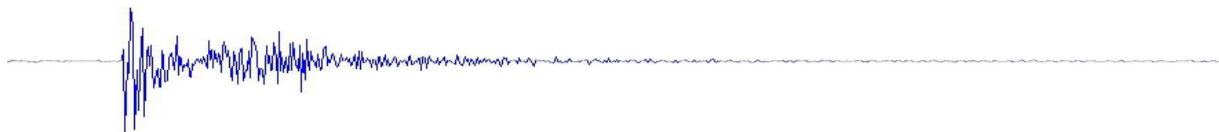


USER MANUAL



GEOtinyMK2 LOW POWER COMPACT DIGITAL SEISMOMETER



Revision	1.0
Firmware Ver.	TinyONGC_500
Last Update	August 2019





PT. EXACT GLOBAL TEKNOLOGI
INDONESIA *Authorized Agent*

Contact us

Wisma Monex 9th Floor, Jl. Asia Afrika 133-137,
Bandung 40112

Phone : 022 8732 1192
Mobile : 081 2886 3447 3
Fax : 022 8732 1001
Email : info@exactglobal.co.id

www.exactglobal.co.id

WARNINGS!!

DO NOT EXPOSE TO SUNLIGHT



DO NOT HEAT



DO NOT EXPOSE IN CHEMICALS



DO NOT SHOCK



DO NOT FORCE THE ANTENNA CONNECTOR

DO NOT APPLY OPOSITE VOLTAGE POLARITY

**DO NOT DICONNECT POWER BEFORE STOP ACQUISITION AND
SHUT-DOWN THE SEISMOMETER**

**DO NOT CONNECT – DISCONNECT INSTANTLY THEB POWER
SUPPLY. IF POWER IS CONNECTED, PLEASE LET SEISMOMETER
BOOT UP, CONNECT TO THE WEB INTERFACE AND SHUT-DOWN
PROPERLY**

**ALWAYS REMEMBER EACH NEW IP ADDRESS YOU SUBMIT TO
THE UNIT. THERE IS NO WAY TO RECOVER IP ADDRESS SO YOU
WILL PERMANENTLY LOOSE CONNECTION**

**READ OPERATION MANUAL CAREFULLY AND CONTACT
MAMUFACTURER IF MORE DETAILS ARE REQUIRED**

Table of Contents

Section 1

Introduction	1-1
1.1 General Description	1-1
1.2 Specifications.....	1-2

Section 2

System Interface	2-1
2.1 LED Indicators	2-1
2.2 Bootloader Button	2-2
2.3 Memory Card Socket	2-2
2.4 Connectors	2-2
2.5 Buttons	2-2

Section 3

Web Interface	3-1
3.1 Configuration	3-1
3.2 Options	3-1
3.2.1 System & Network	3-2
3.2.2 Data Acquisition	3-5
3.2.3 Credentials	3-11
3.2.4 Stream & Trigger Archive	3-13

Section 4

Deployment	4-1
4.1 Making the external connections	4-1
4.1.1 GPS Antenna	4-1
4.1.2 POWER Cable	4-2
4.1.3 ETHERNET Cable.....	4-2
4.2 Running	4-2
4.3 Connectivity	4-4
4.4 Testing	4-5
4.5 Troubleshooting	4-6

Appendix

A. Connectors	A-1
B. SOH Message	B-1
C. Acknowledgments	C-1
D. Quick Setup.....	D-1

Section

1

Introduction

The GEOTiny seismometer is a compact, ultra-low power and cost-effective digital acquisition device. It is consisted by three parts: digitizer, seismic sensor and recorder.

1.1 General Description

The digitizer is based on an extremely high-performance, 24bits analog-to-digital converter (ADC) and it is fully optimized for working with a compact of three component seismic sensor. The sampling rate can be set to 1, 50, 100, 200, 250 and 500 samples per second. It supports on board accelerometer. All the data samples are organized into data blocks and transmitted to the recorder either directly from the internal memory of the digitizer or after storing them on the external memory card.

The recorder of the GEOTiny system is based on an ARM board running Debian operating system. The SeedLink protocol is used for data transmission over the Internet or private circuits that support TCP/IP. The data can be also recorded locally, into the removable memory card in Mini-SEED format. The recording capacity of the card depends on the user's preferences. Web interfaces are also available to provide the configuration settings of the device.

The instrument is equipped with an internal GPS receiver which synchronizes a high precision Phase Locked Loop (PLL) to UTC time in order to maintain stable and accurate time reference over a long period. The PLL is synchronized in a manner such that the first sample in the data is aligned to beginning of the second of the UTC time.

Power is applied through an over-voltage and false polarity protection network. Input voltage ranges from 9-18 VDC, typical current is 90 mA at 12.6 VDC. The power consumption is extremely low, allowing the equipment to operate for long time period connected to a typical 12V/55Ah battery without the need of recharging.

The GEOTiny is intended for installation in harsh environments and is supplied in a small aluminum case. Light indicators on the top of the case show the instrument's operating status.

1.2 Specifications

DIGITISER	
Number of analog channels	3
A/D converter	Fourth Generation, Delta-Sigma, 24 bits resolution
THD	-125Db
Modulator	Fourth Generation, 4th order Delta-Sigma Modulator
Filter	Programmable SINC filtering, auto-calibration function
Input resistance	Up to 80 MOhms differential (depending on data rate settings)
Sampling Rate	1, 50, 100, 200, 400, 500
Power	9-18Vdc , 0.9W
Autonomy	One week powered from a 12V/9Ah battery, 36days powered from a 12V/55Ah car battery.
RMS noise	127dB @ 100sps.
DATA RECORDING	
Media	MicroSD flash card up to 64GBytes
Data file type	Mini-SEED
Information file	State Of Health UDP packet, log file
Recording mode	Continuous, Triggered
TIME BASE	
Type	12 channels GPS receiver/DPLL
Accuracy	Time: +/-1usec to UTC time pulse, +/-5 meters to position
Timing Sources	Ultra low drift DPLL unit using TCVCXO, RTC
DPLL drift	Less than 17usec between one hour GPS cycles
COMMUNICATION	
Telemetry	Ethernet port, WiFi
Connectivity	SeedLink protocol
LED	Five high brightness LEDs
INTEGRATED FORCE-BALANCE SENSOR ELECTONICS	
Bandwidth	10sec – 50Hz, 5sec – 50Hz, 1sec – 50Hz, 4.5Hz – 50Hz
Technology	Overdamped Geophone (Lippmann method)
Sensitivity	1500V/m/sec using force-balance electronics.
PHYSICAL (DIGITISER/RECORDER WITH INTEGRATED SENSOR ELECTRONICS)	
Size	130mm Diameter, 115 mm height
Weight	3.9kgr
ENVIRONMENT (DIGITIZER/RECORDER)	
Temperature range	-20 to +70 °C
Humidity	100%, IP67 enclosure
ACCELEROMETER	
Type	MEMS , three axis
Noise level	150ugRMS
Range	+/-2g standard, +/-4g, +/-8g, +/-16g optional
GEOPHONES	
Type	4.5Hz
Distortion	0.3%
Resistance	3750hm
Sensitivity	28.8V/m/s
Typical spurious frequency	140Hz

Section

2

System Interface

The GEOTiny interface consisted of several components that are located inside or outside of the unit. The function of each one of them is described below:

2.1 LED Indicators

The unit provides five led indicators. All of them are placed on the top side of the device. They are named DATA, ERROR (ERR), GPS, TRAFFIC (TRAF) and LINK. If one of these LED indicators is permanent on, a fault condition is met.

