INSTALLATION AND OPERATING INSTRUCTIONS FOR THE

RADIATION DETECTION SYSTEM

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1 Introduction

The Mini Rad-DX is a handheld security and inspection device that detects emissions from radioactive material. The Mini Rad-DX system can operate as a stand-alone detector or as the roving detection part of a larger Mini Rad-DX and Rad-DX network for monitoring a building or facility.

1.1 Key Features

Device Highlights

- High sensitivity detector (CsI scintillator with PMT)
- Operator selectable alarm levels (password controlled)
- Two bright, high-resolution display screens
- Real-time dose rate graph
- Units displayed in rems per hour, Sieverts per hour, or counts per second
- 130 hours between recharge (depending on options selected)
- Integrated GPS for complete logging of dose rate, location, and time
- Vibrate or audio alarm
- ANSI N42.32, N42.33 and N42.42 compliant

Mesh Network

- Integrated mesh radio
- 2.4 GHz, 25 selectable channels
- Network range between devices is 1000m LOS
- Up to 50 devices per network
- Easy to set-up and modify network

Communication and Security

- Mini USB interface
- 128 bit AES encryption

With Network Integration

- Real-time control and monitoring of an entire network via smartphone, PC, or tablet
- Network can include Rad-DX area monitors and Rad-DXG portal monitors
- Autologging – every time a MiniRad-DX comes within range of its DX network it will upload time, position, and alarm data –no user interaction required
- Emails can be sent when an alarm occurs

1.2 Version xx: Change Log

- TBD
- TBD

2 Getting Started

Additional documentation, such as Getting Started and Installation Guides, is available to help you setup your Mini Rad-DX network of detectors. Software is also available for configuration and communication including the DX-View software and the DX Cloud Server Software (DX-Dashboard).

List of Quick Start and Installation Guides

- Mini Rad-DX Handheld Radiation Detector Quick Start Guide**
- Rad-DX Radiation Detector Quick Start Guide
- DX-View Quick Start Guide
- DX-Dashboard Quick Start Guide

**Coming Soon

3 Specifications

Specification	MiniRad-DX
Detectors	6 cm^3 CsI(Na) scintillation crystal with a PMT
Communication	D-tect SensorNet mesh network, USB
Power	Lithium Ion Battery (Rechargeable)
Battery Life	130 hrs (depending on options selected) (1)
Detection Speed	1 second
Dose Rate Range	1 µrem/hr - 70 mrem/hr (0.01 µSv – 0.7 mSv/hr).
Sensitivity (^{137}Cs)	1.93 cps/µrem/hr (193 cps/µSv/hr)
Dose Rate Response (^{137}Cs)	Less than 20%
Energy Range	50 keV – 3 MeV

Display	Two advanced displays to provide a rich user interface along with a quick display for detection status.
	• Main Display
	  ○ Type: Transflective TFT LCD
	  ○ Resolution: 320 x 240
	  ○ Color Depth: 18-bits providing up to 262,144 color rendering
	• Top Display
	  ○ Type: Organic LED
	  ○ Resolution: 128 x 64

Display Units	(µ – m)rem/hr, (n – m)Sv/hr, CPS
Alarm Volume	> 85 dB (A-weighted in free air) at 30cm
Humidity	95% at 35 °C non-condensing
Temperature	-20 °C to 50 °C
Dimensions	62 mm x 31 mm x 107 mm (2.44" x 1.22" x 4.21")
Weight	172.9 g (6.1 oz)
Environment	IP65 rated
Regulatory	FCC and CE Compliant Designed to meet ANSI N42.32(2) and N42.33 requirements

Table 1: MiniRad-DX Specifications

(1) Battery life testing was completed with GPS and SensorNet radio turned off. Enabling these features will reduce actual battery life.

(2) The Mini Rad-DX uses a built-in rechargeable battery that, due to safety concerns, is not replaceable. Therefore D-tect claims an exemption from ANSI 42.32 Section 5.15.1.

4 Box Contents

Figure 1: Mini Rad-DX Handheld Radiation Detector

Other hardware components packaged with each Mini Rad-DX include:

Mini USB Cable	Holster

Table 2: Additional Mini Rad-DX Hardware

5 Software Options

Two different software applications are available to monitor and configure Mini Rad-DX radiation detectors.

