

Affinity

User's Guide

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1 Preliminary Notes

1.1 Proprietary Notice

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Whilst every effort is made to ensure the accuracy, completeness and usefulness of the information in the document, neither Güralp Systems Limited nor any employee assumes responsibility or is liable for any incidental or consequential damages resulting from the use of this document.

1.2 Cautions and Notes

Cautions and notes are displayed and defined as follows:



Caution: A yellow triangle indicates a chance of damage to or failure of the equipment if the caution is not heeded.



Note: A blue circle indicates indicates a procedural or advisory note.

1.3 Manuals and Software

All manuals and software referred to in this document are available from the Güralp Systems website: www.guralp.com unless otherwise stated.

1.4 Conventions

Throughout this manual, examples are given of command-line interactions. In these examples, a fixed-width typeface will be used:

```
Example of the fixed-width typeface used.
```

Commands that you are required to type will be shown in bold:

`Example of the fixed-width, bold typeface.`

Where data that you type may vary depending on your individual configuration, such as parameters to commands, these data are additionally shown in italics:

`Example of the fixed-width, bold, italic typeface.`

Putting these together into a single example:

`System prompt:` **`user input with`** ***`variable parameters`***

2 Introduction

Thank-you for purchasing a Güralp Affinity.

The Affinity, a digitiser with combined storage and communications module, is a flexible and expandable tool for connecting analogue and digital instruments to your network.



Inside the robust, waterproof, stainless steel casing is a 31-bit, high-fidelity digitiser with state-of-the-art timing precision and enhanced acquisition module capability. Designed for data quality and durability, the Güralp Affinity is a stable and robust Linux-powered unit with on-board storage and networking facilities.

Built for challenging environments, the Güralp Affinity is suitable for post-hole and bore-hole deployment or can be wall-mounted for vault applications. The Güralp Affinity can be fully controlled and accessed via a web interface suitable for both expert and non-expert field staff.

2.1 Applications

- Borehole
- Vault
- Networked Arrays
- Earthquake early-warning systems

2.2 Key features

- Four low-noise 31-bit analogue-to-digital conversion (ADC) channels (three primary plus one auxiliary)
- An eight-channel version is also available
- Ultra-low-noise: 138 dB of dynamic range at 100 samples per second
- 16 environmental multiplexed ADC channels
- Sensor control lines (LOCK, UNLOCK, CENTRE) automatically detect whether connected instruments use "active-low" or "active-high" logic.
- Triggering/events subsystem capabilities including STA/LTA, level (threshold), software triggers, per-channel voting and peer-to-peer network voting
- Four concurrent output sample rates (continuous or triggered) up to 4,000 samples per second
- UTC time-stamped data using a low-power GPS receiver
- Multi-user Linux operating system with full network support
- On-board Web server (HTTP and HTTPS) allows full remote configuration of digitizer parameters and broadband sensors, including remote lock, unlock and centre
- 16 to 64 GB of on-board storage. Additional connection for external USB storage
- Built in calibration signal generator: step, sine or broadband
- Supports multiple data formats, including GCF, GDI, miniSEED and CD1.1
- Specifications independently verified by Sandia Laboratories

3 The Affinity documentation

The Affinity documentation comes in two parts: this document and the Platinum manual.

The Güralp Affinity runs the Platinum operating system, which is common to many Güralp data acquisition modules, including the EAM, the NAM and the legacy DCM. Platinum provides rich web and command-line interfaces to configure, control and monitor all data storage, protocol conversion, and communications functions. These features of the Affinity are all described in the Platinum manual, **MAN-EAM-0003**, which is available from the Güralp website in both PDF and HTML form.

This document, **MAN-AFT-0001**, partially duplicates the “getting started” section of the Platinum manual and then provides details of the features which are unique to the Affinity, including configuration and operation of the built in ADCs, the PTP timing mode and the connector pin-outs.

It is strongly recommended that this document is read in conjunction with the Platinum manual.

4 Getting Started

4.1 Introduction

The Güralp Affinity can be configured and monitored either over an Ethernet network or via a serial (RS232) line.

If using a network, the Affinity can be accessed using a web browser or, in character mode, using ssh. Instructions for connecting to the network port are given in section 4.2 on page 9.

If you prefer to use serial communications, the module can be accessed using a terminal emulator. Instructions for connecting via the serial port are given in section 4.3 on page 23.

Note: We recommend use of the web interface over a network for general configuration and operation.

4.2 Connecting to the network port

To use the network port, you must first set up a network address. Some networks need manual configuration (normally referred to as "static" addressing); others use the Dynamic Host Configuration Protocol (DHCP) to allow a DHCP server to automatically assign network addresses. If no DHCP server is present, many systems will fall back to a randomly-generated "link-local" address (known by Microsoft as Automatic Private IP Addressing, or APIPA). Before you can access an Affinity over a network, you must set (for static addresses) or discover (if you use DHCP) its IP address.

Note: If you are setting up a unit in the laboratory for subsequent deployment in the field, you can set up the final network address using the web interface but then over-ride it with a temporary, static network address using the command line. The web-configured address will take effect when the unit is next rebooted.

4.2.1 DHCP-assigned addresses

The Affinity is supplied configured for DHCP. If your network uses DHCP to assign addresses, simply connect the Affinity to the network and wait a few minutes for the process to complete. Your network administrator should then be able to tell you the address that has been assigned. If your Affinity has an LCD status display, the assigned address will be displayed in it. The LCD display shows lots of information so you may have to wait a short time until the IP address scrolls into view.

When using DHCP, it is recommended that the DHCP administrator allocates a fixed IP address to the Affinity's MAC address in order to avoid unexpected address changes. The MAC address is displayed by the `ip` command – in the example in section 4.2.1.1 on page 10, it is `00:50:c2:40:54:75`.

If you cannot learn the IP address in this way, there are three methods available to discover which address has been allocated.

If your network includes Güralp Minimus digitisers, Minimus+ digitisers or Fortimus accelerometers, you can enable the guralp-responder service. This allows an Affinity to be detected using Guralp Discovery Software - see section 4.2.1.5 on page 12 for details.

4.2.1.1 Address discovery – serial connection

You can connect via a serial port (as described in section 4.3 on page 23) and issue the `ip` command:

```
G12345 ~ # ip addr show eth0
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
pfifo_fast qlen 1000
   link/ether 00:50:c2:40:54:75 brd ff:ff:ff:ff:ff:ff
   inet 192.168.0.90/24 brd 192.168.1.255 scope global eth0
   inet6 fe80:250:c2ff:fe40:5475/64 scope link
   valid_lft forever preferred_lft forever
G12345 ~ #
```

The key things to note here are the adapter status and the IP address. The first line of the output should contain the word `UP`, confirming that the adaptor has been enabled. The IP address that has been assigned is shown on the line beginning `inet` - in this case, it is `192.168.0.90` (with a netmask of 24 bits indicated by `/24`).



Note: With an IP version 6 network, the IP address will be on a line beginning `inet6`. In practice, most networks today are still IPv4, as in the above example.

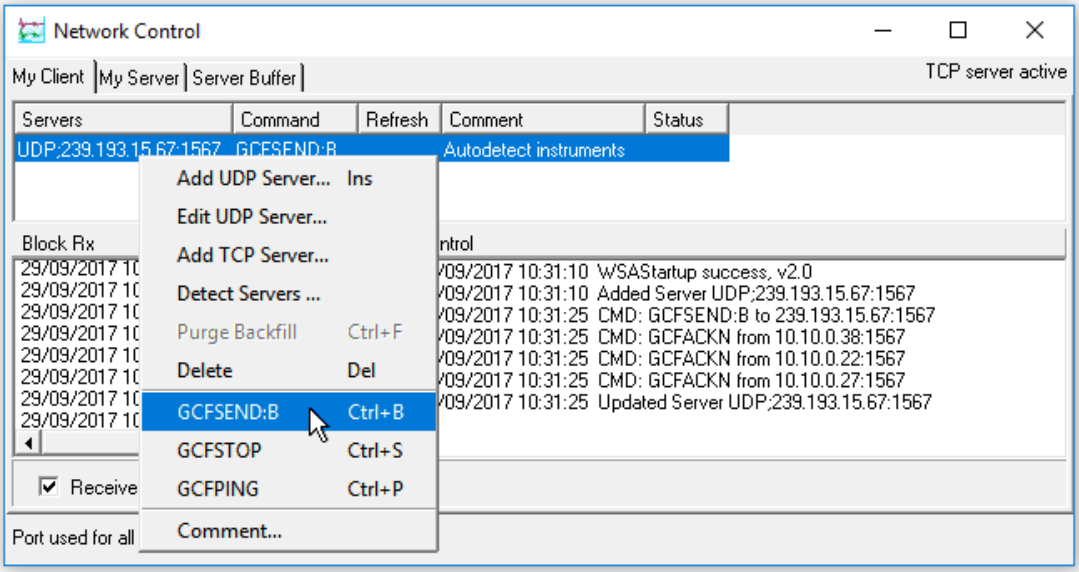
4.2.1.2 Address discovery – Scream's “Detect servers” tool

Start with the Affinity turned off. Then, from Scream's “Network control” window, select the “My Client” tab. Right-click in the server list-box and select “Detect servers...” - Scream will then start monitoring DHCP traffic on the local network. Power up the Affinity and allow it a minute to boot. When Scream notices a DHCP negotiation with an appropriate MAC address, it will display the allocated IP address in the window. You can add the Affinity to Scream's list of servers by clicking the appropriate button.

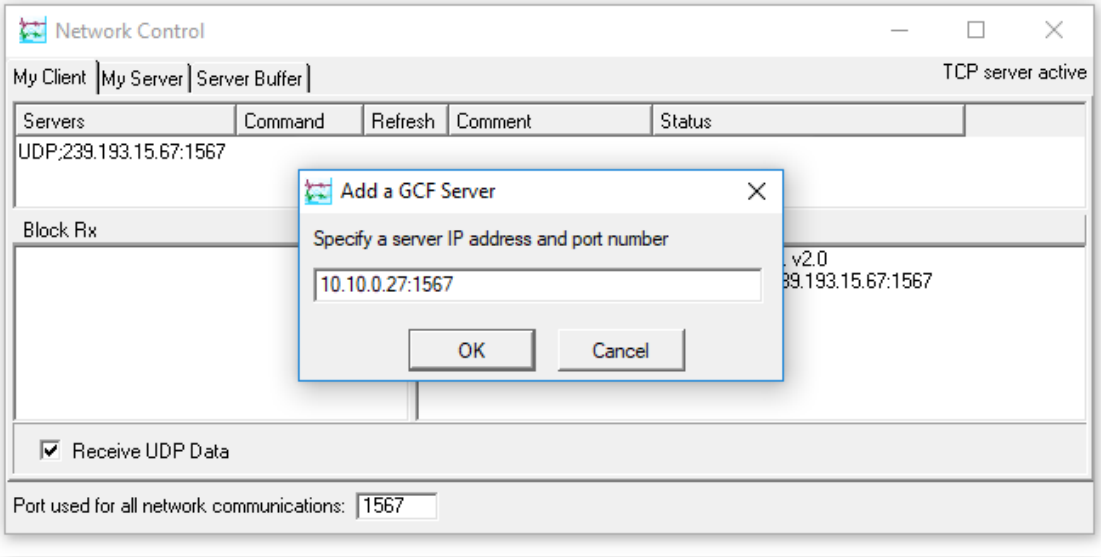
4.2.1.3 Address discovery - GCFPing the multicast address

Scream's “GCFPing” feature can send a special UDP packet to any configured address. Affinities respond to multicast packets addressed to 239.193.15.67. This

address is pre-configured when you first install Scream. To use this feature, right-click on the multicast address and select GCFSEND:B from the context menu:



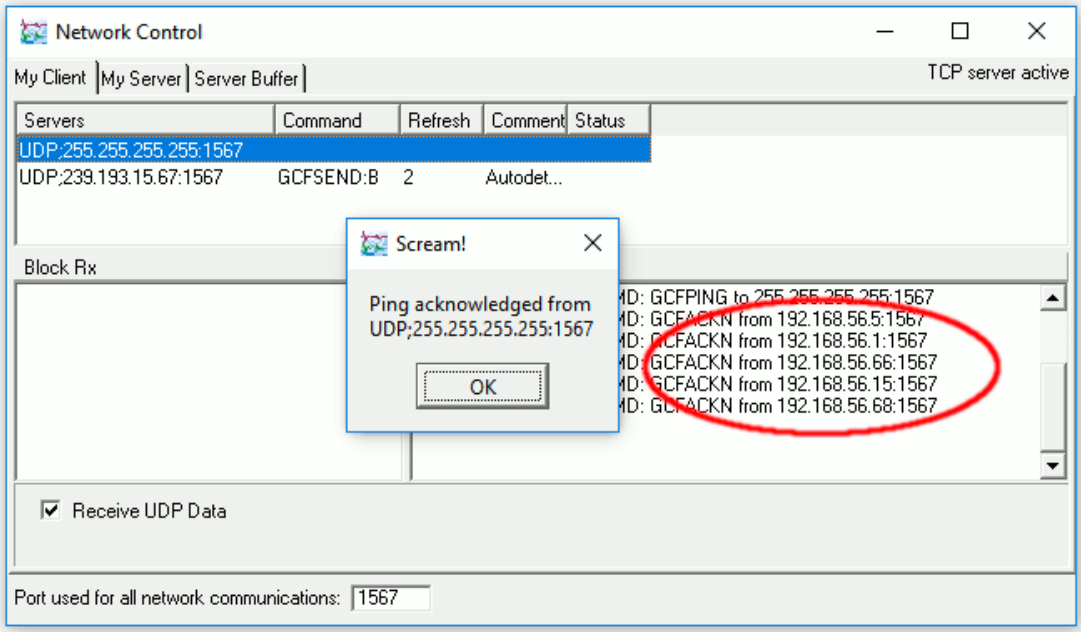
All accessible Affinities (and many other GCF servers) will respond and their IP addresses will be displayed in the right-hand "Control" window. Once you know the appropriate address, you can add the server to Scream by right-clicking in the Servers list at the top of the window and selecting "Add UDP Server ... Ins" from the context menu. Enter the IP address and default port (1567) into the resulting window, as shown below, then click OK.



4.2.1.4 Address discovery – GCFPing the broadcast address

Scream's "GCFPing" feature can send a specially formatted broadcast packet to its broadcast address, reaching all hosts on the local network. Any GCF servers that see this packet should respond with a GCF acknowledgement packet (GCFACKN). Scream displays the IP addresses associated with all acknowledgement packets that it receives.

To use this feature, add a new UDP server with an IP address of 255.255.255.255. Right-click the server and select GCFPING from the context menu. A window will appear as shown below if the ping packet is acknowledged and, in the control pane (at the bottom right of the main window), a GCFACKN line will be printed for every address that responded to the GCFPING. In the example below, you can see responses from 192.168.56.5, 192.168.56.1, 192.168.56.66, 192.168.56.15 and 192.168.56.68. These are the addresses of all GCF servers listening on port 1567 on the local network. One of these will be your Affinity.



