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## **2432 Pressure Scanner**

**INSTALLATION  
AND  
OPERATING MANUAL**



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

900258-1.2

**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.**

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# 1 Description

## 1.1 Introduction

The 2432 pressure scanning module is capable of acquiring 32 accuracy pressures. The scanner has the capacity to measure in both absolute and differential modes.

The 2432 contains a purge / calibration valve to facilitate in-line purging of the measurement lines. The 2432 also contains the purge gas control to give a complete solution.

A Linux operating system which allows the integration of complex interfaces. Supported protocols being the Chell protocol (TCP/IP or UDP), IENA or TE™ emulation. Product configuration can be effected using the on board webserver (over http), via the native command set or using XidML. To maintain the deterministic acquisition of the pressure values, a separate acquisition microcontroller is utilised to cover data acquisition and the output from this is passed to the operating system processor using a dedicated bus.

The measurement connection to the 2432 are made via the SQDC / AQDC interface. This allows the user to connect flexible or solid tubing to the 2432 with an integrated quick disconnect.

## 2 Specification

### 2.1 Power Supply:

DC Supply	18 to 32VDC
Maximum current consumption:	Maximum current = 0.25A at 28VDC
Minimum cold start temp	-20°C
PoE :	See section 3.1.1

### 2.2 Package:

Dimensions	241.2 x 89 x 103.7mm
Weight	2 Kg

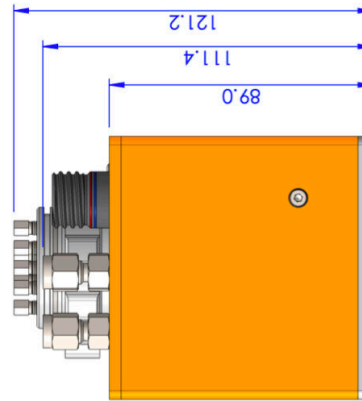
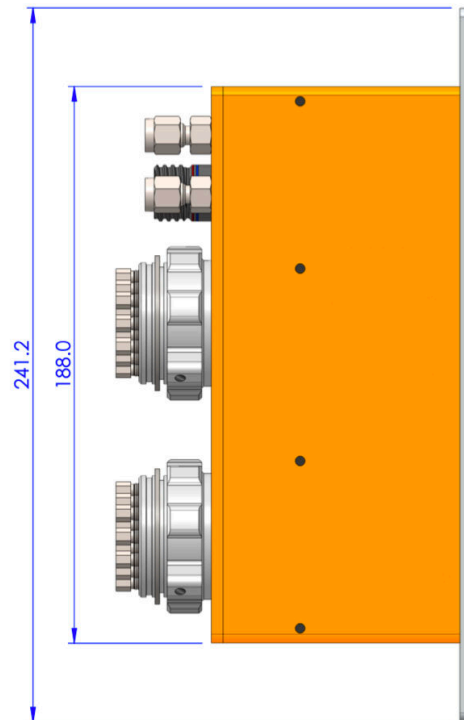
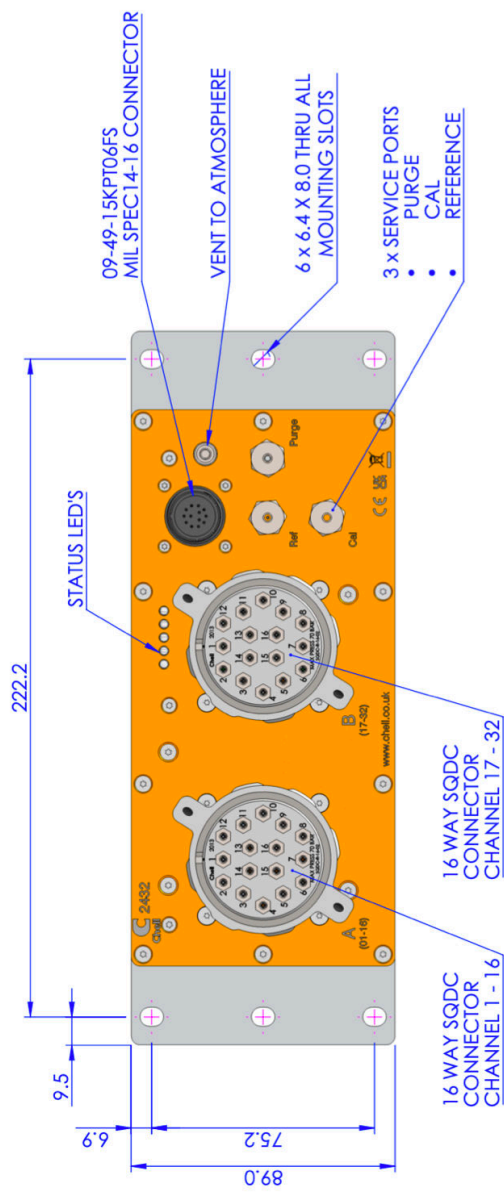
### 2.3 Ethernet Specifications:

TCP/IP	10Mb/s & 100Mb/s via Auto Negotiation TCP and UDP protocols supported
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### 2.4 Operating conditions:

Operating temperature range:	0°C to +90°C
Storage temperature range:	0°C to +90°C
Maximum Relative humidity:	95% at 50°C (non condensing)

## 2.5 Dimensions



## **3 Installation and Interconnections**

### **3.1 Wiring – Power & comms**

#### **3.1.1 2432 Power Supply**

The 2432 is equipped with a DC power supply and a Power-over-Ethernet supply. The DC supply will take priority so a 2432 powered up over DC will not negotiate with a PoE switch. If the DC supply is removed, then the 2432 will establish a power supply from a PoE switch if it is present.

If however, the 2432 is powered via PoE and a DC supply then becomes available, the 2432 will switch all its power consumption over to the DC supply.

### 3.1.2 09-49-15KPT Mating Connector

(Souriau 851-36-G-14-15S-51-38)

Recommend use : DC supply and PoE.

Pin Number	Designation
A	Ethernet DB+ (RX+)
B	Ethernet DA+ (TX+)
C	Ethernet DA- (TX-)
D	Trigger Input (TTL)
E	Trigger Return
F	Ethernet DC+
G	Chassis Common
K	Ethernet DC-
L	Ethernet DD+
M	Ethernet DD-
N	DB- (RX-)
P	DC Power Return
R	DC Power Supply

### 3.1.3 M12 Mating Connector (recommended cable of type 'Harting 09478411002 or equivalent)

Recommend use : PoE Type 2 and 3.

Pin Number	Colour Code
1	DA+ (TX+)
2	DA- (TX-)
3	DB+ (RX+)
4	DB- (RX-)
5	DD+(Non POE PSU supply +)*
6	DD- (short to pin5)*
7	DC- (Non POE PSU supply -)*
8	DC+ (short to pin7)*

\*Can be used for DC supply or passive PoE.

## 3.2 Measurement Connection

Type : 2 x 16 way SQDC (SQDC-R-16-X0)

SQDC 1 : Channels 1 -16

SQDC 2 : Channels 17-32



### 3.2.1 Mating connectors

The Chell SQDC range provides a wide range of possible mating connectors. Please refer to the SQDC data sheet for more information.

Part Number	Description
SQDC-R-16-02	Mating connector for 1/16" o/d solid tubing
SQDC-R-16-03	Mating connector for 0.040" (1.0mm) i/d flexible tubing.
SQDC-R-16-04	Mating connector for 0.063" (1.6mm) i/d flexible tubing.
SQDC-R-16-07	Mating connector for 1mm o/d solid tubing
SQDC-R-16-02	Mating connector for 1/16" solid tubing
SQDC-R-16-08	Plastic cap for the 2432 SQDC connector
SQDC-R-16-05	Stainless steel blank (all ports sealed) for the 2432 SQDC connector
SQDC-R-16-06	Aluminium blank (overall seal) for the 2432 SQDC connector

### 3.3 Service Connections

The service connections on the top of the 2432 cover the purge gas, cal and reference ports. These connections can be made either by 1/8" Swagelok compression fittings or Chell AS205 quick disconnects. These fittings can be interchanged as they both mate with the 5/16-24SAE feature in the top plate.

Port	Description	
Supply	N/A	Where fitted this is used only as a parking facility for legacy looms
Purge	Purge supply pressure	Clean, dry gas with max pressure 3 bar gauge. <b>Care must be taken if the purge pressure exceeds the pressure range of the scanner.</b>
Calibration	Calibration source for calibrating the 2432	Clean, dry gas with a maximum pressure not exceeding the scanner capacity. Where this is unknown do not exceed 25psia.
Reference	Reference for pressure measurement	Reference pressure (usually left open to atmosphere). <b>Maximum positive or negative gauge pressure applied to the reference must not exceed the full-scale pressure of the internal scanner.</b>

### 3.4 Mounting Holes.

The 2432 has 6 mounting holes suitable for a M6 bolt or stub. It is advisable that at least the four outer most holes are used in service.

