



DRT4311B

Miniature Test Receiver

Hardware Manual

DRT Part No. 434-00174

Rev. 1.1, 26 March 2013

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DECLARATION OF CONFORMITY

Application of Council Directive(s):

EMC Directive: 2004/108/EC

Low Voltage Directive: 2006/95/EC

Standard(s) to which Conformity is Declared:

CISPR 11:2004; EN61000-3-2:2005; EN61000-3-3:1995:A1 (2001):A2 (2005); IEC 61326:2005

EN60950-1:2006

Manufacturer's Name:

Digital Receiver Technology Inc.

Manufacturer's Address:

12409 Milestone Center Drive
Germantown, MD 20876

Importer's Name:

(EC Community Representative's Name Here)

Importer's Address:

(EC Community Representative's Address Here)

Type of Equipment:

Wideband Test Receiver

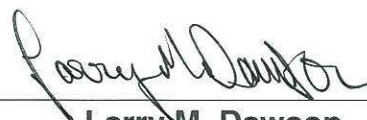
Model Number:

DRT4311B

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place: Germantown, Maryland, USA

Date: March 21, 2013



Larry M. Dawson

Director of Quality Assurance

Regulatory Information

FCC

This device complies with part 15 of the FCC Rules. 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.

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 DRT for help.

Industry Canada

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.

European Union



This equipment conforms with the EMC Directive: 2004/108/EC and the Low Voltage Directive: 2006/95/EC

Conformity is demonstrated using the following standards: CISPR 11:2004; EN61000-3-2:2005; EN61000-3-3:1995:A1 (2001):A2 (2005); IEC 61326:2005; EN60950-1:2006

DRT4311B

1 DRT4311B Hardware

1.1 Overview

The DRT4311B is a small, low-power single or dual channel VHF/UHF receiver. The combination of small size and low power consumption makes the DRT4311B ideal for field operations. An optional battery pack provides up to 4 hours of operation.

The DRT4311B is available in two configurations:

- V1 – Single Tuner
- V2 – Dual Tuner

The DRT4311B provides:

- Single or dual RF channel(s) that can operate in an independent mode.
- Digital signal processing for complex waveform applications.
- 100 Mbps Ethernet interface.
- Integrated Spectrum Analysis Tool for all protocols and bands.
- Small size and low power with power management capability.
- Software Developers Kit (SDK) with drivers and documentation.
- *Galena*, software test GUI.

Options:

- Various receive antennas
- Additional software-enabled protocols and measurements.
- Battery Pack and charger



1.2 Unpacking the Equipment

NOTICE

To maximize battery life, batteries are not shipped with a full charge. We recommend that you fully charge each battery prior to first use.

After unpacking the equipment, please retain the shipping container and packing material until the equipment has been thoroughly inspected and you are sure reshipment is not necessary. Please perform the following inspections:

- Carefully inspect the outside of the shipping container for discolorations, stains, charring, or other signs of exposure to excessive heat, moisture, or liquid chemicals. Check for any physical damage to the shipping container such as dents, snags, rips, crushed areas, or similar signs of excessive shock or careless handling.
- Inspect the equipment for dents, scratches, damaged or loose connectors or any other signs of physical abuse or careless handling during shipment.

1.3 Damaged Shipment

If damage is found, contact the shipping carrier immediately requesting an inspection. Do not destroy any packing material until the shipper has examined it. At the same time, report the damage to DRT. Include equipment serial numbers in your report to us.

2 Hardware Supplied

2.1 Equipment Supplied with a DRT4311B

A typical list of equipment supplied with a DRT4311B is shown below. Your order may vary.

<u>Part No.</u>	<u>QTY</u>	<u>Description</u>
DRT4311B-V1	1	Single Tuner Receiver, Battery Compatible without Battery
DRT4311B-V2	1	Dual Tuner Receiver, Battery Compatible without Battery
DRT4311B-V2	1	Dual Tuner Receiver, Battery Compatible with Battery
428-02423-001	1	Battery Kit, Black
225-00008-001	2	DRT4311 Battery Pack
428-02680-001	1	DRT4000 Series AC/DC Powered Battery Charger
255-00000	1	AC Power Cable, 10 Amp @ 125 Volts, Shielded, 6' 7"
428-02529-001	1	DC Input / Battery Charger Flying Leads Cable, 6 ft
255-00228	1	AC Power Cable, 6 ft
428-01123-001	1	Switching (AC/DC) Power Supply with Lemo Connector
434-00174	1	DRT4311B User Manual
434-00191		DRT4300B System Software Manual
805-00471	1	DRT4300B System Software CD
805-00472	1	DRT4300B Software Development Kit (SDK) CD
		Optional Equipment
255-00008	1	Ethernet LAN Crossover Cable
170-00154	1	8 GB SDHC Flash Memory Card
255-00291	1	Test Cable Assembly, USB Type A to USB Mini-B, 1 Meter
425-00270	1	Cigarette Lighter to Lemo Connector
428-00859-001	1	GPS Magnetic Antenna to SMB Connector
428-01650-001	1	Dual Band Cellular Antenna With Magnetic Mount
225-00008-001		Battery Pack
		Carrying Case

2.2 DRT4311B Hardware

The DRT4311B has the following physical properties:

Description	Range
Dimensions	V1 / V2 Without Battery Pack: 1.3 in H x 3.0 in W x 6.8 in D (3.3 cm H x 7.6 cm W x 17.3 cm D) V2 With Battery Pack: 1.6 in H x 3.0 in W x 10.0 in D (4.1 cm H x 7.6 cm W x 25.4 cm D)
Weight	V1 Without Battery Pack – TBD V2 Without Battery Pack – 1.59 lbs. (721 g) V2 With Battery Pack – 2.44 lbs. (1107 g)
Operating Temperature	+32° F to +122° F (0° C to +50° C)
Storage Temperature	–40° F to +185° F (–40° C to +85° C)
Humidity	The system is designed to operate when the relative humidity is 0 to 95% and non-condensing. The system is not specified for operation in an environment where the prevailing humidity, temperature, and barometric pressure will allow condensation, moisture, or frost to form on any internal or external surface of the unit. Before testing the system for humidity, contact DRT.
Power Consumption	V1: 8 W (maximum) V2: 10 W (maximum)
Power Required	9-30 VDC (DC IN [Lemo] connector)

The DRT4311B has the following electrical properties:

Parameter	Specification
Maximum Number of Receive Channels	V1: 6 (half-duplex) V2: 12 (half-duplex)
Frequency Coverage	2 MHz to 3000 MHz
RF Tuning Resolution	4 MHz
Digital Tuning Resolution	1 Hz
Frequency Accuracy	±1.0 ppm
RF Input Impedance	50 Ω
VSWR	2.5:1
Safe Input Level	+30 dBm max.
Amplitude Accuracy	±1.0 dB
Instantaneous Dynamic Range	75 dB
1st Image Rejection	90 dB
2nd Image Rejection	80 dB
IF Rejection	90 dB
Internally Generated Spurious Coherent & Independent Tuners	–100 dBm, input equivalent

Parameter	Specification
Phase Noise	–85 dBc/Hz at 10 kHz offset –105 dBc/Hz at 100 kHz offset –120 dBc/Hz at 1 MHz offset
LO Sideband Spurs	–80 dBc max., offsets > 1 MHz –75 dBc max., offsets < 1 MHz
LO Radiation	–95 dBm max., f < 10 GHz
RF Tuning Time	2 ms within 1 kHz
Analog IF Bandwidth	40 MHz
Digital IF Bandwidth	1 kHz to 40 MHz range (mode dependent)
Gain Control	50 dB
AFC	20% Digital IF

Typical RF Performance (max)

