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.
## Document History

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

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

**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.

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

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.

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.

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.

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.

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.

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.
**WARNING**

**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.

**CAUTION**

**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.

**CAUTION**

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

**CAUTION**

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

**CAUTION**

**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.

**CAUTION**

**Safety Instruction – Operation!** All operators must read the Operation section of this manual and be properly trained.
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 Complete light tower is a vertically mounted light tower which was designed to be installed externally to the side or rear of a vehicle. The Vertical Complete includes an on-board compressor for elevation and requires no truck air. The unit is designed for the purpose of providing temporary on-the-scene lighting. It may also serve as a platform for communications antennae or a camera.

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 Complete 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)
1.5 Major Components

The major components of the Vertical Complete are:

- Mast
- Remote Controlled Positioner (RCP)
- Control Box
- Lights
- Controller (not shown)
- Mounting Hardware
- Non-Rotatable Base Plate
- Saddle

Refer to Figure 1-2 for identification of the major components of the Vertical Complete. Note: Depending on the model, the control box may be attached either to the bottom or the side of the Vertical Complete.
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

![Figure 1-3 Mast Components](image)

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 Remote Controlled Positioner (RCP)
The single-tilt RCP (Figure 1-4) 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. 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.

![Figure 1-4 Remote Controlled Positioner (RCP)](image)
1.5.3 Control Box

The control box (Figure 1-5) contains the Base Board for the system, and the Solenoid Valve Assembly.

![Control Box Setups](image)

1.5.4 Lights

The Night Scan Vertical Complete systems can come with a variety of LED or Halogen lighting packages (Figure 1-6). For additional information on the lights, see [www.willburt.com](http://www.willburt.com).
1.5.5 Controller
The wired hand-held remote controller (HHRC) can be used to operate all functions of the system.

The controller (Figure 1-7) 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

![Wired HHRC](image)

*Figure 1-7 Wired HHRC. Standard (non-NFPA) models do not include the green NFPA Start button.*

1.5.5.1 Controller Interface
The wired HHRC connects through a bulkhead (Figure 1-8).
1.5.6 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.

1.5.7 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.

1.6 Unit Specifications

Table 1-1 lists the specifications for your system.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td>Extended Height</td>
<td>7.5 ft. (2.3m)</td>
</tr>
<tr>
<td>Number of Tubes</td>
<td>5</td>
</tr>
<tr>
<td>Tube Diameter Range</td>
<td>3.5 to 2.5 in. (88.9 to 63.5 mm)</td>
</tr>
<tr>
<td>Number of Lights Available</td>
<td>2 or 4</td>
</tr>
<tr>
<td>Light Type Available</td>
<td>LED / Halogen</td>
</tr>
<tr>
<td>Maximum Lumens</td>
<td>140,000</td>
</tr>
</tbody>
</table>

Note: The electronics in the system will run from 10-33 VDC, but are nominal 12 VDC devices. The boards driving them monitor and chop the battery voltage at 300 Hz adjusting the duty cycle to deliver 12 VDC. During mast incline at 13.8 VDC the system may draw up to 13 amps. During mast incline at 28.8 VDC the system may draw up to 9 amps.
(This page is intentionally left blank.)
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>
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<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
- Wired HHRC with Bulkhead
- 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 mounted in a well, provide adequate drainage. A minimum of four 1” diameter drain holes (one per corner) are recommended.

2. Ensure that the control box, mast, and saddle are on a flat surface and in same plane. Switches set at the factory are based on a level surface. If the system is not level, these switches may need adjusted as described in Section 4 of this manual.

3. The areas to which the unit is mounted must be reinforced to withstand mast loads. Be sure to mount the unit out of reach in order to ensure safety distances and prevent hazardous zones being reached by upper extremities or the operator or bystanders.

4. Reference Figure 2-2 for mounting hole locations for your system. These locations will vary based on which system you are using. Drill six 5/16” mounting holes into the vehicle mounting structure in the mounting locations. There are four holes for the control box, and two holes for the saddle.

5. Attach the system to the vehicle using 5/16” bolts. Torque all hardware as appropriate for its material and size. The saddle must be attached so that it is centered with the RCP and mast base tube.

It is the responsibility of the customer to properly secure the payload for vehicle travel.
Figure 2-2 Mounting Hole Locations
2.6 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 2-3). 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.
2.7 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 2-4).

