OM5350/1

Operation Manual for

DAS3

Magnetic Range Data Acquisition System

Bartington® Instruments

bartington.com

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1. About this Manual

This document describes the installation, operation and maintenance of the DAS3 Data Acquisition System from Bartington Instruments. It should be read in conjunction with the product brochure, which can be found found on the product page of the Bartington Instruments at: www.bartington.com. The DAS3 system includes a PXIe system from National Instruments. Instructions for operation of the PXIe system can be found on the National Instruments website at: www.ni.com.

1.1. Symbols Glossary

The following symbols used within this manual call your attention to specific types of information:

WARNING: Indicates a situation in which serious bodily injury or death could result if the warning is ignored.

Caution: Indicates a situation in which bodily injury or damage to your instrument, or both, could result if the caution is ignored.

Identifies items that must be disposed of safely to prevent unnecessary damage to the environment.

Note: A note provides useful supporting information and sometimes suggests how to make better use of your purchase.

1. Safe Use

WARNING: These products are not qualified for use in explosive atmospheres or life support systems. Consult Bartington Instruments for advice.

WARNING: The DAS3 is powered by mains electricity. The unit MUST be earthed. The centre pins of the IEC mains inlet sockets on the rear panel of the Decaport units and the PXIe rack are internally connected to all the metal panels of the unit. Use of the 3-core IEC mains connecting cables supplied with the unit will ensure the unit is correctly earthed. Use of alternative cables may render the unit unsafe.

WARNING: The IEC mains connecting cables must be protected with the maximum fuse ratings shown in the product brochure.

WARNING: The DAS3 must be operated from an AC mains electricity supply as specified in in the product brochure.

WARNING: This unit is not sealed against the ingress of water and should be operated only under dry conditions.

2. Compatible Magnetometers

The DAS3 is designed to be compatible with the sensors shown on the Product Compatibility page of the Bartington Instruments website at: www.bartington.com/product-compatibility.html.

Caution: Use of incompatible sensors may cause damage to the DAS3 and/or the sensor.

3. Introduction to the DAS3

3.1. Summary

The DAS3 Magnetic Range Data Acquisition System is a complete digital hardware solution for data collection and processing from large arrays of magnetometers, e.g. a marine signature range.

When used with compatible Bartington Instruments sensors, the DAS3 provides all the required power, anti-alias filtering and analogue to digital (A-to-D) conversion. The DAS3 CPU performs basic data processing and display, using software supplied with the system. Where additional data processing is required, users can run their own software on the system, or the DAS3 can be connected to an ethernet network to transfer data to another system.

Power supply monitoring, cable leakage test and sensor self-test (where available) are all provided under software control.

3.2. System Architecture

The DAS3 consists of two main components:

One or more Decaport Interface Modules, which power attached sensors, and provide analogue signal conditioning of the sensor output signals. Each Decaport module can support up to 10 three-axis magnetometers (or other compatible sensors).

A PXIe Data Acquisition system, which provides A-to-D conversion of the magnetometer signals, and processing and storage of the acquired data. The PXIe system consists of a CPU controller module (or alternatively, an interface via a PXIe remote control module to a remote computer control system) and A-to-D conversion modules, housed in a standard PXIe chassis. Each A-to-D module supports one Decaport. Interface with the entire system is via a monitor and keyboard connected to the CPU, or a remote computer connected to the PXIe remote control module.

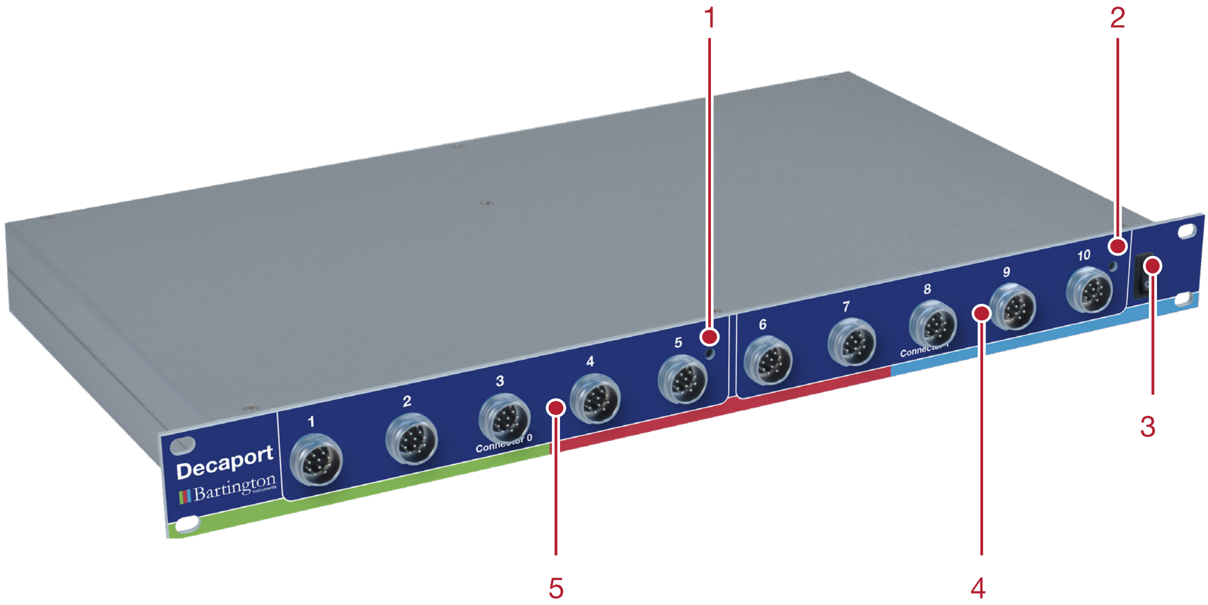
The modular design of the DAS3 allows Decaports and A-to-D modules to be added, if required, to support additional sensors. The minimum configuration is one Decaport and one A-to-D module.

3.3. Decaport Features

The Decaport conforms to the standard 19-inch rack mount specification and is 1U (Rack Unit) high. It does not require any extra space above or below.

Note: If a single Decaport is mounted in a rack with deeper units, ensure the back panel of the Decaport can be accessed.

3.3.1. Decaport front panel



Decaport front panel.

1. LED indicator – Inputs 1 to 5. The LED colour state (red or green) is controlled by the user software.

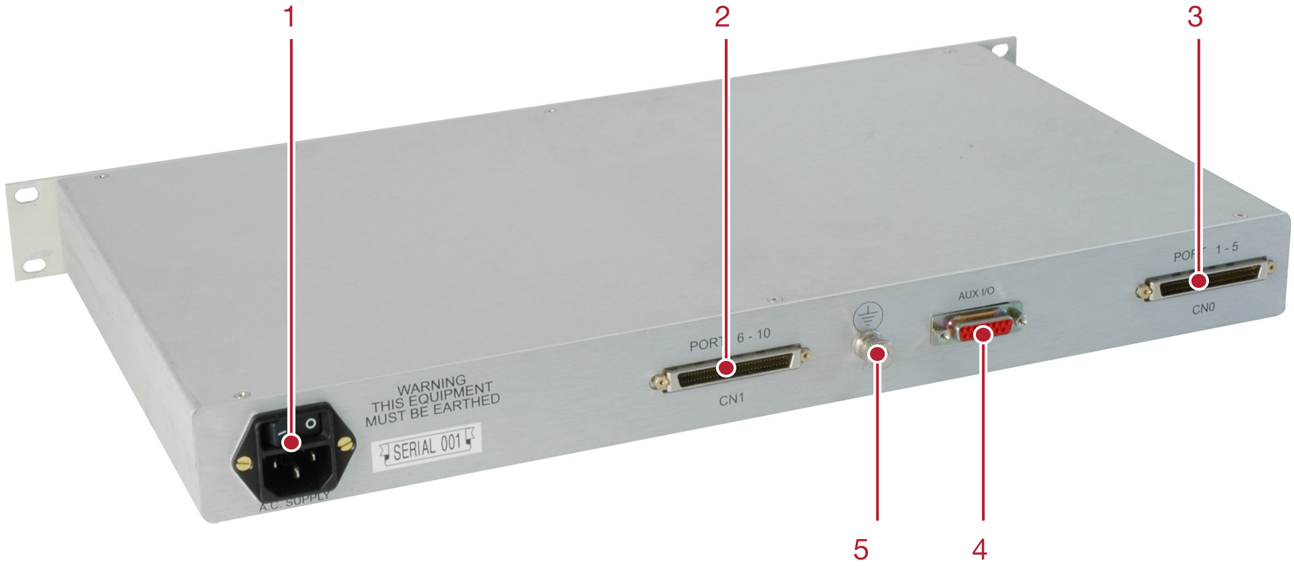
2. LED indicator – Inputs 6 to 10. The LED colour state (red or green) is controlled by the user software.

3. ON/OFF power switch. Controls overall power to the Decaport.

4. Sensor connector sockets – Inputs 6 to 10. Set of five input sockets for connection of three-axis magnetometers or other compatible sensors.

5. Sensor connector sockets – Inputs 1 to 5. Set of five input sockets for connection of three-axis magnetometers or other compatible sensors.

3.3.2. Rear panel



Decaport rear panel.

1. Mains input sockets, for connection of IEC lead. See the product brochure for supply voltage.
2. PXIe interface socket (CN1). Connection for inputs 6 to 10 to the PXIe 4303 and 6509 DAQ modules.
3. PXIe interface socket (CN0). Connection for inputs 1 to 5 to the PXIe 4303 and 6509 DAQ modules.
4. AUX I/O connector. (Not in use)
5. Earth terminal post. If an appropriate earth/ground connection is not provided through your mains supply lead, connect this terminal post to the PXIe Chassis earth terminal, the 19” rack and a permanent earth ground, as described in AC Mains Power Cables and Earthing.

WARNING: The mains supply must be earthed. Ensure all local and national codes on electrical installation and grounding are observed.

3.4. System Configuration Options

The Decaport and PXIe system are connected using an industry standard PXIe interface configuration. This enables users to construct a system based on individual component modules, if desired, rather than the full DAS3 system. For example, the user could choose to substitute a remote computer (with suitable PXIe interface) in place of the DAS3 standard CPU controller module. Configuration using the integral CPU module, and an alternative configuration using a PCMCIA or PCI interface to an external computer, are given in the product brochure.

4. Installing the DAS3 System

4.1. Location of Equipment

4.1.1. Potentially Hazardous Locations

WARNING: This equipment is powered by mains electricity. It should not be used in wet or damp locations, where water may enter the unit and create a safety hazard.

4.1.2. Mounting

WARNING: The DAS3 is normally supplied within a 19” rack for 1 Decaport. Failure to use the rack, or another suitable fixing method, may create a risk of personal injury or damage to the DAS3 in the event of it falling. It is recommended that the system be used in the supplied rack.

Caution: If the system is be transferred to an equivalent 19” rack for 1 Decaport, it is important to leave 1U (Rack Unit) of free space above the PXIe chassis component to ensure adequate cooling.

4.1.3. Orientation

Caution: The equipment should be used in a horizontal orientation in the 19” rack, to ensure correct cooling.

4.1.4. Ventilation

Caution: Ensure that the location does not restrict ventilation from the fans in the back of the NI-PXIe chassis.

4.2. Connecting the Equipment

Caution: Connect all external sensors and peripheral devices to the DAS3 before switching on power to system. Damage may occur if equipment is connected or disconnected whilst powered.

4.2.1. PXIe Decaport Cabling

For initial system assembly, connect the PXIe cables from the Decaport rear panel connectors CN0 and CN1 to the PXIe Chassis DAQ module Connector 0 and Connector 1 respectively. Route the cables through the large aperture on the right hand side of the PXIe chassis.

If your system has more than one Decaport/ADC pair, connect the top Decaport in the stack to the leftmost DAQ module in the chassis, etc.

Note: The PXIe cables can be left permanently connected, but may need to be removed if the system is ever repacked for transportation.

4.2.2. CPU Peripherals and Interfaces

If the system includes the CPU controller module, connect a suitable display to the CPU DVI-I connector, and a keyboard and mouse to free USB connectors.

Connect any other interfaces (e.g. Ethernet, serial, USB) that you require for your system implementation.

4.2.3. Sensors

Connect the cabling from your system sensors (e.g. magnetometers, depth/tilt sensors) to the Decaport front panel input sockets (for details see Sensor Inputs).

4.2.4. AC Mains Power Cables and Earthing

Connect the supplied IEC mains cables to the mains inlet sockets on the PXIe chassis and Decaports.

Note: Each Decaport requires its own mains cable.

WARNING: If your mains power supply arrangement does not provide appropriate earth/ grounding, connect the Decaport Earth Terminal Posts (see Decaport Features), the PXIe Chassis Earth Terminal Posts (see PXIe Chassis Features) and the 19” rack metalwork to a permanent earth ground point, using 16 AWG (1.3mm) wire with a grounding lugs. If in doubt, consult Bartington Instruments.

5. Using the DAS3 System

5.1. Switching the Equipment On and Off

Use the following sequence for powering-up the various components of a DAS3 based system:

If your system includes one, power-up your remote control computer.

Power-on the PXIe chassis using the ON/OFF switch on the front lower left corner.

