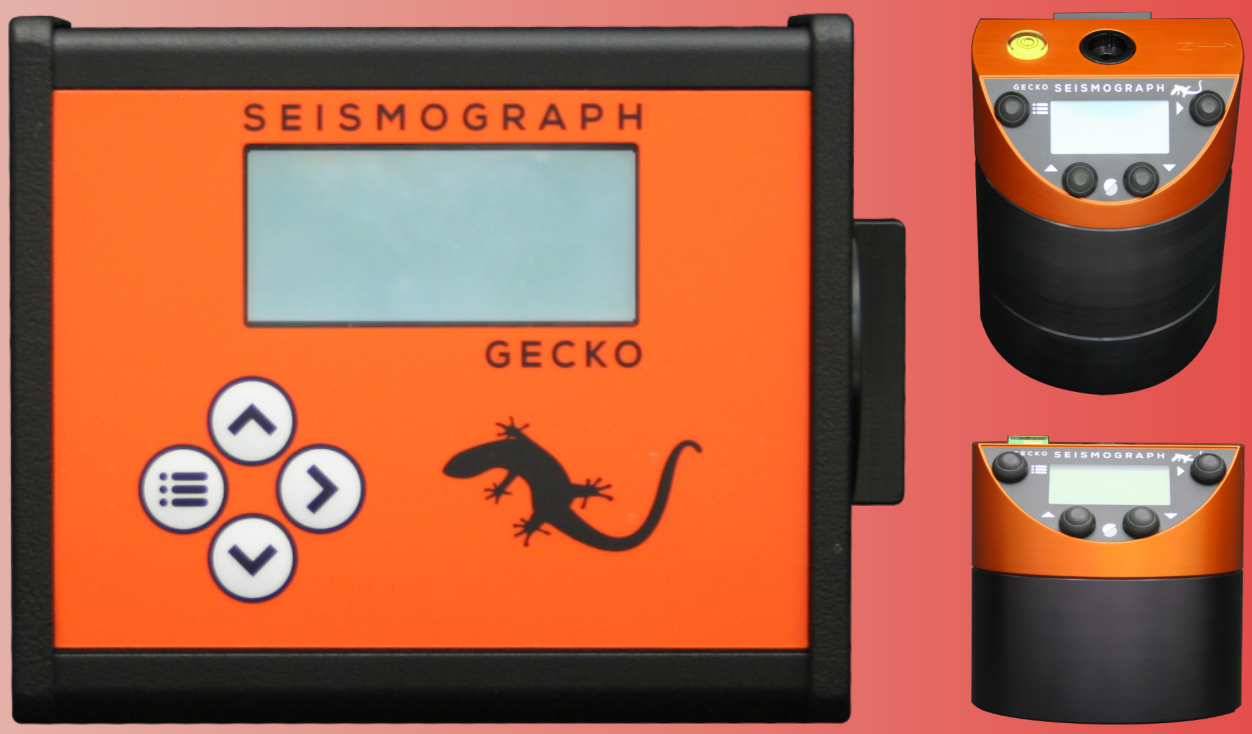
SEISMOLOGY
RESEARCH
CENTRE

Gecko

SEISMOGRAPHS, ACCELEROGRAPHS, RECORDERS (all models)

PRODUCT USER MANUAL



141 Palmer Street, Richmond VIC 3121 Australia T:+61 3 8420 8940 sales@src.com.au

Welcome to the world of simplified seismic recording with your new Kelunji Gecko seismograph. Within minutes you can be recording earthquakes, blasts and other ground vibrations using our latest generation instrument that makes high dynamic range, high sample rate, low power, continuous recording accessible to experts and novices alike.

In the Gecko, we have simplified the modern digital seismograph. The low cost of flash memory means you can save weeks, months, even years of continuous data on a single memory card. The Gecko can record everything continuously while logging trigger times for you to sort through back at the lab. Even if your trigger settings missed the event, you'll always be able to retrieve that chunk of time from the continuous archive.

An even more efficient way of managing your data is not to have to collect it at all, so we have included a simple telemetry protocol that streams data packets over the Internet via a cellular data modem or Ethernet/WiFi link. Data from all of your stations is then available in a single archive for you to access whenever you need it. Simply install our free "Streams" data reception software on your Windows, macOS or Ubuntu PC and watch your data live on screen while it is archived away to your PC. Streams is ideal for collating data from multiple network-connected structural monitoring instruments. Download it free today from the SRC website: https://www.src.com.au/downloads/streams/

Our "Waves" waveform analysis application is available as a free download for Windows, macOS and Ubuntu from http://www.src.com.au/downloads/waves/. Each Gecko purchased is entitled to one Waves product key that will remove the advertisement that pops up for 10 seconds when you launch the program. You can email sales@src.com.au with your recorder serial number to obtain a product key. Each product key can only be used once and is not transferable to another computer.

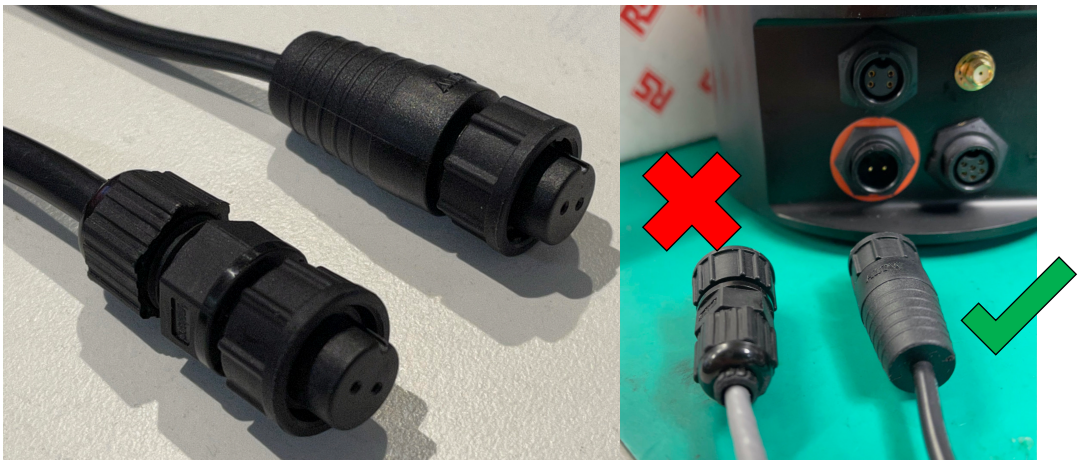
Happy recording!

From the Gecko development team.

Table of Contents

Getting Started

All Gecko models have a 2-pin power port, 6-pin alarm/communications port, and a coaxial GPS aerial connection. From 2021 all Gecko models have a 4-pin port for the 1D external sensor channel, and all model use black plastic LTW plugs that are rated to IP67 whether mated or not. If your Gecko's power socket has an orange ring, the polarity matches the wire colours of the pre-moulded power cables. The original power cables with cable gland back-shells can be used with an orange-ringed socket, but wire polarity must be reversed.



Setting up your recorder

The two-pin connector is the power input to the Gecko. The default Gecko operating voltage range is 11.8 to 24 Volts DC (useful for 12V DC battery over-discharge protection), but it can be factory switched to extend the range to 7V to 30V DC at no cost.

If the power is removed then restored, the Gecko will restart using the saved settings.

The Gecko only takes a few seconds to initialise the operating system after power is applied. If an SD card is installed at power-up, the card is checked during the boot process. When the card is ready, the Gecko will start storing continuous data, usually within a few seconds.

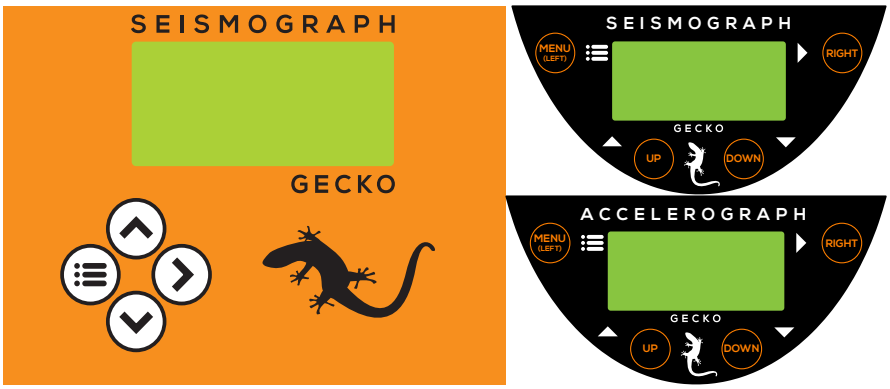
The small gold coaxial socket is the connection for the GPS aerial. The GPS is crucial in maintaining accurate absolute time to synchronise recordings from various instruments and monitoring locations, but it also provides global position information. Simply screw the GPS cable plug onto the threaded GPS socket until finger-tight.

The Gecko Compact and Rugged is supplied with a sensor plug which you can attach to your sensor cable. You can find the wiring diagram at the end of this manual. Align the keyed plug with the socket and push it on, locking it in place with the bayonet-style collar.

At this point you now have a fully functioning recorder, but you will need to modify some settings to suit your application. Setting a unique station code is an essential starting point.

The User Interface

The Gecko does not require a computer to control it. All recorder settings are accessible through the LCD and are modified using the four control buttons.

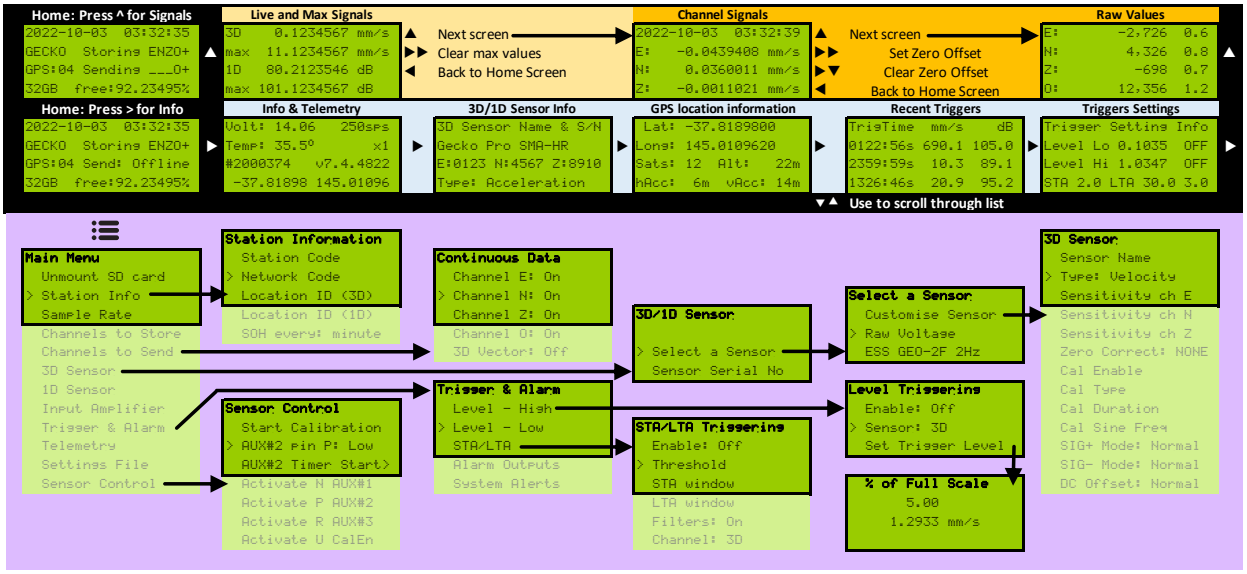


Gecko Compact (left), digital velocity sensors (top right), digital acceleration sensors (bottom right)

Menu Map

After start-up, pressing the **Menu** button will toggle between the main menu and the home screen. The LCD backlight will stay on for 2 minutes after the last button press.

On most screens you can scroll **Up** and **Down** through a list and enter a menu item or toggle a setting by using the **Right** button. Pressing the **Menu** button will save the current setting and take you back one menu level. From the Home Screen, pressing **Up** screen shows signal level screens, and pressing the **Right** shows general information screens.

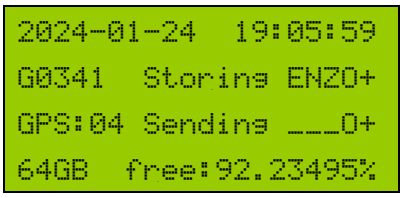


Depending on the model of Gecko and your current configuration, some menu items may be hidden from view. For example, if you have a Gecko digital seismograph or accelerograph, the 3D sensor menu will not be visible to protect the sensor settings.

The Home Screen

The four lines on the home screen show:

- the Gecko clock's date and time (in UTC – Universal Time Coordinated)
- the station code, and which channels are being stored to the SD card
- the number of GPS satellites visible; and if channels are being streamed
- the SD card capacity and percentage of storage remaining



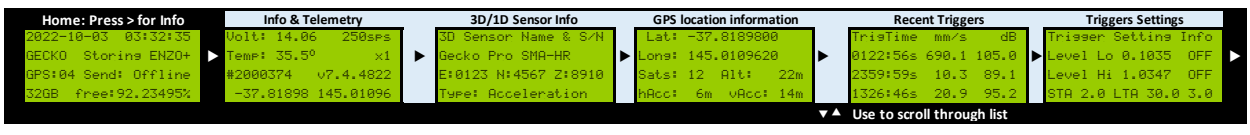
"O" is the 4th channel on some Gecko models, and "+" is the vector sum of channels ENZ.

The "Storing" word animates using ▼ down arrows to indicate packets of data are being written to the SD card. The "Sending" word animates using ▲ up arrows to indicate packets of data are being streamed to a remote computer.

Status Screen Loop – Right Button

The Gecko has several status pages accessible from the Home screen. Press the **Right** button to scroll through them, or press the **Menu** button to return to the Home screen.

- The first screen shows input power voltage and CPU temperature, the current sample rate and input amplifier (gain) setting, followed by the Gecko serial number and firmware version number. The bottom line shows the time remaining on the AUX#2 activation timer (if started) or the latitude and longitude
- The next screen shows the name and serial number of the 3D sensor connected to channels ENZ. The sensor type is shown on the bottom line
- If you have a 4-channel recorder, the next screen shows the 1D sensor information
- Next is the GPS location information. The "hAcc" value is the horizontal accuracy in metres as read from the GPS receiver, and "vAcc" is the vertical accuracy.
- The next screen shows the time of the last triggers, and peak amplitude in the 10 seconds after the trigger. An "s" after the time indicates it was an STA/LTA trigger, a ▲ indicates a Level-High trigger, and a ▼ indicates a Level-Low trigger. Use the **Down** button to scroll to older triggers, or **Up** to view the latest trigger.
- The final screen shows the current trigger settings, with OFF indicating it is disabled.

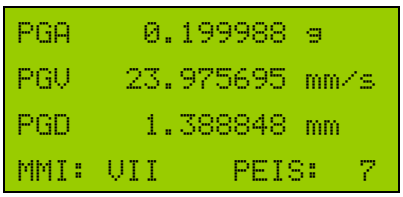


Realtime Data Loop – Up Button

Press the **Up** button from the Home screen to view real time sensor data.

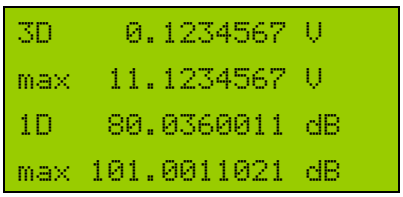
Peak Motion / Vector Sum

NEW in 7.8 If a velocity or acceleration sensor is attached to the Gecko's 3-channel sensor input, pressing **Up** will show a new screen in place of the old "3D max" display:



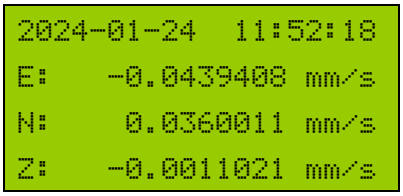
These values are the Peak Ground Acceleration (PGA), Velocity (PGV) and Displacement (PGD) calculated from the vector sum of the 3 channels, each of which are converted from velocity or acceleration into the corresponding units before the vector sum is calculated. The bottom line shows an estimate of the Modified Mercalli Intensity (MMI) and Philippine Earthquake Intensity Scale (PEIS) value based on the PGA. Press the **Right** button twice to clear the peak values.

If you have another type of sensor, this first screen will display the old 3D and 1D real time peak sensor outputs in sensor units.



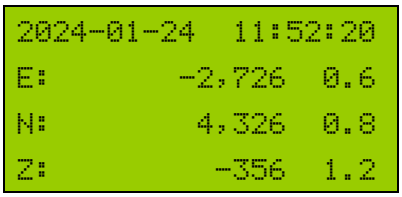
It shows the live peak vector sum of the 3D sensor, and holds the peak value (max). For 4-channel models, the live data from channel O is shown and its peak (max) value is also held.

Sensor Signal



Press the **Up** button again to see the ground motion values for each sensor axis in real time. Pressing the **Right** button on this screen will prompt you to either press the **Right** button again to remove any signal offset (it averages the signal for 2 seconds), or press the **Down** button to clear the any existing offset correction. The Drift Correction feature (see: 3D Sensor settings) will also correct signal offset over time.

Raw Signal

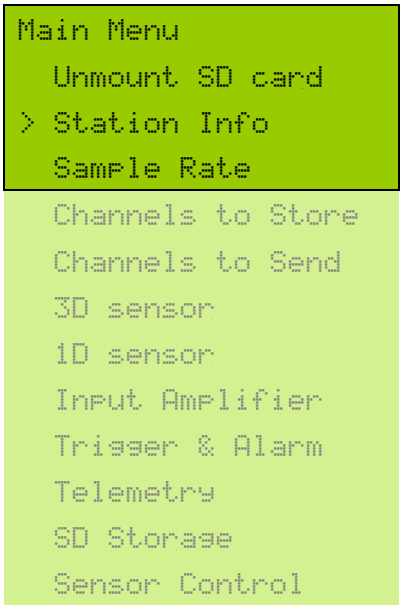


Pressing **Up** again will display the raw numbers from the analogue-to-digital converter (ADC) in real time. The values shown are up to ±8.4 million recorder counts, which represents a signed 24-bit range number.

