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MicroDaq-8
Pressure Scanner
Acquisition System

INSTALLATION
AND
OPERATING MANUAL

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<http://www.chell.co.uk>

900235-1.0

Please read this manual carefully before using the instrument.



Use of this equipment in a manner not specified in this manual may impair the user's protection.

Chell Document No. : 900235 Issue 1.0
ECO : ---- Date: 18th June 2020

Chell's policy of continuously updating and improving products means that this manual may contain minor differences in specification, components and software design from the actual instrument supplied.

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1 Description

1.1 General

The MicroDaq-8 is an acquisition system that can acquire data from up to 8 pressure scanners and transmits data to a host via Ethernet or a CAN bus. It is an extension of the popular Chell MicroDaq acquisition system range.

The MicroDaq-8 provides an easy to use interface to the pressure scanners by using an embedded web server for configuration. The MicroDaq-8 has a number of high quality 18-bit ADC converters enabling the MicroDaq-8 to acquire pressure and temperature data from the scanners simultaneously – thereby removing any ‘thermal bump’ issues associated with other acquisition devices.

The MicroDaq-8 is able to accommodate up to 8 DTC scanners manufactured by TE (formally PSI) The MicroDaq-8 is compatible with the variants of the Digital Thermal Compensation (DTC) scanners with 16, 32 and 64 channels (including MicroScanners). The MicroDaq-8 supports all the functions of the DTC scanners such as de-range and valve position detection.

The MicroDaq-8 addresses the scanners at a defined rate, acquires the output and applies a pressure and thermal calibration to derive the engineering units. These engineering units are then made available over Ethernet (TCP and UDP) and CAN. Please refer to the MicroDaq-8 programmer guide for further information (900236-X.X)

The MicroDaq-8 also has a hardware trigger, to give some time determination to the data acquired – a standard TTL level hardware trigger that can be clocked at speeds between 2Hz and 200Hz.

This manual revision covers firmware version 1.0.0.

1.2 Architecture

The MicroDaq-8 consists of two high accuracy 18 bit analogue to digital converters (ADC's) and two powerful processors – one to control the data acquisition and one to control the data output interface.

The ADC's will acquire pressure and temperature data for every data point. The temperature data is used to modify a pressure to compensated pressure look-up-table as the measured temperatures changes. This ensures that the temperature compensation is continuous and doesn't require the system to stop and acquire temperature data as a separate event.

All the ADC's, processors and associated electronics are mounted on a single PCB ensuring reliability.

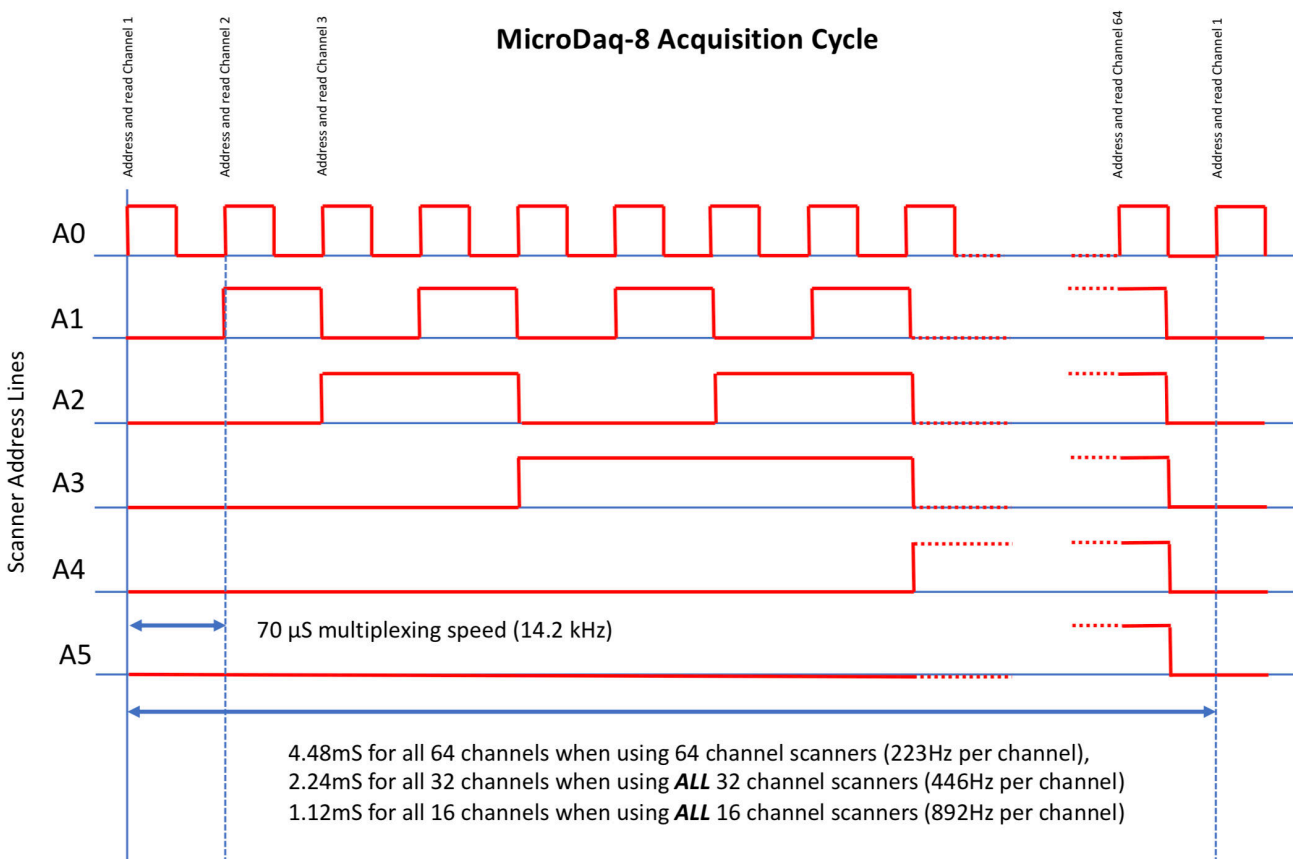
The MicroDaq-8 uses a digital interface to communicate with each of the scanners connected to it. It will establish communication with the scanner and download its calibration coefficients into the memory of the MicroDaq-8. These coefficients (23 per scanner channel) are then used to remove the errors caused by temperature changes of the scanners.