5.1 DX-View Software

The DX-View is a PC application used to monitor and configure MiniRad-DX and Rad-DX detectors. Multiple detectors can be monitored in real-time as long as a Rad-DX device is connected to the PC directly and the other detectors are configured to communicate via the mesh network. This software is available for download from www.dtectsystems.com. If you wish to configure your Mini Rad-DX directly using this tool, install the downloaded software and connect the device to your computer using the included mini USB cable.

5.2 DX-Dashboard Setup Tool

The DX-Dashboard Setup Tool is needed to initially configure devices in the Rad-DX family to connect to the DX Cloud Server. The DX-Dashboard is the web server application and can be used to monitor and control a MiniRad-DX and Rad-DX network from any smart phone, tablet, or PC. DX-Dashboard runs on either the D-tect Cloud server or the DX Network Assistant (if installed at your facility). You will be asked for your user name and password to allow access to your network.

Note: In order for MiniRad-DX devices to appear in the DX-Dashboard software, one Rad-DX device in the network needs to be connected to the network via Wi-Fi or Ethernet.

6 Maximizing Battery Life

The MiniRad-DX battery can last up to 130 hours with the mesh radio turned off, the GPS capability turned off, and displays set to sleep after one minute. Turning up screen brightness, keeping displays on longer, turning on the mesh radio and turning on GPS will require more frequent recharging. Monitor the battery icon in the upper left corner of the front display to determine when it is time to recharge the MiniRad-DX.

7 Recharging the MiniRad-DX

The MiniRad-DX is recharged through a USB connection. Either a USB port on a PC or a USB wall charger can be used to recharge the MiniRad-DX.

8 Stand-Alone Operation

The MiniRad-DX can operate in a stand-alone mode with information displayed directly on the device's LCD and OLED screens. Options for the MiniRad-DX, such as screen brightness, screen sleep timers, and radiation units, can be set up using the following process:

1. The Home Screen will appear on the LCD screen after pressing the power button.

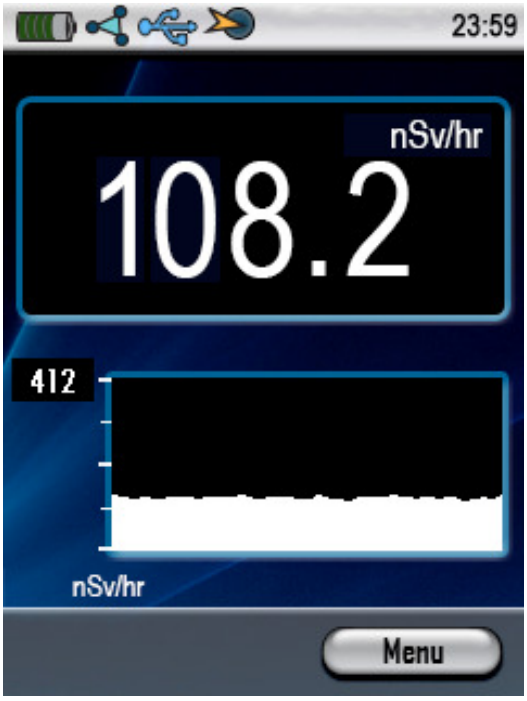

Figure 2: LCD Front Screen: Dose Rate and Graph

2. Pushing the upper right button on the keypad will open up the menu screen.
3. To toggle through the different screens, use the directional buttons on the keypad and the upper left button go back to the main menu.

8.1 Communication Icons

The appearance of any network connection icon indicates that the device is currently connected and active through the referenced connection.

Battery: The battery icon is split into 5 segments. Each segment represents 20% of the total capacity of the battery. This icon will change to a battery symbol with a lightning bolt when the MiniRad-DX is plugged into a USB port. This indicates that the device is charging.

Mesh Network: The mesh network symbol indicates that the MiniRad-DX is connected to a greater network of devices in the Rad-DX product line. For more information about the MiniRad-DX's network capabilities, see Section 9: PC Connection and Network.

USB: The USB icon indicates that the MiniRad-DX is communicating directly with the DX-View configuration software. See Section 9 [note: need to link this section number]: PC Connection and Network for more information about the networking capabilities of your MiniRad-DX.

GPS: The GPS symbol indicates that your MiniRad-DX has determined its location. GPS must be turned on to acquire a location.