Power-on the Decaport(s) using the ON/OFF switch(es) on the right of the front panel.

5.2. Operating the System

Details of operation vary greatly depending on the configuration of your system, and in particular the exact software that you will be using.

5.2.1. Standard DAS3 Software

To use the DAS3 data capture and storage software supplied with the standard system, see Decaport Interface Module Technical Reference (describing the features and functions within the DAS3 Decaport Interface unit) and Software User Manual (describing how you can use the software to control these functions, and also how to collect and process data recorded by the system).

5.2.2. User-designed Software

Decaport Interface Module Technical Reference provides programming details for controlling the Decaport functions using your own software. The reference manual uses standard PXIe notation; read it in conjunction with the LabVIEW technical manuals from National Instruments.

Software User Manual provides useful background information for your own design.

6. Decaport Interface Module Technical Reference

The Decaport module provides several functions associated with powering, controlling and conditioning signals from the attached magnetometer sensors. Most of the functions can be controlled via digital input signals to the Decaport.

The main functions are:

- power to sensors (on/off and voltage high/low control)
- sensor analogue input type (balanced/unbalanced selection control)
- analogue outputs to the A-to-D module
- sensor test signal (normal/test state control)
- low pass filter (corner frequency control)
- power supply monitoring (sensor selection control)
- cable leakage test (initiate test control).

6.1. Interface and Control

Internally, the Decaport has two identical five-sensor channel input modules, each using one of the connectors on the PXIe card. The I/O lines are all used as control inputs to the Decaport. These are all standard 5V TTL logic inputs. All the inputs are static logic, i.e. no shift registers, latches or clocks are used. If an alternative data acquisition system is used, most of the control lines could be hardwired to the required state; however, it is recommended that the magnetometer Power Enable lines are controllable. If the power supply monitor and/or other control functions are to be utilised then sufficient control lines will be required.

6.2. Other National Instruments Interfaces

The Decaport will directly connect to other data acquisition cards and modules from National Instruments. These can offer different solutions, such as desktop computer PCI bus and USB bus.

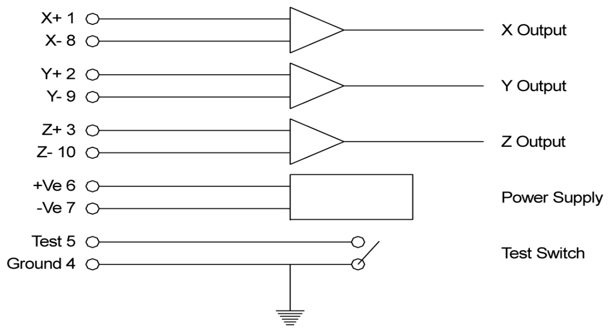
Note: Bartington Instruments cannot guarantee that these solutions will achieve the published specification of the Decaport and standard range data acquisition system.

6.3. Sensor Inputs

The Decaport can connect up to ten Bartington Instruments three-axis magnetometers or other compatible sensors. Each input can be set independently to operate with either an unbalanced (single ended) or balanced (differential) output sensor (please refer to the sensor's datasheet for details of it's output). The setting will automatically select the correct wiring of the input connector. See the product brochure for details of connectors.

Note: Bartington Instruments can supply suitable cables for all types of compatible sensors.

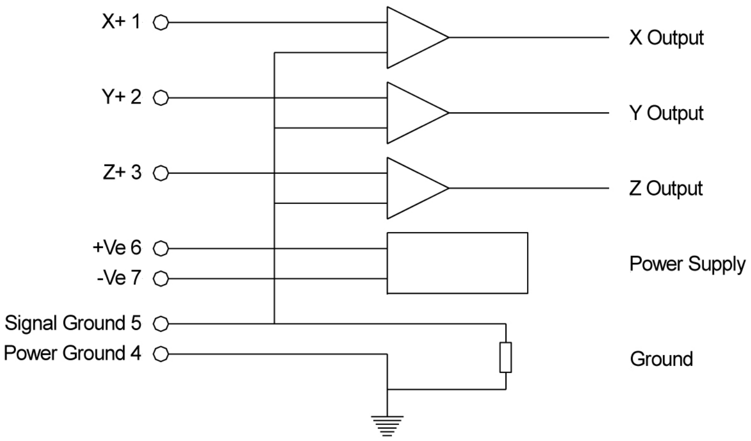
6.3.1. Balanced Input Connection



Balanced Input Connection

In balanced mode (Figure 3), the differential signals and input amplifiers give the best possible accuracy. There is no interaction of signal ground currents and unequal sensor ground potentials caused by different voltage drops in the power ground cabling. Compared to unbalanced mode, this configuration has the higher interference noise rejection, as noise will appear as a common mode signal at the input amplifiers.

6.3.2. Unbalanced Input Connection



Unbalanced Input Connection

In unbalanced mode (Figure 4), the differential input amplifiers are retained. This eliminates the effect of differing signal ground potentials of each sensor, caused by differing voltage drops in the power ground cabling. However, the unbalanced mode is inferior to the balanced mode. The use of a common signal ground gives reduced accuracy with very long cables, due to interaction of the signal ground currents. This configuration is also more susceptible to interference noise.

6.3.3. Input Connector Pin-Out

See Table 1.

Function		
Pin	**Balanced Input**	**Unbalanced Input**
1	X axis Positive Signal	X axis Signal
2	Y axis Positive Signal	Y axis Signal
3	Z axis Positive Signal	Z axis Signal
4	Ground	Ground
5	Test	Signal Ground Reference
6	Positive Power Supply	Positive Power Supply
7	Negative Power Supply	Negative Power Supply
8	X axis Negative Signal	No Connection
9	Y axis Negative Signal	No Connection
10	Z axis Negative Signal	No Connection

Table 1. Input Connector Pin Out.

6.3.4. Setting Sensor Input Type

The sensor input types are set individually for each sensor by digital I/O lines from the PXIe interface. The Input Select lines are 5V TTL compatible static inputs.

See Table 2.

Signal	PXIe function	Pin
Sensor 1 Input Select	P2.0	CN 0.37
Sensor 2 Input Select	P2.1	CN 0.3
Sensor 3 Input Select	P2.2	CN 0.45
Sensor 4 Input Select	P2.3	CN 0.46
Sensor 5 Input Select	P2.4	CN 0.2
Sensor 6 Input Select	P5.0	CN 1.37
Sensor 7 Input Select	P5.1	CN 1.3
Sensor 8 Input Select	P5.2	CN 1.45
Sensor 9 Input Select	P5.3	CN 1.46
Sensor 10 Input Select	P5.4	CN 1.2

Table 2. Setting sensor input type.

A **logic high** (+5V) on an Input Select sets the balanced input mode; a **logic low** (0V) selects the unbalanced input mode.

6.3.5. Sensor Test Enable

A test function is available on some Bartington Instruments sensors. This causes a fixed offset to be added to each of the magnetometer outputs.

The Sensor Test Enable signals will initiate the test function on an attached sensor. This function is only available when the input is set to the balanced mode.

Signal	PXIe function	Pin
Sensor 1 Test Enable	P0.0	CN 0.52
Sensor 2 Test Enable	P0.1	CN 0.17
Sensor 3 Test Enable	P0.2	CN 0.49
Sensor 4 Test Enable	P0.3	CN 0.47
Sensor 5 Test Enable	P0.4	CN 0.19
Sensor 6 Test Enable	P3.0	CN 1.52
Sensor 7 Test Enable	P3.1	CN 1.17
Sensor 8 Test Enable	P3.2	CN 1.49
Sensor 9 Test Enable	P3.3	CN 1.47
Sensor 10 Test Enable	P3.4	CN 1.19

Table 3. Sensor test enable.

A **logic low** (0V) on a Test Enable signal puts an attached sensor in to test mode. A **logic high** (+5V) puts the sensor into normal operating mode.

6.4. Sensor Outputs

6.4.1. Analogue Output Connections

Signal	PXIe function	Pin
Sensor 1 X Output	AI.0	CN 0.68
Sensor 1 Y Output	AI.1	CN 0.33
Sensor 1 Z Output	AI.2	CN 0.65
Sensor 2 X Output	AI.3	CN 0.30
Sensor 2 Y Output	AI.4	CN 0.28
Sensor 2 Z Output	AI.5	CN 0.60
Sensor 3 X Output	AI.6	CN 0.25
Sensor 3 Y Output	AI.7	CN 0.57
Sensor 3 Z Output	AI.8	CN 0.34
Sensor 4 X Output	AI.9	CN 0.66
Sensor 4 Y Output	AI.10	CN 0.31
Sensor 4 Z Output	AI.11	CN 0.63
Sensor 5 X Output	AI.12	CN 0.61
Sensor 5 Y Output	AI.13	CN 0.26
Sensor 5 Z Output	AI.14	CN 0.58

Sensor 6 X Output	AI.16	CN 1.68
Sensor 6 Y Output	AI.17	CN 1.33
Sensor 6 Z Output	AI.18	CN 1.65
Sensor 7 X Output	AI.19	CN 1.30
Sensor 7 Y Output	AI.20	CN 1.28
Sensor 7 Z Output	AI.21	CN 1.60
Sensor 8 X Output	AI.22	CN 1.25
Sensor 8 Y Output	AI.23	CN 1.57
Sensor 8 Z Output	AI.24	CN 1.34
Sensor 9 X Output	AI.25	CN 1.66
Sensor 9 Y Output	AI.26	CN 1.31
Sensor 9 Z Output	AI.27	CN 1.63
Sensor 10 X Output	AI.28	CN 1.61
Sensor 10 Y Output	AI.29	CN 1.26
Sensor 10 Z Output	AI.30	CN 1.58

Table 4. Analogue output connections.

The Decaport sensor signal outputs to the PXIe rack are analogue, single ended with a range of ±10V.

Note: The full DAS3 system uses the PXIe A-to-D converter modules in Non-Referenced Single-Ended (NRSE) configuration, to avoid problems of ground offset. In this configuration, the A-to-D converter measures the voltage of an analogue input (AI) signal relative to one of the AI SENSE inputs, which is connected to a star point common (ground) reference for each group of 16 inputs on the Decaport PCB. This input configuration is recommended if users are implementing their own A-to-D system.

6.5. Power Supply

The Decaport has two internal 30W ±15V supplies that require a 100-250 VAC supply, via an IEC connector on the rear panel (see Figure 2). Each power supply independently provides power for five sensors and their signal conditioning electronics. The ±15V supply is used internally. It is also reduced to ±12V and supplied externally to the sensors.

Note: Long cables can cause a power voltage drop at the sensor. The Decaport can be programmed to increase the sensor supply output to ±14V, to compensate for this loss. This can be set independently for each set of five sensors.

6.5.1. Power Switch

The mains power switch is situated on the right hand of the front panel. (See Figure 1.)

6.5.2. Protection

The power supply to each sensor is protected by self-resetting semiconductor fuses that limit the current on each rail to approximately 50mA. The fuses can be reset by switching off the unit and allowing it to cool for a few minutes.

Two 1A slow blow fuses are fitted internally to limit the mains supply current to each of the power supply modules.

WARNING: If the power supply 1A fuses have blown, this indicates a faulty unit. Contact Bartington Instruments.

6.5.3. Power Supply Monitor

To allow monitoring of the connected sensors whilst the system is operational, the current and voltage to each sensor and the internal power supply voltages can be routed to an analogue output, for measurement by the A-to-D system.

7.5.3.1. Power Supply Monitor Select Input Pins

Power supply monitor select input pins are shown in Table 5.

Sensor Channels 1 to 5		
Signal	PXIe function	Pin
PSU Monitor Enable	P1.5	CN 0.6
PSU Monitor Select 0	P1.0	CN 0.11
PSU Monitor Select 1	P1.1	CN 0.10
PSU Monitor Select 2	P1.2	CN 0.43
PSU Monitor Select 3	P1.3	CN 0.42
PSU Monitor Select 4	P1.4	CN 0.41
PSU Monitor Output 1-5	AI.15	CN 0.23

Sensor Channels 6 to 10		
Signal	PXIe function	Pin
PSU Monitor Enable	P4.5	CN 1.6
PSU Monitor Select 0	P4.0	CN 1.11
PSU Monitor Select 1	P4.1	CN 1.10
PSU Monitor Select 2	P4.2	CN 1.43
PSU Monitor Select 3	P4.3	CN 1.42
PSU Monitor Select 4	P4.4	CN 1.41
PSU Monitor Output 6-10	AI.31	CN 1.23

Table 5. Power Supply Monitor Select Input Pins

Note: The input **PSU Monitor Enable** has an internal pull up resistor. The PXIe system default output state should be set to **logic high**, to ensure that the system starts up in a safe mode.

7.5.3.2. Using the Power Supply Monitor

The parameter to be read is selected by the power supply monitor control inputs and is presented on the analogue output AI 15 (for ch 1-5) and AI 31 (for ch 6-10).

Caution: Ensure that the enable line is set false when changing monitor channel, to prevent accidental shorts within the power supply circuit.

Use the following four stage cycle:

Set **PSU Monitor Enable** false (**logic high**).

Select parameter using **PSU Monitor Select** Inputs 0-4.