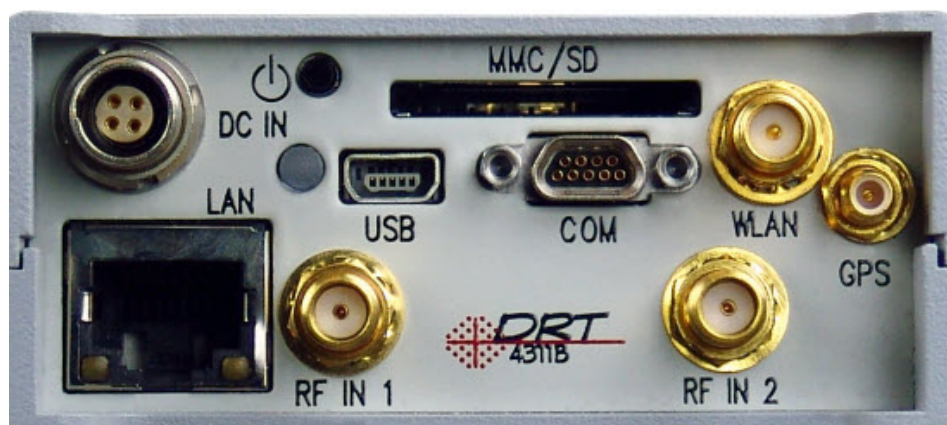
	Bypass			Preamplifier Enabled		
Frequency Range	2 – 5 MHz	5 – 32 MHz	32 – 3000 MHz	2 – 5 MHz	5 – 32 MHz	32 – 3000 MHz
Noise Figure	17 dB (21 dB)	11 dB (14 dB)	12 dB (14 dB)	16 dB (20 dB)	5 dB (10 dB)	5 dB (8 dB)
Input 2nd Order Intercept	+22 dBm (+17 dBm)	+30 dBm (+17 dBm)	+43 dBm (+31 dBm)	–3 dBm (–11 dBm)	+3 dBm (0 dBm)	+12 dBm (+4 dBm)
Input 3rd Order Intercept	–10 dBm (–18 dBm)	+2 dBm (–7 dBm)	–5 dBm (–10 dBm)	–20 dBm (–30 dBm)	–10 dBm (–19 dBm)	–19 dBm (–24 dBm)

The battery charger has the following specifications:

Description	Range
Dimensions	5.00 in L x 6.0 in W x 5.25 in H (12.70 cm L x 15.24 cm W x 13.34 cm H)
Weight	2.2 lbs. (998 g)
Operating Temperature	+32° F to +113° F (0° C to +45° C)
Storage Temperature	–40° F to +185° F (–40° C to +85° C)
Humidity	5% to 95%, non-condensing
Power Consumption	87 W, max.
Power Required	100 to 240 VAC RMS, 50 / 60 Hz, 1.0 A 10-36 VDC, 8.0 A
Typical Battery Recharge Time	4 Hours
Charge Temperature Range	Battery charging is permitted from +32° F to +113° F (0° C to +45° C)

2.2.1 DRT4311B Connectors

DRT4311B-V2 Front Panel Connections



FRONT PANEL CONNECTORS	
COM	Mini DB9 female - See <i>COM Port Pinout</i> section; Provides an RS-232 serial connection for access to the root console and to 10 MHz and 1PPS signals.
LAN	RJ-45, 10/1000 Ethernet receptacle for connection to a laptop PC or a network.
DC IN	4-pin Lemo female receptacle. See the <i>DC Input</i> section.
GPS	SMB male jack for GPS Antenna input.
MMC/SD	Multimedia Card / SD card memory slot.
RF IN 1	SMA female jack for RF Antenna input (2 - 3000 MHz)
RF IN 2	SMA female jack for RF Antenna input (2 - 3000 MHz) [V2 systems only]
USB	Mini A/B USB 2.0 jack. NOTE: Connect a Mini B cable to the unit when the unit is to be a device (controlled unit – for example connected to a PC.) and connect a Mini A cable when the unit is to be the Host (controlling unit).
WLAN	RPSMA male jack for 802.11b/g Wi-Fi or Class 2 Bluetooth antenna (Not supported)

2.2.1.1 SMA Connectors

When a cable is connected to an SMA connector, the cable connector nut should be torqued. The recommended torque for SMA connectors is 8-10 lbf-in (0.90 - 1.13 Nm). The recommended torque wrench for SMA connectors is the DRT P/N 428-01274-001 which is preset to 9 lbf-in (1.02 Nm) [Not included]. An alternate wrench is an AEP TA-0397 which is preset to 8 lbf-in (0.90 Nm).

2.2.1.2 GPS Antenna

The GPS antenna requires an active antenna to provide sufficient GPS sensitivity. The default condition for the DRT4311B is that it provides power to the active GPS antenna via the same coax cable that connects the antenna to the GPS SMB connector on the front panel. This means that the connector and cable will have +3VDC of potential on the center pin. Because power is provided to the antenna as a default condition, the operator does not need to configure the unit for this. Use the GPS antenna supplied with the unit.

2.2.1.3 COM Connector Pinout

The front panel of the DRT4311B has an RS-232 female serial port. The pinout is as follows:

 Mini DB9 Receptacle	Pin	Function
	1	Do not connect
	2	Do not connect
	3	Do not connect
	4	Do not connect
	5	GND
	6	NPPS I/O
	7	Do not connect
	8	Do not connect
	9	10 MHz Ref I/O

2.2.1.3.1 Pin 5: Ground

This pin provides a ground reference for all signal pins.

2.2.1.3.2 Pin 6: NPPS I / O

This NPPS pin is software defined to be either an input or an output. As an input, it will accept a DC coupled pulse with a minimum width of 200 ns. As an output, it provides a DC coupled NPPS pulse output to the pin.

- **Input** – When this pin is defined as an input, it will accept a pulse with a minimum width of 200 ns. The input impedance is 100 k Ω . The frequency of the pulse is 1PPS.
- **Output** – When this pin is defined as an output it will provide a 1 Hz pulse output with a 100 ms high pulse width as its default. This is a low impedance output and is not intended to drive a 50 Ω impedance.

1PPS Input Requirements

Parameter	Minimum	Absolute Maximum	Typical
V_{ih} – Input voltage high rating	+2.0 V	+3.3 V	+3.3 V
V_{il} – Input voltage low rating	–0.3 V	+0.8 V	0 V

1 PPS Output Requirements

Parameter	Typical
V_{oh} – Output voltage high rating	+3.3 V
V_{ol} – Output voltage low rating	+0.05 V
I_{out} – Absolute maximum current rating	20 mA

2.2.1.3.3 Pin 9: 10 MHz Ref I / O

This 10 MHz pin is software defined in the running application to be either an input or an output. As an input, it will accept sine or square waves with 50% duty cycles. As an output, it will provide a square wave output.

- **Input:**
 - **DC-Coupled Source Signal** – When the source signal is DC-coupled, the signal must be maintained within a 0 V to +3.3 V window to ensure that the unit is not damaged. The input impedance is approximately 100 k Ω .
 - **AC-Coupled Source Signal** – If there are no resistive loads or terminations on the output of the signal source's AC-coupled output then this signal will self-center the signal voltage within the required 0 Vp-p to +3.3 Vp-p range. The signal voltage swing must be within a 1 mVp-p and 3.3 Vp-p window when connected to the 100 k Ω impedance of this 10 MHz input. The input can be either a sine wave or a square wave. If the generator is not AC coupled, then a DC block needs to be added between the generator and the 10 MHz I/O connector.
- **Output** – When this pin is defined as an output it will provide a 10 MHz square wave with an approximately 50% duty cycle. This is a low impedance output, but is not intended to drive a 50 Ω load.