1.3 Timing

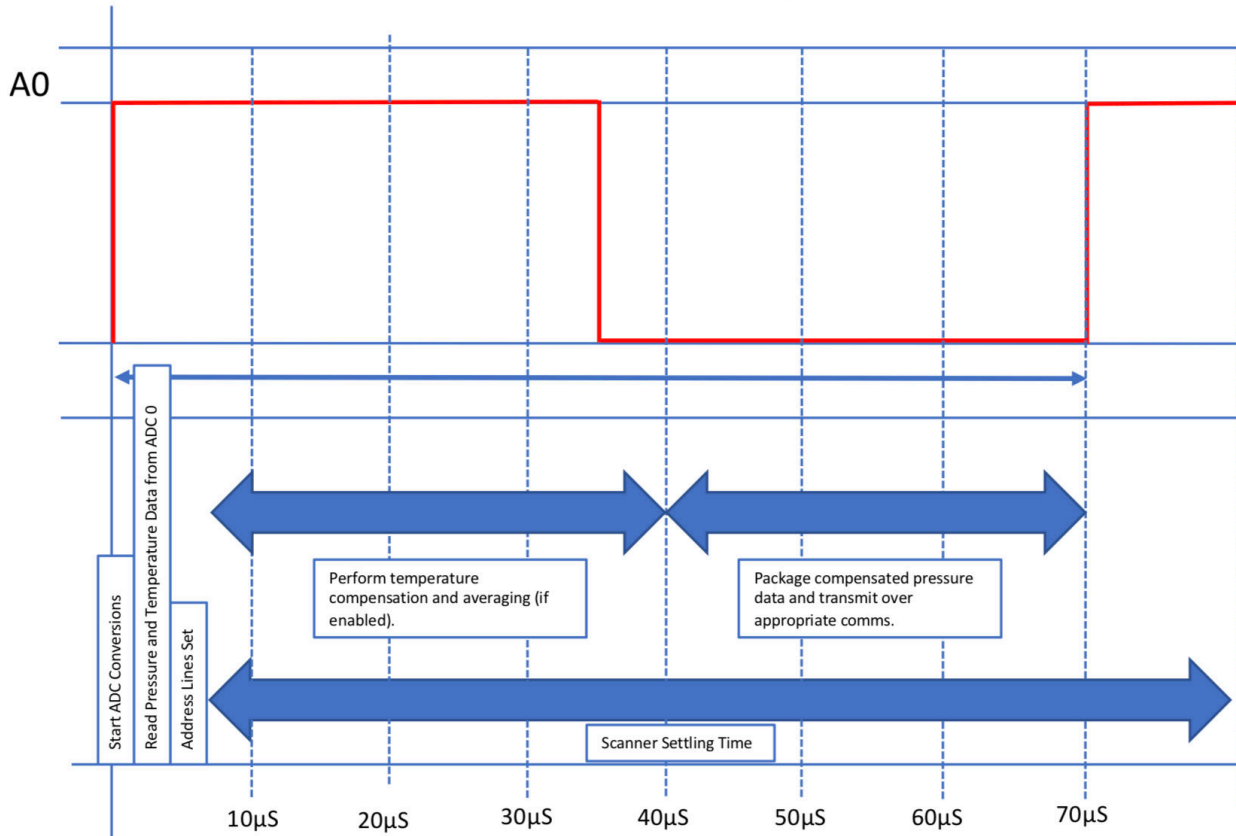
The Microdaq-8 builds on 15 year's experience interfacing with the TE HD scanners and the precise timing control required. The scanners are multiplexed devices which controlled by 6 address lines (for a 64-channel scanner). The address lines for all 8 scanners are common so all will be addressed at the same time and speed. The multiplex speed for the MicroDq-8 is fixed at 14.285 kHz or 70µS per channel. As such, for 64 channels, it will change channels every 70µS. Each scanner's channel will then be read at 223Hz per channel. For all 8 scanners, this translates to measuring 114,176 channels per second.

If 32 channel scanners are used, the multiplexing speed remains the same but as the number of channels is halved, the rate is doubled to 446Hz per channel. For 16 channels, it is doubled again to 892Hz. As the scanners are addressed in parallel, for a higher rate, all the scanners used have to be 32 or 16 channel versions (or the number of channels used on a 64-channel reduced).

These speeds represent the maximum speeds available. In practical terms, the maximum speeds would also be dependent to the efficiency of data retrieval over Ethernet or CAN. For high-speed applications, we would always recommend using Ethernet and UDP.



MicroDaq-8 Acquisition Cycle



1.4 Data Synchronisation

The MicroDaq-8 features two methods of synchronising the pressure data other data sources; either a pulse train synchronisation (hardware trigger) or by time stamping the data using IEEE 1588 PTPv2 time stamping.