Time: The current time can be displayed in the 12 hour or 24 hour format.

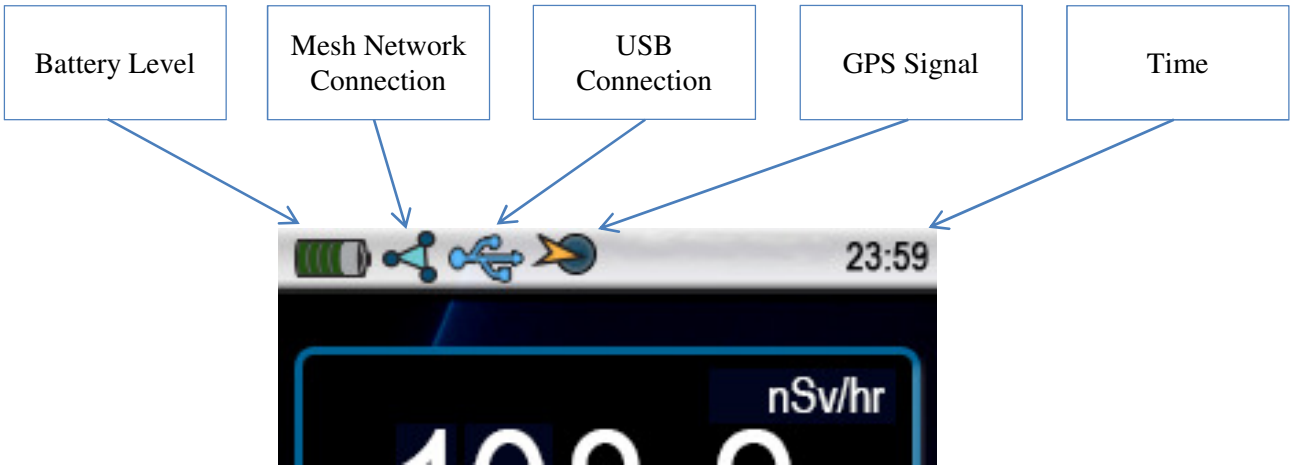

Figure 3: Communication Icons

8.2 Main Menu Screen

The main menu screen can be accessed by pressing the upper right navigation button on the keypad. The available options inside the menu are Device, GPS, Alerts and Display. Use the directional keys on the keypad to open that specific submenu. Use the upper left navigation button to return to the main menu from the submenu screens. Press the same button to close the main menu and return to the home screen.

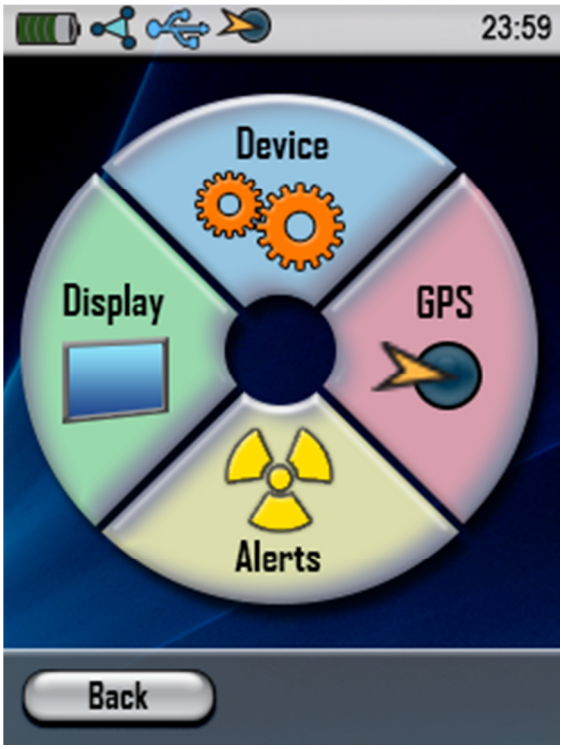

Figure 4: Menu Screen

8.3 Device Menu

The device menu displays device specific information including device name, firmware version, battery state, mesh signal strength, and current mesh channel.

