

PathTrax

User's Manual

Praxsym, Inc.

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Introduction

PathTrax is a user-friendly microprocessor-based transmitter and receiver system that measures relative signal strength, path loss and shielding level. The units are powered by rechargeable batteries for up to 4 hours of continuous operation (2 hours for the transmitter). The battery charging circuitry allows full recharge in 90 minutes or less.

The large backlit LCD screen provides numeric as well as graphic representation of signal levels. Operation is via top mounted controls or through the RS-232 port provided. Complete control of the unit's operation can be accomplished via the serial port, with the exception of power ON/OFF and receiver volume. Measurement data can be transferred to a portable computer for later analysis.

The unit is powered by a 9.6 volt 1800 mAh nickel-cadmium battery. The integral charging circuit also has a low battery cutoff feature to protect the battery from full discharge, which could lead to premature battery failure. The unit will not turn ON when the battery voltage is less than approximately 8.8 volts. When the unit is operating it will shut OFF at approximately 8.4 volts. The bar display of battery level has a range of 8.5 to 11.2 volts, which closely covers the operational range of the battery. When the battery voltage drops to approximately 8.7 volts, the BATT text on the display will flash. When the charger is connected, the CHG text in the battery display area will flash, indicating that the charger is providing sufficient voltage to the internal charging circuit.

Specifications

All models of the PathTrax line share the same specifications except for the operating frequency. The frequency ranges for these models are listed below:

PTS – 915 (GSM) covers 885-960 MHz

PTS – 900 covers 864 to 936 MHz

PTS – 860 (Cellular) covers 824 – 900 MHz

Receiver

Tuning Step:	1 MHz, 100 kHz and 10 kHz (depending on model)
Operating Modes:	Path Loss, Signal Strength, Shielding Level
IF Bandwidth:	20 kHz nominal
1 st IF:	90 MHz
2 nd IF:	455 kHz
RF Input Connector:	TNC Female
RF Input Impedance:	50 ohms nominal
Input Preselection:	5 pole Chebychev, 80 MHz 1 dB bandwidth
Measurement Accuracy:	+/- 1.0 dB (-110 dBm to 0 dBm) +/- 2.0 dB (-120 dBm to -110 dBm)
Maximum Safe Input Level:	+30 dBm (1 watt) minimum
Battery Operation:	4 hours minimum at full charge
AC/Charger Operation:	95-265 VAC, 48-65 Hz
Charge Time:	90 minutes typical, “REFLEX” charge control
Remote Operation:	via 9600 baud RS – 232 serial interface
I/O Connectors:	9 Pin subminiature D connector
Controllable Functions:	All functions except ON/OFF/Volume

Output Data:	All measurement data and instrument status
Reading Rate:	500 ms (step tuning frequency and read data)
Controls:	ON/OFF/VOLUME, FREQUENCY TUNE, COARSE/FINE, THOLD (sets threshold for go/no-go testing), LOCK (locks out control panel), MODE (PATH LOSS, SHIELDING LEVEL, or SIGNAL STRENGTH, CAL, used to provide path loss or shielding reference level normalization)
LED Indicators:	BATTERY OVERTEMP, BATTERY CHARGE, BATTERY FAULT
LCD Displayed Functions:	Frequency, Battery Level, Mode (Path Loss, Shielding Level, or Signal Strength), CAL Status, LOCK Status, Frequency Adjust Status (Coarse or Fine)
Weight:	5.5 lb. Nominal
Case Size:	11.7”H x 5.1”D x 4.9”W
Standard Accessories:	32 ohm Headphones, battery charger/power pack, manual, antenna

Transmitter

Tuning Step Size:	1 MHz, 100 kHz and 10 kHz (depending on model)
Maximum Output Power:	+30 dBm nominal
Output Power Control:	1 dB steps from -30 to +30 dBm
Output Level Accuracy:	+/- 1.0 dB maximum over Temp and Frequency
Harmonics:	-40 dBc nominal
Output Impedance:	50 ohms nominal
Load VSWR:	Safe operation into infinite VSWR
RF Output Connector:	TNC Female
Battery Operation:	2 hours minimum at full charge
Batteries:	Nickel Cadmium 9.6V @ 1800 mAh
AC/Charger Operation:	95-265 VAC, 48-65 Hz
Charge Time:	90 minutes typical, “REFLEX” charge control
Remote Operation:	via 9600 baud RS – 232 serial interface