Set **PSU Monitor Enable** input true (**logic low**).

Read the analogue voltage from **PSU Monitor Output**.

Set **PSU Monitor Enable** false (**logic high**).

7.5.3.3. Power Supply Monitor Data

The value returned for the voltage is half the measured voltage. The value returned for the current is the voltage measured across a 1Ω 1% resistor, and will include a small current drawn by the voltage measuring circuit.

Note: The current drawn by a magnetometer will vary with the applied magnetic field. Therefore, this measurement is mainly intended for an indication of major changes in current, due to fault conditions.

6.5.4. Cable Leakage Current Test

Caution: This test must only be performed with Mag-03RC or DTS1 sensors. Use with other sensor types may damage the sensor.

The test can be used to detect system faults caused by water ingress. When the sensors form part of a seawater range, seepage of water into the cable, connectors or sensors will result in a significant leakage current being detected. Significant leakage current is an indication of a potential fault in the system.

The test enables the power supply leakage current to be measured, for each block of five sensors, by placing +15V on both power supply lines.

7.5.4.1. Implementing the Cable Leakage Test

Use the following sequence to implement the cable leakage test:

Select the leakage current monitor in the power supply monitor function.

Turn off the magnetometer power supply by setting **Sensor PSU Enable** false (**logic high**).

Select the leakage test supply by setting **Test Relay Enable** true (**logic low**).

Enable the leakage test power supply by setting **Test PSU Enable** true (**logic low**).

Wait sufficient time for the current to stabilise. The measuring circuit uses a high impedance (47kΩ) with a long cable. The time constant will be significant.

Read the value returned on the analogue output AI 15 (ch 1-5) or AI 31 (ch 6-10).

Disable the leakage test power supply by setting **Test PSU Enable** false (**logic high**).

Select the magnetometer supply by setting **Test Relay Enable** false (**logic high**).

Restore the magnetometer power supply by setting **Sensor PSU Enable** true (**logic low**).

Note: This process interrupts the power supply to the magnetometers and should not be carried out when the data capture system is active. It should be used as part of the system start up and verification procedure.

7.5.4.2. Cable Leakage Current Data

The leakage current is measured as the voltage across a 47KΩ resistor.

Use the following formula to calculate the leakage current I_L (the formula includes a correction to compensate for the quiescent current drawn by the measuring circuits):

$$I_L = \frac{3V_0 - V_{cc}}{50} \quad \text{(mA)}$$

Where:

V_O is the voltage returned by the leakage current measurement;

V_{CC} is the power supply voltage, nominally 15V.

This is not intended to yield a fully accurate result, but will alert the user to any significant increase in leakage current due to seawater ingress.

Power Supply Control Signal Functions

The power supply functions are controlled by digital I/O lines from the PXIe interface. The input signals are 5V TTL compatible static inputs.

7.5.5.1. Sensor PSU Enable

A **logic low** (0V) enables the sensor power supplies.

Note: The states of both **Test Relay Enable** and **Test PSU Enable** (described below) are ignored when **Sensor PSU Enable** is low.

7.5.5.2. Sensor PSU Voltage

A **logic high** (+5V) selects the higher voltage (±14) sensor power supplies. A **logic low** (0V) selects the lower voltage (±12) sensor power supplies.

7.5.5.3. Test Relay Enable

A **logic low** (0V) selects the leakage test power supply. A **logic high** (+5V) enables the normal sensor power supply.

Caution: Both supplies must be disabled (using **Sensor PSU Enable**) before changing the state of **Test Relay Enable**.

7.5.5.4. Test PSU Enable

A **logic low** (0V) enables the leakage test power supply.

7.5.5.5. LED

A **logic low** (0V) sets the LED red. A **logic high** (+5V) sets the LED green.

7.5.5.6. PSU Monitor Enable / PSU Monitor Select 0-4

These controls enable and select the power supply parameter that is routed to the **PSU Monitor Output** signal, according to Table 6.

Caution: Ensure that the **PSU Monitor Enable** line is set to <u>DISABLED</u> (**logic high**) before changing monitor select inputs, to prevent accidental shorts within the power supply circuit.

PSU Monitor Select Function						Function
0	1	2	3	4	EN	
X	X	X	X	X	1	Monitor Disabled (output voltage uncertain)
1	1	1	1	1	0	Sensor 2 [7] Positive Supply Current
0	1	1	1	1	0	Sensor 2 [7] Positive Supply Voltage
1	0	1	1	1	0	Sensor 2 [7] Negative Supply Current
0	0	1	1	1	0	Sensor 2 [7] Negative Supply Voltage
1	1	0	1	1	0	Sensor 3 [8] Positive Supply Current
0	1	0	1	1	0	Sensor 3 [8] Positive Supply Voltage
1	0	0	1	1	0	Sensor 3 [8] Negative Supply Current
0	0	0	1	1	0	Sensor 3 [8] Negative Supply Voltage
1	1	1	1	0	0	Sensor 4 [9] Positive Supply Current
0	1	1	1	0	0	Sensor 4 [9] Positive Supply Voltage
1	0	1	1	0	0	Sensor 4 [9] Negative Supply Current
0	0	1	1	0	0	Sensor 4 [9] Negative Supply Voltage
1	1	0	1	0	0	Sensor 5 [10] Positive Supply Current

0	1	0	1	0	0	Sensor 5 [10] Positive Supply Voltage
1	0	0	1	0	0	Sensor 5 [10] Negative Supply Current
0	0	0	1	0	0	Sensor 5 [10] Negative Supply Voltage
1	1	1	0	1	0	Sensor 1 [6] Positive Supply Current
0	1	1	0	1	0	Sensor 1 [6] Positive Supply Voltage
1	0	1	0	1	0	Sensor 1 [6] Negative Supply Current
0	0	1	0	1	0	Sensor 1 [6] Negative Supply Voltage
1	1	0	0	1	0	Leakage Test Current
0	1	0	0	1	0	+15V Supply
1	0	0	0	1	0	+5V Supply
0	0	0	0	1	0	–15V Supply
X	X	X	0	0	0	Invalid Input (output voltage uncertain)
Note: Number in square bracket [n] is for ports 6-10						

Table 6. PSU Monitor Select Function.

7.5.5.7. Power Supply Control Input Pins

Power Supply Control Input pins are shown in Table 7.

Note: The four inputs, **Sensor PSU Enable**, **Test Relay Enable**, **Test PSU Enable** and the LED have internal pull up resistors. The PXIe system default output states should be set to **logic high**, to ensure that the system starts up in a safe mode.

Sensor Channels 1 to 5		
Signal	**PXIe function**	**Pin**
Sensor PSU Enable	P1.7	CN 0.38
Sensor PSU Voltage	P1.6	CN 0.5
Test PSU Enable	P0.7	CN 0.48
Test Relay Enable	P0.6	CN 0.16
LED	P0.5	CN 0.51
Sensor Channels 6 to 10		

Signal	PXIe function	Pin
Sensor PSU Enable	P4.7	CN 1.38
Sensor PSU Voltage	P4.6	CN 1.5
Test PSU Enable	P3.7	CN 1.48
Test Relay Enable	P3.6	CN 1.16
LED	P3.5	CN 1.51

Table 7. Power Supply Control Input Pins.

7.6 Low Pass Filters

A low pass, anti-aliasing filter is incorporated in the Decaport with switchable frequency settings (see the product brochure). Each block of five channels is set independently, with the option of disabling the filter altogether.

In Table 8: 0 = logic low (0V), 1 = logic high (5V).

Select Inputs			Nominal frequency at –3dB point of Selected filter
0	1	EN	
1	1	0	10kHz
0	1	0	1kHz
1	0	0	100Hz
0	0	0	10Hz
X	X	1	No Filter

Sensor Channels 1 – 5		
Signal	**PXIe function**	**Pin**
Filter Enable	P2.5	CN 0.40
Filter Select 0	P2.6	CN 0.1
Filter select 1	P2.7	CN 0.39

Sensor Channels 6 – 10		
Signal	**PXIe function**	**Pin**
Filter Enable	P5.5	CN 1.40
Filter Select 0	P5.6	CN 1.1
Filter select 1	P5.7	CN 1.39

Table 8. Low pass filters.

With Mag-03 and Mag-03RC magnetometers, a setting of 10kHz low pass filter must be used if the system must record across the full magnetometer 3kHz bandwidth. Where sampling frequencies below 20kHz are used, set the filter to a lower frequency to avoid aliasing.

Note: This filter is only intended for anti-aliasing purposes, and filter frequencies are only approximate values. If a high accuracy frequency filter is required, it should be implemented in software digital signal processing routines available in most data processing software.

7.8. PXIe Interface Connections by Pin

CN0 and CN1 pin out details are given in Tables 10 and 11.

Pin	Decaport Signal	PXIe pin Name	In/Out	Range
1	Filter Select 0	P2.6	In	0/5V Digital
2	Input Select 5	P2.4	In	0/5V Digital
3	Input Select 2	P2.1	In	0/5V Digital
4	Digital Ground	D.Gnd	Ground	0V Nominal
5	PSU Voltage Select	P1.6	In	0/5V Digital
6	PSU Monitor Enable	P1.5	In	0/5V Digital
7	Digital Ground	D.Gnd	Ground	0V Nominal
8	No Connection	+5V		
9	Digital Ground	D.Gnd	Ground	0V Nominal
10	PSU Monitor Select 1	P2.1	In	0/5V Digital
11	PSU Monitor Select 0	P2.0	In	0/5V Digital
12	Digital Ground	D.Gnd	Ground	0V Nominal
13	Digital Ground	D.Gnd	Ground	0V Nominal
14	No Connection	+5V		
15	Digital Ground	D.Gnd	Ground	0V Nominal

16	Test Relay Enable	P0.6	In	0/5V Digital
17	Sensor Test 2	P0.1	In	0/5V Digital
18	Digital Ground	D.Gnd	Ground	0V Nominal
19	Sensor Test 5	P0.4	In	0/5V Digital
20 (NIU)	APFI0	APFI0	In	0/5V Digital
21 (NIU)	Analogue Input 2	AO.1	In	±10V Analogue
22 (NIU)	Analogue Input 1	AO.0	In	±10V Analogue
23	PSU Monitor Out 1-5	AI.15	Out	±10V Analogue
24	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
25	Sensor 3, X Output	AI.6	Out	±10V Analogue
26	Sensor 5, Y Output	AI.13	Out	±10V Analogue
27	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
28	Sensor 2, Y Output	AI.4	Out	±10V Analogue
29	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
30	Sensor 2, X Output	AI.3	Out	±10V Analogue
31	Sensor 4, Y Output	AI.0	Out	±10V Analogue
32	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
33	Sensor 1, Y Output	AI.1	Out	±10V Analogue
34	Sensor 3, Z Output	AI.8	Out	±10V Analogue
35	Digital Ground	D.Gnd	Ground	0V Nominal
36	Digital Ground	D.Gnd	Ground	±10V Analogue
37	Input Select 1	P2.0	In	0/5V Digital
38	Sensor PSU Enable	P1.7	In	0/5V Digital

39	Filter Select 1	P2.7	In	0/5V Digital
40	Filter enable	P2.5	In	0/5V Digital
41	PSU Monitor Select 4	P1.4	In	0/5V Digital
42	PSU Monitor Select 3	P1.3	In	0/5V Digital
43	PSU Monitor Select 2	P1.2	In	0/5V Digital
44	Digital Ground	D.Gnd	Ground	0V Nominal
45	Input Select 3	P2.2	In	0/5V Digital
46	Input Select 4	P2.3	In	0/5V Digital
47	Sensor Test 4	P0.3	In	0/5V Digital
48	Test PSU Enable	P0.7	In	0/5V Digital
49	Sensor Test 3	P0.2	In	0/5V Digital
50	Digital Ground	D.Gnd	Ground	0V Nominal
51	LED CN0	P0.5	In	0/5V Digital
52	Sensor Test 1	P0.0	In	0/5V Digital
53	Digital Ground	D.Gnd	Ground	0V Nominal
54	Analogue Input Ground	AO.Gnd	Ground	0V Nominal
55	Analogue Input Ground	AO.Gnd	Ground	0V Nominal
56	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
57	Sensor 3, Y Output	AI.7	Out	±10V Analogue
58	Sensor 5, Z Output	AI.14	Out	±10V Analogue
59	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
60	Sensor 2, Z Output	AI.5	Out	±10V Analogue
61	Sensor 5, X Output	AI.12	Out	±10V Analogue
62	Analogue Output Reference	AI. Sense	Ground	0V Nominal

63	Sensor 4, Z Output	AI.11	Out	±10V Analogue
64	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
65	Sensor 1, Z Output	AI.2	Out	±10V Analogue
66	Sensor 4, X Output	AI.9	Out	±10V Analogue
67	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
68	Sensor 1, X Output	AI.0	Out	±10V Analogue

Table 10. CN1 sensor channels 1 to 5.

