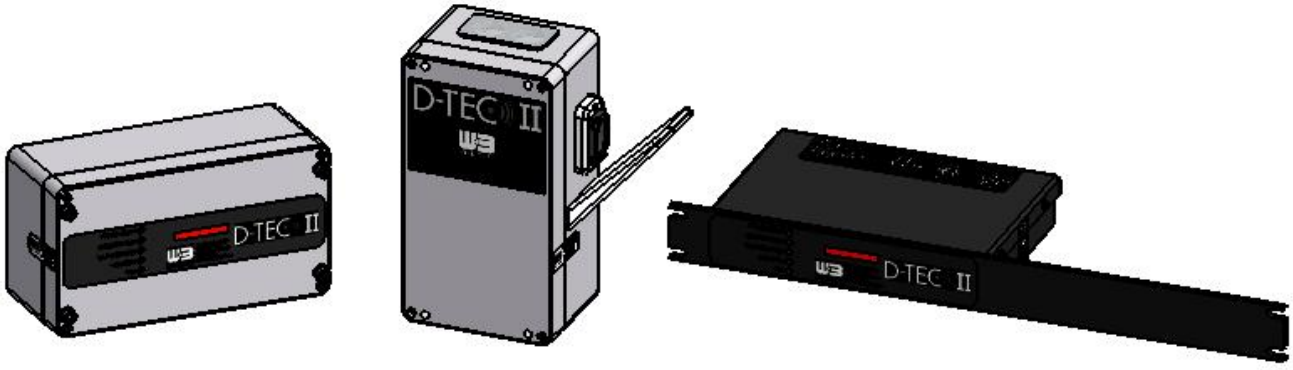
# INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

## COMBINED SYSTEM OF:

## D-Tec II SENSOR

## &

## D-Tec II DISPLAY

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# WARRANTY

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

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, AND NO REPRESENTATIONS, GUARANTEES OR WARRANTIES, EXPRESS OR IMPLIED, (INCLUDING, BUT NOT LIMITED, TO A WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) ARE MADE BY MANUFACTURER IN CONNECTION WITH THE MANUFACTURE OR SALE OF ITS PRODUCTS. NO EMPLOYEE, DISTRIBUTOR, OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY ON BEHALF OF MANUFACTURER.

Claims for defects in material and workmanship shall be made in writing to Manufacturer within thirty (30) days of the discovery of defect. Failure to provide notice as required hereby shall be conclusive evidence that the product was in conformity with the warranty, and the Manufacturer shall be released from any and all liability relating to the product. Manufacturer may either send a service representative or have the product returned to its factory at Buyer's expense for inspection. If judged by Manufacturer to be defective in material or workmanship, the product will be replaced or repaired at the option of Manufacturer, free from all charges except authorized transportation.

THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER REMEDIES. THE LIABILITY OF MANUFACTURER WHETHER IN CONTRACT, TORT, UNDER ANY WARRANTY, OR OTHERWISE, SHALL NOT EXTEND BEYOND ITS OBLIGATION TO REPAIR OR REPLACE, AT ITS OPTION, ANY PRODUCT OR PART FOUND BY MANUFACTURER TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP. MANUFACTURER SHALL NOT BE LIABLE FOR COST OF INSTALLATION AND/OR REMOVAL, OR BE RESPONSIBLE FOR DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.

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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.

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 D-Tec II.

**⚠ 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. 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**

**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**

**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.

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

SPECIFIC SAFETY PRECAUTIONS

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

**⚠ WARNING**

**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!** 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**

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

**⚠ WARNING**

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

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

**⚠ WARNING**

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

**⚠ 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.

**⚠ WARNING**

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**

**Safety Hazard!** Keep personnel clear of unit during operation

**⚠ WARNING**

**Safety Instruction – Operation!** Make sure all power has been disconnected from the D-Tec II 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**

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

**⚠ 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 control unit electronics will void warranty.

**⚠ 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, air fittings, or D-Tec II sensor unit may render unit inoperable and cause major equipment damage. Open drain, when mast is not in operation, in temperatures near or below freezing.

# 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 operation, maintenance, troubleshooting, repair, and installation instructions for the D-Tec II. 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 D-Tec II consists of a Sensor (attached to the top of a mast) and a status Display/control unit, which is mounted on the inside of a vehicle. See Figure 1-1. The control unit is wired into the mast air valve control to stop mast extension in the event of a hazardous condition. The two units communicate over an RS-485 link with the Display unit operating as the communications master. This means that the Display unit initiates all communication. The D-Tec II only allows or disallows the operator to extend a mast. It does not provide direct power to the mast. This unit is intended as a safety tool, and in no way is a substitute for common sense and caution.

The D-Tec II has four 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.
- Ultrasonic detection to sense the presence of nearby and overhead physical obstructions.
- Inclinometer to sense the orientation of the device and ensure proper operation of the afore-mentioned modes.

Additionally, the Sensor unit includes a look-up light composed of two ultra-bright white LEDs. An ambient light sensor interacts with these to ensure that they are only illuminated when it is dark.

The Display unit 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 valve (for raising the mast).

Both the Sensor and Display units perform self-diagnostic routines each time the unit is powered up.

## 1.4 REFERENCE DATA

Reference data for the D-Tec II is given in Table 1-1.

Table 1-1 Reference Data

| Functional Characteristics | Limits |
|---|---|
| Temperature Limits | -40 °C. to +85 °C. |
| Duty Cycle | 100% |
| Power Supply | 11 to 33 Volts DC |
| Allowable Vertical Tilt | +/- $10^{o}$ |
| Minimum Voltage Detection | 2.3 Kilovolts/Meter |
| Distance of Ultrasonic Detection | 10 Feet |

Table 1-2 General Dimensions

| Basic Enclosure Dimensions (inches) | |
|---|---|
| Sensor Unit | 3.6L x 7.8W x 8.7H |
| Panel Mount Display Unit | 8.7L x 4.7W x 3.6H |
| Rack Mount Display Unit (Rear Enclosure)<br>(Front Panel) | 8.5L x 5.8W x 1.6H<br>EIA 19 inch rack single height unit |

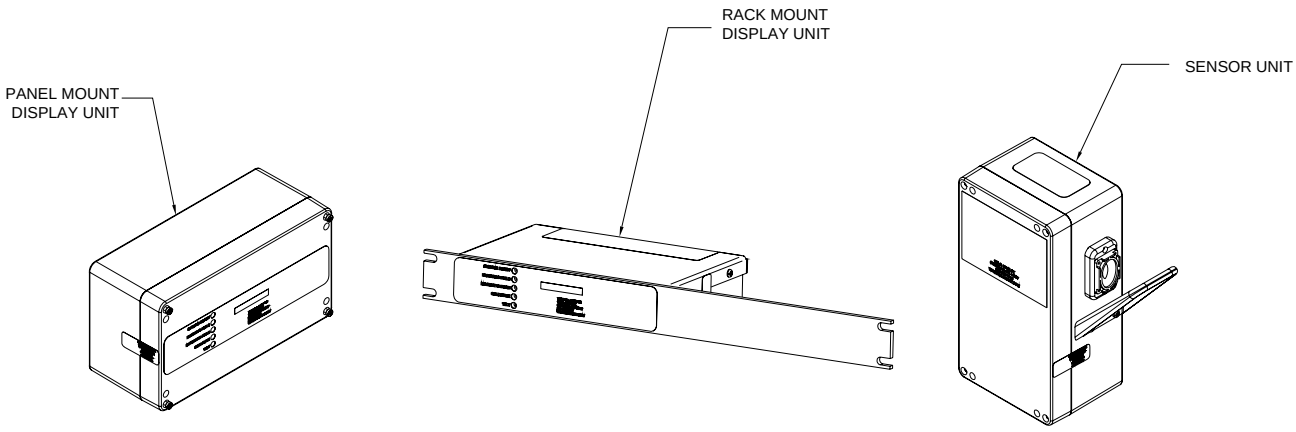


Figure 1-1 D-Tec II

# CHAPTER 2
# INSTALLATION

**⚠ WARNING**

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

**⚠ 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**

**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.

## 2.1 INTRODUCTION

The D-Tec II Sensor should be installed on the uppermost point of an extendable device (mast). The D-Tec II Display should be installed inside a vehicle.

## 2.2 TOOLS AND MATERIALS REQUIRED FOR INSTALLATION

Table 2-1 provides a list of tools and materials required to install the unit and test it after installation is complete.

Table 2-1 Tools and Materials Required for Installation

| | |
|---|---|
| Wrenches | Allen Wrenches |
| Screwdrivers | Hand Drill, ¼” Drill |
| Electrical Tape | Multimeter (to verify power is turned OFF) |
| Crimping tool or Solder set | Wire cutter/stripper |
| Hook-up Wire | |

## 2.3 UNPACKING

Unpack the D-Tec II as follows:

1. Carefully open and remove all parts from shipping container.
2. Inspect for any shipping damage. If damage occurred, notify carrier.
3. Be sure that all components are included and that the required tools are readily available.

## 2.4 INSTALLATION

For a list of parts included in the installation kit, please see Table 5-2.

2.4.1 Sensor Unit with an Antenna

If the D-Tec II is being mounted with an antenna, the top of the sensor must be located 2 to 3 inches above the highest component of the antenna (see Figure 2-2 and Figure 2-3). If any part of the antenna is above the sensor, the D-Tec II may sound a collision alarm and/or prevent the mast from being raised. Shield any wire carrying 120V AC or higher if closer than 24 inches to the sensor unit. The Sensor unit should be mounted on the supplied bracket using the four screws (size M6) located on the bottom of the unit. See Figure 5-1 for additional reference. Because the size and shape of antennae will vary, the customer is responsible for modifying and mounting this bracket to the antenna fixture. The emissions pattern of the ultrasonic sensor has secondary lobes that may detect obstructions off to the side.

The Sensor must be installed in the upright position to operate properly. The lookup lights must be facing upwards, as shown in Figure 2-1. If the unit is tilted greater than ten degrees in any direction from the vertical position, the tilt sensor will sound an alarm and prevent the mast from being raised.

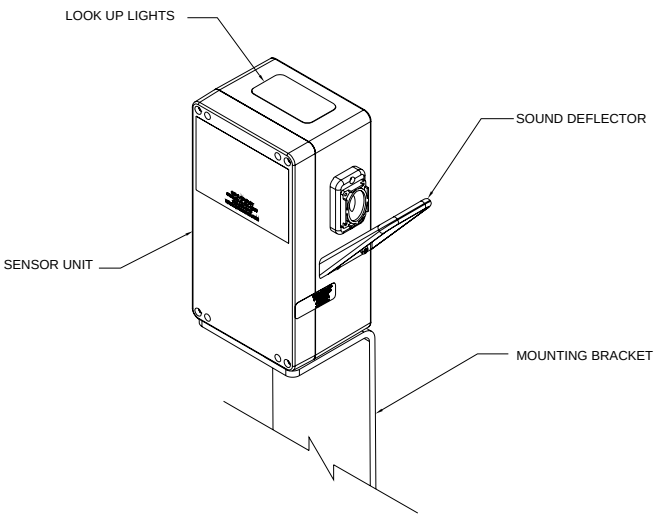


Figure 2-1 D-Tec II Sensor in Upright Position

The Sensor's ultrasonic sound pattern (detection range) of the ultrasonic sensor is oval shaped. The sound pattern is reflected off the sound deflector. **Avoid having anything mounted in the way of the sound pattern.** See Figure 2-2 and Figure 2-3 for the sound pattern. **(Note: If installing an antenna that is wider than six feet, the antenna may not be fully protected.)**

If installing the D-Tec II unit to protect a “Dish” type antenna, mount the D-Tec II unit with the deflector towards the dish (see Figure 2-2). If the antenna is longer in one direction, the sensor should be positioned so that the wider sound pattern is in line with the direction of the antenna (Figure 2-3).

