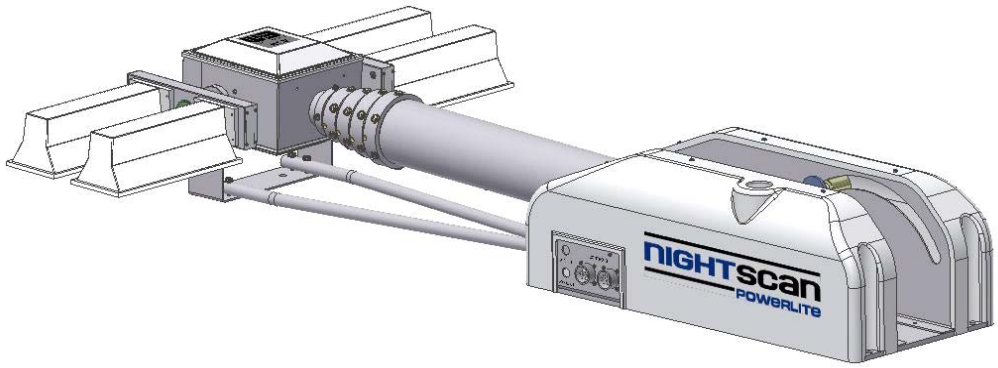
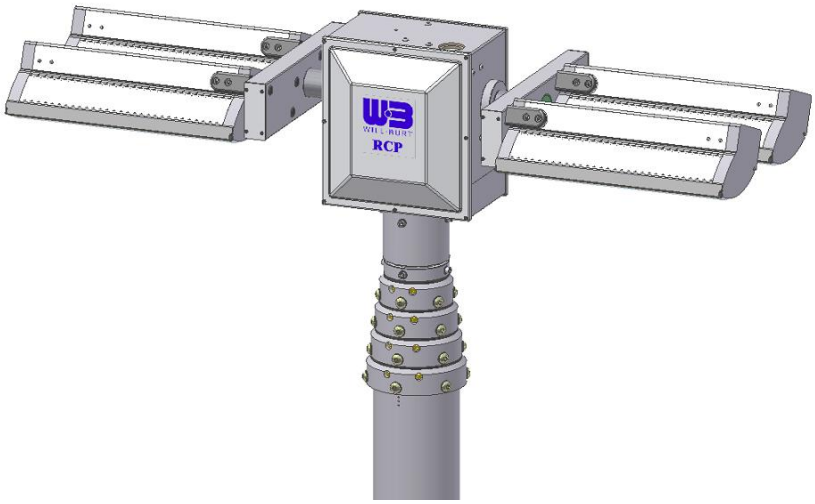
NIGHT SCAN POWERLITE AND VERTICAL INSTALLATION, OPERATION & MAINTENANCE MANUAL





The Will-Burt Company
www.willburt.com

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SAFETY SUMMARY

SIGNAL WORD DEFINITION

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

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

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 Night Scan Powerlite. 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 Night Scan Powerlite is a transportable lighting system consisting of a directionally adjustable group of lights attached to a self-erecting, extensible mast. It may also serve as a platform for communications antennae or a camera. Air pressure required to extend the mast is provided by an available vehicle air system, or an optional compressor unit mounted within the Night Scan. The unit is designed for installation on any vehicle 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 Night Scan Powerlite unit and Figure 1-2 for Powerlite Vertical.

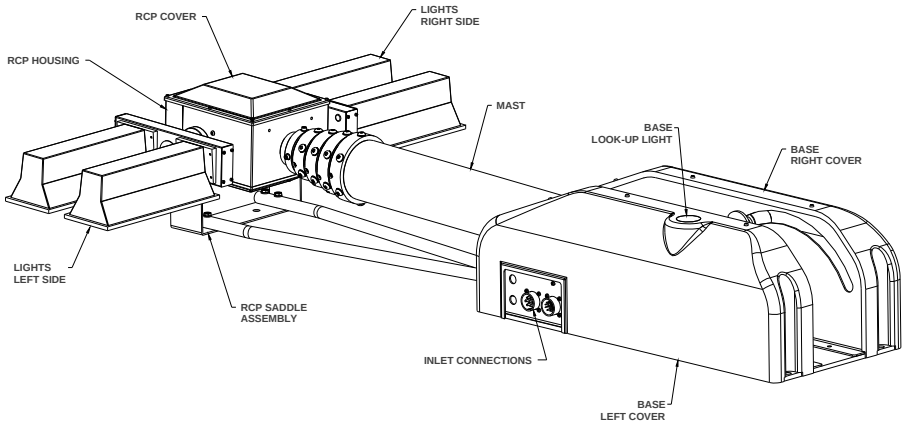


Figure 1-1 Night Scan Powerlite Base and Remote Control Positioner

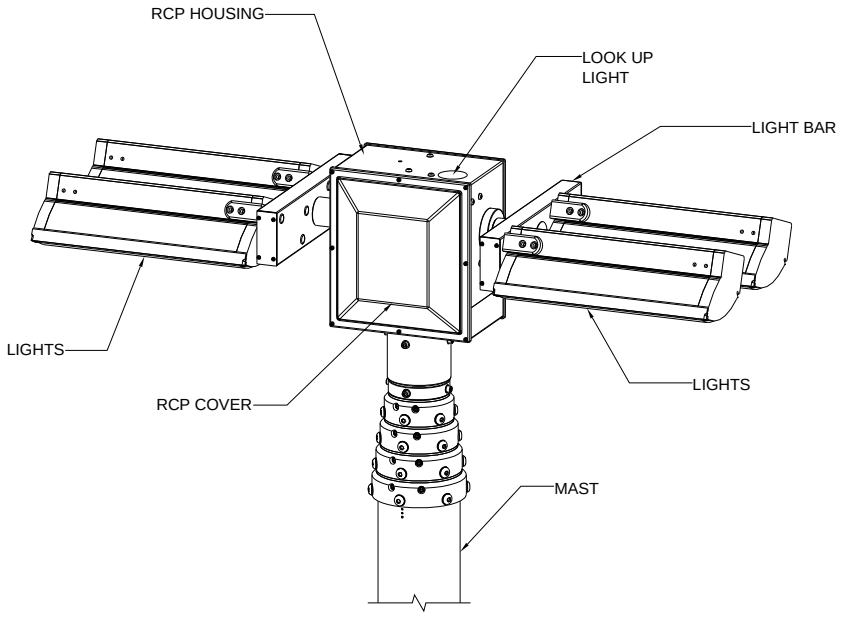


Figure 1-2 Powerlite Vertical RCP

1.4 REFERENCE DATA

The reference data for the Powerlite 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 Night Scan Powerlite

Model No.	3000	3600	5400	4500P	6000	9000	Camera Mt.
NS10 Stowed Height	1ft/	1ft/	1ft/	1ft/	1ft/	1ft/	1ft/
NS15 Stowed Height	1ft/	1ft/	1ft/	1ft/	1ft/	1ft/	1ft/
NS10 Ext. Height	10ft.	10ft.	10ft.	10ft.	10ft.	10ft.	10ft.
NS15 Ext. Height	15ft.	15ft.	15ft.	15ft.	15ft.	15ft.	15ft.
Total Unit Weight**	150 lb.	155 lb.	170 lb.	170 lb.	165 lb.	180 lb.	135 lb.
Tube Diameter Range	5 to 3 in.	5 to 3 in.	5 to 3 in.	5 to 3 in.	5 to 3 in.	5 to 3 in.	5 to 3 in.
No. of Mast Sections	5	5	5	5	5	5	5
Mast Air Volume (NS15)	1.2 cu. ft.	1.2 cu. ft.	1.2 cu. ft.	1.2 cu. ft.	1.2 cu. ft.	1.2 cu. ft.	1.2 cu. ft.
Max. Operating Air Pressure	20 psi	20 psi	20 psi	20 psi	20 psi	20 psi	20 psi
Required DC Electrical Power Supply	12V/20 amp 24V/10 amp	12V/20 amp 24V/10 amp	12V/20 amp 24V/10 amp	12V/20 amp 24V/10 amp	12V/20 amp 24V/10 amp	12V/20 amp 24V/10 amp	12V/20 amp 24V/10 amp

Table 1-2. Reference Data Powerlite Vertical

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

*Maximum dimension is the largest dimension on all specified models.

**Weight given is approximate for 15-foot models

1.5 TECHNICAL INFORMATION

1.5.1 **AC Power Requirements**

1.5.1.1 Night Scan Powerlite

The AC power for the Night Scan Powerlite is supplied through a 7-pin MIL-type connector located on the side of the Night Scan. The mating connector is an MS3106E24-10SF80A206 or equivalent (Will-Burt Item Number 000013-107-007). Cable assemblies with the AC connector installed are available from Will-Burt in two lengths – 30 ft. (P/N 914378) and 50ft. (914379). Two pins are provided for each of two lighting loads (right and left) plus an additional two pins for earth/chassis ground. The remaining pin is unconnected. See Table 2-2 for pin out information and schematics in section 4.4 for wiring connection detail. This connector is sufficient to handle up to 8-gauge wire.

1.5.1.2 Powerlite Vertical RCP

The AC power for the Powerlite vertical RCP is supplied by wiring directly to the terminal block located in the control box. See Figure 4-12 for wiring connection detail and

Figure 5-3 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 Night Scan 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 since both sides of the AC are switched by a common relay.

1.5.2 DC Power Requirements

The DC power for the Powerlite 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 4032502) and 50ft. (4032503). The DC power connects to two pins that accept up to 10-gauge wire. See Table 2-3 for pin out information and schematics in section 4.4 for wiring connection detail. The DC power is internally protected with a 20 amp auto-resetting circuit breaker. The Powerlite 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 Powerlite base connector. Long runs of cable can introduce power loss. A good method of checking the voltage at the Powerlite is to connect a voltmeter to the wires in the junction box powering the Remote Control(s) (pins B and C of J1 see schematics in section 4.4). 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. If use of heavier gage power wiring is required because of a long wiring run, it may be simpler to butt splice to the DC cable assembly rather than use the terminal block in the junction box for those two wires.

1.5.3 Mast Loads (For Night Scan Powerlite only)

It is important that the mast be securely mounted to a sturdy platform, which will not overturn during operational loading of the mast. Figure 1-3 provides loading information for the mast, which can be expected during operation. All values given are in lbs.

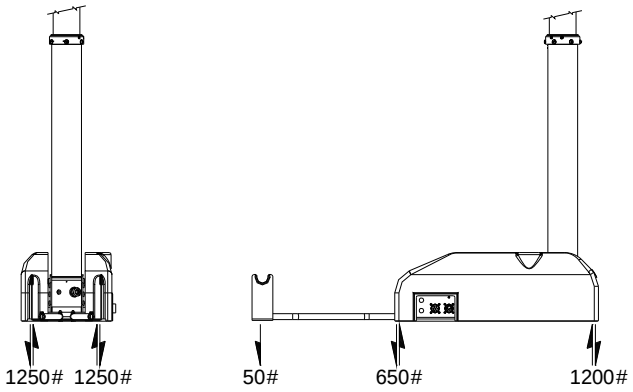


Figure 1-3 Mast Loads

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

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

2.2 TOOLS AND MATERIALS REQUIRED FOR INSTALLATION

Table 2-1 provides a list of tools and materials required to install and test the Night Scan Powerlite.

Wrenches	Crimping tool or Solder set
Screwdrivers	Wire cutter/stripper
½ inch or M12 Mounting Hardware (6 each)	Multimeter (to verify power is turned OFF)
Torque wrench	Clean Shop Rags
Drill	
Hoist (minimum 500 lb capacity)	

Table 2-1. Tools and Materials Required for Installation

2.3 UNPACKING

Unpack the Night Scan Powerlite as follows:

1. Carefully open and remove all parts from shipping container.
    - Night Scan Powerlite: Lift the unit from the shipping container by the two struts and the lower portion of the base tube (see Figure 2-1).
    - Vertical Powerlite**:** Lift the unit from the shipping container by the two horizontal RCP shafts and the vertical shaft (see Figure 2-2).
    - **Do not lift the Night Scan by the lights or RCP.**
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.

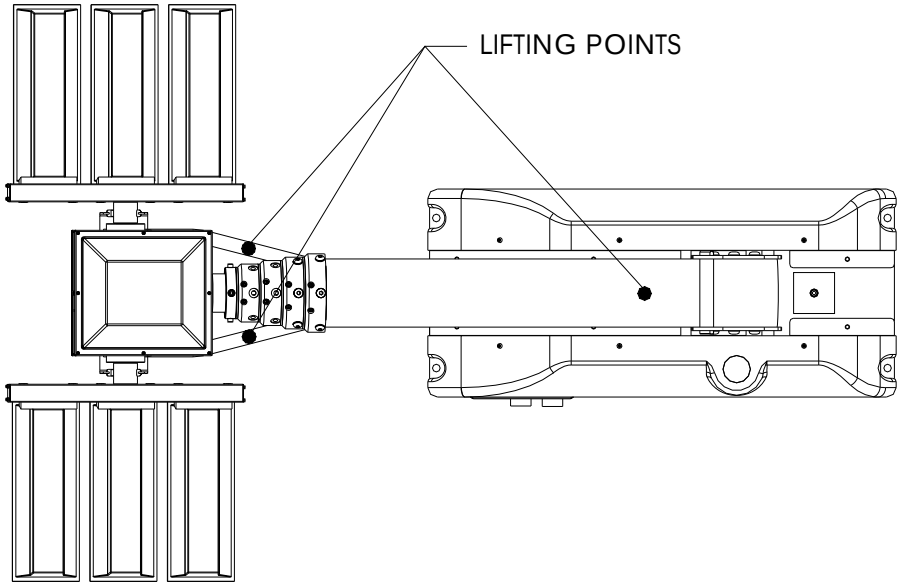


Figure 2-1 Lifting points on the Night Scan Base

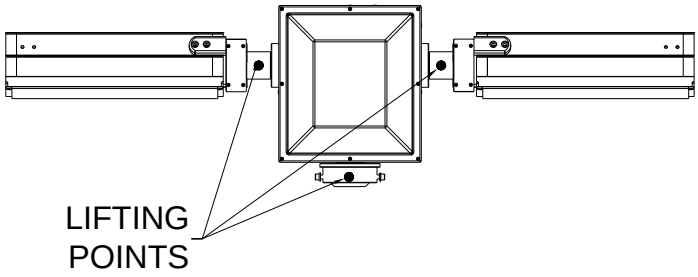


Figure 2-2 Lifting points on the Powerlite Vertical RCP

2.4 ATTACHING TO VEHICLE

2.4.1 Night Scan Powerlite

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

The mounting holes provided in the Night Scan unit are 9/16 inches in diameter. There are four holes in the base plate and two holes in the RCP saddle. Studs or bolts (not provided) shall be located on the vehicle in accordance with Figure 2-3. It is important that the surface be flat such that the saddle and base plate are in the same plane. The areas to which the unit is mounted must be reinforced to withstand loading as shown in Figure 1-3. Attach and torque all hardware as appropriate for its material and size. It may be advantageous to attach the four (4) mounting bolts in the base plate, complete the wiring as outlined in the following sections and raise the unit before attaching the saddle bolts. Be certain that the saddle bolts are located in accordance with Figure 2-3 and that the saddle is centered with respect to the RCP. Adjust the location if necessary so that the saddle flanges do not hang up on the lights when the unit is raised.

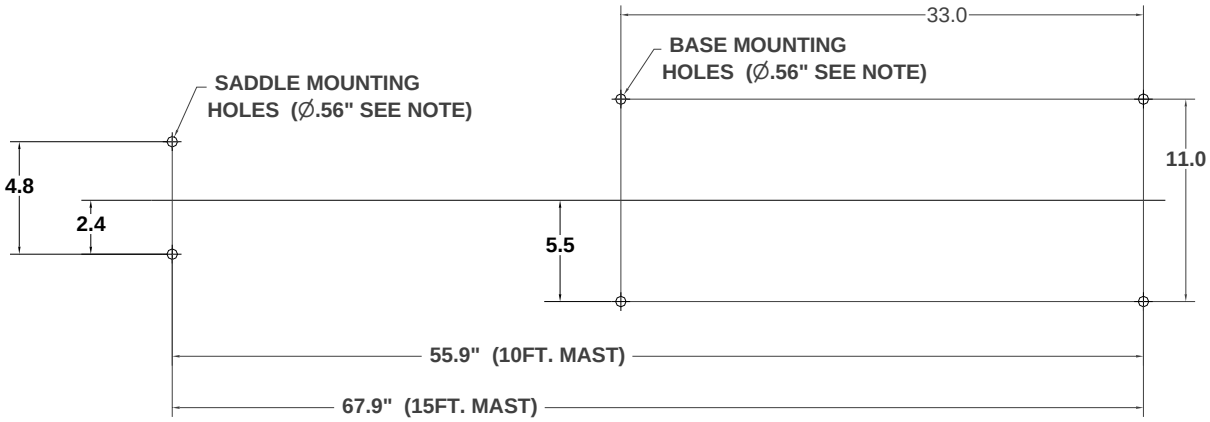


Figure 2-3 Night Scan Base Mounting Hole Locations

Profiler models require two additional holes as indicated below to provide support to the light assembly.

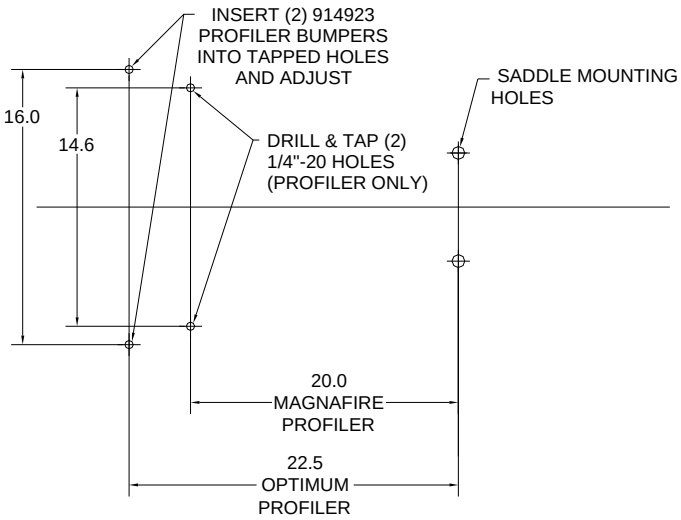


Figure 2-4 Additional Mounting Requirements – Profiler

2.4.2 **Powerlite Vertical**

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 2-5. 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 2-6). The saddle must be attached so that it is centered with the RCP and the mast base tube. See Figure 2-6 for saddle mounting and Figure 2-8 for additional reference.

IMPORTANT NOTE: The mast, RCP and control box assemblies must be installed and wired prior to power up. Failure to do so will result in errors and could damage the unit.

