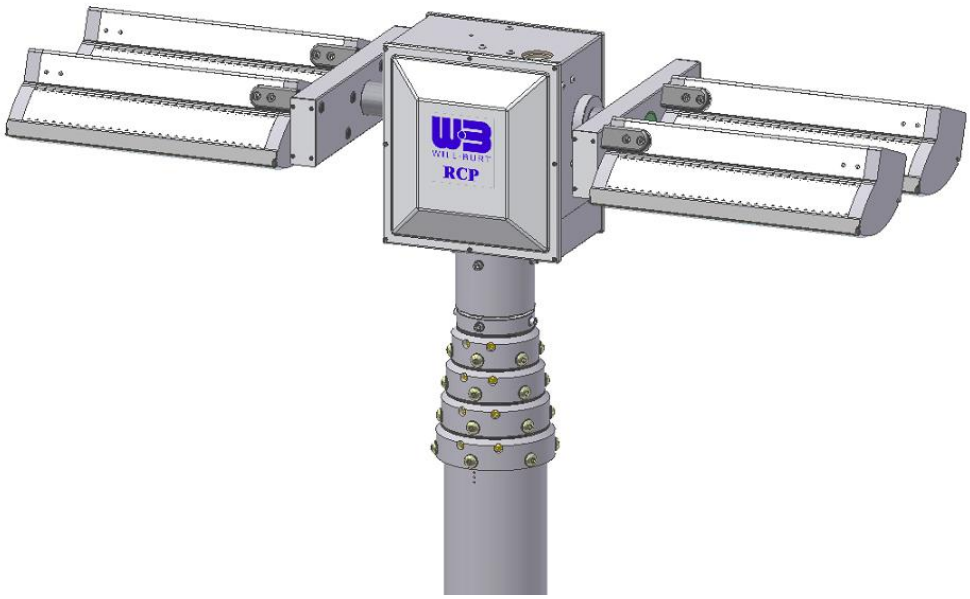
POWERLITE VERTICAL RCP
INSTALLATION, OPERATION & MAINTENANCE MANUAL

POWERLITE



The Will-Burt Company
169 S. Main Street
Orrville, OH 44667
330-682-7015 – Fax: 330-684-1190
www.willburt.com
Revision 2, June 2006

WARRANTY

The Manufacturer warrants its products to be free from defects in material and workmanship for a period of one year from the date of shipment from the factory. The Manufacturer shall not be responsible for any damage resulting to or caused by its products by reason of improper installation, improper storage, unauthorized service, alteration of products, neglect or abuse, or use of the product in a manner inconsistent with its design, accident, acts of God, or failure to properly maintain this product. This warranty does not extend to any component parts not manufactured by Manufacturer, however, Manufacturer's warranty herein shall not limit any warranties made by manufacturers of component parts which may extend to 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 OR FITNESS FOR A PARTICULAR PURPOSE) ARE MADE BY MANUFACTURER 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 MANUFACTURER.

Claims for defects in material and workmanship shall be made in writing to Manufacturer 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 the Manufacturer shall be released from any and all liability relating to the product. Manufacturer may either send a service representative or have the product returned to its factory at Buyer's expense for inspection. If judged by Manufacturer to be defective in material or workmanship, the product will be replaced or repaired at the option of Manufacturer, 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 MANUFACTURER 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 MANUFACTURER TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP. MANUFACTURER SHALL NOT BE LIABLE FOR COST OF INSTALLATION AND/OR REMOVAL, OR BE RESPONSIBLE FOR DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

SAFETY SUMMARY

SIGNAL WORD DEFINITION

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

GENERAL SAFETY PRECAUTIONS

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

⚠ DANGER

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

⚠ WARNING

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

⚠ WARNING

Tip Over Hazard! Mast tip over could result in death or serious injury. Do not operate in high winds. Operate on level ground only. Stand clear of mast and mast payload during operation. Be certain mast is level and secure before and during installation, operation and maintenance.

⚠ WARNING

Safety Instruction - Trained Personnel Only! Death or serious injury could result if proper inspection, installation, operation and maintenance procedures are not observed. Installation, operation and maintenance to be performed by trained and authorized personnel only. Proper eye protection should be worn when servicing the mast.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Safety Instruction – Resuscitation Alert! Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

SPECIFIC SAFETY PRECAUTIONS

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

When relamping an installed fixture, make sure all power to fixture is off and that the fixture is cool

⚠ WARNING

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

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

Safety Instruction – Installation! At all times while using pipe and hose during installation, recognize that:

1.) Pipe and hose should be routed, mounted and restrained to protect from damage;
2.) Do not use second hand piping for installation;
3.) Do not bend air pipe and hose at a radius less than specified by the manufacturer;
4.) Pipes should be marked to avoid hazards from incorrect connection;
5.) The exhaust should be fitted with a silencer and be directed away from personnel;
6.) When routing piping, install in such a way as to minimize torsion on the joints;
7.) Mounting air pipe and hose shall be accomplished only by the use of tools to prevent readily disconnecting air pipe and hose from mast.

⚠ CAUTION

Safety Instruction – Operation! Do not operate the Powerlite vertical RCP during an electrical storm.

⚠ CAUTION

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

⚠ CAUTION

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

CHAPTER 1
INTRODUCTION

1.1 SAFETY PRECAUTIONS

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

1.2 INTRODUCTION

This manual covers the installation, operation, troubleshooting and maintenance instructions for the Powerlite vertical RCP. The manual should be reviewed in its entirety. Contact the Will-Burt factory with any questions before performing any procedures outlined in this manual.

1.3 DESCRIPTION

The Powerlite vertical RCP is a transportable lighting system consisting of a directionally adjustable group of lights attached to an extendable mast. It may also serve as a platform for communications antennae or a camera. Please contact the Will-Burt factory for available mast models (sold separately). Air pressure, required to extend the mast, is provided by an available vehicle air system or an optional compressor unit. The unit is designed for installation on any vehicle used for the purpose of providing on the scene temporary lighting, communications or surveillance. Refer to Figure 1-1 for identification of the major components of the Powerlite vertical RCP unit.

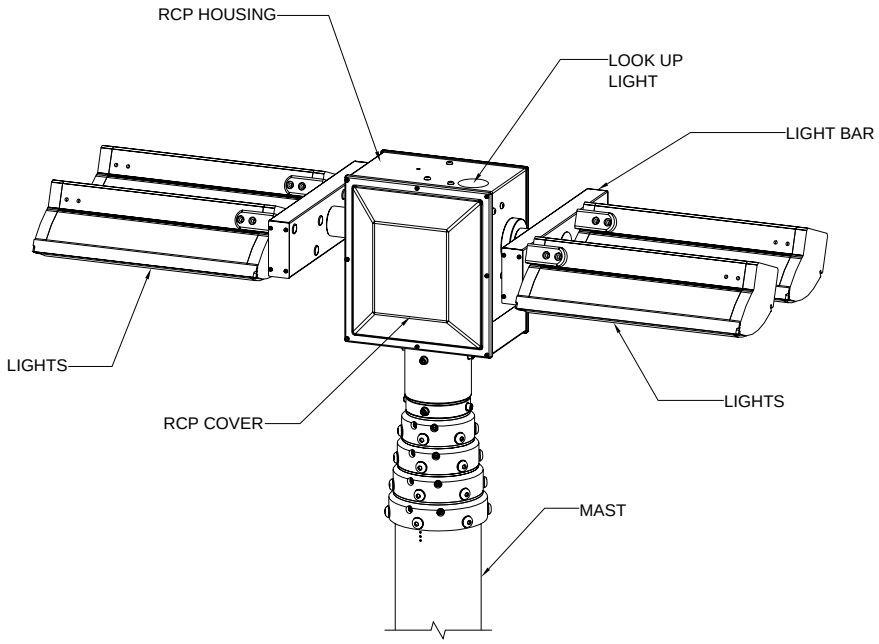


Figure 1-1 Powerlite Vertical RCP

1.4 REFERENCE DATA

The reference data for the Powerlite vertical RCP's given in Table 1-1 is not inclusive of all models. Please refer to product literature or www.willburt.com for additional information including length, width and height information.

Table 1-1. Reference Data

Model No.	3000	3600	5400	6000	9000	Camera Mt.
Light Description	(4) 750W Magnafire	(4) 900W Magnafire	(6) 900W Magnafire	(4) 1500W Optimum	(6) 1500W Optimum	N/A
RCP Width	42.3 in	42.3 in	42.3 in	44.4 in	44.4 in	13.8 in
RCP Height	11.3 in	11.3 in	11.3 in	11.3 in	11.3 in	13.3 in
RCP Depth	12.3 in	12.3 in	17.3 in	14.8 in	19.5 in	8.0 in
Total Unit Weight**	45 lb.	45 lb.	55 lb.	45 lb.	60 lb.	20 lb.
Required DC Electrical Power Supply	12V/15 amp 24V/7.5 amp	12V/15 amp 24V/7.5 amp	12V/15 amp 24V/7.5 amp	12V/15 amp 24V/7.5 amp	12V/15 amp 24V/7.5 amp	12V/15 amp 24V/7.5 amp

*Lights facing down (as standard stow position).

**Weight given is approximate.

1.5 TECHNICAL INFORMATION

1.5.1 AC Power Requirements

The AC power for the Powerlite vertical RCP is supplied by wiring directly to the terminal block located in the control box. See Figure 4-2 for wiring connection detail and Figure 5-1 for a drawing of the control box. Wire gauge size for external wiring should be chosen based on the actual lighting wattage/voltage load while taking into consideration overall length of wiring run for IR losses. All of the Powerlite lighting options require 20 amps nominal or less. No internal fusing or other circuit protection is provided, so the customer is responsible for adequate overload protection. Polarity is of no concern because both sides of the AC are switched by a common relay.

1.5.2 DC Power Requirements

The DC power for the Powerlite vertical RCP is supplied through an 11-pin MIL-type connector. Cable assemblies with the connector installed are available from Will-Burt in two lengths – 30 ft. (P/N 913933) and 50ft. (913934). The DC power connects to two pins that accept up to 12-gauge wire. See Table 2-2 for pin out information and Figure 4-2 for wiring connection detail. The DC power is internally protected with a 20 amp auto-resetting circuit breaker. The Powerlite vertical RCP will operate from either 12 or 24 volt DC power with no customer changes necessary. The electronic system has built in reverse polarity protection. For optimum performance, a minimum of 11 volts is required at the control box. Long runs of cable can introduce power loss. A good method of checking the voltage at the control box is to connect a voltmeter to the wires in the junction box powering the HHRC (pins B and C of J1 (see Figure 4-2). This will give a good indication of power loss across the DC cabling. For long runs, it may be necessary to add an intermediate junction box in the DC cable so that DC power can be applied closer to the Powerlite.

CHAPTER 2
INSTALLATION

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

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

2.1 INTRODUCTION

2.1.1 The Powerlite vertical RCP has been designed to provide for ease of installation. This section of the manual provides the procedures that must be followed to ensure a successful installation. Be sure to read and understand the entire installation procedure before you begin.

2.2 TOOLS AND MATERIALS REQUIRED FOR INSTALLATION

2.2.1 Table 2-1 provides a list of tools and materials required to install and test the Powerlite vertical RCP.

Table 2-1. Tools and Materials Required for Installation

Wrenches	Hoist (minimum 75 lb capacity)
Screwdrivers	Crimping tool or Solder set
$^{3}/_{8}$ inch or M8 Mounting Hardware (4 each)	Wire cutter/stripper
Torque wrench	Multimeter (to verify power is turned OFF)
Drill	Clean Shop Rags

2.3 UNPACKING

Unpack the Powerlite vertical RCP as follows:

1. Carefully open and remove all parts from shipping container. Lift the unit from the shipping container by the two horizontal RCP shafts and the vertical shaft (see Figure 2-1). **Do not lift the Powerlite by the lights or the RCP itself.**
2. Inspect for any shipping damage. If damage has occurred, notify carrier.
3. Be sure that all components are included and that the required tools are readily available.

