WILL-BURT

nightscan®

Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical Heavy Duty Towing (HDT) Operating Instructions

Night Scan Vertical Complete

Night Scan Vertical

Night Scan Vertical Heavy Duty Towing

The Will-Burt Company
401 Collins Blvd
Orrville, OH 44667, USA

Phone: +1 330 684 4000
E-Mail: info@willburt.com
Website: www.willburt.com

TP-4836201-13, March 2025

Original Instructions

CE UKCA

Authorized Representative:
Will-Burt Germany GmbH & Co. KG
Fischergasse 25
D-91344 Waischenfeld, Germany

INNOVATION ELEVATED®

Warranty

Will-Burt warrants its Night Scan Vertical 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 NONINFRINGEMENT 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.

Contents

1 Safety Summary 5
1.1 Signal Word Definitions 5
1.2 Safety Instructions 5
1.3 Symbols Used on Product Labels 11
2 Specification Compliance 13
2.1 NFPA 1901-2016 13
2.2 CE Declaration of Conformity 13
3 Introduction 15
3.1 Additional Documentation 15
3.2 Intended Use 16
3.3 Mast Position Definition 16
3.4 Mast Component Descriptions 17
3.5 Remote Control Options 25
4 Technical Data 27
5 Installation 29
5.1 Mounting Location Requirements 29
5.1.1 Dimensions 30
5.2 Recommended Installation Tools 31
5.3 Unpacking & Handling 31
5.4 Attaching to the Vehicle 34
5.4.1 Night Scan Vertical Mounting Instructions 34
5.4.2 Night Scan Vertical Complete Mounting Instructions 35
5.4.3 Night Scan Vertical HDT Mounting Instructions 36
5.4.4 Attach Internal Mounting Kit 37
5.4.5 Attach the Base Plate to the Mast 39
5.4.6 Attach the Base Plate to the Vehicle 40
5.4.7 Attach the Support Bracket 41
5.4.8 Attach Optional Shelf Bracket 42
5.4.9 Attach the RCP Saddle Brackets 44
5.4.9.1 Night Scan Vertical 45
5.4.9.2 Night Scan Vertical HDT 47
5.5 Attaching the Control Box 48
5.5.1 Night Scan Vertical 48
5.5.2 Night Scan Vertical Complete 48
5.5.3 Night Scan Vertical HDT 49
5.6 Attaching the Air Connections 50
5.6.1 Night Scan Vertical 50
5.6.2 Night Scan Vertical Complete 52
5.6.3 Night Scan Vertical HDT 52
5.7 Attaching the RCP to the Mast 54
5.8 Installing the Magnetic Switches 55
5.8.1 Attaching the Power Converter 57
5.9 Installing Remote Control 57
5.9.1 Wired Hand-Held Remote Control (HHRC) 57
5.9.2 Panel Mount Remote Control (PMRC) 59
5.9.3 Wireless Remote Control 60
5.10 Electrical Installation Detail 61

5.10.1 Wiring Remote Control Cable to the Base Board 62
5.10.2 Wiring Magnetic Switches to the Base Board 62
5.10.3 Wiring DC Source Power to the Mast Control Circuit 63
5.10.4 Wiring Source Power to the Lighting Circuits 63
5.10.5 Wiring Vehicle Safety Interconnect Circuit 65
5.10.6 Wiring Optional Enable Circuit 65
5.10.7 Power-up and Magnetic Switch Adjustment 66
5.10.8 Secure Wiring and Attach Control Box Lid 66
5.11 Test the Installation 67
6 Operation 69
6.1 Pre-Operation Check 69
6.2 Remote Control Functions 69
6.3 Quick Operation Summary 70
6.4 Initiating (Power-Up) 71
6.5 Extending the Mast 71
6.6 Controlling the Lights 71
6.7 Lowering the Mast 71
6.8 Stowing the Mast 72
6.8.1 Using the Auto Stow® Feature 72
6.8.2 Using the Mast Down Button 73
6.8.3 Emergency Stow with Power 74
6.8.4 Emergency Stow without Power 74
7 Maintenance, Adjustments and Disposal 75
7.1 Power Isolating Procedure 75
7.2 Cleaning and Lubricating the System 75
7.3 Spare Parts 76
7.4 Periodic Inspections 77
7.4.1 Adjusting the Mast Magnetic Switches 78
7.5 Adjusting the RCP Home Position 80
7.5.1 Single-Tilt RCP Home Position Adjustment 80
7.5.2 Dual-Tilt RCP Home Position Adjustment 83
7.6 System Disposal 84
8 Reference Information 85
8.1 DIP Switch Definitions 85
8.2 Beacon Light 86
8.3 D-TEC® Sensor 87
8.3.1 D-TEC® Sensor Location 87
8.3.2 D-TEC® Functionality 88
8.4 Nycoil® (Optional) 90
8.5 Bulb Replacement 90
8.6 The Will-Burt Company Mast Oil Safety Data Sheet 97
9 Troubleshooting 101
9.1 Troubleshooting Electrical 101
9.2 Troubleshooting Mechanical Symptoms 109
10 Appendix 111
10.1 Automated Hatch Cover 111
10.2 System Wiring Diagram 111
10.2.1 Night Scan Vertical Drawings 112
10.2.2 Night Scan Vertical Complete Drawings 116

10.2.3 Night Scan Vertical Heavy Duty Towing (HDT) Drawings 120

Document History

Table 0-1 Document History

Document Revision	Date	Change Details	Changes Backward Compatible with Previous Manual Version
TP-4836201-00	Feb. 2015	Initial release	--
TP-4836201-C	Oct. 2015	Updated Sections 2.12, 2.15, 3.4, 3.8.2, and 5.3. Update formatting.	Yes
TP-4836201-D	Mar. 2016	General update.	Yes
TP-4836201-E	Apr. 2016	Updated Sections 1.5.6, 2.7, 7.1, and 8. Removed Section 7.4. Fixed formatting issue in Section 1.	Yes
TP-4836201-F	Oct. 2016	Updated Section 2.12.	Yes
TP-4836201-G	Mar. 2021	Reformatted including section number and page number changes; updated to latest wireless control; added inspection interval table; Added 4.3-15 model.	Yes for all but the wireless HHRC and remote junction box (No longer covers Zigbee model)
TP-4836201-H	May 2021	Added information about the Vertical Complete and Heavy Duty Towing	Yes
TP-4836201-J	June 2021	Updated graphics and information regarding HDT Air Inlet Assembly	Yes
TP-4836201-L	Nov. 2023	Updated info about control box installation for NS Vertical	Yes
TP-4836201-13	Mar. 2025	Updated Safety Summary, Drawings, and beacon terminology.	Yes

1 Safety Summary

This section describes safety instructions for the Night Scan Vertical that personnel must understand and apply throughout all product activities such as transportation, handling, installation, operation, maintenance, storage, disposal and troubleshooting. Read and understand this entire document, and contact The Will-Burt Company with any questions, before performing any procedure outlined in this document. Keep this document during the entire duration of use of the device. Pass this document along to trained and qualified end users.

1.1 Signal Word Definitions

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 or equipment damage. It is also used to alert against unsafe practices.

1.2 Safety Instructions

⚠ 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. Allow sufficient clearance on all sides of mast to allow for side sway. Do not operate mast during an electrical storm. Be certain electrical cables are undamaged and properly terminated. Do not touch live wires. Follow OSHA or other national safety regulations when working near energized power lines. Personnel working with or near high voltages should be familiar with methods of resuscitation.

⚠ DANGER

Disconnect Power for Service! Always disconnect all power sources following proper lock-out tag-out procedures before performing service, repair or test operations. Remove the tethered hand held control where applicable for added protection during maintenance.

⚠ DANGER

Mast Tip Over Hazard! Mast tip over could result in death or serious injury. 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 and cable size and weight, payload sail area, wind speed, guy line arrangement, support bracket or roof line location, and base plate assembly. Do not operate in wind speed conditions exceeding the maximum rated wind speed. Do not operate on slopes exceeding the maximum deployment angle. Do not install a payload that exceeds the maximum payload lifting capacity of mast. Do not install a payload with the center of gravity offset from mast centerline exceeding the maximum allowed offset. Stand clear of mast and mast payload during operation. Be certain mast is level and secure before and during installation, operation, and maintenance.

⚠ DANGER

Falling Objects from Mast Hazard! Wear a protective hard hat when working on mast or situated near mast operating area while mast is extending, retracting or deployed in any position above the nested position. Improperly secured payload or mast components, ice formations, etc. could be dislodged from mast and fall. Be sure the payload is properly installed and secured.

⚠ DANGER

Relocation/Driving Hazard! Do not relocate the system during operation or while mast is extended to any height above the nested position or powered up. Do not move vehicle until mast has been securely nested and isolated from power. Power-up and operate mast only if the vehicle is stationary and securely parked with the parking brake properly applied. Do not put mast in service or operate without the vehicle interlock warning circuit or magnetic warning kit installed to provide confirmation mast is nested prior to moving the vehicle. Contact The Will-Burt Company Engineering team for special on-the-move situations for military only use on specialized products.

⚠ DANGER

Burst Hazard! For pneumatically operated masts, do not operate without the over-pressure safety valve installed. Keep personnel clear of safety valve exhaust direction. Do not exceed the maximum rated pressure of mast. If the mast air pressure is not fully discharged prior to removing air hoses, a rapid release of air pressure will occur requiring hearing and eye protection.

⚠ WARNING

Payload Lifting Hazard - Intended Use! The mast is intended to lift a specific payload for lighting, surveillance or communication use only. Any other use without written consent is prohibited and could cause death or serious injury. Do not use mast to lift personnel. Do not exceed specified payload capacity. Large payload wind sail areas can reduce payload capacity. Consult The Will-Burt Company Engineering team.

⚠ WARNING

Safety Instruction – Lightning! Lightning protection is not part of this system. A proper means of electrical grounding should be provided. Failure to observe this warning could result in death or serious injury.

⚠ WARNING

Read Operating Instructions! Read and observe the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed in the instructions, wrong installation or incorrect handling can seriously affect the safety of operators and machinery. Adhere to the safety instructions when carrying out any activity relating to the Night Scan Vertical.

⚠ WARNING

Trained Personnel Only! This product is intended for use by trained professionals only. It is not intended for general use by the public or untrained personnel. Handling, installation, operation and maintenance to be performed by trained and authorized personnel only. Only a properly trained and qualified certified electrician should perform electric installations and service.

⚠ WARNING

Erratic Mast Operation Impact Hazard! The mast should operate smoothly during extension and retraction. If erratic mast motion is observed during extension or retraction that results in impact loading between the tube and the tube collar (mechanical travel stop), cease use of the mast and contact The Will-Burt Company service department. Repeated operation with impact loading can damage tubes and lead to mast separation.

⚠ WARNING

Over-current Protection! Over-current protection or power switching by the installer on mast incoming power supply as specified in this document should be a type suitable to allow lock-out tag-out procedures for power disconnect.

⚠ WARNING

Safety Instruction - Explosion! For outdoor use only. Do not use in explosive areas or areas that have been classified as hazardous as defined in Article 500 of the National Electric Code or equivalent national standards. 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.

⚠ WARNING

Safety Equipment (PPE)! Proper personal protective equipment (PPE) like hard hats, gloves, and safety shoes shall be properly worn while working on mast or near the deployment area of mast. In addition, eye protection shall be worn during maintenance procedures. Follow national PPE guidelines in your area of operation.

⚠ WARNING

Pinch Point Hazard! Keep clear of all moving parts like mast collars nesting. Be sure to stay clear of system during operation. Moving parts can crush and cut resulting in serious injury. The mast shall be mounted out of reach of the operator during operation.

⚠ WARNING

Crush Hazard - Mast Failure! Do not stand directly beneath mast or its payload. Be certain the payload is properly installed and secured.

⚠ WARNING

Entanglement Hazard! Tangled cables can cause equipment damage. Ensure payload cables, Nycoil®, trip lines, guy lines or other cables are not tangled and are free to pay out as mast is deployed. Cables that get tangled or snagged on mast or other objects can cause mast tubes to lurch upward suddenly when the cable is freed. This can cause damage to mast and lead to mast separation if repeatedly allowed to continue.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Bright Light Radiation Hazard! For systems equipped with scene lighting or look-up lights, do not look directly into lights when they are illuminated. Temporary impairment or permanent vision damage could occur.

⚠ WARNING

Personnel Freezing/Burn Hazard! If the system is equipped with lights, make sure the lights are completely cool before attempting to clean the lens, replace bulbs or perform maintenance. Wear gloves to protect from contact with exposed metal that may be at extremes of hot and cold temperatures from sun or cold outdoor exposure.

⚠ WARNING

Mast Extension Hazard - Obstruction! Extending mast into obstructions could result in death or serious injury and could render mast inoperable and partially extended. Before applying power and operating 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 mast. Locate the operator station such that the operator has a clear view of the operating space of mast and payload prior to deployment to avoid contact with overhead objects.

⚠ WARNING

Manual Retraction! For powered masts, make sure all power sources have been disconnected from the system prior to manually lowering mast to avoid unexpected start-up motion and/or damage to mast.

⚠ WARNING

Mast Lifting/Handling! Use extreme caution while lifting mast system and when mast system is suspended to avoid injury and equipment damage. Be certain mast is properly secured using at least two sling points at the center of gravity label. All operators should be aware of and follow the applicable local, regional, and national standards and codes of practice for slinging and transporting equipment. Never lift Mast System over people. Ensure lifting equipment including, but not limited to, lifting straps and hoist, are capable of handling the forces generated from lifting the system. Observe manufacturer instructions on lifting equipment.

⚠ WARNING

Remove Payload! For mast systems shipped with no payload (customer installed payloads), remove payload before performing maintenance on mast system. The Will-Burt Company installed devices can remain installed.

⚠ WARNING

Equipment Damage - Submerged! Do not submerge mast in liquid or operate the vehicle in a fording situation that would result in a submerged mast.

⚠ WARNING

Safety Instruction – Keep Clear! Keep personnel clear of the system during operation.

⚠ WARNING

Safety Instruction - Potential Air Contaminants! If internally mounted in a vehicle, air from mast and any accumulated water will discharge into the vehicle. Install appropriate drainage and venting.

⚠ WARNING

Fastener Vibration Hazard! Mast system and payload mounting hardware must include proper means to resist vibration loosening such as thread-locking compound, locking hardware, or equivalent. Use specified assembly torques appropriate for the fastener size.

⚠ CAUTION

Frozen Water Hazard! Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage such as tube deformation. Ensure water is free to exit at the base of mast. Open drain cock when mast is not in operation. The drain cock shall be installed at the lowest position in the pneumatic system. If mounted internally in a vehicle or structure, direct the draining water to a suitable location. Cover locking masts when not in use to limit water ingress. Non-locking masts stored outdoors should be covered if possible. A cover is available from The Will-Burt Company.

⚠ CAUTION

Safety Instruction - Guy Anchors! For masts using Guy Lines, verify the Guy Anchor point strength is adequate to support the Guy Line forces.

⚠ CAUTION

Lubrication! Do not lubricate the exterior of mast moving tubes. The lubricant will attract dust and other environmental contaminants into mast.

⚠ CAUTION

Equipment Damage - Forces! Before unloading the system, be certain the unloading region is capable of resisting forces generated from unloading the system including but not limited to system weight. Ensure the unloading region is level and has sufficient room and strength to hold the system. If the unloading region is incapable of meeting the requirements of the system, damage to the system and/or unloading region could occur.

⚠ CAUTION

Equipment Damage - Support Bracket! For masts using an upper support bracket, do not over-tighten mast support bracket. Over-tightening may damage the Base Tube causing mast tubes to stick.

⚠ CAUTION

Mast and Payload Access! The operator must provide safe means to access mast and payload during installation, removal and maintenance.

⚠ CAUTION

Tripping Hazard! Cables, trip lines, guy lines and guy anchors can be hard to see during and after installation. Any equipment posing trip hazards should be clearly marked.

⚠ WARNING

Emergency Stow! Using the emergency stow button causes the actuator to lower 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. When using the emergency stow button, normal operation switches are disabled. The mast can be overdriven into saddle and cause damage to the unit. Disengage the emergency stow button when the payload reaches the saddle and is tight. Do not drive mast beyond this position.

⚠ WARNING

Manual Tilt! If manually tilting mast, make sure all power has been disconnected from the system prior to manually lowering mast to avoid unexpected motion and/or damaging mast components.

⚠ WARNING

Safety Instruction - Motion on Power Interruption or Emergency Stop! Mast uses a normally open air control valve. If power is lost or turned off or the emergency stop is activated while mast is extended, mast will begin releasing air pressure and retracting at a controlled rate until power is restored or mast fully retracts. Masts that fold down will not initiate any tilt motion.

1.3 Symbols Used on Product Labels

The following symbols are displayed on the product. The symbol meanings are as follows:

This symbol indicates an electrocution hazard or hazardous voltage hazard. There is voltage present inside mast and control box. Do not operate mast near electrical lines or during electrical storms. Contact with high voltage will result in death or serious injury.

This symbol indicates a pinch point hazard. Keep fingers and hands clear of moving parts.

This symbol indicates a tip-over hazard. The mast must be properly supported during transport, handling, installation, maintenance, operation and decommissioning. System tip-over could result in death or serious injury.

This symbol indicates a general warning. In this unit, this symbol indicates a frozen water hazard. Water must be permitted to exit mast to avoid ice damage to mast.

This symbol is used to remind users to read and understand the operator's manual before operating the mast system. Failure to follow operating instructions could result in death or serious injury. Read and understand operating instructions before handling, installing, operating, or maintaining the mast system.

This symbol indicates an electrical ground connection point.

This symbol is used to indicate the center of gravity (COG) of a fully nested mast in a horizontal transport position.

This page intentionally left blank.

2 Specification Compliance

2.1 NFPA 1901-2016

The mast system is designed to be compliant with the following sections of National Fire Protection Agency NPFA-1901-2016 Edition:

22.14 Powered Operated Light Masts

23.13 Power Operated Masts

2.2 CE Declaration of Conformity

Refer to the Product page at www.willburt.com for the latest Declaration of Conformity.

The Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical HDT systems conform to CE standards when used with CE approved lights.

This page intentionally left blank.

3 Introduction

Thank you for selecting The Will-Burt Company for your critical payload elevation needs. These operating instructions describe transporting, handling, installing, operating, maintaining, storing, and troubleshooting procedures for the Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical Heavy Duty Towing (HDT). These procedures assume the use of standard mast systems. Procedures and characteristics for mast systems customized to meet customer-specific needs may vary.

These masts are transportable lighting systems that consist 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 the vehicle air system or an optional compressor unit. The Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical HDT mast systems are designed for installation on any vehicle for the purpose of providing on-the-scene temporary lighting and communications or surveillance. The Night Scan Vertical HDT is designed to fit between the cab and toolbox of a heavy wrecker. This manual covers both the single-tilt and dual-tilt of the masts.

These operating instructions are intended for professionals who are qualified by their appropriate training and experience to perform the procedures. Review this document in its entirety. Contact The Will-Burt Company with any questions before performing any procedure outlined in this manual.

The views depicted in this manual are provided for clarification and are subject to change without notice. Views are not to scale.

The following models are covered in these operating instructions:

- Night Scan Vertical 4.3-15 (1.35-4.08 meters)
- Night Scan Vertical 5.4-17 (1.62-5.18 meters)
- Night Scan Vertical 6-20 (1.83-6.1 meters)
- Night Scan Vertical 7-25 (2.13-7.62 meters)
- Night Scan Vertical 8-30 (2.43-9.14 meters)
- Night Scan Vertical Complete (1.6-2.3 meters)
- Night Scan Vertical Heavy Duty Towing (HDT) (1.8-4.5 meters)

The Night Scan Vertical, Night Scan Vertical Complete, and the Night Scan Vertical HDT mast systems are each available with many options installed by The Will-Burt Company. This includes the option to come with a Profiler (available for Night Scan Vertical masts), which is a space-saving roof-mounted unit designed to enable installation on vehicles with limited available mounting space. There are also different light fixture types and manufacturers, camera types and manufacturers, special heights and optional beacon lighting.

3.1 Additional Documentation

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

3.2 Intended Use

The Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical HDT are intended for use by professionals in the fire/rescue/first responder/security/towing industries to provide elevated and directional emergency scene lighting and surveillance or communication capabilities. It is not intended for use by non-professionals. Do not use the mast to lift personnel. The mast systems are intended to be installed on fire/rescue/towing first responder vehicles with the vehicle interconnect safety circuit installed and operational.

The Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical HDT mast systems are intended to be used only when the vehicle is stationary and the vehicle parking brake is properly applied. Do not supply input supply voltage or operate the mast system when the vehicle is in motion. The mast must remain in the powered-down, nested position during vehicle motion.

3.3 Mast Position Definition

The mast is pneumatically moved by air pressure to the extended position. The following positions (see Figure 3-1) are used throughout this manual:

- **Stowed:** the position in which the Remote-Controlled Positioner (RCP) is firmly seated in the saddle. This position is sometimes referred to as the "nested" position.
- **Extended:** 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 3-1 Mast Positions

3.4 Mast Component Descriptions

Figure 3-2 shows major components of the Night Scan Vertical system. Figure 3-3 shows major components of the Night Scan Vertical Complete system. Figure 3-4 shows major components of the Night Scan Vertical HDT system.

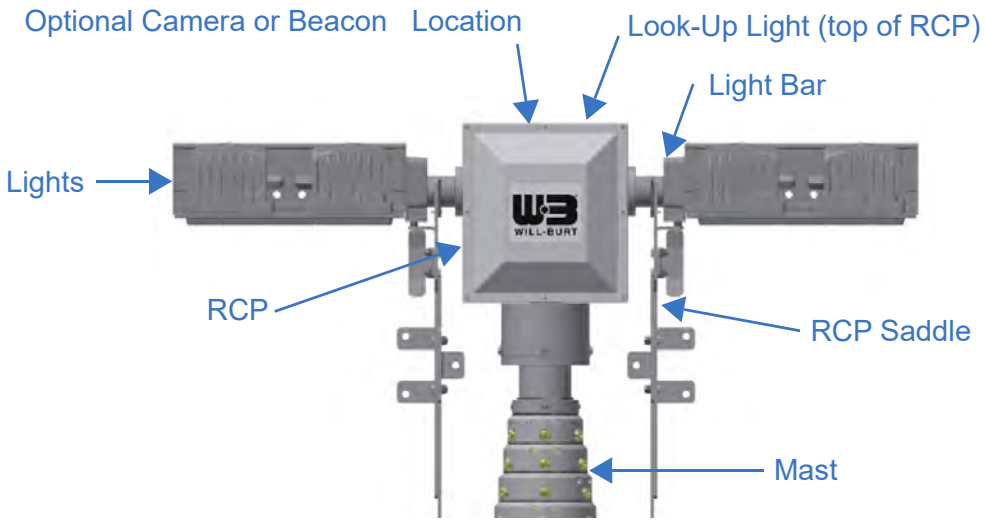
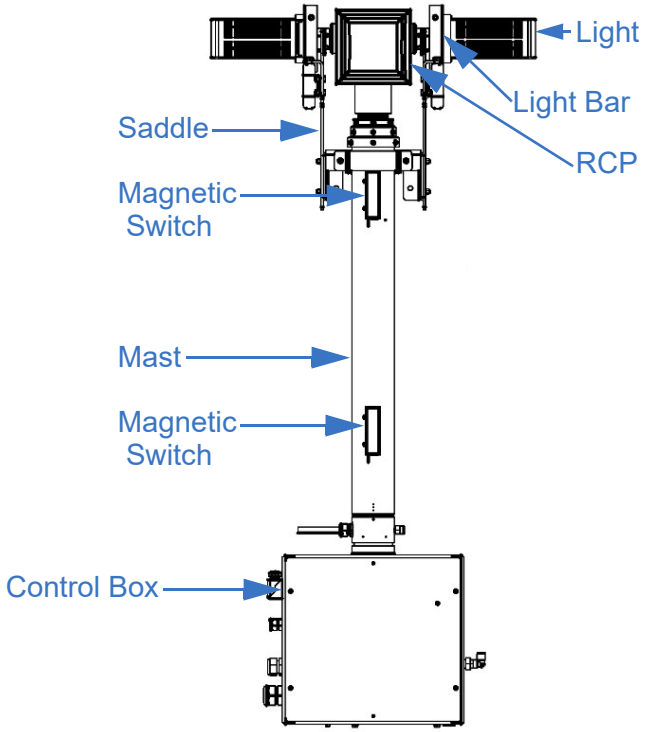


Figure 3-2 Night Scan Vertical Stowed View



Note: Depending on the model, the control box may be attached either to the bottom or the side of the Night Scan Vertical Complete.

Figure 3-3 Night Scan Vertical Complete (Model 720087040 shown)

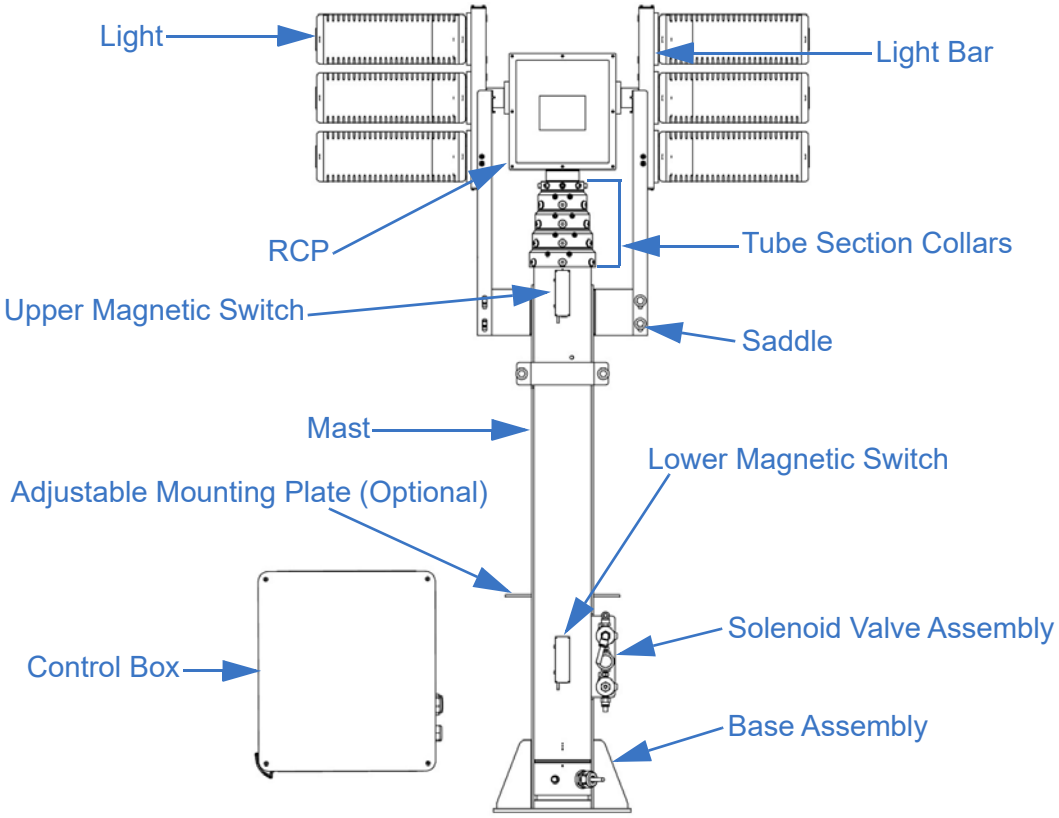


Figure 3-4 Night Scan Vertical HDT (Model 72030005 shown)

Mast: The mast consists of concentric tube sections that extend as air pressure is applied. The mast contains a coiled cord in the center for power and data. Optionally, an external Nycoil® may be included (not shown) for camera or other accessory cables. The bottom of the mast typically connects to the base plate. The bottom of the mast also connects to the air source. The top of the mast connects to the Remote-Controlled Positioner (RCP). 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.

The mast (Figure 3-5) contains:

- Tube sections
- Internal coil cord

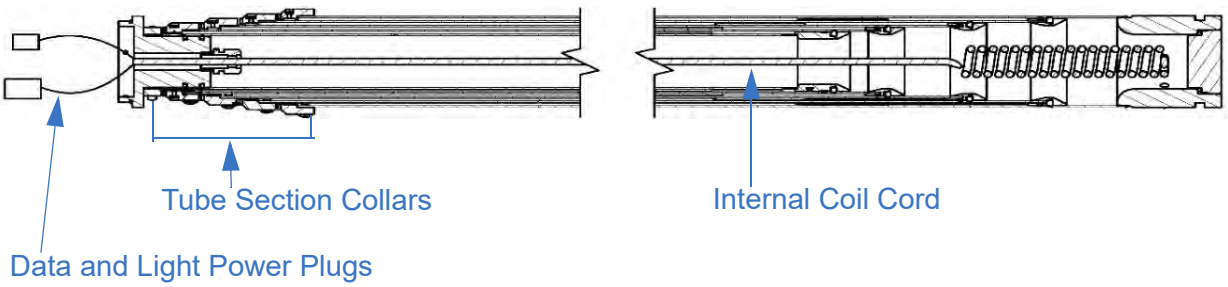


Figure 3-5 Mast Components

Mounting Hardware: Your system may come with either internal or external mounting hardware. Note: Night Scan Vertical Complete mounting hardware is customer-provided.

Internal: The internal mounting kit (Figure 3-6) contains the brackets and seals used to position and support an internally mounted mast. The kit includes a two-piece bracket, sealing gasket, wear ring, and V-Seal. Bolts, lock washers and hex nuts, 1/4 inch 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.

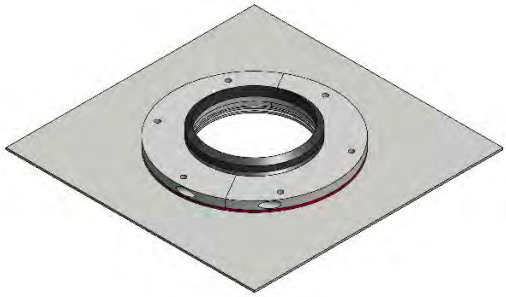


Figure 3-6 Internal Mounting Kit

External: The external support bracket assembly (Figure 3-7) is a painted weldment that can be bolted into a mounting structure and used to position and support an externally mounted mast. Bolts, lock washers and hex nuts, 3/8 inch or M10 (not provided) can be used to secure the support bracket to the support structure.

Figure 3-7 External Support Bracket Assembly

Non-Rotatable Base Plate: The vertical mast attaches to a 5 inch square non-rotatable base plate (Figure 3-8). Countersunk holes in the non-rotatable base plate match threaded holes on the bottom of the base mast section.

Figure 3-8 Base Plate

The base plate attaches to the mounting structure by screwing four bolts through the base plate and mounting structure.

Shelf Bracket: An optional shelf bracket (Figure 3-9) is available to support the mast base. The base plate attaches to the shelf bracket. The shelf bracket attaches to the support structure to support the mast. The shelf bracket has extra holes to accommodate multiple mast sizes.

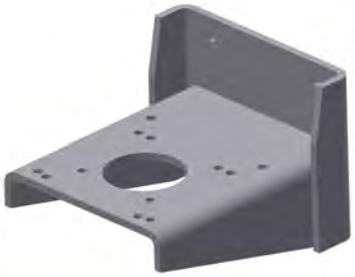


Figure 3-9 Optional Shelf Bracket

RCP Saddle: The saddle supports the RCP and lights when nested for stable vehicle transit. It connects to the mounting surface and extends to provide a curved surface for the RCP to rest on when the mast is nested. The saddle is adjustable to accommodate all models of the RCP and various mounting methods.

Remote-Controlled Positioner (RCP): The RCP (Figure 3-10) 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 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.

Note: The Night Scan Vertical is available with either a single-tilt or dual-tilt RCP. The Night Scan Vertical Complete is only available with a single-tilt RCP. The Night Scan Vertical HDT is only available with a dual-tilt RCP.

Single-Tilt RCP

Dual-Tilt RCP (shown with lights attached)

Figure 3-10 RCPs

Control Box: The control box (Figure 3-11, Figure 3-12, Figure 3-13) contains the base board for the system, and the solenoid valve assembly. This is where power and air supply are connected.

