

# Operation Manual for CU1 Helmholtz Coil System Control Unit



## Table of Contents

1. About this Manual	3
1.1. Symbols Glossary	3
2. Safe Use	4
3. Introduction	4
4. CU1 Features	5
4.1. Front Panel	5
4.1.1. ON/OFF Power Switch with LED Indicator	5
4.1.2. Front Panel Connectors	5
4.2. Rear Panel	6
4.2.1. Rear Panel Connectors	6
5. Compatibility	6
6. CU1 Control Unit Installation	7
6.1. Test Assembly Location and Ventilation Requirements	7
6.2. CU1 Control Unit Connection to the PA1 Power Amplifier	7
6.2.1. Current Control Output	7
6.2.2. Current Monitor Input	7
6.3. Sensor Connection to CU1 Control Unit Device Under Test Input	7
6.4. Sensor Connection to CU1 Control Unit Auxiliary Input	8
6.5. CU1 Control Unit Connection to NI Acquisition Card	8
6.6. CU1 Control Unit Mains Power Supply	8
7. Powering Sequence	9
8. Troubleshooting, Care and Maintenance	9
9. Storage and Transport	9
10. Disposal	10
10.1. Waste Electrical and Electronic Equipment (WEEE) Regulations	10
Appendix A: Connecting the Components of the Helmholtz Coil System	11
Appendix B: Helmholtz Control Unit CU1 DAQ/PXI Connection	12
Appendix C: Guidance for Connection to Mains Supply	20

## 1. About this Manual

This manual provides the information necessary to help customers install and operate the CU1 Control Unit. It is one component of the Bartington Instruments Helmholtz Coil System. This manual should therefore be read in conjunction with:

- Compatible Helmholtz Coils Operation Manuals
- PA1 Control Power Amplifier Manual OM3225
- CU2 Closed-Loop Module (if applicable) OM3999
- Helmholtz Coil Control Software OM3596.

All manuals are available from the Helmholtz Coil System [Operation Manual page](#). The relevant products outline drawings can be found on the Helmholtz Coil System [outline drawing page](#).

This manual should also be read in conjunction with the product brochure [DS2613](#) which can also be found on the product page.

Photographs of key components are included, labelled with numbers. A number in the text in square brackets [ ] refers to that label.

Bartington Instruments cannot advise on the integration of this equipment with any third party products.

### 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 paragraph in this format provides useful supporting information on how to make better use of your purchase.

## 2. Safe Use



**WARNING:** The CU1 Control Unit is powered by mains electricity and contains uninsulated parts. Ensure that the unit is properly earthed at all times. Ensure all local and national codes on electrical installation and grounding are observed. Safety protection will be impaired if the unit is used in a manner not specified in this manual.



**WARNING:** There are no customer serviceable components within this unit. The unit should be opened by Bartington Instruments personnel only.



**WARNING:** This product is not qualified for use in explosive atmospheres or life support systems. Consult Bartington Instruments for advice.

## 3. Introduction

The CU1 Control Unit constitute an interface unit between a Helmholtz Coil System and a National Instruments-based control system. Signal corresponding to field generation are sent to the PA1, whilst current monitor signals are return to the CU1. It also provides signal filtering and power supply to one or two magnetometers connected to the Auxiliary and/or Device Under Test inputs. Compatible NI cards can be directly connected to the back of the CU1 for ease of interface.

The full Helmholtz Coil System consists of:

- HC1, HC2, HC9 or HC16 Helmholtz Coils: an assembly of up to three Helmholtz coils. See related operation manuals. Ferronato Helmholtz Coils can also be operated through this system.
- PA1 Power Amplifier. See OM3225.
- CU1 Control Unit: the control unit for the system which enables it to interface with a PC-based test, measurement and control system.
- Optional CU2 Closed-Loop Module: allows active cancellation of external DC and AC magnetic field disturbances using the CU2 Reference Magnetometer. See OM3999.