10 MHz Reference Input Requirements

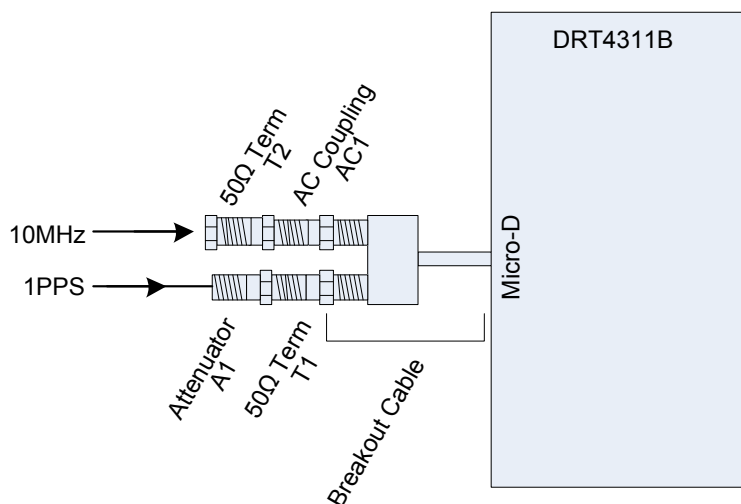
Parameter	Minimum	Maximum
Input Voltage Window	0 VDC	+3.3 VDC
Peak to Peak Input Voltage Swing	1 Vp-p	3.3 Vp-p

10 MHz Reference Output Requirements

Parameter	Maximum
Voh – Output voltage high rating into a high-Z load	+3.3 V
Vol – Output voltage low rating into a high-Z load	+0.05 V
Iout – Absolute maximum current output rating	20 mA

2.2.1.3.1 Interfacing 10MHz and 1PPS to a DRT4311B

It is common for frequency or timing sources to provide 10 MHz reference and 1PPS sync signal from a 50 Ω source impedance. Since the DRT4311B inputs are high-impedance, those signals should be terminated into 50 Ω close to the DRT4311B. We suggest using the mini DB-9 Communications connector with a breakout cable that provides SMA connectors for the 10 MHz and 1PPS. 50 Ω through-terminations would be used at the cable as seen below. Include AC coupling to the 10 MHz on the DRT4311B



1PPS Input Level and Attenuator Selection

1PPS Logic-High Level from Timing Source	Attenuator A1 Selection
+3.0 V - +3.3 V	0 dB
+3.3 V - +3.7 V	1 dB
+3.7 V - +4.1 V	2 dB
+4.1 V - +4.7 V	3 dB
+4.7 V - +5.2 V	4 dB

1PPS is typically specified as +5V logic-high voltage into a 50 Ω load (assumes a logic-low is 0V). The DRT4311B can accept only a maximum logic-high voltage of +3.3V, so an attenuator will be required to support the higher 1PPS voltages so as not to damage the unit. These are described above.

10MHz Input and Level Range in dBm

10MHz Signal Source Level	
With 50 Ω Termination T2 at Breakout Cable	Without 50 Ω Termination T2 at Breakout Cable
+4 dBm to +14 dBm	–2 dBm to +8 dBm

10 MHz signal sources are typically 50 Ω and specify the output level in dBm. To help determine if the level is within the input range of the DRT4311B specifications, the table above can be used. It is desirable that a 50 Ω termination and AC coupling are provided at the DRT4311B as shown in the illustration above, but the DRT4311B can be used without the termination if the cable is short and the output level is lowered (see table above).

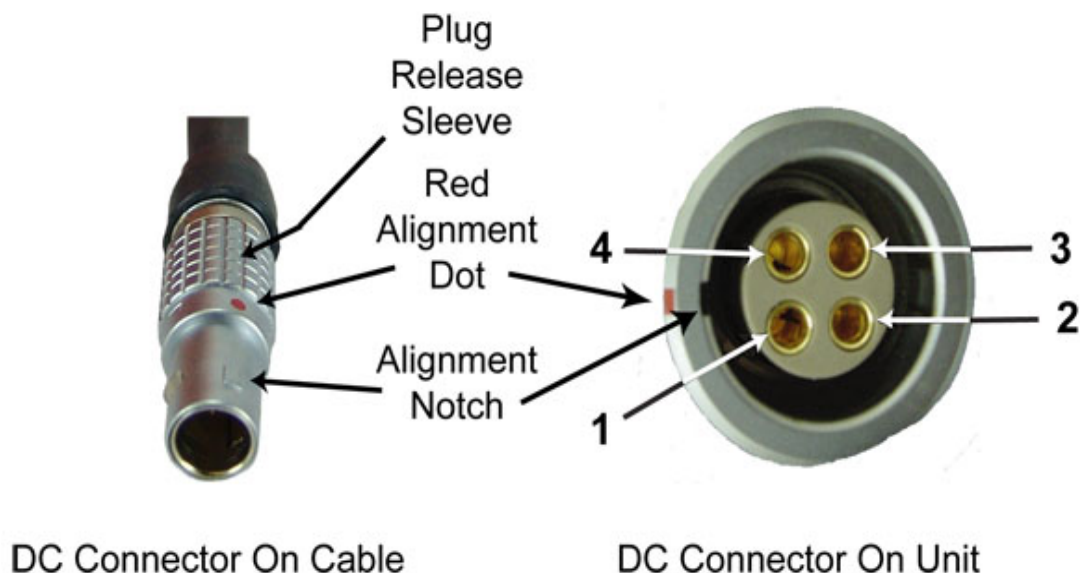
2.2.1.4 DC Input

The unit requires a 9.0 VDC to 30.0 VDC DC power input. DC power is supplied through the **DC IN** (Lemo) connector on the front panel. To install the input power connector, simply align the red keying dot on the cable plug with the red keying dot on the panel jack and slide the plug into the jack. To remove the Lemo connector, DO NOT pull the cable to disconnect the connector as this will damage the connector. There is a release sleeve on the connector plug that should be gripped with a thumb and forefinger and gently slid back. This will unlock the plug from the jack. If continued light pressure is maintained on the sleeve, the cable plug will disengage from the panel jack and slide out.

NOTE: On the DRT4311B, the panel jack's red alignment dot and/or alignment notch are located at 9 o'clock.

CAUTION

Do NOT attempt to twist the sleeve to remove the connector. Slide the sleeve back using a thumb and forefinger. Force is NOT necessary to remove this connector.



The pinout for the **DC IN** connector is shown in the table below:

Pins	Terminal
1, 2	Positive
3, 4	Negative

2.2.2 System Power

The unit uses an internal switching-type DC supply that converts an input voltage in the range from 9.0 VDC to 30.0 VDC to the internal voltages required by the receiver. This range of acceptable input voltage allows operation from a variety of external power sources such as an AC / DC converter or vehicle power.

2.2.2.1 AC Power

The system can be powered from an AC source using the Switching (AC/DC) Power Supply with Lemo Connector. Connect the Lemo connector to the DC IN connector on the front panel. Then connect the AC Power Cable between the Switching Power Supply and a 100 - 240 VAC, 50 - 60 Hz power source. When DC power is available at the Lemo connector, power is supplied to the unit's control circuitry which turns the unit On.

2.2.2.2 DC Power

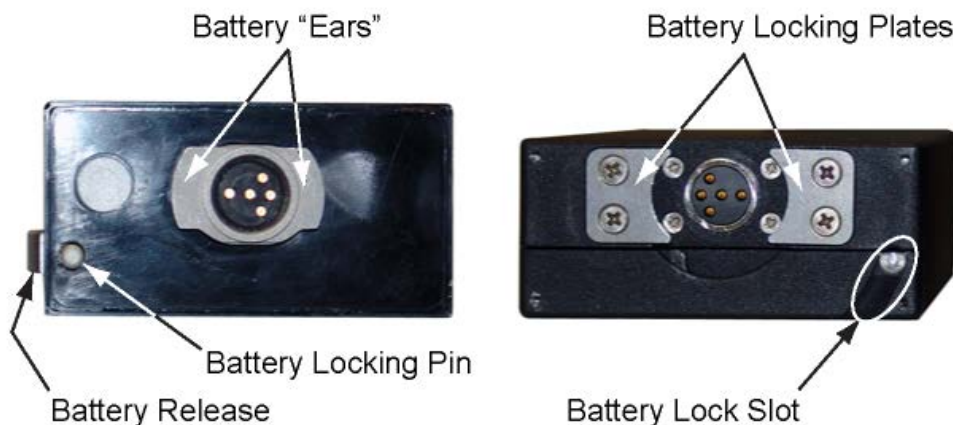
The system can also be powered from a DC source such as the cigarette lighter connector in a vehicle using the Cigarette Lighter to Lemo Connector Auto Adapter. Connect the Lemo connector to the **DC IN** connector on the front panel. Then connect the cigarette lighter connector to the vehicle's auxiliary power connector. When DC power is available at the Lemo connector, power is supplied to the unit's control circuitry which turns the unit On.