Pin	Decaport Signal	PXIe pin name	In/Out	Range
1	Filter Select 0	P5.6	In	0/5V Digital
2	Input Select 10	P5.4	In	0/5V Digital
3	Input Select 7	P5.1	In	0/5V Digital
4	Digital Ground	D.Gnd	Ground	0V Nominal
5	PSU Voltage Select	P4.6	In	0/5V Digital
6	PSU Monitor Enable	P4.5	In	0/5V Digital
7	Digital Ground	D.Gnd	Ground	0V Nominal
8	No Connection	+5V		
9	Digital Ground	D.Gnd	Ground	0V Nominal
10	PSU Monitor Select 1	P5.1	In	0/5V Digital
11	PSU Monitor Select 0	P5.0	In	0/5V Digital
12	Digital Ground	D.Gnd	Ground	0V Nominal
13	Digital Ground	D.Gnd	Ground	0V Nominal
14	No Connection	+5V		
15	Digital Ground	D.Gnd	Ground	0V Nominal
16	Test Relay Enable	P3.6	In	0/5V Digital
17	Sensor Test 7	P3.1	In	0/5V Digital
18	Digital Ground	D.Gnd	Ground	0V Nominal
19	Sensor Test1a	P3.4	In	0/5V Digital

20 (NIU)	APFI 1	APFI 1	In	0/5V Digital
21 (NIU)	Analogue Input 4	AO.3	In	0/5V Digital
22 (NIU)	Analogue Input 3	AO.2	In	0/5V Digital
23	PSU Monitor Out	AI.31	Out	±10V Analogue
24	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
25	Sensor 8, X Output	AI.22	Out	±10V Analogue
26	Sensor 10, Y Output	AI.29	Out	±10V Analogue
27	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
28	Sensor 7, Y Output	AI.20	Out	±10V Analogue
29	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
30	Sensor 7, X Output	AI.19	Out	±10V Analogue
31	Sensor 9, Y Output	AI.26	Out	±10V Analogue
32	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
33	Sensor 6, Y Output	AI.17	Out	±10V Analogue
34	Sensor 8, Z Output	AI.24	Out	±10V Analogue
35	Digital Ground	D.Gnd	Ground	0V Nominal
36	Digital Ground	D.Gnd	Ground	0V Nominal
37	Input Select 1	P5.0	In	0/5V Digital
38	Sensor PSU Enable	P4.7	In	0/5V Digital
39	Filter Select 1	P5.7	In	0/5V Digital
40	Filter enable	P5.5	In	0/5V Digital
41	PSU Monitor Select 4	P.4.4	In	0/5V Digital
42	PSU Monitor Select 3	P4.3	In	0/5V Digital
43	PSU Monitor Select 2	P4.2	In	0/5V Digital
44	Digital Ground	D.Gnd	Ground	0V Nominal
45	Input Select 8	P5.2	In	0/5V Digital
46	Input Select 9	P3.3	In	0/5V Digital
47	Sensor Test 9	P3.3	In	0/5V Digital
48	Test PSU Enable	P3.7	In	0/5V Digital
49	Sensor Test 8	P3.2	In	0/5V Digital
50	Digital Ground	D.Gnd	Ground	0V Nominal
51	LED CN1	P0.13	In	0/5V Digital

52	Sensor Test 6	P3.0	In	0/5V Digital
53	Digital Ground	D.Gnd	Ground	0V Nominal
54	Analogue Input Ground	AO.Gnd	Ground	0V Nominal
55	Analogue Input Ground	AI.Gnd	Ground	0V Nominal
56	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
57	Sensor 8, Y Output	AI.23	Out	±10V Analogue
58	Sensor 10, Z Output	AI.30	Out	±10V Analogue
59	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
60	Sensor 7, Z Output	AI.21	Out	±10V Analogue
61	Sensor 10, X Output	AI.28	Out	±10V Analogue
62	Analogue Output Ground	AI.Sense	Ground	0V Nominal
63	Sensor 9, Z Output	AI.27	Out	±10V Analogue
64	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
65	Sensor 6, Z Output	AI.18	Out	±10V Analogue
66	Sensor 9, X Output	AI.25	Out	±10V Analogue
67	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
68	Sensor 6, X Output	AI.16	Out	±10V Analogue

Table 11. CNO sensor channels 6 to 10.

8. Software User Manual

The software supplied with the DAS3 is a data capture system. Output is a data file in Comma Separated Variable (CSV) format.

Note: The software is a LabVIEW application. LabVIEW source files are supplied to enable users to extend and customise the system, if they possess a suitable licensed LabVIEW development system.

8.1. Windows

6.5.5. Running Background Applications

The DAS3 system is supplied with Windows 11 installed. When running the DAS3 software, do not run other applications within Windows. This will limit the processing time available for data collection, and may cause errors. (If an application takes control of the processor for more than the sample read period – nominally set at 100 mSec – then the buffer in the PXIe NI A-to-D card will be overwritten and the data logging process will stop.)

Note: All general Windows maintenance (Windows updates, etc.) must be performed when the DAS3 software is not running.

6.5.6. Data Save format

Data is saved in a CSV file format. All the data from one reading is in decimal text form, on one line, separated by commas with a carriage return at the end. The first line in the CSV file carries the magnetometer label text.

8.2. Forced Zero Offset Compensation

This facility allows removal of static, or slow changing, magnetic fields, e.g. a local geomagnetic field.

For each sensor channel, the average of the last N readings is taken to obtain an offset value; this offset is subtracted from the current reading. The readings are stored in an averaging buffer. The value of N can be varied by the user.

There are controls for this function:

Zero Offset: Sets offset to zero on all Mag channels.

8.3. Sample Rate Considerations

The A-to-D converter board consists of a high speed, 24 bit converter with a sample rate of 51.2K samples/sec per channel. This gives a bandwidth of 23.04 kHz.

When the DAS3 is used with three-axis magnetometers, each magnetometer requires three input channels.

Note: These calculations indicate the sample rates available in the PXIe A-to-D board hardware. If the user extends the DAS3 LabVIEW application, the maximum achievable sampling rates may be limited by other data processing activities being performed by the software.

8.4. Anti-aliasing Filter

The National Instruments PXIe analogue input channels have an optional low pass filter set at 40kHz. However, this is located after the input multiplexer, severely reducing the maximum sample rates. The DAS3 software does not enable the programmable filter and the cut off frequency is fixed at 750kHz.

The software uses the low pass, anti-aliasing filter in the Decaport, with switchable settings for each frequency.

Full details of the filter can be found in Low Pass Filters.

8.5. Setup Screens

1. Initial setting that can be set manually or load from a file.

2. Multiple Measurements with Defined Duration. Displays the Measurement Test Titles and their settings.

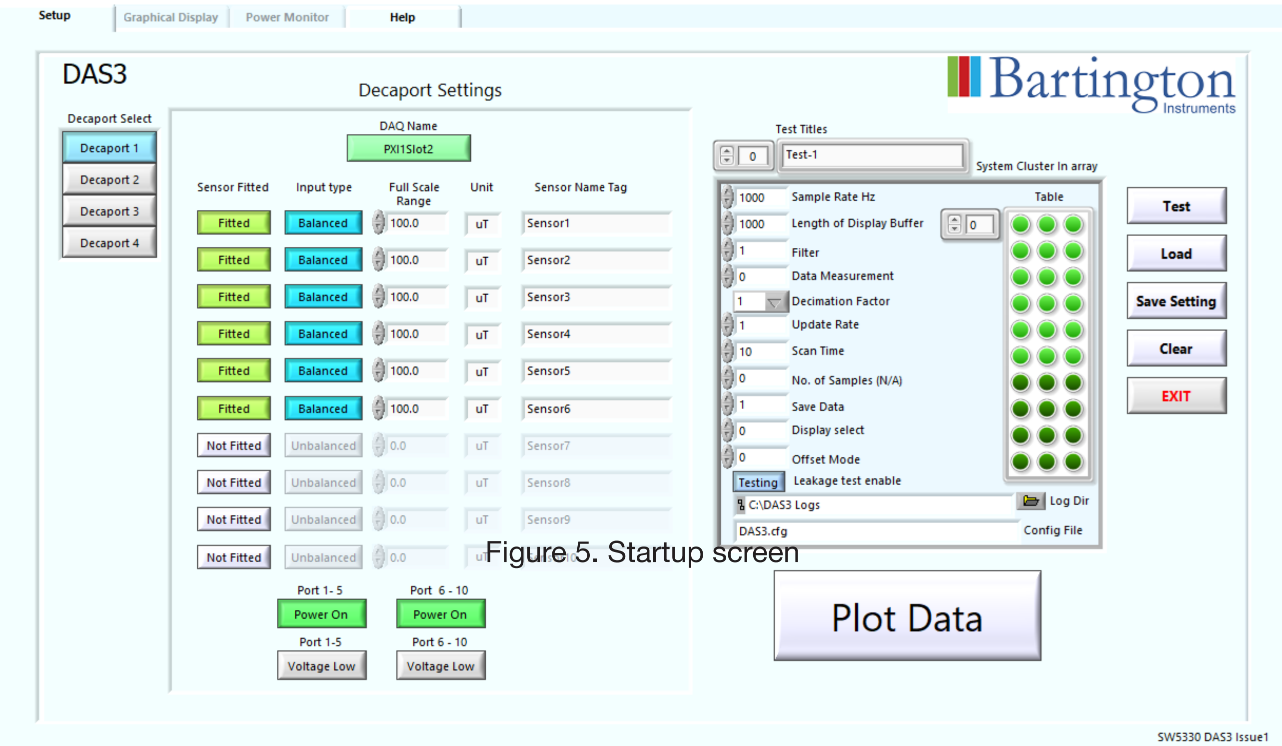


Figure 5. Startup screen

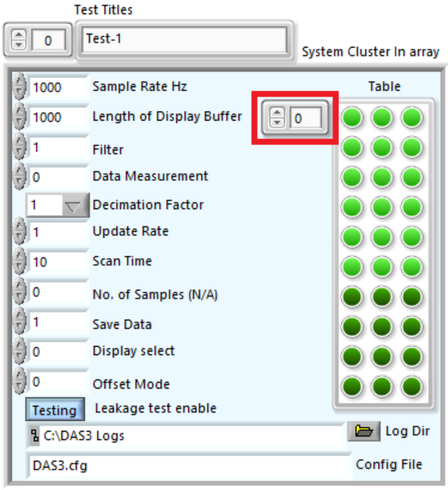


Figure 6. Setting

When the Load button is clicked, a File Select box is displayed (Figure 6) to allow the user to select a pre-saved configuration (.cfg) file. Select a file if desired, or select Cancel to retain the current configuration settings.

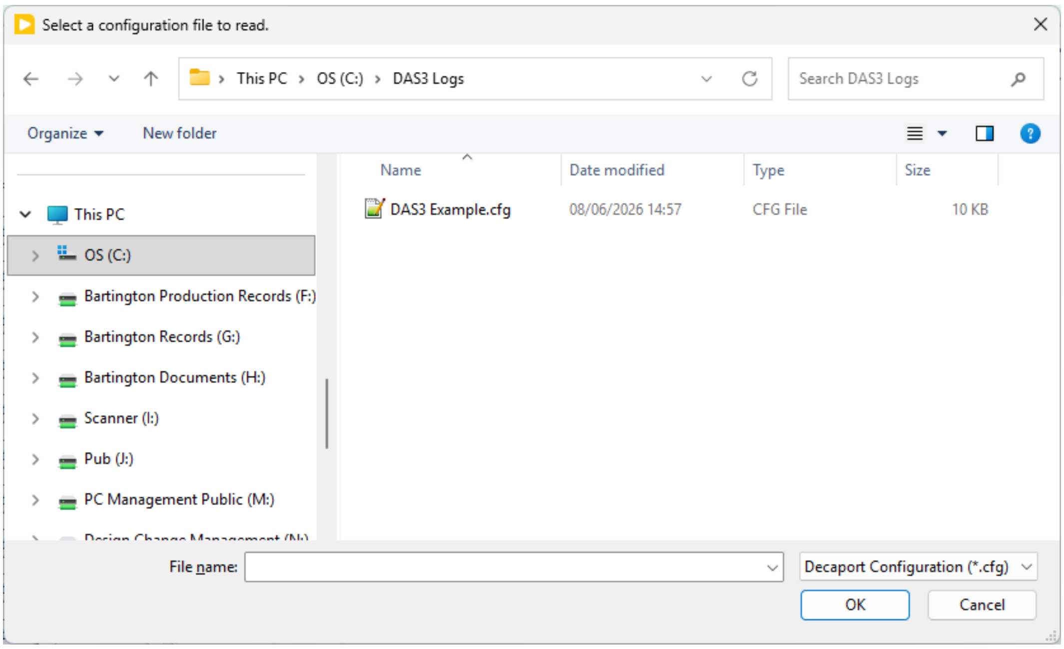


Figure 7. File Select box

Note: A complete system is supplied with the factory test file. This can be loaded to observe the correct configuration for the system supplied.