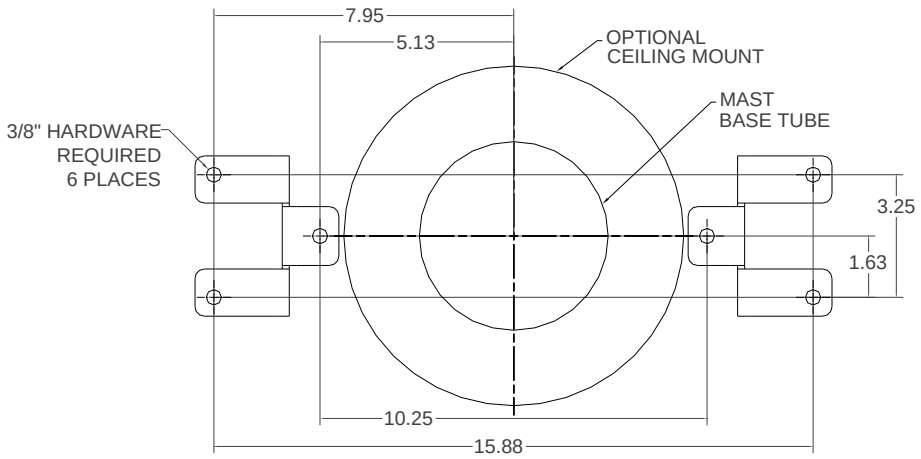


Figure 2-5 Vertical Saddle Mounting Holes

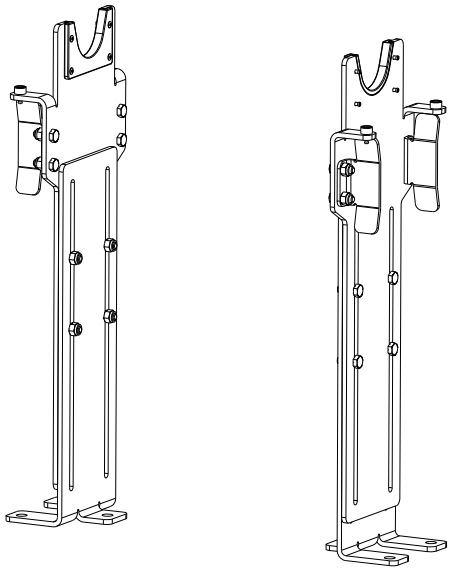


Figure 2-6 Vertical Saddle Deck Mount

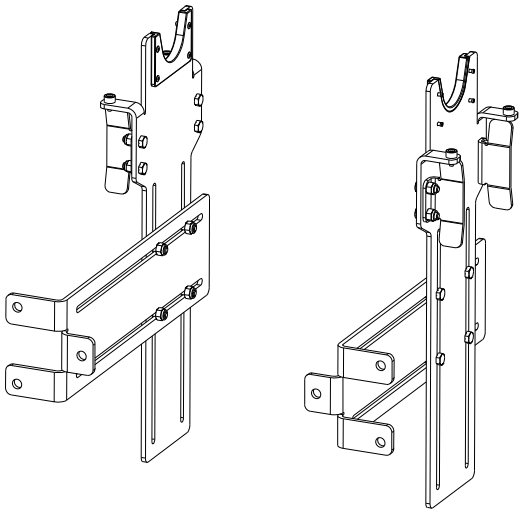


Figure 2-7 Vertical Saddle Wall Mount

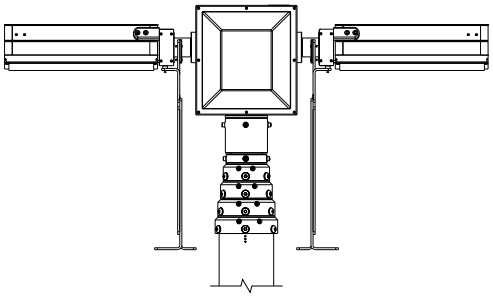


Figure 2-8 Vertical Saddle and RCP Assembly Lights Stowed Horizontally

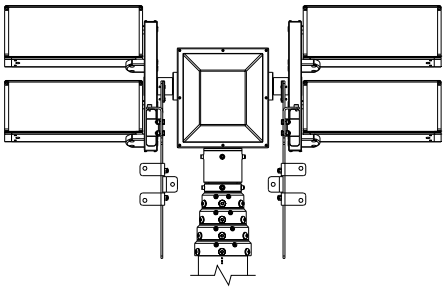


Figure 2-9 Vertical Saddle and RCP Lights Stowed Vertically

2.4.3 **Junction Box Installation**

The junction box serves as an interface between the Hand Held Remote Control and the Night Scan Base. It is not used in installations where only the Panel Mount Remote Control is used. The junction box is not rated for installation in wet locations. The installer must take necessary precautions to seal the lid and the knockouts if installation in a wet location is unavoidable. The junction box also serves as a location to which DC power is routed by the installer for the unit. It may be flush or surface mounted. Hardware for mounting is not supplied.

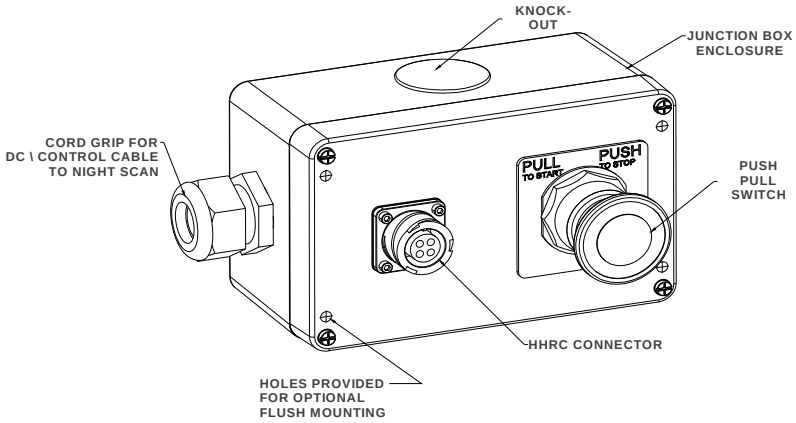


Figure 2-10 Standard Junction Box

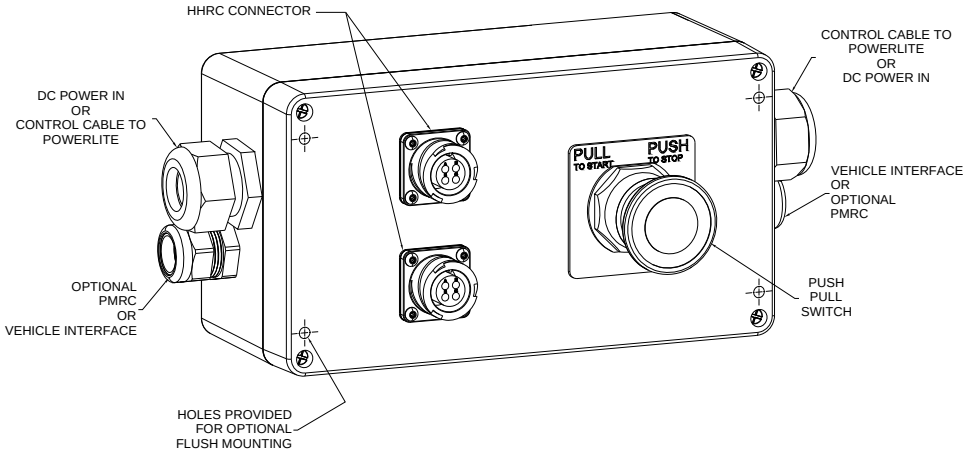


Figure 2-11 Wireless Junction Box

2.4.4 **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 schematics in section 4.4). Place the junction box behind the panel and guide the screws through the panel, junction box cover and junction box. Secure on back side using lock washers and nuts.

2.4.5 **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 back side using lock washers and nuts. Make the necessary cable connections (see schematics in section 4.4) and replace cover.

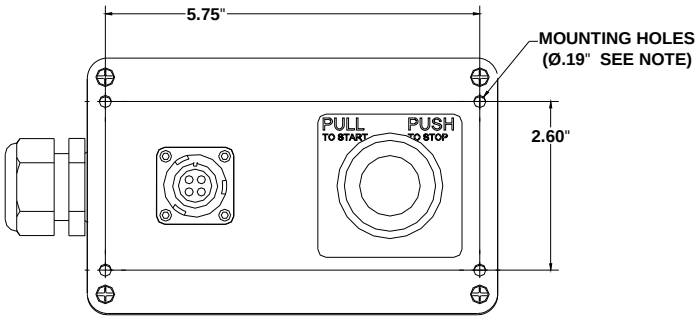


Figure 2-12 Standard Junction Mounting Hole Locations

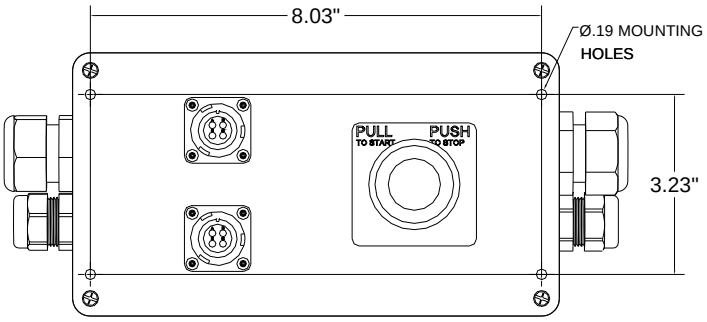


Figure 2-13 Wireless Junction Box Mounting Hole Locations

2.5 CONTROL BOX INSTALLATION

(For Powerlite vertical RCP only)

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 (see Figure 2-14). Attach the lock washers and nuts to secure the unit. Reconnect any cables and replace the cover.

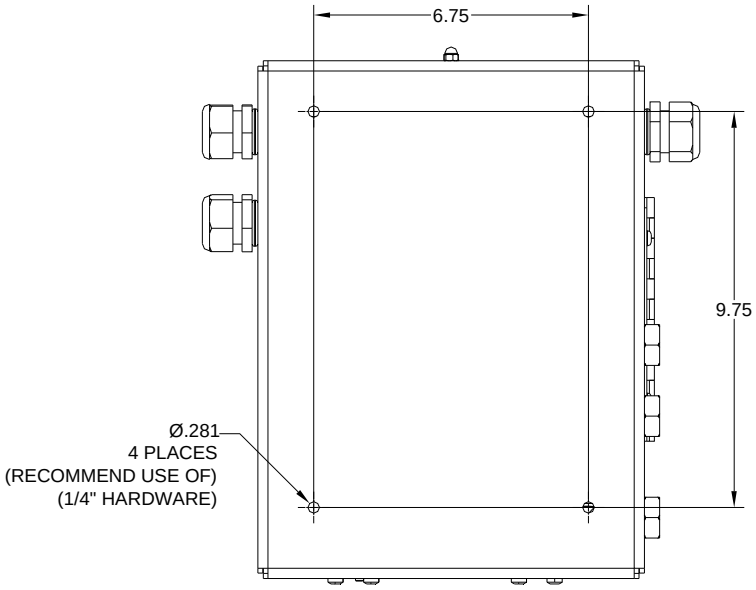


Figure 2-14 Control Box Mounting Hole Locations

2.6 CABLE (S) INSTALLATION

2.6.1 AC Power Cable

2.6.1.1 Night Scan Powerlite

AC power for the Night Scan Powerlite has its own connector (see Figure 2-15). If the connector mentioned in the AC Power Requirements (Section 1.5.1) is utilized, the wires are best crimped in the pins although soldering is possible. A power crimping tool is available from Pico Corporation. To maintain maximum creepage distance on the connector pins, it is recommended that pins A and F have the same electrical phasing, and that pins D and C have the same electrical phasing. Please refer to Table 2-2. See schematics in section 4.4 for wire color information.

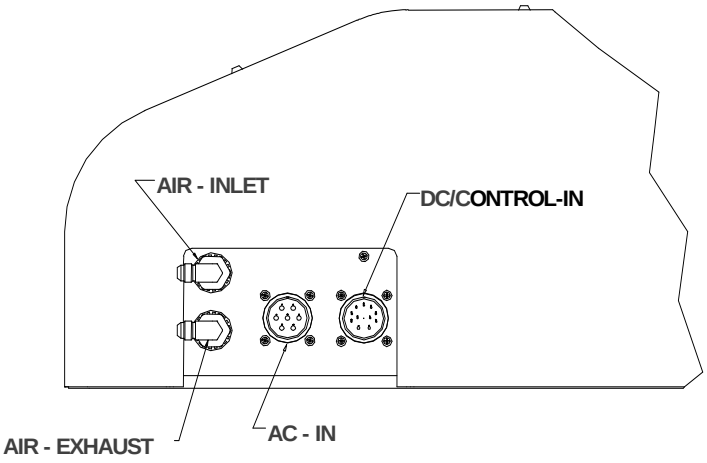


Figure 2-15 Powerlite Inlet Connections

2.6.1.2 Powerlite Vertical RCP

AC power for the Powerlite vertical RCP should be routed into the control box through the liquid tight strain relief (see Figure 2-16). Connections are made on the terminal block in the control box. See schematics in section 4.4 for wire connection information and

Figure 5-3 terminal block location.

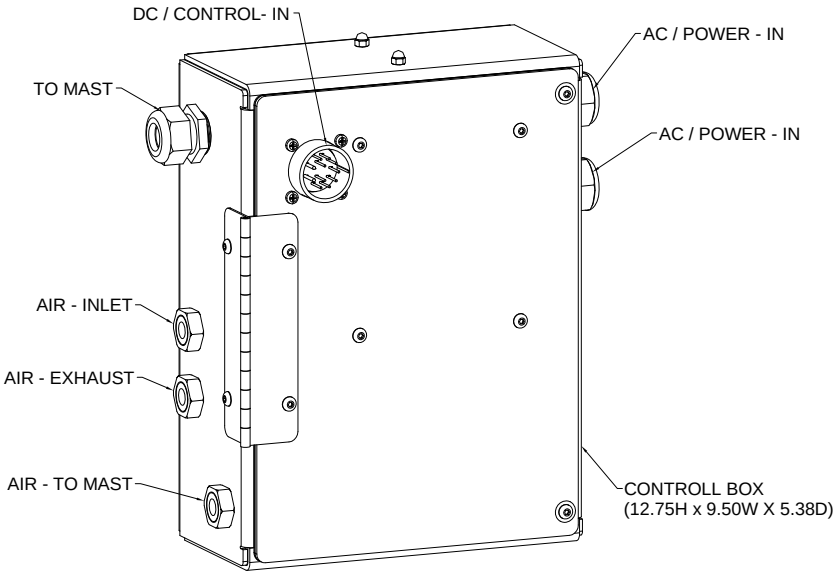


Figure 2-16 Control Box Inlet Connections

2.6.2 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 2-3. See schematics in section 4.4 for wire color information.

2.6.3 Connector Pin-outs

Pin Letter	Pin Function	Recommended Wire Ga.
A	Right Light Power – L1 (or +V)	10
B	Earth/Chassis Ground	10
C	Right Light Power – L2 (or –V)	10
D	Left Light Power – L2 (or –V)	10
E	Earth/Chassis Ground	10
F	Left Light Power – L1 (or +V)	10
G	(Unused)	N/A

Table 2-2. AC Power Connector Pin-out (Night Scan Powerlite only)

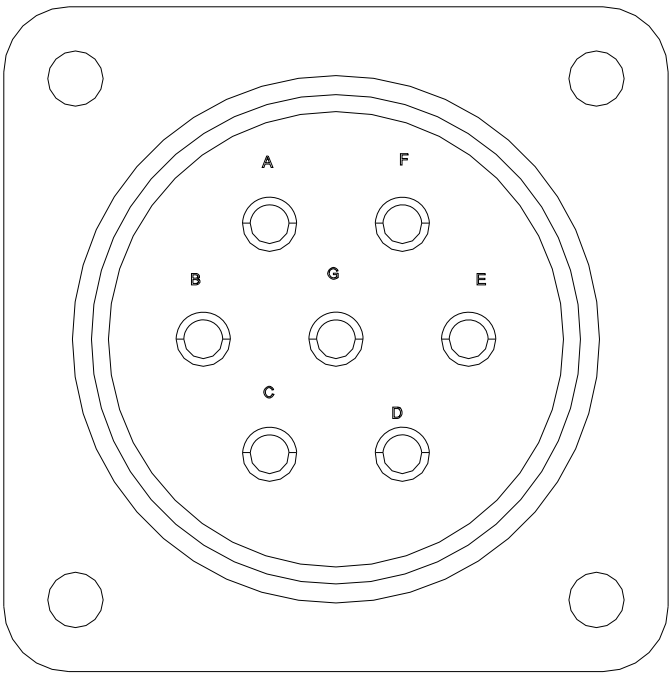


Figure 2-17 AC Connector Pins (Night Scan Powerlite only)

Table 2-3. DC Power Connector Pin-out

Pin Letter	Pin Function	Recommended Wire Ga.	Destination	Comments
A	Int. Power. To Remote Control(s) - Pos.	20 minimum	Remote Control(s) Pin B	In twisted pair with Pin C of Remote Control(s)
B	Int. Power. To Remote Control(s) - Neg.	20 minimum	Remote Control(s) Pin C	In twisted pair with Pin B of Remote Control(s)
C	RS-485 Link – Data +	20 minimum	Remote Control(s) Pin A	In twisted pair with Pin D of Remote Control(s)
D	RS-485 Link – Data -	20 minimum	Remote Control(s) Pin D	In twisted pair with Pin A of Remote Control(s)
E	DC Power – Battery Pos.	10 minimum	Bat. + Term.	
F	DC Power – Battery Neg.	10 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

2.6.4

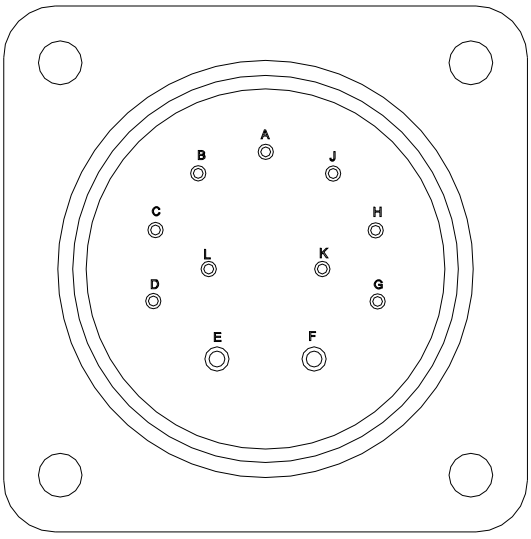


Figure 2-18 DC Power Connector Pins

2.7 AIR CONNECTIONS

2.7.1 Night Scan Powerlite

Two barbed fittings are provided for connecting the air lines required to pressurize and exhaust the Night Scan mast unit. Air may be supplied externally by a compressor or other source of clean, dry air with a maximum pressure of 100 psi. The Night Scan has an internal regulator factory set to 20 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 (ie. high temperatures). Refer to Figure 2-19 for identification of the air fittings located adjacent to the power and control connectors. The exhaust hose must be routed to a location where it will not expel air or water onto personnel or equipment sensitive to moisture.