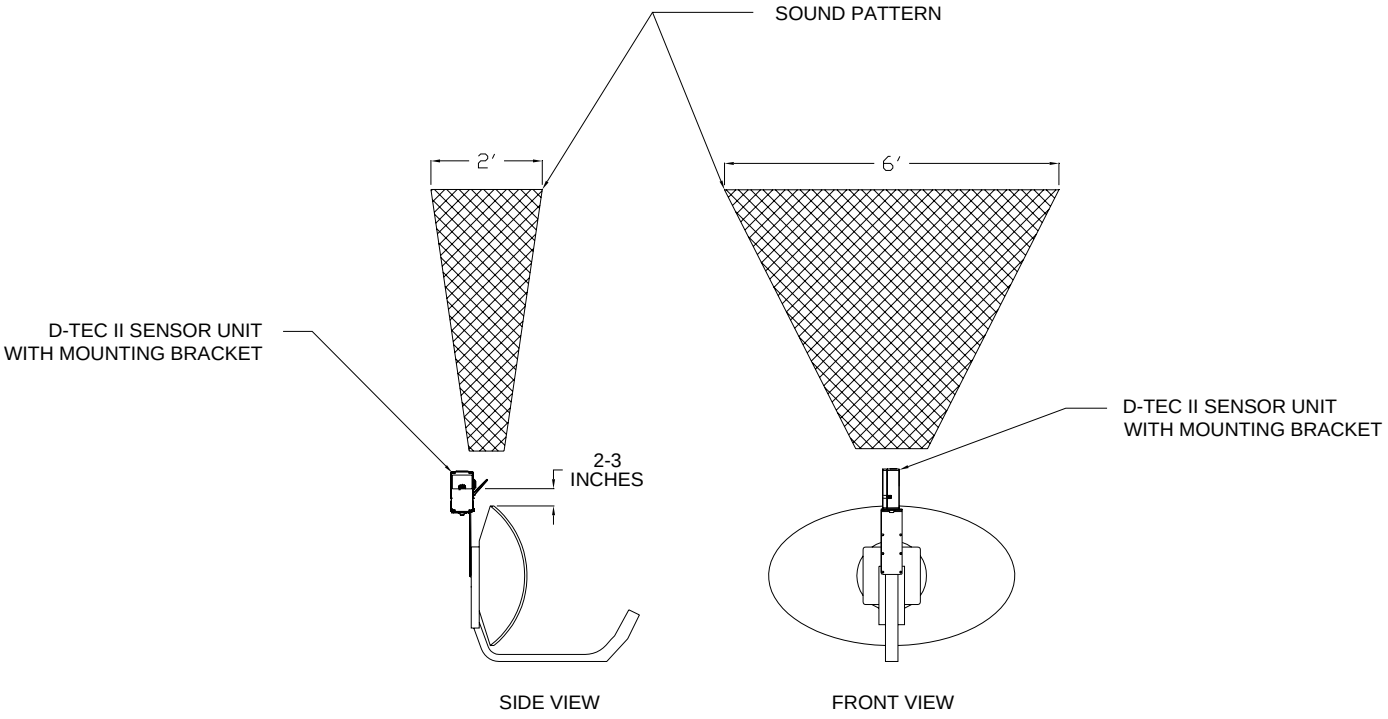


Figure 2-2 D-Tec II Installation with Dish Antenna

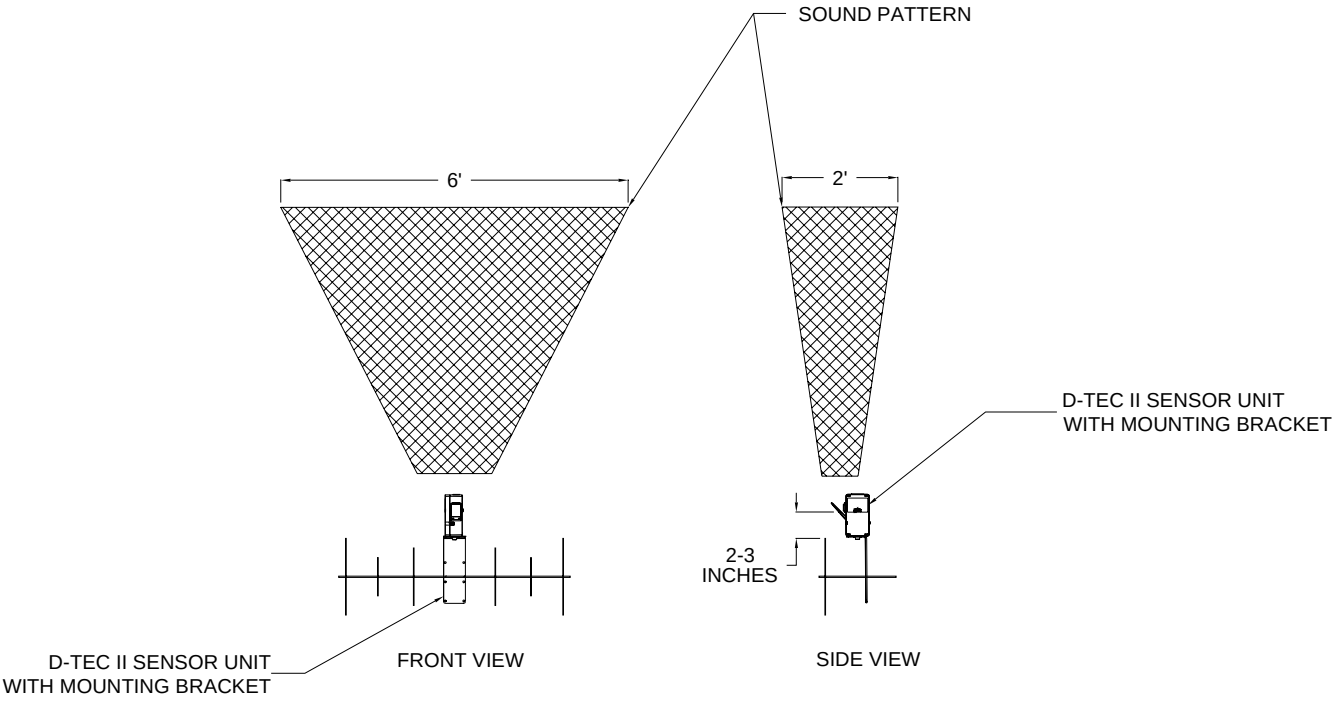


Figure 2-3 D-Tec II Installation with Multi-Element Antenna

2.4.2 Display Control Unit

The D-Tec II Display unit may be panel mounted or rack mounted depending on customer specification. When using a rack mounted unit, the necessary rack mounting hardware will be customer supplied. See Figure 2-4 for further reference. For a panel mounted display unit, use the included mounting brackets to mount the display on the inside of the vehicle. The customer will be responsible for providing the appropriate hardware. For this type of mounting, see the drill pattern in Figure 2-5.

Mount the D-Tec II display/control unit inside the vehicle. Make sure the alphanumeric display screen is visible while operating the mast. See Figure 5-2 and Figure 5-3 for additional reference.

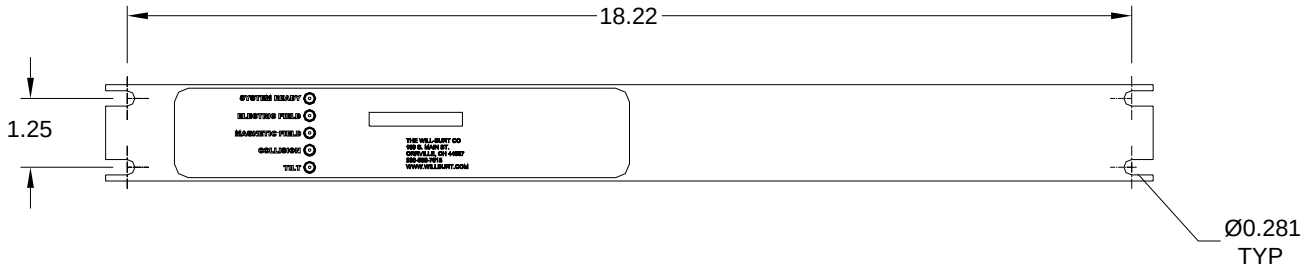


Figure 2-4 Mounting Dimensions for Rack Mounted Display

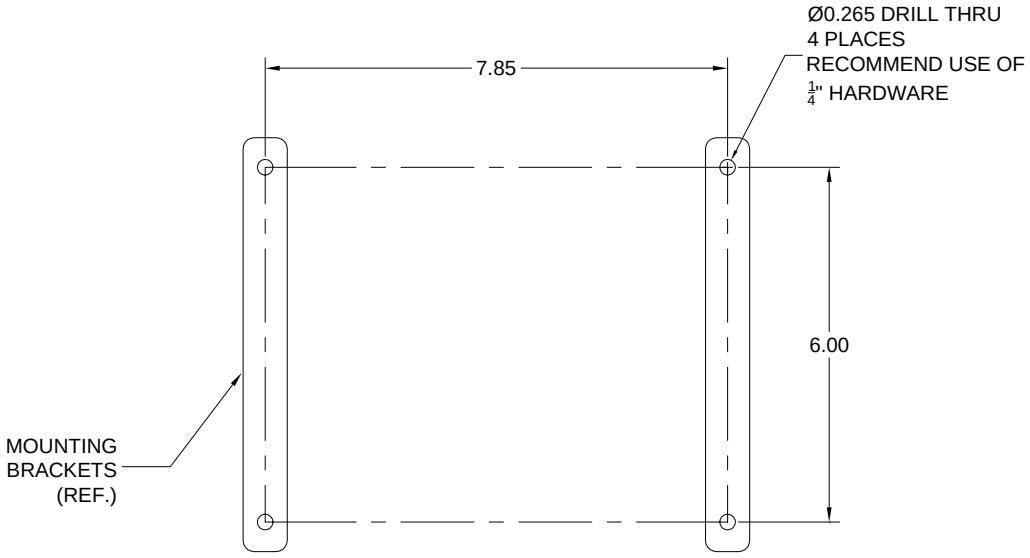


Figure 2-5 Drill Pattern for Panel Mounted Display

The Display unit should be mounted to provide easy access to the connectors (J3, J4, J5, and J6) located on the bottom (or back, in the case of the Rack mounted Display) of the Display enclosure. See Figure 2-6 below.