Settable Parameters

Parameter	Range	Default Value
Display Units	mRem/hr, CPS, µSv/hr	mRem/hr
Mesh Enable	On, Off	On

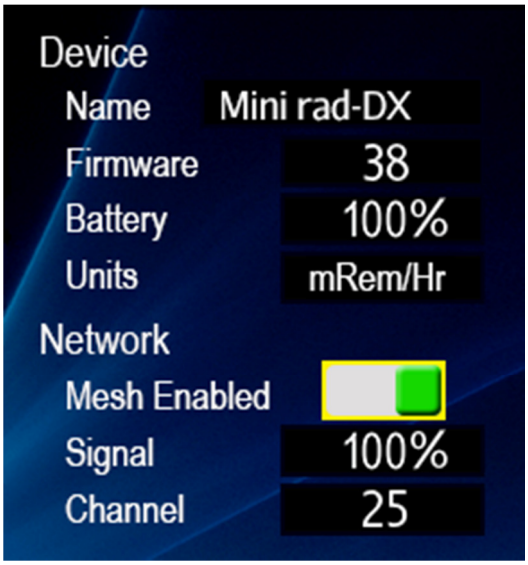

Figure 5: Device Menu

8.4 GPS Menu

The GPS feature can be toggled on and off in this menu.

Settable Parameters

Parameter	Range	Default Value
GPS Enable	On, Off	Off

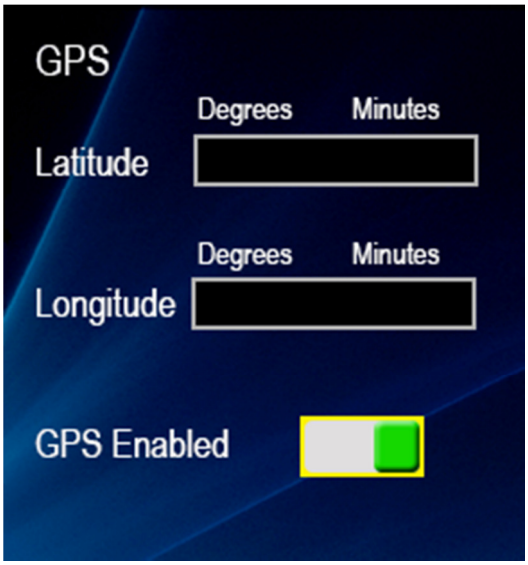

Figure 6: GPS Menu

8.5 Alerts Menu

The sound and vibration features can be turned on and off in this menu. The different alarm thresholds are also reported in this menu.

Settable Parameters

Parameter	Range	Default Value
Alert Vibration	On, Off	On
Alert Sound	On, Off	On

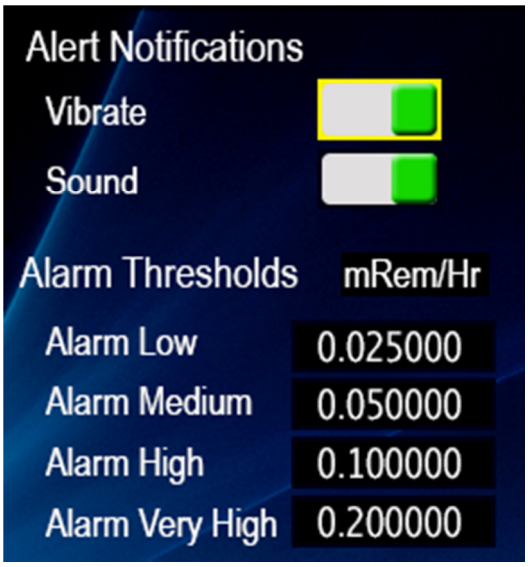

Figure 7: Alerts Menu

8.5.1 Alarm Options

The different levels of alarm thresholds are reported in the Alerts Menu. As the radiation level increases and the device measures above each limit, the frequency of the alarming will increase and the alarm level will display in the upper left corner of the dose rate screen.

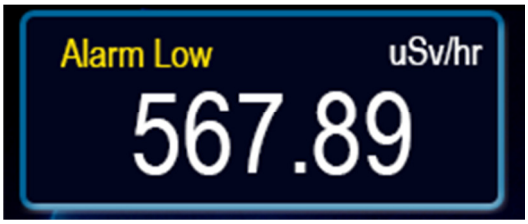

Figure 8: Home Screen with Alarm Triggered

8.5.2 Setting Alarm Levels

Alarm levels can be set on the MiniRad-DX using either the DX-View or DX-Dashboard software. Both are secured by password and prevent unauthorized modification of the alarm levels.

