

PORTABLE SMART SEISMIC DIGITISER WITH ADVANCED COMMUNICATIONS AND STATE OF HEALTH



Compact and portable fourchannel, ultra-low-power smart seismic digitiser.

KEY FEATURES

- > IIltra-low-power < 0.8 W
- > 24-bit, 4-channel ADC
- > 142 dB dynamic range
- > Compact and lightweight
- > Bluetooth and Power-over-Ethernet
- > Dual-redundant microSD storage
- > Advanced State-of-Health capabilities
- > Utilises Güralp Discovery software interface providing access to a range of instrument and data management tools
- > Güralp Data Centre compatible

Minimus₂

The portable, ultra-low-power Güralp Minimus₂ offers advanced communication capabilities with rapid GNSS lock, making it ideal for rapid deployments.



Multidisciplinary functionality with simplified streaming and filtering options and advanced communications capabilities.

The four channel $Minimus_2$ is our lowest power digitiser and can accommodate any triaxial analogue seismic sensor plus an auxillary input (e.g., for infrasound).

The portable and ergonomic Minimus₂ features a rapid GNSS lock making it particularly suited for field applications where speed of deployment is of the utmost importance.

Integrated network connectivity enables the ${\rm Minimus}_2$ 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 or data centre, eliminating the need for static IP addresses.

Discovery also provides simple and streamlined instrument and data management for arrays of any scale, with access to hardware State-of-Health (SoH); data streaming; GNSS location; instrument response and calibration values.

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

Versatile streaming options.

Users can select sample rates of up to 4000 samples per second with the option to simultaneously stream multiple sample rates in addition to two recording rates.

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. Whilst traditional 'Nominal Response' files are supported, the system also provides 'machine generated Response files' to faithfully represent the exact configuration of the station and sensors.

Key features

24-bit, four channel digitiser

Compatible with any analogue seismic sensor

Rapid GNSS lock with accuracy of ± 50 ns once locked

Industry standard triggering algorithms for EEW (STA/LTA and Threshold) $\,$

Common Alert Protocol (CAP) enabled for automated emergency warning

Identification of IP address via Discovery and Cloud registry server

Remote instrument and data management via easy-to-use Discovery software

Scream!TM compatible

 $\mbox{G\"{\sc u}}\mbox{\sc u}\mbox{\sc u}$ Bluetooth app for installation integrity checking available (Android)

Dual redundant 128 GB microSD cards

Select from GNSS (GPS and GLONASS, BeiDou optional)

Applications

- > Temporary seismic stations
- > Earthquake Early Warning
- > Rapid deployment arrays
- > Volcanology
- > Multi-discipline seismic observatories
- > Structural health monitoring
- > Induced seismicity detection

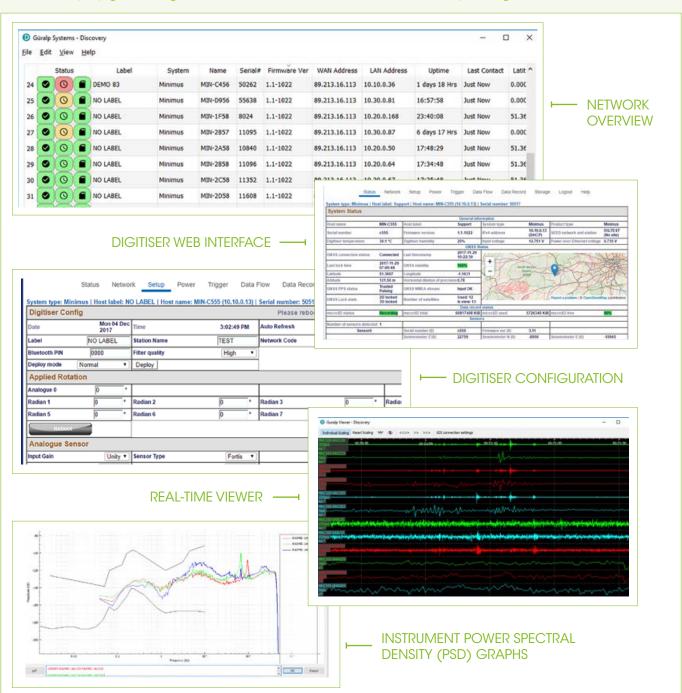
Minimus₂ Tools:

Güralp Discovery Software*

*See Discovery datasheet for more details

Discovery dramatically simplifies instrument and data management and gives users powerful tools via a web interface:

- > Identify instrument IP address
- > Analysis of hardware State of Health
- > Data streaming control
- > Remotely upgrade digitiser firmware
- > Upload configuration to multiple units simultaensouly
- > Advanced analysis on waveform data such as PSD and spectogram