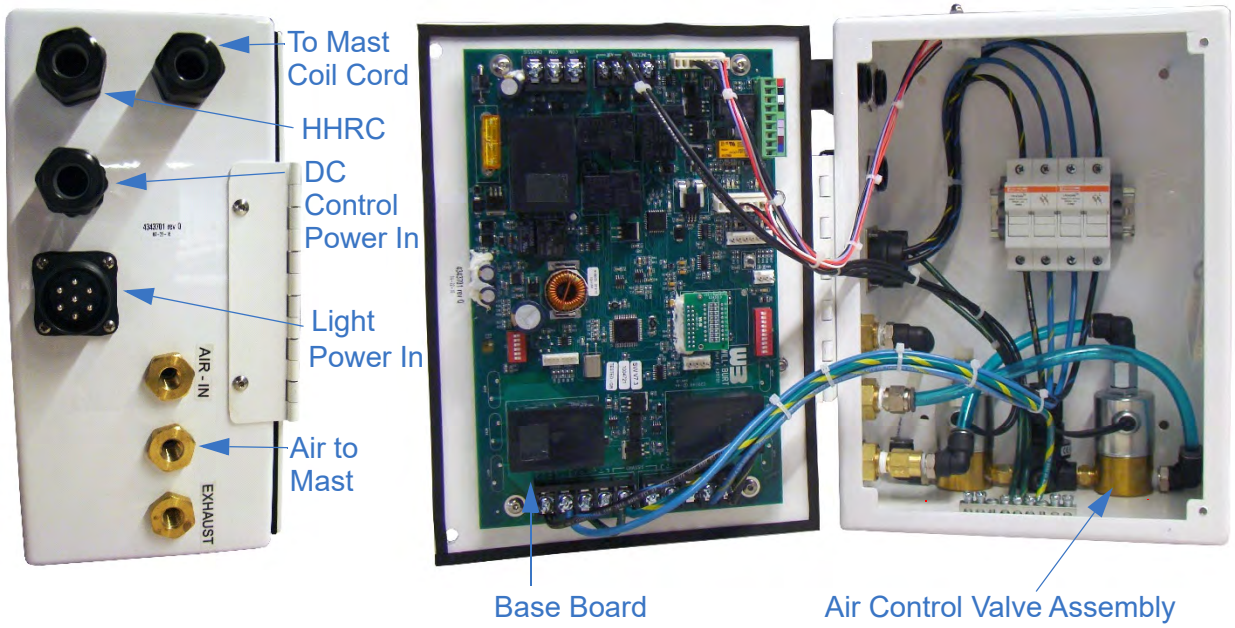
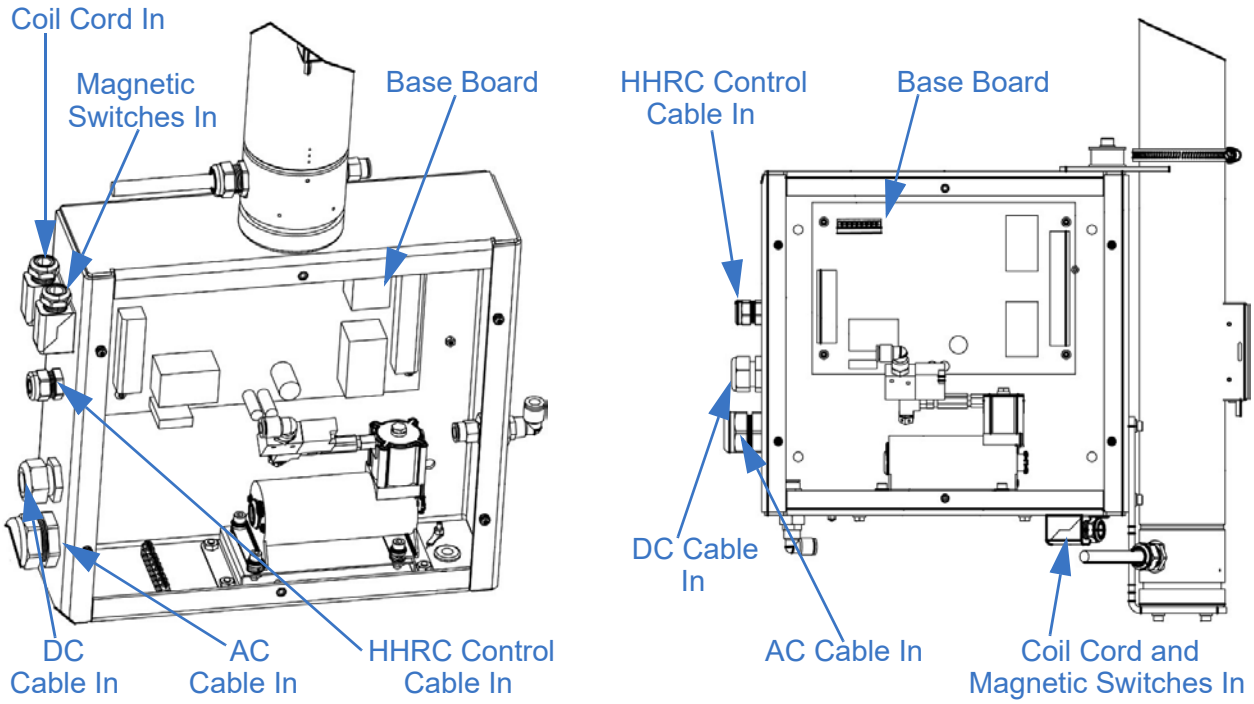


Figure 3-11 Night Scan Vertical Control Box



Control Box Underneath Mast

Control Box Beside Mast

Figure 3-12 Night Scan Vertical Complete Control Box Setups

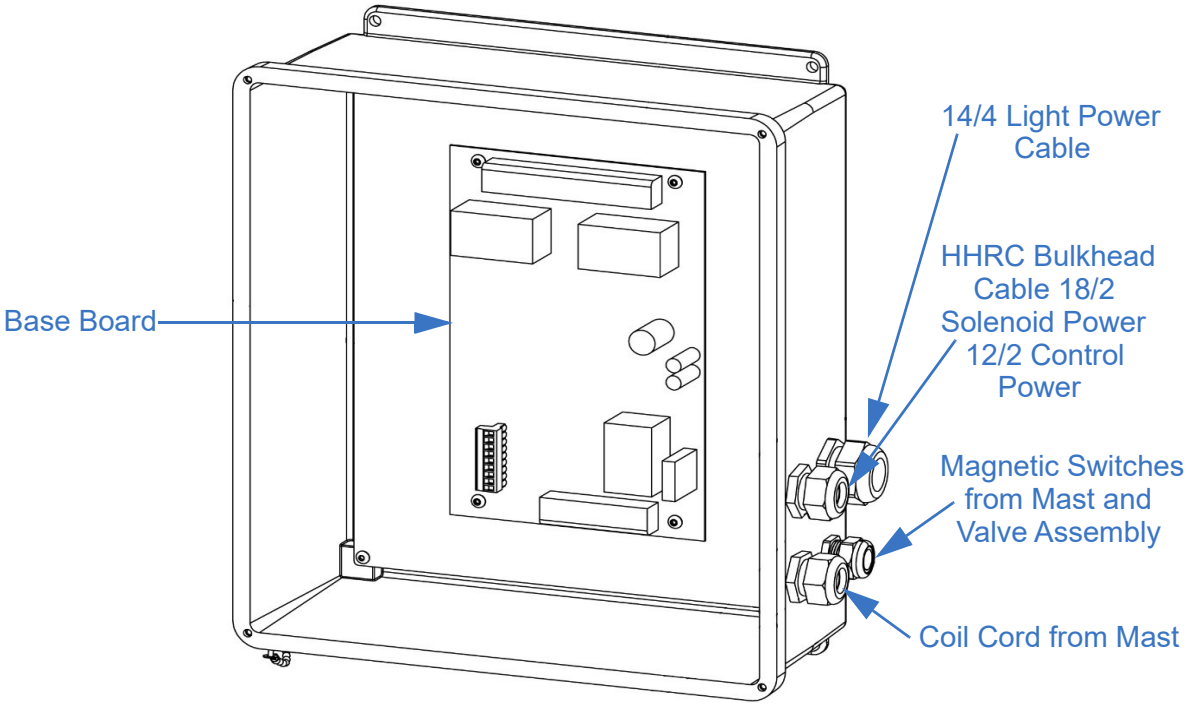


Figure 3-13 Night Scan Vertical HDT Control Box (Front Cover Removed)

Base Board: The PC Board (PCB) contains the system logical controller and provides landing points for customer power supply and vehicle interlock cables. The PCB also distributes DC (and optional AC light) power to components in the system.

Air Control Valve Assembly: The air control valve assembly consists of the extend and exhaust valve and factory set regulator to control pressure into the mast. Optionally, an air compressor can replace the air control valve assembly. The mast does not have a switch that indicates the mast has reached its full extended height. When the mast is deployed, the operator should release the extension button on the hand-held control. If the operator keeps the button pressed, the system will continue to build pressure until the safety valve blows off to relieve pressure. The safety valve is provided with the hardware kit and should be installed at the base of the mast.

Lights: The Night Scan Vertical systems and Night Scan Vertical Complete systems can come with a variety of LED or Halogen lighting packages. Night Scan Vertical HDT systems ship with Will-Burt XL-160 LED lights. Lights are attached to the RCP by the light bar (Figure 3-14). Go to www.willburt.com for additional information on available light packages.

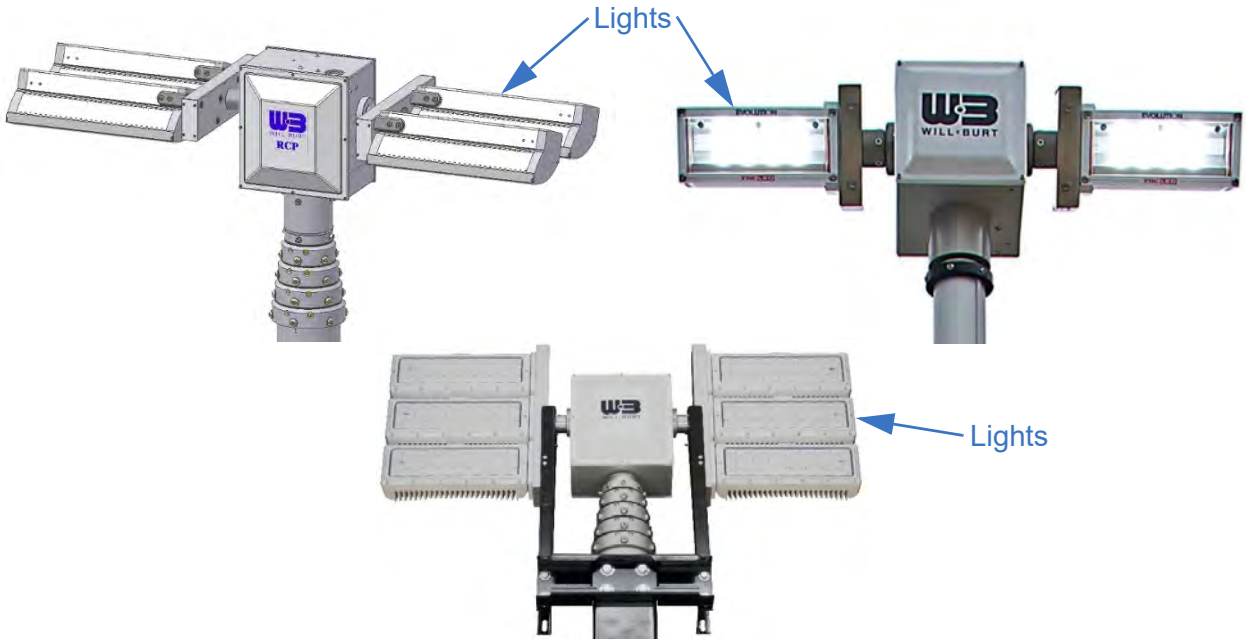


Figure 3-14 Left: Night Scan Vertical Lights; Right: Night Scan Vertical Complete Lights; Bottom: Night Scan Vertical HDT Lights

Camera/Beacon: Go to www.willburt.com for the latest optional cameras and beacon lights.

Lower Magnetic Switch (not shown): This magnetic switch is attached with a band clamp on the base tube of the mast (see Figure 5-20). It indicates when the mast has reached the stowed position.

Upper Magnetic Switch (not shown): This magnetic switch is attached with a band clamp on the base tube of the mast and is located above the lower magnetic switch (see Figure 5-20). It indicates when the lights have reached a height sufficient to clear all vehicle obstructions to RCP motion. Once this switch is activated, the RCP functions are enabled.

Labels: Extra warning labels are provided to attach near the operator control station.

Power Converter: The Power Converter is standard with the Night Scan Vertical HDT, but it is optional with other Night Scan Vertical models. The system uses a 12 to 48 volt DC to DC power converter (Figure 5-21). The power converter has a 58 volt, 30 amp fudualse (P/N: 221033) on the output side. Operating the power converter above 150°F (65°C) may cause damage to the unit.

Base Assembly: The base assembly is connected to the mast and is used to secure the vertical HDT to the mounting structure (Figure 3-15). The optional adjustable mounting plate can assist in securing the mast.

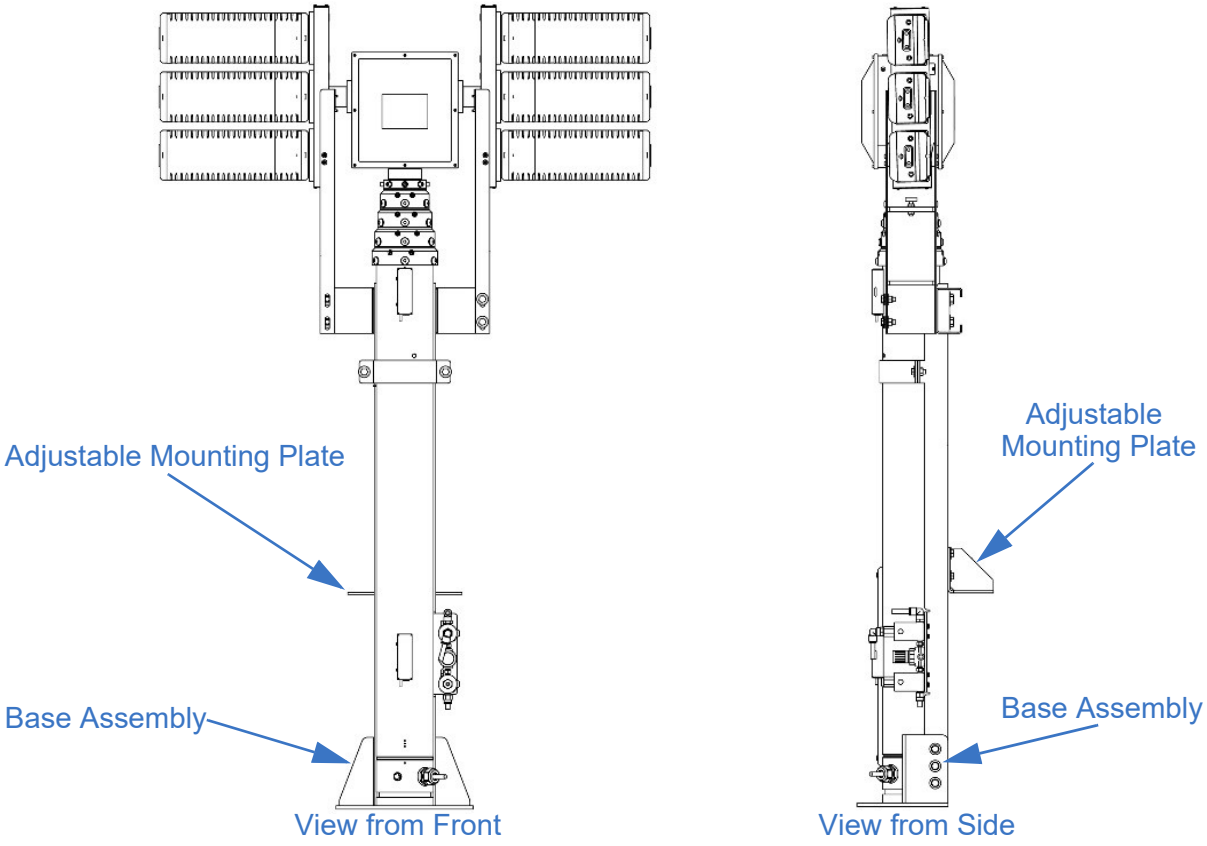


Figure 3-15 Night Scan Vertical HDT Mounting

3.5 Remote Control Options

There are three options for controlling the mast functions. Each option provides full system control. These controllers all have two-way communication with the system and LED display that include alphanumeric feedback. There are different controllers for dual-tilt and single-tilt RCP applications. The dual-tilt versions have additional tilt buttons compared to the single-tilt versions. See Figure 3-16 for a representative picture of each option.

HHRC PMRC WHHRC

Figure 3-16 Remote Control Options (not to scale)

The controllers can be used to operate all functions of the system and are as follows:

1. **Wired Hand-Held Remote Control (HHRC):** This option includes a 25 foot (7.6 meters) quick connect coil cord and LED display. It also contains an integrated emergency stop button.

2. **Panel Mount Remote Control (PMRC):** This option mounts to a panel and has LED display. It also contains an integrated emergency stop button.

3. **Wireless Hand-Held Remote Control (WHHRC):** This option comes with a separate control box that contains the transceiver. This control box is mounted separately from the mast. A HHRC can be plugged into the wireless control box and used with the wireless control. Refer to operating instructions TP-5543301 for installation and operation for the optional WHHRC.

The PMRC plugs directly to the system. The HHRC plugs into a bulkhead connector that can be located remotely on the vehicle at the operator's station. See Figure 3-17.

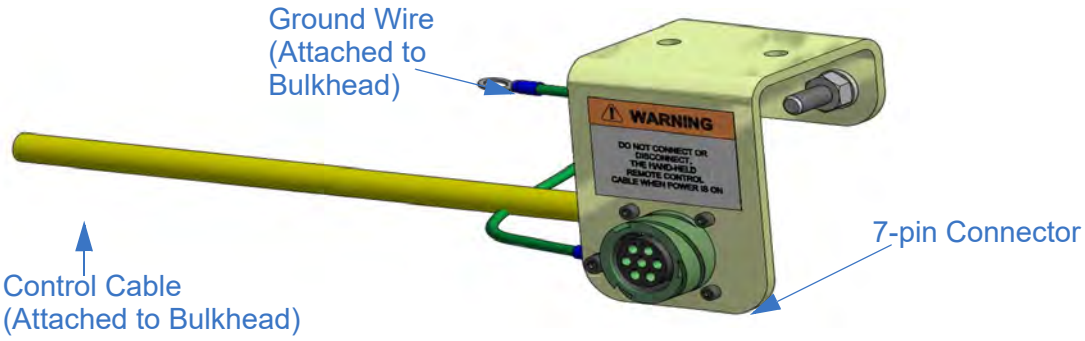


Figure 3-17 HHRC Bulkhead Connection

4 Technical Data

	Night Scan Vertical					NS Vertical Complete	NS Vertical HDT
	4.3-15	5.4-17	6-20	7-25	8-30		
Extended Height (ft / m)	13.4 / 4.08	17 / 5.2	20.4 / 6.2	25.4 / 7.7	30.4 / 9.2	7.5 / 2.3	15 / 4.5
Nested Height (ft / m)	4.5 / 1.3	5.5 / 1.68	6.1 / 1.9	7.1 / 2.2	8.1 / 2.5	5.3 / 1.6	5.75 / 1.8
Mast Control System Input Voltage	12VDC - 24VDC						
Mast Control System Current	14A Max at 12VDC 10A Max at 24VDC						
Lighting Input Voltage (for DC lights)	12VDC - 24VDC						
Lighting Current (for DC lights)	50A Max at 12VDC 25A Max at 24 VDC						
Lighting Input Voltage (for AC lights)	110VAC - 220VAC (50 or 60 Hz)						
Lighting Current (for AC lights)	38A Max at 110VAC 28A Max at 220VAC						
System Operating Temperature	-22 to 149 °F / -30 to 65 °C						
System Storage Temperature	-40 to 149 °F / -40 to 65 °C						
Deployment Angle	±5° Maximum						
Deployment Wind Speed (mph / km/h)	40 max / 64 max						
Altitude Above Sea Level (ft / m)	15,000 / 4572 Maximum						
*Survival Wind Speed (mph / km/h)	119-140+ / 191-225+	100-121 / 160-195	87-104 / 140-167	73-86 / 117-138	63-73 / 101-117	119-140+ / 191-225+	100-121 / 160-195
Auto Stow®	Yes						
Number of Lights Available	4 or 6					2 or 4	6
Light Type Available	LED or Halogen						LED Spot/ Flood
Maximum Lumens	220,000	220,000	220,000	220,000	220,000	140,000	220,000
Full Pan and Tilt Light Positioning	Yes						
Opposable Light Fixtures	Yes					No	Yes
Profiler - Space Saving Fixture Option	Yes					No	No
Beacon Light Option Available	Yes						
D-TEC Powerline Detection System Option	Yes					No	Yes
Camera Option Available	Yes						
**Airborn Noise Emissions	equivalent A-weighted sound pressure level at the operating position is less than 70 dB(A)						

*Varies depending on light package - NFPA 125% Safety Factor

**Measured according to EN ISO 3744:2010

This page intentionally left blank.

5 Installation

This section describes the physical and electrical installation of the Night Scan Vertical, Night Scan Vertical Complete, and Night Scan Vertical Heavy Duty Towing (HDT) mast systems. This section provides the general procedures that must be followed to ensure a successful installation. Be sure to read and understand the entire installation procedure and the Safety Summary in Section 1 before beginning installation.

5.1 Mounting Location Requirements

The following factors must be included when selecting an appropriate mounting location:

1. Your system is designed to withstand adverse weather conditions, however it cannot be submerged in water. If the system is mounted in a well, provide adequate drainage. A minimum of four 1 inch (25 mm) diameter drain holes (one per corner) are recommended.

2. Ensure that the mounting surface is flat and has sufficient room and strength to hold the system. Reinforce as necessary. Table 5-1 shows the shear force and the bending moment load acting at the base plate (bottom of mast) of the mast due to wind loading. The load values correspond to the maximum wind load ratings in the Technical Data Section. The combination of the support bracket (or internal roof mount kit) and the base plate support structure must resist these loads to adequately support the mast.

   Note: Shear force is larger with shorter masts because rated wind load is higher.

Table 5-1 Mounting Structure Reaction Loads

Model	Base Shear Force (lb. / N)	Base Moment (ft.-lb. / Nm)
Night Scan Vertical		
4.3-15	495 / 2202	4681 / 6345
5.4-17	412 / 1833	4695 / 6366
6-20	352 / 1566	4658 / 6316
7-25	293 / 1304	4678 / 6343
8-30	250 / 1112	4684 / 6351
Night Scan Vertical Complete		
1.6-2.3	495 / 2202	4681 / 6345
Night Scan Vertical HDT		
1.8-4.5	412 / 1833	4695 / 6366

3. The roof-line for internally mounted masts or the support bracket for externally mounted masts must lie between the weep hole and 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 support bracket or roof mounting kit should be as high as possible on the mast and not block the weep hole. In an internal mount application, the drain kit provided with the mast can redirect the water exiting the weep hole.

4. The areas beneath the floor must be free of obstructions to allow for accessibility to base plate fasteners and air inlet port.

5. The installed elevation of the bottom collar of the mast (this is where moving parts are located) must be at least 2.7 meters (8.8 feet) above ground level to prevent reach of upper extremities during operation. Alternatively, lower elevations are permitted if the mast is properly guarded by the installer, or if the mast is offset towards the middle of the roof with reach limited by vehicle structure to prevent contact with the mast during operation.

5.1.1 Dimensions

Refer to the drawings that 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, beacon light, or D-TEC Power Line Detection System.

5.2 Recommended Installation Tools

Table 5-2 lists recommended tools and materials for installation.

Table 5-2 Recommended Installation Tools & Materials

Tools and Materials		
Safety Glasses	Safety Gloves	Safety Shoes
Hard Hat or Helmet	Hearing Protection	Crimping Tool or Solder Set
Wrenches	Screwdrivers	Multimeter (to verify power is turned off)
Torque Wrench	Drill	Knife or Scissors to Cut Crate Band
Wire Cutter/Stripper	RTV Silicone	Shop Rags
Hoist (minimum 500 lb. (227 kg) capacity)	**Night Scan Vertical:** 3/8 inch or M10 Mounting Hardware (10 each)	**Night Scan Vertical Complete:** 5/16 inch or M8 Mounting Hardware (2 each) and 1/4 inch or M6 Mounting Hardware (4 each)
Night Scan Vertical HDT: 9/16 inch or M14 Mounting Hardware (8 each)		
Note: Depending on the national and local standards and codes of practice, and the environment, additional personal protective equipment may be necessary.		

5.3 Unpacking & Handling

Unpack and handle the items as follows:

1. Carefully remove all the small cartons from the large crate or carton.
2. Remove all the items from the small cartons.
3. Ensure all components are included and that the required tools are readily available. The components in the system shipment are shown in Table 5-3.

Table 5-3 Components in the Mast Unit Ship

Components			
Night Scan Vertical			
Mast	Mounting Kit (Internal or External)	Base Plate	Saddle Kit
RCP Assembly	Lights	Controller (Selected from the following:) • HHRC with Bulkhead • WHHRC • PMRC	Mast Control Power Cable
Light Cable	Air Hose	Magnetic Switches	Control Box
*Label Kit	Beacon Light (Optional)	D-TEC (Optional)	Operators Manual
Mast Hardware Kit			
Night Scan Vertical Complete			
Mast	Saddle	RCP Assembly	Lights
Wired HHRC with Bulkhead	Board Power Cable	Light Cable	Ferrite
*Label Kit	Beacon Light (Optional)	Operators Manual	
Night Scan Vertical HDT			
Mast	Mounting Kit (Internal or External)	Base Plate	Saddle Kit
RCP Assembly	Lights	Wired HHRC with Bulkhead	Board Power Cable
Light Cable	Ferrite	*Label Kit	Beacon Light (Optional)
D-TEC II (Optional)	Operators Manual		

Note: 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 in site of the operating station.

4. Inspect for any shipping damage. If damage has occurred, notify the carrier.

5. Unbolt (for wooden crates) and remove any banding fixing the mast to the shipping crate or carton. Remove any banding fixing the mast.

6. **Night Scan Vertical and/or Night Scan Vertical Complete:** Using a hoist, lift the unit from the shipping container by the two horizontal Remote-Controlled Positioner (RCP) shafts and the vertical shaft (Figure 5-1). Lifting from locations other than those indicated could result in equipment damage.

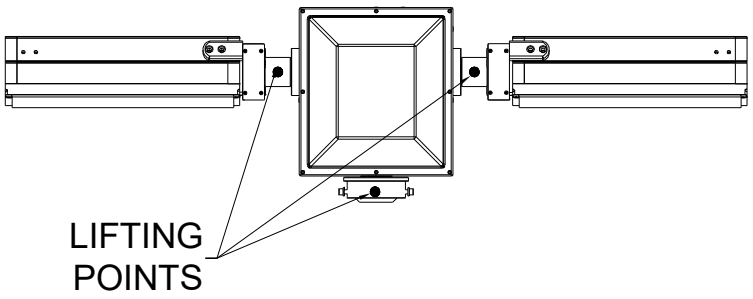


Figure 5-1 Lifting Points on the Night Scan Vertical and Night Scan Vertical Complete RCP

Night Scan Vertical HDT: Lift the base out with a hoist. Lift the unit from the shipping container by the two struts and the lower portion of the base tube (Figure 5-2). Do not lift by the lights or RCP. Lifting from locations other than those indicated could result in equipment damage.

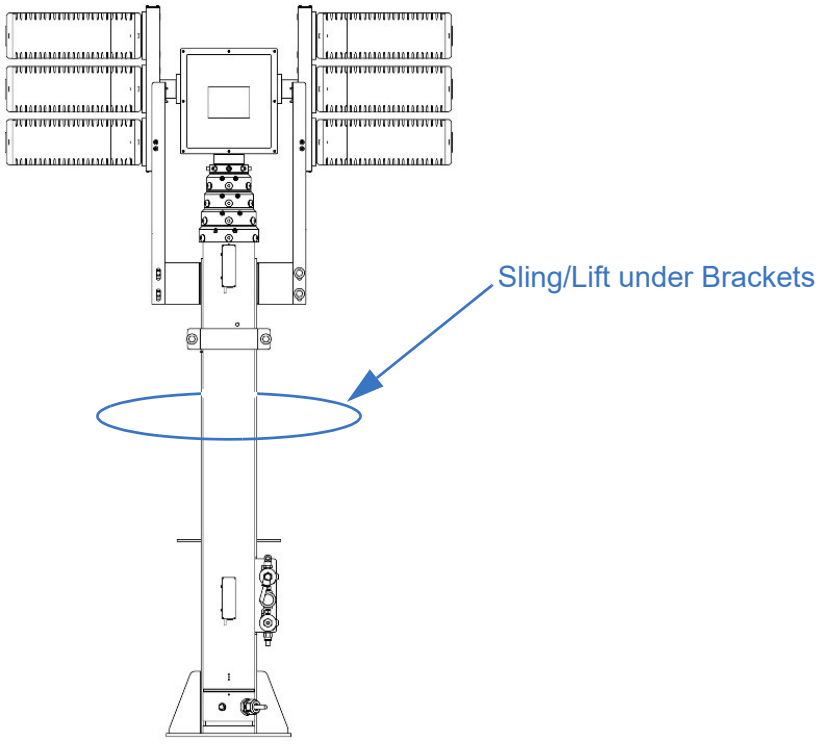


Figure 5-2 Lifting Points on the Night Scan Vertical Heavy Duty Towing (HDT)

5.4 Attaching to the Vehicle

Read and understand all the mounting requirements in Section 5.1.

Note: The only section in Section 5.4 that applies to the Night Scan Vertical Complete is Section 5.4.2. The rest of the sections apply only to the Night Scan Vertical and Night Scan Vertical HDT. This is because the Night Scan Vertical Complete arrives almost fully put together. For information on how to attach the Night Scan Vertical Complete to the vehicle, see Section 5.4.2.

5.4.1 Night Scan Vertical Mounting Instructions

Physically attach the system as follows:

1. Drill six 3/8 inch mounting holes into the mounting structure (Figure 5-11).

2. Attach the mast using 3/8 inch studs or M10 bolts (customer-provided). Torque all hardware as appropriate for its material and size.

3. The saddle is adjustable to accommodate all models of the RCP as well as variations in mounting (Section 5.4.9, Figure 5-12). 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.

5.4.2 Night Scan Vertical Complete Mounting Instructions

Physically attach the system as follows:

1. Ensure that the control box, mast, and saddle are on a flat surface and in the same plane. Switches set at the factory are based on a level surface. If the system is not level, these switches may need adjusted.

2. 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.

3. Reference Figure 5-3 and Figure 5-4 for mounting hole locations for your system. These locations will vary based on which system you are using. Drill two 5/16 inch clearance holes into the vehicle mounting structure where the saddle part of the mast will mount. Drill four 1/4 inch clearance holes into the vehicle mounting structure where the control box part of the mast will mount. There are four holes for the control box, and two holes for the saddle.

4. Attach the system to the vehicle using 5/16 inch or M8 bolts and 1/4 inch or M6 bolts (customer-provided). Torque all hardware as appropriate for its material and size.

It is the responsibility of the customer to properly secure the payload for vehicle travel.

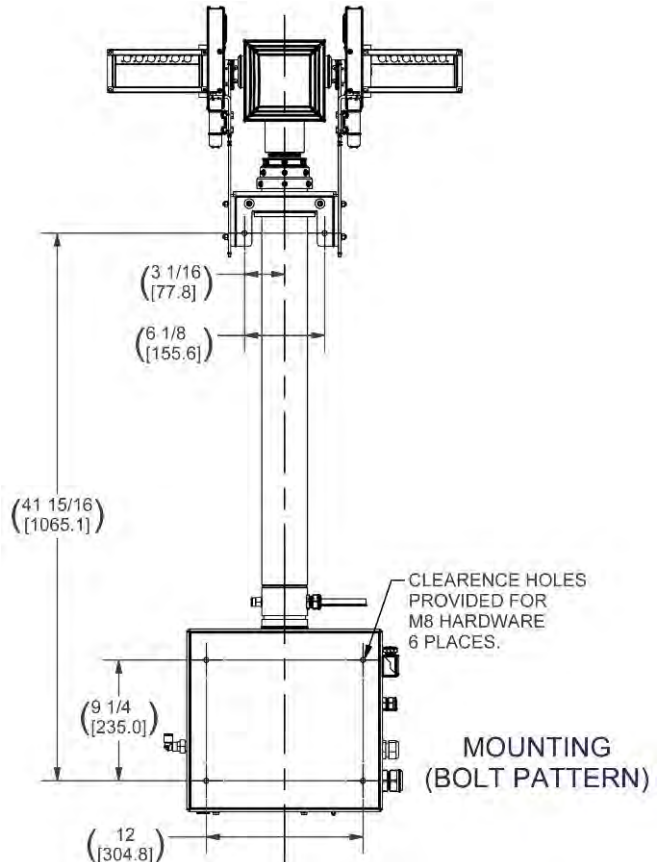


Figure 5-3 Night Scan Vertical Complete Mounting Hole Locations (Control Box Mounted to the Bottom of the Mast)

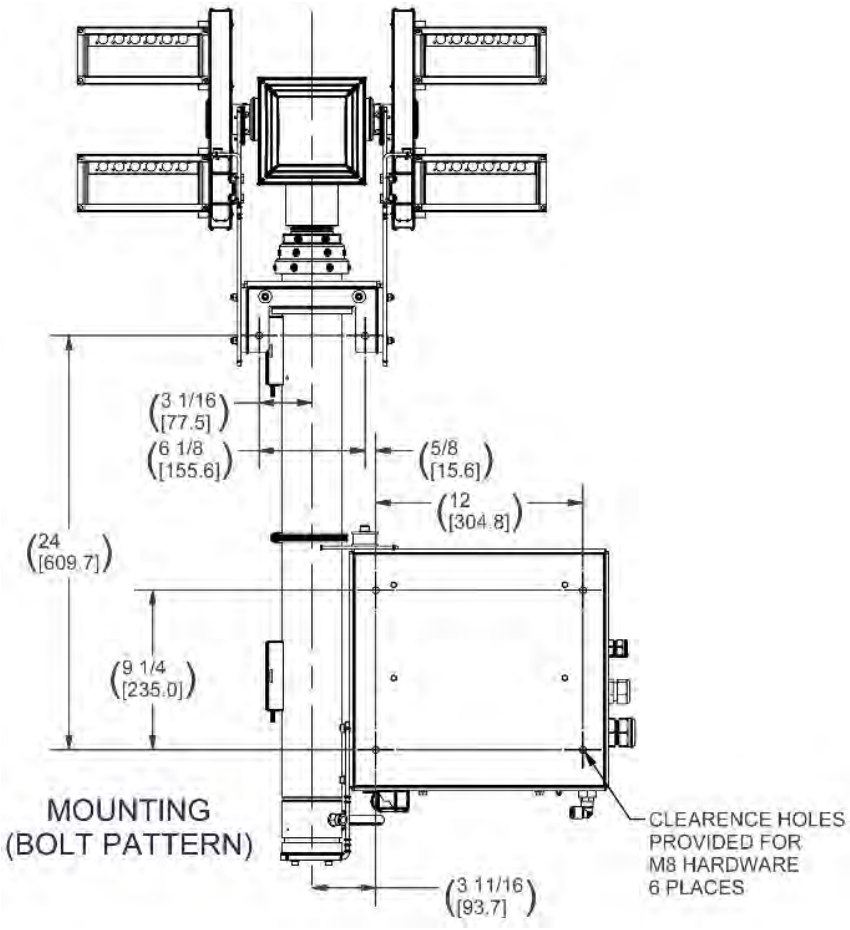


Figure 5-4 Night Scan Vertical Complete Mounting Hole Locations (Control Box Mounted to the Side of the Mast)

5.4.3 Night Scan Vertical HDT Mounting Instructions

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 inch diameter drain holes (one per corner) are recommended.

2. Drill eight 9/16 inch mounting holes into the mounting structure (Section 5.4.9, Figure 5-13).

3. Attach the mast using 9/16 inch or M14 studs or bolts (customer-provided). Torque all hardware as appropriate for its material and size.

4. 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.

5.4.4 Attach Internal Mounting Kit

This section describes the installation for the internal mounting kit. If your mast is externally mounted, you can skip to the next section.

The roof-line for internally mounted masts should be as flat as possible where the mast mounts. The roof-line must lie between the weep hole and base tube collar. The internal mounting hardware should be at least 1 inch (25 mm) above the weep hole and at least 3 inches (76 mm) below the collar. The roof mounting kit should be as high as possible on the mast and not block the weep hole. In an internal mount application, the drain kit provided with the mast can redirect the water exiting the weep hole. Water will exit the weep hole as the mast extends. Do not orient the weep hole toward any personnel or sensitive equipment.

The holes in the roof for the internal mounting kit should align with the mounting location at the base of the mast for the base plate.

Before installing the base plate or any pneumatic hardware, the internal mounting kit should be installed on the roof. The mast must be lowered in from the top of the vehicle. This is so that the mast will fit through the internal mounting bracket access hole.

To begin installing the internal mounting kit:

1. Remove any roof liner or ceiling panels from the roof.

2. Cut out the roof hole according to Figure 5-5. Using the bracket as a fixture, mark and drill the mounting holes as shown.

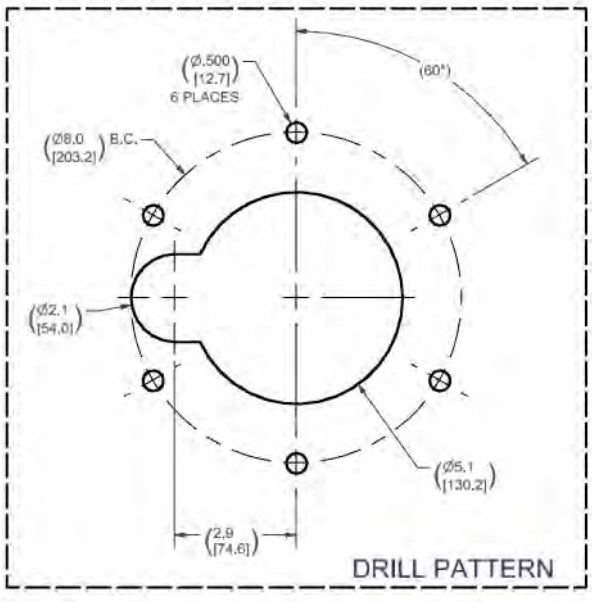


Figure 5-5 Internal Mounting Kit Roof Cutout Dimensions

3. If necessary, use washers or short spacers made of ¼ inch (6.35 mm) pipe to level out any irregularities that exist in the roof.

4. Place the gasket on the roof and align the mounting holes.

5. Install the V-Seal over the mast base tube and slide the seal towards the top of the mast. Soapy water can be used to assist in sliding the seal.