8.6 Display Menu

This menu allows the user to customize the device's display settings. Both screen brightness and sleep settings will affect the time that the MiniRad-DX can operate between charges.

Settable Parameters

Parameter	Range	Default Value
Time Format	12hr, 24hr	12hr
Top Screen Sleep	30 sec, 1 min, 5 min, Never	30 sec
Front Scr. Sleep	30 sec, 1 min, 5 min, Never	30 sec
Brightness Meter	Nine step slider	Step 6 of 9

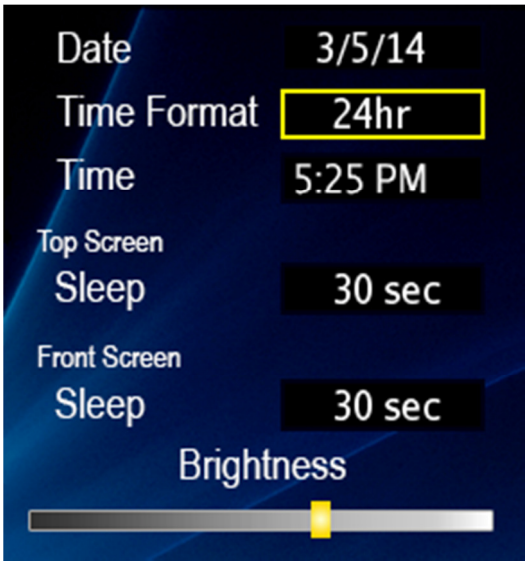

Figure 9: Display Menu

8.6.1 Sleep Modes

There are 4 options for setting sleep timers for each screen. The timers for the two screens can be set independently of one another. The options are as follows: 30 seconds, 1 minute, 5 minutes, or never. Enabling sleep modes allows for the device to function longer between charges.

For example, say that a security guard is carrying a MiniRad-DX with them on their rounds through the building. Typical use would have them wearing the device on their belt. To preserve battery life, the front screen could be set to 1 minute of inactivity before shutting off and the top screen could be set to never sleep. This allows for continuous status monitoring through the top screen and turning on the front screen only when further information is needed.

Regardless of the sleep settings, the MiniRad-DX will alarm if radiation above the set threshold is encountered.

9 PC Connection and Network

Using the DX-View PC software, a simple network of detectors in the Rad-DX family can be controlled and monitored from a PC as shown below by utilizing the DX Link USB radio and the Mesh communication network. For Wi-Fi and/or Ethernet based communication, see the D-tect Cloud Network and D-tect Network Assistant sections that follow.

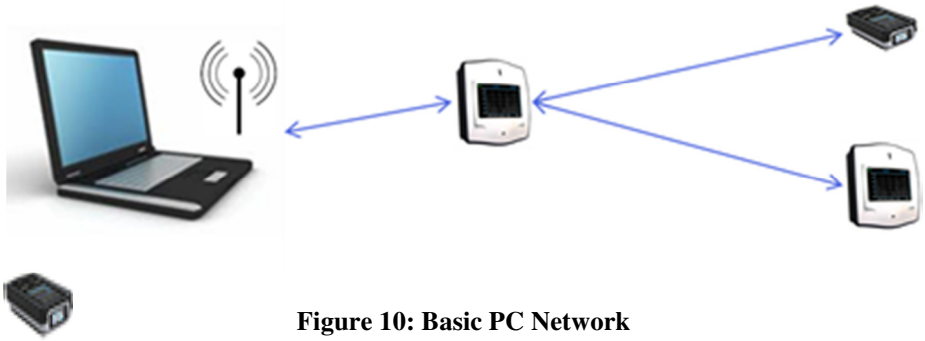

Figure 10: Basic PC Network

D-tect Cloud Network: The D-tect Cloud Network is an easy method to control and monitor a network of detectors in the Rad-DX family. It also allows the detectors to be monitored via smartphone, tablet, or PC. Setting up your MiniRad-DX unit within the Cloud Network will require a PC with an internet connection and a DX Link USB radio (or Rad-DX) to act as an intermediary between the PC and MiniRad-DX. All information sent over the Cloud is SSL encrypted.