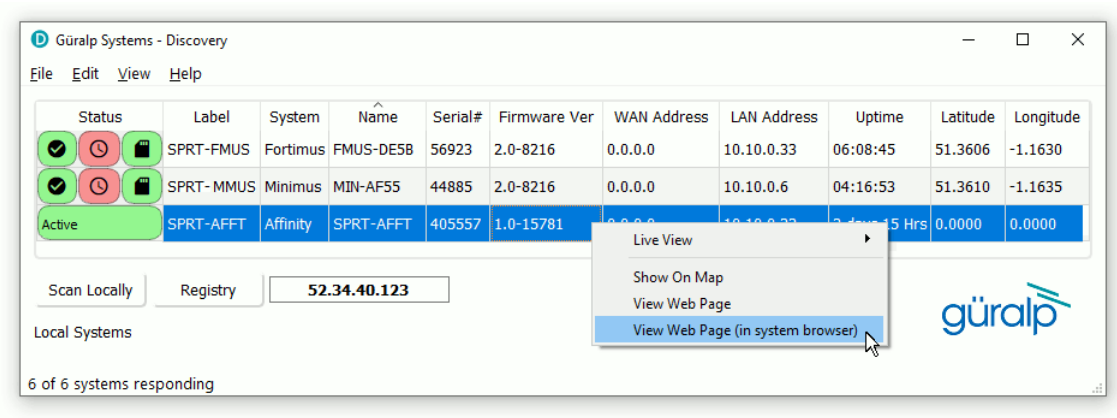
4.2.1.5 Address discovery – using Güralp Discovery software

The `guralp-responder` service allows the Affinity to respond to network scans performed by Güralp's Discovery software. The service is not started by default. It can be started from the web interface by navigating to Control → Services, scrolling down to the Guralp responder entry and clicking the associated Start button.

From the command line, run

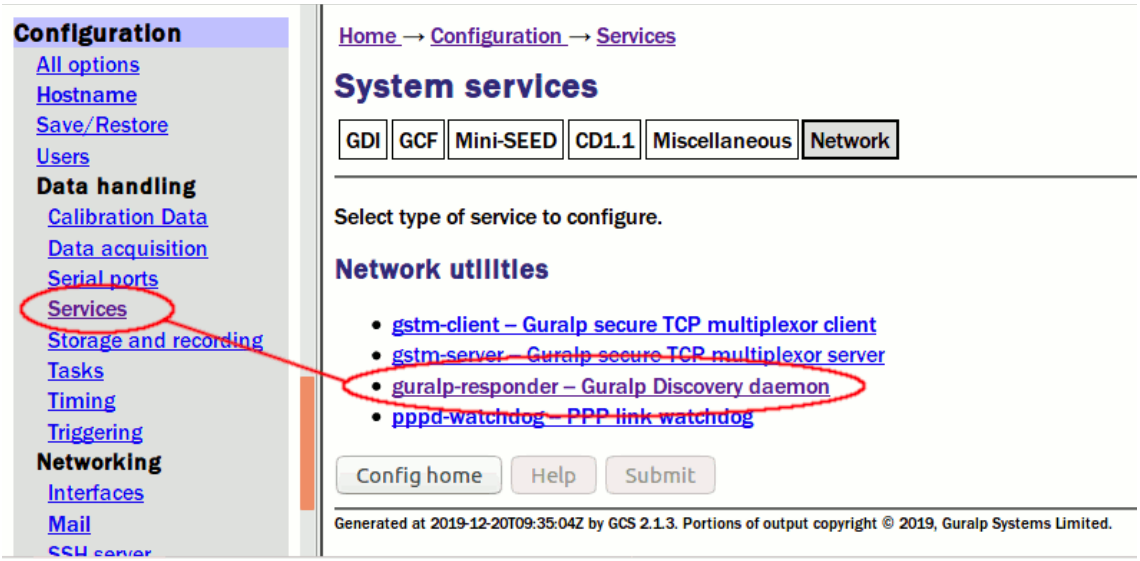
```
svc guralp-responder start
```

Once the responder service is running, Discovery will identify the Affinity on its local network.



The entry will show the IP address of the Affinity together with limited status information. Right-clicking on the entry shows the context menu, as above, which allows you easily to reach the Affinity's web interface.

Navigate to Home→Configuration→Data handling→Services



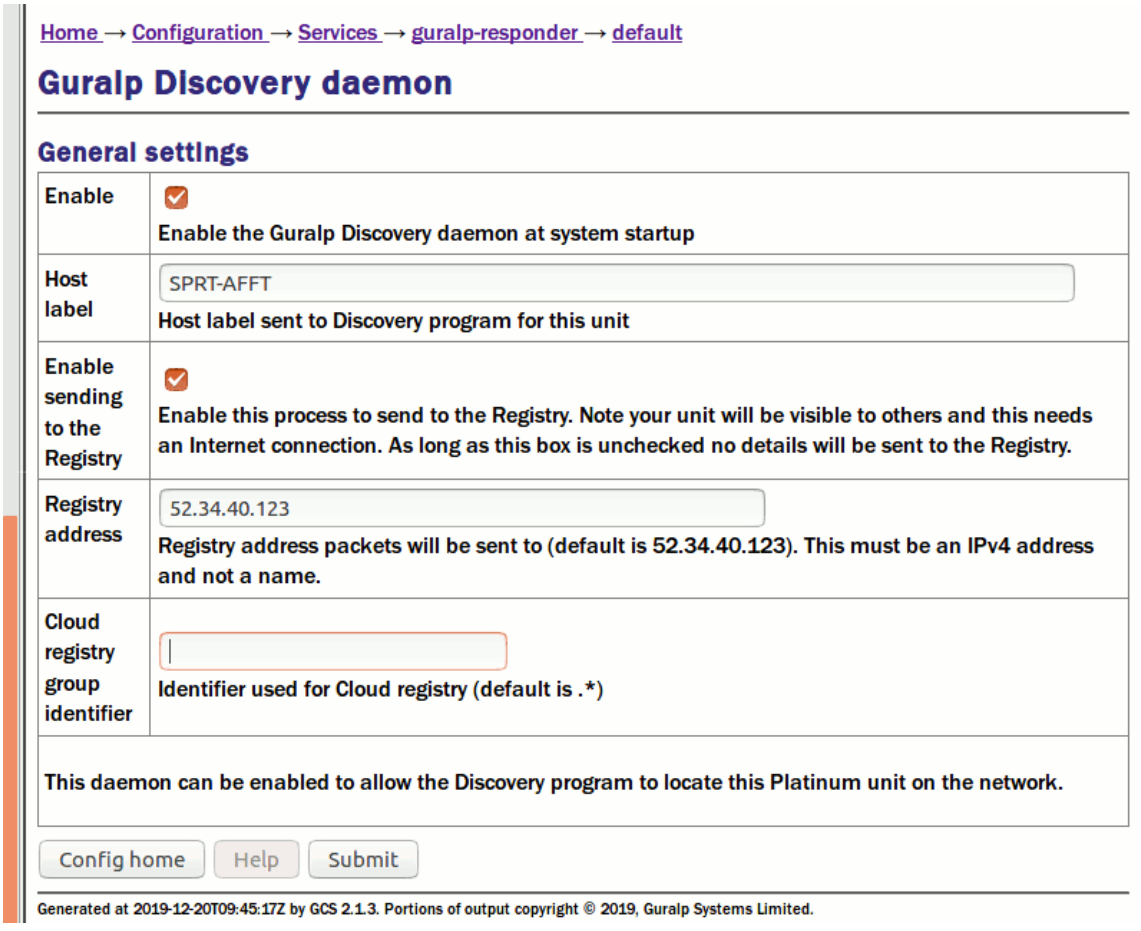
and click on the `guralp-responder` link. Click through the link on the next page to configure the default instance. The following configuration options are available:

- Enable - This check-box controls whether the service is started automatically when the Affinity boots
- Host label - This field allows the label shown on Discovery's main page to be changed frrom its default, which is the host-name of the Affinity
- Enable sending to the Registry - If this check-box is ticked, the Affinity will periodically broadcast its details to the registry server identified in the remainder of this form. This facility allows Affinity units connected to the Internet via dynamic IPs to be tracked, monitored and controlled. See the Minimus manual, MAN-MIN-0001, for further details.

- Registry address - This field allows specification of an alternative registry server, if desired. Güralp own and operate the server at 52.34.40.123, which is the default, and this server is available for public use. You may prefer to operate your own registry server if, for example, your telemetry network is not connected to the public Internet. In this case, please contact Güralp support for details of downloading and running the server software and then enter the I.P. address of your server here.
- Cloud registry group identifier - If you use the standard Güralp registry server, you may wish to arrange that you see only your own digitisers and not those of other users. You can do this by providing a "group identifier" in this field.

> **Note:** Every participating device and instance of Discovery needs to be configured with an identical group identifier.

When configuration is complete, click the Submit button to save your changes.



4.2.2 Link-local addresses

Many systems, when configured for DHCP, will generate a random address if no DHCP server is present. This is known as a “link-local” or APIPA address. For IPv4

networks, it will be in the range 169.254.0.0 to 169.254.255.254 (i.e. on the 169.254.0.0/16 network). For IPv6 networks, it will be in the fe80::/10 network. The random, host-specific part of the address is derived from the (unique) MAC address, so there are unlikely to be conflicts between addresses of systems in networks with small or medium numbers of hosts.

This is useful when, for example, visiting a remote Affinity: A laptop can be plugged directly into the network port of the Affinity (using a cross-over cable, if necessary) and, provided both systems are set to use DHCP, both will assign themselves addresses on the same network. If the laptop is running Scream, you can open Scream's Network Control window and add a UDP server using the link-local network's broadcast address, 169.254.255.255, and start communicating immediately. If the address of the Affinity is required (for, say, web access), this can be read from Scream's control window, or in the acknowledgement window resulting from a GCFPING.

The Affinity will search for a DHCP server once every minute and, should one become available, it will ask it for a new address.

4.2.3 Assigning a static IP address

If you wish to configure a static IP address, you must first connect to the command line via a serial port. This process is described in detail in section 4.3 on page 23.

4.2.3.1 Assigning a static IP address using net-setup

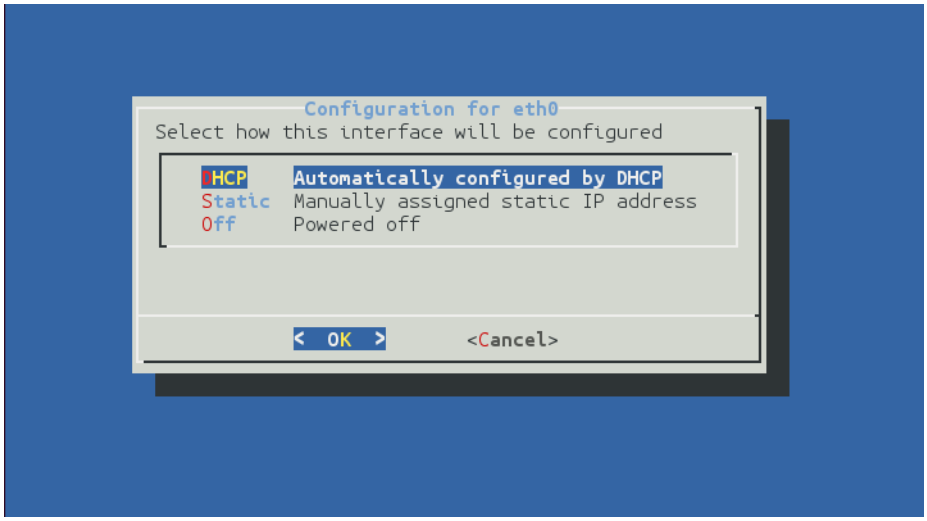
Once logged in, issue the following command:

```
G12345 ~ # net-setup
```



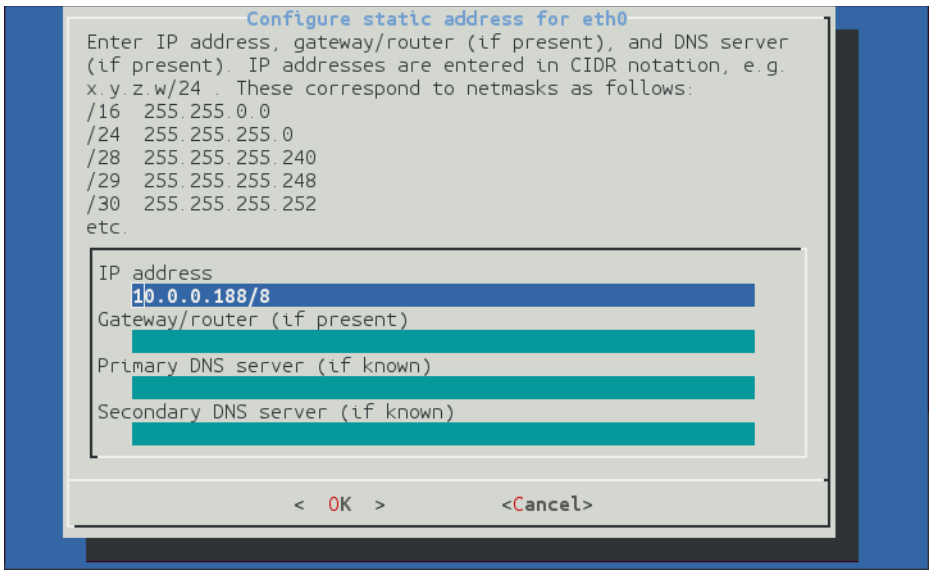
Note: This command relies on the Affinity understanding what type of terminal emulator you are using. If the display is corrupted and not usable, set the TERM variable (see the Platinum manual for details), or simply power-cycle the Affinity and use the `ip` command (see section 4.2.3.2 on page 17) instead.

The following screen is displayed:



Using the ↑ and ↓ keys (or, on some systems, depending on your terminal type, the mouse), select whether you wish to use DHCP or static addressing. The red letters in the display indicate short-cut keys so, for example, you can, key D to select DHCP or S to select static addressing. Use the ENTER key to confirm your choice. If you do not wish to make a change, use the ⇄ key to select "Cancel" and then key ENTER to close the `net-setup` tool and return you to the command prompt.

If you select static addressing, the following screen is displayed:



The IP address field must be populated with a valid IP address in CIDR notation. If you know the netmask but not the corresponding CIDR notation, use the information on screen as a guide or search the web for an on-line converter.

If your network has a router which acts as a gateway to the Internet or to other networks, use the  key (or, on some systems, the mouse) to move to the "Gateway/router" field and enter the address of the gateway in standard, dotted-quad notation (e.g. `10.0.0.1`).

If your network has a DNS (domain-name service) server, sometimes called a name-server, use the  key (or, on some systems, the mouse) to move to the "Primary DNS server" field and enter the address of the name-server in standard, dotted-quad notation (e.g. `10.0.0.5`).

Note: If your network is connected to the Internet but you do not know the name of your DNS server, ask your Internet Service Provider for the correct address to use or enter `8.8.8.8`, which is a free, public DNS server operated by Google Inc.

Use the ENTER key to confirm your choice and reconfigure the network. If you do not wish to make a change, use the  key to select "Cancel" and then key ENTER to close the net-setup tool and return you to the command prompt.

4.2.3.2 Assigning a static IP address using the ip command

The ip command is an alternative to net-setup. You may wish to use it if

- you want to configure a temporary address without updating the configuration files
- you cannot use the `net-setup` utility for any reason
- you are very familiar with the linux command line

Log in as normal and then issue the following command:

```
G12345 ~ # ip addr add 192.168.0.1/24 dev eth0
```

replacing the example IP address (`192.168.0.1/24` in the example above) with the required value. It must be specified in CIDR format, where the actual address is followed by the number of bits of the network mask. The above example uses `192.168.0.1` with a netmask of `255.255.255.0` (24 bits of network address). A PC connected to this network could communicate with the Affinity if it was configured to use an IP address of (for example) `192.168.0.2` with a matching netmask of `255.255.255.0`.

