

**WB**  
WILL-BURT  
**DTEC**  
OPERATOR'S MANUAL



Sensor (P/N: 5354901) Shown



Rack Mount Display (P/N: 5354801) Shown



Wall Mount Display (P/N: 5354701) Shown

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Original Instructions

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## Safety Summary

This section describes safety precautions for the D-TEC Safety System. These are recommended precautions that personnel must understand and apply throughout many phases of installation, operation, transportation, maintenance, storage, and troubleshooting. Be sure to read and understand the entire manual, and contact The Will-Burt Company with any questions, before performing any procedure outlined in this manual.

## Signal Word Definitions

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 Instructions

The following are general safety precautions that are not related to any specific procedures. These are recommended precautions that personnel must understand and apply throughout installation, operation, transportation, maintenance, storage, and troubleshooting. Additional precautions that apply to specific procedures and steps may be listed with the procedure or step to which they apply.

### 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. Be sure to allow sufficient clearance on all sides of the mast to allow for side sway. 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 D-TEC.



**⚠ 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**

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

**⚠ WARNING**

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

**⚠ WARNING**

**Health and Safety Hazard!** Solvent used to clean parts is potentially dangerous. Follow solvent manufacturer's safety procedures and recommendations. Avoid inhalation of fumes and also prolonged contact to skin. Death or serious injury could occur if solvents are not handled properly.

**⚠ WARNING**

**Safety Equipment!** Helmets or hard hats, eye protection, gloves, and safety shoes must be properly worn while working in the deployment area. Death or serious injury could result if proper safety equipment is not properly worn.

**⚠ WARNING**

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

- The mast area is free of personnel and mechanical obstruction
- All electrical cables are undamaged and properly terminated
- The operator has full view of the mast during use
- Any transit tie-downs on the payload have been removed
- The vehicle is not moving
- The Magnetic Warning Kit is installed on a vehicle
- The area above the mast is free of mechanical obstructions and electrical power lines

**⚠ WARNING**

**Equipment Hazard!** Do not raise mast while vehicle is in motion. Do not move vehicle while mast is extended.

**⚠ WARNING**

**Equipment Hazard!** Do not allow objects to strike unit.

**⚠ WARNING**

**Pinch Point Hazard!** Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

**⚠ WARNING**

**Crush Hazard – Mast Failure!** 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**

**Safety Instruction – Operation!** Lamps are extremely hot when operating 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.

## Symbols

The following are symbols that are used with the system and their meaning. Symbols are provided for quick reference only. Read the label information with the symbols for additional safety information. Contact The Will-Burt Company with any questions before performing any procedure outlined in this manual.



This symbol indicates an electrocution hazard. In the case of this particular unit, it indicates the presence of DC power.



This symbol indicates a general warning.

## Section 1 Introduction

Review this manual in its entirety. Contact The Will-Burt Company with any questions before performing any procedure outlined in this manual. The views depicted in this manual are provided for clarification and are subject to change without notice. Views are not to scale.

This manual describes installation, operation, maintenance, and troubleshooting procedures for the D-TEC Safety System.

This manual is for the following D-TEC Safety Systems:

- P/N: 5354501 (Rack Mount D-TEC System)
- P/N: 5354601 (Wall Mount D-TEC System)

This manual is not for the following D-TEC Safety Systems:

- P/N: 4370401 (Obsolete Rack Mount D-TEC System)
- P/N: 4370402 (Obsolete Wall Mount D-TEC System)

Contact The Will-Burt Company for information on these and other Will-Burt products.

The D-TEC is a safety device which:

- Mounts at the highest point of the mast/payload configuration
- Provides overhead power line detection
- Provides above-the-mast illumination

This unit is intended as a safety tool and in no way is a substitute for common sense and caution.

### 1.1 Safety Precaution Notification

Refer to the Safety Summary for precautions to be observed while installing, operating, or maintaining this equipment.

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## 1.2 Manual Organization

This manual is organized into the following sections:

Section 1 Introduction

Section 2 Installation

Section 3 Operation

Section 4 Maintenance

Section 5 Troubleshooting

Section 6 Reference

## 1.3 Definitions of Terms

Throughout this manual, the following terms are used:

- D-TEC stands for the entire D-TEC Safety System (Sensor, Display, Installation Kit, and Installation Bracket)
- Mast refers to the telescoping structure that raises the payload
- Payload stands for the object or equipment being raised by the mast to an operational height

See Section 6.2 for an Extended Glossary of Terms used within this manual.

## 1.4 Specifications

Table 1-1 lists specifications for the D-TEC.

Table 1-1 D-TEC Specifications

Functional Characteristic	Specification*
Detection	Simultaneous Electric Field and Electromagnetic and Electrostatic (Magnetic Field) Detection
Minimum Voltage Detection	2.3 Kilovolts/Meter at 0° (Reduced with angle)
Detection Frequency Range	47 Hz to 70 Hz
Look-Up Light	LED
Input Voltage	11 to 33 VDC
Power Requirements	12 VDC 10 Amps or 24 VDC 5 Amps
Interconnecting Cable	2 twisted pair shielded (Sensor to Display)
Operating Temperature Range	-40°C to 71°C (-40°F to 160°F)
Duty Cycle	100%
Sensor Unit (P/N: 5354901)	
Dimensions (L x W x H)	5 x 3.6 x 5.6 inches (127 x 92 x 141 mm)
Approximate Weight	3 lb. (1.4 kg)
IP Rating	IP67
Rack Mount Display (P/N: 5354801)	
Dimensions (L x W x H)	19 x 6.089 x 1.75 inches (483 x 154.7 x 44.5 mm)
Approximate Weight	2.1 lb. (0.95 kg)
Wall Mount Display (P/N: 5354701)	
Dimensions (L x W x H)	8.661 x 4.784 x 4.173 inches (220 x 121.5 x 106 mm)
Approximate Weight	4.4 lb. (2 kg)
IP Rating	IP65
* Note:	
<ul style="list-style-type: none"> <li>• Dimensions and specifications are provided for reference only and are not intended for vehicle design purposes.</li> <li>• Specifications may be subject to change without notice.</li> </ul>	

## 1.5 Major Components

The major components of the system are:

- (1) Sensor (P/N: 5354901)
- (1) Rack Mount Display (P/N: 5354801) (For Rack Mount Kits only)
- (1) Wall Mount Display (P/N: 5354701) (For Wall Mount Kits only)
- (1) Installation Kit (P/N: 5523901)
- (1) Installation Bracket
- Air Control Valve Kit (For Pneumatic Masts Only)

### 1.5.1 Sensor (P/N: 5354901)

The Sensor (Figure 1-1):

- Mounts to the top of the mast
- Has two detection modes that operate simultaneously:
  - Electric Field (E-Field) detection to sense the presence of nearby high voltage AC
  - Magnetic Field (H-Field) detection to sense the presence of nearby high current AC
- Includes a Look-Up Light composed of two ultra-bright white LEDs. An ambient light sensor interacts with these to ensure they only illuminate when it is dark.
- Communicates with the Display over an RS-485 link (Section 1.5.2 or Section 1.5.3)
- Allows or disallows the operator to extend the mast based on electric field and magnetic field detection, but does not provide direct power to the mast
- Performs self-diagnostic routines each time the unit is powered up

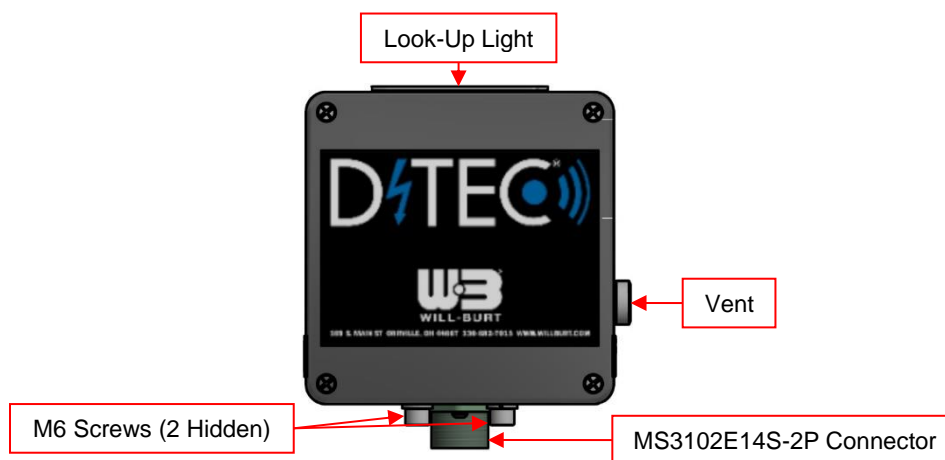


Figure 1-1 Sensor

For the E-field sensor to trip the field alarm, the voltage source must be from a single power line (insulation does not matter) without being twisted or shielded with neutral, ground, or any other opposite phase power line. This source configuration matches standard transmission line configurations. E-Field effect from a power line is squashed when twisted or run in close proximity with neutral, ground, or another line. The sensor is designed to alarm with standard transmission line configurations. These configurations have enough space between opposing phases and ground to allow for reliable E-Field sensing. A single line with 208 VAC without the presence of neutral or ground is enough to alarm the sensor when in very close proximity to the enclosure. This single line of 208 VAC can be used to test the D-TEC installation when placed in close proximity to the top of the D-TEC sensor.

### 1.5.2 Rack Mount Display (P/N: 5354801) (Rack Mount Kits only)

The Rack Mount Display (Figure 1-2):

- Is mounted inside the vehicle on a rack mount
- Is wired into the mast Air Control Valve (pneumatic masts) or the Stiletto Control (Stiletto masts)
- Stops mast extension in the event of a hazardous condition
- Communicates with the Sensor over an RS-485 link (Section 1.5.1)
- Operates as the communications master with the Sensor (The Display initiates all communication)
- Includes an eight character alphanumeric LED display, a speaker output for audible alarms and messages, inputs for switches, and a relay to enable or disable operator engagement of a remote Air Control Valve (for raising the mast)
- Performs self-diagnostic routines each time the unit is powered up

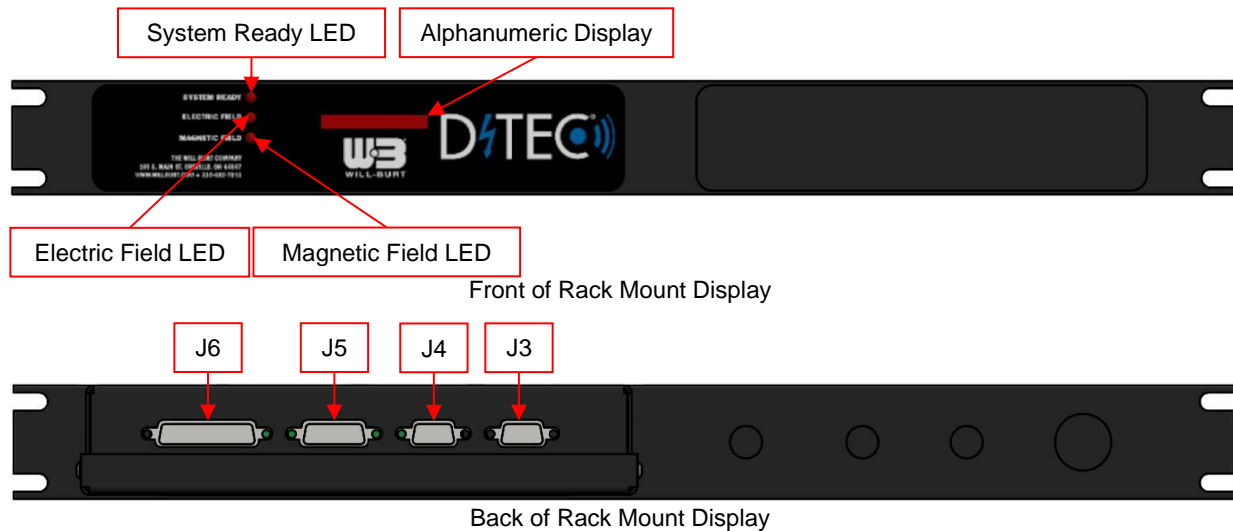


Figure 1-2 Rack Mount Display

### 1.5.3 Wall Mount Display (P/N: 5354701) (Wall Mount Kits only)

The Wall Mount Display (Figure 1-3):

- Is mounted inside the vehicle on a wall
- Is wired into the mast Air Control Valve (pneumatic masts) or the Stiletto Control (Stiletto masts)
- Stops mast extension in the event of a hazardous condition
- Communicates with the Sensor over an RS-485 link (Section 1.5.1)
- Operates as the communications master with the Sensor (The Display initiates all communication)
- Includes an eight character alphanumeric LED display, a speaker output for audible alarms and messages, inputs for switches, and a relay to enable or disable operator engagement of a remote Air Control Valve (for raising the mast)
- Performs self-diagnostic routines each time the unit is powered up

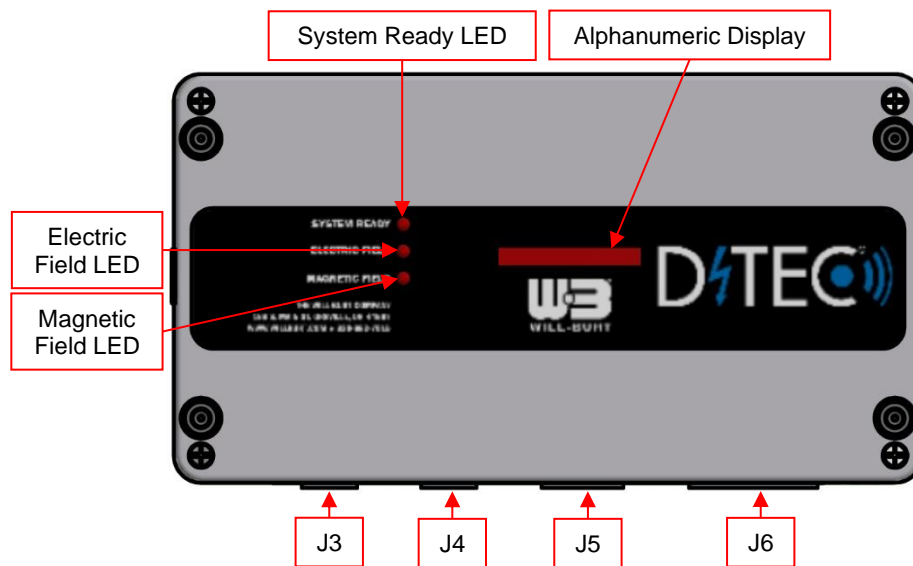


Figure 1-3 Wall Mount Display



### 1.5.4 Installation Kit (P/N: 5523901)

The Installation Kit (Table 1-2) is used to assist in installation of the system.

*Table 1-2 Installation Kit*

P/N	Description	Qty	Usage
3597	Cap Screw ¼-20x4.00 PHIL PAN HD-SSTL	4	Mounting Screws
900711	Electrocution Hazard Warning Label	1	Provides warning about electrocution hazards.
5526701	D-TEC Warning Label	1	Provides general safety precautions.
911960	D-TEC Override Danger Label	1	Provides overriding warning.
000021-503-501	5 Amp Fuse	1	Installed inline with power supply.
901723	Inline Fuse Holder	1	Installed inline with power supply.
34061	Cable Tie (Clear)	20	Used to secure cables inside the vehicle.
901765	Cable Tie (Black, UV Rated)	80	UV rated cable ties are used to secure cables outside the vehicle.
908510	3-Position Toggle Switch	1	Used to operate the mast.
000016-400-101	Keylock Switch Operator 22mm	1	Used to override alarms.
000013-202-005	4-Pin Plug (MS3106E14S-2S)	1	Connects 2 PR D-TEC Custom Cable to Sensor.
000016-300-101	Mushroom Operator 22mm	1	Used to clear and override alarms.
000016-901-101	Mounting Base with Normally Opened Contact 22mm	2	
000018-500-001	2 PR D-TEC Custom Cable	150 ft.	Connects to the Sensor.
000018-520-301	Jacketed 2-Conductor Cable	100 ft.	Connects to Speaker.
000023-000-440	Speaker (30 W Compact Horn)	1	Used to announce alarms
911184	Shipping Carton	1	Packaging
915169	Toggle Switch (MS35058-22)	1	Power Switch
000013-109-003	DB9 Plug with Pigtail	1	Connects to J3 on the Display.
000013-125-002	DB25 Plug with Pigtail	1	Connects to J6 on the Display.
901193	10 Circuit Terminal Block	3	Used to assist in electronically connecting D-TEC components.
TP-5522901	D-TEC Operator's Manual	1	Provides general information on the operation of the D-TEC.
WD-5354501	D-TEC Wiring Diagram	1	Provides information on system wiring.