### 3.5 Earthing

Any of the 6 mounting holes can be used to provide a suitable ground connection (the coating used on the base plate is conductive). It is always recommended that the 2432 is connected to a good ground.

## 4 Internal Valving

The 2432 contains the necessary valving to purge the measurement lines of the 2432 and to perform a re-zero – even when the measurement lines are subject to pressures.

The schematics below illustrates the function of the internal valves. There are two states of the scanner shuttle valve – run mode and calibrate mode. The shuttle valve is shifted by applying pneumatic pressure (from the supply gas port) which is switched by additional internal valves.

In run mode, the measurement ports on the integral SQDC are connected to each measurement port on the scanner. The reference port is connected to the barometric sensor and the reference cavity of the differential pressure scanner. In this mode normal differential or absolute pressure measurements can be performed.

In calibrate or purge mode, the differential pressure transducers are all connected to the calibrate port and the measurement lines are connected to the purge supply valve. Purge gas supplied to the purge port on the top of the 2432 can then be switched (by using the internal valve) to purge the measurement lines of contaminants and moisture.

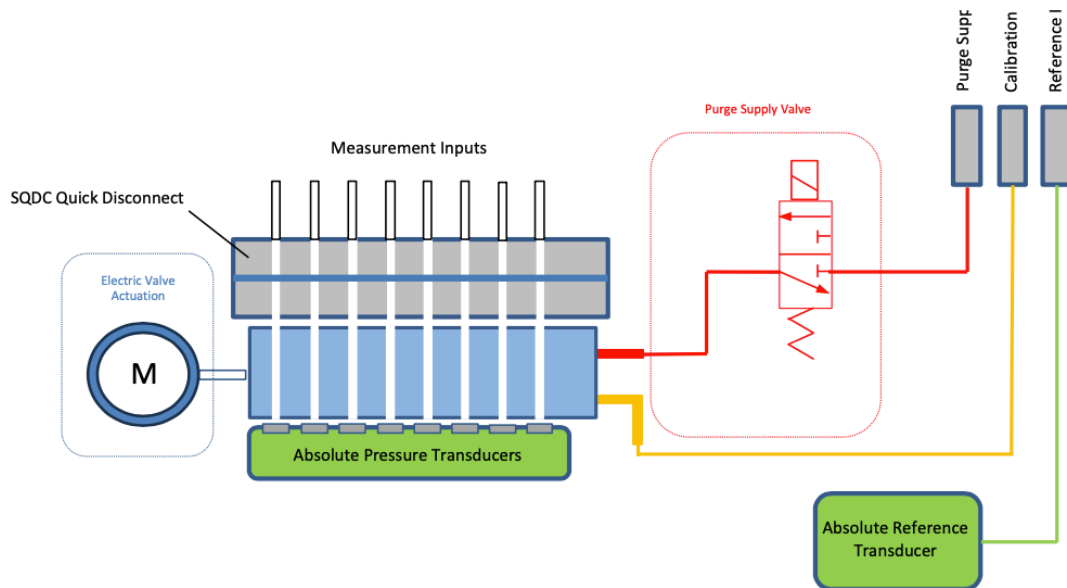


Please see note in section 5.5 on purge methods for on-ground and in-flight situations.