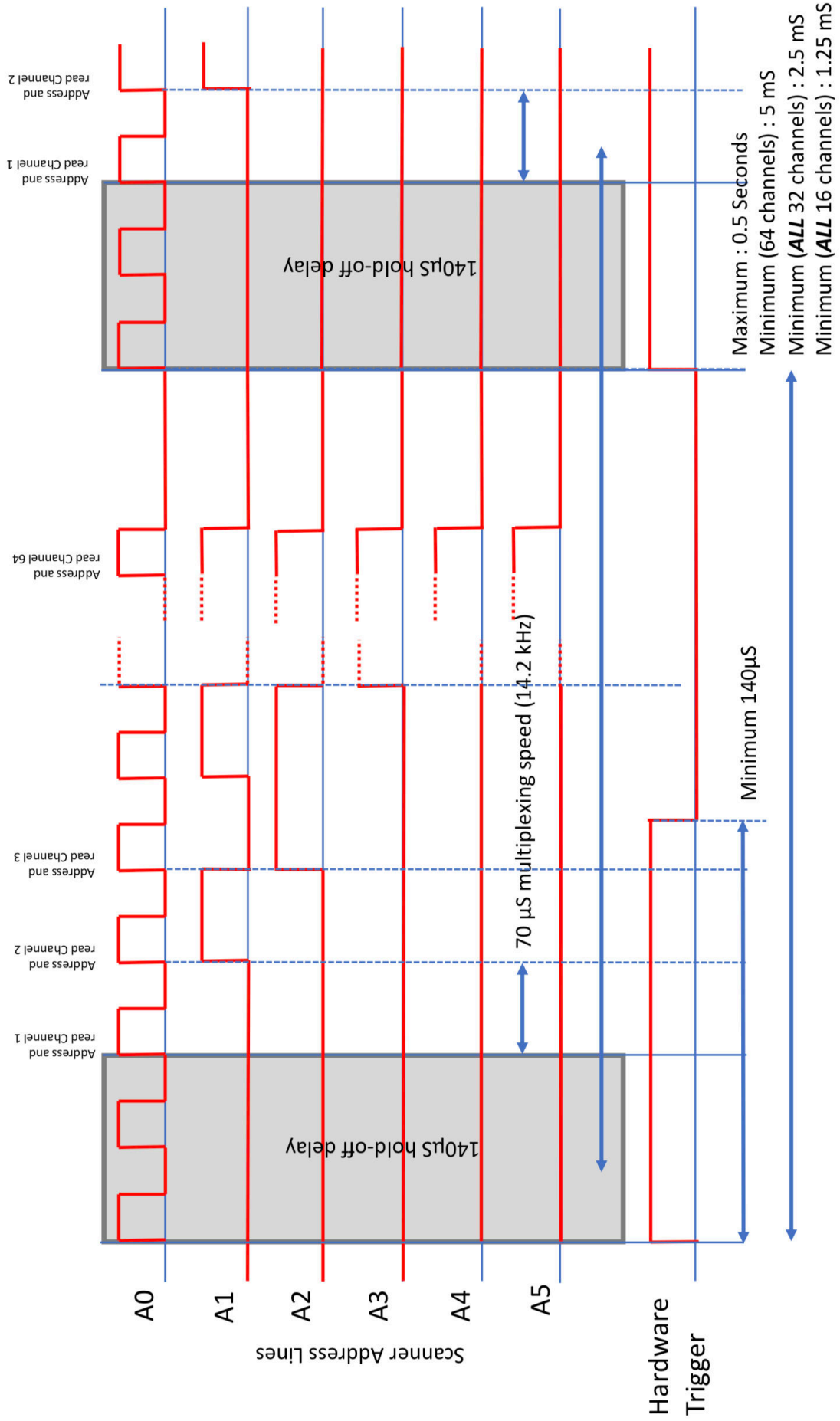
1.4.1 Hardware Trigger

The MicroDaq-8 features the Chell standard hardware trigger as used by the other products in the MicroDaq and nanoDaq range.

The conventional hardware trigger works by applying a TTL pulse train to the MicroDaq8 at a known rate. When the rising edge of the hardware trigger line is detected, the MicroDaq-8 will acquire all the channels for all the scanners connected to it. It will then wait for the next pulse to be received. Therefore, if you wanted to measure at a rate of 100Hz per channel, you would supply a TTL pulse of 100Hz to the MicroDaq-8. Referring to the timing diagram overleaf, it is then possible to determine the timing of each channel relative to the hardware trigger pulse. It can be seen that channel 1 would be addressed 140 μ S after the trigger (known as the hold-off delay). The timing for each channel would therefore be:

$$\text{Channel timing offset } (\mu\text{S}) = 140 + ((\text{channel number}-1)*70)$$

MicroDaq-8 Hardware Trigger Acquisition Cycle



1.4.2 Enabling hardware Trigger

The hardware trigger mode is activated by the T command over the CAN or Ethernet interfaces (in addition to the embedded web server). The T command can be used to enable the hardware trigger that will cause the MicroDaq-8 to stop free-running and wait for the first pulse. The disable command will return the MicroDaq-8 to free-running. The command structure is as follows:

| Command | Interface | On / Off |
|---------|-----------|----------|
| T01 | Ethernet | Off |
| T11 | Ethernet | On (TTL) |
| T02 | CAN | Off |
| T12 | CAN | On (TTL) |

The hardware trigger can also be set to auto enable on power up which means that the MicroDaq-8 will not go into free-running mode after initialisation and will instead wait for the first hardware trigger pulse. In this instance the blue LED will not flash at a constant rate after initialisation and will actually turn off. This feature can be enabled/disabled from the embedded webserver configuration.

NOTE : It is easy to confuse the static appearance of the MicroDq-8 in a waiting for hardware trigger mode with a faulty condition. If the blue light is not flashing and a power cycle doesn't restore it, please check the it is not configured to power up in a hardware trigger mode.

2 Specification

2.1 Power Supply:

| | |
|-----------------------------------|----------|
| Line voltage: | 9-32 VDC |
| Absolute Max. Line voltage | 32 VDC |
| Consumption: | Max 6W |
| With full load of 64 ch scanners: | Max 22W |

2.2 CAN specifications:

| | |
|-------------------------|--|
| CAN type | 2.0B |
| CAN baudrate | Configurable (by internal registers) from 1M, 500K, 125K and 100K. |
| Programmable variables: | |
| Address 0x?nn | Most significant programmable device ID |
| Address 0xn?n | Next most significant programmable device ID |
| BRP | CAN bus timing |
| TSEG1 | CAN bus timing |
| TSEG2 | CAN bus timing |
| SJW | CAN bus timing |

2.3 Ethernet Specifications:

| | |
|---|---|
| TCP/IP | 10Mb/s & 100Mb/s via Auto Negotiation TCP & UDP protocols supported TCP/UDP port: 101 |
| Default settings (if no label attached) | IP address: 192.168.1.190 Subnet mask: 255.255.0.0 |