2.2.2.3 Battery Pack

The DRT4311B is available with an optional removable Battery Pack. The Battery Pack contains no user controls.

The Battery Pack has a circular connector on the top with two metal ears extending out from the connector. To mount the battery onto the DRT4311B, rotate the battery pack so that the connector faces the unit and the battery release is down. Mate the battery to the unit and rotate the battery counter-clockwise. The Locking Pin will slide into the Lock Slot until the ears are fully mated with the Locking Plates and the Locking Pin extends into the hole at the end of the Slot.

To release the Battery Pack from the unit, slide the Battery Release to the rear and rotate the battery clockwise, when viewed from the rear.



2.2.2.4 Battery Option Upgrade

All DRT4311B units are capable of battery operation. Units not purchased with the battery option are shipped with a plate at the rear of the unit covering the battery connections to protect them from damage. If it is determined that battery operation is desired, a Battery Kit is available from DRT that includes 2 rechargeable Lithium-ion batteries plus a charger and cables. Contact DRT for more information.

2.2.2.5 Battery Charging

For information on charging DRT4311B's battery packs, refer to [Battery Charging](#).

2.2.3 Power ON / OFF

The DRT4311B has two power states, ON and OFF. To turn the system ON, momentarily press the power button, labeled . This will start the software which will start the unit. The status LED will go green.

To turn the unit from ON to OFF, if the status LED is green, momentarily press the power button. The unit will perform a soft shutdown and the status LED will go out. System settings are retained with a soft shutdown. If the status LED is not green, you will need to perform a hard shutdown.

To perform a hard shutdown, which erases system settings, press and hold the power button until the status LED goes out then release the button. If the unit is writing to the SD card when a hard shutdown is performed, the SD card can be corrupted and data can be lost.

NOTICE

After the status LED has been disabled using the GUI, the LED will remain unlit until re-enabled using the GUI. However, when the unit has been powered OFF and later turned ON, the LED may illuminate for a very short period at startup before going out and staying out.

2.2.3.1 Resetting the Unit for an Unlit LED

The system software may be used to turn off the LED.

If the unit is plugged into a known-good power source and the unit is believed to be ON, but the LED is not lit, either the LED has been turned off in software or a problem has been encountered and it is necessary to reset the unit

- Verify that power is applied to the unit. If unsure, perform a soft shutdown to power the unit OFF then power it back ON. If the LED is not lit, continue.
- Verify that the LED has not been turned off in software – turn the LED on if required. Consult the software manual.
- Reset the unit: to reset the unit, perform a hard shutdown then disconnect the power source. After 30 seconds, reapply power to the unit.

2.2.4 Shutting Down and Disconnecting from the Unit

- Shut Down the Unit – If the status LED is green, shut down the unit by stopping the current scan and closing the GUI. Then momentarily press the power button to perform a soft shutdown. If the status LED is not green, perform a hard shutdown.
- Remove Power – If you wish to completely power down the unit, disconnect both ends of the power cable and / or disconnect the battery pack. If it is necessary to disconnect all cabling from the unit, first disconnect the power cable or battery pack and then disconnect all other cables.

NOTE: In the OFF mode, a small amount of power is consumed.

2.2.5 Flash Memory Card Slot

A flash memory card slot is standard on all units. The slot, labeled **MMC/SD**, will support both Multimedia Cards (MMC) and Secure Digital (SD) cards. It is not necessary for the card to be installed for the unit to operate. However, if a card is to be used, it must be installed in the slot before the unit turns On for logging to take place. Data must be logged to the memory card.

2.2.5.1 MMC/SD Memory Card

Units are shipped with one FAT32 formatted 8 GB SDHC memory card. Additional MMC / SDHC cards are available from DRT or MMC / SDHC cards are available commercially.

- DRT4311B will support MMC and SDHC cards up to 32 GB.
- It is important that any card used with the DRT4311B must be a Class 10 memory card with a speed rating of 133X or higher.
- All memory cards **MUST** be FAT32 formatted to enable the unit to log data. The DRT4311B software does not include the ability to format cards in the unit. There are several vendors that, in addition to selling memory cards, have readers that plug into a PC's USB port. One of these devices can be used to format the card prior to use in the unit and download the files saved to the card during logging operations.
- Memory cards that are purchased from vendors other than DRT may **NOT** be formatted for use in the DRT4311B.

NOTE: Most, but not all, SDHC cards have a write-protect slide switch. This switch is located on the left side of the card when the card is oriented with contacts on the far side and the alignment notch at the top. To be able to write to the card, slide the write-protect switch to the "unlocked" position, towards the notch.



CAUTION

When using a memory card from any vendor other than DRT, after formatting, verify the operation of each individual card prior to operational use. It has been observed that some cards may not support the data throughput required by the DRT4311B. Failure to test each card may result in loss of data.

2.2.6 Status LED Indicator

The DRT4311B has a multi-colored status LED indicator on the front panel. The color of the LED indicates the status of the unit. The table below describes what the LED colors mean.

Color	Status
Solid RED	The unit has power (This occurs briefly when power is first applied. It very quickly turns to solid Yellow.) (<i>TI</i> Boot)
Solid YELLOW	The unit is booting (<i>UBOOT</i> running)
Solid BLUE	The operating system is booting (Linux Kernal)
Blinking BLUE (Fast – appx. 1 blink each 0.5 seconds)	The embedded software is loading
Blinking BLUE (Slow – appx. 1 blink per second)	The system is trying to find an IP address on the network.
Solid GREEN	The embedded software is running. The system is ready for operation
Blinking GREEN	Unit rebooting
Blinking WHITE	The unit is in Software Upgrade mode
Blinking RED	An error has been encountered (Watchdog system triggered) Contact DRT for repair

NOTE: LED colors may vary slightly.

2.3 Set Up the DRT4311B

Use the following steps to set up the DRT4311B:

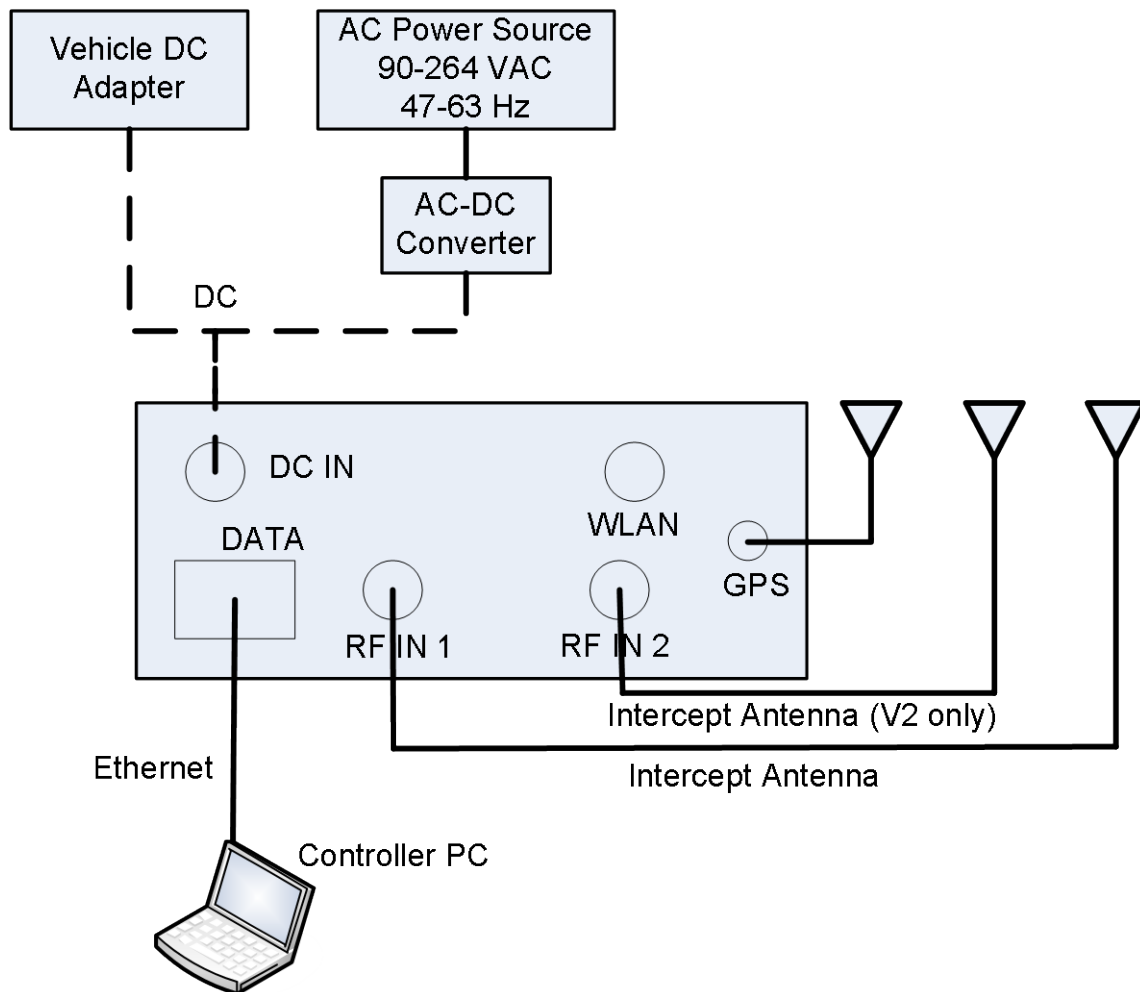
If data logging is to be performed, insert an MMC / SD memory card in the **MMC/SD** slot. (The memory card must be installed in the slot when the unit turns On for logging to take place.)

