Night Scan® Warranty

Will-Burt warrants its Night Scan® to be free from defects in material and workmanship for a period of two (2) years, with such time period running from the date of shipment by Will-Burt. Will-Burt shall not be responsible for any damage resulting to or caused by its products by reason of failure to properly install, maintain or store the product; use of the product in a manner inconsistent with its design; unauthorized service, alteration of products, neglect, abuse, accident, or acts of God. This warranty does not extend to any component parts not manufactured by Will-Burt; provided, however, Will-Burt’s warranty herein shall not limit any warranties by manufacturers of component parts which extend to the buyer.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, AND NO REPRESENTATIONS, GUARANTEES OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, A WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT ARE MADE BY WILL-BURT IN CONNECTION WITH THE MANUFACTURE OR SALE OF ITS PRODUCTS. NO EMPLOYEE, DISTRIBUTOR, OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY ON BEHALF OF WILL-BURT.

Claims for defects in material and workmanship shall be made in writing to Will-Burt within thirty (30) days of the discovery of defect. Failure to provide notice as required hereby shall be conclusive evidence that the product was in conformity with the warranty, and Will-Burt shall be released from any and all liability relating to the product. Will-Burt may either send a service representative or have the product returned to its factory at Buyer's expense for inspection. If judged by Will-Burt to be defective in material or workmanship, the product will be replaced or repaired at the option of Will-Burt, free from all charges except authorized transportation.

THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER REMEDIES. THE LIABILITY OF WILL-BURT WHETHER IN CONTRACT, TORT, UNDER ANY WARRANTY, OR OTHERWISE, SHALL NOT EXTEND BEYOND ITS OBLIGATION TO REPAIR OR REPLACE, AT ITS OPTION, ANY PRODUCT OR PART FOUND BY WILL-BURT TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP. WILL-BURT SHALL NOT BE LIABLE FOR COST OF INSTALLATION AND/OR REMOVAL, OR BE RESPONSIBLE FOR DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.
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Safety Summary

SIGNAL WORD DEFINITION

Per the ANSI Z535.4 standard, the following signal words and definitions are used to indicate hazardous situations:

⚠️ DANGER

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

⚠️ WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

⚠️ CAUTION

CAUTION indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices.

NOTES address practices not related to personal injury.

GENERAL SAFETY PRECAUTIONS

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

⚠️ DANGER

Electrocution Hazard! Contact with high voltage will result in death or serious injury. Observe general safety precautions for handling equipment using high voltage. Do not locate or operate mast near electrical lines, cables or other unwanted sources of electricity. Do not operate mast in lightning. Be certain electrical cables are undamaged and properly terminated. Always disconnect power at the breaker box of the unit before performing service, repair, or test operations.

⚠️ WARNING

Safety Instruction – Read Manual! Failure to follow operating instructions could result in death or serious injury. Read and understand the operator’s manual before using the mast.

⚠️ WARNING

Tip Over Hazard! Mast tip over could result in death or serious injury. Do not operate in high winds. Operate on level ground only. Stand clear of mast and mast payload during operation. Be certain mast is level and secure before and during installation, operation, and maintenance.
**Safety Instruction – Trained Personnel Only!** Death or serious injury could result if proper inspection, installation, operation, and maintenance procedures are not observed. Installation, operation, and maintenance to be performed by trained and authorized personnel only. Proper eye protection should be worn when servicing the mast.

**WARNING**

**Health and Safety Hazard!** Solvent used to clean parts is potentially dangerous. Avoid inhalation of fumes and also prolonged contact to skin.

**WARNING**

**Safety Instruction – Do not look at lights!** Do not look directly into lights when they are illuminated. Temporary impairment or permanent vision damage could occur.

**SPECIFIC SAFETY PRECAUTIONS**

The following are safety precautions that relate to specific procedures that may appear elsewhere in this publication for emphasis. These are recommended precautions that personnel must understand and apply during specific phases of installation, operation, and maintenance.

**WARNING**

**Safety Instruction – Operation!** For outdoor use only. Do not use in areas that have been classified as hazardous as defined in Article 500 of the National Electric Code.

**WARNING**

**Crush Hazard!** Death or serious injury could result if mast fails suddenly. Do not stand directly beneath the mast or its payload. Be certain payload is properly installed and secured.

**WARNING**

**Burst Hazard!** Over-pressurizing mast will trip safety valve and could result in death or serious injury. Do not exceed maximum operating pressure of 20 psi (138 kPa) for Standard Duty masts. Keep personnel clear of safety valve exhaust direction.

**WARNING**

**Fire Hazard!** Cleaning solvent, used for maintenance, is flammable and can be explosive resulting in death or serious injury. Do not smoke. Use cleaning solvent in a well-ventilated area. Keep cleaning solvent away from ignition sources. Always store cleaning solvent in the proper marked container.

**WARNING**

**Relocation Hazard!** Relocating the mast during operation or after being raised could result in death or serious injury. Do not relocate the mast during operation or while raised. This applies especially to masts mounted to vehicles. Operate the mast only if the vehicle is stationary and the vehicle engine is off.
**WARNING**

**Mast Extension Hazard!** Extending mast into obstructions could result in death or serious injury and could render the mast inoperable and partially extended. Before applying power and operating the mast, be certain there is sufficient clearance above and to all sides of the expected location of the fully extended mast and payload. Keep all persons clear of mast and mast extension. Do not lean directly over the mast.

**WARNING**

**Mounting Structure Hazard!** Mounting mast into a structure unable to resist the forces generated from customer-specific loading scenario could result in death or serious injury and could damage the mast. Before operation, be certain mounting structure is capable of resisting forces generated from all loading and environmental conditions, including, but not limited to, mast size and weight, payload size and weight, sail size, wind speed, guy line arrangement, support bracket or roof line location, and base plate assembly.

**WARNING**

**Electrocution Hazard!** Do not touch live wires. Death or serious injury could result.

**WARNING**

**Safety Instruction – Operation!** Make sure all power has been disconnected prior performing maintenance.

**WARNING**

**Safety Instruction – Trained Personnel Only!** Only trained and qualified personnel should perform installation, adjustments, and servicing. Only a properly trained and qualified certified electrician should perform electric installations and service.

**WARNING**

**Safety Instruction – Operation!** At all times prior to mast operation, ensure that:

- The mast area is free of personnel and mechanical obstruction;
- All electrical cables are undamaged and properly terminated;
- The operator must have full view of the mast during use;
- Any transit tie-downs on the payload have been removed;
- The vehicle is not moving;
- The area above the mast is free of mechanical obstructions.

**WARNING**

When re-lamping an installed fixture, make sure all power to fixture is off and that the fixture is cool.

**WARNING**

Make certain that the area is free of overhead power lines and other unwanted sources of electricity. Follow OSHA safety regulations when working near energized power lines. Be sure to allow sufficient clearance on all sides of mast to allow for side-sway.
WARNING

Do not use in the presence of flammable gases or liquids such as paint, gasoline or solvents. Do not use in areas of limited ventilation or where high ambient temperatures are present. Contact with combustible materials can cause ignition resulting in fire or explosion.

WARNING

Keep personnel clear of mast while during operation.

WARNING

Do not move vehicle until mast has been securely stowed.

WARNING

Using the emergency stow button causes the actuator to lower the mast without regard to any faults, switches, or system interlocks. It is totally up to the operator to ensure safe operation during an emergency stow attempt.

WARNING

When using the emergency stow button, normal operation switches are disabled. The mast can be overdriven into saddle and cause damage to the unit.

WARNING

If manually lowering the mast, make sure all power has been disconnected from the system prior to manually lowering the mast.

WARNING

Keep hands clear of the descending collars while the mast is being lowered to avoid pinching.

WARNING

A pneumatic telescoping mast is a pressurized vessel. Caution must be exercised to stay clear when the mast is being extended. Do not lean directly over the mast. Proper eye protection should be worn when working on the mast.

WARNING

Do not lubricate the exterior of the mast. This will cause the lubricant to attract dust and contaminants from the air.

WARNING

Make sure the lights are completely cool before attempting to clean the light lenses.

WARNING

Make sure all power has been disconnected from the system prior to manually lowering mast. This can be accomplished by turning all breakers to the OFF position.
Safety Instruction – Hard Hat! Due to the risk of head injuries from falling objects, operators should wear a properly secured hard hat while the mast is in the process of being deployed, deployed, or in the processes of being stowed.

Safety Instruction – Operation! Lamps are extremely hot and should not come into contact with people or combustible and/or explosive materials. Do not operate if breakage occurs or unit is knocked over.

Entanglement Hazard! Tangled cables can cause equipment damage. Ensure control cables are not tangled and are free to pay out as mast is raised.

Safety Instruction – Operation! Do not operate the mast during an electrical storm.

Lifting Hazard! Manually lifting over 55 lb. (25kg) is prohibited. In the UK, all lifting equipment must be thoroughly examined annually by a competent person according to the Lifting Operations and Lift Equipment Regulations 1998. Equivalent regulations exist in other EU states.

Safety Instruction – Operation! All operators must read the Operation section of this manual and be properly trained.
(This page is intentionally left blank.)
Section 1 Introduction

Review this manual in its entirety. Contact the Will-Burt Company with any questions before performing any procedure outlined in this manual.

The Night Scan Vertical® is a transportable lighting system consisting of a directionally adjustable group of lights attached to a self-erecting, extensible mast. It may also serve as a platform for communications antennae or a camera. Air pressure required to extend the mast is provided by an available vehicle air system, or an optional compressor unit mounted within the Night Scan. The Night Scan is designed for installation on any vehicle for the purpose of providing on-the-scene temporary lighting and communications or surveillance. This manual covers both the single-tilt and dual-tilt Vertical.

1.1 Safety Precautions

Refer to the Safety Summary for precautions to be observed while operating or servicing this equipment.

1.2 How this Manual is Organized

This manual describes the installation, operation, and maintenance of the Night Scan Vertical mast. Typical hardware includes the base, mast, lights, remote controlled positioner, and a controller to operate the system.

This manual is organized into the following sections:

- Section 1 Introduction
- Section 2 Installation
- Section 3 Operation
- Section 4 Maintenance and Adjustments
- Section 5 Reference Information
- Section 6 Troubleshooting
- Section 7 Appendix
- Section 8 Drawings
1.3 Additional Documentation

In addition to this manual, your system ships with top-level drawings. These drawings can be referenced during the installation process.

1.4 The Definition of the Mast Position

The mast is pneumatically moved by air pressure to the extended position. The following positions (Figure 1-1) are used throughout this manual:

- “Stowed” is the position in which the remote controlled positioner is firmly seated in the saddle. This position is sometimes referred to as the “nested” position.
- “Extended” is the partial or full raised position that the mast pneumatically raises to from the stowed position. In the extended position, some or all of the mast sections have risen.

![Figure 1-1 Mast Positions](image-url)
1.5 Major Components

The major components of the Vertical are:

- Non-Rotatable Base Plate
- Mounting Hardware
- Saddle
- Mast
- Remote Controlled Positioner
- Lights
- Control Box
- Controller

Refer to Figure 1-2 for identification of major parts of the Night Scan Vertical.

1.5.1 Mast

The bottom of the mast typically connects to the base plate. The bottom of the mast also connects to the air compressor. The top of the mast connects to the RCP.

The mast (Figure 1-3) contains:

- Tube Sections
- Internal Coil Cord
1.5.1.1 Tube Section
The mast consists of concentric sections that extend as air is applied. Each tube and collar is protected by low friction synthetic bearings for smooth operation and long life. Bumpers reduce shock on extension and retraction. The exterior surfaces of the tubes are anodized and sealed for long life. The fasteners are corrosion-resistant stainless steel.

1.5.1.2 Internal Coil Cord
The center of the tubes route an internal coil cord from the bottom of the mast to the RCP. The highly flexible internal coil cord contains power to the RCP.