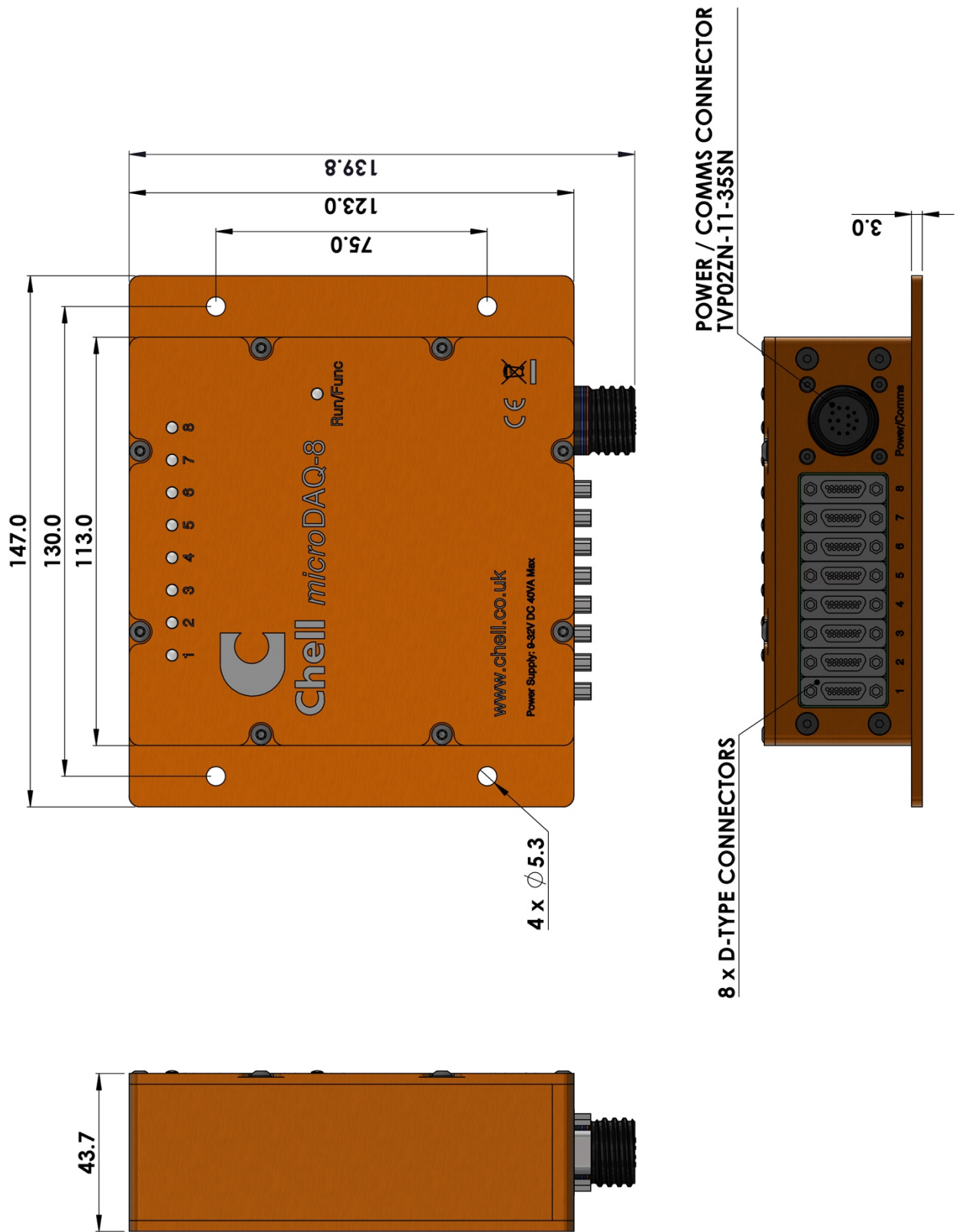
2.4 Operating conditions:

| | |
|------------------------------|------------------------------|
| Operating temperature range: | +5°C to +85°C |
| Storage temperature range: | -20°C to +85°C |
| Maximum Relative humidity: | 95% at 50°C (non condensing) |

2.5 Measurement specifications:

| | |
|---|--------------------|
| System accuracy: | ±0.06% FS |
| Resolution: | 18 Bit |
| Max Measurement Speed: | 205Hz ¹ |
| (actual data output is limited by chosen comms available bandwidth) | |

2.6 Dimensions



3 Installation and Interconnections

3.1 Power & Comms Connector – Mating connector: TV06ZN-11-35PN-UWBSB2

| Pin Number | Designation |
|------------|--------------------------|
| 1 | 28V DC Supply |
| 2 | Power Supply Return (0V) |
| 3 | Ethernet RX+ |
| 4 | Ethernet RX- |
| 5 | Ethernet TX+ |
| 6 | Ethernet TX- |
| 7 | TRIGGER IN (TTL) |
| 8 | CAN Hi |
| 9 | CAN Lo |



Hot plugging the power to the MicroDaq-8 at the connector can cause permanent damage to the unit. Always switch the power at the power supply source.

3.2 Scanner Connector – 8 x 15 way micro miniature ‘D’ type, female.

| Pin number | Signal |
|------------|--------------------|
| 1 | Address line A0 |
| 2 | Address line A1 |
| 3 | Address line A2 |
| 4 | Address line A3 |
| 5 | Address line A4 |
| 6 | +12VDC |
| 7 | -12VDC |
| 8 | +5VDC (Vs) |
| 9 | +5VDC RTN |
| 10 | Ground |
| 11 | Output |
| 12 | Address line A5 |
| 13 | Ov sense |
| 14 | Not used |
| 15 | Temperature signal |

4 Operation of the instrument

4.1 Connecting up the MicroDaq-8.

The MicroDaq-8 has one connector and cable which supplies the unit with power and also provides trigger, CAN and Ethernet comms. Ensure all the connections are made before powering up the MicroDaq-8. The MicroDaq-8 should not be hot plugged with the power connector. Doing so can cause permanent damage to the unit. Always switch the power at the power supply source.

Upon power up, the blue LED will light constantly while the MicroDaq-8 boots up. This boot-up period will vary depending on the type and number of scanners and the number of channels per scanner. The boot up time is also influenced by the Ethernet initialisation process. This process requires a valid network connection to perform auto negotiation and link check status. If there isn't a valid connection the process waits until either a network is found or the timeout occurs. This timeout is configurable via setup and ranges from 0 to 30 secs per check (2 checks).

When the MicroDaq-8 has finished booting, the blue LED will flash at a constant rate to show that the system is running (unless auto hardware trigger enable has been set – see later).

The MicroDaq-8 also has a series of connectors for 8 Scanners, these can be any combination of ESP (DTC) scanners or MicroScanners. When connected these are indicated by a row of 8 green LEDs. Scanners should not be hot plugged. Doing so can cause permanent damage to the device.

When the MicroDaq-8 detects a DTC scanner and downloads its coefficients, it will light the appropriate green LED to show a successful connection to the scanner.

5 MicroDaq-8 Configuration Webserver

5.1 Introduction.

The MicroDaq-8 web Configuration provides the means of setting up, calibrating and demonstrating the MicroDaq-8 unit from a standard PC with an ethernet port and browser.

The software is divided by tabs into five areas of functionality, namely 'Setup', 'Scanner info', 'Advanced', 'Timestamp' and 'Factory Tools'

'Setup' provides the means to set MicroDaq-8's main operating parameters. The unit's function may be checked and demonstrated using 'Scanner Info' to show attached pressure scanner raw readings and MicroDaq-8's calibrated output. This tab also allows for configuration of scanner specific setup parameters. 'Advanced' has extra system wide functions that most users will not need but might be necessary for some. 'TimeStamp' provides a means for the user to control the timestamping settings of the MicroDaq-8. 'Factory Tools' provides some functionality to read DTC coefficients and current scanner values and change the MAC address of the Ethernet hardware. This tab is not readily available to everyone and further detail is beyond the scope of this document.

