-1, PC 302-1S)</td>
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<td>Capacitor, 3 mfd, tuning</td>
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<td>Diode Bridge</td>
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<td>Fuse, Power</td>
<td>*4900307</td>
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<td>Relay, 24V, Low Intensity Mode</td>
<td>*8900494</td>
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<td>6-1</td>
<td>Relay, 120V, Discharge</td>
<td>*8900493</td>
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<td>Choke, Burst</td>
<td>4175200</td>
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<td>Timing and Trigger Board (PC 302-2)</td>
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</tr>
<tr>
<td>6-1</td>
<td>Timing and Trigger Board (PC 302-2S)</td>
<td>†2904410</td>
</tr>
<tr>
<td>6-1</td>
<td>HV Rectifier Board</td>
<td>*2458005</td>
</tr>
<tr>
<td>6-1</td>
<td>Sense Module</td>
<td>2811101</td>
</tr>
<tr>
<td>6-1</td>
<td>Resistor, Discharge, 35K 50W</td>
<td>6900541</td>
</tr>
<tr>
<td>6-1</td>
<td>Resistor, Burst, 750 ohm each, 50W (PC 302-1, PC 302-1S)</td>
<td>†6900533</td>
</tr>
<tr>
<td>6-1</td>
<td>Resistor, Burst, 500 ohm each, 50W (PC 302-1R)</td>
<td>†6900532</td>
</tr>
<tr>
<td>6-1</td>
<td>Switch, Interlock</td>
<td>8205501</td>
</tr>
<tr>
<td>6-1</td>
<td>Transformer, Power</td>
<td>†8841501</td>
</tr>
<tr>
<td>6-1</td>
<td>Transformer, Coupling</td>
<td>8336701</td>
</tr>
<tr>
<td>6-1</td>
<td>Terminal Strip, 11 Position</td>
<td>8721011</td>
</tr>
<tr>
<td>6-1</td>
<td>Terminal Strip, 3 Position</td>
<td>4902157</td>
</tr>
</tbody>
</table>

† This part number varies according to the specific equipment configuration.

* Recommended as a spare part.

### Table 4-2 Flashhead Major Replaceable Parts

<table>
<thead>
<tr>
<th>Reference</th>
<th>Item</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-2</td>
<td>P1, P2, P4, P5, P12</td>
<td>Ceramic Spacer, 3/4&quot; diameter, large</td>
<td>5900844</td>
</tr>
<tr>
<td>6-2</td>
<td>P3, P6, P7, P8, P9, P10, P11</td>
<td>Ceramic Spacer, 1/2&quot; diameter, short</td>
<td>5900842</td>
</tr>
<tr>
<td>6-2</td>
<td>FT101</td>
<td>FH 308 Flashtube</td>
<td>*8384329</td>
</tr>
<tr>
<td>6-2</td>
<td>RC101</td>
<td>R.C. Network</td>
<td>1403411</td>
</tr>
<tr>
<td>--</td>
<td>--</td>
<td>Flashtube Mounting Plate Assembly</td>
<td>†8812401</td>
</tr>
<tr>
<td>6-2</td>
<td>RC102</td>
<td>R.C. Network</td>
<td>1403412</td>
</tr>
<tr>
<td>6-2</td>
<td>T101</td>
<td>Transformer, Trigger</td>
<td>8288201</td>
</tr>
<tr>
<td>6-2</td>
<td>T102</td>
<td>Transformer, Coupling</td>
<td>8336701</td>
</tr>
</tbody>
</table>

* Recommended as a spare part.

† Acts as a flashhead for testing the power converter to avoid climbing the tower.
Figure 4-1 Power Converter Component Locations
Figure 4-2 Flashhead Component Locations
Section 5 — Programming
T&T Board P/N 2904410/11

Connecting the Handheld

Table 5-1 shows the connector pin assignments for the handheld. The receive and transmit directions shown in the table are with respect to the handheld. The DB9 connector is located at the top of the handheld programmer.