The **DATA LED (WHITE)** indicates the status of the digitizer. It turns on every time that a new data block is ready for transmission to the recorder and it is turned off at the end of the transmission. Normally, the DATA LED blinks once per second. If MIN_LATENCY operation mode is selected, this LED blinks too fast following the data flow, so it looks like be slightly on.

The **ERROR LED (ORANGE)** represents a warning or fault condition if it is permanent on. Normally, it is permanent off.

The **GPS LED (BLUE)** represents the state of the GPS receiver. It illuminates when the GPS receiver is on and searching for a lock condition, while the GPS LED is turned off when the GPS receiver is locked to the UTC time.

The **LINK LED (YELLOW)** indicates the status of the Ethernet network. It illuminates when the network is up, while it is turned off when the network is down. The **TRAFFIC LED (GREEN)** is also related to the Ethernet network as it represents the network activity.

2.2 Bootloader Button

The digitizer firmware can be updated through the web interface and there is no need to use the bootloader button.

2.3 Memory Card Socket

There are two memory card sockets. Each of them has been provided to accept a microSD card. Special care must be taken while inserting or removing the memory card. Although the memory card socket provides side fuse to avoid wrong orientation of the card, if the user applies more force, while trying to insert it with wrong orientation, the fuse will break. As a result, the card will be inserted with wrong orientation, causing permanent damage to the instrument. In case that the user wants to swap the card, he has to press slightly the card inwards the socket. The card will be released, and it can be removed. Then he should insert a new card into the socket with the label facing down (assuming horizontal and normal position of the instrument) and slide the card into the slot until a click is felt or heard.

Note: EXCHANGE OF THE MEMORY CARD MUST BE DONE ONLY WHEN THE SYSTEM POWER IS OFF.

2.4 Connectors

The design of GEOTiny datalogger focused at easy installation. There are two connectors on the top side of the unit that allow easy, hermetically sealed and watertight connection of the cables. The first one provides connection to the GPS antenna while the second one provides connection to the power supply unit and the Ethernet network.

See Appendix A for pin numbering of connectors.

2.5 Buttons

The GEOTiny datalogger is equipped with 2 buttons at its top that control the restart/shutdown of the data logger and the start/stop of the acquisition process. More precisely, the button that is close to the power connector controls the system restart/shutdown. In a stable (>500msec) but short (<3sec) press, it instructs a RESTART and in a longer press (>3sec) a system SHUTDOWN. In a similar way, a stable (<500msec) but short (<3sec) press of the other button is a START command for the data acquisition and processing chains that are configured to start at boot, while a longer press (>3sec) is a STOP command.

Section 3

Web Interface

Although the user can modify manually (i.e. through command-line SSH) the GEOTiny device parameters located into the various configuration files, the instrument provides also a web interface to assist the user in setting up a consistent configuration environment and prevent malfunctioning due to wrong settings.

3.1 Configuration

The GEOTiny operates as a single seismic station that can transmit data over a private or public network. The data communication protocol is based on SeedLink. The configuration process involves selecting appropriate values for parameters that define the operation of the network, the SeedLink server and the digitizer.

3.2 Options

The station's web interface may be reached by default at the following address:

`https://192.168.1.3:9091`

The non-secure version of http is disabled by default but can be subsequently enabled through the relevant configuration field – although this is not recommended without

a strong reason. At the beginning, all browsers will complain about unsecure and untrusted connection, but it is safe to proceed, even if the address bar remains at red – section 4.2.3 describes the right way to correctly configure the needed certificates and overcome this “red” condition. Typing both username and password is required to modify the system settings. The default values are:

Username= “**admin**”, password= “**geobit**”.

Once the credentials have been correctly provided, the top-level configuration page will appear. This is the device configuration home page and it is directly accessible from any other child page by clicking over the large red device header (i.e. the “GEOTiny! Compact Digital Seismometer” logo in the following figure).



Contents

- [System & Network](#)
- [Data Acquisition](#)
- [Credentials](#)
- [Stream Archive](#)
- [Trigger Archive](#)

In most of the settings the web interface will not allow changes while the Seedlink data server is active, however it is strongly advised to stop the data server (from *Data Acquisition* page) before changing anything, as well as to reboot the machine (from *System & Network* page) after the last change is completed.

By default, all parameter changes are applied only after pressing the relevant SUBMIT button and activated after reboot, unless otherwise noticed.

3.2.1 System & Network

The *System & Network* page consists of three panels that can be expanded or collapsed by clicking over the blue $\pm$ symbol at the left of the panel’s header.

The **System** panel allows to Reboot or Shutdown the device, as well as to set the basic operating mode after reboot, which is one or a combination of three distinct functionality blocks, that is:

Basic Stream: Activates the standard continuous Seedlink data stream (Seedlink server) accessible from port 18000 (unsecure) or

18001 (secure over SSL-tunnel)

Triggered Stream: Activates the triggered Seedlink data stream, where data flow only after a triggering signal has been received. The triggering signal may come from a network source (e.g. a centralized decision server) or may be produced locally by the relative trigger detection functionality. The triggered stream is available at port 19000 (unsecure) or 19001 (secure over SLL-tunnel)

Trigger Detection: Activates the trigger detection mechanisms producing the triggering signal that will be either used locally to directly trigger the above-mentioned Triggered Stream functionality, or sent to a remote server for centralized triggering decisions.

The parameters of each functionality block can be changed through the *Data Acquisition* page.



