

MINIMUS

CAPTURE. PROCESS. DISTRIBUTE.

- > Ultra compact and low-power digitiser
- > Compatible with analogue seismic or geophysical sensors
- > Advanced software communications for quick and easy instrument and data management
- > Hot-swappable and dual-redundant microSD storage
- > Choose from GPS, GLONASS or BeiDou precision timing sources
- > Optional low-latency mode for Earthquake Early Warning

Minimus

The Güralp Minimus is a small, portable, 24-bit, four-channel digitiser packed with a host of features that make it the ideal plug-and-play solution for rapid deployments.

MINIMUS DIMENSIONS:



MINIMUS PROFILE SHOWN ACTUAL SIZE



MINIMUS SIMPLIFIES REMOTE GAIN SELECTION ON THE GÜRALP FORTIS ACCELEROMETER

Multidisciplinary functionality with simple instrument and data management.

The Minimus simultaneously accommodates an analogue seismic sensor; an auxiliary input e.g. for infrasound feed; a Radian posthole or borehole instrument; and its own internal MEMS accelerometer (2g).

Integrated network connectivity allows the Minimus to be controlled remotely using Güralp Discovery, our software platform, or via a standard web browser. Discovery allows the user to identify the instrument IP address via a Cloud registry server eliminating the need for static IP addresses.

Discovery also allows for simpler instrument and data management with access to hardware State-of-Health (SoH); data streaming; GNSS location; instrument response and calibration values.

For added confidence during deployments, Güralp Vü, a Bluetooth App, displays waveforms, orientation, temperature and humidity data, for instant checking of installation integrity.

Key features

24-bit, four-channel digitiser

Compact form measuring 136 mm × 99 mm × 39 mm and weighing just 674 g

Compatible with any analogue seismic sensor, plus additional simultaneous capacity for infrasound sensor *and* digital feed from Radian posthole or borehole

Internal 2 g MEMS accelerometer

Low-latency mode for Earthquake Early Warning - when used with GDI protocol, transmission can be achieved in 40 ms (network dependent)

Identification of IP address via Discovery and Cloud registry server

Remote instrument and data management via easy to use Discovery software

Bluetooth Android App for installation integrity checking available for both Android and IOS devices

Hot-swappable data storage and dual-redundant microSD cards

Select from GPS, GLONASS or BeiDou precision timing sources

Scream!™ compatible

Versatile streaming and filtering options.

Users can select sample rates of up to 5000 samples per second with the option to simultaneously stream multiple sample rates in addition to the recording rate.

Data are locally recorded in miniSEED (with metadata stored in dataless SEED format) and can be streamed in realtime using GCF (Scream!), GDI-link and SEEDlink.

For Earthquake Early Warning applications, the Minimus has a low-latency mode running causal filters alongside traditional acausal filters. When used with our GDI protocol this low-latency mode means network transmission can be achieved in 40 milli-seconds (network dependent).

Data storage is hot-swappable for uninterrupted data retrieval with dual redundant microSD cards to ensure data integrity.

Encased in an environmentally sealed, hard anodised aluminum casing to withstand the harshest environments, the Minimus has an internal humidity sensor to alert you to any moisture ingress.

Applications

- > Earthquake Early Warning Systems
- > Volcanology
- > Multi-scale seismic networks
- > Structural health monitoring
- > Hydrocarbon exploration
- > Permanent reservoir monitoring
- > Induced seismicity detection
- > Explosion monitoring

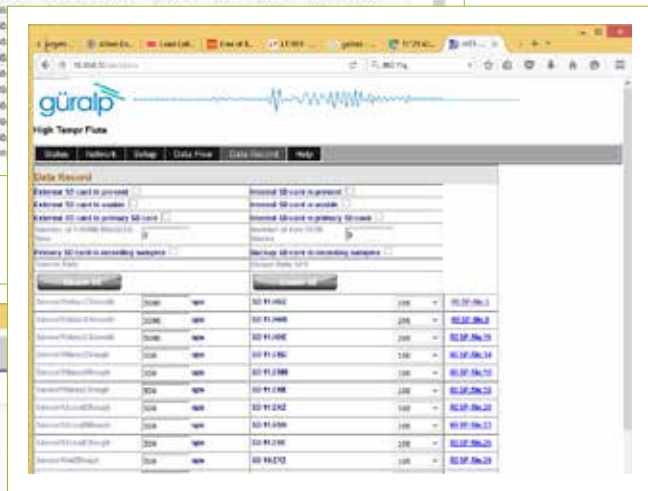
Minimus: Guralp Discovery Software

- > Identify instrument IP address
- > Access to hardware State of Health
- > Data streaming control
- > Access instrument RESP files
- > Fully interactive waveform viewer

