microDAQ

Pressure Scanner Acquisition System

INSTALLATION
AND
OPERATING MANUAL

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900165-1.9

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.**

CONTENTS

1 Description

1.1 General

The microDAQ is a self contained acquisition system and combined pressure scanner that acquires and transmits data to a host via USB, Ethernet (<u>not on standard 16 channel variants</u> – a special factory fit option can be requested if required) or a CAN bus. It is the next generation of the popular Chell CANdaq acquisition system.

The microDAQ comes in several variants to accommodate both conventional HD series scanners and Digital Thermal Compensation (DTC) scanners with 16, 32 and 64 channels.

The microDAQ is supplied with all the software required to configure it and read the data from it.

The microDAQ addresses the scanner at a defined rate, acquires the output and applies a pressure and thermal calibration to derive the engineering units. The microDAQ can be re-zeroed at any time either from a host controller via comms or by closing contacts between two pins on the Autosport connector (if configured in this mode).

The microDAQ also has a hardware trigger like the Mk3 CANdaq system, to give some time determination to the data acquired.

This manual revision covers firmware version 1.0.14. Some of the functions and options detailed here may not be available in earlier firmware versions.

2   Specification

2.1 Power Supply:

Line voltage:	8-24 VDC
Absolute Max. Line voltage	25VDC
Consumption:	Max 4VA
With a 64 channel scanner:	

2.2 CAN specifications:

CAN type	2.0B
CAN baudrate	Configurable (by internal switch) 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 – see Infineon data sheet
TSEG1	CAN bus timing – see Infineon data sheet
TSEG2	CAN bus timing – see Infineon data sheet
SJW	CAN bus timing – see Infineon data sheet

2.3 Serial specifications:

USB2.0 (micro)	57600 baud, no parity, 8 data bits and 1 stop bit.

2.4 Ethernet Specifications:

TCP/IP	10Mb/s & 100Mb/s via Auto Negotiation TCP & UDP protocols supported

2.5 Operating conditions:

Operating temperature range:	+5°C to +90°C
Storage temperature range:	-20°C to +90°C
Maximum Relative humidity:	95% at 50°C (non condensing)

2.6 Measurement specifications:

System accuracy:	±0.25% FS for conventional scanners
	±0.06% FS for DTC scanners
	±0.06% FS for I-Daq scanners
Resolution:	16 Bit
Maximum Measurement Speed:	See table below:

	Number of Scanner channels Acquired			
	16	32	48	64
Speed M/C/S	1250	625	400	300

All measurements are in measurements / channel / second.

3 Installation and Interconnections

3.1 Connector – Mating connector: DEUTSCH ASDD606-09SN-HE

Pin Number	Designation
1	TX+
2	RX+
3	TRIGGER IN (TTL)
4	+8~25V SUPPLY
5	0V
6	CAN_H
7	CAN_L
8	TX-
9	RX-

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

3.2 USB Connector – Mating connector: Micro B

Pin Number	Designation
1	+5v USB transceiver supply
2	USBDM
3	USBDP
4	N/C
5	0V

3.3 Scanner Connector – Internal 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

Note: The connection pinouts for the microDAQ-INT interface adapter can be found at the end of this document (Section 7).

4 Operation of the instrument

4.1 Connecting up the microDAQ.

The microDAQ has one connector and cable which supplies the unit with power and also provides CAN and Ethernet comms. An industry standard micro USB (typeB) connector is provided to allow for RS232 connection for changing the setup parameters of the unit. Ensure all the connections are made before powering up the microDAQ. The microDAQ 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 boots up. This boot-up period will vary depending on the type of scanner and the number of channels. 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 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).

4.1.1. USB driver installation

If a USB cable is connected to the microDAQ, the host PC will require the user to install the driver for the USB controller on the microDAQ board. This driver may install automatically if already on the PC, but if not it can be found under the Serial Port Driver directory on the CD provided.

Note that if another microDAQ is attached to the same USB port at a different time then the PC will once again ask for driver installation and will automatically assigned a different COM port number to that new microDAQ. This is because each USB controller chip has a unique serial number associated with it internally. When several microDAQs are being connected in this way this can be lead to a large number of COM ports being assigned which can become unwieldy. To avoid this there is a Windows registry modification that can be made so that the PC assigns the same driver instance and COM port for several microDAQ connections to that one USB port.
To do this, add the following Binary value and set it to 01:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\UsbFlags\IgnoreHWSerNum04036001

4.2 Installing the software.

The microDAQ interface software should now be installed so that the microDAQ may be configured. Simply run the appropriate setup.exe on the CD provided.

4.3 Re-zeroing the microDAQ.

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

The microDAQ is re-zeroed by sending the appropriate command over the CAN, USB or Ethernet link via the Chell software. 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.

4.4 Hardware Trigger

The microDAQ features a hardware trigger to enable the user to synchronise multiple microDAQ's and to calculate the timing of the measurements made. The hardware trigger takes the form of a pulse train. Each time the microDAQ receives a positive edge, it will generate a set of measurements for all the channels configured in the system.

4.4.1 Hardware Trigger Input.

The hardware trigger input is a 5V TTL square wave pulse train. Minimum frequency 2Hz and maximum frequency 1KHz (16 channels only).

4.4.2 Timing Information

The hardware trigger allows the user to calculate the time of each measurement. For example if the hardware trigger were running at 100Hz then the user would receive 100 measurements per channel per second. The first pulse would generate the first set of measurements and 10ms later the second pulse would generate the second set and so on. When the hardware trigger is activated, the microDAQ will wait for the first pulse. The time that this first pulse is generated can be measured by the user and therefore the time of the first set of data and all subsequent sets can be determined. For more details on hardware trigger timing a technical paper is available – Chell document no. 900118 (this paper was developed for the CANdaq but applies to the microDAQ as well).

4.4.3 Software Control

The hardware trigger mode is activated by the T command over the RS232, CAN or Ethernet interfaces. The T command can be used to enable the hardware trigger that will cause the microDAQ to stop free-running and wait for the first pulse. The disable command will return the microDAQ to free-running. The command structure is as follows:

Command	Interface	On / Off
T00	RS232	Off
T10	RS232	On
T01	CAN	Off
T11	CAN	On
T02	Ethernet	Off
T12	Ethernet	On

The hardware trigger can also be set to auto enable on power up which means that the microDAQ 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 contanst rate after initialisation and will actually turn off. This feature can be enabled/disabled from the microDAQSetup program.