1.5.2 Mounting Hardware
Your system may come with either internal or external mounting hardware.

1.5.2.1 Internal Mounting Kit
The internal mounting kit (Figure 1-4) contains the hardware used to position and support an internally mounted mast. The kit includes a two-piece roof-ring, O-ring, two gaskets and a ceiling plate. Bolts, lock washers and hex nuts, ¼” or M6, not provided, can be used to secure the assembly to the roof. Bolt length will depend on the specific application and is to be determined by the installer.

![Figure 1-4 Internal Mounting kit (P/N: 4009302)](image)

1.5.2.2 External Shelf Bracket Assembly
The external shelf bracket assembly (Figure 1-5) is a painted weldment that can be bolted into a mounting structure and used to position and support an externally mounted mast.

![Figure 1-5 External Shelf Bracket Assembly](image)
1.5.3 Non-Rotatable Base Plate

Typically, the vertical attaches to a 5” base plate. The base plate attaches to the mounting structure by screwing four bolts through the base plate and mounting structure. The non-rotatable base plate is a square aluminum plate used to stabilize the mast and to provide a means of securing the mast to a mounting structure. Countersunk holes in the non-rotatable base plate match threaded holes on the base mast section. Flat head screws included in the hardware bag can be used to attach the non-rotatable base plate to the base mast section.

1.5.4 Saddle

The saddle connects to the mounting surface and extends to provide a curved surface for the RCP to rest on when the mast is stowed. The saddle is adjustable to accommodate all models of the RCP and various mounting methods.

1.5.5 Remote Controlled Positioner (RCP)

The RCP (Figure 1-6) mounts on top of the mast and between the lights. The RCP contains gears and gear motors to position the lights. The RCP also contains the RCP Board which receives data through the Base Board from the controllers. This allows the RCP to control the lights to pan and tilt. Vertical Night Scan systems can come with either a single-tilt or dual-tilt RCP. The single-tilt RCP tilts both sets of lights in together. For example, if the lights are directed downward, both sets of lights will tilt downward. The dual-tilt RCP allows for individual tilt control of each side of lights. For example, one side of the lights could be directed forward, while the other side of the lights could be directed backward.
1.5.6 Control Box
The control box (Figure 1-7) contains the Base Board for the system, and the Solenoid Valve Assembly.

1.5.7 Lights
The Night Scan Vertical systems can come with a variety of LED or Halogen lighting packages (Figure 1-8). For additional information on the lights, see www.willburt.com.
1.5.8 Controllers (Dual Tilt Systems Only)

Several controllers are available for your system. These controllers all have two-way communication with the system and LED display that include alphanumeric feedback. The controllers can be used to operate all functions of the system and are as follows:

**Wired Hand-Held Remote Controller (HHRC)**

The wired HHRC (Figure 1-9) has the following features:

- Connects with a 25 foot (7.62 meter) bayonet-disconnect coiled cord
- Integrated emergency stop button

**Panel Mount Remote Controller (PMRC)**

The PMRC (Figure 1-9) has the following features:

- Integrated emergency stop button

**Wireless Hand-Held Remote Controller (HHRC)**

The wireless HHRC (Figure 1-9) has the following features:

- Operates as a wireless unit using a rechargeable internal power source, or as a wired unit when connected directly with a cable
- Assigns a unique communication channel with the J-Box when a direct connection is made during system initialization
- Emergency stop button on separate J-Box
- Connects with a 25 foot (7.62 meter) bayonet-disconnect coiled cord

*Figure 1-9  Dual-tilt controller options. Standard (non-NFPA) models appear the same, except that they do not have the green NFPA Start button.*
1.5.8.1 Controller Interface

The wired HHRC connects through a bulkhead (Figure 1-10). The PMRC connects directly to the system. The wireless HHRC connects through a J-Box with a “Start/Stop” button (Figure 1-11). The “Start/Stop” button on the J-Box serves as an emergency stop. The wireless HHRC plugs into the J-Box to recharge, and during the initialization process to establish wireless communication.
1.5.9 Controllers (Single Tilt Systems Only)

Several controllers are available for your system. These controllers can be used to operate all functions of the system and are as follows:

**Wired Hand-Held Remote Controller (HHRC)**

The wired HHRC has the following features:

- Connects with a 25 foot (7.62 meter) quick-disconnect coiled cord
- Integrated emergency stop button
- LED display that includes alphanumeric feedback

**Panel Mount Remote Controller (PMRC)**

The PMRC has the following features:

- Integrated emergency stop button
- LED display that includes alphanumeric feedback

*Figure 1-12  Single-tilt controller options. Standard (non-NFPA) models do not include the green NFPA Start button.*
### 1.6 Unit Specifications

Table 1-1 lists the specifications for your system.

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<td>Profiler – Space-Saving Feature Option</td>
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<td>D-TEC II Power Line Detection System Option</td>
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</tbody>
</table>

All electrical devices on the system are nominal 12 V devices. The boards driving them monitor and chop the battery voltage at 300 Hz adjusting the duty cycle to deliver 12 V. During mast incline at 13.8 V the system may draw up to 13 amps. During mast incline at 28.8 V the system may draw up to 9 amps.
Section 2 Installation

This section describes the installation of your system and provides the general procedures that must be followed to ensure a successful installation. Be sure to read and understand the entire installation procedure before beginning installation.

2.1 Ensuring That it Fits

Ensure that the mounting surface is flat and has sufficient room and strength to hold the system. The roofline must lie between the weep hole and the base tube collar. Mounting hardware should be at least 1 inch (25 mm) above the weep hole and 3" inches (76 mm) below the collar. The area beneath the floor must be free of obstructions to allow for accessibility to base plate fasteners and, if used, the bottom air inlet port.

2.1.1 Dimensions

Refer to the drawings which ship with the mast for detailed information on the size of the system. Additional room may be required for optional components such as a camera, strobe light, or D-Tec II Power Line Detection System.

2.2 Get Your Tools

Table 2-1 lists recommended tools and materials for installation.

<table>
<thead>
<tr>
<th>Tools and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Glasses</td>
</tr>
<tr>
<td>Safety Gloves</td>
</tr>
<tr>
<td>Safety Shoes</td>
</tr>
<tr>
<td>Hard Hat or Helmet</td>
</tr>
<tr>
<td>Hearing Protection</td>
</tr>
<tr>
<td>Crimping Tool or Solder Set</td>
</tr>
<tr>
<td>Wrenches</td>
</tr>
<tr>
<td>Screwdrivers</td>
</tr>
<tr>
<td>Multimeter (To verify power is turned off)</td>
</tr>
<tr>
<td>Torque Wrench</td>
</tr>
<tr>
<td>Drill</td>
</tr>
<tr>
<td>Knife or scissors to cut plastic band</td>
</tr>
<tr>
<td>Wire cutter/stripper</td>
</tr>
<tr>
<td>RTV Silicone</td>
</tr>
<tr>
<td>½ inch or M12 Mounting hardware (6 each)</td>
</tr>
<tr>
<td>Clean shop rags</td>
</tr>
<tr>
<td>Hoist (minimum 500 lb. capacity)</td>
</tr>
</tbody>
</table>

Note: Depending on the national and local standards and codes of practice, and the environment, additional personal protective equipment may be necessary.
2.3 Components

When unpacking, check to ensure all ordered components have arrived. Your system should ship with the following components:

- Mast
- Mounting Kit (Internal or External)
- Base Plate
- Saddle Kit
- RCP Assembly
- Lights
- Controller (Selected from the following)
  - Wired HHRC with Bulkhead
  - Wireless HHRC with J-Box
  - PMRC
- Board Power Cable
- Light Cable
- Exhaust Hose
- Supply Air Hose
- Ferrite
- Label Kit
- Strobe Light (Optional)
- D-TEC II (Optional)
- Operator’s Manual (this manual) on CD

Additionally, you should receive drawings of your system to assist in the installation process.

The labels from the label kit can be applied where the operator deems appropriate.
2.4 Unpacking

Unpack the items as follows:

1. Carefully remove all the cartons.
2. Remove all the items from the cartons.
3. Ensure that all components are included and that the required tools are readily available.
4. Inspect for any shipping damage. If damage has occurred, notify your carrier.
5. Lift the base out with a hoist. Lift the unit from the shipping container by the two horizontal Remote Control Positioner (RCP) shafts and the vertical shaft (Figure 2-1). Lifting from locations other than those indicated could result in equipment damage.

![Lifting Points on the Vertical RCP](image)

Figure 2-1 Lifting Points on the Vertical RCP

2.5 Attaching to the Vehicle

Your system is designed to withstand adverse weather conditions; however, it cannot be submerged in water. Hardware for attaching the base to a roof is not included with the shipped items.

Physically attach the system as follows:

1. If the system is to be mounted in a well, provide adequate drainage. A minimum of four 1" diameter drain holes (one per corner) are recommended.
2. Drill six 3/8" mounting holes into the mounting structure (Figure 2-2).
3. Attach the mast using 3/8" studs or bolts (not provided). Torque all hardware as appropriate for its material and size.
4. The saddle is adjustable to accommodate all models of the RCP as well as variations in mounting (Figure 2-3). The saddle must be attached so that it is centered with the RCP and mast base tube.

**NOTE:** The mast, RCP, and control box assemblies must be installed and wired prior to power up. Failure to do so will result in errors and could damage the unit.
Figure 2-2  Saddle Mounting Holes

Figure 2-3  Mounting Variations. Clockwise from upper left: Saddle Deck Mount; Saddle Wall Mount; Saddle and RCP Assembly Lights Stowed Horizontally; Saddle and RCP Lights Stowed Vertically.
2.6 Attaching the Control Box

The control box may be surface mounted using four ¼” screws, nuts, and lock washers provided by the installer. To install the control box:

1. Disconnect any attached cables before installation.
2. Open the cover and mount the unit through the clearance holes located on the rear side of the control box (Figure 2-4).
3. Attach the lock washers and nuts to secure the unit.
4. Reconnect any cables and replace the cover. Be sure to secure the green ground wire provided on the bulkhead to vehicle ground.

![Control Box Mounting Hole Locations](image)

2.7 Attaching the Air Connections

Air may be supplied externally by a compressor or other source of clean, dry air with a maximum pressure of 100 psi. The inlet fittings are for use with 3/8” inside diameter air hose rated for the pressure supplied in combination with environmental factors, which may derate the hose (e.g. high temperatures). The Night Scan has an internal regulator factory set to 20 psi. The unit is supplied with 20 ft. of air hose labeled SUPPLY to designate the pressurized air to be routed to the INLET of the unit. The exhaust fitting is to be used with a ½” inside diameter air hose. The unit is supplied with 20 ft. of air hose labeled EXHAUST to designate its use to route exhausted air to a location where it will not expel air or water onto personnel or equipment.
sensitive to moisture. The different size hose with the labeled intention of the hose is designed to prevent pressurized air to be routed into the EXHAUST of the unit. If pressurized air is routed into the EXHAUST port of the mast, the unit is equipped with a blow-off valve that will prevent this pressurized air from entering the mast. An audible air leak will be evident to alert you that air has been improperly connected to the unit.

Refer to Figure 2-5 and Figure 2-6 for identification of the air fittings located on the control box. The exhaust hose must be routed to a location where it will not expel air or water onto personnel or equipment sensitive to moisture.

Figure 2-5 Control Box Valve Layout (Cover Removed)
2.8 Attaching the RCP to the Mast

To attach the RCP to the mast:

1. Ensure the power is off.

   **Note:** The RCP is not shipped in the Auto Stow® position. The unit may rotate as soon as power is applied.

2. Attach the 4-circuit male plug from the RCP to the 4-circuit female plug from the mast. This is the data cable.

3. Attach the 10-circuit male plug from the RCP to the 10-circuit female plug from the mast. This is the power cable.

4. Tuck the wires in and place the RCP on the mast being careful not to pinch the wires.
5. Connect the RCP and mast with the four provided screws and washers. Light-Duty Loctite (blue) is recommended.