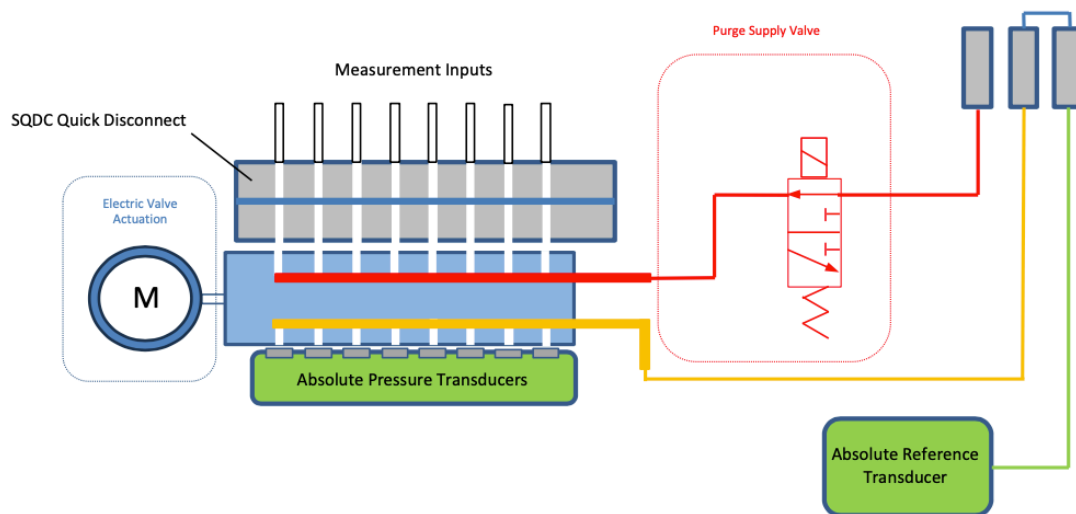
As all the differential transducers are connected to the calibration port in this mode, it is possible to re-zero the scanner and remove any zero offset – even when the system is subjected to pressures. This is simply achieved by externally connecting the calibrate and reference port together (as shown in the cal / purge mode schematic) which will ensure that the differential transducers have no pressure differential across them.

All of the internal valves are controlled via the embedded web server or over the communications protocol used. In addition to manually actuating each valve, we offer a re-zero and purge routine that will actuate all the necessary valves in the appropriate sequence.

#### 4.1 Scanner in run mode.



#### 4.2 Scanner in calibrate or purge mode.



## 5 2432 Configuration Webserver

### 5.1 Introduction.

The 2432 web Configuration provides the means of setting up, calibrating and demonstrating the 2432 unit from a standard PC with an ethernet port and browser.

The software is divided by tabs into seven areas of functionality, namely 'Setup', 'Live data', 'Advanced', and 'Factory Tools'

'Setup' provides the means to set 2432's operating parameters and its identification information. The unit's function may be checked and demonstrated using 'Live Data' to show pressure in both absolute and differential, along with temperature and binary pressure. 'Advanced' has extra functions like PTP timestamp and emulation controls. 'Factory Tools', as the name suggests permits the factory to make configurations that would not be appropriate for the customer domain, such as serial number and manufacture date.

The screenshot shows the '2432 Configuration' web interface. At the top left is the Chell Instruments logo. Below it, the unit's serial number '2432 S/N: 2399901' and firmware version 'FW version: 2.0.1 DC powered' are displayed. A navigation bar contains tabs for 'Setup', 'Live Data', 'Advanced', and 'Factory Tools'. On the left side, there are buttons for 'Soft Reset', 'Hard Reset', 'RESET', 'Rezero', 'Valve Zero', and 'Valve Purge'. The main content area is divided into three sections: 'Data Streaming', 'General Ethernet Comms', and 'UDP Specific Comms'. The 'Data Streaming' section has radio buttons for 'TCP' (selected) and 'UDP', with dropdown menus for 'Data Rate' (10Hz), 'Protocol' (16 bit LE), and 'Active Channels' (All), plus an 'Apply' button. The 'General Ethernet Comms' section has radio buttons for 'Static' (selected) and 'DHCP', with input fields for 'Local Static IP Address' (192.168.1.177), 'Local Subnet' (255.255.0.0), and 'Local port' (101), plus an 'Apply' button. The 'UDP Specific Comms' section has input fields for 'Remote UDP IP address' (192.168.1.7) and 'Remote UDP port (if known)' (19152), a checkbox for 'Use IENA Specification for Data Stream', and an 'Apply' button.

Figure 5.1, Main Setup page

### 5.3 Common Controls Sidebar

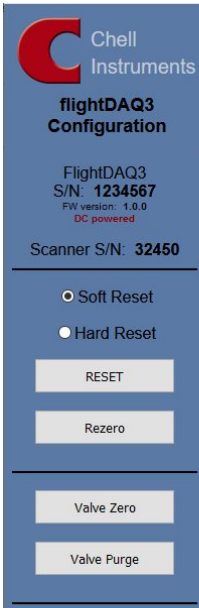


Figure 5.1 above shows the first page viewed when navigating to the webserver. The menu at the top allows the user to choose what is visible in the central window, and the sidebar (shown left) shows information and has a select few commands that are useful regardless of the central page the user is on. The function of the controls on the sidebar is detailed in the subsequent table (Table 5.1)

Control	Function
'RESET' button	Resets the 2432. Use to activate new settings and/or rebuild calibration tables. The option exists for a hard reset and a soft reset. A hard reset will re-start the operating system within the 2432 and is required when low-level changes are made such as the IP address. A soft reset will restart with modified settings and is suitable for changed to channel configuration etc. A soft reset will take around 20 seconds but a hard reset will take around 90 seconds.
'Rezero' button	Starts a 2432 rezero operation, tares the applied pressure.
'Valve zero' button	Runs the Valve Rezero routine, tares transducer offset independent of the applied pressure.
'Valve Purge' button	Runs the Valve Purge routine.

