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# nanoDAQ-LTC
# Pressure Scanner Acquisition System

## INSTALLATION AND OPERATING MANUAL

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**Visit the Chell website at:**
**http://www.chell.co.uk**

900231-1.0

**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.**

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**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.**

# CONTENTS

# 1 Description

## 1.1 General

The nanoDAQ-LTC is a self contained acquisition system combined with pressure sensors, that acquires and transmits data to a host via CAN bus. It is the newest version of the popular Chell nanoDAQ-LT acquisition system.

The current derivative of the nanoDAQ-LTC has 16 channels of acquisition.

The nanoDAQ-LTC addresses the sensors at a defined rate, acquires the output and applies a pressure and thermal calibration to derive the engineering units.

The nanoDAQ-LTC also has Ethernet connectivity, mainly for diagnostics use, but this requires the addition of an Ethernet Diagnostics Adaptor (Chell Part No – 801480).

This manual revision covers firmware version 1.0.0

# 2 Specification

## 2.1 Power Supply:

| | |
|---|---|
| Line voltage: | 8-24 VDC |
| Absolute Max. Line voltage | 25VDC |
| Consumption: | Max 1VA<br>(At 12 volts consumotion is 68mA for 1 minute until Ethernet functions shuts down, then it is 56mA) |

## 2.2 CAN specifications:

| | |
|---|---|
| CAN type | 2.0B |
| CAN baudrate | Configurable 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 |
| Address 0xnn? | Least significant programmable device ID |
| BRP | CAN bus timing |
| TSEG1 | CAN bus timing |
| TSEG2 | CAN bus timing |
| SJW | CAN bus timing |

## 2.4 Ethernet Specifications (Via diagnostic adaptor):

| | |
|---|---|
| TCP/IP | 10Mb/s & 100Mb/s via Auto Negotiation<br>TCP protocols supported |

## 2.5 Operating conditions:

| | |
|---|---|
| Operating temperature range: | -40°C to +90°C |
| Storage temperature range: | -40°C to +90°C |
| Maximum Relative humidity: | 95% at 50°C (non condensing) |

## 2.6 Measurement specifications:

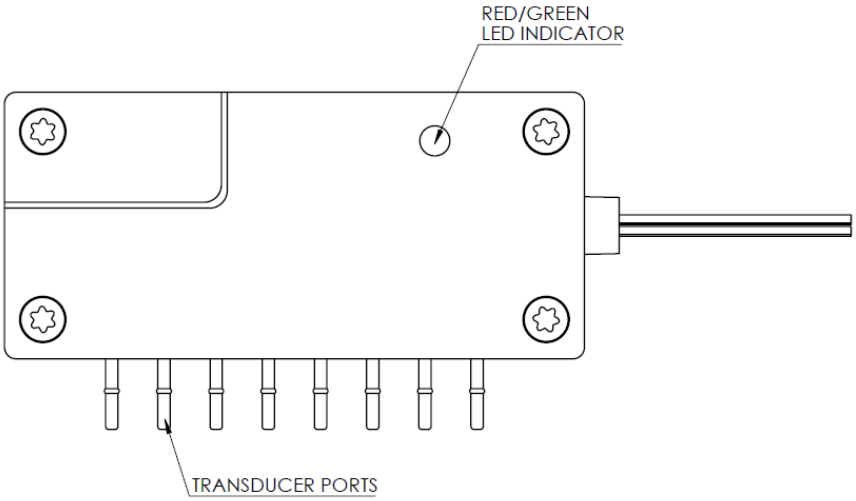
| | |
|---|---|
| System accuracy: | |
| Differential measurement | |
| Range=35kPa / 5 psi | ±0.1% FS |
| Range=17kPa / 2.5 psi | ±0.2% FS |
| Range=7kPa / 1 psi | ±0.5% FS |
| Absolute measurement | ±0.04% FS |
| Proof pressure | 50 psig |
| Maximum Measurement Speed: | 180 measurements / channel / second\ |
| Weight: | <20g |