<table>
<thead>
<tr>
<th>DB9 Female</th>
<th>EIA-232 Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Receive +receive</td>
</tr>
<tr>
<td>6</td>
<td>No connection -receive</td>
</tr>
<tr>
<td>2</td>
<td>Transmit +transmit</td>
</tr>
<tr>
<td>1</td>
<td>No connection -transmit</td>
</tr>
<tr>
<td>9</td>
<td>Power</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
</tr>
</tbody>
</table>

A 9-pin RS-232 cable is used to connect the handheld to the 9044-01 controller board at connector J2 (9 pin Male connector). Power and ground is provided by this connector.

The same connector J2 on the 9044-01 is also used to connect a computer serial port for the enhanced user interface. This interface is used to set parameters, run production and vendor tests and display general operating information.

Using the Programmer

The programmer has a four line LCD display and 24 keys as shown in fig. 5.1.

The following is a general discussion of how the programmer works. See Parameters under the SETUP section below for more details.

In the discussions to follow the 4 line LCD display will be represented as shown:

L1: **********
L2: **********
L3: **********
L4: **********
All the messages displayed on the LCD will be in capital letters.

The display does not show the L1: etc. this is used to represent line 1, 2, 3 and 4 on the LCD.

Once the handheld programmer is connected to the 9044-01 and power is applied the 9044-01 will automatically recognize that the terminal is connected to it and will display the sign on message. Only terminals provided by Flash Technology will work with the 9044-01.

The general format of the sign on message for non S versions is:

L1: FLASH TECHNOLOGY
L2: BOARD 4988
L3: (Blank or further information)
L4: ENTER TO CONTINUE

For S versions it is:

L1: FLASH TECHNOLOGY
L2: BOARD 4990
L3: (Blank or further information)
L4: ENTER TO CONTINUE

Once enter is pressed the first menu is displayed as follows:

L1: PRESS A FUNC KEY
L2: F1. SETUP F2. INFO
L3: F3. SHORTTEST
L4: F4. MODE CHANGE

To continue further a function key must be pressed. The function keys are on the top row of the terminal. See fig. 5.1.

F1: Enters the setup menus, used to configure the 9044-01.
F2: Enters the information menu, used to show a limited amount of useful operating info.
F3: Causes the 9044-01 to perform the short test.
F4: Enters the mode change menu, used to manually change the operating mode (DAY, TWI, and NITE). Note: DAY equals HIGH, TWI equals MED and NITE equals LOW intensity

Note: The handheld terminal will return to the sign on message from any other menu if no key is pressed within two minutes. The 9044-01 does this to take the serial port out of the handheld terminal mode if the terminal has been removed to allow the serial port to be used for the enhanced user interface. This means that if you remove the handheld terminal and connect a computer to use the enhanced interface you must wait at most two minutes before pressing any key on the computer. You can cycle the power to the 9044-01 for faster access to the computer interface.

**SETUP for non S versions**

The setup menu has the following format:

L1: SETUP
L2: 0-1-1
L3:
L4: OK NEXT BACK EXIT

The first line displays the current menu. The second line displays the current setup. The numbers correspond to the selected parameters. The third line is blank. The fourth line displays what functions the keys F1 thru F4 will perform if pressed; the words are spaced to be over the corresponding function key. So, to move to the next menu you would press F2 (NEXT).

F1: OK- is used to enter data.
F2: NEXT- moves to the next item.
F3: BACK- moves to the previous item.
F4: EXIT- exits the setup menu.

**SETUP for S versions**
The setup menu has the following format:
L1: SETUP
L2: DASH 10 T 1 B 1
L3:
L4: OK NEXT BACK EXIT

The first line displays the current menu. The second line displays the current setup. The numbers correspond to the dash number tier and beacon selected. The third line is blank. The fourth line displays what functions the keys F1 thru F4 will perform if pressed; the words are spaced to be over the corresponding function key. So, to move to the next menu you would press F2 (NEXT).

F1: OK- is used to enter data.
F2: NEXT- moves to the next item.
F3: BACK- moves to the previous item.
F4: EXIT- exits the setup menu.