The zero level can be controlled in the same way as the Sensor Signal screen. If you have a 4-channel Gecko, the date and time line will not be shown, with channel O appearing at the bottom.

If STA/TA triggering is enabled, the STA/LTA ratio is also displayed in real time at the end of each line. It is the ratio of the average signal in the short term divided by the average signal in the long term. When nothing much is happening, this value will sit around 1.0, but a short burst of anomalous signal will increase the number. This ratio may assist you in determining at what level to set your STA/LTA trigger threshold.

The Main Menu



Pressing the **Menu** button from the home screen will show you a list of actions and settings for managing your recorder. Depending on your Gecko model, the main menu includes some or all of the items shown in the table (right).

If you change any Gecko settings, they are usually applied once you exit to the home screen. The settings are automatically saved to the recorder's configuration file.

Unmount SD card

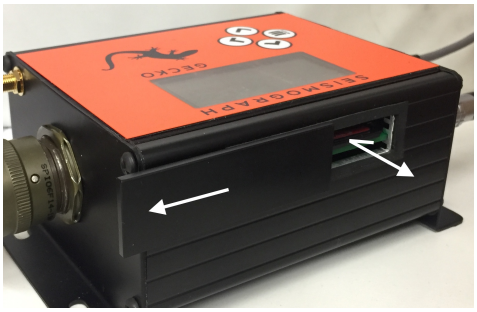
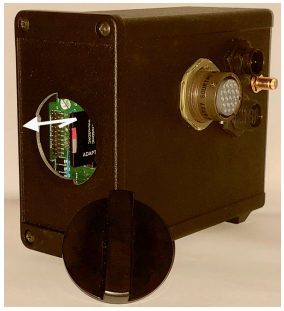
Data is being sampled at all times, whether an SD card is present or not, because data can be telemetered without an SD card. If there is no SD card, backfilling of unsent data will not be possible.

Before you remove the SD card, you should unmount the SD card so that the system does not try to write data to the card while it is being removed, an action that can corrupt the current file, the FAT file system, or the SD card.

When you insert an SD card, it will automatically be mounted.

Data Storage

The Gecko is supplied with a 64GB SD card, formatted with the FAT file system. Larger capacity SD cards can be used in the Gecko if they are pre-formatted as FAT (not exFAT).


To remove the card from a Gecko Compact 3ch (above, left) slide open the SD card cover and press in the SD card to eject it. The SD card faces up, and it cannot be inserted upside-down. For the Gecko Compact 4ch (above, centre), the SD card cover requires a quarter turn anti-clockwise before removal. The SD card faces the rear of the recorder.

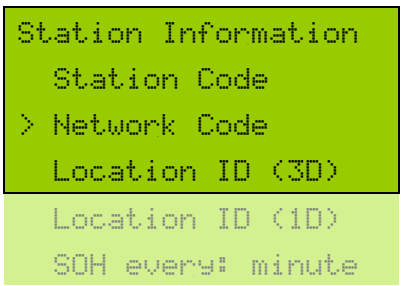
If you have a Rugged model with optional internal sensor, unscrew the card cover to access the SD card slot (above, right). The SD card faces the rear of the recorder.

Insert the SD card into your computer (directly if you have an SD card slot, or via a USB card reader) and you'll be able to browse your continuous data files.

To re-insert the card, **check you have the correct orientation and do not force the card if it does not insert easily**. Push the SD card down into the socket, ensuring you feel the card spring back from push-lock. The SD card will automatically mount and recording should resume. Check that the ▼ arrows are animating over the word "Storing" on the Home screen, which indicates data packets are being written "down" to the SD card.

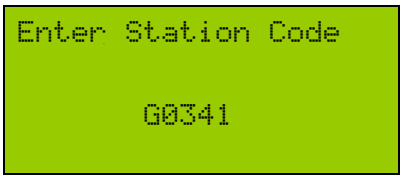
Station Info

Every seismic monitoring point needs to have a unique identifier. As part of the MiniSEED data format standard there are three tiers of identifier – Network, Station, and Location.



Station Code

This station code can be up to 5 characters long and can only contain uppercase letters and numbers. By default this is "G" followed by the last 4 numbers of the serial number. If you wish to use less than 5 characters, end the code with blank space character. Note that any characters after a blank space will be ignored (e.g. if you enter "ABC 1" the Gecko will truncate the station code to "ABC").



A flashing block indicates the cursor position. Use the **Up** and **Down** buttons to scroll through letters and numbers, and use the **Right** button to move to the next character. Press the **Left/Menu** button when on the first character to save and exit.

Network Code

The MiniSEED format allows you to include a two character network code, which can be your FDSN code. For example, the Seismology Research Centre uses "OZ", Geoscience Australia uses "AU", and the British Geological Survey uses "GB". You can register for an FDSN code at fdsn.org, or you can use this field for you own identification purposes.

Location ID

A seismic monitoring location may have multiple monitoring points, so rather than coming up with a station code for each, they can all use the same station code with a unique Location ID. This field is any two character code. For example, if you are monitoring the basement, middle and top of a building you could use Location IDs of B1, M1, and T1; or simply 01, 02 and 03.

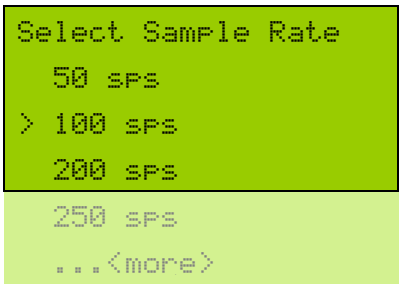
Alternatively you could use the Location ID to group Geckos with different Station Codes to a common location (e.g. several strong motion accelerographs on different floors in the same building), allowing them to be grouped in the Streams intensity display web page.

The default value for channels ENZ is 00, and for 4-channel systems channel O has ID 01.

SOH frequency

The Gecko creates a CSV format histogram summarising some State-Of-Health (SOH) parameters. By default this is logged once per minute. You can increase the logging frequency to every 2 seconds or every 5 seconds with fewer parameters to save file size.

Sample Rate



The standard ADC sample rates are 250, 500, 1000, 2000 and 4000 sps use a 4 stage FIR filter. The Gecko use an additional FIR filter and 5th-sample decimation to produce the following sample rates: 50, 100, 200, 400, and 800 sps.

Scroll to the sample rate you wish to use, then press the **Left/Menu** button to exit and apply the new sample rate.

Channel Naming

The naming of channels has been automated in the Gecko based on the selected sample rate and sensor type, with preset channel names.

The SEED standard states that each channel requires a 3-letter code, where the first letter indicates the Band Code, the second letter indicates the Instrument Code, and the third letter is the Orientation Code. Detailed information on this standard can be found here:

https://ds.iris.edu/ds/nodes/dmc/data/formats/seed-channel-naming/

The Gecko will set the first letter of the channel name based on the sample rate:

- B: 50 sps
- H: 100 & 200 sps
- C: 250, 400, 500, 800 sps
- F: 1000, 2000, 4000 sps

The Gecko will set the second letter of the channel name based on the sensor type:

- H: Velocity Seismometer
- N: Accelerometer
- D: Pressure Sensor (e.g. Microphone)
- J: Rotation Sensor
- Y: Displacement Sensor
- Q: Voltage

The Gecko will set the third letter of the channel name based on the channel number:

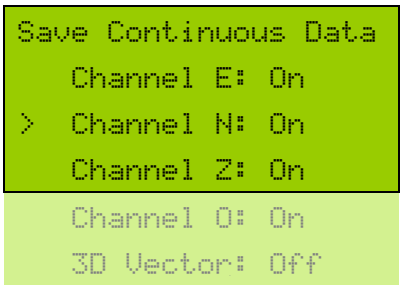
- E: channel 1, typically used for East, Transverse, or X
- N: channel 2, typically used for North, Radial, or Y
- Z: channel 3, typically used for Up, Vertical, or Z
- O: channel 4, typically used for Outdoor Microphone or an extra Vertical sensor

For example, the vertical channel of a 50sps broadband seismograph would be BHZ, where a horizontal channel of a 100sps structural monitoring accelerograph might be HNE or HNN.

The data stored as the vector sum of the 3D sensor uses channel code **SUM** and will use the same location ID as channels E, N, and Z to reinforce the association with those channels.

Channels to Store

You can turn off any unused channels to save storage space. Storing the vector sum is a waste of space if you are already storing ENZ. Toggle the channels on or off as required.



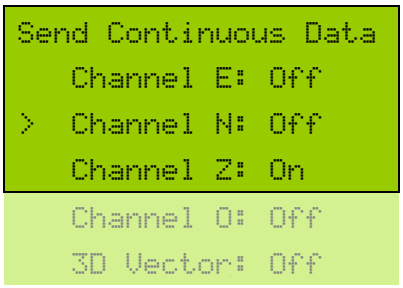
The 3D Vector channel should not be enabled unless it is required for data if telemetry bandwidth is limited. Note that if a channel is enabled for telemetry (see next setting below), it will automatically be stored to the SD card to ensure the data is available for backfill should the communication link drop out.

If all channels are accidentally turned off, the Z channel is automatically re-enabled to ensure at least one channel is being recorded. Note that if a channel is turned off here, it will also be turned off in the "Channels to Send" settings – see below.

If you are recording channels ENZ, we recommend turning of "3D Vector" recording to save on storage space. The 3D vector sum can be calculated in the Waves analysis software.

Channels to Send

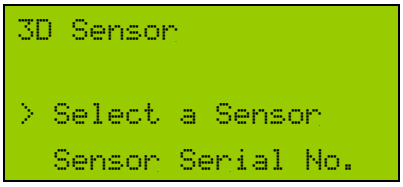
You can select which channels to send **continuously** to your remote server. For blast and structural vibration monitoring applications you may choose to send the 3D Vector sum channel continuously, storing the ENZO channels to be streamed only when a trigger process detects an event.



Toggle the channels that you want to send continuously on or off using the **Right** button.

Note that if a channel is enabled for telemetry, it will automatically be turned on in the "Channels to Store" settings as the stored data is required for backfilling gaps in data telemetry. Disabling a channel in telemetry will not disable that channel in the "Channels to Store" settings.

Sensor Setup

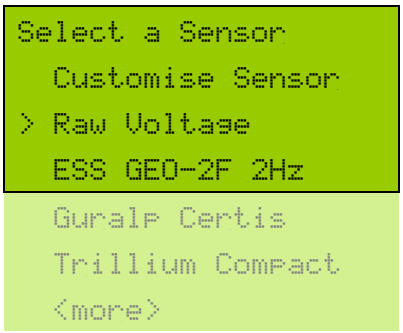


3D Sensor

This menu has items that deal with 3D sensor information and control. This will only be visible in the Gecko Compact, but the same method applies for setting up the 1D sensor, so users of Gecko digital seismographs and accelerographs should also read this section.

Select a Sensor

The Gecko has a range of popular sensors settings preloaded into the menu to save users the trouble of entering all of the parameters that allow the data to be displayed in engineering units (e.g. mm/s, g, mm, dB, rad/s, etc.) rather than recorder counts.



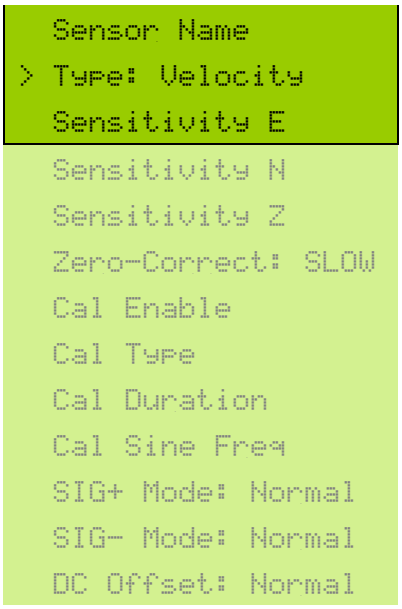
Scroll down to the sensor you have connected and press the **Menu/Left** button to exit and save. This will set the typical sensitivity for this 3D sensor to channel E, N and Z, which will be stored in the .ss (seismograph settings) file in each data folder.

You can modify the settings for your particular sensor by re-entering the "Select a Sensor" menu and press the **Right** button on Customise Sensor to edit the parameters.

Customise Sensor

If you are connecting a sensor that is not in the predefined list, start from a similar type of sensor and customise the parameters to match your sensor so that the data is stored with the basic corrections that can be applied automatically when viewed in Waves.

If a setting has a colon, press the **Right** button to toggle its value, otherwise **Right** will enter a menu to select a setting from a list. In the latter case, edit the parameter using the **Up** and **Down** buttons, and use the **Menu/Left** button to save and exit.



The **Sensor Name** is a text field to help you identify the model of sensor. This can be up to 20 characters long.

The **Type** of sensor you are using can be toggled between Velocity (where units are defined in metres per second), Acceleration (*g*), Pressure (pascal), Rotation (radians per second), Displacement (metres), Volts, and Other.

Sensitivity can be set per channel, which indicates how many Volts-per-unit your sensor outputs, e.g. 750V/m/s for a Nanometrics Trillium Compact velocity sensor. Note that Acceleration units will be saved as $V/m/s^2$ in accordance with international standards, but entered as V/g for convenience as most sensors are specified in this manner.

The Gecko can automatically correct for any zero-offset in your sensor. If you do not wish to adjust the zero level, toggle the value to NONE. If your sensor slowly drifts due to thermal variations, setting **Zero-Correct** to SLOW will correct the signal offset at a rate of 1% of full scale per week. If you are only interested in high frequency data (>1Hz) you can set it to FAST to correct at a rate of about 1% in 3 hours.

Some sensors have a calibration circuit whereby the recorder can send a voltage to the sensor, and the components will respond accordingly to show that they are working as expected. Some sensors require a control signal to tell it to enter calibration mode – the type of control signal is set under the **Cal Enable** menu.

The **Cal Type** defines the type and amplitude of the signal size that is sent to the sensor. There are four sizes of step voltages and sine waves: small, medium, large and extra large, which generate amplitudes of about 0.5V, 1V, 5V, 10V respectively.

The **Cal Duration** is the number of seconds that the sine or step signal is active, which is normally set to the long period response time of your broad band seismometer, or just a few seconds for a short period seismometer or accelerometer. A "Step" calibrate will run for twice the entered value to capture the trailing edge of the step response.

The frequency of the sine wave can also be set in the **Cal Sine Freq** menu, with available choices being 1Hz, 5Hz, 10Hz, 50Hz, 100Hz, 500Hz, and 1000Hz.

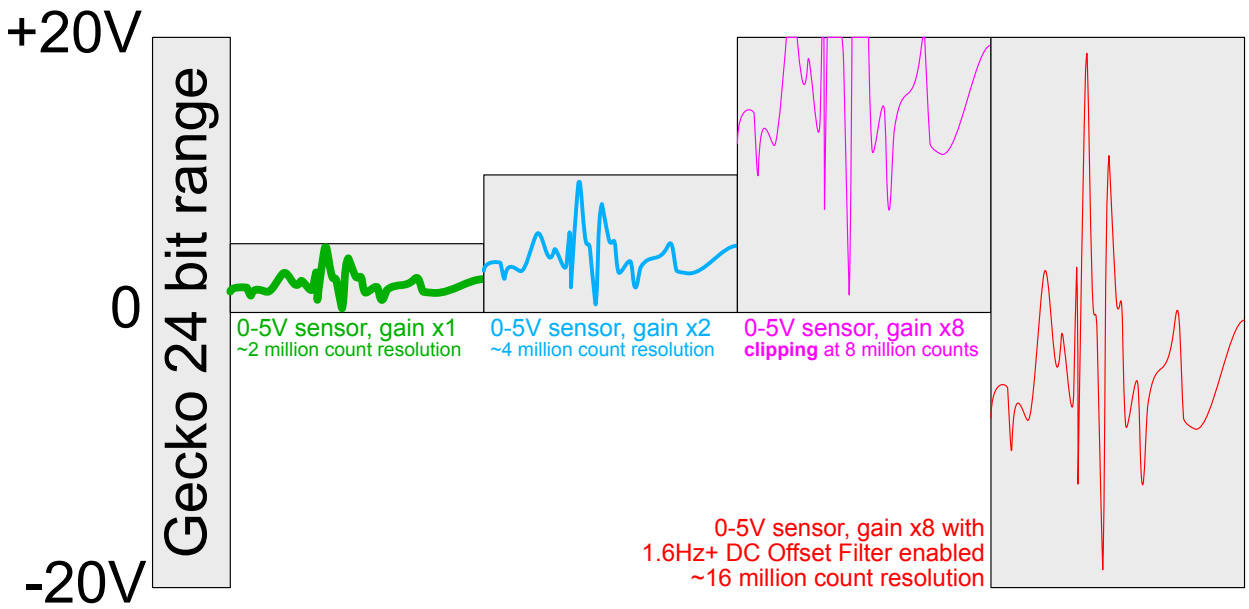
The **SIG+ Mode** setting tells the Gecko whether or not 25V power needs to be applied to the sensor channel positive wires (pins C, E, and G on the 3D sensor connector). For most sensors, this mode should be set to "Normal", but if you are using an IEPE sensor, you can select "25V" which will put a 25V of DC power at 4mA out to the sensor channel.

WARNING! Enabling **SIG+** 25V output to non-IEPE sensors may damage your sensor

The **SIG- Mode** tells the Gecko whether the sensor channel negative wires (pins D, F, & H on the 3D sensor connector) need to be connected to power ground or not. Most sensors require you to measure the difference between the positive and negative wires, so the "Normal" setting would be used in most cases. If your sensor requires the negative channel wire to be connected to power ground (e.g. for IEPE sensors) then select "Ground".

The **DC Offset** filter when enabled electrically removes signal offset by introducing a low order high pass (~1.6Hz) frequency filter. For most sensors, it is best to leave this setting as "Normal". Do not enable this filter for long-period or broadband seismometers.

