Güralp 40TDE

Operator's Guide

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1 Introduction

The Güralp 40TDE seismometer is a three-axis, broad-band, force-feedback seismometer packaged together with a 24-bit digitiser and a flexible data acquisition and storage unit, all in a single sealed case. The entire system is self- contained except for its power supply.

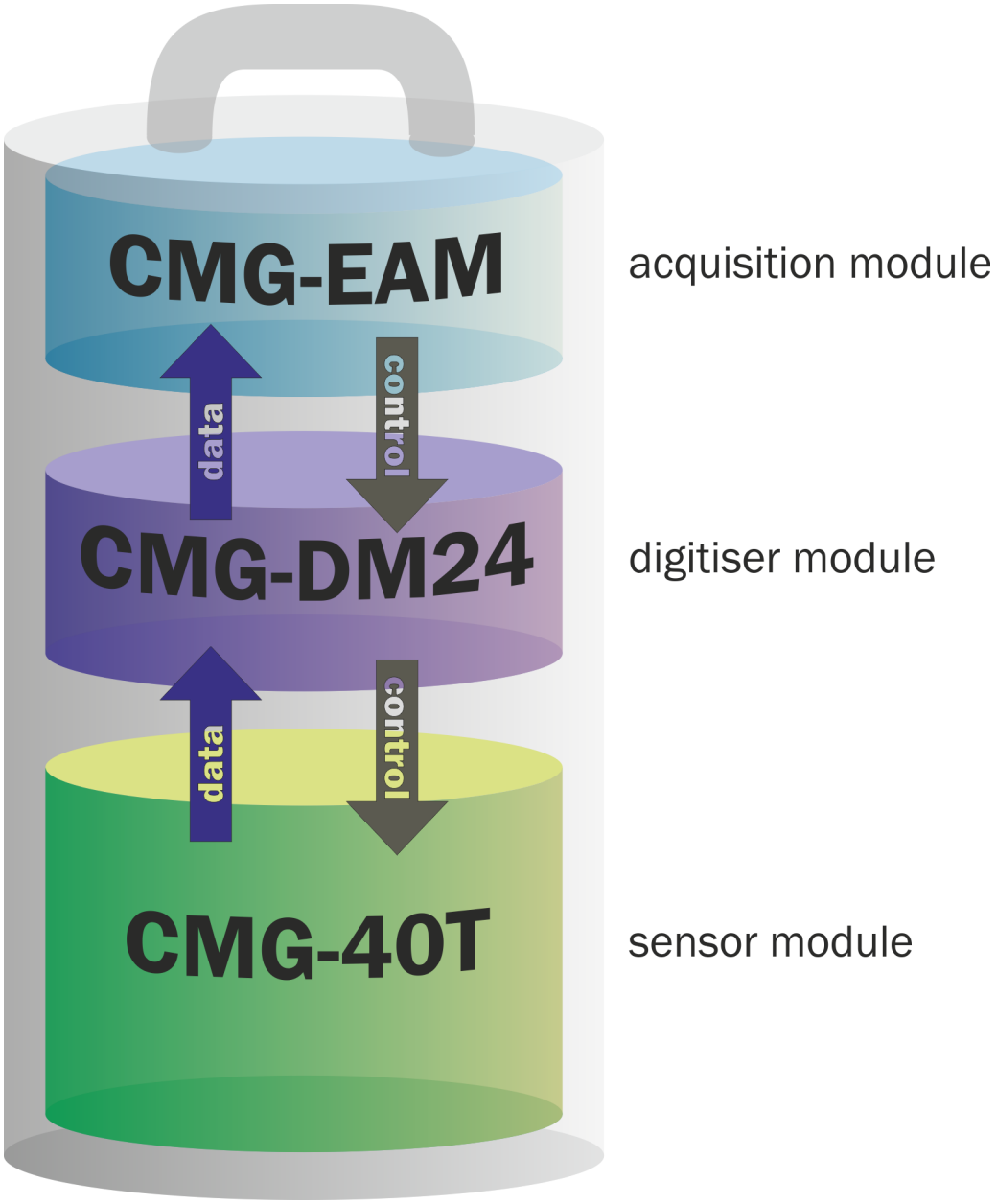
The 40T system combines low-noise components with high feedback loop gain to provide a linear, precision transducer with a large dynamic range.