3. Initiate a measurement session with a user-specified duration, 0 for continuous measurement.

4. Displays the configuration file name.

	X	Y	Z
Sensor1	45015.054 nT	39061.003 nT	31861.488 nT
Sensor2	27543.202 nT	25915.757 nT	31597.082 nT
Sensor3	37234.883 nT	44047.027 nT	50260.633 nT
Sensor4	N/A	N/A	N/A
Sensor5	N/A	N/A	N/A
Sensor6	N/A	N/A	N/A
Sensor7	N/A	N/A	N/A
Sensor8	N/A	N/A	N/A
Sensor9	N/A	N/A	N/A
Sensor10	N/A	N/A	N/A

Figure 8. Live Graphical Display

- Save each measurement's data separately with configuration file and test name file naming or internal record distinctions.
- Result Display:
- Display the results immediately upon each measurement's completion.
- Provide a consolidated view for multiple measurements, with options to compare individual sessions side by side.
- Indicate progress with status updates (e.g.,1 of 3 and the test title).
- Notify the user as each measurement finishes and when all measurements are complete.

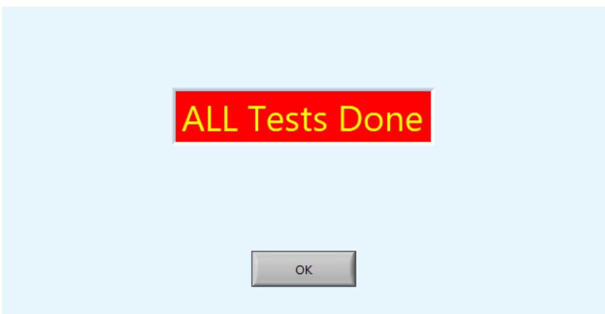


Figure 9. Display finishing message

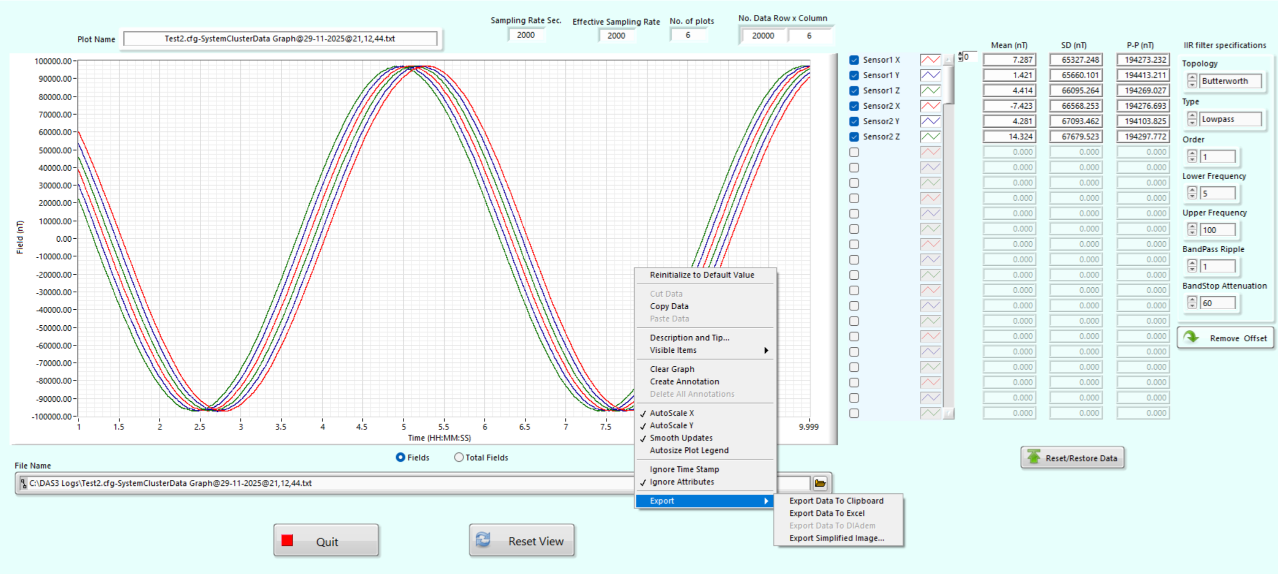


Figure 10. Log data graph

1. Load previously saved measurement data files.
2. Display loaded measurement data with meaningful plots (e.g., time-series for magnetic field strength).
3. Automatically compute and display the Mean, Standard deviation and peak-to-peak value (nTpp) from the measurement data.
4. Provide digital filters: low pass, high pass, bandpass, and filters for specific frequencies.
5. Allow users to specify filter parameters (cutoff frequencies, filter order, etc.).
6. Provide clear visual indicators when filters are applied and allow users to revert easily to the unfiltered view.

- Display data
- Sample Rate Hz
- Effective Sampling Rate
- e.g. Effective Sampling Rate 2500 = Number of samples e.g. 10000 samples / Decimation factor 4
- Number of data Column x Row
- Number of plots
- Plot Name

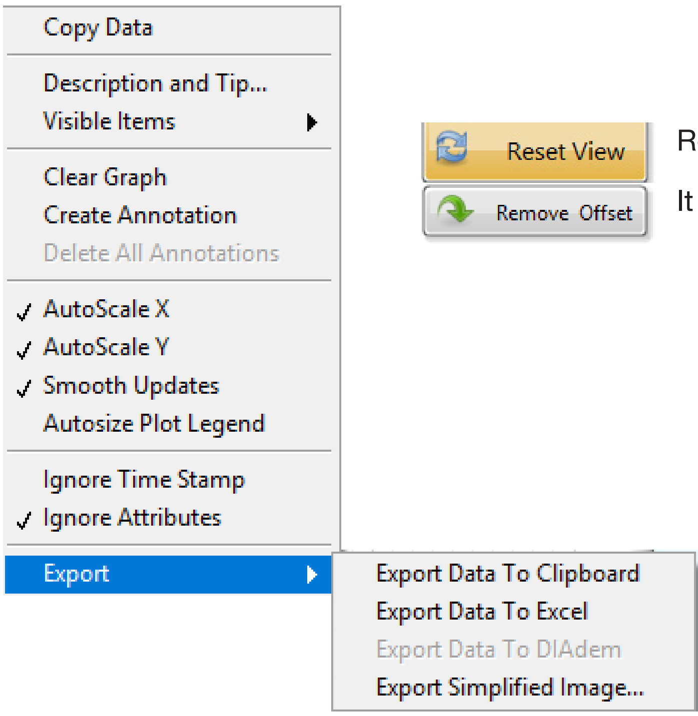
  0= No Log; 1=Log Plots data chosen to display; 2=Log Table data; 3=Log All Samples from all available Sensors

- Display select

  0=Oscilloscope 1=FFT grap
  Offset Mode

  0=Remove Offset On 1=Remove Offset Off

- Write click on the graph to display context menu.



Remove offset / Undo remove offset.

It clears all graphs.

Figure 11. Customising Data Display and Export

You cannot interact with other windows while a modal window is open. Most dialogue boxes in LabVIEW are modal windows, such as the Options dialogue box.

[Test-1]

- Sample Rate Hz

Number of samples Maximum 50000

- Length Of Display Buffer

Normally is set to the same value as number of samples

- Filter

0=Off 1=10KHz 2=1KHz 3=100Hz 4=10Hz

- Data Measurement

0=Ave 1=PK-PK 2=RMS 3=Offset

- Decimation Factor

Decimates number of samples e.g. 10000 samples / Decimation factor 4 = Effective Samples 2500

- Update Rate

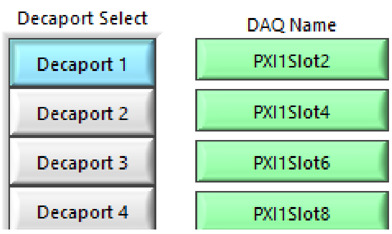
Number of updating the measurement in a second

- Scan Time unit: Seconds ±1 second tolerance
- Number of Samples is not in use currently
- Log Directory
- Sensors name and axes X=Red, Y=Blue and Z=Green

8.5.1. Setup Control Window

This window (Figure 7) has the following fields:

- **Decaport Select**: Lists the available Decaports.



- **Test**: Closes the setup screen and displays the signal monitor screen.
- **Save Setting**: Opens a window allowing the setup configuration to be saved as a .cfg file.
- **Load**: Opens a window allowing the setup configuration to be loaded from a .cfg file.
- **Clear**: Clears the Decaport setting.
- **Plot data**: plots data from the previous tests

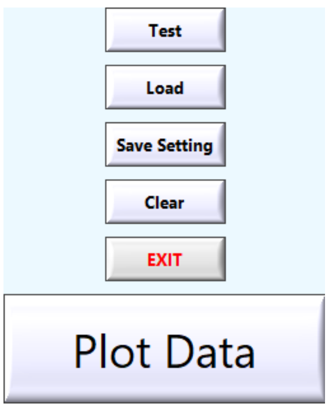


Figure 12. Setup Control window

8.5.2. Decaport Configuration Window

Figure 13. Decaport Configuration Window

This window (Figure 8) has the following fields:

- **I/O slot**: Shows the I/O slot number used within the LabVIEW software.
- **Sensor Fitted**: Controls each of the Decaport inputs to be enabled (Fitted) or disabled (Not fitted). When Fitted, the input is allocated three channels of A-to-D converter sampling. If set to Not Fitted, no sampling channels are allocated.
- **Input Type**: Sets the input to Balanced or Unbalanced mode on the Decaport. The magnetometer test function will operate on a sensor, if and only if its input type is set to Balanced.
- **Sensor Scale Factor**: Enter the scaling factor in µT.
- **Sensor Units**: Either µT or V.
- **Sensor Tag**: Enter a descriptive name for each sensor here or use the default names: Sensor 1, Sensor 2 etc. Do not leave this field blank.
- **Port 1-5 Power**: Sets the ON/OFF state of the Decaport Power Supply for sensor ports 1 to 5.
- **Port 6-10 Power**: Sets the ON/OFF state of the Decaport Power Supply for sensor ports 6 to 10.
- **Port 1-5 Voltage**: Selects low (±12V) or high (±14V) power supply voltage for sensor ports 1 to 5.
- **Port 6-10 Voltage**: Selects low (±12V) or high (±14V) power supply voltage for sensor ports 6 to 10.

Caution: This button activates the test on all Decaports. Only Mag-03RC and DTS1 sensors are compatible with the leakage test. Do NOT use leakage test if any incompatible sensors are connected to the DAS3. The test may cause damage to the sensors. Refer to cable leakage test (initiate test control)”.

8.5.3. System Configuration Window

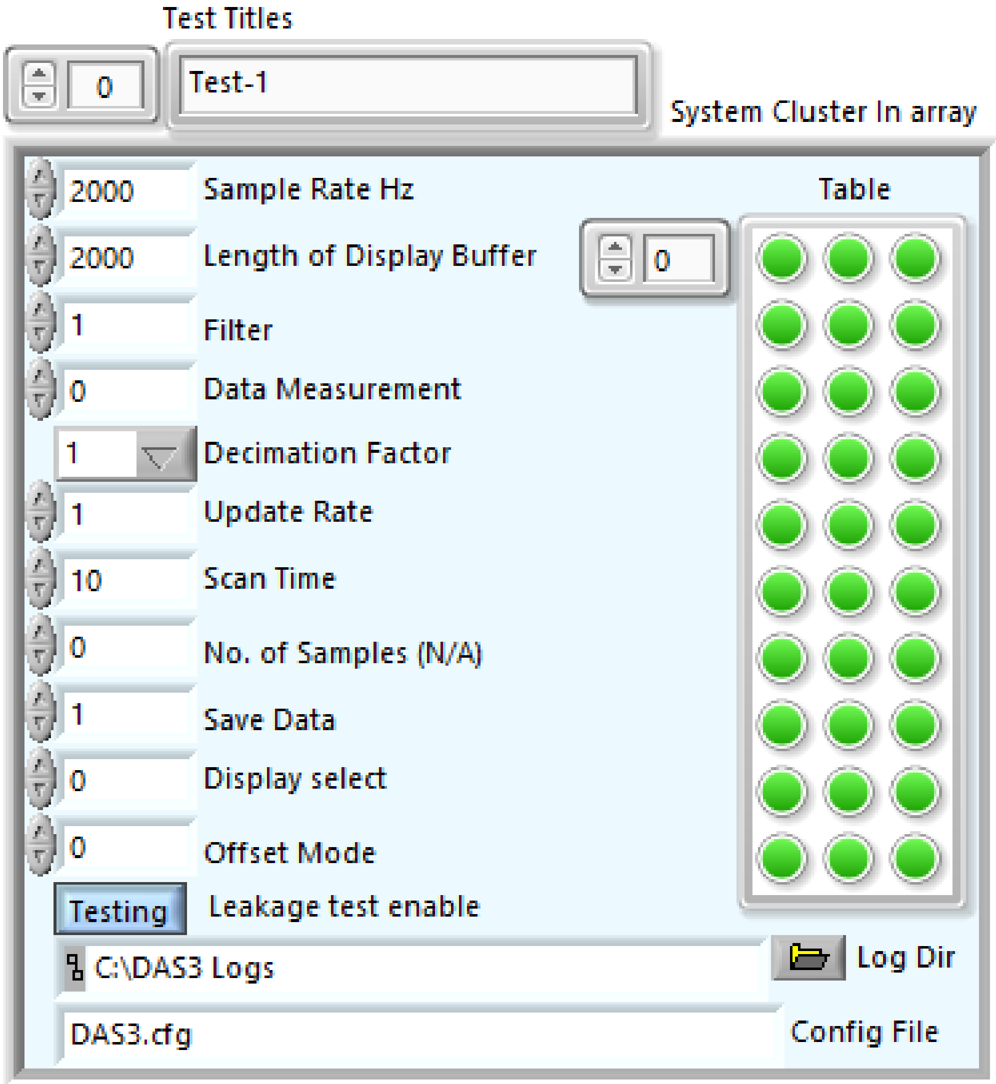


Figure 14. System Configuration Window

This window (Figure 14) has the following fields:

- **Sample Rate**: Set the desired A-to-D conversion sample rate in this field. The same sample rate is used on all sensor input channels. This rate is divided by the decimation factor (below) to give the effective sampling rate per channel. Care must be taken in setting this to a realistic value as the amount of processing will affect the maximum data the system can process.