GEOTiny!
Compact Digital Seismometer

± System

Boot Mode

Basic Stream:

☒

Triggered Stream:

☐

Trigger Detection:

☐

Persistent Logs:

☐

SUBMIT

REBOOT

± Shutdown

± Network

Firmware Update

UPLOAD

Choose File

No file chosen

From the **System** panel the user may also configure the persistence of system logs, that is whether the linux system logs are preserved between device reboots or not. In

the former case, the SD card is used to store the system logs, thus allowing also for larger storage space compared to the RAM-based storage of non-persistent logs. In both cases, the logs are cyclically overwritten. It is advised to keep the non-persistent default setting in order to avoid unnecessary SD card wear.

The *Persistent Logs* change is applied immediately after pressing SUBMIT, however it is recommended to also reboot the machine after this.

The **Network** configuration panel appears in the following figure and the IP related parameters are rather straightforward, requiring a basic knowledge of a typical IP interface configuration.

WARNING: *In the case of wrong Network parameter settings, the system may become unreachable.*



GEotiny!
Compact Digital Seismometer

+ System

+ Network

Hostname:	GBT3
Mode:	Static
Static IP address:	192.168.1.3
Netmask:	255.255.255.0
Gateway:	192.168.1.1
DNS:	192.168.1.1
NTP:	☐
NTP Server(s):	pool.ntp.org
PTP:	☐
SSH:	☒
HTTPS Only:	☒
Wireless Access:	☐
Country & Channel:	GR 6
WAN Router:	☐
SUBMIT REFRESH	

Firmware Update

No file chosen

The *NTP Server(s)* field may receive multiple servers separated by a single whitespace character, or may be empty at all, if only the local GPS should be used as NTP source. For the latter to be valid, the NTP must be enabled, the GPS must be enabled and the GPS Cycle must be set to 0 (from the Data Acquisition page).

The *HTTPS Only* checkbox refers to the (de)activation of the clear HTTP access of the web configuration interface at hand. When not installing at secure and private links, it is strongly recommended to keep the default setting of the latter (i.e. “*HTTPS Only*” checked).

The functionality of the PTP checkbox depends on the NTP choice: if both are selected, the device becomes a PTP master, distributing the NTP received time to PTP slaves in the network, otherwise, if only PTP is selected, the device becomes a PTP slave.

The *Wireless Access* checkbox enables the embedded WiFi Access Point with the node’s name as SSID, at the channel and region selected by the following fields. The *WAN Router* checkbox enables the forwarding of data between the wireless AP and the backend WAN connected to the Ethernet port.

Finally, the *Firmware Update* panel allows for the remote update of the digitizer’s firmware.

3.2.2 Data Acquisition

The *Data Acquisition* page consists of four panels. The ***Digitizer & SeedLink Stream Server*** panel is the main data acquisition functionality configuration panel. The parameters will be set once the “SUBMIT” button is pressed and the web page has been refreshed showing the new value of the parameters.

All related parameters appear in the following table:

Name	Description
Sampling rate	100 sps (based on filtering of a raw 200sps stream)
GPS cycle	GPS cycle in minutes.
Digitizer Buffer	Controls whether the digitizer will use the SD card (SD_CARD) or its internal memory (INTERNAL) as data buffer, or no buffer at all (MIN_LATENCY)
MiniSEED Packet	Controls the size of the MiniSEED packets. Values other than the standard (512) are intended to support low latency data streams but require adaptations at the client side (e.g. earthworm’s slink2ew.d SLRecSize parameter value). If this value is changed, the seedlink server’s segment buffers need to be cleared too, by using the CLEAR BUFFER button.
Enable on-board	Enables / Disables the digitizer’s on-board accelerometer

Accelerometer	
Network Description	A short description of the network where the station will be used.
Network ID	Seismic Network identifier (only two characters allowed)
Station Name	SeedLink station name (only five characters allowed)
Station Description	A short description of the seismic station
Channels Prefix	Seismic Channel identifier (only two characters allowed)
Use Location Code	Controls whether the seedlink stream will use also a location code, together with the network, station and channel codes (SCNL)
Location	The (2 char) location codes for the 3 channels of the main stream, as well as of the 3 channels of the triggered stream (see Triggered Seedlink Chain panel below)
Archive	Controls whether acquired data will be archived to the SD or not
Archive Keep	In case of active archiving, it controls the number of days the stored data will be kept in the SD

For further explanation of the digitizer-related parameters, the user may refer to section 2.3.1 of this manual.

Note: *Any digitizer parameters change will cause a reset to the digitizer. The digitizer will be restarted automatically and operate according to the new acquisition parameters.*



GEOtiny! Compact Digital Seismometer

+ Seismometer

+ Digitizer & SeedLink Stream Server

Seedlink Server is running

Sampling Rate:

▼ sps

GPS cycle:

▼ min

Digitizer Buffer:

▼

MiniSEED packet:

▼ bytes

Enable on-board Accelerometer:

☒

Network description:

Network ID:

Station Name:

Station description:

Channel Prefix:

Use Location Code:

☐

Location:

Archive:

☒

Archive Keep:

days

[± Triggered SeedLink Chain](#)

[± Trigger Detection](#)

The **Triggered SeedLink Chain** panel controls the operation of the secondary Seedlink stream server that outputs data only after a triggering signal has been produced or received.



GEOTiny!

Compact Digital Seismometer

[± Seismometer](#)

[± Digitizer & SeedLink Stream Server](#)

[± Triggered SeedLink Chain](#)

Seedlink Chain is running

Pre Trigger: min

Post Trigger: min

Local Trigger: ☒

Subscribe Network Trigger: ☐

Trigger Server:

Archive: ☒

Archive Keep: days

[± Trigger Detection](#)

All related parameters appear in the following table:

Name	Description
Pre Trigger	The time (in minutes) of the signal output immediately preceding the triggering time.
Post Trigger	The time (in minutes) of the signal output immediately following the triggering time.
Local Trigger	The local trigger detection mechanism controls the triggered stream output.
Subscribe Network Trigger	A centralized decision server controls the triggered stream output
Trigger Server	The IP address of the trigger decision server
Archive	Controls whether triggered data will be archived to the SD or not
Archive Keep	In case of active archiving, it controls the number of days the stored triggered data will be kept in the SD



GEOTiny! Compact Digital Seismometer

[± Seismometer](#)

[± Digitizer & SeedLink Stream Server](#)

[± Triggered SeedLink Chain](#)

[± Trigger Detection](#)

Trigger Detection is running

LTA Time: sec

STA Time: sec

Decimation Factor:

Ratio:

Quiet:

Trigger History:

Time Tolerance: sec

Publish Network
Trigger: ☐

Trigger Server:

The **Trigger Detection** panel controls the parameters of the signal-processing block that detects a triggering condition, based on Earthworm's implementation of the Carl Johnson's STA/LTA algorithm¹. All related parameters appear in the following table:

¹ http://www.earthwormcentral.org/documentation/ovr/carltrig_ovr.html

Name	Description
LTA Time	The Long Term Average (LTA) parameter (in sec)
STA Time	The Short Term Average (STA) parameter (in sec)
Decimation Factor	The decimation factor used in averages
Ratio	The Carl Johnson's algorithm Ratio parameter
Quiet	The Carl Johnson's algorithm Quiet parameter
Trigger History	The history length (in number of triggers) used to filter out duplicate triggers
Time Tolerance	The time tolerance (in sec) used to filter out duplicate triggers ²
Publish Network Trigger	Enables the transmission (publication) of the trigger detection signal to a centralized trigger decision server
Trigger Server	The IP address if the trigger decision server

Finally, the **Seismometer** panel is provided in case that a broad-band sensor is connected.