A diagram showing the connection of these separate items into one system is given in [Appendix A](#).

The CU1 can connect directly to a National Instruments acquisition card or PXI system to provide a PC-based control system for the Helmholtz Coil System. A LabVIEW™-based Helmholtz Coil Control Software is available from our website, and is designed to operate when the system is running from a NI card, with the CU1 and PA1.

## 4. CU1 Features

### 4.1. Front Panel

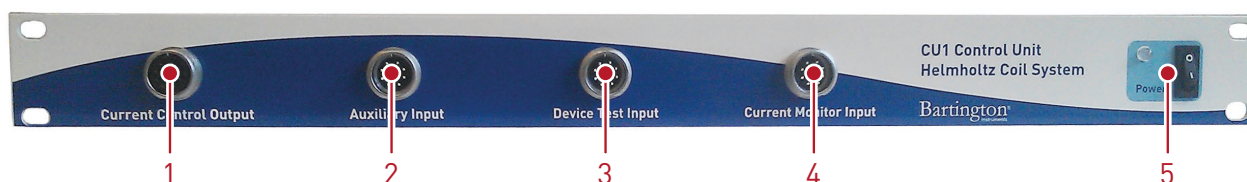


Figure 1. Front view of CU1 Control Unit.

#### Key

- |                           |   |
|---------------------------|---|
| 1. Current Control Output | 4. Current Monitor Input                  |
| 2. Auxiliary Input        | 5. ON/OFF power switch with LED indicator |
| 3. Device Test Input      |   |

#### 4.1.1. ON/OFF Power Switch with LED Indicator

The ON/OFF power switch [5] controls AC mains power to the CU1 Control Unit.

The LED indicator has two colour states (red or green) and is controlled by the user software.

#### 4.1.2. Front Panel Connectors

##### Inputs

**Auxiliary Input [2]:** this is a single ended or differential input, which can be that of a three-axis magnetic field sensor.

**Device Test Input [3]:** this is a single ended or differential input for a three-axis magnetic field sensor to be tested. This sensor is also termed the Device Under Test (DUT).

**Current Monitor Input [4]:** this is a differential input for monitoring the current in the Helmholtz Coil. This should be connected to the Current Monitor Output of the PA1 Power Amplifier.

Auxiliary and DUT inputs are provided with a switchable, analogue, anti-aliasing filter which can be enabled via a National Instruments acquisition card connected to the CU1.

Details of the pin-outs are available in DR3320.

##### Outputs

**Current Control Output [1]:** this provides three differential analogue outputs to the PA1 Power Amplifier which control the power to be applied to the Helmholtz Coil in order to generate and regulate the required DC or AC magnetic field.

Details of the pin-outs are available on DR3320.

## 4.2. Rear Panel

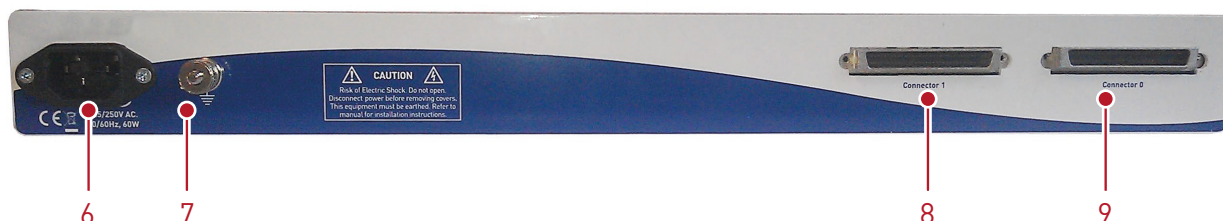


Figure 2. Rear view of CU1 Control Unit

### Key

- |                           |                |
|---------------------------|----------------|
| 6. Mains input IEC socket | 8. Connector 1 |
| 7. Earth terminal post    | 9. Connector 0 |

### 4.2.1. Rear Panel Connectors

**Mains Input IEC Socket [6]:** this is for connection of an IEC lead. See datasheet DS2613 for supply voltage.

**Earth terminal post [7]:** if an appropriate earth/ground connection is not provided through the mains supply lead, connect this terminal post to the National Instruments system chassis earth terminal, the instrument rack earth, or a permanent earth ground.