The Güralp 40TDE has a rugged, waterproof stainless steel design for ease of installation. The lightweight sensor elements are designed so that no

mechanical clamping is required. Because of this, the 40T is ready to record ground movements as soon as you provide it with power. In addition, the sensor does not have to be levelled or centred as long as the base is within 3 ° of horizontal. For the best results, however, you should install where possible on a hard, near-horizontal surface well coupled to the bedrock.

The Güralp 40TDE consists of three internal modules, the 40T sensor, an integrated digitiser and an integrated data acquisition system



The integrated digitiser is a Güralp DM24, a low-noise, 24-bit ADC module specifically designed for seismic data. The built-in digital signal processor (DSP) provides simultaneous, multiple sample-rate data streams at user-selectable rates. Up to 6 streams of data for each component are available at sample rates from 1 to 1000 samples/s. A precision microprocessor-controlled time-base synchronizes the analogue-to-digital converters to

the DSP and provides time-stamps for data. A separate microprocessor system handles configuration and sensor control, including mass centring and calibration.

The integrated data acquisition system is a Güralp EAM, which provides serial and Ethernet communications, along with a convenient web-based interface to all functions, including digitiser and sensor configuration and control. It can act as a data recorder as well as a protocol converter and communications controller. Based around the powerful and stable Linux operating system, the Güralp EAM offers unrivalled flexibility, even including the ability to run user-installed scripts.

Each instrument is delivered with a detailed calibration sheet showing its serial number, measured frequency response in both the long period and the short period sections of the seismic spectrum, sensor DC calibration levels, and the transfer function in poles/zeros notation.

1.1 Connections

The Güralp 40TDE has five connectors on the top panel, the uses of which are described in this section.



1.1.1 DATA

The DATA port is the power input and also a general-purpose serial port. It is a command line terminal running at 115,200 Baud in the default configuration but it can also be used for GCF output (suitable for serial connection to Scream!) , PPP network connections, in-bound GCF (from a digital instrument, for example), NMEA functions, TCP serial conversion, a modem answering service or as a recorder to store and forward data from any instrument with a serial output.

1.1.2 NET

The NET port is a 100BASE-TX Ethernet connection. The supplied cable supports connection to a hub, switch or router. If direct connection to a PC or laptop is desired, an optional cross-over cable can be ordered.

1.1.3 GPIO

The GPIO (General Purpose Input/Output) port fulfils three functions: it provides a serial console to the EAM, which can be used for monitoring, configuration and control; it provides USB access from a PC or laptop to the internal FLASH storage for data collection (Use of this feature is described in the EAM manual, MAN-EAM-0001) and it provides a number of tri-state lines which can be used to control or monitor external equipment. One application is as tamper detection lines, which can be connected to external switches and monitors as part of a secure installation.

1.1.4 USB

The USB port allows connection of an external USB storage device for data collection. It is also possible to perform firmware upgrades using this port in situations where internet access is not available.

1.1.5 GPS

The GPS port allows connection of a GSL GPS receiver for use as a timing source for time-stamping seismic data. An additional serial port, ttySA2, is also available on this connector. It can be used for any of the functions listed above (in section 1.1.1).

2 Getting started

The Güralp 40TDE accelerometer is preconfigured for terminal access at 115,200 Baud from the DATA connector, to provide serial console access at 38,400 Baud via the GPIO connector and to configure its Ethernet interface (on the NET connector) using DHCP or APIPA.