If the unit was provided with the optional on-board air compressor, only the exhaust hose need be connected. The exhaust hose must be routed to a location where it will not expel air or water onto personnel or equipment sensitive to moisture.

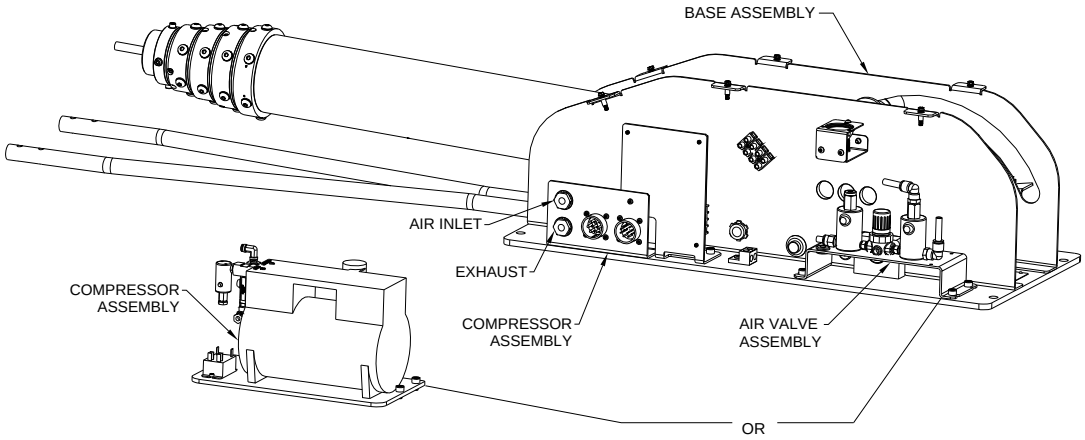


Figure 2-19 Night Scan Powerlite Base with Valve Assembly (optional Compressor also shown)

2.7.2 Powerlite Vertical RCP

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 2-20 and Figure 2-21 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.

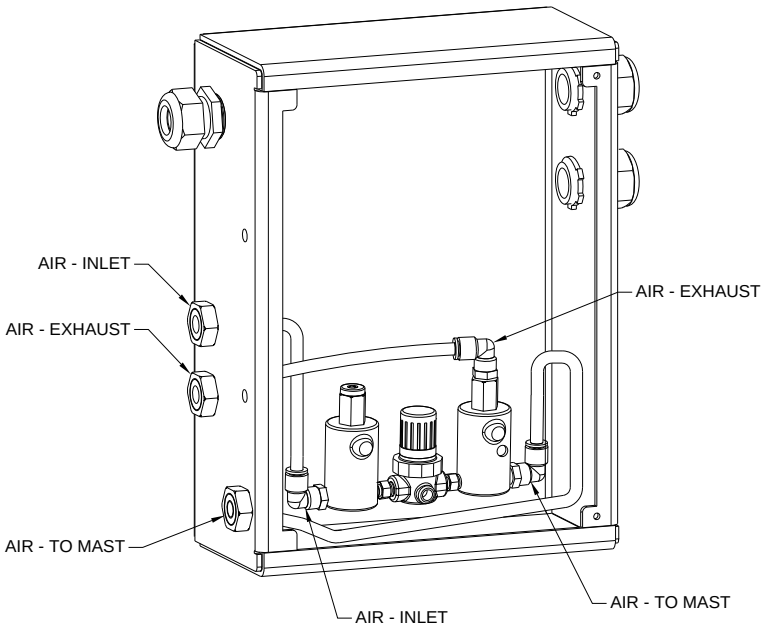


Figure 2-20 Control Box Valve Layout (Powerlite Vertical RCP)

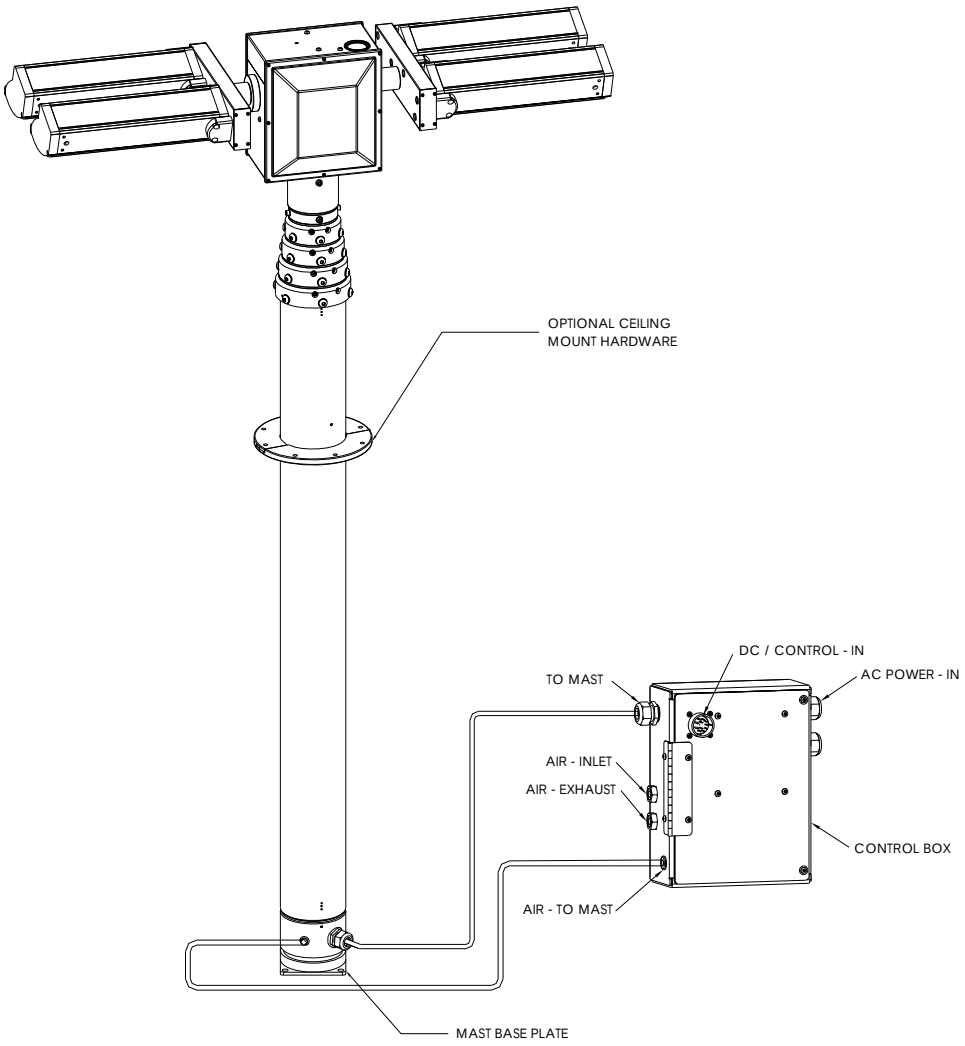


Figure 2-21 Powerlite Vertical RCP Mast Base Assembly with Control Box

2.8 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 2-3 and schematics in section 4.4.

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 blocks of the switches are wired in series. The connectors for the hand held remote controls are wired in parallel. One twisted pair connects pins B and C of one connector to B and C of the other connector respectively. The same is true for pins A and D. Refer to Figure 2-22 for a schematic of a dual junction box installation.

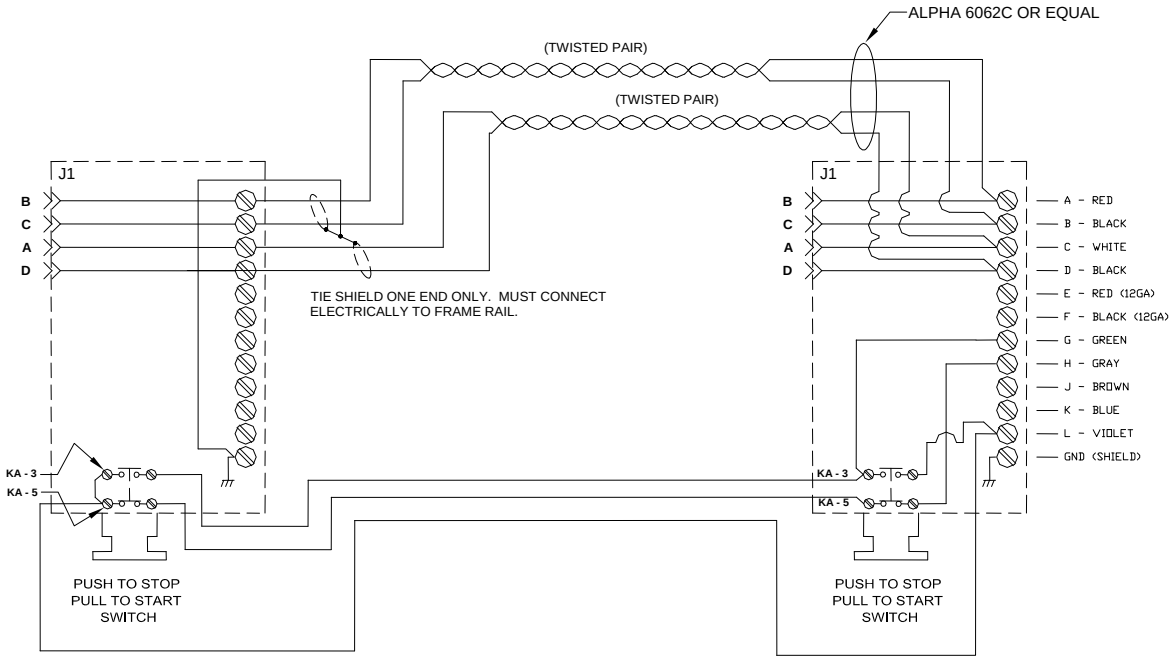
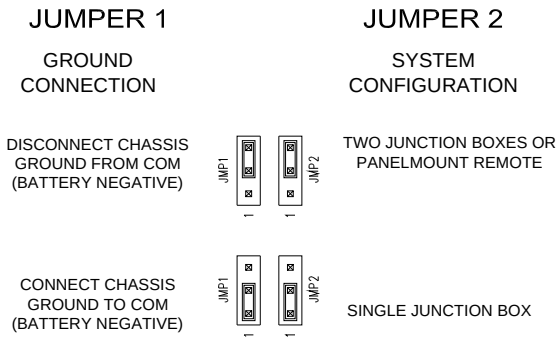


Figure 2-22 Dual Junction Box Installation Wiring



2.9 CONNECTING THE REMOTE CONTROL(S)

2.9.1 Hand Held Remote Control (HHRC)

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 2-4 and Figure 4-6 for wiring schematic.

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. If the HHRC is to be used in conjunction with the Will-Burt Panel Mount Remote Control (PMRC), refer to Figure 4-7 for the wiring schematic.

Table 2-4. 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

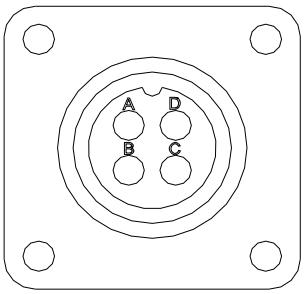


Figure 2-23 Hand Held Receptacle Pins

2.9.2 Panel Mount Remote Control (PMRC)

The Panel Mount Remote Control (PMRC) can be connected along with the HHRC (see Figure 4-7), or without the HHRC (see Figure 4-5). It has a 12-pin Deutsch connector (Deutsch part number: DT15-12PA). A mating connector (Deutsch part number: DT06-12SA) is supplied with Will-Burt PMRC connector kit (part # 4032201). Refer to

Figure 2-24 and Table 2-5 for the PMRC connection to the DC Power/input connector.

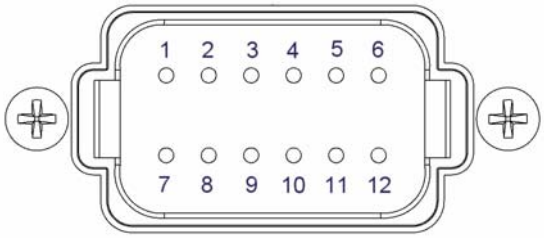


Figure 2-24 PMRC Connector pins

Table 2-5. Panel Mount Remote Control Connector Pin-out

PMRC Pin	Pin Function	To Pin of DC Power Connector	Recommended Wire Ga.
1	POWER (+)	A	18
2	GROUND (-)	B	18
3	DATA +	C	20
4	DATA -	D	20
5	INITIATE SW IN	G	18
6	INITIATE SW OUT	H	18
7	KILL SW IN	H	18
8	KILL SW OUT	L	18
9	UNUSED		
10	UNUSED		
11	UNUSED		
12	UNUSED		

The overall dimensions of the PMRC are shown in Figure 2-25. The mounting panel should match the panel cutout and the hardware requirements shown in Figure 2-26.

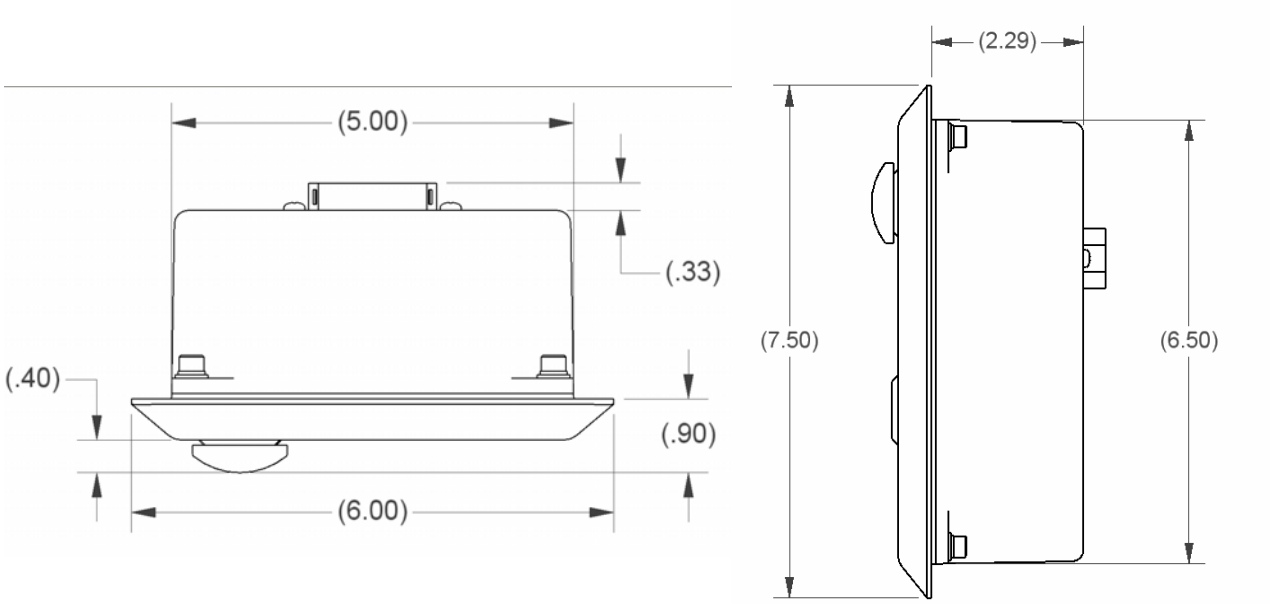


Figure 2-25 Overall dimensions of PMRC

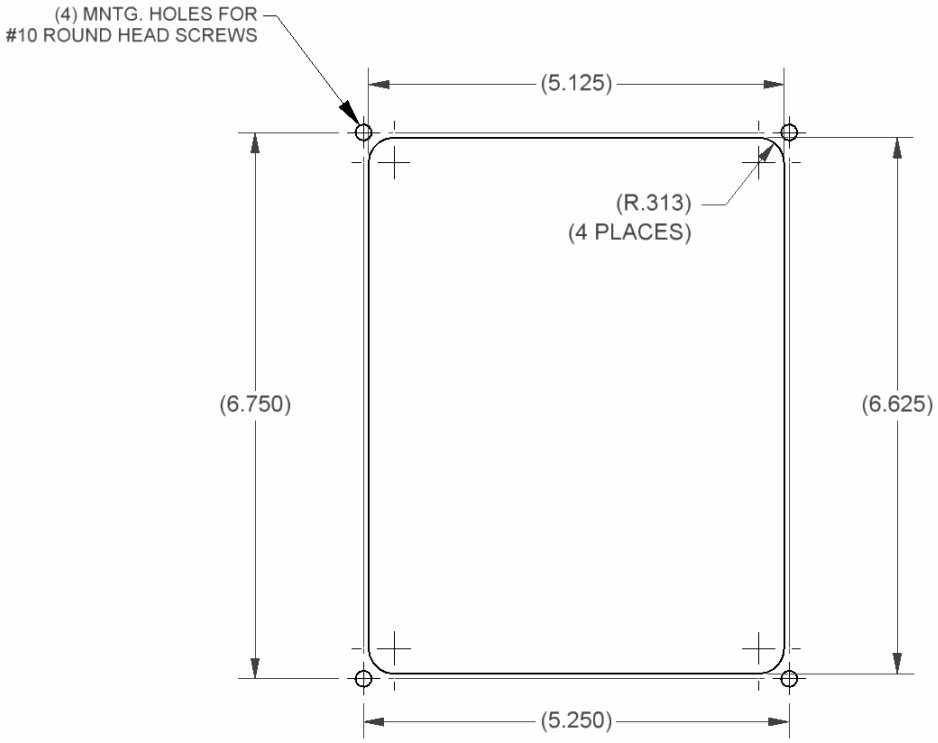


Figure 2-26 Recommended panel cutout

2.10 INSTALLING D-TEC II SENSOR (OPTIONAL)

Refer to the Will-Burt D-Tec II manual before installing D-Tec II on the Powerlite RCP.

When using the D-Tec II Sensor with a Will-Burt RCP, the unit will be mounted on the side of the RCP cover plate opposite of the RCP circuit board (see Figure 2-27). The Sensor unit must be mounted in the upright position with the look up lights pointing up. The cable used to connect the Sensor unit to the RCP should be connected to the bottom of the Sensor unit and wired into the RCP PC board as shown in Figure 2-28.