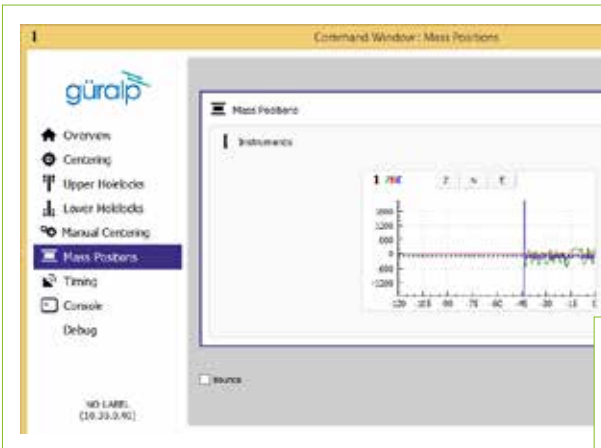
Status	Label	System	Manufacturer	Serial	Firmware Ver	WAN Address	LAN Address	Network	Uptime	Last Contact	Latitude	Longitude	Altitude	GPS Quality	
0	Active	NO LABEL	DAS	DAG-4054C	4054c	1.0-2205	10.30.0.23	10.30.0.23	255-255.0.0	14 days 8 Hrs	Last None	0.0000	0.0000	0.00 m	0%
7	Active	NO LABEL	Flute	HTF-8193	25426	0.00-7960	10.30.0.75	10.30.0.75	255-255.0.0	5 days 8 Hrs	Last None	51.3817	-1.1540	113.30 m	100%
8	Active	NO LABEL	DAS	MNA-7789	20400	0.00-8025	10.30.0.54	10.30.0.54	255-255.0.0	5 days 8 Hrs	Last None	51.3812	-1.1540	113.40 m	100%
9	Not Responding	NO LABEL	DAS	RAMBLER-7785	30600	0.00-8018	10.30.0.54	10.30.0.54	255-255.0.0	00/0/18	Last None	0.0000	0.0000	0.00 m	100%
10	Not Responding	NO LABEL	Flute	RAMBLER-8055	26787	0.00-8025	10.30.0.50	10.30.0.50	255-255.0.0	00/0/18	Last None	51.3812	-1.1540	114.20 m	0%
11	Active	NO LABEL	Flute	HTF-8055	26787	0.00-8025	10.30.0.50	10.30.0.50	255-255.0.0	5 days 5 Hrs	Last None	51.3817	-1.1540	109.40 m	100%
12	Not Responding	NO LABEL	Flute	RAMBLER-8955	26965	0.00-8089	10.30.0.72	10.30.0.72	255-255.0.0	00/0/111	Last None	0.0000	0.0000	0.00 m	100%
13	Not Responding	NO LABEL	Flute	MNA-8055	20965	0.00-8085	10.30.0.72	10.30.0.72	255-255.0.0	00/0/35	Last None	0.0000	0.0000	0.00 m	100%
14	Not Responding	NO LABEL	Unknown	NORMAN-5055	26965	0.00-8118	10.30.0.72	10.30.0.72							
15	Not Responding	NO LABEL	Flute	ANCON-8055	26965	0.00-8115	10.30.0.72	10.30.0.72							
16	Active	NO LABEL	Flute	HTF-8055	27733	0.00-8142	10.30.0.83	10.30.0.83							
17	Active	NO LABEL	Flute	HTF-8055	27477	0.00-8132	10.30.0.40	10.30.0.40							
18	Not Responding	NO LABEL	DAS	ANCON-8055	27733	0.00-8136	10.30.0.83	10.30.0.83							
19	Not Responding	NO LABEL	Flute	MNA-8055	27733	0.00-8142	10.30.0.83	10.30.0.83							
20	Not Responding	NO LABEL	DAS	ANCON-8055	27477	0.00-7979	10.30.0.40	10.30.0.40							
21	Not Responding	NO LABEL	Flute	MNA-8055	27477	0.00-8142	10.30.0.40	10.30.0.40							
22	Not Responding	NO LABEL	MAM M42	ATF-8055	27477	0.00-8133	10.30.0.40	10.30.0.40							
23	Not Responding	NO LABEL	MAM M42	ATF-8055	27477	0.00-8133	10.30.0.40	10.30.0.40							