The easiest way to configure the Güralp 40TDE is via the web interface so, if you have a DHCP server on your network, simply connect the provided network lead to the NET connector and apply 12VDC power via the supplied lead to the DATA connector. Allow the instrument thirty seconds to boot and then check the log of the DHCP server to ascertain the allocated IP address. You can then enter this into the address bar of your web browser (using http or https) and immediately access the status information and configuration interface.

Alternatively, you can connect the Güralp 40TDE via a network switch or network cross-over cable directly to a laptop or PC (some laptops and PCs automatically configure their network ports so that a cross-over cable is not required). If your operating system supports APIPA (link-local addressing), both the Güralp 40TDE and the computer will acquire automatic IP addresses. You can then determine the IP address of the Güralp 40TDE by pinging the computer's broadcast address.

If you have a network but cannot use DHCP or APIPA, you need to manually configure an IP address using a serial connection. Connect the provided network lead to the NET connector, 12VDC power via the supplied lead to the DATA connector, and a serial port on your PC to the GPIO connector. Start your terminal emulation software, such as HyperTerm or Minicom (configured for 38,400 Baud), and then follow the instructions in section 2.2.2 of the EAM manual to set a temporary IP address. You can then enter this into the address bar of your web browser (using HTTP or HTTPS) and immediately access the status information and configuration interface. You should set a permanent IP address at this point as the temporary address that you have just set will not persist after a reboot. See section 6.1 of the EAM manual for more details.

If you do not have a network, you can still access the configuration interface using the serial console. Connect 12VDC power via the supplied lead to the DATA connector and a serial port on your PC to the GPIO connector. Start your terminal emulation software, such as HyperTerm or Minicom (configured for 38,400 Baud), and then follow the instructions in section 3.2 of the EAM manual.