I/O Connectors:	9 Pin subminiature D connector
Controllable Functions:	All functions except ON/OFF
Output Data:	Instrument Status
Reading Rate:	500 ms (step tuning frequency)
Weight:	5.5 lb. Nominal
Case Size:	11.7”H x 5.1”D x 4.9” W
Standard Accessories:	Battery charger/power pack, manual, antenna

CONTROLS AND CONNECTIONS

RECEIVER

FREQUENCY – CO/FINE – The frequency control knob operates in conjunction with the Coarse/Fine control. The current frequency step is displayed on the bottom line of the LCD display as 1 MHz, 100 kHz, or 10 kHz depending on the model. Turning the knob clockwise raises the frequency in the selected increments. Counterclockwise rotation lowers the frequency in the selected increments.

MODE – The Mode button toggles the receiver between Signal Strength, Path Loss and Shielding Level. The current mode is always displayed on the LCD screen. Press the Mode button until the desired mode of operation is displayed.

CAL – When setting up the unit for Path Loss or Shielding Level measurements, pressing this button initiates the internal System Calibration sequence. (See section on CALIBRATION for details).

THOLD – These two buttons increment the threshold value up or down. The value is displayed on the LCD. This is the signal level at which the audible alarm is triggered.

LIGHT – This button activates the backlighting for the LCD display.

LOCK - The lock button toggles on and off to lock the control panel, in order to guard against accidental changes during a measurement. The status of the lock function is displayed on the LCD screen.

POWER ON/OFF/VOLUME – As its name implies, this is the power control for the unit. The volume control changes the audio level for the alarm output. Turn the control clockwise to power ON the unit and counter-clockwise to turn it off.

OUTPUT – This is the audio jack for the alarm output. The supplied headphones can be plugged into this output jack.

INPUT – RF Input, normally connected to the flexible antenna

REMOTE – This is the RS-232 connection port. See the section on remote operation for details on this connection.

TRANSMITTER

FREQUENCY – CO/FINE – The frequency control knob operates in conjunction with the Coarse/Fine control. Pressing the Coarse/Fine button causes a cursor to move below the displayed frequency. The cursor will move from the 1 MHz position down to the 10 kHz position. Turning the knob clockwise raises the frequency in the selected resolution. Counter-clockwise rotation lowers the frequency in the selected resolution. In this manner the operator can select frequency changes in 10kHz, 100kHz, and 1 MHz step sizes.

MODE – The mode button toggles the unit between **FREQ**, **ATTEN**, and **TONES** (Model A version only). When in the Frequency mode, the Encoder knob controls the frequency as set by the Coarse/Fine button. When in the TONE mode, the 3 SAT tones may be selected or the Tone set to OFF.

ATTEN – Pressing the **ATTENUATOR** button changes the power output level in 10 dB steps, from –30 to +30 dBm. The current power level is displayed on the LCD screen. Press the **ATTEN** button until the desired output power is displayed. If the **MODE** is set to the **ATTEN** then the encoder will change the output power in 1 dB steps. If the level is set in this manner to 15 dBm, then pressing the attenuator button will cause the attenuation to change to 25, 35, 45, 55 and then 60 dB.

SAT TONES – When the **MODE** has been set to **TONES**, the Encoder selects one of the three **SAT TONES** or **OFF**. The three available tones are: **SAT 0** (5970 Hz), **SAT 1** (6000 Hz), **SAT 2** (6030 Hz) and **OFF** (Model A version only).

REMOTE – This is the RS-232 connection port. (See section on remote operation for details on this connection.)

LIGHT – This button activates the backlighting for the LCD display.

LOCK – The lock button toggles on and off to lock the control panel in order to guard against accidental changes during a measurement. The status of the lock function is displayed on the LCD screen.

POWER – This is a rotary ON/OFF switch. Rotate clockwise to turn ON, rotate counter-clockwise to turn OFF.

OUTPUT – RF output connector, normally connected to the flexible antenna.