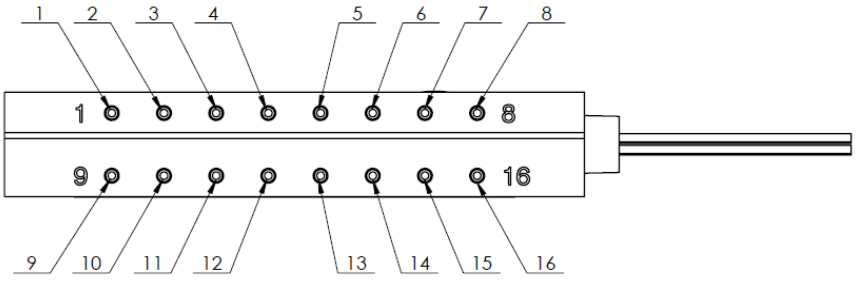
# 3 Installation and Interconnections

## 3.1 Wiring – Power & comms

| Wire Colour | Function |
|---|---|
| Red | 8V-24V supply |
| Black | Ground |
| Blue | CAN L |
| White | CAN H |

## 3.2 Pneumatic Connection – 1mm bulged tabulation



# 4 Operation of the instrument

## 4.1 Connecting up the nanoDAQ-LTC.

The nanoDAQ-LTC has one cable which supplies the unit with power and also provides comms. Ensure all the connections are made before powering up the nanoDAQ-LTC. **Always switch the power at the power supply source.**

Upon power up, the blue LED will light constantly while the nanoDAQ-LTC boots up. This boot-up period normally takes around 1 second or two. If using the Ethernet Diagnostics Adaptor, the boot up time can also be 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 (around 10 seconds).

When the nanoDAQ-LTC has finished booting, the blue LED will flash at a constant rate to show that the system is running.

## 4.3 Re-zeroing the nanoDAQ-LTC.

Before any measurements are made, the nanoDAQ-LTC should be re-zeroed. The nanoDAQ-LTC may need further re-zeroing if the unit should be subject to significant thermal variations.

The nanoDAQ-LTC is re-zeroed by sending the appropriate command over the CAN (or Ethernet) link via the user command protocol (or via the embedded webserver). The system will then average a number of zero readings and perform a re-zero. Naturally, there should be no pressure applied to the ports of the scanner when a re-zero is being performed.

When a re-zero is being performed, the red LED will light momentarily.

# 5 nanoDAQ-LTC Configuration Webserver

## 5.1 Introduction.

The nanoDAQ-LTC web Configuration provides an alternative means of setting up and demonstrating the nanoDAQ-LTC unit from a standard PC with an Ethernet port and browser. The Ethernet diagnostic adaptor is also required to be able to communicate over TCP/IP (Part No – 801480).

The webserver is divided by tabs into five areas of functionality, namely 'Setup', 'Live Data', 'Advanced', 'Timestamp' and 'Factory Tools'.

'Setup Parameters' provides the means to set nanoDAQ-LTC's main operating parameters such as data streaming rates and device comms addresses.

The unit's function may be checked and demonstrated using 'Live Data' to show the raw readings and nanoDAQ-LTC's calibrated output.

'Advanced' provides setup for the all other more advance parameters that may require tweaking on a per application basis.

'Timestamp' provides some options for configuring the timestamping feature of the nanoDAQ-LTC.
(only useful if using TCP comms)

'Factory Tools' provides some functionality to change the MAC address of the Ethernet hardware. This tab is password protected and therefore not readily available to everyone and further detail is beyond the scope of this document.