Chell Instruments Setup Scanner info Advanced Timestamp Factory Tools

microDAQ-8 Configuration

microDAQ-8 S/N:
FW version: 1.0.0

Scanner 1 S/N:
Scanner 2 S/N:
Scanner 3 S/N: **642164**
Scanner 4 S/N:
Scanner 5 S/N:
Scanner 6 S/N: **160016**
Scanner 7 S/N:
Scanner 8 S/N:

REBOOT

Rezero All

Burn to Eeprom

Data Streaming

Comms Protocol TCP
 UDP
 CAN

Data Rate

Protocol

| | Scanner | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------------------------|---------|----|----|----|----|----|----|----|----|
| Pressure Input Average Samples | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| Temperature Input Average Samples | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |

Apply

TCP Comms

IP Address

Subnet

Local port

Apply TCP

Figure 1 - Main setup page

5.2 Common Controls Sidebar

Figure 1 above shows the first page viewed when navigating to the webserver. The menu at the top allows the user to choose what is visible in the central window, and the sidebar shows information and has a select few commands that are useful regardless of the central page the user is on. The function of the controls on the sidebar is detailed in the subsequent table (Table 1).

| Control | Function |
|-------------------------|---|
| 'REBOOT' button | Resets the MicroDaq-8, similar to power cycling the device. Use to activate new settings and/or rebuild calibration tables. |
| 'Rezero all' button | Starts a MicroDaq-8 rezero operation on connected scanners. |
| 'MicroDaq-8 S/N' | Displays the serial number of the MicroDaq-8. |
| Scanner serial s/n's | Displays the serial numbers of each connected scanner. |
| 'Burn to eeprom' button | Burns all changes made to the local settings into the eeprom. |

Table 1 - Common sidebar control functions

5.3 The 'Setup' Page

5.3.1 Introduction

The 'Setup' page shows all of the MicroDaq-8's main operating parameters. Setup is divided into different categories by function, and each category is detailed separately in the following.

5.3.2 Data Streaming

The 'Data Streaming' section allows the user to change settings that affect all three communication protocols, and allows the user to choose the protocol that is to be used, along with the data transfer rate and the amount of channels.

Data Streaming

Comms Protocol [?] TCP
 UDP
 CAN

Data Rate

Protocol

| | Scanner | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------------------------|---------|----|----|----|----|----|----|----|----|
| Pressure Input Average Samples | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| Temperature Input Average Samples | | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |

Figure 2 - Data streaming settings

| Control | Function |
|-------------------------------|--|
| 'Comms Protocol' radio button | Chooses the communication protocol that is to be used. When selected this button will change the communications page underneath to the appropriate comms menu. |

| | |
|--------------------------------------|--|
| 'DATA Rate' option list | Selects the rate at which the MicroDaq-8 will transmit data, whether this value is for TCP, UDP or CAN will depend on the comms protocol selection. |
| 'Protocol' option list | Selects the format that the data will be transmitted as, options are 16 bit LE, 16 bit BE for all protocols and eng. units as an extra option for TCP and UDP Comms. |
| 'Apply' button | Applies the changes made to the local settings |
| Pressure input Average Samples | Standard moving averaging filter for the acquired pressure readings. |
| Temperature input average samples | Standard moving averaging filter for the acquired temperature readings. |

Table 2 - Data Streaming Settings

5.3.3 TCP Parameters

The TCP communication protocol parameters are shown in Figure 3. Options control the MicroDaq-8s IP address and subnet mask, in addition to any gateway IP address required.

The screenshot shows a window titled "TCP Comms". It contains three rows of input fields:

- IP Address: 192 . 168 . 3 . 193
- Subnet: 255 . 255 . 0 . 0
- Local port: 101

 Below these fields is a button labeled "Apply TCP".

Figure 3 - TCP Comms group

| | |
|--------------|---|
| 'IP Address' | IP address allocated to MicroDaq-8 on the user's network. |
| 'Subnet' | Subnet mask as set on the user's network. |
| 'Apply' | Applies the settings to the local settings memory |

Table 3 - TCP Comms group settings

5.3.4 UDP Parameters

The UDP section (Figure 4) holds all the settings specific to UDP. In UDP mode each acquisition cycle (of 'x' number of channels) is packed as a separate UDP packet with a four byte representation of the MicroDaq-8 serial number at the start of the packet. These are attempted to be sent out at the required rate but with no checking for reception or validity of data.

Note that the MicroDaq-8's local IP address is the same setting as from the TCP Comms group and the MicroDaq-8's local UDP port is also the same as for the TCP comms. Settings available from this section include setting the UDP address and port for a remote connection (for auto streaming via UDP at boot up) and a setting for auto broadcasting a UDP message at bootup to inform the network of the availability of the MicroDaq-8.

UDP Comms

Local IP Address 192 . 168 . 3 . 194

Local Subnet 255 . 255 . 0 . 0

Local port 101

Remote UDP IP address 0 . 0 . 0 . 0

Remote UDP port(if known) 0

Figure 4 - UDP Comms group

| | |
|------------------------|---|
| Local IP Address | This is the IP address of the device. This address is the same as the TCP comms section. |
| Local Subnet | This is the subnet of the device. This subnet is the same as the TCP comms section. |
| Local port | This is the Local connection port of the MicroDaq-8. |
| Remote UDP IP address. | Address of remote connection to MicroDaq-8. If set then the MicroDaq-8 can be set to auto stream data to that remote host on boot up (after initialisation) |
| Remote UDP port. | Port of remote connection to MicroDaq-8. If set then the MicroDaq-8 can be set to auto stream data to that remote host on boot up (after initialisation) |
| 'Apply' | Applies the settings to the local settings memory |

Table 4 - UDP Comms group settings

5.3.5 CAN Parameters

The CAN communication settings are shown in Figure 5. Options are available to set the base message ID number may be selected, and the offset from this base number for the reception of user commands over CAN, and whether an acknowledgement of these user commands is sent on the next higher message number. Data may be transmitted on either multiple messages, or alternatively on a single message ID, with a selectable delay between messages. Additionally the CAN bus baudrate and sample point can be modified via the setting of the BRP, TSEG1, TSEG2 & SJW registers.