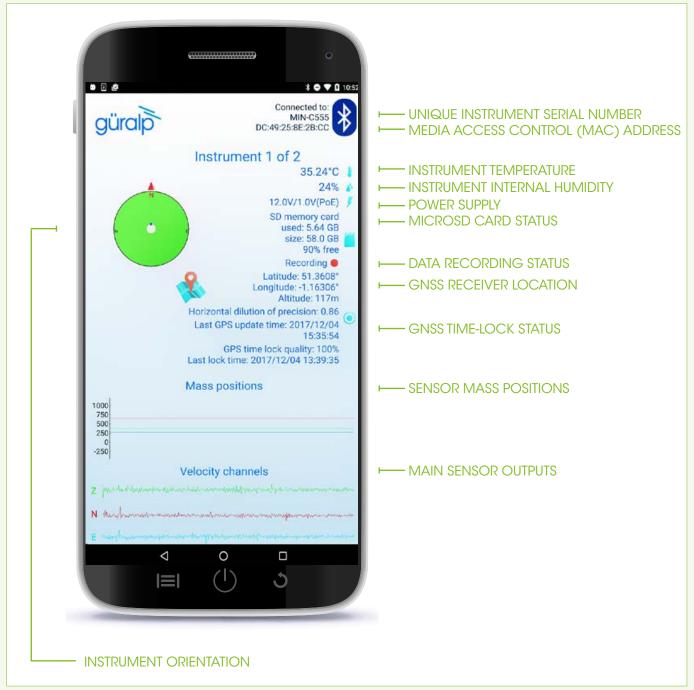


Minimus₂ Tools:

GüVü Bluetooth App

Check the integrity of your installation instantaneously

GüVü displays a range of instrument data such as waveforms, orientation, temperature and humidity data. Additionally you can lock/unlock and centre the masses of analogue sensors, reboot Minimus₂ and alter sample rates without instrument disturbance. GüVü can also format replacement SD cards. A deployment status report can then be emailed for a detailed record of the installation.







SPECIFICATIONS

SENSOR INPUTS	
Primary digitisation channels	Four at 24 bits
	Differential input: 40 V peak-to-peak (\pm 20 V). Also compatible with single-ended inputs: 20 V peak-to-peak (\pm 10 V)
Secondary channels	Three analogue channels for sensor mass positions, one internal calibration channel
Internal environmental channels	Humidity Temperature Supply voltage/Power consumption
Input impedence	50 kΩ
PERFORMANCE	
ADC converter type	Delta-sigma
ADC conversion delay	6 μs
Output format	32-bit
Dynamic Range	>142 dB at 100 samples per second
Gain drift	3 ppm / °C
Common-mode rejection	>110 dB
DATA PROCESSING	
Output rates available	1 sample per hour up to 4000 samples per second for primary channels, user-selectable
	Multiple independent data streams at different sample rates for all channels (transmission and recording)
	Up to 500 samples per second for environmental channels
Decimation filters	$\div 2, \div 3, \div 4, \div 5$ decimation (Causal / Acausal)
Out-of-band rejection	>167 dB
Data transmission mode	Continuous and trigger modes
Triggered data	Retrievable using event table in digitiser's web page. User selectable pre and post event time.
Trigger modes	STA/LTA, Threshold
Selectable gain	Unity ×1 , ×2, ×4, ×8, ×12
TIMING AND CALIBRATION	
Timing source precision	Accuracy when GNSS locked ±50 ns. Typical drift when unsynchronised (without GNSS) <1 ms per day once temperature trained
Timing sources	GNSS (GPS and GLONASS, BeiDou optional)
Calibration signal generator	Broadband noise and Sinewave

OPERATION AND POWER USAGE	
-20 to +60 °C	
zero to 100 %	
5 - 36 V DC* (2S lithium compatible)	
$<0.8\mbox{W}$ in power save mode with no GNSS or Ethernet	
$<\!1.3$ W in standard mode with constant GNSS and 10 Mb/s Ethernet output	
*Power voltage for operation of this unit only. Connection to additional instrumentation or use of longer cables may result in a higher input voltage requirement.	
Windows, Linux and macOS compatible	
Ethernet (10/100BASE-T)	
Power over Ethernet (IEEE 802.3af compliant)	
USERINTERFACE	
(Ethernet) Güralp Discovery - free download, web browser interface. GüVü Bluetooth app (Android)	
$\label{eq:miniSEED} \mbox{ (metadata stored in dataless SEED format)}$	
GCF (Scream!), GDI-link¹ and SEEDlink¹ (¹metadata sent in RESP, StationXML and dataless SEED file formats)	
Dual redundant 128 GB microSD cards (1 fixed, 1 hot-swappable)	
PHYSICAL CHARACTERISTICS	
Environmentally sealed, hard anodised aluminium on a stainless steel base	
Humidity and temperature	
600 g (disconnected)	
$98 \text{ mm} \times 108 \text{ mm} \times 40 \text{ mm}$	
MIL-DTL-26482 Series 1: Analogue - 26 way Power - 4 pin	
SURE-SEAL IPMODM: Waterproof Ethernet	
LEMO : GNSS/serial - 14 pin	
Compact, encapsulated, waterproof, precision timing GPS/GLONASS (BeiDou optional) receiver	
IP68 - protection against effects of prolonged immersion at 3 m depth for 72 hours	

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In the interests of continual improvement with respect to design, reliability, function or otherwise, all product specifications and data are subject to change without prior notice.