6. Use a properly rated hoist to lift the mast above the roof. Use the lifting points shown in Figure 5-1. Lower the mast through the gasket and roof opening. Once the mast is through the access hole, it is recommended to install the base plate while the mast is still supported by the lifting device (see section 5.4.5). Once the base plate is installed, lower the mast into its final position and loosely install the base plate mounting bolts to locate the base of the mast and fix the mast orientation.

7. Lift up the gasket and apply silicone sealant to both sides. Place the gasket into position with the mounting holes aligned. Place the bracket halves and wear ring into position and apply silicone sealant where the bracket halves come together. The wear band should rest in the groove of the bracket halves.

8. Tighten the two M5 bracket screws to fix the bracket halves together. Torque the bracket screws to 4-5 Nm (35-45 in.-lb.). It is recommended to apply a low strength thread-locking compound.

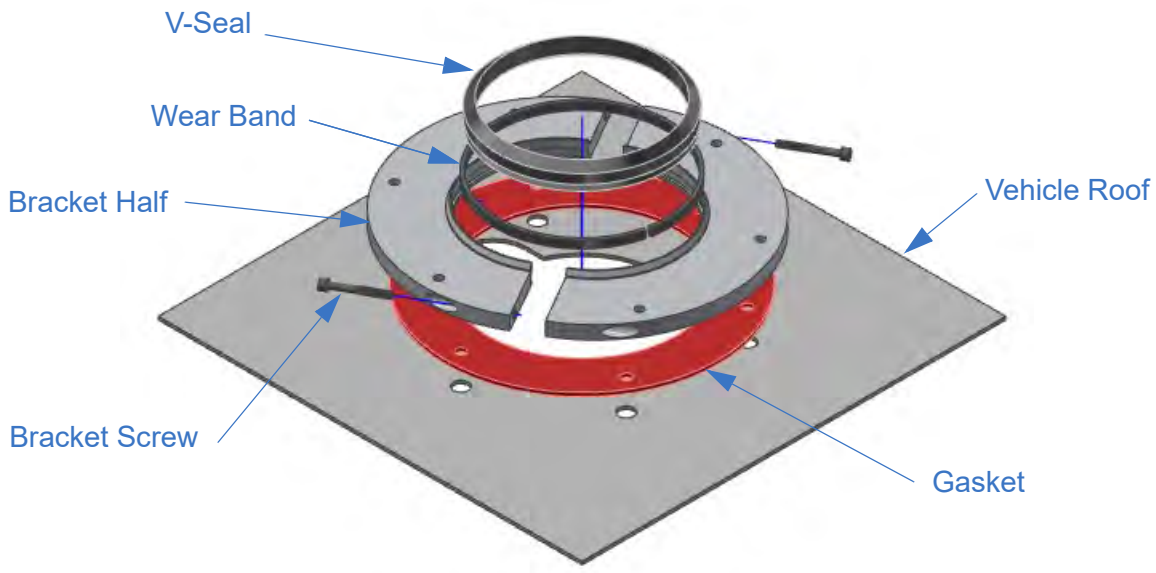


Figure 5-6 Internal Mounting Kit Assembly Detail

9. Loosely install six user provided 1/4 inch or M6 bolts, lock washers and hex nuts to secure the internal mounting kit bracket to the roof. Bolt length depends on the specific application and is to be determined by the installer. Once all bolts are loosely in place, check alignment of the mast base plate to the mounting surface. If properly aligned, tighten the base plate mounting hardware according to section 5.4.6. Once the base plate is tightly fixed, tighten the internal mounting kit bolts. The recommended installation torque for an M6 or 1/4 inch stainless steel fastener is 7-8 Nm (60-72 in.-lb.). Note: This torque assumes the roof structure is firm. It is recommended to use a low strength thread-locking compound.

10. Remove any excess silicone. A bead of silicone sealant can be added to the top of the bracket where the V-Seal mates if desired. Slide the V-Seal down over the bracket to complete the installation.

5.4.5 Attach the Base Plate to the Mast

Using the four 1/4-20 flat head screws provided in the mast hardware kit, install the base plate to the bottom of the mast base tube. Torque the flat head screws to 7-8 Nm (62-70 in.-lb.). Be sure to match the countersink side of the base plate to the screws.

Note: For use with an internal mounting kit, the internal mounting kit should be installed before the base plate.

5.4.6 Attach the Base Plate to the Vehicle

Before final tightening of the base plate bolts, it is recommended to install the support bracket or roof mount kit loosely before final tightening to ensure alignment of all components. Once alignment is achieved, all bolts can be tightened according to these instructions.

See Figure 5-7 for dimensions for the mounting hole pattern on the base plate. Use the base plate to mark and drill mounting holes in the mounting structure.

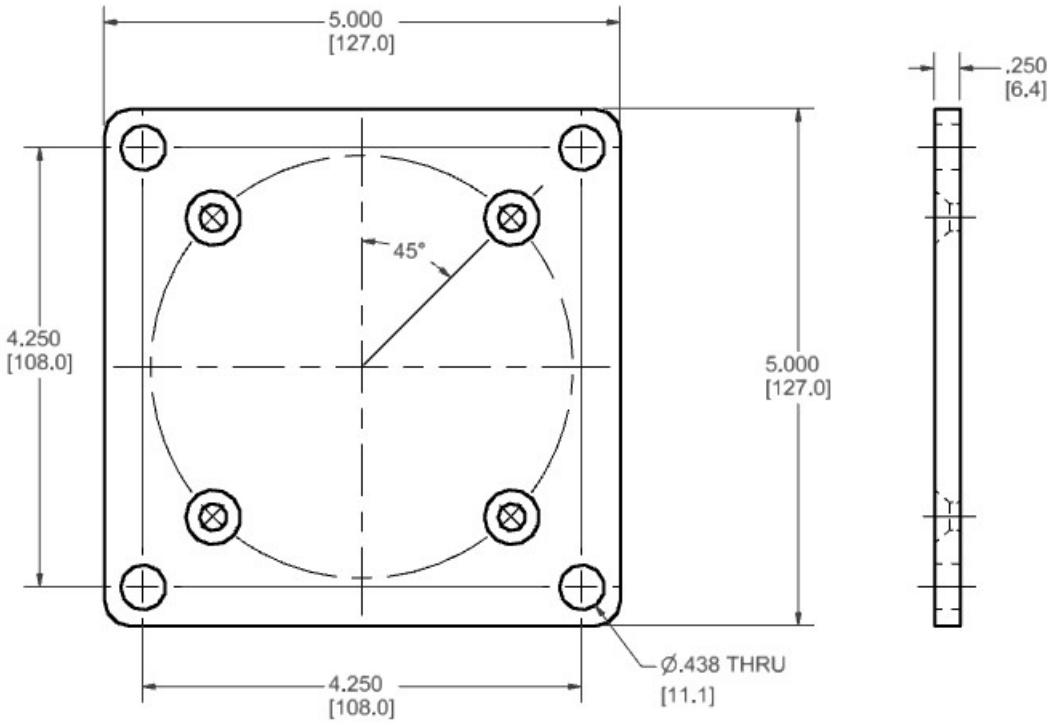


Figure 5-7 Base Plate Dimensions

Move the mast into the desired mounting position, noting the desired mast orientation. Bolts, lock washers and hex nuts, 3/8 inch or M10 (not provided) can be used to secure the base plate to the support structure. Bolt length depends on the specific application and is to be determined by the installer. The recommended installation torque for an M10 stainless steel fastener is 28-33 Nm (245-290 in.-lb.). The recommended installation torque for a 3/8 inch stainless steel fastener is 21-27 Nm (190-240 in.-lb.). The hardware kit includes 3/8 bolts (1.5 inches [38 mm] long), washers and lock washers that can be used if the length fits the application and when attaching to the optional shelf bracket. The installer must determine if the bolts provided are the proper length for the application. It is recommended to use a thread-locking compound in addition to lock washers or other thread-locking methods.

5.4.7 Attach the Support Bracket

This section describes the installation of the external support bracket. For external mounting, the base plate and support bracket should be fitted loosely with all fasteners installed to ensure everything aligns. Once alignment is achieved, all bolts can be tightened according to these instructions.

1. Using the dimensions shown in Figure 5-8 or using the support bracket as a template, drill six holes to mount the support bracket. The support bracket should be at least 1 inch (25 mm) above the weep hole and at least 3 inches (76 mm) below the collar. The support bracket should be as high as possible on the mast and not block the weep hole.

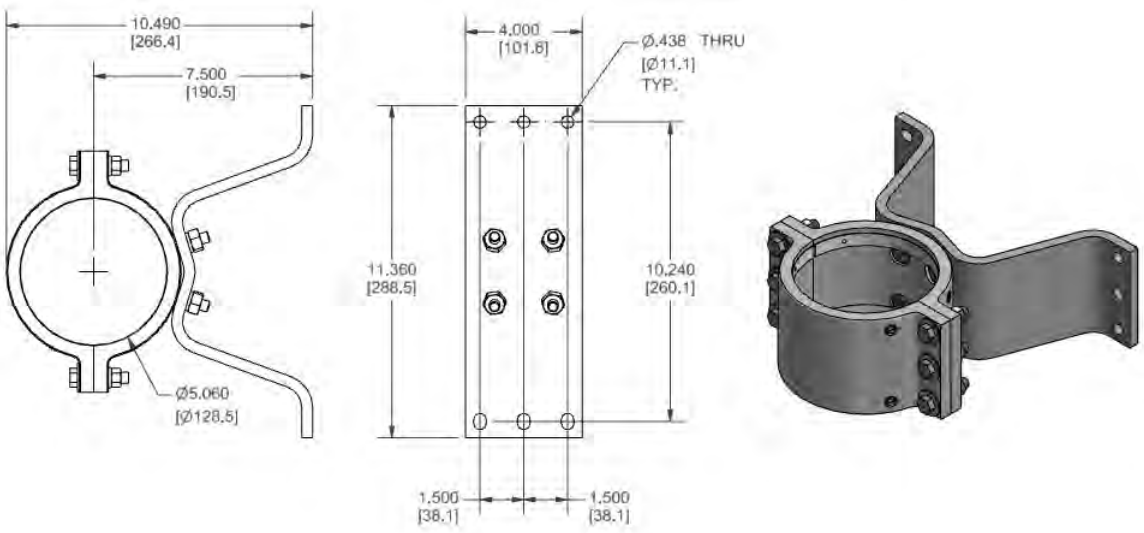


Figure 5-8 Support Bracket Mounting Dimensions

2. Remove all the support bracket bolts holding the clamp halves together.

3. Install the clamp around the mast base tube and loosely re-install the six 3/8-16 bolts/ washers/lock washers.

4. Loosely install the customer supplied 3/8 inch or M10 bolts, lock washers and flat washers. Bolt length depends on the specific application and is to be determined by the installer. If all the holes align, tighten the support bracket to the support structure. The recommended installation torque for an M10 stainless steel fastener is 28-33 Nm (245-290 in.-lb.). The recommended installation torque for a 3/8 inch stainless steel fastener is 21-27 Nm (190-240 in.-lb.). Finally, tighten the mast clamp bolts to the same torque. Be careful not to over-tighten these clamp bolts because it may deform the base tube and hinder mast function.

5.4.8 Attach Optional Shelf Bracket

If using the optional shelf bracket, the mast base plate is installed on the shelf bracket instead of the vehicle structure following section 5.4.6. The shelf bracket attaches to the vehicle structure using the following steps:

1. Drill holes according to the dimensions shown in Figure 5-9, or use the shelf bracket as a template.

2. Locate the shelf bracket into position and install customer supplied 3/8 inch or M10 bolts, lock washers and flat washers. The installer should determine the proper bolt length for the application. The recommended installation torque for an M10 stainless steel fastener is 28-33 Nm (245-290 in.-lb.). The recommended installation torque for a 3/8 inch stainless steel fastener is 21-27 Nm (190-240 in.-lb.). It is recommended to also use thread-locking compound.

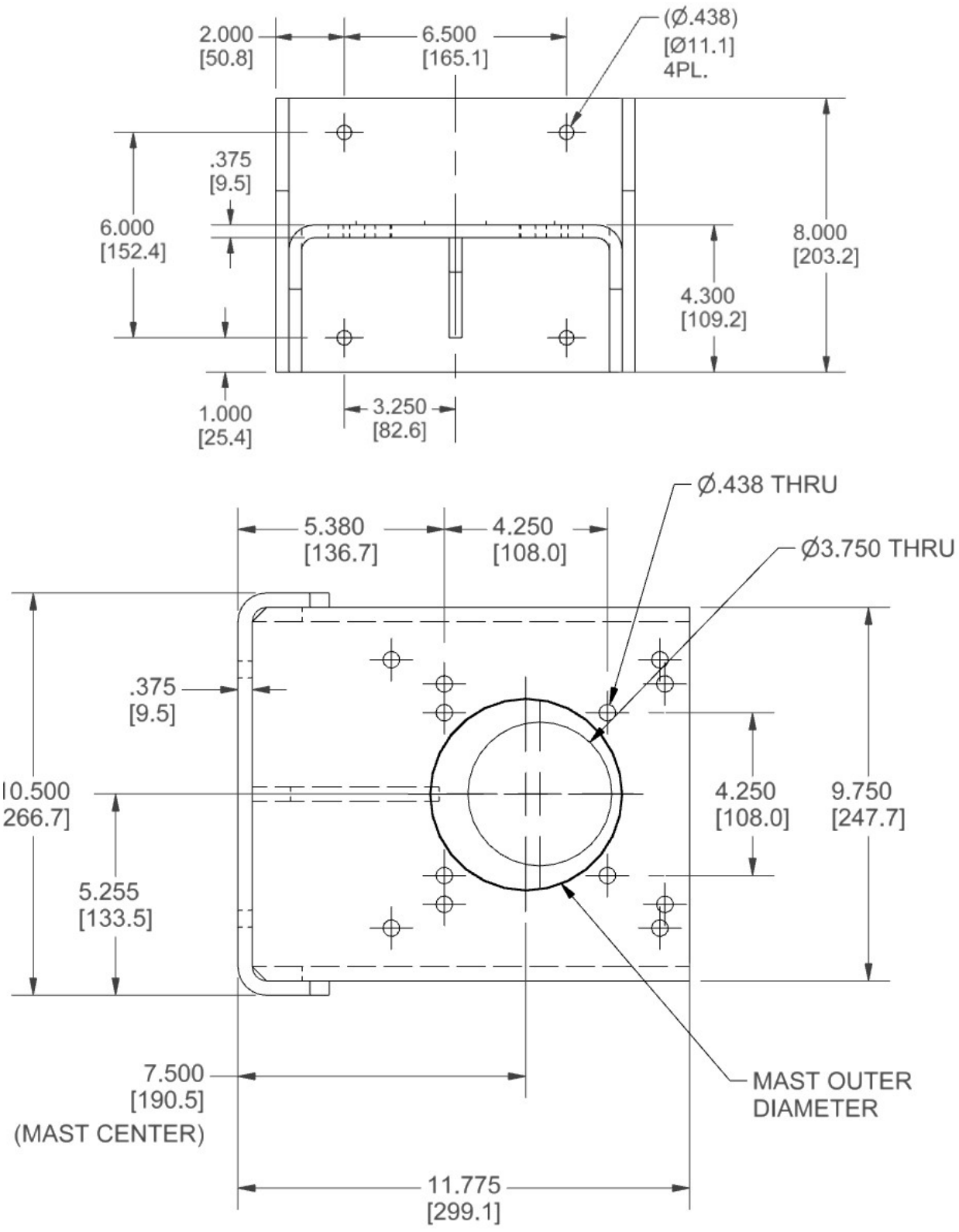


Figure 5-9 Shelf Bracket Installation Dimensions

5.4.9 Attach the RCP Saddle Brackets

The RCP saddle brackets (Figure 5-10) must be installed to support the lights and RCP when the mast is nested and the vehicle is in transit. The brackets are adjustable in height to obtain the proper position to allow the RCP to rest against the saddle brackets when nesting. When the mast is nested, the saddle brackets should be in firm contact with the RCP structure to prevent vibration damage to the mast and RCP. Leaving a gap may result in damage to the mast system. The bolt pattern between the two brackets is square so the bracket can be deck mounted vertically or rotated 90° to bolt to a vertical support structure as shown in Figure 5-12.

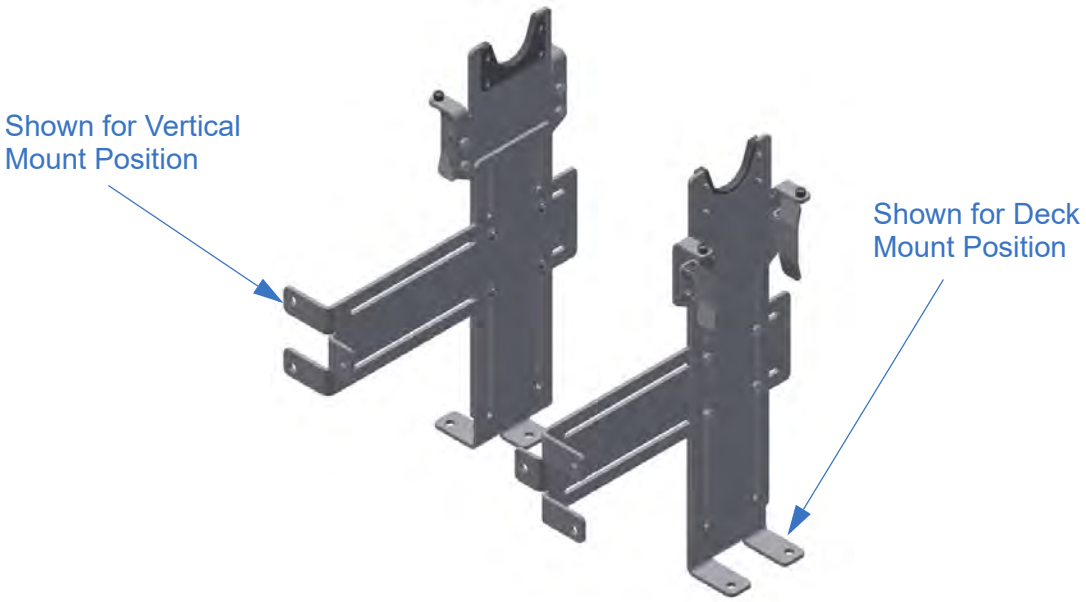


Figure 5-10 Saddle Brackets (shown in two optional orientations)

The support structure must be rigid enough to support the RCP and lights at a combined weight of 45 kg (100 lb.).

To attach the RCP saddle brackets for the Night Scan Vertical, see Section 5.4.9.1. To attach the RCP saddle brackets for the Night Scan Vertical HDT, see Section 5.4.9.2.

5.4.9.1 Night Scan Vertical

To attach the RCP saddle brackets:

1. Drill six mounting holes into the mounting structure according to Figure 5-11. The brackets can be used as a template to mark locations.

2. Attach the brackets using 3/8 inch or M8 bolts, lock washers and flat washers (customer-provided). The installer must select the proper bolt length for the application. The recommended installation torque for an M8 stainless steel fastener is 15-17 Nm (130-155 in.-lb.). The recommended installation torque for a 3/8 inch stainless steel fastener is 21-27 Nm (190-240 in.-lb.). It is recommended to use low strength thread-locking compound.

3. The saddle is adjustable to accommodate all models of the RCP as well as variations in mounting (Figure 5-12). The saddle must be attached so that it is centered with the RCP and mast base tube. The height should be adjusted to firmly contact the RCP when the mast is nested. To adjust the saddle height, loosen the 1/4 inch bolts and slide the bracket upward. Tighten the four bolts when positioned properly. The nuts have inserts to prevent vibration loosening. Ensure each nut is tight to the bracket. Ensure the saddle is in contact with the RCP after tightening.

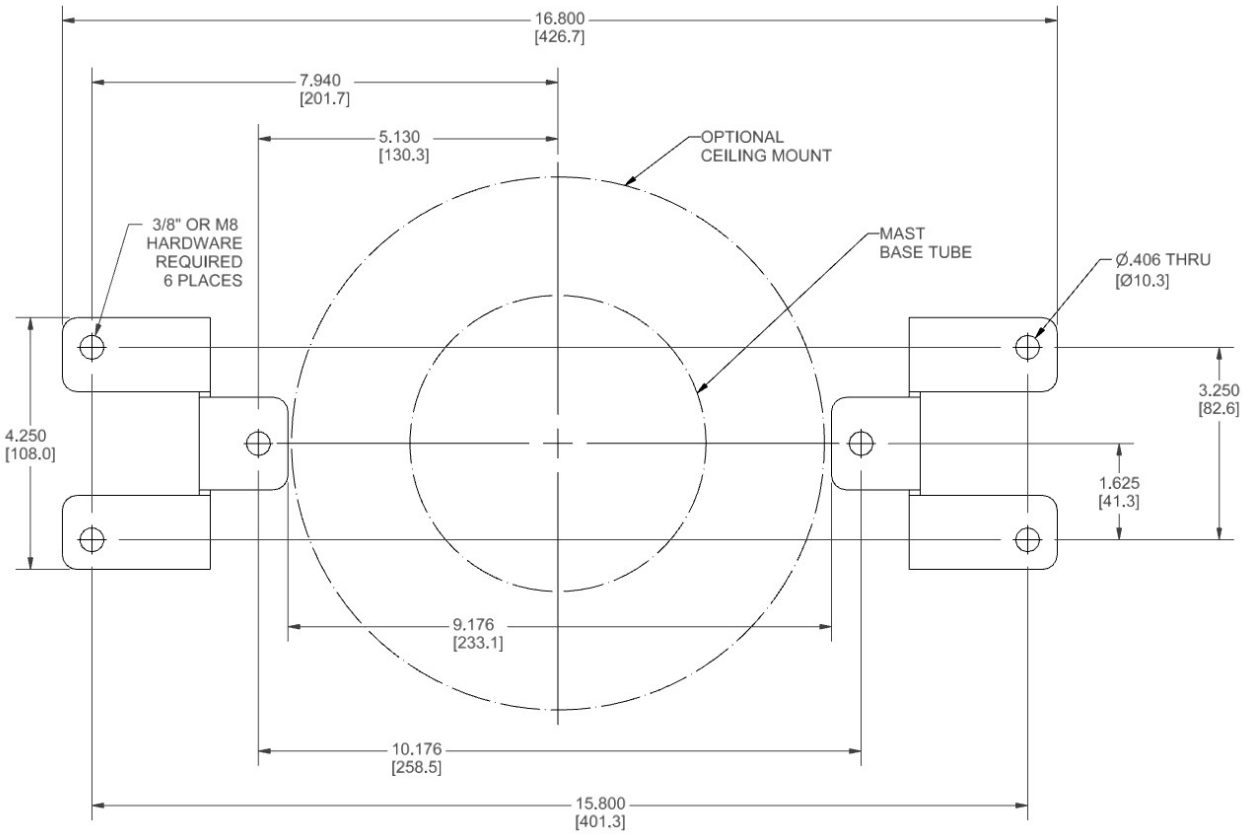


Figure 5-11 Night Scan Vertical Saddle Mounting Holes

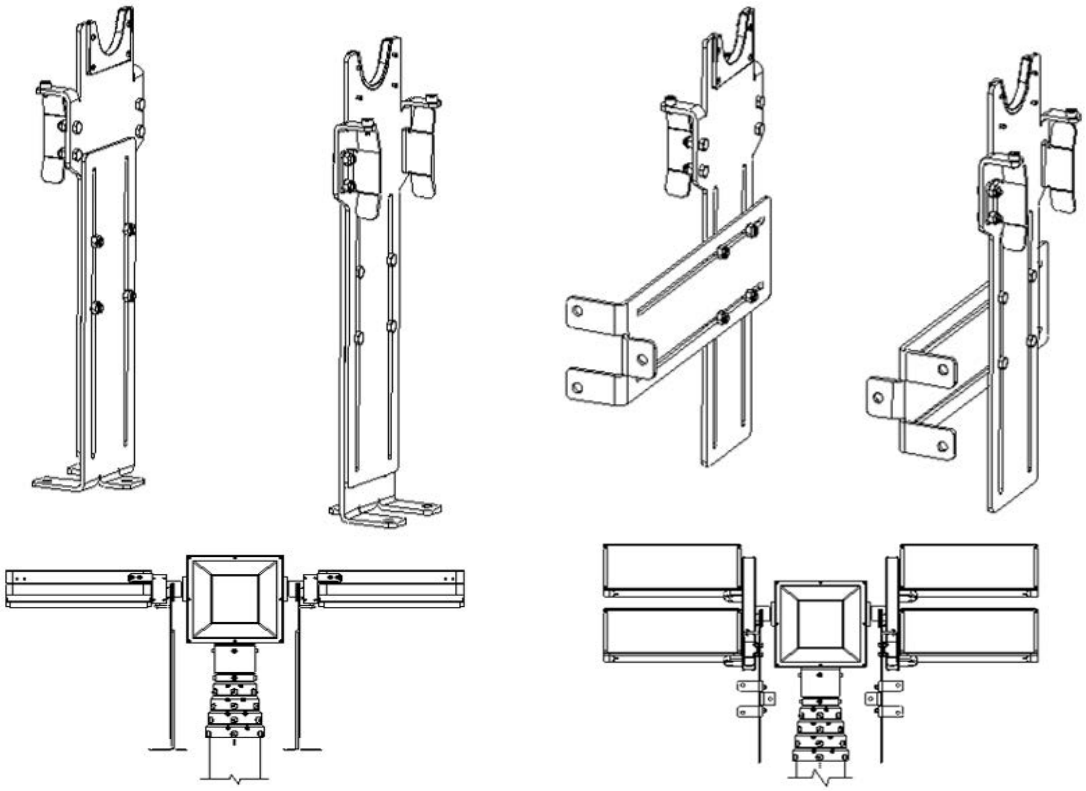


Figure 5-12 Mounting Variations. Clockwise from upper left: Saddle Deck Mount; Saddle Wall Mount; Saddle and RCP Assembly Lights Stowed Horizontally; Saddle and RCP Lights Stowed Vertically

5.4.9.2 Night Scan Vertical HDT

To attach the RCP saddle brackets:

1. Drill eight mounting holes into the mounting structure according to Figure 5-13. The brackets can be used as a template to mark locations.

2. Attach the brackets using 9/16 inch or M14 bolts, lock washers and flat washers (customer-provided). The installer must select the proper bolt length for the application. Torque all hardware as appropriate for its material and size. It is recommended to use low strength thread-locking compound.

3. The saddle is adjustable to accommodate all models of the RCP as well as variations in mounting. The saddle must be attached so that it is centered with the RCP and mast base tube. The height should be adjusted to firmly contact the RCP when the mast is nested. To adjust the saddle height, loosen the 9/16 inch bolts and slide the bracket upward. Tighten the bolts when positioned properly. The nuts have inserts to prevent vibration loosening. Ensure each nut is tight to the bracket. Ensure the saddle is in contact with the RCP after tightening.

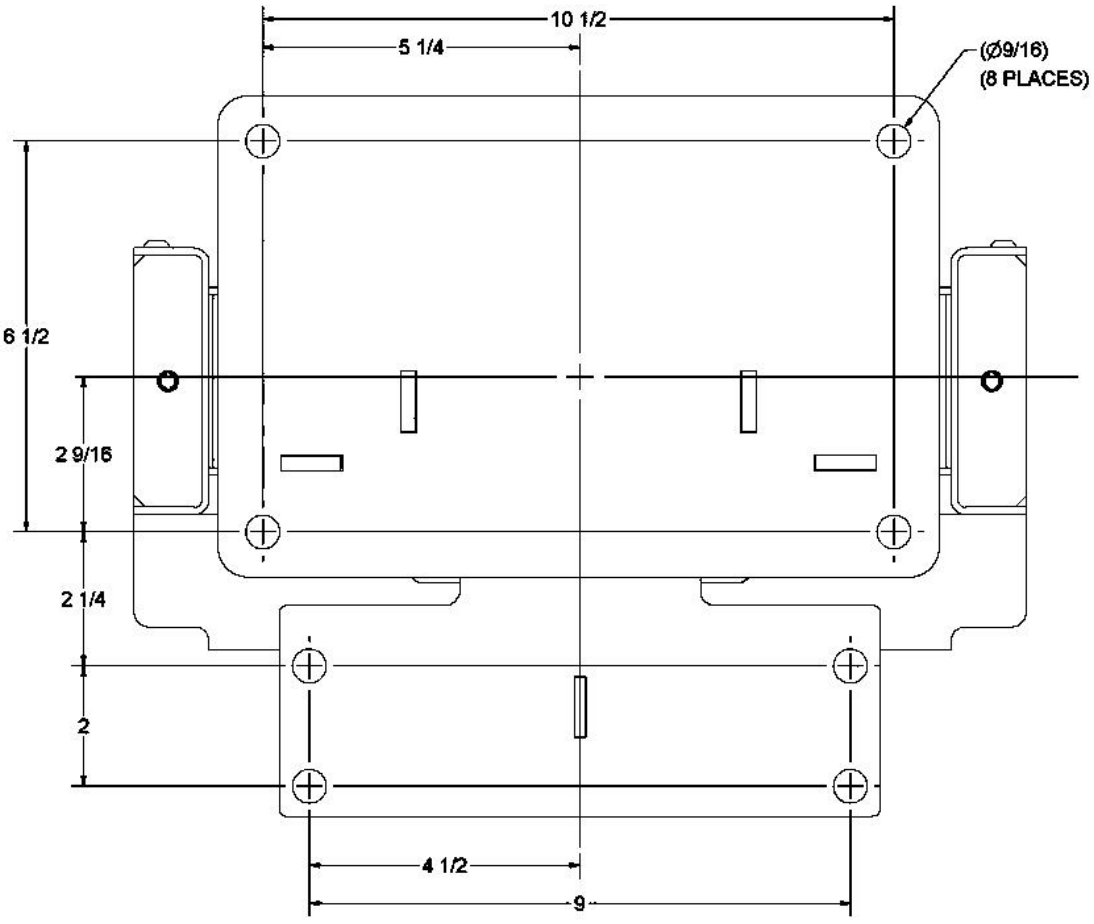


Figure 5-13 Night Scan Vertical HDT Saddle Mounting Holes

5.5 Attaching the Control Box

5.5.1 Night Scan Vertical

The control box should be located in a protected, dry location such as in a vehicle or in a weather-protected enclosure. The control box may be surface mounted using four M6 or 1/4 inch 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 four clearance holes located on the rear side of the control box (Figure 5-14).

3. Attach the bolts, lock washers and nuts to secure the unit. The recommended installation torque for an M6 or 1/4 inch stainless steel fastener is 7-8 Nm (60-72 in.-lb.). It is recommended to use low strength thread-locking compound.

4. Reconnect any cables and replace the cover. Be sure to secure the green ground wire provided on the bulkhead to vehicle ground.

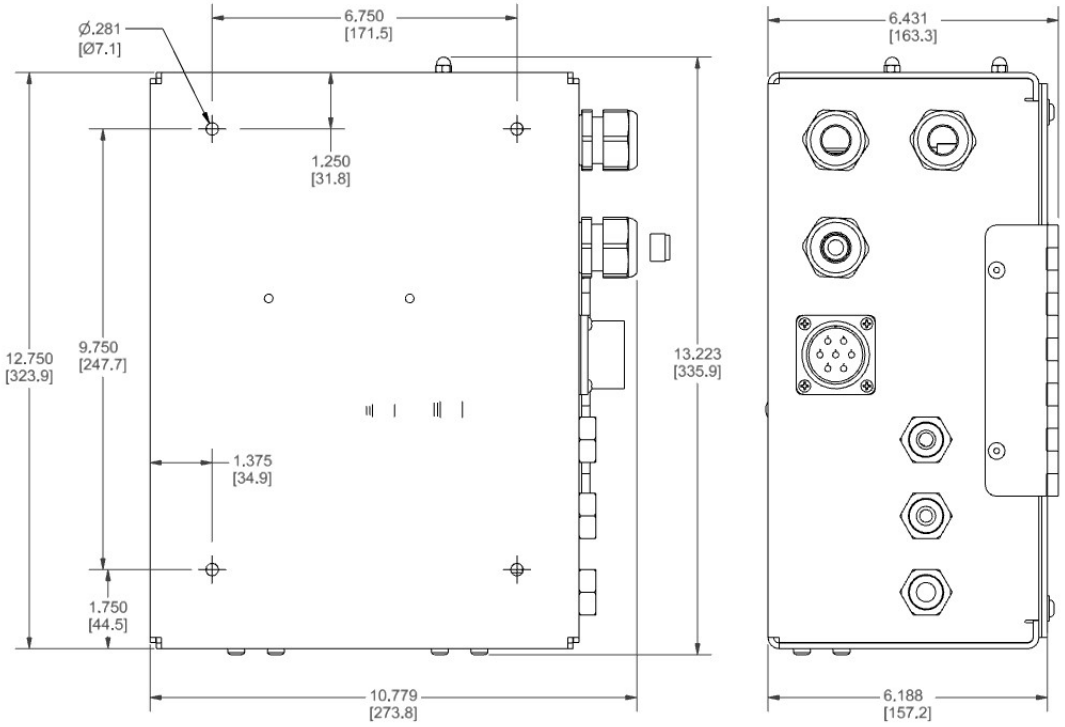


Figure 5-14 Night Scan Vertical Control Box Mounting Hole Locations

5.5.2 Night Scan Vertical Complete

See Section 5.4.2 to see how to attach the Night Scan Vertical Complete control box.

5.5.3 Night Scan Vertical HDT

The control box may be surface mounted using four ¼ inch or M6 screws, nuts, and lock washers provided by the installer.

To install the control box:

1. Mount the unit through the clearance holes located on the back of the control box (Figure 5-15).

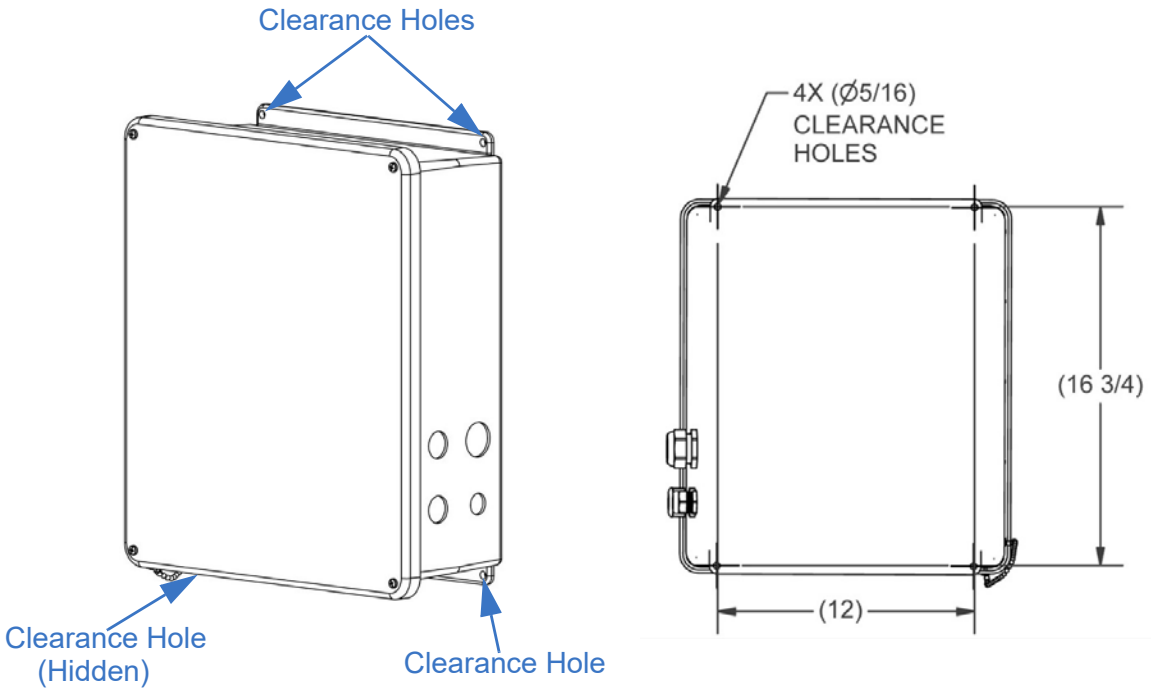


Figure 5-15 Night Scan Vertical HDT Control Box Clearance Holes

2. Attach the lock washers and nuts to secure the unit.

3. Be sure to secure the green ground wire provided on the bulkhead to vehicle ground.

5.6 Attaching the Air Connections

5.6.1 Night Scan Vertical

Source air may be supplied externally by a compressor or other source of clean, dry air with a maximum pressure of 6.9 bar (100 psi). The source air should be attached to the port on the control box labeled “Air - Inlet” (see Figure 5-16). The supply air hose and fitting are supplied by the customer and should be rated properly for the air pressure of the supply. The air inlet port on the control box is a 1/4 inch NPT female thread. The fitting can be installed with PTFE tape or pipe sealant. To not choke the air flow rate to the mast, a 3/8 inch or 8 mm inner diameter hose is recommended.