Will-Burt has provided two receptacles with pigtails and terminal blocks in the installation kit to simplify wiring of the D-Tec II Display. The DB25 receptacle should be plugged into the J6 connector. The attached pigtail will run to the provided terminal block where the operator should make necessary wire connections. Likewise, receptacle DB9 will be plugged into connector J3 and the attached pigtail will run to a separate terminal block. See the wiring diagrams in Figure 2-7 and Figure 2-8 for connection detail. For a complete system schematic, see Figure 2-11.

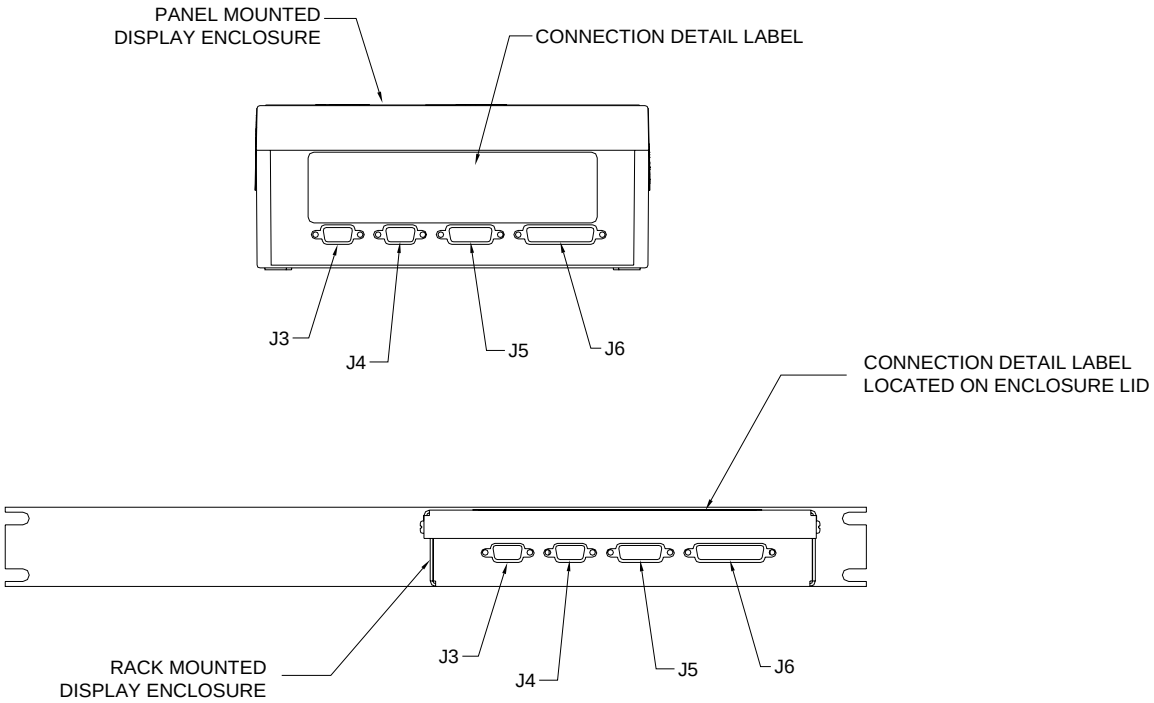


Figure 2-6 Display Unit Connector Information

2.4.3 Mast Up/Down Switch

To install the "Mast Up/Down" switch, locate the switch so that the top of the mast will always be visible to the operator while the switch is engaged. Use a section of 3-conductor wire for installation. Connect the Up/Down wires from the DB25 connector on the Display unit to the terminal block. The mast raise connection (orange wire) runs from DB25 pin 14. The mast lower connection (yellow wire) runs from DB25 pin 15. Connect the switch common wire from DB25 to the terminal block. See Figure 2-7 for connection detail.

2.4.4 Override/Clear Switch

To install the "Override/Clear" switch, locate the switch close enough to the Mast Up/Down switch such that the operator may utilize both switches and always have the top of the mast within the operators field of vision. The green and white wires running from DB25 pins 3 and 16 respectively should be connected to the terminal block. Use a section of 2-conductor wire for installation of the switch. Connect one side of the Override/Clear switch to the green wire, and the other side of the switch to the white wire. See Figure 2-7 for connection detail.

2.4.5 Key Switch

The Key switch should be installed seven feet or greater from the Override/Clear switch such that it is impossible for one person to operate both simultaneously. Additionally, the Key Switch must be installed such that the top of the mast will always be visible to the second operator while the switch is engaged. The distance between should force a two-person override. The blue and brown wires running from DB25 pins 4 and 17 respectively should be connected to the terminal block. Use a section of 2-conductor wire for installation of the switch. Connect one side of the Key switch to the blue wire, and the other side of the switch to the brown wire. See Figure 2-7 for connection detail.

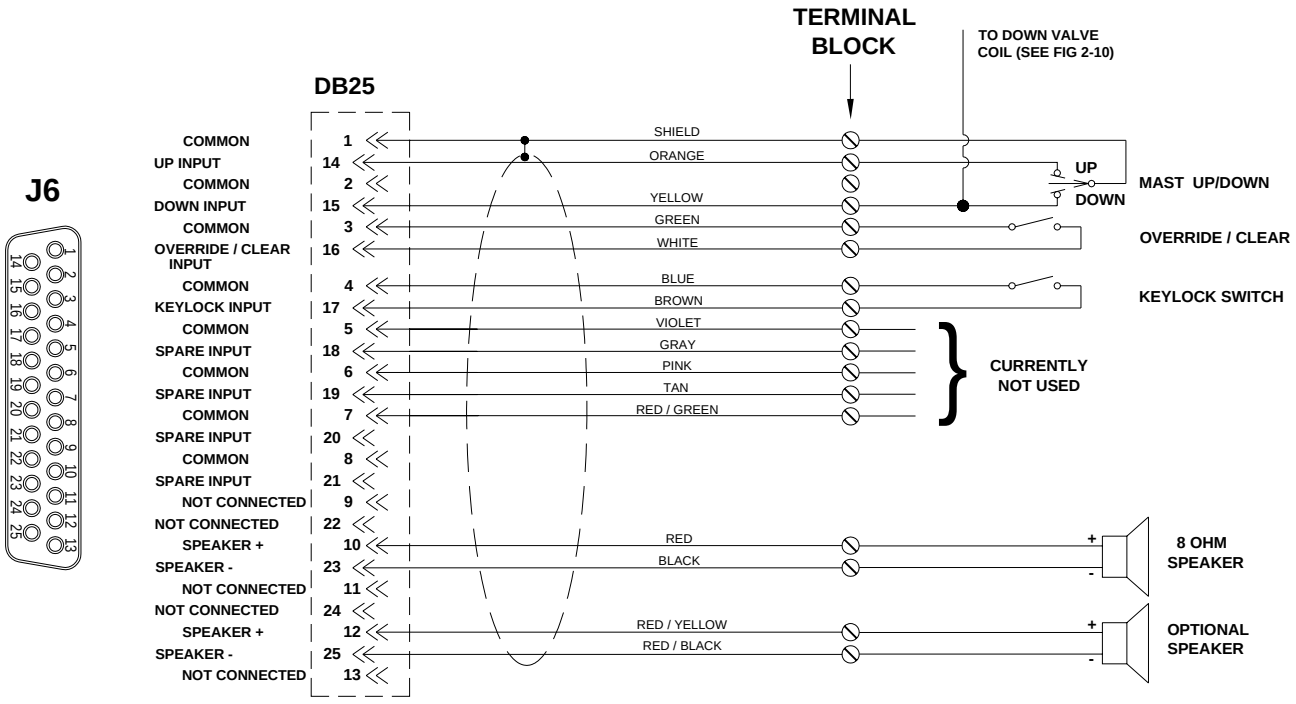


Figure 2-7 Wiring of J6

2.4.6 System Power

The D-Tec II system is designed to operate from either a 12-volt or 24-volt DC supply. The system power is connected from receptacle DB9. See Figure 2-8. Use an 18-gauge minimum two-conductor power cord (customer supplied) for installation. Connect the red +12V (or battery positive) wire from DB9 pin 2 to the terminal block. Connect the black common (or battery negative) wire from DB9 pin 7 to the terminal block as well. Use the supplied in-line fuse inserted into the +12 volt source wire to provide 5-amp protection to the D-Tec II unit. An optional power On/Off switch may be added at the customer's discretion in series with the in-line fuse.

The wires providing the supply voltage should be at least AWG #18. The maximum current drawn is approximately 4 amperes. Once the system has been turned on, use a multimeter to check the input voltage of the display unit. The voltage must be between 11-33 volts. If the voltage is too low, increase the supply wire thickness, and/or shorten the length of the supply wire (if possible).

2.4.7 Air Valve System (Optional Will-Burt supplied)

The customer may choose to purchase the air valve control Will-Burt supplies. The air valve control is used to stop the mast from extending in the event of an obstruction, electric field, etc. The air valve control is comprised of two valves plumbed together. Each valve coil has two black wires. One wire of each valve coil should be tied together with each other and then connected to the red wire on the terminal block where battery positive is also connected. Next, connect the remaining wire from the Up air valve coil to the orange wire from the DB9 at the terminal block. Finally, connect the remaining wire from the Down air valve coil to the yellow wire from the DB9 at the terminal block. Polarity is of no concern for the black wires from each valve coil. See Figure 2-8 for connection detail and Figure 5-6 for additional reference. For air valve controls not supplied by Will-Burt, the customer is responsible for making the correct wire connections.

**Note:** A check valve must be installed between the air supply and the valve set. All Will-Burt compressor systems are supplied with a check valve.