2.9 Installing the Magnetic Switches

While the mast is stowed, the Lower Magnetic Switch should be installed first by locating the magnet in the bottom of the top tube. The magnet is in line with the key on the intermediate tubes located between the air and cable inlets. Once found, align the switch with the magnet and tighten the clamp. The Upper Magnetic Switch should be installed in line with the lower switch at a minimum of 36 inches above it (Figure 2-7). This switch will sense the magnet in the top tube as the mast is raised and allow the user to operate the RCP. The Upper Magnetic Switch should be installed so that the RCP will clear any obstructions including those caused by mounting the mast in a well.

![Figure 2-7 Upper and Lower Magnetic Switches](image_url)
2.10 Attaching the Controller

There are several types of controllers available for your system. This section will describe how to install the Wired HHRC with a bulkhead. The installation process for other controllers will be described in the Appendix.

To attach the bulkhead:

1. Find a convenient, dry location to mount the bulkhead.
2. Drill the mounting holes as indicated (Figure 2-8).

3. Using the screws, washers, and nuts provided, attach the bulkhead to the vehicle.
4. Attach the ground wire to the vehicle.
2.11 Attaching the Holder

The HHRC has a holder to hang the controller on. To install the holder:

1. Using the (2) screws and the holder provided, attach the holder where the HHRC will hang. The inside of the holder is angled to better hold the HHRC (Figure 2-9). Ensure that the wider end of the bevel is up.

2. Place the HHRC onto the holder.

2.12 Wiring the Base Board

Ensure the power is off before wiring the Base Board. See Figure 2-5 for information on where the cables run into the control box.
2.12.1 Wiring the Bulkhead Control Cable to the Base Board

The Bulkhead Control Cable connects the bulkhead, controller, and Base Board. Depending on the components used in your system, the Bulkhead Control Cable in your system may be connected through either a control box with plugs, or a control box without plugs.

2.12.1.1 Control Box with Plugs

To electrically connect a control box with plugs, plug the Bulkhead Control Cable into the appropriate plug on the control box (Figure 2-5).

2.12.1.2 Control Box without Plugs

To electrically connect a control box without plugs, run the Bulkhead Control Cable into the control box through one of the strain reliefs, then follow these steps:

1. Connect the wires from the Bulkhead Control Cable to the green J4 connector ensuring the wires match the color strip on the J4 connector (Figure 2-5).

   ![Figure 2-11 Wiring J4](image)

   If using the “Mast Active” contacts, note that they are factory set to be OPEN when the mast is active; S2-1 is OFF (open). To set them to be CLOSED when the mast is active, set S2-1 ON (closed).

   Important! Be aware of the different "look" of the ON position of rocker and slide switches. Both are shown (Figure 2-12) with position 1 ON (closed).
2.12.2 Wiring the DC Power to the Base Board

Incoming DC power is provided by the customer from the vehicle battery.

2. Connect the DC battery power to the +VIN (red or white) and COM (black) connections on terminal block TB4 on the Base Board (Figure 2-11). The source must be capable of delivering (5) amps minimum.

2.13 Connecting the Warning Light/ Interlock Output Contact

The mast provides an isolated relay contact output to enhance integration into vehicle safety circuitry (Figure 2-13). This relay output is from a bi-stable (latching) relay whose contacts either open or close (switch selectable) when the mast is active (not stowed). Its state is not affected by whether or not there is power to the mast. This contact is capable of carrying up to two amperes and is available on pins J4-8 and 9. Its usage is highly recommended by Will-Burt and should be used to comply with various safety standards. It can be used in conjunction with a customer-supplied relay to drive a flashing warning light.
2.14 Connecting the Interlock Input Contact

Some safety standards require preventing operation of the mast unless other conditions are first met. An example might be having the parking brake set. This can be accomplished by inserting an isolated contact in series with the stop circuit of the “Start/Stop” button. Inserting these contacts in line with the wire connected to pin J4-7 on the base circuit board breaks continuity and will inhibit operation of the mast and prevent operation until the parking brake is set. After use, and properly stowing the mast, when the parking brake is released, the mast is again prohibited from energizing until the parking brake is set.

Note: Using this parking brake feature is the same as pushing the E-stop button—power to the control is opened, the mast immediately exhausts air, and the mast comes down without regard to the proper RCP alignment (stowing to the home position). The parking brake should not be released until the mast is safely (and automatically) stowed by the controls.

For Standard (non-NFPA) mode, to force the mast to Auto Stow® if the vehicle emergency brake is off, replace the jumper on connector J4, wires 5 and 7, with the contacts from the parking brake. The contacts should close when the brake is on.

2.15 Testing the Installation

Review the operation section of this manual and observe all safety dangers, warnings, and cautions in this manual before proceeding to test the installation. If any part of the testing fails, check the LEDs on the controller and Base Board.

To test the installation, proceed as follows:

1. Reconnect power.
2. Turn the red “Start/Stop” button to enable the system, then push the green “Start” button.
3. Check for proper clearance above the mast.
4. Press the “Mast Up” button to raise the first tube section to activate the RCP.
5. Press each “Light” button several times to turn the lights on and off.
6. Tilt (and ) and pan ( and ) both sets of lights. Check the lights on each side again.
7. Press and hold the “Mast Up” button. When the mast is fully extended and the blow-off valve opens, release the “Mast Up” button.
8. Press each “Light” button several times to turn the lights on and off.
9. Tilt and pan both sets of lights. Check the lights on each side again.
10. If the strobe/beacon light is installed, press the “Auxiliary Light” button several times to turn the light on and off.
11. To ensure that the mast is properly sealed, while the mast is fully extended, watch for any type of mast settling.

12. Press the “Mast Down” button twice rapidly. This invokes the Auto Stow® feature that places the mast into the saddle and turns power off.
Section 3 Operation

This section describes the operation of the system. Be sure to read and understand the entire operation procedure before beginning operation.

3.1 Pre-Operation Check

Before operating the system:

1. Ensure that there are no overhead obstructions, and that there are no power lines within 20 feet of the mast.
2. Visually inspect the system for damage. If damage is apparent, do not use the mast and have it serviced prior to use.
3. Check for and remove any objects which might obstruct motion of the mast; cause binding; or hinder mast function.
4. Ensure that the following warnings are understood and followed:

   **WARNING**

   Make certain that the area is free of overhead power lines and other unwanted sources of electricity. Follow OSHA safety regulations when working near energized power lines. Be sure to allow sufficient clearance on all sides of mast to allow for side-sway.

   **WARNING**

   Safety Instruction – Operation! For outdoor use only. Do not use in areas that have been classified as hazardous as defined in Article 500 of the National Electric Code.

   **WARNING**

   Do not use in the presence of flammable gases or liquids such as paint, gasoline or solvents. Do not use in areas of limited ventilation or where high ambient temperatures are present. Contact with combustible materials can cause ignition resulting in fire or explosion.

   **WARNING**

   Keep personnel clear of mast while during operation.

   **WARNING**

   Do not move vehicle until mast has been securely stowed.

   **CAUTION**

   Safety Instruction – Operation! All operators must read the Operation section of this manual and be properly trained.
3.2 Controllers

The following controllers are available on your system:

- Dual-Tilt Wired Hand-Held Remote Controller (HHRC)
- Dual-Tilt Panel Mount Remote Controller (PMRC)
- Dual-Tilt Wireless Hand-Held Remote Controller (HHRC)
- Single-Tilt Hand-Held Remote Controller (HHRC)
- Single-Tilt Panel Mount Remote Controller (PMRC)

Using the controller, the operator can move the mast up and down, tilt the lights up and down, pan the lights right and left, turn the lights on and off, and turn the optional strobe light on and off. The following are the controller buttons:

- Start/Stop
- Auxiliary Light
- Lights
- Mast Up
- Tilt Up
- NFPA Start
- Pan Left
- Pan Right
- Mast Down
- Tilt Down

The “NFPA Start” button is only found on NFPA controllers.

On the Dual-Tilt controllers, there are three duplicate buttons on the controllers:

- Tilt Down
- Tilt Up
- Lights

These buttons operate the separate sides of the RCP. For example, if you press the “Tilt Down” button on the right side of the controller, the lights on the right side will go down. If you press the “Tilt Down” button on the left side of the PMRC, the lights on the left side will go down.

3.3 Quick Summary

Following is a quick summary of the operation of the system. Detailed steps follow the quick summary.

If an emergency stop is required at any time, press the “Start/Stop” button. This will disconnect the unit from power and cause all air to be exhausted from the mast.

1. Ensure that the vehicle parking brake is engaged.
2. Ensure that there are no obstructions overhead.
3. Turn the red “Start/Stop” button. For NFPA systems, then press the green “NFPA Start” button.
4. Raise the mast by press and hold the “Mast Up” button to raise the mast. Then press the “Lights” button to turn the lights on.

5. If desired, raise the mast further by pressing “Mast Up”.

6. Position the lights vertically by pressing “Tilt Down” and “Tilt Up”.

7. Position the lights horizontally by pressing “Pan Right” and “Pan Left”.

8. Use the “Lights” button to turn on the strobe/beacon light (if equipped).

9. If desired, lower the mast by pressing “Mast Down”.

10. Stow the mast by performing one of the following steps:

   - Quickly press the “Mast Down” button twice (Auto Stow® feature). It is recommended to use the Auto Stow® feature to stow the mast. To abort Auto Stow®, press the any controller button.
   - Press and hold “Mast Down” until all LEDs on the controller turn off. Ensure that “Mast Down” is released only after the controller LEDs turn off which means the mast is stowed.

### 3.4 Initiating

Before operating a stowed mast, the “Start/Stop” button must be turned. This will enable the system to power up and initiate. NFPA systems must also then press the green “NFPA Start” button. On initiation, the Base Board establishes communication with the other boards in the system. If communication cannot be established, an error code is shown on the display and the communication system is shut down.

To initiate the system:

1. If using a wired HHRC, ensure it is plugged in before initiation. This allows the board to establish communication between all boards. If the wired HHRC is connected after the unit is powered up, then an error will occur.

2. Turn the “Start/Stop” button while viewing the display.

3. For NFPA operation, wait until the system initializes before releasing the “Start/Stop” button. When the first letter “N” of NightScan is shown on the controller display, release the “Start/Stop” button.

4. The letter “N” of NightScan is normally displayed a couple of seconds after turning the “Start/Stop” button. You may also be able to hear the initiate relay click into place. Do not release the “Start/Stop” button before seeing the first letter on the display. Releasing too early may cause a communication error between the Base Board and the controller. After the letter “N” of NightScan is displayed, the “Mast Up” LED is lit showing that the “Mast Up” button is enabled.

5. For NFPA controllers, press the green “NFPA Start” button.
3.5 Extending the Mast

The mast can be extended to full or partial height. To extend the mast, press the “Mast Up” button until the mast reaches the desired height.

Pushing the “Mast Up” button will cause the mast to rise until the “Mast Up” button is released, or the mast reaches its maximum extended height. If the “Mast Up” button is not released, the mast will reach its fully extended height, the air pressure will rise to 20 lb., and then the exhaust valve will open and exhaust any more air that enters the mast, leaving the mast at its maximum extended height.

3.6 Controlling the Lights

The lights can be turned on and off from the controller after the first tube section has been extended and the RCP become active. The RCP can only initially position the lights down and to the right. Once the RCP reaches a 350° position, the RCP can only rotate back in the other direction.

To pan and tilt the lights:

- Holding the “Tilt Down” button turns the lights down and all the way around to 350°.
- Holding the “Tilt Up” button, turns the lights back in the other direction.
- Holding the “Pan Right” button turns the lights to the right.
- Holding the “Pan Left” button turns the lights to the left.
- Pressing the “Lights” button turns the lights on and off.