5 'microDAQ Setup' Configuration Software

5.1 Introduction.

microDAQSetup provides the means of setting up, calibrating and demonstrating the microDAQ unit from a standard PC with a serial port. Version 1.0.11 is written to complement microDAQ firmware V1.0.14.

The software is divided by tabs into five areas of functionality, namely 'Setup Parameters', 'Live data', 'Calibration', 'DTC Information' and 'Tools'

'Setup Parameters' provides the means to set microDAQ's operating parameters and its identification information. The unit's function may be checked and demonstrated using 'Live Data' to show attached pressure scanner raw readings and microDAQ's calibrated output. 'Calibration' gives access to microDAQ's existing on board, non DTC calibration coefficients, the tools for performing a new calibration, namely calculating and downloading new coefficients, and the means to managing calibration data. Data from the calibration procedure and resulting coefficients may be loaded, stored and exported for filing, reuse and examination in other packages. 'DTC Information' provides a means for interrogating a DTC variant of the microDAQ, the user having access to identification information, the current status of the calibration shuttle valve and both excitation and temperature voltages. '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.

5.2. The 'Setup Parameters' Tab.

5.2.1 Introduction.

The 'Setup Parameters' tab allows the reading and writing of all of microDAQ's operating settings to its on board non volatile EEPROM. The operator may upload the current settings from microDAQ, edit them, and then download them back into the unit. A submenu of tabs divides the available setup parameters into different categories by function, and each category is detailed separately in the following. Figure 5.1 shows the common controls and the 'Signal' group of parameters. The function of the common controls is detailed in the subsequent table.

5.2.2 Signal Parameters.

The microDAQ has settings to allow the user flexible control over the data throughput of the device. Averaging options allow the preference of noise reduction over time domain response, the frequency of calibration temperature compensation renewal may be chosen as may be the size of the average (and hence time taken) for the rezero routine. Table 5.1 details the function of the signal parameter option controls.

Control	Function
'Pressure Input Impulse Filter'	Check box to apply impulse 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.
'Pressure output average samples'	Selects the number of samples for a moving average of post calibration pressure data.
'Reset average on output'	Overrides the rolling pressure output filter. When checked, the unit builds a fresh post calibration average between each data delivery event.
'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. 'With zero only' permits the use of a designated user command to request a rezero.
'No Rezero samples'	The number of samples in the average to calculate a new pressure zero offset.

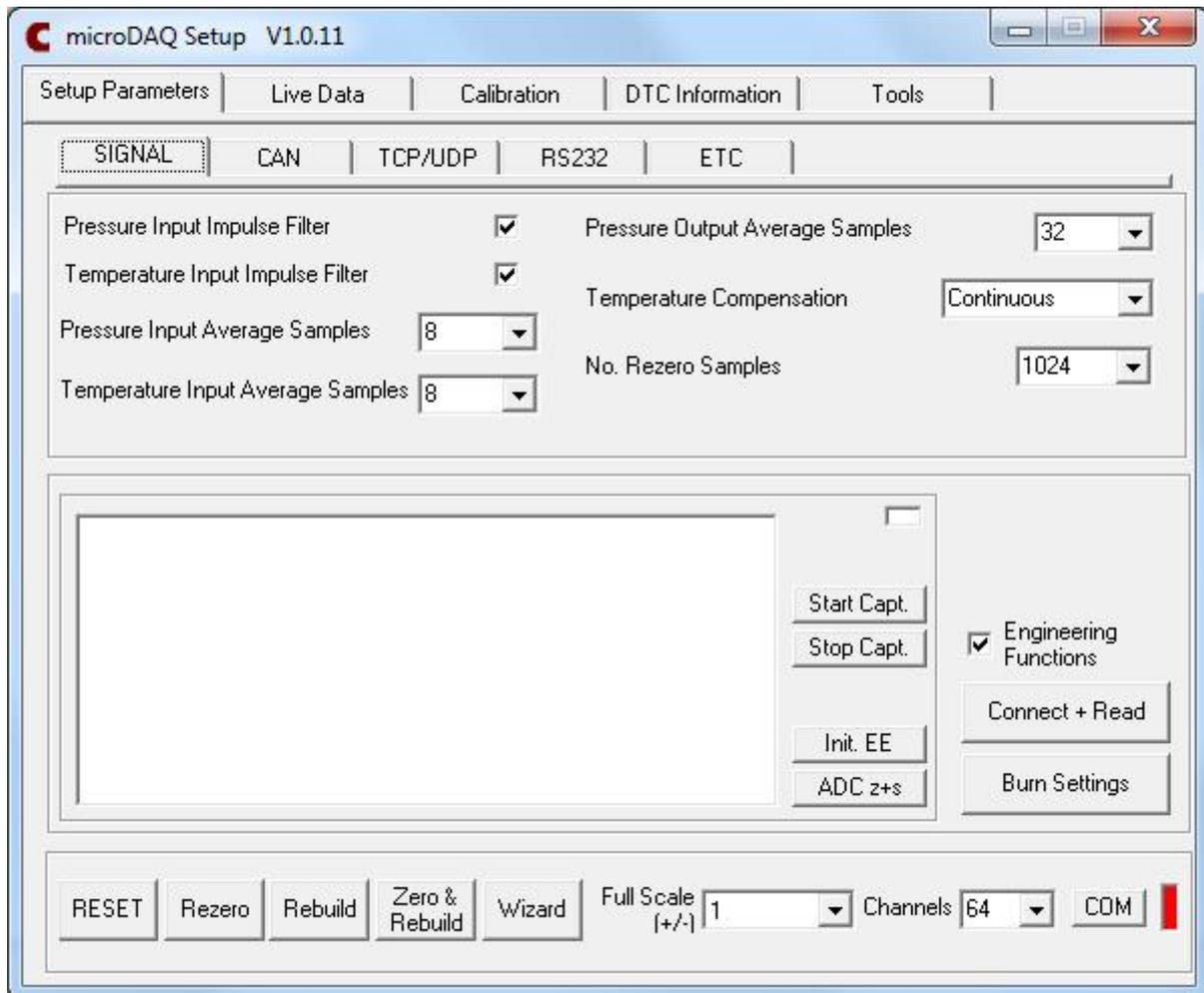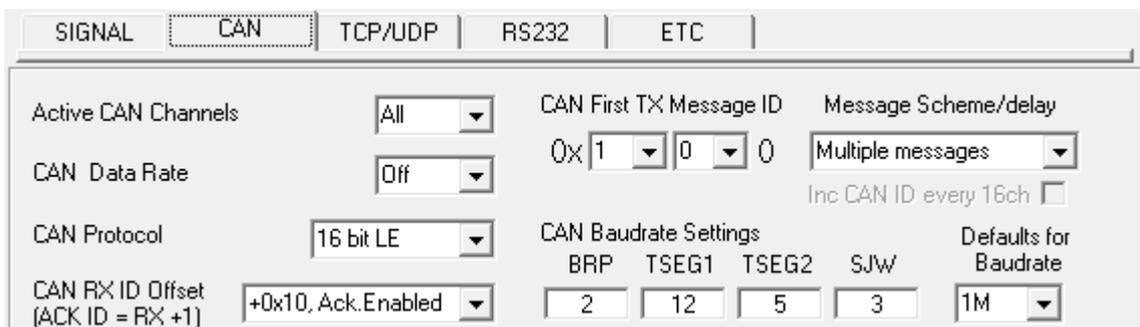**Table 5.1, Function of the 'Signal' parameter controls**