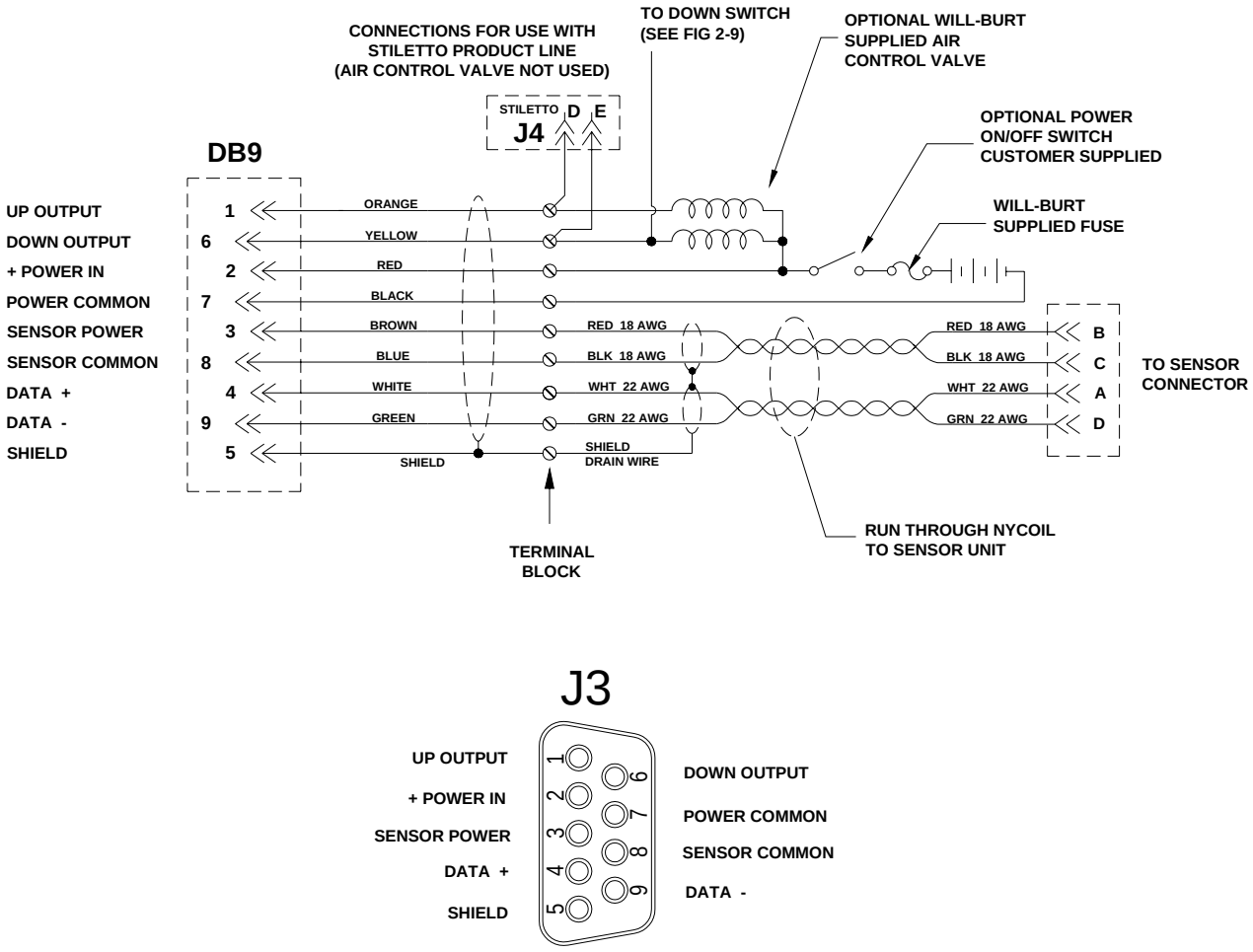


Figure 2-8 Wiring of J3

2.4.8 Remote Computer (Not Supplied)

The D-Tec II has certain functionality that is available through a standard RS-232 connector. Personnel from a factory authorized service center reserve this for their use only. For connection detail of J4, see Figure 2-9.

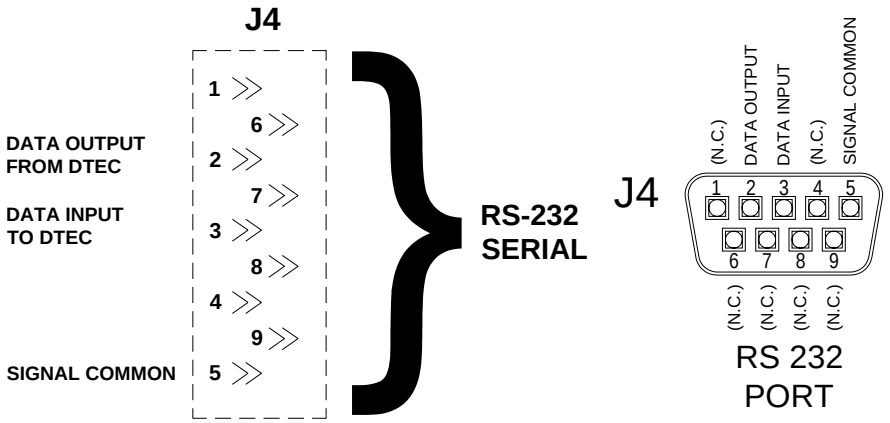


Figure 2-9 Wiring of J4

2.4.9 Remote Annunciators

The D-Tec II has outputs suitable for driving optional remote annunciators. These may take the form of a small incandescent pilot light, an LED, or a small Sonalert. Please note that these outputs cannot supply large amounts of current. See Figure 2-10 for connection detail.

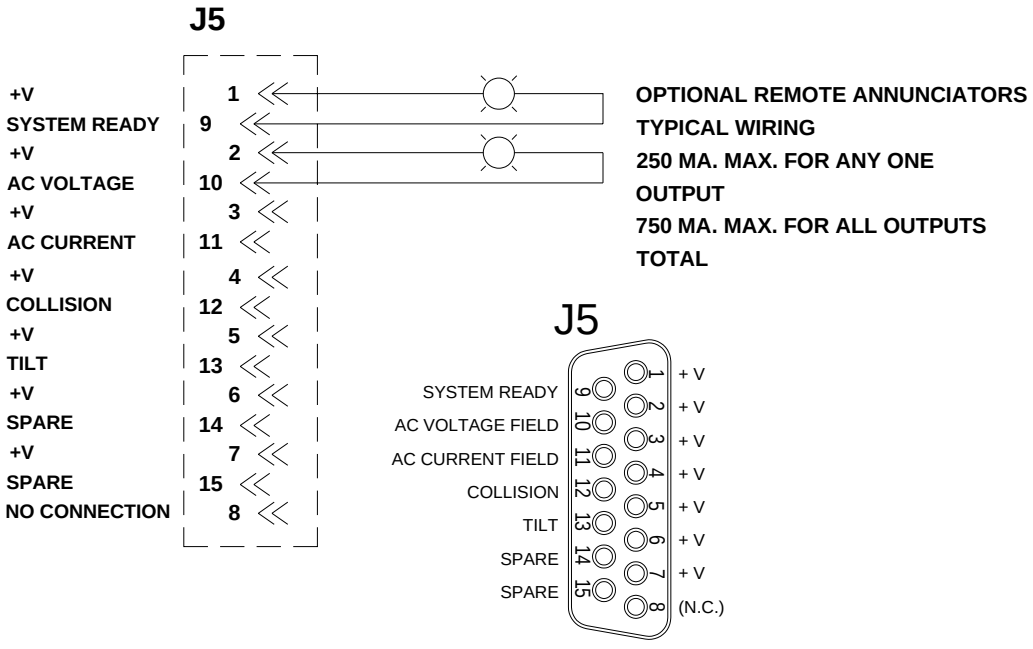


Figure 2-10 Wiring of J5

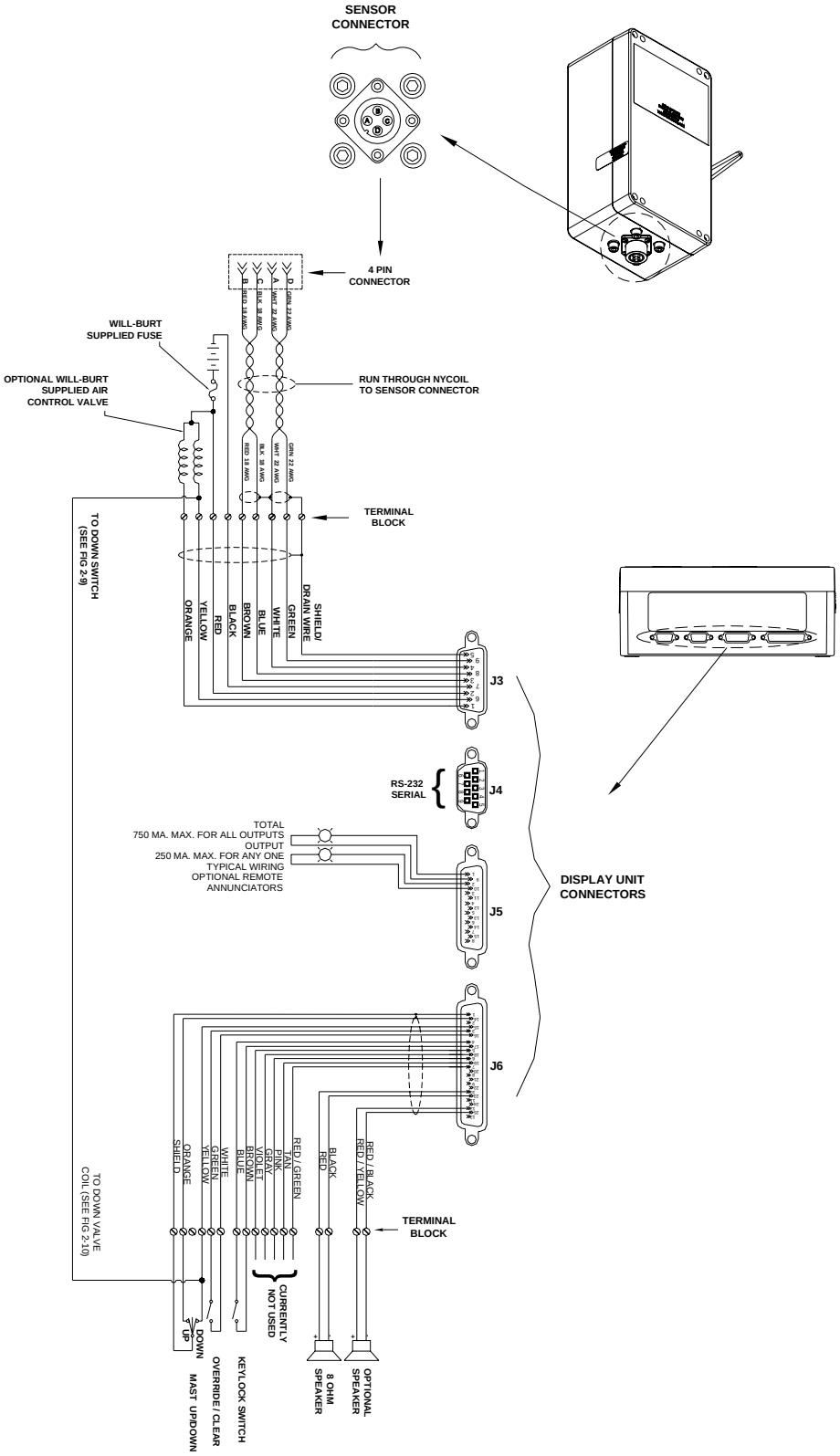


Figure 2-11 Complete System Schematic

2.4.10 Integration with Stiletto Controls

The D-Tec II may be successfully integrated with the Stiletto control by using the valve output of the D-Tec II display to drive the Handheld Remote Control port of the Stiletto control. Follow the wiring scheme of Figure 2-8. This approach assumes that both the D-Tec II and the Stiletto share a common power source, or that the negative sides of their power sources are connected together. The Up/Down switch of the D-Tec II will then cause the Stiletto mast to raise and lower accordingly.

## 2.5 PRE-OPERATIONAL CHECK

Before testing the installation, re-check that you have made all the connections that are required. Also, make sure that you have mounted the display unit to the wall and made all necessary wire connections from the connectors into the sensor. **Be sure the connector on the sensor is tight.**

The following pre-operational check should be completed following installation of the D-Tec II. The unit should meet all of the below criterion before use in the field.

**1)** Turn on the display unit. When power is applied to the display unit, a self-test is performed, and the audible message "Running Diagnostics" should be heard on the speaker and the text message "Self Tst" should be displayed. When testing has been successfully completed, the system ready LED (green) should come on, a "MAST ENA" message should be displayed, and the audible message "D-Tec II Active" should be heard on the speaker.

