

## Wrangler Data Sheet

The Wrangler is the latest high dynamic range broadband seismograph for permanent or temporary strong as well as weak motion, low amplitude measurements. Consisting of the latest low noise A/D technology the Wrangler offers 32-bit performance and a dynamic range greater than 142dB. With a mobile friendly user interface, accessed through the inbuilt wireless modem, simply connect to the unit and view it's configuration and status through any web browser. The internal 8GB circular memory data buffer is sufficient to store up to 8 months of data and securely saves measurements onto a interchangeable non-volatile USB flash drive (8,16 or 32GB). The removable USB device is easily accessible allowing an operator to recover data within 30 seconds. For longer period operations the Wrangler can be configured with Seedlink server transmitting data to cloud based storage for seamless analyses. Alternatively, when real-time information is key, data can be sent via RTPD offering low latency telemetry for earthquake early warning.



RefTek have included features within the Wrangler to optimise power consumption enabling the system to run for longer. It is common practise throughout geophysical instrumentation to exploit GNSS 1 PPS for accurate time synchronisation. In order to conserve power the Wrangler actively manages the GNSS receiver, cycling it every hour. Once phase lock as been achieved and a PPS has been received the Wrangler automatically shuts down the GNSS. In addition the LED status indicators and WiFi are turned off until the magnetic switch is activated, following which both remain on until thirty minutes of inactivity whereby they are automatically switch off. As a result of these measures a three channel Wrangle system, with Cult Seismometer and Cell Modem, requires 130W to operate all day and can be sustained by a single solar panel.



Seismic monitoring applications inherently lead to equipment remaining in situ for extended periods of time. The equipment is generally installed in remote locations which are challenging or time consuming to access. Being able to remotely interrogate the systems performance is key. To tackle this problem the Wrangler permits users to call upon a series pre-installed of calibration waveforms to test and verify system performance. Alternative the user can load their own bespoke waveform file. The calibration waveform can be used to confirm the correct installation of the equipment and can be scheduled to run periodically during the observation period. A dedicated 32 bit A/D converter records the calibration signal to ensure the general system operation is not interrupted.

The Wrangler can be supplied as a 3 or 6 channel system. There are two connectors on the front panel, each comprising of three channels and six auxiliary channels. The auxiliary channels can be used to record a variety of metadata but the most common application is to re-centre and monitor the mass position. Each auxiliary channel can be configured to record either single ended or differential input with a  $\pm 10V$  full scale at 16bit resolution.

## Product Dimensions

Physical	Dimensions (L x W x H)	Weight
(instrument only)	213 x 132 x 88	1.36

## Technical Specifications

<b>Status LEDs:</b>	16 status LEDs including Input Power, GNSS/Time, USB, Acquisition and Link status
<b>Controls:</b>	Magnetic on/off switch
<b>A/D:</b>	32-bit SAR A/D converters
<b>Dynamic Range:</b>	>142 dB @100 sps
<b>Channels:</b>	3 or 6
<b>Gain Selection:</b>	x1 and x64
<b>Input Full Scale:</b>	40 Vpp @ x1 gain
<b>Input Impedance:</b>	26 Kohms, 0.002 uFd, differential @ x1 2 Mohms, 0.002 uFd, differential @ x64
<b>Common Mode Rejection:</b>	>90 dB
<b>Sample Rates:</b>	4000, 1000, 500, 250, 200, 125, 100, 50, 40, 20, 10, 5, 1, 0.1 sps
<b>Multiple Sample Rates:</b>	Supported for rates in the group 1000
<b>Sampling:</b>	Simultaneous on all channels
<b>FIR Filter:</b>	140 dB down in the stopband
<b>Type:</b>	GNSS Receiver with Internal Disciplined Oscillator
<b>Accuracy with GNSS:</b>	±10 ?sec after validated 3-D Fix and Locked
<b>Free-Running Accuracy:</b>	0.1 ppm over the temp. range of 0 °C to 70 °C 0.2 ppm from –30 °C to 0 °C
<b>Alternate Time Sources:</b>	PTP or NTP
<b>Power:</b>	Average Power (6 channels, with communication, GNSS duty cycle) 2.3 Watts
<b>Format:</b>	Miniseed, MRF
<b>Communication:</b>	- Ethernet - Wifi - WebUI
<b>Transmission:</b>	SeedLink Server, RTP
<b>Memory:</b>	Internal Capacity: 8Gb External Capacity: up to 32Gb
<b>Auxiliary channels:</b>	16-bit A/D Converter, ±10 V Single-ended or Differential input. sample rate 10,2 or 0.1sps
<b>Cal Signal:</b>	16-bit DAC
<b>Cal Waveforms:</b>	Pre-defined waveforms including Sine, Step, Noise, Swept Sine signals, along with playback of user uploaded .wav files
<b>Cal Signal Recording:</b>	Additional 32-bit ADC dedicated to recording the calibration output signal
<b>Control Signals:</b>	6 per channel connector: Including Lock, Unlock, Center, Calibration Enable, Damping, UVW

**Automatic Mass Recentering:** User settable thresholds, interval and retries

**Sensor ID:** Interfaces with REF TEK sensors

**Watertight Integrity:** IP68

**Humidity:** 0 to 100%

**Shock:** Survives a 1 meter drop on any axis

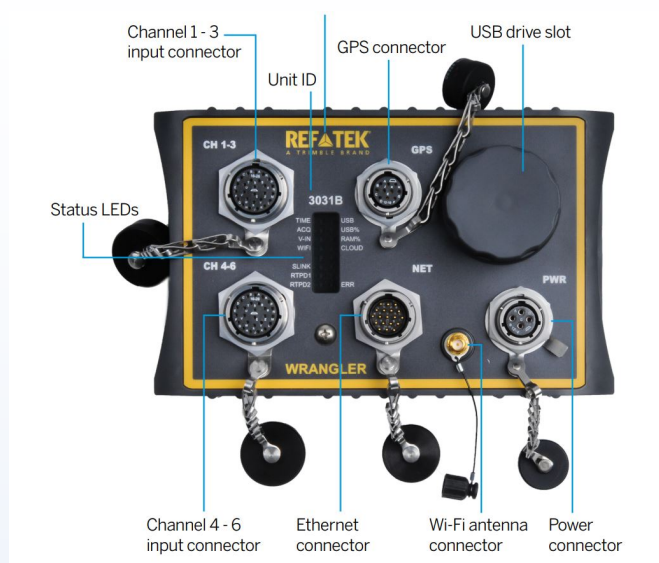
**Transportation:** Survives MIL-STD-810G transportation test

**Operating Temp:** -30 °C to 70 °C

**Storage Temp:** -40 °C to 80 °C

**Compliance:** CE, FCC, RoHS

## Gallery



*Wrangler connectors, image courtesy of RefTek, a Trimble Brand*

LED	Off	Green Solid	Green Blink	Red Blink	Red Solid
TIME	n/a	Reference Clock 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
V-IN	n/a	Input voltage is at or above 13.0 V	Input voltage is less than 13.0 V and >= 11.5 V	Input voltage is below 11.5 V and not in LVD mode	Input voltage is below 11.5 V and in LVD mode
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 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
ERR	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

*Wrangler LED Light Status Table*

## Videos

<https://youtu.be/-aXCglqH-2M>  
<https://youtu.be/-aXCglqH-2M>