GEOTiny!
Compact Digital Seismometer

± Seismometer

LOCK
UNLOCK
CENTER
AUX_COMMAND

± Digitizer & SeedLink Stream Server

± Triggered SeedLink Chain

± Trigger Detection

3.2.3 Credentials

The *Credentials* page consists of two panels. The **Administrator Credentials** panel changes the user account's password for the web interface (the *admin* user). Notice

² <http://www.earthwormcentral.org/documentation/ovr/statrigfilter.designspecs.txt>

that this is a third, non-linux system account, separate from the *sysop* and *root* accounts that need command-line access (i.e. through SSH) to change their passwords.



GEotiny! Compact Digital Seismometer

Administrator Credentials

Old Password:

New Password:

Retype New :

X.509 Certificate

Self-Signed [Chain](#) ☒

CN DNS:

CN Lock IP: ☒

CN Alternative IP:

The **X.509 Certificate** panel provides an interface for device-level certificate creation, as well as access to the default root certificate of the Geobit SRI32 product line, as a simple and fast way to overcome the various browsers' complains and regain a fully trusted, "green" address field. This certificate chain may be used as is, or it may be completely replaced by any other enterprise certificate scheme.

As a first step, the user has to click over the "Chain" link inside the panel, in order to download the root certificate and install it locally in the root certificate storage of the operating system or browser. Be aware that for some operating systems this storage is not the default storage proposed by the OS (as it happens with the MS Windows OSs) and the user must explicitly select it in order for the process to work. After installing it once, it will work for all other Geobit's SRI32 devices. However, an additional step is needed for each SRI32 device after changing its IP address and/or the DNS name through which it is accessed. A new device certificate has to be regenerated by clicking to the REGENERATE button, using the panel's parameters according to the following table:

Name	Description
CN DNS	Additional DNS hostname through which the node is accessed. By default, the hostname configured through the System & Network page is always added to the certificate.
CN Lock IP	Enables the inclusion of the node's IP address in the certificate. Must be checked if the node is accessed through an IP address and not through a DNS hostname.
CN Alternative IP	By default, if the CN Lock IP field is checked, the local IP address is always encoded to the certificate, so this field may be left blank. However, if the web interface is accessed using a different IP address (e.g. the node is behind a NAT router), then this field must contain the NAT router's IP address.

It must be noted that before a new certificate is regenerated, a valid IP address and a hostname must be active; therefore, this cannot be done at the same time with IP/hostname change and a separate reboot might be needed.

3.2.4 Stream & Trigger Archives

The *Stream Archive* and the *Trigger Archive* pages provide web access to the archived continuous or triggered data streams, respectively, organized under a “one file per day per seismic channel” directory structure. The lifetime of each file, i.e. the depth of the archive history, is controlled by the *Archive Keep* fields of the relative panels under the *Data Acquisition* page, as described in section 4.2.2.

By clicking on the ‘+’ sign at the right of each archive file, the device allows to extract a specific time window from the large file, in order to support more efficient downloads.



GEOTiny!
Compact Digital Seismometer

Trim Archive

File :	HP.GTN2.00.SHE.D.2018.3
Start Time :	00:00:00.00
End Time :	00:00:10.00
EXTRACT	

4

Section

Deployment

The GEOTiny datalogger is designed for easy installation in harsh environments. In this section the features that must be considered by the user during the installation of the instrument will be presented.

4.1 Making the external connections

Install the instrument at the recording site, preferably on a flat, solid surface. If it is necessary use the adjustable legs that are at the bottom of the instrument to regulate the case of the instrument as close as to horizontal position. The arrow with the N mark that is on the top of the instrument must be oriented to the North Pole. It is recommended to use a compass during the installation.

Note: Any deviation in the horizontal position of the instrument or in the orientation of the instrument to the North Pole will affect the quality of the produced data.

Once the instrument has been installed, the user should proceed to the external connections of the device. There are two different connectors on the top side of the instrument: a connector that provides 6-pins for the POWER connector and ETHERNET CONNECTOR, and a GPS connector (see Appendix A).

4.1.1 GPS Antenna

Connect the antenna cable to GPS connector before power up the instrument. Ensure that the screws on the GPS connector are fully tightened to ensure a watertight seal. Position the antenna at a place ensuring best satellite signal reception at the given recording site, preferably at/above the free surface outside the seismometer vault, as far as possible away from shielding bodies like massive walls, parapets etc. It is advisable to provide some protection from the sun in hot climates. A white fabric cover or shield is quite suitable and will not reduce satellite visibility. The same applies to the GEOTiny unit itself. It is possible for the unit to reach this temperature in moderate climates if it is left in the sun. Try to avoid direct sunlight.

The GPS antenna is a small magnetic surface mount active antenna. The standard cable length is 3 meters, but it can be extended to 30 meters. The device can work with any similar more than 26dB gain antenna.

Note: It is very important to be noted here that the antenna works much better when it is mounted over a metal surface as the GPS lock time is much less.

4.1.2 POWER Cable

The instrument requires a simple 9-18 VDC power source. Connect a nominal 12 Volts battery to the POWER connector using the power cable of the equipment. The red wire (“+”) of the cable must be connected to the positive pole of the power supply while the black wire (“-”) must be connected to the negative pole (GND) of the power supply. Reverse connection may damage the instrument.

The user must ensure that the power source is in good condition in order to supply with current the instrument for a long time. A power source in bad condition will be exhausted very soon and the instrument may malfunction in an unpredictable way.

4.1.3 ETHERNET Cable

The ETHERNET connector provides connectivity of the device to network. This is the major feature of the GEOTiny datalogger which allows the user to have the full control of the device remotely. Generally, the ETHERNET port of the device is connected to a data Modem (but this is not the scope of this manual).