CAN comms

CAN First TX Message ID 0x 1 0

Message Scheme/delay Multiple messages

CAN RX ID Offset (ACK ID = RX +1) No RX

Figure 5 - CAN Comms group

| | |
|---------------------------|---|
| 'CAN First TX Message ID' | MicroDaq-8 uses standard CAN message arbitration id's, and the unit is assigned the most significant 2 digits of the Hex base address. For the digits 0x1A for example, data for the first 4 channels will be sent on 0x1A0, the next 4 on 0x1A1, etc. |
| Message scheme/delay | Select 'Multiple Messages' for the 4 channels per message, multiple message scheme. Alternatively data may be packed 3 channels per message + identifier byte, with a selectable delay between messages. |
| 'CAN RX ID Offset' | Selects the hex offset from the base message ID where MicroDaq-8 will receive incoming user commands (see user command document). If 'Ack. Enabled' is selected, the unit will acknowledge the reception of a correctly formatted command on the message ID calculated as Base ID + RX Offset + 1 |
| 'Apply' | Applies the settings to the local settings memory |

Table 5 - CAN Comms group settings

5.4 'Scanner Info' Page

Figure 6 shows the 'Scanner Info' page of the webserver, the user selects a pressure scanner and the system then display all scanner specific data in this window. In the top sub-tab, scanners are shown in grey if they have been detected by the system and in red if no scanner was found. The currently selected scanner is shown in white (or yellow if the user has selected a channel where no scanner was detected).

The screenshot displays the 'Scanner Info' page for a Chell Instruments microDAQ-8. The page is divided into several sections:

- Navigation:** Setup, Scanner info (active), Advanced, Timestamp, Factory Tools.
- Configuration:** microDAQ-8 Configuration, microDAQ-8 S/N: FW version: 1.0.0.
- Scanner Selection:** Scanner 1 (white), Scanner 2 (grey), Scanner 3 (grey), Scanner 4 (red), Scanner 5 (red), Scanner 6 (red), Scanner 7 (red), Scanner 8 (red).
- Scanner 1 Data:**

| | | | | | | | |
|----|---------|----|---------|----|---------|----|---------|
| 1 | -0.0008 | 17 | 0.0016 | 33 | 0.0027 | 49 | 0.0027 |
| 2 | 0.0022 | 18 | -0.0013 | 34 | 0.0013 | 50 | -0.0004 |
| 3 | -0.0018 | 19 | 0.0022 | 35 | 0.0023 | 51 | 0.0030 |
| 4 | 0.0011 | 20 | -0.0022 | 36 | 0.0017 | 52 | 0.0007 |
| 5 | -0.0003 | 21 | 0.0027 | 37 | 0.0015 | 53 | 0.0023 |
| 6 | -0.0004 | 22 | 0.0010 | 38 | 0.0040 | 54 | 0.0027 |
| 7 | 0.0005 | 23 | 0.0027 | 39 | 0.0026 | 55 | 0.0022 |
| 8 | 0.0026 | 24 | 0.0014 | 40 | 0.0002 | 56 | 0.0006 |
| 9 | 0.0003 | 25 | -0.0018 | 41 | -0.0012 | 57 | -0.0024 |
| 10 | -0.0008 | 26 | -0.0002 | 42 | 0.0006 | 58 | 0.0011 |
| 11 | 0.0026 | 27 | -0.0014 | 43 | 0.0026 | 59 | 0.0020 |
| 12 | -0.0013 | 28 | 0.0027 | 44 | 0.0016 | 60 | 0.0005 |
| 13 | 0.0024 | 29 | 0.0000 | 45 | 0.0014 | 61 | 0.0019 |
| 14 | -0.0005 | 30 | -0.0004 | 46 | 0.0031 | 62 | 0.0011 |
| 15 | 0.0024 | 31 | 0.0023 | 47 | 0.0013 | 63 | 0.0034 |
| 16 | -0.0005 | 32 | -0.0006 | 48 | 0.0005 | 64 | -0.0004 |
- Buttons:** REBOOT, Rezero All, Burn to Eeprom, Rezero Scanner.
- Derange:** Inactive, Derange: 0.
- Filtering:**
 - Pressure Input Impulse Filter
 - Temperature Input Impulse Filter
 - Pressure Input Average Samples: 16
 - Temperature Input Average Samples: 16
 - Temperature Compensation: Continuous

Figure 6 - Scanner info page

The 'Scanner info' page is a means to demonstrating the correct operation of MicroDaq-8 and testing the unit's calibration. The type of value shown in the label may be selected by means of the option buttons to the right of the frame, the user selecting between Pressure (Eng), Temperature (Eng), voltage scaled to the known full scales, Binary 18bit ADC, Binary Pressure and Temperature 18bit may be displayed. Values are updated automatically, once a second, with the default view being Pressure (Eng). Use the Select button to start showing values from one of the other selectable options.

The 'Derange' shows whether the derange is active or inactive, this is changed by changing the DTC Gain value in the DTC information section. A DTC Gain of 1 means derange will be inactive and a DTC Gain of 3 means derange will be active. The derange value will be displayed on if derange is active, if not then the displayed value will be 0.

The Rezero scanner button will rezero just the scanner currently selected.

5.4.1 'Filtering' Section

The MicroDaq-8 has settings to allow the user flexible control over the data throughput of a scanner attached to the device. Averaging options allow the preference of noise reduction over time domain response, the frequency of calibration temperature compensation renewal may be chosen. Table 6 details the function of the signal parameter option controls.

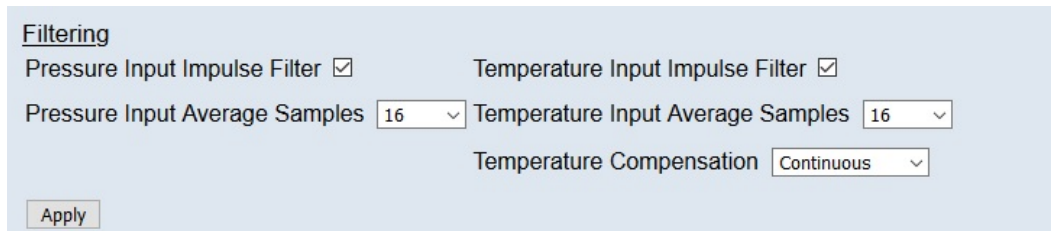


Figure 7 - Filtering section

| Control | Function |
|-------------------------------------|---|
| 'Pressure Input Impulse Filter' | Check box to apply a 3-term median filter to pre calibration data - will remove single impulse noise events in the pressure data. |
| 'Temperature Input Impulse Filter' | As above but with temperature data. |
| 'Pressure input average samples' | Selects the number of samples for a moving average of pre calibration pressure data. |
| 'Temperature input average samples' | As above but with temperature data. |
| 'Temperature Compensation' | Selects the temperature compensation scheme for the calibration. 'Continuous' repeatedly rebuilds the calibration data on a channel by channel basis without interrupting the flow of data. This is the recommended setting. 'With zero only' rebuilds the table when a user rezero is issued, after the rezero has been actioned. |
| 'Apply' | Applies the settings to the local settings memory |

Table 6 - Filtering group settings

5.4.2 'DTC Information' Section

The 'DTC information' section gives the user access to some information regarding the Selected DTC scanner. The scanner voltages for temperature and excitation may be read and the position of the calibration shuttle valve determined as either being in 'RUN' or 'CAL.' mode. Also, the information contained in the scanner header may be displayed. Note that the value of the parameter read from the scanner (ie temperature, excitation voltage and particularly valve position) is valid only for the time that it is read.

