



# Wrangler Users Guide

109650-00-UG

Rev A

7/18/2019



This REF TEK manual provides an overview and basic operating procedures for the Wrangler 3-Channel (109650-03) or Wrangler 6-Channel (109650-06) and its related family of products.

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## Revision History

Rev	Date	Reason for Change	Pages
0.7	2019-07-09	Initial development	All
A	2019-07-18	Initial release	All

## Legal Notices

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### Product warranty information

For applicable product warranty information, please refer to the Warranty Card included with this product.

## Notation Conventions

The following notation conventions are used throughout REF TEK documentation:

Notation	Description
ASCII	Indicates the entry conforms to the American Standard Code for Information Interchange definition of character (text) information.
Binary	Indicates the entry is a raw, numeric value.
Hex	Indicates hexadecimal notation. This is used with both ASCII characters (0 – 9, A – F) and numeric values.
BCD	Indicates the entry is a numeric value where each four bits represents a decimal digit.
FPn	Indicates the entry is the ASCII representation of a floating-point number with n places following the decimal point.
<n>	Indicates a single 8-bit byte. When the contents are numeric, it indicates a hexadecimal numeric value; i.e. <84> represents hexadecimal 84 (132 decimal). When the contents are capital letters, it represents a named ASCII control character; i.e. <SP> represents a space character, <CR> represents a carriage return character and <LF> represents a line feed character.
MSB	Most Significant Byte of a multi-byte value.
MSbit	Most Significant Bit of a binary number.
LSB	Least Significant Byte of a multi-byte value.
LSbit	Least Significant Bit (bit 0) of a binary number.
YYYY	Year as a 4-digit number
DDD	Day of year
HH	Hour of day in 24-hour format
MM	Minutes of hour
SS	Seconds of minute
TTT	Thousandths of a second (milliseconds)
III	Unit ID number
n, ns	nano, nanosecond; $10^{-9} = 0.000000001$
u, us	micro, microsecond; $10^{-6} = 0.000001$
m, ms	milli, millisecond; $10^{-3} = 0.001$
K, KHz	kilo, kilohertz; $10^3 = 1,000$
M, MHz	mega, megahertz; $10^6 = 1,000,000$
G, GHz	giga, gigahertz; $10^9 = 1,000,000,000$
Kb, KB	kilobit, kilobyte; $2^{10} = 1,024$
Mb, MB	megabit, megabyte; $2^{20} = 1,048,576$
Gb, GB	gigabit, gigabyte; $2^{30} = 1,073,741,824$



### WARNING

This alert warns of a potential hazard which, if not avoided, could result in severe injury or even death.



### CAUTION

This alert warns of a potential hazard or unsafe practice that could result in minor injury or property damage or irretrievable data loss.

**NOTE: This is a note.**

## REF TEK Support and update notifications

As a valued user of REF TEK equipment we would like to provide the best support possible by keeping you up to date with our product updates.

If you would like to be notified of any REF TEK product updates please spend a couple of minutes to register with the REF TEK customer support team.

To register enter your company information through the Register link on our website at <http://support.reftek.com>

Our support team will send you a unique Username and Password allowing secured access to all product documentation and software sold to your company.

Once we register your contact we will only send necessary notifications via email. The same notifications will be shown on our website's <http://support.reftek.com> notifications page.

Support Phone: 1-888-879-2207

Support Email: [reftek\\_support@trimble.com](mailto:reftek_support@trimble.com)

Thanks,  
Your REF TEK support team

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## 1 Overview

### 1.1 Introduction

This section describes operations and maintenance requirements for the REF TEK Wrangler 3-Channel (109650-03) OR 6-Channel (109650-06) Broadband Seismic Recorder. It includes the following:

- An explanation of the general purpose of the Wrangler DAS units.
- Standard faceplate connection functions, pin-out, and associated cables drawings.
- General Wrangler DAS control considerations and operation.
- Frequently Asked Questions about the Wrangler.



#### CAUTION

A Wrangler DAS is shipped pre-configured with a link-local IP address that is safe to connect to your LAN. This should be changed to a fixed IP or to DHCP.

### 1.2 Purpose of the Wrangler Broadband Seismic Recorder

The REF TEK Wrangler DAS units are rugged, portable, and versatile data recorders. The modular design of their software allows you to reconfigure them for various types of applications, both short- and long-term. Some specific uses include the following:

- Collecting seismic data from earthquakes and micro-seismic events in local, regional, and global studies.
- Broadband
- Aftershock
- Active-Source
- Micro-Zonation Survey
- Site Noise Survey

### 1.3 Specifications

Mechanical	
Size:	3.8" High x 5.4" Wide x 8.5" Long
Weight:	3 lbs. (1.4 kg)
Watertight Integrity:	IP68
Shock:	Survives a 1 meter drop on any axis

Connectors	
Power:	PT07A12-4S
NET:	PT07A14-19P
GPS:	PT07A12-10S
Channel Input:	PT07A16-26S (2 each for a 6 Channel DAS)
Antenna:	SMA