> *Some sensors (e.g. IEPE accelerometers) only output positive voltages, often over a 0-5V range. At rest the signal will often sit at mid point of this range (known as "Bias voltage" but it can be anywhere from about +2.5V to +12V DC. As the sensor moves, the voltage output moves up or down from this DC offset by half of the sensor's range. The Gecko can mathematically remove the offset after digitisation, but half of the -20V to +20V input range of the Gecko is wasted. By enabling the DC Offset Filter, the pre-digitised signal is brought down to almost 0V, and the digitised signal then moves between negative and positive voltages around the zero level. This allows you to use a higher Input Amplifier setting (for example of x8 to stretch a ±2.5V range to the Gecko's full ±20V) to utilise the full dynamic range of the Gecko's 24-bit resolution.*

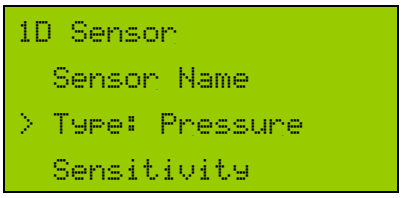


Sensor Serial No.

A 20-character field is available to record your sensor's serial number. This information is stored in the station status text file for future reference. Upper and lower case letters, numbers, and some special characters are available.

1D Sensor

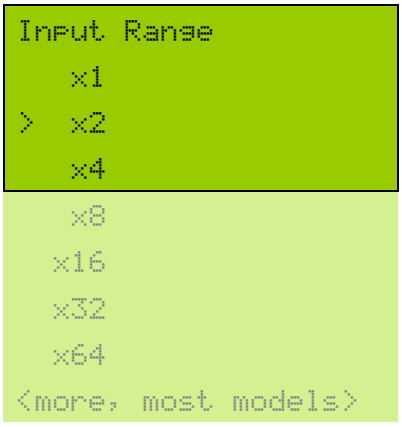
If you have a 4-channel Gecko Compact, Rugged, Blast or SMA, you can set up your 1D sensor in a similar way to the 3D sensor. Select a sensor from the list and set the serial no.



Like the 3D sensor, you can customise the name, units and sensitivity of the 1D sensor. The **SIG+**, **SIG-**, **DC Offset**, & **Zero-Correct** are always the same as the 3D sensor, and calibration settings are not available for the 1D sensor.

Input Amplifier

The Gecko is, fundamentally, a high speed, high resolution voltage logger. It measures the voltage across each channel's pair of wires, and it can measure from -20V to +20V DC at 24-bit resolution. This 40V peak-to-peak range is converted into a 24-bit number, producing a value between 0 and 16,777,216 counts, which equates to 419,430 counts per volt.



If you are using a sensor with a 40Vpp output (for ±10V differential output sensors, such as Nanometrics or Guralp seismometers) set the gain to x1.

If you are using sensors with lower full scale voltage, use the input amplifier to utilise the full dynamic range of the Gecko.

For example, if you have a ±4V MEMS accelerometers (as used in the Gecko SMA) you should use a gain of x4 to shrink the input range to ±5V to record the signal at higher resolution. Note that DC offsets will also be amplified.

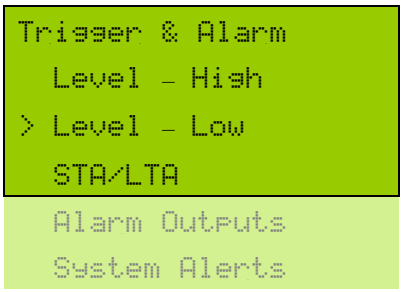
If you are using a passive sensor (e.g. geophone) you can use very higher gains to see smaller signals at higher resolution. For example, the Gecko Tremor's geophones (nominal sensitivity of 78.74 V/m/s) normally have a clip level of 254mm/s, but by using a gain of x16 you can see smaller signals and get a similar effective sensitivity (1260 V/m/s) and clip level (16mm/s) as a typical short period active seismometer.

The maximum gain for a 40Vpp sensor is x512, giving a measurement range of ±0.04 volts. Most seismic sensors would be continually clipping at this range, the exception being low sensitivity passive geophones.

The Gecko Pro SMA-HR and Prism sensors have a 60Vpp range, so these recorders have a sensitivity of 279620 counts per volt, with a maximum gain of x64.

Trigger & Alarm

The primary function of the Gecko is to record data continuously, but triggering is still required to help detect events of interest and to control alarms. The Gecko has two Level trigger processes and an STA/LTA trigger process that can be enabled and disabled. The Gecko also monitors some system parameters that can generate an alarm.

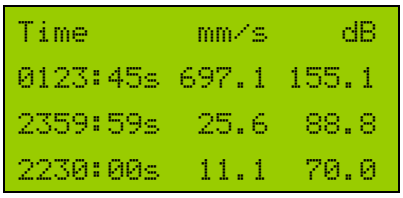


The Gecko logs the trigger time to a text file that can be used to help you find the data in the continuous archive. This "trig.txt" file is located in the top level folder of the SD card.

We have developed a Windows application that can be copied to the Gecko SD card and run from a PC that will scan the trig.txt folder and then automatically extract the continuous data from the archive. The program will create a discreet file for each trigger time, stored in a folder called "reports" on the SD card. Each waveform file contains one minute of data before and after the trigger time. At the same time a PDF report is generated for the triggered event, with files named based on the local time in your PC. This app simplifies vibration monitoring reporting for non-technical users.

Trigger List

The latest 20 trigger times stored in the "trig.txt" file are also visible via the LCD by pressing the **Right** button from the home screen until you see the trigger list.

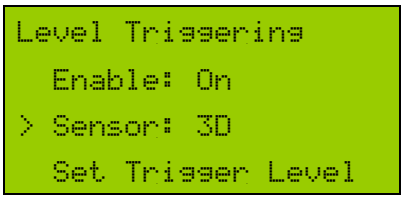


The latest event is at the top of the list (time in UTC) and you can scroll down to view older trigger times. The peak 3D and 1D signal levels that occurred within the first 10 seconds after the event was detected are shown in the units of the 3D and 1D sensor.

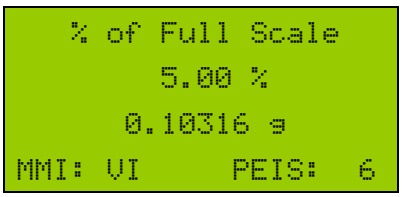
An "s" after the trigger time indicates the Trigger was generated by the STA/LTA process. Similarly "▲" indicates a Level-High trigger, and "▼" indicates a Level-Low trigger.

Level Triggering

By default each Level trigger process is OFF, but simply toggle this using the **Right** button.



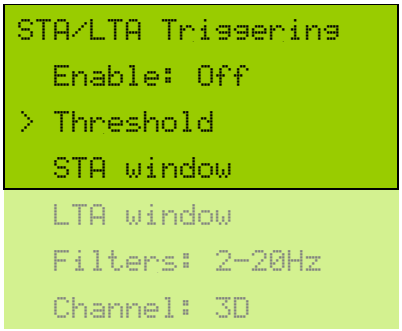
The Gecko can trigger on the vector sum of the 3D sensor channels, or from the 1D sensor channel. The percentage level of the trigger threshold will affect the ground motion units displayed on the Set Trigger Level screen. For accelerometers, the estimated MMI and PEIS intensity that relates to this trigger threshold will also be displayed.



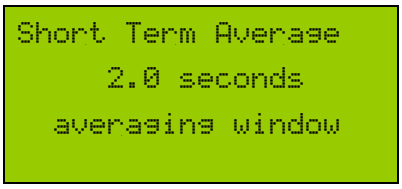
Use the **Up/Down** buttons to change the number values from 0.01% to 99.99% of the recorder's full scale range. The line below will update with the ground motion value based on the calibrated sensor sensitivity and gain of your Gecko.

STA/LTA Triggering

By default the STA/LTA trigger process is OFF. Toggle this ON/OFF using the **Right** button.



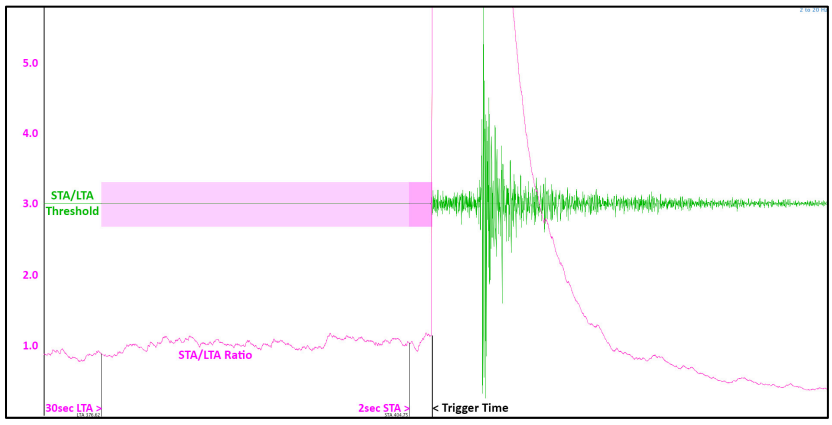
The Short Term Average (**STA**) signal level divided by the Long Term Average (**LTA**) signal level produces a ratio indicating how much above-average signal is occurring.



If you want to declare and event when the short term average signal level is three times higher than the long term average signal level, you set the **Threshold** to 3. The length of the short and long term time windows is also user selectable. The LTA value must be larger than the STA value.

Signal averages can be calculated using the raw data or filtered to suit to local earthquake detection. On the **Filters** line, use the **Right** button to toggle the 2-20Hz filter on or off.

The STA/LTA algorithm can run on one of the triaxial channels (Z, N or E), on the 1D channel, or on all of the 3D input channels. Toggle the **Channel** using the **Right** button.

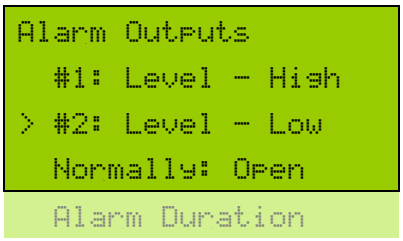


A more detailed explanation of the STA/LTA trigger algorithm is provided in our **Waves** data analysis application's user manual. You can visualise the effect of changing the various STA/LTA settings using **Waves**.

Alarm Outputs

Gecko recorders built from mid 2016 include an alarm output function. There are two alarm outputs available. The signal on pin 6 of the comms/alarm connector is connected to pin 4 when Alarm #1 is activated, and to pin 5 for Alarm #2, for the alarm duration.

By default the Gecko's positive power is hard-wired to pin 6, but on request we can modify the hardware to make pin 6 a user input line that switches to the Alarm outputs. If this modification is done, the switching circuit is rated to 0.13A at 50VAC or 50VDC, but we can optionally supply an external box with dual relays rated to 10A @ 250VAC or 30VDC.



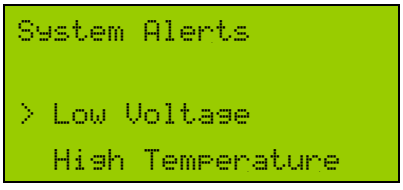
Each Alarm can be controlled by one of three processes – Level triggers, STA/LTA triggers, and System Alerts; or the alarm feature can be turned Off. Simply press the **Right** button to cycle through the options for each alarm.

The alarm output has always been set to Normally Open (i.e. the relay closes for the duration when an alarm is active), but you can now toggle this to be Normally Closed.

The final menu determines how long the alarm stays active after being triggered. If this value is set to zero, the alarm will continue until it is manually reset from the home screen.

System Alerts

System Alerts enable an alarm to be raised when certain monitored parameters get to a particular level that may indicate an impending problem with the system.



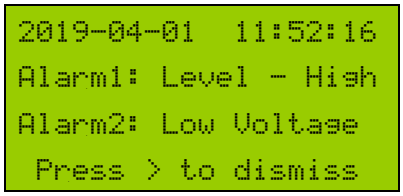
The values are user-editable, but by default the alert will be raised when the voltage drops below 11.9V, or the CPU temperature exceeds 55°C, and when storage is below 4%.

A Gecko can optionally operate down to almost 6V, but a voltage this low may damage some batteries. We suggest using a charge regulator that has a low voltage load disconnect.

The internal temperature of the Gecko CPU can get close to 80°C if the external ambient temperature gets as high as 70°C, but at typical stations the reading would not exceed 50°C, hence the default alert value of 55.

On-screen Alerts

When an enabled alarm is triggered, a message will appear on the home screen to indicate which of the two Alarm Outputs has activated, and which parameter triggered the alarm.



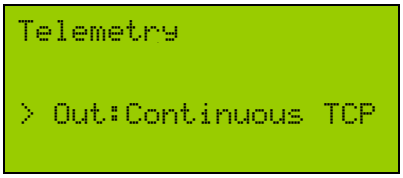
The on-screen alert will be cleared after the Alarm Duration time has elapsed if the alarm condition is no longer true (e.g. when the ground motion subsides after an earthquake).

If the alarm condition persists (e.g. low voltage) the alert will be displayed on the LCD until the user presses the **Right** button to dismiss the alert. The on-screen alert for this alarm will not be displayed again until the condition changes to false (e.g. voltage returns to normal) and then becomes true again.

The Gecko uses a data ring buffer, which means it will overwrite old data with new data when the memory card has only 1% storage remaining. A Low Memory alert will be raised when less than 4% of storage remains to indicate an issue with the memory card.

Telemetry

The Gecko has a serial port to allow streaming of continuous data to a remote computer. Data is sent using a custom protocol that communicates with "KelunjiHub", a process that is built into our Streams application and eqServer cloud service. It is also available as background process application to run on your data reception system computer.



NEW in 7.8 The layout of the Telemetry screen setup has changed to include a new option to output ASCII text strings of the histogram values to the serial port, as well as provide an option to store 1-hour files instead of 1-minute files when telemetry is disabled.

The options are:

- "Continuous TCP" - Continuously stream data via serial-to-TCP Client device
- "Trig. Only TCP" – Maintain link but only stream when triggered via serial-to-TCP
- "ASCII on RS232" – output histogram text strings to the serial port
- "Cont. HE910-3G" – support for continuous streaming via this obsolete modem. This option includes a second menu item to take you to modem configuration
- "Trig. HE910-3G" – support for triggered streaming via this obsolete modem
- "OFF Store 1min" – telemetry disabled, store files to SD card in 1 minute files
- "OFF Store 1hr" – telemetry disabled, store files to SD card in 1 hour files

The Gecko can stream data to KelunjiHub with or without an SD card present. If telemetry is enabled on start-up and no SD card is present, it will connect and stream data. If an SD card is removed or fails during operation, telemetry will continue regardless.

Out

In all telemetry modes, the Gecko stores data in 1-minute long files on the SD card.

When a **Continuous** output mode is selected, the enabled "Channels to Send" (see main menu) will be streamed continuously to the remote server. A good network connection should be able to support a sample rate of 500sps for continuous telemetry.

If **Triggered** output mode is selected, a connection to the remote computer is maintained, and heartbeat signals are sent to the server every few seconds. If a Level or STA/LTA trigger process is enabled and detects an event, a trigger packet will be immediately sent to the remote server. The Gecko will immediately streaming all channel defined in "Channels to Store" and also dump data from these channels from its buffer. The amount of data in the pre-trigger buffer that is streamed immediately will depend on the sample rate, from around 80 seconds at 50sps to around 4 seconds at 1000sps. The length of time continuous streaming will continue after a trigger also varies by sample rate: 300 seconds at 50sps, 150 seconds at 100-250sps, and 30 seconds for 400-1000sps. The data reception software (Streams or eqServer) can request additional pre-trigger data in 1-minute blocks.

When telemetry output is set to **Off** the Gecko will not attempt to start a serial connection.

TCP Client Devices

Cellular modems require localised telecommunication authority approval, so we recommend that you source a modern cellular modem from a local provider. It should have a DB9 serial port for the Gecko connection, and have TCP Client or PAD support that allows the serial port to be mapped to a port on a remote computer that is being monitored by Streams or eqServer applications. You can also use Serial-to-Ethernet adaptors with TCP Client feature to connect your Gecko to an Ethernet network.

Some models that have been successfully configured and tested with the Gecko include:

- Netcomm NTC 220 series 4G LTE Industrial IoT Router (221-01 AU/NZ spec tested)
- Netcomm NTC 6000 and 6200 series 3G M2M Router (AU/NZ spec tested)
- Robustel R1511 single RS232 port (R1511-4L-A03AU-A Oceania model tested)
- Robustel R1500-4L dual RS232 – **allows two Geckos to share one data service**
- Sierra Wireless AirLink RV50X (NA/EMEA/AP spec tested) 4G LTE
- USR W610 serial to Ethernet/WiFi adaptor
- USR TCP232-302 serial to Ethernet adaptor
- Perle DS1 serial to Ethernet adaptor

ASCII on RS232

NEW in 7.8 A new feature of the Gecko changes the protocol of data streamed from the serial port. Instead of our "KelunjiHub" protocol, the output changes to a simple text string output every 2 seconds, 5 seconds, or 1 minute, in accordance with the Histogram file entry interval. This interval is set in the **Station Info** menu under the "SOH every:" setting.