Note: IP addresses assigned using this method will be lost if the unit is rebooted. To permanently assign an IP address, use `net-setup` (see section 4.2.3.1 on page 15), the web interface or `gconfig`. Please see the Platinum manual for more details.

If you wish to connect to the Affinity from a PC, they must either both be on the same physical network and have the same network address (usually the first three numbers of the IP address) or be able to connect to each other via routers.

In the latter case, you will need to tell the Affinity the address of its default router (also known as the gateway). Issue the command:

```
G12345 ~ # ip route add default via 192.168.0.254
```

substituting the address of your network's default router in place of the example address (`192.168.0.254`) shown.

If you wish to be able to access your Affinity across the Internet, perform firmware upgrades or access GSL remote support, you will also need to configure a default router as described in the preceding paragraph.

Note: Both the static IP address and any route configured in this way are temporary and will persist only until the Affinity is rebooted or powered off. Refer to the Platinum manual for information about configuring permanent static IP addresses and routes.

If you wish your Affinity to initiate connections with remote systems across the Internet, or to be able to access firmware upgrades, you need to configure a DNS server (also known as a name-server). If you do not know the address of your DNS server, your Internet Service Provider (ISP) will be able to tell you. You can also use `8.8.8.8`, which is a free, public DNS server operated by Google Inc.

Enter the command

```
G12345 ~ # echo "nameserver 8.8.8.8" >> /etc/resolv.conf
```

substituting the address of the required DNS server in place of the example address (`8.8.8.8`) shown in the example above.

4.2.4 Connecting to the web interface

The Platinum firmware on the Affinity provides a web interface for configuration and control of the module and connected equipment. While there are other methods of connecting, the web interface is recommended.

Once the IP address of the Affinity has been set or determined, enter it into the address bar of a web browser to connect to the module's web interface . The examples below are for an Affinity address entered into Firefox and Internet Explorer:





The web interface will initially show a status display and a brief menu which contains an option to log in. Click on the link and enter the default user-name of **`root`** and password of **`guralp3`**.

If you are connecting to the Affinity over a network that you consider insecure (such as the Internet), it is recommended that you use the HTTPS (secure HTTP) protocol, which uses TLS to encrypt the link. Simply change the `http://` prefix to `https://` in the browser's address bar. Most browsers will complain that the certificate cannot be verified: This is not a problem: simply press the "accept" button to proceed. The link will then be encrypted and nobody will be able to "sniff the wire" in an attempt to discover passwords and other data.

Once connected and logged in, you will be presented with the main summary screen and a much larger menu. The summary screen contains general information about the status and health of the connected modules and equipment.

The exact contents and layout of this screen will vary depending on the configuration of both the Affinity and of any attached devices.

See the Platinum manual for information on using the web interface.

4.2.4.1 Connection trouble-shooting

If the browser fails to connect, the most likely explanation is that the machine running the browser does not have working network communications to and from the Affinity. This can be verified by "`ping`ing" the IP address of the browser from the command line of the Affinity:

```
G12345 ~ # ping -c3 192.168.0.2
PING 192.168.0.2 (192.168.0.2): 56 data bytes
64 bytes from 192.168.0.2: seq=0 ttl=63 time=2.284 ms
64 bytes from 192.168.0.2: seq=1 ttl=63 time=1.129 ms
64 bytes from 192.168.0.2: seq=2 ttl=63 time=1.944 ms
--- 192.168.42.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 1.129/1.785/2.284 ms
G12345 ~ #
```

To resolve this class of problem, ensure that the cables are functioning (which can be verified by checking the diagnostic lights on most network switches/hubs) and double-check that the PC and Affinity are on the same subnet (which means the CIDR suffices must match and the first sections of the IP addresses – as defined by the CIDR suffices - must also match).

The website http://en.wikipedia.org/wiki/IP_address has some useful information for those for whom sub-networking is unfamiliar.

4.2.5 Connecting to the command line using SSH

SSH (**S**ecure **SH**ell) is the most flexible way to control an Affinity, but it is less friendly than using the web interface. It is possible to configure more advanced operations using SSH but the majority of control and configuration tasks can be achieved most easily through the web interface.

SSH is shipped as standard with most Linux distributions and is available for Windows as part of the free terminal emulation package PuTTY, which is available from http://www.chiark.greenend.org.uk/~sgtatham/putty/

4.2.5.1 SSH connections using the ssh program (Linux PCs)

To use SSH, you must know or discover the IP address of the unit, as described in the previous section. Once you have the IP address, issue the **ssh** command on the PC you are using:

```
mypc$ ssh root@192.168.0.1
```

Replace ***192.168.0.1*** with the IP address of the Affinity.

The first time you use SSH to connect to any host, you will be asked to verify the "host key". This is normal but, if you are ever asked this again, it means that either the host key of the Affinity has changed – perhaps because of a firmware upgrade – or there is a network address conflict or, worse, a security problem on your network.

```
user@mypc:~$ ssh root@192.168.0.1
The authenticity of host '192.168.0.1 (192.168.0.1)' can't
be established.
RSA key fingerprint is
62:a6:70:29:d4:1a:db:5a:75:6e:96:13:54:f5:a9:d9.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.0.1' (RSA) to the list
of known hosts.
root@192.168.0.1's password:
G12345 ~ #
```

You will be prompted for a password; the default password is **guralp3**. Note that no characters will be echoed to the screen as you type the password.

Once connected, you will be presented with a shell prompt which is ready to accept commands.

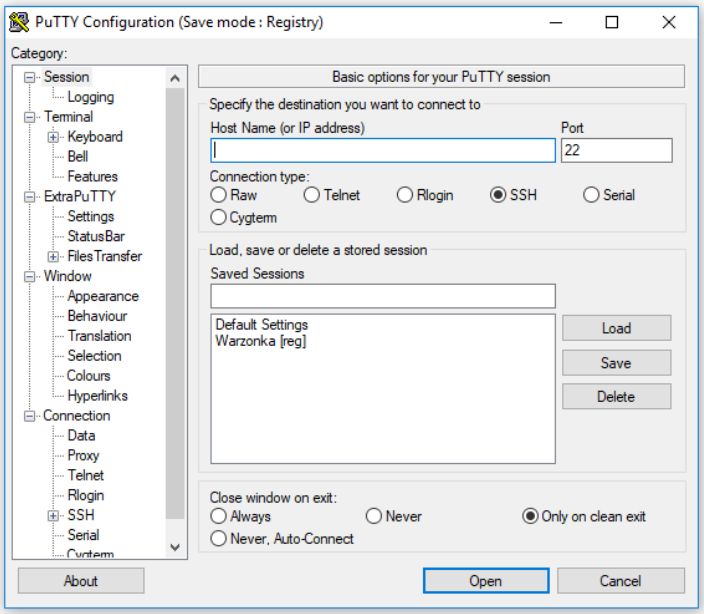
When you are finished with your SSH session and want to disconnect, enter **exit** at the command line, or type Ctrl + D. There are a number of escape sequences for controlling the session, all of which begin with a tilde ('~') so, if you need to send a tilde character to the Affinity, type two tildes consecutively. For more information, see the section on "Escape Characters" in the manual at https://manpages.org/ssh

Note: If you plan to use ssh regularly to communicate with your Affinity, you can configure the system to bypass the password prompt when logging in from a list of pre-authorised computer/user combinations. This involves generating a unique key-pair (for the user and PC which will access the Affinity) and then copying the public half of the key-pair to the Affinity. This can be more secure than passwords and is fully documented at https://www.ssh.com/academy/ssh/keygen. For details about uploading your keys to the Affinity, see the Platinum manual.

4.2.5.2 SSH connections using PuTTY (Windows PCs)

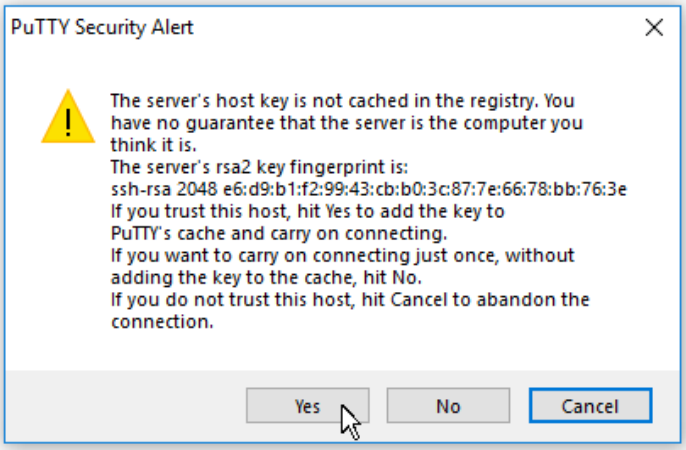
To use PuTTY, you must first know or discover the IP address of the unit, as described in the previous sections. Once you have the IP address, start PuTTY by choosing it from the "Start" menu or double-clicking on its icon.

You will be presented with the following screen:



Enter the IP address of the Affinity into the **Host Name (or IP address)** field, check that SSH is selected as the Connection type and then click the Open button.

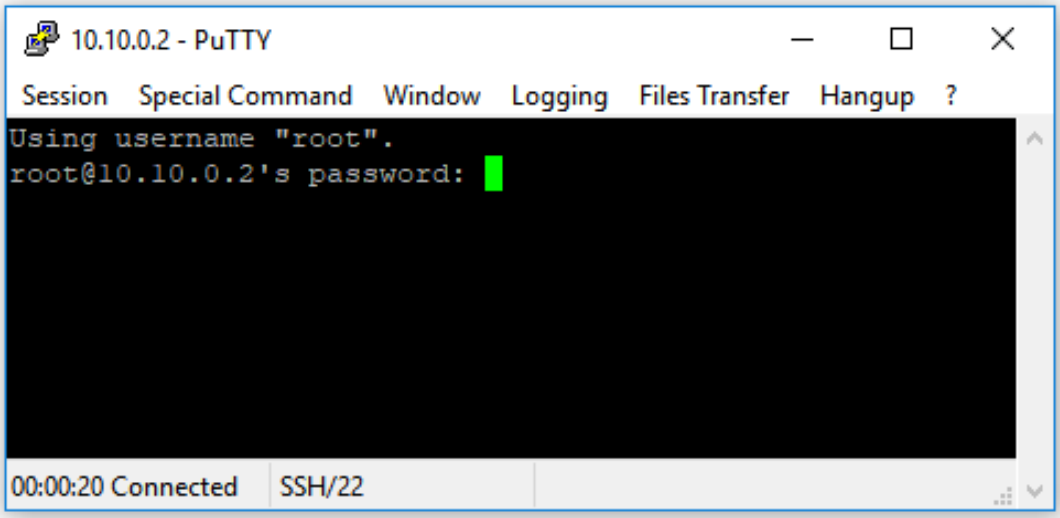
The first time you use SSH to connect to any host, you will be asked to verify the "host key":



This is normal (simply click Yes to dismiss the dialogue) but, if you are ever asked this again, it means that either the host key of the Affinity has changed –

perhaps because of a firmware upgrade – or there is a network address conflict or, worse, a security problem on your network.

You will now be prompted for a login name: the default is **root**. Type this at the prompt and press the ENTER key. You will next be prompted for a password; the default password is **guralp3**. Note that no characters will be echoed to the screen as you type the password.



Once connected, you will be presented with a shell prompt which is ready to accept commands. The shell prompt contains the serial number of the Affinity.

When you are finished with your SSH session and want to disconnect, type “exit” at the command line, or Ctrl + D.

PuTTY allows you to save multiple sessions, along with a default login identity and screen colours for each. See the PuTTY manual for more details.

Note: If you plan to use ssh regularly to communicate with an Affinity, you can configure the system to bypass the password prompt when logging in from a list of pre-authorised computer/user combinations. This involves generating a unique key-pair (for the user and PC which will access the Affinity) and then copying the public half of the key-pair to the Affinity. This can be more secure than passwords and is fully documented at https://www.ssh.com/academy/ssh/keygen. For details about uploading your keys to the Affinity, see the Platinum manual.

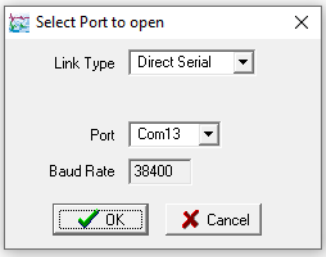
4.3 Connecting to the Serial Console

The serial console of the Affinity is accessed using the GPIO connector. The Affinity is shipped with a blue serial cable, terminating in a female DE9 connector, which can be used for console connections.

Once you have connected the serial cable, you can run either Scream or a terminal emulator to interact with the Affinity.

4.3.1 Using Scream

Select `Terminal...` from the `File` menu. A window will open, from where you can select the correct serial port:



Set the Baud Rate to 38400, as shown, and click 

. Once the Affinity and computer are communicating properly, an emulation window will open and you will see the Login: prompt. If the prompt does not appear immediately, press the ENTER key a few times.

Note: If a terminal session has just been closed, it can take up to ten seconds for a new session to start.

4.3.2 Using a terminal Emulator

You are free to use whatever terminal emulation software you wish. Common choices are applications such as minicom on Linux or PuTTY on Microsoft Windows. See the Platinum manual for more information.

Configure your emulation software to use the correct serial port. Set the line speed (Baud rate) to 38,400 and the communication parameters to eight data bits, no parity bits and one stop bit. This combination is commonly referred to as “8-N-1”. Turn off all hardware flow control (RTS/CTS and/or DSR/DTR should not be used). Turn off all software flow control (XON/XOFF should not be used).

Once the emulator is connected, you will see a `Login:` prompt. If the prompt does not appear immediately, press the ENTER key a few times.

Note: If a terminal session has just been closed, it can take up to ten seconds for a new session to start.

4.3.3 Logging in

The Affinity is shipped with a default user-name of **root** and password of **guralp3**. (Additional users with controlled capabilities can be added if required).

Enter the user name and password. Note that nothing will display on the screen when typing the password. You will then be presented with a shell prompt, which will accept commands as shown in the image below:

```
G12345 login: root
Password:
G12345 ~ #
```

The output may vary slightly due to the configuration of the unit. In particular, the Affinity name, as displayed in the prompt (G12345 in this example), will be different.

4.4 Viewing data

Once you know the IP address of the Affinity, it is simple to view the data using Güralp's Scream! Software. To do this:

1. Start Scream! And choose "Network Control" from the "Windows" menu (or key Ctrl + N, which has the same effect).
2. Switch to the "My Client" tab.
3. Tick the "Receive UDP Data" check-box to start Scream! listening.
4. Right-click anywhere in the Servers list box, and select "Add UDP Server..." (or key Ins, which has the same effect). Enter the IP address of the Affinity.