Power	
Input Voltage:	9 to 30 VDC
Average Power:	~1.4 W (3 channel, No Communications) ~1.7 W (3 channels, With Communications) ~2.0 W (6-channels, No Communications) ~2.3 W (6-Channels, With Communications)

A/D Converter	
Type:	32-bit Successive Approximation 30-bit output resolution
Channels:	3 or 6 channels
Input Impedance:	2 Mohms, 0.002 $\mu$ Fd, differential @ x 32 25 Kohm, 0.002 $\mu$ Fd, differential @ x1
Common Mode Rejection	Greater than 70 db within $\pm$ 2.5 VDC
Gain Selection:	x1 and x64
Input Full Scale:	40 VPP @ x1 0.625 VPP @ x64
Bit Weight:	37.2 nanovolts/count @ x1 0.582 nanovolts/count @ x64
Sample Rates:	4000, 2000, 1000, 500, 250, 200, 125, 100, 50, 40, 20, 10, 5, 1, 0.1 sps

Time Base	
Type:	Disciplined oscillator phase-locked to external time source
Accuracy with GPS:	$\pm$ 10 $\mu$ s after validated 3-D fix and locked
Accuracy with PTP:	$\pm$ 100 $\mu$ s after PTP clock is stable
Accuracy with NTP:	$\pm$ 500 ms after two valid NTP polls (2 minute poll rate)
Free-Running Accuracy:	0.1 ppm over the temperature range of 0 $^{\circ}$ C to 70 $^{\circ}$ C 0.2 ppm from -30 $^{\circ}$ C to 0 $^{\circ}$ C

Auxiliary Channels	
Inputs:	6 Channels Available on each Sensor Connector (3 for typically for mass position and 3 for auxiliary channels)

Communication	
Ethernet:	10BASE-T/100BASE-TX, TCP/IP, UDP/IP, FTP, RTP
WiFi:	802.11 b/g

Recording Mode	
Continuous Trigger:	Record length
Time Interval:	A periodic recording time
Time Trigger:	A list of record times and lengths
Event Trigger:	STA/LTA with advanced features including bandpass filter LTA hold, etc.
Level Trigger:	Absolute value, user selectable: g, or % of full scale, or counts including bandpass filter
Vote/External Trigger:	Votes per channel including bandpass filter, external pulse on trigger input line
External Trigger:	External pulse on trigger input line



Recording Capacity	
Battery Backed SRAM:	16 MB
Internal non-volatile Seedlink ring buffer	8 GB
External USB Flash Disk:	8/16/32 GB

Recording Format:	
Format:	MRF Recording Format MiniSEED Recording Format

Compliance:	
Specifications:	CE, FCC, RoHS

## 1.4 Standard Faceplate Connections

The functions of the standard connectors on the Wrangler Broadband Seismic Recorder faceplate are as follows:



### 1.4.1 Power Connector: 4-pin PT07

Pin	Description	Pin	Description
A	External DC Power Input	C	Ground
B	Battery DC Power Input	D	Ground

### 1.4.2 GPS Connector: 10-pin PT07

Pin	Description	Pin	Description	Pin	Description
A	DAS Reset	E	GPS TX+	J	GPS Power
B	DAS Reset Ground	F	GPS TX-	K	GPS Power Ground
C	GPS RX+	G	GPS PPS+	-	-
D	GPS RX-	H	GPS PPS-	-	-

### 1.4.3 Net Connector: 19-pin PT07

Pin	Description	Pin	Description	Pin	Description
A	n.c.	H	Enet TX+	R	n.c.
B	n.c.	J	Enet TX-	S	Trigger+
C	n.c.	K	Enet RX+	T	Trigger -
D	n.c.	L	Enet RX-	U	n.c.
E	n.c.	M	NET Power	V	n.c.
F	n.c.	N	Ground	-	-
G	n.c.	P	Ground	-	-

#### 1.4.4 Channel/Sensor Connector: 26-pin PT07

Pin	Description	Pin	Description	Pin	Description
A	Chn 1 / 4 +	K	Cal Signal	V	Sensor ID
B	Chn 1 / 4 -	L	Cal Enable	W	Digital Ground
C	Chn 2 / 5 +	M	Center	X	Mass Position 1 / 4
D	Chn 2 / 5 -	N	Lock	Y	Mass Position 2 / 5
E	Chn 3 / 6 +	P	Unlock	Z	Mass Position 3 / 6
F	Chn 3 / 6 -	R	Undamp	a	Aux 1 / 4
G	Analog Ground	S	UVW Enable	b	Aux 2 / 5
H	Sensor Power	T	Accel Test +	c	Aux 3 / 6
J	Sensor Power Ground	U	Accel Test -	-	-

#### 1.4.5 Power Connector

Power is supplied to the Wrangler DAS unit through the power connector. A separate ground connection can be attached to the quick-disconnect spade attached to the power connector.



#### CAUTION

Disk operations are suspended when the input voltage drops below a user-settable threshold (above 10V).