- **Length of Display Buffer**: This parameter sets the length (in number of samples at the effective sampling rate, i.e. after decimation) of the display on the monitor screen. This value should be the same as “Sample rate” for FFT.

- **Filter**: Use these buttons to select the anti-aliasing filter, as described in Anti-aliasing Filter.

- **Decimation Factor**: Set this parameter to select the desired level of oversampling to increase effective A-to-D conversion resolution, as shown in the table below. This is used with the sample rate (above) to determine the effective sampling rate. This value should be 1 for FFT

Decimation Factor	Effective Resolution
1	16
4	17
16	18
64	19
256	20
1024	21
4096	22

Figure 15. Decimation Factors and Regulations

- **Effective Sample Rate**: This displays the effective sample rate per channel, after the decimation factor has been applied.
- **Display Select**: Display graph of the raw data or FFT data.
- **Data Measurement**: These buttons select the type of data that is displayed for each channel in the table and written to the data save file:

  AVE: The average of the display buffer values is used.
  P-P: The peak-to-peak measurement of the values in the display buffer is used.
  RMS: The Root Mean Square of the display buffer values is used.
  Offset: The Forced Zero Offset value is used.

- **Display Select**: Display graph of the raw data or FFT data.

  Leakage Test: Initiates the cable leakage test, as the system starts up. If you are using this function, use higher “Data Update Rate” e.g. 10 for quicker display data.

- **Log Dir**: To save data in a file, enter the desired filename and path. If the field is blank, data is displayed on screen but not saved.
- **Table**: Choose the sensors and axes to display

  Offset Mode: It applies to the Sample Rate and remove offset

9. Monitor Screens

9.1. Signal Monitor

Figure 16. Signal Monitor Window

The Signal Monitor window displays the sampled data from sensors connected to the Decaports. The window includes both:

- A time domain graph or frequency domain (FFT)
- A tabular format, showing data from each sensor in X, Y and Z columns.

The following controls are available:

- **Setup**: Click on this button to return to the Setup and Configuration windows.
- **Display Select**: Display graph of the raw data or FFT data.
- **Input Filter**: These buttons enable the user to change the anti-aliasing filter frequency during data sampling.
- **FFT Setting**: Fast Fourier Transform graph is displayed. The graph data for each graph depends on the sample rate and length of display buffer. Their value should be set equal if FFT required. The data can only be Logged. Caution! There would be a large log file and occupy the hard disk in a few hours.

- **Table**: This displays the sampled data in numerical table format, one row of three columns (channels) for each sensor that has been set to Fitted in the Sensor Configuration window. The table is also used to select the input channels that are present in the graphical display. X, Y and Z Graphs for a sensor can be selected by double clicking on the sensor name or for individual axis by double clicking on the axis:

  add/remove the channel to/from those included in the graphical display, if Table Select Control is in 'View' mode. Any number of channels can be shown in the time domain display, but only one (the last selected) will be shown in frequency domain mode. Channels currently displayed have a blue background.

  set that channel's sensor into test mode, if the sensor type is set to **Balanced** and if **Table Select Control** is in 'Test' mode. Sensors in mode test have a red background.

- **Table Measurement**: These buttons select the type of data that is displayed for each channel in the table and written to the data save file:

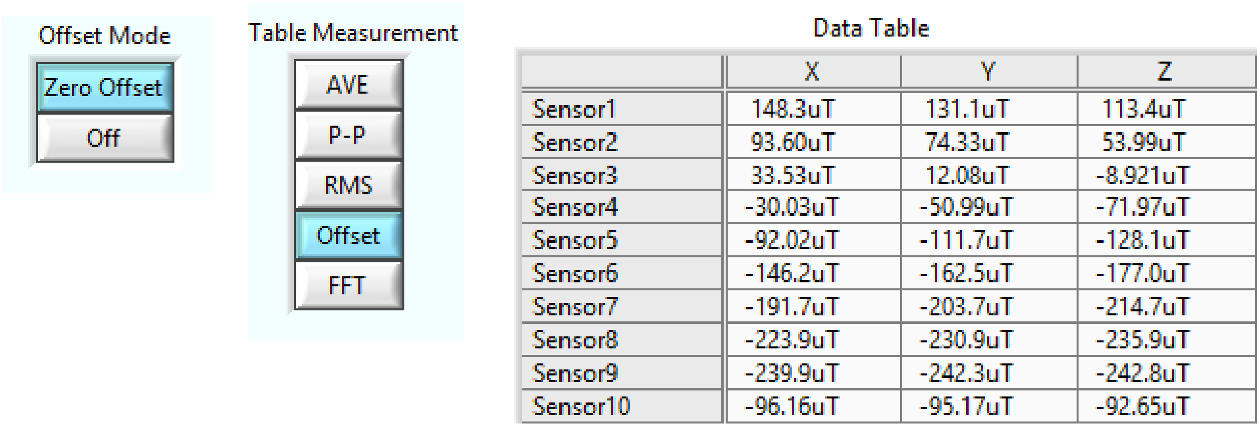
  AVE: The average of the display buffer values is used.
  P-P: The peak-to-peak measurement of the values in the display buffer is used.
  RMS: The Root Mean Square of the display buffer values is used.
  Offset: The Forced Zero Offset value is used.

- **Table Select Controls**: These set the mode for the display table:

  Test: Sets the table into Test mode, allowing sensors to be toggled in and out of test. If the sensor type is set to Balanced and if Table Select Control is in 'Test' mode. Sensors in mode test have a red background and control button shows Test Active.
  Reset View: Clears all channels from the graphical display.
  Select All: Selects all channels.
  Test Active: This is illuminated when test is active on one or more sensors. Clicking this button turns off all sensor tests and sets table into Test mode.
  Save Data: 2 options are available:
  Log graph data: that saves all samples for the selected channels and therefore takes a large space. In FFT mode only "Log Graph Data" available.
  Log table data: that saves all the data in the table

- **Offset Controls**: Use this button to set the desired offset mode, as described in Forced Zero Offset Compensation. If the set button is flashing, the buffer contains insufficient values to calculate a correct offset. After a period (dependent on the sample rate), this situation will resolve automatically as sampled data fills the buffer.

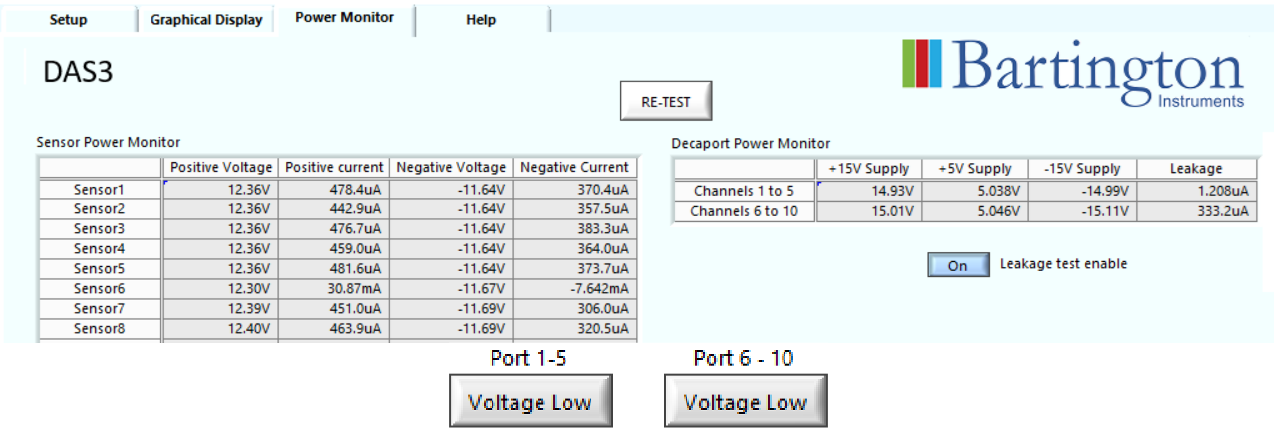
- To measure the offset, "Offset" from "Table Measurement" and "Zero Offset" from "Offset Mode" must be selected.



	X	Y	Z
Sensor1	148.3uT	131.1uT	113.4uT
Sensor2	93.60uT	74.33uT	53.99uT
Sensor3	33.53uT	12.08uT	-8.921uT
Sensor4	-30.03uT	-50.99uT	-71.97uT
Sensor5	-92.02uT	-111.7uT	-128.1uT
Sensor6	-146.2uT	-162.5uT	-177.0uT
Sensor7	-191.7uT	-203.7uT	-214.7uT
Sensor8	-223.9uT	-230.9uT	-235.9uT
Sensor9	-239.9uT	-242.3uT	-242.8uT
Sensor10	-96.16uT	-95.17uT	-92.65uT

Figure 17. Table Select Controls

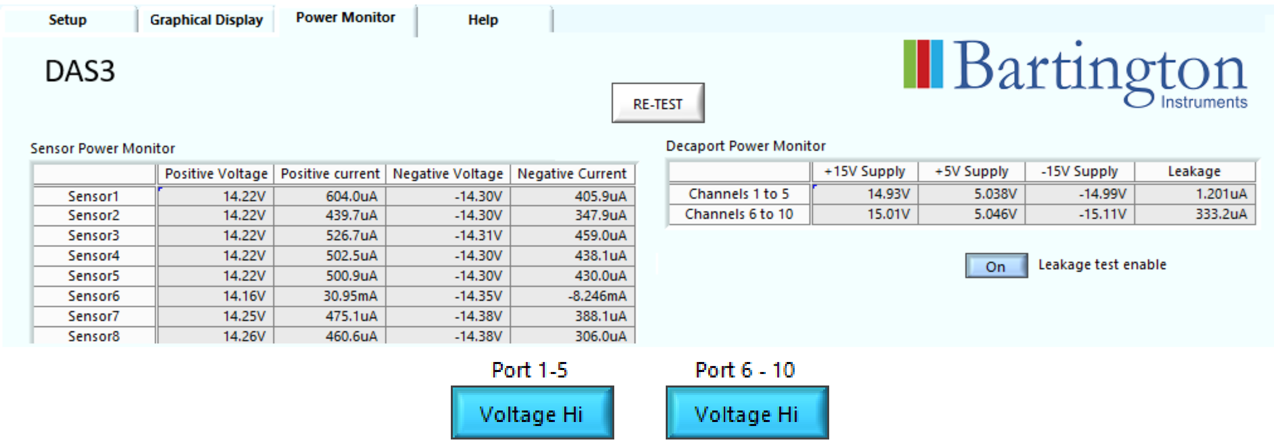
9.2. Power Monitor



	Positive Voltage	Positive current	Negative Voltage	Negative Current
Sensor1	12.36V	478.4uA	-11.64V	370.4uA
Sensor2	12.36V	442.9uA	-11.64V	357.5uA
Sensor3	12.36V	476.7uA	-11.64V	383.3uA
Sensor4	12.36V	459.0uA	-11.64V	364.0uA
Sensor5	12.36V	481.6uA	-11.64V	373.7uA
Sensor6	12.30V	30.87mA	-11.67V	-7.642mA
Sensor7	12.39V	451.0uA	-11.69V	306.0uA
Sensor8	12.40V	463.9uA	-11.69V	320.5uA

	+15V Supply	+5V Supply	-15V Supply	Leakage
Channels 1 to 5	14.93V	5.038V	-14.99V	1.208uA
Channels 6 to 10	15.01V	5.046V	-15.11V	333.2uA

Figure 18-a. Power Monitor Window



	Positive Voltage	Positive current	Negative Voltage	Negative Current
Sensor1	14.22V	604.0uA	-14.30V	405.9uA
Sensor2	14.22V	439.7uA	-14.30V	347.9uA
Sensor3	14.22V	526.7uA	-14.31V	459.0uA
Sensor4	14.22V	502.5uA	-14.30V	438.1uA
Sensor5	14.22V	500.9uA	-14.30V	430.0uA
Sensor6	14.16V	30.95mA	-14.35V	-8.246mA
Sensor7	14.25V	475.1uA	-14.38V	388.1uA
Sensor8	14.26V	460.6uA	-14.38V	306.0uA

	+15V Supply	+5V Supply	-15V Supply	Leakage
Channels 1 to 5	14.93V	5.038V	-14.99V	1.201uA
Channels 6 to 10	15.01V	5.046V	-15.11V	333.2uA

Figure 18-b. Power Monitor Window

The Power Monitor window (Figure 18) displays the readings from the most recent sensor and cable leakage test (if enabled).