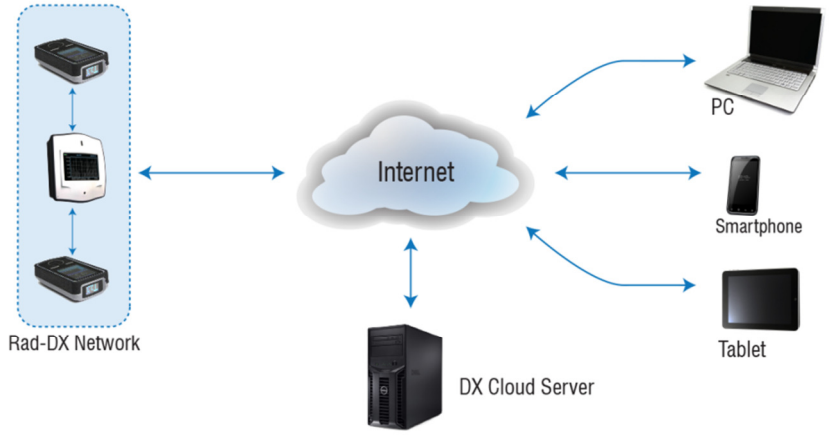

Figure 11: D-tect Cloud Network

DX Assistant: The DX Assistant appliance allows MiniRad-DX and Rad-DX devices to operate behind a firewall that blocks access to the internet. The DX Assistant is a computer that includes all the software needed to control and monitor the network of detectors. DX Assistant software can also be installed on a virtual machine on a local server.

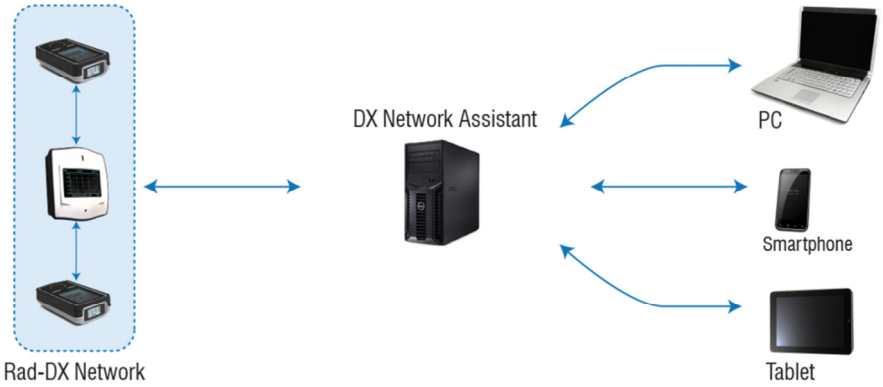

Figure 12: DX Assistant Network

A Rad-DX network can include Rad-DX area monitors, Rad-DXG gateway monitors, MiniRad-DX handheld units, and DX-Link repeater/gateway devices. An example of a DX-Dashboard monitoring screen (on a PC, tablet, or smart phone) is shown below.

Figure 13: Rad-DX Device Network Example

10 Compliance Requirements

This device complies with part 15 of the FCC rules and Industry Canada ICES-003. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Idustrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) I'appareil ne doit pas produire de brouillage, et (2) I'utilisateur de I'appareil doit accepter tout brouillage radioélectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT! Tous les changements ou modifications pas expressément approuvés par la partie responsible de la conformité ont pu vider I' autorité de I'utilisateur pour actioner cet equipment.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

For Industry Canada

Important Note:
Radiation Exposure Statement:
This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Note Importante: (Pour l'utilisation de dispositifs mobiles)
Declaration d'exposition aus radiations:
Cet équipement est conforme aux limites d´exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipment doit être installé et utilisé avec un mimimum de 20 cm de distance entre la source de rayonnement et votre corps.

11 Technical Support

For any technical questions you are encouraged to contact your distributor, or you may also contact us directly.