### 1.5.5 Installation Bracket

The 18 inch (45.72 cm) Installation Bracket (Figure 1-4) is used to position the Sensor above the payload.

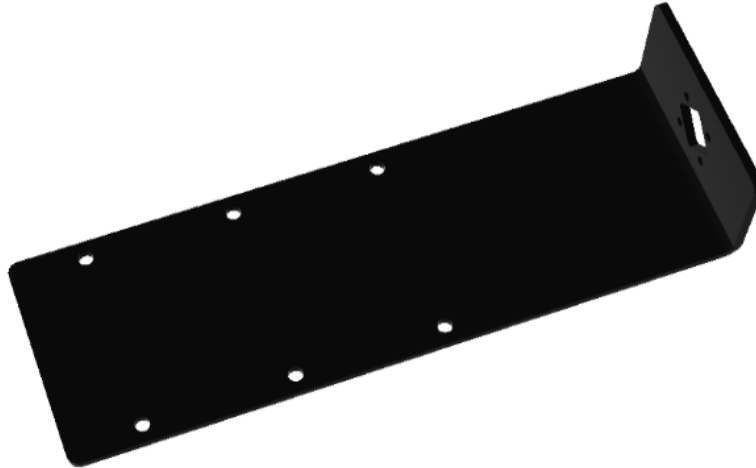


Figure 1-4 Installation Bracket

Table 1-3 lists Installation Bracket options.

Table 1-3 Installation Bracket Options

P/N	Description*
5524101	18" Black Powder Coat Installation Bracket (Standard Version)
5524102	18" White Powder Coat Installation Bracket
* Note: The current version of D-TEC Sensor is smaller than the previous version of the D-TEC Sensor. To allow for easy retrofitting of old-style systems to the current system, the D-TEC now ships standard with an 18 inch (45.72 cm) Installation Bracket rather than the previously used 14 inch (35.56 cm) bracket. Using the 18 inch Installation Bracket will position the Sensor in the same location that the previous Sensor would have been positioned using a 14 inch bracket.	

### 1.5.6 Air Control Valve Kit (For Pneumatic Masts Only)

Operation of a pneumatic mast requires an Air Control Valve (Figure 1-5). The Air Control Valve is used to stop the mast from extending in the event of an electric or magnetic field.

The Air Control Valve may be customer-provided or purchased separately through The Will-Burt Company. For this application, Will-Burt offers Air Control Valve Kit Part Number 915530.

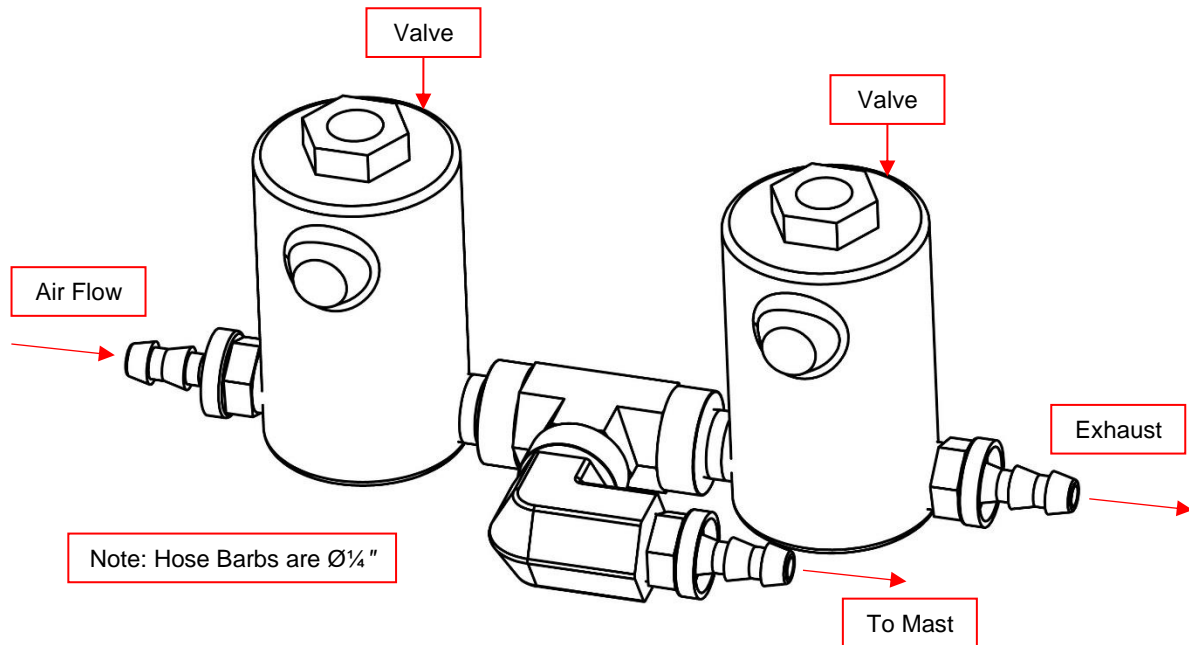


Figure 1-5 Air Control Valve

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## Section 2 Installation

This section describes installation of the D-TEC and provides general procedures that must be followed to ensure a successful installation. Use care to understand and follow all precautions while installing.

### 2.1 Pre-Installation Check

Before installing the system, ensure:

- All installers read and understand the entire installation procedure
- All components are included (Section 1.5)
- All required equipment is readily available (Section 2.2)
- The mounting structure is level with sufficient room to mount the system (Section 2.4)
- When installing on a vehicle, that the vehicle is stationary
- That the following precautions are understood and followed:

**⚠ WARNING**

**Safety Instruction – Operation!** Before beginning operation, 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. Your attention is directed to the OSHA electrical safety requirements in 29 C.F.R. part 1910. Be sure to allow sufficient clearance on all sides of mast to allow for side sway.

**⚠ 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**

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

**⚠ WARNING**

**Lifting Hazard!** The mast is intended to lift a specific payload for lighting, surveillance or communication use only. Any other use without written consent is prohibited and could cause death or serious injury. Do not use mast to lift personnel. Do not exceed specified payload capacity.

**⚠ CAUTION**

**Safety Instruction – Roof Access!** If mast will be mounted to a vehicle, the operator must provide safe means to access the roof of the vehicle during installation and maintenance.

**⚠ CAUTION**

**Equipment Damage – Qualified Personnel!** All persons installing and maintaining this equipment should be suitably qualified and work to local, regional, and national standards and codes of practice.

## 2.2 Installation Equipment

Table 2-1 lists equipment recommended for installation.

*Table 2-1 Equipment Recommended for Installation*

Recommended Equipment*			
Personal Protective			
	Safety Glasses	Work Gloves	Nitrile or Vinyl Gloves
	Hearing Protection	Hard Hat or Helmet	Safety Shoes
Hand Tools			
	¼" Drill	Crimping Tool or Solder Set	Electrical Tape
	Hand Drill	Hex Wrenches	Hook-Up Wire
	Screwdrivers	Wire Cutter / Stripper	Wrenches
	Multimeter		
* Note: <ul style="list-style-type: none"> <li>Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.</li> <li>Depending on the configuration, additional equipment, including but not limited to electrical components (e.g. wire, switches, fuses, circuit breakers, etc.), may be required.</li> <li>When disposing of any disposables or components, do so according to any applicable local, regional, and national standards and codes of practice.</li> </ul>			

## 2.3 Installation Hardware

Table 2-2 describes hardware that may be used during installation. Depending on the specific installation application, all hardware may not be used.

Table 2-2 Installation Hardware

Hardware*	Supplied By	Notes
<b>Sensor (P/N: 5354901) to Installation Bracket</b>		
(4) M6-1x22 mm Screws	Will-Burt	Ships attached to the Bottom of the Sensor.  Note: Will-Burt provided hardware assumes the mounting surface is ¼ inch (6 mm) thick. If the mounting surface is thicker than this distance, the customer will need to supply longer M6x1 screws. Screws should be sized to length to allow for the thickness of the mounting surface, the Wall Mount Display, and all mounting hardware (e.g. flat washers, lock washers, and nuts).
(4) M6 Lock Washers	Will-Burt	Ships attached to the Bottom of the Sensor.
<b>Installation Bracket (P/N: 5524101) to Mounting Structure</b>		
(6) ⅜ inch or M8 Screws	Customer	Screws should be sized to length to allow for the thickness of the mounting brackets, mounting surface, and all mounting hardware (e.g. flat washers, lock washers, and nuts).
<b>Rack Mount Display (P/N: 5354801) to Mounting Structure (For Rack Mount Kits only)</b>		
(4) 0.281 inch (7.1 mm) slots have been provided to assist in securing the Rack Mount Display to the Rack Mount.	Customer	Screws should be sized to length to allow for the thickness of the Rack Mount Display, rack mount, and all mounting hardware (e.g. flat washers, lock washers, and nuts).
<b>Wall Mount Display (P/N: 5354701) to Mounting Structure (For Wall Mount Kits only)</b>		
(4) M6-1x100mm Socket Head Cap Screws	Will-Burt	Ships with Wall Mount Display.  Note: Will-Burt provided hardware assumes the mounting surface is ¼ inch (6 mm) thick. If the mounting surface is thicker than this distance, the customer will need to supply longer M6x1 screws. Screws should be sized to length to allow for the thickness of the mounting surface, the Wall Mount Display, and all mounting hardware (e.g. flat washers, lock washers, and nuts).
(4) M6 Flat Washers	Will-Burt	Ships with Wall Mount Display.
* Unless otherwise indicated, the mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade. Torque values in these instructions assume the use of Will-Burt provided hardware. Depending on the specific installation application, all hardware may not be used. Additional hardware may be required for additional accessories, or customer-specific applications.		

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## 2.4 Installation Dimensions

This section describes installation dimensions as follows:

- Sensor Dimensions (Section 2.4.1)
- Rack Mount Display Dimensions (Section 2.4.2)
- Wall Mount Display Dimensions (Section 2.4.3)
- Installation Bracket Dimensions (Section 2.4.4)

Dimensions are provided for reference only.



### 2.4.1 Sensor (P/N: 5354901) Dimensions

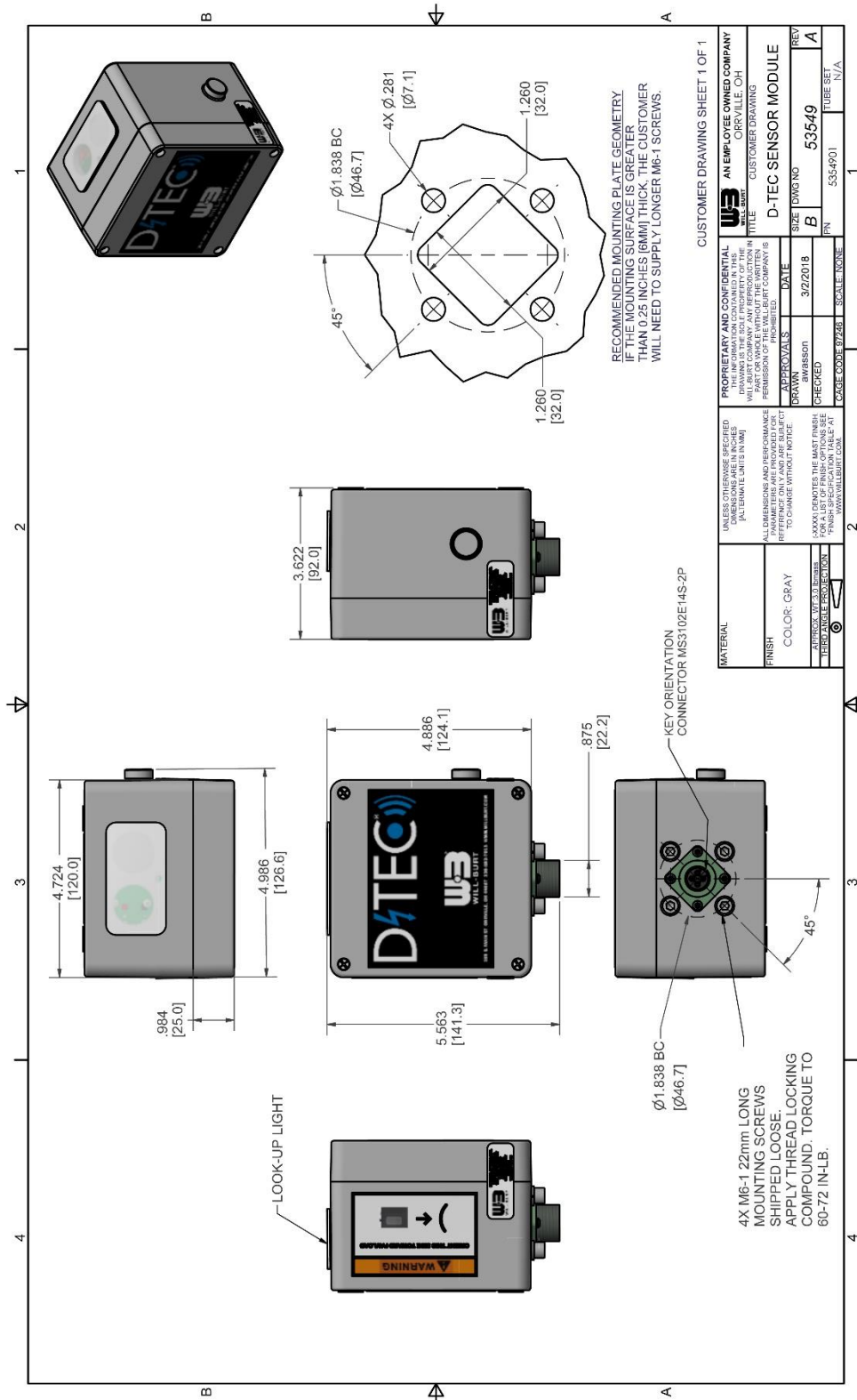


Figure 2-1 Sensor Dimensions (Measurements in Inches [Measurements in Millimeters])

## 2.4.2 Rack Mount Display (P/N: 5354801) Dimensions

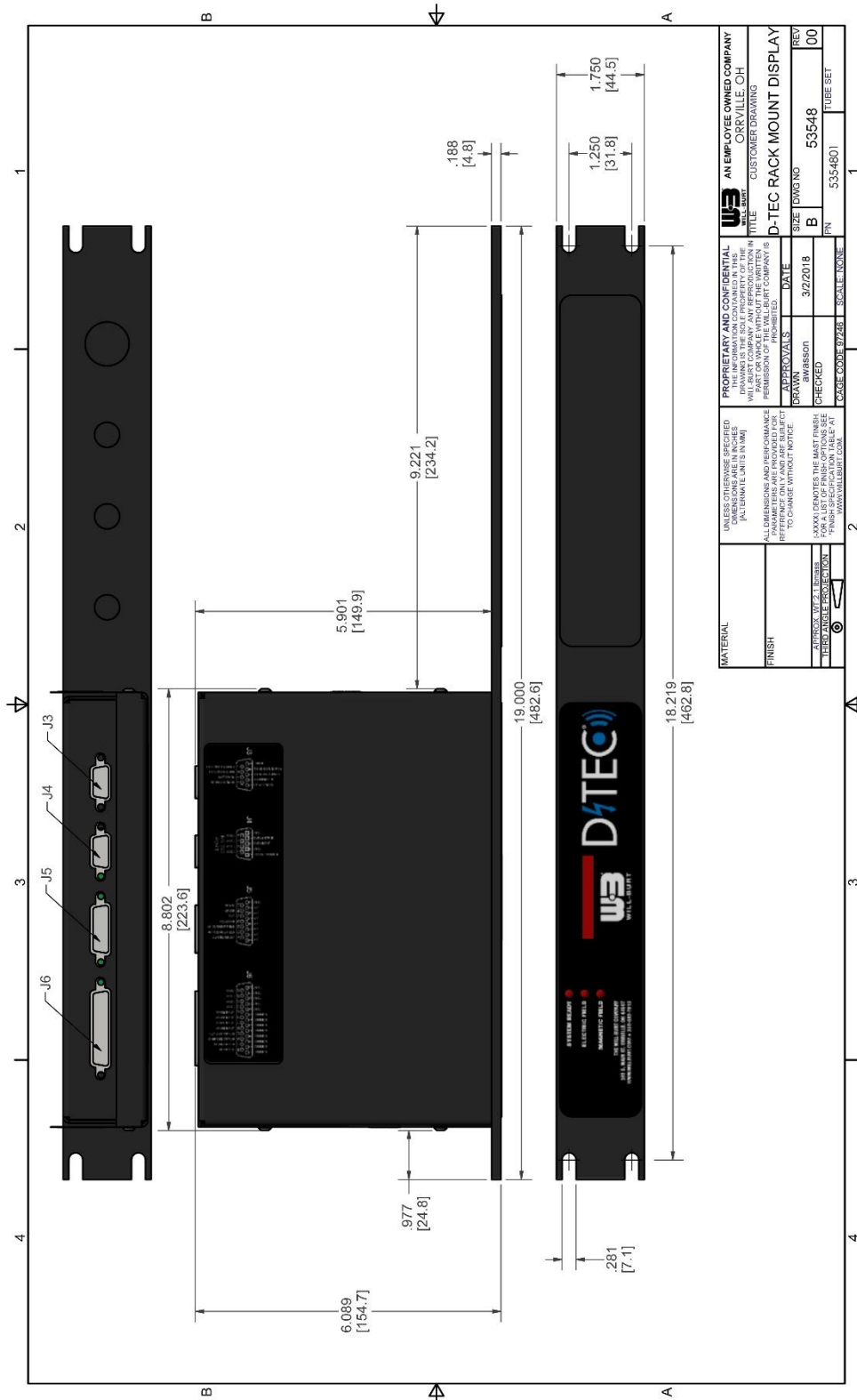


Figure 2-2 Rack Mount Display Dimensions (Measurements in Inches [Measurements in Millimeters])