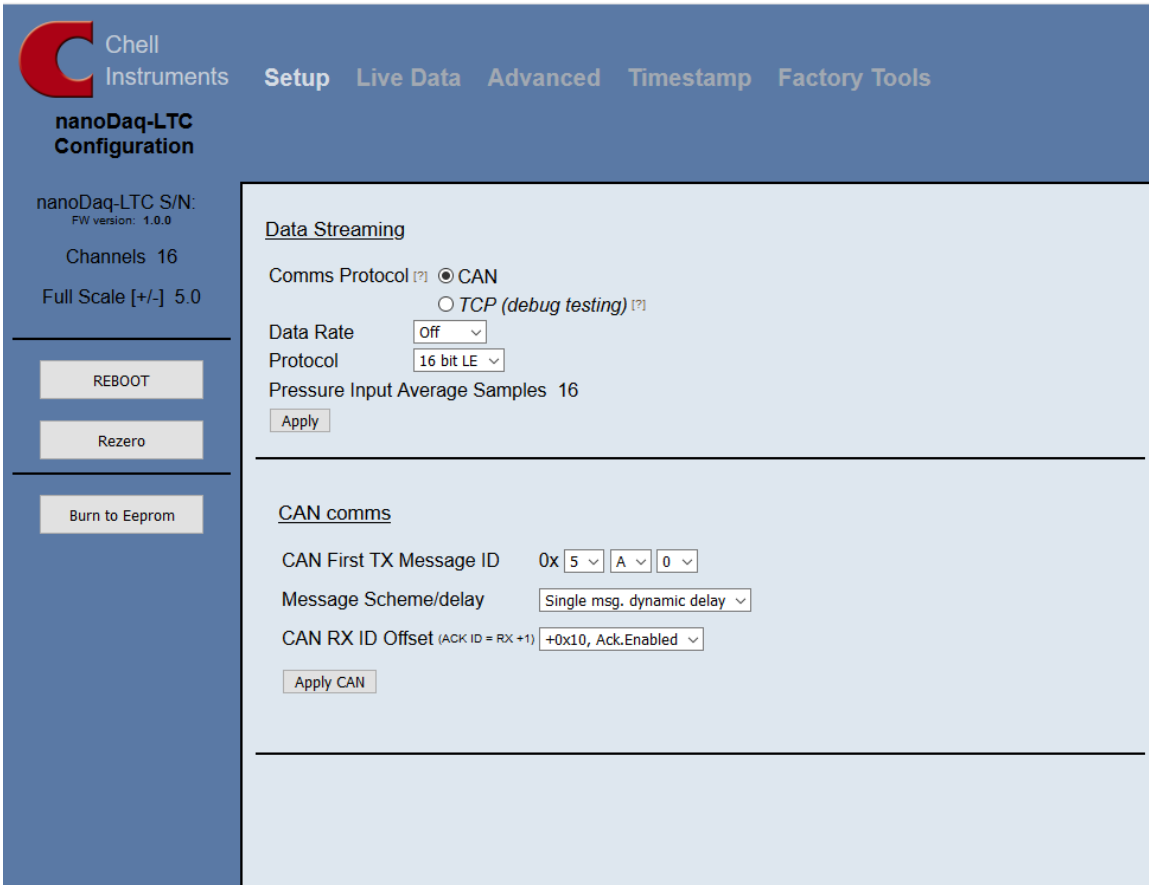



**Figure 5.1, Main Setup page**

## 5.2 Common Controls Sidebar

Figure 5.1 above shows the first page viewed when navigating to the webserver. It includes the common controls sidebar and the main group of setup parameters. The sidebar provides information on the nanoDAQ-LTC unit, including serial number and current firmware revision along with the configured fullscale and total channels. The function of the common controls is detailed in the subsequent table (Table 5.1)

| | Function |
|---|---|
| 'RE | e nanoDAQ-LTC , similar to power cycling the device. Use to ew settings and/or rebuild calibration tables. |
| 'Re | anoDAQ-LTC rezero operation. |
| 'Bu but | changes made to the local settings into the EEprom so they trieved on restart. |

**Table 5.1, Common sidebar control functions.**

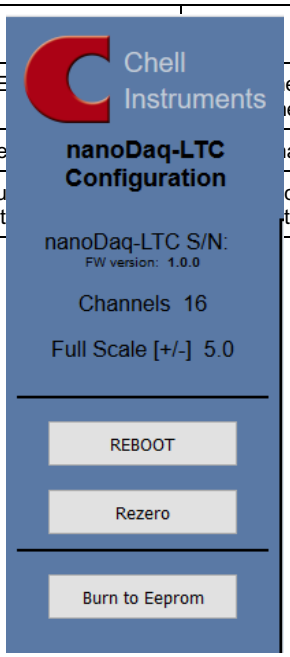



**Figure 5.2, Sidebar**

## 5.3 The 'Setup Parameters' Page

### 5.3.1 Introduction

The 'Setup Parameters' page shows all of the nanoDAQ-LTC's main operating parameters. Setup Parameters 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 both communication protocols, and allows the user to choose the protocol that is to be used, along with the data transfer rate.