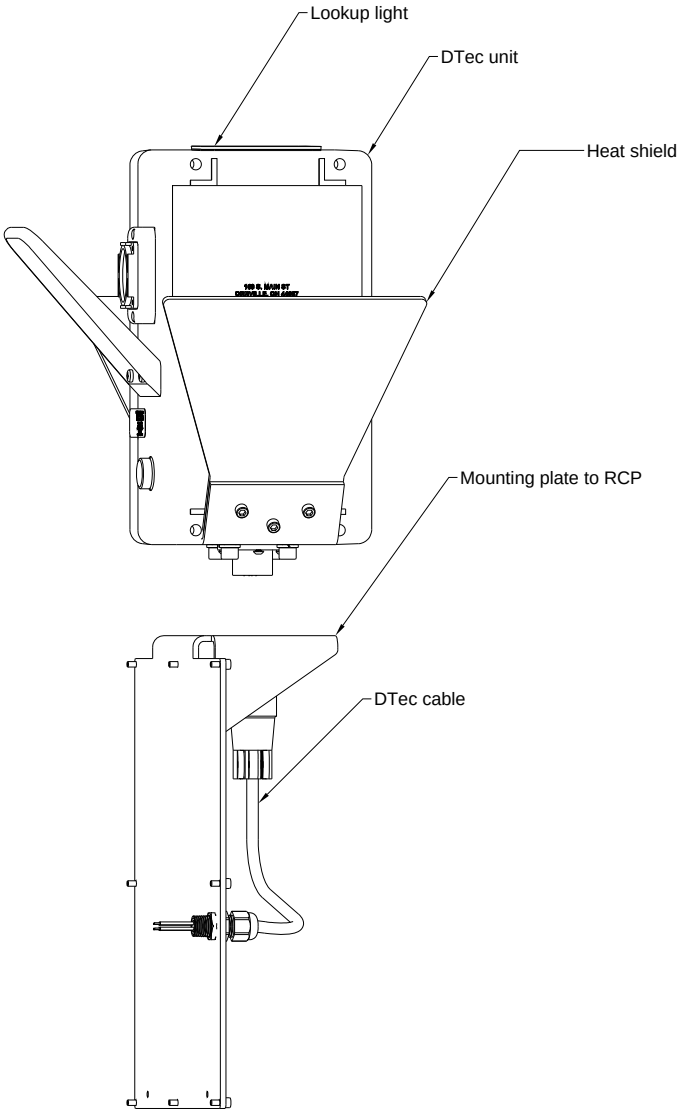


Figure 2-27 Mounting of D-Tec II sensor to RCP

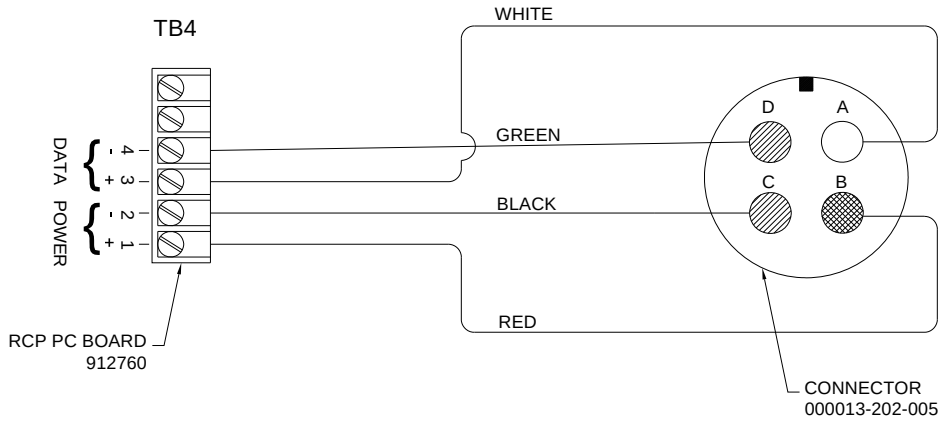


Figure 2-28 RCP to D-Tec II sensor Unit Schematic

2.11 INSTALLING THE MAGNETIC SWITCHES (POWERLITE VERTICAL RCP ONLY)

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 3-2). This switch will sense the magnet in the top tube as the mast is raised and allow the user to operate the RCP. The upper magnetic switch should be installed so that the 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 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 unit 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 2-3 and schematics in section 4.4. 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. (refer to Figure 2-29)

2.13 CONNECTING INTERLOCK INPUT 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 2-3 and schematics in section 4.4.

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 2-3 and schematics in section 4.4. A customer supplied flashing relay and lamp may then be installed in the driving compartment such that the driver can see the lamp. One example using a Bosch relay is shown below. Prior to powering the Powerlite for the first time after installation, test the warning light circuitry in this manner. With the DC/Control cable disconnected from the Powerlite, the warning light should flash. Holding the connector end of the DC/Control cable in one hand, short pins J and K on the cable connector and the warning light should go out. This might also be accomplished (with the DC/Control cable disconnected from the Powerlite) by momentarily shorting the blue and brown wires inside the junction box while checking for the same effect.

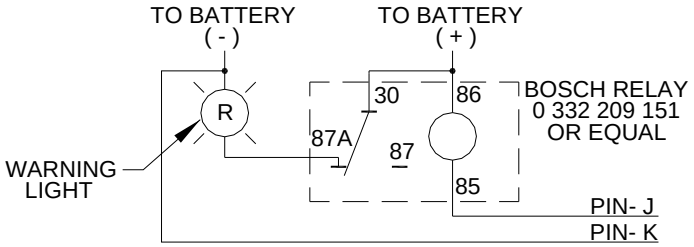


Figure 2-29 Example of Warning Light Installation

2.15 PRE-OPERATIONAL CHECK

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Do not use in the presence of flammable gases or liquids such as paint, gasoline or solvents. Do not use in areas of limited ventilation or where high ambient temperatures are

present. Contact with combustible materials can cause ignition resulting in fire or explosion.

Before operating the Powerlite, be sure that there are no overhead obstructions and that there are no power lines within 20 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 which might obstruct motion of the mast or cause binding. Remove any material that may hinder mast function.

CHAPTER 3
OPERATING INSTRUCTIONS

⚠ WARNING

All operators must read the Operation section of this manual and be properly trained.

⚠ WARNING

Keep personnel clear of mast while during operation.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Before operating, make certain that the area is free of overhead power lines and other unwanted sources of electricity. Be sure to allow sufficient clearance on all sides of mast to allow for side sway.

⚠ WARNING

Do not move vehicle until mast has been securely stowed.

3.1 THEORY OF OPERATION – MECHANICAL

3.1.1 Night Scan Powerlite – Mast

The Night Scan Powerlite operates using a DC powered actuator to drive the mast from nest to 90 degrees. When at 90 degrees, a proximity sensor detects the actuator position and prevents further driving of the actuator. The sensor also notifies the operator through the Remote Control(s) that certain RCP functions are available. The standard valve assembly included in the Night Scan Base will receive power and allow air to enter the mast when the up button is depressed. Alternatively, an optional internal AC compressor will force 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 (or the compressor stops) and the exhaust valve opens. This will exhaust all air from the mast.

As the mast is nested, the base control looks for indication from a magnetic switch that the mast has fully retracted and may be safely restored to its fully nested (horizontal) position. If the “double click” unattended stow sequence was not used, the RCP will begin the autostow sequence to insure that the RCP is properly positioned for engagement with the saddle. If the autostow “double click” sequence was used, the RCP will have properly positioned itself as the mast descended prior to horizontal nesting into the saddle.

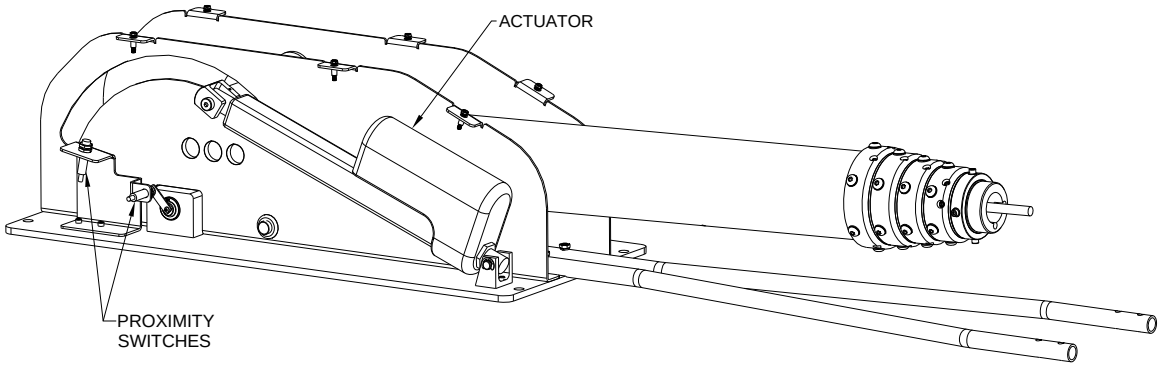


Figure 3-1 Actuator and Proximity Sensors

3.1.2 Powerlite Vertical - Mast

When the up button is depressed, the standard valve assembly included in the control box will receive power and allow air to enter the mast. When the mast has extended at least one section, the upper magnetic switch will make the RCP functions available through the Remote Control(s). 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 and it will lower.

As the mast is nesting, 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.

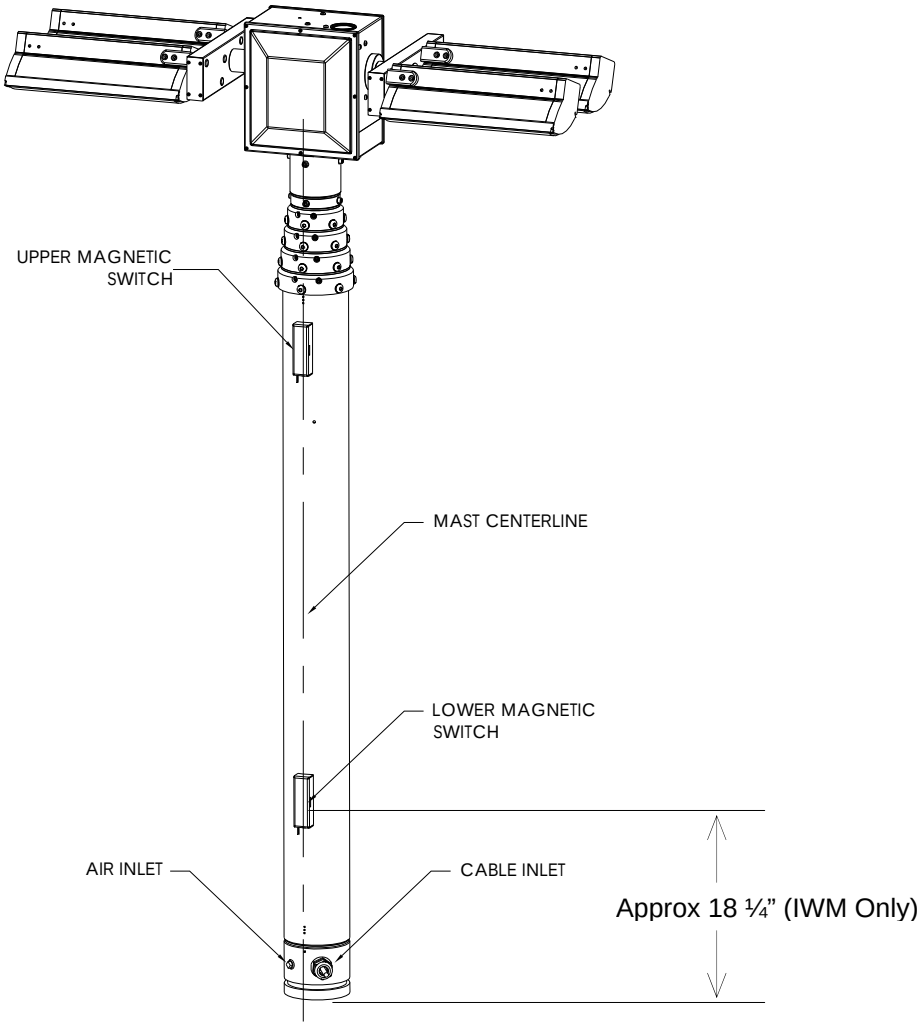


Figure 3-2 Upper and Lower Magnetic Switches

3.1.3 **RCP**

The RCP provides pan and tilt functions upon command from the Remote Control(s). 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 Remote Control(s) for that direction of travel will go out, indicating that a limit has been reached in that direction.

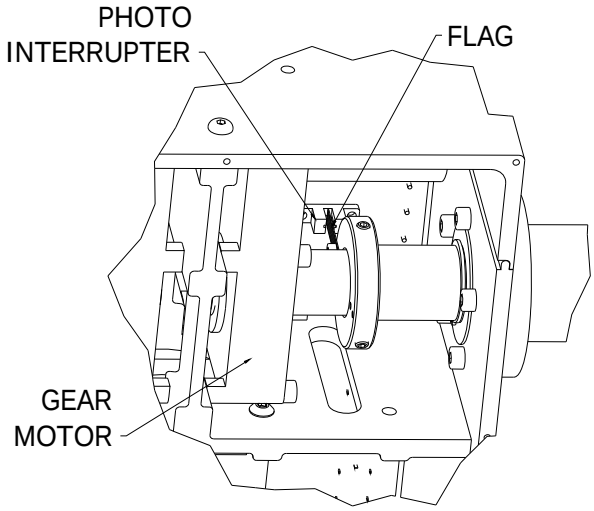


Figure 3-3 Photo Interrupter and Flag

3.2 THEORY OF OPERATION – ELECTRICAL

The Powerlite control is based on a distributed intelligence control structure. Each main section of the Powerlite has a circuit board with an embedded micro controller. These sections are: the Base, the RCP, and the Remote Control(s). 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 Night Scan 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 function such as a “Park/Neutral” switch from the vehicle transmission. Relay contacts inserted in the violet wire coming from pin L of the DC Power cable function to inhibit operation of the Powerlite (See schematics in section 4.4)

Additionally, a bi-stable (latching) 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 Night Scan 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 to horizontal position (Night Scan Powerlite), the control monitors the current of the actuator. When the mast lowers, trips the Mast Nested limit switch, and comes up against the mechanical resistance of the saddle; it senses it, considers itself stowed, and shuts itself down. This ensures a certain amount of pre-load on the RCP saddle.

In case of the Powerlite Vertical, the control monitors the two magnetic switches. When the mast lowers and comes to the upper magnetic 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 (see section 4.5.2) will be displayed on the Remote Control(s) display. Clearing the fault is accomplished by pushing the Push/Pull switch or momentarily interrupting power in 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 Night Scan. 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 also a momentary function, and the switch will return itself to a neutral position on its own. When using Will-Burt's accessory kit push/pull switch, accidental initiating is extremely unlikely since it would require pulling the switch button. Even with this, the Remote Control(s) would have to be subsequently pushed to get any action. In the unlikely event that the initiate switch were engaged, the Night Scan will power itself down if no Remote Control 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. **It should be noted that prematurely disconnecting power in this way will immediately cause the mast to vent.** 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 appropriate error code will be displayed (Err, 1.09). This is a preventative measure to ensure the initiate input is not hot-wired. Once the mast has been initiated, the Remote Control 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.

Note: When using Will-Burt Panel Mount Remote Control (PMRC), the push/pull switch funtionality is incorporated in the PMRC itself. The "KILL SW" switch (red) in the PMRC acts as "push" action and pushing the recessed "INITIATE SW" switch (green) acts as "pull" action as explained above.

3.4 REMOTE CONTROLS (HAND HELD AND PANEL MOUNT)

The Remote Control 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 Remote Control 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 Remote Control(s). Additionally, various states of the system will be passed to the Remote Control so that button status LEDs can give proper indication of the state of the Night Scan. 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. Another reason for a button status LED not being lit could be an actuator reaching the extent of its travel (or limit switch). Switches available to the operator are shown in Figure 3-4, 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)

In addition to the above switches, the Panel Mount Remote Control (PMRC) has the following two additional switches as shown in Figure 3-5.

- Kill
- Initiate

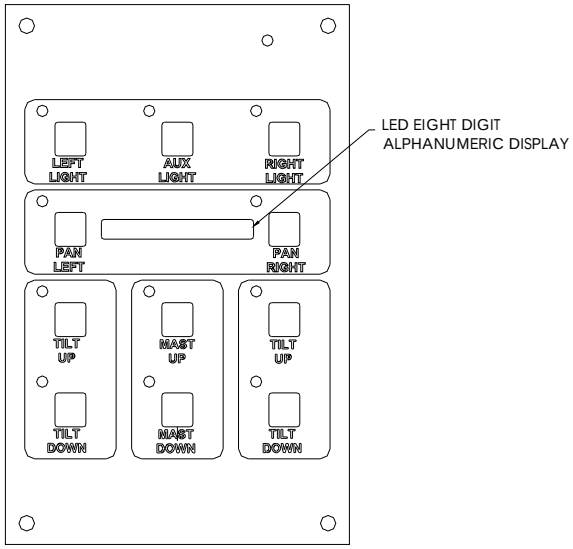


Figure 3-4 HHRC Keypad Layout

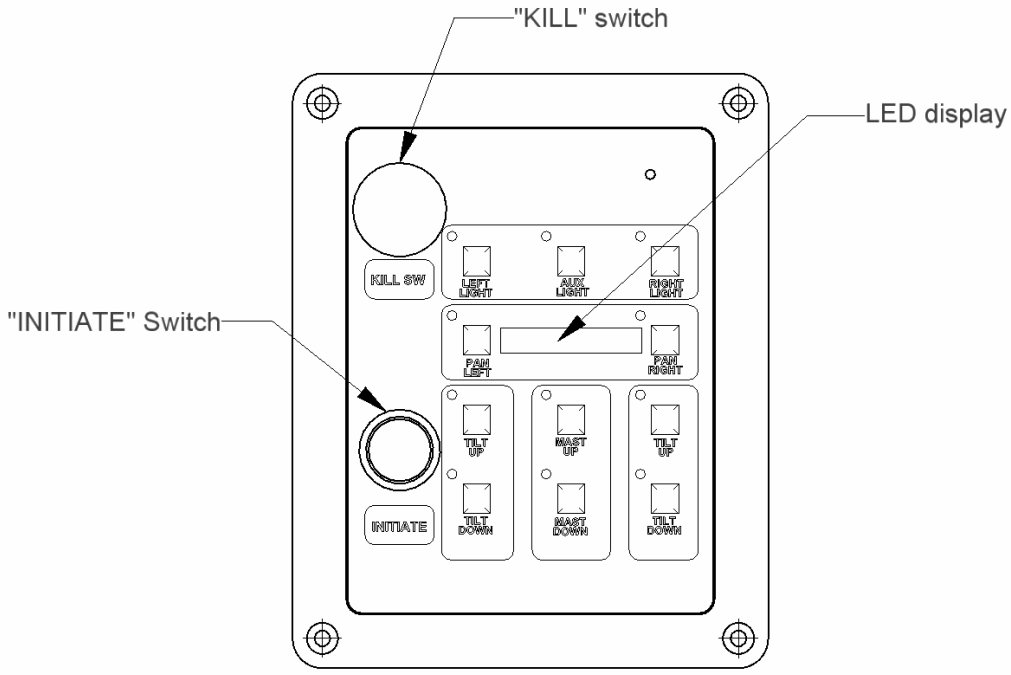


Figure 3-5 PMRC Keypad layout

Two special functions are implemented in software whereby the operator can initiate an unattended lowering and stowing of the mast, or an unattended partial raising of the mast. The Autostow 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 Remote Control(s). The Auto-Up function is accomplished by two rapid sequential activations of the “Mast Up” 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 Down” button or any other button on the Remote Control(s). The Auto-Up function will only bring the Powerlite from the horizontal stowed position up to the 90º position and turn the lights on. It will not raise the mast any further vertically on its own. The Auto-Up function is not available on the vertical Powerlite.