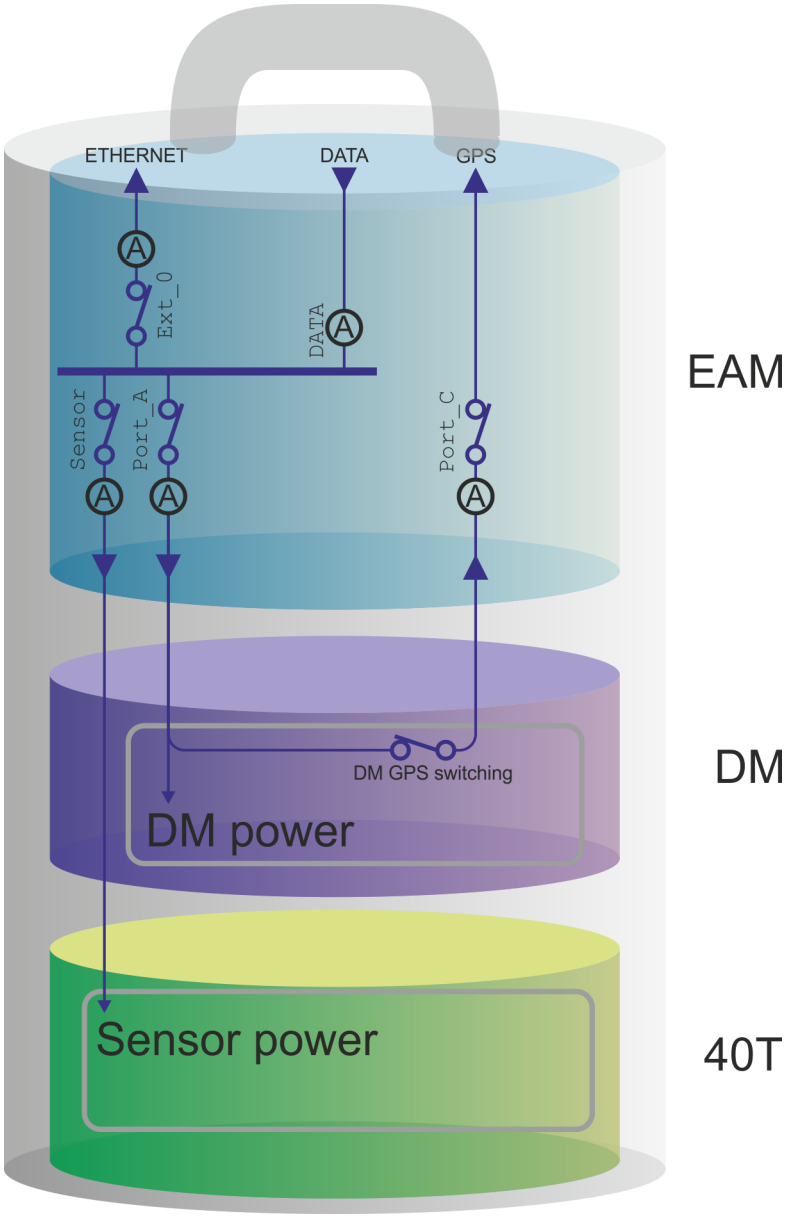
3 Understanding the manuals

The Güralp 40TDE is a complex piece of equipment, the true flexibility of which can only be fully appreciated by studying the manuals. The instrument is covered by four separate documents:

- **MAN-040-0004** - This document, which provides an overview, a getting-started guide and a list of other relevant manuals;
- **MAN-EAM-0003** - The Güralp EAM manual, which covers use of the data acquisition module, including configuration of the digitiser and control of the sensor. All of the instrument's external connectors are described in the Güralp EAM manual but, for convenience, this information is reproduced in section 5 of this manual.
- **MAN-040-0001** - The Güralp 40T Operator's Manual, which describes the construction and operation of the sensor.
- **MAN-D24-0004** - The Güralp DM24 digitiser manual, which describes the features of and command-line interaction with the digitiser. Note that, thanks to the EAM's convenient web and menu-based interfaces, direct use of the digitiser's command line is seldom necessary.

4 Power Distribution

The Güralp 40TDE is powered using the DATA connector. Incoming voltage and current are monitored. From here, power is routed through various switches and monitors (indicated by circled 'A's) to various parts of the instrument and to outlets on the GPS and ETHERNET connectors, as shown in the diagram below.

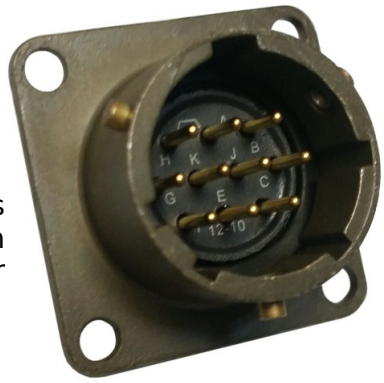


Monitored voltages and currents (and calculated wattages) can be displayed in real-time, using the Digital I/O page of the web interface, and stored for future use via the Environment Logging system, which also allows downloading or graphical display of historical values.

5 Connector pin-outs

5.1 DATA

This is a standard ten-pin military-specification bayonet plug, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-12-10P although the initial “02E” varies with manufacturer.



Suitable mating connectors have part-numbers like ***-12-10S and are available from Amphenol, ITT Cannon and other manufacturers.

The pin-out is the same as the serial output of a Güralp DM24 digitiser and any GSL digital instrument, allowing you to insert an instrument with an embedded Güralp EAM into a pre-existing installation and maintain connectivity.

Pin	Function
A	Power input, 0 V
B	Power input, +10 to +35 V
C	RS232 CTS
D	RS232 RTS
E	RS232 DTR
F	RS232 DSR
G	RS232 ground
H	RS232 CD
J	RS232 receive
K	RS232 transmit



Wiring details for the compatible socket, ***-12-10S, as seen from the cable end (i.e. during assembly).