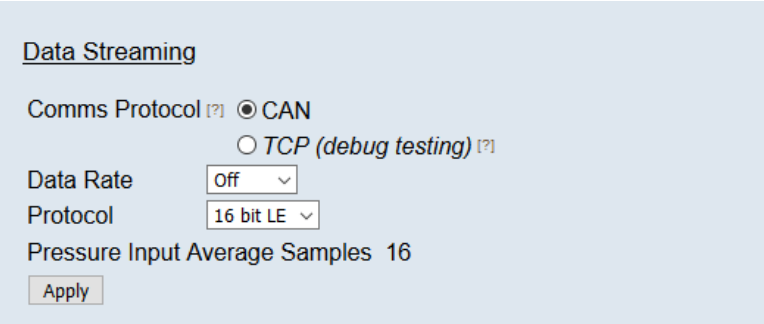



**Figure 5.3, Data Streaming group**

| Control | Function |
|---|---|
| 'Comms Protocol' radio button | Chooses the communication protocol that is to be used. This button changes what options are available below it. |
| 'Data Rate' option list | Selects the rate at which the nanoDAQ-LTC will automatically transmit data after reset. The maximum data rate available will be changed by which Oversampling rate is selected (see later). |
| 'Protocol' option list | Selects the format that the data will be transmitted as, options are 16 bit LE & 16 bit BE. |
| 'Apply' button | Applies the changes made to the local settings memory. |
| Pressure Input Average Samples | Displays the number of samples used for deriving the average pressure. |

**Table 5.2, Data Streaming settings.**

It should also be noted that changing the data rate also changes the Pressure input averaging samples to optimum settings based on the requested data rate…

The max measurement per channel per second value is gained from the oversampling rate, so when the oversampling is in high speed mode, this value will be 166 Hz, in low resolution mode it will be 125 Hz, in standard resolution it will be 83 Hz, in high resolution mode it will be 50 Hz and in ultra high resolution it will be 25 Hz

Averaging required = max measurement per channel / requested data rate

The average required is then dropped to the next value down in the averaging index. An averaging of 1 is equal to off.

So if the Oversampling is on High resolution and the data rate selected is 5Hz then the Pressure and Temperature input average samples will be 4.

### 5.3.3 TCP Parameters

The TCP communication protocol parameters are shown in Figure 5.3. This only shows if the TCP radio button is selected in the datastreaming section. The options in this section control the nanoDAQ-LTC's IP address, subnet mask and Local port.

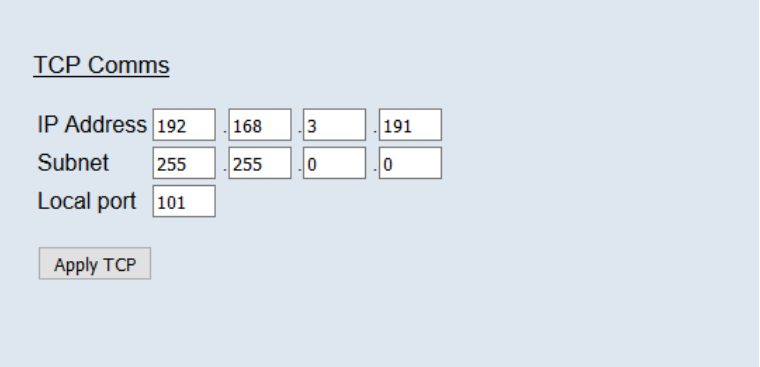



**Figure 5.4, TCP Comms group**

| | |
|---|---|
| 'IP Address' | IP address allocated to nanoDAQ-LTC on the user's network. |
| 'Subnet' | Subnet mask as set on the user's network. |
| 'Local port' | Local port of the device. |
| 'Apply TCP' | Applies the settings to the local memory |

**Table 5.3, TCP Comms group settings**

### 5.3.4 CAN Parameters

The CAN communication settings are shown in Figure 5.5. Options are available to set the base message ID number and the message scheme. Data may be transmitted on either a single message (with either a selectable or dynamic inter-frame delay) or alternatively multiple messages.