### 2.4.3 Wall Mount Display (P/N: 5354701) Dimensions

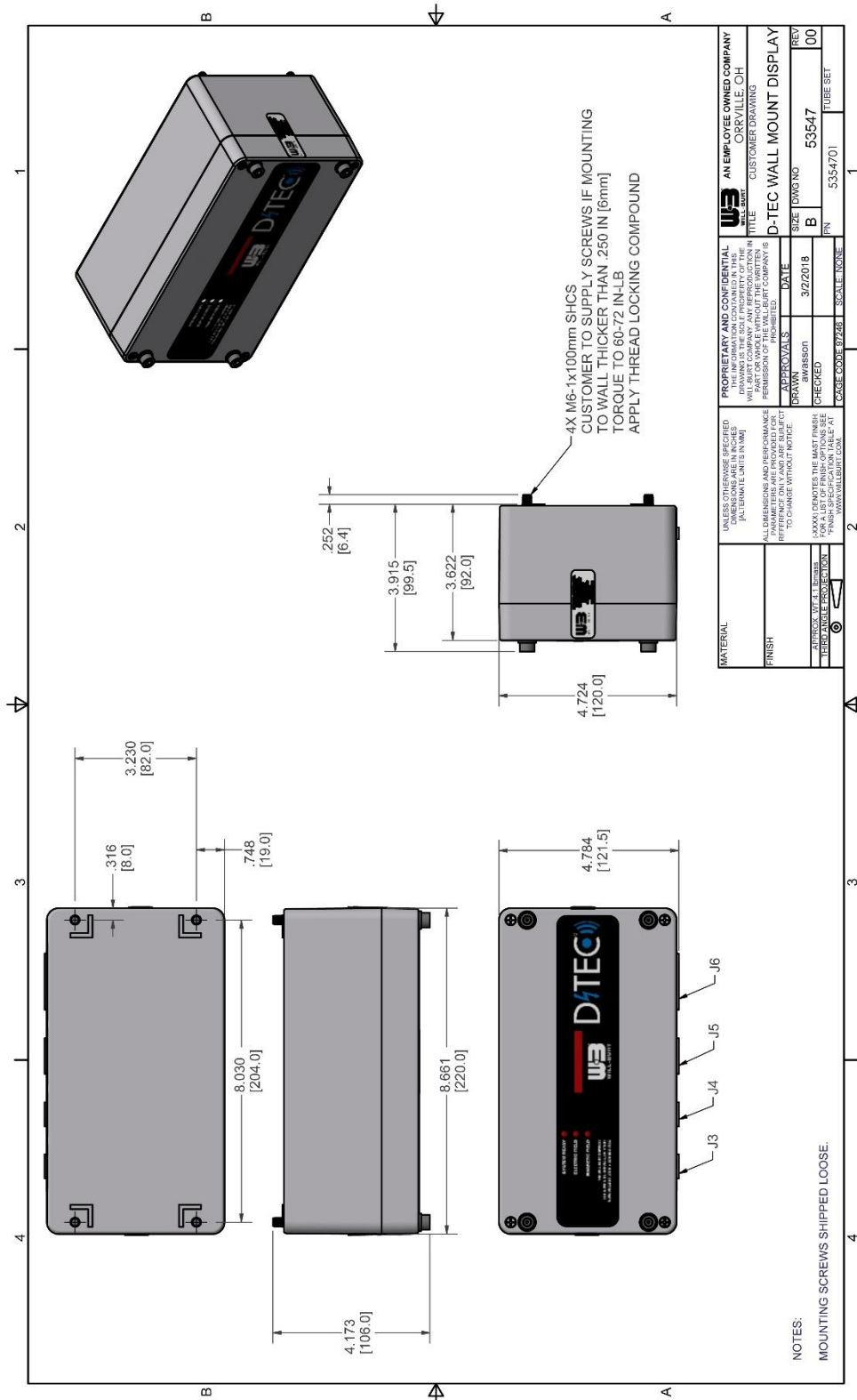


Figure 2-3 Wall Mount Display Dimensions (Measurements in Inches [Measurements in Millimeters])

## 2.4.4 Installation Bracket (P/N: 5524101) Dimensions

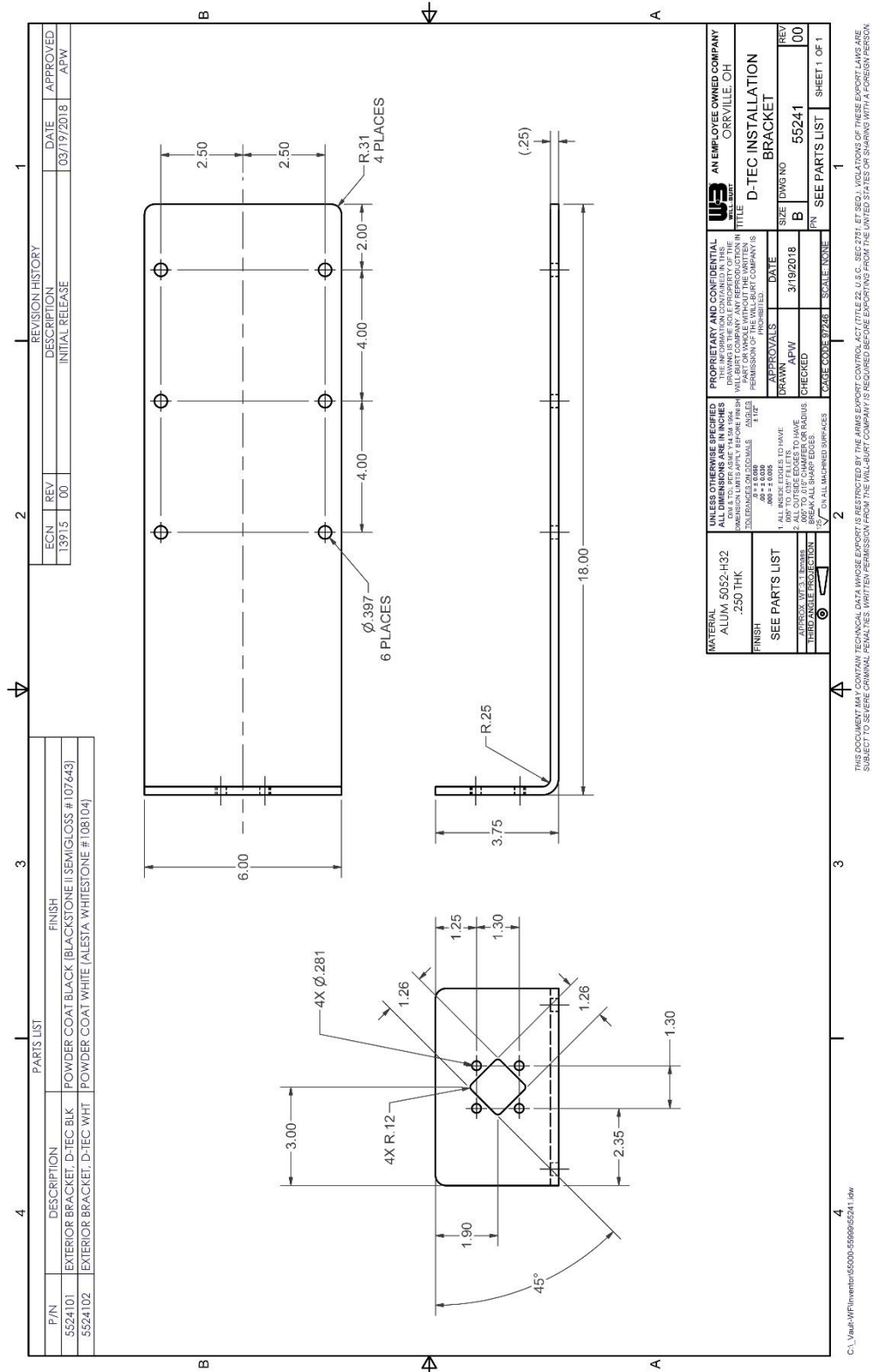


Figure 2-4 Installation Bracket Dimensions (Measurements in Inches [Measurements in Millimeters])

## 2.5 Physical Installation

This section describes physical installation of the D-TEC.

### 2.5.1 Physical Installation Quick Summary

The following is a quick summary of physical installation of the D-TEC. Detailed steps follow the quick summary (Section 2.5.2).

In general, physically install the D-TEC as follows:

1. Select Suitable Mounting Locations (Section 2.5.2.1)
2. Unpack the D-TEC (Section 2.5.2.2)
3. Install the Sensor (Section 2.5.2.3)
4. Install the Display (Section 2.5.2.4)

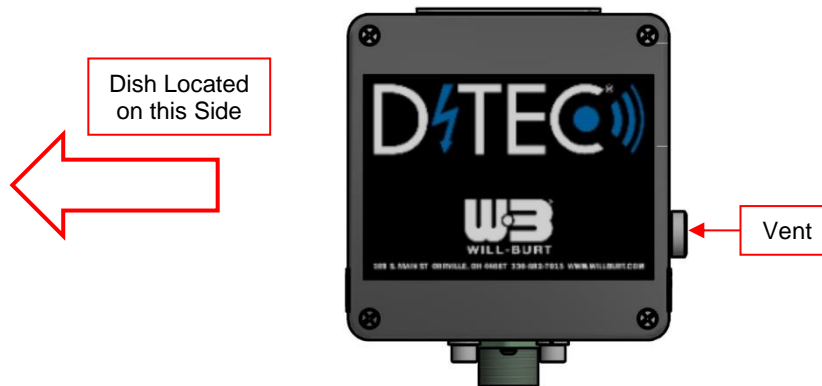
### 2.5.2 Physical Installation Detailed Instructions

The following are detailed steps describing physical installation of the D-TEC. The exact installation procedures may vary based on the installation environment. Use the best and safest method for your circumstances.

### 2.5.2.1 Select Suitable Mounting Locations

To select a suitable mounting location, consider the following:

- The Sensor should be installed on the uppermost point of the extendable device (mast). If the D-TEC is being mounted with a satellite dish or antenna, the top of the Sensor must be located 2-3 inches (50-76 mm) above the highest component of the dish or antenna. When installing with a dish, the Sensor vent should face directly away from the dish or antenna (Figure 2-5).



*Figure 2-5 Vent Location as Related to Dish*

- The Display should be installed inside the vehicle so that the alphanumeric display screen is visible while operating the mast.
- The mounting structures must have sufficient room to mount the system.
- The mounting structures must be level in all directions, solid, and capable of holding the forces required by the bolts. Check the strength and rigidity of the mounting structure where the system is to be attached. Reinforce as necessary.
- Cables will eventually need routed between components as follows (Figure 2-6):
  - The Sensor, Display, Power Supply, and the Air Control Valve or Stiletto Control (through a Terminal Block)
  - The Display, Switches, and Speakers (through a Terminal Block)
  - The 3-Way Mast Up/Down Switch to the Air Control Valve (Pneumatic applications only)
  - The Power Supply to the Air Control Valve or Stiletto Control

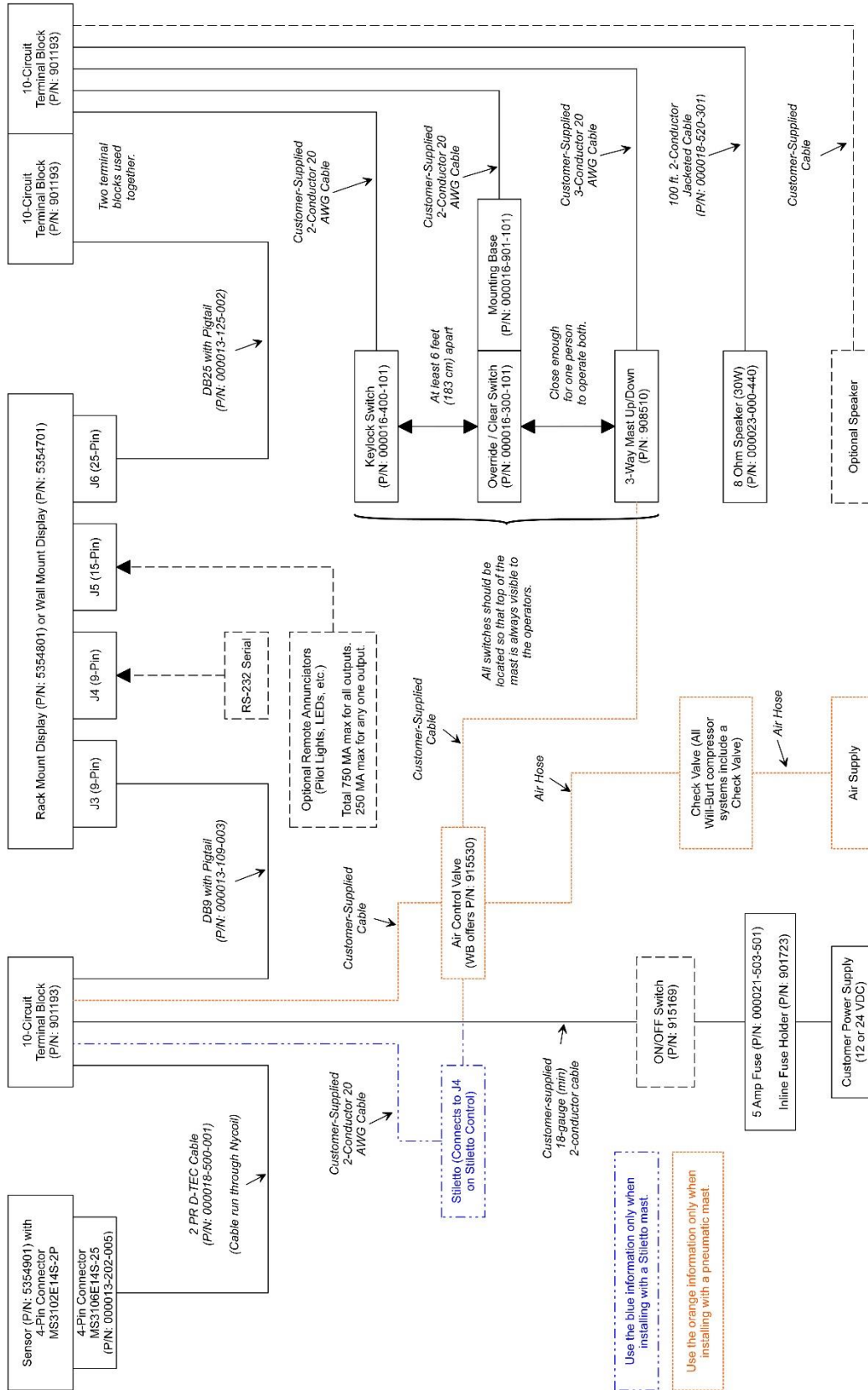


Figure 2-6 Quick Installation Overview

### 2.5.2.2 Unpack the D-TEC

Unpack the D-TEC as follows:

1. Carefully open and remove all parts from the shipping container.
2. Inspect for any shipping damage. Notify the carrier if damage is evident.
3. Ensure all components are included and that the tools are readily available.