9 meters (30 feet) of 3/8 inch inner diameter air hose is supplied with the mast system along with two 1/4 inch NPT hose barb fittings. Install one hose barb fitting to the control box port labeled “Air - to Mast” (see Figure 5-16) and the other hose barb fitting to the cross fixture at the base of the mast (see Figure 5-17). PTFE tape or thread sealant can be used on the hose barb threads. Route the air hose and connect both ends to the fittings. The hose can be cut to the desired length.

When nesting the mast, exhaust air will exit the control box through the port labeled “Air - Exhaust” (see Figure 5-14). The exhaust air hose and fitting are supplied by the customer. The port is a female 1/4 inch NPT. It is recommended to use a larger inner diameter air hose and fitting than the supply port to not restrict the exhaust flow rate (slows mast retraction rate) and also to prevent someone from accidentally connecting the air supply to the exhaust port. The other end of the exhaust air hose should be routed to a location that does not allow exiting air to contact personnel or sensitive equipment as moisture may be discharged.

The hardware kit shipped loose with the mast system contains two 90° elbow fittings. These are optional to use to account for space limitations for an application and can be installed where needed.

The mast ships with pneumatic fittings and components loose. Assemble the pneumatic components according to Figure 5-17. This assembly installs in the air inlet port near the bottom of the mast. PTFE tape or pipe sealant can be used on all these components. Do not operate the mast system without the safety valve installed.

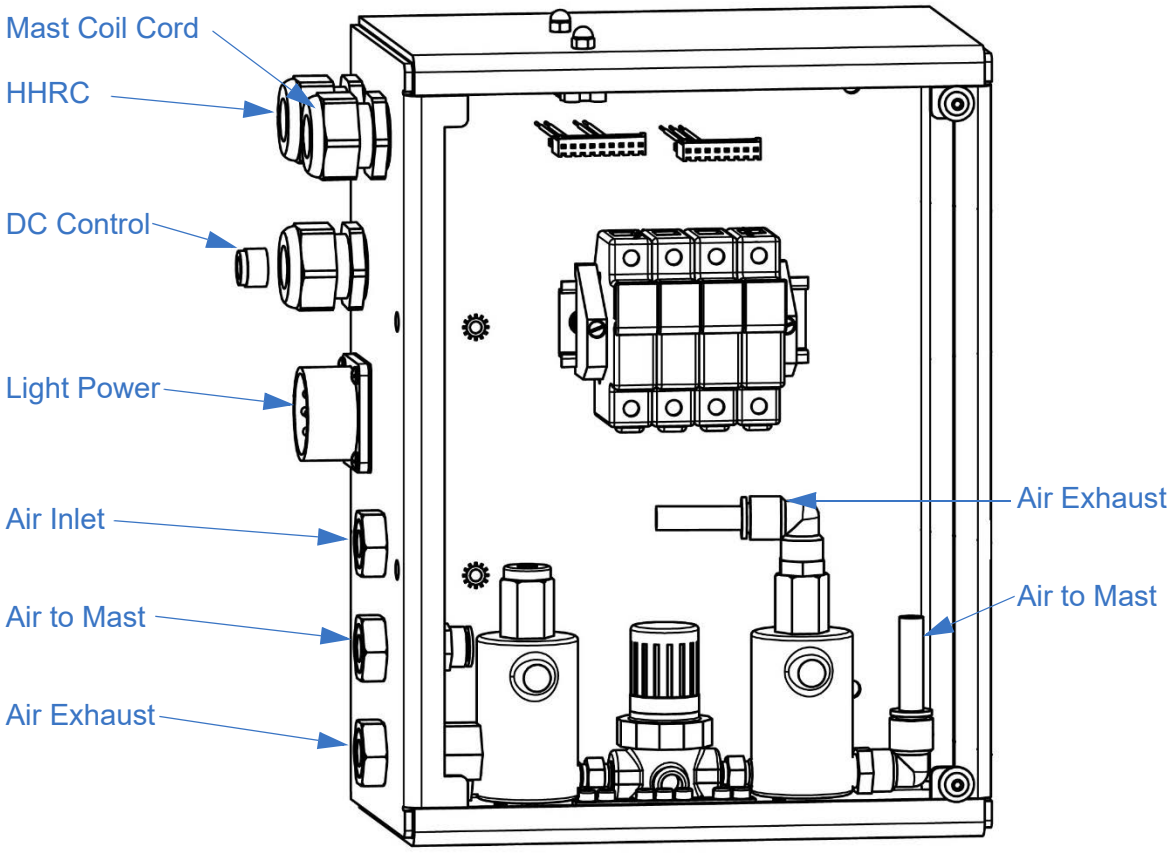


Figure 5-16 Control Box Valve Layout (Cover Removed)

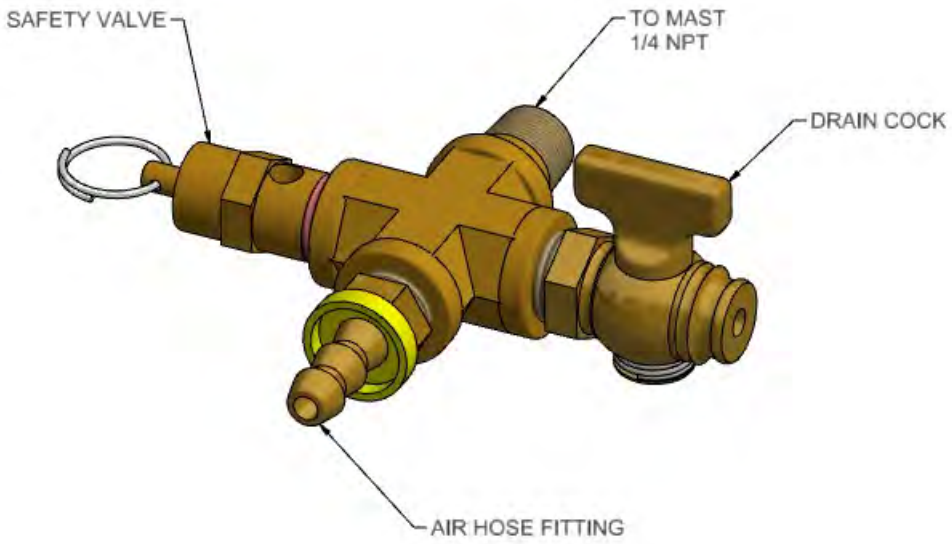


Figure 5-17 Mast Air Inlet Hardware Kit Assembly Detail

5.6.2 Night Scan Vertical Complete

The Night Scan Vertical Complete operates with an air compressor, which arrives already installed. This means that there is no air connection setup required.

5.6.3 Night Scan Vertical HDT

Air may be supplied externally by a compressor or other source of clean, dry air with a maximum pressure of 6.9 bar (100 psi). The inlet fittings are for use with 3/8 inch or 8 mm 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 Vertical HDT has an internal regulator factory set to 1.4 bar (20 psi).

The unit is supplied with 6.1 meters (20 feet) 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 inch or 13 mm inside diameter air hose. The unit is supplied with 6.1 meters (20 feet) 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.

Refer to Figure 5-18 for identification of the air fittings in the system. The exhaust hose must be routed to a location where it will not expel air or water onto personnel or equipment sensitive to moisture.

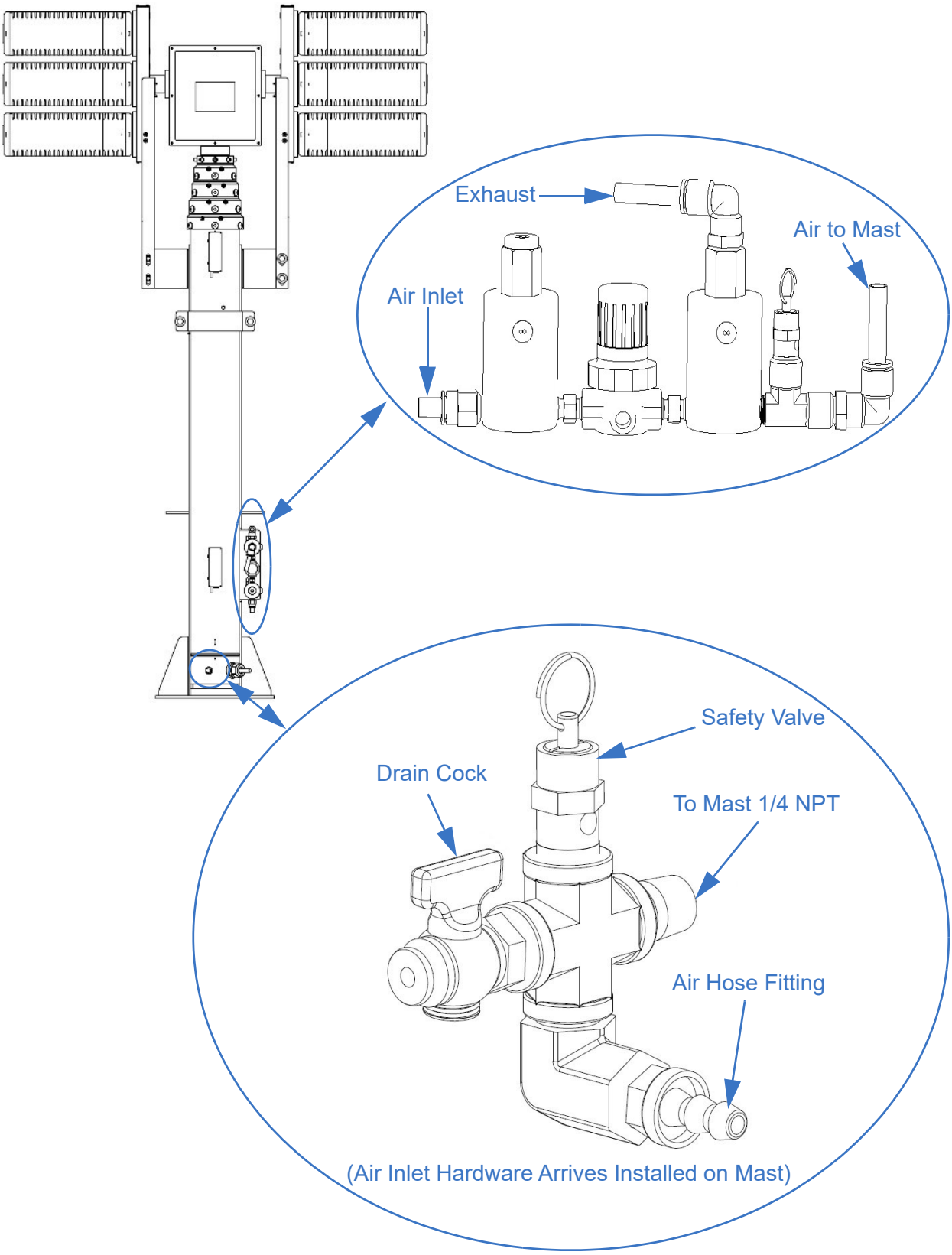


Figure 5-18 Night Scan Vertical HDT Valve Assembly and Air Inlet Hardware Assembly

5.7 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 for the light tilt angle. The unit may rotate the light fixtures as soon as power is applied for the first time.

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 while being careful not to pinch the wires.

5. Orient the RCP in the desired direction noting the RCP shipped in the Auto Stow® position for panning. Connect the RCP and mast with the four provided screws and washers (see Figure 5-19). Torque the screws to 7-8 Nm (62-70 in.-lb.). Once all four screws are tight, re-torque each screw a second time to ensure that tightening one screw did not loosen another on the diameter. Each screw must be installed with low strength Loctite (blue).

Figure 5-19 RCP Installation

5.8 Installing the Magnetic Switches

Note: The magnetic switches contain Reed switches made from glass tubes that can be damaged under high impact loading due to handling. This requires the installer to be careful when handing the switches.

The magnetic switches interact with a permanent magnet installed at the bottom of the mast top tube (not visible). When the magnet is in proximity to the switch, the switch is triggered. For internal mounting applications, be sure to install the mast in the internal mounting kit in the vehicle before installing magnetic switches so the mast will fit through the opening in the roof.

The magnetic switches are shipped loose with the mast. The upper magnetic switch defines the trigger point to make the RCP functions active. The goal is to have this trigger point high enough to clear all vehicle obstructions before panning or tilting the lights. First, install the upper magnetic switch at the top of the mast per Figure 5-20. This should be located within 12 mm (1/2 inch) from the bottom of the base tube collar as a starting point. This height can be adjusted later. Tighten the band clamp in the desired position. Note the orientation of the switch on the tube diameter must match Figure 5-20 because the magnet is installed to one side of the mast top tube. Note the orientation of the cable entry and pneumatic port at the bottom of the mast to position both the top and bottom switch orientation.

Attach the bottom switch toward the bottom of the mast, again noting the proper orientation shown in Figure 5-20. The final height of this switch will be adjusted after the control systems are wired and powered up (see Section 5.10.7). This switch is used to confirm the mast is in the nested position for the vehicle interconnect circuit and mast logic.

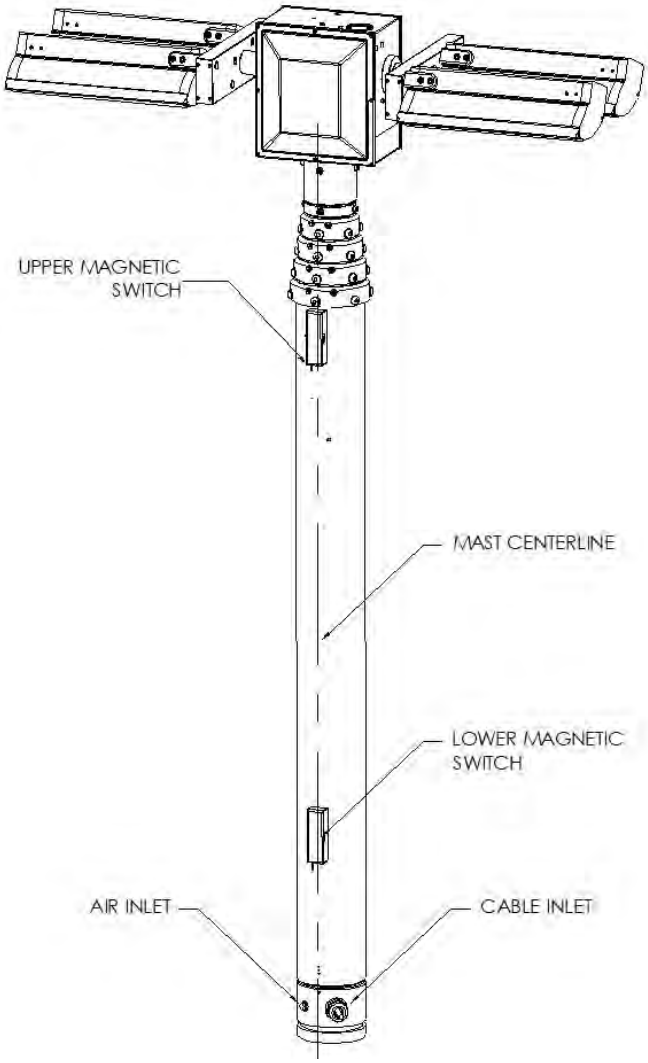


Figure 5-20 Upper and Lower Magnetic Switches

5.8.1 Attaching the Power Converter

Note: The Power Converter is standard with the Night Scan Vertical HDT, but it is optional for the Night Scan Vertical and Night Scan Vertical Complete.

Mount the power converter vertically (fins up and down) for better heat dissipation (Figure 5-21). The best practice is to mount the power converter in a fan-cooled enclosure. Do not mount the power converter in the engine compartment or an enclosed space without ventilation.

Figure 5-21 Power Converter Mounting

5.9 Installing Remote Control

This section provides information to install the remote control. Several options are available. Follow the instructions appropriate for your system.

5.9.1 Wired Hand-Held Remote Control (HHRC)

Go to section 5.9.2 to if you are installing the Panel Mount Remote Control (PMRC) or section 5.9.3 for the wireless control option. This section describes how to install the Wired HHRC with a bulkhead.

The bulkhead connector is provided to remotely install the connection point for the HHRC at the operator control location. The operator station should be located where the operator has line-of-sight to the mast operating space. The bulkhead and HHRC should be located in a protected, dry location (the HHRC is IP54).

To attach the bulkhead:

1. Drill clearance holes for 1/4-20 screws located per Figure 5-22. Either two hole pattern can be selected according to the space available.

2. Using the screws, washers, and nuts provided, attach the bulkhead to the vehicle. Torque the 1/4-20 screws to 62-70 in.-lb. (7-8 Nm). Alternative M6 stainless steel hardware (not provided) can be used.

3. Attach the ground wire to the vehicle.

4. Attach the HHRC connector to the bulkhead connector by rotating the lug until it locks in place.

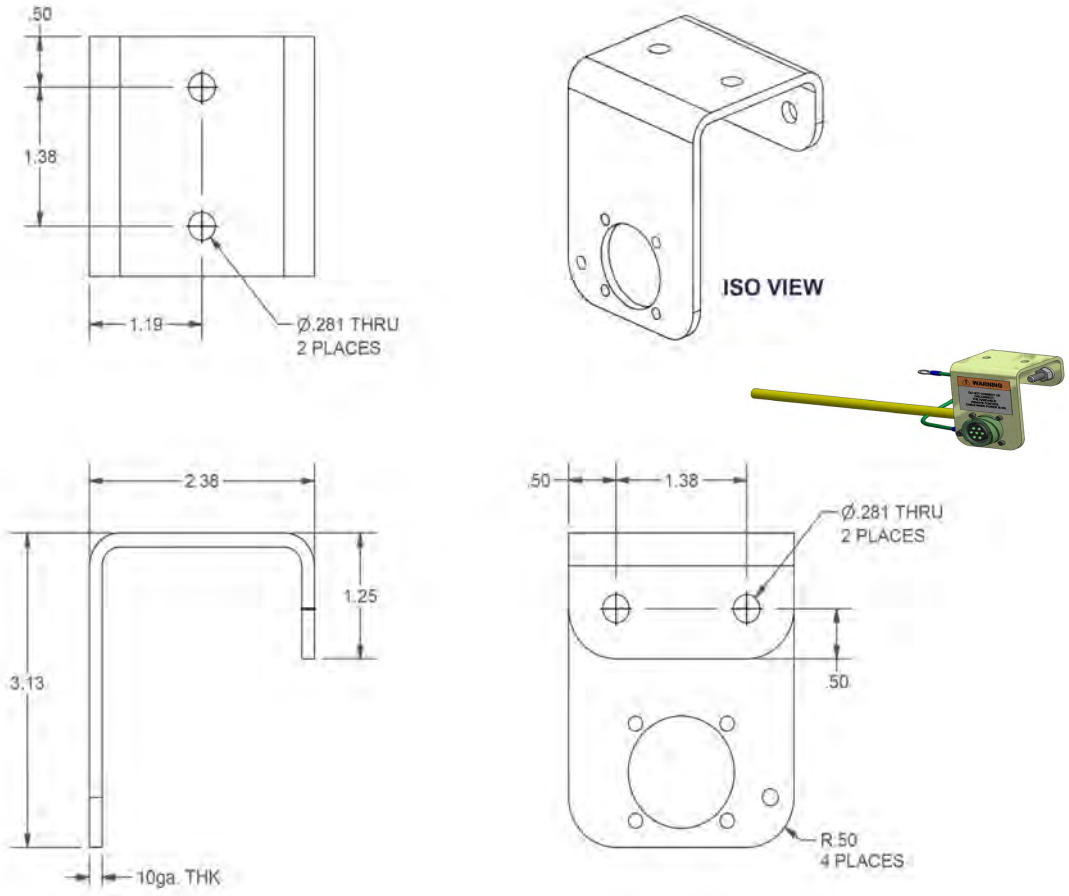


Figure 5-22 HHRC Bulkhead Bracket Installation Dimensions

The HHRC comes with a holder (see Figure 5-23) to hang the HHRC. Attach the HHRC holder at a convenient location to hang the HHRC in a dry, protected environment. To install the holder:

1. Drill two holes 1.125 inches (28.6 mm) apart as appropriate for the screws and mounting method (nut/bolt or sheet metal screw or other) selected.

2. The mounting screws are provided by the installer based on the method of attaching selected. The recommended screw size is M4 flat head to sit flush with the surface after installation. Use the proper installation torque for the screw selected and use thread-locking techniques to prevent the screws from backing out due to vibration. Mount the holder to ensure the wedged side in the groove is facing upward to mate to the HHRC.

3. Place the HHRC on the holder.

Warning labels are shipped loose with the mast. These labels should be posted in view of the operator.

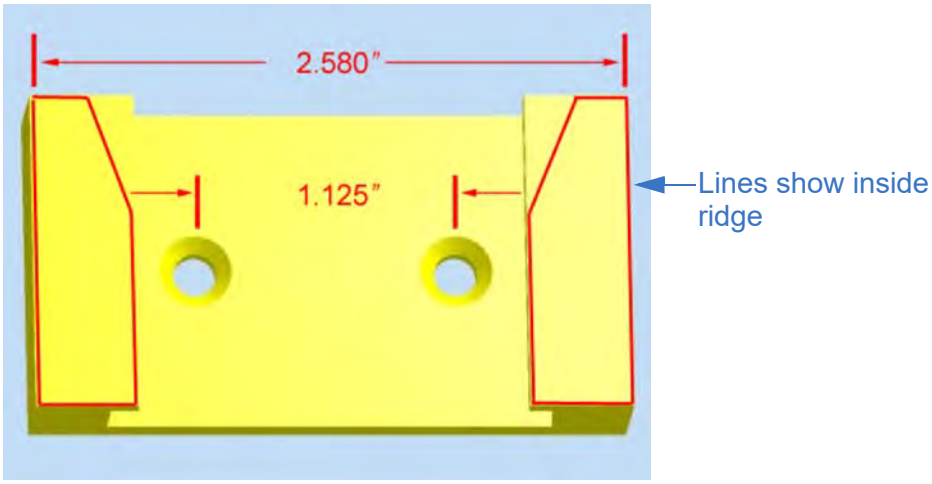


Figure 5-23 HHRC Holder

5.9.2 Panel Mount Remote Control (PMRC)

If your system was not ordered with the optional PMRC, go to section 5.10.1.

The PMRC should be located where the operator has line-of-sight to the mast operating space. The PMRC should be located in a protected, dry location (the PMRC is IP54). To attach the PMRC:

1. Cut the panel according to the dimensions shown in Figure 5-24.

2. The screws are provided by the installer. #10 stainless steel screws are recommended with an installation torque of 20-24 in.-lb. (2.2-2.7 Nm).

3. Place the PMRC through the panel cutout and secure with screws.

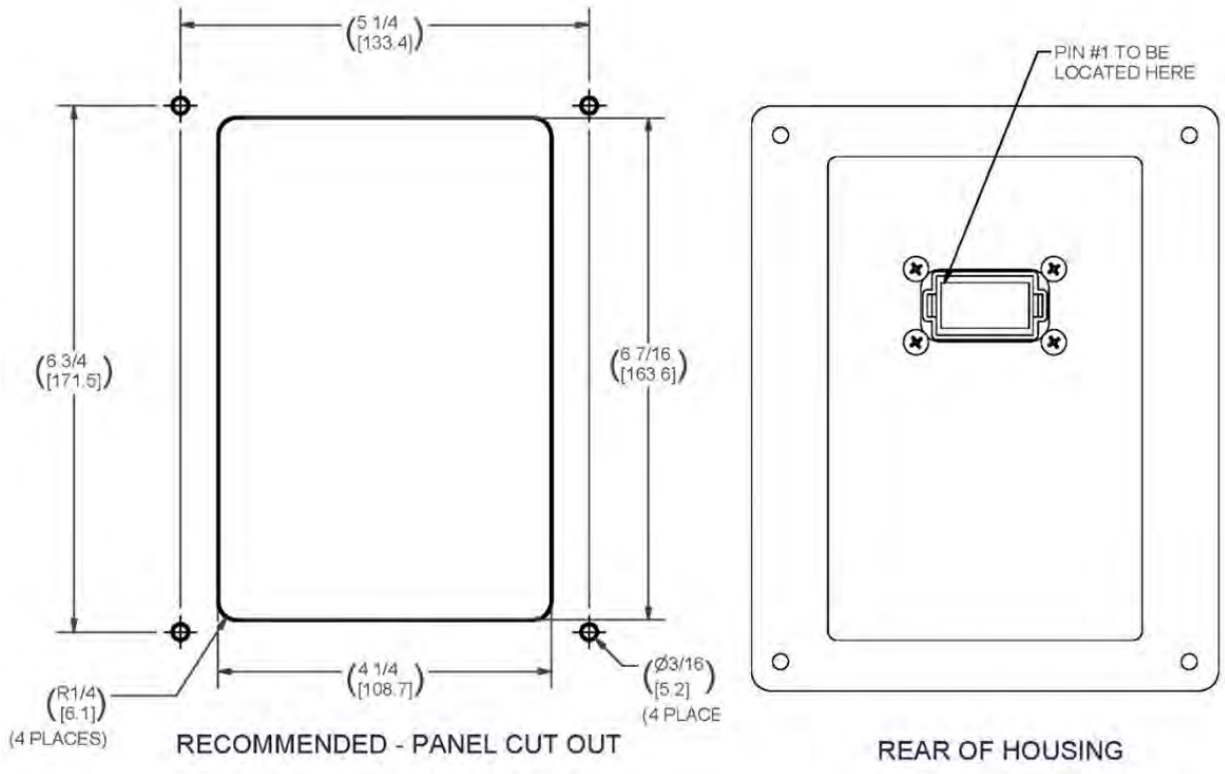


Figure 5-24 PMRC Panel Cutout Dimensions

A loose wiring connector is shipped with the PMRC to allow cable routing in the vehicle. Once the cable is routed, wire the connector and attach the connector to the back of the PMRC.

To wire the PMRC connector:

1. See the wiring diagrams provided in the Appendix.
2. Ensure power is properly disconnected from the system.
3. Connect the wires from the Control Cable to the supplied PMRC plug according to the wiring diagram.
4. Plug the cable into the back of the PMRC.

5.9.3 Wireless Remote Control

Refer to TP-5543301 for installation instructions for the Wireless Remote Control option.

5.10 Electrical Installation Detail

Ensure the source power for the mast and lights is not connected or turned off before wiring the system following proper lock-out tag-out procedures. See Figure 3-11, Figure 3-12, Figure 3-13, and Figure 5-16 for information on where the cables run into the control box. There is a bushing provided if the cable outer diameter does not match the cable grip diameter to install if needed. Refer to the wiring diagrams contained in the Appendix section. Be sure to follow the recommended torque requirements found in the wiring diagram. Remove the screws on the control box lid and open the lid to expose the base board mounted to the back of the lid.

Note: The Night Scan Vertical HDT comes pre-wired internally from the factory. During installation, electrically connect the other ends of the following:

- Solenoid Power
- DC Board Power
- DC Light Power Input
- Bulkhead Control Cable

See drawing WD-47621 in the Appendix Section for more information on how to electrically install the Night Scan Vertical HDT.

5.10.1 Wiring Remote Control Cable to the Base Board

The bulkhead cable (or PMRC Control Cable) connects the bulkhead, remote control, and base board.

Route the cable through the cable grip labeled HHRC in Figure 5-16. Then connect the wires from the bulkhead cable (or PMRC Control Cable) to the green J4 connector located on the top left of the base board, ensuring the wires match the color strip on the J4 connector and the wiring diagram. Connect the J4 connector to the base board.

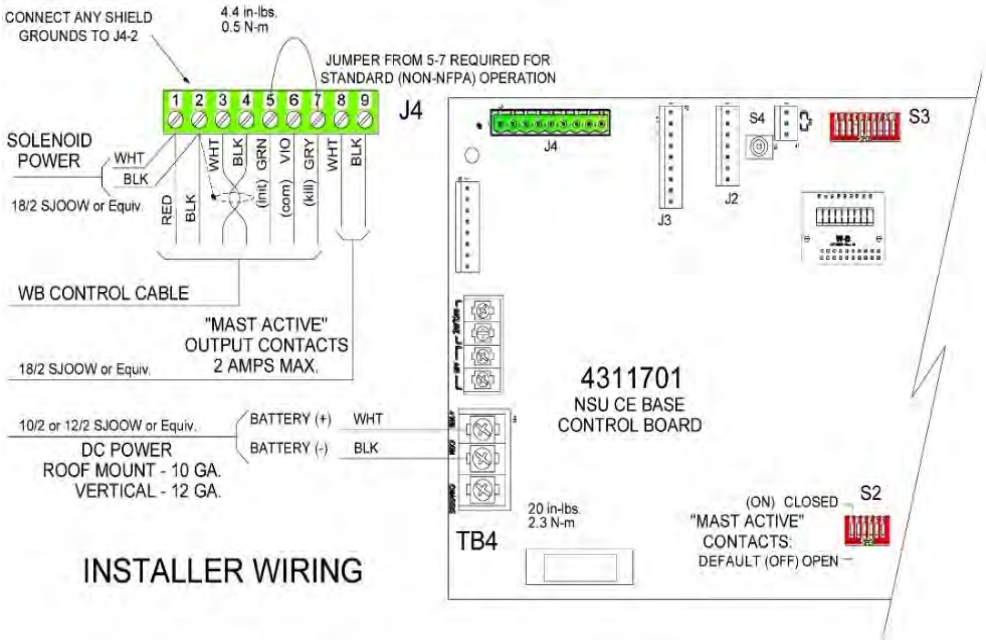


Figure 5-25 Wiring J4

5.10.2 Wiring Magnetic Switches to the Base Board

The cables for the upper and lower magnetic switches installed on the mast can be routed through one of the cable grips. These cables may need to be extended, depending on the location of the control box.

Connect the magnetic limit switch wires to the connector supplied for J3, ensuring the wires match the wiring diagram. Connect the J3 connector to the base board.

5.10.3 Wiring DC Source Power to the Mast Control Circuit

The mast control system requires DC power regardless of what power is required by the lighting circuits (AC or DC). Source DC power is provided by the installer from the vehicle battery. The mast system will operate with 12VDC or 24VDC source power.

The base board contains a 20 amp fuse to protect the mast control circuits from over-current events. The installer is responsible for providing the means to remove/isolate power from the mast and permit the operator to follow proper lock-out tag-out procedures for maintenance or troubleshooting.

Route the DC power cable into the control box. Attach the 0.709 inch (18 mm) inside diameter ferrite (shipped loose with the mast) around the Control/DC cable as it enters the control box. This ferrite provides electromagnetic interference (EMI) filtering.

Power cables for the mast controls are provided by the installer. The cables must:

- Be type SJOOW or equivalent
- Be 10 AWG (or 6 mm^2) conductors
- Have a maximum length for acceptable voltage drop of 70 feet (21 meters)

Connect the DC battery power to the +VIN (red or white) and COM (black) connections on terminal block TB4 on the lower left side of the base board. The source must be capable of delivering the maximum current as defined in the Technical Data table.

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.

5.10.4 Wiring Source Power to the Lighting Circuits

The lighting circuits consist of two (2) independently powered circuits: left and right. Depending on the light package installed on the unit, the source power for the left and right light circuits will change to match the light fixtures. Be sure to confirm the installed light fixture voltage requirements before applying light power to avoid damaging equipment.

It is important to calculate the current draw for the wires in each lighting circuit. To calculate the current draw for the wires:

- Divide the total watts of the entire mast unit by two (since there are two circuits).
- Divide the result by the voltage.
- This final result is the amperage required for each side light circuit.

Table 5-4 shows some example current calculations. Your mast may have different results based on the installed light type and number of lights. In Example 1 (Table 5-4), the lights in the system are a total of 500 watts. This is divided by two to get the watts per side. The result is then divided by the voltage (12) to get the amps (21 rounded). The wires in this example should be able to carry at least 21 amps with minimal voltage drop.

Table 5-4 Sample Light Circuit Current Draw Calculation

	Total Watts	Voltage	Current Draw Per Side (Amps)
Example 1	500 W	12 VDC	21 Amps per side
Example 2	1500 W	120 VAC	6.25 Amps per side

It is the responsibility of the installer to provide over-current protection for both lighting circuits. The over-current protection on each circuit should be sized for the calculated current draw for the installed lights (and not based on wire size current capacity). It is also the responsibility of the installer to provide a means to remove/isolate power from the mast light circuits and permit the operator to follow proper lock-out tag-out procedures for maintenance or troubleshooting.

Light power cables can be purchased from The Will-Burt Company or provided by the installer. For CE conformity, the installer must provide the light power cables in conformance with applicable Directives. Cables supplied by The Will-Burt Company do not have blue color for conductor identification.

If the cables are supplied by the installer, the cables must:

- Be type SOOW or equivalent.
- Be 10 AWG (or 6 mm^2) conductors.
- Have a maximum length for acceptable voltage drop of 70 feet (21 meters).

Light power lands on a connector on the side of the control box (see Figure 5-16). When purchasing optional Will-Burt power cables, these cables are supplied with the mating connector installed. These cables can handle 20 amp maximum current.

For customer supplied lighting power cables, the customer must supply the connector. The connector to attach to the power cable is: MIL-DTL-5015 Style, PLUG, 7 PIN, CA3106E24-10S-F80A206. This connector will mate to the connector installed on the control box.

Plug the source power connector into the control box connector.

5.10.5 Wiring Vehicle Safety Interconnect Circuit

The mast provides an isolated relay contact output to enhance integration into vehicle safety circuitry. This output indicates whether or not the mast is stowed to indicate it is safe to move the vehicle. The use of this vehicle safety interconnect is required for vehicle National Fire Protection Association (NFPA) regulation compliance. The Will-Burt Company does not recommend installing the mast on a vehicle without connecting to the vehicle safety interconnect circuit to warn the driver or prevent the driver from moving the vehicle with the mast extended.

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 (2) amperes and is available on pins J4-8 and 9 (data cable supplied by the installer). Figure 5-26 shows an example vehicle safety interconnect circuit. It can be used in conjunction with a customer-supplied relay to drive a flashing warning light. Other arrangements are possible.