#### 1.4.6 GPS Connector

The GPS connector allows connection of an external Trimble Acutime360 114650-00 Global Positioning System clock. This connector provides power and serial connections to the 114650-00 GPS Receiver via the 113920-XX cable. See the 114650-00 manual for more information.

#### 1.4.7 Net Connector

Communications between the Wrangler DAS and an external Ethernet device occurs across the Wrangler DAS unit's NET connector. Power (+12VDC) can also be provided to an external communications device. The standard cable (130-8019) only provides the Ethernet connection.



#### CAUTION

A Wrangler DAS is shipped pre-configured with a default IP address. Be sure to change this address before connecting the DAS to an Ethernet port.

#### 1.4.8 Channel Input Connectors

Both three and six channel units have channel input connectors on the faceplate. Signals from an external sensor enter the three-channel Wrangler DAS through the channel input connector labeled CH 1 - 3. Six channel Wrangler DAS units use a second input connector labeled CH 4 - 6. Channel connectors also provide pins for calibration signals to be sent to a sensor.

**NOTE: The Wrangler DAS WebUI will show how many channels are enabled for your Wrangler DAS.**

## 1.5 Mating Connectors

Function	Mating Connector
Power	PT06SE124P
GPS	PT06SE128P
NET	PT06SE1419S
Channel	PT06SE1626P

## 1.6 LED Status

The Wrangler DAS displays various status conditions using 16 bi-color LEDs. In general, a green light indicates a positive working condition and a red light indicates a warning or error condition. The following lists the conditions and their meaning for the LEDs:

LED	Off	Green Solid	Green Blink	Red Blink	Red Solid
TIME	n/a	Reference Clock last locked within the last hour	Reference Clock last locked between 1 – 4 hours ago	Reference Clock last locked longer than 4 hours ago	Reference Clock has not locked since boot
ACQ	n/a	Acquisition is on and no non-continuous triggers are active	Acquisition is on and at least one non-continuous trigger is active	n/a	Acquisition is off
Vin	n/a	Input voltage is at or above 13.0 V	Input voltage is less than 13.0 V and at or above 11.5 V	Input voltage is below 11.5 V and not in LVD	Input voltage is below 11.5 V and in LVD
WIFI	Wi-Fi is off	Wi-Fi is on and the mobile app is connected via Wi-Fi	Wi-Fi is on but the mobile app is not connected via Wi-Fi	Wi-Fi is turning on	n/a
SLINK	No clients are connected	One client is connected	Multiple clients are connected	n/a	n/a
RTPD1	Not configured	Connected	n/a	n/a	Not connected
RTPD2	Not configured	Connected	n/a	n/a	Not connected
ERROR	No other LEDs are red	n/a	n/a	n/a	At least one other LED is Red Solid or Red Blink
RAM%	n/a	Less than 20% total RAM used	Between 20% and 80% total RAM used, and at least one RTP link using less than 20% of total RAM	Between 20% and 80% total RAM used, and at least one RTP link using more than 20% of total RAM	More than 80% total RAM used
USB%	n/a	Less than 33% total USB used	Between 33% and 66% total USB used	Between 66% and 99% total USB used or more than 99% total USB used and Disk Wrap is enabled	More than 99% total USB used and Disk Wrap is disabled
USB	n/a	USB off and no data read or write errors	n/a	USB on	USB off and a read or write error occurred

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## 1.7 General Recorder Control Considerations

The Wrangler DAS is a microprocessor-based instrument. Each Wrangler DAS unit contains programmable flash memory that contains the Wrangler DAS firmware (control code, microprocessor instructions and FPGA images). Occasionally, REF TEK revises the Wrangler DAS firmware, adding features and improving efficiency. The firmware can be upgraded by downloading new code images onto the USB flash drive. To download new code see "Firmware update options". Contact REF TEK to determine the availability, applicability and advantages of such an upgrade.

In addition to the CPU control code in the Wrangler DAS, the Wrangler DAS requires that you enter specific parameter information to instruct it exactly how and when to record data and perform other system functions. A web-based User Interface (Web UI) is used to enter these parameters. REF TEK provides specific software for both iOS and Android devices to allow access to the Web UI over Wi-Fi. REF TEK maintains release notes on its document site.

### 1.7.1 General Recorder operation

The Wrangler DAS provides a Web UI to select data collection parameters. All Wrangler DAS units have multiple datastream capability (maximum of 4 plus one auxiliary), allowing users a vast array of possible parameter combinations.

You may set the following parameters for each datastream:

- Which input channel or channels to include
- Sample rate
- Data compression format
- Trigger type

The trigger type selected for a datastream defines the particular mechanism that controls when the Wrangler DAS records data. The various predefined trigger types supported are as follows:

- Continuous trigger
- Level trigger
- External trigger
- Time Interval trigger
- Time List trigger
- Event trigger
- Vote/External trigger

Each trigger has its own set of parameters that determines the exact conditions under which the Wrangler DAS records data.

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Detailed explanations and methods for using all Wrangler DAS unit parameters, including datastreams and triggers, are provided in subsequent sections in this manual.