Figure 5.1, Contents of the 'Setup Parameters' tab, Signal Tab and Engineering Functions Selected.

Control	Function
Common Functions	
'Connect and Read' button	Retrieves all setup data from microDAQ including software version, setup parameter values and identification. Diagnostic information may be seen in the central listbox.
'Burn Settings' button	Downloads setup values and identification strings to microDAQ, and then writes them into the EEPROM. Diagnostic information may be seen in the central listbox.
'Rezero' button	Starts a microDAQ rezero operation.
'RESET' button	Resets the microDAQ, similar to power cycling the device. Use to activate new settings and/or rebuild calibration tables.
'Channels' dropdown	The number of channels on the attached scanner should be chosen from the 'Channels' drop down. It is important that this number is correct when performing any calibration or reading data from microDAQ.
'Full Scale' dropdown	This dropdown is the only means of selection of the scanner's full scale operating pressure. The value affects the display of live engineering values and the generation of calibration coefficients.
'Wizard' button	Start the setup wizard for a simple way to apply common settings to the microDAQ.
'Rebuild' button	Force a calibration table rebuild.
'Zero & Rebuild' button	As above but performs a rezero operation first.
'Start Capt.' button	Start capturing characters received on the serial port / TCP socket to the text file microDAQCapture.log and display on the engineering screen.
'Stop Capt.' button	Stop capture of serial characters.
'Engineering Functions' checkbox	Show or hide the engineering functions panel.
For calibration file management controls, see the calibration section.	

Table 5.2, Common setup control functions.

5.2.3 CAN Parameters.

The optional CAN communication parameter controls are shown in figure 5.2. Options control the CAN bus baudrate, the rate of data delivery, the number of channels enabled and the data format. Additionally the base message number may be selected, as can 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 single message ID scheme can be modified to increment the ID after every block of 16 channels until all channels for a scanner have been transmitted.

Figure 5.2, CAN parameters within the setup data.

'CAN baudrate'	Shows the setting of the four register values required to set up the CAN bus timing in microDAQ's microcontroller. Selecting a CAN baudrate from the combo box sets different register values to achieve one of a number of preset baudrates. The user is free to set their own preference in consultation with the appropriate datasheet. Note the internal CAN peripheral clock runs at 60Mhz. All register values should be calculated based on that clock frequency.
'CAN First TX Message ID'	microDAQ 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.
'Inc CAN ID every 16ch' checkbox	Becomes available for the single ID message scheme and allows for incrementing the CAN message ID after every 16 channels until all channels have been transmitted.
'Active CAN channels'	Allows the selection of a subset of total scanner channels to be active.
'CAN data rate'	The delivery rate of data for each channel
'CAN protocol'	The data format delivered by the CAN module. Can be 16 bit data, as two bytes (either big or little ended).
'CAN RX ID Offset'	Selects the hex offset from the base message ID where microDAQ 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
BRP, TSEG1, TSEG2, SJW	Register values for the CAN module within microDAQs microcontroller.

Table 5.3, CAN parameter control functions.
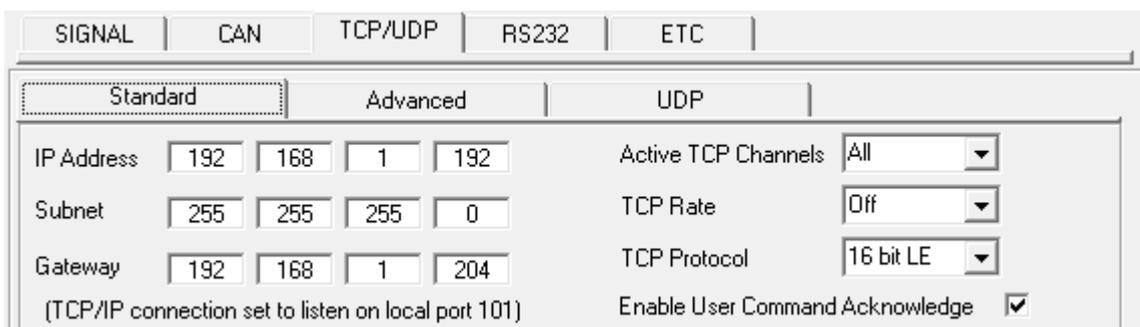
5.2.4 TCP/UDP Parameters.

(Note these settings are ignored/meaningless on a 16 channel microDAQ variant.)
The optional TCP/UDP communication parameters Standard controls are shown in figure 5.3a. Options control the microDAQs IP address and subnet mask, in addition to any gateway IP address required. Options for channels and delivery rate and protocol are the same as for the CAN system above. microDAQ's active TCP listening port is fixed at 101.
The Advanced tab (figure 5.3b) allows changing of the primary & secondary DNS addresses (not currently used by the microDAQ), and also a setting for the Ethernet initialisation timeouts.
The UDP tab (figure 5.3c) 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 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. The microDAQ's UDP port is also fixed at 101. Settings available from this tab 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.

Note that selecting Engineering Units for a protocol will cause the scanner addressing rate to be reduced; it is better to scale calibrated 16 bit data to engineering units within the client software.