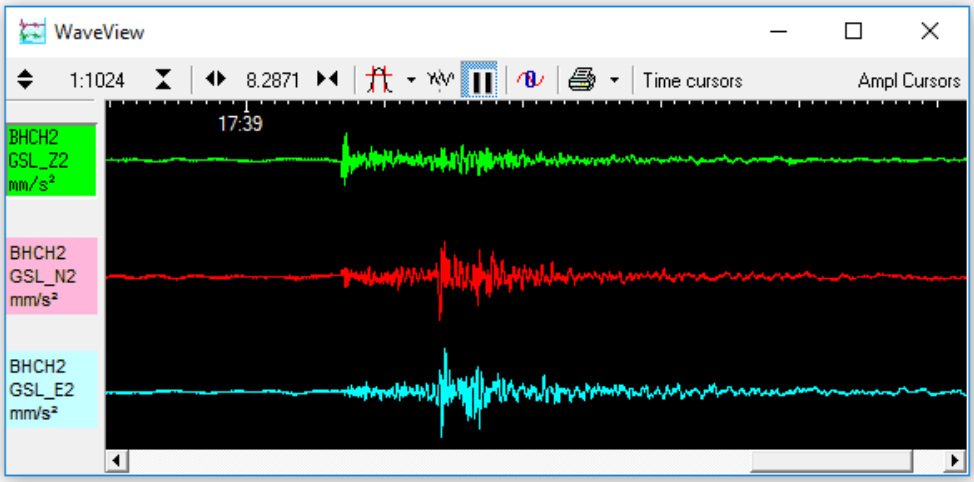
   Note: If you have already configured the Affinity's Scream server to use a non-standard UDP port, type a colon and the required port number after the IP address, e.g. `192.168.0.14:1568`. The default port is 1567: this is used if no port number is entered.

5. Test communications by right-clicking on the newly-added server, and selecting GCFPING from the context menu (or by keying Ctrl + P, which has the same effect). A message appears in the Control pane logging the ping being sent. If communication is good and the server accepts client requests, you will receive an acknowledgement message (GCFACKN) from the server. This will also appear in the Control pane.

6. Request data by right-clicking on the server and selecting GCFSEND:B from the context menu (or by keying Ctrl + B, which has the same effect). Streams should soon begin to appear in Scream!'s main window.

> **Note:** The steps above can be repeated as many times as necessary to pull data from several servers. Scream! remembers all the network settings when it exits, and automatically tries to reconnect when you start it again.

7. Switch to the main window and select the streams that you wish to view by holding the Ctrl key while clicking each. Once all desired streams are selected, key Enter to open a WaveView window showing live data streaming from the Affinity.



For more details, please see the Scream! Manual, MAN-SWA-0001, which can be downloaded from http://www.guralp.com/documents/MAN-SWA-0001.pdf

5 Connections

5.1 Analogue connections



The analogue connector panel of the Affinity has one or two SENSOR connectors (depending on the model) and an AUXILIARY connector. The pin-outs for these connectors are given in the following sections.

Note: Early models did not provide power via the AUXILIARY connector.

The auxiliary connector provides a differential input to the fourth full-rate channel and single-ended inputs to ten of the sixteen multiplexed inputs. (The other six are connected internally for use as mass position channels on the main SENSOR A and SENSOR B inputs.)

5.1.1 SENSOR A and SENSOR B

This is a standard twenty-six-pin bayonet plug, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-16-26P although the initial "02E" varies with manufacturer.

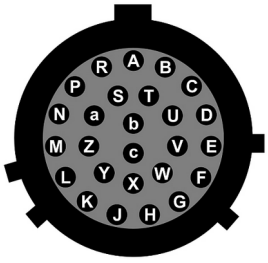
Suitable mating connectors have part-numbers like ***-16-26S and are available from Amphenol, ITT Cannon and other manufacturers.



Pin	Function
A	Vertical velocity non-inverting input
B	Vertical velocity inverting input
C	N/S velocity non-inverting input
D	N/S velocity inverting input
E	E/W velocity non-inverting input
F	E/W velocity inverting input
G	Vertical mass position input
H	*not connected*
J	N/S mass position input
K	Busy indicator LED
L	E/W mass position input
M	*not connected*
N	Signal ground

Pin	Function
P	Calibration signal
R	Vertical calibration enable
S	N/S calibration enable
T	E/W calibration enable
U	Centre *
V	*not connected*
W	Unlock *
X	Lock *
Y	Digital (logic signal) ground
Z	*not connected*
a	*not connected*
b	Power 0 V & digital ground
c	Power output +9 to +36 VDC (via 550 mA poly-fuse)

** Sensor control lines automatically detect whether connected instruments use "active-low" or "active-high" logic.*



Wiring details for the compatible socket, ***-16-26S, as seen from the cable end (i.e. during assembly).

Note: Early models provided RS232/RS422 sensor control lines via this connector. This functionality is no longer available.

5.1.2 AUXILIARY input

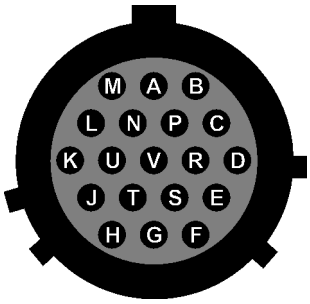
This is a standard nineteen-pin bayonet plug, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-14-19P although the initial "02E" varies with manufacturer.

Suitable mating connectors have part-numbers like ***-14-19S and are available from Amphenol, ITT Cannon and other manufacturers.



Pin	Function
A	*SENSOR B* auxiliary / calibration channel non-inverting (+ve)
B	*SENSOR B* auxiliary / calibration channel inverting–ve
C	*SENSOR B* Signal ground
D	Multiplexed input A / Aux 6
E	Multiplexed input B / Aux 7
F	Multiplexed input C / Aux 8
G	Power output +ve
H	Multiplexed input D / Aux 9
J	*SENSOR A* auxiliary / calibration channel non-inverting (+ve)
K	*SENSOR A* auxiliary / calibration channel inverting–ve

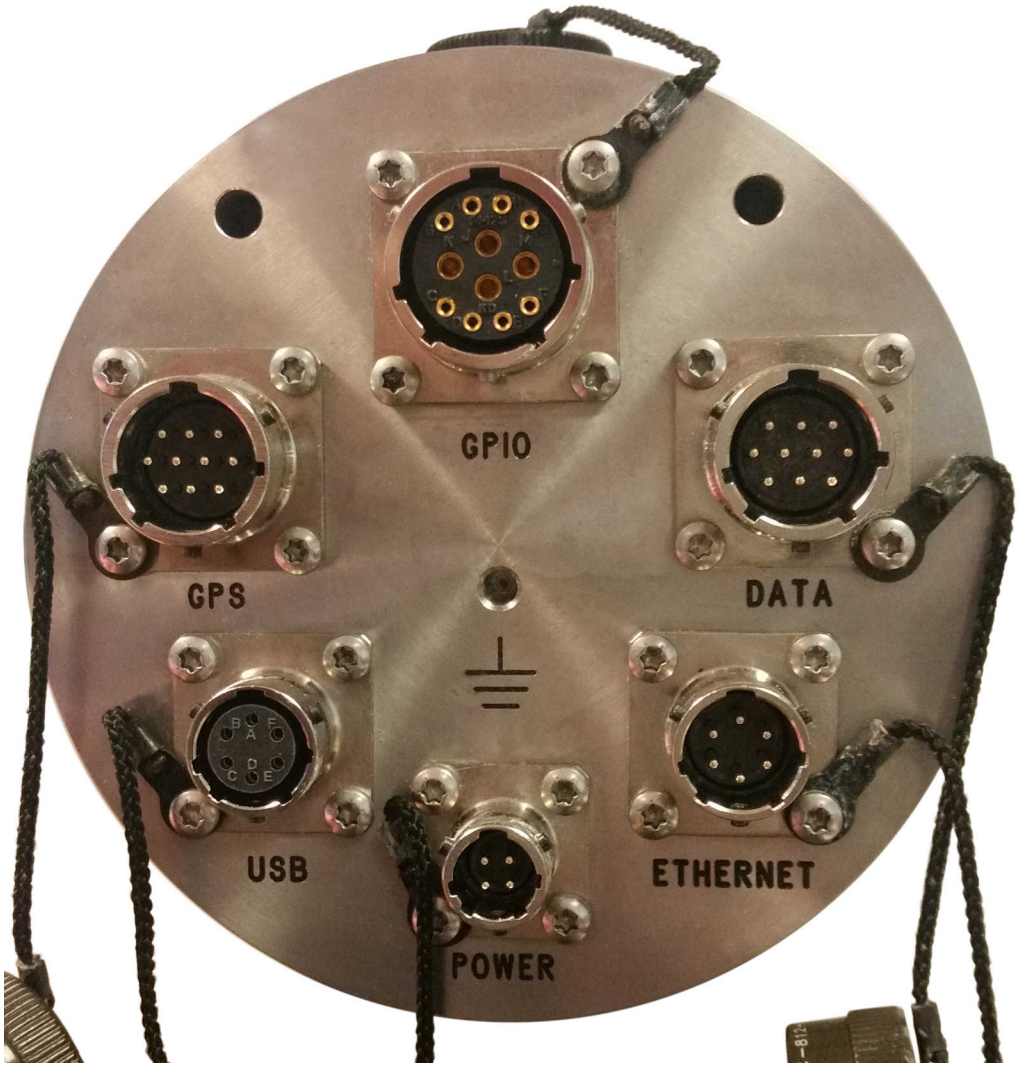
Pin	Function
L	*SENSOR A* and multiplexed inputs signal ground
M	Multiplexed input E / Aux 10
N	Digital ground
P	Power output -ve
R	Multiplexed input F / Aux 11
S	Multiplexed input G / Aux 12
T	Multiplexed input H / Aux 13
U	Multiplexed input J / Aux 14
V	Multiplexed input K / Aux 15



Wiring details for the compatible socket, ***-14-19S, as seen from the cable end (i.e. during assembly).

Note: Early models did not provide power via the AUXILIARY connector.

5.2 Digital connections



The Affinity has six connectors on the digital connection panel, the pin-outs and uses of which are described in this section.

5.2.1 Connector usage summary

5.2.1.1 DATA

The DATA port is a general-purpose serial port and it can also be used as alternative power input. It provides 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, inbound 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.

5.2.1.2 ETHERNET

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.

5.2.1.3 POWER

The POWER connector functions as the main power input and also provides a switched power outlet for external equipment.

5.2.1.4 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.

5.2.1.5 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 available from the DATA connector (see section 5.2.1.1 on page 29).

5.2.1.6 GPIO

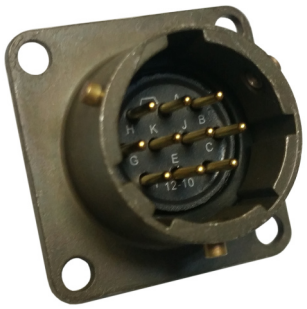
The GPIO (*G*eneral *P*urpose *I*nput/*O*utput) port fulfils two functions: it provides a serial console to the Affinity, which can be used for monitoring, configuration and control; and it provides a number of tri-state lines which can be used to control or monitor external equipment. One application is as tamper detection lines, which can be connected to external switches and monitors to form part of a secure installation.



Note: Early models provided access to the internal USB storage via this connector. This functionality is no longer available.

5.2.2 Connector Pin-outs

5.2.2.1 DATA



This is a standard ten-pin 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.

Pin	Function
A	Power input, 0 V
B	Power input +10 to +28 Volts DC
C	RS232 CTS
D	RS232 RTS
E	External trigger output
F	External trigger output
G	RS232 ground
H	External trigger input
J	RS232 receive
K	RS232 transmit



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

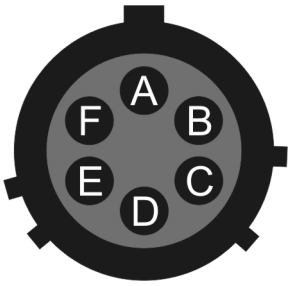
5.2.2.2 ETHERNET

This is a standard six-pin 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	Ethernet auxiliary power output (see section 8.2.3 on page 51)
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).

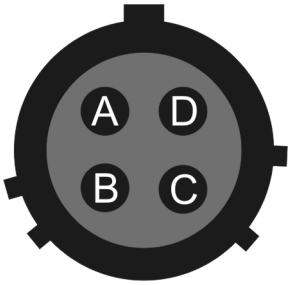
5.2.2.3 POWER

This is a standard four-pin bayonet plug, conforming to MIL-DTL-26482 (formerly MIL-C-26482). A typical part-number is 02E-08-04P although the initial “02E” varies with manufacturer.



Suitable mating connectors have part-numbers like ***-08-04S and are available from Amphenol, ITT Cannon and other manufacturers.

Pin	Function
A	Ground
B	Power input +10 to +28 Volts DC
C	*Not connected*
D	Auxiliary power output (see section 8.2.1 on page 51)



Wiring details for the compatible socket, ***-08-04S, as seen from the cable end (i.e. during assembly).

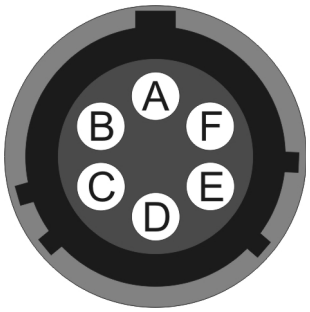
5.2.2.4 USB

This is a standard six-pin 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.

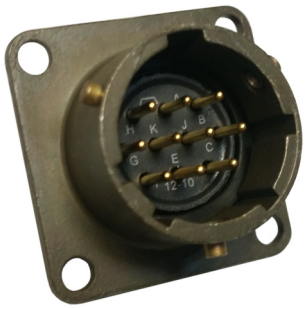


Pin	Function
A	+5 Volt DC (USB Type A pin 1) (see section 8.2.11 on page 52)
B	Data –ve (USB Type A pin 2)
C	Data +ve (USB Type A pin 3)
D	0 V (USB Type A pin 4)
E	Shielding
F	"USB on-the-go" detection (see section 8.2.12 on page 52)



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

5.2.2.5 GPS



This is a standard ten-pin 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 GPS input of a DM24 digitizer.

Pin	Function
A	Power 0 V
B	Power +V
C	1pps signal
D	*not connected*
E	Digitizer console transmit
F	Digitizer console receive
G	RS232 ground
H	Digitizer console 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).

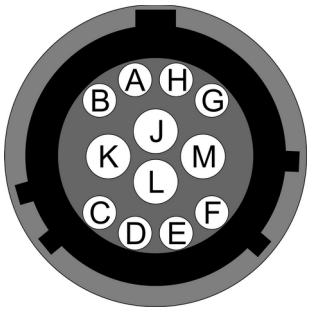
5.2.2.6 GPIO

This is a standard twelve-pin 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.



Pin	Function
A	*Not connected*
B	*Not connected*
C	*Not connected*
D	Anti-tamper line 3 (see section 8.2.8 on page 52)
E	Anti-tamper line 2 (see section 8.2.8 on page 52)
F	Anti-tamper line 1 (see section 8.2.8 on page 52)
G	Console transmit (RS232 TXD)
H	Console receive (RS232 RXD)
J	*Not connected*
K	*Not connected*
F	Anti-tamper line 1 (see section 8.2.8 on page 52)
M	Ground



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

Note: Early models provided access to the internal USB storage via this connector. This functionality is no longer available.