- Connect the unit to a network port by connecting an Ethernet cable between the network and the **DATA** jack on the unit or connect the unit to a controller PC by connecting an Ethernet crossover cable between the PC and the **DATA** jack on the unit.
- Connect the antenna(s) to the **RF IN** port(s).
- Connect the GPS antenna cable to the **GPS** port.
- External Power – For units without the optional Battery Pack, an external power connection is required (either the AC / DC power supply or the DC vehicle adapter). Plug the power cable's Lemo connector into the unit's **DC IN** connector. Then connect the AC power supply to an AC source or the vehicle adapter cable to the vehicle's auxiliary power connector.

or

Battery Power – For units with the Battery Pack, either external power or battery power can be used. If external power is used while the battery is attached, external power will power the unit and not the battery. Also, if external power is used while a battery is connected the battery will be charged. If external power is to be used (either the AC / DC power supply or the DC vehicle adapter) plug the power cable's Lemo connector into the unit's **DC IN** connector. Then connect the AC power supply to an AC source or the vehicle adapter cable to the vehicle's auxiliary power connector.

The Power Control is a momentary button which changes the unit between the two states of operation, Off and On. When a charged battery is attached or external power is supplied, the unit is under power, is initially in On, and is capable of operation.

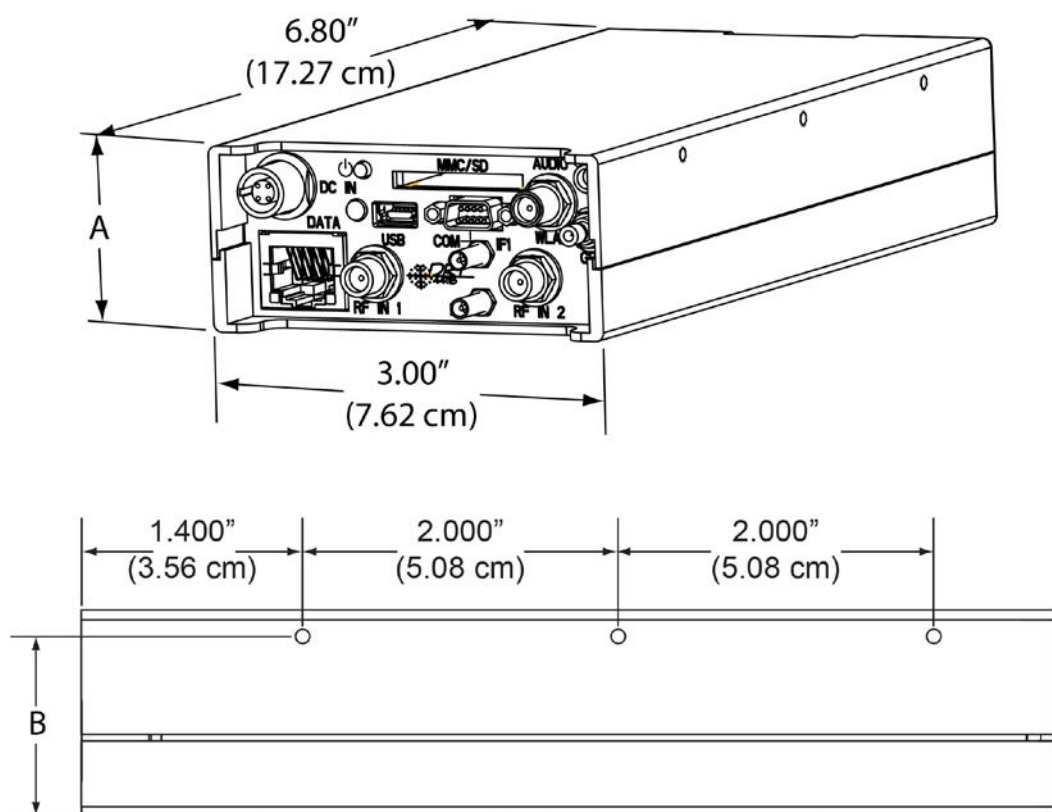


2.4 Mounting the DRT4311B

Although the DRT4311B is designed for mobile operation, it may be desirable to hard mount the unit for certain types of operation. The unit is equipped with three mounting holes on the left and on the right sides of the unit. Either set of mounting holes or both sets can be used to mount the unit. The mounting holes are tapped for 4-40 screws.

For units equipped with an attached battery pack, ensure that there is ample room to remove and replace the battery pack. The battery rotates from horizontal to vertical in a clockwise direction, when viewed from the rear, for removal. Allow a minimum of 1.00" (2.54 cm) below the unit and 1.25" (3.18 cm) above the unit for battery rotation and removal. The battery pack adds 0.3" (.76 cm) to the overall height of the unit and approximately 3.2" (8.13 cm) to the overall length of the unit.

Configuration	Unit Height – A	Mounting Height – B
V1 / V2	1.30" (3.30 cm)	1.15" (2.92 cm)



Mounting the DRT4311B Dual Channel Receiver

NOTICE

The 4-40 mounting screws must not penetrate more than 0.25" (0.63 cm) from the outer surface of the unit.

2.5 Temperature Management

The DRT4311B requires the case temperature to be maintained between 0°C and +50°C for the unit to operate within specifications. There is sufficient airflow in many environments to provide adequate cooling, but that airflow needs to meet these specifications:

System Power Consumption and Air Flow Requirements

Unit	Power Consumption	Air Flow
DRT4311B-V1	8.0 W	125 LFM*
DRT4311B-V2	10.0 W	125 LFM*

*125 LFM = 1.42 mph

Alternate methods of cooling include mounting the unit to surfaces that can enhance cooling.

NOTE: Power consumption is application dependent and thus may be less than that shown in the data sheet.

3 DTR4311B Software

A software CD is provided that includes the latest embedded (system) software and *Galena*, a test GUI. Use of the *Galena* GUI is described in the DRT4300B System Software Manual, DRT P/N 434-00191. A copy of the software manual can be installed on the controller PC when *Galena* and/or the system software are loaded.

In addition, a second CD is provided with a Software Development Kit (SDK), which includes an Application Programming Interface (API). Contact DRT for more information. Some documentation is found on the CD for the kit.

4 Rechargeable Batteries

4.1 Operating Lithium-ion Batteries under Extreme Conditions

The batteries used to power the DRT4311B are Lithium-ion rechargeable batteries. Observe these precautions when operating in areas where severe climatic conditions may exist. Lithium-ion batteries, outside the normal operating temperature range, will charge slowly if at all.