**Connector 0 [8]:** this is a National Instruments system interface socket for connection to the National Instruments system DAQ module.

**Connector 1 [9]:** as Connector 0.

## 5. Compatibility

The CU1 Control Unit is compatible with Bartington Instruments PA1 for use in Bartington Helmholtz Coil System. The CU1 is also compatible for use with the CU2 Closed-Loop Module.

A range of National Instruments card can directly connect to the CU1. A non-exhaustive list of compatible card is included here:

- NI-PXI-6289 Card + compatible Chassis and Controller and connection cables
- NI-PCIe-6353 + connection cables
- NI-USB-6363 + connection cables

## 6. *CU1 Control Unit Installation*

### 6.1. *Test Assembly Location and Ventilation Requirements*

The CU1 has no forced ventilation requirements and can be sited typically on top of the PA1. The CU1 and PA1 should be located at least 3m from the Helmholtz Coils to avoid interferences.

**Note:** For optimum results, the ambient temperature should not exceed the maximum specified in the data sheet.

### 6.2. *CU1 Control Unit Connection to the PA1 Power Amplifier*

#### 6.2.1. **Current Control Output**

Connect the CU1 Current Control Output [1] to the PA1 Current Control Input using the cable provided. Labels on the cable identify each end of the cable.

#### 6.2.2. **Current Monitor Input**

Connect the Current Monitor Input [4] to the PA1 Current Monitor Output using the cable provided. Labels on the cable identify each end of the cable.

The Current Monitor signal is sent to the National Instruments card for digitisation and is available in the Helmholtz Coil Control Software.

### 6.3. *Sensor Connection to CU1 Control Unit Device Under Test Input*

Both single-ended and differential output sensors can be connected to the Device Under Test input. The supply voltage to the sensor can be set by the user. Both the selection of the sensor output type and the supply voltage can be set through the software and is controlled via one of the digital I/O line on the National Instruments card.

The Device Under Test output is sent to the National Instruments card for digitisation and is available in the Helmholtz Coil Control Software.

Refer to the datasheet DS2613 for details of the supply voltage limits, and the analogue input range.

Ensure to not apply a supply voltage exceeding the connected sensor's rating.

An extension cable to connect to the sensor's cable to the CU1 Device Under Test port is supplied with the CU1. This is to be used in case the sensor cable is not long enough.

**Note:** Bartington Instruments can supply suitable cables for all Bartington Instruments compatible magnetic field sensors.

#### 6.4. *Sensor Connection to CU1 Control Unit Auxiliary Input*

Both single-ended and differential output sensors can be connected to the Auxiliary input. The selection of the sensor output type is set through the software and is controlled via one of the digital I/O line on the National Instruments card. The supply voltage to the sensor is set to  $\pm 15V$  and cannot be changed by the user.

The Auxiliary output signal is sent to the National Instruments card for digitisation and is available in the Helmholtz Coil Control Software.

Refer to the datasheet DS2613 for details of the supply voltage limits, and the analogue input range.

Ensure to not apply a supply voltage exceeding the connected sensor's rating.

Self-resetting semiconductor fuses limit the current to each Auxiliary power rail output, protecting the connected sensor. The fuses can be reset by switching off the unit and allowing it to cool for a few minutes.

**Note:** Bartington Instruments can supply suitable cables for all Bartington Instruments compatible magnetic field sensors.

#### 6.5. *CU1 Control Unit Connection to NI Acquisition Card*

The CU1 Control Unit can be connected to a National Instruments interface cards using two shielded cables manufactured by National Instruments (SHC68-68-EPM cables). Details of the pin-out of the CU1 to the acquisition card can be found in [Appendix B](#).