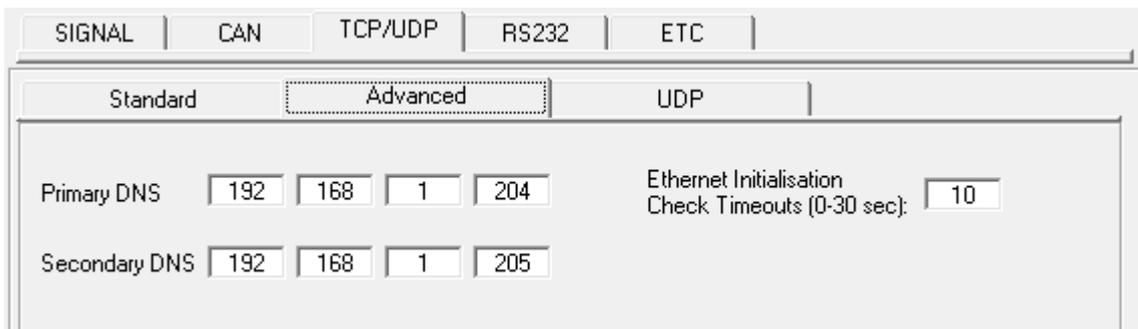**Figure 5.3a, TCP/UDP parameters (Standard tab) within the setup data.**

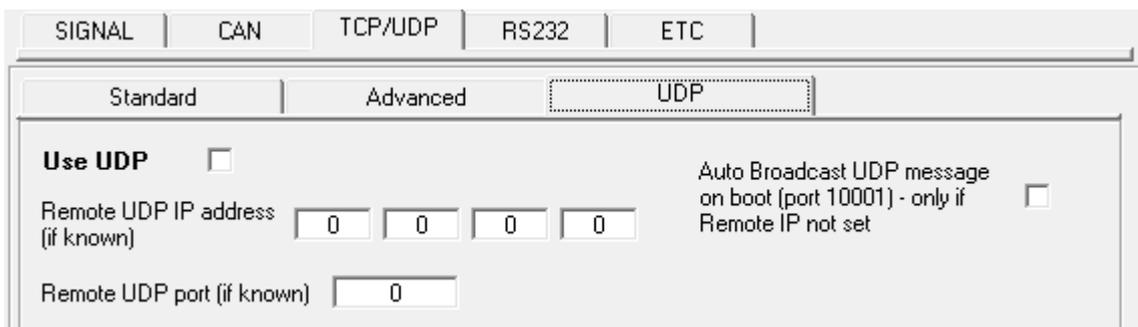**Figure 5.3b, TCP/UDP parameters (Advanced tab) within the setup data.**

Figure 5.3c, TCP/UDP parameters (UDP tab) within the setup data.

'IP Address'	IP address allocated to microDAQ on the user's network.
'Subnet'	Subnet mask as set on the user's network.
'Gateway'	IP address of the gateway on the user's network.
'Active TCP channels'	Allows the selection of a subset of total scanner channels to be active.
'TCP rate'	The delivery rate of data for each channel
'TCP protocol'	The data format delivered by the TCP module. Can be 16 bit data, as two bytes (either big or little ended) or engineering units.
'Enable User Command Acknowledgement'	If checked, returns acknowledgement to incoming user TCP commands.
Primary & Secondary DNS	Addresses of Primary and Secondary DNS servers (not currently used on microDAQ)
Ethernet Initialisation Check Timeouts	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.
Use UDP	If checked, uses the UDP protocol rather than the TCP protocol for Ethernet transmission. Each packet is one cycle of data acquisition with 4 byte representation of microDAQ serial number at the start.
Remote UDP IP address and port	Address and port of remote connection to microDAQ. If set then the microDAQ can be set to auto stream data to that remote host on boot up (after initialisation)
Auto Broadcast UDP message on boot	If checked, auto broadcasts a UDP message on port 10001 on startup which details the microDAQs 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)

Table 5.4, TCP parameter control functions.

5.2.5 RS232 Parameters.

The data delivery options of CAN and TCP are repeated for the RS232 interface, in addition to a baudrate selection allowing user configuration of microDAQ's baudrate on powerup. The baudrate selected is valid for both data delivery functions, and communication to the setup software.

Note that selecting Engineering Units for a protocol will cause the scanner addressing rate to be reduced; it is better to scale calibrated 16 bit data to engineering units within the client software.

Figure 5.4, RS232 parameters within the setup data.

'RS232 baudrate'	microDAQ communication baudrate for both data streaming and user interface
'Active RS232 channels'	Allows the selection of a subset of total scanner channels to be active.
'RS232 data rate'	The delivery rate of data for each channel
'RS232 protocol'	The data format delivered by the RS232 module. Can be 16 or 14 bit data, as two bytes (either big or little ended) or engineering units.
'Enable User Command Acknowledgement'	If checked, returns acknowledgement to incoming user RS232 commands.

Table 5.5, RS232 parameter control functions.

5.2.6 Remaining Sundry Parameters.

The remaining parameters are edited via the 'ETC' tab, shown in figure 5.5. Scanner and microDAQ identification strings may be written 'as is' to the device, as may a date. If the microDAQ is a DTC variant and DTC mode is to be used, the 'Use DTC' checkbox should be checked. If the microDAQ is an I-daq variant then the 'use raw calibration' checkbox can be ticked to apply a linear calibration function on boot up. The DTC scanner's options of sensistor and gain configuration may also be selected from this tab. 'All DTC Channels Active', defaults the number of active channels to all on a DTC scanner, overriding the number in the setup. The 'Trig In' line on the Autosport connector can be configured to be used for Hardware Trigger or Mute/Rezero. The scanner type should always be set to the type of scanner installed in the microDAQ to ensure proper operation of the system.

Figure 5.5, Remaining ('ETC') parameters within the setup data.