3.7 Lowering the Mast

Once the mast has been extended, pressing the “Mast Down” button will lower the mast. Continue to press the “Mast Down” button until the mast reaches the desired height and then release the button.

3.8 Stowing the Mast

The “stowed” position is also called the “nested” position. The stowed position is the position of the mast when it is firmly seated in the saddle. When the mast lowers and comes to the upper magnetic switch, the RCP begins to Auto Stow®. When the lower magnetic switch is reached, the system is stowed and shuts down.

It is the responsibility of the customer to properly secure the payload for vehicle travel.
The mast can be stowed by using:

- Auto Stow®
- Mast Down

The best method is to stow the mast with the Auto Stow® feature. It does not require the operator to stop the mast exactly in the saddle. The mast can be auto stowed from any position including partially extended or fully extended.

On NFPA systems, all power is removed after the mast is stowed. To operate the mast again on NFPA systems, the red “Start/Stop” button must be turned. The green “NFPA Start” button must then be pushed. This is a safety feature that prevents the mast from being inadvertently raised.

On Standard systems, power is still applied to the system after the mast is stowed and it is not required to turn the “Start/Stop” button to operate the mast again. Since power is still applied, care must be taken to ensure the controller buttons are not accidently hit.

If the mast loses power, the mast will lose power and lower.

### 3.8.1 Using the Auto Stow® Feature

To use the Auto Stow® feature:

1. Press the “Mast Down” button twice quickly in successive depressions (two depressions within ½ second). The mast will pan and tilt the RCP to the home position, turn off any lights, and stow the mast. This automatic sequence can be aborted by pushing any of the buttons on the controller at any point during the Auto Stow®. If a button is pressed, the mast will not stow by itself, and will await further operator input.

2. On an NFPA system, wait until all controller LEDs turn off. Any lit LEDs indicate that the mast is not stowed.

3. Visually inspect that the mast is properly stowed. Ensure that the payload will not bounce as the vehicle drives down the road.

4. Store any controllers so they will not be damaged during transportation.

### 3.8.2 Using the Mast Down Button

Another method used to stow the mast is to press the “Mast Down” button on the controller. This method is not as reliable as using the Auto Stow® feature. Care must be taken to ensure that the operator does not release the button before the mast is completely stowed. If the mast is not completely stowed, equipment may be damaged during transportation.

To stow the mast using the “Mast Down” button:

1. Press the “Mast Down” button until the mast stops and the “Mast Down” LED is turned off. The mast will go to the home position and then stow the mast. Once stowed, the Mast Stowed Safety Interlock Contact signals it is safe to move the vehicle.
2. On an NFPA system, wait until all controller LEDs turn off. Any lit LEDs indicate that the mast is not stowed.

3. Visually inspect that the mast is properly stowed. Ensure that the payload will not bounce as the vehicle drives down the road.

4. Store any controllers so they will not be damaged during transportation.
Section 4 Maintenance and Adjustments

This section describes the routine maintenance and adjustment procedures required to keep your system operational.

4.1 Cleaning the System

Will-Burt pneumatic telescoping masts come from the factory pre-lubricated and require no scheduled maintenance under normal operating conditions. In extremely harsh environmental conditions, maintenance of the mast might be required.

Signs that cleaning and lubrication are needed can be:

- A noticeable gritty film on the exterior surfaces of the mast sections
- Erratic extension or retraction of the mast
- Noisy operation of the mast
- Sticking of one or more mast sections when mast is extending or retracting

Make sure the lights are completely cool before attempting to clean the light lenses.

To clean the system:

1. Wipe down the RCP using a soft cloth or sponge and a mild solution of soapy water.
2. Clean the light lenses using a soft cloth and standard glass cleaner.

A pneumatic telescoping mast is a pressurized vessel. Caution must be exercised to stay clear when the mast is being extended. Do not lean directly over the mast. Proper eye protection should be worn when working on the mast.

After cleaning the mast, if the mast is in extremely harsh environmental conditions, lubricate the mast with TMD Mast Lubricant (P/N: 900600). TMD Mast Lubricant is specifically formulated for cold weather use, but is also suitable for year around use. Regular winter maintenance and frequent use of TMD Mast Lubricant should significantly reduce the potential for mast freeze-ups.

To clean and lubricate the mast:

1. Reduce the regulator setting such that it pressurizes the mast to between 5 and 10 PSIG. Pull up on the regulator cap and rotate counterclockwise. Push cap down to lock into place.
2. While at the 90° position, have one person press the “Mast Up” button to slowly pressurize the mast just enough to extend the desired mast section. A second person may have to hold down the larger mast section collars to ensure the desired tube extends. Release “Mast Up” button as soon as the desired mast section is fully exposed.

**WARNING**

**Fire Hazard!** Cleaning solvent, used for maintenance, is flammable and can be explosive resulting in death or serious injury. Do not smoke. Use cleaning solvent in a well-ventilated area. Keep cleaning solvent away from ignition sources. Always store cleaning solvent in the proper marked container.

3. Wipe down the desired mast section using a non-abrasive cleanser or solvent such as lacquer thinner. Do not allow the cleaning fluid or solvent to run down inside the collar.

4. Repeat steps two and three for the next larger mast section.

**WARNING**

Do not lubricate the exterior of the mast. This will cause the lubricant to attract dust and contaminants from the air.

5. Inject approximately ½ oz. of TMD Mast Lubricant or lightweight machine oil into the weep hole (drain) of each exposed mast section. The weep holes are located approximately 10” below the collar on each tube except the top tube.

**WARNING**

Keep hands clear of the descending collars while the mast is being lowered to avoid pinching.

6. Using the “Mast Down” button, lower the mast to 90°.

7. Wait several minutes to allow the lubricant to settle and spread around the wear ring and seal at the bottom of each mast section.

8. Using the “Mast Up” button, extend the mast one section at a time. For each section wipe off any excess lubricant which flows out the weep holes.

### 4.2 Functional Test

To test the functionality of the system, perform the following tests.

#### 4.2.1 Emergency Circuit Test

To test the emergency circuit, power up the system and operate the system, and then press the “Start/Stop” button at the following stages and check if the system is stopped and de-energized:

1. Mast Extending (Up valve active – actual telescoping mast raising in height)
2. Light Pan ( and )
3. Light Tilt (and)
4. Mast Down (Down valve active – telescopic mast lowering in height)

4.2.2 Brake Function Test
To test the brake function, check the following:

1. If the vehicle brake signal is off, the system should not operate.
2. If the vehicle brake is on, the system should be able to operate.
3. During operation, if the vehicle brake signal goes off, the system should shut down and:
   a. Stow automatically (units in Standard [non-NFPA] mode)
   b. Exhaust air (units in NFPA mode)

4.2.3 Function Circuit Test
To test the limit switches:

1. Pan Left: Hold the “Pan Left” button on HHRC to let the light pan to left side. The light will turn almost one circle (less than 360°) and the motor will stop. After fully panned to the left, only the “Pan Right” button on HHRC is active; the indicator for the “Pan Left” button on HHRC should be off.

2. Pan Right: Hold the “Pan Right” button on HHRC to let the light pan to right side. The light will turn back to the original home position and the motor will stop. At the home position, only the “Pan Left” button on HHRC is active; the indicator for the “Pan Right” button on HHRC should be off.

3. Tilt down: Hold the “Tilt Down” button on HHRC to let the light tilt down. The light will tilt almost one circle (less than 360°) and the motor will stop. After fully tilted down, only the “Tilt Up” button on HHRC is active; the indicator for the “Tilt Down” button on HHRC should be off. (This applied to both side of the lights.)

4. Tilt up: Hold the “Tilt Up” button on HHRC to let the light tilt up. The light will tilt back to the original home position and the motor will stop. At home position, only the “Tilt Down” button on HHRC is active; the indicator for the “Tilt Up” button on HHRC should be off. (This applied to both side of the lights.)

5. Mast Down and Mast Not Down: Power on the system. Using an external magnet to attach the top magnet switch and observe the LED D3 and D4 on the base board. If the sensor is active, D3 should be on and D4 off, otherwise D4 should be on and D3 off.
4.3 Adjusting the Magnetic Switches

The Magnetic Switches are located on the mast base tube (Figure 4-1). The Upper Magnetic Switch senses that the top tube is extended. The Lower Magnetic Switch senses when the mast is completely stowed. It is important that the mast has properly nested by verifying that the collars are stacked with no gaps between them. If a switch is found to require adjustment, it will most commonly need to be moved upward (toward the RCP) on the mast. The magnet is located at the lower end and side of the top tube. It is not visible outside the mast.

The following procedure must be followed to adjust the Magnetic Switch.

1. Loosen the band clamp securing the switch to the base tube. Move the switch upwards approximately ⅛ inch and tighten band clamp.

2. Initiate the mast, if necessary, and press the down button on the hand held remote. If the mast does not nest, repeat the adjustment until it does. A small piece of steel or iron filings may be used to help locate the magnet.

3. If repeated attempts do not succeed, hold a magnet up to the switch and press the down button. If the mast begins to nest, continue repeating the adjustment until the switch has sensed the magnet.

4. If the mast will not nest when a magnet is held to the switch, check the wiring to at the circuit board for loose or disconnected wires. If the wiring is intact, replace the Magnetic Switch.
4.4 Resetting the RCP Home Position

The RCP home position is the position of the RCP and lights where the light bars are parallel to the axis of the mast and the lights are facing down when stowed. If the RCP home position is set properly, when being stowed the RCP shafts should contact the saddle simultaneously. The home position is established by setting small flags in the RCP that engage photo interrupters on the RCP board. Adjusting the RCP home position should be done indoors. Adjusting the home position outside can cause improper RCP operation due to sunlight reaching the photosensors. Before delivery of a new system, the RCP home position is tested and normally no adjustment is necessary.

WARNING

Make sure all power has been disconnected from the system prior to manually lowering mast. This can be accomplished by turning all breakers to the OFF position.

To set the home position:

1. Disconnect all light power to the system.
2. Initiate the mast and raise one section. The controller should show both left and right tilt up functions are available and the pan left function is available.
3. Remove the front RCP cover to access the flags. The flags are attached to the timing rings on the horizontal and vertical shafts. Each timing ring has two set screws that must be loosened. It may be necessary to loosen one in each, then pan and tilt the unit to access the others. The flags have sharp edges that may cause cuts. For systems using a dual tilt RCP reference Figure 4-2. For systems using a single tilt RCP reference Figure 4-3.

Figure 4-2 Dual Tilt Photo Interrupter and Flag
4. Once the set screws are loose, pan (_clkwise and counterclockwise) and tilt ( and counterclockwise) the unit to the correct home position. Be careful that the flags do not come into contact when panning and tilting, they may become bent.

5. It is important that the flags engage the correct photo interrupter when setting the home position. For systems using a dual tilt RCP reference Figure 4-4. For systems using a single tilt RCP reference Figure 4-5. Turn the timing ring on the right horizontal shaft such that it rotates down toward the upper photo interrupter. As you approach the interrupter, watch the controller. As soon as the right tilt down LED goes out, stop rotating the ring and tighten the set screw. Repeat on the left horizontal shaft. To set the pan home position, turn the timing ring counterclockwise (looking from above the RCP) until the pan right LED goes out. Tighten the set screw to secure the ring.
6. Pan and tilt the unit until the second set screw in each ring is accessible and tighten.

7. Stow the mast, watching for the lights to be oriented as described in the beginning of this section.

8. Initiate and raise the mast to 90°. Replace the RCP cover.

Figure 4-5  Single Tilt RCP Home Position
(This page is intentionally left blank.)
Section 5 Reference Information

This section describes reference information for your system.