3.5 REMOTE CONTROL FUNCTION FOR PROFILER

The remote control supplied with Powerlite Profiler models is the same as that supplied with the standard dual tilt models. However, on the Profiler model, the lights may be toggled on and off using either the left or right light buttons. Similarly, the tilt function is available from either the left or right tilt buttons.

3.6 RAISING THE MAST

Operation of the mast using the Remote Control(s) 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 Remote Control(s) 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 Remote Control(s) goes dead.

Note: In the Night Scan Powerlite, during the process of raising the mast, the mast will first be inclined to a position perpendicular to its mounting surface by an actuator. Once the control senses it is in this position, air pressure will be applied to the tube sections to raise the mast further into the air. Lowering the mast is in reverse order. Air is vented from the tube sections reducing its height. Then the actuator declines the mast until it is finally stowed.

3.6.1 Auto-up Function (Night Scan Powerlite only)

With the Enhanced Powerlite, an “Auto-up” function has been added. This function can be initiated by giving two quick successive depressions of the “Mast Up” button (within ½ second). The mast will then raise to the 90° position and automatically turn on both banks of lights. This automatic sequence can be aborted by pushing any of the buttons on the Remote Control(s) at any point during the Auto-up sequence. The mast will not extend up by itself, but will await further operator input from the Remote Control(s).

3.6.2 D-Tec II Functionality

An optional D-Tec II sensor provides additional limited protection against raising the mast into power lines or physical obstructions. As soon as the mast begins raising, the control begins initiating the D-Tec II sensor and self-tests it until it either passes, or the mast reaches the point where the RCP becomes active (90° in the case of the normal Powerlite, or the first tube section in the case of a Vertical Powerlite). Assuming that it passes, the operator is then permitted to extend the mast. If the mast senses an

obstruction or a power line, the mast will stop extending even though the operator continues to push the "Mast Up" button. In each of these two cases, there will be a message displayed on the alphanumeric display of the Remote Control(s). If the operator believes the sensed condition to be false, they may clear it in either of two ways: momentarily initiating an "Autostow" function, or lowering the mast to the bottom of the 90° position. This will clear the alarm and allow the operator another chance to raise the mast to its full extension. The following messages may be displayed on the Remote Control(s).

Message	Meaning	Root Issue
D-Tec Testing	The D-Tec II sensor is performing a self-test.	The D-Tec II has repeatedly been trying to pass the self-test while moving to the RCP active position. Normally, it will pass one of these attempts and no message will be displayed. If not, once there it tries one more time to pass and this message will displayed during the self-test.
Power Line E-Field	The D-Tec II 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 Powerlite.
Power Line H-Field	The D-Tec II has sensed 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 Powerlite.
D-Tec Obstruction	The D-Tec II has sensed current some type of physical obstruction.	A physical obstruction may be in close proximity. If so, move the vehicle to a location away from the obstruction, and then redeploy the Powerlite.
D-Tec OSHA Limit	The D-Tec II 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 Powerlite.

3.7 AIMING THE REMOTE CONTROL POSITIONER

The positioner can be "aimed" by utilizing the pan and tilt buttons located on the Remote Control(s). 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.

3.8 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 Remote Control.

Note: To ensure proper seating of the RCP in Night Scan Powerlite saddle, the control watches for an increase of current from the actuator. Once this has been satisfied, the control will shut itself off. If by chance there is no increase in current and the actuator shuts off because of its internal limit switch, a fault message will be displayed.

Once the control has shut itself off, the Night Scan 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 you believe it is stowed. Illuminated buttons indicate that the**

unit is <u>not</u> 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.

3.9 EMERGENCY STOW

3.9.1 Emergency Stow (Loss of Power): For Night Scan Powerlite only

⚠ WARNING

Make sure all power has been disconnected from the Night Scan prior to manually lowering mast.

⚠ WARNING

Make sure lights have cooled completely before manually panning or tilting the RCP.

In the event of power loss or an unrecoverable error condition, the Night Scan Powerlite will automatically exhaust all air. However, the mast will NOT return to its fully stowed, horizontal position. This must be accomplished manually. It is required that two people perform this operation as the mast is very heavy and can cause severe injury or death if not done with extreme caution. It may be necessary to manually pan the RCP so that when it is manually nested, the lights do not make contact with the mounting surface or the saddle. To manually pan the unit, firmly grasp the RCP by the horizontal shafts and **slowly** rotate to a point perpendicular to the length of the base. Additionally, it may be necessary to manually tilt the lights to prevent damage when stowing the mast. Tilt the lights by grasping the top and bottom of the light bar and **slowly** rotating the lights such that they face down when fully stowed.

⚠ WARNING

Support the mast before removing shoulder screw! Once removed, the mast and light assembly is free to fall.

Remove the right side base cover (opposite look up light). Secure the mast in an upright position to prevent it from falling freely. **Remove the M3 set screw from the top of the actuator yoke**. Remove the M10 shoulder screw from the side of the yoke. CAREFULLY lower the mast down into the saddle. Secure the mast in this nested position before moving the vehicle.

3.9.2 Emergency Stow (With Power but due to HHRC failure or error conditions)

In the event of an HHRC failure or error condition that prevents normal mast operation, the Emergency Stow Pushbutton may be used to lower and nest the mast. The Emergency Stow Pushbutton is a small pushbutton located on the Base Circuit Board and is labeled “S2” on the circuit board. This pushbutton may be used to lower the mast without disconnecting the actuator from the mast, as long as the actuator is still functional.

⚠ WARNING

When using the Emergency Stow Pushbutton with active faults/errors, it will be TOTALLY up to the operator to assure safe operation.

⚠ WARNING

When using the Emergency Stow Pushbutton with active faults/errors, the operator must first manually pan the RCP and tilt the lights to their home positions before lowering the mast to prevent damage to the lights and the vehicle.

Remove the left side cover to access the Base Circuit Board. Switch “S2” is located a the top of the circuit board on the inward facing side.

With No Active Faults/Errors: The pushbutton on the Base Circuit Board will act just like the “Mast Down” button on the HHRC when pressed. The RCP will go to its home position and the mast will stow normally. Be sure to confirm that the RCP has moved to its home position before lowering the mast from the vertical position with the actuator. Movement will only occur when the button is pressed.

With Active Faults/Errors: The pushbutton on the Base Board will cause the actuator to lower the mast without regard to any faults, switches or system interlocks. It will be TOTALLY up to the operator to assure safe operation. The operator MUST first assure that the mast has been fully lowered by releasing the air in the mast (if it has not already been done automatically) and MANUALLY place the RCP in the appropriate (home) position before lowering the mast. The operator also MUST IMMEDIATELY STOP lowering of the mast when it touches the saddle as the software can no longer determine when it has reached the saddle. Movement will only occur when the button is pressed.

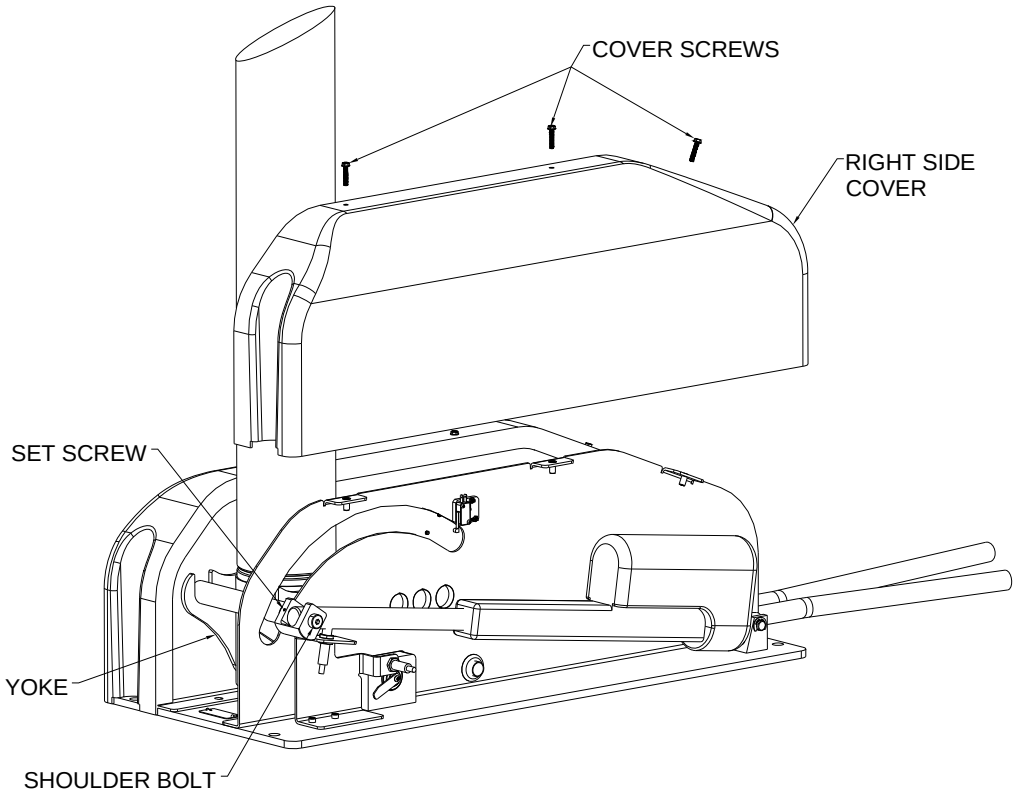


Figure 3-6 Cover and Screw Removal for Manual Stow (Night Scan Powerlite only)

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 Night Scan Powerlite 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 insure smooth operation and to 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 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 which 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 Night Scan Base and Remote Control Positioner (RCP)

⚠ WARNING

Make sure lights are completely cool before attempting to clean.

The exterior of the RCP and Night Scan base 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 90º Proximity Switch (Night Scan Powerlite only)

The proximity switch (sensor) is intended to stop the actuator when the mast is at 90 degrees when being raised. It senses the steel in the actuator shaft and signals the base circuit board to cut power when the actuator is in the correct position. In the event that this switch needs adjusted (i.e. after replacing the actuator) to stop the mast at 90 degrees, the following procedure must be followed. Use Figure 4-1 as an aid to identify the components.

1. Make certain that the Powerlite is level.
2. Remove the right hand base cover (opposite the look up light)
3. Loosen the upper jam nut to lower the switch approximately 1/8”.
4. Initiate the mast by pulling the Push-Pull switch on the junction box and raise the mast to 90 degrees. Verify that the mast is plumb using a level or check to see that it is square to the sheet metal side plate on the base.

5. Raise the switch until it senses the actuator. This will be indicated by 1) an audible “click” of the exhaust valve closing, 2) lights on the hand held will change state, indicating that RCP functions are available and 3) the LED on the proximity switch will light.
6. Secure the switch in position using the upper and lower jam nuts.
7. Cycle the mast several times, checking that the mast is plumb each time. Adjust the switch if necessary.
8. Replace cover.

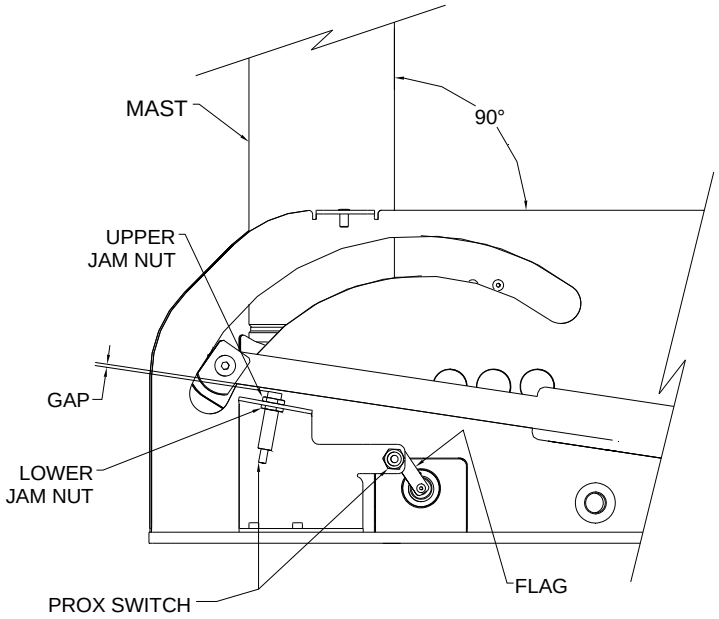


Figure 4-1 Proximity Switch Adjustment

4.3.2 **Adjusting the Magnetic Switch**

The Magnetic Switches are located on the mast base tube. In the Night Scan Powerlite, the magnetic switch senses a magnet located in the top tube and serves to indicate that the mast has exhausted all air and that it is safe to nest into the saddle. In the Powerlite Vertical, The upper magnetic switch senses that the top tube is extended and the lower switch senses when the mast is completely stowed. If the switch is out of adjustment, it will prevent the mast from nesting to the saddle from the 90 degree position. **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 4-6 for further instructions. If the 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 up approximately 1/8” and tighten band clamp.
2. Initiate the mast, if necessary, and press the down button 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 the circuit board for loose or disconnected wires. See schematics in section 4.4. If the wiring is intact, replace the magnetic switch.

4.3.3 **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 parallel to the axis of the mast and are facing downward when nested. In Profiler models, the lights should be face down when nested and parallel to the base plate of the Powerlite. On all models, the RCP shafts should contact the saddle simultaneously during nesting when correctly set. It should be noted that having the RCP covers off could 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 it to the 90-degree position. 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 (face down when nested) RCP cover to access the flags.
4. Refer to Table 5-3 and Figure 5-4 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 become bent.
6. It is important that the flags engage the correct photo interrupter when setting the home position, see Figure 4-2. 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 90 degrees. Replace the RCP cover.

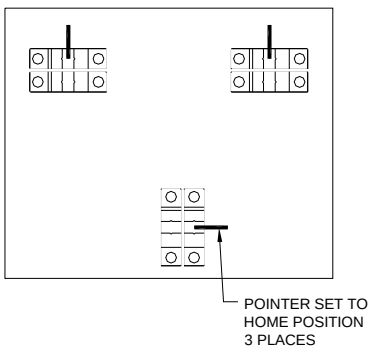


Figure 4-2 Flag Settings (Viewed from RCP front)

4.3.4 DIP switch setting

Powerlite base boards with software version 3.4 or newer require that the DIP switch be set appropriately to determine operational mode. RCP boards with software version 3.2 or newer require that the DIP switch be set appropriately to determine operational mode. This takes the place of setting the operational mode through software by changing a variable.

To set the operational mode for the Base board, locate the DIP switch S1 (see Figure 4-3) and set the DIP switch as follows:

- Position 1 - Close if a D-Tec II option is installed and is to be enabled.
- Position 2 - Close if the system is a Vertical Powerlite.
- Position 3 - Close if the system does not have an RCP (camera mast).
- Position 4 - DO NOT CLOSE

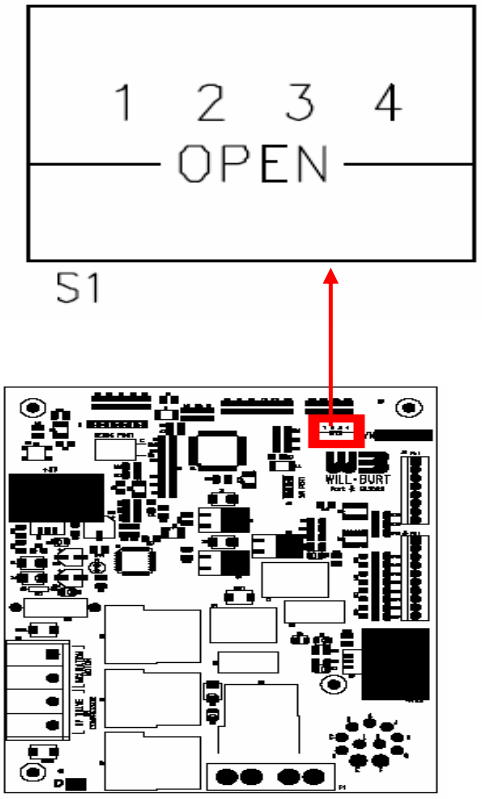


Figure 4-3 DIP switch location: Powerlite base board

To set the operational mode for the RCP board, locate the DIP switch S1 (see Figure 4-4) and set the DIP switch as follows:

- Position 1 - Close to cause the RCP to self stow if there is an error.
- Position 2 - Close if the system is a Profiler.
- Position 3 - (not presently used)
- Position 4 - (not presently used)