### 2.5.2.3 Install the Sensor

These instructions assume the use of the Installation Bracket. As the size and shape of the antennae will vary, the customer is responsible for modifying the Installation Bracket to position the Sensor appropriately above the antenna.

To install the Sensor:

1. Keeping in mind the information on mounting location and orientation discussed in Section 2.5.2.1, mount the Sensor on the Installation Bracket using the four M6 screws and M6 lock washers located on the bottom of the Sensor (Figure 2-7). The mounting hardware must include a proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque to 60-72 in.-lb. (6.8-8.1 N-m).

Note: Will-Burt provided hardware assumes the mounting surface is  $\frac{1}{4}$  inch (6 mm) thick. If the mounting surface is thicker than this distance, the customer will need to supply longer M6x1 screws.

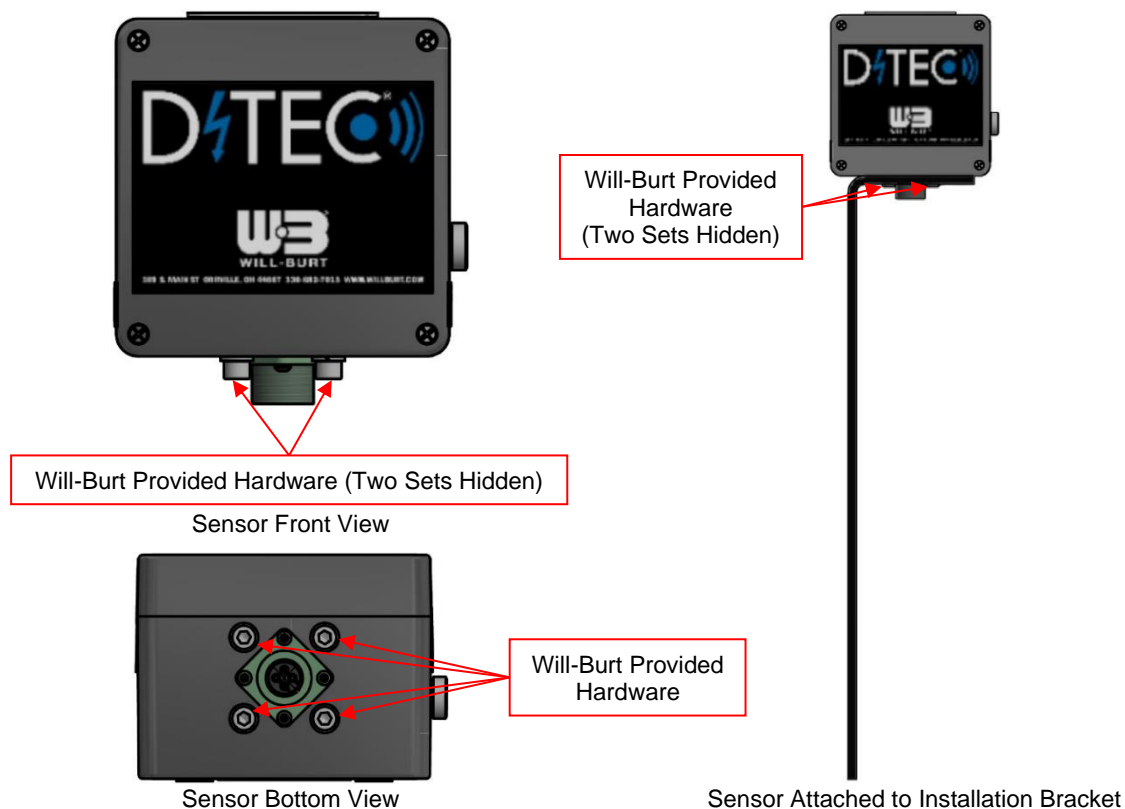


Figure 2-7 Mount Sensor to Installation Bracket



2. Secure the Installation Bracket to the antenna fixture with customer-supplied hardware. The mounting hardware must include a proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.

### 2.5.2.4 Install the Display

Depending on the customer specification, the Display may be a:

- Rack Mount Display (P/N: 5354801)
- Wall Mount Display (P/N: 5354701)

Follow the installation instructions appropriate for your system.

The Display should be mounted:

- Inside the vehicle
- Where the alphanumeric display screen is visible while operating the mast
- So that there is easy access to the connectors (J3, J4, J5, and J6) on the Display

### Rack Mount Display Installation

To install the Rack Mount Display:

1. Position the Rack Mount Display in the desired mounting location.
2. Secure the Rack Mount Display at the mounting holes in position with customer-supplied hardware (Figure 2-8). The mounting hardware must include a proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.



Figure 2-8 Rack Mount Display Mounting Hole Locations

## Wall Mount Display Installation

The Will-Burt provided hardware assumes the mounting surface is ¼ inch (6 mm) thick. If the mounting surface is thicker than this distance, the customer will need to supply longer M6x1 screws. Screws should be sized to length to allow for the thickness of the mounting surface, the Wall Mount Display, and all mounting hardware (e.g. flat washers, lock washers, and nuts).

To install the Wall Mount Display:

1. Use either the installation dimensions for the Display (Section 2.4.3), or the Wall Mount Display itself as a template to mark the mounting holes locations (Figure 2-9).



*Figure 2-9 Wall Mount Display Mounting Hole Locations*

2. Drill the mounting holes.
3. Position the Wall Mount Display and secure it in position. The mounting hardware must include a proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.

## 2.6 Electrical Installation

This section describes electrical installation of the D-TEC.

### 2.6.1 Electrical Installation Quick Summary

The following is a quick summary of electrical installation of the D-TEC. Detailed steps follow the quick summary (Section 2.6.2).

In general, electrically install the D-TEC as follows:

1. Install DB25 (Section 2.6.2.1)
2. Install Up/Down Switch (Section 2.6.2.2)
3. Install Override/Clear Switch (Section 2.6.2.3)
4. Install Keylock Switch (Section 2.6.2.4)
5. Install Speaker (Section 2.6.2.5)
6. Install DB9 (Section 2.6.2.6)
7. Electrically Connect the Sensor (Section 2.6.2.7)
8. Install the Air Control Valve (Pneumatic Masts Only) (Section 2.6.2.8)
9. Install the Stiletto Control (Stiletto Family Masts Only) (Section 2.6.2.9)
10. Install Remote Annunciators (Optional) (Section 2.6.2.10)
11. Install Remote Computer (Not Supplied) (Section 2.6.2.11)
12. Install System Power (Section 2.6.2.12)
13. Finalize Installation (Section 2.6.2.13)

### 2.6.2 Electrical Installation Detailed Instructions

The following are detailed steps describing electrical installation of the D-TEC. The exact installation procedures may vary based on the installation environment. Use the best and safest method for your circumstances.

Shield any cable carrying 120 VAC (or higher) if the cable will run closer than 24 inches to the Sensor.

See Figure 2-10 for the electrical diagram.

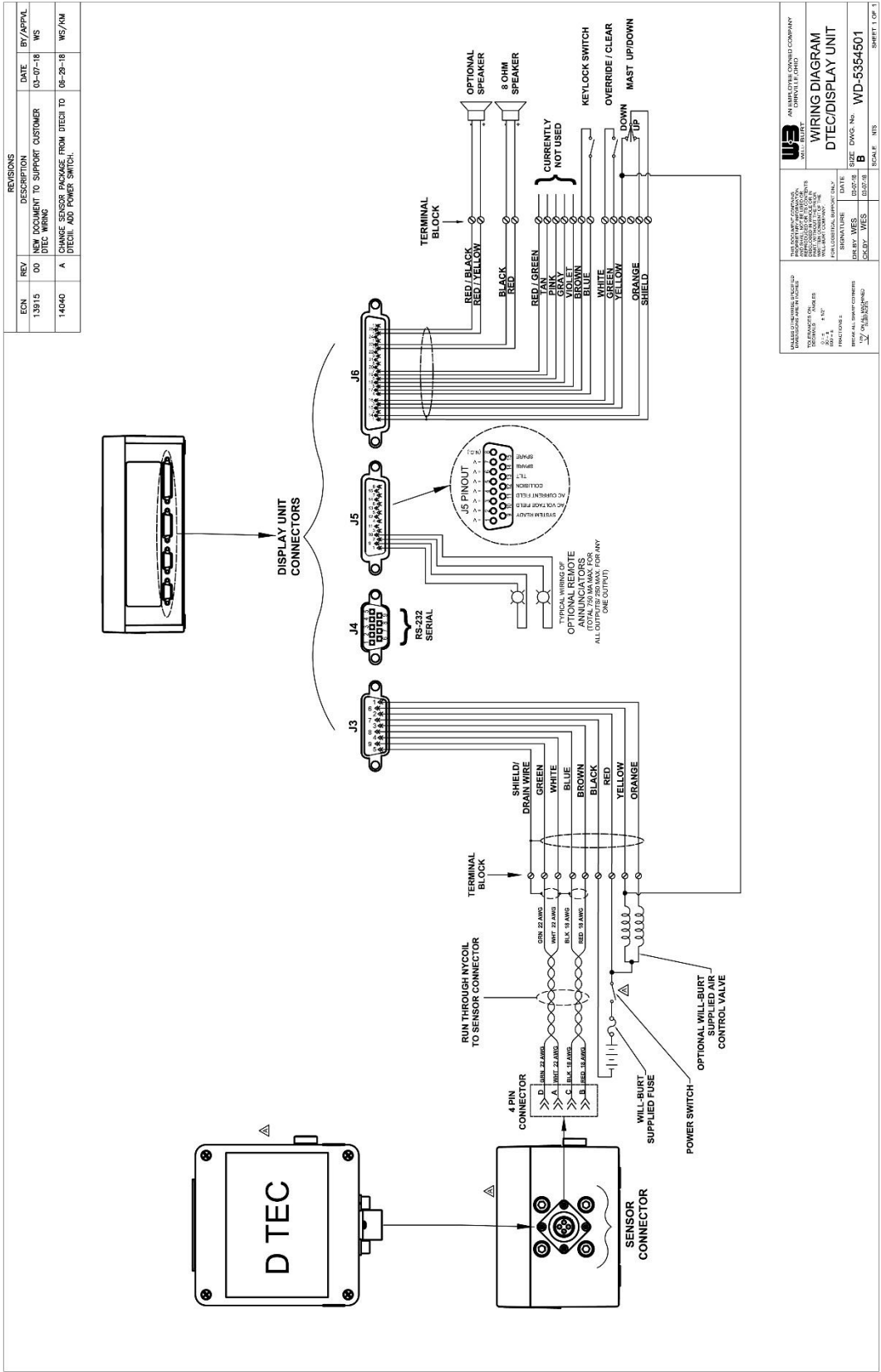


Figure 2-10 Wiring Diagram

### 2.6.2.1 Install DB25

To install DB25 (P/N: 000013-109-003):

1. Plug DB25 into the J6 connector on the Display (Figure 2-11).



Figure 2-11 DB25

2. Connect the DB25 pigtail to the remaining two Terminal Blocks as shown in Figure 2-12.

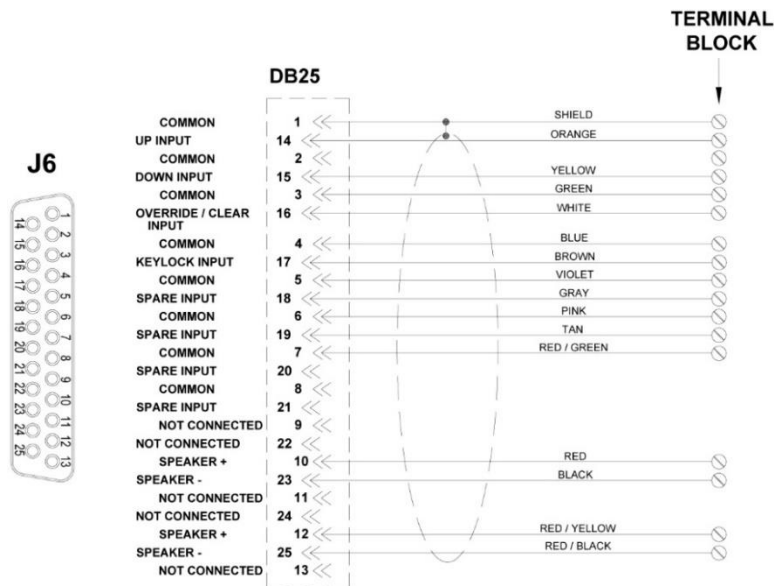


Figure 2-12 DB25 to Terminal Blocks

### 2.6.2.2 Install Up/Down Switch

The Up/Down Switch (P/N: 908510) is a Single Pole Double Throw (SPDT) On-Off-Momentary On switch, used to extend and retract the mast. The Up/Down Switch shall be wired so that the Up function is momentary. The operator should use a customer-supplied 3-conductor 20 AWG cable for installation.

To install the Up/Down Switch (Figure 2-13):

1. Install the Up/Down Switch keeping in mind that:
  - The Override/Clear Switch will need to be installed near the Up/Down Switch so that the same operator may use both switches.
  - The Keylock Switch will need to be installed at least six feet (183 cm) or greater from the Override/Clear Switch so that it is impossible for one person to operate both simultaneously. The distance should force a two-person override.
  - All switches need to allow the top of the mast to always be visible to the operator while engaged.
2. Secure the:
  - a. Mast up input cable from the Up/Down Switch to the DB25 Terminal Block where the orange wire from DB25-14 connects.
  - b. Mast down input cable from the Up/Down Switch to the DB25 Terminal Block where the yellow wire from DB25-15 connects.
  - c. Common cable from the Up/Down Switch to the DB25 Terminal Block where the shielded wire from DB25-1 connects.

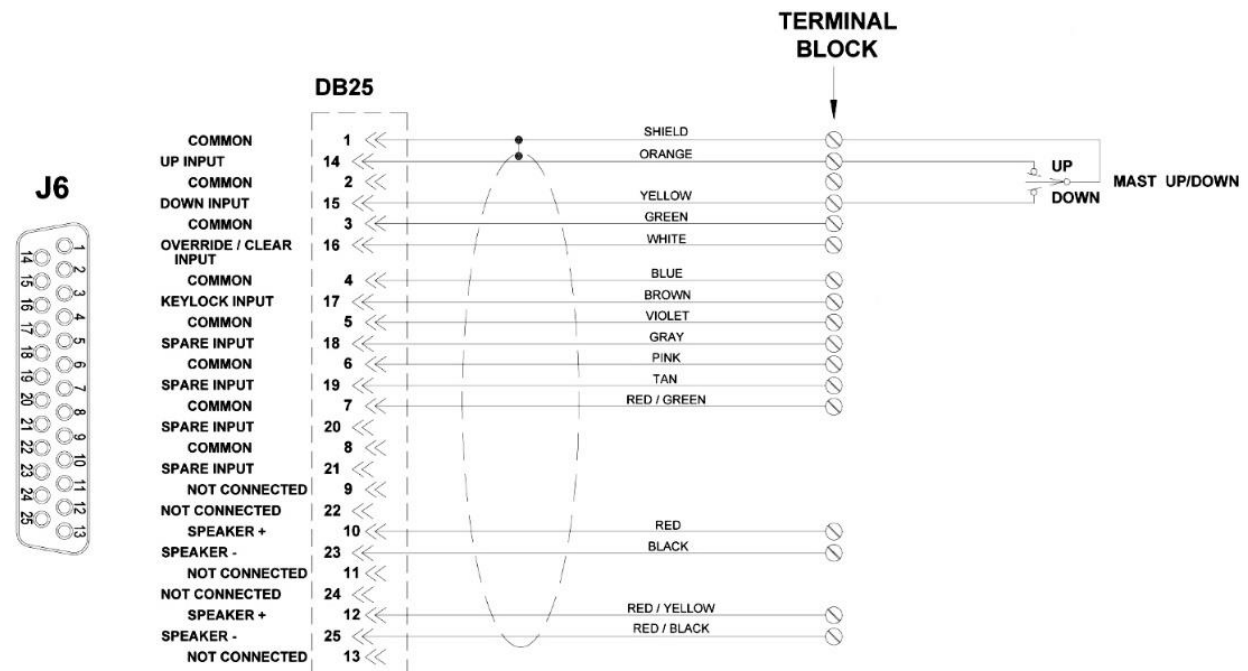


Figure 2-13 Install the Up/Down Switch

### 2.6.2.3 Install Override/Clear Switch

The Override/Clear Switch (P/N: 000016-300-101) is a momentary push button switch which mounts inside the Mounting Base (P/N: 000016-901-101) and is used to clear and override alarms. The operator should use a customer-supplied 2-conductor 20 AWG cable for installation.