The CU1 will emit a beep when connection to a National Instruments acquisition card and PC is not detected. The beep will also sound at powering up until the Helmholtz Coil Control Software is started.

#### 6.6. *CU1 Control Unit Mains Power Supply*

Details of suitable power supply for the CU1 Control Unit are provided in the product brochure, with the supply being earthed/grounded. The supply from a standard wall outlet should be suitable in most countries. A compatible mains cable supplied with a UK 13A plug, an EU plug or bare ends can be specified at the time of ordering. In the latter case, refer to [Appendix C](#).

A slow blow fuse is fitted internally, to limit the mains supply current to the power supply modules.



**Caution:** If the power supply fuse has blown, this indicates a faulty unit. Please contact Bartington Instruments on +44 1993 776813.



## 7. Powering Sequence

Before powering the system, you should ensure that all the connections between the Helmholtz Coil and the PA1, the PA1 and the CU1 and/or CU2 as well as the CU1 to a suitable National Instruments acquisition card (or PXI-system) are done.

Once all connections are done, the following sequence should be used:

- Power the PC and National Instruments acquisition card or PXI system
- If using a CU2, ensure that the CU2 Reference Magnetometer is connected to the CU2 Module
- Power the CU1
- Power the PA1

To power down the system, the reverse sequence should be followed.

Please note that the equipment should be left to warm up for at least 12 hours before any of the calibration is undertaken.

## 8. Troubleshooting, Care and Maintenance

In the event of any apparent malfunction, please email [service@bartington.com](mailto:service@bartington.com), or telephone the Bartington Instruments service team on +44 (0)1993 706565.

**Note:** Fault finding by customers may invalidate the warranty.

## 9. Storage and Transport

The CU1 Control Unit should be handled with care.

Bartington Instruments has supplied this product in appropriate packaging for transporting it safely. This packaging should be used for any future transport.

Refer to datasheet DS2613 for this product's maximum environmental, electrical and mechanical ratings.