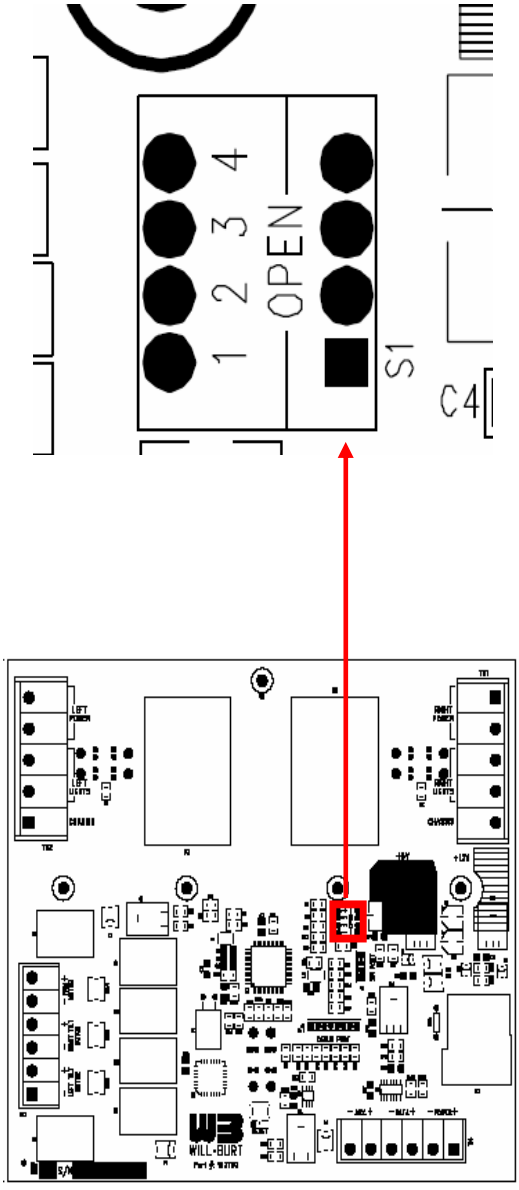


Figure 4-4 DIP switch location: Powerlite RCP board

4.4 SYSTEM SCHEMATICS

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

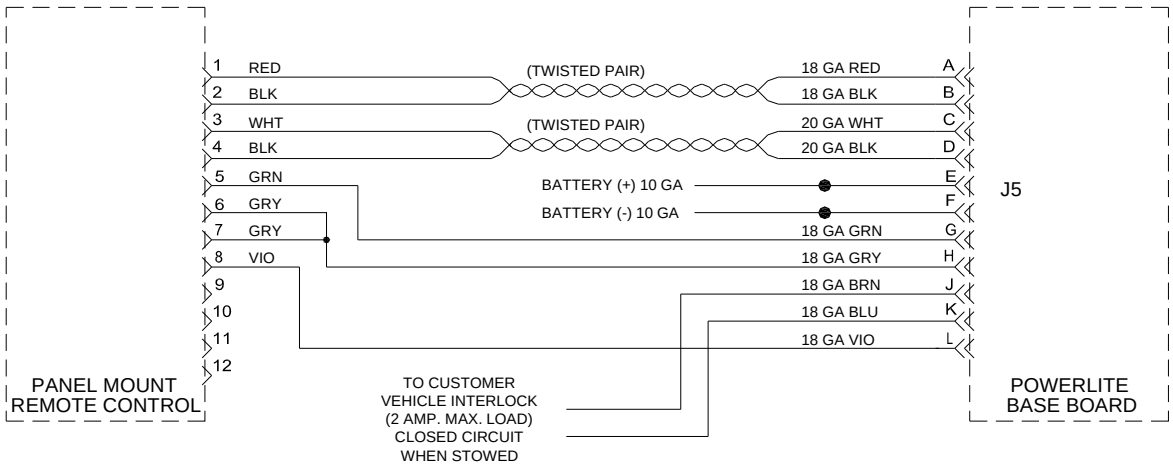


Figure 4-5 Panel Mount Remote Wiring

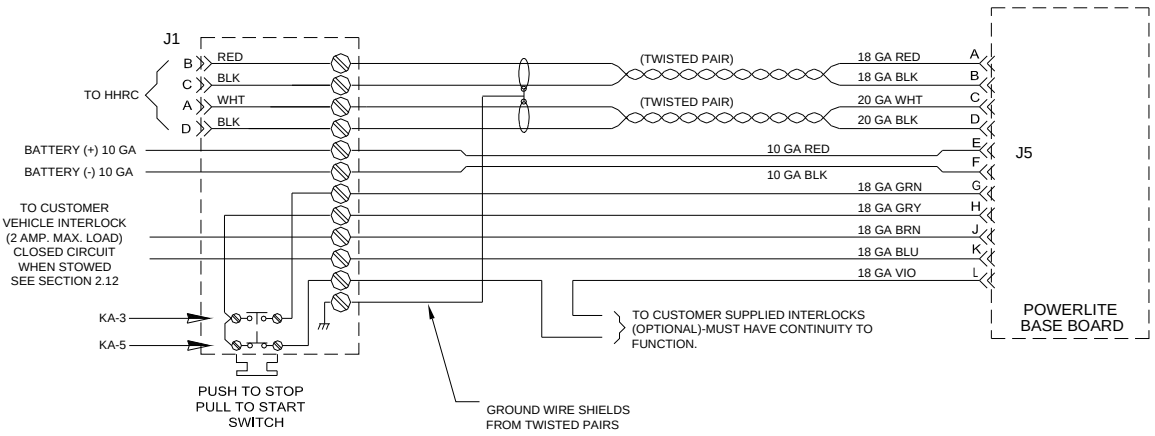


Figure 4-6 Hand Held Remote Wiring

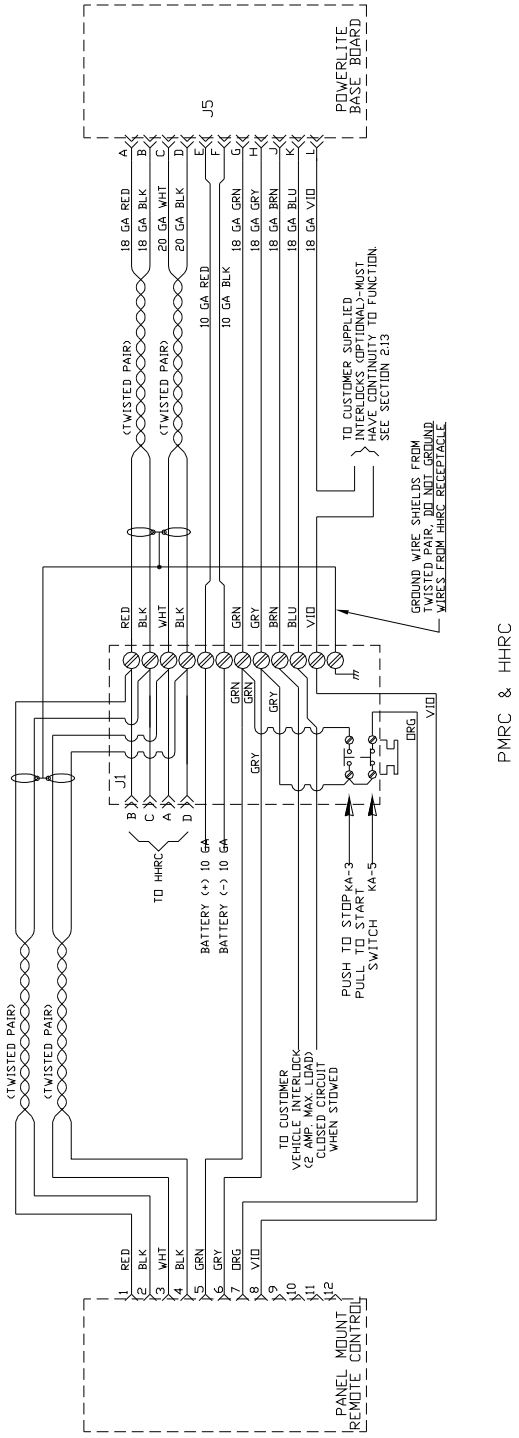


Figure 4-7 Panel Mount with Hand Held Remote Wiring

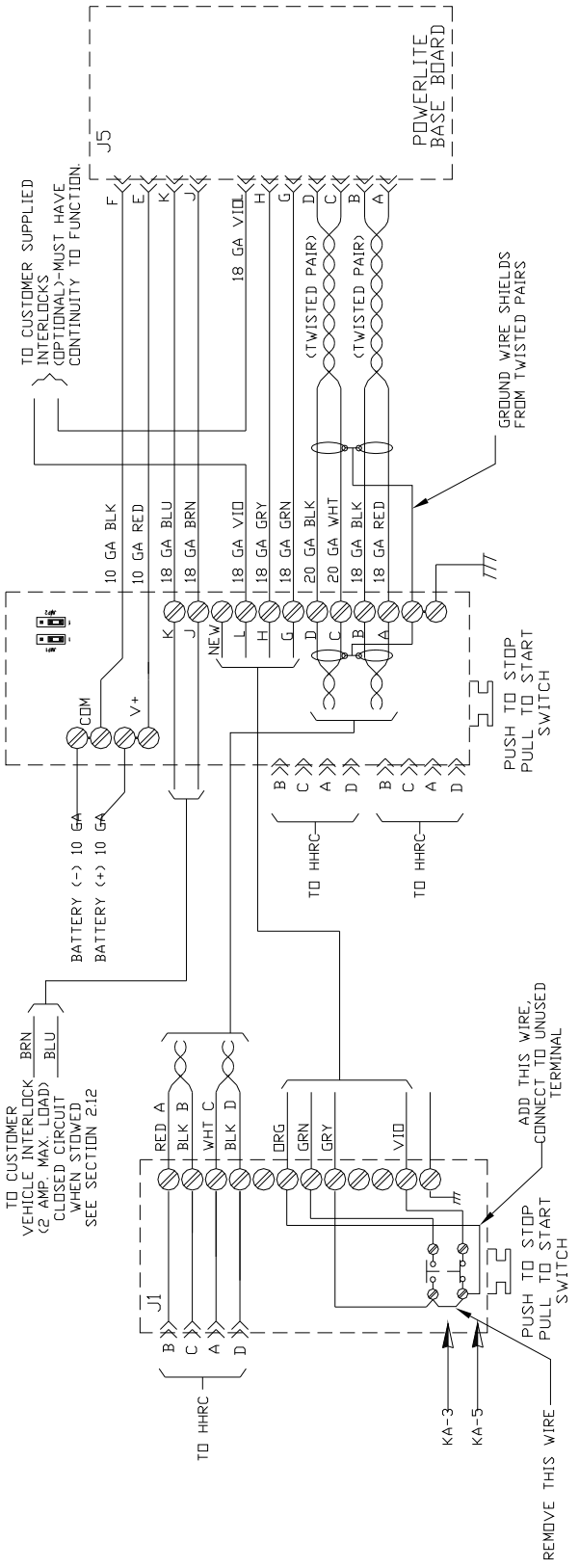


Figure 4-8 Hand Held Remote Junction Box to Wireless Junction Box Wiring

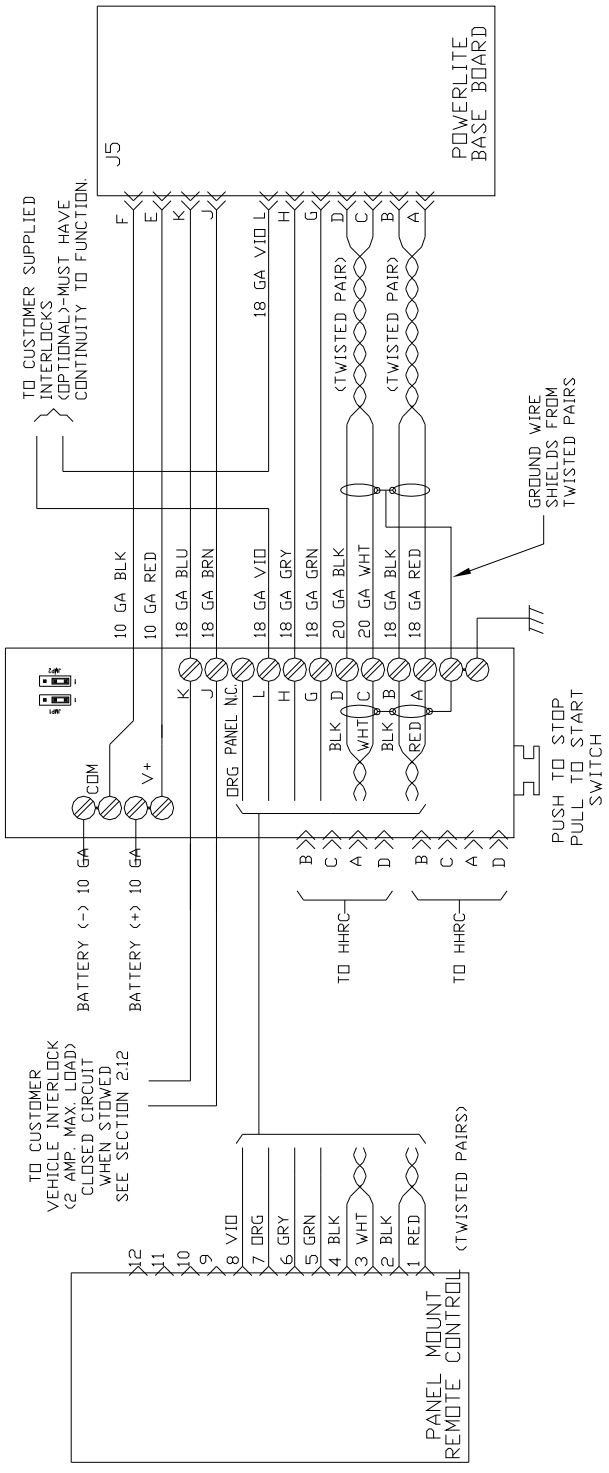


Figure 4-9 Panel Mount Remote to Wireless Junction Box Wiring

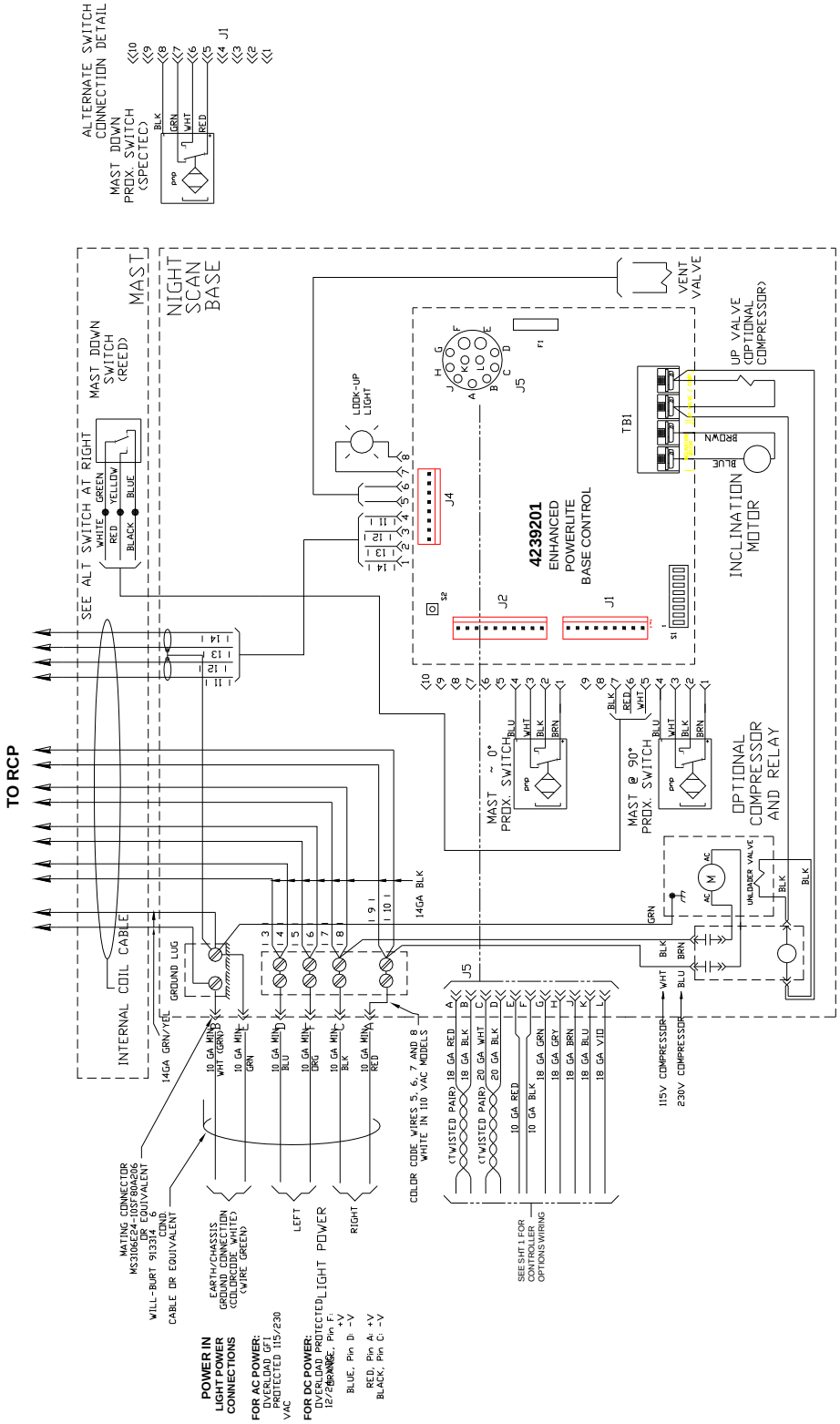


Figure 4-10 Night Scan Base System Schematic

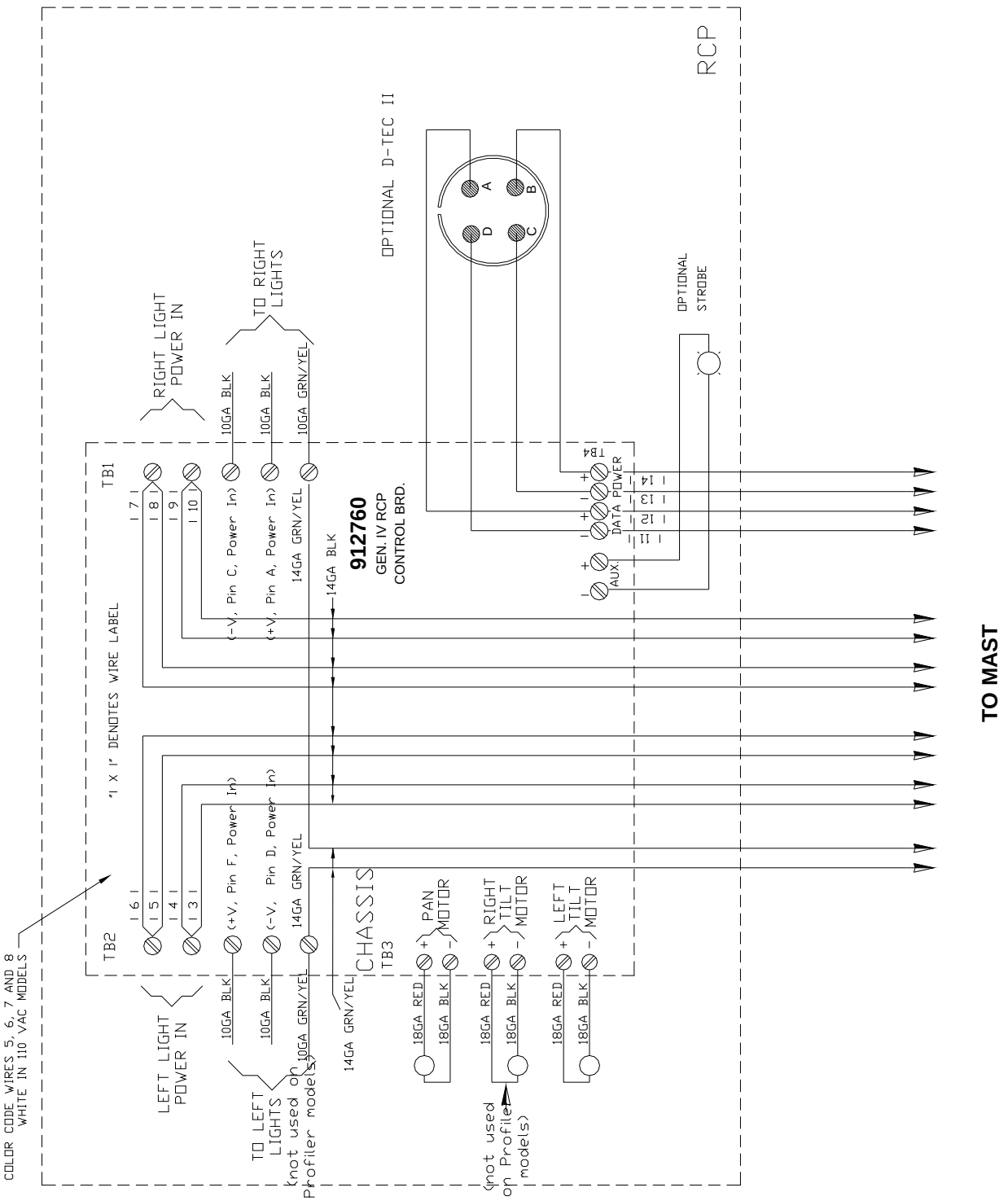


Figure 4-11 Night Scan Powerlite Remote Control Positioner (RCP) Schematic

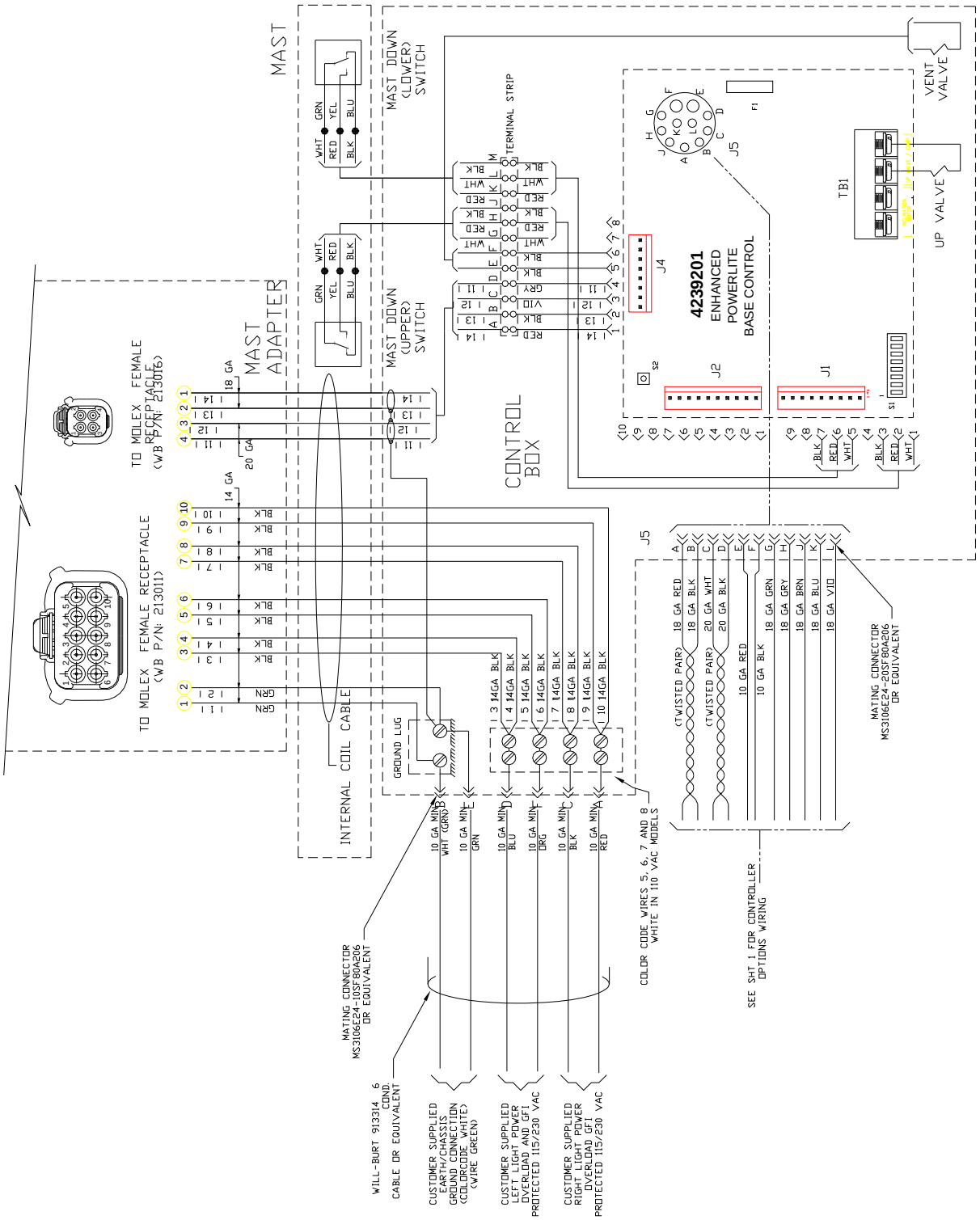


Figure 4-12 Vertical Powerlite Control Box and Mast Wiring

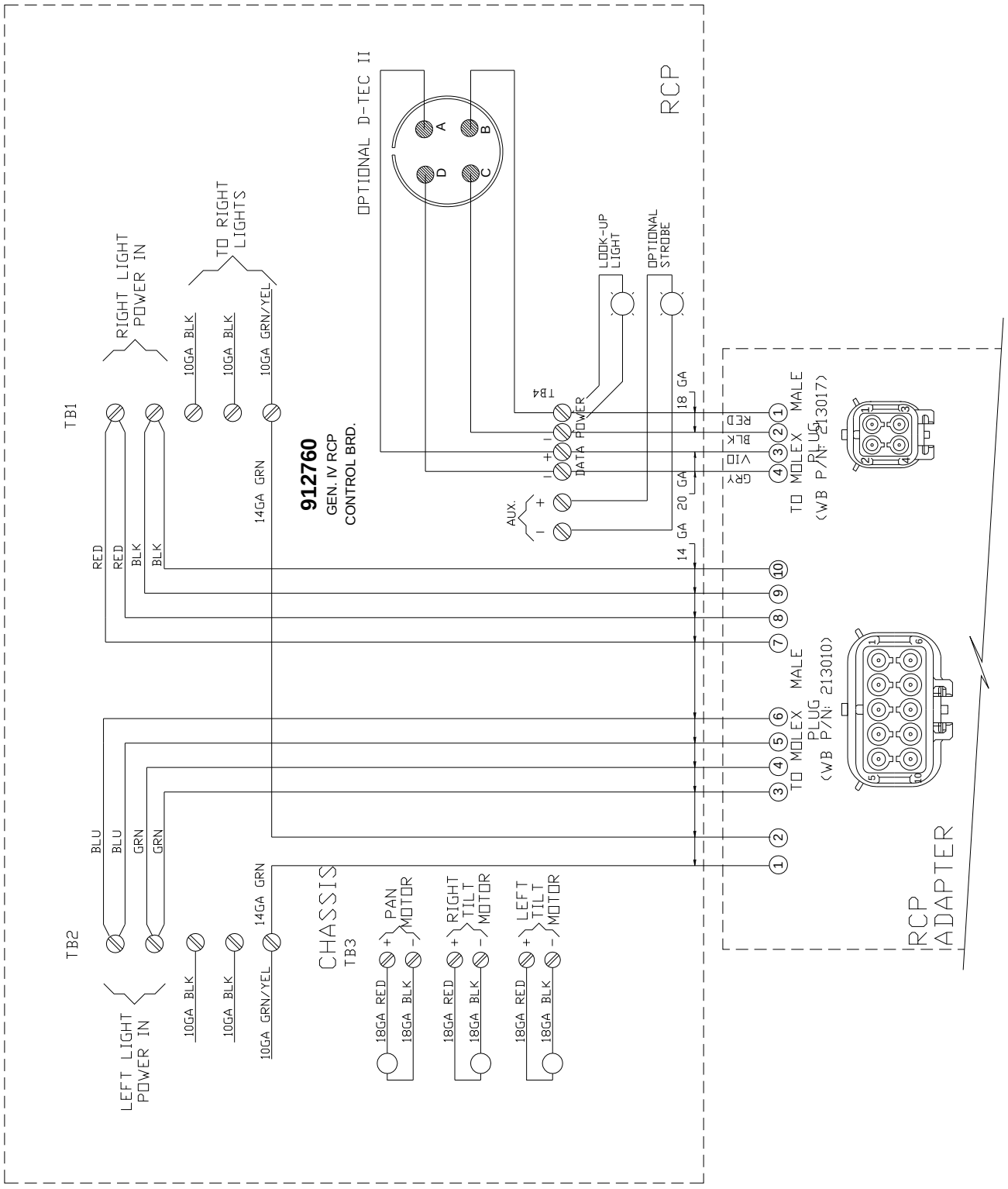


Figure 4-13 Vertical Powerlite Remote Control Positioner (RCP) Schematic

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 section 1.5.2 for DC power requirements). A good method of checking the voltage at the Powerlite is to connect a voltmeter to the wires in the junction box powering the Remote Control(s) (pins B and C of J1 (see schematics in section 4.4). 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 3-4). 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 except for error codes 5.xx, the mast will be allowed to move up to vertical where the RCP and lights will function, but the mast will not be allowed to extend vertically past that point. Faults may only be cleared by killing power to the Powerlite. This may be accomplished by momentarily pushing in the Push/Pull switch and then re-initializing. Additionally, the fault code is also flashed by a red status LED located on the Base board. For instance, if the fault code were 3,07, then the LED would flash three times, pause, flash seven times, pause longer, and the repeat the flash sequence. During normal operation, the LED should flash a slow steady on/off pattern. The codes are as follows:

4.5.2.1 Base Board

The Base board is located in the base 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 6 and 7 of J1 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 1,02	Mast Nested Proximity Switch Disagreement (Should never occur on Vertical Powerlites)	The proximity switch sensing the mast actuator at almost nested position has conflicting complementary outputs.	There may be a wiring problem, or a defective proximity switch. Check the voltages at black and white wires with respect to the blue wire. These two voltages should be opposite of each other as the proximity switch is activated and inactivated. The voltages should be close to battery voltage or close to ground. If they are not, replace the actuator almost nested proximity switch. Refer to system schematics in section 4.4

Err 1,03	Mast Nested Proximity Switch Wiring Error (Should never occur on Vertical Powerlites)	The proximity switch sensing the mast actuator at almost nested position appears to have its complimentary outputs wired backwards	This check is only made at power-up when the mast thinks it is nested. The black and white wires on the proximity switch may need to be swapped. The proximity switch not being energized could also cause it. Place a large piece of ferrous metal close to the switch to check before changing wiring. Refer to system schematics in section 4.4
Err 1,04	Excessive actuator current draw during nesting (Should never occur on Vertical Powerlites)	The current drawn by the actuator has exceeded a level of current greater that that required for proper nesting	Either a rigid object is in the way of the mast as its nesting, or the Mast Nested Proximity Switch is not being activated as the mast approaches the saddle. Check for foreign objects in the mast path, and confirm that the proximity switch is being properly activated.
Err 1,05	Well Open Switch Disagreement (Only should occur on Vertical Powerlites when a Well Open Switch is added by the OEM).	The Well Open Switch sensing the well doors' position has conflicting complementary outputs.	There may be a wiring problem or a defective switch. Check the voltages at J2 pins 6 and 7 with respect to pin 8. These two voltages should be opposite of each other as the Well Open Switch is activated and deactivated. The voltages should be close to battery voltage or close to ground. If they are not, replace the Well Open Switch. Refer to system schematics in section 4.4.
Err 1,06	Well Open Switch Wiring Error (Only should occur on Vertical Powerlites when a Well Open Switch is added by the OEM).	The Well Open Switch 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 6 and 7 of J2 may need to be swapped. The switch not being energized could also cause it. Refer to system schematics in section 4.4.
Err 1,07	Unrecoverable Communication Error	The Base board has not sent out communications recently	Indicates a software problem. Notify Will-Burt
Err 1,08	Software Fault	Internally detected error	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 EPROM 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 Powerlite base. Shim the saddle up as needed. Refer to section 2.4 for flatness requirement.
Err 1,12	Actuator 90° Proximity Switch Disagreement (Should never occur on Vertical Powerlites)	The proximity switch sensing the mast actuator at 90° has conflicting complementary outputs.	There may be a wiring problem, or a defective proximity switch. Check the voltages at J1 pins 2 and 3 with respect to pin 4. These two voltages should be opposite of each other as the proximity switch is activated and inactivated. The voltages should be close to battery voltage or close to ground. If they are not, replace the actuator 90° proximity switch. Refer to system schematics in section 4.4
Err 1,13	RCP Stow Magnetic Switch Disagreement (Only should occur on Vertical Powerlites)	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 J1 pins 2 and 3 with respect to pin 4. 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 system schematics in section 4.4
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 J1 pins 6 and 7 with respect to pin 4. 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 system schematics in section 4.4
Err 1,15	Actuator 90° Proximity Switch Wiring Error (Should never occur on Vertical Powerlites)	The proximity switch sensing the mast actuator at 90° 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 3 of J1 may need to be swapped. The proximity switch not being energized could also cause it. Place a large piece of ferrous metal close to the switch to check before changing wiring. Refer to system schematics in section 4.4