Once the ASCII output mode is enabled, strings of text will periodically appear on the serial port. Your serial terminal should be configured for 115200 baud 8N1 connections, with no handshaking. An example of the serial strings are shown below:

```
G0225 2024-01-23T23:33:00Z PGA  0.000410 g PGV   0.021 mm/s PGD   0.001 mm P1D   0.000 mm/s VOLT 12.29 TEMP 29.1 LAT -37.81890 LONG  145.01096 SATS 07 FREE 15.110
G0225 2024-01-23T23:34:00Z PGA  0.000290 g PGV   0.018 mm/s PGD   0.001 mm P1D   0.000 mm/s VOLT 12.29 TEMP 29.6 LAT -37.81892 LONG  145.01094 SATS 07 FREE 15.110
G0225 2024-01-23T23:35:00Z PGA  0.876861 g PGV 165.688 mm/s PGD   6.163 mm P1D   0.000 mm/s VOLT 12.29 TEMP 29.9 LAT -37.81890 LONG  145.01094 SATS 07 FREE 15.110
G0225 2024-01-23T23:36:00Z PGA  0.000286 g PGV   0.020 mm/s PGD   0.001 mm P1D   0.000 mm/s VOLT 12.30 TEMP 30.1 LAT -37.81888 LONG  145.01095 SATS 07 FREE 15.110
```

To decode the data, treat any space (or multiple spaces) as a single column separator. The string is designed to be generally fixed spacing, but if there is an unexpectedly large value in one of the fields, the string length can vary. An example is shown below:

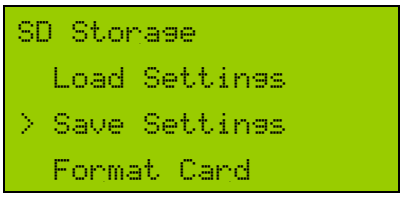
```
G0225 2024-01-23T23:36:00Z PGA  0.000286 g PGV   0.020 mm/s PGD   0.001 mm P1D   0.000 mm/s VOLT 12.30 TEMP 30.1 LAT -37.81888 LONG  145.01095 SATS 07 FREE 15.110
G0225 2024-01-23T22:59:00Z PGA 3210.577881 g PGV  48.738 mm/s PGD   1.535 mm P1D   0.000 mm/s VOLT 12.30 TEMP 31.7 LAT -37.81891 LONG  145.01093 SATS 08 FREE 15.115
```

A description of each separated field of the string is as follows:

- **Station Code** (e.g. "G0225")
- **Date-Time in UTC** (e.g. "2024-01-23T23:33:00Z")
- **PGA** (Peak Ground Acceleration since the last string)
- <PGA value>, followed by **g** (acceleration due to gravity, g = 9.80665 mm/s^2)
- **PGV** (Peak Ground Velocity since the last string)
- <PGV value>, followed by **mm/s** (velocity units, i.e. millimetres per second)
- **PGD** (Peak Ground Displacement since the last string)
- <PGD value>, followed by **mm** (displacement units, i.e. millimetres)
- **P1D** (Peak 1D sensor value since the last string)
- <P1D value> followed by <**P1D units**> (depends on 1D sensor selected, e.g. dB)
- **VOLT** (Gecko DC input voltage), followed by <VOLT value>
- **TEMP** (Gecko CPU temperature), followed by <TEMP value>
- **LAT** (GPS aerial latitude), followed by <LAT value>
- **LONG** (GPS aerial longitude), followed by <LONG value>
- **SATS** (number of GPS satellites visible), followed by <SATS value>
- **FREE** (percentage of free storage on SD card), followed by <FREE value>

SD Storage

You can save the configuration of your Gecko to a text file. Enter the "SD Storage" menu near at the bottom of the main menu.



Use the **Right** button to select the action. When saved, a file called "user-settings.dat" is written to the top level folder of the SD card. Similarly, using the Load command will read in this file and apply the settings contained therein. If a user-settings.dat file does not exist, no settings will be changed.

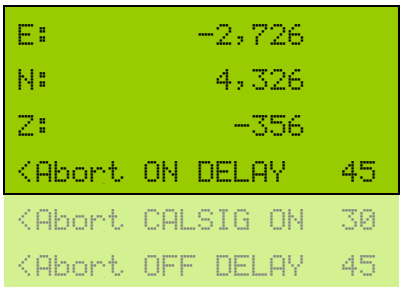
NEW in 7.8 You can now format the SD card from the Gecko. This will erase all data from the SD card and format the storage using a FAT32 file system. This can take several minutes depending on the size of your SD card. This can only be done for SD card that are already formatted with FAT32 file system. New cards formatted with exFAT will not be recognised by the Gecko, so you will need to format them in a computer with FAT32.

Sensor Control

The **Start Calibration** has been moved to the Sensor Control menu along with other sensor control line actions that can be used for actions such as mass control.

Start Calibration

Some sensors include circuitry to test the response of the sensor components to a known input signal. The Gecko can generate a signal (voltage step or sine wave) or simply initiate the sensor's own calibration routine. If your 3D sensor has a calibration duration this feature, you can initiate a calibration sequence by pressing the **Right** button.



Once started, the raw ENZ channel values are shown in real time. The bottom line shows that you can press **Left** to abort the calibration process, and also shows a countdown timer describing the current stage of the process.

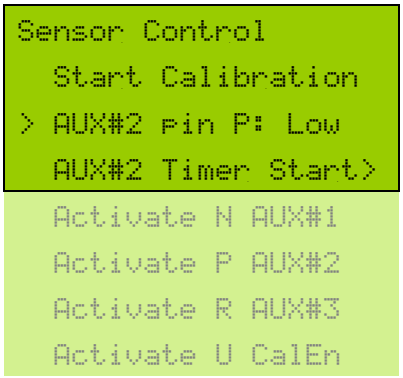
There are three stages to the process – the on-delay, the signal, and the off-delay. For step calibrations, each stage runs for the "calibration duration" in the sensor setting. For sine wave calibrations the delay periods are only a few seconds.

The start delay allows velocity sensors to settle after the Calibrate Enable circuitry is switched on (which can cause a small step response) before the calibration signal is applied, and the end delay allows the sensor to respond to the signal being removed.

The sensor should not be disturbed during the test process. View the files from the continuous data archive to see how the sensor responded compared to past tests.

Sensor Control Lines

Some seismometers have additional control lines to perform certain functions such as enabling a calibration mode, sensor mass re-centring, locking and unlocking.

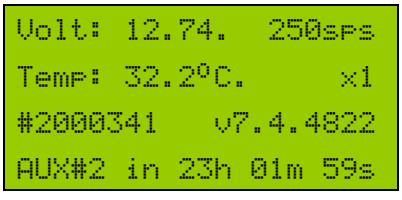


The Gecko includes one line dedicated to Calibrate Enable on pin U of the 19-pin sensor connector. The line can be driven high (+5V) or to (GND) and this function is defined in the Customise Sensor menu.

As of firmware v7.4, pin P of the 19-pin sensor connector can also be driven high or low based on user preference. Pin P is now defined as AUX#2. Pins N and R are now identified as AUX#1 and AUX#3 and can only be driven low.

Manually activating AUX#1, AUX#2, AUX#3 or CalEnable will drive the corresponding sensor connector pin high or low for 5 seconds, then the line will return to a floating state.

If AUX#2 (pin P) is being used to re-centre the mass position of a sensor, the Gecko now includes a 24-hour timer that the field operator can start after installing the sensor. Some sensors need to thermally adjust to their installed environment before they are centred for optimal range and performance. This time allows this function to be scheduled to avoid a return visit. The countdown timer replaces the lat/long display on the first information screen, accessed by pressing the Right button once from the Home Screen.



The maximum load allowed for pins P and U when set to be driven high is 10mA. This line is not intended to provide power to external devices.

Data Storage and Formats

The Gecko stores continuous data to the SD card in a logical file hierarchy to make it easy to find the data you're looking for, but it also stores some additional files that you may find useful. The SD card is formatted in standard FAT32 file system and can be read by most computers with an SD card slot or using a USB SD card reader.

The sample rate affects the size of the data files stored, so we will briefly discuss how much data you can expect to record given a particular sample rate. The Gecko is recording data to the SD card continuously in MiniSEED format using Steim-1 compression. Data is stored on the SD card in one-minute long files in a Year > Month > Day > Hour folder hierarchy to make browsing data on your computer as easy as possible.

Your Gecko will probably be recording low levels of signal from your sensor most of the time, so the data files are usually quite small. The occasional earthquake or noise signal will increase the size of the data files in the short term, but for estimation purposes we will look at what volume of data is generated at typical background signal levels.

Recording 3-channels at 100sps in an urban environment generates about 2GB per month. Increasing the sample rate to 250sps generates about 5GB per month, and running at 4000sps creates about 70GB per month, so the sample-rate to data-volume relationship is reasonably linear. Low noise environments (such as underground vaults or remote stations) will generate smaller amounts of data due to the MiniSEED format data optimisation.

Recording at 250sps, the included 64GB SD card will typically store over 1 year of continuous 4-channel data.

We recommend replacing the SD card every year for archiving and reliability.

You can view your data by inserting your SD card into your computer and starting up **Waves**. Simply drag a single file, an hour folder, or a day folder (Waves can display up to 24 hours data in a single window) onto the empty Waves viewer window to view your data. Waves will read the ".ss" file from your data folder to auto-fill the station information. Keep your files in their respective folders or risk losing this meta-data link, or save the file in a meta-rich format like PC-SUDS, or as a MiniSEED zip file (where the waveform file and .ss files are zipped together into a folder that can be read directly by Waves without decompression).

Download **Waves** for free from http://www.src.com.au/downloads/waves/

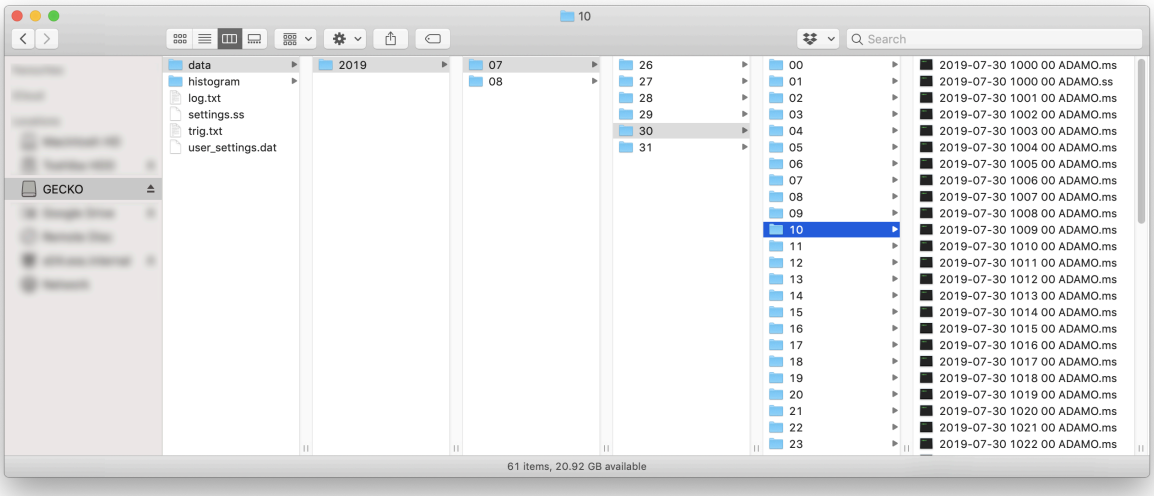
The Root Directory

The root directory contains a folder called "data" that contains all of the seismic waveform files, and a folder called "histogram" which contains daily files that record data values each minute. The top level folder also contains a number of other files:

- **log.txt** (and older log_0.txt … log_9.txt): a simple text files that record several parameters for instrument performance analysis, such as history of restarts and any system exceptions. Up to 10 past text files are stored, with a new file started on power-up if the current log file is too big
- **settings.ss**: also a text file, containing all of the current configuration settings of the Gecko. It is updated each time the user changes a setting.
- **user-settings.dat**: the current configuration of the Gecko as written by the Load/Save Settings function described earlier
- **trig.txt**: a list of times and information when a trigger process was activated

The Data Folder

The top level folder named "data" contains subdirectories named by date to allow you to quickly find the files you're looking for. The first level down is the Year folder, which contains Month folders, which in turn contain Day folders, and the Hour folders are the next and final folder level. Each hour folder will contain MiniSEED format data files, each file being one minute long. Each hour folder also contains one or more files ending in ".ss" which contains information about the recorder parameters which include the correction factors that are needed for analysis of the data.



The Histogram Folder

The top level folder named "histogram" contains daily CSV files where an entry can be written to file every minute, every 2, every 5 seconds. This logging can also be set to OFF. The CSV files are named by date (e.g. 2022-10-03.csv) and can be opened with a text editor, Excel, or Waves which will plot peak motion values, voltage and temperature.

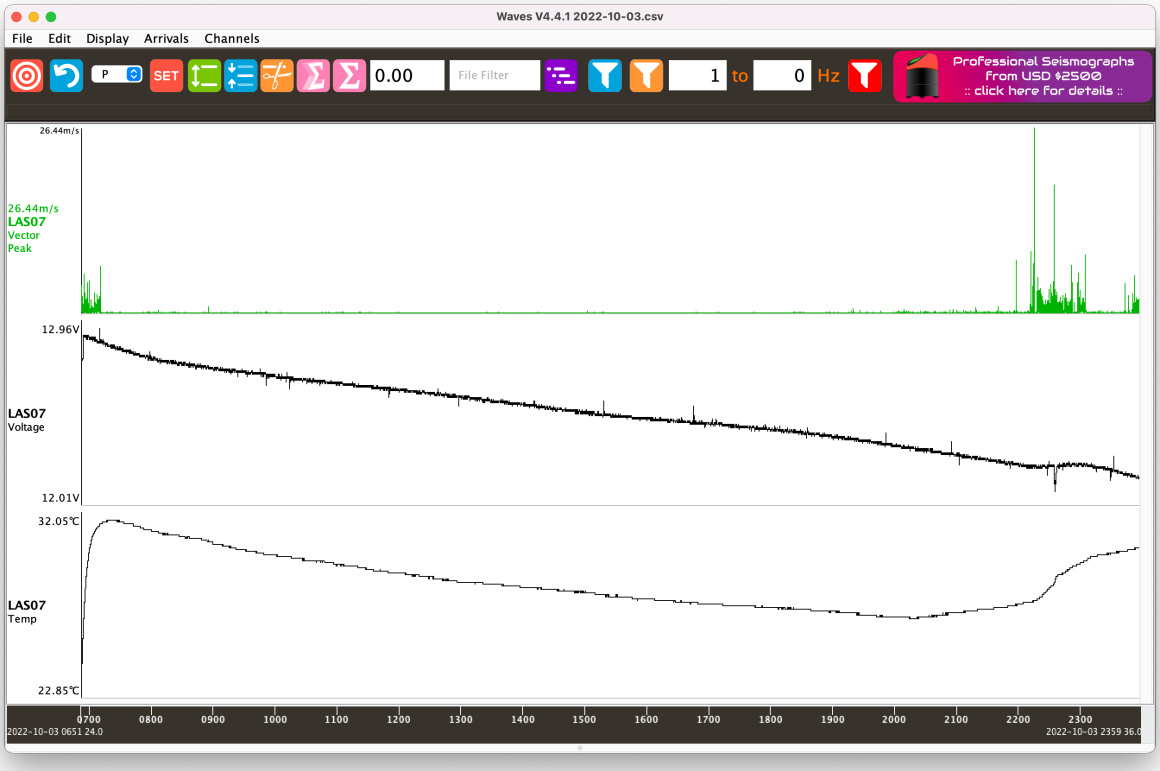
The file contains a header with some Gecko and sensor settings followed by:

- An estimate of the peak motion the 3D and 1D sensor in the last minute
- † The **raw ADC** value at the time of sampling for each channel: E N Z O
- † The absolute peak unit values for each channel in the last minute
- Input Voltage and CPU Temperature at the time of the data entry
- Latitude, Longitude, Altitude, and number of visible GPS satellites
- The percentage of storage memory available

† These values are only stored in one-minute mode, not when logging at 2- and 5-second intervals

The file header contains information about the station, including parameters for converting raw values into sensor units. Divide the **raw ADC** value by the **sens_X** value to estimate the value in **units_XD** for this 1/12/30 samples per minute data,

e.g. **23009** ÷ **324303584** = 0.000071 **m/s** (0.071 mm/s).



Waves displaying the 3D vector peak, Voltage and Temperature as logged every 2 seconds.
Note that each "day" file can be several MB in size.

MiniSEED files

Continuous data files in the Gecko are in MiniSEED format, which is a widely adopted international standard format for seismic data. You can find out more about this data format at the IRIS website:

http://ds.iris.edu/ds/nodes/dmc/data/formats/miniseed/

Being a "data only" format, the lack of embedded station information makes it impossible to simply open a file and read a ground motion value (and therefore calculate magnitude). The way we have handled this is to embed a seismograph settings (.ss) file in every Hour folder. If you use our **Waves** application to open a data file, it will look for an .ss file in the file's folder and automatically read and apply the appropriate corrections to the data so that ground motion units are displayed. Similarly if you drag an entire Hour or Day folder into Waves, it will read the first .ss file and apply these station settings to the merged data file displayed in the Waves window.

The problem then becomes needing to keep the .ss files and MiniSEED data files together to retain this association. The simplest solution is to use the "Save As…" function in **Waves** to save the file in "PC-SUDS" format (a less common international standard seismic data format) which embeds all of the relevant station data within the data file. Alternatively, select the option to save the file as a "MiniSEED zip" file which will bundle the .ms data with the .ss info file (and a station.xml file) into a zip file that can be read directly by Waves.

Upgrading the Gecko firmware

The process of upgrading the firmware in the Gecko is very simple. The firmware upgrade file is called **Rasbora.bin** and simply needs to be copied to the root level of your Gecko's SD card. With the Gecko turned off, insert the SD card, then apply power. After a few seconds you will see a message indicating that it is "Upgrading Firmware", which only takes a few seconds. The Gecko will then restart and the new firmware features will be available.

A Gecko will only upgrade its firmware if the Rasbora.bin file has a later firmware number, otherwise the file will be ignored. After the upgrade the Rasbora.bin file remains in the root folder of the SD card so that the card can be used to upgrade other Gecko recorders, but it can be deleted from the folder at any time with no adverse effect on the Gecko.

Always check your settings after an upgrade to be sure something has not unexpectedly changed, which can happen when upgrading from much older versions of firmware.

Ports & Wiring

Over the years we have improved the design of our various models, and as a consequence there are three major configurations of connection ports.

Pre 2021 - LEMO

The original Gecko Compact through to the late-2020 rugged models used a push-pull connector system from manufacturer LEMO. These connections are rated IP67 when mated, but required a cap to maintain this dust/water ingression protection rating, otherwise they are rated IP56. On the 2-pin power input connector, pin 1 is positive, 2 is negative. See the next section for the 6-pin alarm/communication connector wiring.

From mid 2019 Gecko SMA and Blast were fitted with an input for the 1D sensor input, typically used with a microphone for blast monitoring. Wiring for the connector follows:
Pin 1: O+ signal, **Pin 2:** O- return, **Pin 3:** Ground, **Pin 4:** DC Power output

LEMO power, communication, and 1D sockets fitted to various models prior to 2021

Pre 2021 - ALTW

Power port

Gecko Compacts built since 2018 (and some Gecko SMA from 2020) were fitted with ALTW connectors, which have the benefit of being rated to IP67 whether mated or not. The power connector was originally wired with pin 1 as positive and pin 2 as negative, and were wired by ESS by soldering cables through a gland on the plug's back-shell, terminating in bare wire ends (red or white=positive; black=negative) for connection to a battery.