4.2 Running

Once the user has applied an acceptable voltage to the instrument, it will automatically start operating. At the beginning diagnostic tests are executed and the results are perceived by the user through the LED activity. Because the tests last only a little, the user must pay special attention to the flashing sequence of the LEDs. At the end of the tests all LEDs must be off. If a LED is on, it means that an error has occurred. In the event of a significant error, the system will stop functioning until the cause of the fault has been removed. At the end of the test, the BLUE LED will turned on (indicating that the GPS has been activated) and Ethernet LINK& TRAFFIC LEDs will blink indicating a network connection.

At the beginning of the self tests, all LEDs are turned on. If there are not, the power of the device has failed. Therefore, check the power supply as well as the power connection of the instrument. If the voltage level of the power supply is acceptable then the internal power supply of the instrument should have been damaged and the user must contact GEObit Company for further instructions.

As a guideline, the voltage level of the power supply should be more than 12 Volts. If the voltage level is less than 12 Volts but more than 11 Volts, a “Low Battery” condition is considered. If the voltage level becomes lower than an acceptable level (11 volts), the user should replace the battery as **the system will not boot**.

If the operation of the instrument starts successfully, first of all the communication between the controller and the memory card will be tested. If it fails, both LED ERROR and LED DATA will be permanently on. This happens if the memory card is not inserted correctly or is not configured as FAT32. In that case, the user must remove the memory card, identify and fix the cause of failure. If the communication channel test is successful, then the ERROR LED turns off.

Then, the validity of the data controller operation parameters is checked. These parameters are stored in the initialization file on the controller's memory card. If for any reason the initialization file does not exist or is incorrect, the LED DATA remains on, indicating to the user that the device operation will continue with the default parameter values. However, if the data controller reads a valid initialization file from the memory card, the LED DATA will be turned off.

The next step of the self tests involves the communication channel between the controller and the on board PLL. If it fails, the ERROR LED will be permanently turned on while the DATA LED will be turned off. That means that the communication channel between the controller and the PLL is broken. In that case, the user must contact GEObit Company for further instructions.

The final step of the self tests is the accelerometer control, which includes presence monitoring and accelerometer programming. This check is carried out if the user has chosen to operate the device with an accelerometer. If the test fails, then the ERROR LED will turn on and remain permanently on but the device will not stop operating. The LED ERROR informs the user that the device will continue to operate without an accelerometer. The LED ERROR will go off when the GPS unit locks for the first time.

After the end of the self tests, the instrument enters in the normal operation mode. Both GPS receiver and GPS LED are turned on. As soon as a GPS lock condition is met, the PLL is successfully adjusted to the UTC time and both GPS receiver and GPS LED turn off. The GPS receiver remains off for time that is depended by GPS Cycle parameter in order to reduce the power consumption of the instrument.

If a GPS lock condition cannot be achieved for a long time, the user must check the GPS antenna installation and the connection of the GPS antenna to the instrument. If the error persists, the user must contact GEObit Company for further instructions.

Once PPL is synchronized with UTC world time and PPS (Pulse Per Second) signal, the digitizer begins to acquire data samples. All data is organized into packets. The first sample of each packet is aligned with the PPS signal. The digitizer can transmit a data packet to the recorder either directly from its internal memory (MINIMUM_LATENCY) or after storing the packet on the external memory card (MEMORY_CARD). Also, packet delivery can be started after it has been completed with data samples of one second (INTERNAL, MEMORY_CARD) or less than one second (MINIMUM_LATENCY).

This depends on the user's preferences. The DATA indicator illuminates according to the data transmission rate. For example, the LED DATA blinks once per second if the INTERNAL or MEMORY_CARD mode is selected. At MINIMUM_LATENCY mode, the LED DATA flashes at a fast rate, making it appear dimly flickering.

4.3 Connectivity

When the unit starts operating in normal mode, the user must check the internet connectivity from a console. The OS of the GEOTiny datalogger supports SSH connections. The user can't be connected as root for safety reasons but as sysop (initial Username: "**sysop**", password: "**sri32geobit**") using any SSH terminal console (e.g. TeraTermPro).

```
Linux GBT1 4.9.35-rt23 #3 PREEMPT RT Thu Nov 2 17:09:48 EET 2017 armv5tej1
***** Geobit SRi32 Digitizer & Data Logger *****

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

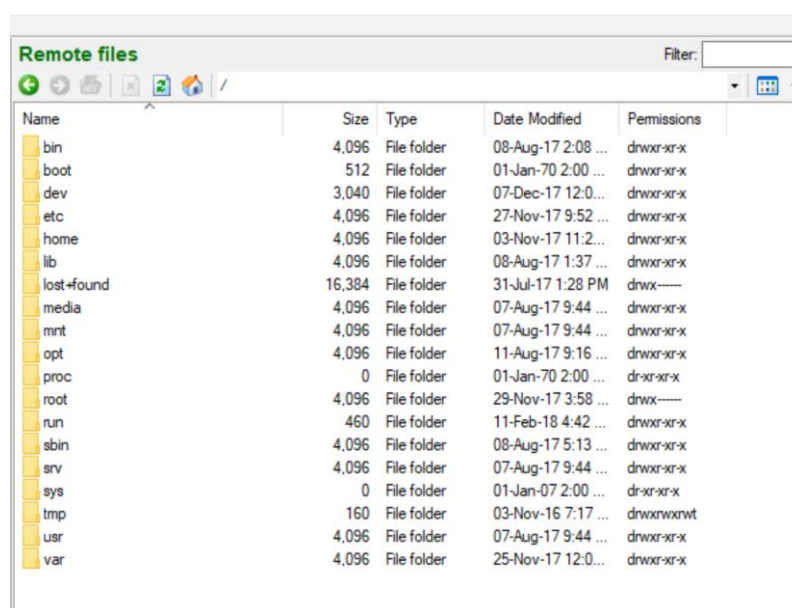
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

This product includes software developed by the GEOFON devel group (GFZ)

This product includes software developed by the Earthworm Software Users Group

Last login: Fri Jan 19 19:55:58 2018 from 79.166.36.102
sysop@GBT1:~$
```

SFTP connection are also supported. The user can be connected as sysop (initial Username: "**sysop**", password: "**sri32geobit**") using any SFTP terminal (e.g. WinSCp).