The left hand table shows the power supply voltage and current for each sensor. Where a sensor is not fitted, the current value is blank.

The right hand table shows internal supply voltages for each five-input section of the Decaport(s) fitted. The rightmost column of this table shows the results of the leakage current test, if enabled; if the leakage current test is not enabled, this column is blank.

The power monitor runs once at start-up, then stops to keep the system noise to a minimum.

- **Retest Button**: Use this button to trigger the power monitor to run the power and cable (if enabled) tests once. The system will complete one set of measurements, displaying the new results as they are acquired.

    Note: The data shown in the tables is intended only for detection of faulty sensors or cables, rather than accurate determination of system power consumption.

10. FFT

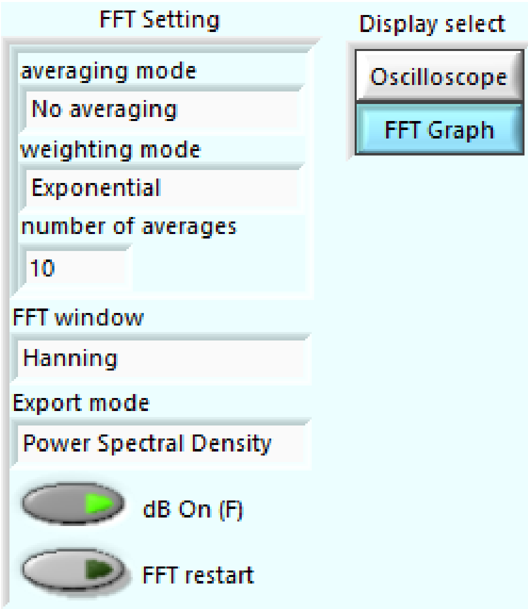


Figure 19. FFT Analysis

10.1. FFT Setting

Averaging mode Averaging successive measurements usually improves measurement accuracy. Averaging usually is performed on measurement results or on individual spectra but not directly on the time record.

Weighting mode When performing RMS or vector averaging, you can weight each new spectral record using either linear or exponential weighting.

Number of averages specifies the number of averages used for RMS and vector averaging. If Weighting mode is exponential, the averaging process is continuous. If Weighting mode is linear, the averaging process stops after calculating the selected Number of averages.

FFT restart specifies whether to restarts the selected averaging process. If it is TRUE, the selected averaging process restarts. If it is FALSE, the selected averaging process does not restart. The default is FALSE. When you choose this for the first time, the averaging process restarts automatically. A typical case when you should restart averaging is when a major input change occurs in the middle of the averaging process.

FFT window to use depends on the type of signal you acquire and on the application. Choosing the correct window requires some knowledge of the signal that you are analyzing. The following table lists common types of windows, the appropriate signal types, and example applications. These are some popular windows.

- **Hanning** Transient signals that are longer than the length of the window for speech signal processing
- Hamming Transient signals that are longer than the length of the window; a modified version of the Hanning window that is discontinuous at the edges Speech signal processing
- **Flat Top** The best amplitude accuracy of all the windows but limits frequency selectivity. For accurate, single-tone amplitude measurements with no nearby frequency components
- **Rectangular (no window)** Transient signals that are shorter than the length of the window; truncates a window to within a finite time interval for order tracking, system analysis (frequency response measurements) with pseudorandom excitation, separation of two tones with frequencies very close to each other but with almost equal amplitudes.

dB on specifies whether the results are expressed in decibels.

Export mode selects the output to export to Power Spectrum or Power Spectral Density.

- Power Spectrum–exports the power spectrum of the input signal.
- Power Spectral Density–exports the power spectral density of the input signal.

10.2. Annotations

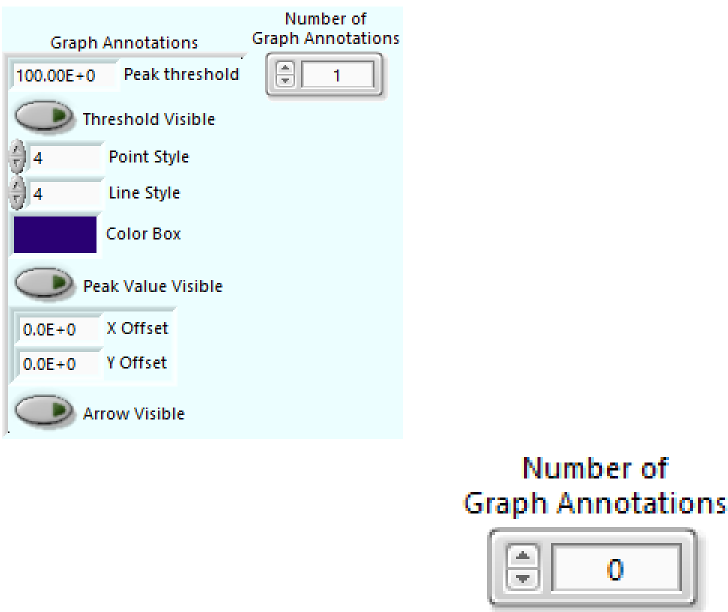


Figure 20. Annotations

- **Peak Threshold** Shows peaks in the input signal at specified value.
- **Threshold** Visible Shows threshold line.
- **Point Style** The symbol that, in combination with Line Style, is drawn at the focal point of the annotation. Valid values are 0-16
- **Line Style** The symbol that, in combination with Point Style, is drawn at the focal point of the annotation. Valid values are 0-8.
- **Colour Box** The colour of the annotation, including its point, value, and arrow.
- **Peak Value Visible** Shows Peak X-Y coordination value in plot area.
- **X Offset** The X coordinate of the value position, relative to the annotation.
- **Y Offset** The Y coordinate of the value position, relative to the annotation.
- **Arrow Visible** Displays the arrow that points from the annotation peak value to peak point.
- **Number of Graph Annotations** Number of channels to show their graph annotations.

Sequence testing

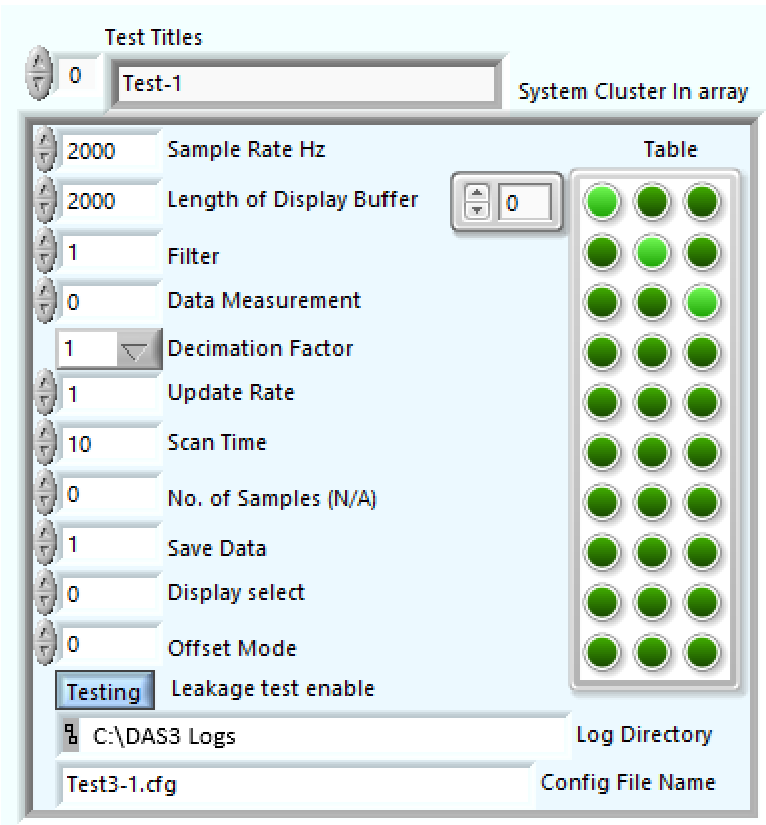


Figure 21-a. Test3-1.cfg-Test-1 Graph@07-11-2025@20,47,53.txt

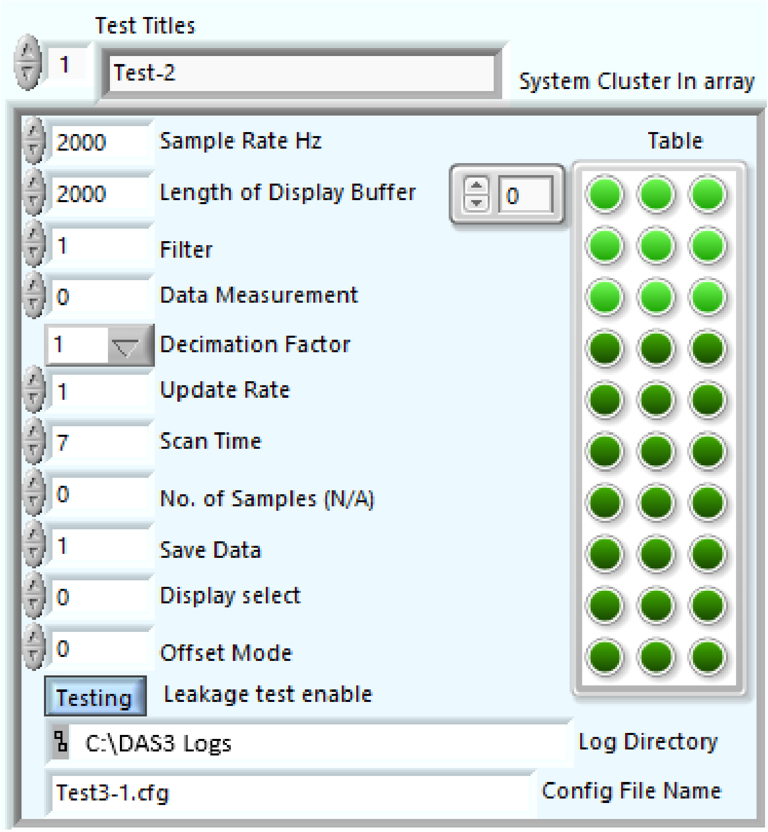


Figure 21-b. Test3-1.cfg-Test-2 Graph@07-11-2025@20,48,10.txt

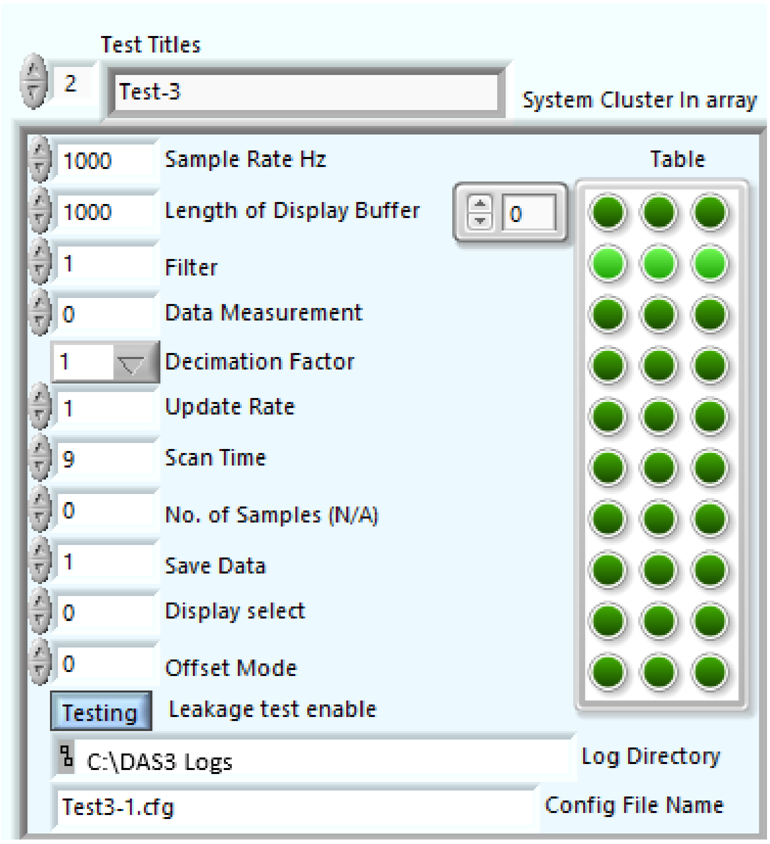


Figure 21-c. Test3-1.cfg-Test-3 Graph@07-11-2025@20,48,24.txt

	X	Y	Z
Sensor1	65.845 nT	-7845.613 nT	-15736.168 nT
Sensor2	-23391.339 nT	-31007.318 nT	-38341.163 nT
Sensor3	-45343.422 nT	-52061.198 nT	-58269.236 nT
Sensor4	N/A	N/A	N/A
Sensor5	N/A	N/A	N/A
Sensor6	N/A	N/A	N/A
Sensor7	N/A	N/A	N/A
Sensor8	N/A	N/A	N/A
Sensor9	N/A	N/A	N/A
Sensor10	N/A	N/A	N/A