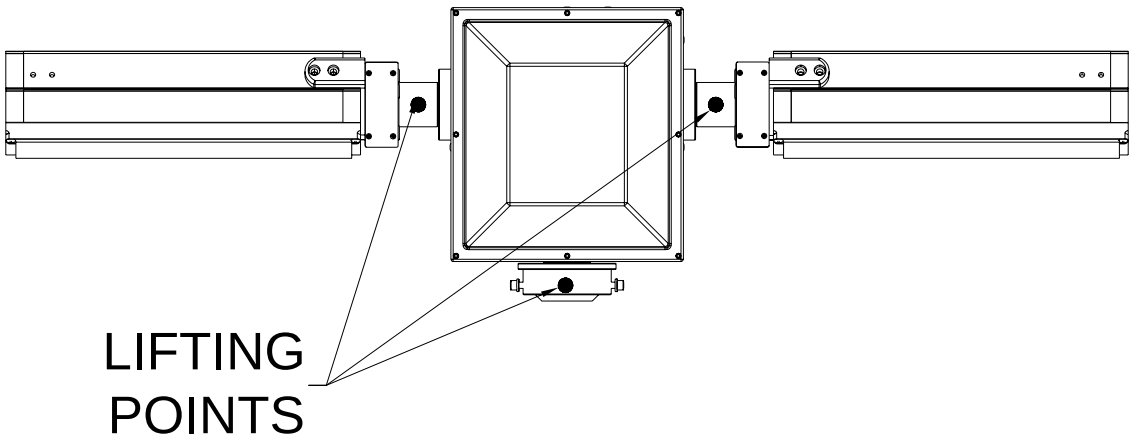


Figure 2-1 Lifting Points on the Powerlite Vertical RCP

2.4 ATTACHING TO VEHICLE

If the vertical Powerlite is to be mounted in a well, be certain that adequate drainage is provided. A minimum of (4) 1" diameter drain holes (one per corner) is recommended. While the unit has been designed to withstand adverse environmental conditions, it cannot be submerged.

The mounting holes provided in the saddle are 25/64 inches in diameter. The saddle is designed to support the light bars of the Powerlite vertical RCP. There are a total of four mounting holes on the vertical saddle. Studs or bolts (not provided) should be located on the vehicle in accordance with Figure 2-2. Attach and torque all hardware as appropriate for the material and size. The vertical saddle is adjustable to accommodate all models of the Powerlite vertical RCP as well as variations in mounting (see Figure 2-3). The saddle must be attached so that it is centered with the RCP and the mast base tube. See Figure 2-2 for saddle mounting and Figure 2-4 for additional reference.

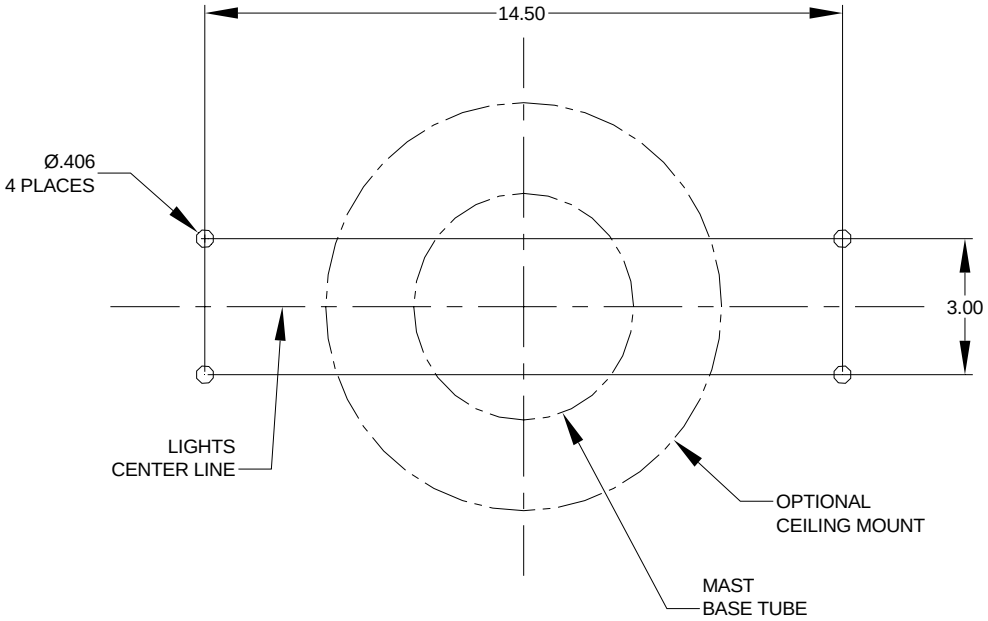


Figure 2-2 Vertical Saddle Mounting

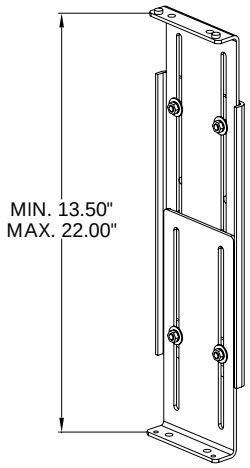


Figure 2-3 Vertical Saddle

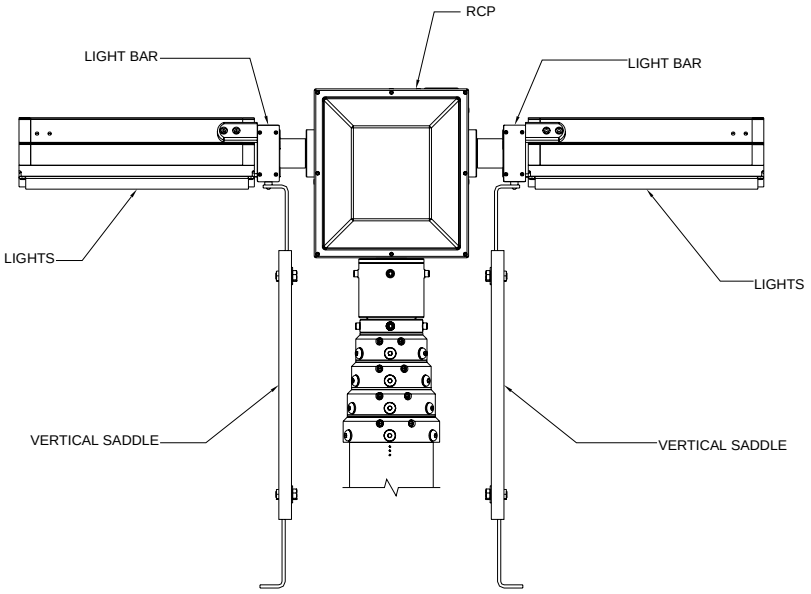


Figure 2-4 Vertical Saddle and RCP Assembly

2.5 JUNCTION BOX INSTALLATION

The junction box serves as an interface between the Hand Held Remote Control and the Control Box. It also serves as a location to which DC power is routed by the installer for the unit. The junction box may be flush or surface mounted. Hardware for mounting is not supplied.

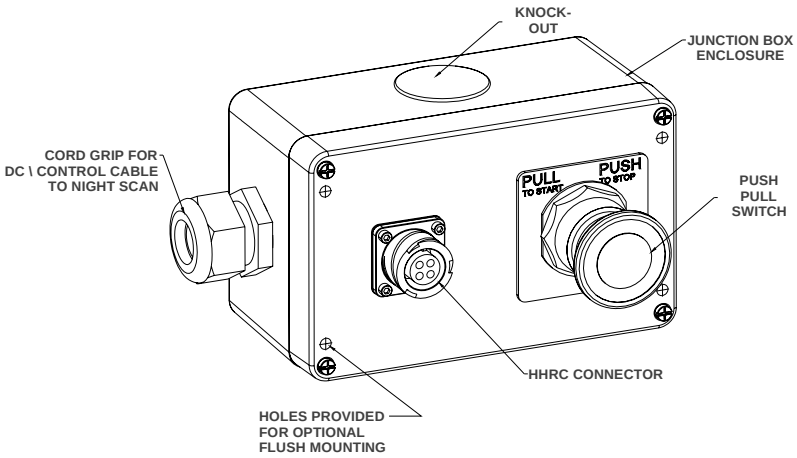


Figure 2-5 Junction Box

2.5.1 Flush Mounting

For a flush mount installation, four #8 screws, nuts and lock washers must be provided by the installer. The screw length should be 3 ½ inches plus the panel thickness. Remove the junction box cover and make the necessary cable connections (see Figure 4-2). Place the junction box behind the panel and guide the screws through the panel, junction box cover and junction box. Secure on backside using lock washers and nuts.

2.5.2 Surface mounting

For a surface mount installation, four #8 screws, nuts and lock washers must be provided by the installer. The screw length should be ¾ inch plus the panel thickness. Remove the junction box cover and mount unit through the counter bored holes in the junction box. Secure on the backside using lock washers and nuts. Make the necessary cable connections (see Figure 4-2) and replace cover.

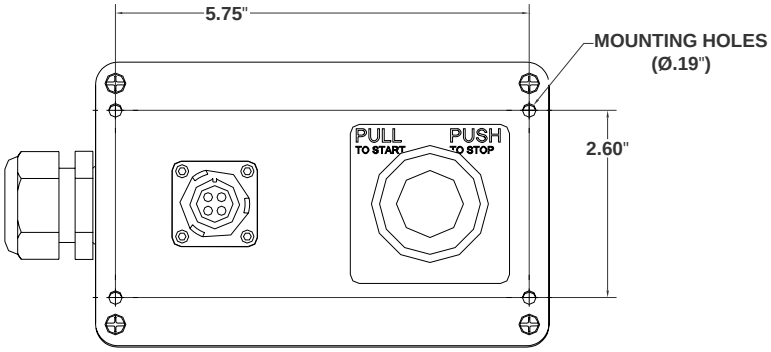


Figure 2-6 Junction Mounting Hole Locations

2.6 CONTROL BOX INSTALLATION

The control box may be surface mounted using four ¼ inch screws, nuts, and lock washers provided by the installer. Disconnect any attached cables before installation. Remove the cover and mount the unit through the clearance holes located on the rear side of the control box. Attach the lock washers and nuts to secure the unit. Reconnect any cables and replace the cover.