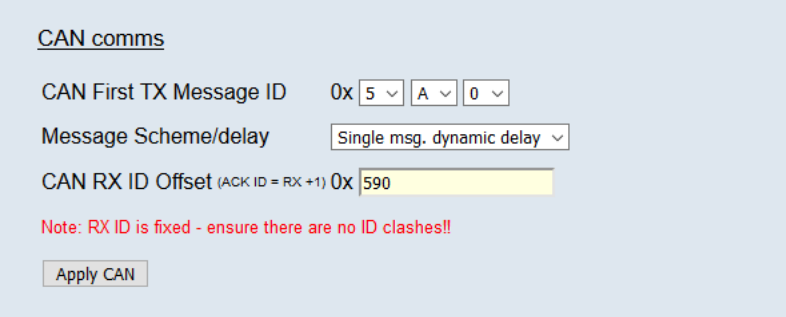



**Figure 5.5, CAN Comms group**

| | |
|---|---|
| 'CAN First TX Message ID' | nanoDAQ-LTC uses standard CAN message arbitration id's. The least significant byte for the CAN ID is only selectable in multiples of 4 (E.G 0,4,8,C) |
| Message scheme/delay | By default, the message scheme is single message, dynamic delay. This is where the data is packed 3 channels per message + identifier byte. The delay between messages is determined by the data rate (see user programming guide – 900230). Alternatively select 'Multiple Messages' for the 4 channels per message. |
| 'CAN RX ID Offset' | This is the fixed message ID used for incoming user commands (see the user programming guide). This differs from other nanoDAQ-LT derivatives where this field is an offset from the base address. **Note: it is the users responsibility to ensure there are no ID clashes**. On receiving messages the unit will acknowledge the reception on a message ID of 'RX ID' + 1. |
| 'Apply' | Applies the settings to the local settings memory |

**Table 5.4, CAN Comms group settings.**

## 5.4. ‘Live Data’ Page

Figure 5.6 shows the 'Live Data' page of the webserver, for the 16 channel nanoDAQ-LTC.