STATUS PAGE

DIGITISER WEB INTERFACE



MASS POSITIONS



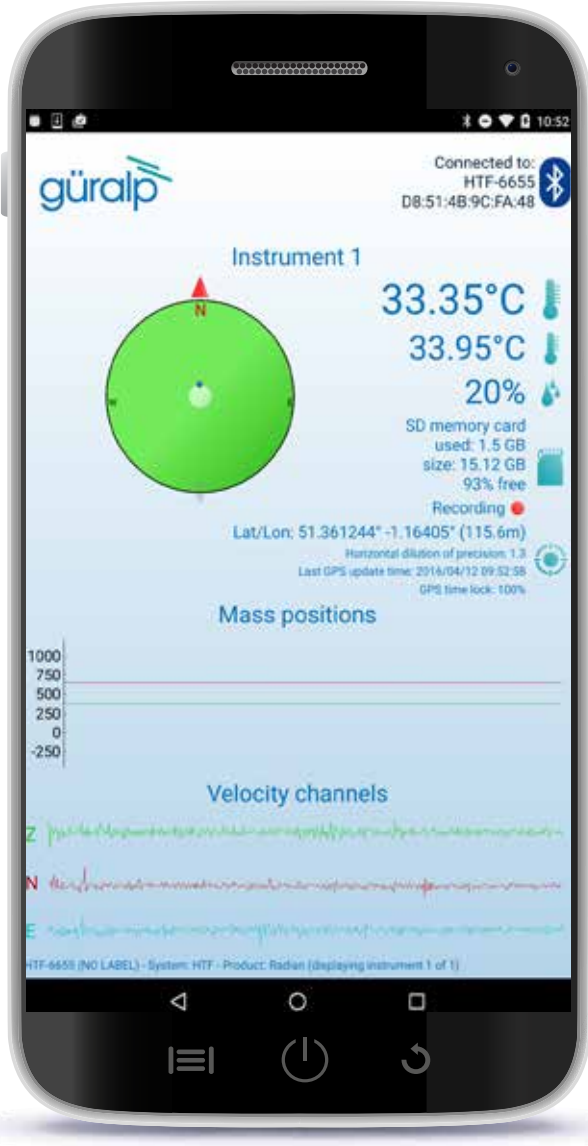
REAL-TIME VIEWER



SENSOR CONTROL

Minimus: Güralp Vü Bluetooth App

For efficient field deployments, Vü allows you to check the integrity of your installation instantaneously. Vü displays waveforms, orientation, temperature and humidity data without instrument disturbance.



The smartphone screen displays the following information:

- Connected to:** HTF-6655 (Unique Instrument Serial Number), D8:51:4B:9C:FA:48 (Media Access Control (MAC) Address)
- Instrument 1:** A circular orientation indicator showing the instrument's direction.
- Temperature:** 33.35°C (Digitiser Temperature) and 33.95°C (Instrument Temperature)
- Humidity:** 20% (Digitiser Internal Humidity)
- SD memory card:** used: 1.5 GB, size: 15.12 GB, 93% free (MicroSD Card Status)
- Recording:** Status indicator (Recording)
- GNSS Receiver Location:** Lat/Lon: 51.361244°-1.16405° (115.6m)
- GNSS Time-Lock Status:** Horizontal dilution of precision: 1.3, Last GPS update time: 2016/04/12 09:52:58, GPS time lock: 100%
- Mass positions:** A graph showing sensor mass positions over time.
- Velocity channels:** A graph showing main sensor outputs (Z, N, E) over time.