REF TEK pre-sets and tests the hardware of each Wrangler DAS before you receive the unit to ensure that it performs as specified. The Wrangler DAS units do not require hardware adjustments for normal operations. You may use a Wrangler DAS unit as a stand-alone recorder, or you may use a network of many Wrangler DAS units deployed over a survey site. During field operations, the Wrangler DAS can store data in a USB flash drive. The Wrangler has a network connection that allows connection to IP-based networks and devices.

All Wrangler DAS units employ hardware, firmware, and software that comply with the requirements of the IRIS PASSCAL Program, portable and telemetry stations, US ARRAY (the USGS and ANSS) specification for national, regional, strong motion, and structural stations.

### 1.7.2 Power Considerations

This section describes current draw, power load, and general power supply considerations for Wrangler DAS units, peripherals, and subsystems.

All Wrangler DAS units operate on nominal 12-volt power (9 to 24 VDC). This range allows a Wrangler DAS unit to be powered from an ordinary lead acid battery that can be charged from either a solar or AC power source.

To ensure continual, uninterrupted power to your Wrangler DAS and peripherals, use a well-regulated power supply that can deliver at least 1.25 times the maximum current that the load of your combined system components requires. Be sure to account for the cable resistance (especially if you build your own cables). Power for an external modem is available from the network connector (5 VDC or 12 VDC). Also 12 VDC is available on the two channel connectors.

In general, perform the following to ensure a sufficient power supply:

1. Use the specification data and add the maximum current draw for the Wrangler DAS and each peripheral that uses the same power supply to obtain the maximum total current they will draw at any given time then add at least 25%.
2. Check your power supply's specifications to ensure that it can handle this load. The power specifications for Wrangler DAS units are provided for each configuration of Wrangler DAS. Contact REF TEK if you require more accurate calculations or other information regarding power considerations.

Solar power setups are frequently used in remote locations and these are available in several capacities that cover the various equipment configurations. Solar power arrays

supplied by REF TEK include solar panels, battery charge regulators, and protective safety devices, but they may or may not include the actual batteries.

## 1.8 Sensor Control

This section describes the handling of various sensor control features, such as mass re-centering and calibration signal output for two sensors. For more information on sensor control see the Wrangler Theory of Operations.

### 1.8.1 Sensor Control Signals

Sensors vary in the number and type of signals they support. The following table shows some common sensors used with the REF TEK Wrangler:

Sensor	X, Y, Z Mass Pos. (3)	M Mass Re- Center	P Unlock	L CalEn	N Lock	K Cal Signal
REF TEK 147A	-	-	-	TestEn	-	-
REF TEK Colt	Mass Pos (3)	Center-	Unlock-	CalEn-	Lock-	Cal Signal
REF TEK 151B	Mass Pos (3)	Center+	-	CalEn+	-	Cal Signal
Guralp	Mass Pos (3)	Center-	Unlock-	CalEn-	Lock-	Cal Signal
Nanometrics	Mass Pos (3)	Center+	Unlock+	CalEn+	Lock+	Cal Signal
Streckeisen /Kinometrics	Mass Pos (3)	Center+	Unlock+	CalEn+	Lock+	Cal Signal

### 1.8.2 Auxiliary Channels

Three auxiliary channels are provided on each sensor connector, in addition to the mass position inputs. Each channel connects to a 12-bit A/D converter with an input range of +/- 10v. These channels are read once per second and stored as left-justified, 2's-complement, 16-bit values. This equates to a bit-weight of 305.2 uV. These channels can be used to measure mass position or other auxiliary input data, such as temperature and wind speed. The current readings of the auxiliary channels are available on demand using the Auxiliary Data status response (SSAD).

### 1.8.3 Mass Re-center

Mass re-centering can be performed on-demand or automatically.

The Sensor Calibration – Mass Re-center command forces activation of the Center pins of the specified sensor for 7 seconds.

Automatic re-centering can be enabled. This requires that the auxiliary input channels are connected to the mass position outputs of the sensor.

Parameter	Range	Description
Sensor	1 – 2	Sensor number
Level Vertical	0.1 – 9.9	Voltage level that triggers re-centering
Cycle Interval	0 – 99	Days between re-center cycles, 0 = disabled
Level Horizontal	0.1 – 9.9	Voltage level that triggers re-centering
Attempts	1 - 20	Maximum attempts per re-center cycle, 0 = disable
Attempt Interval	5 – 59	Minutes between attempts in a cycle, 0 = single attempt

At power-up or after a reset there is a 3 hour delay, to allow the sensor to stabilize, before mass position sampling begins.

## 1.9 Frequently Asked Questions

Question: Does any data loss occur if acquisition is turned on and the NET is not connected?

The data loss that occurs depends upon the parameters of the unit. If the unit parameters are set to store data to disk ONLY then there is no effect, otherwise RAM will fill and acquisition will stop. For further clarification see the explanation in the section "NET Port".

Question: What happens if the Flash drive is pulled from the Wrangler when the Well LED is illuminated?