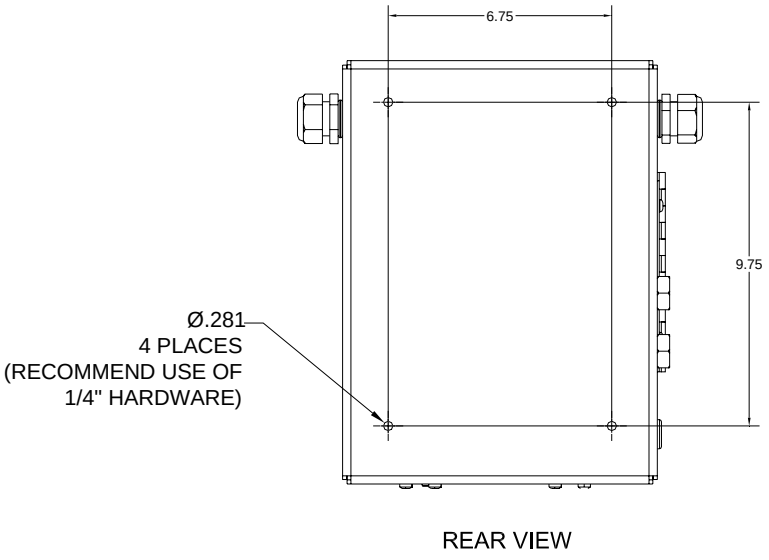


Figure 2-7 Control Box Mounting Hole Locations

2.7 CABLE (S) INSTALLATION

2.7.1 AC Power Cable

AC power for the Powerlite vertical RCP should be routed into the control box through the liquid tight strain relief (see Figure 2-8). Connections are made on the terminal block in the control box. See Figure 4-2 for wire connection information and Figure 5-1 terminal block location.

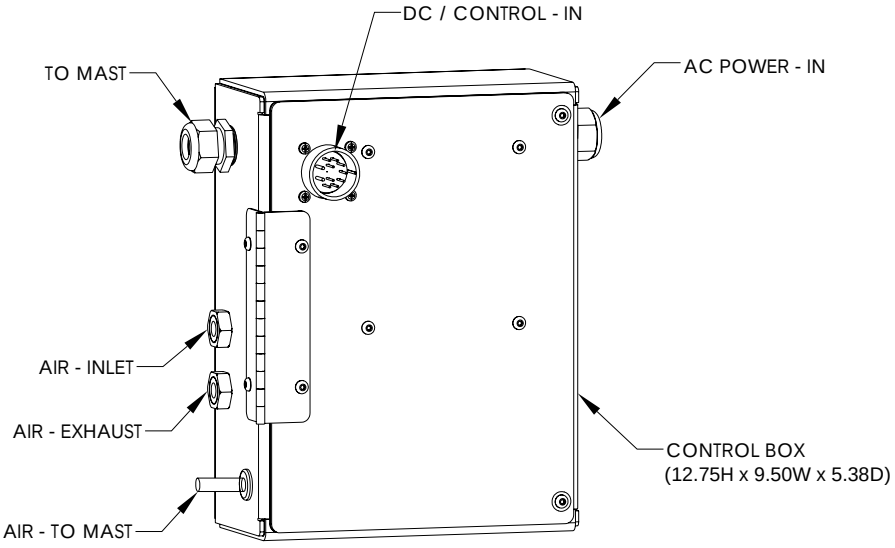


Figure 2-8 Control Box Inlet Connections

2.7.2 DC Power/Signal Cable

All of the DC lines have a common connector. If the connector mentioned in the DC Power Requirements (section 1.5.2) is utilized, the wires are best crimped in the pins although soldering is possible. A power crimping tool is available from Pico Corporation. Please refer to Table 2-2. See Figure 4-2 for wire color information.

2.7.3 Connection Pin-outs

Table 2-2. DC Power Connector Pin-out

Pin Letter	Pin Function	Recommended Wire Ga.	Destination	Comments
A	Int. Power. To HHRC - Pos.	20 minimum	HHRC Pin B	In twisted pair with Pin C of HHRC
B	Int. Power. To HHRC - Neg.	20 minimum	HHRC Pin C	In twisted pair with Pin B of HHRC
C	RS-485 Link – Data +	20 minimum	HHRC Pin A	In twisted pair with Pin D of HHRC
D	RS-485 Link – Data -	20 minimum	HHRC Pin D	In twisted pair with Pin A of HHRC
E	DC Power – Battery Pos.	12 minimum	Bat. + Term.	
F	DC Power – Battery Neg.	12 minimum	Bat. – Term.	
G	Initiate Switch Input	20 minimum	Push/Pull Switch	Momentary Normally Open switch
H	Switch Common	20 minimum	Push/Pull Switch	Same potential as Battery Negative
J	Mast Inactive Relay Output	20 minimum	Customer Circuit	2 ampere load maximum
K	Mast Inactive Relay Return	20 minimum	Customer Circuit	2 ampere load maximum
L	Emergency Stop Switch Input	20 minimum	Push/Pull Switch	Maintained Normally Closed switch

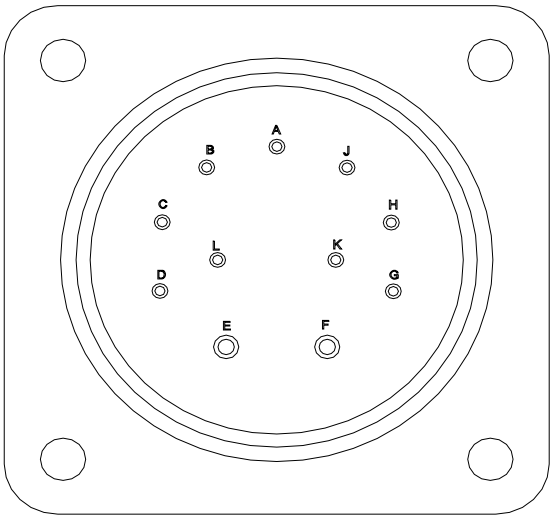


Figure 2-9 DC Power Connector Pins

2.8 AIR CONNECTIONS

Air may be supplied externally by a compressor or other source of clean, dry air with a maximum pressure of 100 psi. The fittings are for use with 3/8 inch I.D. air hose rated for the pressure supplied in combination with environmental factors, which may derate the hose (i.e. high temperatures). Refer to Figure 2-11 for identification of the air fittings located on the control box. The exhaust hose must be routed to a location where it will not expel air or water onto personnel or equipment sensitive to moisture.

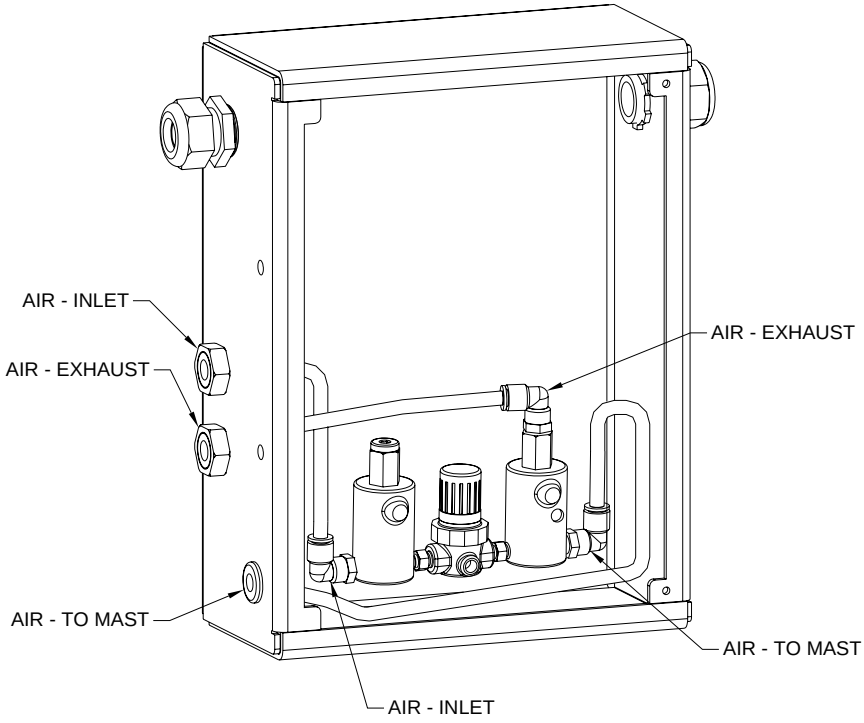


Figure 2-10 Control Box Valve Layout

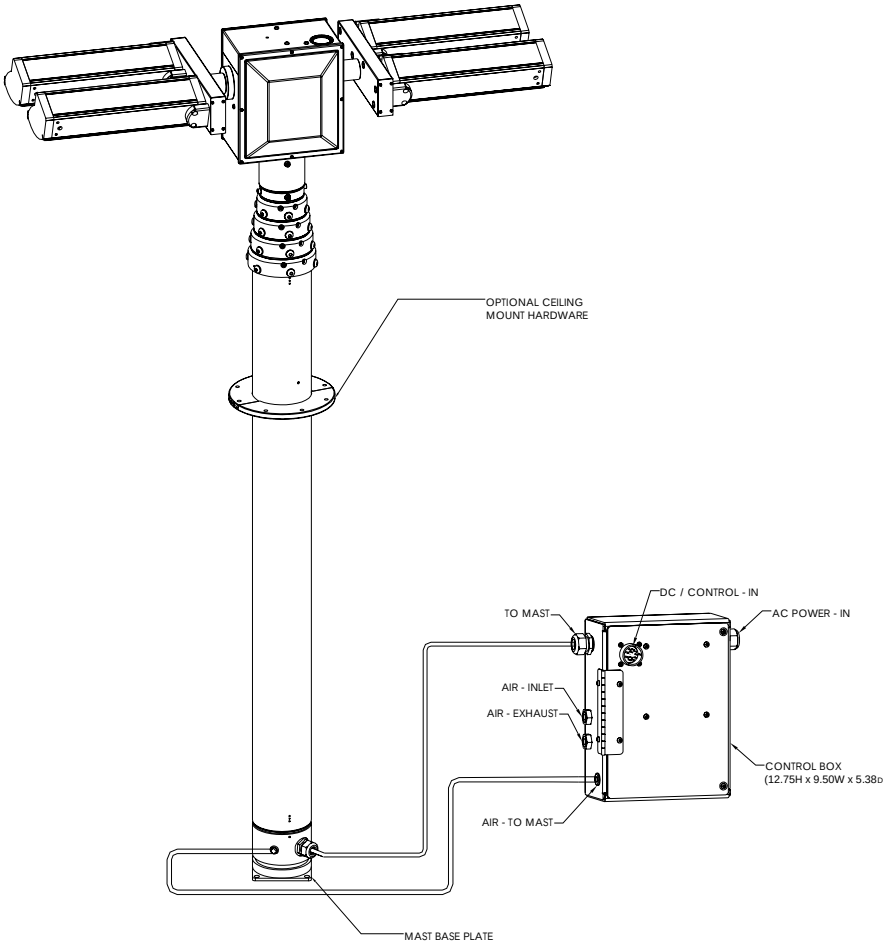


Figure 2-11 Mast Base Assembly with Control Box

2.9 CONNECTING THE PUSH/PULL SWITCH (JUNCTION BOX)

While a two switch implementation of this circuit can be realized, the use of a Push/Pull switch is highly preferred. One switch available is a Square-D 9001SKR8RH25. Other manufacturers of Industrial Control Pilot Devices should have equivalent switches. This switch is available as part of a pre-wired kit (part # 913316) from Will-Burt or in a Connector/Switch kit (part #913935). For the initiate part of the circuit, a normally open switch must be connected between Pins G and H of the DC Power/input connector. For the emergency stop part of the circuit, a normally closed switch must be connected between Pins H and L of the DC Power/input connector. Please refer to Table 2-2 and Figure 4-2.

If the installation requires multiple junction boxes be installed, the normally open (KA-3) contact block of the push-pull switches are wired in parallel. The normally closed (KA-5) contact block of the switches are wired in series. Refer to Figure 2-12 for a schematic of the dual junction box installation.