Err 1,16	RCP Stow Magnetic Switch Wiring Error (Should only occur on Vertical Powerlites)	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 3 of J1 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 system schematics in section 4.4
Err 1,17	Well Closed Switch Disagreement (Only should occur on Vertical Powerlites when a Well Closed Switch is added by the OEM).	The Well Closed Switch sensing the well doors' position has conflicting complementary outputs.	There may be a wiring problem or a defective switch. Check the voltages at J2 pins 2 and 3 with respect to pin 4. These two voltages should be opposite of each other as the Well Closed Switch is activated and deactivated. The voltages should be close to battery voltage or close to ground. If they are not, replace the Well Closed Switch. Refer to system schematics in section 4.4.
Err 1,18	Well Closed Switch Wiring Error (Only should occur on Vertical Powerlites when a Well Closed Switch is added by the OEM).	The Well Closed Switch 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 3 of J2 may need to be swapped. The switch not being energized could also cause it. Refer to system schematics in section 4.4.

NOTE: Both a Well Open Switch and Well Closed Switch with N.O. and N.C. contacts must be used if the Enhanced Base Board dip switch S1.4 is set for "Well Cover Present".

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	Unrecoverable Communication Error	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 system schematics in section 4.4)
Err 2,08	Software Fault	Internally detected error	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 4.3.3. If the flag is not in between, replace the RCP board

Err 2,10	Left Tilt Down Limit0	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 4.3.3. 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 4.3.3. 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 4.3.3. 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 4.3.3. 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 4.3.3. 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 Remote Control(s) Board

The handheld remote control (Remote Control(s)) board is located in the handheld unit and is assigned unit number three (3). In the case where there are two Remote Control(s)s, one of the two will be assigned the unit number six (6) during negotiation at power-up. Thus, that Remote Control will have error messages beginning with the number six instead of three (for instance – Err 6,07) The Remote Control(s) board may generate the messages of Table 4-3:

Table 4-3. List of Remote Control Board Faults

Message	Meaning	Root Issue	Potential Causes
Err 3,07 (Err 6,07)	Unrecoverable Communication Error	The Remote Control(s) board has not received communications from the base board recently	Bad or improper connection in communications link, or Remote Control(s) is not properly powered. Check continuity of the data lines from the DC power cable connector to the Remote Control(s) connector. Refer to system schematics in section 4.4. Check to make sure that the base board software is 2.6 or newer. Refer to section 0 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 6,08)	Software Fault	Internally detected error	Indicates a software problem. Notify Will-Burt
Err 3,09 (Err 6,09)	Internal Communication Fault	The Remote Control(s) has problems communicating with internal Remote Control(s) circuitry	Return Remote Control(s) to factory for repair

4.5.2.4 D-Tec II Sensor

The D-Tec II Sensor is an optional accessory that is mounted on the backside of the RCP. The sensor is not serviceable, so most issues will end with returning the sensor to Will-Burt for repair. The D-Tec II Sensor may generate the messages of Table 4-4

Table 4-4. List of D-Tec II Sensor Faults

Message	Meaning	Root Issue	Potential Causes
Err 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. Return the D-Tec Sensor to the factory for repair or replacement.
Err 5,03	SPI Fault	A communications bus internal to the D-Tec II sensor has failed during self-test.	If the fault persists, return the D-Tec Sensor to the factory for repair or replacement.
Err 5,07	Communication Fault	Communication has been lost with the D-Tec II sensor	Check connection (data lines, ground) for continuity. If the fault persists, return the D-Tec Sensor to the factory for repair or replacement.
Err 5,09	E-Field Fault	The Electric Field portion of the D-Tec II failed its self-test.	If the fault persists, return the D-Tec Sensor to the factory for repair or replacement.
Err 5,10	H-Field 1 Fault	One axis of the Magnetic Field portion of the D-Tec II failed its self-test.	If the fault persists, return the D-Tec Sensor to the factory for repair or replacement.
Err 5,11	H-Field 2 Fault	One axis of the Magnetic Field portion of the D-Tec II failed its self-test.	If the fault persists, return the D-Tec Sensor to the factory for repair or replacement.
Err 5,12	H-Field 3 Fault	One axis of the Magnetic Field portion of the D-Tec II failed its self-test.	If the fault persists, return the D-Tec Sensor to the factory for repair or replacement.
Err 5,15	Ultrasonic Fault	The ultrasonic portion of the D-Tec II failed its self-test.	Check for ultrasonic physical sensor or deflector damage. Return the D-TEC Sensor to the factory for repair or replacement.
Err 5,16	Supply Voltage Fault	The power supply section of the D-Tec II sensor is outside proper operational limits.	Check power connections, voltage level and induced noise on power source.

4.5.3 **Warning Codes**

Warning codes are presented on the LED eight-digit alphanumeric display (see Figure 3-4). 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 4-5. 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 errors detected	The Base board has received an erroneous communication but was able to recover	Improper shield connection at the junction box(es). Loose connection in the data lines.
WRN 1,04	Lookup Light Out.	The lookup light bulb is burned out and needs replaced.	Replace bulb. See Table 5-1 Parts List for the correct replacement bulb.
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 errors detected	The RCP board has received an erroneous communication but was able to recover	Improper shield connection at the junction box(es). Loose connection in the data lines.
WRN 3,01 (WRN 6,02)	Low Voltage Warning	The Remote Control(s) 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)	Dual HHRC Contention	One or more buttons are being pressed on each HHRC at the same time.	Only use one HHRC at a time
WRN 3,03 (WRN 6,03)	Communication errors detected	The Remote Control(s) board has received an erroneous communication but was able to recover	Improper shield connection at the junction box(es). Loose connection in the data lines.