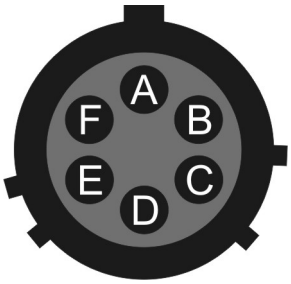
5.2 NET

This is a standard six-pin military-specification bayonet plug, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-10-06P although the initial “02E” varies with manufacturer.

Suitable mating connectors have part-numbers like ***-10-06S and are available from Amphenol, ITT Cannon and other manufacturers.



Pin	Function
A	Ground
B	Data transmit +ve (RJ45 pin 1)
C	Data receive +ve (RJ45 pin 3)
D	External switched power output #0
E	Data receive –ve (RJ45 pin 6)
F	Data transmit –ve (RJ45 pin 2)



Wiring details for the compatible socket, ***-10-06S, as seen from the cable end (i.e. during assembly).

5.3 GPIO

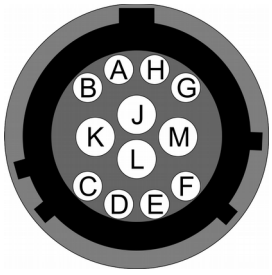
This is a standard twelve-pin military-specification bayonet socket, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-14-12S although the initial "02E" varies with manufacturer.



Suitable mating connectors have part-numbers like ***-14-12P and are available from Amphenol, ITT Cannon and other manufacturers.

The USB lines provide external host access to the internal USB memory device. When power is sensed on pin J, an internal switch disconnects the memory device from the internal circuitry and connects it to this socket.

Pin	Function
A	USB Data -ve (USB Type A pin 1) - see text above.
B	USB Data +ve (USB Type A pin 3) - see text above.
C	Anti-tamper line 4
D	Anti-tamper line 3
E	Anti-tamper line 2
F	Anti-tamper line 1
G	Console transmit (RS232 TXD)
H	Console receive (RS232 RXD)
J	USB Power input (USB Type A pin 1) - see text above.
K	Ground (USB Type A pin 4)
L	Anti-tamper line 0
M	Ground



Wiring details for the compatible plug, ***-14-12P, as seen from the cable end (i.e. during assembly).

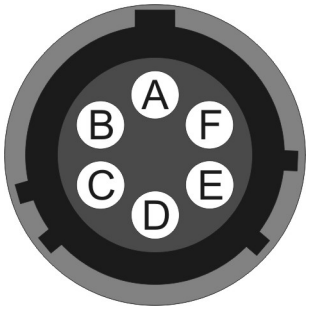
5.4 USB

This is a standard six-pin military-specification bayonet socket, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-10-06S although the initial “02E” varies with manufacturer.

Suitable mating connectors have part-numbers like ***-10-06P and are available from Amphenol, ITT Cannon and other manufacturers.



Pin	Function
A	+5 V DC (USB Type A pin 1)
B	Data –ve (USB Type A pin 2)
C	Data +ve (USB Type A pin 3)
D	0 V (USB Type A pin 4)
E	Shielding
F	*not connected*



Wiring details for the compatible plug, ***-10-06P, as seen from the cable end (i.e. during assembly).

5.5 GPS

This is a standard ten-pin military-specification bayonet plug, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-12-10P although the initial “02E” varies with manufacturer.



Suitable mating connectors have part-numbers like ***-12-10S and are available from Amphenol, ITT Cannon and other manufacturers.

This pin-out is the same as the GPS input of a DM24 digitizer.

Pin	Function
A	Power 0 V
B	Power +12 V
C	1pps signal
D	*not connected*
E	Serial port (ttySA2) TxD
F	Serial port (ttySA2) RxD
G	RS232 ground
H	Serial port (ttySA2) ground
J	RS232 transmit to GPS
K	RS232 receive from GPS



Wiring details for the compatible socket, ***-12-10S, as seen from the cable end (i.e. during assembly).

6 Revision history

2016-06-29		Re-styled for new branding. No significant changes.
2012-11-05	B	Added Power Distribution chapter
2012-08-31	A	New document