Alarm & Communications port

The six-pin connector for alarm output and communication were wired by ESS for both LEMO and gland-back-shell ALTW connectors using the colours detailed in the table below:

- Pin 1 (white wire) RS232 Transmit (for Ethernet adaptor or 3G modem)
- Pin 2 (green wire) RS232 Receive (for Ethernet adaptor or 3G modem)
- Pin 3 (black wire) Ground (for RS232 and Power)
- Pin 4 (red wire) Alarm #1 output (connects pin 6 when active)
- Pin 5 (blue wire) Alarm #2 output (connects pin 6 when active)
- Pin 6 (orange wire) Power +VDC (optionally factory-set to be alarm line in)

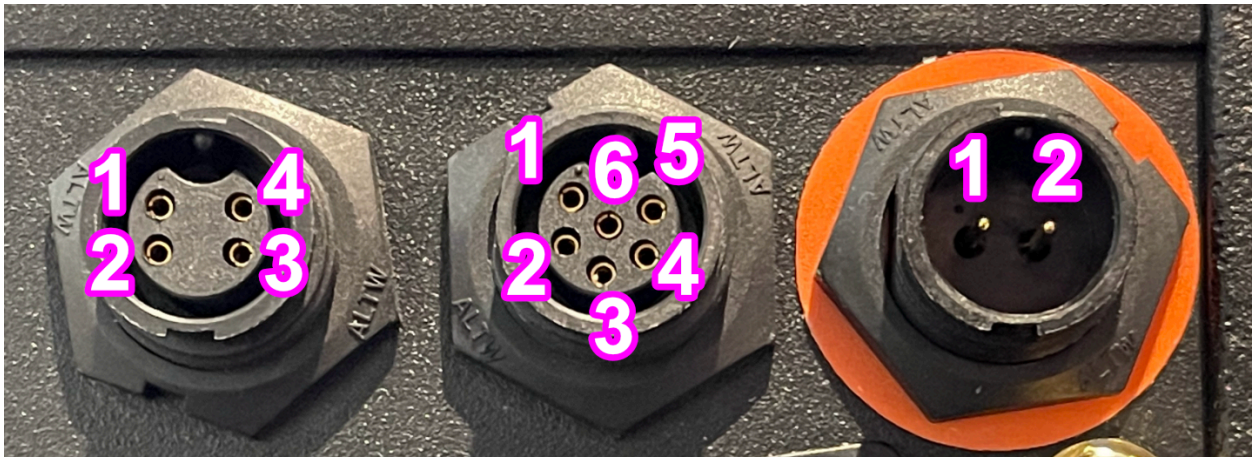
Post 2021 - ALTW

Power port

From 2021, pre-made cables with moulded back-shells were supplied for all ALTW sockets. Unfortunately the 2-wire cable has a red wire attached to pin 2 and a black wire attached to pin 1, opposite to the way the original Gecko was configured.

This means that <u>you can't use an old cable-gland type power cable with a new orange-ringed Gecko power port</u> without swapping the wire polarity at the battery.

If your Gecko has an orange ring around its black plastic ALTW power connector, pin 1 is the negative for the input voltage and pin 2 is positive. The supplied moulded cable have a red(+) and black(-) wire that matches this wiring.



Alarm & Communications port

The moulded six-pin connector for the alarm output and communication port also has different wire colours that correspond to each pin. The wire colours for the moulded cables are shown in the table below:

- Pin 1 (blue wire) RS232 Transmit
- Pin 2 (green wire) RS232 Receive
- Pin 3 (yellow wire) Ground (for RS232 and Power)
- Pin 4 (orange wire) Alarm #1 output (connects pin 6 when active)
- Pin 5 (red wire) Alarm #2 output (connects pin 6 when active)
- Pin 6 (white wire) Power +VDC (optionally factory-set to be alarm line in)

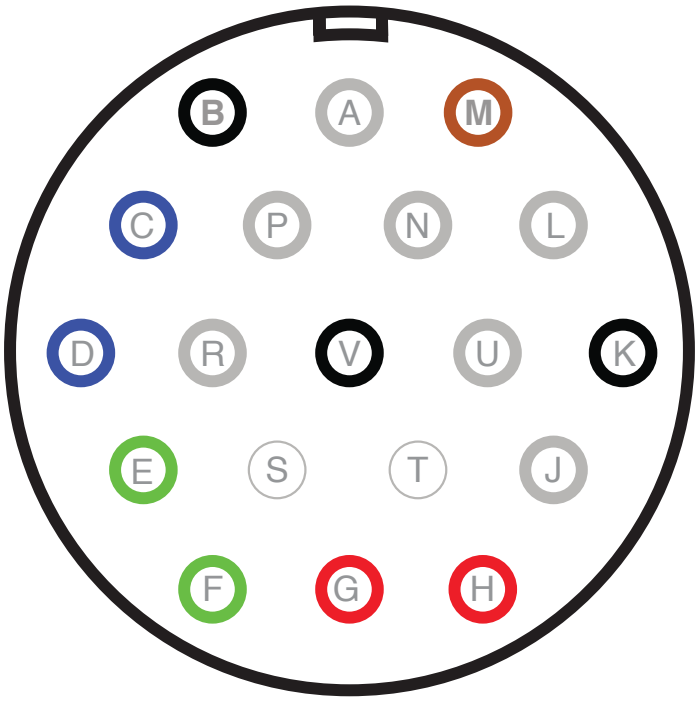
1D Sensor port

A four-pin connector became standard as the 1D sensor input. Wiring colours as follows:

- Pin 1 (white wire) Channel O+ signal
- Pin 2 (green wire) Channel O- return
- Pin 3 (red wire) Ground
- Pin 4 (yellow wire) DC Power Out (nominally input voltage, +5V optional)

3D Sensor Port (Compact/Rugged)

The wiring for the 19-pin milspec-style sensor socket is shown below. Early model Gecko models were 3-channel only and may not have a 4th input on pins S & T.



A +5V DC power
B DC GROUND (power source negative)
C E+ (East-West channel)
D E-
E N+ (North-South channel)
F N-
G Z+ (Vertical channel)
H Z-
J Calibrate Signal
K Calibrate Ground
L 2.5V DC reference voltage (no load)
M DC POWER (power source positive)
N AUX#1 output (active LOW)
P AUX#2 output (user set HIGH or LOW)
R AUX#3 output (active LOW)
S *O+ not connected on models with 1D socket*
T *O- not connected on models with 1D socket*
U Calibrate Enable (user set HIGH or LOW)
V Sensor cable overall shield

If your Gecko has a 4-pin 1D sensor socket, pins S & T on this port will not be connected.

Technical Specifications

Analogue to Digital Converter:	**32-bit ADC on each channel**
Input (most models)	**40V peak to peak (at gain x1)**
Pre-gain sensitivity (gain x1 to x4):	457,000* counts per volt (to serial #2000224)
Pre-gain sensitivity (gain x1 to x4):	406,000* counts per volt (from serial #2000225)
Pre-gain sensitivity (gain x8 to x512):	419,430* counts per volt (all serial numbers)
Input (Pro SMA-HR, Prism-xP)	**60V peak to peak (at gain x1)**
Pre-gain sensitivity (gain x1 to x64):	280,000* counts per volt (all serial numbers)
Data Format:	**MiniSEED with STEIM-1 compression**
	Stored as 24-bit number (±8,388,608 counts)
Frequency Response:	**Flat from DC to ~40% of sampling frequency**

**Nominal ǂSee our website to download the Gecko Data Sheet for full technical specifications for each model*

Sampling and Linear Phase Filter Stages & Coefficients – v6.0

Previous Gecko firmware used more complicated up-sampling, decimation and a longer string of FIR filter coefficients. Gecko v6 has the same simpler floating point FIR filter as used the Kelunji EchoPro, and only uses factor 5 decimation for non-native sample rates.

32-bit ADC Rate FIR Filtered	Apply Gecko FIR filter	Decimation	**24-bit Output Rate**	Band Code
250	YES	/5	**50**	B
500	YES	/5	**100**	H
1000	YES	/5	**200**	H
250			**250**	C
2000	YES	/5	**400**	C
500			**500**	C
4000	YES	/5	**800**	C
1000			**1000**	F
2000			**2000**	F
4000			**4000**	F

	32-bit ADC Rate FIR Filter Coefficients				Gecko FIR Filter	
	SESSION 1	SESSION 2	SESSION 3	SESSION 4		
	1/512	1/8388608	134,217,728	134,217,728		
1	3	-10,944	0	-132	-0.000000006030395875672310	1
2	0	0	0	-432	0.000000039273955950695000	2
3	-25	103,807	-73	-75	0.000000150497734052610000	3
4	0	0	-874	2,481	0.000000317739527810828000	4
5	150	-507,903	-4,648	6,692	0.000000477985022033730000	5
6	256	0	-16,147	7,419	0.000000510951576907698000	6
7	150	2,512,192	-41,280	-266	0.000000266419050555070000	7
8	0	4,194,304	-80,934	-10,663	-0.000000372167659237507000	8
9	-25	2,512,192	-120,064	-8,280	-0.000001399665080748170000	9
10	0	0	-118,690	10,620	-0.000002607789781355910000	10
11	3	-507,903	-18,203	22,008	-0.000003554774337654340000	11
12		0	224,751	348	-0.000003629266326355300000	12
13		103,807	580,196	-34,123	-0.000002229297593673560000	13
14		0	893,263	-25,549	0.000000965205187386368000	14

15		-10,944	891,396	33,460	0.000005699971339394690000	15
16			293,598	61,387	0.000010950591159917300000	16
17			-987,253	-7,546	0.000014951530566022000000	17
18			-2,635,779	-94,192	0.000015540581624434900000	18
19			-3,860,322	-50,629	0.000010818910428655000000	19
20			-3,572,512	101,135	-0.000000000000000000004001	20
21			-822,573	134,826	-0.000015805124923760500000	21
22			4,669,054	-56,626	-0.000033193633907045700000	22
23			12,153,698	-220,104	-0.000046770453743219300000	23
24			19,911,100	-56,082	-0.000050295592532326500000	24
25			25,779,390	263,758	-0.000038573397733256000000	25
26			27,966,862	231,231	-0.000009667616639616780000	26
27			25,779,390	-215,231	0.000033236113317013400000	27
28			19,911,100	-430,178	0.000081101077933385300000	28
29			12,153,698	34,715	0.000120079201507104000000	29
30			4,669,054	580,424	0.000134538404696266000000	30
31			-822,573	283,878	0.000111674023590753000000	31
32			-3,572,512	-588,382	0.000046631473179107800000	32
33			-3,860,322	-693,209	-0.000053428759753574300000	33
34			-2,635,779	366,118	-0.000167995006527137000000	34
35			-987,253	1,084,786	-0.000265832570634519000000	35
36			293,598	132,893	-0.000311839646880736000000	36
37			891,396	-1,300,087	-0.000277071862540788000000	37
38			893,263	-878,642	-0.000149554297399733000000	38
39			580,196	1,162,189	0.000057382021528532100000	39
40			224,751	1,741,565	0.000302542731014214000000	40
41			-18,203	-522,533	0.000522374959220875000000	41
42			-118,690	-2,490,395	0.000644812750659916000000	42
43			-120,064	-688,945	0.000609168320939303000000	43
44			-80,934	2,811,738	0.000387327820914431000000	44
45			-41,280	2,425,494	-0.000000000000000000087598	45
46			-16,147	-2,338,095	-0.000478120270233289000000	46
47			-4,648	-4,511,116	-0.000928355413245014000000	47
48			-874	641,555	-0.001213526936277000000000	48
49			-73	6,661,730	-0.001214557768707530000000	49
50			0	2,950,811	-0.000869531681079239000000	50
51			0	-8,538,057	-0.000204006023962944000000	51
52			0	-10,537,298	0.000658270310132482000000	52
53				9,818,477	0.001511373026321910000000	53
54				41,426,374	0.002110513066394890000000	54
55				56,835,776	0.002235199867344920000000	55
56				41,426,374	0.001757531857436100000000	56
57				9,818,477	0.000696633393682163000000	57
58				-10,537,298	-0.000759162353710550000000	58
59				-8,538,057	-0.002274691874439100000000	59
60				2,950,811	-0.003436446931095760000000	60
61				6,661,730	-0.003855647628448220000000	61
62				641,555	-0.003282442706574410000000	62
63				-4,511,116	-0.001700612940325510000000	63
64				-2,338,095	0.000627394157059466000000	64
65				2,425,494	0.003186125033401470000000	65
66				2,811,738	0.005307926174682660000000	66
67				-688,945	0.006332914209053510000000	67
68				-2,490,395	0.005793042236071030000000	68
69				-522,533	0.003573020796205280000000	69
70				1,741,565	-0.000000000000000000392660	70
71				1,162,189	-0.004173757507853660000000	71
72				-878,642	-0.007907042152766810000000	72
73				-1,300,087	-0.010105944064525200000000	73
74				132,893	-0.009911628881897400000000	74
75				1,084,786	-0.006970252752547790000000	75
76				366,118	-0.001610490072892130000000	76
77				-693,209	0.005131947589591350000000	77
78				-588,382	0.011671825583291200000000	78
79				283,878	0.016199845354484200000000	79
80				580,424	0.017117206422356000000000	80
81				34,715	0.013485366401283500000000	81
82				-430,178	0.005381695993606490000000	82

83				-215,231	-0.005938112840912750000000	83
84				231,231	-0.018134363838502300000000	84
85				263,758	-0.028143200411775700000000	85
86				-56,082	-0.032748865004025400000000	86
87				-220,104	-0.029260590689252000000000	87
88				-56,626	-0.016152651698018100000000	88
89				134,826	0.006477078543044040000000	89
90				101,135	0.036744662245894800000000	90
91				-50,629	0.071170175943248200000000	91
92				-94,192	0.105202641609477000000000	92
93				-7,546	0.133988424033414000000000	93
94				61,387	0.153235428461293000000000	94
95				33,460	0.160000000000000000000000	95
96				-25,549	0.153235428461293000000000	96
97				-34,123	0.133988424033414000000000	97
98				348	0.105202641609477000000000	98
99				22,008	0.071170175943248200000000	99
100				10,620	0.036744662245894800000000	100
101				-8,280	0.006477078543044040000000	101
102				-10,663	-0.016152651698018100000000	102
103				-266	-0.029260590689252000000000	103
104				7,419	-0.032748865004025400000000	104
105				6,692	-0.028143200411775700000000	105
106				2,481	-0.018134363838502300000000	106
107				-75	-0.005938112840912750000000	107
108				-432	0.005381695993606490000000	108
109				-132	0.013485366401283500000000	109
110				0	0.017117206422356000000000	110
111					0.016199845354484200000000	111
112					0.011671825583291200000000	112
113					0.005131947589591350000000	113
114					-0.001610490072892130000000	114
115					-0.006970252752547790000000	115
116					-0.009911628881897400000000	116
117					-0.010105944064525200000000	117
118					-0.007907042152766810000000	118
119					-0.004173757507853660000000	119
120					-0.000000000000000000392660	120
121					0.003573020796205280000000	121
122					0.005793042236071030000000	122
123					0.006332914209053510000000	123
124					0.005307926174682660000000	124
125					0.003186125033401470000000	125
126					0.000627394157059466000000	126
127					-0.001700612940325510000000	127
128					-0.003282442706574410000000	128
129					-0.003855647628448220000000	129
130					-0.003436446931095760000000	130
131					-0.002274691874439100000000	131
132					-0.000759162353710550000000	132
133					0.000696633393682163000000	133
134					0.001757531857436100000000	134
135					0.002235199867344920000000	135
136					0.002110513066394890000000	136
137					0.001511373026321910000000	137
138					0.000658270310132482000000	138
139					-0.000204006023962944000000	139
140					-0.000869531681079239000000	140
141					-0.001214557768707530000000	141
142					-0.001213526936277000000000	142
143					-0.000928355413245014000000	143
144					-0.000478120270233289000000	144
145					-0.000000000000000000087598	145
146					0.000387327820914431000000	146
147					0.000609168320939303000000	147
148					0.000644812750659916000000	148
149					0.000522374959220875000000	149
150					0.000302542731014214000000	150

151					0.000057382021528532100000	151
152					-0.000149554297399733000000	152
153					-0.000277071862540788000000	153
154					-0.000311839646880736000000	154
155					-0.000265832570634519000000	155
156					-0.000167995006527137000000	156
157					-0.000053428759753574300000	157
158					0.000046631473179107800000	158
159					0.000111674023590753000000	159
160					0.000134538404696266000000	160
161					0.000120079201507104000000	161
162					0.000081101077933385300000	162
163					0.000033236113317013400000	163
164					-0.000009667616639616780000	164
165					-0.000038573397733256000000	165
166					-0.000050295592532326500000	166
167					-0.000046770453743219300000	167
168					-0.000033193633907045700000	168
169					-0.000015805124923760500000	169
170					-0.000000000000000000004001	170
171					0.000010818910428655000000	171
172					0.000015540581624434900000	172
173					0.000014951530566022000000	173
174					0.000010950591159917300000	174
175					0.000005699971339394690000	175
176					0.000000965205187386368000	176
177					-0.000002229297593673560000	177
178					-0.000003629266326355300000	178
179					-0.000003554774337654340000	179
180					-0.000002607789781355910000	180
181					-0.000001399665080748170000	181
182					-0.000000372167659237507000	182
183					0.000000266419050555070000	183
184					0.000000510951576907698000	184
185					0.000000477985022033730000	185
186					0.000000317739527810828000	186
187					0.000000150497734052610000	187
188					0.000000039273955950695000	188
189					-0.000000006030395875672310	189

Register for Updates

We highly recommend registering your Gecko with us so that we can add you to our product update notification list. Simply email sales@src.com.au with your Gecko serial number and we will notify you when Gecko firmware updates and Waves or Streams software updates are available – usually just a few times per year.

You can also register for email updates on the Waves, Streams or Gecko product pages at http://src.com.au or directly through the MailChimp service at http://eepurl.com/hgD3HD

You can opt out of emails at any time using the automated Unsubscribe link in the emails.