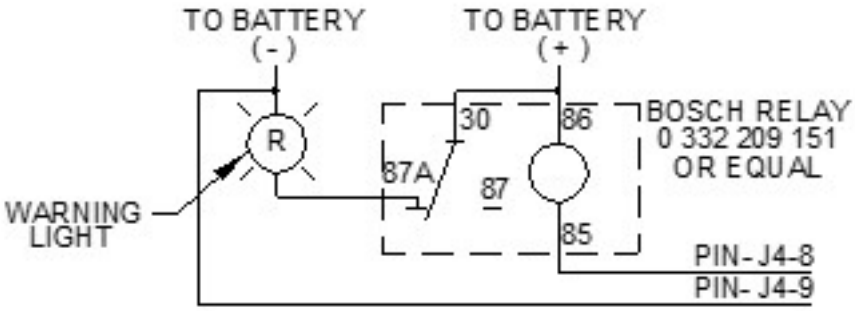


Figure 5-26 Example Vehicle Safety Interconnect Circuit

The contact output is set at the factory to be OPEN when the mast is active (not stowed) by setting the S2-1 Dual In-Line Package (DIP) Switch to the OFF (OPEN) position. To change the contact output to be CLOSED when the mast is active, set the S2-1 DIP Switch to the ON (CLOSED) position. Mast power needs to be cycled for this change to take effect.

5.10.6 Wiring Optional Enable Circuit

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 "E-Stop" button. Inserting these contacts in line with the wire connected to pin J4-7 on the base circuit board breaks continuity, which inhibits operation of the mast and prevents 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.

5.10.7 Power-up and Magnetic Switch Adjustment

Note: When applying power to the mast for the first time, it is possible the light fixtures will rotate (tilt) to the stowed position. Stay clear from the light fixtures during power-up.

Once all wiring connections have been made, apply DC power to the mast control system. Press the start button to power up the mast system.

With the mast fully nested (no gaps between any of the collars and the RCP is touching the saddle brackets) and the lower magnetic switch is toward the bottom of the mast base tube, loosen and slowly move the lower magnetic switch up on the mast. Continue to raise the bracket location while observing the base board LED labeled “Mast Down”. When the LED turns green, you have reached the location of the magnet inside the mast. Move the magnetic switch up 6 mm (1/4 inch) from this activation point (this accounts for temperature variations in magnetic field and magnet physical position) and tighten the band clamp. Be sure the magnetic switch bracket is still oriented properly and the LED light is still green after the band is tightened.

The upper magnetic switch does not need to be adjusted from the initial position just below the mast base tube collar. If desired, the upper switch can be lowered to cause the RCP to become active at a lower height. The installer must ensure that the RCP is free to pan and rotate 360° without hitting any obstructions on the vehicle at any lowered height.

5.10.8 Secure Wiring and Attach Control Box Lid

1. Secure all loose wires with wire ties.

2. Tighten all cable grips. If multiple cables are routed through the same cable grip on the control box, apply sealant to help keep water from entering the control box.

3. Close the control box lid and secure the lid screws to complete the installation.

5.11 Test the Installation

Review the Operation (Section 6) and the Safety Summary (Section 1) sections and observe all safety dangers, warnings, and cautions 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 to the mast and light circuits.

2. Turn the E-Stop button to reset and enable the system (if it was pressed).

3. Push and hold the green “NFPA Start” button until the system begins power-up.

4. Check for proper clearance above the mast.

5. Press and hold the “Mast-Up” button to raise the mast high enough to activate the RCP (approximately the height of the first mast tube section). This point can be detected by the LED indicator lights on the RCP for the pan and tilt functions lighting up. At the lowest point of activation, test the panning and tilting motions to ensure the lights do not contact any vehicle structures.

6. Press each “Light” button several times to turn the lights on and off.

7. Press “Tilt-Up” and “Tilt-Down” buttons one at a time. Press “Pan-Left” and “Pan-Right” buttons one at a time. Check the lights on each side again.

8. Press and hold the “Mast-Up” button. When the mast is fully extended, release the “Mast-Up” button. The mast should extend smoothly. If a tube section “sticks” and lurches upward rapidly causing impact loading between two mast tube sections, consult The Will-Burt Company’s service department.

9. Press each “Light” button several times to turn the lights on and off.

10. Tilt and pan both sets of lights. Check the lights on each side again.

11. If the optional beacon light is installed, press the “AUX” button several times to turn the light on and off.

12. To ensure that the mast is properly sealed, while the mast is fully extended, watch for any type of mast lowering.

13. Rapidly press the “Mast-Down” button two times to invoke the Auto Stow® feature that places the mast into the saddle and turns power off. Confirm the power automatically turns off when nested.

14. Ensure the RCP is in firm contact with the saddles when nested. Adjust the saddle height if they are not contacting according to Section 5.4.9.

15. Visually confirm the safety over pressure relief valve is installed at the mast air inlet.

6 Operation

This section describes the operation of the system. Be sure to read and understand the entire operation procedure and the Safety Summary (Section 1) before beginning operation.

6.1 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 (6 meters) 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 that might obstruct motion of the mast, cause binding or hinder mast function.

6.2 Remote Control Functions

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 (WHHRC)
- Single-Tilt Hand-Held Remote Controller (HHRC)
- Single-Tilt Panel Mount Remote Controller (PMRC)

Using the Remote Control, the operator can perform an emergency stop, 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 beacon light on and off. The following are the Remote Control buttons:

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

- Tilt Down
- Tilt Up
- Lights

These buttons operate the sides of the Remote-Controlled Positioner (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.

6.3 Quick Operation Summary

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

If an emergency stop (E-Stop) is required at any time, press the “E-Stop” button. This disconnects the unit from power and causes all air to be exhausted from the mast. The mast fully lowers (if it was raised) regardless of the orientation of the RCP.

1. Ensure the vehicle is stationary and the parking brake is engaged.

2. Ensure there are no obstructions in the mast operating space.

3. If the “E-Stop” was activated, it must be reset by turning to enable the system to power-up. Do not reset the “E-Stop” until the cause of the event is corrected. Turn the red “E-Stop” button if needed. Then press "NFPA Start" to power-up the mast.

4. Raise the mast by pressing and holding the “Mast Up” button. Then press the “Lights” 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 "AUX" button to turn on the 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 "Mast Down" twice (Auto Stow® feature). It is recommended to use the Auto Stow® feature to stow the mast. To abort Auto Stow®, press 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.

6.4 Initiating (Power-Up)

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. The Wired Hand-Held Remote Controller (HHRC) must be connected prior to power-up to be recognized by the controller.

Perform the following to power up the system:

1. If the “E-Stop” was activated during prior use, it must be reset by turning to enable the system to power-up. Do not reset the “E-Stop” until the cause of the event is corrected. Turn the red “E-Stop” button if needed.

2. Press and hold the "NFPA Start" button until the mast powers-up.

6.5 Extending the Mast

The mast can be extended to full or partial height. To extend the mast, press and hold "Mast Up" 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 psi (1.4 bar), and then the exhaust valve will open and exhaust any more air that enters the mast, leaving the mast at its maximum extended height.

6.6 Controlling the Lights

The lights can be turned on and off from the remote control after the first tube section has been extended far enough to activate the upper magnetic switch and the RCP has 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. LED indicators on the Wired Hand-Held Remote Controller (HHRC) light up with that particular motion button is possible.

To pan and tilt the lights:

- Holding "Tilt Down" turns the lights down and all the way around to 350°.
- Holding "Tilt Up" turns the lights back in the other direction.
- Holding "Pan Right" turns the lights to the right.
- Holding "Pan Left" turns the lights to the left.
- Pressing "Lights" toggles the lights on and off.
- Pressing “AUX” toggles the auxiliary power (optional beacon light or camera).

6.7 Lowering the Mast

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

6.8 Stowing the Mast

The "stowed" position is also called the "nested" position. The stowed position is the position of the mast when it is fully lowered and firmly seated in the saddle. The mast is considered stowed when the Mast Stowed Switch (lower magnetic switch) is closed and the mast powers-off.

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 and ensure contact is made with the saddle.

The mast can be stowed by using:

- Auto Stow®
- “Mast Down”
- Emergency Stow With Power

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.

If the mast loses power, it will lower.

6.8.1 Using the Auto Stow® Feature

To use the Auto Stow® feature:

1. Press "Mast Down" twice quickly in successive depressions (two depressions within ½ second). The mast will pan and tilt the RCP to the home position, lower the mast (if not already there) and turn off lights. 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. Visually inspect that the mast is properly stowed and powered down. Ensure that the payload will not bounce as the vehicle drives down the road.

3. Store remote controls if used so they will not be damaged during transportation.

6.8.2 Using the Mast Down Button

Another method used to stow the mast is to press and hold "Mast Down" 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 "Mast Down":

1. Press and hold "Mast Down" until the mast stops and the "Mast Down" LED is turned off, indicating the mast has powered down. The mast will lower (if not already there), then go to the RCP home position, and then stow the mast. Once stowed, the Mast Stowed Safety Interlock Contact signals it is safe to move the vehicle.

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

3. Store remote controls if used so they will not be damaged during transportation.

6.8.3 Emergency Stow with Power

If the mast cannot be stowed using the Auto Stow® feature or "Mast Down" button, the emergency stow button (S4) on the base board can be used to stow the mast if the following are both true:

- Power is still applied to the system.
- Applicable system components are still functional.

Using the emergency stow button causes the mast to lower 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. Release the S4 button once the saddle is reached. Pressing the emergency stow button causes the system to generate an "ERR 1,20" error. Errors cause the mast to automatically:

- Move the RCP to the home position (provided there are no electrical or mechanical issues with the RCP).
- Exhaust all air from the mast, which lowers the mast to its nested position.

To stow the mast using the emergency stow button:

1. Open the control box lid to expose the base board.

2. Tap S4 on the base board. Do not hold down S4; just press, then immediately release S4 once. This causes the controller to show an "ERR 1,20". The error causes the RCP to go to its home position and exhausts all air from the mast.

3. Wait until all air has exhausted from the mast. The mast should now be retracted.

4. Visually check that the mast is properly stowed. Ensure that the lights do not bounce as the vehicle drives on the road.

5. Close the lid on the control box.

6.8.4 Emergency Stow without Power

Since the pneumatic system operates with the mast pressure chamber normally open without power, it is likely the mast will retract automatically without power. If it does not retract, turn the drain cock at the base of the mast to exhaust air and lower the mast.

Note: This method will leave the RCP and lights in whatever orientation they were left in. Ensure they do not contact vehicle structures.

7 Maintenance, Adjustments and Disposal

This section describes the routine maintenance and adjustment procedures required to keep your system operational. Be sure to read and understand the entire operation procedure (Section 6) and the Safety Summary (Section 1) before beginning any maintenance or adjustment procedure.

7.1 Power Isolating Procedure

Remove all power sources from the mast system (including mast controls, lighting power, and auxiliary device power) before performing any maintenance operation on the mast system other than optional cleaning and lubricating. Use proper lock-out tag-out procedures.

To isolate power to the mast system:

1. Disconnect all power sources using lock-out tag-out procedures. It is recommended that the vehicle ignition keys be held by the maintenance engineer as an additional precaution to prohibit unexpected power-up.

2. Unplug the mast Hand-Held Remote Control (HHRC) and keep it with the maintenance engineer during maintenance to avoid unexpected mast operation. Be sure the HHRC is attached before powering up the system again to avoid a communications error.

Refer to section 6.4 for power-up procedure once maintenance is complete.

7.2 Cleaning and Lubricating the System

The Will-Burt Company's pneumatic telescoping masts come from the factory pre-lubricated and require no scheduled lubrication under normal operating conditions for the life of the product. In extremely harsh environmental conditions, cleaning and lubrication of the mast may 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.

To clean the system:

1. Wipe down the Remote-Controlled Positioner (RCP) using a soft cloth or sponge and a mild solution of soapy water.

2. After light fixtures cool, clean the light lenses using a soft cloth and standard glass cleaner.

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-round 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. 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.

2. 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.

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

4. Repeat steps 1-3 for the next larger mast section. Do not lubricate the exterior of the mast. This will cause the lubricant to attract dust and contaminants from the air.

5. Using the "Mast Down" button, lower the mast.

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

7. Using the "Mast Up" button, extend the mast one section at a time. For each section, wipe off any excess lubricant that flows out the weep holes.

7.3 Spare Parts

To order spare or replacement parts, always refer to the mast model number and serial number. The model number, serial number, and additional information is located on the mast Identification Plate on the mast base. To order spare parts, contact The Will-Burt Company.

7.4 Periodic Inspections

This section describes the systematic care and inspection of equipment to keep it in safe operating condition and to prevent breakdowns. If the system does not perform as required, see Section 9 for troubleshooting. If anything looks wrong and cannot be diagnosed and/or fixed, contact The Will-Burt Company. Table 7-1 provides a schedule of periodic inspections and procedures required to keep the Mast System in safe operating condition.

Table 7-1 Periodic Inspections

Frequency	Inspection	Action
As Needed; In salt water or sandy environments, clean the mast every 3 months.	Inspect to ensure the Mast System is kept clean and free from foreign material. Dirt, grease, oil, sand and debris may cover up a serious problem.	Clean the mast per the procedure in Section 7.2.
During Operation	Inspect for damage during operation.	If damage is apparent, do not use the mast, and have it serviced prior to use.
Monthly	Visually observe tube motion during extension and retraction to ensure the tubes move smoothly and do not cause excessive impact loads when each tube fully extends or retracts.	Clean and lubricate the mast per the procedure in Section 7.2. If the condition remains after lubrication, cease all mast use and contact Will-Burt Service immediately.
Monthly	Inspect for any damage to electric cables and pneumatic tubes.	Replace cables/tubes as required.
Monthly	Test the Vehicle Interconnect safety warning circuit to ensure the vehicle driver is warned or prevented from driving with the mast deployed.	Repair the interconnect circuit if not functioning properly.
Monthly	Inspect the Look-Up light lens for debris or dirt that prevent light from reaching the operating space.	Make sure the lens is cool and clean the lens with a mild cleaner and soft cloth.
Monthly	Inspect all hardware to ensure fasteners are not damaged, loosening, backing out or missing. Take special note of hardware keeping the payload mounted, mast collar bolts, and hardware used to mount the mast to the support structure.	Tighten or replace any loose, damaged or missing fasteners.
Every 6 Months (3 months in salt water environment)	If the mast remains idle for long periods of time, operate the mast to full extension at least once every six months (3 months in salt water environment).	Exercise mast.

Table 7-1 Periodic Inspections (Continued)

Frequency	Inspection	Action
Every 6 Months	With the mast fully nested, check to ensure the RCP is firmly in contact with the saddle and there is no mechanical play present.	If the joint is loose, adjust the saddle height according to Section 5.4.9
Yearly	Test the function of the emergency stop button to ensure it is working properly.	Replace defective parts.

7.4.1 Adjusting the Mast Magnetic Switches

The Magnetic Switches are located on the mast base tube (Figure 7-1, Figure 7-2, Figure 7-3). The upper magnetic switch senses that the top tube is extended and activates the RCP functions. The lower magnetic switch senses when the mast is completely stowed and triggers the vehicle interconnect signal. It is important to ensure that the mast has properly nested by verifying 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.

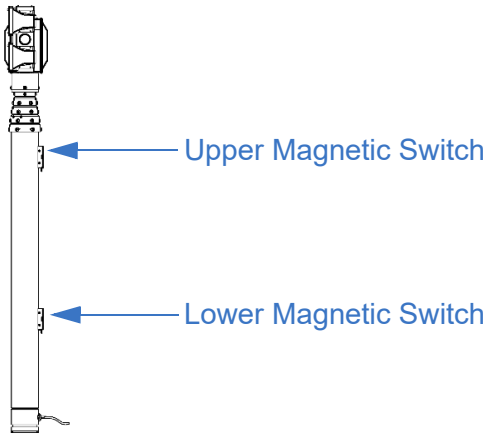


Figure 7-1 Night Scan Vertical Upper and Lower Magnetic Switches

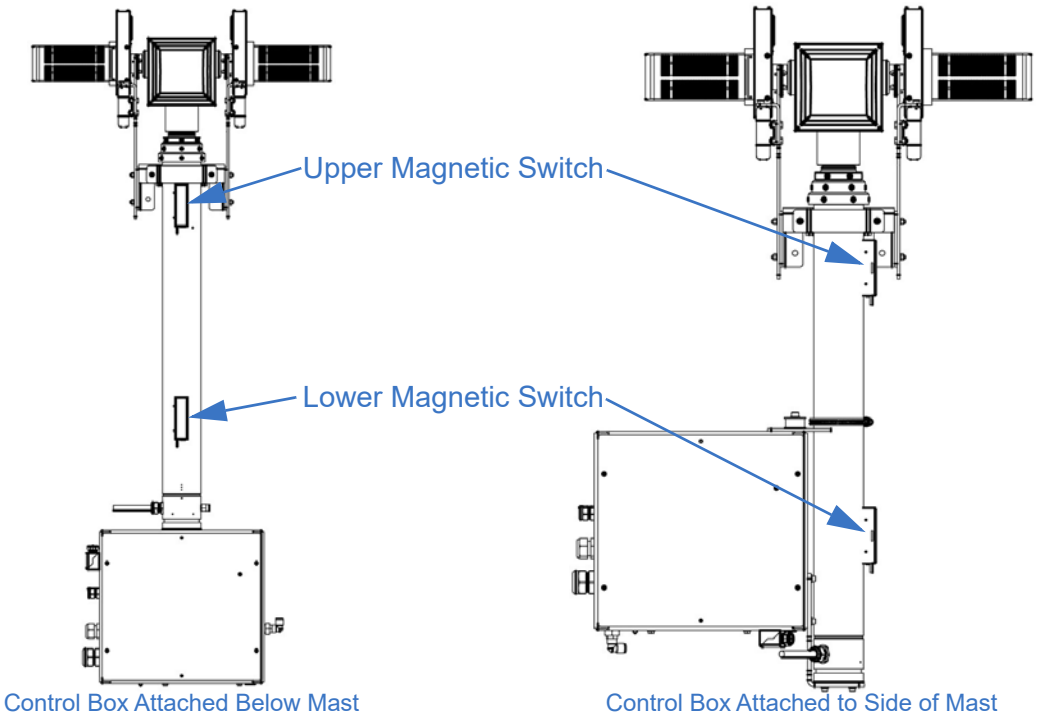


Figure 7-2 Night Scan Vertical Complete Upper and Lower Magnetic Switches

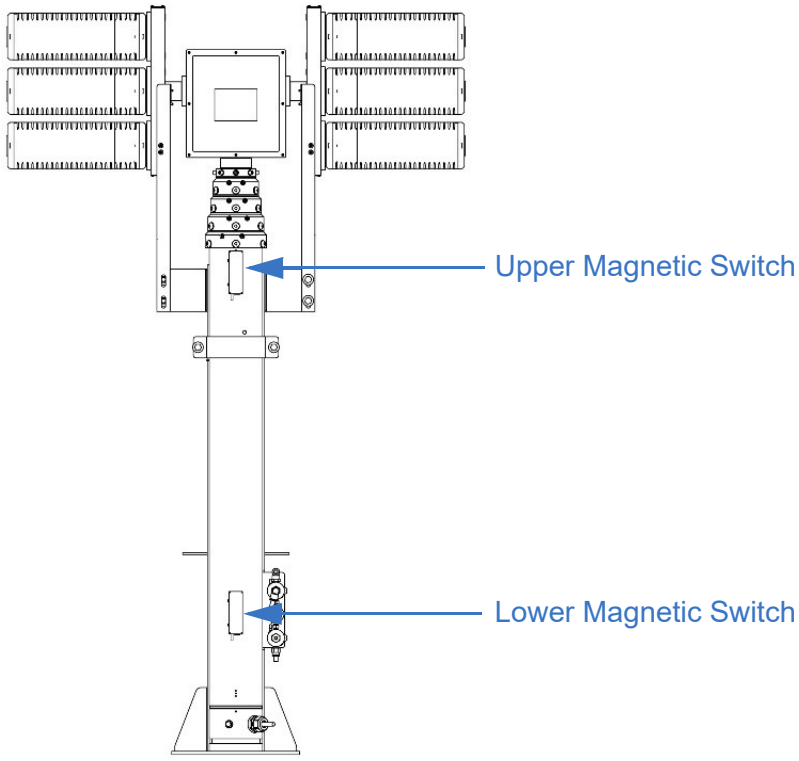


Figure 7-3 Night Scan Vertical Heavy Duty Towing (HDT) Upper and Lower Magnetic Switches

Follow the instructions in Section 5.10.2 and Section 5.10.7 for adjusting the Magnetic Switch positions.

7.5 Adjusting the RCP Home Position

The RCP home position is the position of the RCP and lights where the light bars align with the saddle 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 positioning small flags in the RCP that engage photo interrupters on the RCP PC 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 photo sensors. Before delivery of a new system, the RCP home position is tested and normally no adjustment is necessary.

A dual-tilt RCP and single-tilt RCP have slightly different adjustment procedures. If an adjustment is required, adjust the RCP home position as follows:

7.5.1 Single-Tilt RCP Home Position Adjustment

If your system is a dual-tilt RCP, skip to Section 7.5.2. Adjust the single-tilt RCP as follows:

1. Disconnect all light power to the system using proper lock-out tag-out procedures (see Section 7.1). Keep the DC power connected to the mast control system.

2. Initiate the mast and raise one section.

3. Remove the RCP cover to access the flags. The pan and tilt flags are attached to the timing rings on the horizontal and vertical shaft gears (Figure 7-4). The tilt timing ring has two set screws that must be loosened. The pan timing ring has two cap screws that must be loosened. It may be necessary to loosen one in each, then pan and tilt the unit to access the others. Note: The flags have sharp edges that may cause cuts.

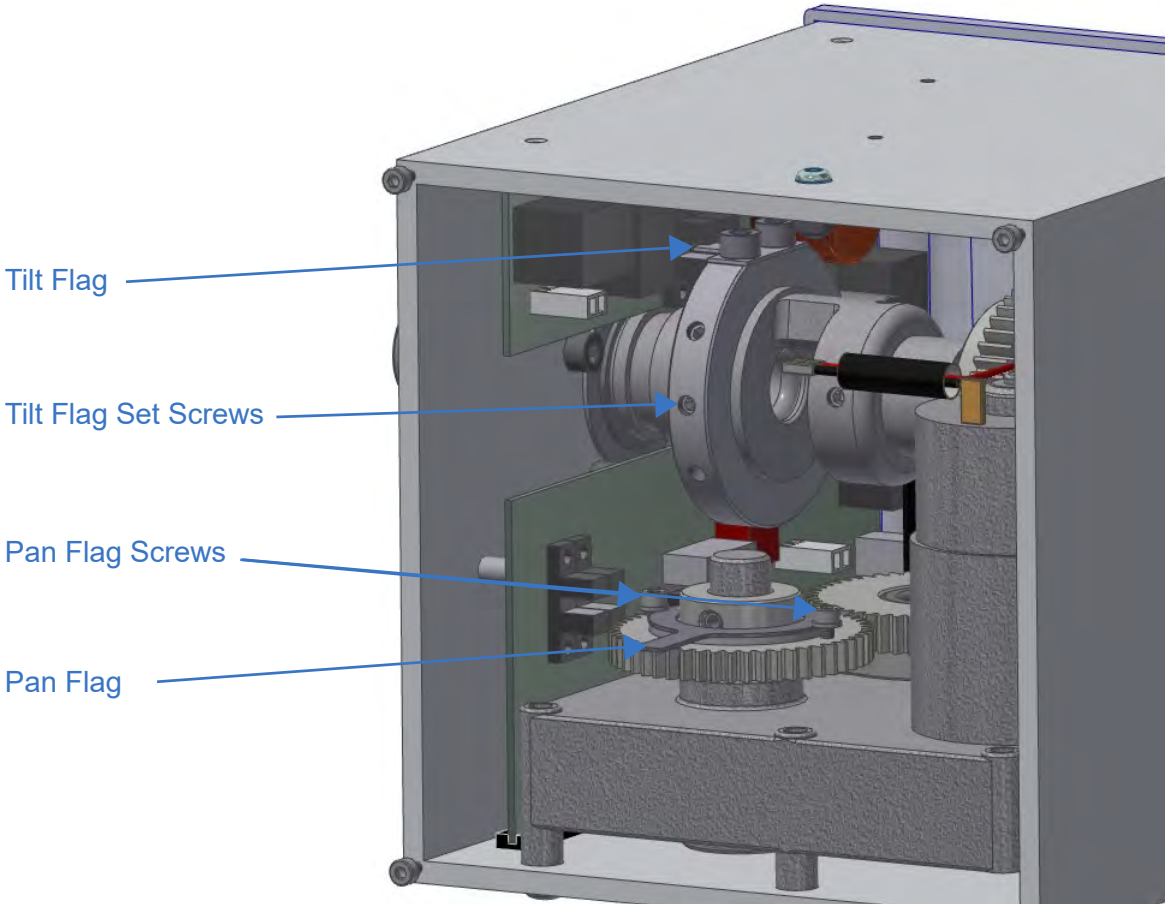


Figure 7-4 RCP Flags Single-Tilt RCP (cover removed)

4. Once the set screws are loose, pan and tilt the unit to the correct home position. Be careful that the flags do not come into contact when panning and tilting, or they may be bent.

5. The pan and tilt functions have two photo sensors for each function. It is important that the flags engage the correct photo sensor from the proper direction when setting the home position. To set the Tilt Home Position, turn the timing ring on the tilt shaft such that it rotates counterclockwise towards the photo sensor (see Figure 7-5). As you approach the sensor, watch the controller. As soon as the "Tilt Down" LED goes out, stop rotating the ring and tighten the set screw. This should be roughly 80% penetration into the sensor with the flag.

6. To set the Pan Home Position, turn the flag counterclockwise (looking from above the RCP) until the "Pan Right" LED goes out (see Figure 7-5). Tighten the adjustment screws to secure the ring.

7. Tilt the unit until the second set screw for the tilt flag is accessible. Tighten the second set screw.

8. Stow the mast, watching for the RCP and lights to become oriented as described in the beginning of this section. If it does not look like the RCP is properly positioned during stowing, use the Emergency Stop to stop motion and re-adjust the flags.

9. Once proper positioning is achieved, replace the RCP cover.

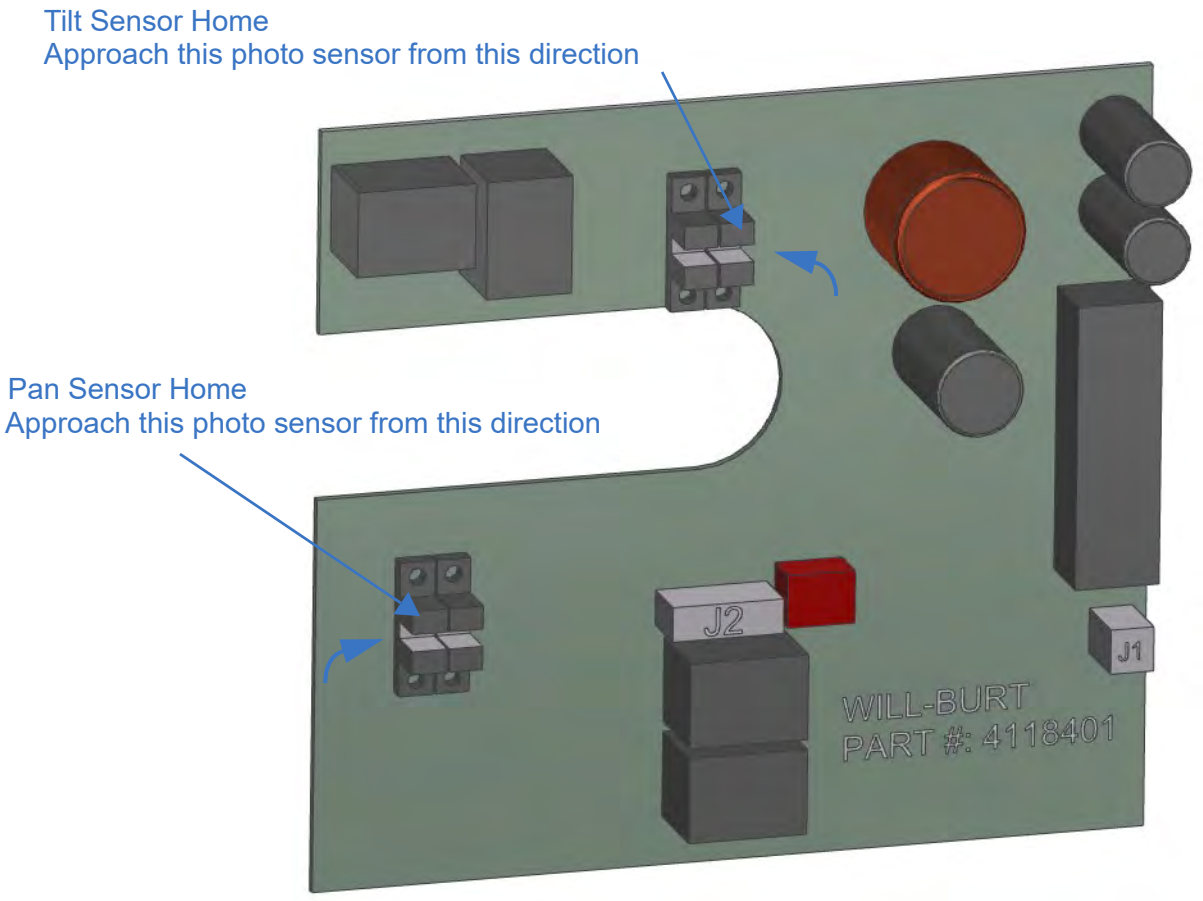


Figure 7-5 RCP PCB Photo Sensors

7.5.2 Dual-Tilt RCP Home Position Adjustment

If an adjustment is required, adjust the RCP home position as follows:

1. Disconnect all light power to the system using proper lock-out tag-out procedures (see Section 7.1). Keep the DC power connected to the mast control system.

2. Initiate the mast and raise one section.

3. Remove the RCP cover to access the flags. The flags are attached to the timing rings on the horizontal and vertical shaft gears (Figure 7-6). 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.

   Note: The flags have sharp edges that may cause cuts.

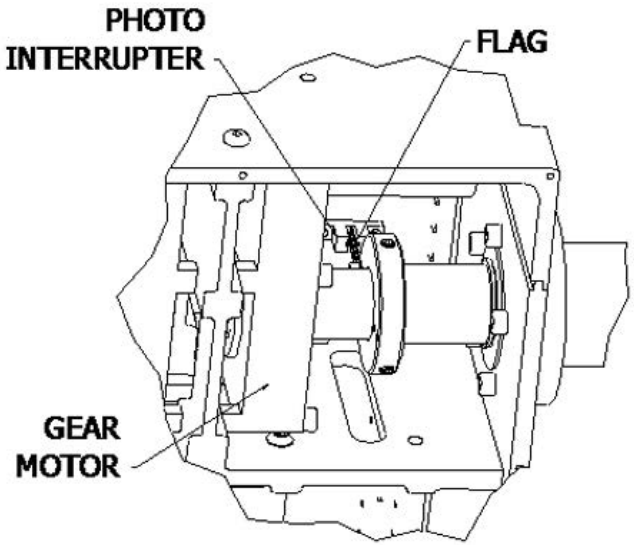


Figure 7-6 Dual-Tilt Photo Interrupter and Flag (cover removed)

4. Once the set screws are loose, pan and tilt the unit to the correct home position. Be careful that the flags do not come into contact when panning and tilting, or they may be bent.

5. The pan and tilt functions have two photo sensors for each function. It is important that the flags engage the correct photo sensor from the proper direction when setting the home position. To set the Tilt Home Position, turn the timing ring on the tilt shaft such that it rotates down towards the upper photo sensor (Figure 7-7). As you approach the sensor, watch the controller. As soon as the right "Tilt Down" LED goes out, stop rotating the ring and tighten the set screw. This should be roughly 80% penetration into the sensor with the flag. Repeat for the other tilt shaft.

6. To set the Pan Home Position, turn the flag counterclockwise (looking from above the RCP) until the "Pan Right" LED goes out (see Figure 7-7). Tighten the adjustment screws to secure the ring.

7. Tilt the unit until the second set screw for the tilt flag is accessible. Tighten the second set screw.

8. Stow the mast, watching for the RCP and lights to become oriented as described in the beginning of this section. If it does not look like the RCP is properly positioned during stowing, use the Emergency Stop to stop motion and re-adjust the flags.

9. Once proper positioning is achieved, replace the RCP cover.

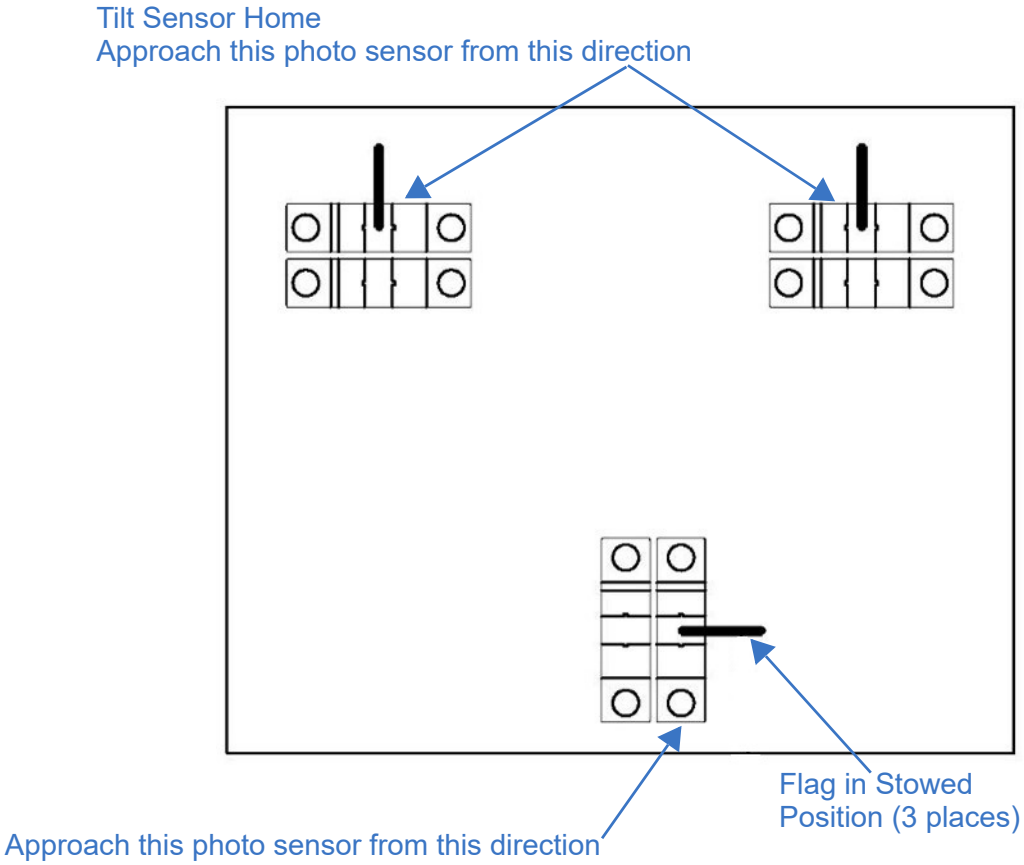


Figure 7-7 RCP PCB Photo Sensors (Dual-Tilt)

7.6 System Disposal

Dispose of the mast in accordance with the national environmental regulations.

8 Reference Information

This section describes reference information for your system, including some optional equipment.

8.1 DIP Switch Definitions

Dual In-Line Package (DIP) Switches on the base board and the Remote-Controlled Positioner (RCP) PC 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 type. 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 wiring diagram in the Appendix.

By default, the RCP becomes active when the upper magnetic switch is sensed. If this is too early and there is a possibility that the RCP may be accidentally turned and hit the vehicle (and the upper magnetic switch cannot be adjusted higher), an addition of 5, 10, or 15 seconds of “Mast Up” time can be set as shown in Table 8-1. If set, the RCP will continue to be inactive for 5, 10, or 15 seconds after sensing the upper magnetic switch.