Figure 22. Data Table

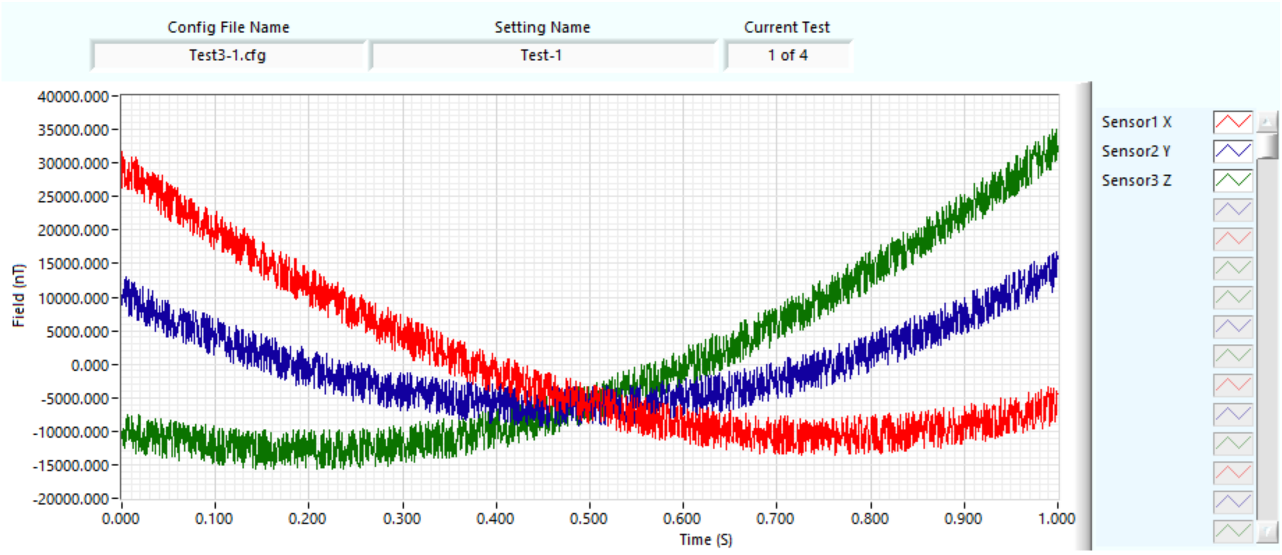


Figure 23. Live Graph Data

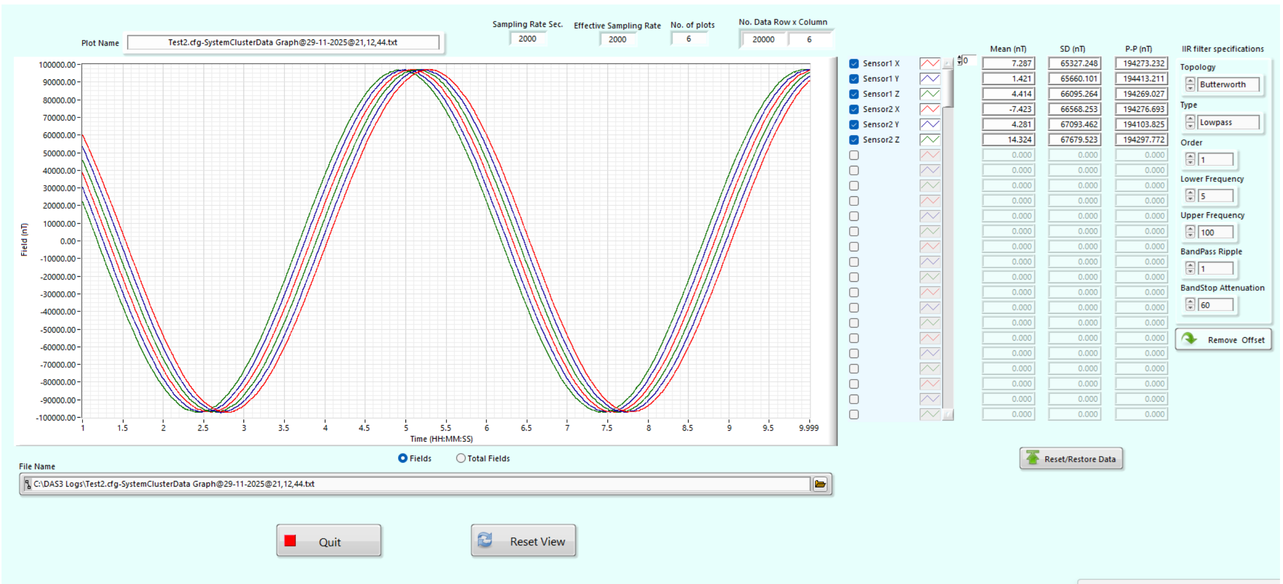


Figure 24-a. Log data graph

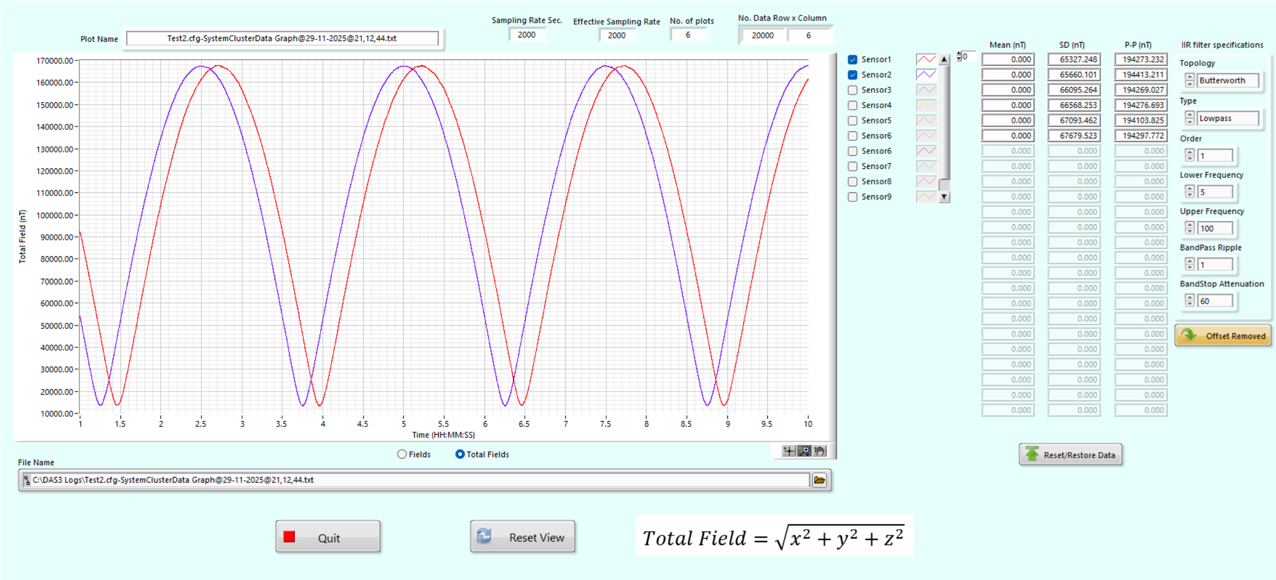


Figure 24-b. Graph data total field

The configuration file for the above setting
[Test-1]
Sample Rate Hz = “2000”
Length of Display Buffer = “2000”
Filter = “1”
Data Measurement = “0”
Decimation Factor = “1”
Update Rate = “1”
Scan Time = “10”
Save Data = “1”
Display select = “0”
Offset Mode = “0”
Leakage test enable = “1”
Log Directory = “C:\\DAS3 Logs”
Config File Name = “Test3-1.cfg”

Decaport1 Sensor1 = “100”
Decaport1 Sensor2 = “010”
Decaport1 Sensor3 = “001”
Decaport1 Sensor4 = “000”
Decaport1 Sensor5 = “000”
Decaport1 Sensor6 = “000”
Decaport1 Sensor7 = “000”
Decaport1 Sensor8 = “000”
Decaport1 Sensor9 = “000”
Decaport1 Sensor10 = “000”

[Test-2]
Sample Rate Hz = “2000”
Length of Display Buffer = “2000”
Filter = “1”
Data Measurement = “0”
Decimation Factor = “1”
Update Rate = “1”
Scan Time = “7”
Save Data = “1”
Display select = “0”
Offset Mode = “0”
Leakage test enable = “1”
Log Directory = “C:\\DAS3 Logs”

Config File Name = “Test 3-1.cfg”
Decaport1 Sensor1 = “111”
Decaport1 Sensor2 = “111”
Decaport1 Sensor3 = “111”
Decaport1 Sensor4 = “000”
Decaport1 Sensor5 = “000”
Decaport1 Sensor6 = “000”
Decaport1 Sensor7 = “000”
Decaport1 Sensor8 = “000”
Decaport1 Sensor9 = “000”
Decaport1 Sensor10 = “000”

[Test-3]
Sample Rate Hz = “1000”
Length of Display Buffer = “1000”
Filter = “1”
Data Measurement = “0”
Decimation Factor = “1”
Update Rate = “1”
Scan Time = “9”
Save Data = “1”
Display select = “0”
Offset Mode = “0”
Leakage test enable = “1”
Log Directory = “C:\\DAS3 Logs”
Config File Name = “Test3-1.cfg”

Decaport1 Sensor1 = “000”
Decaport1 Sensor2 = “111”
Decaport1 Sensor3 = “000”
Decaport1 Sensor4 = “000”
Decaport1 Sensor5 = “000”
Decaport1 Sensor6 = “000”
Decaport1 Sensor7 = “000”
Decaport1 Sensor8 = “000”
Decaport1 Sensor9 = “000”
Decaport1 Sensor10 = “000”

[Decaport 1 Port Cluster]
Port 1 Fitted = “1”
Port 2 Fitted = “1”
Port 3 Fitted = “1”
Port 4 Fitted = “0”
Port 5 Fitted = “0”
Port 6 Fitted = “0”
Port 7 Fitted = “0”
Port 8 Fitted = “0”
Port 9 Fitted = “0”
Port 10 Fitted = “0”
Scale 1 = “100.0”
Scale 2 = “100.0”
Scale 3 = “100.0”
Scale 4 = “0.0”
Scale 5 = “0.0”
Scale 6 = “0.0”

Scale 7 = “0.0”
Scale 8 = “0.0”
Scale 9 = “0.0”
Scale 10 = “0.0”
Tag 1 = “Sensor1”
Tag 2 = “Sensor2”
Tag 3 = “Sensor3”
Tag 4 = “Sensor4”
Tag 5 = “Sensor5”
Tag 6 = “Sensor6”
Tag7 = “Sensor 7”
Tag 8 = “Sensor8”
Tag 9 = “Sensor9”
Tag 10 = “Sensor10”
DAQmx Device Name = “PXI1Slot2”
Unit 1 = “1.0E-7”
Unit 2 = “1.0E-7”
Unit 3 = “1.0E-7”
Unit 4 = “1.0E-7”
Unit 5 = “1.0E-7”
Unit 6 = “1.0E-7”
Unit 7 = “1.0E-7”
Unit 8 = “1.0E-7”
Unit 9 = “1.0E-7”
Unit 10 = “1.0E-7”

[Decaport 1 I/O Cluster]
P 1 BAL = “1”
P 2 BAL = “1”
P 3 BAL = “1”
P 4 BAL = “0”
P 5 BAL = “0”
P 6 BAL = “0”
P 7 BAL = “0”
P 8 BAL = “0”
P 9 BAL = “0”
P 10 BAL = “0”
PSU A EN = “0”
PSU A VOL = “0”
PSU A LED = “1”
PSU B EN = “0”
PSU B VOL = “0”
PSU B LED = “1”

11. Troubleshooting

Fault	Cause	Solution
No power in the PXIe chassis.	The circuit breaker may have activated.	Check the circuit breaker switch on the rear panel of the PXIe rack. If the circuit breaker activates for a second time, the equipment may require repair.
No power to one group of five sensors.	The PSU enable signal may not be set correctly.	Check in the software, or your own control program, that the **Sensor PSU Enable** signal for these sensors is set to the correct state.
	The sensor PSU protection fuse may have tripped.	Power down the full system, allow to cool for a few minutes, then re-power to clear the fault.
Faulty signal from a sensor.	The sensor input may be set to the incorrect type (balanced or unbalanced).	Check the settings in the software or your own control program.
	Cable fault.	Check the cabling. If sensor is a Mag-03RC, use cable leakage test.
Unexpected frequencies present in the sensor signals.	Data sampling may be causing aliasing.	Ensure you have the anti-aliasing low pass filters set to a suitable value to match your sampling frequency.

If problems remain after following the troubleshooting guide, contact the Bartington Instruments helpdesk.

12. Care and Maintenance

12.1. Cleaning

WARNING: This equipment is powered by mains electricity. It should not be used in wet or damp locations, where water may enter the unit and create a safety hazard.

Periodic cleaning is not normally required.

1. Use a damp cloth to clean the outer surfaces.
2. Use an air duster to blow debris from the connectors.

12.2. Calibration

Return the DAS3 to Bartington Instruments for calibration at the recommended intervals. Refer to the calibration certificates for further details.

13. End of Life Disposal

Identifies items that must be disposed of safely to prevent unnecessary damage to the environment.

14. Notes

The specifications of the products described in this brochure are subject to change without prior notice.

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