3. Using the screws, washers, and nuts provided, attach the bulkhead to the vehicle.
4. Attach the ground wire to the vehicle.
2.8 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 2-5). Ensure that the wider end of the bevel is up.

2. Place the HHRC onto the holder.

2.9 Wiring the Base Board
Ensure the power is off before wiring the Base Board. See Figure 1-5 for information on where the cables run into the control box.
2.9.1 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.

2.9.1.1 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 1-5).

2.9.1.2 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 2-7).

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 2-8) with position 1 ON (closed).
2.9.2 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 2-7). The source must be capable of delivering (5) amps minimum.

2.10 Connecting the Warning Light/ Interlock Output Contact

The mast provides an isolated relay contact output to enhance integration into vehicle safety circuitry (Figure 2-9). 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.

![Figure 2-9 Relay](image)

2.11 Connecting the Interlock Input Contact

Some safety standards requires 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.
2.12 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 Controller

Using the single-tilt wired hand-held 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 for the wired HHRC:

- 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.

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. Ensure the wired HHRC 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.
(This page is intentionally left blank.)
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

⚠️ WARNING

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.

⚠️ 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.

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 ( 和 )

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 single tilt RCP reference Figure 4-2.

![Single Tilt Flags](Figure 4-2 Single Tilt Flags)
4. Once the set screws are loose, pan (\(\text{\rotatebox{90}{\small\text{\(\pm\)}}}\) and \(\text{\rotatebox{90}{\small\text{\(\pm\)}}}\)) and tilt (\(\text{\rotatebox{90}{\small\text{\(\pm\)}}}\) and \(\text{\rotatebox{90}{\small\text{\(\pm\)}}}\)) 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 single tilt RCP reference Figure 4-3. 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.

![Figure 4-3 Single Tilt RCP Home Position](image)

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.
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 5-1 RCP Delay

<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.

Figure 5-1 Optional Strobe/Beacon Light
5.3 Will-Burt Mast Oil MSDS Sheet

MATERIAL SAFETY DATA SHEET (MSDS)
The Will-Burt Company Orrville, 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)-229-3882
CHEMTREC Phone Number: (800)-424-9300

Product Name: Masterdraw B985 B
Product Number: 008826
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 mucus 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 Explosion Hazards: None

Products of Combustion: Highiy 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 diking 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 free 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 overexposure 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:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>% by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 &quot;up&quot; (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 0°) – 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:</td>
<td>If mast stops at ~70° and issues error, replace Base Board. Current sense circuit has failed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12v systems) 10A for 100ms</td>
<td>If error occurs during nesting, check LED D7 &quot;MAST STOWED (near 0°)&quot;. Once the sensor &quot;sees&quot; 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(24v systems) 6.0 amps AND less than 10 amps for (100 msec)</td>
<td>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).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>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>Memory Error</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:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>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>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>WRN 2,05</td>
<td>Right Tilt Stuck</td>
<td>Checked only when moving out of a limit position. 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>Something is preventing movement of right tilt mechanism, the motor is defective, or the RCP board is defective.</td>
</tr>
<tr>
<td>WRN 2,06</td>
<td>Pan Stuck</td>
<td>Checked only when moving out of a limit position. 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>Something is preventing movement of pan mechanism, the motor is defective, or the RCP board is defective.</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 (Positioner Only)</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>2,04 (Positioner Only)</td>
<td>PAN pot stuck</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 (RCP Only)</td>
<td>(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 (RCP Only)</td>
<td>(Left) Tilt Down wrap around</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,09 (Positioner Only)</td>
<td>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 (Positioner Only)</td>
<td>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>
</tbody>
</table>
### Table 6-3  HHRC Codes

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
<th>Root Issue</th>
<th>Potential Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,12</td>
<td>2,12 Right Tilt Down wrap around</td>
<td>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>2,13</td>
<td>2,13 Pan Right 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>The limit photosensor is defective.</td>
</tr>
<tr>
<td>2,14</td>
<td>2,14 Pan Left wrap around</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,15</td>
<td>Left Tilt Limit Overlap</td>
<td>The software indicates both tilt photosensors appear to be blocked simultaneously.</td>
<td>Foreign material in one of the photosensors or faulty photosensor.</td>
</tr>
<tr>
<td>2,16</td>
<td>Right Tilt Limit Overlap</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<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. 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>
6.2 Troubleshooting Mechanical Symptoms

This section describes mechanical troubleshooting of your system.

Table 6-5 lists some problems that may be observed, but may not generate an error or warning code on the controller.