5.1 DIP Switch Definitions

DIP Switches on the Base Board and the RCP board are set at the factory and normally do not have to be changed. The DIP Switches on the Base Board define the warning light signal, NFPA verses Standard mode, if an RCP is present, and if the mast is a Vertical or a fold-down. The RCP DIP Switches define if the system should stow automatically while on a fault, if the RCP is a Profiler unit, and if the system stows before or while lowering. For additional information on the DIP Switches and their settings, see the drawings in Section 8. By default, the RCP becomes active when the upper magnetic switch is sensed. If this is too early and the RCP may be accidently turned and hit the vehicle, an addition of 5, 10, or 15 seconds of “Mast Up” time can be set as shown in Table 5-1. If set, the RCP will continue to be inactive for 5, 10, or 15 seconds after sensing the upper magnetic switch.

<table>
<thead>
<tr>
<th>DIP Switch Position</th>
<th>Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position 8 On</td>
<td>5 Seconds</td>
</tr>
<tr>
<td>Position 9 On</td>
<td>10 Seconds</td>
</tr>
<tr>
<td>Positions 8 and 9 On</td>
<td>15 Seconds</td>
</tr>
</tbody>
</table>

Note: The controls check the status of the DIP switches only during initialization. After flipping a DIP switch, the system will need restarted for the change to take effect.

5.2 Strobe/Beacon Light

The optional strobe/beacon light (Figure 5-1) provides visibility and safety by mounting on top the RCP and brightly showing the height of the mast. The strobe/beacon light can be used at any voltage from 12 to 48 VDC. The strobe/beacon lights are available in amber, blue, clear, red, and green. LED strobe lights are also available. The strobe/beacon light can be turned on by pressing the “Auxiliary Light” controller button when the mast is at 90° or extended. Pressing the button again would turn the strobe/beacon light off. When ordered, the optional strobe/beacon light is shipped installed and no additional wiring is required.
5.3 D-TEC II Sensor

The D-TEC II Sensor is an optional accessory that is mounted on the backside of the RCP. Refer to the Will-Burt D-TEC II Safety System Manual before installing the D-TEC II.

5.3.1 Installing the D-TEC II Sensor

When using the D-TEC II Sensor with a Will-Burt RCP, the unit will be mounted on the side of the RCP cover plate opposite of the RCP circuit board (see Figure 5-3). The Sensor unit must be mounted in the upright position with the look up lights pointing up. The cable used to connect the Sensor unit to the RCP should be connected to the bottom of the Sensor unit and wired into the RCP PC board as shown in Figure 5-2.

![Figure 5-2 Mounting of D-TEC II Sensor to RCP](image)

![Figure 5-3 RCP to D-TEC II Sensor Unit Schematic](image)
5.3.2 D-TEC II Functionality

An optional D-TEC II Sensor provides additional limited protection against raising the mast into power lines or physical obstructions. As soon as the mast begins raising, the control begins initiating the D-TEC II Sensor and self-tests it until it either passes, or the mast reaches the point where the RCP becomes active (first tube section extended). Assuming that it passes, the operator is then permitted to extend the mast. If the mast senses an obstruction or a power line, the mast will stop extending even though the operator continues to push the “Mast Up” button. In each of these two cases, there will be a message displayed on the alphanumeric display of the Remote Control(s). If the operator believes the sensed condition to be false, they may clear it in either of two ways: momentarily initiating an Auto Stow® function, or lowering the mast to the bottom of the 90° position. This will clear the alarm and allow the operator another chance to raise the mast to its full extension. The following messages may be displayed on the Remote Control(s).

Table 5-2 D-TEC II Error Codes

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-TEC Testing</td>
<td>The D-TEC II Sensor is performing a self-test.</td>
<td>The D-TEC II has repeatedly been trying to pass the self-test while moving to the RCP active position. Normally, it will pass one of these attempts and no message will be displayed. If not, once there it tries one more time to pass and this message will displayed during the self-test.</td>
</tr>
<tr>
<td>Power Line E-Field</td>
<td>The D-TEC II has sensed voltage from a power line.</td>
<td>A power line may be in close proximity. If so, move the vehicle to a location away from the power line, and then redeploy the system.</td>
</tr>
<tr>
<td>Power Line H-Field</td>
<td>The D-TEC II has sensed current from a power line.</td>
<td>A power line may be in close proximity. If so, move the vehicle to a location away from the power line, and then redeploy the system.</td>
</tr>
<tr>
<td>D-TEC Obstruction</td>
<td>The D-TEC II has sensed some type of physical obstruction.</td>
<td>A physical obstruction may be in close proximity. If so, move the vehicle to a location away from the obstruction, and then redeploy the system. Certain high frequency sounds (e.g. air from pneumatic tools) or fluorescent lights may also interfere.</td>
</tr>
<tr>
<td>D-TEC OSHA Limit</td>
<td>The D-TEC II has sensed voltage from a very high power line.</td>
<td>A power line may be in close proximity. If so, move the vehicle to a location away from the power line, and then redeploy the system.</td>
</tr>
</tbody>
</table>

5.3.3 D-TEC II Sensor Faults

The D-TEC II Sensor is not serviceable, so most issues will end with returning the sensor to Will-Burt for repair. See Troubleshooting for a list of related error codes.
5.4 Nycoil (Optional)

The Nycoil Cable Conduit (Figure 5-4) is an optional external coiled hose used to house electrical wiring, antenna RF, and positioner cables.

![Nycoil Cable](image)

*Figure 5-4 Nycoil Cable*

Nycoil cables come in a variety of sizes. Depending on the system being used, some restrictions on the size of the Nycoil may occur. The standard sizes for the Nycoil are:

- ½ inch inside diameter of the cable with the outside diameter of the coil being 8 inch
- ¾ inch inside diameter of the cable with the outside diameter of the coil being 13 inch

Consult engineering on specific applications for other Nycoil sizes.
5.5 Bulb Replacement

This section contains bulb replacement procedures provided by Fire Research Corporation (FRC) – Focus, Optimum Lights, and Magnafire.

Note: There are no bulb replacement procedures for LED lights.

5.5.1 Fire Research Corporation (FRC) Lights

SAFETY SUMMARY

FRC lighting products are engineered and manufactured with safety in mind. It is critical that FRC scene lights are installed, maintained, and operated correctly. Read and understand all instructions before installing, performing maintenance, or operating.

All components, equipment, and installation procedures shall conform to NFPA 1901, Standard for Automotive Fire Apparatus and NFPA 70, National Electrical Code.

The following safety precautions shall be observed.

General Safety Precautions

Ensure power is off prior to connecting or disconnecting wires and plugs or performing maintenance.

Scene lighting lamphoods are designed for outdoor use and will be extremely hot when operating. Do not use in areas of limited ventilation.

Installation Safety Precautions

Ensure power is off prior to connecting wires or cable to the power source.

Connect only to the type of power source as indicated on the lamphood identification label.

Ensure an appropriate sized circuit protection device is installed (circuit breaker or fuse).

Use a minimum of 16 AWG wire to connect AC lights and 12 AWG to connect DC lights.

FRC lights are intended for mounting to a noncombustible surface only. Do not install insulation within 76 mm (3 in) of any part of the light, lighting fixture, or its components.

Install approved rubber or plastic grommets or bushings where wires or cable will pass through a surface.

Ensure all wire connectors or terminals provide a positive mechanical and electrical connection.

Electrical connections not enclosed in a box must be covered with an insulation equivalent to that on the conductors.

Lamphoods will be extremely hot when operating, do not mount such that personnel or equipment could inadvertently come in contact with the lamphood.

Recessed lights require a minimum of 3 inch clearance between wall insulation and the light housing.

Operation Safety Precautions

Operate portable lighting products only from the power source indicated on the identification label.

During operation use the handle to move the light, the housing will be extremely hot.

Ensure that all lighting components are clear of obstructions when raising telescopic poles.

Ensure that telescopic poles are lowered and stowed before moving the vehicle.

Maintenance Safety Precautions

Ensure power is off prior to removing the front glass or opening covers.

Do not operate the light with the front glass removed or cover opened.

Ensure replacement bulbs have the same voltage and wattage rating.

When handling a new quartz halogen, HIR, or HID bulb avoid touching it except on the flat seal at either end.

Use a clean soft cloth to wipe the reflector clean if necessary, do not use liquid or aerosol cleaners.
MAINTENANCE

Bulb Replacement Optimum and Focus

1. Ensure power is OFF and the lamphed is cool to the touch prior to replacing the bulb.
2. Ensure the replacement bulb has the same voltage and wattage rating. (If there are two bulbs installed, each bulb will be half the listed wattage.)
3. Hold the glass in place while removing the bezels. Remove the four cap head screws and remove the bezels. Remove the glass.

Note: Optimum gasket is attached, the Focus gasket may come off.
4. Slide the bulb sideways into the spring contact and lift it out from the opposite side.

Note: When handling the new bulb avoid touching it except on the flat seal at either end. (Grease or oily fingerprints can cause damage the quartz bulb.) If the bulb is accidently touched, gently wipe it clean with alcohol.
5. Check both lamp base contacts to be sure they are perfectly clean.
6. Push one end of the bulb into the spring contact until the other end can be placed into the opposite contact. Rotate the lamp back and forth about its axis to ensure adequate seating of contacts.

Caution: Do not operate the light with the front glass removed.
7. Insert the Focus gasket in the groove with the splice positioned down.
8. Hold the glass in position. Ensure the glass is inside the lip on all four sides.
9. Install the bezels and secure with the four screws.

Note: Bulb life is extended when the lamphed is mounted so the bulb is in a horizontal position.

Cleaning

High intensity lights may, over time, develop a powdery white film on the reflector. If this happens remove the glass (see bulb replacement procedure) and gently wipe the reflector clean with a soft cloth.

VERTICAL LAMPHEAD

Bulb
Glass
Bezel
Screw

Wiring

12/24 VDC
Connect the BLACK wire to GROUND.
Connect the WHITE or RED wire to POWER.

120/240 VAC
Connect the GREEN wire to chassis GROUND.
Connect the WHITE wire to RETURN.
Connect the BLACK wire to POWER.

CAUTION
Position the glass inside the housing lip on all four sides. Failure to do so may result in racking the glass when the screws are tightened.

Bulb Replacement Optimum and Focus Lampheads
5.5.2 Havis Incorporated Lights

Changing Lamps:
MagnaFire Series Fixtures (Halogen)

1. Remove (4) screws.

2. Remove lens cover.

3. Obtain a napkin or towel free from debris, dirt, oil, etc. to remove the lamp with.

4. Holding the lamp with the napkin, push in as far as possible on spring-loaded lamp holder on the left. This should release or free the lamp for removal (see step #5)
5. Right side of lamp will free if the left, spring-loaded side is pushed all the way in. This may require strong force as the lamp holders are tight.

6. Remove and discard old lamp.

7. Holding the new replacement lamp with a napkin or clean cloth, insert the lamp into the left, spring-loaded lamp holder first. Push in all the way on the left spring-loaded lamp holder, until the right side of lamp clicks into place. This could require using some strong force as the lamp holders are factory set exceptionally tight.

8. Replace lens cover and (4) screws. Test to ensure normal working conditions.
Changing Lamps: Magnafire Series Fixtures (H.I.D.)

1. Remove (4) screws.

2. Remove lens cover.

3. Obtain a napkin or towel free from debris, dirt, oil, etc. to remove the lamp.

4. Holding the lamp with the napkin, push in as far as possible on spring-loaded lamp holder on the left. This should release or free the lamp for removal (see step #5)
5. Right side of lamp will free if the left, spring-loaded side is pushed all the way in. This may require strong force as the lamp holders are tight.

6. Remove and discard old lamp.

7. Holding the new replacement lamp with a napkin or clean cloth, insert the lamp into the left, spring-loaded lamp holder first. Push in all the way on the left spring-loaded lamp holder, until the right side of lamp clicks into place. This could require using some strong force as the lamp holders are tight.