4.6 TROUBLESHOOTING MECHANICAL

Table 4-6. 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.
Erratic or noisy when raising to 90 degrees	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. See section 0 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 actuator for binding. Replace actuator if binding.
Mast will not begin to lower from 90° position	Mast tube sections do not fully collapse	1) Extend and retract mast. 2) Check tube sections for damage. 3) Internal coil cord may be binding, contact Will-Burt.
Mast will not begin to lower from 90° position	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 PART LISTS

Table 5-1. Night Scan Powerlite Base Assembly Parts List

Mark No.	Description	Part Number
1	Base Circuit Board	4239201
		-
2	Air Inlet Hose Barb	-
3	Air Exhaust Hose Barb	-
4	AC Power Connector	914019
5	Circuit Board Bracket	913157
6	DC / Control Connector	-
7	Valve Assembly	913502
8	Upper Light Bracket	914099
9	Look Up Light Bulb, MR16, 20 Watt, 40 Degree Flood	913397
10	Bulb Socket	913420
11	Valve Mounting Bracket	913185
12	Base Left Side Wall	4143701
13	Actuator Set Screw, M3	3383
14	Actuator Shoulder Bolt, M10	3382
15	Proximity Sensor	913429
16	Proximity Sensor Mounting Bracket	4146901
17	Lower Pivot Block	913179
18	Actuator	4136301
19	Actuator Pivot Shaft	913196
20	Actuator Pivot Block	4138901
21	Base Right Side Wall	4139101
22	Yoke Weldment	4139401
23	Lower Light Bracket	914100
24	Compressor Assembly, 110 VAC	4059701
	Compressor Assembly, 220 VAC	4059702
N/A	Base Cover Right	913198
N/A	Base Cover Left, Standard	913199

	Base Cover Left, for Compressor Models	4118101
N/A	Handheld Remote Control	913255
N/A	Panel Mount Remote Control	915377
25	Mast Stow Flag	4158101

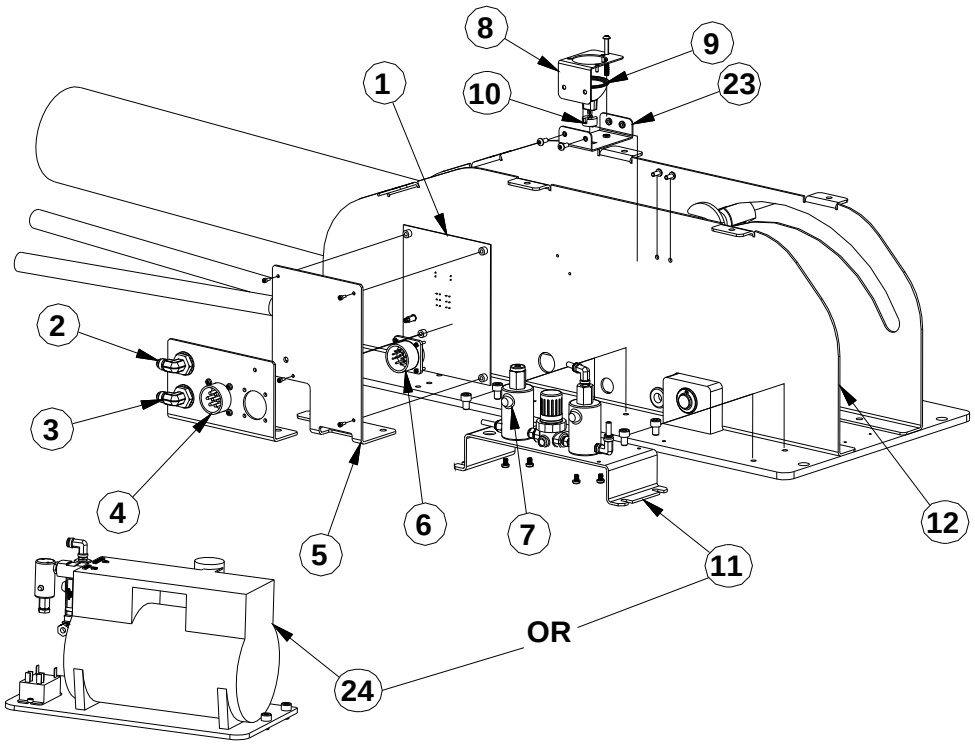


Figure 5-1 Exploded View - Base Left Side

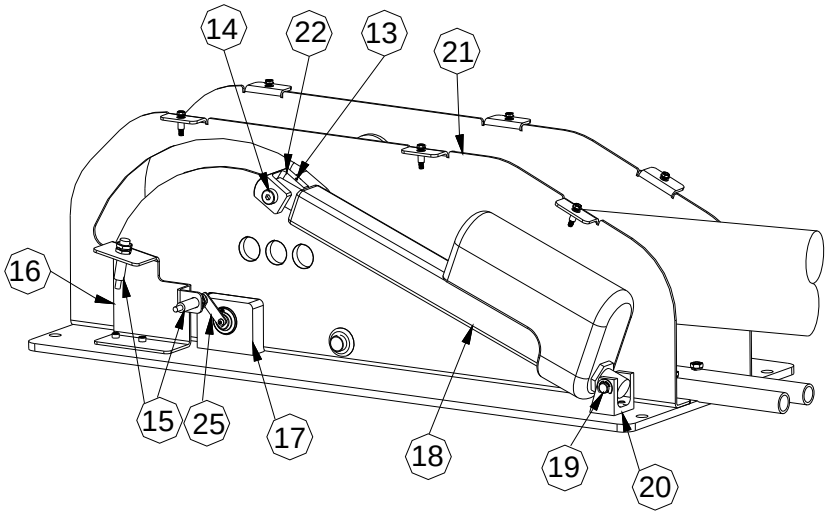


Figure 5-2 Base Right Side

Mark No.	Description	Part Number
1	Solenoid Valve Assembly	913502
2	NS Base PC Board	4239201
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

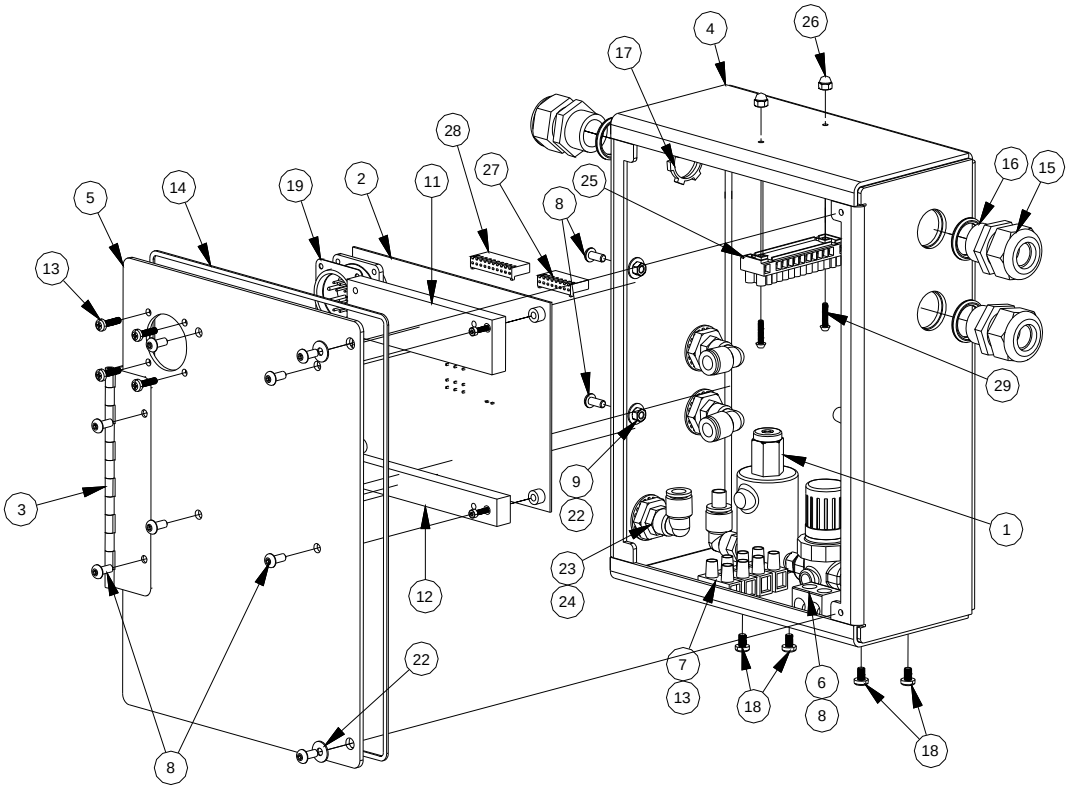


Figure 5-3 Exploded View - Vertical Powerlite Control Box

Mark No.	Description	Part Number
1	Remote Control Positioner Frame	913165
2	Circuit Board, Standard RCP	912760
	Circuit Board, Profiler RCP	914942
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	4158501
N/A	RCP Cover	913167
N/A	D-Tec II sensor	912672
N/A	D-Tec II Mounting plate To RCP	4043601
N/A	D-Tec II sensor cable to RCP	4004001

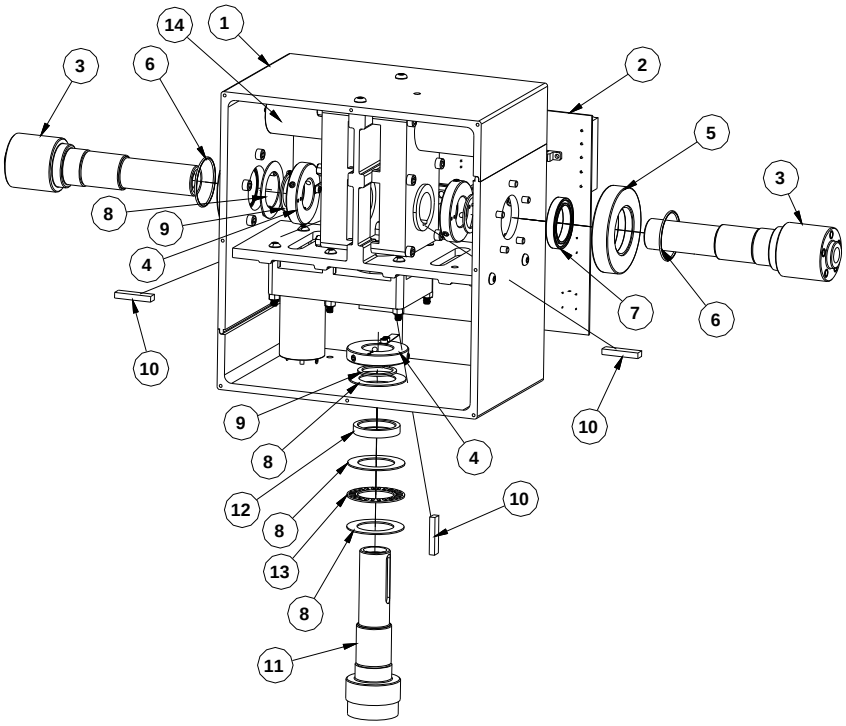


Figure 5-4 Exploded View - Remote Control Positioner (RCP)

CHAPTER 6
REVISIONS

Revision 1, July 2007: Initial Release.

Revision 2, December 2007: Updated RCP motor part number in Figure 5-3. Added statement re complete assembly required prior to power up in Section 2.4.2. Corrected 4 pin wire connections in Figure 4-12 and Figure 4-13.

Revision 4, April 2008:

1. Replace Wiring diagram with dwg # 42690 and 42691 (Fig 4-6 to 4-13)
2. Update Warning/Error codes
3. Update Figure 2.27 (DTec with wings)
4. Update part list (Table 5-1 and 5-2, 913002 to 4239201)
5. Update software revision
6. Add emergency stow switch functional description.
7. Remove Nested Signal Adapter Board (4146601) from Parts List.

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 Remote Control(s) 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 “1:4.0 2:4.2 3:4.1 5:2.07 6:4.2”. This would indicate that board 1 (the base board) has revision 4.0, board 2 (the RCP board) has revision 4.2, board 3 (a Remote Control board) has revision 4.1, board 5 (the D-Tec II Sensor board) has revision 2.07, and board 6 (a second Remote Control board) has revision 4.2. To date, all software revisions are backward compatible, and require no hardware changes.

Table 7-1. Software Revision Log

Board	Board No.	Revision	Comments	Compatibility Issues
HHRC (PMRC)	3	2.0	Initial Release to production	None
HHRC (PMRC)	3	2.1	Added factory test routines	None
HHRC (PMRC)	3	3.0	Major Release to add several functions. See Base Revision 3.0. Added Low Voltage warning.	None (Although two Remote Control(s)s require version 3.0 Base software or newer)
HHRC (PMRC)	3	3.1	Improved error recovery for communication noise tolerance, updates for D-Tec II, added auto-up message	None (Although two Remote Control(s)s require version 3.0 Base software or newer)
HHRC (PMRC)	3	3.2	Enhanced dual Remote Control(s) detection	None (Although two Remote Control(s)s require version 3.0 Base software or newer)
RCP	2	2.0	Initial Release to production	None
RCP	2	2.1	Added factory test routine	None
RCP	2	2.2	Added Profiler capability via settable data bit	None
RCP	2	3.0	Major Release to add several functions. See Base Revision 3.0. Corrected some Error Code functions. Added Low Voltage warning.	None
RCP	2	3.1	Improved error recovery for communication noise tolerance	None
RCP	2	3.2	Change to configure via DIP switches (see section 4.3.4)	None (with the exception that operational mode must be now set with DIP switch)

RCP	2	3.3	Fix for stow-on-fault logic not always stowing	None (with the exception that operational mode must be now set with DIP switch)
RCP	2	3.4	Changed handling of 24 volt drive of motors and relays	None (with the exception that operational mode must be now set with DIP switch)
Base	1	2.0	Initial Release to production	None
Base	1	2.1	Added factory test routine	None
Base	1	2.2	Added code to prevent premature actuator retraction if unit came off of 90° limit switch (wind gust, etc.)	None
Base	1	2.3	Added code to prevent RCP stowing if momentary loss of 90° limit switch (wind gust, etc.)	None
Base	1	2.4	Added code to latch the vertical state to further strengthen false retractions or stowing	None
Base	1	2.5	Relax communication startup and error recovery timing	None
Base	1	2.6	Reworked current sense algorithm to correct occasional incomplete nesting. Added time at nesting to confirm proper state of the Nested output contacts	None
Base	1	2.7	Improved recovery from dissimilar board power-up times. Reduces communication faults at power-up.	None
Base	1	2.8	Improved handling of internal compressor units to minimize surge currents.	None
Base	1	3.0	Added support for D-Tec II, dual Remote Control(s)s, 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	Requires dual output magnetic switch on mast
Base	1	3.1	Improved recovery from dissimilar board power-up times. Reduces communication faults at power-up.	Requires dual output magnetic switch on mast
Base	1	3.2	Improved handling of internal compressor units to minimize surge currents.	Requires dual output magnetic switch on mast
Base	1	3.3	Improved error recovery for communication noise tolerance, improved stow algorithm, improved factory test, updates for D-Tec II, added auto-up function (tilt mast only)	Requires dual output magnetic switch on mast
Base	1	3.4	Change to configure via DIP switches (see section 4.3.4), misc. changes for vertical masts,	Requires dual output magnetic switch on mast and mode set via DIP

				switch
Base	1	3.5	Fix anomaly when vertical mast with D-Tec powered up.	Requires dual output magnetic switch on mast and mode set via DIP switch
Base	1	3.6	Chg vertical mast stow status to support hatch cover	None
Base	1	4.1	Release for enhanced Powerlite, added RF support and auto-detect support for mast nest limit switch	None
Base	1	4.2	Treat a direction reversal during auto-up/auto-stow as a stop command to prevent current spiking	None
Base	1	5.0	Initial release to production of redesigned Base Board (new part number: 4239201) (4/21/08)	Requires Enhanced Base Board, (p/n 4239201)
HHRC (PMRC)	3	4.3	Initial board release for RF module support (not production release)	None
HHRC (PMRC)	3	4.4	Fix EEPROM re-init, debug mode exit, addition of check board id	None
Base	1	4.3	Fix transceiver enable timing	None
HHRC (PMRC)	3	4.5	Fix transceiver enable timing	None

7.1

CHAPTER 8
APPENDICES

8.1 AUTOMATED HATCH COVER FOR VERTICAL POWERLITE

Some integrators may want to put the Vertical Powerlite in a well and include a hatch cover that would be automatically opened by the Powerlite. The schematic below gives one example of how this might be implemented. The relay K1, both limit switches, and hatch solenoid valves are all supplied by the integrator. The theory of operation is as follows:

When the Powerlite is initiated and the up button pressed, the Powerlite will open its “mast inactive” contact between pins J and K of the DC/Control Cable (see Figure 2-18 and Figure 4-6) thus de-energizing K1. This will apply pressure to the air valve to open the hatch. As soon as the hatch cover moves off the “Hatch Closed” limit, the switch will open and the warning light will come on. (The “Hatch Closed” limit switch is wired to take the place of the Powerlite “mast inactive” contacts.) Once the hatch is fully opened, the “Hatch Open” limit switch will close allowing the up valve of the mast (part of the system supplied by Will-Burt) to be energized and the mast will extend. Stowing of the mast reverses this process. When the mast is completely lowered, the Powerlite system will de-energize itself and close the “mast inactive” contact between pins J and K of the DC/Control. This will energize relay K1 removing power to the hatch open valve and energize the hatch close valve. Once the hatch is completely closed, the “Hatch Closed” limit switch will close and turn off the warning light.

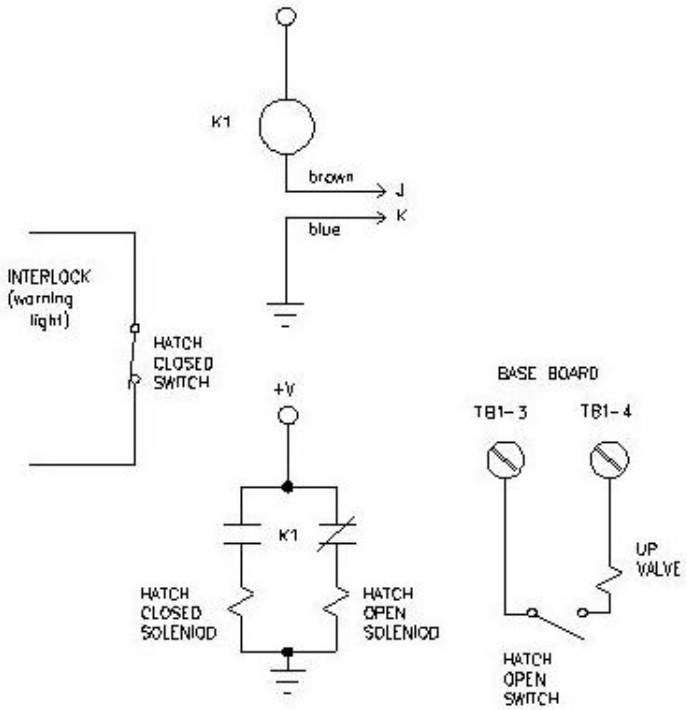


Figure 8-1 Automated Hatch Cover Control for Vertical Powerlite Schematic