'Scanner ID'	Provision for a scanner serial number.
'CANdaq ID'	Provision for the microDAQ serial number
'Date'	Provision for a date field – used for date of manufacture
'Use DTC calibration if available'	On powerup, uses the DTC scanners internal calibration coefficients to build the microDAQ's internal calibration data table.
If I-daq detected, use raw calibration	If checked, this replaces the normal polynomial calibration function with a 'raw' linear function whenever an I-daq is present in the microDAQ.

|	
'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.
'All DTC Channels Active'	If checked, defaults microDAQ to setting the number of active channels to the number read from the DTC scanner header
'Span Calibration to DTC Full Scale'	If checks, defaults the span of the calibrated output to the full scale read from the DTC scanner header.
'Span High'	Sets the value of pressure for the 'high' point in the linear span and zero calibration. Valid values range from 0.144PSI (3"WC) to 90PSI. Typically this value should be set to 90% of the scanners full scale value, if possible.
Scanner Type	Sets the type of scanner installed into the microDAQ (Conv, DTC, I-Daq, T-DAQ)
[Trig In] line options	Selects the use of the [Trig In] hardware line on the Autosport connector.
'Auto enable HW trigger on startup' dropdown	If set to anything other than Off, the microDAQ 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.

Table 5.6, Remaining ('ETC') parameters within the setup data.
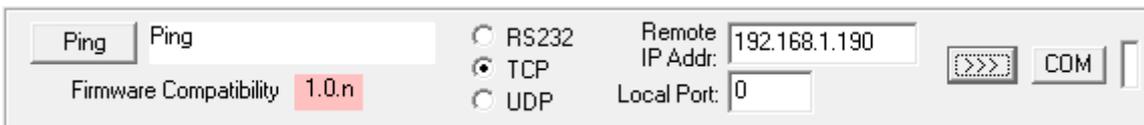
5.2.7 The COM Frame.

The 'COM' button towards the bottom right of the main from, toggles the frame it sits in between the 'COMMANDS' frame as seen in figure 5.1 and the 'PING' frame, as seen in figures 5.6a & 5.6b below. Access to the communications settings and the ping function to determine the current software version of the microDAQ, is from this alternate frame. The red indicator shows the software is connected to the serial port or a TCP/UDP socket has been successfully opened.

Note for TCP & UDP connections, the indicator changes to light blue whilst the software attempts to open a socket connection to the microDAQ. After a timeout period (normally around 5 seconds) the software stops attempting a connection and informs the user that the connection was not possible. If this occurs the user should confirm that the IP address is correct and that the physical connection between the PC and the microDAQ is good. Power cycling the microDAQ may also help in these situations.

Setup mode via TCP or UDP is dependant on the selection of the 'Use UDP' flag (see Fig. 5.3c & Table 5.4 above). If 'Use UDP' is set then connection via TCP is not possible and similarly connection via UDP is not possible if the flag is cleared.
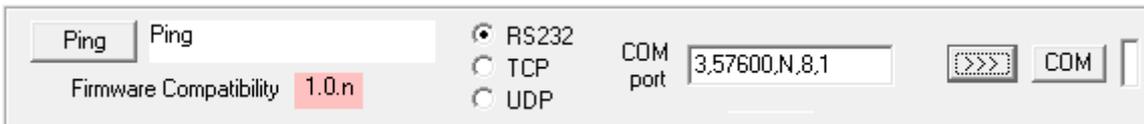
Figure 5.6a, The alternate 'PING' frame with RS232 comms settings, accessed from the 'COM' button.

Figure 5.6b, The alternate 'PING' frame with TCP/UDP comms settings, accessed from the 'COM' button.

'Ping CANdaq' button	To confirm that the attached microDAQ is alive and communicating, clicking the ping button retrieves the current software version string from the device and displays it in the label next to the button.
COM port parameters	The software defaults to the last used microDAQ communications operating settings, though these settings may be overwritten by selecting the chosen setup comms protocol (RS232 or TCP) and by typing the appropriate desired settings into the text boxes and clicking the '>>>' button. NOTE: for RS232 comms ensure the USB cable is connected to the microDAQ before clicking the '>>>' button to connect and ALWAYS click the '<<<' button to disconnect before disconnecting the USB cable from the microDAQ.

Table 5.7, Functions within the alternate 'PING' frame accessed from the 'COM' button.

5.3. 'Live Data'.

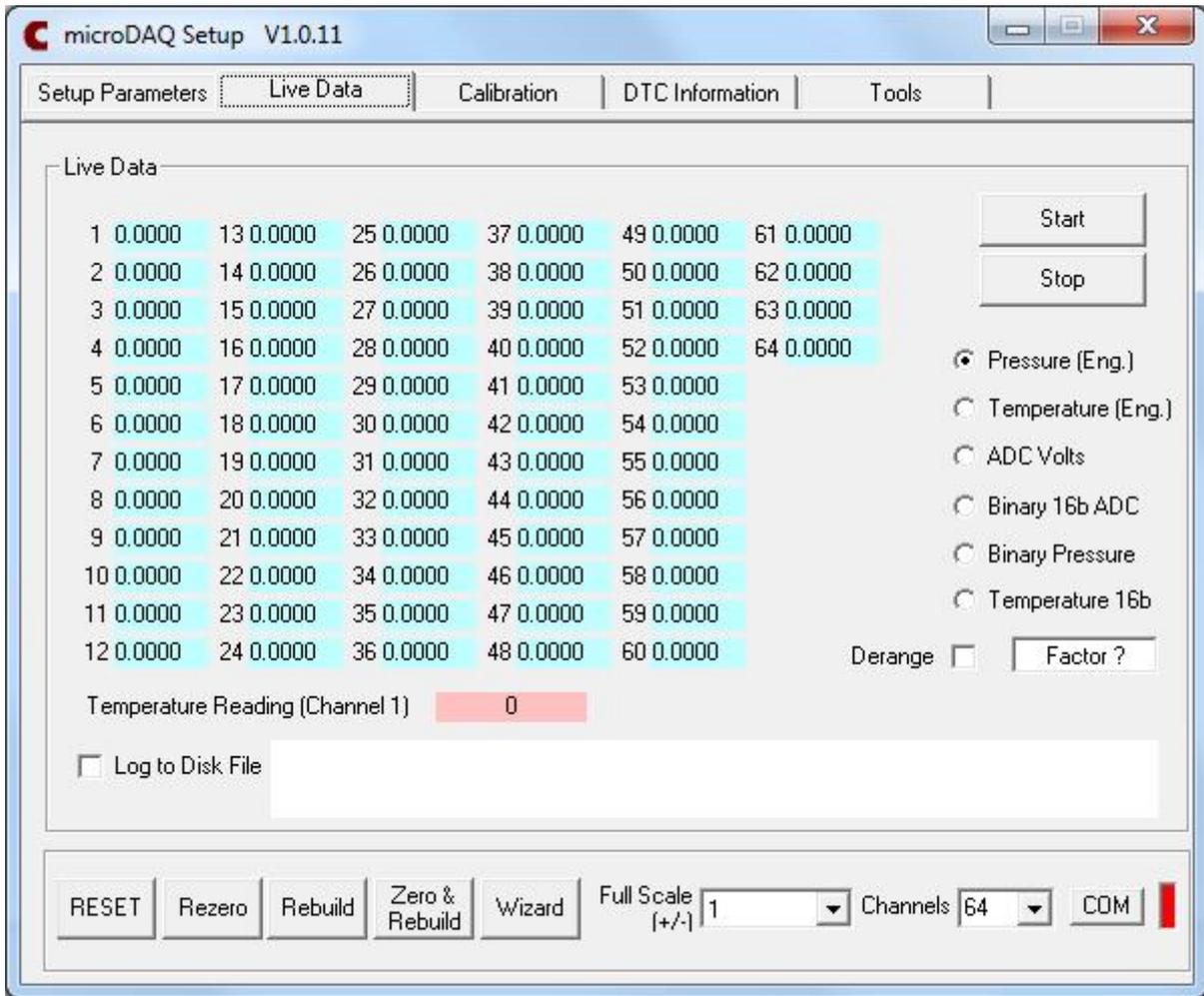Figure 5.7 shows the 'Live Data' tab of the software selected for a 64 channel pressure scanner.