The screenshot shows the 'Remote files' window of WinSCP. It displays a directory listing of the root directory of the GEOTiny datalogger. The columns are Name, Size, Type, Date Modified, and Permissions. The files listed are:

Name	Size	Type	Date Modified	Permissions
bin	4,096	File folder	08-Aug-17 2:08 ...	drwxr-xr-x
boot	512	File folder	01-Jan-70 2:00 ...	drwxr-xr-x
dev	3,040	File folder	07-Dec-17 12:0...	drwxr-xr-x
etc	4,096	File folder	27-Nov-17 9:52 ...	drwxr-xr-x
home	4,096	File folder	03-Nov-17 11:2...	drwxr-xr-x
lib	4,096	File folder	08-Aug-17 1:37 ...	drwxr-xr-x
lost+found	16,384	File folder	31-Jul-17 1:28 PM	drwx-----
media	4,096	File folder	07-Aug-17 9:44 ...	drwxr-xr-x
mnt	4,096	File folder	07-Aug-17 9:44 ...	drwxr-xr-x
opt	4,096	File folder	11-Aug-17 9:16 ...	drwxr-xr-x
proc	0	File folder	01-Jan-70 2:00 ...	dr-xr-xr-x
root	4,096	File folder	29-Nov-17 3:58 ...	drwx-----
run	460	File folder	11-Feb-18 4:42 ...	drwxr-xr-x
sbin	4,096	File folder	08-Aug-17 5:13 ...	drwxr-xr-x
srv	4,096	File folder	07-Aug-17 9:44 ...	drwxr-xr-x
sys	0	File folder	01-Jan-70 2:00 ...	dr-xr-xr-x
tmp	160	File folder	03-Nov-16 7:17 ...	drwxrwxrwt
usr	4,096	File folder	07-Aug-17 9:44 ...	drwxr-xr-x
var	4,096	File folder	25-Nov-17 12:0...	drwxr-xr-x

4.4 Testing

If the internet connection of the device is ready, the user can verify the installation of the equipment by reviewing the data acquisition. This can be done using a real time data viewer such as Seisgram. The user must take care to the configuration of the program viewer according the instructions of the developer. For example, the following parameter must be set to Seisgram in order to retrieve data from the SRI32S:

```
"C:\Program Files (x86)\SeisGram2K\SeisGram2K.exe" -seedlink  
"192.168.1.3:18000#HP_GBT1:???.D,#100"
```



4.5 Troubleshooting

In this section are presented common error causes and user actions that must be taken.

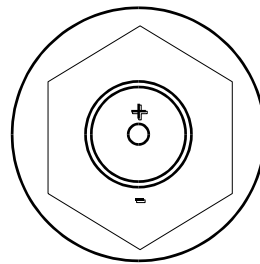
Error	Cause	Action
No light indication comes on after the power supply has been applied.	Bad power supply	Check power source
Both DATA LED and ERROR LED indicators are permanent turned on.	• The memory card is not present. • The memory card has not been properly inserted. • The memory card is not usable (FAT32).	• Check memory card and the INI.TXT file • Replace memory card if it is necessary.
The DATA LED is permanent ON (It is turned off when the GPS turns on)	The INI.TXT file is corrupted	Set the parameters value using the Web Interface of the device
The GPS LED is permanent ON	Bad GPS signal	Check GPS installation
The ERROR LED is permanent on while the DATA LED is off and the GPS LED is on.	The communication channel between the digitizer and PLL is broken (Fatal Error).	Reset the instrument and if the error persists, contact with technical team.
The ERROR LED is permanent on while both DATA LED and GPS LED are off.	The communication channel between the digitizer and the accelerometer is broken. The instrument will continue to operate without the functions of the accelerometer.	Reset the instrument and if the error persists, contact with technical team.
The DATA LED is permanent turned ON or flashing at abnormal rate.	• The settings of the INI.TXT file are different from the settings that are provided by the web page interface. • The sampling rate is too high according to the selected baud rate.	• Replace the INI.TXT file settings with the settings provided by the web interface (Avoid editing the INI.TXT file manually unless instructed to do so). • Adjust the baud rate according to the sampling rate. It is recommended to use the highest baud rate which is 230400 bits/sec.

Appendix

A

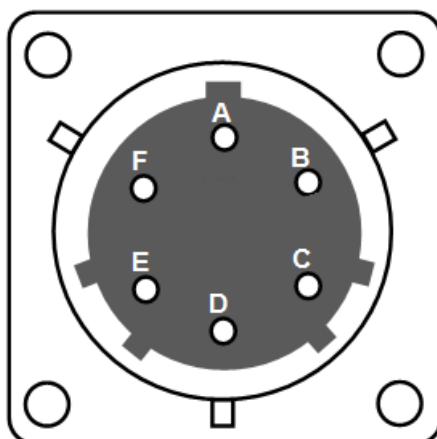
Connectors

GPS: *Part No. SMA*



Pin	Signal
+	IN
-	GND

Communication: *Part No. PT02A-10-6P (025)*



Pin	Description
A	+12V DC
B	0V (Power Return)
C	NETWORK_TXD+
D	NETWORK_TXD-
E	NETWORK_RXD+
F	NETWORK_RXD-
CHASSIS	GND



SOH Message

The SRI32S device provides the State Of Health (SOH) sentence under request. The transmission is taking place over UDP protocol. The SOH request keyword is the "GEOBIT_SOH" string and must be transmitted over UDP to the instrument's IP address on communication port 50000.

The instrument upon receiving the SOH request string, sends a SOH message as a reply. The message starts with an identifier being followed by the system parameters, all commas separated. The message is consisted by 18 fields:

SOH,GBT4,GPS,110219,114105,3817.7917N,02148.6520E,1,1,400,100,10,224,15,31,27,12126,Tiny 10.0.0

1. **<SOH>**: Each sentence starts with the SOH character string
2. **<GBT4>**: The name of the station as described in the initialization file
3. **<GPS>**: Character string indicating if time comes from GPS or real time clock RTC (GPS or RTC, respectively).
4. **<110219>**: Date
5. **<114105>**: Time
6. **<3817.7917N>**: Latitude being followed by the direction (N or S)
7. **<02148.6520E>**: Longitude being followed by the direction (E or W)
8. **<1>**: GPS TDOP (time accuracy)
9. **<1>**: GPS PDOP (position accuracy)
10. **<400>**: Sampling rate of the analogue channels (samples-per-second)
11. **<100>**: Sampling rate of the accelerometer (samples-per-second)
12. **<10>**: GPS activation cycle (minutes)
13. **<224>**: Device ID*
14. **<15>**: Device Mode*
15. **<31>**: Accelerometer status*
16. **<27>**: Device temperature (°C)
17. **<12126>**: Voltage of the power supply (mVolts)
18. **<Tiny 10.0.4>**: Firmware Version

* These fields only make sense for the technical support team in the event of incorrect operation of the instrument.

Appendix



Acknowledgements

The programs included with the Debian GNU/Linux system are free software; the exact distribution terms for each program are described in the individual files in `/usr/share/doc/*/copyright`.