**Caution:** Exceeding the maximum environmental ratings may cause irreparable damage to the equipment.

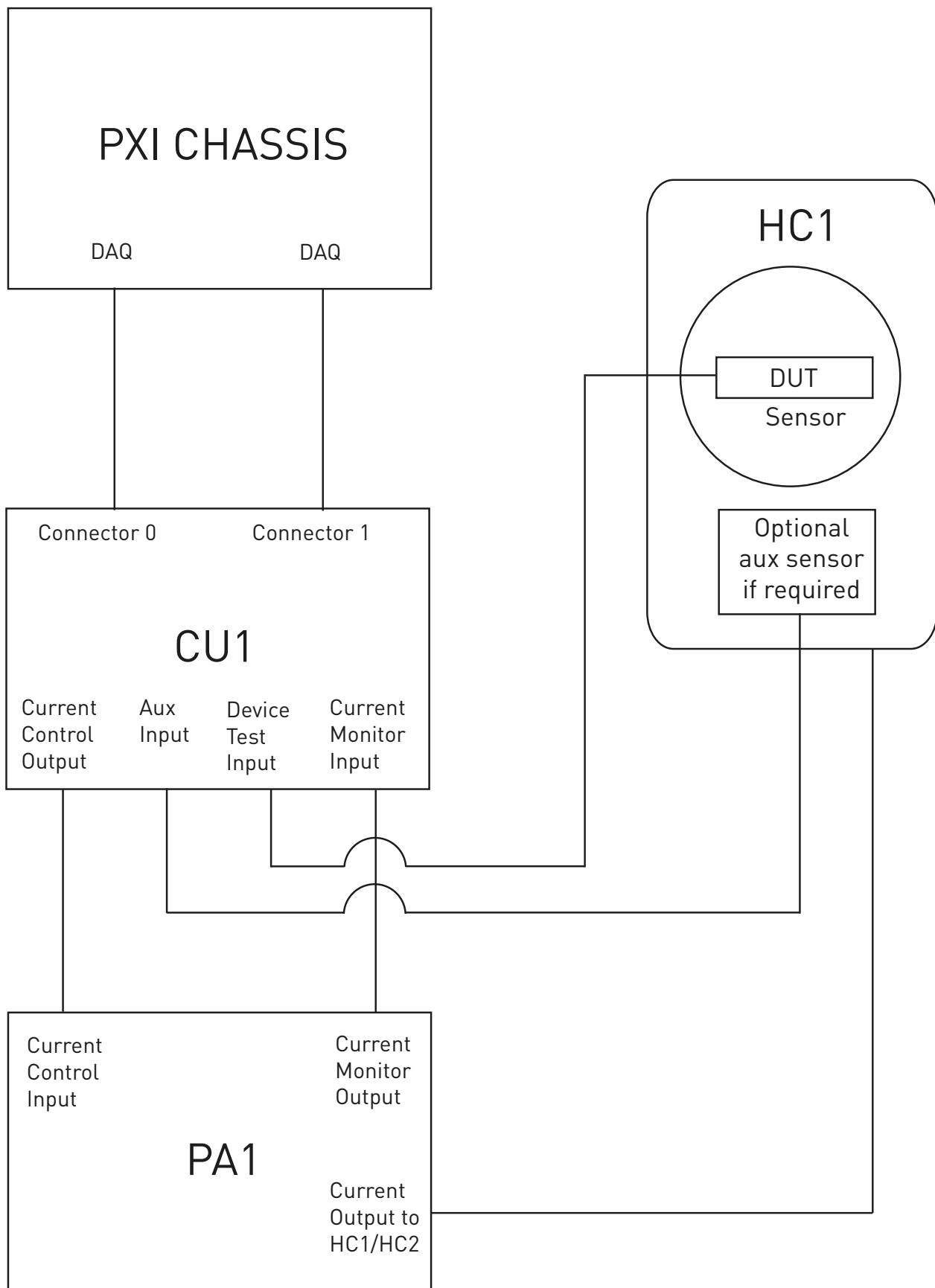
## 10. Disposal

This product should not be disposed of in domestic or municipal waste. For information about disposing of this product safely, check local regulations for disposal of electrical / electronic products.

### 10.1. Waste Electrical and Electronic Equipment (WEEE) Regulations



This product complies fully with Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and WEEE Regulations current at the time of writing.

*Appendix A: Connecting the Components of the Helmholtz Coil System*

## Appendix B: Helmholtz Control Unit CU1 DAQ/PXI Connection

<b>Analogue Outputs</b> Signal	PXI function	Pin (Cn1)
Auxiliary X output	AI.16	68
Auxiliary Y output	AI.17	33
Auxiliary Z output	AI.18	65
Device Under Test X output	AI.19	30
Device Under Test Y output	AI.20	28
Device Under Test Z output	AI.21	60
No Connection	AI.22	25
No Connection	AI.23	57
No Connection	AI.24	34
No Connection	AI.25	66
No Connection	AI.26	31
No Connection	AI.27	63
Current Monitor X output	AI.28	61
Current Monitor Y output	AI.29	26
Current Monitor Z output	AI.30	58
Power Supply Monitor	AI.31	23
Analogue Output Reference	AI.Gnd	64

<b>Analogue Inputs</b> Signal	PXI function	Pin (Cn1)
Y Channel Drive Signal	AO.2	Cn1.22
X Channel Drive Signal	AO.3	Cn1.21
Z Channel Drive Signal	AO.1	Cn0.21
Power Supply Control Signal	AO.0	Cn0.22

<b>Digital Control Inputs</b> Signal	PXI function	Pin (Cn1)
AUX self-Test Enable	P0.8	52
Device Under Test Self-Test Enable	P0.9	17
Device Under Test Input Gain	P0.10	49
Reserved	P0.11	47
Reserved	P0.12	19
LED colour	P0.13	51
Reserved	P0.14	16
Alarm Buzzer	P0.15	48
PSU Monitor Select 0	P0.16	11
PSU Monitor Select 1	P0.17	10