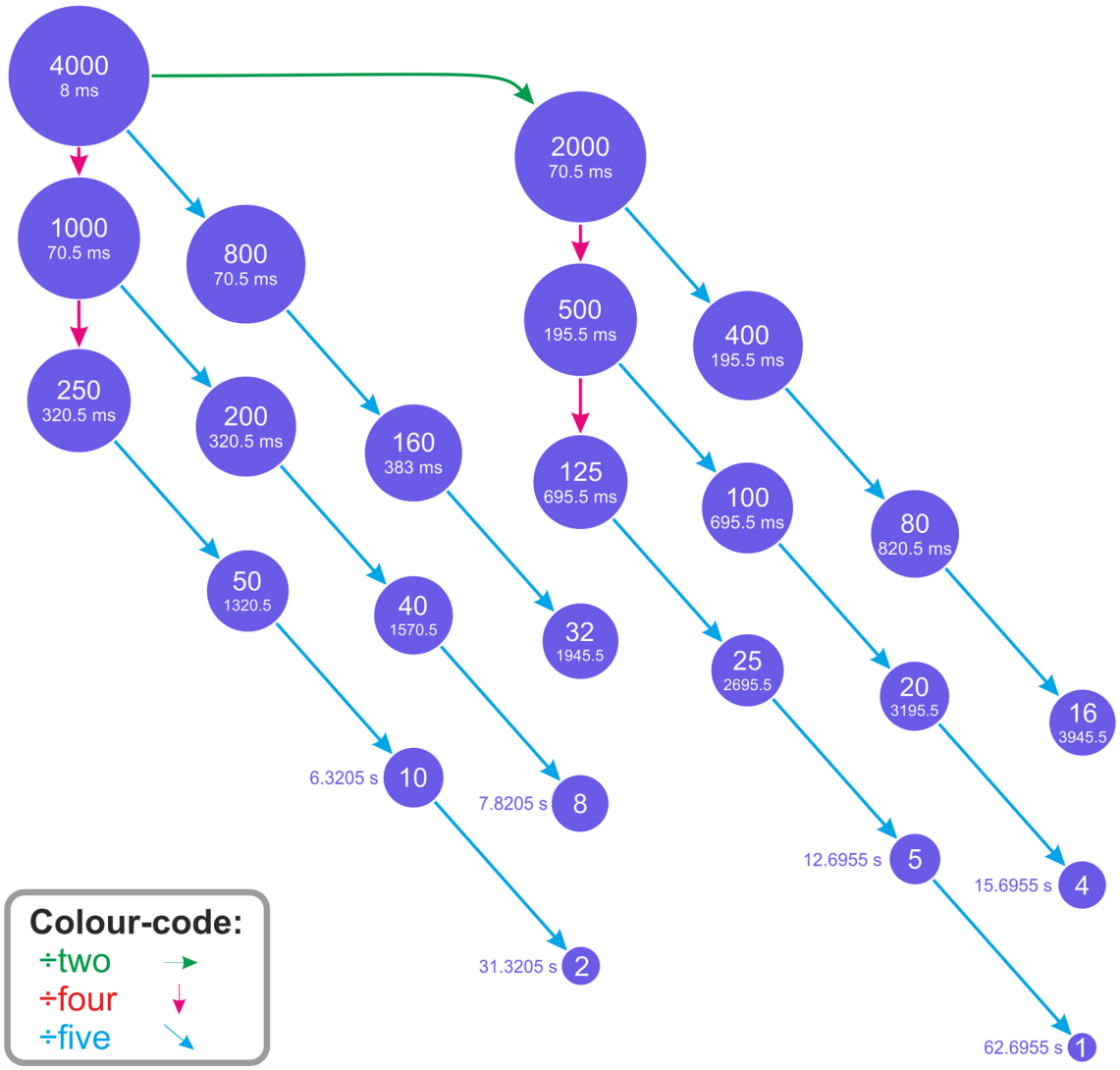
6 ADC configuration

6.1 Introduction

The Güralp Affinity contains one or two ADC cards. Each ADC card provides four full-featured, synchronous ADC channels and a single ADC with an input multiplexor that can handle eight different channels at a lower resolution. Because this style of ADC is unique to the Affinity, its configuration is not covered in the Platinum manual.

6.1.1 Sample rates and decimation

Unlike other Güralp digitisers, the Affinity has a simple decimation model which uniquely maps each output sample rate to a single filter chain configuration. The available output rates (and associated latencies), are shown below:



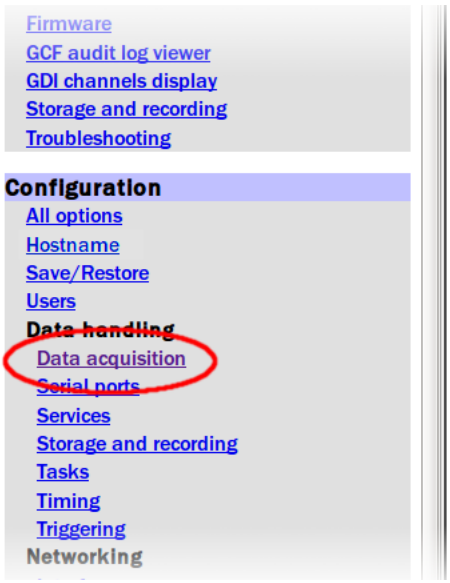
This arrangement offers the lowest possible latency for each output sampling rate without sacrificing quality.

6.2 Data acquisition configuration

The configuration interface can be used to configure the ADC in an Affinity, the digitiser module in a DM24S*x*EAM or any serially attached Güralp digitiser, such as a Güralp DM24 or CD24, or digital instrument. The interface for external digitisers and digital instruments is described in the Platinum manual. This section describes the interface for the ADC in an Affinity.

To configure the ADC using the web interface select:

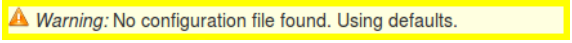
Configuration → Data handling → Data acquisition



If external digitisers and digital instruments are present, a list will be displayed from which you can select the digitiser to configure. If there are no external digitisers, the ADC configuration screen appears immediately.

Note: To control an attached instrument, as opposed to configuring the ADC, please see the Sensor Control section of the Platinum manual.

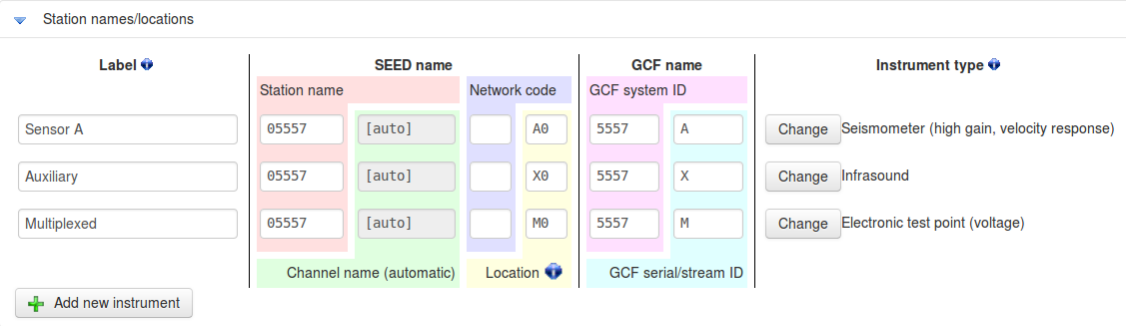
The first time that this screen is accessed, a warning is displayed:



This is normal and, once a configuration has been saved, it will not be shown again.

The ADC configuration screen has three parts: “Station name/locations”, “Synchronous channels” and “Multiplexed channels”. Each section can be expanded (displayed) or contracted (hidden) by clicking one of the blue arrow symbols, and .

6.2.1 Station name/locations



Use this section to configure the logical instruments which are being associated with the ADCs. Each row represents a logical instrument and additional rows can be added as required using the Add new instrument button.

For each logical instrument, the following attributes are displayed:

- **SEED name** – these values are used for naming channels transmitted over SEEDlink, CD1.1 and some other protocols.
  - **Station name** – this is initially based on the serial number of the Affinity but can be altered here as desired.
  - **Channel name** – this is automatically determined from the Instrument type
  - **Network code** – this can be entered if desired or left blank if not required
  - **Location** – this field is automatically populated but can be over-ridden if desired
- **GCF name** – these values are used for naming channels transmitted using GCF protocols, such as Scream and BRP, or GDI.
  - **GCF system ID** – this is initially based on the serial number of the Affinity but can be altered here as desired.
  - **GCF serial/stream ID** – this field is automatically populated but can be over-ridden if desired
- **Instrument type** – The instrument type can be chosen from the extensive menu which is displayed when you click the Change button. Additional entries may be added by describing the desired instruments in the file `/etc/gdi-base/instrument-models.local` - contact support@guralp.com for details.

6.2.2 Synchronous channels

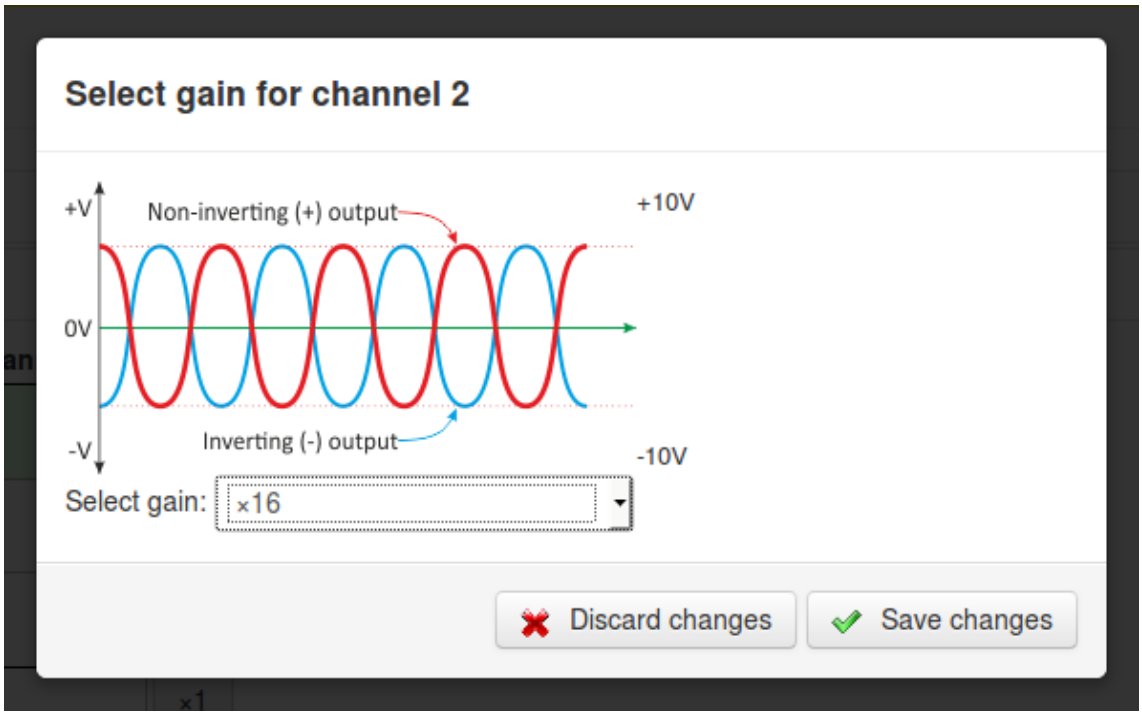
Synchronous channels

Station and location	Channel 1	Channel 2	Channel 3	Channel 4
Sensor A *05557.A0 / 5557-A*	Z	N	E	
Auxiliary *05557.X0 / 5557-X*				X
Multiplexed *05557.M0 / 5557-M*				
Channel gain	×1	×1	×1	×1
100 samples/second	05557.HHZ..A0 5557-AZ0	05557.HHN..A0 5557-AN0	05557.HHE..A0 5557-AE0	05557.HDF..X0 5557-XX0
1 samples/second	05557.MHZ..A0 5557-AZ2	05557.MHN..A0 5557-AN2	05557.MHE..A0 5557-AE2	05557.MDF..X0 5557-XX2

Select sample rates

For each of the four main synchronous channels, this section allows you to select the component letter used for stream naming, the Channel gain to be applied and the sample rate(s) to be generated. The default, recommended component lettering for a single triaxial velocity sensor is shown above.

Channel gains from unity to ×64 are available in binary steps. To change a channel gain, click the appropriate ×1 button. The following screen is displayed:

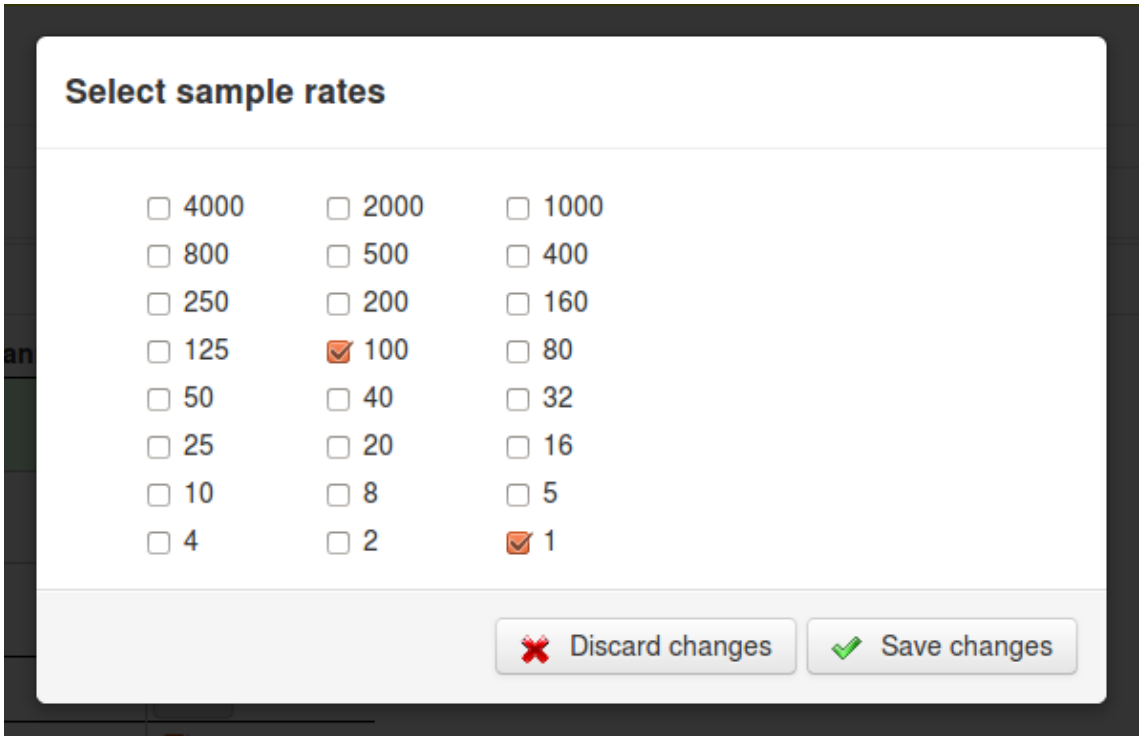


The desired gain can then be selected from the drop-down menu and saved to the configuration with the Save changes button.

One or more sample rates can be selected for each synchronous channel. Each selected sample rate appears in a separate row at the bottom of the table and output from each channel at that sample rate can be enabled or disabled using the check-box.

The automatically-generated SEED names (in S.C.N.L. format) are displayed beside each check-box, above the automatically-generated GCF names.

To add, delete or change the sample rates, click the Select sample rates button. The following screen is displayed:



Use the check-boxes to select which sample rates are to be displayed in the main Synchronous channels screen, and then click the Save changes button to return to the main screen.