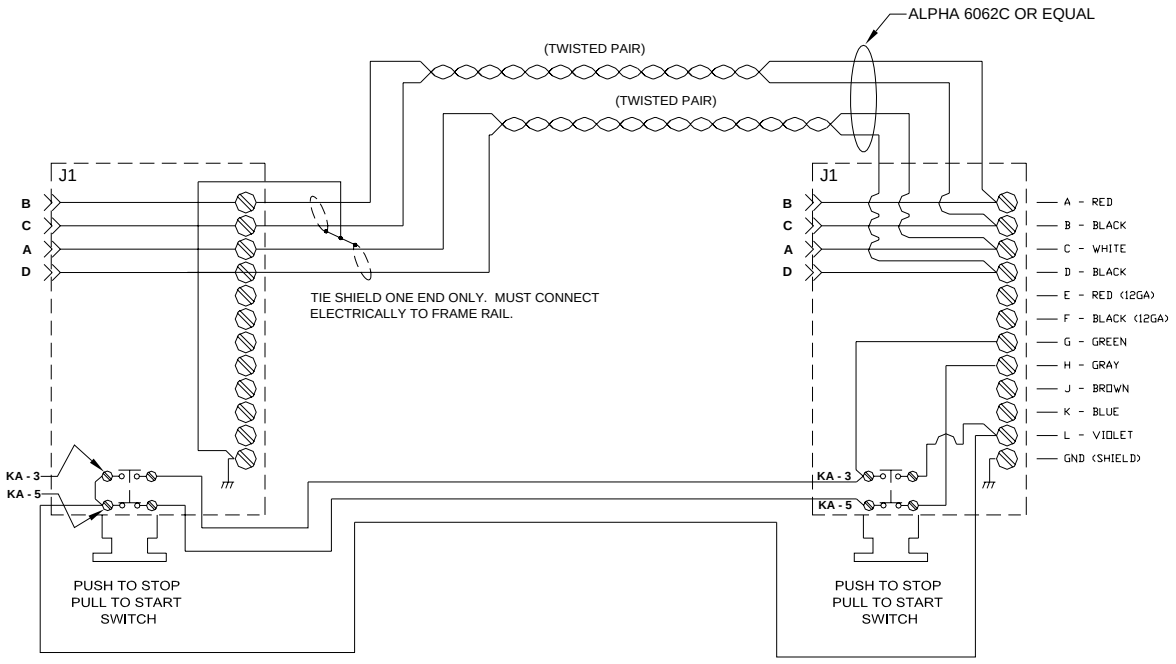


Figure 2-12 Dual Junction Box Installation Wiring

2.10 CONNECTING THE HAND HELD REMOTE CONTROL

In the event that the accessory kit (part # 913316) is not used, a suitable connector must be supplied by the customer to mate with the connector of the handheld remote control (HHRC). The connector on the HHRC is an ITT Cannon CA3106E14S-2P-B-F80-A232. Please refer to Table 2-3 and Figure 4-2.

Pin B of the HHRC should connect to pin A of the DC Power/input connector. Pin C of the HHRC should connect to pin B of the DC Power/input connector. Pin A of the HHRC should connect to pin C of the DC Power/input connector. Pin D of the HHRC should connect to pin D of the DC Power/input connector. See Figure 2-13.

Table 2-3. Handheld Remote Control Connector Pin-out

HHRC Pin	Pin Function	To Pin of DC Power Connector	Recommended Wire Ga.
A	+Signal	C	20
B	+ Power	A	20
C	- Power	B	20
D	- Signal	D	20

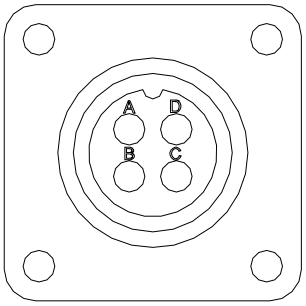


Figure 2-13 Hand Held Receptacle Pins

2.11 INSTALLING THE MAGNETIC SWITCHES

While the mast is stowed, the lower magnetic switch should be installed first by locating the magnet in the bottom of the top tube. The magnet is in line with the key on the intermediate tubes located between the air and cable inlets. Once found, align the switch with the magnet and tighten the clamp. The upper magnetic switch should be installed inline with the lower switch at a minimum of 36 inches above it (refer to Figure 3-1). This switch will sense the magnet in the top tube as the mast is raised and allow the user to operate the HHRC. The upper magnetic switch should be installed so that the Powerlite vertical RCP will clear any obstructions including those caused by mounting the mast in a well.

2.12 CONNECTING THE INTERLOCK CONTACT (OPTIONAL)

The Powerlite vertical RCP provides an interlock relay contact output to enhance integration into vehicle safety circuitry. This relay output is from a bi-stable (latching) relay whose contacts close when the Powerlite has completely stowed. This type of scenario gives the best failsafe condition in the event of a broken wire. Its state is not affected by whether or not there is power to the mast. This isolated contact is capable of carrying up to 2 amperes and is available on pins J and K. Please refer to Table 2-2 and Figure 4-2. Its usage is at the discretion of the integrator. It can be used in conjunction with a customer-supplied relay to drive a flashing warning light.

2.13 CONNECTING THE INTERLOCK CONTACTS (OPTIONAL)

Some customers may require preventing operation of the Powerlite 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 Push/Pull switch. Inserting these contacts between the violet wire connected to pin L of the DC Power cable and the KA-5 contact of the Push/Pull switch breaks continuity and thus will immediately stop operation of the Powerlite and prevent further operation until continuity is restored through the contacts. Please refer to Table 2-2 and Figure 4-2.

2.14 INSTALLING THE WARNING LIGHT

As required by NFPA regulations, a red flashing or rotating light, located in the driving compartment, must be automatically illuminated whenever the vehicle parking brake is not fully engaged and the light tower is extended. The warning light is wired into the system via the interlock contact described above. A customer provided, normally closed, pilot relay should be installed on pins J and K of the DC/Control cable. See Table 2-2, Figure 4-2 and Figure 4-3. A cus-

tomer supplied flashing relay and lamp may then be installed in the driving compartment such that the lamp can be seen by the driver. One example using a Bosch relay is shown below.

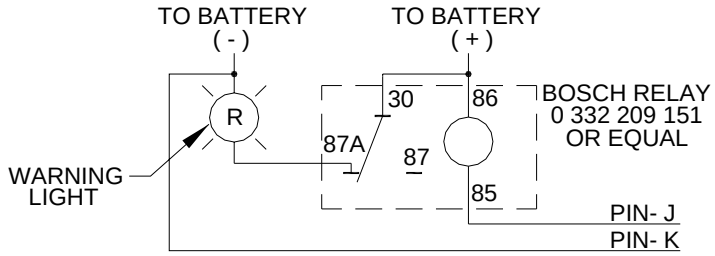


Figure 2-14 Example of Warning Light Installation

2.15 PRE-OPERATIONAL CHECK

Before operating the Powerlite vertical RCP, be sure that there are no overhead obstructions and that there are no power lines within 40 feet of the mast. Visually inspect the unit for any damage. If damage is apparent, do not use the mast. Have it serviced prior to use. Check for any objects that might obstruct motion of the mast or cause binding. Remove any material that may hinder mast function.

CHAPTER 3
OPERATING INSTRUCTIONS

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

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

⚠ CAUTION

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

⚠ CAUTION

Safety Instruction – Operation! Do not operate the Powerlite vertical RCP during an electrical storm.

⚠ CAUTION

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

3.1 THEORY OF OPERATION – MECHANICAL

The Powerlite vertical RCP operates using DC power for the pan/tilt motors. When the mast has extended at least one section, the upper magnetic switch will make the RCP functions available through the HHRC. The standard valve assembly included in the control box will receive power and allow air to enter the mast when the up button is depressed. If, at any time, power to the unit is lost, the inlet valve closes and the exhaust valve opens. This will exhaust all air from the mast.

As the mast is retracted, the control box looks for indication from the upper magnetic switch that the mast has nearly nested. If the "double click" unattended stow sequence was not used, the RCP will begin the auto-stow sequence to ensure that the RCP is properly positioned for engagement with the saddle. If the auto-stow "double click" sequence was used, the RCP will have properly positioned itself as the mast descended into the saddle.

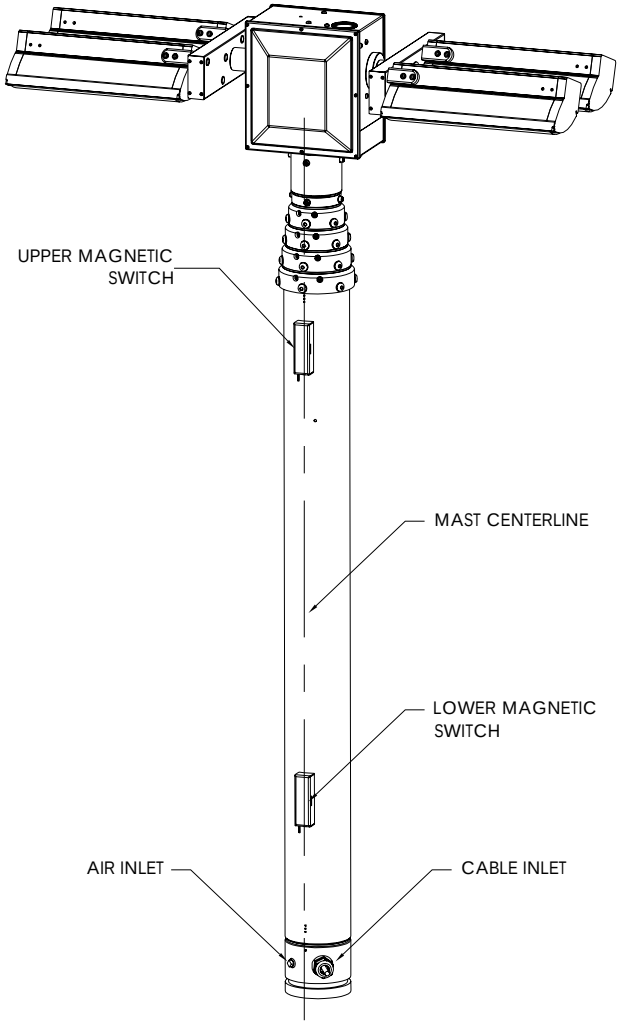


Figure 3-1 Upper and Lower Magnetic Switches

The RCP provides pan and tilt functions upon command from the HHRC. DC powered gear motors turn the shafts until an opaque flag in the assembly reaches a photo interrupter. At this time, the LED on the HHRC for that direction of travel will go out, indicating that a limit has been reached in that direction. See Figure 3-2 for additional reference.

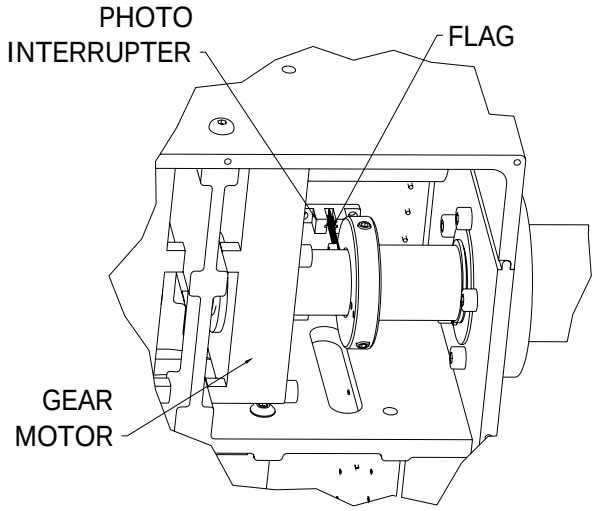


Figure 3-2 Photo Interrupter and Flag

3.2 THEORY OF OPERATION - ELECTRICAL

The Powerlite vertical RCP control is based on a distributed intelligence control structure. Each main section of the system has a circuit board with an embedded micro controller. These sections are: the control box, the RCP, and the HHRC. These boards "talk" to each other over a multi-drop RS-485 serial communications link.