Table 5.1, Common sidebar control functions.

## 5.4 Valve Purge Routine

When a purge routine is called either by clicking the 'Purge' button or calling the routine via an interface, the following procedure is followed:

Step	Function
1	Move the shuttle valve to Cal / purge.
2	Set the internal purge valve to on, pushing gas out of the measurement ports.
3	Wait the time value set in 'Valve control' under the advanced tab.
4	Vent the purge valve
5	Move the shuttle valve to 'Run'



### Caution!

The user should be aware that performing a purge whilst high pressure exists on the measurement port may result in back-flow creating dirt or moisture ingress and product damage. Therefore, the measurement port pressure vs purging pressure must be considered. Given the purge pressure is vented briefly before the shuttle valve is returned a failed or incomplete purge may permit dirt or moisture ingress. Due to this risk the Valve control Function timer should not be set to a value of short duration. The default duration is 5 seconds, this can be extended where longer tubing is used.

## 5.5 The 'Setup' Page

### 5.5.1 Introduction

The 'Setup Parameters' page shows all of the 2432's main operating parameters. Setup Parameters is divided into different categories by function, and each category is detailed separately in the following.

### 5.5.2 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.

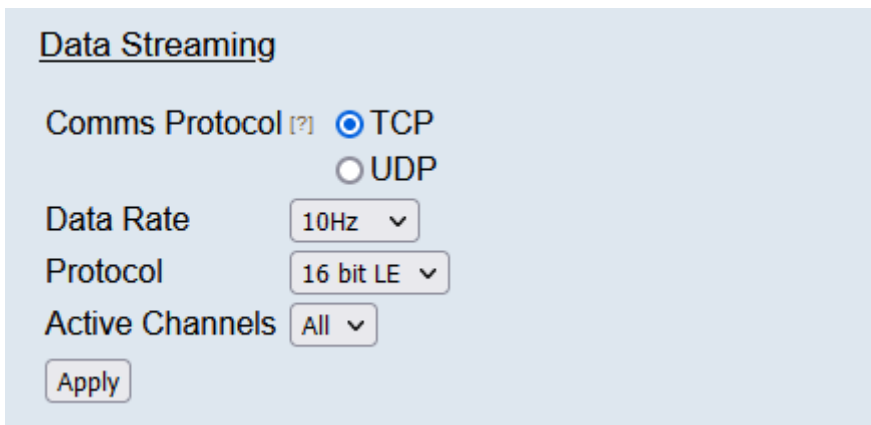


Figure 5.41, Data Steaming Setup

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 2432 will automatically transmit data after reset. Note that other data rates can be selected via the protocol. The setting here is non-volatile. It is possible to set this to OFF and still stream data in response to a command.
'Protocol' option list	Selects the format that the data will be transmitted as, options are 32 bit LE & 32 bit BE.
'Apply' button	Applies the changes made to the local settings memory. Note a restart is required.
Active channels	Displays the number of active channels that will be transmitted.

Table 5.41, Data Streaming settings.

### 5.5.3 General Ethernet Comms

#### 5.5.3.1 TCP

The General Ethernet Comms parameters are shown in Figure 5.42. The options in this section control the 2432's IP address, subnet mask and Local port.

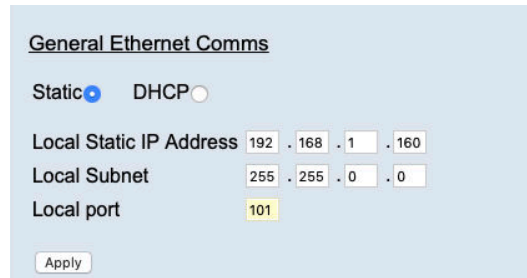


Figure 5.42, TCP Comms group

'IP Address'	Enter the fixed IP address allocated to 2432 on the user's network.
'Subnet'	Enter the fixed Subnet mask as appropriate. The value of 255.255.255.0 is default.
'Local port'	This value should be 101
'Apply'	Save the values then apply a 'Hard Reset'

Table 5.42, TCP Comms group settings

#### 5.5.3.2 DHCP

DHCP can be selected by clicking the radio button. In this configuration, the IP address and subnet mask are configured by the network administrator and cannot be edited. Ensure you have management controls available to determine the IP address of a DHCP controlled device before selecting this option!