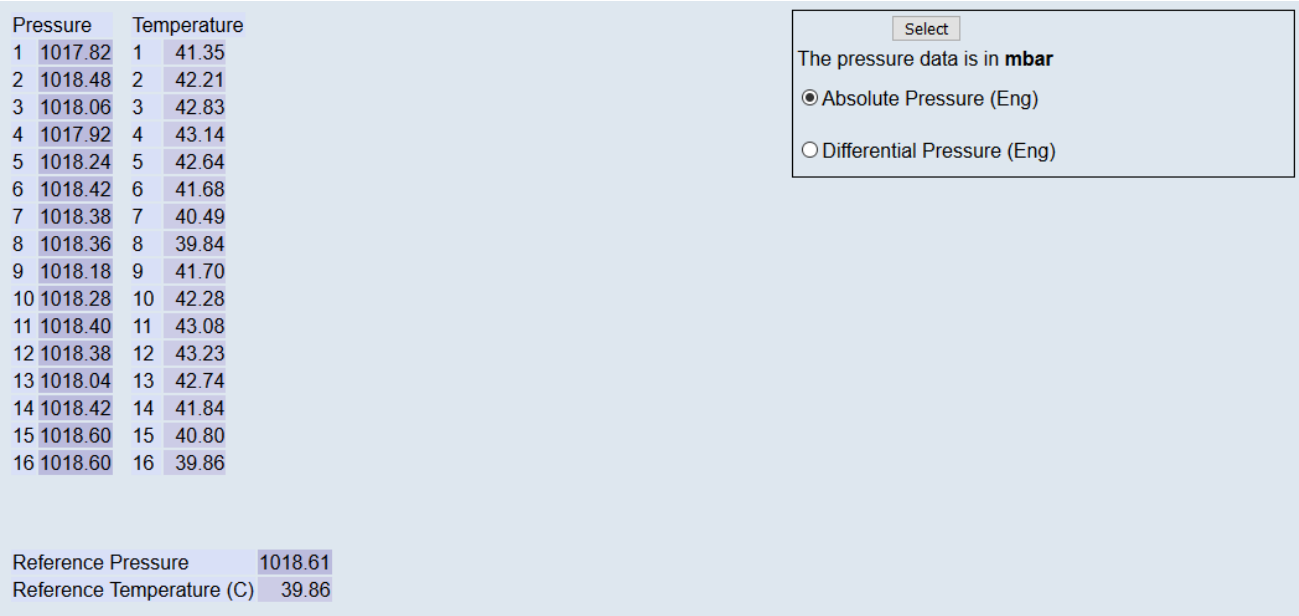



**Figure 5.6, Live Data Page**

The live data page is a means to demonstrating the correct operation of the nanoDAQ-LTC and testing the unit's calibration. A value label is shown for each channel with 1-16 for both the temperature and the pressure data.
There is also a reference pressure and temperature value at the bottom of the page. Please note that there isn’t a separate refrence sensor on the nanoDAQ-LTC. Instead one of the other channels can be chosen as the reference channel (via user configuration) for differential pressure use. If no channel is selected as the reference, then the reference fields will show 0.0.

The pressure data can be in either mbar, PSI or KPa (Kilopascals), this is decided on the advanced page, but is displayed on the top right of the live data page for information & convenience.
The type of value shown in the labels may be selected by means of the option buttons in the righthand frame. These are as follows:

- Absolute Pressure (Eng) — Calibrated engineering units pressure value.
- Differential Pressure (Eng) — As above, but represented as a differential pressure, using the reference pressure reading as a base.

Values are updated automatically, once every 500ms, with the default view being Absolute Pressure (Eng). Use the Select button to switch between the selectable view options.

## 5.5 ‘Advanced’ Page

The advanced tab contains extra options that users may find useful for more exact configuration but are not compulsory.

### 5.5.1 Advanced CAN settings

The nanoDAQ-LTC has extra communication variables that may help get a more precise connection between the nanoDAQ-LTC and the PC.


**Figure 5.7 Advanced comms group**

| Control | Function |
|---|---|
| BRP, TSEG1, TSEG2, SJW | Register values for the CAN module within the nanoDAQ-LTCs microcontroller. |
| Status CAN ID | CAN ID for 500ms status message. Please ensure that this CAN ID does not clash with TX message CAN ID. |

**Table 5.5 Advanced comms settings**

### 5.5.2 Miscellaneous

The remaining parameters are edited via the Miscellaneous group shown in Figure 5.8. The nanoDAQ-LTC allows the user to change the pressure unit and type output in the data stream

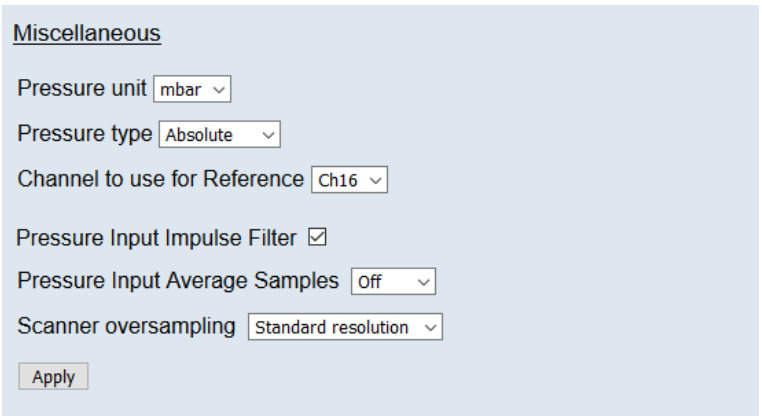



**Figure 5.8, Miscellaneous group.**

| | |
|---|---|
| 'Pressure unit' | Selects whether the data is in mbar, kPa or PSI. |
| 'Pressure type' | Selects how the data output stream is encoded. In Absolute mode, by default the data is 0.02mbar per bit. In Differential mode the data is -/+ fullscale = 0-65535 bits. |
| 'Channel to use for reference' | This drop down allows you to nominate a channel to be used as a reference. This is required if using differential pressure output. |
| 'Pressure input impulse filter' | Applies impulse filter to pre-calibration data – will remove single impulse noise events in the pressure data. |
| 'Pressure input average samples' | Selects the number of samples for a moving average of pre-calibration data. |
| 'Scanner oversampling' | Select the resolution of the scanner sampling. |
| 'Apply' | Applies the settings to the local settings memory |

**Table 5.6, Miscellaneous group settings**

### 5.5.3 Zero Coefficients

The Zero coefficients for the linear cal. are displayed as a separate group at the bottom of this page. These values are the current zero offsets acquired when the device is rezeroed.