Table 8-1 RCP Delay

DIP Switch Position	Delay
Position 8 On	5 seconds
Position 9 On	10 seconds
Position 8 and 9 On	15 seconds

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

8.2 Beacon Light

The optional beacon light (Figure 8-1) provides visibility and safety by mounting on top the RCP and brightly showing the height of the mast. The beacon light can be used at any voltage from 12 to 48 VDC. The beacon lights are available in amber, blue, clear, red, and green.

The beacon light can be turned on by pressing the "AUX" controller button when the RCP is high enough to be active. Pressing the button again would turn the beacon light off. When ordered, the optional beacon light is shipped already installed and no additional wiring is required.

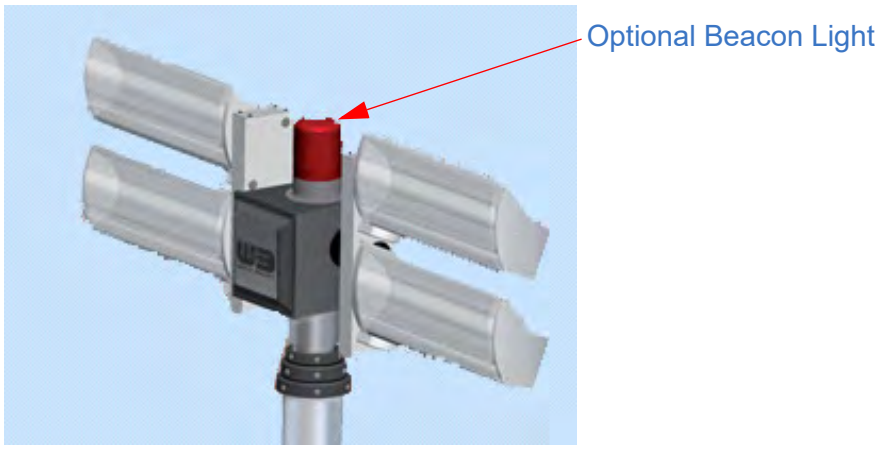


Figure 8-1 Optional Beacon Light

8.3 D-TEC® Sensor

The D-TEC® Sensor is an optional accessory that is mounted on the backside of the RCP to detect and prevent operation near power lines. The D-TEC® Sensor senses electric field strength and prevents the mast from raising if the field strength is above the alarm threshold.

8.3.1 D-TEC® Sensor Location

When using the D-TEC® 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. This typically is installed by The Will-Burt Company. The Sensor unit must be mounted in the upright position with the look-up light pointing up.

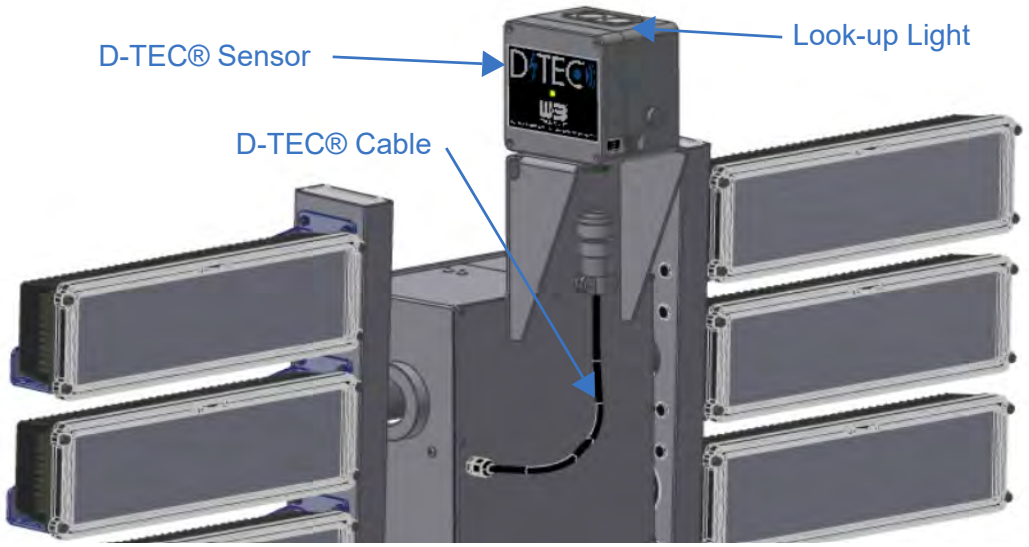


Figure 8-2 D-TEC® Sensor Installed on RCP

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.

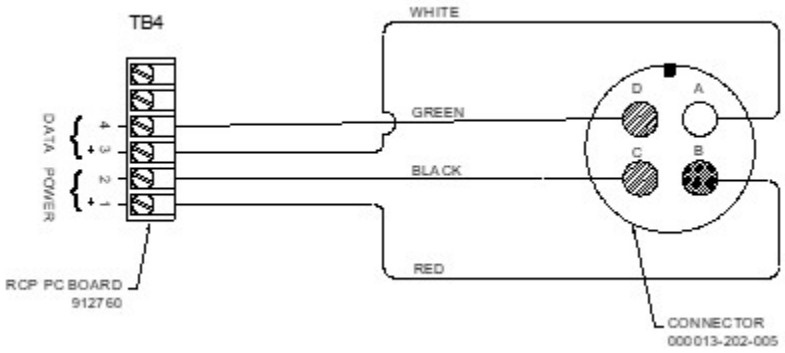


Figure 8-3 D-TEC® Wiring Schematic

8.3.2 D-TEC® Functionality

The optional D-TEC® Sensor provides additional limited protection against raising the mast into power lines. On Night Scan fold-down units, as soon as the mast begins tilting, the control begins initiating the D-TEC® Sensor and self-tests it until it either passes, or the mast reaches the point where the RCP becomes active (at 90°). Assuming that it passes, the operator is then permitted to extend the mast. For vertical mast applications, the self-test is performed during power up and the unit begins actively sensing. If the mast senses an electrical field strength above the alarm threshold, the mast will stop extending even though the operator continues to push the "Mast Up" button. In this case, there will be a message displayed on the alphanumeric display of the Remote Control(s) (for Night Scan models). 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 (for fold-down models). 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).

The following table contains possible D-TEC® messages:

Table 8-2 D-TEC® Messages

Message	Meaning	Root Issue
D-TEC® Testing	The D-TEC® Sensor is performing a self-test.	The D-TEC® 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.
Power Line E-Field	The D-TEC® has sensed voltage from a power line.	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.
Power Line H-Field	The D-TEC® has sensed current from a power line.	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.
D-TEC OSHA Limit	The D-TEC® has sensed voltage from a very high power line.	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.

The D-TEC® Sensor is not serviceable, so most issues will end with returning the sensor to The Will-Burt Company for repair. The following table shows D-TEC® error code meanings:

Table 8-3 D-TEC® Sensor Error Codes

Message	Meaning	Root Issue	Potential Cause
5,01	Lamp Fault	The D-TEC® has sensed a fault in the LED lamp circuit.	This check is made when the mast thinks it has just arrived at 90º. 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.
5,03	SPI Fault	A communications bus internal to the D-TEC® Sensor has failed during self-test.	Defective Sensor.
5,07	Unrecoverable Communication Error	No successful communication for 250ms.	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.
5,09	E-Field Fault	E-Field portion of the D-TEC® Sensor failed its self-test.	Defective Sensor.
5,10	H-Field 1 Fault	One axis of the Magnetic Field portion of the D-TEC® failed its self-test.	Defective Sensor.
5,11	H-Field 2 Fault	One axis of the Magnetic Field portion of the D-TEC® failed its self-test.	Defective Sensor.
5,12	H-Field 3 Fault	One axis of the Magnetic Field portion of the D-TEC® failed its self-test.	Defective Sensor.

Table 8-3 D-TEC® Sensor Error Codes (Continued)

Message	Meaning	Root Issue	Potential Cause
5,16	Supply Voltage Fault	The power supply section of the D-TEC® sensor is outside proper operational limits.	Check power connections, voltage level and induced noise on power source.

8.4 Nycoil® (Optional)

The Nycoil® Cable Conduit (Figure 8-4) is an optional external coiled hose used to house electrical wiring, antenna AF, camera, and positioner cables.

Figure 8-4 Nycoil® Conduit

Nycoil® conduit comes in a variety of sizes. Depending on the system being used, some restrictions on the size of the Nycoil® may occur. The standard sizes are:

- 1/2 inch inside diameter of the conduit with the outside diameter of the coil being 8 inches.
- 3/4 inch inside diameter of the conduit with the outside diameter of the coil being 13 inches.

Consult engineering on specific applications for other Nycoil® sizes.

Note: Nycoil® is a registered trademark of the Nycoil company.

8.5 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.

Document Number
XM-LGT1PMEX-R1A

LGTR1A-Rev0806

FRC
FIRE RESEARCH CORPORATION
26 Southern Blvd., Nesconset, NY 11767
TEL 631.724.8888 FAX 631.360.9727
TOLL FREE 1.800.645.0074
www.fireresearch.com

OPTIMUM FOCUS

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 lampheads 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 lamphead 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.

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

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 lamphead 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.

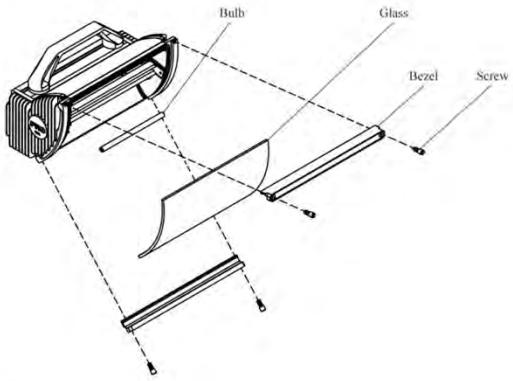
7. Insert the Focus gasket in the groove with the splice positioned down.
8. Hold the glass in position. Ensure the glass is inside the lip on all four sides.
9. Install the bezels and secure with the four screws.

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

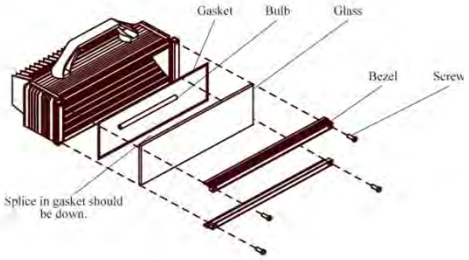
Cleaning

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 refelctor clean with a soft cloth.

OPTIMUM LAMPHEAD



FOCUS LAMPHEAD



Wiring

12/24 VDC

Connect the BLACK wire to GROUND.

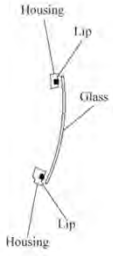
Connect the WHITE or RED wire to POWER.

120/240 VAC

Connect the GREEN wire to chassis GROUND.

Connect the WHITE wire to RETURN.

Connect the BLACK wire to POWER.



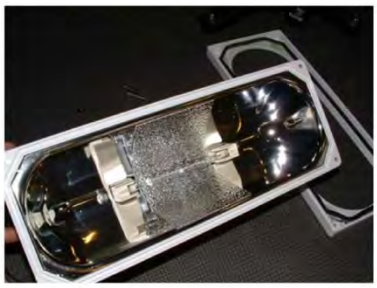
CAUTION
Position the glass inside the housing lip on all four sides. Failure to do so may result in racking the glass when the screws are tightened.

Bulb Replacement Optimum and Focus Lampheads

Havis, Inc.
75 Jacksonville Road, PO Box 2099
Warminster, PA 18974
T 800-524-9900 F 215-957-0729
www.havis.com

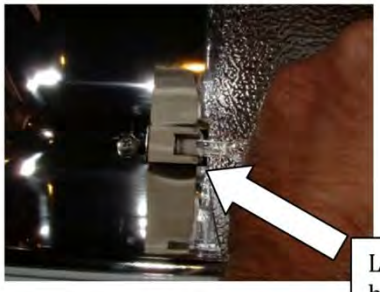
Changing Lamps:
Magnafire Series Fixtures (Halogen)

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)

Havis, Inc.
75 Jacksonville Road, PO Box 2099
Warminster, PA 18974
T 800-524-9900 F 215-957-0729
www.havis.com

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.

Havis, Inc.
75 Jacksonville Road, PO Box 2099
Warminster, PA 18974
T 800-524-9900 F 215-957-0729
www.havis.com

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)

HAVIS
Productivity in motion

Havis, Inc.
75 Jacksonville Road, PO Box 2099
Warminster, PA 18974
T 800-524-9900 F 215-957-0729
www.havis.com

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.

8.6 The Will-Burt Company Mast Oil Safety Data Sheet

SAFETY DATA SHEET

Will-Burt Company Orrville, Ohio 330-682-7015

SECTION 1: PRODUCT AND COMPANY Identification

Etna Products, Inc.
16824 Park Circle Drive
Chagrin Falls, Ohio 44023

Company Phone Number: (440) 543-9845
Emergency Phone Number: (800) 229-3862
CHEMTREC Phone Number: (800) 424-9300

Product Name: MASTERDRAW® B985B
Product Code: G-E-000826
Issue Date: 06/03/2015
Revision Date: 07/18/2016

Will-Burt Product Name: Mast Lubrication
Will-Burt Part Number: 900600
Recommended use: Industrial lubricant
Recommended restrictions: Use only as directed.

SECTION 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Physical hazards:	Not classified
Health hazards:	Acute toxicity, oral Category 4
Environmental hazards:	Not classified
OSHA defined hazards:	Not classified
Signal word:	Warning
Hazard statement:	Harmful if swallowed
Precautionary statement:	
Prevention:	Wash thoroughly after handling. Do not eat, drink or smoke when using this product.
Response:	If swallowed, call a poison center/doctor if you feel unwell. Rinse mouth.
Storage:	Store away from incompatible materials.
Disposal:	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC):	Combustible
Supplemental information:	99.6% of the mixture consists of component(s) of unknown acute oral toxicity.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

The table below will only list hazardous ingredients. If the table below is blank, none are present.

Component	Chemical Abstracts Number (CAS)	% by Weight
2, 6-Di-tert-butyl-4-cresol	128-37-0	< 1
BENZOTRIAZOLE	95-14-7	< 0.2
Other components below reportable levels		90-100

SECTION 4: FIRST-AID MEASURES

Skin contact:	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact:	Rinse with water. Get medical attention if irritation develops and persists.
Inhalation:	Move to fresh air. Call a physician if symptoms develop or persist.
Ingestion:	Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical advice/attention if you feel unwell.
Most important symptoms/effects, acute and delayed:	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed:	Provide general supportive measures and treat symptomatically. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information:	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

SECTION 5: FIRE-FIGHTING MEASURES

Suitable extinguishing media:	Foam. Dry chemicals. Carbon dioxide (CO2).
Unsuitable extinguishing media:	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical:	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters:	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions:	Cool containers exposed to heat with water spray and remove container, if no risk is involved.
Specific methods:	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards:	Combustible. No unusual fire or explosion hazards noted.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures:	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up:	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.

1/4 07/18/2016

	Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precaution:	Avoid discharge into drains, water courses or onto the ground.

SECTION 7: HANDLING AND STORAGE

Precautions for safe handling:	Avoid prolonged or repeated contact with skin. Avoid prolonged exposure. Do not taste or swallow. When using, do not eat, drink or smoke. Use only in well-ventilated areas. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities:	Keep away from heat and sources of ignition. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Guidlines
US. ACGIH Threshold Limit Values

Components	Type	Value	Form
2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0)	TWA	2 mg/m3	Inhalable fraction and vapor.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0)	TWA	10 mg/m3

Biological limit values:	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment:	
Eye/face protection:	Wear safety glasses with side shields (or goggles).
Skin protection:	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.
Hand protection:	Other Wear suitable protective clothing.
Respiratory protection:	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards:	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations:	Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Transparent Blue Liquid
Physical state:	Liquid
Form:	Liquid
Color:	Not available
Odor:	Petroleum Odor
Odor threshold:	Not available.
pH:	Not available.
pH concentration:	N/A
Melting point/freezing point:	Not available.
Initial boiling point and boiling range:	> 500 °F (> 260 °C)
Flash point:	> 300.0 °F (> 148.9 °C)
Evaporation rate:	> 1
Flammability (solid, gas):	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%):	Not available
Flammability limit - lower (%) temperature:	Unknown
Flammability limit - upper (%):	Not available
Flammability limit - upper (%) temperature:	Unknown
Explosive limit - lower (%):	Not available
Explosive limit - upper (%):	Not available

Vapor pressure:	Unknown
Vapor density:	Unknown
Relative density:	Not available
Solubility(ies)	
Solubility (water):	Nil
Partition coefficient (n-octanol/water):	Not available
Auto-ignition temperature:	Unknown
Decomposition temperature:	Not available
Viscosity:	Not available
Other information	
Explosive properties:	Not explosive
Kinematic viscosity 43 mm^2/s	
Kinematic viscosity temperature:	104 °F (40 °C)
Oxidizing properties:	Not oxidizing
Specific gravity:	0.87

SECTION 10: STABILITY AND REACTIVITY

Reactivity:	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	No dangerous reaction known under conditions of normal use.
Conditions to avoid:	Contact with incompatible materials.
Incompatible materials:	Strong oxidizing agents.
Hazardous decomposition products:	No hazardous decomposition products are known.

SECTION 11: TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation:	Prolonged inhalation may be harmful.
Skin contact:	No adverse effects due to skin contact are expected.
Eye contact:	Direct contact with eyes may cause temporary irritation.
Ingestion:	Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics: Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity: Harmful if swallowed.

Product	Species	Test Results
MASTERDRAW® B985B		
Acute		
Inhalation		
LD50	Rat	1900 mg/l estimated

Components	Species	Test Results
2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0)		
Acute		
Oral		
LD50	Guinea pig	10700 mg/kg
	Mouse	1040 mg/kg
	Rat	890 mg/kg
BENZOTRIAZOLE (CAS 95-14-7)		
Acute		
Inhalation		
LD50	Rat	1.9 mg/l
Oral		
LD50	Mouse	615 mg/kg
	Rat	600 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation:	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation:	Direct contact with eyes may cause temporary irritation.
Respiratory or skin sensitization	
Respiratory sensitization:	Not a respiratory sensitizer.
Skin sensitization:	This product is not expected to cause skin sensitization.
Germ cell mutagenicity:	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity:	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.
IARC Monographs. Overall Evaluation of Carcinogenicity	
2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0) 3:	Not classifiable as to carcinogenicity to humans.
OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):	Not listed.
Reproductive toxicity:	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure:	Not classified
Specific target organ toxicity - repeated exposure:	Not classifieD Aspiration hazard Not an aspiration hazard.
Chronic effects:	Prolonged inhalation may be harmful.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity:	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability:	No data is available on the degradability of this product.
Bioaccumulative potential:	
Partition coefficient n-octanol / water (log Kow)	
BENZOTRIAZOLE 1.44	
Mobility in soil:	No data available.
Other adverse effects:	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

SECTION 13: DISPOSAL CONSIDERATIONS

Disposal instructions:	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/ container in accordance with local/regional/national/international regulations.
Local disposal regulations:	Dispose in accordance with all applicable regulations.
Hazardous waste code:	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products:	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging:	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14: TRANSPORT INFORMATION

DOT: Not regulated as dangerous goods.

SECTION 15: REGULATORY INFORMATION

US federal regulations: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D):	Not regulated
CERCLA Hazardous Substance List (40 CFR 302.4):	Not listed
SARA 304 Emergency release notification:	Not regulated
OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):	Not listed

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories:	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
SARA 302 Extremely hazardous substance:	Not listed
SARA 311/312 Hazardous chemical:	Yes
SARA 313 (TRI reporting):	Not regulated

Other federal regulations:

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List:	Not regulated
Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):	Not regulated
Safe Drinking Water Act (SDWA):	Not regulated

US state regulations:

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100): Not listed

US. Massachusetts RTK - Substance List

2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0)
BENZOTRIAZOLE (CAS 95-14-7)

US. New Jersey Worker and Community Right-to-Know Act

2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0)

US. Pennsylvania Worker and Community Right-to-Know Law

2, 6-Di-tert-butyl-4-cresol (CAS 128-37-0)

US. Rhode Island RTK

Not regulated

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

**A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)*
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

SECTION 16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OR LAST REVISION

Disclaimer: The information contained herein is based on the data available to us and is believed to be correct. Etna Products Inc. does not warrant or guarantee their accuracy or reliability and Etna Products, Inc. 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 users responsibility to satisfy itself that they are suitable and complete for its particular use.

Revision Information: Exposure controls/personal protection: Eye/face protection
Physical & Chemical Properties: Multiple Properties
Regulatory information: US federal regulations
Other information, including date of preparation or last revision: Disclaimer
HazReg Data: North America

4/4 07/18/2016

9 Troubleshooting

This section describes system troubleshooting information.

Please contact The Will-Burt Company if these guides do not solve the issue. Be sure to read and understand the entire operation procedure and the Safety Summary (Section 1) before beginning any maintenance or troubleshooting procedure.

9.1 Troubleshooting Electrical

This section includes a list of warning and error codes and their potential causes. Warning codes do not stop motion or use, but let you know about potential issues. Error codes point out problems and usually inhibit operation to prevent potential damage. These codes are shown on the Hand-Held Remote Control (HHRC) display or 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.

Table 9-1 Error and Warning Codes for Base Board

Message	Meaning	Root Issue	Potential Cause
WRN 1,04	Look-Up Light is burned out	The control circuit is not sensing the Look-Up Light current	Look-up Light is burned out or disconnected
WRN 1,05	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	Well cover switches indicate closed when they should be open	Wiring error or defective switch
WRN 1,06	RCP Stow (Vertical, upper mag switch) - Sensor State Error	Switch outputs are valid (opposite), but switch shows wrong polarity for nested state	Defective mag switch, defective base board
WRN 1,07 (Vertical Only)	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	The lower mag switch needs to be adjusted. D13 should be green when it "sees" the magnet	Wiring error, defective mag switch

Table 9-1 Error and Warning Codes for Base Board (Continued)

Message	Meaning	Root Issue	Potential Cause
1,01	Mast Down (mag switch) - Sensor State Error	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)	1. The magnetic sensor is not being energized or is defective 2. Mag switch out of position
1,02	Mast Stowed (near 0°) - Sensor Output Error	Sensor outputs are bad	Defective sensor or defective board
1,03	Mast Stowed (near 0°) - Sensor State Error	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	Base board was changed or software was updated with the mast at 90°
1,04	Excessive amp draw during actuator decline	Current sensor indicating it has exceeded: (12v systems) 10A for 100ms (24v systems) 6.0 amps AND less than 10 amps for (100 msec)	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.
1,05	Well Open (Vertical with well cover) - Switch Output Error	Sensor outputs are bad	Defective switch or wiring error. Refer to System Wiring Diagram

Table 9-1 Error and Warning Codes for Base Board (Continued)

Message	Meaning	Root Issue	Potential Cause
1,06	Well Open (vertical with well cover) - Switch State Error	Switch outputs are O.K., but show wrong polarity for closed state	Well cover open or wiring error. System is expecting the well cover to be closed at power-up
1,07	Microprocessor Error	No successful poll / response communication for 250ms	Defective processor on the board
1,08	Internal firmware detected error	Internal state machine logic has detected an invalid state transition. Firmware logic error	
1,09	Initiate Pushbutton input error	Initiate input has remained active for 5 seconds. Input is stuck, or has been hot-wired	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
1,10	Memory Error	Memory Error	Memory Error
1,11	Actuator current has unexpectedly stopped	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	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

Table 9-1 Error and Warning Codes for Base Board (Continued)

Message	Meaning	Root Issue	Potential Cause
1,12	Sensor Output Error Roof-mount - Actuator at 90° magnetic sensor Vertical - Upper magnetic sensor switch	Sensor outputs are bad	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"
1,13	RCP STOWED magnetic sensor - Sensor Output Error (Upper magnetic sensor on Vertical)	Sensor outputs are bad	Wiring problem, defective magnetic sensor
1,14	Mast Down (lower magnetic sensor) 1. Sensor Output Error 2. Sensor State Error	1. Sensor outputs bad. They have not been opposite for >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). 3. Sensor is not seeing magnet when mast is fully retracted	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. 3. Sensor not seeing magnet - sensor needs to be re-aligned
1,15	At 90° (Actuator) - Sensor State Error	Checked at power up after stowing. Sensor outputs are O.K., but sensor shows wrong polarity for nested state	Board was changed or updated while the mast was at 90°
1,16	Not Used	Not Used	Not Used
1,17	Well Closed (Vertical with well cover) - Switch Output Error	Sensor outputs are bad	D7 Green = Closed D8 Yellow = Not Closed
1,18	Well Closed (Vertical with well cover) - Sensor State Error	Switch outputs are O.K., but show wrong polarity for Well Closed	Switch wiring, defective switch, board

Table 9-1 Error and Warning Codes for Base Board (Continued)

Message	Meaning	Root Issue	Potential Cause
1,19	Both Near 0° and 90° - Sensor State Error	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	Both sensors indicate proximity, one may be bad
1,20	Forced Stow has been activated	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	Forced Stow button has been activated

Table 9-2 Error and Warning Codes for RCP

Message	Meaning	Root Issue	Potential Cause
WRN,2.04	Single-tilt - Tilt Stuck Dual-tilt - Left Tilt Stuck	Checked only when moving out of a limit position. The software indicates the state of the (left) tilt photo sensor has not changed even though the motor has been told to move for more than 1/2 second	Something is preventing movement of left tilt mechanism, the motor is defective, or the RCP board is defective
WRN 2.05	Right Tilt Stuck	Checked only when moving out of a limit position. The software indicates the state of the right tilt photo sensor has not changed even though the motor has been told to move for more than 1/2 second	Something is preventing movement of right tilt mechanism, the motor is defective, or the RCP board is defective

Table 9-2 Error and Warning Codes for RCP (Continued)

Message	Meaning	Root Issue	Potential Cause
WRN 2,06	Pan Stuck	Checked only when moving out of a limit position. The software indicates the state of the pan photo sensor has not changed even though the motor has been told to move for more than 1/2 second	Something is preventing movement of pan mechanism, the motor is defective, or the RCP board is defective
2,01	Pan Limit Overlap	The software indicates both pan photo sensors are blocked simultaneously	Foreign material in one of the photos sensors or faulty photo sensor
2,03 Positioner Only	TILT pot stuck	No movement detected in expected direction for 2.0 seconds	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
2,04 Positioner Only	PAN pot stuck		
2,07	Communication Timeout	The RCP or P-T Drive board has not sent out communications recently	Bad board or connection in communications link
2,08	Microprocessor error	The RCP board has sent an invalid message	Indicates a software problem
2,09 RCP Only	(Left) Tilt Up wrap around	The software indicates the same photo sensor was made before the opposite limit photo sensor 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 photo sensor 2. The limit photo sensor is defective
2,10 RCP Only	(Left) Tilt Down wrap around		
2,09 Positioner Only	Pan Pot Failure	The Positioner software indicates the pot feedback voltage is out of acceptable operating range	Defective pot, incorrect wiring, bad connection, defective P-T board
2,10 Positioner Only	Tilt Pot Failure		

Table 9-2 Error and Warning Codes for RCP (Continued)

Message	Meaning	Root Issue	Potential Cause
2,11	Right Tilt Up wrap around	The software indicates the same photosensor was made 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 photo sensor is defective
2,12	Right Tilt Down wrap around		
2,13	Pan Right wrap around	The software indicates the same photo sensor was made before the opposite limit photo sensor was made to stop rotation. This indicates wrap around	The limit photo sensor is defective
2,14	Pan Left wrap around		
2,15	Left Tilt Limit Overlap	The software indicates both tilt photo sensors appear to be blocked simultaneously	Foreign material in one of the photo sensors or faulty photo sensor
2,16	Right Tilt Limit Overlap		

Table 9-3 Error and Warning Codes for HHRC

Message	Meaning	Root Issue	Potential Cause
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	Multiple users controlling the mast

Table 9-3 Error and Warning Codes for HHRC (Continued)

Message	Meaning	Root Issue	Potential Cause
WRN 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.	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 9-4 Error and Warning Codes for Wireless HHRC

Message	Meaning	Root Issue	Potential Cause
8,07	Unrecoverable communication error	No successful poll / response communication for 250ms	Wireless Control Box is not 'talking' to any other board. Check Base Board flashes and HHRC display for x,07
8,08	Internal firmware detected error	Internal state machine logic has detected an invalid state transition	Firmware logic error
8,09	RF module error	Wireless plug-in module did not properly initialize	Bad module

Table 9-4 Error and Warning Codes for Wireless HHRC (Continued)

Message	Meaning	Root Issue	Potential Cause
8,10	Memory Error	Memory Error	
8,11	HHRC power up negotiation failed	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	Wireless HHRC is not plugged in during power-up
8,12	In-system reprogramming failed	Dip-switch activated in-system reprogramming of attached devices was not able to successfully complete	

9.2 Troubleshooting Mechanical Symptoms

This section describes mechanical troubleshooting. Table 9-5 lists some problems that may be observed, but may not generate an error or warning code on the controller.

Table 9-5 Mechanical Symptoms and Troubleshooting Sequence

Symptom	Root Issue	Troubleshooting Sequence
Mast sticking during extension or retraction	Mast is dirty and/or requires lubrication	1) Clean and lubricate mast 2) If condition continues, mast requires overhaul

Table 9-5 Mechanical Symptoms and Troubleshooting Sequence (Continued)

Symptom	Root Issue	Troubleshooting Sequence
Mast leaks down when extended	Air leak in mast or valve/ compressor assembly	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.
Erratic or noisy when raising to 90° (fold-down units only)	Bent or worn actuator or pivot shaft	Replace damaged component
RCP continually pans or tilts	Bent flag in RCP	1) Remove RCP cover straighten or replace flag 2) Make sure wiring is not wound tight. Reset home position
Pan or tilt motor will not respond with no errors displayed on remote control(s)	Broken or loose motor wire lead or faulty motor	1) Reconnect wire lead 2) Replace motor
Mast fails to fully nest in saddle and disconnects power	Binding of actuator, software fault or control erroneously sensed an increase in current	1) Check that Base Board has software version 2.6 or later. Contact Will-Burt if update is required 2) Check actuator or mast for binding. Replace actuator if binding or remove source of binding
Mast will not begin to lower from 90° position (fold-down unit only)	Mast tube sections do not fully collapse to nested position	1) Extend and retract mast 2) Check tube sections for damage 3) Internal coil cord may be binding, contact The Will-Burt Company
Mast will not begin to lower from 90° position (fold-down unit only)	Magnetic switch band-clamped to mast is not activated	1) Magnetic switch may be out of adjustment. Loosen clamp and slide switch up and down the mast until contact is established (see procedure in instructions) 2) Check wiring 3) Replace defective magnetic switch

10 Appendix

This section contains the appendixes for your system.

10.1 Automated Hatch Cover

Some integrators may want to put the vertical mast in a well and include a hatch cover that is automatically opened by the system. Figure 10-1 shows one example of how this may 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 is pressed, the system opens its “mast inactive” contact between pins J and K of the DC/Control Cable, which de-energizes K1. This applies pressure to the air valve to open the hatch. As soon as the hatch cover moves off the “Hatch Closed” limit, the switch opens and the warning light comes 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 closes, which allows the up valve of the mast (part of the system supplied by The Will-Burt Company) to be energized and the mast extends.

Stowing the mast reverses this process. When the mast is completely lowered, the system de-energizes itself and closes the “mast inactive” contact between pins J and K of the DC/Control. This energizes relay K1, which removes power to the hatch open valve and energizes the hatch close valve. Once the hatch is completely closed, the “Hatch Closed” limit switch closes and turns off the warning light. See the system wiring diagram in Section 10.2 for information on how to wire an automated hatch cover.