Warranty

Seismic equipment manufactured by ESS Earth Sciences is warranted to the original purchaser only, to be free of defects in material and workmanship at the time of shipment and for a period of one year from the delivery date. This warranty applies to equipment purchased from ESS Earth Sciences that has been properly installed and operated, but not to equipment which has been subject to neglect, accident, improper installation, misuse, misapplication, abuse or alteration. It does not apply to damage caused by factors beyond our control including fire, flood, lightning or vandalism.

ESS Earth Sciences will, at its own option, repair at its laboratory or replace equipment covered under this warranty. All costs of freight and insurance plus any applicable customs and clearance fees will be paid by the purchaser. All goods must be sent in original packaging with appropriate protection against damage including electrostatic charge.

It is the responsibility of the purchaser: to give prompt notice of any claim; to request a return authorisation before returning any equipment to ESS Earth Sciences; and to return the goods within the warranty period.

Extended warranty

Extensions to the standard 12 month warranty are available. These are available at the time of purchase, or at any time before the expiry of the original warranty. Extended warranties have the same conditions as the original warranty. Please contact ESS Earth Sciences for further information.

Products that are out of warranty can be returned to the factory for refurbishment and will then qualify for extended warranty. Contact ESS Earth Sciences for further information.

Seismology Research Centre
a division of ESS Earth Sciences
141 Palmer Street, Richmond
VIC 3121 Australia
+61 3 8420 8940
www.src.com.au

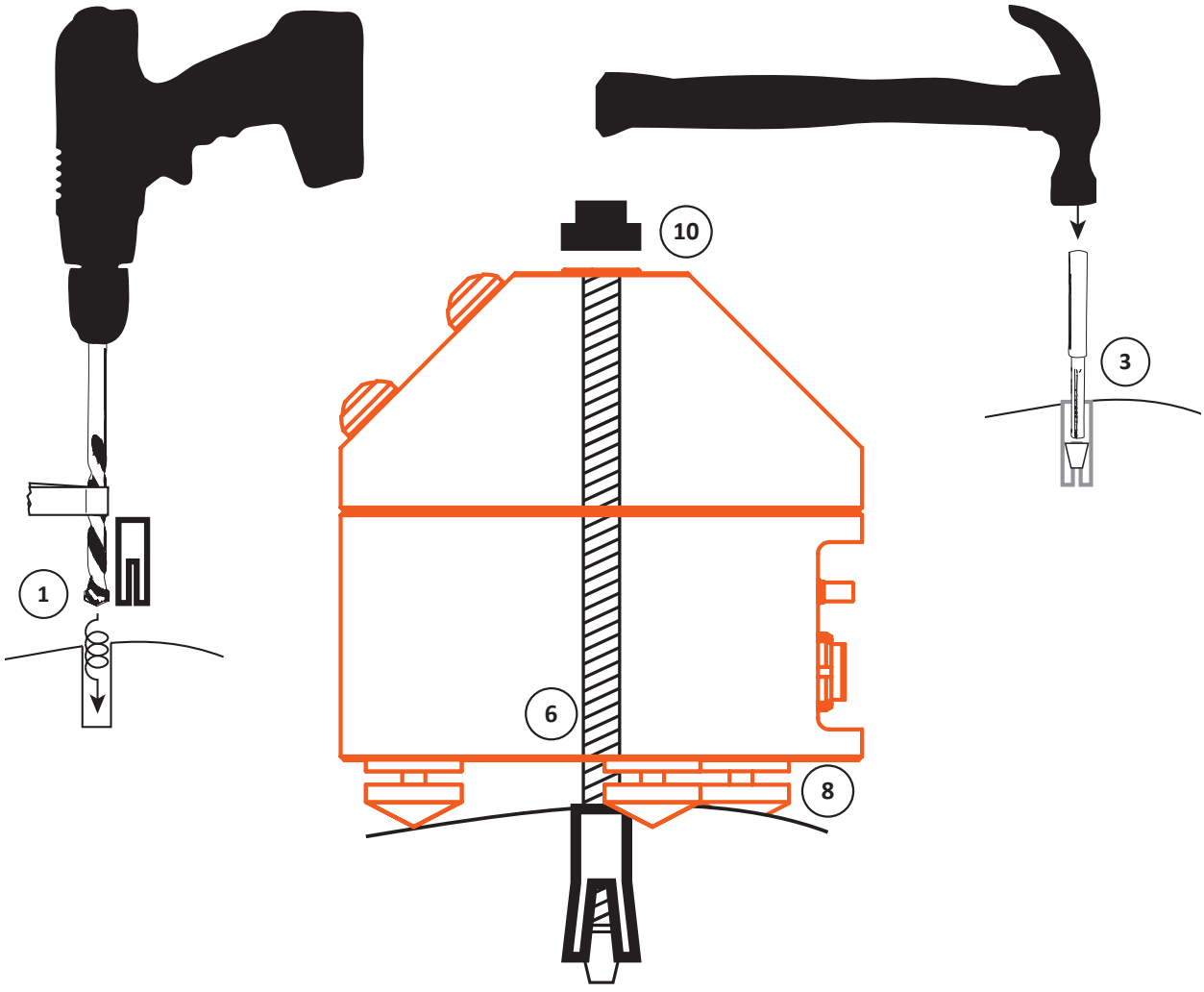
Appendix A

Installing the Gecko Blast, Force, or SMA

Gecko Blast, Force, and SMA are designed to measure large vibrations. You can sit them on a surface to measure ground motion, but we recommend you bolt the sensors down.

To install in soft soil, screw the three included spikes into the holes in the base, which may require you to unscrew the standard adjustable feet. Push the sensor and spikes into the soil by hand as far as you can, using the bubble on the lid to level the sensor as close to flat as is practical (being perfectly level is not critical).

To attach to a hard surface (e.g. rock or concrete) we recommend you use the included threaded rod, nut and anchor system through the centre of the sensor, along with the standard feet for level adjustment. You'll need a hammer drill, a hammer, and the included installation kit.



1. Using the supplied 10mm masonry bit and your hammer drill, make a vertical hole for the drop-in anchor.

   Tip: measure the depth of the anchor and place some tape on the drill bit so you know how deep to drill

2. Insert anchor thread-side up into hole. Gently tap with hammer until flush with surface
3. Insert the tapered end of the anchor setting tool into the anchor.
4. By tapping down the embedded spreader, the anchor will bite into the hole. A few firm taps of your hammer will be enough to punch the spreader to the bottom of the anchor.
5. Screw the supplied 8mm threaded rod into the anchor. After tightening, ensure the rod cannot be pulled out of the ground by hand.
6. Using the central hole in the Gecko, slide the unit over the threaded rod.
7. Orienting your recorder depends on your application. We recommend:
    a. For earthquake monitoring, rotate the Gecko until the arrow is pointing North
    b. For structural monitoring, point the North arrow along an axis of your structure
8. Loosen the upper locking nuts on the adjustable feet and screw the feet in or out until the bubble on top of the Gecko is centred indicating that the chassis is level.
9. Screw the locking nuts up to the base of the Gecko so that the feet can no longer be adjusted.
10. Use the supplied flanged plastic nut to lock the Gecko down onto the threaded rod. Hand tightening is sufficient to tie the Gecko down for better coupling and to avoid accidental movement.

If you need to move your sensor, you can reuse the threaded rod and locking nut. Additional M8 Ramset DynaSet Drop-in Anchors can be purchased at hardware stores, or contact us if you require any spare parts.

Gains, range and clip levels

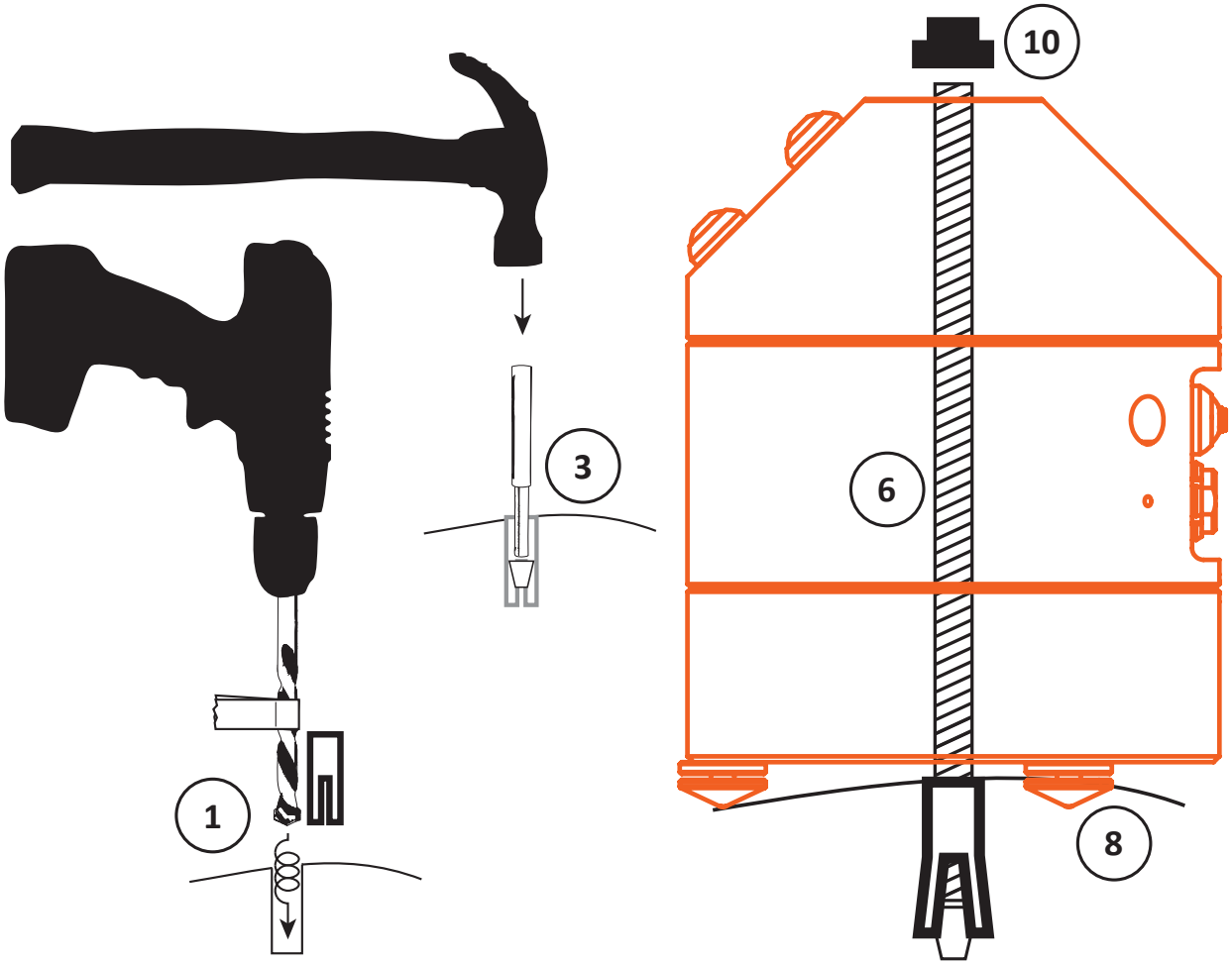
Gain	Blast Clip Level	Force Clip Level
x1	±695 mm/s	±909 mm/s
x2	±347 mm/s	±455 mm/s
x4	±174 mm/s	±227 mm/s
x8	±89 mm/s	±114 mm/s
x16	±43 mm/s	±57 mm/s
x32	±22 mm/s	±28 mm/s
x64	±11 mm/s	±14 mm/s
x128	±5.4 mm/s	±7.1 mm/s
x256	±2.7 mm/s	±3.6 mm/s
x512	±1.4 mm/s	±1.8 mm/s

The unpowered geophones in the **Gecko Blast** and **Force** generate a voltage as the mass moves. The standard Gecko recorder has maximum sensing voltage range of ±20V at a gain of x1. Increasing the sensitivity reduces the maximum motion recordable. The Gecko's resolution is about 50 times lower than a typical monitoring site, but if uou change the gain for higher sensitivity, the clip level will be affected as estimated in the table (left).

The Gecko SMA uses ±4V output range sensors, so to maximise the resolution of the data the **Gecko SMA will be shipped with a gain of x4**, which will use 80% of the Gecko's dynamic range. Increasing the gain further will reduce the clip level of your SMA.

Installing the Gecko Pro-bodied sensors

To securely install a Gecko SMA-HR, SMA-XR, Tremor or Prism variant you'll need a hammer drill, a hammer, and the included installation kit.

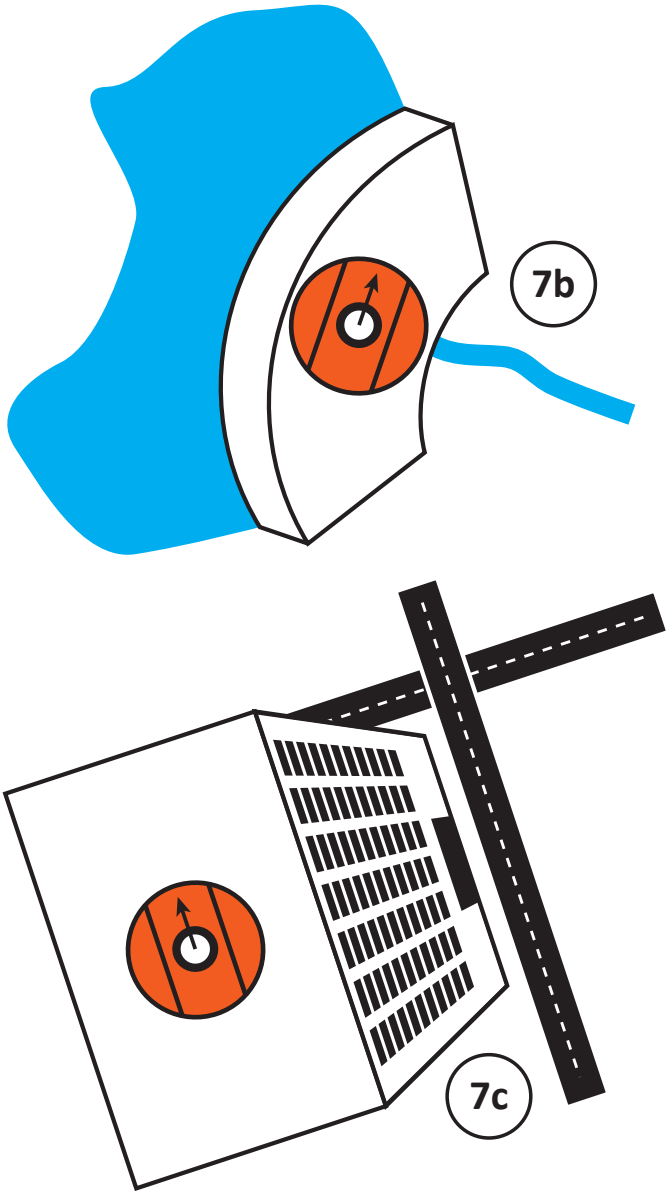


1. Using the supplied 10mm masonry bit and your hammer drill, make a vertical hole for the drop-in anchor.

   Tip: measure the depth of the anchor and place some tape on the drill bit so you know how deep to drill

2. Insert anchor thread-side up into hole. Gently tap with hammer until flush with surface
3. Insert the tapered end of the anchor setting tool into the anchor.
4. By tapping down the embedded spreader, the anchor will bite into the hole. A few firm taps of your hammer will be enough to punch the spreader to the bottom of the anchor.
5. Screw the supplied 8mm threaded rod into the anchor. After tightening, ensure the rod cannot be pulled out of the ground by hand.
6. Using the central hole in the Gecko Pro, slide the unit over the threaded rod.

7. Orienting your recorder depends on your application. We recommend:
    a. For earthquake monitoring, rotate the Gecko until the arrow is pointing North
    b. For dam monitoring, point the North arrow along the dam wall with East direction pointing downstream
    c. For building monitoring, align the arrow of the Gecko to the axis of your building that is closest to North
8. Loosen the upper locking nuts on the two adjustable feet and screw the feet in or out until the bubble on top of the Gecko is centred indicating that the chassis is level.
9. Screw the locking nuts up to the base of the Gecko so that the feet can no longer be adjusted.
10. Use the supplied flanged plastic nut to lock the Gecko down onto the threaded rod. Hand tightening is sufficient to tie the Gecko down in case the ground acceleration exceeds the force of gravity or horizontal friction.

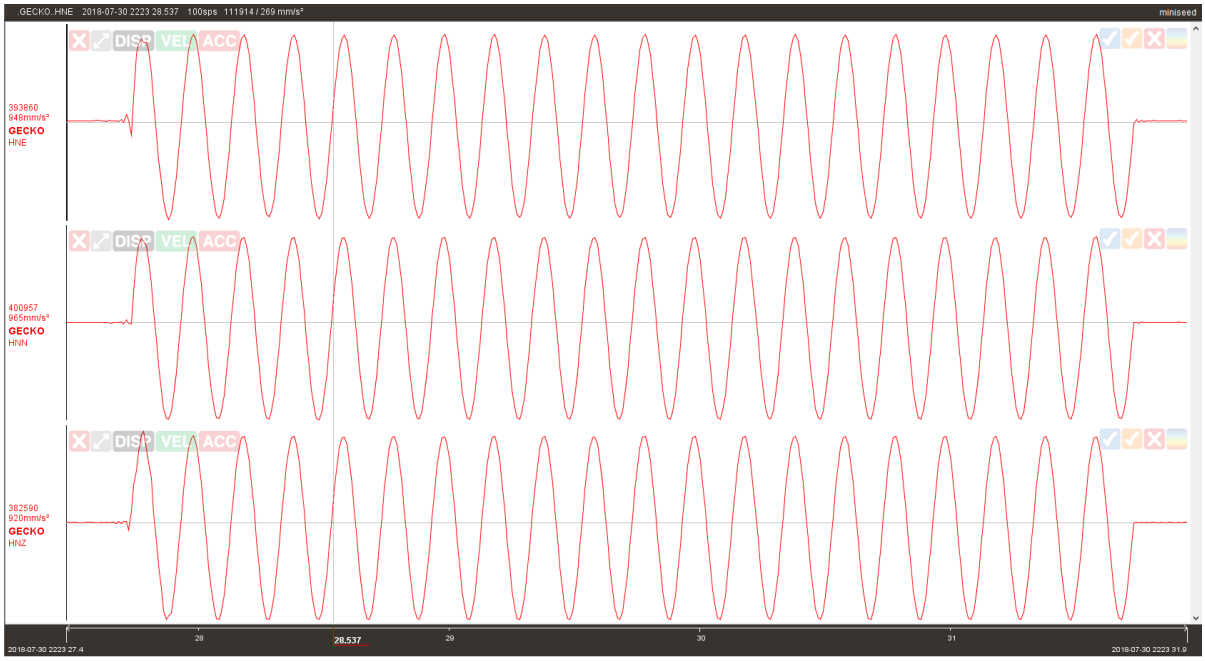


Calibrating a Gecko SMA-HR

The Gecko SMA-HR has an in-built calibration procedure whereby the processor sends a 5Hz sine wave of 1V amplitude to excite the sensor components. By comparing the sensor response over time you can check that your sensor is still within specification.