4.1.1 Operating in Very Hot Climates

When operating in a very dry environment, sand and dust accumulation on the components may cause poor electrical connections. Follow proper cleaning and maintenance guidelines to assure proper operation.

NOTICE

Do NOT allow the external case temperature to exceed +140° F (+60° C). When the internal temperature exceeds approximately 145° F (63° C) the battery will cease operation.

4.1.2 Operating in Very Cold Climates

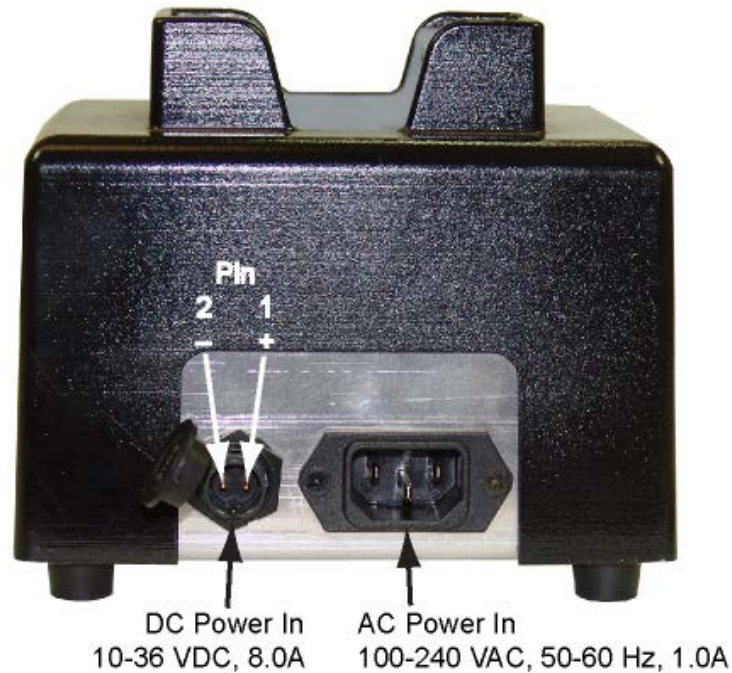
The equipment is designed to operate in temperature extremes as low as +14° F (–10° C). The following precautions should be used:

1. Handle equipment carefully. The plastic components may become more brittle.
2. Keep equipment clean and dry.
3. Prevent ice from forming on the charging components and on the batteries. Ice formation may prevent proper electrical connections.
4. Dry batteries before charging or discharging.

4.2 Battery Charger Power

The DRT4311B Battery Charger is capable of using either AC or DC power. The nominal input requirements are described in the [DRT4311B Hardware](#) section.

Battery Charger Power Inputs



4.3 Battery Charging

4.3.1 The DRT4311B Battery Charger

NOTE: A fully discharged battery will charge in approximately four hours under non-extreme environmental conditions. Extreme conditions will increase the charge time.

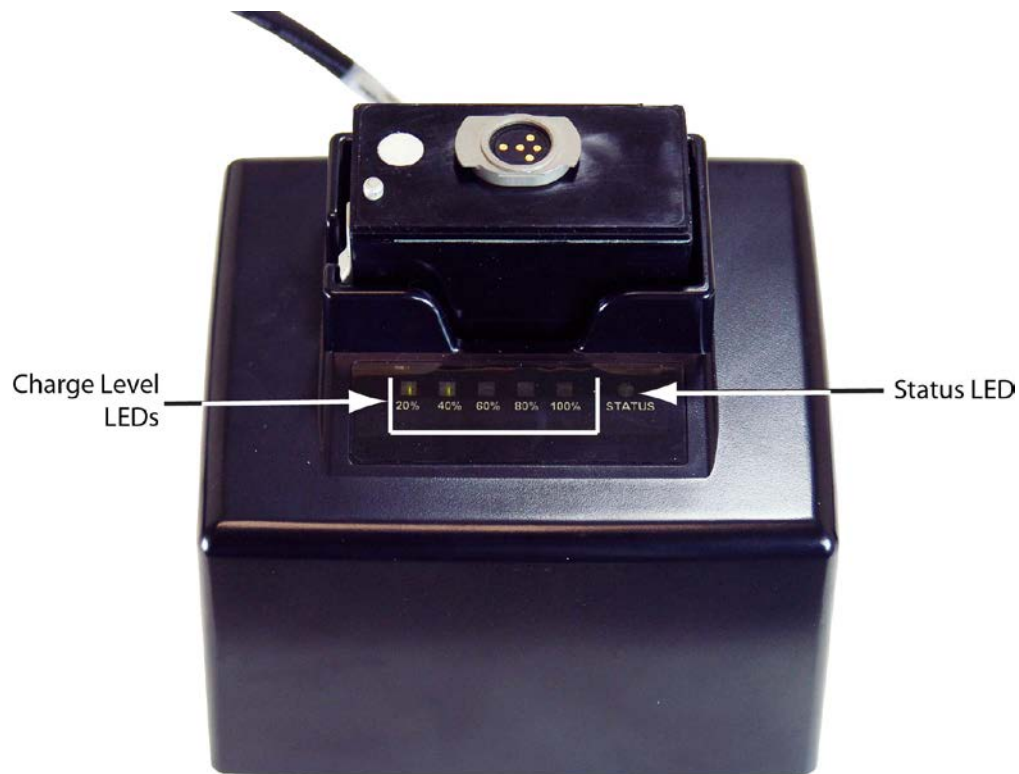
The battery charger is a standalone level 2 smart battery charger that the DRT battery will mount in for charging. The battery charger has five charge level LEDs representing:

- 20% (Green LED)
- 40% (Green LED)
- 60% (Green LED)
- 80% (Green LED) and
- 100% (Green LED) charged.

The charger also has a **Status** (Red/Green) LED that indicates the state of the charger:

- While the battery is in the charger, the **Status** LED will blink Green about every 1/2 second.
- When the battery is fully charged, the **Status** LED will appear solid Green.
- If a charging error is detected, the **Status** LED will appear solid Red.
- The internal battery temperature is monitored during charging. If the battery is too hot or too cold to be properly charged, the **Status** LED will blink red until the battery temperature reaches an acceptable operating temperature and charging can resume. This fault is self-clearing.
- If a system fault is encountered, the **Status** LED will appear solid Red and charging will stop. If the system fault clears, charging will resume. This fault is self-clearing.

DRT4311B Battery Being Charged



The charger supports "wake-up" charging for deeply discharged batteries. The battery will request a low current wake-up charge of no greater than 100 mA when it is deeply discharged.

When power is first applied to the charger, it will perform a self test (all LEDs will blink simultaneously one time in each step):

- Step 1 – The **20%, 40%, 60%, 80%, 100%** charge level **LEDs** and the **Status** LED will blink Green.
- Step 2 – The **20%, 40%, 60%, 80%, 100%**, and **Status** LEDs will blink Green a second time.
- Step 3 – All LEDs will remain out, the self-test is complete.

After the self-test is complete, insert a battery into the charger with the battery release to the left. The battery cannot be inserted incorrectly.

When the battery is first inserted, the LEDs will cycle between 20% and 100% while the charger waits for the battery to broadcast its charge state. This can take up to 50 seconds. When the battery's charge state is received by the charger, the LEDs will stop cycling and display the level of charge in the battery. The Status LED will begin blinking indicating that the battery is being charged. As the level of charge increases and as the level approaches the next LED percentage level, that LED will start blinking at half the rate of the **Status** LED. When the battery has reached that percentage of charge, the blinking LED will change to solid. When the battery is 100% charged, all percentage LEDs will be lit and the **Status** LED appears solid Green.

4.3.2 Charging the DRT4311B Battery

CAUTION

Do NOT attempt to charge a DRT4311B battery when the ambient temperature is below +32° F (0° C) or above +113° F (+45° C). If mistreated, a cell can rupture and, in extreme cases, **explode**.

NOTICE

Do NOT insert a battery into the charger until the charger has completed its self test.