Annotations on the right side of the image:

- UNIQUE INSTRUMENT SERIAL NUMBER
- MEDIA ACCESS CONTROL (MAC) ADDRESS
- DIGITISER TEMPERATURE
- INSTRUMENT TEMPERATURE
- DIGITISER INTERNAL HUMIDITY
- MICROSD CARD STATUS
- GNSS RECEIVER LOCATION
- GNSS TIME-LOCK STATUS
- SENSOR MASS POSITIONS
- MAIN SENSOR OUTPUTS

Annotation on the left side of the image:

- INSTRUMENT ORIENTATION (RADIAN ONLY)

SPECIFICATIONS

SENSOR INPUTS	
Primary digitisation channels	Four at 24 bits. Differential input: 40 V peak-to-peak (± 20 V). Also compatible with single-ended inputs: 20 V peak-to-peak (± 10 V)
Secondary channels	Three analogue channels for sensor mass positions. One internal calibration channel.
Internal environmental channels	Humidity Temperature Supply voltage MEMS accelerometer (three component - see below) Magnetometer (three component)
Input impedance	50 k Ω
MEMS ACCELEROMETER	
Frequency bandwidth	DC to 100 Hz (0.01 s)
Linear acceleration noise density	150 $\mu\text{g}/\text{Hz}^{-0.5}$ at 100 Hz
Clip level	2 g
PERFORMANCE	
ADC converter type	Delta-sigma
ADC conversion delay	6 μs
Output format	32-bit
Dynamic Range	>136.5 dB at 100 samples per second
Gain drift	3 ppm / $^{\circ}\text{C}$
Common-mode rejection	>110 dB
DATA PROCESSING	
Output rates available	1 sample per hour up to 5000 samples per second for primary channels, user-selectable Up to 500 samples per second for environmental channels
Decimation filters	± 2 , ± 3 , ± 4 , ± 5 (Causal / Acausal)
Out-of-band rejection	>194 dB
Data transmission modes	Continuous and triggered
Trigger modes	STA/LTA, level
Selectable gain	Unity, $\times 2$, $\times 4$, $\times 8$, $\times 12$
TIMING AND CALIBRATION	
Timing source precision	Accuracy when GPS locked ± 50 ns typical drift when unsynchronised (without GNSS) <1 ms per day
Timing sources	GPS, GLONASS, BeiDou, NTP (Network Timing Protocol)
Calibration signal generator	Sine, step or broadband noise, all with adjustable amplitude and frequency
OPERATION AND POWER USAGE	
Operating temperature	-20 to +60 $^{\circ}\text{C}$
Relative humidity range	zero to 100 %
Power supply	10 - 36 V DC
Power consumption at 12 V DC	< 1 W (no GNSS or Ethernet) 1.8 W (GPS with 10 Mb/s Ethernet output)
SOFTWARE PROTOCOLS	
Communication technologies supported	RS232, Ethernet (10/100/1000BASE-T) Option for power over Ethernet (POE)
Internet technologies supported	TCP/IP, HTTP, UDP
USER INTERFACE	
Configuration and control	(Ethernet) Güralp Discovery - free download, web browser interface. (Bluetooth) Güralp Vu free Android phone/tablet app
DATA COMMUNICATION	
Data recording formats	miniSEED (metadata stored in dataless SEED format)
Data streaming protocols (via Ethernet)	GCF (Scream!) and GDI-link (metadata sent in RESP / dataless SEED file formats), SEEDlink
Flash memory and storage	64 GB field-swappable microSD card flash storage (dual-redundant).
PHYSICAL CHARACTERISTICS	
Casing type	Environmentally sealed, hard anodised aluminium
Environmental sensor	Humidity and temperature
Weight	674 g (disconnected)
Dimensions	136 mm \times 99 mm \times 39 mm
Connector type	MIL-DTL-26482 Series 1: Analogue - 26 way Ethernet - RJ45 Power - 4 pin Digital - 10 pin GNSS/serial - 14 pin LEMO
Global navigation satellite system (GNSS)	Compact, encapsulated, waterproof, precision timing GPS/GLONASS/BeiDou receiver
Environmental protection	IP68 to 3 metres
Minimus package includes	Power cable, Ethernet cable, GPS/GLONASS/BeiDou receiver and serial cable