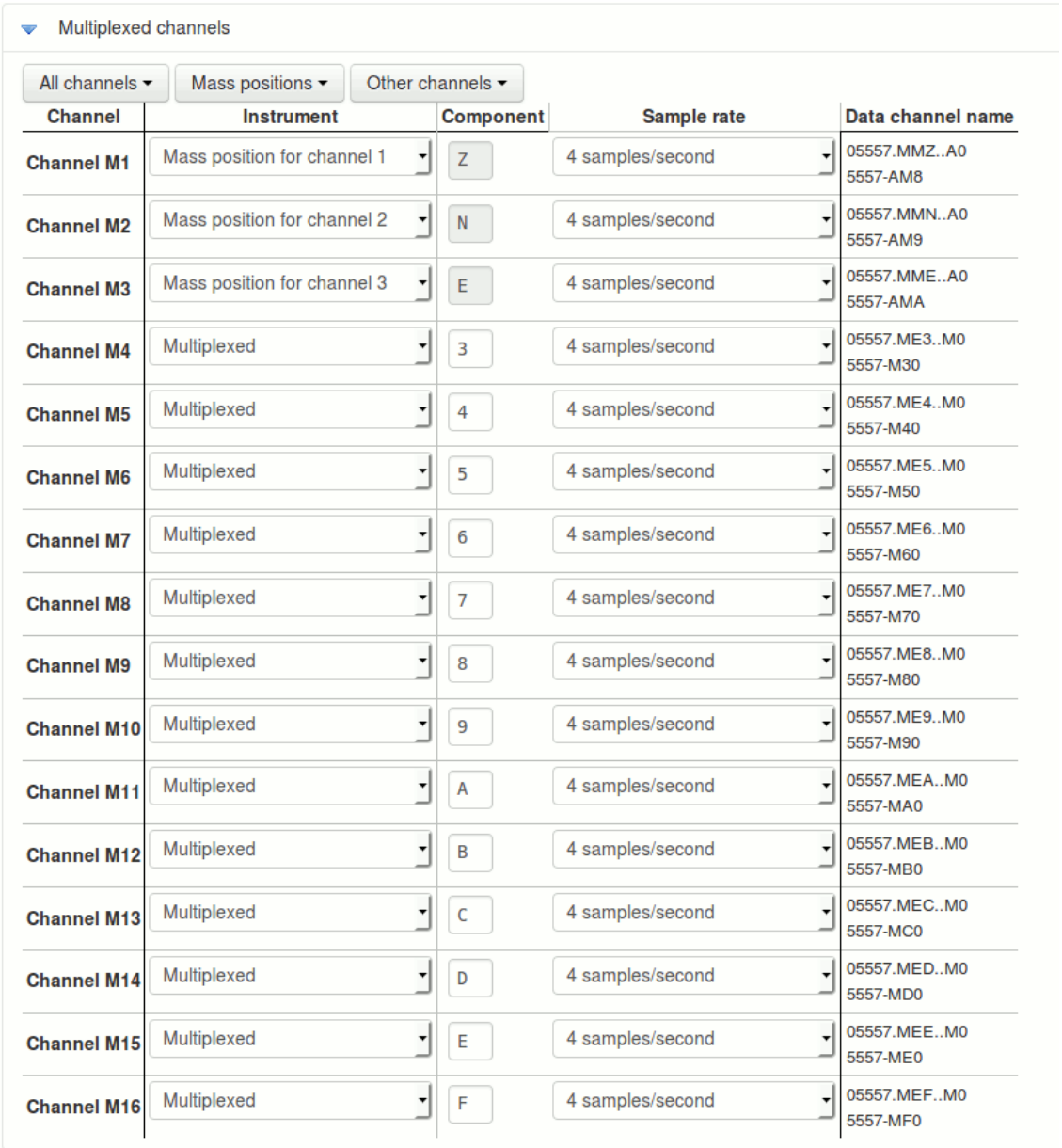
6.2.3 Multiplexed channels

The Multiplexed channels section displays one row for each available multiplexed channel. The display can be filtered to show subsets of the channels:

- The Mass positions button shows only channels designated as mass position channels, typically M1, M2 and M3.
- The Other channels button hides the mass position channels and shows all others.

- The All channels button displays every channel.

For each multiplexed channel, the associated instrument and component are shown, along with a drop-down menu for selecting the sample rate and the associated automatically-generated SEED name (in S.C.N.L. format) and GCF name.



Channel	Instrument	Component	Sample rate	Data channel name
Channel M1	Mass position for channel 1	Z	4 samples/second	05557.MMZ..A0 5557-AM8
Channel M2	Mass position for channel 2	N	4 samples/second	05557.MMN..A0 5557-AM9
Channel M3	Mass position for channel 3	E	4 samples/second	05557.MME..A0 5557-AMA
Channel M4	Multiplexed	3	4 samples/second	05557.ME3..M0 5557-M30
Channel M5	Multiplexed	4	4 samples/second	05557.ME4..M0 5557-M40
Channel M6	Multiplexed	5	4 samples/second	05557.ME5..M0 5557-M50
Channel M7	Multiplexed	6	4 samples/second	05557.ME6..M0 5557-M60
Channel M8	Multiplexed	7	4 samples/second	05557.ME7..M0 5557-M70
Channel M9	Multiplexed	8	4 samples/second	05557.ME8..M0 5557-M80
Channel M10	Multiplexed	9	4 samples/second	05557.ME9..M0 5557-M90
Channel M11	Multiplexed	A	4 samples/second	05557.MEA..M0 5557-MA0
Channel M12	Multiplexed	B	4 samples/second	05557.MEB..M0 5557-MB0
Channel M13	Multiplexed	C	4 samples/second	05557.MEC..M0 5557-MC0
Channel M14	Multiplexed	D	4 samples/second	05557.MED..M0 5557-MD0
Channel M15	Multiplexed	E	4 samples/second	05557.MEE..M0 5557-ME0
Channel M16	Multiplexed	F	4 samples/second	05557.MEF..M0 5557-MF0

The available sample rates for multiplexed channels are 1, 2, 4, 5, 8 or 10 samples per second. Each channel can also be switched off using the “Sample rate” drop-down menu.

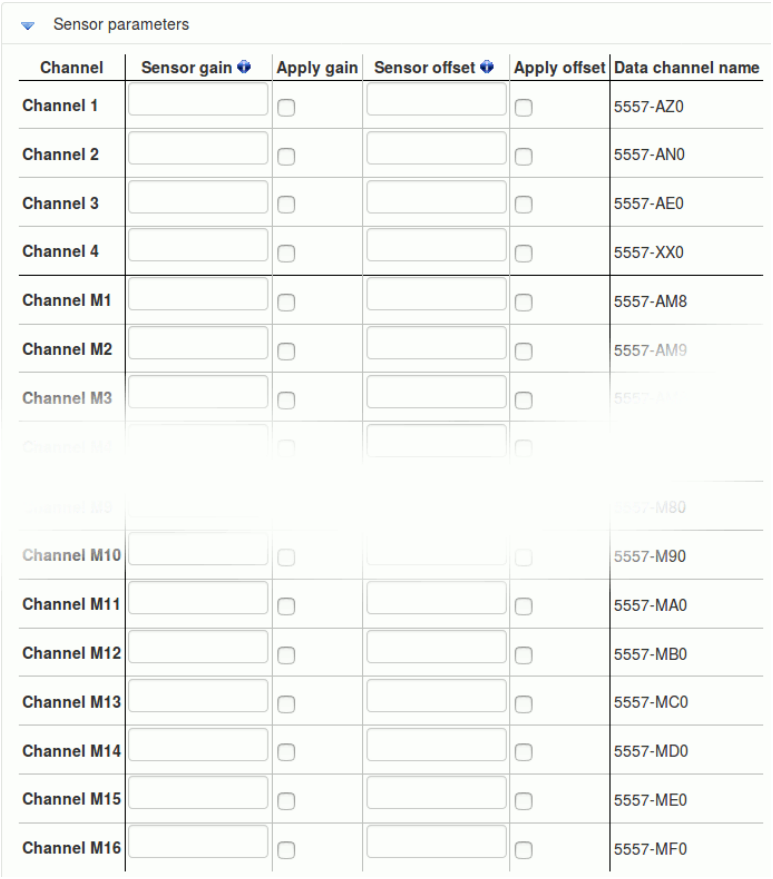
6.2.4 Sensor parameters

The sensor parameters table is accessed by clicking the link below the multiplexed channels table:



This opens the sensors parameters table, which has one row for each input channel. Each row has:

- a field for Sensor gain;
- a check-box which controls whether the gain is applied or not;
- a field for sensor offset;
- a check-box which controls whether the offset is applied or not; and
- a label showing the associated output channel name.



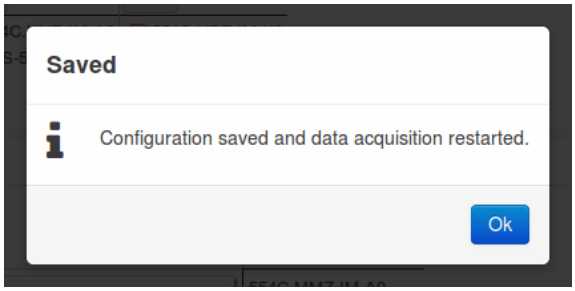
Values entered into the Sensor Gain fields will be reported in the associated channel's meta-data as "sensor-gain" or, if applied to the digitiser input before any sensor offset as "sensor-gain-applied". Similarly, values entered into the Offset fields will be reported in meta-data as "sensor-offset" or, if applied to the digitiser input, as "sensor-offset-applied".

Note: Any specified offset is subtracted after the specified gain has been applied.

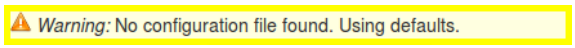
Data entered into this table are stored in the file `/etc/das-in/das-in.local`.

6.2.5 Saving and other actions

When all required changes have been made, scroll back to the top of the screen and click the Save settings button. The following screen is displayed:

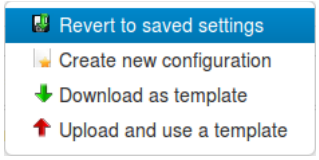


The configuration is saved and the new settings take effect immediately. Click Ok to continue. The warning



is removed and not displayed again.

The More actions... button displays the following menu:



From this menu:

- The Revert to saved settings button abandons all changes that have been made to this form since the last save and resets the form to match the saved configuration.
- The Create new configuration button resets the contents of the form to the factory defaults.
- The Download as template button saves a configuration template file and uses your browser's normal file download facility to allow you to save it to your PC. This feature is intended for use in a future development.
- The Upload and use a template button is currently unimplemented. This feature is intended for use in a future development.

7 Sample-clock Timing



All Platinum systems offer a choice of timing modes. The modes available on the Affinity are:

- **Direct GPS** – the sample clock is trained directly to GPS time, as determined from an attached GPS receiver;
- **PTP** – the sample clock is trained to system time, as synchronised using the Precision Time Protocol (PTP);
- **NTP** – the sample clock is trained to system time, as synchronised using the Network Time Protocol (NTP);
- **Manually set** – the sample clock is manually set by the operator; and
- **CD24/DM24 with GPS** – the sample clock is trained to system time, which is synchronised to incoming Universal Status Packets (USP) from an attached CD24 or DM24 digitiser (which is, in turn, assumed to be synchronised to GPS time).

For the Affinity, the recommended timing mode is Direct GPS. This offers the highest accuracy of all available options.

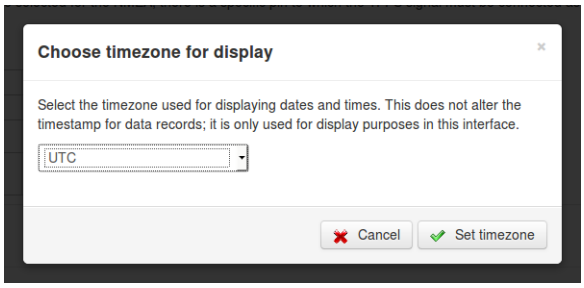
The Platinum manual describes Direct GPS mode, NTP mode, Manual mode and CD24/DM24 with GPS modes. This chapter duplicates the Direct GPS mode section and provides information about PTP mode, which is unique to the Affinity.

To configure the Timing mode using the web interface select:

Configuration → Data handling → Timing

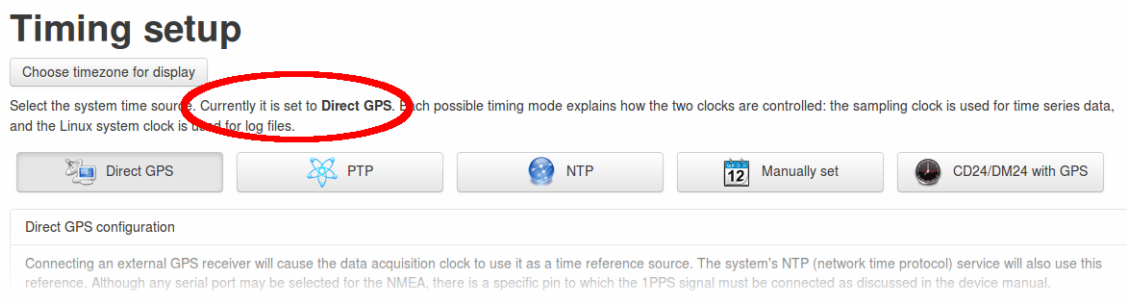
The resulting screen first offers a button, Choose timezone for display, which allows the display time-zone to be set from an extensive list. Note that this does not affect the sample clock – just times and dates displayed in the web interface and log-files.

Clicking the Choose timezone for display button shows the following window.



Select the required time-zone and then click Set timezone to save your choice.

Beneath the time-zone selection button is a paragraph that specifies the currently-selected timing mode, as shown below:



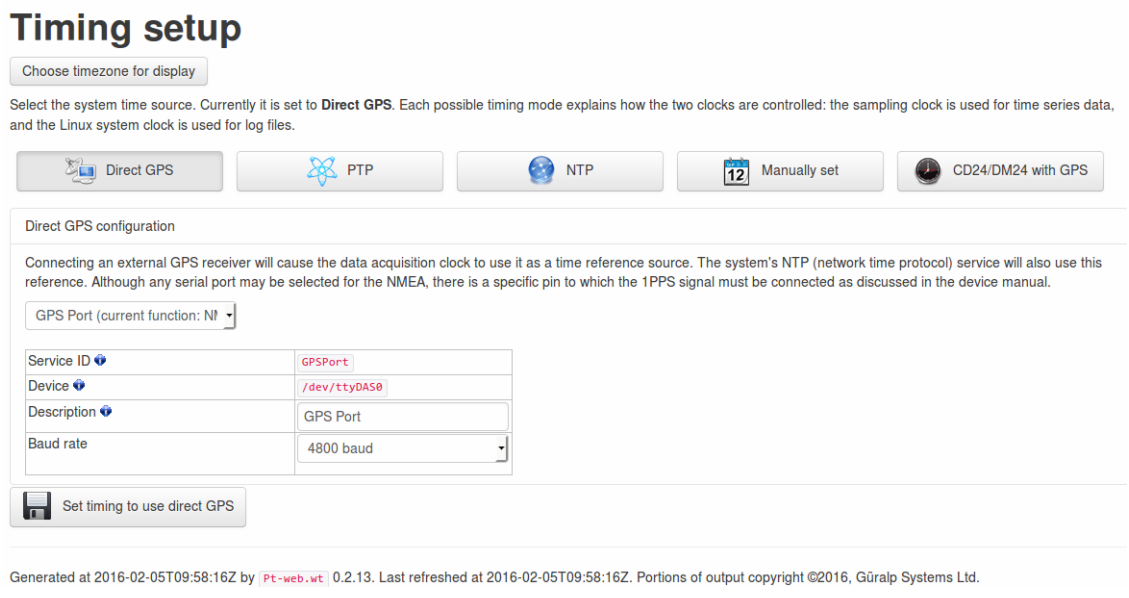
You can visit each of the tabbed screens without changing the mode. Each tabbed screen has its own "Set timing..." button, which saves any changes made to data in put fields on that tab and sets the relevant mode, if it has changed.