If the Well LED is illuminated, the drive is writing data and should not be removed until the Well LED is extinguished. Data loss can result from removing a drive when the LED is illuminated.

Question: Can a different sampling rate be used on different datastreams?

Yes.

The sample rate list can be broken into two groups:

- Group One: The following rates are only available when recording a single sample rate for all streams: 4000, 2000, 1000, 500, 250, and 125.
- Group Two: The following rates may be recorded in any combination within all streams: 200, 100, 50, 40, 20, 10, 5 and 1.



Case	Description	Example of
Selection of a sample rate from Group One.	When the user activates any of the other data streams, the sample rate chosen must be the SAME.	Selection of 125 SPS for Data Stream 1. This means that when Data Stream 2 is activated the sample rate is fixed at 125 SPS and there are no other sample rate choices available.
Selection of a sample rate from Group Two.	When the user activates any of the other data streams, ANY of the group two sample rates can be chosen.	Selection of 40 SPS for Data Stream 1. This means that when Data Stream 2 is activated the choice is selection of any of Group two sample rates (200, 100, 50, 40, 20, 10, 5, or 1).

**NOTE: All channels of a datastream run at the same base sample rate.**

Question: Can I format the USB disk on the PC for use in the Wrangler recorder?

For optimal performance in a REF TEK Wrangler recorder, USB disks should ALWAYS be formatted BY THE RECORDER.

### 1.10 Warranty Statement

REF TEK instruments are warranted free from defects of manufacture for one year from date of shipment.

For the full text covering the Product Limited Warranty, Warranty Remedies, How to Obtain Warranty Service, Warranty Exclusions and Disclaimer, Limitation of Liability, Official Language, Registration and any Product Extended Limited Warranty that may apply, please see:

<http://www.trimble.com/termsofsale>

### 1.11 Warranty/Non-Warranty Service

The customer must obtain a Return Material Authorization (RMA) number from REF TEK before returning any equipment.

**NOTE: Do not return any REF TEK supplied equipment without first obtaining an RMA number.**

The following policy is applicable for warranty/non-warranty equipment when a problem is encountered.

Contact REF TEK, by a means that is listed below, to obtain an RMA number.

**REF TEK**  
**Division of Trimble**  
**5217 Tennyson Pkwy, Suite 400**  
**Plano, Texas 75024**  
**USA**

**Voice: 1-888-879-2207**

**Fax: 972-578-0045**

**EMAIL: [reftek\\_support@trimble.com](mailto:reftek_support@trimble.com)**

**WWW: <http://reftek.com>**

To return equipment, follow these steps:

- 1.** Supply the indicated information at time of contact.
  - a.** Description of Problem
  - b.** Type of Instrument
  - c.** Model No.
  - d.** Serial No.
- 2.** Package the equipment safely, preferably using the original packing materials. Include the RMA on the outside of the shipping container, a return address where the repaired equipment can be shipped and a contact telephone number.

**NOTE: It is advised to use a shipping company that can provide a tracking number.**

- 3.** Ship the unit to the this address, freight prepaid:  
REF TEK  
5217 Tennyson Pkwy, Suite 400  
Plano, Texas 75024 USA



## 2 Startup

This section provides information on the following topics:

- Getting started with the Wrangler DAS and quick power up.
- Minimum hardware configuration.
- Quick start procedures to familiarize a new user with the system.

### 2.1 Getting started with your Wrangler DAS

This introductory material provides the following:

- A brief procedure to establish minimal hardware connections for the recorder in order to perform an initial system power-up.
- External cable list.
- Minimum hardware connection and power-up.
- A procedure to specify an abbreviated set of operating parameters, start and verify data acquisition, and save collected data to a file.

These instructions do not provide you with the detailed comprehensive information you need to prepare your recorder for field deployment and 'real' data collection. The complete process to establish all hardware connections, select and implement parameters, and perform data acquisition is only outlined in this section for rapid familiarization.

### 2.2 Establishing Minimal Hardware Connections

These instructions cover the hardware and connections needed to perform the recorder operations described in the rest of this section.

To perform the system power-up, you need the following hardware:

- A Wrangler DAS.
- An external 12 volt power supply; you can use a 12 volt car battery.
- An Ethernet connected PC or Wi-Fi enabled mobile device with the required app.
- One cable to connect the power supply to the recorder (if you are using an Auxiliary Power Subsystem, you can use a REF TEK PT07A12-4S connector with a power cable).
- If using Ethernet, the Ethernet cable to the recorder.

**NOTE: Note: A sensor is not required for this exercise as the noise pick-up at the open input channel connector is sufficient. If you do have a sensor you must make the channel connections as described in the manual for your particular type of recorder and sensor.**

Assuming you have obtained or made up all the required cables, proceed to make the following hardware connections:

**CAUTION**

Do not install the GPS at the very top of the pole or antenna. Leave some space to allow the top of the pole to act as a lightning rod.