This product includes software developed by the GEOFON devel group (GFZ)

This product includes software developed by the Earthworm Software Users Group

Appendix



Quick Setup

A. Acquisition parameters configuration

1. Connect GPS antenna, Sensor, Ethernet cable and last apply Power.
2. Allow instrument to get synchronized with GPS time (see 2.2)
3. Connect to the data-logger web interface at (or to the provided one):

https://192.168.1.3:9091
Username= "admin", password= "geobit".



GEObit
GEObit
Compact Digital Seismometer

Contents

- [System & Network](#)
- [Data Acquisition](#)
- [Credentials](#)
- [Stream Archive](#)
- [Trigger Archive](#)

4. Go to Data Acquisition section and if you want to make any changes, first **STOP** the seedlink server

+ Seismometer

+ Digitizer & SeedLink Stream Server

Seedlink Server is running

Sampling Rate: sps

GPS cycle: min

Digitizer Buffer:

MiniSEED packet: bytes

Enable on-board Accelerometer: ☒

Network description:

Network ID:

Station Name:

Station description:

Channel Prefix:

Use Location Code: ☐

Location:

Archive: ☒

Archive Keep: days

+ Triggered SeedLink Chain

+ Trigger Detection

5. Make changes and press **SUBMIT**. The digitizer will reboot but not the linux system.
6. Go again to Data Acquisition section and **start manually** the seedlink server. It does not automatically start after manual stop.

B. Network Settings Configuration

1. If you want to change network parameters, at first **stop** the seedlink server and then go to System & Network section.



± System

± Network

Hostname:

GBT3

Mode:

Static ▼

Static IP address:

192.168.1.3

Netmask:

255.255.255.0

Gateway:

192.168.1.1

DNS:

192.168.1.1

NTP:

☒

NTP Server(s):

pool.ntp.org

PTP:

☐

SSH:

☒

HTTPS Only:

☒

SUBMIT

REFRESH

Firmware Update

UPLOAD

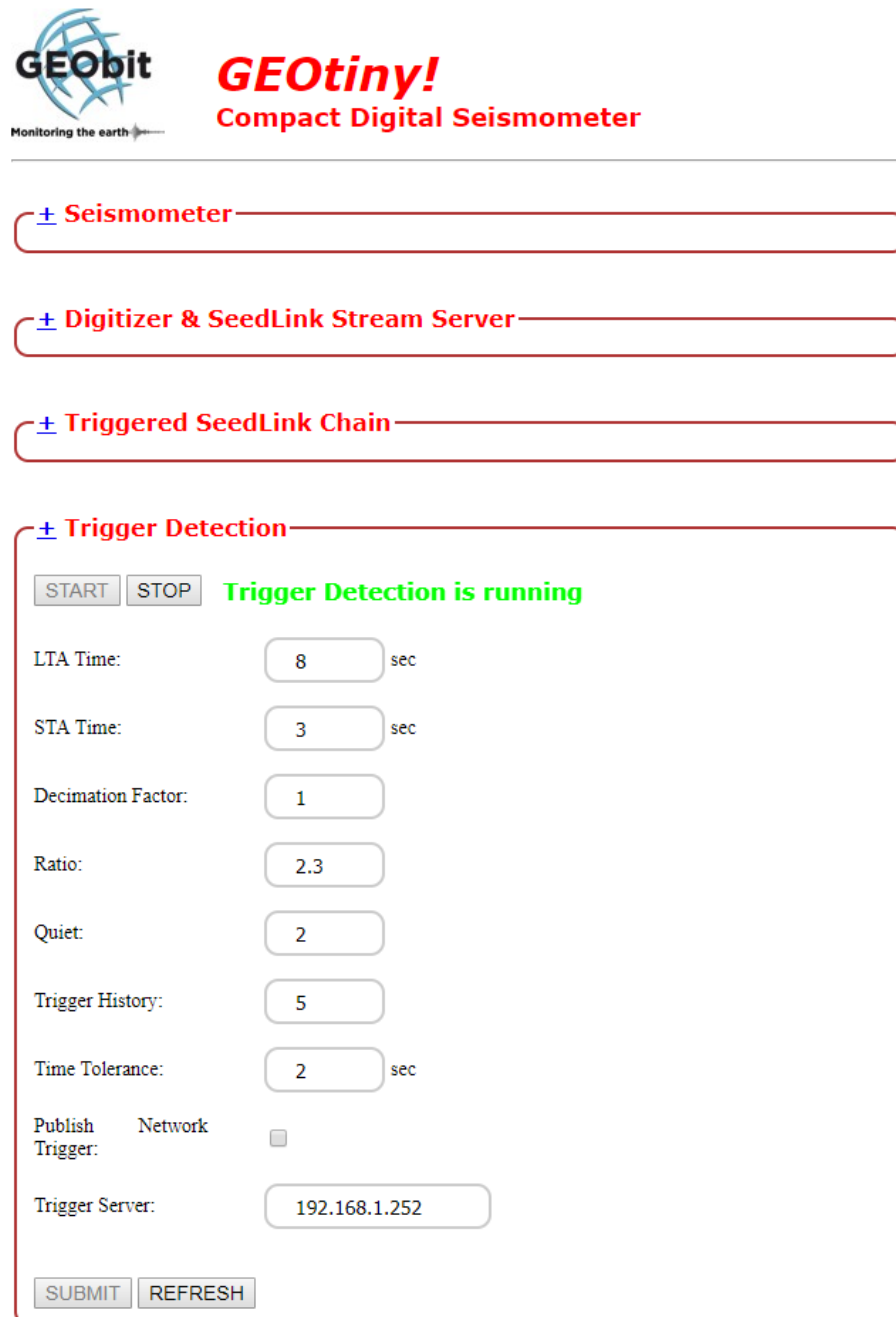
Choose File

No file chosen

2. Apply changes, press **SUBMIT** and then **REBOOT** the linux for enable the new network parameters. Note that after reboot, the seedlink server will automatically start, depending on the Boot Mode parameters of the System panel. LCD will show the new parameters as being set.