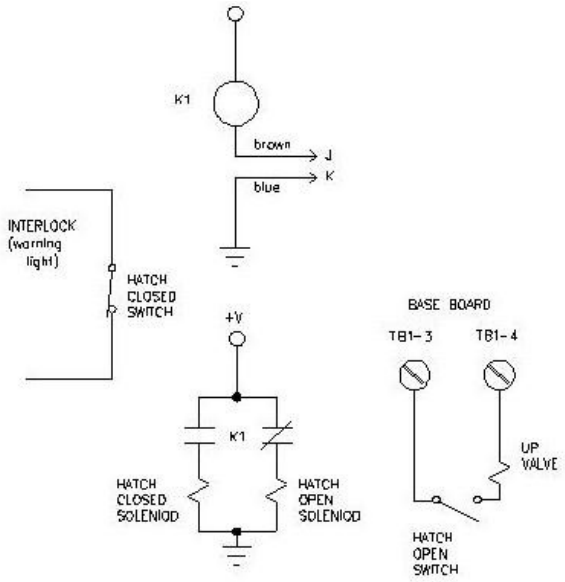
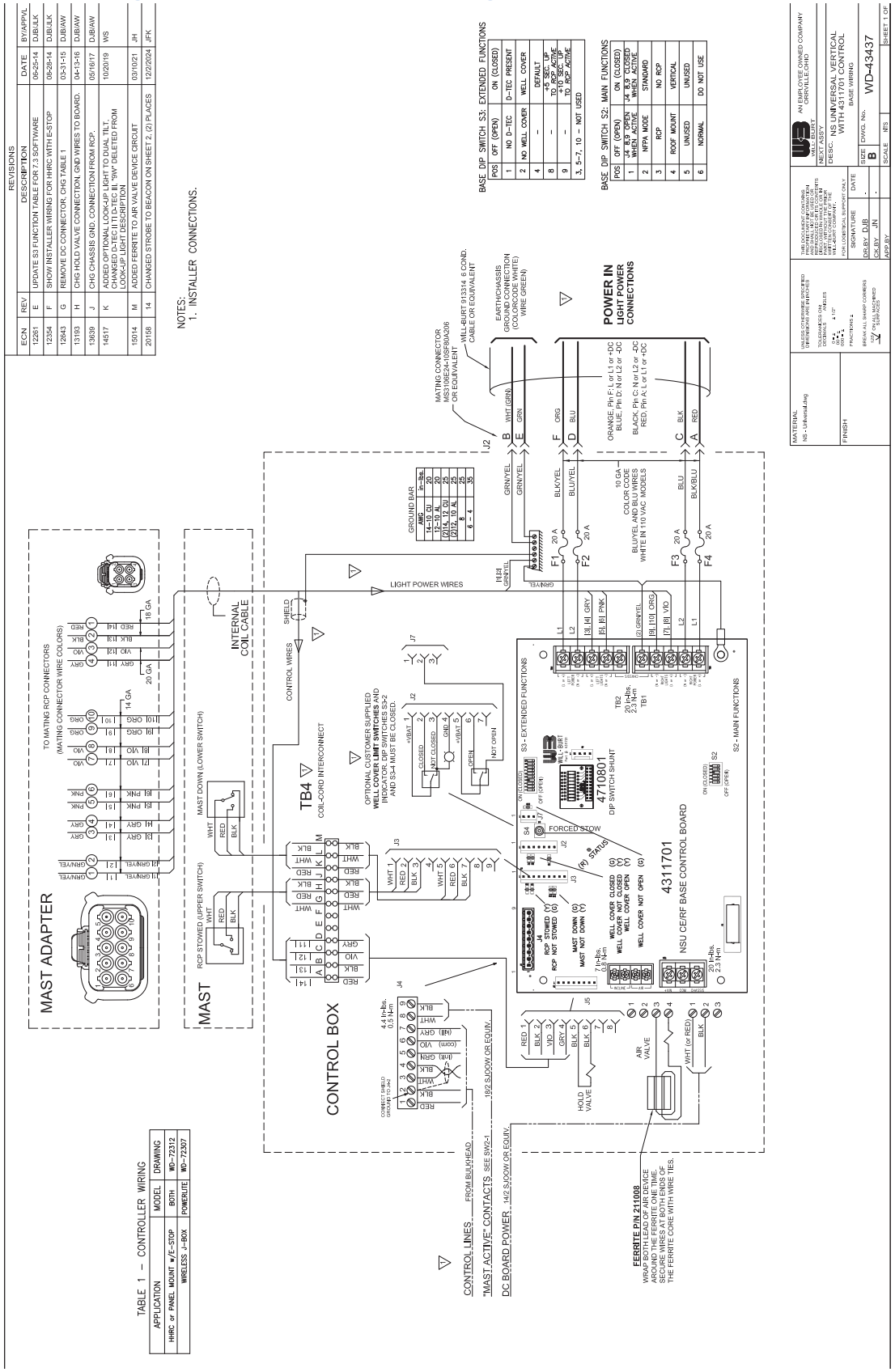


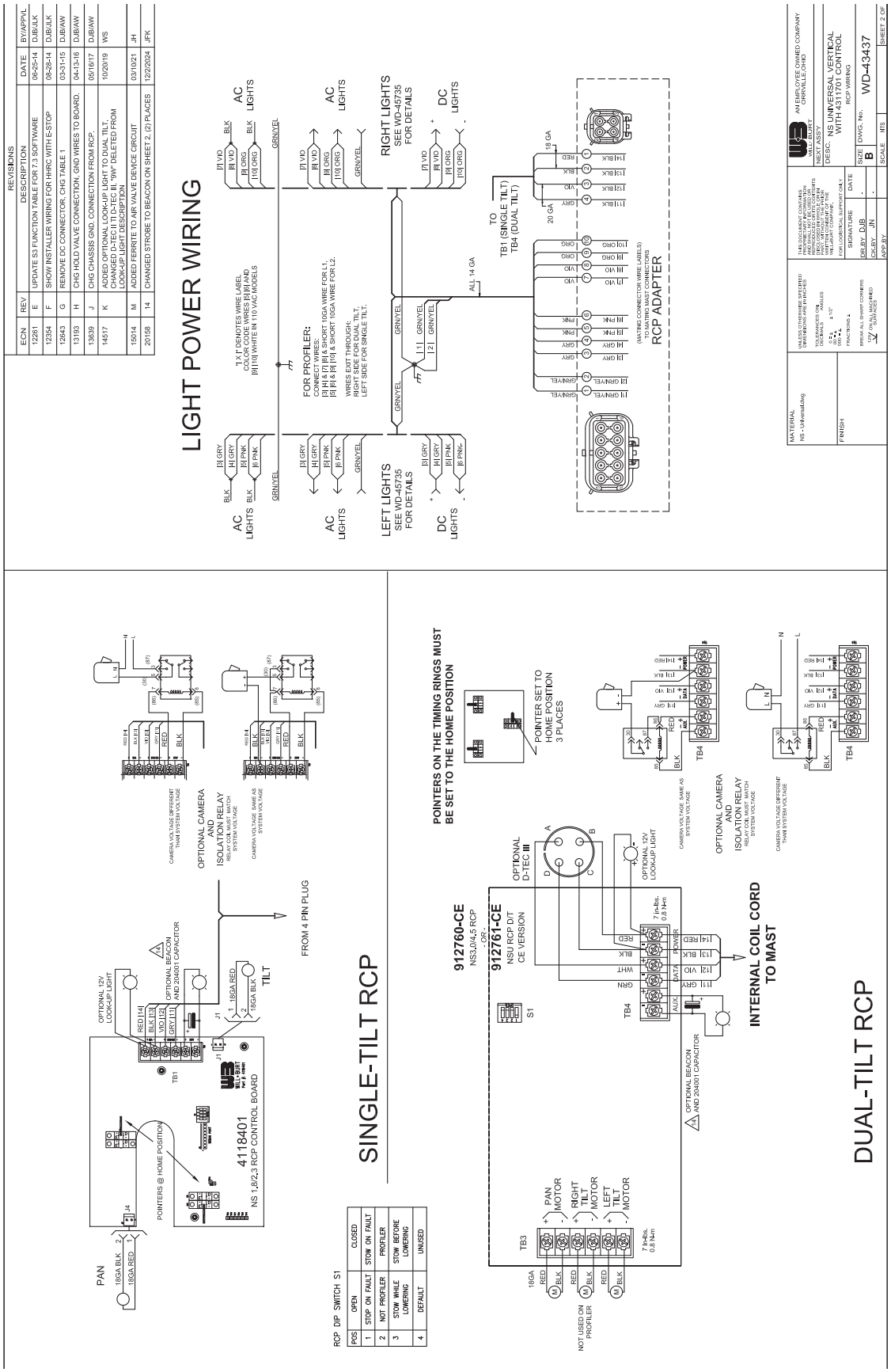
Figure 10-1 Automatic Hatch Cover Control Schematic

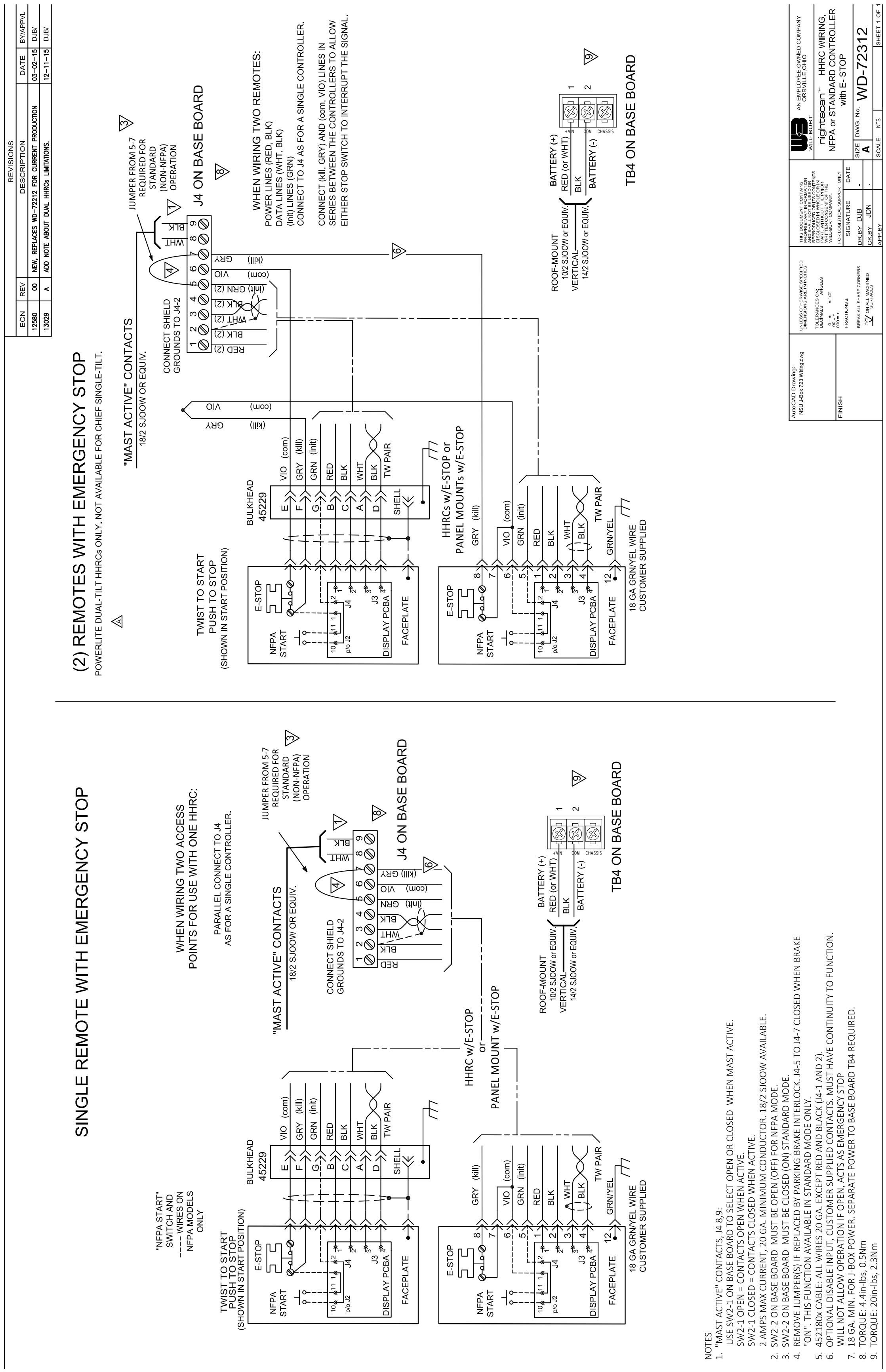
10.2 System Wiring Diagram

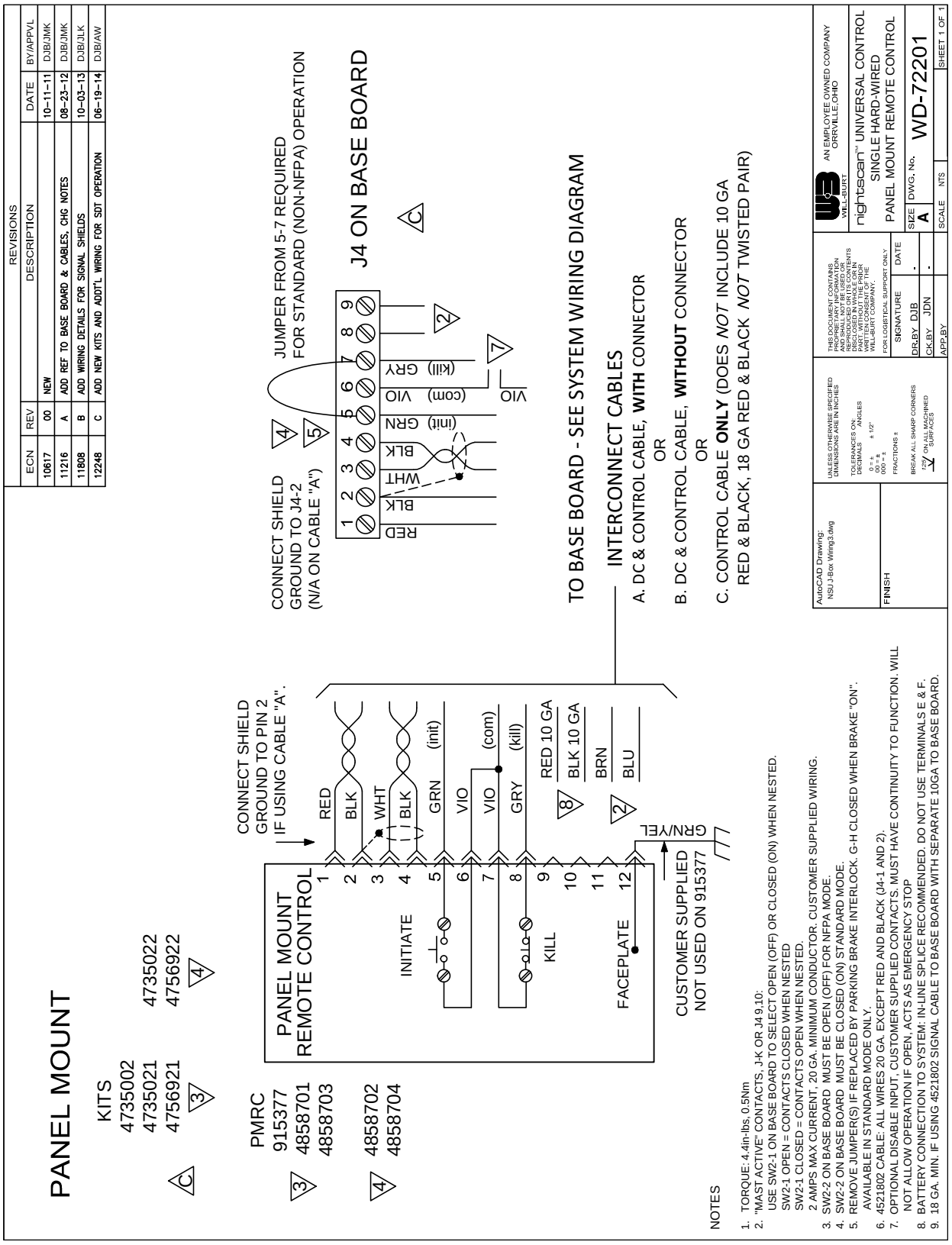
The system wiring diagrams are as follows:

10.2.1 Night Scan Vertical Drawings

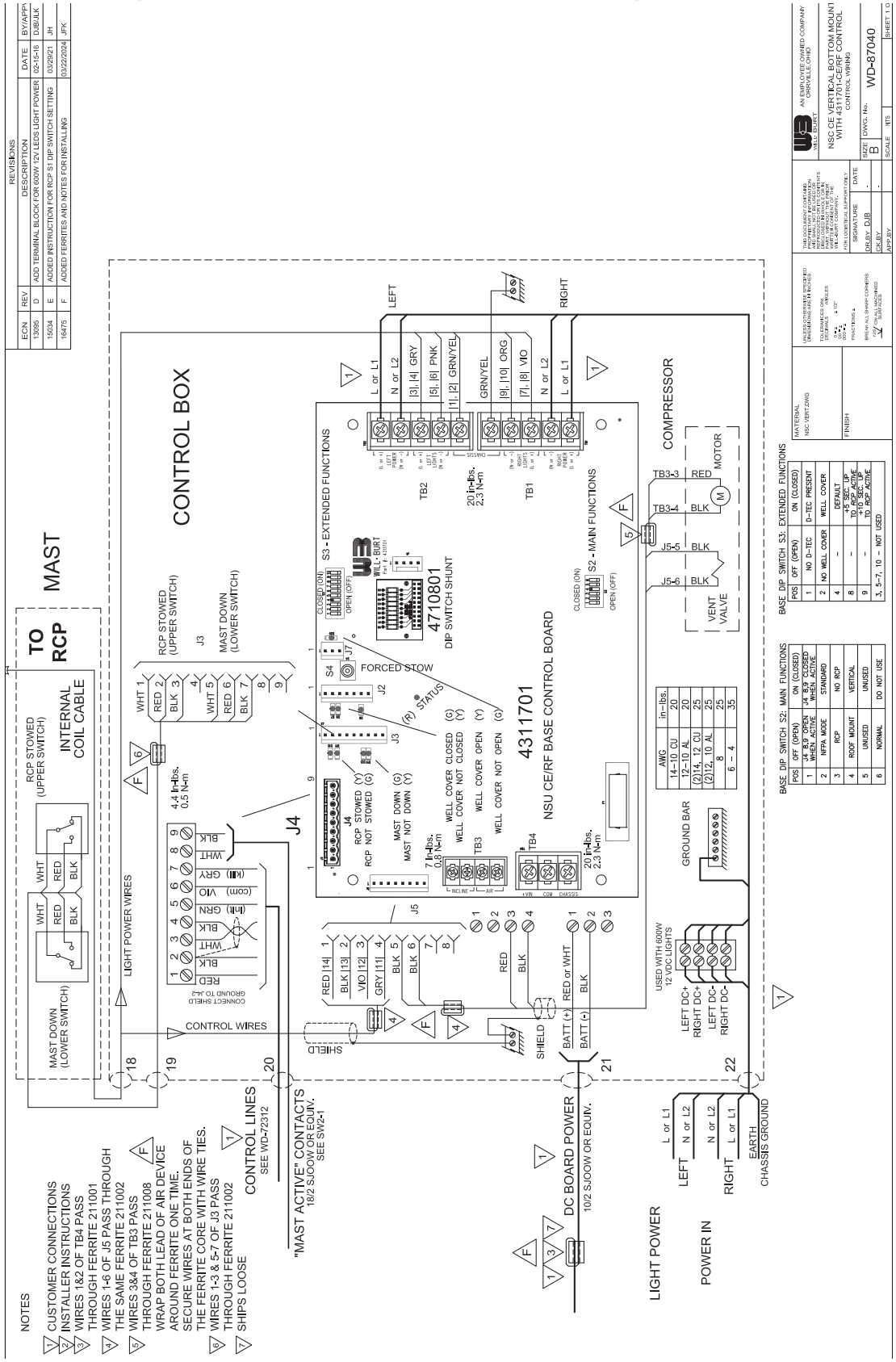


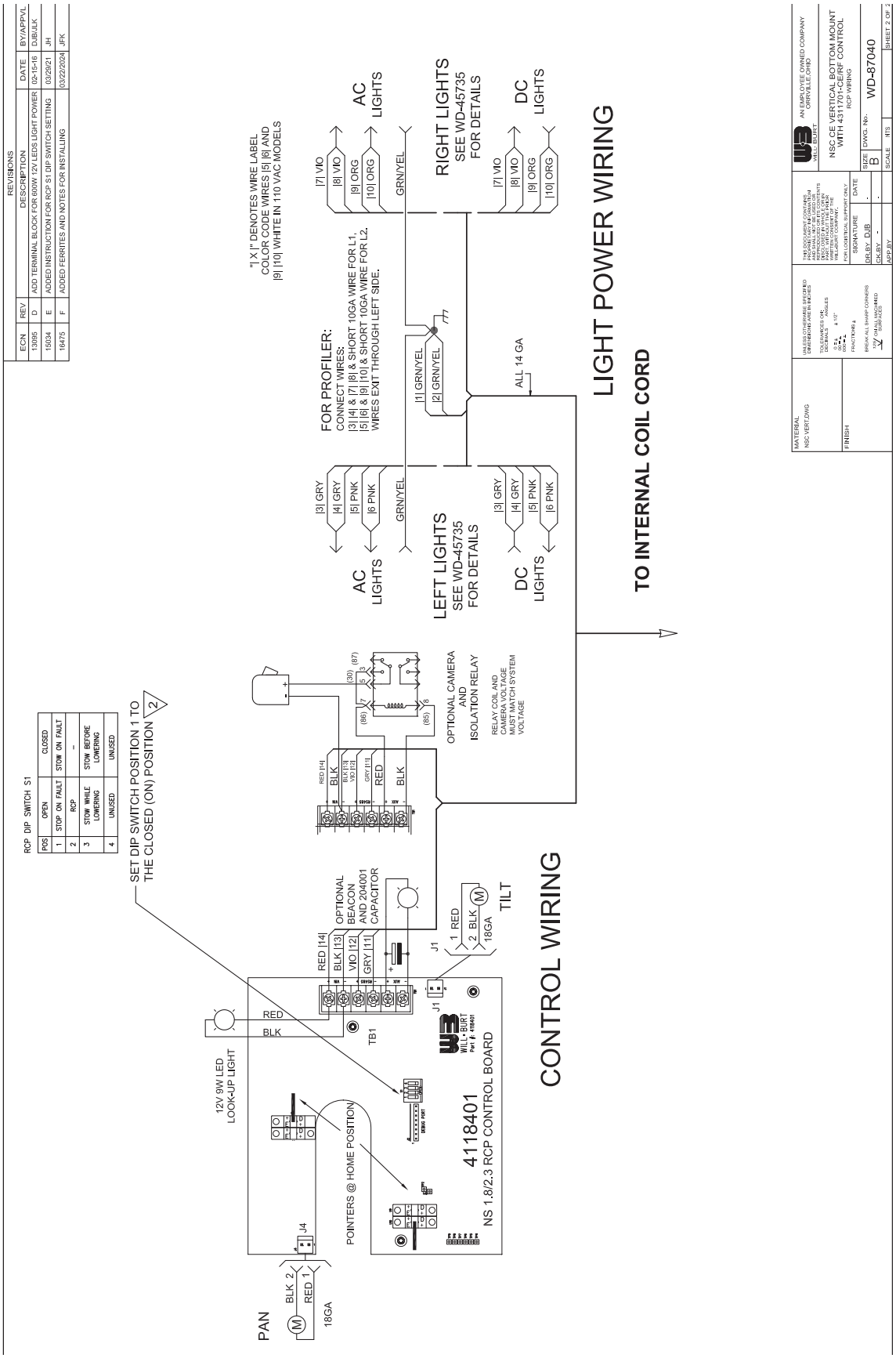

REVISIONS
ECN | REV | DESCRIPTION | DATE | BY/APPVL
12261 | E | UPDATE S3 FUNCTION TABLE FOR 7.3 SOFTWARE | 06-25-14 | DJB/JLK
12354 | F | SHOW INSTALLER WIRING FOR HHRC WITH E-STOP | 08-28-14 | DJB/JLK
12643 | G | REMOVE DC CONNECTOR, CHG TABLE 1 | 03-31-15 | DJB/AW
13193 | H | CHG HOLD VALVE CONNECTION, GND WIRES TO BOARD. | 04-13-16 | DJB/AW
13639 | J | CHG CHASSIS GND. CONNECTION FROM RCP. | 05/16/17 | DJB/AW
14517 | K | ADDED OPTIONAL LOOK-UP LIGHT TO DUAL TILT, CHANGED D-TEC II TO D-TEC III, "9W" DELETED FROM LOOK-UP LIGHT DESCRIPTION | 10/20/19 | WS
15014 | M | ADDED FERRITE TO AIR VALVE DEVICE CIRCUIT | 03/10/21 | JH
20158 | 14 | CHANGED STROBE TO BEACON ON SHEET 2, (2) PLACES | 12/2/2024 | JFK
LIGHT POWER WIRING
AC LIGHTS
LEFT LIGHTS
SEE WD-45735 FOR DETAILS
DC LIGHTS
RIGHT LIGHTS
SEE WD-45735 FOR DETAILS
FOR PROFILER:
CONNECT WIRES:
[3] [4] & [7] [8] & SHORT 10GA WIRE FOR L1.
[5] [6] & [9] [10] & SHORT 10GA WIRE FOR L2.
WIRES EXIT THROUGH:
RIGHT SIDE FOR DUAL TILT.
LEFT SIDE FOR SINGLE TILT.
ALL 14 GA
TO TB1 (SINGLE TILT) TB4 (DUAL TILT)
20 GA
18 GA
(MATING CONNECTOR WIRE LABELS)
TO MATING MAST CONNECTORS
RCP ADAPTER
MATERIAL
NS - UniversalJung
FINISH
AN EMPLOYEE OWNED COMPANY
ORRVILLE,OHIO
NEXT ASSY
DESC. NS UNIVERSAL VERTICAL WITH 4311701 CONTROL
RCP WIRING
SIGNATURE
DRLBY DJB
CHLBY JN
APP BY
DATE
SIZE B
DWG. NO. WD-43437
SCALE NTS
SHEET 2 OF
SINGLE-TILT RCP
4118401
NS 1,8/2,3 RCP CONTROL BOARD
OPTIONAL 12V LOOK-UP LIGHT
OPTIONAL BEACON AND 2A/D01 CAPACITOR
OPTIONAL CAMERA AND ISOLATION RELAY
RELAY COIL MUST MATCH SYSTEM VOLTAGE
CAMERA VOLTAGE DIFFERENT THAN SYSTEM VOLTAGE
CAMERA VOLTAGE SAME AS SYSTEM VOLTAGE
FROM 4 PIN PLUG
PAN
TILT
POINTERS @ HOME POSITION
RCP DIP SWITCH S1
POS | OPEN | CLOSED
1 | STOP ON FAULT | STOW ON FAULT
2 | NOT PROFILER | PROFILER
3 | STOW WHILE LOWERING | STOW BEFORE LOWERING
4 | DEFAULT | UNUSED
DUAL-TILT RCP
POINTERS ON THE TIMING RINGS MUST BE SET TO THE HOME POSITION
POINTER SET TO HOME POSITION 3 PLACES
912760-CE
NS3.0/4.5 RCP
- OR -
912761-CE
NSU RCP DIT
CE VERSION
OPTIONAL D-TEC III
S1
TB3
TB4
PAN MOTOR
RIGHT TILT MOTOR
LEFT TILT MOTOR
NOT USED ON PROFILER
INTERNAL COIL CORD TO MAST

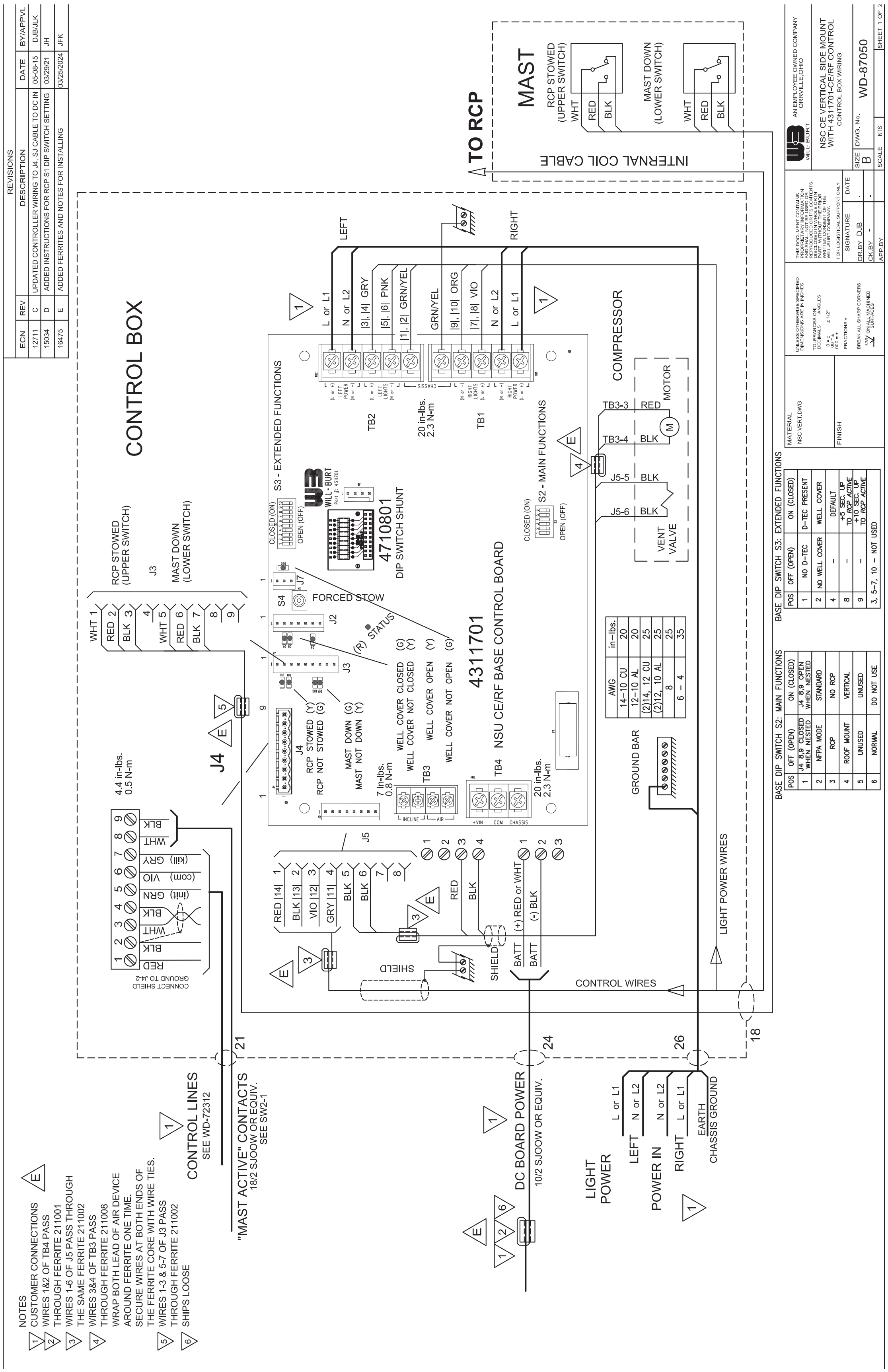

SINGLE REMOTE WITH EMERGENCY STOP
(2) REMOTES WITH EMERGENCY STOP
POWERLITE DUAL-TILT HHRCs ONLY. NOT AVAILABLE FOR CHIEF SINGLE-TILT.
J4 ON BASE BOARD
TB4 ON BASE BOARD
"MAST ACTIVE" CONTACTS
18/2 SJOOW OR EQUIV.
WHEN WIRING TWO REMOTES:
POWER LINES (RED, BLK)
DATA LINES (WHT, BLK)
(init) LINES (GRN)
CONNECT TO J4 AS FOR A SINGLE CONTROLLER.
CONNECT (kill, GRY) AND (com, VIO) LINES IN SERIES BETWEEN THE CONTROLLERS TO ALLOW EITHER STOP SWITCH TO INTERRUPT THE SIGNAL.
WHEN WIRING TWO ACCESS POINTS FOR USE WITH ONE HHRC:
PARALLEL CONNECT TO J4 AS FOR A SINGLE CONTROLLER.
NOTES
1. "MAST ACTIVE" CONTACTS, J4 8,9:
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 SJOOW AVAILABLE.
2. SW2-2 ON BASE BOARD MUST BE OPEN (OFF) FOR NFPA MODE.
3. SW2-2 ON BASE BOARD MUST BE CLOSED (ON) STANDARD MODE.
4. REMOVE JUMPER(S) IF REPLACED BY PARKING BRAKE INTERLOCK. J4-5 TO J4-7 CLOSED WHEN BRAKE "ON". THIS FUNCTION AVAILABLE IN STANDARD MODE ONLY.
5. 452180x 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: 4.4in-lbs, 0.5Nm
9. TORQUE: 20in-lbs, 2.3Nm
HHRC WIRING, NFPA or STANDARD CONTROLLER with E-STOP
WD-72312

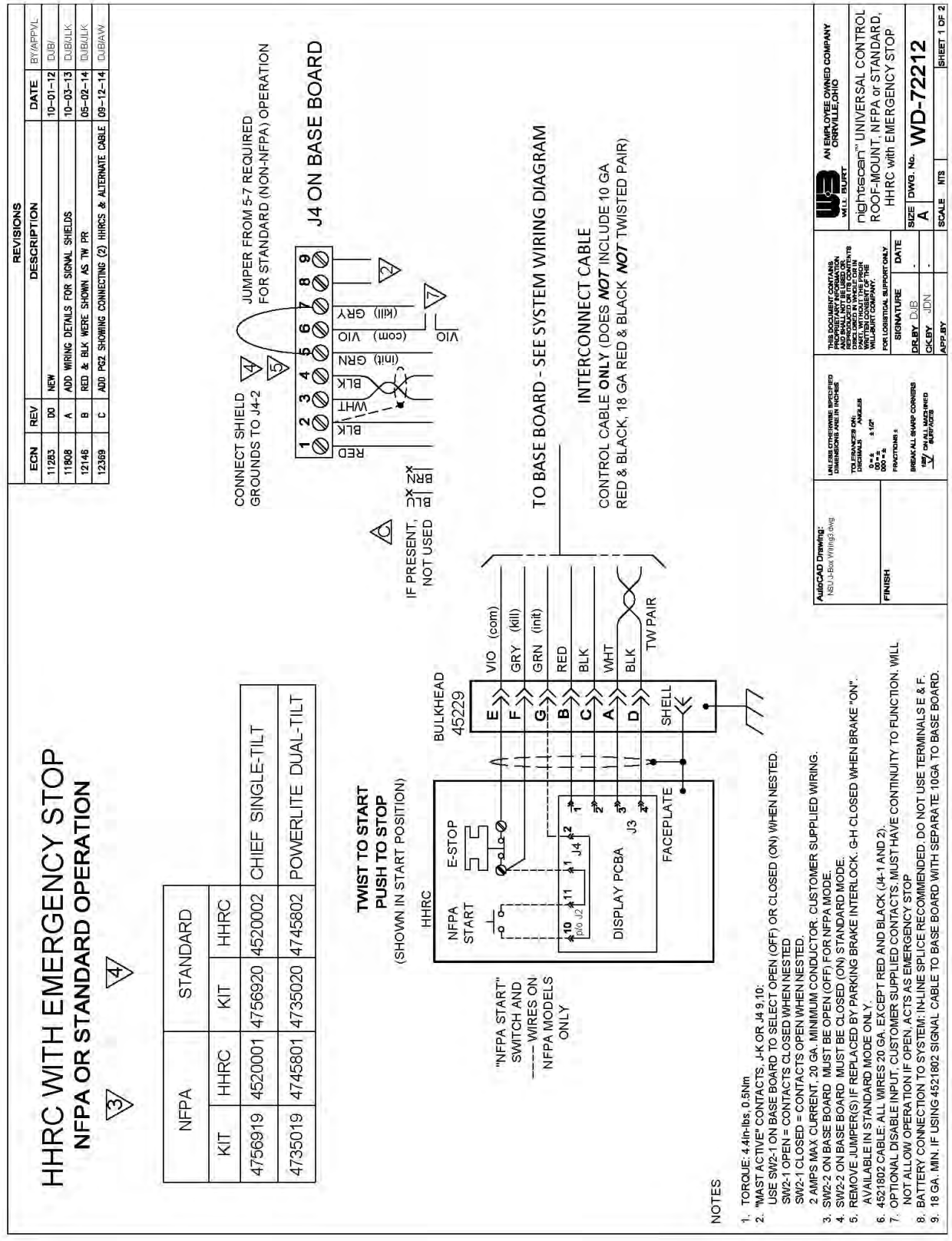

REVISIONS
ECN | REV | DESCRIPTION | DATE | BY/APPVL
10617 | 00 | NEW | 10-11-11 | DJB/JMK
11216 | A | ADD REF TO BASE BOARD & CABLES, CHG NOTES | 08-23-12 | DJB/JMK
11808 | B | ADD WIRING DETAILS FOR SIGNAL SHIELDS | 10-03-13 | DJB/JLK
12248 | C | ADD NEW KITS AND ADDT'L WIRING FOR SDT OPERATION | 06-19-14 | DJB/AW
PANEL MOUNT
KITS
4735002
4735021
4756921
4735022
4756922
PMRC
915377
4858701
4858703
4858702
4858704
PANEL MOUNT
REMOTE CONTROL
CONNECT SHIELD
GROUND TO PIN 2
IF USING CABLE "A".
INITIATE
KILL
FACEPLATE
CUSTOMER SUPPLIED
NOT USED ON 915377
RED
BLK
WHT
BLK
GRN (init)
VIO
VIO (com)
GRY (kill)
RED 10 GA
BLK 10 GA
BRN
BLU
GRN/YEL
CONNECT SHIELD
GROUND TO J4-2
(N/A ON CABLE "A")
JUMPER FROM 5-7 REQUIRED
FOR STANDARD (NON-NFPA) OPERATION
J4 ON BASE BOARD
RED
BLK
WHT
BLK
GRN (init)
VIO (com)
VIO
GRY (kill)
VIO
TO BASE BOARD - SEE SYSTEM WIRING DIAGRAM
INTERCONNECT CABLES
A. DC & CONTROL CABLE, WITH CONNECTOR
OR
B. DC & CONTROL CABLE, WITHOUT CONNECTOR
OR
C. CONTROL CABLE ONLY (DOES NOT INCLUDE 10 GA
RED & BLACK, 18 GA RED & BLACK NOT TWISTED PAIR)
NOTES
1. TORQUE: 4.4in-lbs, 0.5Nm
2. "MAST ACTIVE" CONTACTS, J-K OR J4 9,10:
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.
2 AMPS MAX CURRENT, 20 GA. MINIMUM CONDUCTOR. CUSTOMER SUPPLIED WIRING.
3. SW2-2 ON BASE BOARD MUST BE OPEN (OFF) FOR NFPA MODE.
4. SW2-2 ON BASE BOARD MUST BE CLOSED (ON) STANDARD MODE.
5. REMOVE JUMPER(S) IF REPLACED BY PARKING BRAKE INTERLOCK. G-H CLOSED WHEN BRAKE "ON".
AVAILABLE IN STANDARD MODE ONLY.
6. 4521802 CABLE: ALL WIRES 20 GA. EXCEPT RED AND BLACK (J4-1 AND 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: IN-LINE SPLICE RECOMMENDED. DO NOT USE TERMINALS E & F.
9. 18 GA. MIN. IF USING 4521802 SIGNAL CABLE TO BASE BOARD WITH SEPARATE 10GA TO BASE BOARD.
AutoCAD Drawing:
NSU-J-Box Wiring3.dwg
FINISH
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS ANGLES
0 = ± ± 1/2°
00 = ± .5
000 = ± .25
FRACTIONS ±
BREAK ALL SHARP CORNERS
125 ON ALL MACHINED SURFACES
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SHALL NOT BE USED OR REPRODUCED OR ITS CONTENTS REVEALED IN WHOLE OR IN PART, WITHOUT THE PRIOR WRITTEN CONSENT OF THE WILL-BURT COMPANY.
FOR LOGISTICAL SUPPORT ONLY
SIGNATURE DATE
DR.BY DJB -
CK.BY JDN -
APP.BY -
WILL-BURT
AN EMPLOYEE OWNED COMPANY
ORRVILLE, OHIO
nightscan™ UNIVERSAL CONTROL
SINGLE HARD-WIRED
PANEL MOUNT REMOTE CONTROL
SIZE A
DWG. No. WD-72201
SCALE NTS
SHEET 1 OF 1