1. Install the 114650-00 GPS with a clear view of the sky.



2. Secure the Ethernet cable from your PC to your recorder if using Ethernet.
3. Secure the PT06A12-4S connector on your external power cable to the POWER connector on the recorder. Secure the other end of the power cable to your 12 volt power supply so that connector pins A and B are both at +12 volts and pins C and D are the return lines.
4. Secure the PT06A16-26S connector from each sensor cable (2 each for 6 channel recorder) to each channel connector on the case top.
5. Secure the PT06A12-10S connector of the GPS cable to the GPS connector on the case top.

### 2.3 Install the USB Disk

**CAUTION**

The Wrangler DAS is not shipped with the USB Disk installed. For optimal performance in a REF TEK Wrangler recorder, USB disks should ALWAYS be formatted BY THE RECORDER.

Follow these steps to install the USB Disk.

1. Remove the well cover from the Wrangler DAS as shown below.



2. Remove the USB Disk from the Wrangler accessory kit.
3. Install the USB Disk as shown above.



- Once the USB Disk is installed, close the well with the well cover as shown below.



## 2.4 Power up the Wrangler DAS

Follow these steps to power up the DAS.

- Turn on the supply to apply voltage to the Wrangler Recorder.
- Observe the LEDs start all red, then chase green, then show current status.
- Wait about 30 seconds until the ACQ LED turns green.

## 2.5 General GPS Operations

The Wrangler DAS receives time from an external GPS. To save power the GPS power can be duty cycled. When the GPS is powered on, the DAS waits for time to become stable, and then phase locks its internal oscillator to the GPS pulse-per-second signal. Any drift and offset that was introduced while the GPS was off are corrected before the GPS is turned off again. The GPS can be operated in three modes.

Mode	Description
Duty-cycle	Powers down the GPS and awakens the GPS and repeats the above phase locking algorithm each hour at 40 minutes after the hour.
Continuous	Leaves the GPS powered on continuously.
Off	Powers down the GPS and does not turn the GPS power back on.

The Wrangler DAS can also use a PTP Grandmaster or an NTP server through the internet instead of the external GPS antenna. These time sources are not as precise, but do not require a dedicated GPS for each DAS.

## 2.6 Ethernet for Configuration

As shipped from the factory, the recorder uses a link-local connection, which allows its Ethernet cable to be plugged into any existing Ethernet network. The Wrangler recorder will default to a fixed link-local IP address of 169.254.109.109.

**NOTE: Only one factory default recorder can be connected to a network until the default IP address has been changed to a new, unique IP address.**

From a computer on the same network as the recorder, open a web browser and connect to the Wrangler link-local IP address as follows: <http://169.254.109.109>. Check the status of the DAS using the Status tab and sub-menus.

## 2.7 Using a Mobile Device for Configuration

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The Wrangler DAS includes an internal Wi-Fi hotspot that allows a mobile device to connect directly to the Web UI for configuration.

1. On the mobile device, enable Wi-Fi from its system Wi-Fi settings.
2. Wave the magnet on the DAS to turn on the Wi-Fi hotspot.
3. On the mobile device, select the Wrangler DAS you want to connect to. This may take a few seconds for it to show up on the Wi-Fi list.
4. If a warning pops up indicating Internet connections are not possible, choose an option to stay connected/continue. This is device/OS dependent.
5. On the mobile device, exit the Wi-Fi settings and open the mobile configuration app.
6. The app connects to the DAS and acts a web browser to display the configuration Web UI.
7. Check the status of the DAS using the Status tab and sub-menus.

## 2.8 Check the GPS Status

Follow these steps to check the GPS status.

1. Select the Status – Time Reference display to check the GPS status.
2. Select the Control – Time Reference display to change the GPS mode and source.

## 2.9 Example Configuration Steps

The Wrangler DAS comes from the factory with a default datastream configuration. This is the configuration that starts the first time the DAS is powered on. The default configuration includes all available channels at 200 SPS. A quick check of the data can be made by going to the Monitor tab in the Web UI.

## 2.10 Change the Configuration

Change the configuration to have 1 datastream with 1 channel at 100 SPS using the disk as a destination for the data:

1. Select the Control – Datastream page in the Web UI.
2. Uncheck all channels except Channel 1.
3. Uncheck all destinations except 'D' for disk.
4. Select 100 in the Sample Rate box.
5. At the bottom of the screen, click Send.
6. Acquisition restarts immediately after sending the new datastream parameters. Acknowledge the alert.
7. Go back to the Monitor tab to see that only 1 channel is active.



## 3 Firmware Updates

### 3.1 Firmware Version

Current firmware and documentation is available on our web site. Some early units may require hardware modifications to use the latest software. Contact REF TEK if you have any queries on the compatibility of your unit(s) and the current firmware release.

The latest firmware files can be found at [www.reftek.com/wrangler](http://www.reftek.com/wrangler).

### 3.2 Update Firmware

Updating firmware in a Wrangler DAS requires the presence of one or more firmware files on an installed USB flash disk during DAS startup.