PSU Monitor Select 2	P0.18	43
No Connection	P0.19	42
No Connection	P0.20	41
PSU Monitor Enable	P0.21	6
No Connection	P0.22	5
No Connection	P0.23	38
Auxiliary Input select	P0.24	37
Device Under Test Input Select	P0.25	3
Device Under Test Input Polarity	P0.26	45
Reserved	P0.27	46
Reserved	P0.28	2
Filter Enable	P0.29	40
Filter Select 0	P0.30	1
Filter select 1	P0.31	39

## Input Select

Signal	PXI function	Pin
Device Under Test Input Select	P0.25	3
Auxiliary Input select	P0.24	37

0	Single ended / unbalanced input mode
1	Differential / balanced input mode

## Device Self-Test

Signal	PXI function	Pin
AUX Self-Test Enable	P0.8	52
Device Under Test Self-Test Enable	P0.9	17

0	Device in self-test mode
1	Device in normal operating mode

## Device Input Polarity

Signal	PXI function	Pin
Device Under Test Input Polarity	P0.26	45

0	Device input normal polarity
1	Device input signal polarity inverted

## Device Input gain

Signal	PXI function	Pin
Device Under Test Input Gain	P0.10	49

0	Device Under Test Input Gain = 100
1	Device Under Test Input Gain = 1

## Input Filter

Signal	PXI function	Pin
Filter Enable	P0.29	40
Filter Select 0	P0.30	1
Filter select 1	P0.31	39

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

## Power Supply Monitor

Signal	PXI function	Pin
PSU Monitor Enable	P0.21	6
PSU Monitor Select 0	P0.16	11
PSU Monitor Select 1	P0.17	10
PSU Monitor Select 2	P0.18	43

0	1	2	EN	
X	X	X	0	Output Disabled (voltage uncertain)
0	0	1	1	–Device under test negative supply voltage
1	0	1	1	Device under test negative supply current
0	1	1	1	–Device under test positive supply Voltage
1	1	1	1	–Device under test positive supply current
X	X	0	1	Invalid input (voltage uncertain)

## LED

Signal	PXI function	Pin
LED colour	P0.13	51

0	Led colour = Red
1	Led colour = Green

## Alarm

Signal	PXI function	Pin
Alarm Buzzer	P0.15	48

0	Alarm active
1	Alarm silent

## Notes

Logic inputs are defined as

0	logic Low (0V)
1	logic High (+5V)
X	State has no effect

The National Instruments DAQ analogue outputs are single ended with a common reference connection whilst its analogue inputs should be operated in NRSE (Non-referenced single-ended mode), refer to the relevant National instruments DAQ User manual for further information.

The power supply to the DUT has a dual rail output with a range which is twice the level of the control voltage input from the NI DAQ system. The control voltage range of 0 to +/-10V will correspond to a voltage output of 0 to +/-20V from the power supply.

The X, Y & Z Channel drive signals are balanced outputs with a range twice that of the control voltage input from the NI DAQ system. The control voltage range of 0 to +/-10V will correspond to a voltage output on the drive signals of 0 to +/-20V.

The power supply monitor voltage returns half the actual measured voltage.

The power supply currents return the current measured across a 1 Ohm (1%) resistor.

Reserved lines may be used for later enhancements by Bartington Instruments.

All Reserved lines must be held at logic High (+5V).

Lines marked No Connection Should be left disconnected.