To install the Override/Clear Switch (Figure 2-14):

1. Install the Override/Clear Switch keeping in mind that:
  - The Override/Clear Switch will need to be installed near the Up/Down Switch so that the same operator may use both switches.
  - The Keylock Switch will need to be installed at least six feet (183 cm) or greater from the Override/Clear Switch so that it is impossible for one person to operate both simultaneously. The distance should force a two-person override.
  - All switches need to allow the top of the mast to always be visible to the operator while engaged.
2. Secure the:
  - a. Override/Clear input cable from the Override/Clear Switch to the DB25 Terminal Block where the white wire from DB25-16 connects.
  - b. Common cable from the Override/Clear Switch to the DB25 Terminal Block where the green wire from DB25-3 connects.

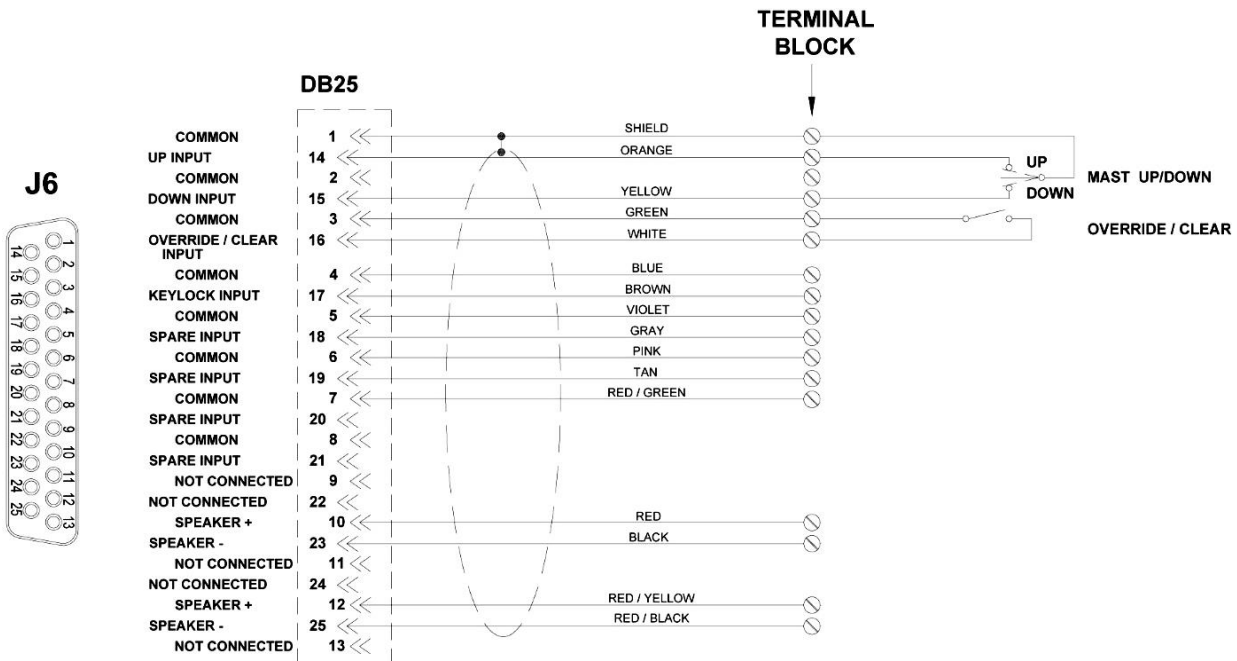


Figure 2-14 Install the Override/Clear Switch

### 2.6.2.4 Install Keylock Switch

The Keylock Switch (P/N: 000016-400-101) is a maintained / momentary switch used to override alarms. The Keylock Switch shall be wired so the override function is momentary. The operator should use a customer-supplied 2-conductor 20 AWG cable for installation.

To install the Keylock Switch (Figure 2-15):

1. Install the Keylock Switch keeping in mind that:
  - The Keylock Switch will need to be installed at least six feet (183 cm) or greater from the Override/Clear Switch so that it is impossible for one person to operate both simultaneously. The distance should force a two-person override.
  - All switches need to allow the top of the mast to always be visible to the operator while engaged.
2. Secure the:
  - a. Keylock input cable from the Keylock Switch to the DB25 Terminal Block where the brown wire from DB25-17 connects.
  - b. Common cable from the Keylock Switch to the DB25 Terminal Block where the blue wire from DB25-4 connects.

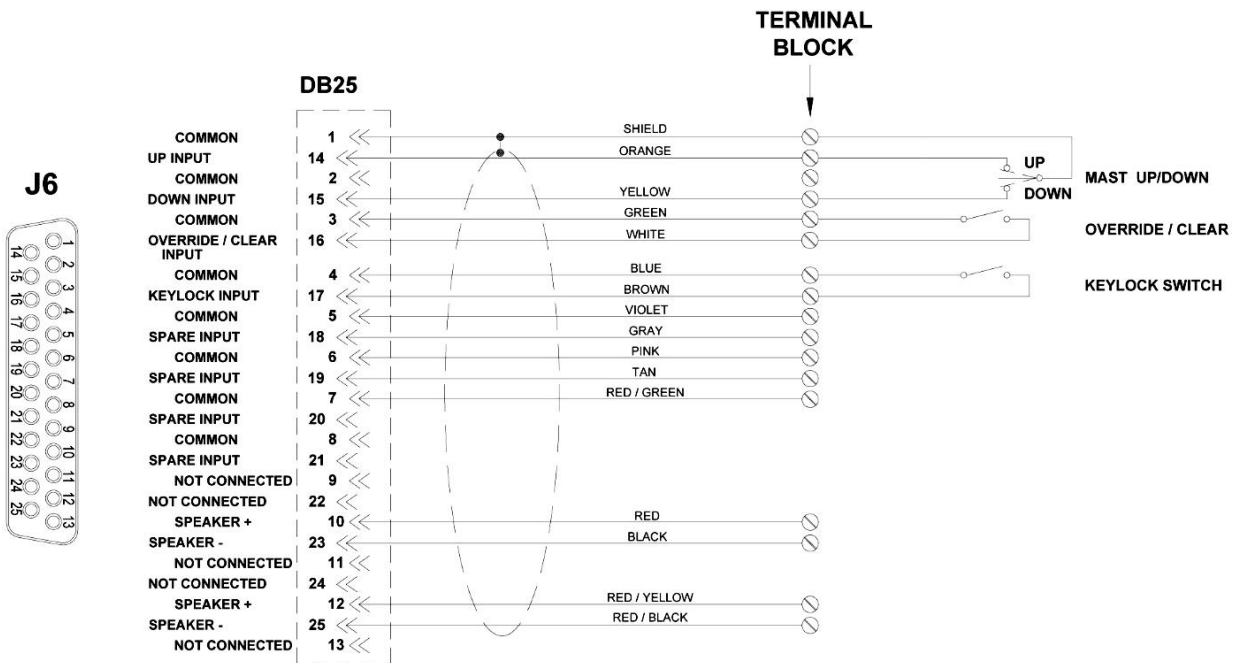


Figure 2-15 Install the Keylock Switch



### 2.6.2.5 Install Speaker

The 8 ohm speaker (P/N: 000023-000-440) is used to announce alarms. The operator should use the provided 100 ft. (30.5 meter) 2-conductor cable (P/N: 000018-520-301) when installing the speaker.

To install the speaker:

1. Mount the U-shaped bracket.
2. Connect the speaker to the U-shaped bracket.
3. Secure the cables from the speaker to the provided 100 ft. (30.5 meter) 2-conductor cable (P/N: 000018-520-301).
4. Run the cable from the speaker to the DB25 Terminal Block. Cable ties have been provided to assist in securing the cable in place. The black Cable Ties are UV rated for outside use. The clear Cable Ties are for inside the vehicle. If necessary, cut off the extra cable, being sure to leave enough to allow the cable to attach to the DB25 Terminal Block.
5. Secure the:
  - a. Negative cable from the speaker to the DB25 Terminal Block where the black wire from DB25-23 connects.
  - b. Positive cable from the speaker to the DB25 Terminal Block where the red wire from DB25-10 connects.

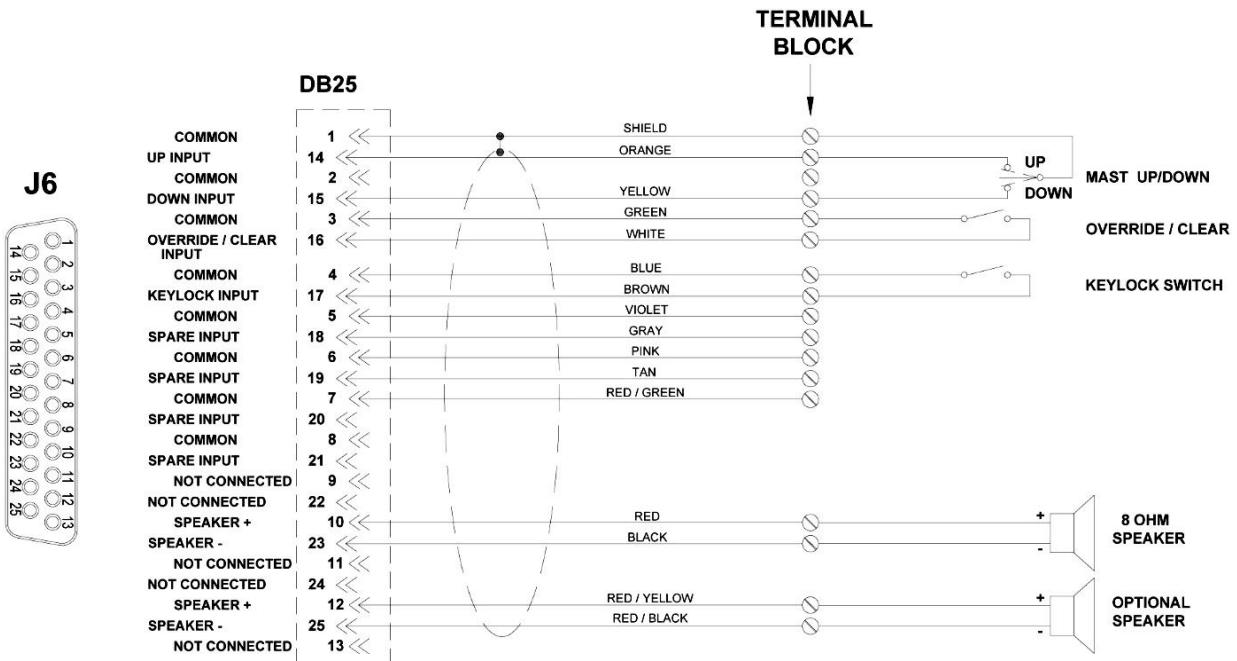


Figure 2-16 Install the Speaker

Note: If desired, an optional second speaker (customer-supplied) may be added (Figure 2-16).

### 2.6.2.6 Install DB9

To install DB9:

1. Plug DB9 into the J3 connector on the Display (Figure 2-17).



Figure 2-17 DB9

2. Connect to DB9 pigtail to a Terminal Block (P/N: 901193) as shown in Figure 2-18.

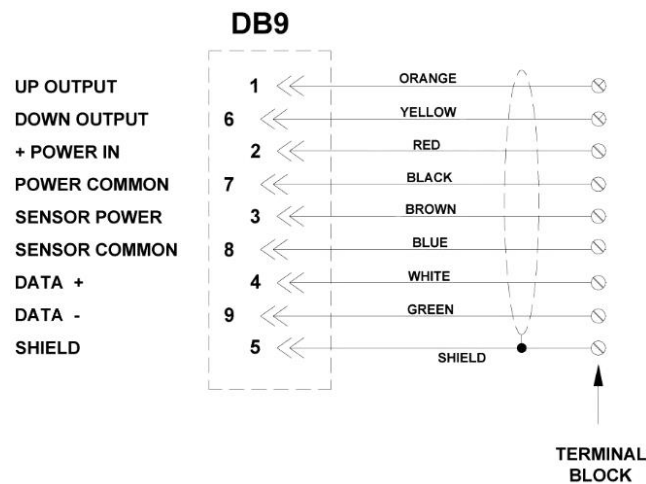


Figure 2-18 DB9 to Terminal Block

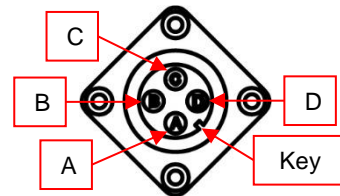
### 2.6.2.7 Electrically Connect the Sensor

The operator should use the provided 150 ft. (45.7 meter) 4-conductor cable (P/N: 000018-500-001) when electrically connecting the Sensor. This cable is typically run through a Nycoil.

To electrically connect the Sensor (Figure 2-19):

1. As necessary, run the cable through a Nycoil.
2. Secure the:
  - a. Red 18 AWG wire to the DB9 Terminal Block where the brown wire from DB9 connects.
  - b. Black 18 AWG wire to the DB9 Terminal Block where the blue wire from DB9 connects.
  - c. White 22 AWG wire to the DB9 Terminal Block where the white wire from DB9 connects.
  - d. Green 22 AWG wire to the DB9 Terminal Block where the green wire from DB9 connects.
  - e. Shield / drain wire to the DB9 Terminal Block where the shield wire from DB9 connects.
3. Secure the 4-Pin MS3106E14S-2S Plug (P/N: 000013-202-005) from the Installation Kit to the end of the cable as follows:

- a. Red 18 AWG wire to B.
- b. Black 18 AWG wire to C.
- c. White 22 AWG wire to A.
- d. Green 22 AWG wire to D.



4. Secure the 4-Pin Plug to the Sensor.

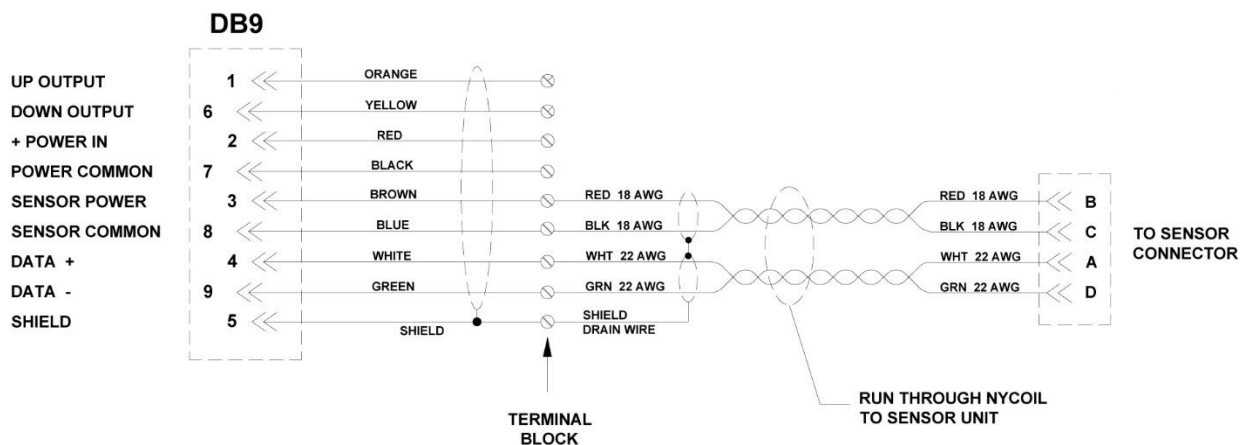


Figure 2-19 Sensor to DB9 Terminal Block

### 2.6.2.8 Install the Air Control Valve (Pneumatic Masts Only)

Operation of a pneumatic mast requires an Air Control Valve (Figure 2-20). The Air Control Valve is used to stop the mast from extending in the event of an electric or magnetic field. The Air Control Valve may be customer-provided or purchased separately through The Will-Burt Company. This section describes installation of the Will-Burt Air Control Valve Kit (P/N: 915530). For Air Control Valves not supplied by Will-Burt, the customer is responsible for making the correct wire connections.