1. On startup, the Wrangler checks the USB disk for the presence of any of the possible firmware files in the /firmware/ directory. The possible files are:
  - a. main.srec
  - b. lid.srec
  - c. bbc.srec
  - d. elc111935.jbc
  - e. cpu106641.jbc
  - f. atd106642.jbc
2. If the one of the files is present on the USB disk, the Wrangler:
  - a. Reads the file. If there is an error reading the file it is renamed by appending '.err' to the filename and the update is aborted.
  - b. Deletes the file.
  - c. Re-programs the related chip with the new firmware

**CAUTION**

DO NOT DISTURB THE UNIT DURING THIS PROCESS. DAS power must be above 11.5V for a firmware update. The DAS may reboot several times during update.

Follow these steps to update the firmware of a Wrangler DAS:

1. Unzip the firmware file or files from the downloaded zip file of the most recently released firmware.
2. Copy the desired firmware image or images to the /firmware/ directory of the USB flash disk. This can be done directly with a PC or remotely via FTP to a running Wrangler DAS.
3. With the USB flash disk with image(s) installed in the Wrangler DAS, issue a reboot command.
  - a. In the Web UI under Control – System, click the Reboot button, then wait for the Acquisition status to show Acquisition is back ON.
  - b. If you are at the Wrangler DAS, you can alternatively hold the magnet to the DAS for 3 seconds to shut down the DAS, and then once the LEDs have all extinguished, hold the magnet for 1 second to start up the DAS again. Then wait for the ACQ LED to turn green.



## 4 Periodic Maintenance

### 4.1 Introduction

This section provides maintenance information for the Wrangler on the following topics:

- Replacing the USB Disk
- Connector Assembly & Maintenance
- Periodic Maintenance checks
- Replace CPU Battery (Wrangler)

This section provides maintenance procedures that increase the effectiveness and useful life of your recorder unit(s).

### 4.2 Replacing the USB Disk



#### CAUTION

If the LED shows Red the drive is reading data; DO NOT REMOVE THE DRIVE UNTIL THE LED EXTINGUISHES.

The following conditions could result if a drive is replaced while the LED is Red: Loss of data on the drive.

The drive may have to be reformatted.

The Wrangler DAS may have to be power-cycled.

If the USB Disk needs to be changed do the following:

1. Remove the cap off the Wrangler DAS.



2. If the LED, in the disk well assembly next to where the USB Disk is installed is extinguished, it can be replaced with an empty formatted drive.
3. Remove the USB Disk as shown below.





4. Install a newly formatted drive into the well of Wrangler DAS.



5. Replace the cap on the Wrangler DAS.



### CAUTION

Due to the large variability of USB Disks available in the world market and the resulting problems with compatibility due to memory layout, signal structuring and power requirements, REF TEK cannot guarantee a USB Disk will work in a REF TEK data recorder unless it is sold through REF TEK itself. REF TEK ensures compatibility through communications with USB Disk manufacturers and rigorous in-house testing. Some USB Disk manufacturers refuse to provide adequate information or factory controls to ensure that the product being sold today is the same as the product sold earlier under the same part number. USB Disks not purchased from REF TEK may work at one temperature but not at another, or may fail all together.

## 4.3 Connector Assembly and Maintenance

To allow you to choose the particular peripherals to use (such as power supply, modem, and external clock), and suitably locate them, REF TEK typically does not always supply complete cables with your recorder. Instead, REF TEK supplies a kit that contains the mating connectors that you need to construct the cables required by your particular peripherals and system configuration. Upon order, REF TEK will supply any or all of our standard connector cables (as described later). Also, REF TEK will construct any custom cables your system needs. For some of the more standard connector/cable drawings of commonly used assemblies see "Standard Faceplate Connections".

Pin connections are supplied in your recorder manual (Starting in Chapter 1, "Overview"). When making the connections follow industry standard practices in

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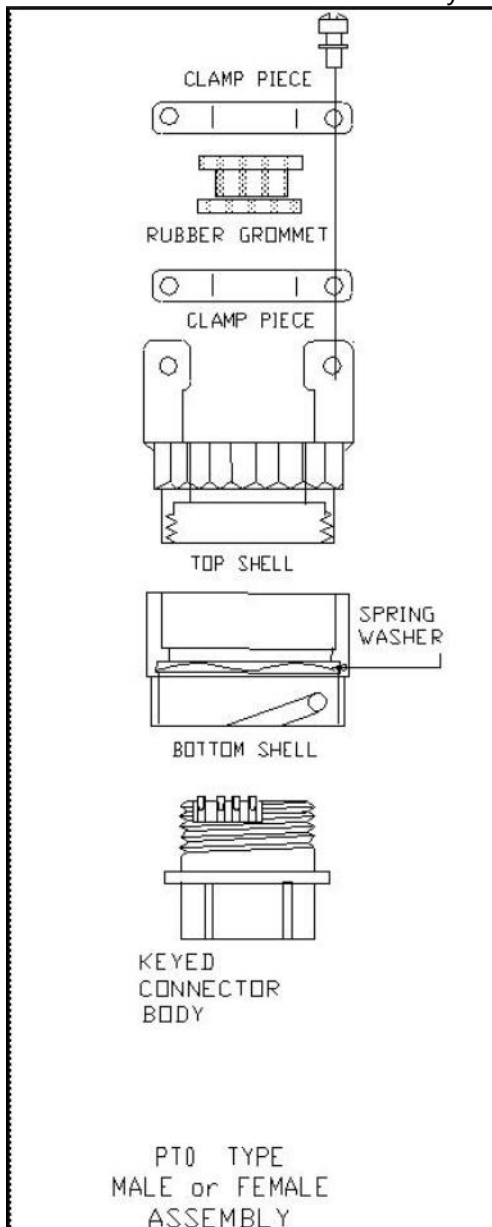
dressing the cable end, soldering the connections and applying shrink tubing. The use of self-vulcanizing tape is preferred to potting the connector since with potting, the connector is no longer field serviceable.