Another key component of the control is an initialization circuit. A completely stowed Powerlite draws zero current and cannot be extended or operated in any shape or form until the initiate circuit is engaged. Included in this initialization circuit is an input for a safety interlock. This can be used for an emergency stop, or other interlock functions such as a "Park/Neutral" switch from the vehicle transmission.

Additionally, a bi-stable contact closure is provided that indicates that the mast is properly stowed. It will close when the mast is properly stowed. If the mast is not stowed, the contact will be open. Even if the emergency stop feature is used prior to the mast completely stowing, the contact will still remain open. If the Powerlite has been stopped using the emergency stop button or by some other interruption of power, the initiate circuit will need to be activated again in order to continue operation.

When stowing the mast, the control monitors the two magnetic switches. When the mast lowers and comes to the upper switch, the RCP begins auto-stow. When it reaches the lower magnetic switch, it considers itself stowed and shuts itself down.

If at any time during the operation of the mast an unexpected control situation occurs, the mast will stop any movement and a fault message will be displayed on the HHRC display. Clearing the fault is accomplished by first manually shutting the control down by pushing the Push/Pull switch or momentarily interrupting power some other way. Then the control may be re-initiated and operated again.

3.3 PUSH/PULL SWITCH

All operation of a completely stowed mast must be preceded by proper initialization. The initiate switch must be momentarily closed to power-up the Powerlite. When the Will-Burt Accessory Kit is used, the Push/Pull switch is located on the junction box. It is used to perform two functions. First, it can be used to "initiate" the control by pulling the switch operator. This is a momentary function, and the switch will return itself to a neutral position on its own. Secondly, it functions as an emergency stop when the switch operator is pushed all the way in. This is a maintained function, and the switch will stay in that position until it is pulled back out. When using Will-Burt's accessory kit push/pull switch, accidental initiating is extremely unlikely since it would require pulling the switch but-

ton. Even with this, the HHRC would have to be simultaneously pushed to get any action. In the unlikely event that the initiate switch were engaged, the Powerlite will power itself down if no HHRC action occurs within thirty seconds. The “Push” portion of the Push/Pull switch functions as an Emergency Stop. If it is pushed, the mast will immediately be disconnected from power and stop. Other interlock contacts could be inserted into this circuit to provide additional safety. The control also monitors the initiate input, and if it sees that this input is present for a prolonged period of time; the control will stop the mast and begin flashing the “Mast Stowed” contact. This is a preventative measure to ensure the initiate input is not hot-wired. Once the mast has been initiated, the handheld remote control (HHRC) must then be used to begin raising the mast within thirty seconds or the control will shut itself down. If the mast has been initiated and raised any amount, the control will remain powered until the mast is fully stowed, the emergency stop function is used, or the power is somehow otherwise interrupted.

3.4 HANDHELD REMOTE CONTROL (HHRC)

The handheld remote control (HHRC) accepts switch activations from the operator and translates them into serial commands for transmission to the base control board via the RS-485 link. If the operator engages a switch, the HHRC will appropriately send commands repeatedly as long as the operator continues to engage that switch. The Base control will pass along appropriate serial commands to the RCP in response to the HHRC. Additionally, various states of the system will be passed to the HHRC so that button status LEDs can give proper indication of the state of the Powerlite. An example of this is that the LED next to the “Mast Down” button will not be lit unless it is appropriate to lower the mast. Upon first beginning to raise the mast, it will be noted that the “Mast Down” button does not become active until a certain amount of movement has been accomplished. This is to ensure that there is enough downward travel available for proper stowing of the mast. If the button status LED for a particular button is not lit, that button will not function. Switches available to the operator are shown in Figure 3-3, and are as follows:

- Mast Up
- Mast Down
- Pan Right
- Pan Left
- Left Tilt Up
- Left Tilt Down
- Right Tilt Up
- Right Tilt Down
- Left Lights (toggles Off and On)
- Right Lights (toggles Off and On)
- Aux. Light (toggles Off and On)

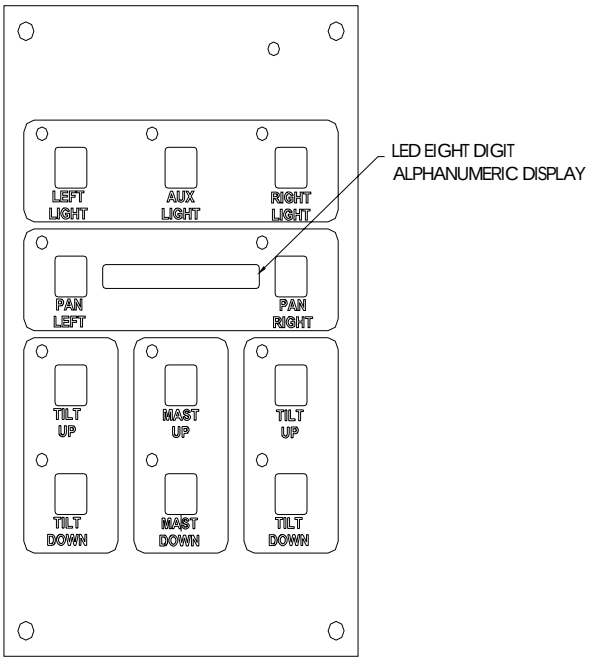


Figure 3-3 Hand Held Remote Keypad Layout

A special function is implemented in software whereby the operator can initiate an unattended lowering and stowing of the mast. This is accomplished by two rapid sequential activations of the "Mast Down" button within a half second period of time. This automatic unattended sequence can be aborted at any time by a single activation of the "Mast Up" button or any other button on the HHRC.

3.5 RAISING THE MAST

Operation of the mast using the HHRC is fairly intuitive. A typical operational sequence could be as follows:

- Momentarily pull the Push/Pull Initiate button.
- Press and hold the "Mast Up" button on the HHRC until the mast has fully extended.
- Press the desired Pan and Tilt buttons until the lights are facing appropriately.
- Press the Right, Left, and Aux light buttons momentarily to turn the desired lights on and off.
- Press the "Mast Down" button until the mast has completely stowed and the HHRC goes dead.

3.6 AIMING THE REMOTE CONTROL POSITIONER

The positioner can be "aimed" by utilizing the pan and tilt buttons located on the HHRC. The Pan Left and Pan Right buttons allow horizontal movement, while there are independent Tilt Up and Tilt Down functions for vertical adjustment of each side of the RCP.

3.7 STOWING THE MAST

There are two methods of stowing the mast. The normal method involves pressing and holding the "Mast Down" button until the mast is fully stowed and the control shuts itself off. A second method involves giving two quick successive depressions of the "Mast Down" button (within ½ second). This will initiate an unattended complete stowing of the mast. This auto-stow mode can be interrupted and canceled at any time by pressing any of the buttons on the HHRC.

Once the control has shut itself off, the Powerlite is totally disconnected from power, and the "Mast Stowed" safety interlock contact closes signaling it is safe to move the vehicle. **Be sure that no buttons are illuminated on the remote after stowing. Illuminated buttons indicate that the unit is not stowed.** After making certain that the unit is properly stowed in the saddle, unplug the remote control and stow it where it will not be damaged in transport. Unplugging the remote will remove any possibility that the Powerlite could become active and extend unexpectedly.

CHAPTER 4
MAINTENANCE AND SERVICE INSTRUCTIONS

4.1 INTRODUCTION

This section of the manual describes routine maintenance procedures and covers general service information. Refer to Chapter 5 for exploded views of the Powerlite vertical RCP and the accompanying Tables with item descriptions and part numbers, which may be used for ordering replacement parts.

4.2 SCHEDULED MAINTENANCE

4.2.1 Cleaning and Lubrication - Mast

Will-Burt pneumatic telescoping masts should be cleaned and lubricated on a regular basis to ensure smooth operation and prolong useful life. This maintenance should be performed typically about once a month depending upon local environmental conditions and frequency of use. Signs that cleaning and lubrication are needed can be:

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

WARNING

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

PROCEDURE:

1. Reduce the regulator setting such that it pressurizes the mast to between 5 and 10 PSIG. Pull up on the regulator cap and rotate counterclockwise. Push cap down to lock into place.
2. One person operating the hand held remote control should slowly pressurize the mast just enough to extend the top mast section. Another person may need to hold down the larger mast section collars to assure the proper sequence of extension. Release “Mast Up” button as soon as the mast section is up.
3. Wipe down the extended mast section using a non-abrasive cleanser or solvent such as lacquer thinner. Do not allow the cleaning fluid or solvent to run down inside the collar.
4. Repeat steps 2 and 3 for the next larger mast section.
5. Inject approximately 1/2 oz. of TMD Mast Lubricant* or a lightweight machine oil into the weep hole (drain) of the exposed mast section. The weep holes are located approximately 10 inches below the collar on each tube except the top one.

6. Repeat steps 2, 3 and 5 for each of the remaining mast sections.

7. Exhaust the mast completely. Allow several minutes for the lubricant to settle and spread around the wear ring and seal at the bottom of each mast section.

WARNING

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

8. Extend the mast again one section at a time in the same sequence (smallest to largest). Wipe off any excess lubricant that flows out of the weep holes.

   NOTE: Do not lubricate the exterior of the mast, as this will cause it to attract dust and contaminants from the air.

* TMD Mast Lubricant is specifically formulated for cold weather use, but is suitable for year around use. Regular winter maintenance and the frequent use of TMD Mast Lubricant should significantly reduce the potential for mast freeze ups. TMD Mast Lubricant is also intended for use in air in-line lubricators.

4.2.2 Cleaning the Remote Control Positioner (RCP)

WARNING

Make sure lights are completely cool before attempting to clean.

The exterior of the RCP should be wiped down periodically to remove dirt and road grime using a soft cloth or sponge and a mild solution of soapy water. The lenses of the lights should be cleaned using standard glass cleaner and a soft towel.

4.3 ADJUSTMENTS

4.3.1 Adjusting the Magnetic Switches

The Magnetic Switches are located on the mast base tube. The upper magnetic switch senses that the top tube is extended. The lower switch senses when the mast is completely stowed. **It is important that the mast has properly nested by verifying that the collars are stacked with no gaps between them.** If the collars are not properly stacked, see Table 4-5 for further instructions. If a switch is found to require adjustment, it will most commonly need to be moved upward (toward the RCP) on the mast. The magnet is located at the lower end and side of the top tube. It is not visible outside the mast.

The following procedure must be followed to adjust the magnetic switch.

1. Loosen the band clamp securing the switch to the base tube. Move the switch upwards approximately 1/8” and tighten band clamp.
2. Initiate the mast, if necessary, and press the down button on the hand held remote. If the mast does not nest, repeat the adjustment until it does. A small piece of steel or iron filings may be used to help locate the magnet.
3. If repeated attempts do not succeed, hold a magnet up to the switch and press the down button. If the mast begins to nest, continue repeating the adjustment until the switch has sensed the magnet.

4. If the mast will not nest when a magnet is held to the switch, check the wiring to at the circuit board for loose or disconnected wires. See Figure 4-2. If the wiring is intact, replace the magnetic switch.