The charger for the DRT4311B battery is a self-contained charger that checks the status of the battery and charges that battery according to its condition. The charger will not allow the battery to become overcharged. Once fully charged, a trickle charge will maintain the battery at full charge. The charger has over temperature protection to prevent the battery from charging with an internal temperature below +32° F (0° C) or above +113° F (+45° C).

NOTICE

When a battery is first inserted into the charger, the charger must wait until the battery sends its charge state for the charger to know how to charge the battery. This can take up to 50 seconds.

Charging can occur even while the receiver is attached to the battery and operating but the charge time will increase.

4.3.2.1 Charging the Deeply Discharged Battery

Because of extended use and / or improper storage, a DRT4311B battery can go into a deeply discharged state. In this state, the battery's protective circuitry shuts itself down to prevent internal damage. In many cases, this self-protection circuitry is effective and the battery can recover. However, the recovery process can more than double the time to recharge a normally discharged battery. Typically, a battery can be recharged in approximately 4 hours because there is no restriction to the amount of charging current that can be used. With a deeply discharged battery, the charging current must be very low initially. It first must reactivate the protective circuitry to allow the battery to accept the charge before the charging can occur.

When attempting to charge a deeply discharged battery, the charge level indicators on the Battery Charger may show no indication of a charge in the battery after 2 hours or more of charging. An interim check can be made to see if the charger has reactivated the protective circuitry and is allowing the battery to accept a charge. Using a digital multimeter, measure the voltage across the battery terminals.

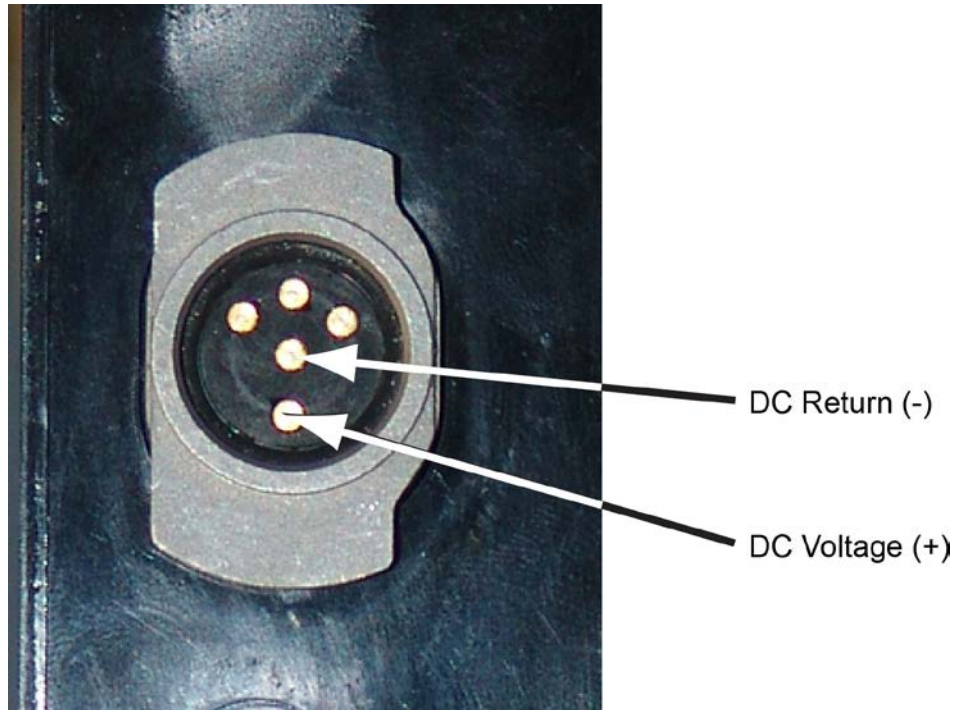
If the voltage is at least 5.0 VDC, the protective circuitry has been reactivated and the battery is accepting a charge so continue to charge the battery.

If the voltage is less than 5.0 VDC, you can continue the attempt to recharge the battery or consider the battery as non-rechargeable and dispose of it in accordance with local requirements. If you elected to continue the attempt to recharge the battery and the battery voltage has not reached 5.0 VDC after 4 hours of charging, the battery cannot be recharged and should be disposed of.

NOTICE

When measuring the battery terminal voltage, be extremely careful to not short out the power terminals. A short applied across these terminals could irreparably damage the battery.

Battery Terminals



4.3.3 Long Term Battery Storage

CAUTION

Charge batteries to between 40% and 60% for long term, up to 1 year, storage. Storing the battery outside this range could shorten the battery's life.

When a battery is to be unused for a period of from 2 weeks to one year, store the battery with between 40% and 60% charge. All batteries will undergo a small internal discharge while in storage. Storing a battery with an initial charge less than 40% could allow the battery to go into a deeply discharged state after extended storage. If the battery goes into a deeply discharged state, the battery could end in an irreparable state. Storing a battery with a full charge will increase the internal discharge rate and could shorten the life of the battery.

4.4 Troubleshooting the DRT4311B

Refer to the table below as a first step in troubleshooting problem(s) related to the operation of your unit.

Problem	Possible Solution
LED not lit.	Power not available to unit – check power source and connections.
LED not lit.	LED disabled – re-enable in software.
Front Panel LED blinking Red then goes to solid Green.	If blinking Red for a short time then goes to solid Green during bootup, unit has invalid calibration file. System will operate, but absolute values may not be accurate. Depending on requirements, use as is or contact DRT for repair.
Front Panel LED Blinking Red.	An unrecoverable error has been encountered. Contact DRT for repair.
Incorrect decoding of signal.	Poor / no GPS reception. GPS Antenna not connected or damaged. Install known-good GPS antenna.
Incorrect decoding of signal.	Not receiving GPS signals due to location. Change location for better GPS reception.
Unable to connect to unit.	Ethernet cable not connected to Controller PC, to unit, and/or to network. Verify connections.
Unable to connect to unit.	Defective Ethernet cable. Replace cable.
Unable to connect to unit.	Does your controller PC have a static IP address? Refer to manual to establish IP address.
Unable to connect to unit.	Does the controller PC have firewall software or anti-virus software, such as Norton's, running? Can you connect with the firewall / AV software turned off?
Unable to connect to unit.	Are there special accesses on the controller PC that will prevent you from connecting? Can you connect with these accesses turned off?
Unable to connect to unit.	Has your PC ever worked with this unit or is this the first time you have tried to connect to this PC?
Unable to connect to unit.	Are you attempting to connect to the unit using a GUI created using API files? Has this GUI ever connected to any DRT unit?
Unable to connect to unit.	Are the GUI and embedded software versions compatible (1.XX vs. 1.YY)?
No Signal.	RF Antenna connected to RF IN 2 – change to RF IN 1 port.
No signal / Low Signal Strength.	Defective antenna or damaged SMA antenna connector.
Low Signal Strength.	Poor connection to RF IN 1 .
Low Signal Strength.	Base Station too far away.
Low Signal Strength.	Monitoring wrong Base Station.
Controller PC connected to unit, but responses not correct.	Version of GUI not the same as version of Embedded (System). Update to latest GUI and Embedded, but verify versions are compatible.

NOTE: When connecting the unit directly to a controller PC, both the unit and the PC require a static IP address. When connecting the unit to a network, the controller PC will probably require a DHCP configuration and the unit may also require DHCP (some networks may accept a static IP address). Use **start > Control Panel > Network Connections** to configure the controller PC and use *Yukon4k.exe* to configure the unit.

4.4.1 Contact DRT with this Information

If the above troubleshooting information is not sufficient to resolve your problem and it is necessary to contact DRT, please include the following information:

1. Unit model number and serial number.
2. Other peripherals involved such as antennas, LAN, MMC, Power Supply.
 - Model number and serial number of each.
3. Version of embedded software that is installed on the unit.
4. Version of DRT software (GUI) being used.
5. Type of interface that is being used to communicate with the unit (C++ API or IDL).
6. Version of C++ API or IDL installed on the controller PC.
7. What features / formats are you running?
8. Error codes generated (screen shots are an easy way to record this – error number and text of the code).
9. What has changed since the last time this worked?
10. TCP/IP and network settings (a lot of issues are connecting to the unit).
11. How much experience do you have with the DRT product, the collection software, RF industry, networking (as needed) – helpful in determining what typical issues may crop up.