10.2.2 Night Scan Vertical Complete Drawings

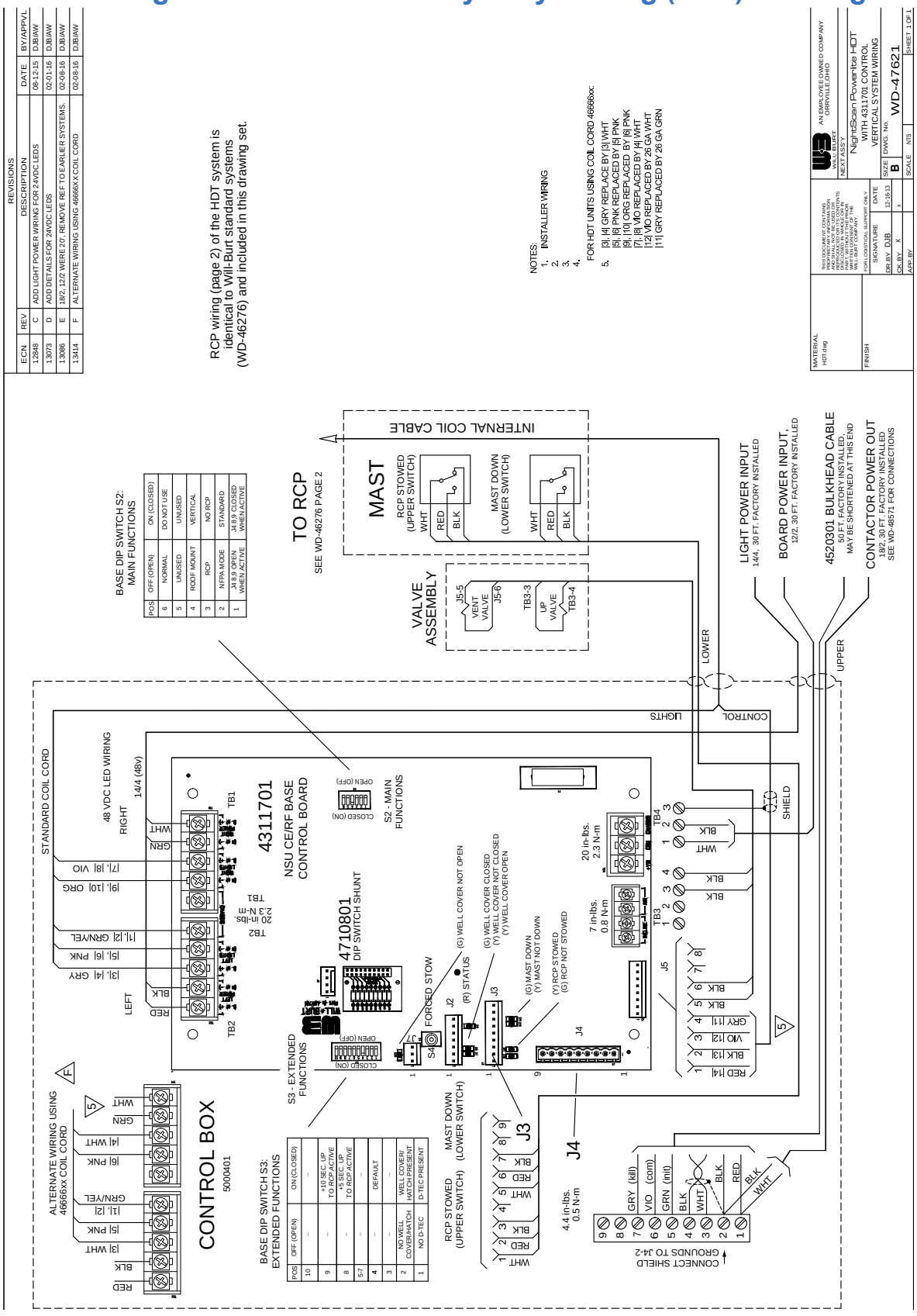


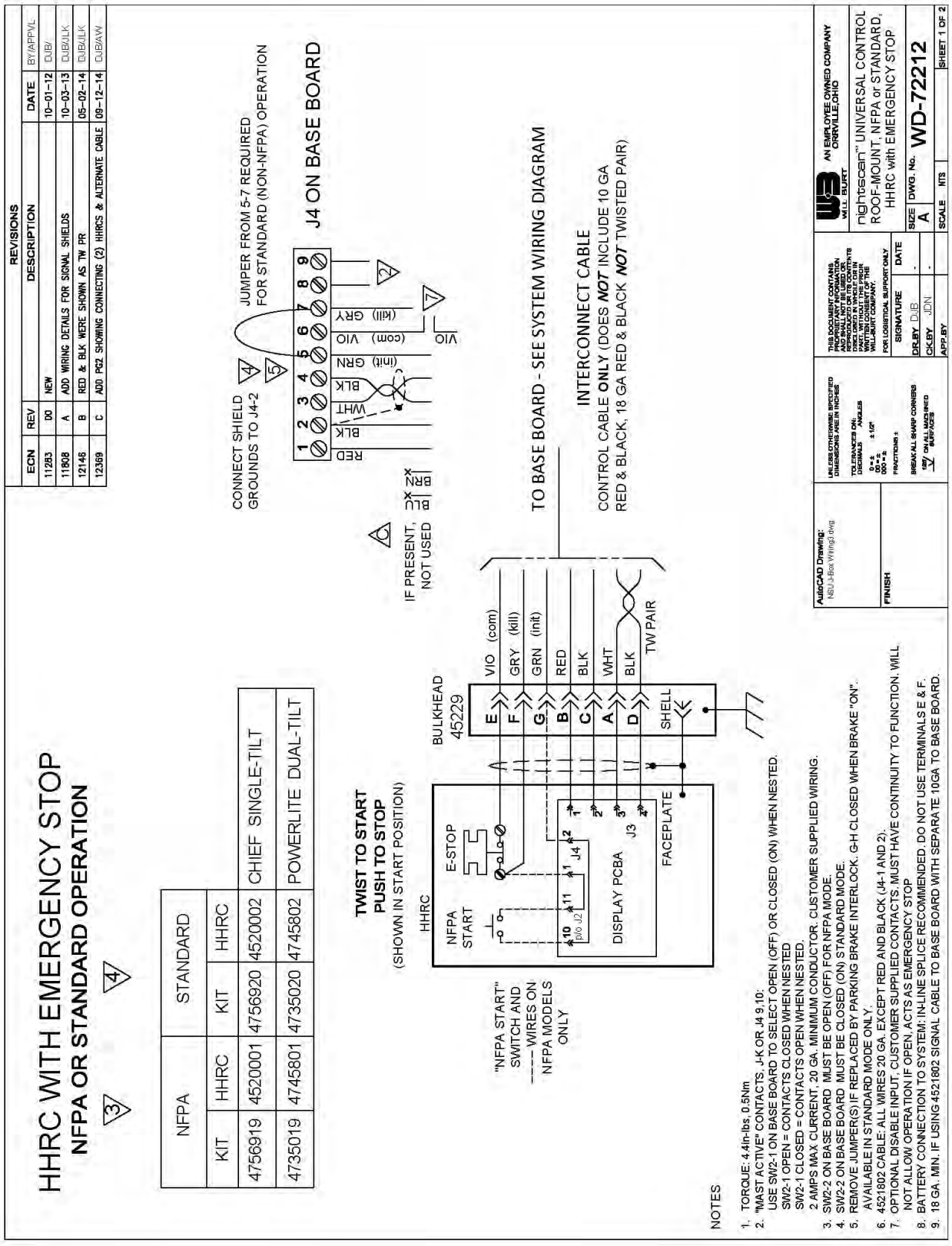

REVISIONS
ECN | REV | DESCRIPTION | DATE | BY/APPVL
13095 | D | ADD TERMINAL BLOCK FOR 600W 12V LEDS LIGHT POWER | 02-15-16 | DJB/JLK
15034 | E | ADDED INSTRUCTION FOR RCP S1 DIP SWITCH SETTING | 03/29/21 | JH
16475 | F | ADDED FERRITES AND NOTES FOR INSTALLING | 03/22/2024 | JPK
RCP DIP SWITCH S1
POS | OPEN | CLOSED
1 | STOP ON FAULT | STOW ON FAULT
2 | RCP | –
3 | STOW WHILE LOWERING | STOW BEFORE LOWERING
4 | UNUSED | UNUSED
SET DIP SWITCH POSITION 1 TO THE CLOSED (ON) POSITION 2
"[X]" DENOTES WIRE LABEL COLOR CODE WIRES |5| |6| AND |9| |10| WHITE IN 110 VAC MODELS
FOR PROFILER:
CONNECT WIRES:
|3| |4| & |7| |8| & SHORT 10GA WIRE FOR L1,
|5| |6| & |9| |10| & SHORT 10GA WIRE FOR L2.
WIRES EXIT THROUGH LEFT SIDE.
AC LIGHTS
LEFT LIGHTS
SEE WD-45735
FOR DETAILS
DC LIGHTS
RIGHT LIGHTS
SEE WD-45735
FOR DETAILS
AC LIGHTS
DC LIGHTS
ALL 14 GA
LIGHT POWER WIRING
TO INTERNAL COIL CORD
OPTIONAL CAMERA AND ISOLATION RELAY
RELAY COIL AND CAMERA VOLTAGE MUST MATCH SYSTEM VOLTAGE
OPTIONAL BEACON AND 204001 CAPACITOR
TILT
12V 9W LED LOOK-UP LIGHT
4118401
NS 1.8/2.3 RCP CONTROL BOARD
POINTERS @ HOME POSITION
PAN
CONTROL WIRING
NSC CE VERTICAL BOTTOM MOUNT WITH 45° FOLD-DOWN CONTROL
RCP WIRING
WD-87040
SHEET 2 OF 2

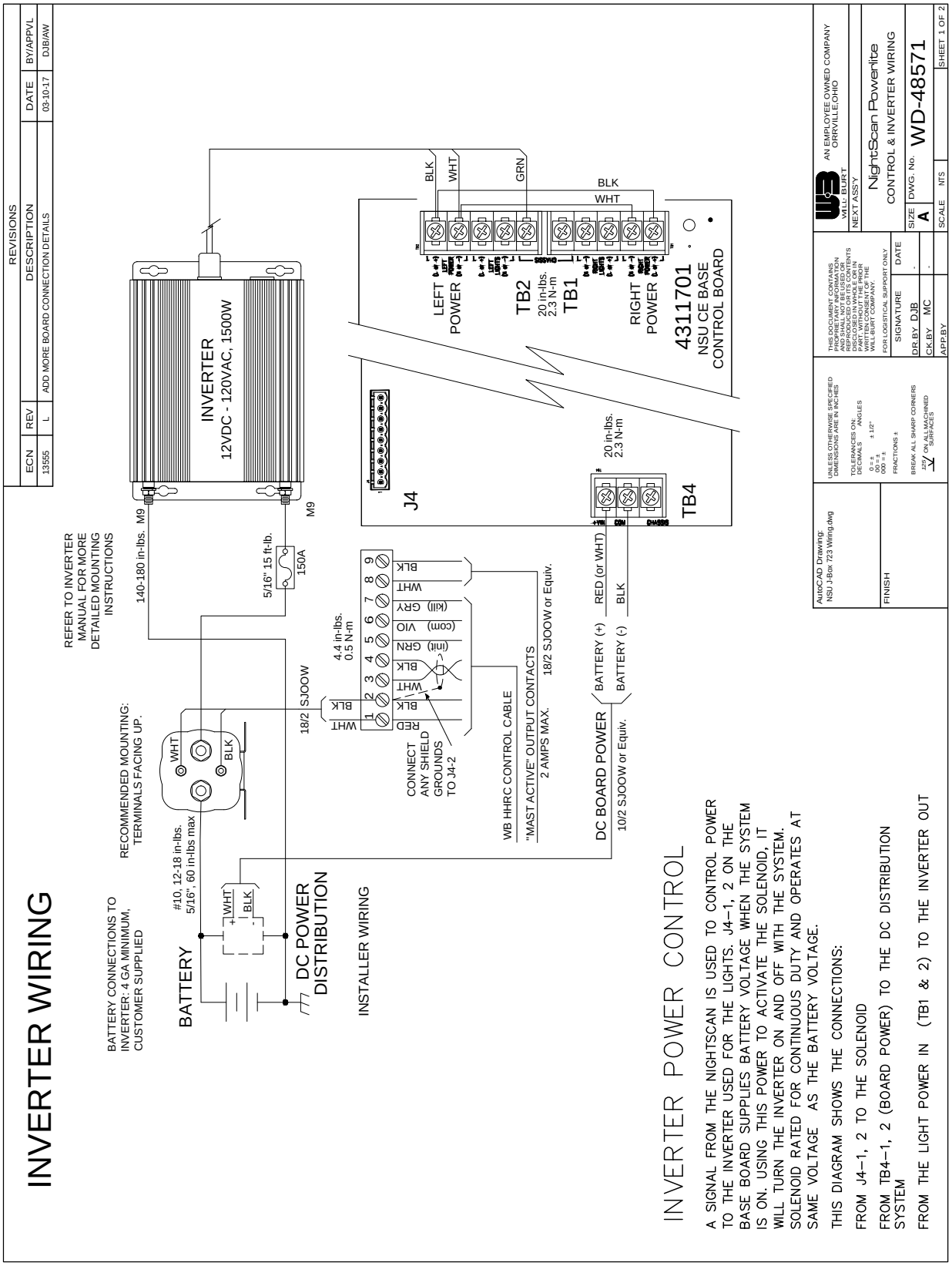

REVISIONS
ECN | REV | DESCRIPTION | DATE | BY/APPVL
12711 | C | UPDATED CONTROLLER WIRING TO J4, SJ CABLE TO DC IN | 05-08-15 | DJB/JLK
15034 | D | ADDED INSTRUCTIONS FOR RCP S1 DIP SWITCH SETTING | 03/29/21 | JH
16475 | E | ADDED FERRITES AND NOTES FOR INSTALLING | 03/25/2024 | JFK
CONTROL BOX
MAST
TO RCP
INTERNAL COIL CABLE
RCP STOWED (UPPER SWITCH)
MAST DOWN (LOWER SWITCH)
COMPRESSOR
MOTOR
VENT VALVE
S3 - EXTENDED FUNCTIONS
S2 - MAIN FUNCTIONS
4710801
DIP SWITCH SHUNT
4311701
NSU CE/RF BASE CONTROL BOARD
FORCED STOW
STATUS
GROUND BAR
CONTROL WIRES
LIGHT POWER WIRES
SHIELD
CONTROL LINES
SEE WD-72312
"MAST ACTIVE" CONTACTS
18/2 SJOOW OR EQUIV.
SEE SW2-1
DC BOARD POWER
10/2 SJOOW OR EQUIV.
LIGHT POWER
POWER IN
LEFT
RIGHT
EARTH
CHASSIS GROUND
NOTES
1 CUSTOMER CONNECTIONS
2 WIRES 1&2 OF TB4 PASS THROUGH FERRITE 211001
3 WIRES 1-6 OF J5 PASS THROUGH THE SAME FERRITE 211002
4 WIRES 3&4 OF TB3 PASS THROUGH FERRITE 211008 WRAP BOTH LEAD OF AIR DEVICE AROUND FERRITE ONE TIME.
SECURE WIRES AT BOTH ENDS OF THE FERRITE CORE WITH WIRE TIES.
5 WIRES 1-3 & 5-7 OF J3 PASS THROUGH FERRITE 211002
6 SHIPS LOOSE
AWG | in-lbs.
14-10 CU | 20
12-10 AL | 20
(2)14, 12 CU | 25
(2)12, 10 AL | 25
8 | 25
6 - 4 | 35
BASE DIP SWITCH S2: MAIN FUNCTIONS
POS | OFF (OPEN) | ON (CLOSED)
1 | J4 8,9 CLOSED WHEN NESTED | J4 8,9 OPEN WHEN NESTED
2 | NFPA MODE | STANDARD
3 | RCP | NO RCP
4 | ROOF MOUNT | VERTICAL
5 | UNUSED | UNUSED
6 | NORMAL | DO NOT USE
BASE DIP SWITCH S3: EXTENDED FUNCTIONS
POS | OFF (OPEN) | ON (CLOSED)
1 | NO D-TEC | D-TEC PRESENT
2 | NO WELL COVER | WELL COVER
4 | - | DEFAULT
8 | - | +5 SEC. UP TO RCP ACTIVE
9 | - | +10 SEC. UP TO RCP ACTIVE
3, 5-7, 10 - NOT USED
NSC CE VERTICAL SIDE MOUNT WITH 4311701-CE/RF CONTROL
CONTROL BOX WIRING
WD-87050
SHEET 1 OF 2

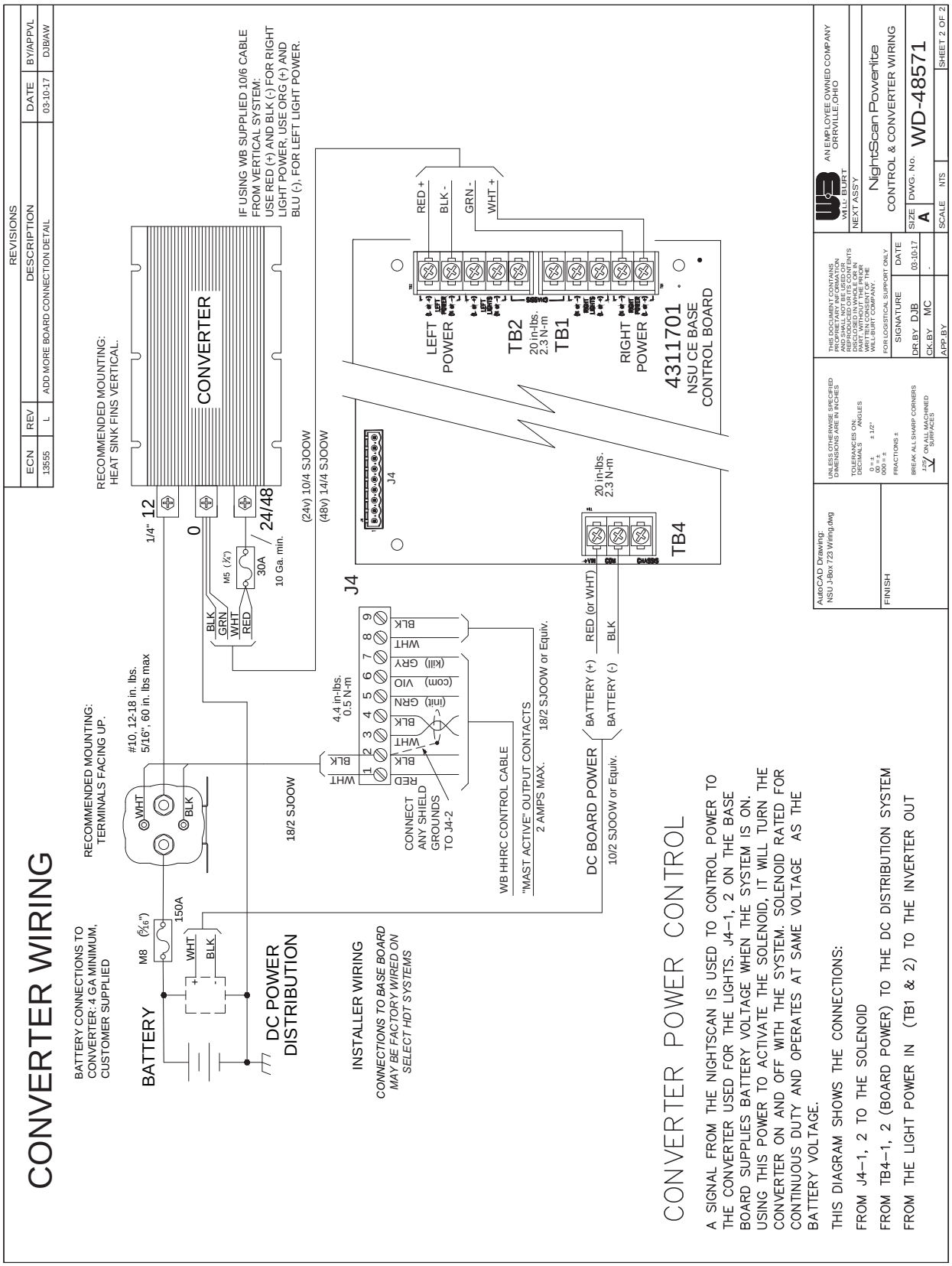

HHRC WITH EMERGENCY STOP
NFPA OR STANDARD OPERATION
NFPA
KIT
HHRC
STANDARD
KIT
HHRC
4756919
4520001
4756920
4520002
CHIEF SINGLE-TILT
4735019
4745801
4735020
4745802
POWERLITE DUAL-TILT
TWIST TO START
PUSH TO STOP
(SHOWN IN START POSITION)
HHRC
NFPA START
E-STOP
DISPLAY PCBA
FACEPLATE
BULKHEAD
45229
"NFPA START" SWITCH AND WIRES ON NFPA MODELS ONLY
IF PRESENT, NOT USED
CONNECT SHIELD
GROUNDS TO J4-2
JUMPER FROM 5-7 REQUIRED
FOR STANDARD (NON-NFPA) OPERATION
J4 ON BASE BOARD
TO BASE BOARD - SEE SYSTEM WIRING DIAGRAM
INTERCONNECT CABLE
CONTROL CABLE ONLY (DOES NOT INCLUDE 10 GA
RED & BLACK, 18 GA RED & BLACK NOT TWISTED PAIR)
VIO (com)
GRY (kill)
GRN (init)
RED
BLK
WHT
BLK
TW PAIR
SHELL
REVISIONS
ECN
REV
DESCRIPTION
DATE
BY/APP'VL
11283
00
NEW
10-01-12
DJB/
11808
A
ADD WIRING DETAILS FOR SIGNAL SHIELDS
10-03-13
DJB/JLK
12146
B
RED & BLK WERE SHOWN AS TW PR
05-02-14
DJB/JLK
12369
C
ADD P62 SHOWING CONNECTING (2) HHRCS & ALTERNATE CABLE
09-12-14
DJB/AW
AutoCAD Drawing:
NSU-Box Wiring3.dwg
FINISH
DR.BY DJB
CK.BY JDN
APP.BY
SIZE A
DWG. No. WD-72212
SCALE NTS
SHEET 1 OF 2
AN EMPLOYEE OWNED COMPANY
ORRVILLE, OHIO
nightscan™ UNIVERSAL CONTROL
ROOF-MOUNT, NFPA or STANDARD,
HHRC with EMERGENCY STOP
NOTES
1. TORQUE: 4.4in-lbs, 0.5Nm
2. "MAST ACTIVE" CONTACTS, J-K OR J4 9,10:
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.
2 AMPS MAX CURRENT, 20 GA. MINIMUM CONDUCTOR. CUSTOMER SUPPLIED WIRING.
3. SW2-2 ON BASE BOARD MUST BE OPEN (OFF) FOR NFPA MODE.
4. SW2-2 ON BASE BOARD MUST BE CLOSED (ON) STANDARD MODE.
5. REMOVE JUMPER(S) IF REPLACED BY PARKING BRAKE INTERLOCK. G-H CLOSED WHEN BRAKE "ON".
AVAILABLE IN STANDARD MODE ONLY.
6. 4521802 CABLE: ALL WIRES 20 GA, EXCEPT RED AND BLACK (J4-1 AND 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: IN-LINE SPLICE RECOMMENDED. DO NOT USE TERMINALS E & F.
9. 18 GA. MIN. IF USING 452182 SIGNAL CABLE TO BASE BOARD WITH SEPARATE 10GA TO BASE BOARD.

10.2.3 Night Scan Vertical Heavy Duty Towing (HDT) Drawings




HHRC WITH EMERGENCY STOP
NFPA OR STANDARD OPERATION
REVISIONS
ECN REV DESCRIPTION DATE BY/APPVL
11253 00 NEW 10-01-12 DJB/
11808 A ADD WIRING DETAILS FOR SIGNAL SHIELDS 10-03-13 DJB/JLK
12146 B RED & BLK WERE SHOWN AS TW PR 05-02-14 DJB/JLK
12369 C ADD P62 SHOWING CONNECTING (2) HHRCS & ALTERNATE CABLE 09-12-14 DJB/AW
NFPA STANDARD
KIT HHRC KIT HHRC
4756919 4520001 4756920 4520002 CHIEF SINGLE-TILT
4735019 4745801 4735020 4745802 POWERLITE DUAL-TILT
TWIST TO START
PUSH TO STOP
(SHOWN IN START POSITION)
HHRC
NFPA START
E-STOP
"NFPA START" SWITCH AND WIRES ON NFPA MODELS ONLY
DISPLAY PCBA
FACEPLATE
BULKHEAD 45229
E VIO (com)
F GRY (kill)
G GRN (init)
B RED
C BLK
A WHT
D BLK
SHELL
TW PAIR
TO BASE BOARD - SEE SYSTEM WIRING DIAGRAM
INTERCONNECT CABLE
CONTROL CABLE ONLY (DOES NOT INCLUDE 10 GA
RED & BLACK, 18 GA RED & BLACK NOT TWISTED PAIR)
IF PRESENT, NOT USED
CONNECT SHIELD GROUNDS TO J4-2
JUMPER FROM 5-7 REQUIRED FOR STANDARD (NON-NFPA) OPERATION
J4 ON BASE BOARD
RED
BLK
WHT
BLK
GRN (init)
VIO (com)
GRY (kill)
VIO
NOTES
1. TORQUE: 4.4in-lbs, 0.5Nm
2. "MAST ACTIVE" CONTACTS, J-K OR J4 9,10:
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.
2 AMPS MAX CURRENT, 20 GA. MINIMUM CONDUCTOR. CUSTOMER SUPPLIED WIRING.
3. SW2-2 ON BASE BOARD MUST BE OPEN (OFF) FOR NFPA MODE.
4. SW2-2 ON BASE BOARD MUST BE CLOSED (ON) STANDARD MODE.
5. REMOVE JUMPER(S) IF REPLACED BY PARKING BRAKE INTERLOCK. G-H CLOSED WHEN BRAKE "ON".
AVAILABLE IN STANDARD MODE ONLY.
6. 4521802 CABLE: ALL WIRES 20 GA. EXCEPT RED AND BLACK (J4-1 AND 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: IN-LINE SPLICE RECOMMENDED. DO NOT USE TERMINALS E & F.
9. 18 GA. MIN. IF USING 4521802 SIGNAL CABLE TO BASE BOARD WITH SEPARATE 10GA TO BASE BOARD.
AutoCAD Drawing: NSU J-Box Wiring3.dwg
FINISH
SIGNATURE DATE
DR.BY DJB -
CK.BY JDN -
APP.BY -
AN EMPLOYEE OWNED COMPANY
ORRVILLE,OHIO
WILL BURT
nightscan™ UNIVERSAL CONTROL
ROOF-MOUNT, NFPA or STANDARD,
HHRC with EMERGENCY STOP
SIZE DWG. No. WD-72212
A
SCALE NTS
SHEET 1 OF 2


INVERTER WIRING
INVERTER
12VDC - 120VAC, 1500W
REFER TO INVERTER MANUAL FOR MORE DETAILED MOUNTING INSTRUCTIONS
140-180 in-lbs.
M9
5/16" 15 ft-lb.
150A
BATTERY CONNECTIONS TO INVERTER: 4 GA MINIMUM, CUSTOMER SUPPLIED
RECOMMENDED MOUNTING: TERMINALS FACING UP.
#10, 12-18 in-lbs. 5/16", 60 in-lbs max
BATTERY
DC POWER DISTRIBUTION
INSTALLER WIRING
18/2 SJOOW
4.4 in-lbs. 0.5 N-m
CONNECT ANY SHIELD GROUNDS TO J4-2
WB HHRC CONTROL CABLE
"MAST ACTIVE" OUTPUT CONTACTS
2 AMPS MAX.
18/2 SJOOW or Equiv.
DC BOARD POWER
10/2 SJOOW or Equiv.
BATTERY (+)
BATTERY (-)
RED (or WHT)
BLK
20 in-lbs. 2.3 N-m
TB4
J4
LEFT POWER
TB2
TB1
RIGHT POWER
4311701
NSU CE BASE CONTROL BOARD
BLK
WHT
GRN
INVERTER POWER CONTROL
A SIGNAL FROM THE NIGHTSCAN IS USED TO CONTROL POWER TO THE INVERTER USED FOR THE LIGHTS. J4–1, 2 ON THE BASE BOARD SUPPLIES BATTERY VOLTAGE WHEN THE SYSTEM IS ON. USING THIS POWER TO ACTIVATE THE SOLENOID, IT WILL TURN THE INVERTER ON AND OFF WITH THE SYSTEM. SOLENOID RATED FOR CONTINUOUS DUTY AND OPERATES AT SAME VOLTAGE AS THE BATTERY VOLTAGE.
THIS DIAGRAM SHOWS THE CONNECTIONS:
FROM J4–1, 2 TO THE SOLENOID
FROM TB4–1, 2 (BOARD POWER) TO THE DC DISTRIBUTION SYSTEM
FROM THE LIGHT POWER IN (TB1 & 2) TO THE INVERTER OUT
REVISIONS
ECN 13555 | REV L | DESCRIPTION: ADD MORE BOARD CONNECTION DETAILS | DATE 03-10-17 | BY/APPVL DJB/AW
AutoCAD Drawing: NSU J-Box 723 Wiring.dwg
FINISH
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON: DECIMALS ANGLES .0 = ± ± 1/2° .00 = ± .000 = ± FRACTIONS ±
BREAK ALL SHARP CORNERS 125 √ ON ALL MACHINED SURFACES
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SHALL NOT BE USED OR DISCLOSED TO OTHERS FOR ANY PURPOSE EXCEPT AS SPECIFICALLY AUTHORIZED IN WRITING BY WILL-BURT COMPANY.
FOR LOGISTICAL SUPPORT ONLY
SIGNATURE DATE
DR. BY DJB
CK. BY MC
APP. BY
AN EMPLOYEE OWNED COMPANY ORRVILLE,OHIO
WILL BURT
NEXT ASS'Y
NightScan Powerlite
CONTROL & INVERTER WIRING
SIZE A | DWG. No. WD-48571
SCALE NTS
SHEET 1 OF 2


CONVERTER WIRING
REVISIONS
ECN 13555
REV L
DESCRIPTION ADD MORE BOARD CONNECTION DETAIL
DATE 03-10-17
BY/APPVL DJB/AW
BATTERY CONNECTIONS TO CONVERTER: 4 GA MINIMUM, CUSTOMER SUPPLIED
BATTERY
M8 (5/16")
150A
WHT
BLK
DC POWER DISTRIBUTION
RECOMMENDED MOUNTING: TERMINALS FACING UP.
#10, 12-18 in. lbs. 5/16", 60 in. lbs max
18/2 SJOOW
INSTALLER WIRING
CONNECTIONS TO BASE BOARD MAY BE FACTORY WIRED ON SELECT HDT SYSTEMS
RECOMMENDED MOUNTING: HEAT SINK FINS VERTICAL.
1/4" 12
0
24/48
CONVERTER
IF USING WB SUPPLIED 10/6 CABLE FROM VERTICAL SYSTEM: USE RED (+) AND BLK (-) FOR RIGHT LIGHT POWER. USE ORG (+) AND BLU (-), FOR LEFT LIGHT POWER.
M5 (1/4")
30A
10 Ga. min.
BLK
GRN
WHT
RED
(24v) 10/4 SJOOW
(48v) 14/4 SJOOW
J4
4.4 in-lbs. 0.5 N-m
WHT
BLK
RED
BLK
WHT
BLK
(init) GRY
(com) VIO
(kill) GRY
WHT
BLK
CONNECT ANY SHIELD GROUNDS TO J4-2
WB HHRC CONTROL CABLE
"MAST ACTIVE" OUTPUT CONTACTS 2 AMPS MAX.
18/2 SJOOW or Equiv.
DC BOARD POWER
10/2 SJOOW or Equiv.
BATTERY (+)
BATTERY (-)
RED (or WHT)
BLK
20 in-lbs. 2.3 N-m
TB4
+VIN
COM
CHASSIS
4311701
NSU CE BASE CONTROL BOARD
J4
LEFT POWER
TB2
20 in-lbs. 2.3 N-m
TB1
RIGHT POWER
RED +
BLK -
GRN -
WHT +
CONVERTER POWER CONTROL
A SIGNAL FROM THE NIGHTSCAN IS USED TO CONTROL POWER TO THE CONVERTER USED FOR THE LIGHTS. J4–1, 2 ON THE BASE BOARD SUPPLIES BATTERY VOLTAGE WHEN THE SYSTEM IS ON. USING THIS POWER TO ACTIVATE THE SOLENOID, IT WILL TURN THE CONVERTER ON AND OFF WITH THE SYSTEM. SOLENOID RATED FOR CONTINUOUS DUTY AND OPERATES AT SAME VOLTAGE AS THE BATTERY VOLTAGE.
THIS DIAGRAM SHOWS THE CONNECTIONS:
FROM J4–1, 2 TO THE SOLENOID
FROM TB4–1, 2 (BOARD POWER) TO THE DC DISTRIBUTION SYSTEM
FROM THE LIGHT POWER IN (TB1 & 2) TO THE INVERTER OUT
AutoCAD Drawing: NSU J-Box 723 Wiring.dwg
FINISH
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON: DECIMALS ANGLES
0 = ± ± 1/2°
00 = ± .
000 = ± .
FRACTIONS ±
BREAK ALL SHARP CORNERS
125 ON ALL MACHINED SURFACES
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SHALL NOT BE USED OR REPRODUCED WITH ITS CONTENTS DISCLOSED TO OTHERS IN WHOLE OR IN PART, WITHOUT THE PRIOR WRITTEN CONSENT OF THE WILL-BURT COMPANY.
FOR LOGISTICAL SUPPORT ONLY
SIGNATURE DATE
DR. BY DJB 03-10-17
CK. BY MC
APP. BY
AN EMPLOYEE OWNED COMPANY ORRVILLE,OHIO
WILL BURT
NEXT ASS'Y
NightScan Powerlite
CONTROL & CONVERTER WIRING
SIZE A
DWG. No. WD-48571
SCALE NTS
SHEET 2 OF 2

This page intentionally left blank.