7.1 Direct GPS mode

7.1.1 Configuration

This is the recommended mode. It requires a physical GPS receiver to be connected.

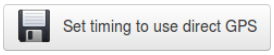
From the Timing setup screen, clicking the Direct GPS button displays the following tab:



The drop-down menu allows you to select the port to use as a GPS input. Although you can select from the Auxiliary serial port, the Data port, the GPS port and the Sensor Control Port A, this should be left set to GPS port in almost every circumstance. Please contact Güralp support if you decide to change this setting. The menu displays the currently-selected port function for each listed port.

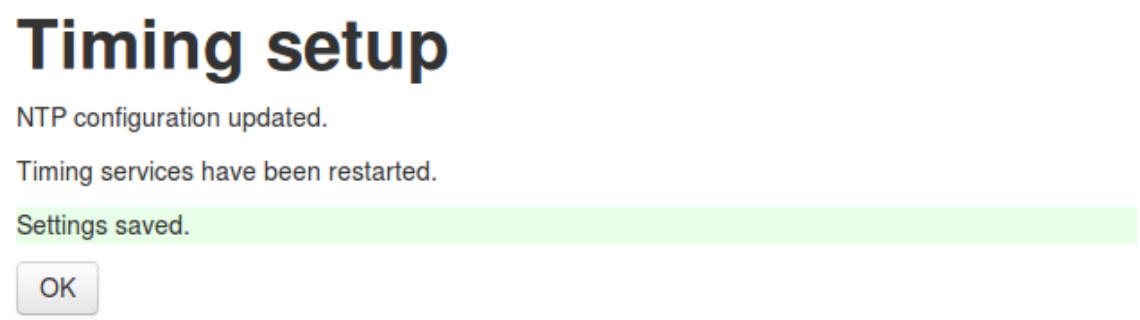
Below the drop-down menu are:

- **The Service ID**: The displayed ID is used as the service name for the serial port. Restarting this service will restart the serial port's function. It is also used to name configuration files and for log messages.
- **The Device name**: This displays the path to the Linux device node. It is only shown for information and for users who wish to interact with ports on the command line.
- **The Description**: This describes the port. It depends on the setting chosen in the drop-down menu.
- **Baud rate**: This drop-down menu allows you to select the line speed of the selected serial port. For Güralp GPS receivers, this should be set to 4,800 Baud. Some combined GPS/Glonass receivers may require higher line speeds. Please contact Güralp support if in any doubt.

Once any required changes have been made, click 

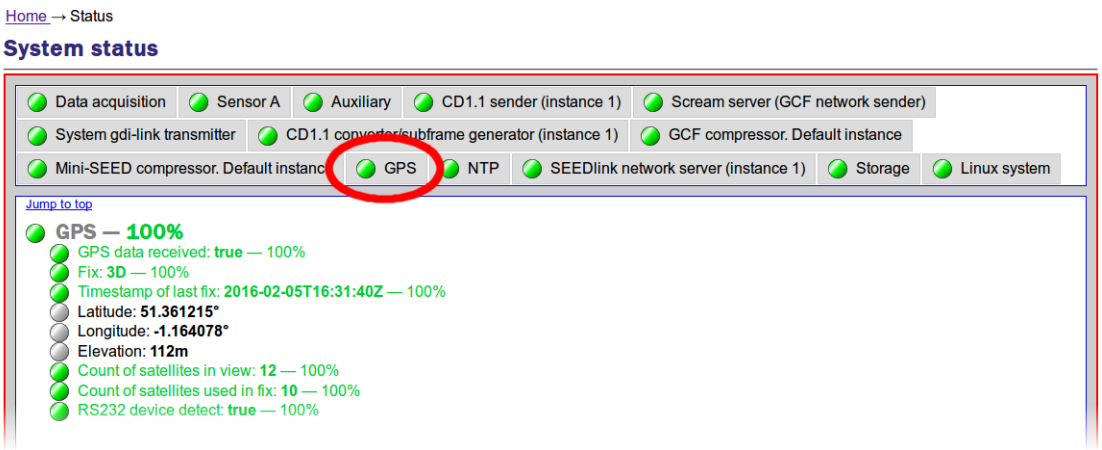
to save your changes (if any) and set the system to use the Direct GPS mode.

An acknowledgement screen is displayed:



7.1.2 Diagnostics

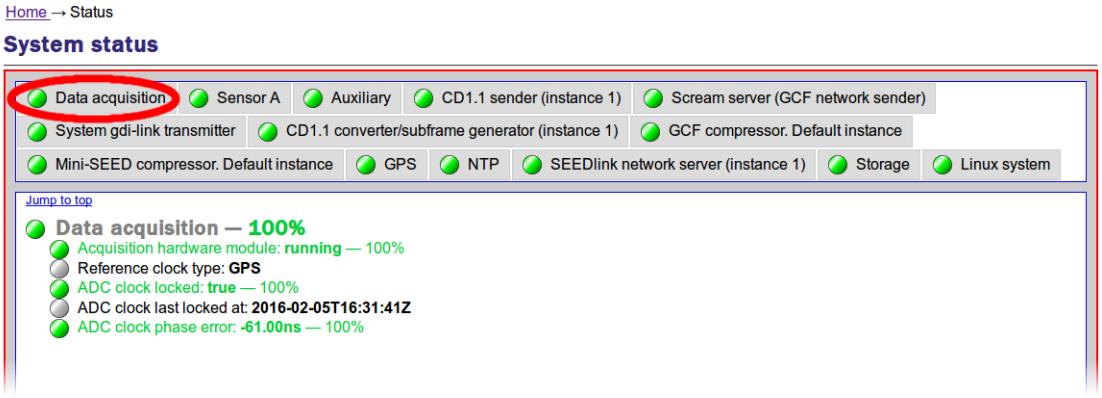
When in Direct GPS mode, the main status screen acquires an extra tab displaying the GPS receiver status:



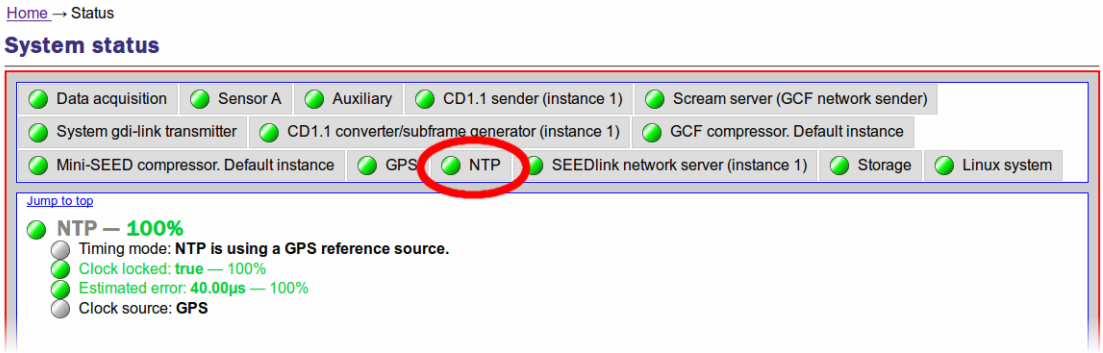
This tab displays various pieces of information about the GPS receiver, including the Fix type (which ***must*** be 3D for correct operation) and the number of satellites currently in view.

Note: There must be at least four satellites in view in order to obtain a 3D fix. If the number of satellites is consistently less than four or if the fix is 2D or none, check that "GPS data received" is true and, if it is, consider re-positioning the GPS receiver so that it has an unobstructed view of the sky. If you still have problems obtaining a 3D fix, please contact Güralp technical support for advice.

The Data acquisition tab of the main status screen also indicates that the timing mode is GPS, in the **Reference clock type** field:



...and the NTP tab shows the timing source to be GPS:



7.2 PTP mode

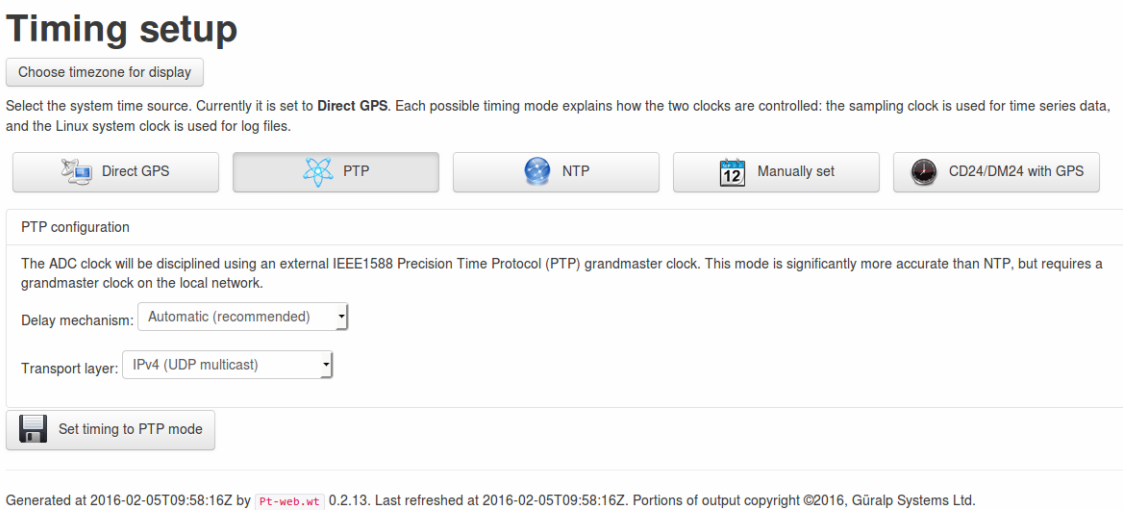
IEEE 1588-2008 Precision Time Protocol (PTP) is a protocol used to synchronise clocks throughout a computer network. On a local area network, it achieves clock accuracy in the sub-microsecond range, making it significantly better than NTP but not as good as accurate as GPS.

The PTP implementation on the Güralp Affinity (`ptp4l`) requires that a grandmaster clock be present on the same network segment as the Affinity (***or*** all the routers between the grandmaster clock and the Affinity must be configured to allow

multicast UDP packets on 224.0.1.129 and 224.0.0.107 for IPv4 or FF0x::181 and FF02::6B for IPv6).

7.2.1 Configuration

From the Timing set-up screen, clicking the PTP button displays the following configuration screen:



PTP requires very little configuration. The following parameters can be adjusted:

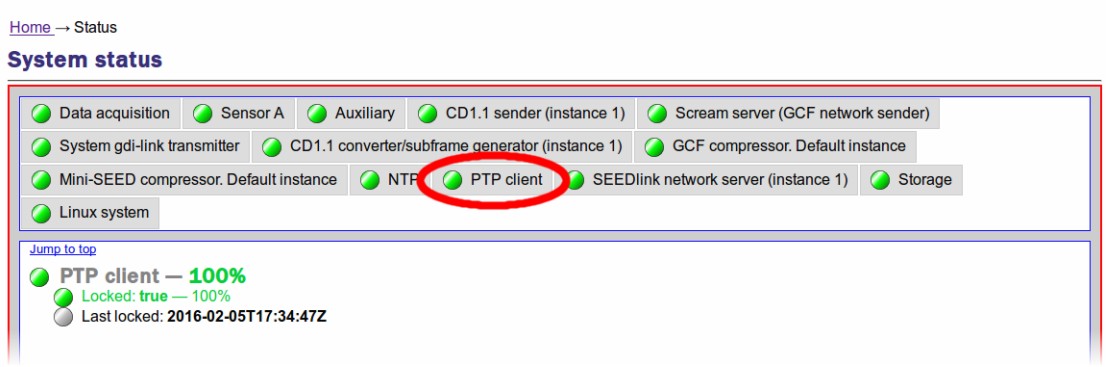
- **Delay mechanism**: The options are:
  - **E2E** – end-to-end mode is appropriate for basic networks;
  - **P2P** – peer-to-peer mode is appropriate for networks which have been optimised for PTP; and
  - **Automatic** – this mode automatically detects whether to use E2E or P2P. It is the recommended setting.
- **Transport Layer**: The options are
  - IPv4 (UDP Multicast);
  - IPv6 (UDP Multicast); and
  - 802.3 (raw Ethernet).

  Unless you have very specific requirements, and you understand the implications, this should be left set to IPv4.

Once any required changes have been made, click Set timing to PTP mode to save your changes (if any) and set the system to use the Direct GPS mode.

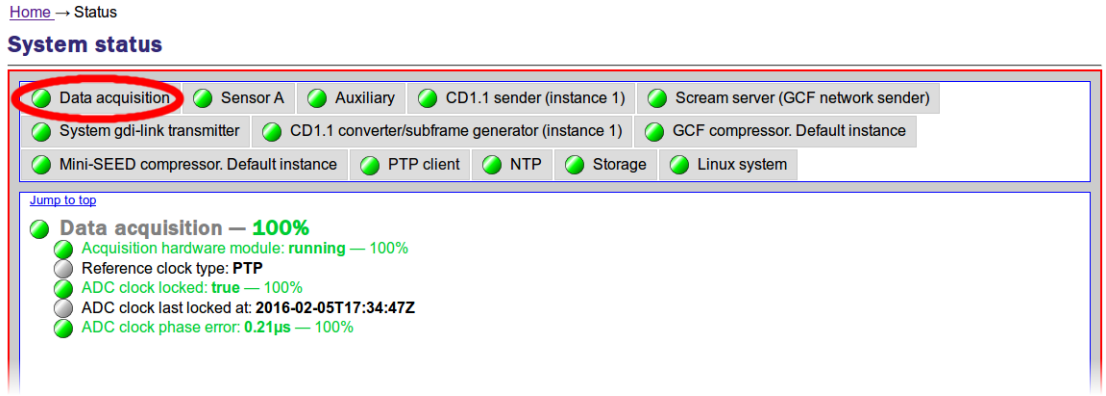
7.2.2 Diagnostics

When in PTP mode, the main status screen acquires an extra tab displaying the PTP status:

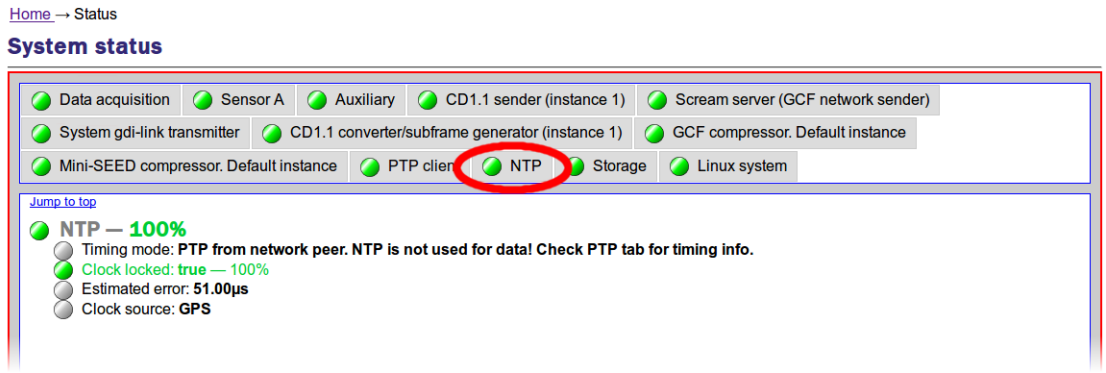


This tab simply displays the current lock status and the time that a lock was last achieved.