Figure 5.7, Contents of the Live Data Tab

The live data tab is a means to demonstrating the correct operation of microDAQ and testing the unit's calibration. By selecting the correct number of channels for the attached scanner, the software shows a data label dedicated to each. 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 raw (decimal 16 bit unsigned), calibrated (decimal 16 bit unsigned) and engineering units or voltage scaled to the known full scales. Also for DTC scanners, the temperature values as raw unsigned 16 bit and calibrated engineering units may be displayed. For non DTC scanners, the temperature value read from the scanner is displayed in the Temperature Reading label. Once a type is selected, clicking the start button causes continuous reads of microDAQ until the stop button is pressed. Clicking the start button will cause most of the function buttons within the software to be disabled, preventing their operation until the 'Stop' button is pressed.

The 'Derange' checkbox allows the application of a constant to the data in the case of the DTC deranging function being active - the value of this constant may either be typed into the text box, or reading the DTC header will automatically fill in this value

The live data may be logged to a comma delimited file by checking the 'Log to Disk File' checkbox. Checking the file causes a new file to be opened in the current data directory, with a filename of the form 'microDAQlive_DDMMYY_n.csv' (where DDMMY is the current date and n is a number incremented with each checking of the checkbox). Each time a set of live values is read from microDAQ they are written in the current selected format to the disk file. Unchecking the checkbox

causes the current file to be closed. The name of the last file generated is shown in the white text box on the form.

5.4. 'Calibration'.

The 'Calibration' tab allows access to microDAQ's existing non DTC calibration coefficients and provides a means to acquiring live calibration data and calculating new coefficients. The loading, saving and export of both tests and coefficients is also possible from this tab.

Calibrations may either be 3 temperature based for a temperature calibration, or by unchecking the 'Temperature Cal.' checkbox, a non temperature calibration may be performed at a single temperature. Figure 5.8 shows the 'Calibration' tab controls which are further explained in table 5.8.

The software maintains two sets of coefficients - those uploaded from microDAQ and a local set, which is either loaded from the file of a previous calibration, or calculated from live or reloaded test data. Either of the two sets may be examined by choosing which is viewed via the 'Remote' or 'Local' tab, and selecting the channel from the dropdown box. The compare button may be used to compare the local set with the microDAQ upload set to confirm a successful burning of new coefficients.

Other controls include the 'Send and Burn' button which writes the current local coefficients to microDAQ EEPROM. The 'Clear' button sets all local coefficients to zero. The 'Actions' buttons may be seen in figure 5.9.
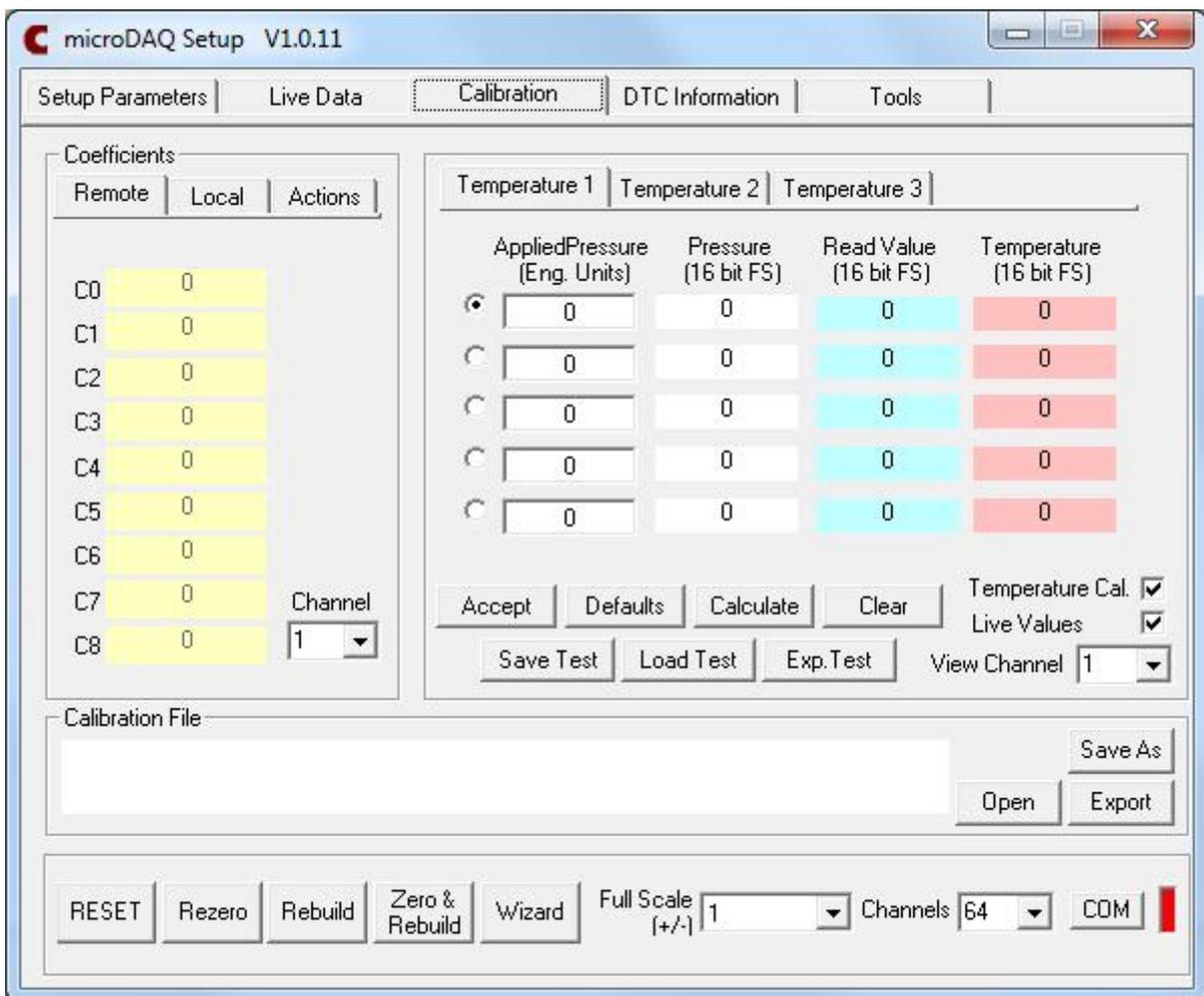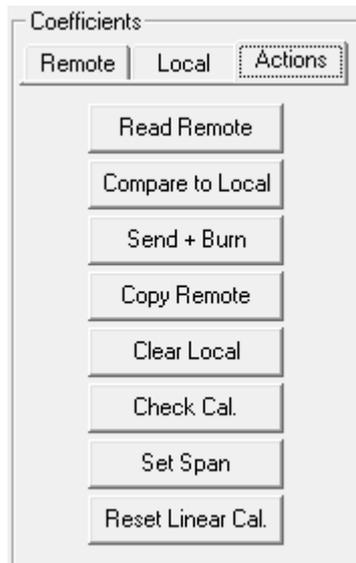