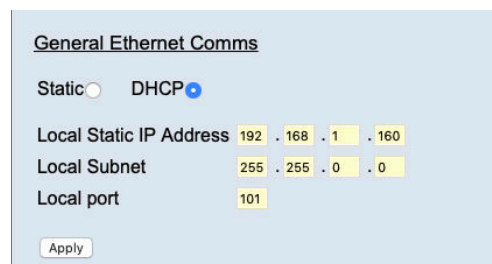


Figure 5.43, DHCP Comms

### 5.5.4 UDP Specific Comms

The UDP section (shown in Figure 5.44) 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 2432 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.

It is also possible to change the output data packet format to IENA specification format by using the check box.

The format of these packets are described more in the user programming guide.



NOTE: The 2432's local UDP IP address is shared with TCP Comms.

The screenshot shows a configuration window titled "UDP Specific Comms". It contains the following elements:

- Label: "Remote UDP IP address" followed by four input boxes containing the values "10", "254", "144", and "241".
- Label: "Remote UDP port (if known)" followed by an input box containing the value "4915".
- Label: "Use IENA Specification for Data Stream" followed by an unchecked checkbox.
- Label: "Apply" followed by a button.

**Figure 5.44, UDP comms**

'Local IP address and subnet'	This is the IP address of the 2432, this is the same as in the TCP comms section.
'Remote UDP IP address'	Address of remote connection to 2432. If set then the 2432 can be set to auto stream data to that remote host on boot up (after initialisation)
'Remote UDP Port'	Port of remote connection to 2432. If set then the 2432 can be set to auto stream data to that remote host on boot up (after initialisation)
'Use IENA Specification for data stream'	Changes the format of data output packets to IENA specification. Note Differential or Absolute may be set under advanced tab.
'Apply'	Save the values then apply a 'Hard Reset'

## 5.6 'Live Data' Page

Figure 5.6 shows the 'Live Data' page of the webserver, selected for a 32-channel pressure scanner.

Chell Instruments Setup Live Data Advanced Factory Tools

2432 Configuration

2432 S/N: 2399901  
FW version: 2.0.1  
DC powered

Soft Reset  
 Hard Reset  
 RESET  
 Rezero  
 Valve Zero  
 Valve Purge

CH	PRESSURE (RANGE: 0.36)	CH	PRESSURE (RANGE: 0.36)
1	-0.0024	17	-0.0048
2	-0.0054	18	0.0063
3	-0.0037	19	0.0021
4	0.0032	20	0.0031
5	-0.0047	21	-0.0053
6	0.0041	22	0.0058
7	-0.0052	23	-0.0049
8	-0.0121	24	-0.0028
9	-0.0056	25	-0.0086
10	0.0089	26	0.0117
11	-0.0057	27	0.0126
12	0.0029	28	0.0153
13	-0.0046	29	0.0119
14	-0.0021	30	0.0136
15	-0.0008	31	0.0081
16	-0.0081	32	0.0106

REFERENCE CHANNEL

Pressure: 16.6227  
Temperature: 19.68

Engineering Pressure data is in **PSI**

Differential Pressure (Eng)  
 Absolute Pressure (Eng)  
 Temperature (Eng)  
 Binary Pressure  
 Select

Figure 5.6, Live Data Page

The live data page is a means to demonstrating the correct operation of 2432 and testing the unit's calibration. The user can select between a number of different parameters to display. To do so, highlight the radio button next to the desired output and click in 'select'.

Selected Data	Description
Differential pressure (Eng)	This is the compensated engineering unit output of the 2432 in differential mode – relative to the reference port. It is displayed in PSI by default although the units can be changed in the 'Advanced' tab.
Absolute pressure (Eng)	This is the compensated engineering unit output of the 2432 in absolute mode – the sum of the differential scanner and the absolute scanner. It is displayed in PSI by default although the units can be changed in the 'Advanced' tab.
Temperature (Eng)	This is the temperature measurement for each channel.
Binary Pressure	This displays the decimal of the 16 bit pressure data that would be transmitted via the protocol. Note that this would change with the absolute / differential setting under the 'Advanced' tab.