The Data acquisition tab of the main status screen also indicates that the timing mode is PTP, in the **Reference clock type** field:



The NTP tab also changes to show that the timing mode is PTP. The message “NTP is not used for data” is not an error: it is there to remind you that the sample clock is disciplined directly by PTP.



8 Digital I/O

8.1 Introduction

The Güralp Affinity has a number of hardware lines that are typically used for power monitoring and supply, tamper detection, although they are available for other purposes if desired. These lines are monitored and controlled via the digital I/O page of the web interface. General use of this page is described in the Platinum manual.

The following section lists the available lines and described the purpose of each.

8.2 Lines

8.2.1 Auxiliary power output

This output is presented on pin D of the POWER connector (see section 5.2.2.3 on page 33). It provides the same voltage as the main input power supply and is protected by a 550 mA fuse.

8.2.2 Auxiliary power output B

This output is only exposed in OBS packages. It provides the same voltage as the main input power supply and is protected by a 550 mA fuse.

8.2.3 Ethernet auxiliary power output

This output is presented on pin D of the ETHERNET connector (see section 5.2.2.2 on page 32). It provides the same voltage as the main input power supply and is protected by a 550 mA fuse.

8.2.4 GPS Port

This output is intended to power the GPS receiver. It is presented on pin B of the GPS connector (see section 5.2.2.5 on page 35). It provides the same voltage as the main input power supply and is protected by a 550 mA fuse.

8.2.5 GPS Port detect

This “input” is connected to an RS232 detector at the NMEA input of the GPS port. It is driven high when an RS232 device is detected at pin K (see section 5.2.2.5 on page 35).

8.2.6 System

This input monitors the main power supply input to the Affinity and displays the voltage being received and the current being drawn.

8.2.7 Tamper line 0

This “input” is driven by the outputs of an internal photo-detector and two micro switches which act together to indicate whether the casing has been opened. It is typically used to affect the status of the `authentication_seal_broken` and/or `digitizing_equipment_open` security bits in CD1.1 packet headers.

8.2.8 Tamper lines 1, 2 and 3

These three independent inputs are exposed on pins F+L, E and D of the GPIO connector (see section 5.2.2.6 on page 36). Pins F and L are both connected to tamper line 1. They are typically used as tamper-detection inputs and their status can be mapped to appropriate security bits in CD1.1 packet headers.

8.2.9 USB high-power output

This output is only exposed in OBS packages. It provides the same voltage as the main input power supply and is protected by a 550 mA fuse.

8.2.10 Internal USB port

This switchable power output is internally connected to the power input of the internal USB memory device.

8.2.11 External USB port

This switchable power output is intended to power external USB devices such as memories. It is presented on pin A of the USB connector (see section 5.2.2.4 on page 34). It provides 5 V DC, in accordance with the USB standard.

8.2.12 External USB port (peripheral mode)

This input is driven by the USB on-the-go detection on pin F of the USB connector (see section 5.2.2.4 on page 34). This is an experimental feature which has no current application.

9 ADC Calibration

The ADC of each Güralp Affinity is calibrated at the factory. All measurements made are traceable to national standards and conform to the requirements of ISO/IEC 17025:2005. The calibration values are stored on the system and used to automatically scale every channel to an input sensitivity (bit-weight) of 1µV per count.

Note: This does not apply to data which are digitised externally – e.g. from a connected DM24 or CD24 digitiser.

Because of this, it is not necessary for the data consumer to re-scale the data - or even to be aware of the factory calibration results.

If desired, a calibration certificate can be generated and downloaded. To do this, select:

Tools → Calibration certificate

and click the Download certificate button in the resulting page. This uses your browser's standard download facility to deliver a document in Open Document Text (.odt) format. Such documents can be read by Libre Office Writer, Microsoft Word and many other applications.

10 Calibration of connected instruments

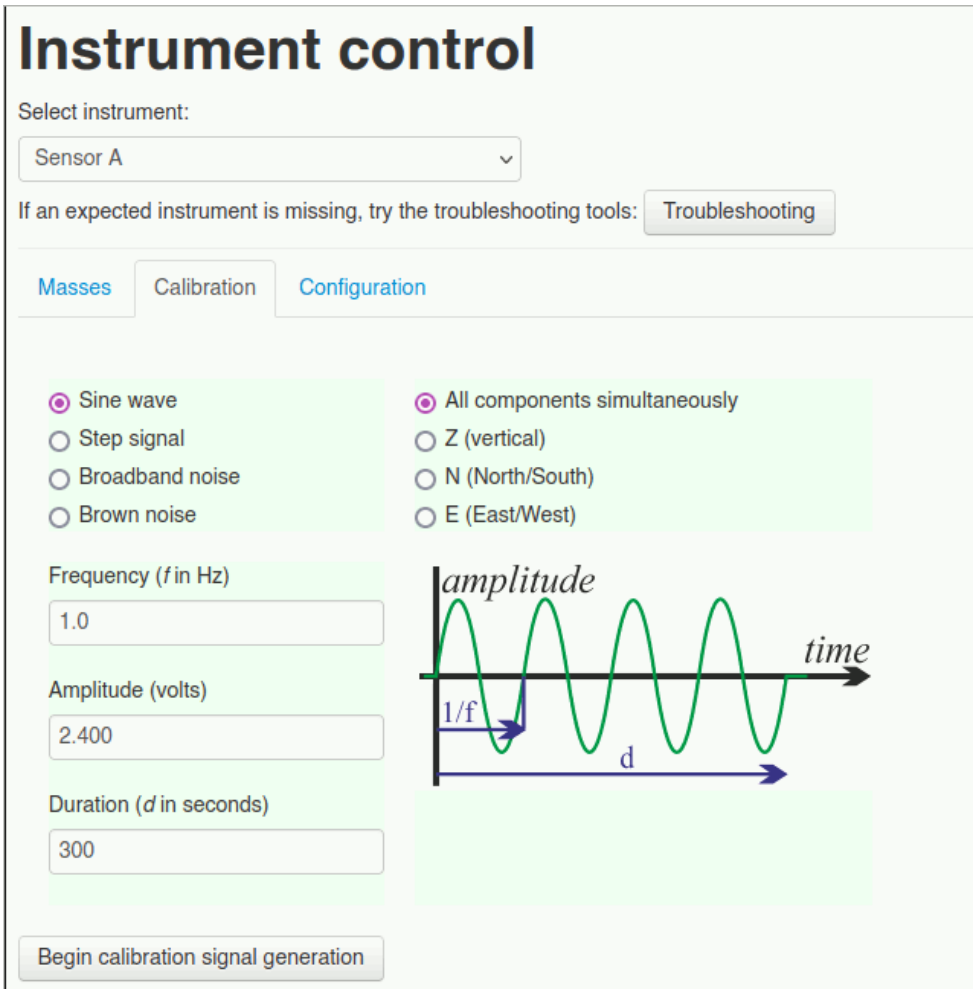
Instruments can be calibrated by the Affinity, which will generate a calibration signal to apply to the calibration input of the instrument. The output from the instrument is digitised in the normal way. The calibration signal is digitised in the same way as the main inputs so that it can be compared to the instrument's output(s). This comparison is most easily performed using Güralp's Scream software; see MAN-SWA-0001 for details.

10.1 Initiating calibration

Calibration can be initiated via the web interface by selecting

Control → Instruments

Specify the instrument to be calibrated from the Select instrument drop-down menu and click to the Calibration tab. The following screen is displayed.



Select the appropriate parameters and then click Begin calibration signal generation.

Note: Güralp recommend performing a Broadband noise calibration with a duration equal to *at least* five times the low-end period of your instrument. For example, an instrument with a response which is flat from 120 seconds to 100 Hz requires a calibration experiment which lasts at least ten minutes and, preferably, longer.

While the calibration is active, the Affinity will

- activate the calibration control line(s) on the appropriate instrument connector (see section 5.1.1 on page 27);
- generate the calibration signal specified and route it to the appropriate calibration output pin;
- suspend digitisation of the X input on the instrument connector and use the resulting free ADC to digitise the generated calibration signal. This ensures that both the calibration signal and the instrument's output(s) are digitised in exactly the same way, making the comparison as accurate as possible; and
- produce a new output channel, with stream-name suffix `C0`, containing the digitised calibration signal.

Note: The calibration signal will be digitised at the same sample-rate as the fastest enabled tap on the main inputs. If, for example, the main inputs are configured to produce output at 100, 40 and 1 sps, the calibration signal will be produced at 100 sps. If it is required to calibrate at a lower sample-rate, the desired rate can be specified by changing the value of key `monitor_sps` in the file `/etc/das-in/sensor_cal.local`

The value specified must already be enabled as a tap on the main outputs. Setting the value to -1 restores the default behaviour and selects the highest available configured rate.

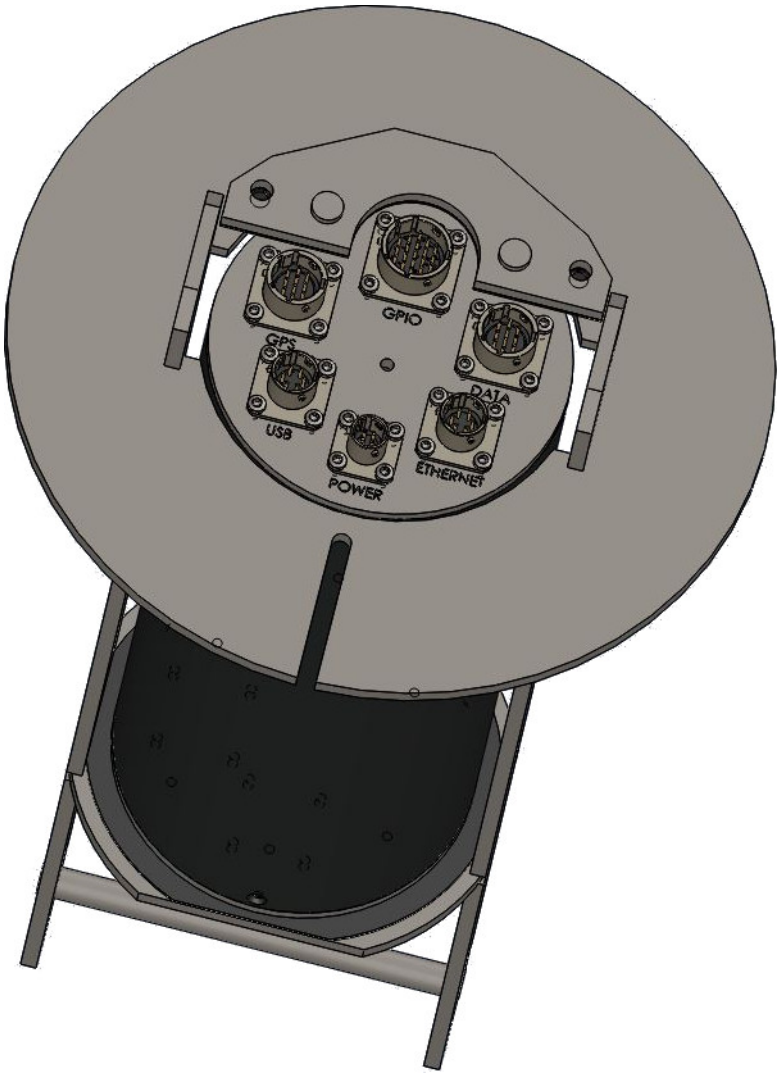
When the calibration is complete, the calibration control lines will be deactivated, transmission of the `*C0` channel will stop and digitisation of the `X*` channel(s) will resume.

You can now use Scream or the software of your choice to compare the signals and calculate the calibration values for your instrument.

11 The Borehole Hanger

11.1 Description

The Affinity Borehole Hanger is a welded steel frame, which is designed to fit into the top of a borehole casing, in place of a trap plate. It is made to securely carry an Affinity unit flush with the top of the borehole casing.



The Borehole Hanger top plate serves in place of a trap plate, giving a secure surface against which to install a clamp on the installation strain wire.

The hanger frame is designed so that the Affinity unit may be removed for service without disturbing the seismometer installation.

11.2 Installation

1. To install the borehole hanger, follow the procedure below:
2. Install the sensor system in the borehole. Fit the last cable clamp between the signal cable and the strain wire such that it will be approximately 1 m below the top of the borehole casing at the final depth, with approximately 1.5 m of signal cable loose above the clamp.
3. If surplus cable must be accommodated, it may be formed into a loop and secured below the hanger frame to the strain wire, or to the cross-bar on the hanger frame, such that the weight of the cable is not applied to the connector on the Affinity.
4. Remove the trap plate from the top of the hanger frame.



5. Feed the free end of the signal cable up through the hanger frame. It should pass the bar at the bottom of the hanger on the side towards the straight edge of the hole in the lower plate.
6. Feed the hanger into the borehole, passing the strain wire through the slot in the top plate so that the top plate rests on the borehole casing.
7. Fit a clamp to the strain wire just above the hanger top plate and lower the strain wire so that the weight of the cables is carried by the top plate.

8. Connect the signal cable to the Affinity digitiser and lower it into the hanger frame. Engage the two pins on the frame lower plate with the peg holes in the end bulkhead of the Affinity. This may be facilitated by connecting one or two of the system cables to the top of the Affinity and using their connectors for purchase.



Caution: Do not suspend the Affinity by the cables but grip the connector bodies.

9. Fit the trap plate, engaging its pins in a similar manner.

12 EU Declaration of Conformity

We

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Midas House, Calleva Park, Aldermaston
READING, RG7 8EA.

Tel: +44 118 981 9056
E-mail: technical@guralp.com

Declare under our sole responsibility that the following product

Equipment name: Affinity
Model Number: AFF-3208SS0VE0643 and appropriate variants

Is in conformity with the

Electromagnetic Compatibility Directive 2014/30/EU
Low Voltage Directive 2014/35/EU
Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU

by applying the following harmonised standards and technical specifications:

EN 61000-4-2:2009 – Electrostatic Discharge Immunity
EN 61000-4-3:2006 +A1:2008 +A2:2010 – Radiated RF Immunity
EN 61000-4-4:2012 – Electrical Fast Transients Immunity
EN 61000-4-5:2014 – Voltage Surge Immunity
EN 61000-4-6:2014 – Conducted RF Immunity
EN 61000-4-8:2010 – Power Frequency Magnetic Field Immunity
EN 61000-4-11:2004 – Voltage Dips and Short Interruptions Immunity
EN 55011:2009 +A1:2010 – Radiated Emissions
EN 55011:2009 +A1:2010 – Conducted Emissions
IEC 61010-1 3rd Edition – Low voltage safety
2011/65/EU – RoHS

Signed for and on behalf of
Guralp Systems Ltd
on 25 February 2020

Systems Director



13 Revision History

J	2024-01-15	Added chapter on Calibration of Connected Instruments
H	2021-09-09	Added EU Declaration of Conformity
G	2019-06-25	Added sensor control lines logic-level autodetection. Refreshed screen-shots for W10. Mentioned configurable instrument types. Added guralp/responder/Discovery details.
F	2019-06-18	Modified GPIO connector pin-out to add pin L (connected to F).
E	2018-07-09	Added Sensor Parameters section.
D	2017-11-06	Added borehole hanger details.
C	2016-10-10	Added SENSOR B auxiliary input details.
B	2016-02-08	Added Calibration and Sample-clock Timing chapters.
A	2016-01-29	Initial release.