4.3.2 Resetting the RCP Home Position

The Powerlite unit is shipped with the lights in home position. Home position is established by setting small flags in the RCP that engage photo interrupters on the RCP board. It orients the lights such that the light bars are perpendicular to the axis of the mast and are facing downward when nested. On all models, the light bars should contact the saddle simultaneously during nesting when correctly set. It should be noted that having the RCP covers off can cause improper RCP operation when outdoors. This procedure should be performed indoors. To set the home position, the following procedure must be observed.

1. **DISCONNECT ALL AC POWER TO THE POWERLITE!**
2. Initiate the mast and raise one section. The hand held remote should show both left and right tilt up functions are available and the pan left function is available.
3. Remove the front RCP cover to access the flags.
4. Refer to Figure 5-2 and Table 5-2 for reference. The flags are attached to the timing rings on the horizontal and vertical shafts. Each timing ring has two set screws that must be loosened. It may be necessary to loosen one in each, then pan and tilt the unit to access the others. **The flags have sharp edges that may cause cuts.**
5. 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; they may bend.
6. It is important that the flags engage the correct photo interrupter when setting the home position, see Figure 4-1. Turn the timing ring on the right horizontal shaft such that it rotates down toward the upper photo interrupter. As you approach the interrupter, watch the hand held remote. As soon as the right tilt down LED goes out, stop rotating the ring and tighten the set screw. Repeat on the left horizontal shaft. To set the pan home position, turn the timing ring counterclockwise (looking from above the RCP) until the pan right LED goes out. Tighten the set screw to secure the ring.
7. Pan and tilt the unit until the second set screw in each ring is accessible and tighten.
8. Stow the mast, watching for the lights to be oriented as described in the beginning of this section.
9. Initiate and raise the mast to one section. Replace the RCP cover.

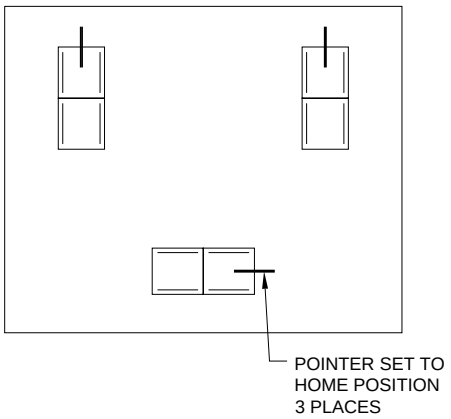


Figure 4-1 Flag Settings (Viewed from RCP front)

4.4 SYSTEM SCHEMATIC

A system schematic is given in order to aid in electrical troubleshooting as outlined in the following section.