8. Replace lens cover and (4) screws. Test to ensure normal working conditions.
5.6 Will-Burt Mast Oil MSDS Sheet

MATERIAL SAFETY DATA SHEET (MSDS)
The Will-Burt Company Orville, Ohio 330-682-7015

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION
Etna Products Inc.
16824 Park Circle Drive
Chagrin Falls, Ohio 44022

Company Phone Number: (440)-543-9845
Emergency Phone Number: (800)-229-3682
CHEMTREC Phone Number: (800)-442-9300

Product Name: Masterdraw B985 B
Product Number: 003826
Issue Date: 02/03/2014
Supersedes Date: 09/22/2009
Will-Burt Product Name: Mast Lubrication
Will-Burt Part Number: 900600

SECTION 2: HAZARDS IDENTIFICATION
EMERGENCY OVERVIEW
Appearance / odor: Transparent Blue liquid with a petroleum oil odor
WARNING: May cause slight to mild irritation of the skin, eyes and mucus membranes with repeated exposure.
Fire: Will burn in a fire.
Likely Routes of Exposure: Skin contact, Eye contact, Inhalation
Skin: Prolonged or repeated exposure may cause irritation or oil acne
Eyes: Contact with the eyes may cause temporary irritation
Inhalation: Vapors generated at high temperatures or oil mist may cause mild irritation of the mucous membranes.
Ingestion: Considered no more than slightly toxic if swallowed.
Medical Conditions Aggravated by Exposure: Pre-existing skin and respiratory disorders.
This product does not contain any SARA 313 reportable compounds
This product does not contain any carcinogens as defined by OSHA, NTP and IARC at greater than 0.1%
Hazardous Materials Identification System Rating (HMIS®) 110 C

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS
The table below will only list hazardous ingredients. If the table below is blank none are present.

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical Abstracts Number (CAS)</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION 4: FIRST AID MEASURES
Skin Contact: Remove contaminated clothing and wash with soap and water. If irritation occurs get medical attention.
Eye Contact: Flush with water for 15 minutes. If irritation occurs get medical attention.
Inhalation: Remove victim to fresh air and provide oxygen if breathing is difficult. Get medical attention.
Ingestion: Do not induce vomiting. Get medical attention.

SECTION 5: FIRE FIGHTING MEASURES
Use water, fog, foam, dry chemical or CO2. Do not use a direct stream of water. Product may float and can be reignited on the surface of the water.
Unusual Fire and Explosive Hazards: None
Products of Combustion: Highly dependent on combustion conditions. Mixture of air borne solids, liquid and gases evolve upon decomposition by heat or combustion. CO2 and other organic compounds may be formed during combustion.
Protection of Firefighters: Cool fire exposed surfaces. Do not enter fire space without proper protective equipment including full fire fighting turnout gear and a NIOSH approved self-contained breathing apparatus.

SECTION 6: ACCIDENTAL RELEASES
Personal Precautions: Use personal protection recommended in Section 8 and by the HIMS Rating.
Environmental Precautions: Recover free product. Prevent product from entering sewers or waterways by digging or impounding. Advise authorities if product enters waterways or extensive land areas.
Methods of Containment: Use sand, earth or other suitable absorbent to the spill.
Methods of Clean-up: Remove oil and absorbed material from the spill area. Dispose of recovered material and residue in compliance with all federal, state and local regulations.

SECTION 7: HANDLING AND STORAGE
Handling: Keep containers away from heat, open flame or strong oxidants. Use personal protection recommended in Section 8 and by the HIMS Rating.
Storage: Store inside away from heat, open flame and strong oxidants. Keep containers closed when not in use.

SECTION 8: EXPOSURE CONTROL / PERSONAL PROTECTION
Occupational Exposure Guidelines
OSHA PEL / TWA: 5 mg / M3
OSHA PEL / Ceiling: N/E
ACGIH TLV / TWA: 5 mg / M3
ACGIH TLV / STEL: 10 mg / M3
Based on: oil mist
Engineering Controls: Provide local exhaust ventilation to prevent exceeding recommended exposure limits. Controls are required only to capture vapor, mist or fumes.

Eye and Face Protection: Use safety glasses or goggles to prevent eye contact.

Skin Protection: Use chemically resistant gloves to avoid prolonged skin contact. Use chemically resistant apron as necessary.

Respiratory Protection: As needed to prevent over exposure to mist or fumes. Use NIOSH approved chemical mist and organic vapor respirator.

General Hygiene Considerations: Wash thoroughly after handling. Wash with soap and water prior to using toilet facilities, eating, drinking or smoking.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point: > 500 F
Specific Gravity @ 15.6 °C: .87
Vapor Pressure: Unknown
% Volatile / % VOC: Unknown
Vapor Density (Air = 1): Unknown
Evaporation Rate (N-BA=1): >1
Solubility in Water: Nil
pH: Not available
Reactivity in Water: Nil
Appearance: Transparent Blue liquid
Odor: Petroleum odor
Flashpoint: > 300 F
Flammable Limits (In air % by Volume): Upper: Unknown Lower: Unknown
Auto Ignition: Unknown

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable
Conditions to Avoid: Strong oxidants, heat, sparks and open flames
Hazardous Polymerization: Will not occur
Incompatibility: Strong oxidants
Decomposition Products: Mixture of air borne solids, liquid and gases evolve upon decomposition by heat or combustion.

SECTION 11: TOXICOLOGY INFORMATION

ACUTE EFFECTS
Oral LD₅₀: Not established
Dermal LD₅₀: Not established
Inhalation LD₅₀: Not established

CHRONIC EFFECTS
None

SECTION 12: ECOLOGICAL INFORMATION

Not available

SECTION 13: DISPOSAL INFORMATION

The material is non-hazardous, dispose of material in compliance with all federal, state and local regulations.

SECTION 14: TRANSPORTATION INFORMATION

Proper shipping Description: None
Consider the product to be non-hazardous. No special labeling is required by the Department of Transportation.

SECTION 15: REGULATORY INFORMATION

Global Inventories
TSCA: United States The ingredients of this product are included
DSL: Canada The ingredients of this product are included
EINECS: European Union The ingredients of this product are included

SARA 313 Information:
Component CAS # % by weight
None

WHMIS: Canadian Workplace Hazardous Material Information System:

SECTION 16: OTHER INFORMATION

Prepared by: The Will-Burt Company Technical Department
The information contained herein is based on the data available to us and is believed to be correct. The Will-Burt Company does not warrant or guarantee their accuracy or reliability and The Will-Burt Company shall not be liable for any loss or damage arising out of the use thereof. The information and recommendations are offered for the user’s consideration and examination and it is the user’s responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.
Section 6 Troubleshooting

This section describes the troubleshooting of your system. The CD that contains this manual will also contain a software Night Scan Product Troubleshooting Guide.

6.1 Troubleshooting Electrical

This section includes a list of warning and error codes and their potential causes. Warning codes do not halt the situation, but let you know of potential issues. Error codes point out problems and usually inhibit operation to prevent potential damage. These codes are shown on the status light on the Base Board. For example, an error of 3,07 would be shown on the status light as three flashes, pause, seven flashes. Additionally, if the controller for your system has a display, errors and warnings will typically be shown there. For more extensive information, see the Night Scan Product Troubleshooting Guide.