Figure 5.8, Contents of the Calibration Tab.

Control	Function
Temperature tabs	Select at which temperature the unit is currently been calibrated
Applied Pressure	The engineering units pressure setpoints - user entered, or set to standard values (+/-FS, +/-0.5FS, 0) by clicking 'Defaults'
Pressure 16 bit	The 16 bit unsigned representation of the pressure setpoints, calculated by the software
Read value 16 bit	The raw value read by microDAQ from the pressure scanner for the pressure setpoint
Temperature 16 bit	The temperature value read by microDAQ from the pressure scanner at that pressure setpoint
Accept button	Clicking 'Accept' stores the current read value as the calibration point, and moves on to the following setpoint
Defaults	Sets the default calibration points as +/- full scale, +/- 0.5 full scale and zero
Calculate	Takes the acquired data and calculates the derived calibration coefficients - will not proceed unless there is no more than one zero in the applied pressure text boxes
Clear	Clear the current calibration test data to zeroes, also clears the calibration controls
Save Test	Save the current calibration test data to a file - defaults to the current data directory
Load Test	Load the test data from a previous calibration - defaults to the current data directory
Exp. Test	Export the current calibration test data to a comma delimited text file
Temperature Cal.	When checked enables temperature tabs 2 and 3 for a 3 temperature calibration. Unchecked only temperature tab 1 is available to the user and the software will calculated coefficients for a non temperature calibration
Live Values	Unchecked, the live values from microDAQ are inhibited from overwriting existing values in the calibration controls. Use when loading a previous test for examination or recalculation of coefficients
View channel	Select the channel that supplies the values displayed in the calibration controls
Remote Coefficients	
C0 – C8	Calibration coefficients uploaded from microDAQ for the selected channel
Channel	Select the channel to view its current calibration coefficients
Local Coefficients	
C0 – C8	Calibration coefficients last calculated from a calibration test or loaded from a previous calibration
Channel	Select the channel to view its local calibration coefficients
Calibration Load/Save	
Calibration file	Shows the path and filename of a calibration file if loaded
Open	Load a file of coefficients from a previous calibration - defaults to the calibration file directory
Save As	Save the current local calibration coefficients to a file - defaults to the calibration file directory
Export	Export the current local calibration coefficients to a comma delimited text file - defaults to the current data directory

Table 5.8, 'Calibration' Tab Control Functions.

Figure 5.9 , 'Calibration' tab 'Action' buttons.

Control	Function
'Read Remote'	Upload the calibration coefficients currently stored in microDAQ, to the software.
'Compare to Local'	Compare the values of coefficients uploaded from microDAQ to those in the local memory, ie those either newly calculated or copied from another microDAQ.
'Send + Burn'	Download the coefficients in the local memory to microDAQ and burn them into EEPROM.
'Copy Remote'	Copy the coefficients over from the microDAQ memory to the local memory.
'Clear Local'	Set all the local coefficients to zero.
'Check Cal.'	Compare the local and microDAQ calibrations held in memory, and confirm if identical.
'Set Span'	Set the span of the linear calibration – confirms the value of pressure that has been set up as the span value is being applied to the sensor.
'Reset Linear Cal.'	Resets the linear calibration to (+ 0) x1 ie no offset, unity gain. Applies ONLY to the current linear calibration, ie the DTC calibration if using a DTC scanner.

Table 5.9 , 'Calibration' tab 'Action' button functions.

5.5. 'DTC Information.