**Parameters for non S versions**
Pressing the NEXT or BACK function key from the SETUP menu takes you to the parameters. The general format is:
L1: SETUP
L2: SYSTEM
L3: 0- Std. 1- Air. 2- Cat
L4: OK NEXT BACK EXIT

The currently selected option will have the cursor under it. For example:
0-Std 1-Air 2-Cat shows that the currently selected option for the parameter is one (1) which in this case means Standard system.

If the board you are configuring is not in the Standard mode press 1 and press F1 (OK). **Note: Even if your board is configured for Standard mode you will need to press 1 and F1 to change the tier and beacon number.**

The display will change to:
L1: SETUP
L2: TIER # 1
L3: Enter TIER #
L4: OK NEXT BACK EXIT

Press the number keys to select the tier number you wish this board to be and then press F1 (OK). The Tier number displayed will change. The display will change to:
L1: SETUP
L2: BEACON # 1
L3: Enter Beacon #
L4: OK NEXT BACK EXIT

Press the number keys to select the beacon number you wish this board to be and then press F1 (OK). The Beacon number displayed will change. When you are done press NEXT. Be sure to write the numbers on the white space provided on the board.

If setting up a catenary system press 2 and F1 (OK).

**Note**
Even if your board is configured for Catenary mode you will need to press 2 and F1 to change the position.

The display will change to:
L1: SETUP
L2: CAT TIER
L3: 0-BOT. 1-MID. 2-TOP
L4: OK NEXT BACK EXIT
Press the number keys to select the catenary tier you wish this board to be and then press F1 (OK).

To change the Flash rate press NEXT until the LCD shows:
L1: SETUP
L2: FPM 1-60 2-30
L3: 3-20 4-100 5-120
L4: OK NEXT BACK EXIT

NOTE: Valid flash rates are 40fpm and 60 fpm for standard and catenary systems respectively.

Then press the number corresponding to the desired flash rate and press F1 (OK)

**Parameters for S versions**

Pressing the NEXT or BACK function key from the SETUP menu takes you to the parameters. The general format is:
L1: SETUP
L2: DASH # 10
L3: Enter Dash #
L4: OK NEXT BACK EXIT

To change the dash number enter a number and press F1 OK. Press NEXT to continue. Note: Dash numbers should only be programmed by trained Flash Technology personnel or under the direction of same.

The display will change to:
L1: SETUP
L2: TIER # 1
L3: Enter TIER #
L4: OK NEXT BACK EXIT

Press the number keys to select the tier number you wish this board to be and then press F1 (OK). The tier number displayed will change. When you are done press NEXT or BACK.

The display will change to:
L1: SETUP
L2: BEACON # 1
L3: Enter BEACON #
L4: OK NEXT BACK EXIT

Press the number keys to select the beacon number you wish this board to be and then press F1 (OK). The beacon number displayed will change. When you are done press NEXT, BACK or EXIT.

**INFO**

The info menu has the following format for non S version:
L1: INFO
L2: BOARD 4988
L3:
L4: NEXT BACK EXIT

The info menu has the following format for S version:
L1: INFO
L2: BOARD 4990
L3:
L4: NEXT BACK EXIT

This menu is used to show a limited amount of information about the current 9044-01 operation and configuration.

The first line displays the current menu. The second and third lines display board information. The fourth line displays what functions the keys F2 thru F4 will perform if pressed; the words are spaced to be over the corresponding function key. So, to move to the next item you would press F2 (NEXT).
F2: NEXT- moves to the next item.
F3: BACK- moves to the previous item.
F4: EXIT- exits the setup menu. Items like energy, trigger voltage, flash rate and operating mode are displayed.

MODE CHANGE

The mode change menu has the following format:

L1: MODE CONTROL
L2: CURRENT DAY
L3:
L4: DAY TWI NITE EXIT

F1: DAY- Changes the mode to DAY.
F2: TWI- Changes the mode to TWI.
F3: NITE- Changes the mode to NITE.
F4: EXIT- exits the mode change menu and returns the mode to automatic.

This menu item is used to manually change the operating modes and functions just like the test jumpers on the board.