Table 6-1 Base Codes

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
<th>Potential Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRN 1,04</td>
<td>Look-Up light is burned out.</td>
<td>The control circuit is not sensing the look-up light current.</td>
<td>Look-up light is burned out or disconnected somehow.</td>
</tr>
<tr>
<td>WRN 1,05</td>
<td>Well cover switches indicate closed when they should be open. This stops all vertical movement of the mast to prevent damage to the mast, covers, or load.</td>
<td>Well cover switches indicate closed when they should be open.</td>
<td>Wiring error, or defective switch.</td>
</tr>
<tr>
<td>WRN 1,06</td>
<td>RCP Stow (Vertical, upper mag switch) – Sensor State Error.</td>
<td>Switch outputs are valid (opposite), but switch shows wrong polarity for nested state.</td>
<td>Defective mag switch, defective base board.</td>
</tr>
<tr>
<td>WRN 1,07</td>
<td>At power up, the lower mag switch is indicating “up” (yellow) when it should be “down” (green). If you ignore the warning and continue, the mast will go up, but will shut down after a few seconds with an ERR 1,14.</td>
<td>The lower mag switch needs to be adjusted. D13 should be green when it “sees” the magnet</td>
<td>Wiring error, defective mag switch.</td>
</tr>
<tr>
<td>1,01</td>
<td>Mast Down (mag switch) - Sensor State Error.</td>
<td>This is only checked at power up, if stowed. Sensor outputs are O.K., but it is indicating that the mast is extended (not down).</td>
<td>1. The magnetic sensor is not being energized or is defective. 2. Mag switch out of position.</td>
</tr>
<tr>
<td>1,02</td>
<td>Mast Stowed (near 0°) – Sensor Output Error</td>
<td>Sensor outputs are bad.</td>
<td>Defective sensor, defective board</td>
</tr>
<tr>
<td>1,03</td>
<td>Mast Stowed (near 90°) – Sensor State Error.</td>
<td>Sensor outputs are O.K., but sensor shows wrong polarity for nested state. The board remembers where it was (0° or 90°) when it was shut off, and this time it powered up, it's sensing the opposite condition.</td>
<td>Base board was changed or software was updated with the mast at 90°.</td>
</tr>
<tr>
<td>Message</td>
<td>Meaning</td>
<td>Root Issue</td>
<td>Potential Cause</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1,04</td>
<td>Excessive amp draw during actuator decline</td>
<td>Current sensor indicating it has exceeded: (12v systems) 10A for 100ms (24v systems) 6.0 amps AND less than 10 amps for (100 msec)</td>
<td>If mast stops at ~70° and issues error, replace Base Board. Current sense circuit has failed. If error occurs during nesting, check LED D7 “MAST STOWED (near 0°)”. Once the sensor “sees” the magnet, it allows 0.5 sec to see the (nesting) current rise. If the circuit does not see the sensor, it does not look for nesting current to shut down. It will keep driving into the saddle and then issue a 1.04. Re-adjust Near 0° sensor. Bad actuator – AC component in current wave shape due to internal mechanical problem. Replace actuator.</td>
</tr>
<tr>
<td>1,05</td>
<td>Well Open (Vertical with well cover) - Switch Output Error</td>
<td>Sensor outputs are bad.</td>
<td>Defective switch or wiring error. Refer to System Wiring Diagram.</td>
</tr>
<tr>
<td>1,06</td>
<td>Well Open (vertical with well cover) - Switch State Error.</td>
<td>Switch outputs are O.K., but show wrong polarity for closed state.</td>
<td>Well cover open or wiring error. System is expecting the well cover to be closed at power-up.</td>
</tr>
<tr>
<td>1,07</td>
<td>Microprocessor Error</td>
<td>No successful poll / response communication for 250ms.</td>
<td></td>
</tr>
<tr>
<td>1,08</td>
<td>Internal firmware detected error.</td>
<td>Internal state machine logic has detected an invalid state transition. Firmware logic error.</td>
<td></td>
</tr>
<tr>
<td>1,09</td>
<td>Initiate Pushbutton input error.</td>
<td>Init input has remained active for 5 seconds. Input is stuck, or has been hot-wired.</td>
<td>1. Unit is in NFPA mode and connected to a Non-NFPA J-box. (Note: if the unit is in Non-NFPA mode and connected to an NFPA junction box, the unit will look normal (UP led on HHRC on), but will not respond to the HHRC. The software is expecting to see the init signal always on. No error message is generated). 2. Wiring short in the control cable or defective switch/wiring in the junction box.</td>
</tr>
<tr>
<td>1,10</td>
<td>Memory Error</td>
<td>Memory Error</td>
<td></td>
</tr>
<tr>
<td>1,11</td>
<td>Actuator current has unexpectedly stopped</td>
<td>During decline, the Base board senses actuator current. After the “Near 0°” sensor is detected, it is expecting to see the current level rise before it stops. This error indicates the sensed current has stopped before nesting.</td>
<td>If it occurs near the nested position: Actuator has reached its internal stop before nesting completed, most likely saddle too low or saddle not secured causing sideways movement when nesting.</td>
</tr>
<tr>
<td>Message</td>
<td>Meaning</td>
<td>Root Issue</td>
<td>Potential Cause</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1,12</td>
<td>Sensor Output Error</td>
<td>Sensor outputs are bad.</td>
<td>Wiring error, faulty sensor (Vertical only) mag switch positioning. Note: Sensor is only active as mast tube magnet goes by. Software watches for direction of travel and sensor activation to determine if mast is “up” or “down”.</td>
</tr>
<tr>
<td></td>
<td>Roof-mount - Actuator at 90° magnetic sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vertical - Upper magnetic sensor switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,13</td>
<td>RCP STOWED magnetic sensor – Sensor Output Error</td>
<td>Sensor outputs are bad.</td>
<td>Wiring problem, defective magnetic sensor.</td>
</tr>
<tr>
<td></td>
<td>(Upper magnetic sensor on Vertical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,14</td>
<td>Mast Down (lower magnetic sensor)</td>
<td>1. Sensor outputs bad. They have not been opposite for &gt;250ms. or 2. Mast was told to go up, and the sensor indicates it did not move after 8 seconds (v7.2), or 15 seconds (v7.3). or 3. Sensor is not seeing magnet when mast is fully retracted.</td>
<td>1. There may be a wiring problem, or a defective magnetic sensor. or 2. Defective magnetic sensor, air supply inadequate, or external magnet affecting sensor. or 3. Sensor not seeing magnet - sensor needs to be re-aligned.</td>
</tr>
<tr>
<td></td>
<td>1. Sensor Output Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Sensor State Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,15</td>
<td>At 90° (Actuator) - Sensor State Error</td>
<td>Checked at power up after stowing. Sensor outputs are O.K., but sensor shows wrong polarity for nested state.</td>
<td>Board was changed or updated while the mast was at 90°.</td>
</tr>
<tr>
<td>1,17</td>
<td>Well Closed (Vertical with well cover) - Switch Output Error.</td>
<td>Sensor outputs are bad.</td>
<td>D7 Green = Closed D8 Yellow = Not Closed</td>
</tr>
<tr>
<td>1,18</td>
<td>Well Closed (Vertical with well cover) – Sensor State Error</td>
<td>Switch outputs are O.K., but show wrong polarity for Well Closed.</td>
<td>Switch wiring, defective switch, board.</td>
</tr>
<tr>
<td>1,19</td>
<td>Both Near 0° and 90° - Sensor State Error</td>
<td>Both the Nested LS and the 90° LS have been detected active at the same time. This is an invalid condition, and indicates a problem with one or both sensors.</td>
<td>Both sensors indicate proximity, one may be bad.</td>
</tr>
<tr>
<td>1,20</td>
<td>Forced Stow has been activated</td>
<td>This fault is set when the Forced Stow switch is activated to assure the system is not in normal operation during the forced stow operation.</td>
<td>Forced Stow button has been activated</td>
</tr>
<tr>
<td>Message</td>
<td>Meaning</td>
<td>Root Issue</td>
<td>Potential Cause</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>WRN 2,04</td>
<td>Single-tilt - Tilt Stuck</td>
<td>Checked only when moving out of a limit position. The software indicates the state of the (left) tilt photosensor has not changed even though the motor has been told to move for more than 1/2 second.</td>
<td>Something is preventing movement of left tilt mechanism, the motor is defective, or the RCP board is defective.</td>
</tr>
<tr>
<td></td>
<td>Dual-tilt - Left Tilt Stuck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRN 2,05</td>
<td>Right Tilt Stuck</td>
<td>Checked only when moving out of a limit position.</td>
<td>Something is preventing movement of right tilt mechanism, the motor is defective, or the RCP board is defective.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The software indicates the state of the right tilt photosensor has not changed even though the motor has been told to move for more than 1/2 second.</td>
<td></td>
</tr>
<tr>
<td>WRN 2,06</td>
<td>Pan Stuck</td>
<td>Checked only when moving out of a limit position.</td>
<td>Something is preventing movement of pan mechanism, the motor is defective, or the RCP board is defective.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The software indicates the state of the pan photosensor has not changed even though the motor has been told to move for more than 1/2 second.</td>
<td></td>
</tr>
<tr>
<td>2,01</td>
<td>Pan Limit Overlap</td>
<td>The software indicates both pan photosensors are blocked simultaneously.</td>
<td>Foreign material in one of the photosensors or faulty photosensor.</td>
</tr>
<tr>
<td>2,03</td>
<td>TILT pot stuck</td>
<td>No movement detected in expected direction for 2.0 seconds</td>
<td>Soft stops are not set, something is preventing the sense voltage (pot) movement, the motor is defective, the sense voltage is going the wrong way (miswire), or the P/T drive board is defective.</td>
</tr>
<tr>
<td></td>
<td>(Positioner Only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,04</td>
<td>PAN pot stuck</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Positioner Only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,07</td>
<td>Communication Timeout</td>
<td>The RCP or P-T Drive board has not sent out communications recently.</td>
<td>Bad board or connection in communications link.</td>
</tr>
<tr>
<td>2,08</td>
<td>Microprocessor error</td>
<td>The RCP board has sent an invalid message.</td>
<td>Indicates a software problem.</td>
</tr>
<tr>
<td>2,09</td>
<td>(RCP Only) (Left) Tilt Up wrap around</td>
<td>The software indicates the same photosensor was made before the opposite limit photosensor was made to stop rotation. This indicates wrap around.</td>
<td>1. The flag that interrupts the light may need to be adjusted to go deeper into the photocell. 2. The limit photosensor is defective.</td>
</tr>
<tr>
<td>2,10</td>
<td>(RCP Only) (Left) Tilt Down wrap around</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,09</td>
<td>(Positioner Only) Pan Pot Failure</td>
<td>The Positioner software indicates the pot feedback voltage is out of acceptable operating range.</td>
<td>Defective pot, incorrect wiring, bad connection, defective P-T board.</td>
</tr>
<tr>
<td>2,10</td>
<td>(Positioner Only) Tilt Pot Failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,11</td>
<td>2,11 Right Tilt Up wrap around</td>
<td>The software indicates the same photosensor was made</td>
<td></td>
</tr>
<tr>
<td>Message</td>
<td>Meaning</td>
<td>Root Issue</td>
<td>Potential Cause</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| 2,12    | 2,12 Right Tilt Down wrap around | before the opposite limit photosensor was made to stop rotation. This indicates wrap around. | 1. The flag that interrupts the light may need to be adjusted to go deeper into the photocell.  
2. The limit photosensor is defective |
| 2,13    | 2,13 Pan Right wrap around | The software indicates the same photosensor was made before the opposite limit photosensor was made to stop rotation. This indicates wrap around. | The limit photosensor is defective. |
| 2,14    | 2,14 Pan Left wrap around | | |
| 2,15    | Left Tilt Limit Overlap | The software indicates both tilt photosensors appear to be blocked simultaneously. | Foreign material in one of the photosensors or faulty photosensor. |
| 2,16    | Right Tilt Limit Overlap | | |

**Table 6-3  HHRC Codes**

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
<th>Potential Cause</th>
</tr>
</thead>
</table>
| WRN 3,02 | Dual HHRC simultaneous inputs | Two HHRCs are sending commands simultaneously.  
- If commands are not conflicting, they will be allowed (Base Board decides).  
- If commands are conflicting, no action/movement will be allowed by the Base Board.  
- Warning appears regardless of conflicting or not conflicting to alert operators that someone else is trying to operate the unit simultaneously. | |
| 3,07 | Unrecoverable Communication Error | The display board in the HHRC or PMRC has power, but the Base Board is not communicating with it. It may be caused by the HHRC, Base Board, RCP Board, or any other device that is using the RS-485 communication lines in the system.  
On an error, the Base Board stops the program, sends out the error code to the display devices and ‘flashes’ the code on the Base Board LED. Because one error can cause others to follow, the only code that is displayed/flashed is the first one that occurs. Other errors may happen after that, but they are not displayed. The idea is to show the actual initial problem, rather than any potentially confusing follow-on errors. | Defective HHRC or defective base board. Bad or improper connection in communications link, or HHRC is not properly powered. Check continuity of the data lines from the DC power cable connector to the HHRC connector. Refer to System schematic. Also check that the shield in the junction box has a good electrical connection to the electronics common at one end or the other, but not both. |
| 3,08 | Microprocessor Error | Internal firmware detected error. | Replace HHRC or HHRC Display pcb. |
| 3,09 | RF module Error | Wireless Transmitter/Receiver did not properly initialize. | Return HHRC to factory for repair. |
Table 6-4  D-Tec II Sensor Board Codes

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
<th>Potential Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,01</td>
<td>Lamp Fault</td>
<td>The D-Tec has sensed a fault in the LED lamp circuit.</td>
<td>This check is made when the mast thinks it has just arrived at 90°. The D-Tec Sensor measures the current through the look-up LED’s to see if it is within a certain range. If it is not, the fault occurs.</td>
</tr>
<tr>
<td>5,03</td>
<td>SPI Fault</td>
<td>A communications bus internal to the D-Tec II sensor has failed during self-test.</td>
<td>Defective Sensor</td>
</tr>
<tr>
<td>5,07</td>
<td>Unrecoverable Communication Error</td>
<td>No successful communication for 250ms.</td>
<td>Check connection (data lines, ground) for continuity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This error may also be displayed on systems without a D-Tec if the Base Board is missing the 4710801 DIP Switch Shunt Board.</td>
</tr>
<tr>
<td>5,09</td>
<td>E-Field Fault</td>
<td>E-Field portion of the D-Tec II failed its self-test.</td>
<td>Defective sensor</td>
</tr>
<tr>
<td>5,10</td>
<td>H-Field 1 Fault</td>
<td>One axis of the Magnetic Field portion of the D-Tec II failed its self-test.</td>
<td>Defective sensor</td>
</tr>
<tr>
<td>5,11</td>
<td>H-Field 2 Fault</td>
<td>One axis of the Magnetic Field portion of the D-Tec II failed its self-test.</td>
<td>Defective sensor</td>
</tr>
<tr>
<td>5,12</td>
<td>H-Field 3 Fault</td>
<td>One axis of the Magnetic Field portion of the D-Tec II failed its self-test.</td>
<td>Defective sensor</td>
</tr>
<tr>
<td>5,15</td>
<td>Ultrasonic Fault</td>
<td>The ultrasonic portion of the D-Tec II failed its self-test.</td>
<td>Check for ultrasonic physical sensor or deflector damage.</td>
</tr>
<tr>
<td>5,16</td>
<td>Supply Voltage Fault</td>
<td>The power supply section of the D-Tec II sensor is outside proper operational limits.</td>
<td>Check power connections, voltage level and induced noise on power source.</td>
</tr>
</tbody>
</table>

Table 6-5  Wireless J-Box and Wireless HHRC Codes

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
<th>Potential Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,07</td>
<td>Unrecoverable communication error</td>
<td>No successful poll / response communication for 250ms.</td>
<td>J-Box is not ‘talking’ to any other board. Check Base Board flashes and HHRC display for x.07.</td>
</tr>
<tr>
<td>8,08</td>
<td>Internal firmware detected error</td>
<td>Internal state machine logic has detected an invalid state transition.</td>
<td>Firmware logic error.</td>
</tr>
<tr>
<td>8,09</td>
<td>RF module error</td>
<td>XBee plug-in module did not properly initialize.</td>
<td>Bad module.</td>
</tr>
<tr>
<td>8,10</td>
<td>Memory Error</td>
<td>Memory Error</td>
<td></td>
</tr>
</tbody>
</table>
### Message Meanings

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
<th>Potential Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,11</td>
<td>HHRC power up negotiation failed</td>
<td>Unit could not establish communication with any HHRC (wired or wireless) when the NS 3.0 / 4.5 was powered up. Panel Mount = unit 3, Wireless HHRC = unit 6, J-Box = unit 8. System can have a panel mount remote and an HHRC, or 2 HHRCs, but never 3 remote units. Negotiation happens every time the Base unit is powered up w/push-pull switch.</td>
<td>Wireless HHRC is not plugged in during “Pull to Start” power-up.</td>
</tr>
<tr>
<td>8,12</td>
<td>In-system reprogramming failed</td>
<td>Dip-switch activated in-system reprogramming of attached devices was not able to successfully complete.</td>
<td></td>
</tr>
</tbody>
</table>

### 6.2 Troubleshooting Mechanical Symptoms

This section describes mechanical troubleshooting of your system.