After running the calibration routine using the feature discussed earlier in this user manual, open the files from your SD card's continuous data archive that correspond to the time you performed the calibration to see how the sensor responded.

The original Gecko SMA-HR calibration response should look like this:



The 2020 Gecko SMA-HR Pro calibration response will have inverted signal on the horizontal components due to the inverted orientation of the sensors in the casing – this is normal.

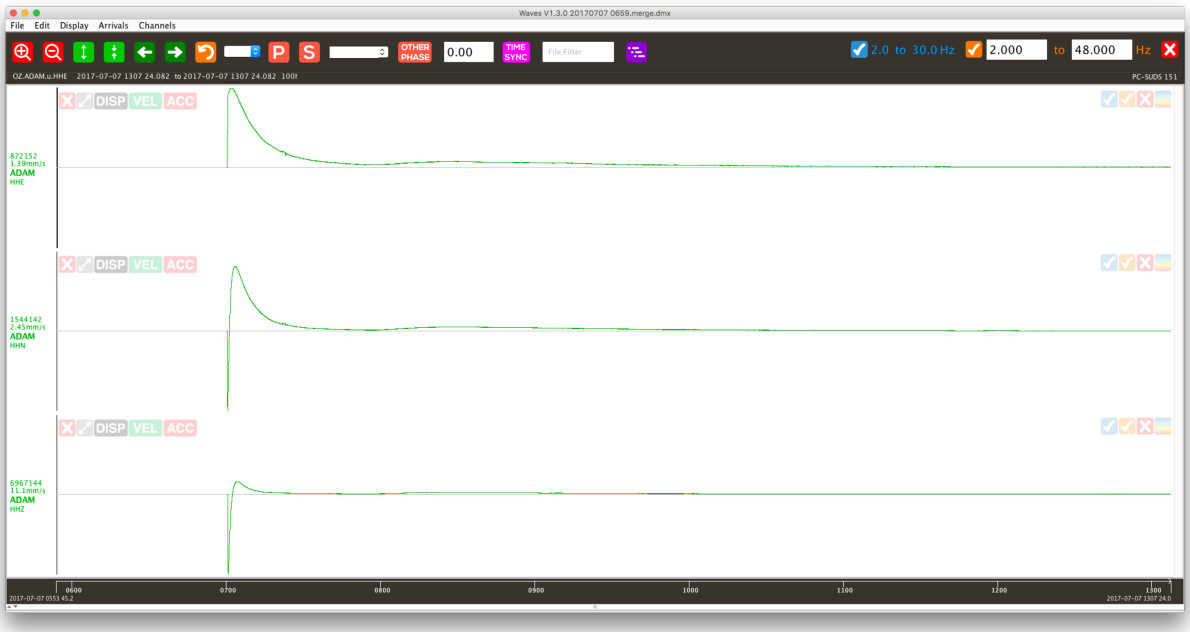
Remember that you can always rotate your signals in Waves during data analysis to correct for stations that were installed at an orientation where the arrow was not pointing North.

The Gecko Prism contains a very robust but very sensitive velocity sensor. Once the seismograph is powered on, be careful not to move the sensor. It should be bolted down to avoid accidental movement. If you accidentally knock the sensor and the signal levels start clipping, simply turn the unit off for a second and then on again to quickly settle the sensor.

Checking Prism Operation

After powering up your Prism, from the Home Screen it is recommended that you press the **Up** button twice to view the signal values to check that the sensor starts up correctly.

About 20 seconds after power is applied, the Prism sensor will start up, one channel at a time: East, North, then Up. Depending on the tilt, the signal values will shoot to a full scale (positive or negative 8 million counts) and it will then begin to settle to the zero level. The values may stay at the clip level for a few seconds as the sensor output has a greater range than that of the recorder, but you'll soon start to see the numbers heading towards a zero signal level. It takes about an hour for the integrators to settle and get close to the zero level, and a few hours to settle completely - see 6+ hour recording below.



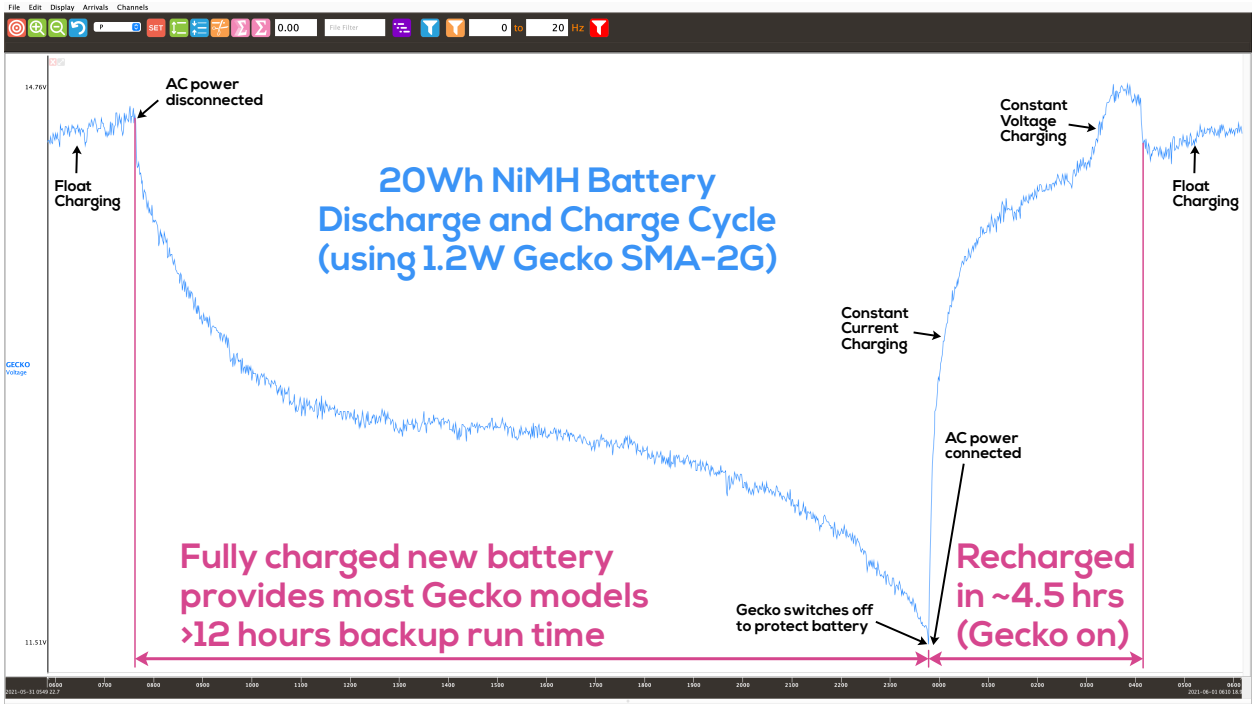
If one of the channel signals appears to be jumping around randomly, or if the sensor is making a regular clicking or buzzing sound, turn the Prism off and on again after a few seconds to restart the sensor initialisation routine. This state may occur if you knock or move the sensor excessively during the initialisation period.

Appendix B

Internal or External NiMH Battery

When the optional internal Nickel Metal Hydride (NiMH) battery is powering your Gecko recording system, to protect the battery from over-discharge a Low Voltage Disconnect (LVD) circuit is enabled to cut power to the Gecko if the voltage drops too low.

The battery pack is expected to run Gecko sensor models for several hours, with backup time depending on Gecko model and the state of battery charge when AC power is disconnected. When power is reconnected after the battery is discharged, the battery should be fully charged in under 5 hours while the Gecko is operating, after which time the regulator will keep a small float current flowing to the battery to offset the power that the system draws while running.



The battery pack is supplied with a 12V power supply plug pack that is compatible with 110-250V AC power sources, along with a NiMH charge regulator which is programmed to charge to battery pack in such a way as to maximise the life of the battery. The internal battery pack can still be charged even if the Gecko itself is switched off.

The AC plug pack outputs a DC voltage, but the charge regulator accepts power from any type of DC power source, from 10V to 70V DC. We recommend that the power rating of your DC supply should be at least 24W (2A @ 12V DC).

Charge Regulator

Rechargeable Nickel Metal Hydride (NiMH) batteries require a particular power delivery cycle for optimum charging and battery life. An unregulated power supply can provide a NiMH battery pack with charge, but without proper regulation the battery can become damaged from over-charging or over-heating. Please use the supplied charge regulator and AC plug pack to maintain battery condition.

Depending on the options ordered, the charge regulator may be supplied in a small weatherproof casing or packaged in a wall-mountable box containing other optional components. In either case, a single LED on the charge regulator provides the status of the charging cycle and displays any errors. Use the information below to decode the status of the charge regulator and the battery condition.

LED Patterns (routine)

Traffic light (Red-Orange-Green)	System reset. Occurs at power-on and when battery is connected
Slow Orange blink	System waiting. Battery disconnected
Solid Orange	Constant current phase
Orange with Green blink	Constant voltage phase
Solid Green	Charge Complete. Float Charge continues

LED Patterns (exceptions)

Three Red Flashes	Charge suspended. Battery voltage too low
Two Red Flashes	Charge suspended. Battery voltage too high
Slow Red blink (Once every 5 sec)	Charge suspended. Battery or PCB too hot
Fast Red blink	Thermistor error. Needs input power reset
Orange blink (Once every 0.5 sec)	Timeout
Solid Red	Fault. Needs input power reset

Appendix C

USR-W610 Ethernet & WiFi Adaptor

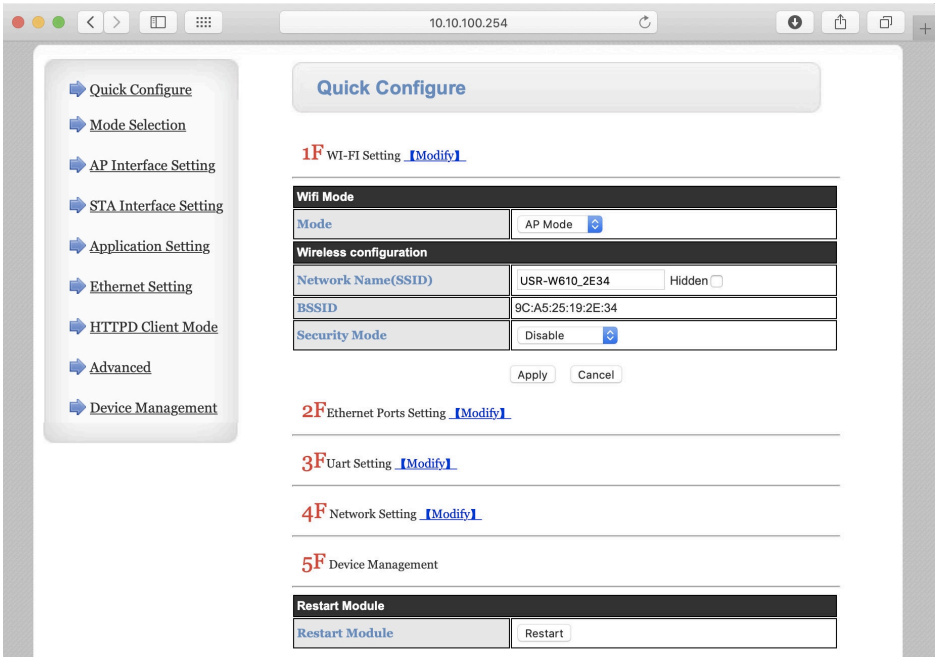
You can stream seismic data over a Local Area Network (LAN) or over the Internet in real time to our Streams application or to our cloud-based eqServer data management system. To do this you will need serial-to-Ethernet/WiFi adaptor. This adaptor is simple to configure and is included in the optional Gecko accessory that provide Power, Alarm & Communications in wall mountable box.

The "W610" adaptor is manufactured by USR IOT and uses web pages for configuration. The device allows an RS232 serial port to be routed to a virtual port on a remote computer, which our data reception software is monitoring for real time connections.

To communicate with the W610 using an Ethernet cable, connect your computer's Ethernet port into the LAN socket, ensuring your computer is set to be automatically assigned an IP address (DHCP, not manual IP). Your computer will likely be assigned the IP address 10.10.100.100. Then open a web browser and type **http://10.10.100.254/** into your web browser. When prompted, log in with username and password **admin** and **admin**.

To communicate with the W610 via WiFi, use your phone, tablet or computer to connect to a WiFi network called **USR-W610_XXXX** (where XXXX is a variable ID). No password is required. Once connected, open a web browser and type **http://10.10.100.254/** into your address bar. When prompted, log in with username and password **admin** and **admin**.

Quick Configure



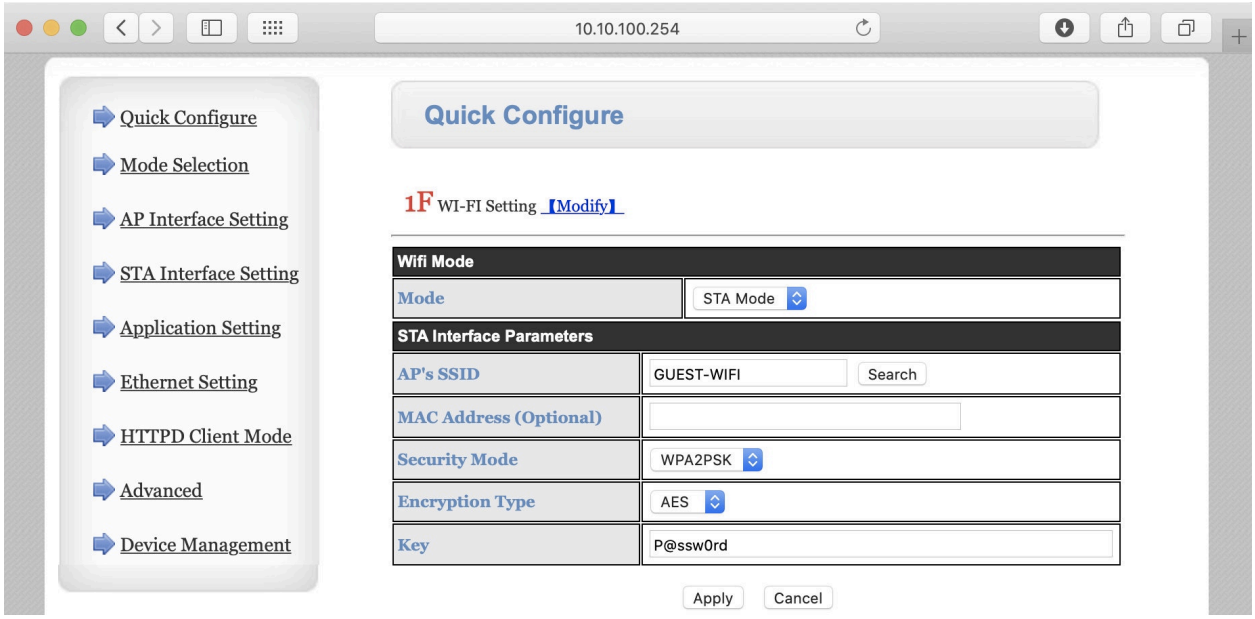
You will be presented with the web page shown here after logging in. The main configuration change required is under Quick Configure item 4F, where you specify the address and port number of the computer to which you are sending data.

If you need to assign the W610 a fixed Ethernet IP address, advanced users are able to work through the additional network settings in the left sidebar menu. If you are unfamiliar with these settings, please consult your IT Administrator for advice.

WiFi Settings

The first Quick Configure menu (1F) relates to configuring the WiFi feature of the W610, both when acting as an Access Point (AP) and as a Station (STA).

The first configuration that appears is for **AP Mode**, where you can modify the SSID name and enable security if required. By selecting **STA Mode** from the drop-down menu, the STA setup appears:

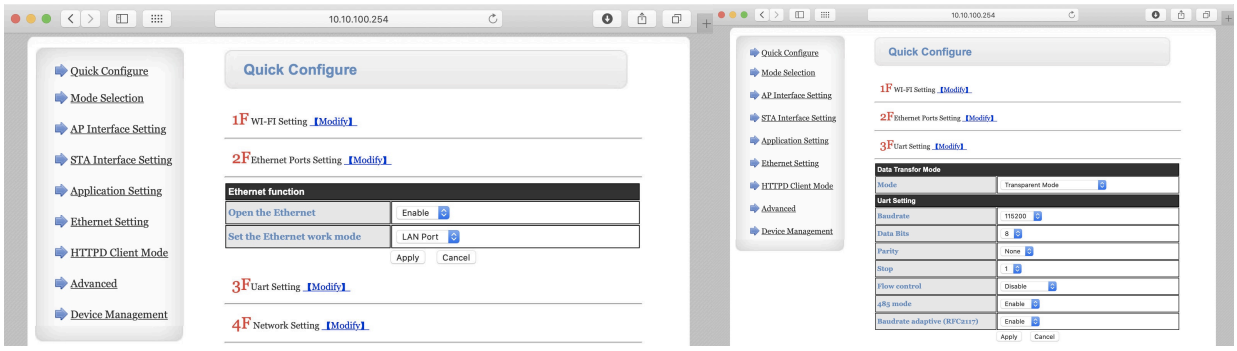


To connect the W610 to a local WiFi network, click on the Search button to scan for available WiFi Access Points, or type in a known Access Point's SSID. Enter the security settings as required. Once connected to an Access Point, the Gecko will be able to stream data over WiFi.