4.4.2 Troubleshooting the Battery Charger

Refer to the table below as a first step in troubleshooting problems related to the operation of your unit.

Item	Malfunction	Possible Corrective Action
1	Power applied but charger didn't go into self-test	1. Check for proper source voltage. 2. Inspect Power Cord for proper connection. 3. Inspect Power Cord for damage.
2	Self-test started, but didn't complete successfully	1. Defective charger. Try a different charger.
3	STATUS LED is blinking Red.	1. Battery too hot or too cold to properly charge properly. Charging will resume when proper temperature is reached.
4	STATUS LED is solid Red.	1. System fault occurred and charging stopped. Charging will resume when fault clears. 2. See Troubleshooting the Solid Red LED, below. 3. Check warranty instructions on battery. If not covered or no instructions, dispose of properly. 4. Note success/failure of future battery charges using this charger. More RED lights? Replace the charger.
5	Charging does not start.	1. Possible poor connection. Inspect and clean battery and Adapter contacts. 2. Defective charger. Try a different charger. 3. Defective Battery, replace.
6	Charging appears to start, but the STATUS LED never turns Red (FAULT) or solid Green (READY); instead remains at intermediate state.	1. Poor connection; inspect and clean battery and adapter contacts. 2. Defective charger. Try a different charger. 3. Defective Battery, replace. 4. See Note 2.a, below

4.4.3 Troubleshooting the Solid Red LED

1. Remove the battery and inspect all contacts. Clean as necessary. Then reconnect for another charge cycle. Note battery and adapter for later review.
2. If Charge indications go "red" again, remove battery and do the following:
 - a. If the battery was in storage and does not charge, try charging it again. If the battery does not fully charge, it may no longer be serviceable.
NOTE: Lithium-based batteries **MUST** be charged yearly if held in storage. If a charge is not maintained, the battery may be permanently damaged.
 - b. Check the battery. Is it 3 years old or older? It may be ready for disposal. Discharge and recharge. If red again, dispose of battery.
 - c. Check warranty instructions on battery. If not covered or no instructions, dispose of battery.
 - d. Note success / failure of future battery charges using the same controller and adapter. More red lights? Change charger.

4.5 Locate a Unit on a Network

If the unit is connected to a network when you install/update the embedded software or start the GUI, you must be able to "see the unit" on the network to continue. However, it is possible that the unit is on the network, but the software cannot locate it. This can be for a reason as simple as having a router between your PC and the unit. To locate the unit follow the instructions below for your PC's operating system.

4.5.1 Windows XP PC

- Click the **Start** button and then click **Run**.
- The **Run** dialog will appear. Enter *cmd* and click **OK**. A command prompt box like the one below will appear with the last line indicating a drive letter followed by a colon, a backslash, and a ">." Enter the word *ping* followed by a space and then the model number and serial number of the unit as follows:

```
ping drt4311bsn649
```

- Press **ENTER** on the keyboard. The software will interrogate the network in an attempt to locate the unit.
- When it is found, the IP address will be returned four times.

```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

U:\>ping drt4311bsn649

Pinging drt4311bsn649.DRT.local [192.168.3.125] with 32 bytes of data:

Reply from 192.168.3.125: bytes=32 time<1ms TTL=63
Reply from 192.168.3.125: bytes=32 time<1ms TTL=63
Reply from 192.168.3.125: bytes=32 time<1ms TTL=63
Reply from 192.168.3.125: bytes=32 time<1ms TTL=63

Ping statistics for 192.168.3.125:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

U:\>

```

4.5.2 Windows 7 PC

- Click the **Start** button.
- In the lower left corner there is a field labeled **Search programs and files**. In this field, enter *cmd* and press **ENTER** on the keyboard or click the  icon. A command prompt box like the one below will appear with the last line indicating a drive letter followed by a colon, a backslash, and a ">." Enter the word *ping* followed by a space and then the model number and serial number of the unit as follows:
ping drt4311bsn6498
- Press **ENTER** on the keyboard. The software will interrogate the network in an attempt to locate the unit.
- When it is found, the IP address will be returned four times.

```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

U:\>ping drt4311bsn649

Pinging drt4311bsn649.DRT.local [192.168.3.125] with 32 bytes of data:

Reply from 192.168.3.125: bytes=32 time<1ms TTL=63
Reply from 192.168.3.125: bytes=32 time<1ms TTL=63
Reply from 192.168.3.125: bytes=32 time<1ms TTL=63
Reply from 192.168.3.125: bytes=32 time<1ms TTL=63

Ping statistics for 192.168.3.125:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

U:\>

```

4.5.3 Updating Hosts / LMHosts

Windows has used both the **HOSTS** and **LMHOSTS** filenames. The file you have may be either filename. As an example, Windows XP Professional SP3 uses **HOSTS**. The files in **C>Windows>System32>Drivers>etc>** include **HOSTS**, **HOSTS.001**, and **LMHOSTS.SAM**. **HOSTS** and **HOSTS.001** are two copies of the same file and **LMHOSTS.SAM** is a sample file providing information about **HOSTS** / **LMHOSTS** files. If it is necessary to modify a **HOSTS** file, DRT recommends that you modify the **HOSTS** file and leave the **HOSTS.001** as an unmodified backup. **HOSTS** is the file used by Windows.

NOTE: **HOSTS** / **LMHOSTS** only works with static IP addresses over time.

You cannot add an **HOSTS** / **LMHOSTS** entry for a computer that is a DHCP client because the IP addresses of DHCP clients change dynamically. To avoid problems, make sure that the DRT systems whose names are entered in the **HOSTS** / **LMHOSTS** files are configured with static IP addresses.

If you should receive an error that says "<hostname> does not appear to be a valid name on this network" then you may have to make a change to the controller PC's **HOSTS** / **LMHosts** file to resolve the DRT unit's name and IP address. Although it may still be possible to connect to the unit using its IP address, if this error appears Kodiak may have trouble storing information in the default file locations on the unit. Note that adding the DRT system IP address to the **HOSTS** / **LMHosts** file will not help if the DRT system has a dynamic IP address.

- Use *Windows Explorer* to navigate to the **HOSTS** / **LMHosts** file:
 - o **C>Windows>System32>Drivers>etc> HOSTS / LMHosts.**
- If the file is not present, you can create one (see below). If it is present, right-click the **HOSTS** / **LMHosts** file and select **Open With>Notepad**.
- Within the file opened in *Notepad*, go to the end of the text and enter the DRT unit's name and its IP address (see example below) and put a carriage return after:

192.168.1.100 DRT4311bsn2156

Note: Although 192.168.1.100 is the most common default IP address that DRT gives to new units, it is NOT the only default IP address used. Check your unit's hardware manual for the default IP address.

- Save the file (*Notepad* main menu>**File>Save**).
- Close the file.
- On the Windows task bar, go to **start>Control Panel>Network Connections**:
 - o Right-click the **Local Area Connection** and select **Properties** from the pop-up menu. On the **Properties** window:
 - o Select (highlight) **Internet Protocol (TCP/IP)** and then click the **Properties** button.
 - o Click **Advanced** button on lower right.
 - o Click the **WINS** tab.
 - o Click the **Import HOSTS / LMHosts** button which brings up a *Windows Explorer* dialog.
 - o Browse to the file you just changed with *Notepad*, select it and click **Open**.
 - o Click **OK**.
- Click **OK** and/or **Close** to close all the open windows.

To create an **HOSTS / LMHosts** file:

1. Open *Notepad*. Enter the DRT unit's IP address and name on the same line and press **ENTER**:
192.168.1.100 DRT4311bsn2156
2. Note that if you are entering more than one DRT system's IP address, each entry must be on a separate line and the final entry in the file must be terminated by a carriage return.
3. Save the file with the name **HOSTS / LMHosts** in this directory: **C:\Windows\System32\Drivers\etc**.
4. *Notepad* will give the file the .txt extension—you need to delete the file extension because the **HOSTS / LMHosts** file does not have a file extension. Rename the file as simply **HOSTS / LMHosts** with no extension.