C. Trigger Parameters Configuration (if trigger detection is required)

1. **Stop** the seedlink server and go to Data Acquisition / trigger detection section
2. Set triggering parameters and press **SUBMIT**



3. Go to Data Acquisition / trigger seedlink chain, set parameters and press submit.

[± Seismometer](#)

[± Digitizer & SeedLink Stream Server](#)

[± Triggered SeedLink Chain](#)

Seedlink Chain is running

Pre Trigger:

min

Post Trigger:

min

Local Trigger:

☒

Subscribe Network Trigger:

☐

Trigger Server:

Archive:

☒

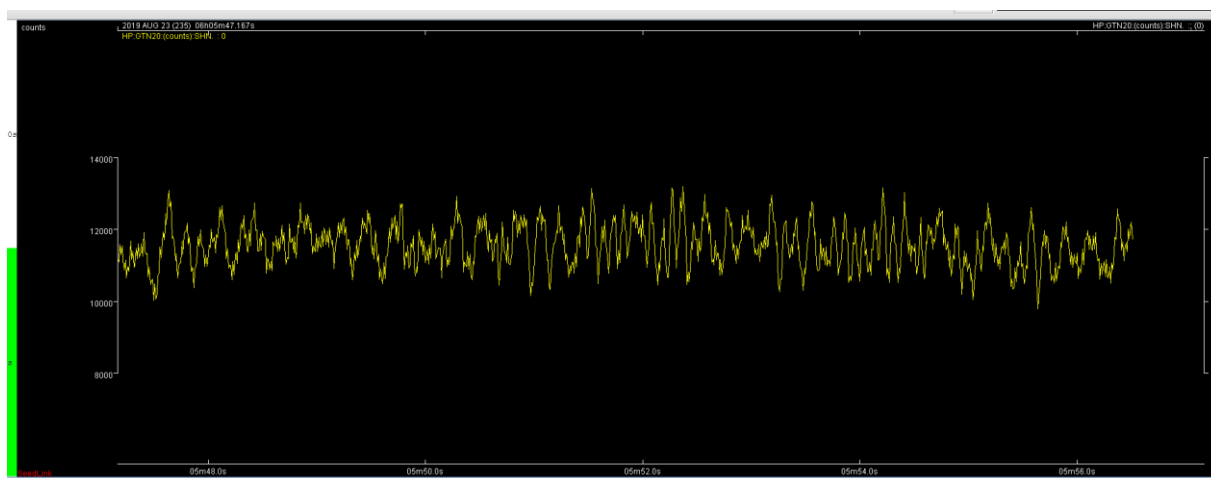
Archive Keep:

days

[± Trigger Detection](#)

4. Start servers manually and/or make appropriate Boot Mode selections at the System panel, for automatic activation.

- 1000



0 0 1 1

- 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

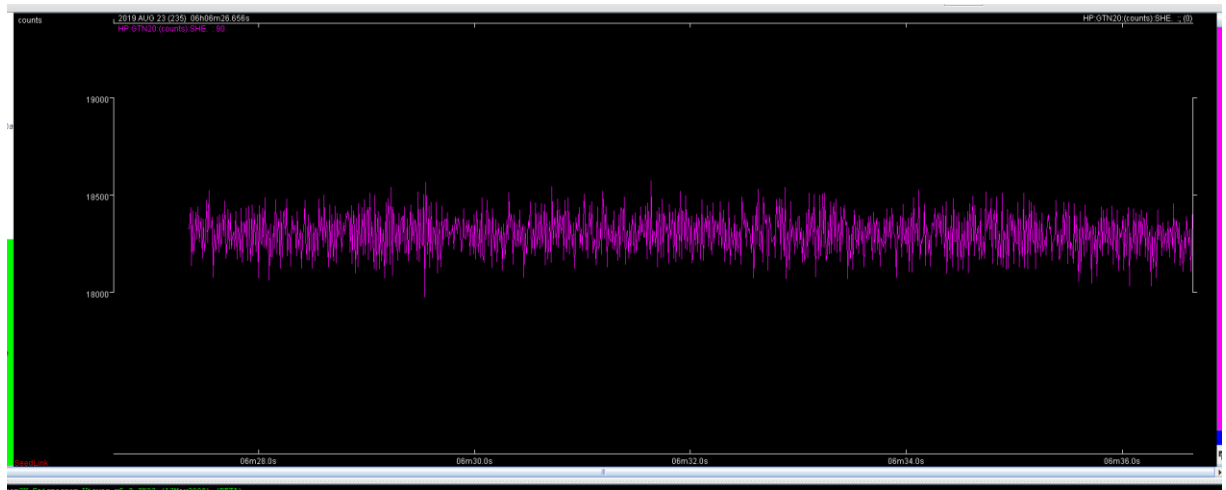


Figure E2. Signal from a NON-proper leveled seismometer.

4. If that happens, the user has to change the leveling of the sensor at the direction of the axis that the miss-leveling happens until the signal becomes as figure E1 shows. In this example, miss-leveling occurs at E-W direction (East component) so the user must change leveling ONLY for this axis. Firstly he must try to level rotating the relevant leg clockwise and if not proper leveling will be achieved, he has to try rotating the leg counterclockwise.

5. After proper leveling the signal will become as E1 figure plots

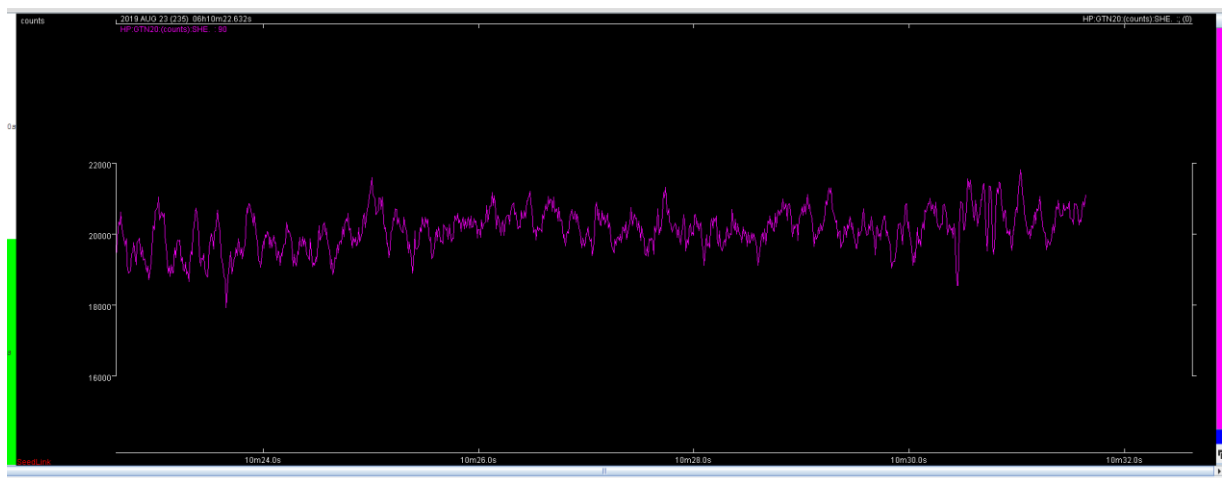


Figure E3. Signal from a proper leveled seismometer after leveling correction.