Figure 8 - DTC information page

| Control | Function |
|------------------------|--|
| 'Sensistor in circuit' | If checked, keeps the sensistor in circuit for a DTC scanner. In normal operation this control should be left unchecked. |
| 'DTC gain = 1/3' | Selects the deranging function of the DTC scanner if the '3' option is selected, otherwise defaults to the standard range of the scanner. |
| 'Apply' button | Applies the derange & sensistor settings to the local settings memory. |
| 'Range' | Shows the floating point value for the range contained within the scanner. |
| 'x3 derange' | Shows the floating point value for the sensitivity derange constant contained within the scanner. |
| 'Channels' | Shows the floating point value for number of scanner channels. |
| 'Read' | Displays the data header from the DTC scanner, splits out the information and displays scanner full scale, the number of channels and the deranging factor. Also shown are the scanner model, serial number and date of manufacture. |
| 'Temperature (V)' | Click '>>' to read the current temperature voltage from the scanner. |

| | |
|----------------------------|---|
| 'Excitation (V)' | Click '>>' to read the current excitation voltage from the scanner. |
| Calibration Valve Position | Click '>>' to read the valve position as 'RUN' or 'CAL'. |

Table 7 - DTC Information page controls

5.4.4 Performing a Pressure Calibration

The pressure scanner may, at some time require re-calibration. The typical re-calibration period is between 6 and 12 months. The temperature dependent and linearity components of the calibration are stable and do not require adjustment so the calibration simply consists of a modified zero and span value.

There are two ways to perform this calibration; one by having the DTC coefficients modified in the scanner which can be carried out at Chell's UKAS (ISO17015) calibration lab. Alternatively, the customer can perform their own calibration using the MicroDaq-8. The calibration coefficients derived will be stored in the particular channel of the MicroDaq-8 and not in the scanner itself. It is therefore important that the scanner then remains connected to that channel.

To perform a pressure calibration' follow the sequence below:

[1] Set the appropriate 'Span High' value. This is the pressure (in PSI) that the span calibration will take place. It is typically 90% of the full-scale pressure of the scanner (0.9 PSI in this example). Burn this setting and restart the MicroDaq-8

[2] Apply zero pressure to the scanner and then zero the appropriate scanner in the MicroDaq-8.

[3] Apply the span pressure to all ports of the scanner (by using the scanner's calibration port). This span pressure must be accurate – usually better than 0.02% of the span pressure.

[4] Select 'Set Span'. You will then be asked if you want to re-write the calibration coefficients. Select 'yes' and continue.

[5] When the Set Span sequence is complete, re-start the MicroDaq-8. You will be able to check the calibration results and the coefficients in the Scanner Info page.

5.5 'Advanced' Page

The advanced page contains functions that will change how the MicroDAQ-8 acts and how it applies various calculations to its data, this page should only be used by users who fully understand what they are changing.

The screenshot shows the 'Advanced' configuration page for a Chell Instruments microDAQ-8. The page has a blue header with the Chell Instruments logo and navigation tabs: Setup, Scanner info, Advanced (selected), Timestamp, and Factory Tools. The main content area is divided into three sections: 'Advanced communication settings', 'Miscellaneous', and 'Device Current Readings'. On the left sidebar, there are buttons for 'REBOOT', 'Rezero All', and 'Burn to Eeprom', along with scanner S/N information.

Chell Instruments Setup Scanner info **Advanced** Timestamp Factory Tools

microDAQ-8 Configuration

microDAQ-8 S/N:
FW version: 1.0.0

Scanner 1 S/N:
Scanner 2 S/N:
Scanner 3 S/N: **642164**
Scanner 4 S/N:
Scanner 5 S/N:
Scanner 6 S/N: **160016**
Scanner 7 S/N:
Scanner 8 S/N:

REBOOT

Rezero All

Burn to Eeprom

Advanced communication settings

Gateway 0 .0 .0 .0

Enable TCP/UDP User Command Acknowledge

Ethernet Initialisation Check Timeouts (0-30 sec): 10

Auto Broadcast UDP message on boot (port 10001) only if Remote IP not set

BRP TSEG1 TSEG2 SJW
5 11 3 3

Apply

Miscellaneous

Auto enable HW Trigger on Startup Off

Pressure unit PSI

Apply

Device Current Readings

| | Scanners 1-4 | 5-8 |
|-------------------|--------------|------|
| +12V Current (mA) | 99.3 | 17.2 |
| +5V Current (mA) | 0.2 | 7.8 |

5.5.1 Advanced communication settings

The MicroDaq-8 has several more advanced communication options available, but these features are unlikely to be used by an everyday user and as such should generally be left as default settings.

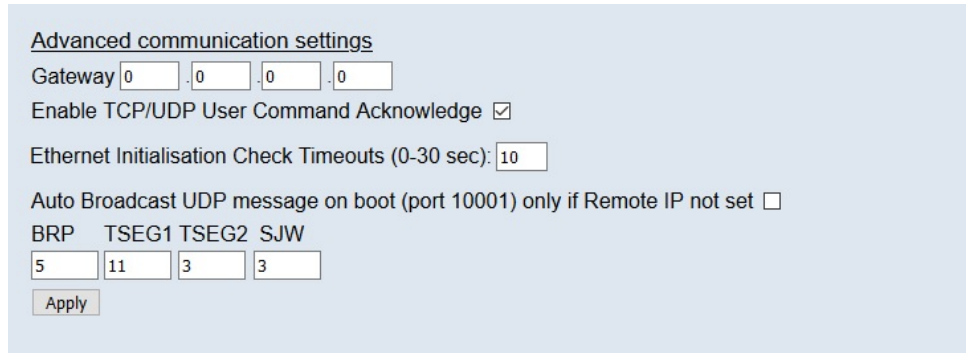


Figure 10 - Advanced Communication settings

| | |
|--|--|
| 'Gateway' | Allows the user to change the Gateway address interface for the local connection. |
| 'Enable TCP/UDP User Command Acknowledge' | If enabled, replies with a two byte acknowledge if a user command is sent to the MicroDaq-8 over TCP or UDP. |
| Ethernet Initialisation Check Timeouts(0-30 sec) | At bootup the Ethernet module performs two checks for auto negotiation and link check status. This timeout can be controlled via this text box. If Ethernet comms are not going to be used then this value can be set at 0 to speed up startup time. |
| Auto Broadcast UDP message on boot (port 10001) | If checked, auto broadcasts a UDP message on port 10001 on startup which details the MicroDaq-8s serial number, IP address, etc. in an ASCII, comma separated list. (should not be used if remote UDP address/port has been configured and auto streaming has been set – via TCP rate on Standard tab) |
| BRP, TSEG1, TSEG2, SJW | Register values for the CAN module within MicroDaq-8s microcontroller. |