**CN0 Connections pin-out**

Pin	Control Unit Signal	PXI pin Name	In/out	Range
1	Reserved	P2.6	In	0/5V Digital
2	Reserved	P2.4	In	0/5V Digital
3	Reserved	P2.1	In	0/5V Digital
4	Digital Ground	D.Gnd	Ground	0V Nominal
5	Reserved	P1.6	In	0/5V Digital
6	Reserved	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	Reserved	P1.1	In	0/5V Digital
11	Reserved	P1.0	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	Reserved	P0.6	In	0/5V Digital
17	Reserved	P0.1	In	0/5V Digital
18	Digital Ground	D.Gnd	Ground	0V Nominal
19	Reserved	P0.4	In	0/5V Digital
20	Reserved	APFI 0	In	0/5V Digital
21	Z Axis Drive	AO.1	In	±10V analogue
22	Power Supply Drive	AO.0	In	±10V analogue
23	No Connection	AI.15	Out	±10V analogue
24	analogue Output Ground	AI.Gnd	Ground	0V Nominal
25	No Connection	AI.6	Out	±10V analogue
26	No Connection	AI.13	Out	±10V analogue
27	analogue Output Ground	AI.Gnd	Ground	0V Nominal
28	No Connection	AI.4	Out	±10V analogue
29	analogue Output Ground	AI.Gnd	Ground	0V Nominal
30	No Connection	AI.3	Out	±10V analogue
31	No Connection	AI.10	Out	±10V analogue
32	analogue Output Ground	AI.Gnd	Ground	0V Nominal
33	No Connection	AI.1	Out	±10V analogue
34	No Connection	AI.8	Out	±10V analogue
35	Digital Ground	D.Gnd	Ground	0V Nominal
36	Digital Ground	D.Gnd	Ground	0V Nominal
37	Reserved	P2.0	In	0/5V Digital
38	Reserved	P1.7	In	0/5V Digital
39	Reserved	P2.7	In	0/5V Digital
40	Reserved	P2.5	In	0/5V Digital



41	Reserved	P1.4	In	0/5V Digital
42	Reserved	P1.3	In	0/5V Digital
43	Reserved	P1.2	In	0/5V Digital
44	Digital Ground	D.Gnd	Ground	0V Nominal
45	Reserved	P2.2	In	0/5V Digital
46	Reserved	P2.3	In	0/5V Digital
47	Reserved	P0.3	In	0/5V Digital
48	Reserved	P0.7	In	0/5V Digital
49	Reserved	P0.2	In	0/5V Digital
50	Digital Ground	D.Gnd	Ground	0V Nominal
51	Reserved	P0.5	In	0/5V Digital
52	Reserved	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	No Connection	AI.7	Out	±10V analogue
58	No Connection	AI.14	Out	±10V analogue
59	analogue Output Ground	AI.Gnd	Ground	0V Nominal
60	No Connection	AI.5	Out	±10V analogue
61	No Connection	AI.12	Out	±10V analogue
62	No Connection	AI. Sense	Ground	0V Nominal
63	No Connection	AI.11	Out	±10V analogue
64	analogue Output Ground	AI.Gnd	Ground	0V Nominal
65	No Connection	AI.2	Out	±10V analogue
66	No Connection	AI.9	Out	±10V analogue
67	analogue Output Ground	AI.Gnd	Ground	0V Nominal
68	No Connection	AI.0	Out	±10V analogue