Note: A Check Valve must be placed between the Air Supply and the Air Control Valve. A Check Valve is supplied with all Will-Burt compressor systems.

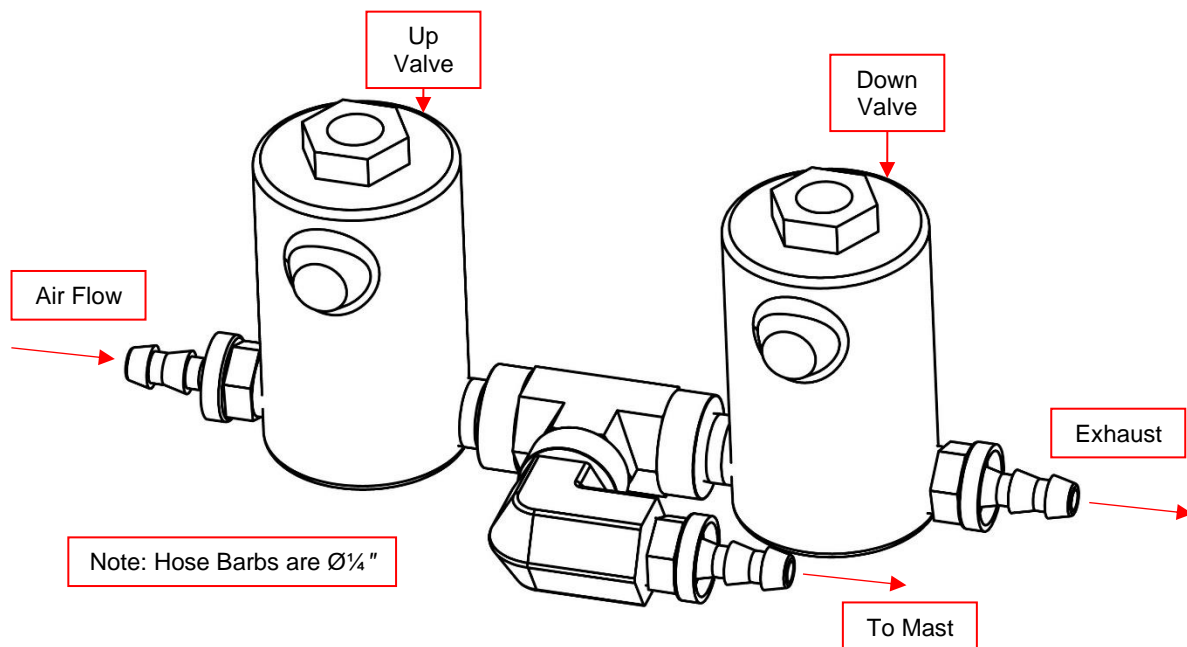


Figure 2-20 Air Control Valve

The Air Control Valve is comprised of two valves plumbed together. Each valve coil has two black wires. During installation, polarity is of no concern for the black wires from each valve coil.

To install the Air Control Valve (Figure 2-21):

1. Connect one of the black wires from each valve coil together.
2. Secure the connected black wires to the DB9 Terminal Block where the red wire from DB9 connects. This is where the battery positive cable from system power will eventually connect.
3. Secure the remaining wire from the Up Air Valve Coil to the DB9 Terminal Block where the orange wire from DB9 connects.
4. Secure the remaining wire from the Down Air Valve Coil to the DB9 Terminal Block where the yellow wire from DB9 connects.

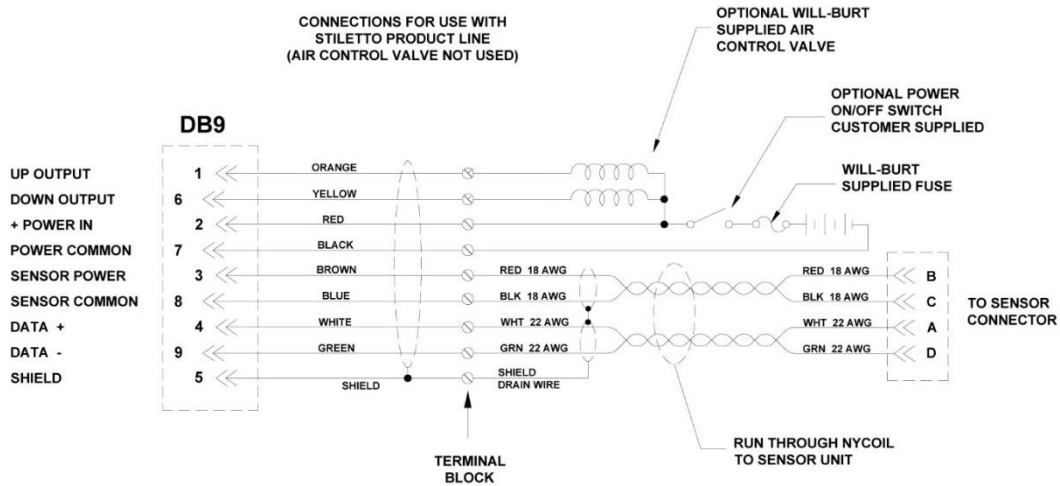


Figure 2-21 Air Control Valve to DB9 Terminal Block (Note: power not hooked up yet)

5. Connect the mast Down Switch to the Down Air Control Valve Coil.

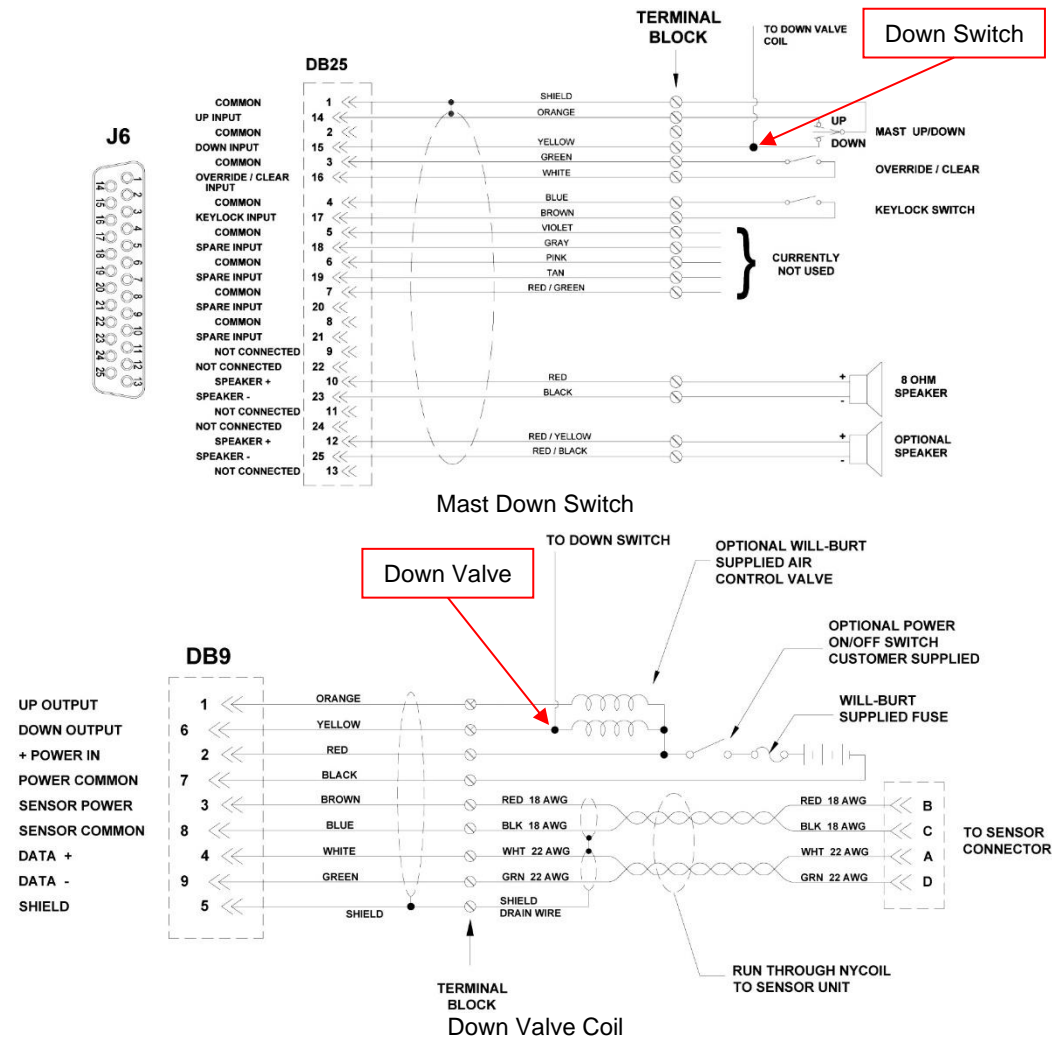


Figure 2-22 Down Switch to the Down Air Control Valve Coil (Note: power not hooked up yet)

### 2.6.2.9 Install the Stiletto Control (Stiletto Family Masts Only)

Using the D-TEC with a Stiletto requires connecting the D-TEC into the Stiletto Control. The operator should use a customer-supplied 2-conductor 20 AWG cable for installation.

To connect the D-TEC to the Stiletto Control (Figure 2-23):

1. Wire from Stiletto Control J4-D (Remote Up) to the DB9 Terminal Block where the orange wire from DB9 connects.
2. Wire from Stiletto Control J4-E (Remote Down) to the DB9 Terminal Block where the yellow wire from DB9 connects.

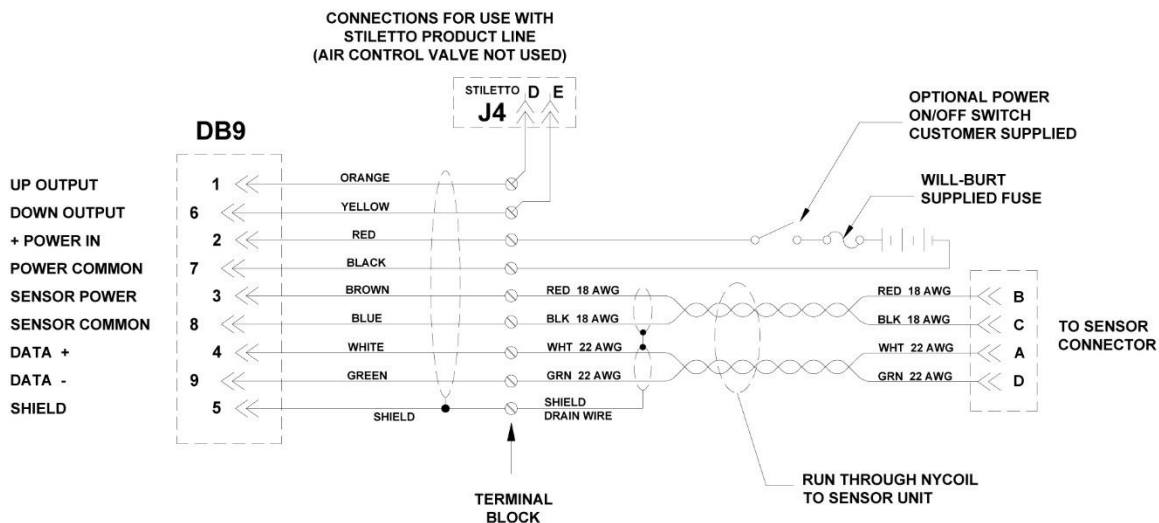


Figure 2-23 Stiletto Control to DB9 Terminal Block

Note: It is important that the D-TEC must use the same power source as the Stiletto. See Section 2.6.2.12 for details on installing system power.

### 2.6.2.10 Install Remote Annunciators (Optional)

Through J5 on the Display, the D-TEC has outputs suitable for driving optional remote annunciators such as small incandescent pilot lights, LEDs, or small audible or visual alarms.

Note: These outputs cannot supply large amounts of current. A maximum output of 750 mA for all outputs can be supplied. A maximum output of 250 mA for any one output can be supplied.

Wire any remote annunciators according to Figure 2-24.

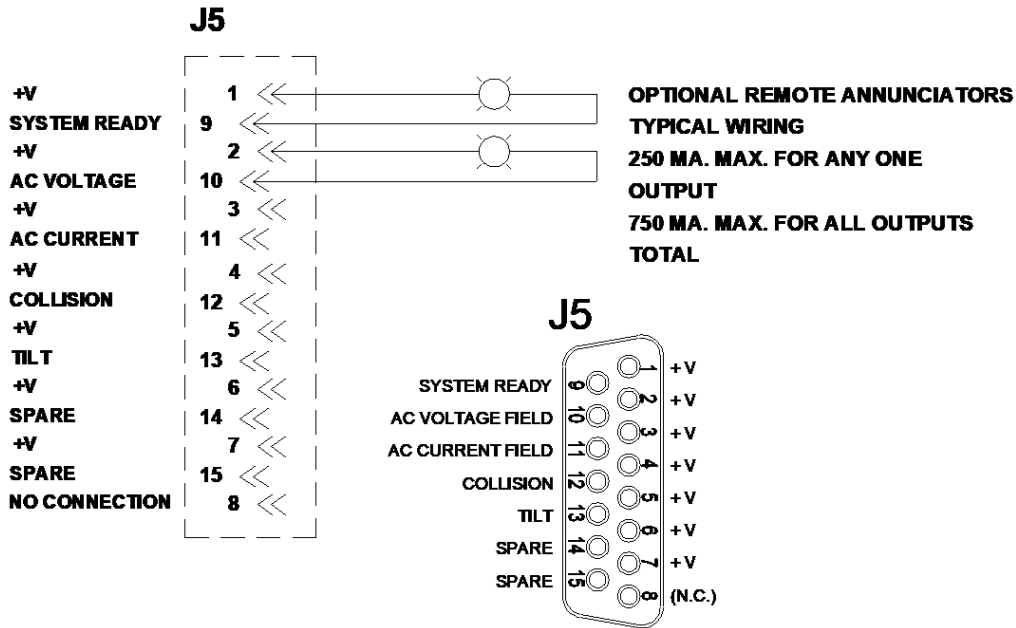


Figure 2-24 J5 Wiring

### 2.6.2.11 Install Remote Computer (Not Supplied)

The D-TEC has certain functionality that is available through a standard RS-232 connector (Figure 2-25). This is primarily used by factory authorized service centers and in Stiletto applications involving PC operation in order to allow the mission computer to know the fault/status conditions of the Display.

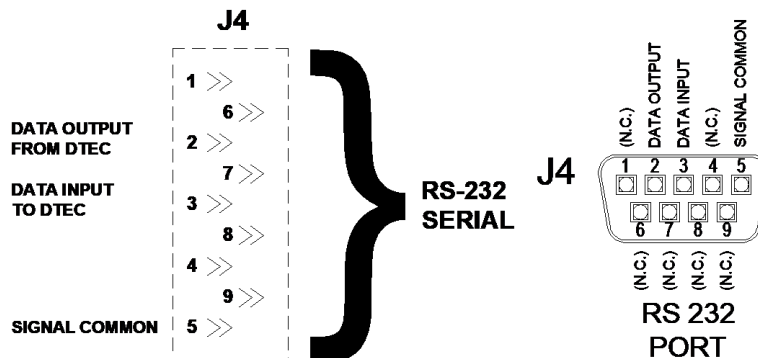


Figure 2-25 J4 Wiring

### 2.6.2.12 Install System Power

The D-TEC system is designed to operate from either a 12-volt or 24-volt DC supply. Use at least an 18-gauge minimum 2-conductor power cord (customer-supplied) for installation. The maximum current draw is approximately 4 amps.

System power is connected to the system through the Terminal Block between DB9 and the Sensor. The Installation Kit includes a 5 amp fuse (P/N: 000021-503-501) and an Inline Fuse Holder (P/N: 901723) to provide 5 amp protection to the D-TEC.

Note: When using the D-TEC with a Stiletto, it is important that the D-TEC must use the same power source as the Stiletto.

To install system power (Figure 2-26):

1. With the supplied fuse inline, secure the battery positive wire to the DB9 Terminal Block where the red (battery positive) wire from DB9 connects.

Note: A Single Pole Single Throw (SPST) On-Off toggle switch (P/N: 915169) is provided to be added at the customer's discretion in series with the inline fuse.

2. Secure the battery negative wire to the DB9 Terminal block where the black (battery negative) wire from DB9 connects.
3. With the system turned on, use a multimeter to check the input voltage of the Display. The voltage must be between 11 to 33 volts. If the voltage is too low, increase the supply cable thickness and/or shorten the length of the supply cable (if possible).