**2)** The system ready LED (green) light on the display unit should be steady.

**3)** The voltage at the input of the display unit should be checked after the system has been turned on. The voltage must be between 11-33 volts. If the voltage is too low, increase the supply wire thickness, and/or shorten the length of the supply wire run (if possible).

**4)** When system ready light is on, the air valve is "Enabled" and the mast controls will become operational.

**5)** If the tilt light comes on, the tilt alarm should go off. Reposition the sensor so it is pointing within +/- $10^{o}$ of vertical.

**6)** Raise the mast one foot and then lower it again. If the mast does not move, check the air valve system wiring and air supply lines. Also, check the Up/Down switch and make sure it is wired correctly. Refer to Figure 2-7 and Figure 2-8.

**7)** Move an object (e.g. broom handle or pole) at least 3 feet above the sensor. The collision alarm should activate.

**8)** Place an insulated, unshielded, energized 120V AC wire above the sensor. Rest the wire 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.

**9)** Move the vehicle beneath an overhead obstruction (e.g. tree or bridge) and verify that the collision alarm comes on about 10 feet away from the obstruction.

**10)** Bring the vehicle near, but not under, high-tension wires. **IMPORTANT: KEEP THE MAST A SAFE DISTANCE FROM THE HIGH VOLTAGE WIRES AT ALL TIMES WHEN TESTING THE D-Tec II SENSOR.** Check to see if the AC alarm sounds and stops the mast extension when the sensor is 10 feet or more away from the power line. This distance should increase when very high voltages are present.

# CHAPTER 3
# OPERATING INSTRUCTIONS

**⚠ 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**

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

**⚠ WARNING**

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

**⚠ WARNING**

**Safety Instruction – Operation!** Make sure all power has been disconnected from the D-Tec II 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**

**Safety Instruction - Operation!** If the D-Tec II 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 control unit 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.

**⚠ 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, air fittings, or D-Tec II sensor unit may render unit inoperable and cause major equipment damage. Open drain, when mast is not in operation, in temperatures near or below freezing.

## 3.1 THEORY OF OPERATION

The D-Tec II device is based on a distributed intelligence control structure. Each section of the D-Tec II has a circuit board with an embedded micro controller. The two sections are the Sensor and the Display. These boards "talk" to each other over a multi-drop RS-485 serial communications link. The D-Tec II activates a relay to complete a circuit between a customer operated toggle switch and a customer or Will-Burt supplied air valve for the mast.

There are two types of voltage sensing with the D-Tec II. Electric field (E-Field) is a measure of the amount of voltage potential present at a given point or distance from an electric source and magnetic field (H-Field) the amount of magnetic energy at a given point or distance from an electric current source. For additional theory of operation of the D-Tec II, see CHAPTER 6.

## 3.2 POWER-UP SEQUENCE

When power is applied to the display unit, a self-test is performed, and the audible message "Running Diagnostics" is played through the speaker and the text message "Self Tst" should be displayed. In addition, all of the LED lights will be illuminated during this self-test. 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 II Active" will be played. Once this has occurred, the unit is ready for normal operation.

During the self-test, the sensor applies a pseudo electric field to make sure the E-field circuitry is functioning properly. The sensor performs a check of the ultrasonic (obstruction) sensor. The sensor applies a pseudo magnetic field to make sure the H-field circuitry is functioning properly. It also checks the look-up light, the inclinometer (tilt), and the supply voltage. The display also checks to make sure it has valid communication with the sensor. In the event that the D-Tec II fails the self-test, the audible message "Sensor Fault" will be played. Additionally, various messages will be displayed. See Table 4-2 for additional information.

During the self-test, the antenna should be positioned such that the D-Tec II sensor is pointing straight up (within +/- $10^{o}$ of vertical). See Figure 2-1.

## 3.3 RAISING THE MAST

Move the Mast Up/Down switch to the "Up" position. The air valve will energize and the mast will begin rising. Provided there are no alarm or fault conditions, the mast will be able to be raised to its full-extended position. However, one or more of the following conditions may be encountered while raising the mast.

### 3.3.1 Collision Detect

Should the D-Tec II encounter an obstruction as sensed by the ultrasonic sensor, the D-Tec II will disable the mast (causing the air valves to change state and lower the mast as long as the toggle is held in the "Up" position). See Table 4-2. As soon as the Mast Up/Down switch is released, both air valves will be deactivated and the mast will stop.

3.3.2 AC Voltage Detect (Electric Field)

Should the D-Tec II encounter an AC electric field, the D-Tec II will disable the mast (causing the air valves to change state and lower the mast as long as the toggle is held in the "Up" position). See Table 4-2. As soon as the Mast Up/Down switch is released, both air valves will be deactivated and the mast will stop.

3.3.3 AC Current Detect (Magnetic Field)

Should the D-Tec II encounter an AC current field, the D-Tec II will disable the mast (causing the air valves to change state and lower the mast as long as the toggle is held in the "Up" position). See Table 4-2. As soon as the Mast Up/Down switch is released, both air valves will be deactivated and the mast will stop.

3.3.4 Tilt Detect

Should the D-Tec II determine that the Sensor head is tilted outside a +/- 10º angle off vertical, the D-Tec II will disable the mast (causing the air valves to change state and lower the mast as long as the toggle is held in the "Up" position). See Table 4-2. As soon as the Mast Up/Down switch is released, both air valves will be deactivated and the mast will stop. This alarm is self-clearing, so simply repositioning the payload will allow you to proceed.

## 3.4 CLEARING AN ALARM

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

## 3.5 OVERRIDING AN ALARM

In the event the D-Tec II has generated a persistent alarm, the operator has the ability to override the unit and continue raising the mast. If the alarm seems to be incorrect, the unit may first be cleared by momentarily pushing the Override/Clear switch. The operator may then again attempt to raise the mast normally. If the alarm persists, the operator may then override the unit. This may be accomplished by simultaneously (within 2 seconds) engaging the Key switch and the Override/Clear switch. If installation is correct, this will require two people. The switches must both be engaged within the same relative time frame or an override will not occur. Each override of an alarm is time-stamped and recorded in the non-volatile memory of the D-Tec II for future reference. If, for instance, an Obstruction alarm is overridden, other types of alarms (i.e. tilt, Electric Field, Magnetic Field, etc.) may still disable the mast. Once a particular type of alarm has been overridden, it will not again disable the mast. 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 complete playing 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 Key switch and Override/Clear switches are engaged.

**NOTE: The electric field, magnetic field and collision alarms can be overridden. The tilt alarm cannot be overridden at any time.**

**NOTE: D-Tec II will not allow an operator to override an alarm in an area where the electric field exceeds the OSHA limit (16.2 kV/m). In this case, the audible warning "OSHA limit" will be played.**

# CHAPTER 4
# MAINTENANCE AND SERVICE INSTRUCTIONS

**⚠ WARNING**

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

## 4.1 INTRODUCTION

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

## 4.2 TOOLS REQUIRED

Table 4-1 Tools Required for Maintenance

| | |
|---|---|
| Wrenches | Allen Wrenches |
| Screwdrivers | Hand Drill, ¼" Drill |
| Electrical Tape | Multimeter (to verify power is turned OFF) |
| Crimping tool or Solder set | Wire cutter/stripper |

## 4.3 SCHEDULED MAINTENANCE

4.3.1 Cleaning.

Semi-annually clean the lens of the Look-Up light located on the top of the Sensor. Use a soft cotton cloth and warm soapy water.

4.3.2 Inspection.

Before each mast deployment, inspect the sound deflector that angles out from the Sensor to ensure it is intact and free of debris.

Before each mast deployment, inspect the Look-up light lens to ensure is clean. If necessary, clean with warm soapy water and a cotton cloth.

A monthly inspection of all connectors and wires should be done to ensure they are firmly attached and properly seated.

## 4.4 TROUBLESHOOTING

### 4.4.1 D-Tec II Debug Menu

The debug is menu displayed from the Display Unit by holding the override switch and toggling the down switch. Each time the down switch is toggled, it changes to the next parameter.

This feature may be used to check the current software version of the Display and Sensor Units. After the message "Debug Menu" is displayed on the screen, toggle to the next parameter and the Display Unit software revision will appear on the screen. The Sensor unit software version is the sixth parameter displayed. To exit the Debug Menu, release the override and down switches.

Table 4-2 State Indications

| LED Status | Text Message | Audible Message | Root Issue | Troubleshooting/ Potential Causes |
|---|---|---|---|---|
| SYSTEM READY (●)<br>ELECTRIC FIELD (●)<br>MAGNETIC FIELD (●)<br>COLLISION (●)<br>TILT (●) | Self Tst | "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 light will illuminate. | N/A |
| SYSTEM READY (○)<br>ELECTRIC FIELD (○)<br>MAGNETIC FIELD (○)<br>COLLISION (○)<br>TILT (○) | US Fault | (Buzzer) "Sensor Fault" | The unit has detected a fault in the Collision Detection (Ultrasonic) circuit during the self-test procedure. | Notify The Will-Burt Co. if problem persists. |
| SYSTEM READY (○)<br>ELECTRIC FIELD (○)<br>MAGNETIC FIELD (○)<br>COLLISION (○)<br>TILT (○) | VR Fault | (Buzzer) "Sensor Fault" | The unit has detected a fault in the Power Supply circuit during the self-test procedure. | Possible Inadequate Wiring. (Read 2.4.6)<br><br>Check Wiring or notify The Will-Burt Co. |
| SYSTEM READY (○)<br>ELECTRIC FIELD (○)<br>MAGNETIC FIELD (○)<br>COLLISION (○)<br>TILT (○) | IN Fault | (Buzzer) "Sensor Fault" | The unit has detected a fault in the Tilt Detection (Inclinometer) circuit during the self-test procedure. | D-Tec II is not pointed straight up<br><br>Notify The Will-Burt Co. if problem persists. |

| | | | | |
|---|---|---|---|---|
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | 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 Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | EF Fault | (Buzzer) "Sensor Fault" | The unit has detected a fault in the AC Voltage Detection (E-Field) circuit during the self-test procedure. | Possible Proximity to AC Voltage Field during self-test<br><br>Notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | HF Fault | (Buzzer) "Sensor Fault" | The unit has detected a fault in the AC Current Detection (H-Field) circuit during the self-test procedure. | Possible Proximity to AC Current Field during self-test<br><br>Notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | HW Fault | (Buzzer) "Sensor Fault" | The unit has detected a fault in the hardware circuitry during the self-test procedure. | Notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | 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.<br><br>Check connectors for tightness and clean contacts.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | 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.<br><br>Check Battery or notify The Will-Burt Co. if problem persists. |

| | | | | |
|---|---|---|---|---|
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | 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 Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | 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 Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | HDWFAULT SPI | (Buzzer) "Self-test Failure" | The Display has identified an internal communications fault. | Notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | 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.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | HDWFAULT COMM | (Buzzer) "Communications Fault" | The Display has identified a communications fault due to an inappropriate message. | Possible Wiring Problem.<br><br>Check for proper cable shielding.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ◯<br>ELECTRIC FIELD ◯<br>MAGNETIC FIELD ◯<br>COLLISION ◯<br>TILT ◯ | HDWFAULT OvrSwFlt | (Buzzer) "Self-test Failure" | The Display has identified that the Clear/Override switch is closed at power-up. | Possible Wiring Problem.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |

| | | | | |
|---|---|---|---|---|
| SYSTEM READY ○<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ○ | HDWFAULT<br>OvrKeyFlt | (Buzzer) "Self-test Failure" | The Display has identified that the Override Key-switch is closed at power-up. | Possible Wiring Problem.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ○<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ○ | HDWFAULT<br>UpSwFlt | (Buzzer) "Self-test Failure" | The Display has identified that the Up switch is closed at power-up. | Possible Wiring Problem.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ○<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ○ | HDWFAULT<br>DnSwFlt | (Buzzer) "Self-test Failure" | The Display has identified that the Down switch is closed at power-up. | Possible Wiring Problem.<br><br>Check Wiring or notify The Will-Burt Co. if problem persists. |
| SYSTEM READY ●<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ○ | Mast ENA | "D-Tec II Active" | The unit is enabling extension of the mast. | N/A |
| SYSTEM READY ○<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ○<br>COLLISION ●<br>TILT ○ | Obstruct<br>XX.XFeet | (Buzzer)<br>"Collision Detect" | The unit has detected a physical obstruction overhead. The approximate distance is shown (in feet). | Move mast away from obstruction.<br><br>Side lobes of emission pattern sensing objects off to side. |
| SYSTEM READY ○<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ●<br>COLLISION ○<br>TILT ○ | Magnetic<br>Field | (Buzzer)<br>"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 |

| | | | | |
|---|---|---|---|---|
| SYSTEM READY ○<br>ELECTRIC FIELD ●<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ○ | 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 V/M (volts per meter). | Move mast away from power line or voltage source. |
| SYSTEM READY ○<br>ELECTRIC FIELD ●<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ○ | 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. |
| SYSTEM READY ○<br>ELECTRIC FIELD ○<br>MAGNETIC FIELD ○<br>COLLISION ○<br>TILT ● | Tilt (X) NNN.Ndeg<br><br>(X is a 1 or 2 depending on the axis and NNN.N is the angle) | (Buzzer) “Off Level Tilt” | The unit has detected that it is not pointing straight up. Operate the Remote Controlled Positioner of the payload to reposition the D-Tec II. See Figure 4-1. The tilt offset from vertical is shown in degrees. | Reposition the unit to within +/- $10^{o}$ of vertical. |

4.4.2 Additional Troubleshooting Tips

In the event that no audible messages are heard during the operation of the D-Tec II, check the wiring of the remote speaker. In the event that overriding the D-Tec II cannot be accomplished, check the wiring and the state of the Key switch and the Override switch.

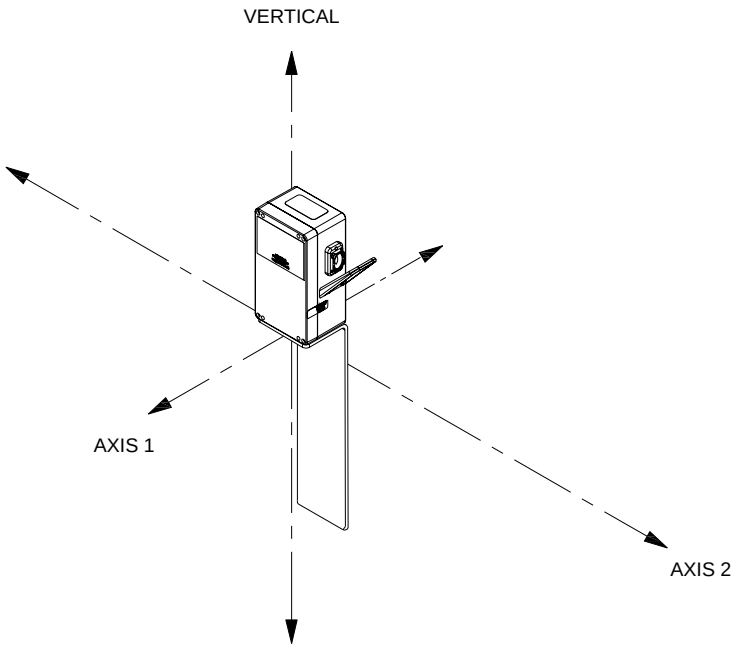


Figure 4-1 Tilt Axes

# CHAPTER 5
# PARTS LIST

## 5.1 INTRODUCTION

This chapter identifies and locates replacement parts of the D-Tec II. **NOTE: The exploded views in Figure 5-1, Figure 5-2 and Figure 5-3 are shown to provide clarity only. Breaking the tamper evident label will void the warranty.**

Table 5-1 provides the provides Will-Burt part numbers for the following replacement parts:

Table 5-1 Replacement Parts

| Mark No. | Description | Part Number |
|---|---|---|
| 1 | D-Tec II Sensor | 912672 |
| 2 | D-Tec II Display | 913949 |
| 3 | D-Tec II Rack Mount Display | 915063 |
| 4 | Installation Kit | 915393 |
| 5 | Sensor Mounting Bracket | 914466 |
| 6 | Supplied Mounting Bracket Hardware | 3494 / 3566 |
| 7 | Panel Mount Display Mounting Brackets | 4005401 |
| 8 | Panel Mount Display Mounting Hardware | 3651 / 3042 |
| 9 | Air Valve Kit | 915439 |
| 11 | D-Tec II Sensor Connector | 000013-202-005 |
| 12 | Sensor to RCP Connector Cable | 4004001 |

The table below lists the parts included in the installation kit.

| ITEM | QTY. | P/N | DESCRIPTION |
|---|---|---|---|
| 1 | 4 | 3597 | CS 1/4-20 X 4.00 PHIL PAN HD-SSTL |
| 2 | 1 | 900711 | WARNING LABEL |
| 3 | 1 | 901767 | WARNING LABEL |
| 4 | 1 | 911960 | LABEL, DTEC OVERRIDE DANGER |
| 5 | 1 | 000021-503-501 | 5 AMP FUSE |
| 6 | 1 | 901723 | INLINE FUSE HOLDER |
| 7 | 20 | 34061 | TIE CABLE |
| 8 | 80 | 901765 | TIE CABLE-BLACK |
| 9 | 1 | 908510 | SWITCH-3 POSITION |
| 10 | 1 | 000016-400-101 | KEY SWITCH OPERATOR 22mm |
| 11 | 1 | 000013-202-005 | CONNECTOR |
| 12 | 1 | 000016-300-101 | MUSHROOM OPERATOR 22mm |
| 13 | 2 | 000016-901-101 | MTG. BASE w/N.O. CONTACT 22mm |
| 14 | 150ft. | 000018-500-001 | WIRE CABLE 2 PR. D-TEC CUSTOM |
| 15 | 100ft. | 000018-520-301 | 2-CONDUCTOR JACKETED CABLE |
| 16 | 1 | 000023-000-440 | SPEAKER, 30W COMPACT HORN ELK44 |
| 17 | 1 | 911184 | SHIPPING CARTON (NI5517) |
| 18 | 1 | 915169 | TOGGLE SWITCH (MS35058-22) |
| 19 | 1 | 000013-109-002 | DB9 PLUG w/2 FT. PIGTAIL |
| 20 | 1 | 000013-125-002 | DB25 PLUG w/2 FT. PIGTAIL |
| 21 | 3 | 901193 | TERMINAL BLCK 10 CIR C4010-401 |
| 22 | 1 | 4022302 | D-Tec II Operations Manual, CD-Version |

Table 5-2 D-Tec II Installation Kit

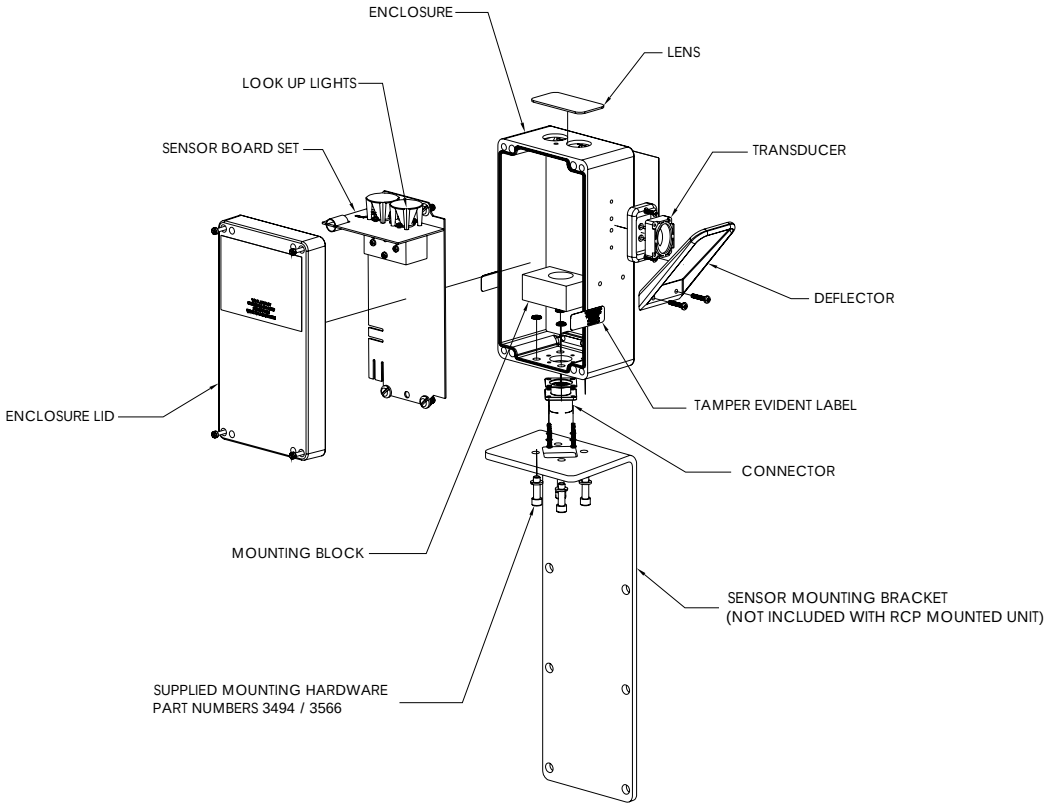


Figure 5-1 D-Tec II Sensor (912672)