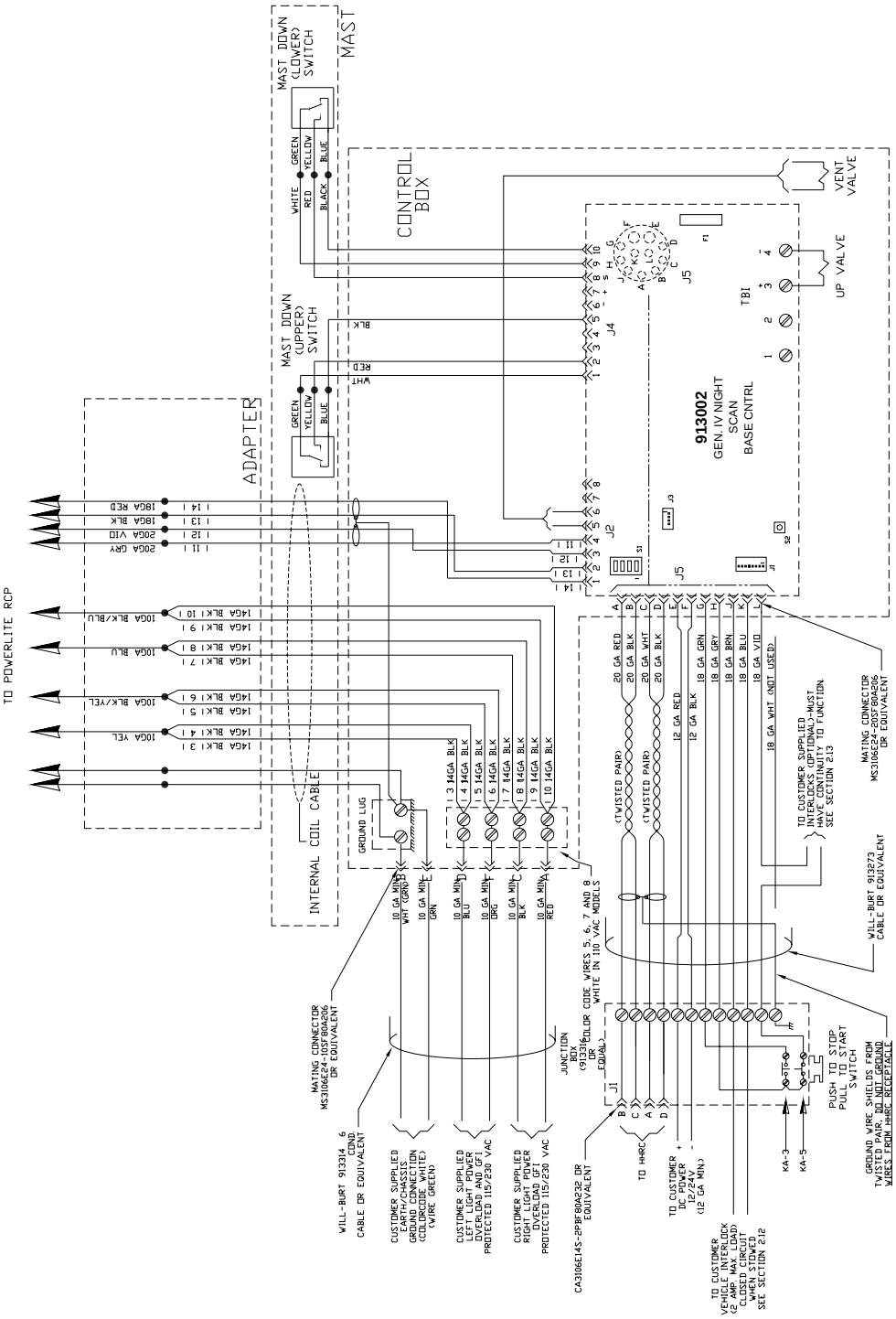


Figure 4-2 Control Box Base Board Schematic for Internally Wired Mast

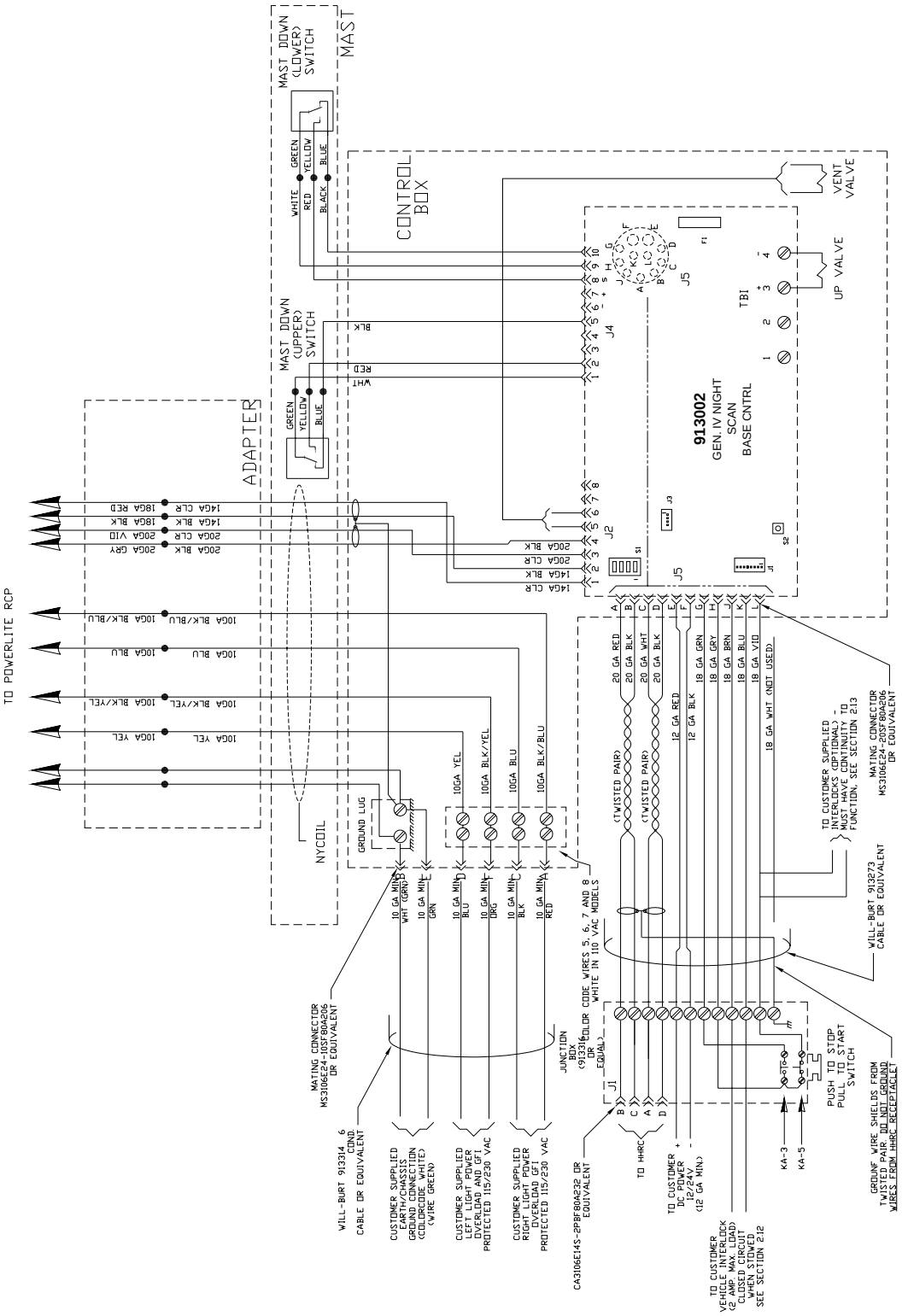


Figure 4-3 Control Box Base Board Schematic with Nycoil

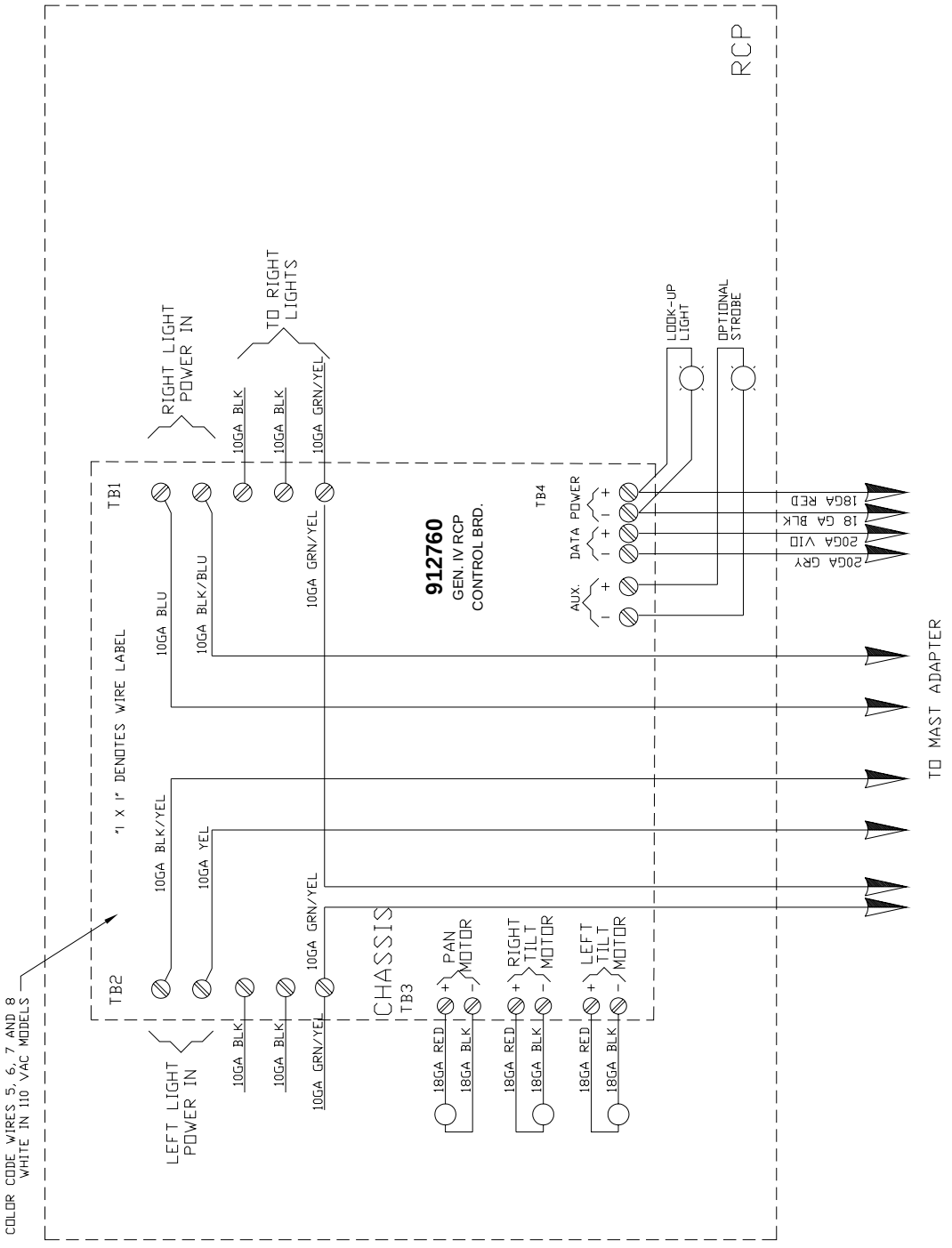


Figure 4-4 Vertical Remote Control Positioner Schematic

4.5 TROUBLESHOOTING ELECTRICAL

4.5.1 Operating Environment

One of the most common causes of improper operation is trying to operate outside of the stated system requirements (see Table 1-1), with low battery voltage being most common. A good method of checking the voltage at the Powerlite is to connect a voltmeter to the wires in the junction box powering the HHRC (pins B and C of J1 see Figure 4-2). This will give a good indication of power loss across the DC cabling. For long runs, it may be necessary to add an intermediate junction box in the DC cable so that DC power can be applied closer to the Powerlite.

4.5.2 Fault Codes

Fault codes are presented on the LED eight digit alphanumeric display (see Figure 3-3). The codes are a combination of numbers that identify both the general location of the fault, and the type of fault. The first of two numbers is a single digit number indicating which board. The second number is a two-digit number indicating the fault. When faults occur, all operation ceases. Faults may only be cleared by killing power to the Powerlite. This may be accomplished by momentarily pushing in the Push/Pull switch. The codes are as follows:

4.5.2.1 Base Board

The Base board is located in the control box of the mast and is assigned unit number one (1). The Base board may generate the messages of Table 4-1:

Table 4-1. List of Base Board Faults

Message	Meaning	Root Issue	Potential Causes
Err 1,01	Mast Down Magnetic Switch Wiring Error	The Mast Down Magnetic Switch appears to have its complimentary outputs wired backwards This switch is located on the side of the mast. For the Vertical Powerlite, it is the lower of the two switches.	This check is only made at power-up when the mast thinks it is nested. The wires on pins 8 and 10 of J4 may need to be swapped. The magnetic switch not being energized could also cause it. Place a magnet close to the switch to check before changing wiring.
Err 1,08	Communication Fault	The base board has sent an invalid message	Indicates a software problem. Notify Will-Burt
Err 1,09	Initiate Pushbutton	The Initiate input has been closed for too long.	Wiring Short in the DC cable or Defective Switch/wiring in the junction box. Disconnect the DC cable from the Powerlite. Check the continuity between pins G and H of the DC cable connector. It should be open. If not, trace to problem. If it is, replace the base board.
Err 1,10	EEPROM Life	More than 20,000 writes have been made to a particular EEPROM location	Will only occur when the mast has had in excess of 20,000 cycles which is unlikely to happen. Replace the base board.
Err 1,11	Saddle Location	The internal linear actuator limit switch has opened before preload occurred	The saddle is too low with respect to the light bars. Adjust saddle height as needed.

Err 1,13	RCP Stow Magnetic Switch Disagreement	The magnetic switch sensing the mast is close to lowered (referring to tube set) has conflicting complementary outputs.	There may be a wiring problem, or a defective magnetic switch. Check the voltages at J4 pins 2 and 5 with respect to pin 3. These two voltages should be opposite of each other as the magnetic switch is activated and inactivated. The voltages should be close to battery voltage or close to ground. If they are not, replace the RCP Stow switch. Refer to Figure 4-2.
Err 1,14	Mast Down Magnetic Switch Disagreement	The magnetic switch sensing the mast is lowered (referring to tube set) has conflicting complementary outputs.	There may be a wiring problem, or a defective proximity switch. Check the voltages at J4 pins 8 and 10 with respect to pin 6. These two voltages should be opposite of each other as the magnetic switch is activated and inactivated. The voltages should be close to battery voltage or close to ground. If they are not, replace the Mast Down switch. Refer to Figure 4-2.
Err 1,16	RCP Stow Magnetic Switch Wiring Error	The RCP Stow Magnetic Switch (the upper of two located on the side of the mast) appears to have its complimentary outputs wired backwards	This check is only made at power-up when the mast thinks it is nested. The wires on pins 2 and 5 of J4 may need to be swapped. The magnetic switch not being energized could also cause it. Place a magnet close to the switch to check before changing wiring. Refer to Figure 4-2.

4.5.2.2 RCP Board

The remote control positioner (RCP) board is located in the positioner at the top of the mast and is assigned unit number two (2). It should be noted that having the RCP covers off can cause improper RCP operation, especially outdoors. The RCP board may generate the messages of Table 4-2:

Table 4-2. List of Remote Control Positioner Board Faults

Message	Meaning	Root Issue	Potential Causes
Err 2,01	Pan Limit Overlap	Both pan photosensors are blocked simultaneously	Foreign material in one of the photosensors or faulty photosensor. Check to make sure there is no foreign material in the photosensors. Clean with a soft cloth. If this does not get rid of the fault, replace RCP board
Err 2,02	Left Tilt Stuck	The state of the left tilt photosensors have not changed even though the motor has been told to move for some period of time	Something is preventing movement of left tilt mechanism or the motor is defective. Check to see if voltage is being applied to the left tilt motor. If it is, replace the gearmotor. Otherwise, the problem is in the photosensor on the RCP board. Replace RCP board
Err 2,03	Right Tilt Stuck	The state of the right tilt photosensors have not changed even though the motor has been told to move for some period of time	Something is preventing movement of right tilt mechanism or the motor is defective. Check to see if voltage is being applied to the right tilt motor. If it is, replace the gearmotor. Otherwise, the problem is in the photosensor on the RCP board. Replace RCP board
Err 2,04	Pan Stuck	The state of the pan photosensors have not changed even though the motor has been told to move for some period of time	Something is preventing movement of pan mechanism or the motor is defective. Check to see if voltage is being applied to the pan motor. If it is, replace the gearmotor. Otherwise, the problem is in the photosensor on the RCP board. Replace RCP board
Err 2,07	Communication Timeout	The RCP board has not sent out communications recently	Bad connection in communications link, or RCP is not powered or is inadequately powered. Make sure the power at the RCP board is at least 10.5 volts (on TB4). Check continuity of the internal coiled cable between the base board and the RCP board (see Figure 4-2 and Figure 4-4)
Err 2,08	Communication Fault	The RCP board has sent an invalid message	Indicates a software problem. Notify Will-Burt
Err 2,09	Left Tilt Up Limit	The left tilt down photosensor was made before the up photosensor indicating wrap around or the up photosensor is linear or defective	Check to make sure the left tilt flag is not located in between the two photosensors. If it is, slowly move the left light bank by hand (with power off) until it is in the proper position. Readjustment of the flag may be necessary to set the proper home position. See 4.3.2. If the flag is not in between, replace the RCP board
Err 2,10	Left Tilt Down Limit	The left tilt up photosensor was made before the down photosensor indicating wrap around or the down photosensor is linear or defective	Check to make sure the left tilt flag is not located in between the two photosensors. If it is, slowly move the left light bank by hand (with power off) until it is in the proper position. 0 Readjustment of the flag may be necessary to set the proper home position. See 4.3.2. If the flag is not in between, replace the RCP

			board
Err 2,11	Right Tilt Up Limit	The right tilt down photosensor was made before the up photosensor indicating wrap around or the up photosensor is linear or defective	Check to make sure the right tilt flag is not located in between the two photosensors. If it is, slowly move the right light bank by hand (with power off) until it is in the proper position. Readjustment of the flag may be necessary to set the proper home position. See 4.3.2. If the flag is not in between, replace the RCP board
Err 2,12	Right Tilt Down Limit	The right tilt up photosensor was made before the down photosensor indicating wrap around or the down photosensor is linear or defective	Check to make sure the right tilt flag is not located in between the two photosensors. If it is, slowly move the right light bank by hand (with power off) until it is in the proper position. Readjustment of the flag may be necessary to set the proper home position. See 4.3.2. If the flag is not in between, replace the RCP board
Err 2,13	Pan Right Limit	The left pan photosensor was made before the right photosensor indicating wrap around or the right photosensor is linear or defective	Check to make sure the pan flag is not located in between the two photosensors. If it is, slowly move the RCP head by hand (with power off) until it is in the proper position. Readjustment of the flag may be necessary to set the proper home position. See 4.3.2. If the flag is not in between, replace the RCP board
Err 2,14	Pan Left Limit	The right pan photosensor was made before the left photosensor indicating wrap around or the left photosensor is linear or defective	Check to make sure the pan flag is not located in between the two photosensors. If it is, slowly move the RCP head by hand (with power off) until it is in the proper position. Readjustment of the flag may be necessary to set the proper home position. See 4.3.2. If the flag is not in between, replace the RCP board
Err 2,15	Left Tilt Limit Overlap	Both left tilt photosensors appear to be blocked simultaneously	Foreign material in one of the photosensors or faulty photosensor. Check to make sure there is no foreign material in the photosensors. Clean with a soft cloth. If this does not get rid of the fault, replace RCP board
Err 2,16	Right Tilt Limit Overlap	Both right tilt photosensors appear to be blocked simultaneously	Foreign material in one of the photosensors or faulty photosensor. Check to make sure there is no foreign material in the photosensors. Clean with a soft cloth. If this does not get rid of the fault, replace RCP board

4.5.2.3 HHRC Board

The handheld remote control (HHRC) board is located in the handheld unit and is assigned unit number three (3). If two remote controls are connected, the second remote control will be re-assigned the unit number six (6). The HHRC board may generate the messages of Table 4-3:

Table 4-3. List of Hand Held Remote Control Board Faults

Message	Meaning	Root Issue	Potential Causes
Err 3,07 (Err 6,07)	Communication Timeout	The HHRC board has not received communications from the base board recently	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 Figure 4-2. Check to make sure that the base board software is 2.6 or newer. Refer to section 7.1 on how to check software revision level. Also check that the shield in the junction box has a good electrical connection all the way to the frame rail.
Err 3,08 (Err 3,08)	Communication Fault	The HHRC board has received an invalid message	Indicates a software problem. Notify Will-Burt
Err 3,09 (Err 3,09)	Internal Communication Fault	The HHRC has problems communicating with internal HHRC circuitry	Return HHRC to factory for repair

4.5.3 Warning Codes

Warning codes are presented on the LED eight digit alphanumeric display (see Figure 3-3). The codes are a combination of numbers that identify both the general location of the warning, and the type of warning. The first of two numbers is a single digit number indicating which board. The second number is a two-digit number indicating the warning. Warning codes differ from Fault codes in that they do not require clearing. If the condition causing the warning goes away, so does the warning. At that point, normal operation continues. The codes are as follows:

Table 4-4. List of Warning Codes

Message	Meaning	Root Issue	Potential Causes
WRN 1,01	Low Voltage Warning	The Base board is experiencing a low voltage condition	The vehicle battery may not be fully charged. There also could be excessive voltage drop across cabling because of long cabling runs/small gage wires
WRN 1,03	Communication Error Warning	Electrical noise interfering with communication	The shield of the internal coil cord may not be connected properly. One of the boards may be damaged.
WRN 2,01	Low Voltage Warning	The RCP board is experiencing a low voltage condition	The vehicle battery may not be fully charged. There also could be excessive voltage drop across cabling because of long cabling runs/small gage wires
WRN 2,03	Communication Error Warning	Electrical noise interfering with communication	The shield of the internal coil cord may not be connected properly. One of the boards may be damaged.
WRN 3,01 (WRN 6,01)	Low Voltage Warning	The HHRC board is experiencing a low voltage condition	The vehicle battery may not be fully charged. There also could be excessive voltage drop across cabling because of long cabling runs/small gage wires
WRN 3,02 (WRN 6,02)	Primary / Secondary HHRC key conflict	The two HHRCs are issuing conflicting commands.	Two operators are trying to operate the unit simultaneously.
WRN 3,03 (WRN 6,03)	Communication Error Warning	Electrical noise interfering with communication	The shield of the internal coil cord may not be connected properly. One of the boards may be damaged.

4.6 TROUBLESHOOTING MECHANICAL

Table 4-5. Mechanical Troubleshooting

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.
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.
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 HHRC	Broken or loose motor wire lead or faulty motor	1) Reconnect wire lead 2) Replace motor.
Mast fails to disconnect from power	Lower magnetic switch out of adjustment, software fault or control erroneously sensed an increase in current	1) Check that base board has software version 3.0 or later. See section 7.1 for verifying revision. Contact Will-Burt if update is required. 2) See Table 4-1, Table 4-2 and Table 4-3 for software fault codes. 3) Check magnetic warning switch location and wiring.
Mast will not begin to auto-stow when lowering	Upper magnetic switch band clamped to mast is not made	1) Magnetic switch is may be out of adjustment. Loosen clamp and slide switch up and down the mast until contact is established. 2) Check wiring 3) Replace defective magnetic switch.

CHAPTER 5
PARTS LIST

5.1 PARTS LIST

Table 5-1. Control Box Parts List

Mark No.	Description	Part Number
1	Solenoid Valve Assembly	913502
2	NS Base PC Board	913002
3	Hinge	914846
4	Enclosure, VCB	914767
5	Cover, VCB	914765
6	Grounding Lug	000015-029-901
7	Terminal Strip	000015-043-001
8	Mounting Bar, Upper VCB	914764
9	Mounting Bar, Lower VCB	914766
10	Strain Relief	901655
11	O-Ring Buna-N	914170
12	Connector Gasket	000045-122-018
Not shown	Magnetic switch assembly (2 each on base tube of mast)	915422

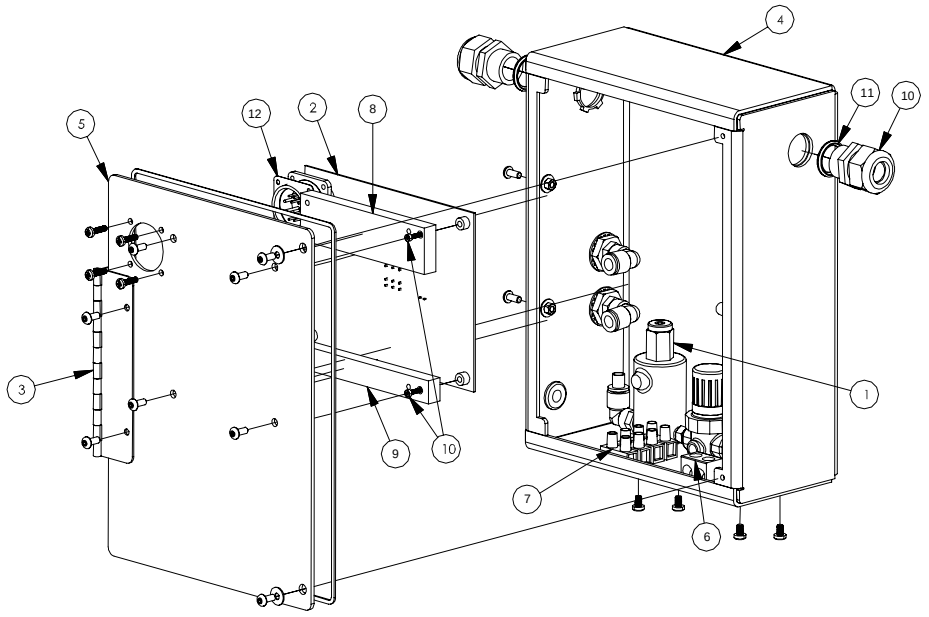


Figure 5-1 Exploded View – Control Box

Table 5-2. Remote Control Positioner Assembly Parts List

Mark No.	Description	Part Number
1	Remote Control Positioner Frame	913165
2	Circuit Board, Standard RCP	912760
3	Horizontal Shaft	913156
4	Timing Ring	913161
5	Bearing Retainer	913168
6	O-ring, Teflon	3398
7	Bearing	913435
8	Thrust Washer	913449
9	Retaining Ring	3401
10	Key	913268
11	Vertical Shaft	913166
12	Bushing	913272
13	Thrust Needle Roller & Cage Assembly	913448
14	RCP Motor	910673
15	Adapter	914397
16	Glass Lens	914954
17	Lamp Bracket	914947
18	Bulb	915171
19	Socket	915172

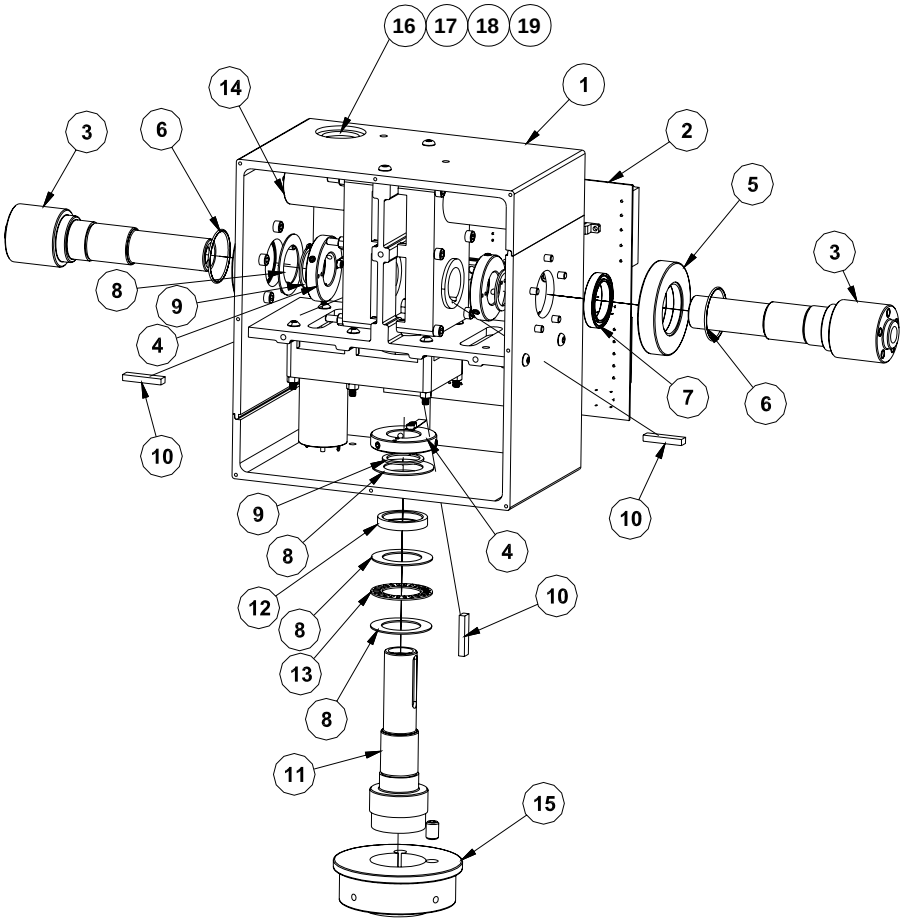


Figure 5-2 Exploded View - Remote Control Positioner

CHAPTER 6
REVISIONS

Revision 0, October 2005: First release.

Revision 1, May 2006: Added Section 2.6 Control Box Installation and Figure 2-7 Control Box Mounting Hole Locations. Added Figure 2-14 Warning Light Installation.and Section concerning Optional Interlock Contacts. Clarified upper prox switch wiring and location in Figure 4-2 and Figure 4-3. Updated Software Revision Log Table 7-1.

Revision 2, June 2006: Updated wiring schematics to add color information to RCP wire harness where missing. Updated Software Revision Log. Added Figure 2-10 showing valve layout in control box

CHAPTER 7
SOFTWARE REVISIONS

7.1 INTRODUCTION

There are several circuit boards in the Powerlite system. Each has its own microcontroller with associated software. A person may "query" the software revisions by simultaneously holding down all four HHRC tilt buttons (up, down, left, right). The revision levels can then be viewed as they scroll across the alphanumeric display. A typical display might be "1:2.6 2:2.2 3:2.1". This would indicate that board 1 (the base board) has revision 2.6, board 2 (the RCP board) has revision 2.2, and board 3 (the HHRC board) has revision 2.1. To date, all software revisions are backward compatible, and require no hardware changes on the boards.

Table 7-1. Software Revision Log

Board	Board No.	Revision	Comments	Compatibility Issues
Base	1	3.0	Added support for D-Tec II, dual HHRCs, non-RCP unit, Vertical (non-tilt) unit; added low voltage warning, added dual inputs for vertical limit switch, added faults for miswiring detection of complementary input limit switches	None
	1	3.1	Improved recovery from dissimilar board power-up times. Reduces communications faults at power-up.	Requires dual output magnetic switch on mast.
	1	3.2	Improved handling of internal compressor units to minimize surge currents (NS Powerlite models).	Requires dual output magnetic switch on mast.
	1	3.3	Improved communication error recovery. Improved stow algorithm. Updates for D-Tec II	Requires dual output magnetic switch on mast.
RCP	2	3.1	Improved communication error recovery.	None
HHRC	3	3.1	Improved communication error recovery.	None