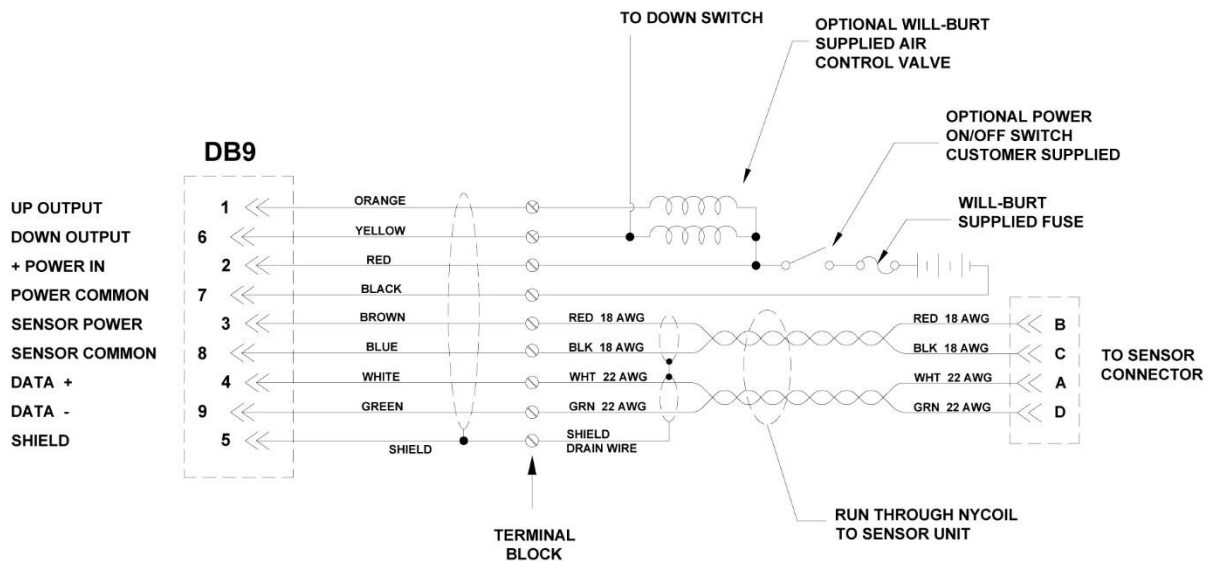


Figure 2-26 System Power to DB9 Terminal Block



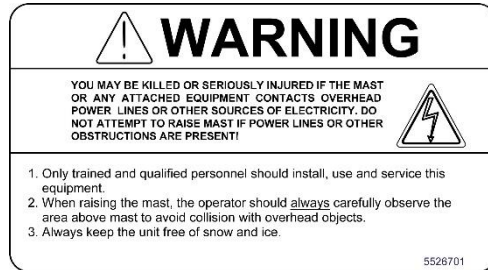
### 2.6.2.13 Finalize Installation

To finalize installation:

1. As necessary, secure the Terminal Blocks and cables. Cable ties have been provided to assist in securing the cables in place. The black Cable Ties are UV rated for outside use. The clear Cable Ties are for inside the vehicle.
2. Apply the warning labels from the Installation Kit where the operator will have a clear view of them while operating the D-TEC (Figure 2-27).



Electrocution Hazard Warning  
(P/N: 900711)



D-TEC Warning Label  
(P/N: 5526701)



D-TEC Override Danger Label  
(P/N: 911960)

*Figure 2-27 Warning Labels (Not to Scale)*

## 2.7 Test the Installation

This section describes testing the installation of the D-TEC. Use care to understand and follow all precautions while testing. Before testing the installation, ensure:

- The Sensor is properly positioned and secured
- The Display is properly positioned and secured
- All required electrical connections have been made and are secure including the connection to the Sensor

The following test should be completed after installation of the D-TEC. The unit should meet all of the below criterion before use in the field. To test the installation:

1. Turn on the Display. When power is applied to the Display, a self-test is performed, and the audible message “Running Diagnostics” will be heard on the speaker and the text message “Self Tst” will be displayed. When testing has been successfully completed, the system ready LED (green) will come on, a “MAST ENA” message will be displayed, and the audible message “D-TEC Active” will be heard on the speaker.
2. Check the green System Ready LED on the Display to ensure it is steady. When the LED is lit for:
  - Pneumatic mast, the Air Control Valve will be enabled and the mast controls will be operational
  - Mechanical masts, the mast controls will be operational

3. With the system turned on, check the input voltage of the Display. The voltage must be between 11 to 33 volts. If the voltage is too low, increase the supply cable thickness and/or shorten the length of the supply cable run (if possible).
4. Raise the mast one foot (30.5 cm) and then lower it again. If the mast does not move:
  - Check the Up/Down Switch and ensure it is wired correctly
  - For pneumatic masts, check the Air Control Valve wiring and air supply lines
  - For Stiletto masts, check the wiring
5. Place an insulated, unshielded, energized 208 VAC cable above the Sensor. Rest the cable on the top of the Look-Up Light lens. The Electric Field Light should come on, and the alarm should sound when you attempt to raise the mast.
6. Bring the vehicle near, but not under, high-tension wires.

**⚠ WARNING**

**Electrocution Hazard!** Keep the mast a safe distance from the high voltage wires at all times when testing the D-TEC Sensor.

Carefully check to see if the AC alarm sounds and stops the mast extension when the Sensor is 10 feet (3 meters) or more away from the power line. This distance should increase when very high voltages are present.

## Section 3 Operation

This section describes operation of the D-TEC. The exact operating procedures may vary based on the configuration of your mast system. Follow the appropriate operation procedures for your mast system. See the operator's manual for your mast system for information on the operation on your specific mast. Use care to understand and follow all precautions while operating.

### 3.1 Pre-Operation Check

Before operating the system, ensure:

- All operators read and understand the entire operation procedure
- The D-TEC is properly installed
- The D-TEC is undamaged. If damage is apparent, do not use the D-TEC and have it serviced prior to use.
- All electrical cables are undamaged and properly terminated
- The vehicle is not moving
- Ensure the following precautions are understood and followed:

**⚠ WARNING**

**Safety Instruction – Operation!** Before beginning operation, 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. Your attention is directed to the OSHA electrical safety requirements in 29 C.F.R. part 1910. Be sure to allow sufficient clearance on all sides of mast to allow for side sway.

**⚠ WARNING**

**Safety Instruction – Operation!** If the D-TEC unit is damaged or collides with any obstructions, remove unit immediately and return to the Will-Burt Company for re-calibration. Operating a damaged unit can cause death or serious injury. Do not use unit in a damaged condition.

**⚠ WARNING**

**Safety Hazard!** Any one or all safety features provided can fail to operate at any time. The system is not a substitute for common sense and proper safety procedures. Tampering with the Sensor or Display electronics will void warranty.

**⚠ WARNING**

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

**⚠ WARNING**

**Safety Instruction – Operation!** Make sure all power has been disconnected from the D-TEC prior to manually lowering mast.

**⚠ WARNING**

**Safety Hazard!** 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**

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

**⚠ WARNING**

**Safety Hazard!** Keep personnel clear of mast during operation.

**⚠ CAUTION**

**Equipment Damage – Deviation!** Deviation from standard operating conditions and procedures could cause system failure.

**⚠ 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**

**Frozen Water Hazard!** Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open Drain Cock, when mast is not in operation. The Drain Cock shall be installed at the lowest position in the Pneumatic System. Cover locking masts when not in use. Non-locking masts stored outdoors should be covered if possible. Will-Burt P/N: 902989 is available from Will-Burt.

## 3.2 Operation Equipment

Table 3-1 lists recommended equipment for operation.

*Table 3-1 Equipment Recommended for Operation*

Recommended Equipment*			
Personal Protective			
Safety Glasses	Work Gloves	Nitrile or Vinyl Gloves	
Hearing Protection	Hard Hat or Helmet	Safety Shoes	
* Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.			

## 3.3 D-TEC Operation

The D-TEC is based on a distributed intelligence control structure. The D-TEC Sensor and Display each have a circuit board with an embedded micro controller which talk to each other over a multi-drop RS-485 serial communications link. For pneumatic masts, the D-TEC activates a relay to complete a circuit between a customer-operated toggle switch and an Air Control Valve. For Stiletto masts, the D-TEC works with the Stiletto control.

The D-Tec senses two types of voltage:

- Electric Field (E-Field), which is a measure of the amount of voltage potential present at a given point or distance from an electric source
- Magnetic Field (H-field), which is the amount of magnetic energy at a given point or distance from an electric current source

For additional information on the function of the D-TEC, see Section 6.1.

### 3.3.1 Power Up Sequence

When power is applied to the Display:

- A self-test is performed
- The audible message “Running Diagnostics” is played through the speaker
- The text message “SelfTst” is displayed
- All LED lights will be illuminated

During the self-test, the:

- Sensor applies a pseudo electric field to ensure the electric field circuitry is functioning properly
- Sensor applies a pseudo magnetic field to ensure the magnetic field circuitry is functioning properly
- Sensor checks the Look-Up Light and supply voltage
- Display checks to ensure it has valid communication with the Sensor

In the event the D-TEC fails the self-test, the audible message “Sensor Fault” will be played and the state indications will be displayed to assist with debugging (Section 5.1).

When the self-test has been successfully completed:

- The System Ready LED (green) will come on when a switch is pressed
- A “Mast ENA” message will be displayed
- The audible message “D-TEC Active” will be played

Once this has occurred, the unit is ready for normal operation. Before extending the mast, ensure the antenna is positioned so that the Sensor is the highest point.

### 3.3.2 Operating the Mast

To extend the mast, hold the Up/Down Switch to the UP position.

For a:

- Pneumatic mast, the Air Control Valve will energize and the mast will begin extending
- Stiletto mast, the mast will begin extending.

Provided there are no alarms or fault conditions, the mast will be able to be extended to full extension.

When extending the mast, it is possible that one or more of the following conditions may be encountered:

- AC Voltage (Electric Field) Detected
- AC Current (Magnetic Field) Detected

Should the D-TEC encounter an electric field (AC voltage) or magnetic field (AC current), an audible alarm will sound, the appropriate LED on the Display will light, and the D-TEC will disable the mast.

For a:

- Pneumatic mast, the Air Control Valve will change state and lower the mast as long as the toggle is held in the Up Position. As soon as the Up/Down Switch is released, the Air Control Valve will be deactivated and the mast will stop.
- Stiletto mast, the mast will change state and lower as long as the toggle is held in the Up Position. As soon as the Up/Down Switch is released, the mast will stop.

To lower the mast, move the Up/Down Switch to the DOWN position.

### 3.3.3 Clearing an Alarm

In the event the D-TEC has generated an alarm, the operator has the ability to clear the alarm by momentarily pushing the Override/Clear Switch. This will enable normal operation of the mast. Should the alarm occur again, the mast will be disabled and the appropriate warning message will be played again.

### 3.3.4 Overriding an Alarm

In the event the D-TEC has generated a persistent alarm, the operator has the ability to override the unit and continue raising the mast.

Note: The D-TEC will not allow an operator to override an alarm in an area where the electric fields exceed the OSHA limit (16.2 kV/m). In this case, the audible warning "OSHA Limit" will be played.

If the alarm appears to be incorrect, the alarm can be overridden as follows:

1. Momentarily push the Override/Clear switch to clear the alarm.
2. Attempt to raise the mast normally.

If the mast works normally, it is not necessary to override the alarm.

If the mast does not work normally, the operator may when override the alarm by simultaneously (within 2 seconds) engaging the Override/Clear Switch and Keylock Switch. If the installation is correct, this will require two people. If the switches are not engaged within the same relative time frame, an override will not occur.

Once the override process has been initiated, the following audible warning will be played in English and Spanish:

*"Warning. Aviso, peligro. Danger. Danger. You are about to override a safety device. Look up; you can be fatally injured. Make sure the area overhead is clear of all obstructions before you continue."*

This warning must play completely through one time before the mast is re-enabled. At that point, the override warning will continue to play and the Up/Down Switch can be utilized to raise the mast as long as the Override/Clear and Keylock Switches remain engaged. Once a particular alarm has been overridden, it will not again disable the mast until after a switch has been released, however another alarm can disable the mast. For example, if an electric field is overridden, an electric field will not disable the mast, but a magnetic field may still disable it. Each override of an alarm is time-stamped and recorded in the D-TEC's non-volatile memory for future reference (factory use only).

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## Section 4 Maintenance

This section describes maintenance procedures required to keep the system operational. Use care to understand and follow all precautions while performing these procedures.

Note: Do not disassemble the Sensor or Display. Doing so will break the tamper evident seal and void the warranty.

### 4.1 Pre-Maintenance Check

Before performing maintenance procedures, ensure the following precautions are understood and followed:

**⚠ WARNING**

**Safety Instruction – Operation!** Observe general safety precautions for handling equipment using high voltage. Always disconnect power before performing repair or test operations.

**⚠ CAUTION**

**Equipment Damage – Qualified Personnel!** All persons installing and maintaining this equipment should be suitably qualified and work to local, regional, and national standards and codes of practice.

### 4.2 Maintenance Equipment

Table 4-1 lists recommended equipment for maintenance.

*Table 4-1 Equipment Recommended for Maintenance*

Recommended Equipment*			
Personal Protective			
	Safety Glasses	Work Gloves	Nitrile or Vinyl Gloves
	Hearing Protection	Hard Hat or Helmet	Safety Shoes
Hand Tools			
	¼ Inch Drill	Crimping Tool or Solder Set	Electrical Tape
	Hand Drill	Hex Wrenches	Multimeter
	Screwdrivers	Wire Cutter / Stripper	Wrenches
* Note:			
<ul style="list-style-type: none"> <li>Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.</li> <li>When disposing of any disposables or components, do so according to any applicable local, regional, and national standards and codes of practice.</li> </ul>			

## 4.3 Spare Parts

To order spare or replacement parts, always refer to the D-TEC model number and serial number. These can be located on the Sensor. Throughout this manual, "P/N" followed by a number represents the part number for that component.

## 4.4 Scheduled Maintenance

Table 4-2 provides a schedule of preventative maintenance inspections and procedures to keep the D-TEC in good operating condition.

*Table 4-2 Preventative Maintenance Schedule*

Frequency	Inspection	Action
Before Each Deployment	Inspect the lens of the Look-Up Light to ensure it is clean.	If necessary, clean with warm soapy water and a soft cotton cloth.
Before Each Deployment	Inspect for damage before use.	If damage is apparent, do not use the system and have it serviced before use.
Monthly	Inspect all connectors and wires to ensure they are firmly attached and properly seated.	If necessary, re-secure connectors and wires.
Monthly	Inspect all external fasteners. Look for loose, missing, bent, or broken fasteners. Pay particular attention to the fasteners securing the D-TEC to the Installation Bracket and the Installation Bracket to the antenna fixture.	Replace any missing or damage hardware. If any hardware is found loose, retighten.
Semi-Annually	Inspect the lens of the Look-Up Light.	Clean with warm soapy water and a soft cotton cloth.

---

## Section 5 Troubleshooting

This section describes troubleshooting for the D-TEC. Use care to understand and follow all precautions while troubleshooting the D-TEC.

This section provides troubleshooting information as follows:

- Debug Menu (Section 5.1)
- No Audible Messages (Section 5.2)
- Unable to Override D-TEC (Section 5.3)

### 5.1 Debug Menu

To debug the D-TEC or check the software versions, hold the Override Switch and toggle the Up/Down Switch (between Down and neutral). The debug menu is shown on the alphanumeric display of the Display unit. Each time the Down Switch is toggled, it changes to the next parameter.

The debug feature may be used to check the current software version of the Display and Sensor units.

The debug menu parameters are shown as follows:

1. "Debug Menu" Message
2. Display Software Version
3. Date of the Software Version
4. #ORXXXXX where "XXXXX" represents the number of overrides the unit has had
5. #CEXXXXX where "XXXXX" represents the number of Communications Errors the unit has had
6. Serial Number of the Display

To exit the debug menu, release the Override/Clear and Up/Down Switches.