Ethernet Port and UART Settings (do not change)

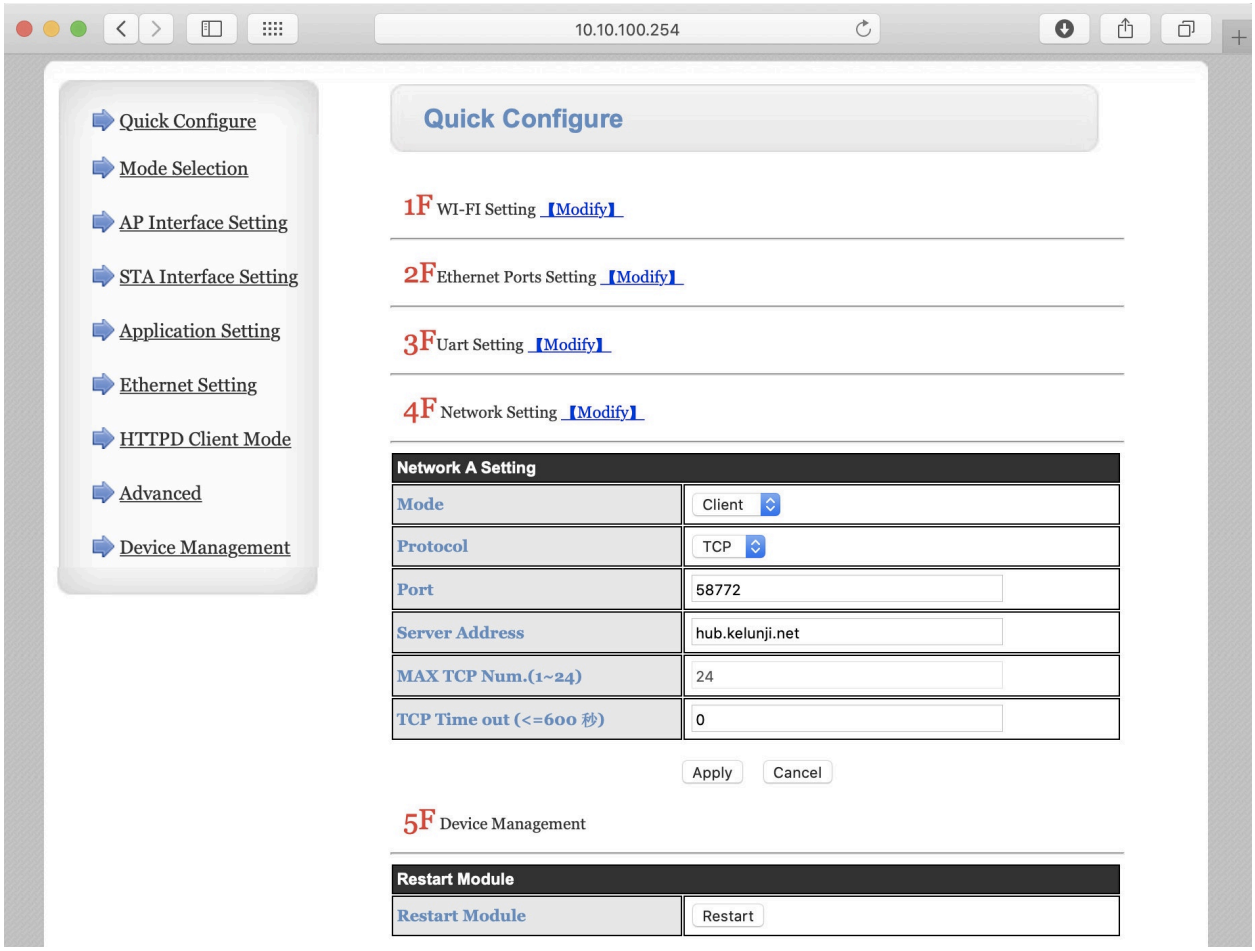
Do not change Ethernet port function (2F) as you should have it enabled and acting as a LAN port connection.

Do not change the serial port setup (3F) as the device is preconfigured to match the Gecko serial port settings. If you reset the W610 to factory defaults, you will need to change the baud rate to 115200 to match the Gecko's port speed.



Network Settings

Quick Configure 4F is the main item that will require configuration as it will define where you want to send the data stream.



Mode should be set to **Client**, protocol to **TCP**, and the default port for Gecko telemetry is **58772**. The address of the data reception computer is entered into Server Address. If you are running Streams on the same computer that you are using to configure the W610, the IP address of computer will probably be 10.10.100.100, but you can also type in a domain name (e.g. the SRC Gecko test server at hub.kelunji.net).

Once complete, use the Apply button to save your changes, then use the Restart button under item 5F to restart the W610 to start up the device in this new configuration.

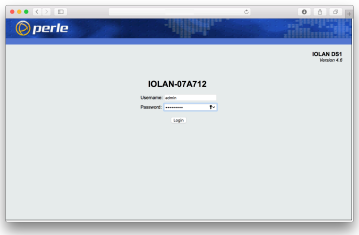
Troubleshooting

The most common issue related to data telemetry is caused by firewalls blocking the port used by the Gecko for data telemetry. This can be resolved by setting a rule that allows port 58772 through your firewall, or by turning off your firewall. Please consult your IT Administrator for assistance with firewall configuration if needed.

If data does not start appearing on Streams, check that your Gecko Telemetry setting is set to **Continuous** over **Serial** (or Ethernet – they are functionally identical).

Perle IOLAN DS1 Ethernet Adaptor

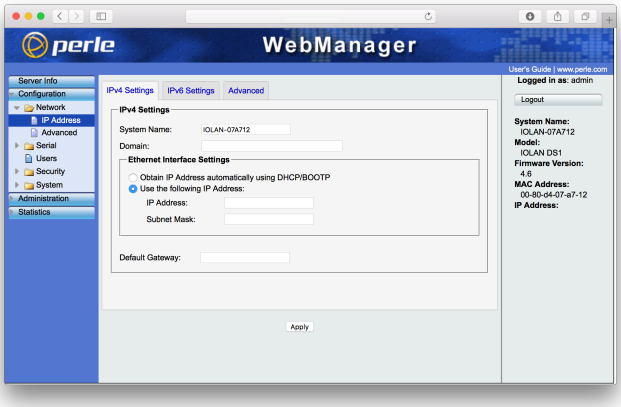
If you are using an older Perle "IOLAN DS1" Ethernet serial-to-Ethernet adaptor, configuration is also performed via web browser. To communicate with the DS1, set your



computer Ethernet settings to IP address 192.168.20.50 and subnet mask 255.255.255.0, then open a web browser and type **http://192.168.20.100/** into the address bar. When prompted, log in with username and password **admin** and **superuser** respectively.

Change IP address of the Ethernet adaptor

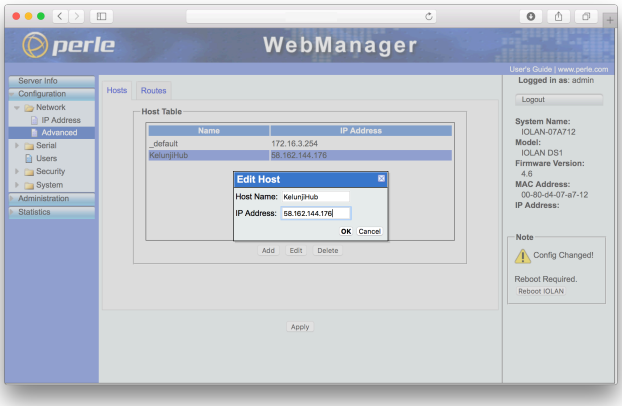
To set the IP address of the device to one that is compatible with your LAN, drop down the "Network" folder in the left side bar to view the network settings. Click on the "IP Settings"



button or icon in the side bar folder to edit the IP address, subnet mask, and gateway address. You can set the device to have a fixed IP address or you can set it to use DHCP to request an automatic address from your network. DHCP is the most common way computers connect to a LAN.

If you have set the device to use DHCP but are unsure what IP address it has been assigned, download the Device Manager software from perle.com and install it on a Windows PC to see the devices on your network.

Set the IP address of the remote data server



If you have chosen to run Streams on a computer on your local network, you'll need to set that computer's IP address as the destination "Host". In the left side bar menu, click on "Advanced" under the Network settings, then click on **KelunjiHub** in the Host Table to highlight it, then click the "Edit" button. A window will pop up allowing you to edit the Host address. Enter the IP address of the computer that is running Live Stream, then click "OK".

To apply the new settings, reboot the DS1 using the link at the bottom right of the screen.

Appendix D

Robustel R1511 4G Modem Router

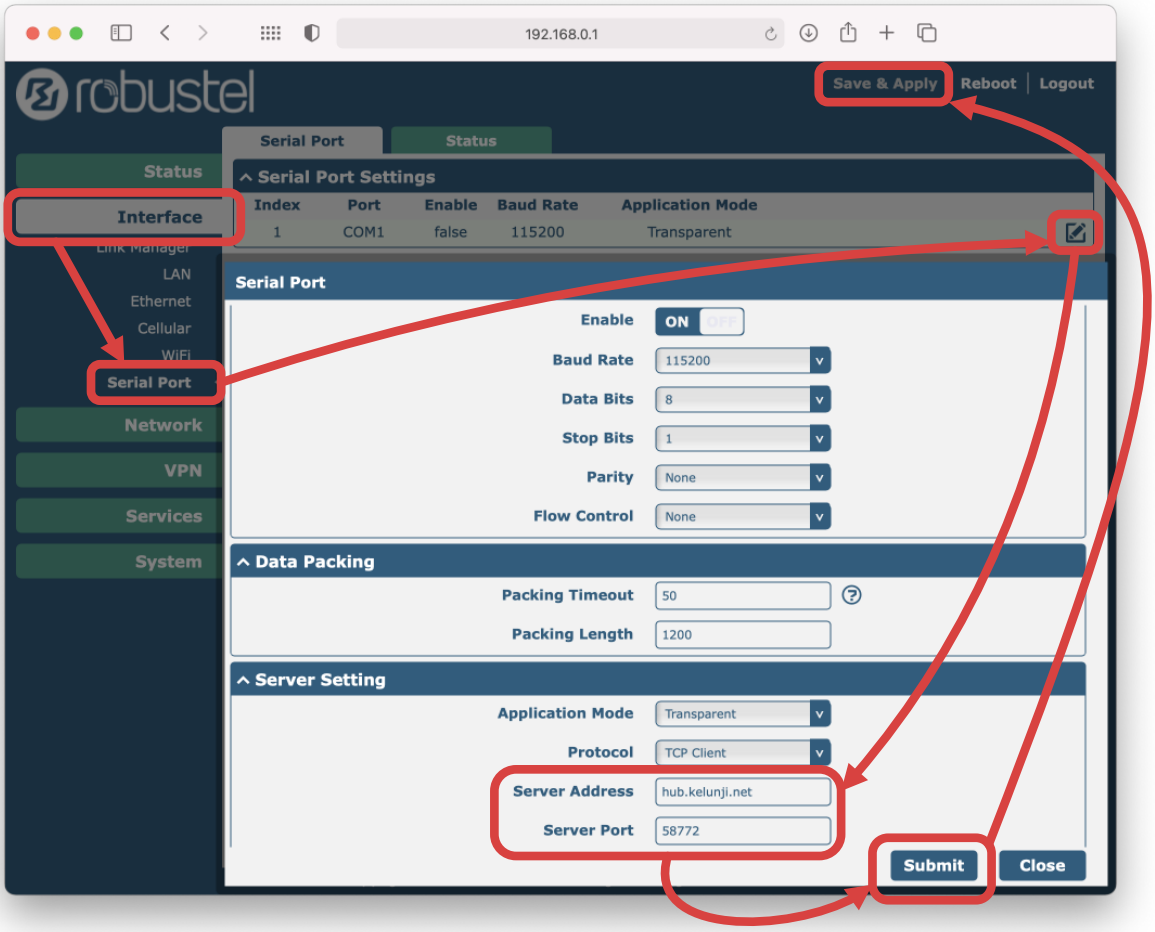
Like the USR-W610, 4G modem routers take the serial output from the Gecko and directs it to a TCP socket on a remote computer, which is configured via web browser.

Connect your computer's Ethernet port (set to DHCP) to the modem ETH0 port, then web browse to 192.168.0.1 and log in with username **admin** and password **admin**.

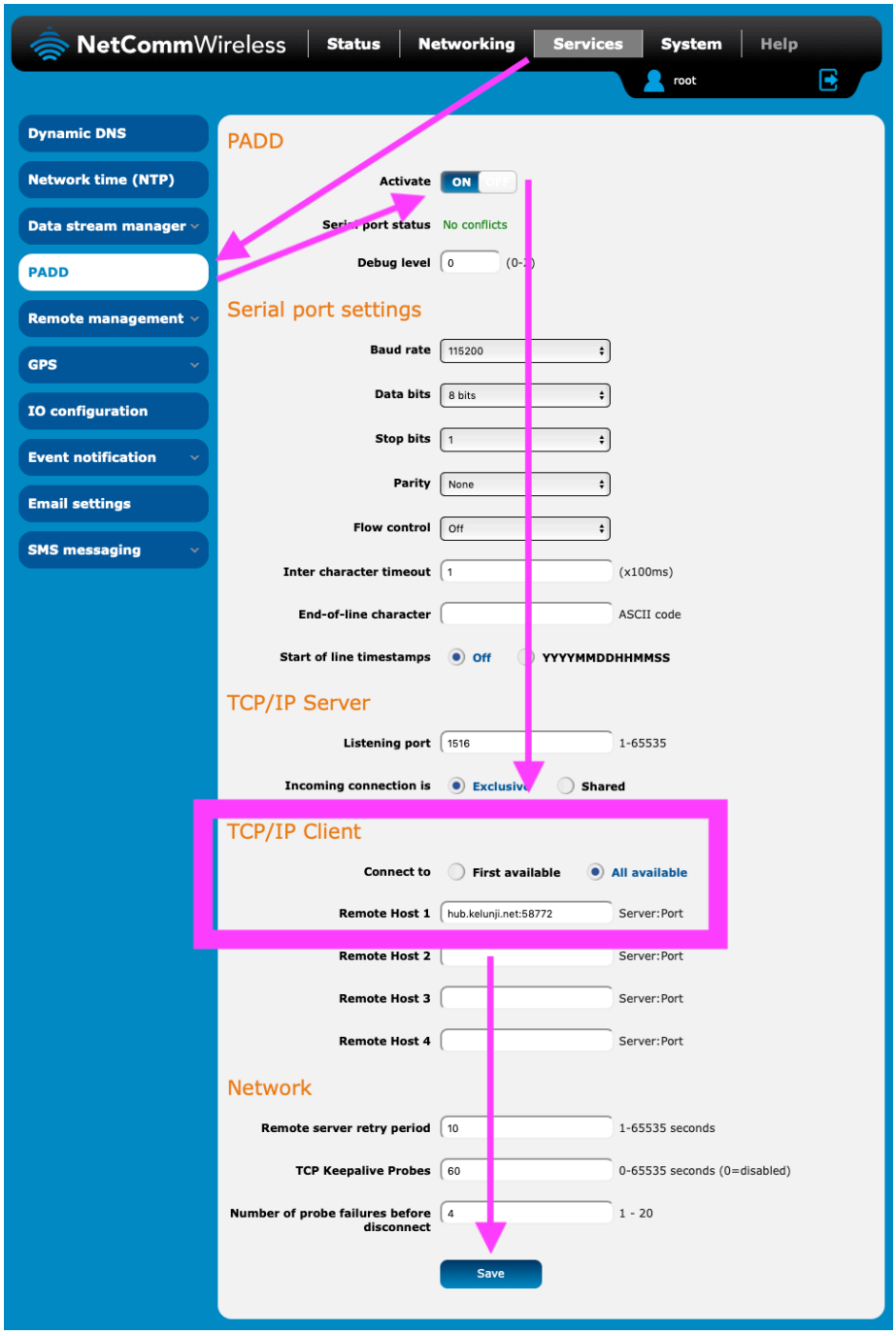
You define the location of your data reception computer under the Interface > Serial Port. Edit the COM1 port, Set Enable on ON, then scroll down to the "Server Setting" section and in the **Server Address** field enter the address of your data reception computer that is running Streams or eqServer (you can use *hub.kelunji.net* to test), and enter the **Server Port** connection number (default for Gecko, Streams and eqServer is 58772**)**

Transmit from Gecko (moulded ALTW cable blue wire) connects to Receive (RXD) on R1511, Receive (green) to TXD, GND (yellow)

Submit, then Save & Apply and Reboot to apply the new settings.



Netcomm NTC 221 4G Modem Router



The Netcomm NTC 221 is a 4G modem router. Like the USR-W610, it takes the serial output from the Gecko and directs it to a TCP socket on a remote computer.

Connect your computer's Ethernet port (set to DHCP) to the NTC 221's LAN port, then web browse to 192.168.1.1 and log in with username **root** and password **admin**.

You define the location of your data reception computer under the Services menu using the PADD setup in the left toolbar. Activate it, then under "TCP/IP Client - Remote Host 1" menu item enter the address of your data reception computer that is running Streams or eqServer, followed by a colon and the default Gecko port connection number, e.g. hub.kelunji.net:**58772**

If you wish to change the IP address of the NTC or use the additional networking and security features, the menu names should be recognisable to those familiar with network settings. If you are unsure, please consult your local IT support staff.

Save your changes and restart the device to apply the new settings.

GECKO SEISMOGRAPHS & ACCELEROGRAPHS

GECKO COMPACT

3+1 Channel
Digitisers
To Record
Any Brand
Of Sensor

BLAST, FORCE and SMA

Low Cost Portable
Velocity and
Acceleration
Vibration
Monitors

SMA-HR and -XR, TREMOR,
PRISM-SP, -MP and -LP

Professional
Earthquake
Seismographs
and
Accelerographs

src.com.au