## 5.7 'Advanced' Page

The advanced page contains functions that will change the how the 2432 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.

### 5.7.1 Filtering

The 2432 has settings to allow the user flexible control over the data throughput of the device. The averaging algorithm is a simple running average so increasing this value will reduce the apparent noise but reduce the response of the measurement.

Table 5.9 details the function of the signal parameter option controls.

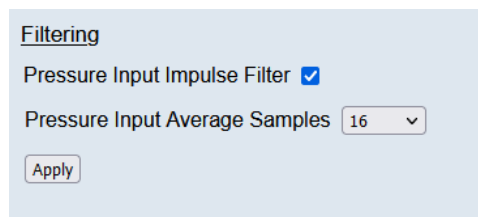


Figure 5.9, Filtering group

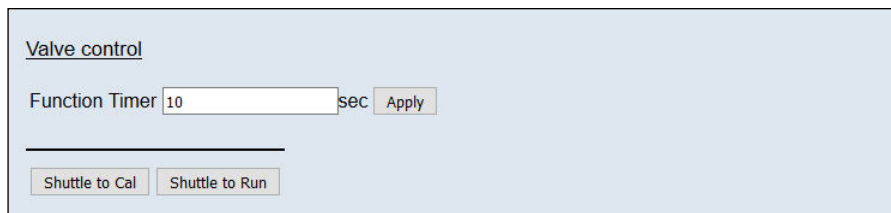
Control	Function
'Pressure Input Impulse Filter'	This filter removes any single instance spikes or anomalous data points. This is performed by applying a 3 point median filter. It should be noted that this could theoretically result in a timestamp being applied to measurement points up to two acquisition points in error.
'Pressure input average samples'	Selects the number of samples for a moving average of pre-calibration pressure data. Chose between OFF and numbers up to 65536. As a guide 16 is default, 4 is a small average and 1024 is a large average. Averages in excess of 2048 would be an unusual selection.
'Apply'	Store the values. A Soft Reset is required.

Table 5.8, Filtering group settings

## 5.7.2 Valve Control

The shuttle valve can be set to 'Cal' or to 'Run' by pressing the appropriate button. It takes approx.. 5 seconds to move from one state to the other. Once moved the shuttle valve will stay in the set position until instructed. The instruction may be from pressing the other button or by use of a routine that moves the valve. Note that a reset may, depending on setting, return the valve to 'Run'

The function timer sets the duration of a purge. The default of 5 seconds is an appropriate minimum. Select a longer duration where long tubing is installed.

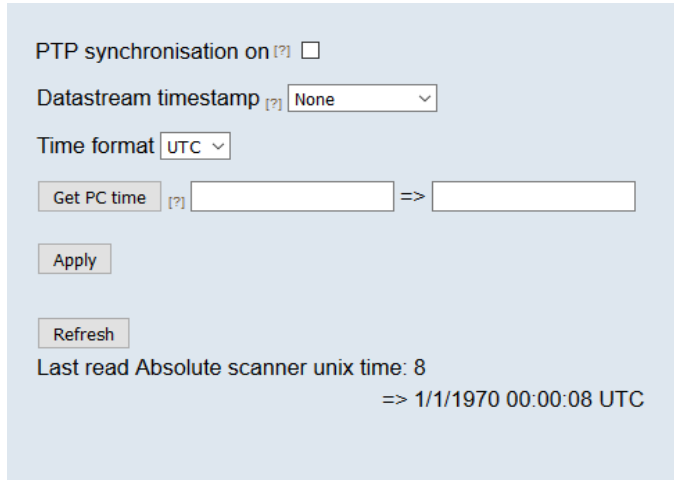


The screenshot shows a software interface for valve control. At the top, the text "Valve control" is displayed. Below it, there is a label "Function Timer" followed by a text input field containing the number "10" and the unit "sec". To the right of the input field is an "Apply" button. A horizontal line separates this section from the bottom section, which contains two buttons: "Shuttle to Cal" and "Shuttle to Run".

Figure 5.10, Valve control settings

### 5.7.3 Time Stamping

This section allows the user to edit the timestamp settings of the 2432. This timestamp will allow the user to get timestamps to nanosecond resolution on the data packets. If the timestamp is enabled it will have an effect on the maximum transmission rate.