Table 5-1 State Indications

LED Status	Text Message	Audible Message	Root Issue	Troubleshooting / Potential Causes
System Ready <span style="color: green;">●</span> Electric Field <span style="color: red;">●</span> Magnetic Field <span style="color: red;">●</span>	SelfTst	"Running Diagnostics"	The unit is running a self-test. This is performed each time the unit powers up or has been reset. Once the self-test is complete and no faults are found, the System Ready green LED will illuminate.	N/A
System Ready ○ Electric Field ○ Magnetic Field ○	VR Fault	(Buzzer) "Sensor Fault"	The unit has detected a fault in the power supply circuit or the internal reference circuits during the self-test procedure.	Possible inadequate wiring (see Section 2.6.2.12).  Check wiring or notify The Will-Burt Company.
System Ready ○ Electric Field ○ Magnetic Field ○	LP Fault	(Buzzer) "Sensor Fault"	The unit has detected a fault in the Look-Up Light (lamp) circuit during the self-test procedure.	Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	EF Fault	(Buzzer) "Sensor Fault"	The unit has detected a fault in the AC voltage detection (electric field) circuit during the self-test procedure.	Possible Proximity to AC voltage field during self-test.  Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	EP Fault	(Buzzer) "Sensor Fault"	The unit has a temperature sensor SPI communication or EEprom fault detected during self-test.	Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HF Fault	(Buzzer) "Sensor Fault"	The unit has detected a fault in the AC current Detection (magnetic field) circuit during the self-test procedure.	Possible Proximity to AC current field during self-test.  Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HW Fault	(Buzzer) "Sensor Fault"	The unit has detected a fault in the hardware circuitry during the self-test procedure.	Notify The Will-Burt Company if problem persists.

Continued

Table 5-1 State Indications Continued

LED Status	Text Message	Audible Message	Root Issue	Troubleshooting / Potential Causes
System Ready ○ Electric Field ○ Magnetic Field ○	Comm Tim	(Buzzer) "Communications Fault"	The Display has not been able to establish communications with the Sensor during the self-test procedure. (This fault will self-clear if the Display is able to re-establish communications with the Sensor.)	Possible wiring problem.  Check connectors for tightness and clean contacts.  Check wiring. Notifying The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HDWFAULT VRAW	(Buzzer) "Self-Test Failure"	The Display has measured the supply voltage and found it outside acceptable limits.	Check the supply voltage to make sure it is within required limits.  Check battery. Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HDWFAULT V10	(Buzzer) "Self-Test Failure"	The Display has measured the internal 10 volt supply voltage and found it outside acceptable limits.	Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HDWFAULT V3.3	(Buzzer) "Self-Test Failure"	The Display has measured the internal 3.3 volt supply voltage and found it outside acceptable limits.	Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HDWFAULT SPI	(Buzzer) "Self-Test Failure"	The Display has identified an internal communications fault.	Notify The Will-Burt Company if problem persists.
System Ready ○ Electric Field ○ Magnetic Field ○	HDWFAULT RELAY	(Buzzer) "Relay Fault"	The Display has determined that the relay enabling the mast is in a state other than what the Display has placed it in.	Possible wiring problem.  Check wiring. Notifying The Will-Burt Company if problem persists.

Continued

Table 5-1 State Indications Continued

LED Status	Text Message	Audible Message	Root Issue	Troubleshooting / Potential Causes
System Ready <input type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input type="radio"/>	HDWFAULT COMM	(Buzzer) "Communications Fault"	The Display has identified a communications fault due to an inappropriate message.	Possible wiring problem.  Check for proper cable shielding.  Check wiring. Notify The Will-Burt Company of problem persists.
System Ready <input type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input type="radio"/>	HDWFAULT OverSwFit	(Buzzer) "Self-Test Failure"	The Display has identified that the Clear/Override Switch is closed at power-up.	Possible wiring problem.  Check wiring. Notify The Will-Burt Company if problem persists.
System Ready <input type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input type="radio"/>	HDWFAULT OvrKeyFit	(Buzzer) "Self-Test Failure"	The Display has identified that the Override Key Switch is closed at power-up.	Possible wiring problem.  Check wiring. Notify The Will-Burt Company if problem persists.
System Ready <input type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input type="radio"/>	HDWFAULT UpSwFit	(Buzzer) "Self-Test Failure"	The Display has identified that the Up Switch is closed at power-up.	Possible wiring problem.  Check wiring. Notify The Will-Burt Company if problem persists.
System Ready <input type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input type="radio"/>	HDWFAULT DnSwFLt	(Buzzer) "Self-Test Failure"	The Display has identified that the Up/Down Switch is in the Down Position (closed) power-up.	Possible wiring problem.  Check wiring. Notify The Will-Burt Company if problem persists.
System Ready <input checked="" type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input type="radio"/>	Mast ENA	"D-TEC Active"	The unit is enabling extension of the mast.	N/A
System Ready <input type="radio"/> Electric Field <input type="radio"/> Magnetic Field <input checked="" type="radio"/>	Magnetic Field	(Buzzer) "Magnetic Field"	The unit has detected a large AC current field, suggesting the nearness of a power line.	Move mast away from power line or voltage source.

Continued

Table 5-1 State Indications Continued

LED Status	Text Message	Audible Message	Root Issue	Troubleshooting / Potential Causes
System Ready <input type="radio"/> Electric Field <input checked="" type="radio"/> Magnetic Field <input type="radio"/>	Power LN XX.XKV/M	(Buzzer) "Electric Field"	The unit has detected a large AC voltage field, suggesting the nearness of a power line. The approximate magnitude of this field is shown in kV/m (kilovolts per meter).	Move mast away from power line or voltage source.
System Ready <input type="radio"/> Electric Field <input checked="" type="radio"/> Magnetic Field <input type="radio"/>	OSHA Limit	(Buzzer) "OSHA Limit"	The unit has detected a very large AC voltage field, suggesting the nearness of a high voltage power line.	Move mast away from power line or voltage source.

## 5.2 No Audible Messages

In the event that no audible messages are heard during operation of the D-TEC, check the wiring of the remote speaker.

## 5.3 Unable to Override D-TEC

In the event that overriding the D-TEC cannot be accomplished, check:

- The state of the Keylock Switch
- The state of the Override Switch
- The wiring for the Override and Keylock Switches

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## Section 6 Reference

This section provides reference information for the system as follows:

- D-TEC Function (Section 6.1)
- Extended Glossary of Terms (Section 6.2)

### 6.1 D-TEC Function

The task of accurately determining when it is safe to raise a mast near power lines is inexact at best. The electric fields around power lines are perturbed by the presence of other objects, other power lines, how the power lines are arranged on the pole, etc. In some cases, the fields can extend quite a distance from one side of the lines, and fade abruptly on the other side of the power lines. Therefore, as was mentioned previously, the D-TEC cannot be used blindly or relied upon without caution. It is simply a tool to help raise your level of caution. See Figure 6-1 and Figure 6-2 for indication of how some cases of electric and magnetic fields are shaped.

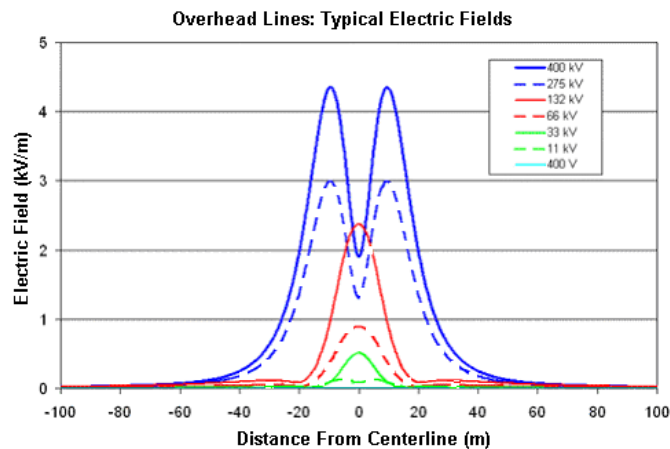


Figure 6-1 Typical Electric Fields

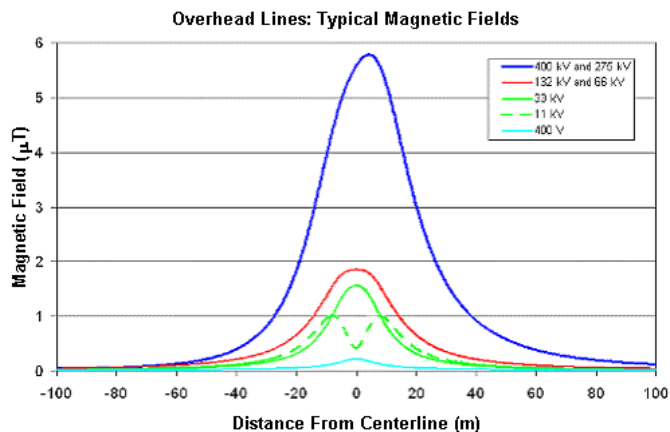


Figure 6-2 Typical Magnetic Fields

## 6.1.1 Electric Field Patterns

As mentioned above, some electric fields can extend a long distance from one side of a power line and fade abruptly on the other side. In Figure 6-3 below, a common power line configuration is shown where this type of electric field pattern occurs. Notice that the electric field will extend only 10 to 20 feet (3 to 6 meters) where two insulators are present but 70 to 80 feet (21 to 24 meters) where there is only one insulator. The operator of the mast and D-TEC may not be able to raise the mast where the electric field extends this far and may have to move to the other side of the power line or to a different location.

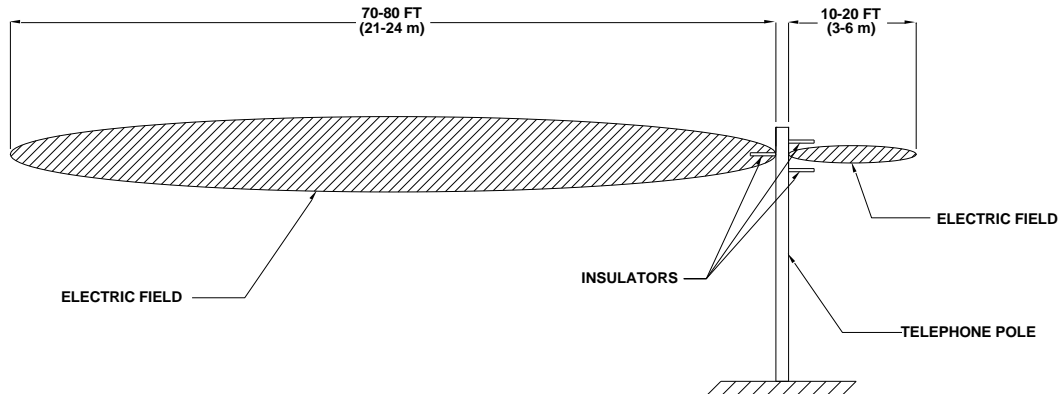


Figure 6-3 Electric Field Pattern

## 6.1.2 Electric Fields

An electric field (E-Field) measures the amount of voltage potential in units of kilovolts per meter (kV/m). When a mast is attached to a vehicle or other object that is in contact with the earth's surface, the electric field is measured relative to ground. The size of the vehicle and height of the mast also have an effect on the field strength that is measured by the D-TEC system. The following illustration shows a perfect electric field compared to an electric field with the presence of a vehicle and mast (Figure 6-4). Note that the vehicle is at ground potential (0 volts). The electric field lines cannot pass through the vehicle and must go up and around. The D-TEC Sensor is negatively affected by its close proximity to the vehicle but as the Sensor is raised into the air via the mast the electric field collapses about the D-TEC Sensor and a more true reading is achieved.

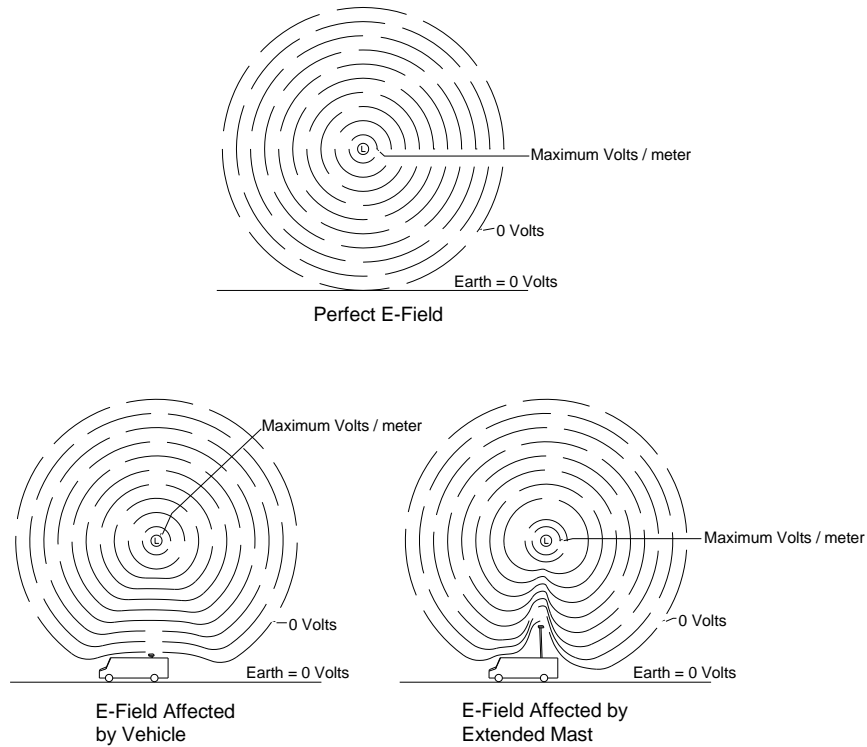


Figure 6-4 Electric Field Patterns

### 6.1.3 Magnetic Fields

A magnetic field (H-Field) is generated by the flow of electric current through a wire. When current flows through a wire, the magnetic field is generated perpendicular to the flow. The more current that flows, the stronger the magnetic field is. The ability of the D-TEC to sense a magnetic field allows the system to sense the presence of electric energy even if the voltage is low. This sensing method has proven to be effective near power generation plants or transformer sub-stations where the relative voltage potential is low compared to the amount of current. There are three magnetic field sensors in the D-TEC system and if any two approach saturation simultaneously, the D-TEC system will alarm for a magnetic field. Buried electric cables may also cause magnetic field alarms since the soil does not impede the magnetic field.

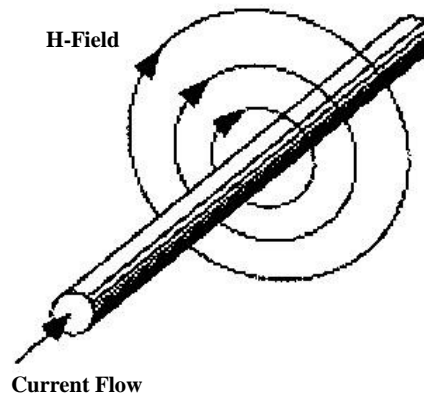


Figure 6-5 Magnetic Field Pattern

## 6.2 Extended Glossary of Terms

This section defines terms used within this manual as follows:

- Amp stands for ampere which is a unit of electric current.
- AWG stands for American Wire Gauge.
- D-TEC stands for the entire D-TEC Safety System (Sensor, Display, Installation Kit, and Installation Bracket).
- EEProm stands for electrically erasable programmable read-only memory.
- E-Field – See electric field.
- Electric Field which is a measure of the amount of voltage potential present at a given point or distance from an electric source. See Section 6.1.2 for additional information.
- H-Field – See magnetic field.
- Hz stands for hertz and is defined as one cycle per second.
- in.-lb. stands for inch-pounds, which is a unit of torque equal to the force in pounds multiplied by the distance in inches to the pivot point.
- Kilovolts stands for 1,000 volts.
- kV/m stands for kilovolts per meter.
- LED stands for light-emitting diode.
- mA stands for milliampere which is a thousandth of an amp.
- Magnetic Field which is the amount of magnetic energy at a given point or distance from an electric current source. See Section 6.1.3 for additional information.
- Mast refers to the telescoping structure that raises the payload.
- N-m stands for Newton Meters, which is a unit of torque equal to the force of one newton applied perpendicularly to a moment arm which is one meter long.
- Ohm which is the SI unit of electrical resistance.
- OSHA stands for Occupational Safety and Health Administration which is a United States agency which works to ensure safe and healthy working environments.
- P/N stands for Will-Burt Part Numbers for various components in the system.
- Payload stands for the object or equipment being raised by the mast to an operational height.
- RS-232 is a standard for serial communications.
- RS-485 is a standard for serial communications.
- SPI stands for Serial Peripheral Interface bus.
- UV Rated pertains to ultra-violet light which degrades plastics.