**NOTE: For additional moisture protection, apply DL-111 inside the top shell to seal against the rubber grommet. Bottom shell must rotate freely after the top shell has been firmly tightened into the connector body.**

The recommended periodic connector maintenance and usage is as follows:

1. Plugs labeled "PT06" have a superintending outer locking collar with a machined inner groove that locks onto the pegs in the side of the panel mount mate receptacle. When removing a PT06 connector, move it out of the locked position by first applying a downward force on the outer collar and then twisting it free in a counter-clockwise direction.
2. Be careful with tools when gripping connectors - use tools with nylon fittings in the jaws if you can, and do not apply excessive force.
3. The connectors have a machined groove inside. To avoid damaging this groove, you must apply a downward force while turning. Because connectors for the Wrangler DAS units are constructed of an alloy, excessive force on the locking groove can cause burrs which make subsequent installation and removal of the connectors more difficult.
4. Do not attempt to remove a plug with pliers.

5. Assemble new connectors correctly as shown below.



#### 4.4 Replace CPU Battery (Wrangler)

The CPU board has a 3.6 volt back-up battery, located in the well area to retain CPU RAM when the recorder loses power unexpectedly. If the Web UI status shows less than 2.2 volts for the battery it should be replaced.

1. The power to the Wrangler may be left on so data in memory will not be lost.
2. Remove the well cap from the USB well enclosure.
3. Disconnect the connector for the battery from the pins located next to the USB disk receptacle.
4. Gently remove the battery assembly from the USB well enclosure.
5. Insert the new battery assembly into the circular battery slot inside the USB well enclosure.

6. Attach the connector off the new battery assembly to the pins located next to the USB disk receptacle inside the USB well enclosure.
7. Check the Web UI status display to be sure the voltage is now close to 3.6 volts.
8. Screw the cap onto the USB well enclosure.
9. To seal the USB well enclosure, turn the cap until it bottoms out to the case.



## 5 Recorder State of Health (Log) Messages

The Wrangler recorder stores messages into State of Health/Log recording packets that are stored in all destinations for data from any datastream. These messages are human-readable, but often contain abbreviations or technical terms that may only be meaningful to Support or Service personnel. When contacting Support, providing the State of Health log around the time of the issue is often one of the first steps taken to understand what occurred.

Messages begin with a timestamp indicating when the message was entered into the log. It is followed by the keyword for the module that the message is associated with, and then the message itself. This allows the log to be easily searched and sorted.

Error messages always start with the keyword "ERROR" followed by the module keyword. The word "ERROR" is not used inside a message but is abbreviated to "ERR", such as "PHASE ERR".

### 5.1 Keyword and Abbreviation Examples

Below is a table of example keywords and what the contents are. There may be more keywords than are listed here.

Keyword	Message Contents
ATD	Messages about the A to D converter (data generation)
CLOCK	Timekeeping messages, including INTERNAL and EXTERNAL time references
REF_CLK	Reference clock messages
RTC	Real Time Clock messages
BBC	Battery Backup Controller messages
PARMS	Parameter messages
BVITRHP	Messages about battery voltage, current, temperature, etc.
RTPx	RTP telemetry link (link 1 and link 2) messages
BFILL	Backfill messages
MEM	Mass memory (data memory) messages
WIFI	Wi-Fi messages
SOH	State of Health log management messages
QCHECK,QERROR	Internal memory queue messages
EEPROM	Internal non-volatile storage messages
CORDMP	Core-dump messages for in-depth system analysis

### 5.2 Some Useful Message Examples

"CLOCK:PLL EXTERNAL POWER IS TURNED ON"

This message is generated when the reference clock is powered on or activated.

"CLOCK:PLL EXTERNAL POWER IS TURNED OFF"

This message is generated when the reference clock is powered off or deactivated.

"CLOCK:PLL INTERNAL TIME JERK ENABLED"

"CLOCK:PLL INTERNAL TIME JERK COMPLETED"

These messages are generated when the internal oscillator is forced into alignment with the reference clock pulse-per-second signal.

"CLOCK:PLL INTERNAL PHASE ERROR OF ..."

"CLOCK:PLL INTERNAL DRIFT OVER ..."

These messages are generated when a phase lock cycle is complete to indicate the observed phase and drift error present between the internal oscillator and the reference clock.