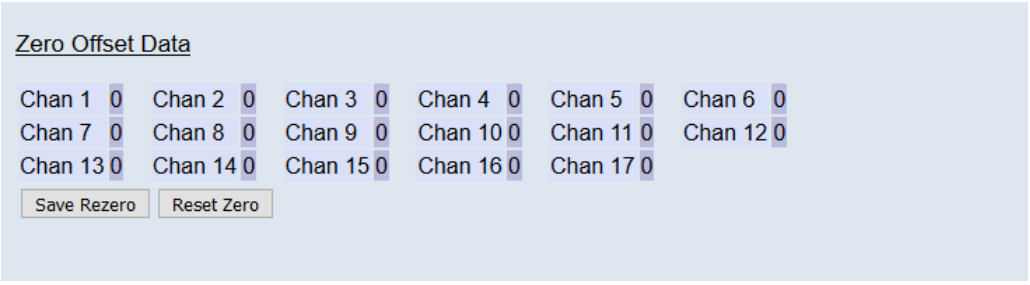



**Figure 5.9 Zero Offset Coefficients group**

| | |
|---|---|
| 'Save Rezero' | Saves the Rezero values to the eeprom |
| 'Reset Zero' | Clears the span calibration on all channels |

**Table 5.7, Zero Coefficients controls**

## 5.6 Timestamp

This page allows the user to edit the timestamp settings of the nanoDAQ-LTC. 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 effect on the maximum transmission rate. **Please note that this is only valid when using TCP comms with the Ethernet Diagnostics Adaptor.**

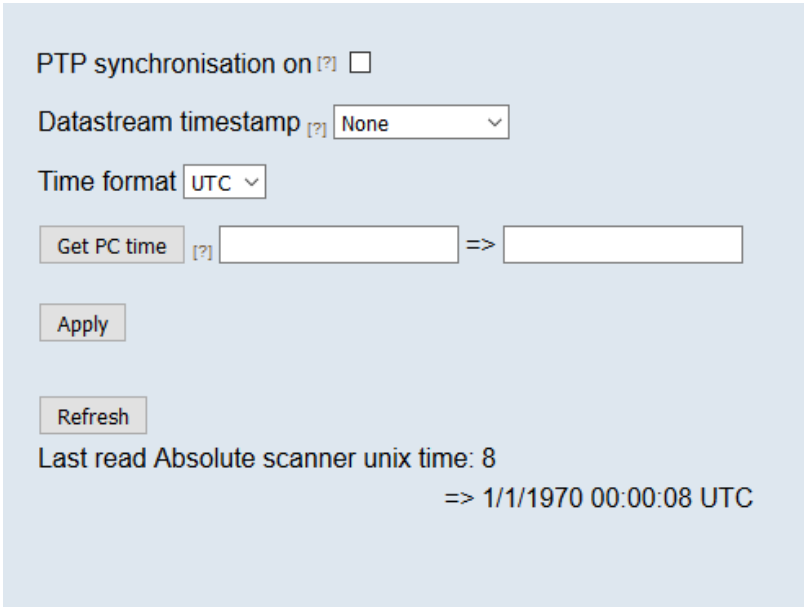



**Figure 5.10, Timestamp**

| | |
|---|---|
| '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 nanoDAQ-LTC. |
| '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. NOTE the user has to click apply to send the timestamp to the nanoDAQ-LTC |
| '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 nanoDAQ-LTC. |
| 'last read Absolute scanner unix time' | The top line shows the current time in the nanoDAQ-LTC |

**Table 5.8, 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 nanoDAQ-LTC, 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 warranty.

## 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.**