Table 6-6 lists some problems that may be observed, but may not generate an error or warning code on the controller.

**Table 6-6 Mechanical Symptoms and Troubleshooting Sequence**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Root Issue</th>
<th>Troubleshooting Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mast sticking during extension or retraction.</td>
<td>Mast is dirty and/or requires lubrication.</td>
<td>1) Clean and lubricate mast. 2) If condition continues, mast requires overhaul.</td>
</tr>
<tr>
<td>Mast leaks down when extended.</td>
<td>Air leak in mast or valve/compressor assembly.</td>
<td>Use a soapy water solution to pinpoint the leak. If the mast is leaking, it will require new seals. If the valve or compressor assembly is leaking at a fitting, remove the fitting, clean and reinstall using thread tape or sealant. Replace a faulty valve or compressor.</td>
</tr>
<tr>
<td>Erratic or noisy when raising to 90°.</td>
<td>Bent or worn actuator or pivot shaft.</td>
<td>Replace damaged component.</td>
</tr>
<tr>
<td>RCP continually pans or tilts.</td>
<td>Bent flag in RCP.</td>
<td>1) Remove RCP cover straighten or replace flag. 2) Make sure wiring is not wound tight. Reset home position.</td>
</tr>
<tr>
<td>Symptom</td>
<td>Root Issue</td>
<td>Troubleshooting Sequence</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pan or tilt motor will not respond with no errors displayed on remote control(s).</td>
<td>Broken or loose motor wire lead or faulty motor.</td>
<td>1) Reconnect wire lead.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Replace motor.</td>
</tr>
<tr>
<td>Mast fails to fully nest in saddle and disconnects power.</td>
<td>Binding of actuator, software fault or control erroneously sensed an increase in current.</td>
<td>1) Check that Base Board has software version 2.6 or later. Contact Will-Burt if update is required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) See the Night Scan Product Troubleshooting Guide for software fault codes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Check actuator for binding. Replace actuator if binding.</td>
</tr>
<tr>
<td>Mast will not begin to lower from 90° position.</td>
<td>Mast tube sections do not fully collapse.</td>
<td>1) Extend and retract mast.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Check tube sections for damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Internal coil cord may be binding, contact Will-Burt.</td>
</tr>
<tr>
<td>Mast will not begin to lower from 90° position.</td>
<td>Magnetic switch band-clamped to mast is not made.</td>
<td>1) Magnetic switch is may be out of adjustment. Loosen clamp and slide switch up and down the mast until contact is established.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Check wiring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Replace defective magnetic switch.</td>
</tr>
</tbody>
</table>
Section 7 Appendix
This section contains the appendixes for your system.

7.1 Automated Hatch Cover
Some integrators may want to put the vertical in a well and include a hatch cover that would be automatically opened by the system. See the system wiring diagram (Section 8) for information on how to wire an automated hatch cover.

7.2 Installing the PMRC
There are several types of controllers available for your system. This section will describe how to install the PMRC. See the drawings at the end of this manual for additional information on installing the controller including information on physical dimensions, and the placement of the mounting holes.

7.2.1 Attaching the PMRC
To attach the PMRC:

1. Find a convenient, dry location to mount the PMRC.
2. At the desired location, cut the panel to the dimensions of the PMRC (Figure 7-1).

![Figure 7-1 PMRC Dimensions](image-url)
3. Provide four #10 round head screws.
4. Place the PMRC through the panel cutout.
5. From the front of the PMRC, fasten the PMRC to the base with the #10 screws.

7.2.2 Wiring the Base Board
See Section 2 of this manual for information on how to wire the Base Board.

7.2.3 Wiring the PMRC
One end of the Control Cable must be wired to a provided plug which connects to the back of the PMRC.

To wire the PMRC plug:

1. See the electrical drawings at the end of this manual.
2. Ensure power is disconnected from the system.
3. Connect the wires from the Control Cable to the supplied PMRC plug.
4. Plug the cable into the back of the PMRC.

7.3 Installing the Wireless HHRC
There are several types of controllers available for your system. This section will describe how to install the Dual-Tilt Wireless HHRC.

7.3.1 Attaching the J-Box
Wireless HHRCs require the installation of a junction box (also called a J-Box) with a “Start/Stop” button. The J-Box should be placed in a dry location where the operator is most likely to be if it is needed to stop the system in an emergency. Hardware for attaching the J-Box is not included with the shipped items.

Attach the J-Box as follows:

1. Measure the thickness of the panel where the J-Box will mount.
2. Provide four #8 screws that are ¾” plus the panel thickness long.
3. Provide four #8 lock washers and nuts.
4. Loosen the four J-Box cover screws and remove the J-Box cover.
5. Drill four holes through the mounting panel based on the mounting hole locations (Figure 7-2).
6. Place the J-Box on the panel.

7. Fasten the J-Box to the panel with the four #8 screws and with lock washers and nuts on the backside.

### 7.3.2 Attaching the Holder

See Section 2 of this manual for information on how to attaching the Holder for the HHRC.

### 7.3.3 Wiring the Base Board

See Section 2 of this manual for information on how to wire the Base Board.

### 7.3.4 Wiring the J-Box

To wire the J-Box:

1. See the electrical schematics in section 7.
2. Strip off ½” off the green, gray, and violet wires.
3. Connect the three wires to the terminal strip in the J-Box. Ensure that the wires match the J-Box label (GREEN, GRAY, VIOLET).
4. Replace the J-Box cover and tighten the four J-Box cover screws.
7.3.5 Connecting the Controller

The wireless HHRC can be operated in wired or wireless mode. To be used in wired mode, the HHRC must be plugged into J-Box. Before the wireless HHRC can be used in wireless mode, it must be initialized and charged.

To connect the Wireless HHRC:

1. Push the “Start/Stop” button to ensure the system is off.
2. Plug the HHRC into the J-Box.
3. Twist the plug to the right to secure the connection.

7.3.5.1 Initializing the Wireless HHRC and J-Box

The wireless HHRC must be plugged into the J-Box when the unit is first powered up so that the HHRC wireless module can be initialized. During initialization, the wireless module in the HHRC and the wireless module in the J-Box negotiate to configure the devices to only communicate with each other. Once complete, the wireless HHRC may be disconnected and will operate the unit in wireless mode so long as the J-Box has power. If the J-Box is turned off or cycled, the wireless HHRC will need reinitialized.

7.3.5.2 Charging the Wireless HHRC

During operation, the display will show the charge level by indicating “BAT xx%” when not in sleep mode. When the unit is not in use, the wireless HHRC should plugged into the J-Box to charge. The word “Charging” will flash on the wireless HHRC display during this process. The first time the wireless HHRC is charged will take 24 hours. With normal use, it will subsequently charge in approximately 15 to 20 minutes. If left unplugged, it will eventually self-discharge and may take 20-24 hours to get back to 100%. In order to conserve power, the wireless HHRC enters sleep mode within 5 seconds if no buttons are pressed.
Section 8 Drawings
This section contains drawings for your system.
SINGLE-TILT RCP

DUAL-TILT RCP

LIGHT POWER WIRING

1. AC LIGHTS
2. DC LIGHTS
3. PROFILE
4. 4 pin plug

912760-CE
NS 24 V RCP

912761-CE
NS 24 V RCP

TP-4836201-F
October 2016

8-5
POWERLITE WIRELESS, J-BOX ONLY

NOTES:
1. "MAST ACTIVE" CONTACTS, J4 R9:
   USE SW2-1 ON BASE BOARD TO SELECT OPEN OR CLOSED WHEN MAST ACTIVE.
   SW2-1 OPEN = CONTACTS OPEN WHEN ACTIVE.
   SW2-1 CLOSED = CONTACTS CLOSED WHEN ACTIVE.
   2 AMPS MAX CURRENT, 20 GA. MINIMUM CONDUCTOR. 18/2 SJOW AVAILABLE.
2. SW2-2 ON BASE BOARD. MUST BE OPEN (OFF) FOR NFPA MODE.
3. SW2-3 ON BASE BOARD. MUST BE CLOSED (ON) STANDARD MODE.
4. REMOVE JUMPER(S) IF REPLACED BY PARKING BRAKE INTERLOCK. J4-5 TO J4-7 CLODED WHEN BRAKE "ON". THIS FUNCTION AVAILABLE IN STANDARD MODE ONLY.
5. 452180W CABLE. ALL WIRES 20 GA. EXCEPT RED AND BLACK (J4-1 AND 2).
6. OPTIONAL DISABLE INPUT, CUSTOMER SUPPLIED CONTACTS. MUST HAVE CONTINUITY TO FUNCTION.
   WILL NOT ALLOW OPERATION IF OPEN, ACTS AS EMERGENCY STOP
7. 18 GA. MIN. FOR J-BOX POWER. SEPARATE POWER TO BASE BOARD TB4 REQUIRED.
8. TORQUE: 4.4N·m, 0.5Nm
9. TORQUE: 20N·m, 2.5Nm
Night Scan Powerlite
Roof-mount, NFPA or Standard,
Wireless J-box

Drawing: WD-72307

Sheet 1 of 2
Night Scan Powerlite
Roof-mount, NFPA or Standard,
Wireless J-box

Drawing: WD-72307
Sheet 2 of 2
SINGLE REMOTE WITH EMERGENCY STOP

WHEN WIRING TWO ACCESS POINTS FOR USE WITH ONE HHRC:
PARALLEL CONNECT TO J4 AS FOR A SINGLE CONTROLLER.

(2) REMOTES WITH EMERGENCY STOP
POWERLITE DUAL-TILT HHRC ONLY, NOT AVAILABLE FOR CHIEF SINGLE-TILT.

NOTES
1. "MAST ACTIVE" CONTACTS (J4 8,9)
   USE SW2-2 ON BASE BOARD TO SELECT OPEN OR CLOSED WHEN MAST ACTIVE.
   SW2-1 OPEN = CONTACTS OPEN WHEN MAST ACTIVE.
   SW2-1 CLOSED = CONTACTS CLOSED WHEN MAST ACTIVE.
   2. HARMS MAX CURRENT, 20 A, MINIMUM CONDUCTOR, 162V SDOW AVAILABLE.
   3. SW2-2 ON BASE BOARD MUST BE OPEN OR CTL FOR HHRC MODE.
   4. REMOTE (JUMPERS) IF REPLACED BY PULLING BRAKE INTERLOCK, J4-5 TO J4-7 CLOSED WHEN BRÅKE "ON". THIS FUNCTION AVAILABLE IN STANDARD MODE ONLY.
   5. E2: PIN 33, 70 CONDUCTORS, 22 GA. WIRES 22 GA. EXCEPT RED AND BLACK (J4-1 AND 2).
   6. OPTIONAL DIAL: USER, CUSTOMER SUPPLIED CONTACTS. MUST HAVE CONTINUITY TO FUNCTION.
   7. 16 GA, MIN. FOR 1 BOX POWER. SEPARATE POWER TO BASE BOARD TB4 REQUIRED.
   8. TORQUE: 4.4 in-lb, 0.5Nm
   9. TORQUE: 20-15 in-lb, 2.9Nm

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