OPERATION

Signal Strength Mode

Turn the receiver ON and using the mode button select Signal Strength mode. As you press the mode button the current mode displayed on the LCD will change. The display will now be showing signal strength at the currently selected frequency. This will be the noise floor in the area of operation. Turn on the transmitter. Set it to the same frequency as the receiver. The displayed signal strength should rise considerably.

Path Loss

Place the transmitter and receiver approximately 5 feet apart. Turn on the transmitter and receiver. Press the CAL button on the receiver. The receiver display should show 60 dB. As the distance between the transmitter and receiver is increased, the value should increase.

Shielding Level

Place the transmitter inside the shielded enclosure. Position the receiver outside the door 5 to 15 feet from the transmitter, with both units the same height from the floor and both antennas either vertical or horizontal. Turn ON the receiver. Select the desired frequency (on both units). Using the Signal Strength Mode, verify that there are no interfering signals present at the desired frequency. Press the mode switch twice to select shielding level. Turn ON the transmitter, and press CAL on the receiver. The receiver display should read 60 dB. Press the ATTN button on the transmitter and select 0 dB attenuation (+30 dBm). The receiver should now read 0 dB (+/- 5 dB). Close the door, the level displayed is the effective attenuation of the enclosure. Set the threshold to the desired minimum attenuation value. As the receiver is moved around the exterior of the enclosure, the tone will sound if the attenuation drops below the threshold setting. The tone will increase in pitch as the difference between the threshold and the reading increase.

REMOTE OPERATION

All PathTrax unit functions can be controlled remotely with the exception of power ON/OFF and Receiver audio output volume. All other functions, including the calibration sequence, can be handled via the RS-232 port. The commands are all in ASCII and are transmitted at 9600 baud 7 bits 2 stop bits and no parity. All commands are terminated with a CR (carriage return hex OD.) Any terminal or PC with a terminal emulation package can be used to communicate with the unit. A cable is provided that connects the PathTrax serial port to the 9 pin COM port of an IBM PC clone.

(NOTE: The under score _ indicates a space (hex 20) is sent in the command).

COMMAND –

FR_XXX.XXXX	Set the frequency to XXX.XXXX where XXX.XXXX is a frequency with the band covered by the unit. The frequency will be echoed back and rounded down to the nearest frequency that meets the current step size (depending on model.)
FR?	Returns the current frequency of operation.
MD_X	Set the mode, where X is 1, 2, or 3 with 1 – Path Loss, 2 – Shielding Level, and 3 – Signal Strength.
MD?	Returns the currently selected mode as MD=2 etc.
CA_	Calibration, used in Path Loss or Shielding Level, same as pressing the CAL button on the control panel.
TH_XXX	Threshold, where XXX is the desired threshold in dB.
TH?	Returns the current threshold setting as TH=080 etc.
SR?	Status Request. Returns LC (for local) or RM for remote followed by OK if conditions are normal. If OK is not sent one or more of the following codes will be returned. UNLCK the unit has lost phaselock BATT the battery is low THRES the selected threshold level was exceeded Example SR=LC, BATT, UNLCK
LV?	Read the input signal level in dB (remote read of the displayed value) As in LV=.080. If the unit is in the wrong mode, it will respond with LV=MER for mode error.
SL?	Return shielding level (or Path Loss value) as in SL=060 if a CAL has not been done the response will be SL=CALER, or if not in mode 1 or 2 SR=MER for mode error.
BA?	Return battery voltage as BA=08.80 (note the BATT on the display

begins to flash at 8.40 volts.)

AT? Returns the current attenuator value in the unit as in AT=060 for 60 dB.
(Will return 000 if attenuator is switched out.)

LC_ Local mode, place the front panel in control.

RM_ Remote mode, locks the front panel.

RL? Raw Level read. Returns as immediate data conversion read when issued. This is a signal read with no rounding or averaging. It is Returned as RL=+/- 0000 as in RL=-0604 or (-60.4 dBm.) This command is intended for high speed reading (faster than 2/second.)

TRANSMITTER ONLY

AT_XX Sets value of attenuator

AT? Returns current setting of attenuator

ST_X Where X=0 to 3 to select the available tones (Model A only)

ST? Returns the current setting of the SAT Tones (Model A only)

ST=X where X equals:

0	SAT 0	5970Hz
1	SAT 1	6000Hz
2	SAT 2	6030Hz
3	OFF	