**CN1 Connections pin-out**

Pin	Control Unit Signal	PXI pin Name	In/out	Range
1	Filter select 0	P0.30	In	0/5V Digital
2	Reserved	P0.28	In	0/5V Digital
3	Device Under Test Input Select	P0.25	In	0/5V Digital
4	Digital Ground	D.Gnd	Ground	0V Nominal
5	No Connection	P0.22	In	0/5V Digital
6	PSU Monitor Enable	P0.21	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	P0.17	In	0/5V Digital
11	PSU Monitor Select 0	P0.16	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	Reserved	P0.14	In	0/5V Digital
17	Device Under Test Self-Test	P0.9	In	0/5V Digital
18	Digital Ground	D.Gnd	Ground	0V Nominal
19	No Connection	P0.12	In	0/5V Digital
20	No Connection	AFPI 1	In	0/5V Digital
21	Y Channel Drive Signal	A0.3	In	±10V analogue
22	X Channel Drive Signal	A0.2	In	±10V analogue
23	PSU Monitor Out	AI.31	Out	±10V analogue
24	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
25	No Connection	AI.22	Out	±10V analogue
26	Current Monitor Y output	AI.29	Out	±10V analogue
27	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
28	Device Under Test, Y output	AI.20	Out	±10V analogue
29	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
30	Device Under Test X output	AI.19	Out	±10V analogue
31	No Connection	AI.26	Out	±10V analogue
32	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
33	Auxiliary Y output	AI.17	Out	±10V analogue
34	No Connection	AI.24	Out	±10V analogue
35	Digital Ground	D.Gnd	Ground	0V Nominal
36	Digital Ground	D.Gnd	Ground	±10V analogue
37	Auxiliary Input select	P0.24	In	0/5V Digital
38	No Connection	P0.23	In	0/5V Digital
39	Filter Select 1	P0.31	In	0/5V Digital
40	Filter enable	P0.29	In	0/5V Digital
41	No Connection	P0.20	In	0/5V Digital
42	No Connection	P0.19	In	0/5V Digital
43	PSU Monitor Select 2	P0.18	In	0/5V Digital
44	Digital Ground	D.Gnd	Ground	0V Nominal
45	Device Under Test Input Polarity	P0.26	In	0/5V Digital
46	Reserved	P0.27	In	0/5V Digital
47	Reserved	P0.11	In	0/5V Digital
48	Alarm Buzzer	P0.15	In	0/5V Digital
49	Device Under Test Input Gain	P0.10	In	0/5V Digital
50	Digital Ground	D.Gnd		

51	LED	P0.13	In	0/5V Digital
52	AUX Test Enable	P0.8	In	0/5V Digital
53	Digital Ground	D.Gnd	Ground	0V Nominal
54	Analogue Input Ground	A0.Gnd	Ground	0V Nominal
55	Analogue Input Ground	A0.Gnd	Ground	0V Nominal
56	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
57	No Connection	AI.23	Out	±10V analogue
58	Current Monitor Z output	AI.30	Out	±10V analogue
59	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
60	Device Under Test Z output	AI.21	Out	±10V analogue
61	Current Monitor X output	AI.28	Out	±10V analogue
62	Analogue Output Reference	AI. Sense 2	Ground	0V Nominal
63	No Connection	AI.27	Out	±10V analogue
64	Analogue Output reference	AI.Gnd	Ground	0V Nominal
65	Auxiliary Z output	AI.18	Out	±10V analogue
66	No Connection	AI.25	Out	±10V analogue
67	Analogue Output Ground	AI.Gnd	Ground	0V Nominal
68	Auxiliary X output	AI.16	Out	±10V analogue

## Appendix C: Guidance for Connection to Mains Supply

1. Ensure that the mains feed is from a clean AC supply with the following characteristics:-

Voltage Range	100V to 240V AC
Frequency	50/60Hz

It is highly recommended that this mains feed is via an appropriate Residual Current Circuit Breaker, rated at 30mA trip current. This must comply with local regulations.

2. The mains input connectors are as follows:-

Device	Input Connector	Mating Cable Connector
Power Amplifier PA1	IEC C20	IEC C19
Control Unit CU1	IEC C14	IEC C13

These cables are available in specific versions for most countries.

3. If an un-terminated IEC connector lead is supplied with the equipment, the wires must be wired accordingly:-

BROWN	LIVE
BLUE	NEUTRAL
GREEN/YELLOW	EARTH

4. It is essential that the control unit CU1 and the Power Amplifier PA1 are properly earthed at all times.

5. It is recommended that the mains to each unit is supplied via an appropriate mains fuse:-

Power Amplifier PA1	13A
Control Unit CU1	13A

This is appropriate for the use over the whole supply voltage range.

6. This installation MUST be carried out by a trained, competent person.
7. Before initial switch-on, an appropriate earth bonding test should be performed to ensure a robust earth connection.
8. To disconnect mains power, the mains supply cord must be removed from the rear panel mains input connector.

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