Phone: 801-260-4000

Email: techsupport@dtectsystems.com

12 Warranty for D-tect System Products

1. What this Warranty Covers and for How Long

D-tect Systems ("D-tect Systems") warrants this device (the "Product") against defects in materials and workmanship under normal use for a period of two years from the date of purchase. This warranty extends to the first end-user purchaser only, and is not transferable. This warranty does not extend to other ancillary and/or consumable products including but not limited to batteries, calibration sources, straps, and shipping cases. D-tect Systems, at its option, will at no charge either repair, replace or refund the purchase price of any Products that do not conform with this warranty. Repair may include the replacement of parts with functionally equivalent reconditioned or new parts. Replacement may include providing a functionally equivalent Certified Reconditioned/Pre-owned or a new Product. Products that have been repaired or replaced are warranted for the balance of the original warranty period or for 90 days from the date that the repaired or replaced Product is received by you, whichever is longer. All Products for which replacements have been provided will become D-tect Systems property.

2. Other Warranty Conditions

This warranty is D-tect Systems' complete warranty for the Product. D-tect Systems assumes no obligation or liability for changes to this warranty unless made in writing and signed by an officer of D-tect Systems.

If D-tect Systems agrees to perform services requested and approved by the customer that are not included in either the Limited or Extended Warranty, these services will be billed to the customer at D-tect Systems' standard prices and terms.

D-tect Systems does not warrant any installation, maintenance, or service that it did not perform. SERVICE WORK PERFORMED BY SERVICE CENTERS NOT AUTHORIZED BY D-TECT SYSTEMS TO PERFORM SUCH WORK WILL VOID THIS WARRANTY.

3. What This Warranty Does Not Cover

a. Defects or damage resulting from: collision of the Product with hard surfaces, contact with water, rain or extreme humidity, contact with sand, dirt or the like, contact with extreme heat or cold, spills of food or liquid, improper testing, operation, maintenance, installation, adjustment; or any alteration or modification of any kind.
b. Normal "wear and tear" of the Product such as scratches, scuffs, and marks on the LCD, case and other external features.
c. Cracked or broken displays, buttons, or damage to other externally exposed parts caused by abnormal use and/or abuse of the Product.
d. Products disassembled or repaired in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.
e. Products on which serial numbers or date tags have been removed, altered or obliterated.

4. How to Get Warranty Service

To get warranty service, please contact your distributor or D-tect Systems at www.dtectsystems.com .

You will receive directions on how to mail the Product to D-tect Systems. All Products shipped to D-tect Systems must be shipped with freight and insurance prepaid. Along with the Product you must include a receipt, bill of sale, or some other comparable proof of purchase, a written description of the problem and, most importantly, your address and telephone number. If additional information is needed, please contact D-tect Systems at the web address indicated above.

5. General Provisions

THIS IS THE COMPLETE WARRANTY FOR THIS PRODUCT BY D-TECT SYSTEMS AND SETS FORTH YOUR EXCLUSIVE REMEDIES. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE GIVEN ONLY IF SPECIFICALLY REQUIRED BY APPLICABLE LAW. OTHERWISE, THEY ARE SPECIFICALLY EXCLUDED. IN NO EVENT SHALL D-TECT SYSTEMS BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT OR FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT, TO THE FULL EXTENT THESE DAMAGES MAY BE DISCLAIMED BY LAW.

6. Patent and Software Provisions

D-tect Systems will defend at its own expense, any suit brought against you to the extent that it is based on a claim that the Products infringe a United States patent. D-tect Systems will pay those costs and damages finally awarded against you in any such suit which is attributable to any such claim. The defense and payments by D-tect Systems

are conditioned on the following: (a) that you will notify D-tect Systems promptly in writing any notice of the claim; and (b) that D-tect Systems will have sole control of the defense of the suit and all negotiations for its settlement or compromise; and (c) should the Products become, or in D-tect System's opinion be likely to become, the subject of a claim of infringement of a United States patent, that you will permit D-tect Systems, at its option and expense, either: to procure for you the right to continue using the Products or parts; to replace or modify them so that they become non-infringing; or to grant you a credit for such Products or parts as depreciated and accept their return. The depreciation will be an equal amount per year over the lifetime of the Products, accessories, battery or parts as established by D-tect Systems.

D-tect Systems will have no liability to you with respect to any claim of patent infringement which is based upon the combination of the Products or parts furnished under this limited warranty with software, apparatus or devices not furnished by D-tect Systems. D-tect Systems will have no liability for the use of ancillary or peripheral equipment or software not furnished by D-tect Systems which is attached to or used in connection with the Products. The foregoing states the entire liability of D-tect Systems with respect to infringement of patents by the Products, accessories, batteries or any parts of them.

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