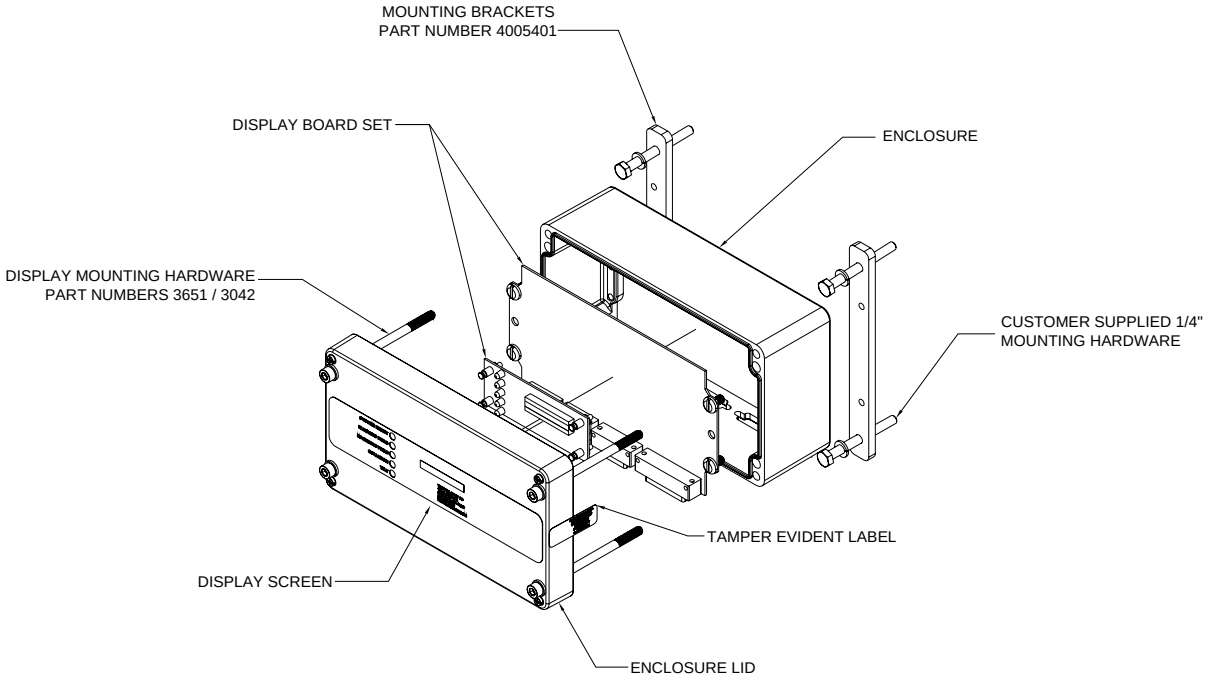


Figure 5-2 D-Tec II Display (913949)

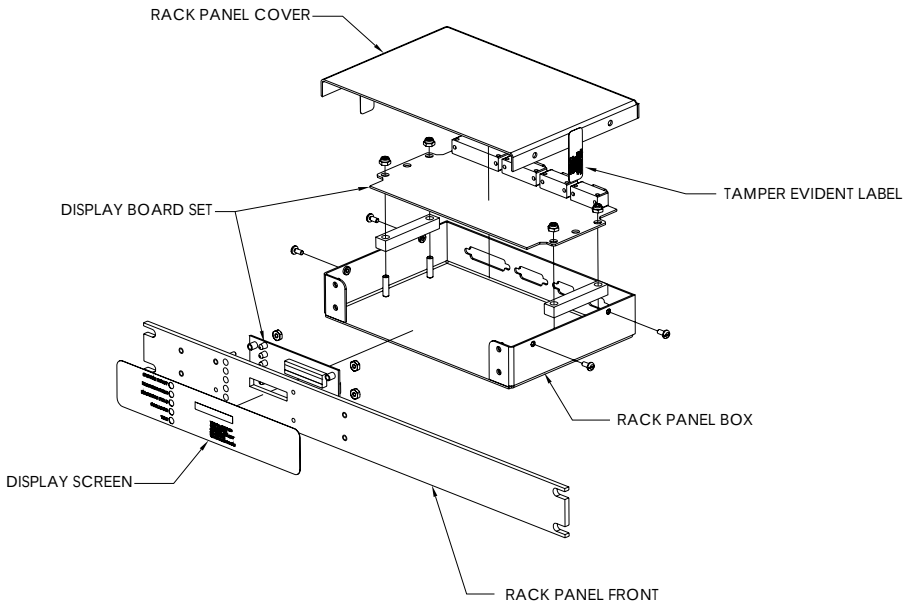


Figure 5-3 D-Tec II Rack Mounting Display (915063)

5.1.1 Exterior Mounting Brackets

Will-Burt will provide the exterior mounting bracket suited for the customer's need. Refer to

Figure 5-4 for the hole pattern of the exterior mounting bracket used with the MRC Ellipse 2000 dish antenna. Refer to Figure 5-5 for the hole pattern of the exterior mounting bracket used with the MRC Prostar, radio waves 2/7 GHz Van Transmit Antenna.

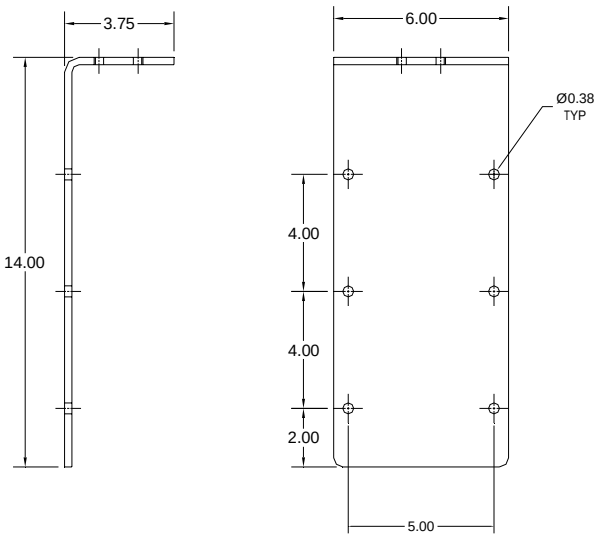


Figure 5-4 Exterior Mounting Bracket, MRC Ellipse 2000

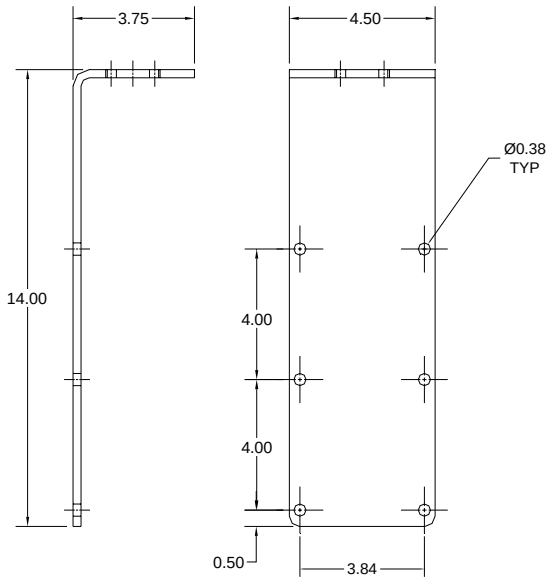


Figure 5-5 Exterior Mounting Bracket, MRC Prostar

5.1.2 Air Control Valve

The figure below shows the optional Will-Burt supplied air control valve.

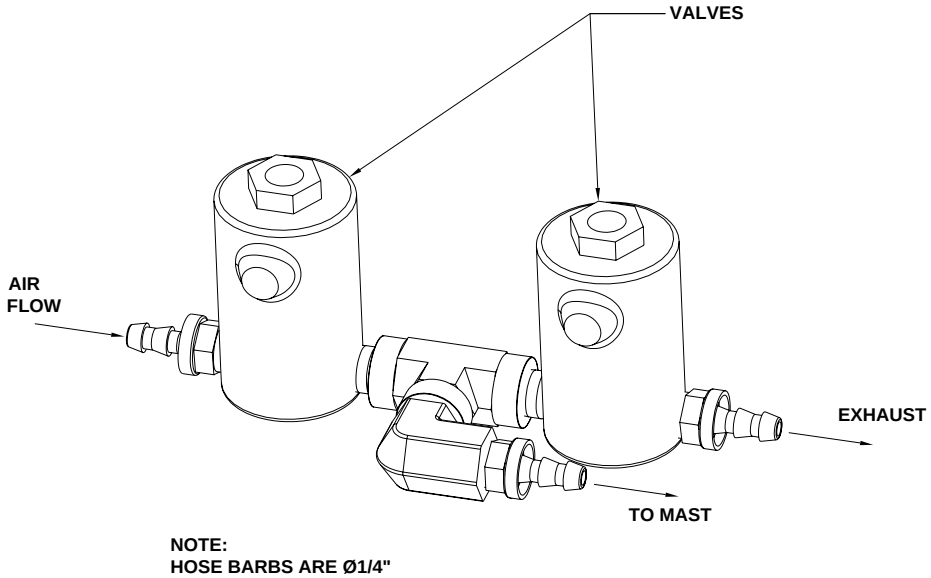


Figure 5-6 Air Control Valve

# CHAPTER 6
# REFERENCE INFORMATION

## 6.1 GENERAL

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 II cannot be used blindly or relied upon without caution. It is simply a tool to help raise your level of caution. Below is an indication of how some cases of electric and magnetic fields are shaped.

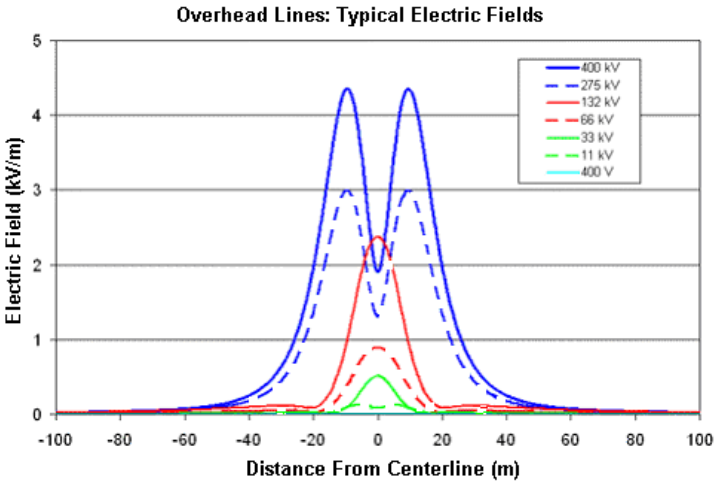


Figure 6-1 Typical Electric Fields

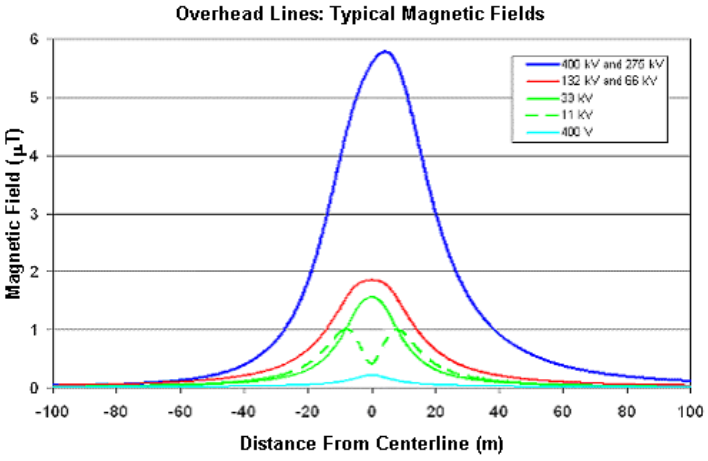


Figure 6-2 Typical Magnetic Fields

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 II 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.