**Figure 5.95, Timestamp**

'PTP synchronisation on' checkbox	Checking this box directs the 2432 to apply a timestamp synchronised with a PTP1588 Grand master clock. Where this is not checked the time applied to a timestamp is an unmanaged system time. Where possible this may be NTP synchronised.
'Data stream timestamp' drop box	To set where the timestamp is positioned in the data stream, 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 data stream.
'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 it is a requirement to click apply to send the timestamp to the 2432.
'Apply'	This button will apply the settings chosen on this page. A Soft Reset is required.
'Refresh'	This allows the user to refresh the displayed value of the last read timestamp from the 2432.
'last read Absolute scanner UNIX time'	The top line shows the current time in the 2432

## 5.7.4 Miscellaneous

**Miscellaneous**

Disable TCP Nagle algorithm [?]

Auto enable HW Trigger on Startup

Pressure units:

Pressure type:

Figure 5.11, Miscellaneous group.

Disable TCP Nagle algorithm	Check to prioritise TCP data packet send over efficiency. This option will result in more data traffic as packets are sent as soon as they are built and will not be combined for efficiency. Use where data reception / decoding appears fragmented. This option applies to all protocols.
Auto enable HW Trigger on Startup	Check to switch on Hardware Trigger by default. Subsequent Hard or Soft Reset operations will NOT clear this flag.
Pressure units	Permits selection of the displayed Engineering Units. Select PSI, Bar or Pascal.
Pressure type	Differential or Absolute measurements may be selected. This sets the transmitted protocol 16 bit range limits. Note the Live Data shown on the webserver can be affected by this setting.
Apply	Saves the settings selected. A Soft Reset is required.

Table 5.11, Miscellaneous group settings

## 5.8 Netscanner Emulation Page

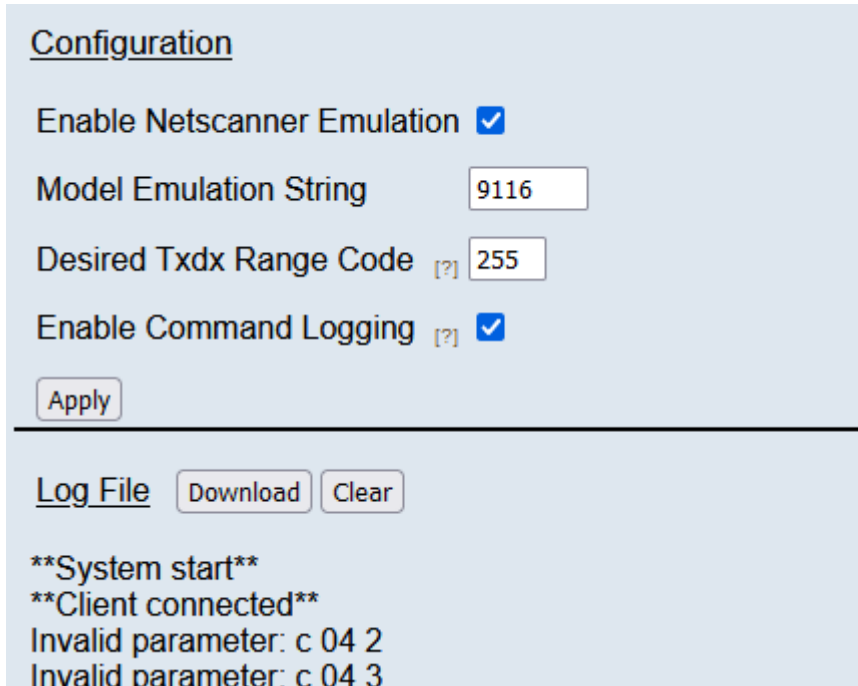


Figure 5.8, Netscanner Emulation Page.

Netscanner Emulation	Check to enable emulation mode. The sets the device to respond to a subset of commands usually associated with the TE NetScanner™ products. Document 900257 offers more detail.
Model Emulation String	Enter the model number for the NetScanner™ emulation. Entries can include 9016, 9116
Desired Txdx Range Code	Enter the TE Range code the device should respond with if asked. Refer to the Netscanner Programmers Guide Page 169 for a list.  A default value is 255  Note this does not affect the data values and only permits the 2432 to respond as a user expects when asked for range detail. This setting does affect the bar graph scaling under NUSS.
Enable Command Logging	Check this to enable the emulation compliance log. The 2432 will log commands used that are not supported and also some events such as a restart.
Download	This presents the logfile as a text document to the browser for download.
Clear	Delete the log file

## **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 2432, 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.



Caution

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