Table 9 - Advanced communication settings

5.5.2 Miscellaneous

The remaining parameters are edited via the Miscellaneous group shown in Figure 11.

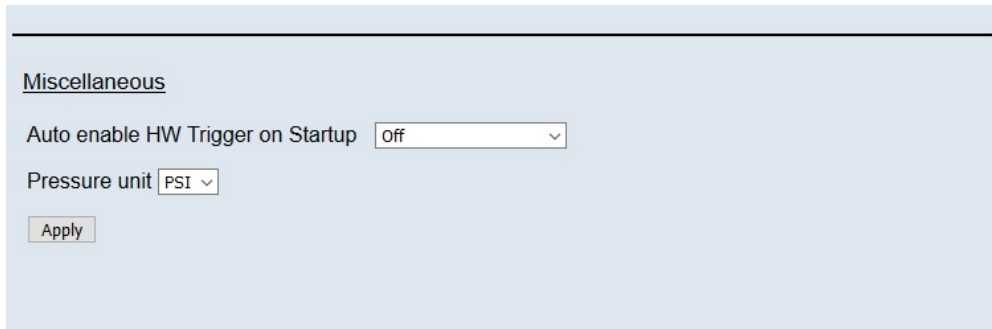


Figure 11 - Miscellaneous group

| | |
|--|--|
| 'Auto enable HW trigger on startup' dropdown | If set to anything other than Off, the MicroDaq-8 will immediately switch to hardware trigger mode, waiting for the first trigger pulse, after initialisation. The dropdown indicates the comms protocol used to send acquired data during triggering. |
| 'Pressure unit' dropdown | Controls whether Data is in PSI or Pascals |
| 'Apply' | Applies the settings to the local settings memory |

Table 10 - Miscellaneous group settings

5.5.3 Scanner Current Draw Measurement

| <u>Device Current Readings</u> | | |
|--------------------------------|------|------|
| Scanners | 1-4 | 5-8 |
| +12V Current (mA) | 99.3 | 17.2 |
| +5V Current (mA) | 0.2 | 7.8 |

To assist with diagnostics, the MicroDaq-8 measures the current drawn by the scanners connected to it. There are measurements for scanners 1-4 and 5-8. In the example above, a 64HD scanner is connected to channel 2 and a 16 channel MicroScanner to channel 6.

For reference, the typical current draws for the scanners are:

| | 16MS | 32HD DTC | 64HD DTC |
|--------------------|------|----------|----------|
| +12 V current (mA) | 25 | 75 | 100 |
| +5 V current (mA) | 8 | 0.5 | 0.5 |

5.6 'Timestamp' page

This page allows the user to edit the timestamp settings of the MicroDaq-8. This timestamp will allow the user to get millisecond level accuracy timestamps on the data packets. If the timestamp is enabled it will have an affect on the maximum transmission rate.

The screenshot shows the 'Timestamp' configuration page for a microDAQ-8. The page is divided into a left sidebar and a main content area. The sidebar contains the Chell Instruments logo, navigation tabs (Setup, Scanner info, Advanced, Timestamp, Factory Tools), and the title 'microDAQ-8 Configuration'. Below the title, it lists the microDAQ-8 S/N (1.0.0) and eight scanner S/Ns, with Scanner 3 (642164) and Scanner 6 (160016) highlighted. At the bottom of the sidebar are three buttons: REBOOT, Rezero All, and Burn to Eeprom. The main content area contains the following settings:

- PTP synchronisation on:
- Datastream timestamp:
- Time format:
- Get PC time: [?] =>
- Buttons: Apply, Refresh
- Last read microDAQ-8 unix time: 9030 => 1/1/1970 02:30:30 UTC

Figure 12 - Timestamp

| | |
|-----------------------------------|---|
| 'PTP synchronisation on' checkbox | This allows the user to select whether any timestamps that may be added to the datastream are PTP synchronised or not. Please note this will only work if there is a PTP grandmaster on the same network as the MicroDaq-8 |
| 'Datastream timestamp' dropbox | The user can use this to select where the timestamp is positioned in the datastream, either none which will turn the timestamp off, start of cycle which will place a timestamp at the beginning of all the channels and every channel which will read the timestamp for every channel. It should be noted that the latter 2 options will reduce the maximum transmission speed datastream. |
| 'get PC time' | This button allows the user to get the timestamp from the PC time of the PC they are using. This can be used as a base time for the timestamps if the user is not using PTP. In the first box it will show the timestamp and in the second |

| | |
|----------------------------------|---|
| | box it displays the timestamp converted date/time to make it easier to understand. |
| 'Apply' | This button will apply the settings chosen on this page. |
| 'Refresh' | This allows the user to refresh the displayed value of the last read timestamp from the MicroDaq-8. |
| 'last read MicroDaq-8 unix time' | The top line shows the current time in the MicroDaq-8 in |

Table 11 – Timestamp

6 Service and Calibration

6.1 Service

There are no user serviceable parts inside the instruments. Should any difficulties be encountered in the use of the MicroDaq-8, it is recommended that you contact Chell Instruments Ltd for advice and instructions.

6.2 Calibration

Calibration is recommended on an annual basis and Chell Instruments Ltd. Provides a fully traceable facility for this purpose.

6.3 Adjustment

There are no user adjustments in the instrument. The user is strictly forbidden from removing the covers without invalidating Chell's obligations under both Warranty and COSSH.

6.4 Cleaning

A dirty instrument may be wiped clean with a soft cloth that has been sprayed with a proprietary 'foaming cleaner', then wiped dry immediately.



Under no circumstances should the instrument be wetted directly or left damp.