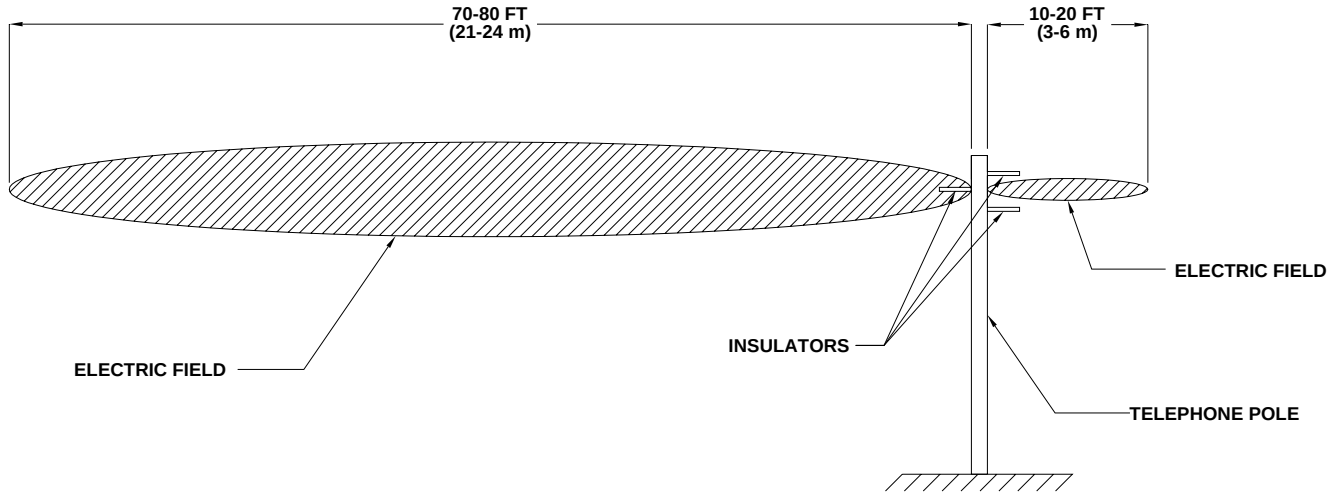


Figure 6-3 Electric Field Pattern

6.1.2 Electric Fields

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

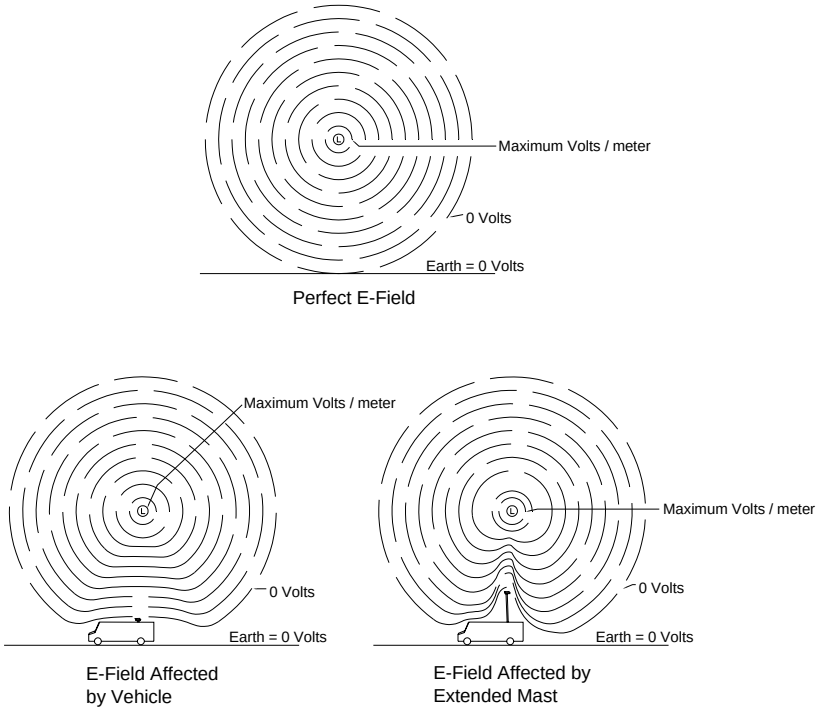


Figure 6-4 Electric Field Patterns

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 H-Field is generated perpendicular to the flow. The more current that flows, the stronger the H-Field is. The ability of the D-Tec II to sense an H-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 H-Field sensors in the D-Tec II system and if any two approach saturation simultaneously, the D-Tec II system will alarm for an H-Field. Buried electric cables may also cause H-Field alarms since the soil does not impede the magnetic field.

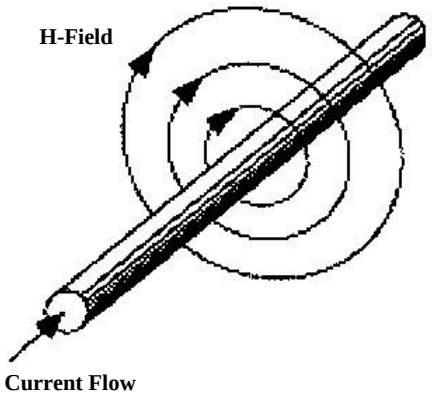


Figure 6-5 H-Field Pattern

6.1.4 Ultrasonic Detection

The D-Tec II system uses an ultrasonic transducer to detect the presence of physical obstructions. The ultrasonic transducer sends out sound pulses that bounce off objects above the D-Tec II. The returned sound pulses received by the transducer indicate the distance of the obstruction from the D-Tec II. Several factors can affect the performance of the D-Tec II ultrasonic detection. Heavy or humid air tends to dampen the sound and causes a slight deterioration in performance. Performance is also affected by the type of material and angle of the obstruction to the transducer. If the material is soft and absorbs sound (soft rubber), less sound is reflected back to the transducer limiting the sensing ability of the D-Tec II system. If the material is hard (metal), more sound is reflected helping the D-Tec II system sense the obstruction. When the angle of the obstruction is not perpendicular to the sound from the transducer, there is less sound returned to the transducer reducing the chance of sensing the obstruction. This is represented in Figure 6-6. The emissions pattern of the ultrasonic sensor has secondary lobes that may detect objects off to the side.

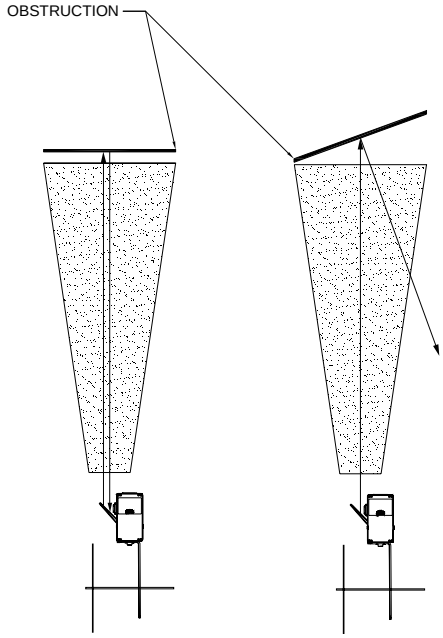


Figure 6-6 Ultrasonic Detection

## 6.2 LIST OF ABBREVIATIONS

Abbreviations listed in Table 6-1 are used throughout this document. They are in accordance with MIL-STD-12 and are listed here for reference.

Table 6-1 List of Abbreviations

| Abbreviation | Term | Abbreviation | Term |
|---|---|---|---|
| AC | Alternating Current | V/m | Volts per Meter |
| Hz | Hertz | A/m | Amps per Meter |
| V | Volts | m | Meter |
| A | Amps | | |

# CHAPTER 7
# REVISIONS

Revision 0, March 2006: First Release.

Revision 1, April 2006: Corrected twisted pair wire colors in Figure 2-8. Added note to install check valve in paragraph 2.4.7. Corrected identification of air to mast and exhaust fittings in Figure 5-6.

Revision 2, April 2006: Text formatting corrections. Clarified valve electrical connection in section 2.4.7. Added information about clearing alarms in section 3.4. Added information about theory of operation (CHAPTER 6).

Revision 3, September 2006: Corrected Product name throughout document. Clarified switch installation. Corrected Installation Kit BOM. Deleted Powerlite D-Tec II from this manual and moved to the Powerlite manual.

Revision 4, January 2007: Minor corrections to Table 4-2. Added part number for Operators Manual CD to Table 5-2. Add additional comments to troubleshooting section 4.4. Add comments about side lobes of ultrasonic and H-Field sensing of buried cables. Add comments to maintenance section 4.3 about cleaning Look-up light lens. Add comment about optional power On/Off switch in the installation section 2.4.6.

Revision 5, April 2007: Add Stiletto J4 connection info to Figure 2-8. Corrected rack mount display dimensions in Table 1-2. Corrected connector part number in Table 5-1.

# CHAPTER 8
# SOFTWARE REVISIONS

| Board | Board No. | Software Version | Comments | Compatibility Issues |
|---|---|---|---|---|
| D-Tec II Display | 4 | 2.07 | Initial Release to production | None |
| D-Tec II Display | 4 | 2.09 | Disabled the alarm audible messages after 20 seconds without any up or down switch press | None |
| D-Tec II Sensor | 5 | 2.04 | Initial Release to production | None |
| D-Tec II Sensor | 5 | 2.06 | Added LED blink every five seconds.<br>Changed ultrasonic min. distance to 2.5 feet.<br>Added Min and Max temp. recording.<br>Improved ultrasonic sensing algorithm. | None |

Customer _____ Date: _____

Job No. _____

Mast Model No._____ Serial No._____

Vehicle Make/Model _____

Vehicle serial No. _____

Location of mast in vehicle:_____

Location of mast controls _____

Can operator see mast while operating controls? _____

Payload configuration: _____

Picture's of payload configuration front and side view taken? _____

Is the D-Tec II orientated correctly with antenna payload. _____

Is the D-Tec II power supply between 12 and 30 DC Volts with 5 amps of power? _____

Are all wire connections tight within there respective terminals? _____

Serial No. of D-Tec II sensor. _____

Serial No. of D-Tec II Display. _____

Payload weight (if it appears excessive for this mast model): _____

Comments on payload: _____

Comments on Nycoil: _____

Turn on unit and verify the following:

Audible Messages are heard? _____

Unit performs Self-Test? _____

All alarm LED's light during self-test? _____

Tilt alarm functions when tilted more that 10 degree? _____

Ready LED (green) light turns on when mast is enabled? _____

Messages appear on the Alphanumeric LED Display? _____

Mast Raises and lowers by use of solenoid valve? _____

Final systems check performed? _____

Manual delivered to user? _____

Move vehicle beneath an over head obstruction e.g. tree or bridge and verify that the collision alarm functions about 10 feet away from the obstruction. Bring vehicle near high tension wires. Check if the AC alarm will stop the mast extension. Keep a safe distance at all times.

Company installing D-Tec II _____

Signed _____ Date _____

Instruction for inspection sheet:

(1) Fill out complete

(2) Attach pictures of installation

(3) Make and retain at least on copy for your files

(4) Send originals to Will Burt PO Box 900 Orrville, OH 44667

Attach pictures of installation

Make and retain at least one copy for your files

Send originals to Will Burt PO Box 900 Orrville, Oh. 44667

**Failure to complete form and return to Will-Burt will void warranty and installer will be responsible for all service of unit thereafter.**

ATTACH ALL FOUR PHOTOGRAPHS HERE