Table 6-5 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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>RCP continually pans or tilts.</td>
<td>Bent flag in RCP.</td>
<td>1) Remove RCP cover straighten or replace flag.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Make sure wiring is not wound tight. Reset home position.</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>
</tbody>
</table>
(This page is intentionally left blank.)
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. Figure 7-1 shows one example of how this might be implemented. The relay K1, both limit switches, and hatch solenoid valves are all supplied by the integrator. The theory of operation is as follows:

When the system is initiated and the up button pressed, the system will open its “mast inactive” contact between pins J and K of the DC/Control Cable, thus de-energizing K1. This will apply pressure to the air valve to open the hatch. As soon as the hatch cover moves off the “Hatch Closed” limit, the switch will open and the warning light will come on. (The “Hatch Closed” limit switch is wired to take the place of the system “mast inactive” contacts.) Once the hatch is fully opened, the “Hatch Open” limit switch will close allowing the up valve of the mast (part of the system supplied by Will-Burt) to be energized and the mast will extend. Stowing of the mast reverses this process. When the mast is completely lowered, the system will de-energize itself and close the “mast inactive” contact between pins J and K of the DC/Control. This will energize relay K1 removing power to the hatch open valve and energize the hatch close valve. Once the hatch is completely closed, the “Hatch Closed” limit switch will close and turn off the warning light. Please refer to the Drawings for details.

Figure 7-1 Automated Hatch Cover Control Schematic
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Section 8 Drawings

This section contains drawings for your system.
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HHRC WITH EMERGENCY STOP
NFPA OR STANDARD OPERATION

<table>
<thead>
<tr>
<th>NFPA</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIT</td>
<td>HHRC</td>
</tr>
<tr>
<td>4756919</td>
<td>4520001</td>
</tr>
<tr>
<td>4756920</td>
<td>4520002</td>
</tr>
<tr>
<td>4735019</td>
<td>4745601</td>
</tr>
<tr>
<td>4735020</td>
<td>4745602</td>
</tr>
</tbody>
</table>

CHIEF SINGLE-TILT
POWERLITE DUAL-TILT

TWIST TO START
PUSH TO STOP
(SHOWN IN START POSITION)

"NFPA START" SWITCH AND WIRE ON NFPA MODELS ONLY

NOTES
1. TORQUE: 4.4 in-lbs, 0.5Nm
2. "MUST ACTIVE" CONTACTS, J4 OR J4 5-10
   USE SW2-1 ON BASE BOARD TO SELECT OPEN (OFF) OR CLOSED (ON) WHEN NESTED
   SW2-1 OPEN = CONTACTS CLOSED WHEN NESTED
   SW2-1 CLOSED = CONTACTS OPEN WHEN NESTED
3. 2 AMPs MAX CURRENT, 20 GA. MINIMUM CONDUCTOR, CUSTOMER SUPPLIED WIRING
4. SW2-2 ON BASE BOARD, MUST BE OPEN (OFF) FOR NFPA MODE
5. REMOVE JUMPER(S) IF REPLACED BY PARKING BRAKE INTERLOCK, G-H CLOSED WHEN BRAKE "ON"
   AVAILABLE IN STANDARD MODE ONLY
6. 4521982 CABLE, ALL WIRES 20 GA. EXCEPT RED AND BLACK (J-1 AND J-2)
7. OPTIONAL DISABLE INPUT, CUSTOMER SUPPLIED CONTACTS, MUST HAVE CONTINUITY TO FUNCTION, WILL
   NOT ALLOW OPERATION IF OPEN, ACTS AS EMERGENCY STOP
8. BATTERY CONNECTION TO SYSTEM (ALIVE SPICE RECOMMENDED, DO NOT USE TERMINALS E & F
9. 18 GA. MIN. IF USING 4521982 SIGNAL CABLE TO BASE BOARD WITH SEPARATE "ON" TO BASE BOARD

CONNECTIONS

J4 ON BASE BOARD

CONNECT SHIELD GROUNDS TO J4-2
JUMPER FROM 5-7 REQUIRED
FOR STANDARD (NON-NFPA) OPERATION

INTERCONNECT CABLE
CONTROL CABLE ONLY (DOES NOT INCLUDE 10 GA RED & BLACK, 18 GA RED & BLACK NOT TWISTED PAIR)
Night Scan Universal Control
Roof-Mount, NFPA or Standard,
HHRC with Emergency Stop

Drawing: WD-72212