The 'DTC Functions' tab gives the user access to an amount of information regarding the attached 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 uploaded and 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. To reduce the likelihood of a misleading reading being displayed, the displays are cleared after a number of seconds.
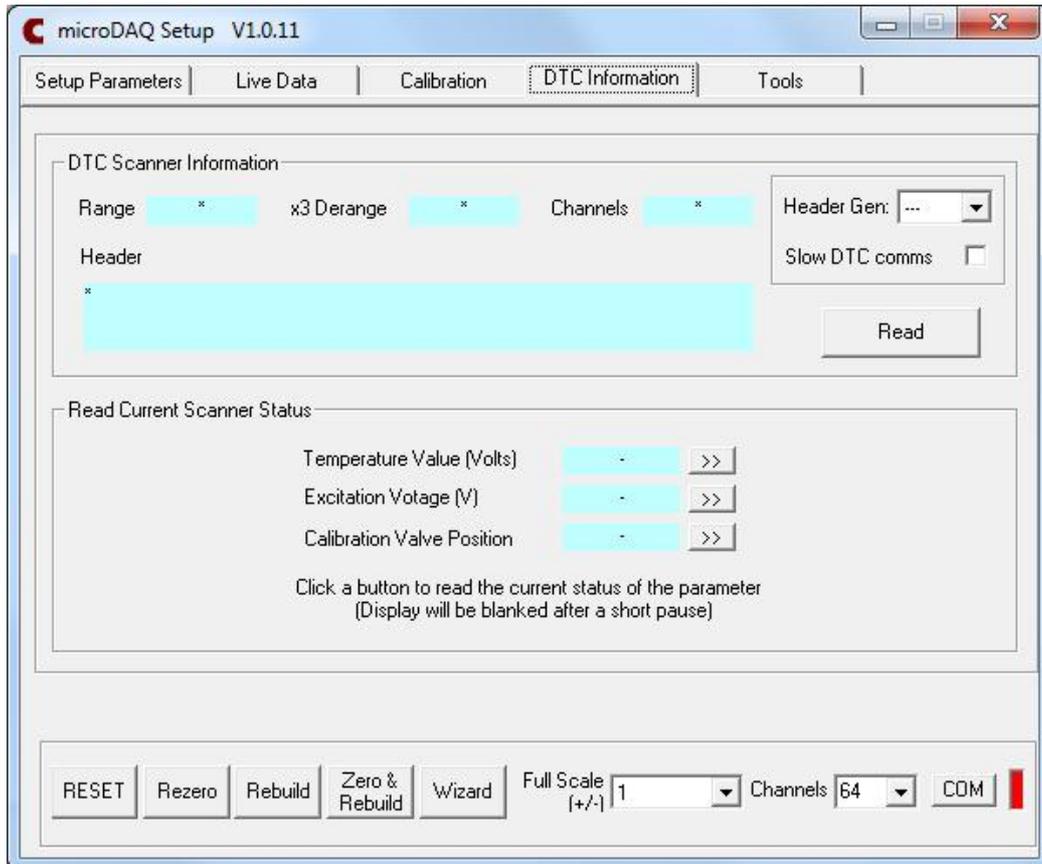

Figure 5.10, 'DTC Information' tab.

Control	Function
'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'.
'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'	Uploads 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.
Header Gen	Used to set the header generation of the attached scanner. Scanners with Gen2 headers do not require as much settling time between channel multiplexing and can hence acquire data faster.
Slow DTC comms	Retained from CANdaq Mk3 for historical purposes – not currently used

Table 5.10, 'DTC Functions' tab control functions.

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, 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.
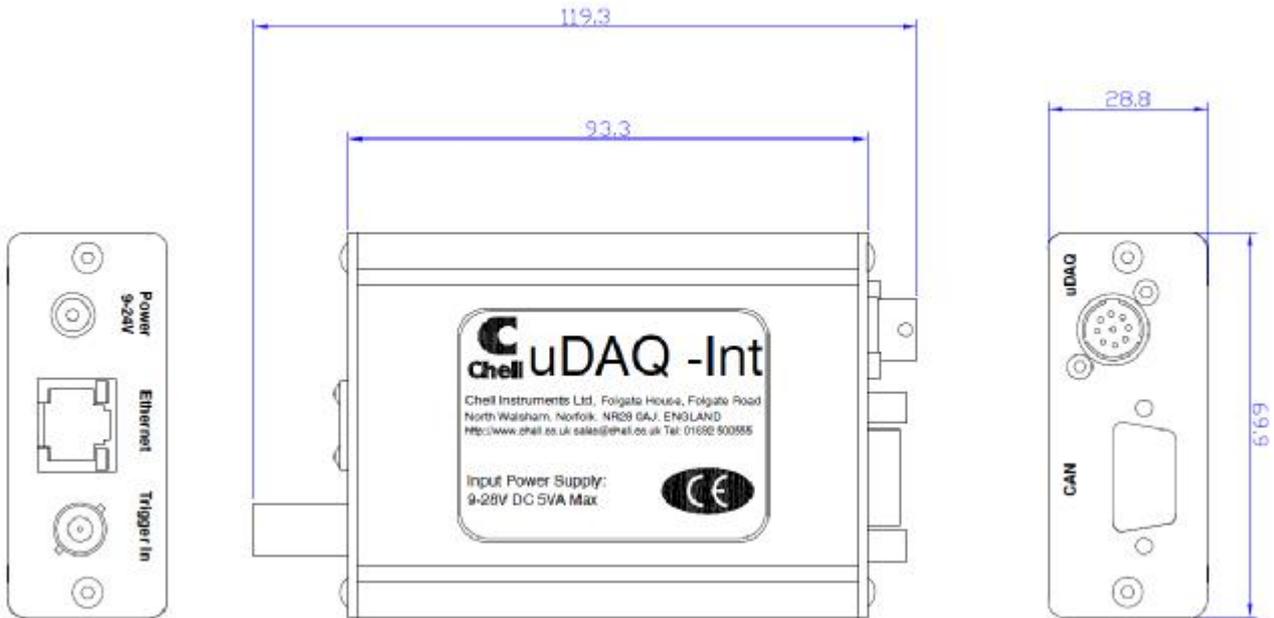
6.4 Cleaning

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.

7. MicroDAQ-INT Connector interface adaptor

7.1 Case Assembly

7.2 Power Connector - Mating connector 2.1mm DC power jack

Pin Number	Designation
Center	+8 to 25Vdc
Outer	Gnd

7.3 Can Connector – Mating connector 9 way dtype male

Pin Number	Designation
2	CAN_L
5	Gnd
7	CAN_H
4	N/C
5	0V

7.4 Trigger Connector - Mating connector 50 Ohm BNC

Pin Number	Designation
Center	TTL level input
Outer	Gnd

7.5 uDAQ – Mating connector: DEUTSCH ASDD606-09SN-HE

Pin Number	Designation
1	TX+
2	RX+
3	TRIGGER IN (TTL)
4	+8~25V SUPPLY
5	0V
6	CAN_H
7	CAN_L
8	TX-
9	RX-