Digitimer

D360R-4

Isolated 4-Channel Research Amplifier/Filter

OPERATOR'S MANUAL

CE

For Research Use Only

WARNING

For Subject and Operator Safety, this manual should be FULLY read and understood before use of this product

Table of Contents

Product Registration

Please take time out to register your new product.

Details are included in the Section 1 - General Information

You can even do it online at:-

www.digitimer.com/register

Section 1 - General Information

D360R-4 Intended Usage & Description

The D360R-4 is a computer controlled 4-channel isolated research amplifier and analogue filter system. Featuring four AC-coupled, differential channels, it has been designed for use in human research where it may be employed for applications including electromyography (EMG), electroencephalography (EEG) or evoked potential (EP) studies.

The Digitimer D360R-4 Amplifier is intended to be used by persons appropriately trained in such techniques, who are familiar with the principles and safety issues of human physiological recordings. Users should be able to operate the D360R-4, the controlling software, and any associated instruments correctly before carrying out any human studies.

The D360R-4 is NOT approved or intended for use in clinical diagnostic, treatment or life support situations and is NOT a medical device.

The system comprises a main amplifier unit with a remote active headstage and D360R-4 Client Software. Any number of D360R-4 amplifiers may be connected to a single PC allowing multiples of 4-channels to be controlled by one PC system. Full and instant control is provided by the Windows PC Client Software, supplied with the system, which gives independent control of each channel.

It is expected that the preamplifier headstage would be placed near to the subject, while the main amplifier unit would be sited near the operator who would be using the host computer and data acquisition equipment.

Precautions and Warnings

Operator's Manual

Carefully study this Operator's Manual before using the D360R-4 4-Channel Amplifier.

Risks to Subject Safety

Operation of the D360R-4 in close proximity (e.g. 1m) to a shortwave or microwave therapy equipment may produce instability.

The D360R-4 is not suitable for use in close proximity to extreme magnetic fields, such as those generated by MRI scanners.

Under no circumstances should the D360R-4 Operator simultaneously touch the D360R-4 main unit and the subject.

WARNING - The D360R-4 should not be modified as this may present a safety hazard to the subject.

Defibrillator Warning

The D360R-4 is NOT classified as defibrillator proof and should not be connected to a subject undergoing defibrillation. Use under such circumstances may cause damage to the D360R-4 and/or impair the function of the defibrillator being used.

Subject Exclusion Criteria

At this time we are not aware of any justification for subject exclusion, but this is continuously under review.

Explosion and Fire

The D360R-4 must not be used in an explosive atmosphere or in the presence of flammable anaesthetic gasses.

High Voltages

Dangerous voltages are present within this unit. Do not remove covers or make any modifications to the D360R-4. Refer all servicing to a Digitimer representative.

Damage

The D360R-4 and/or any accessories must not be used if there are any signs of external damage. Please report any such damage to the local Digitimer representative.

Moisture

The D360R-4 and/or any accessories must not be used if any parts are wet or damp.

Temperature

The D360R-4 and/or accessories should be stored or transported at temperatures between -40°C and +70°C. The recommended usage temperature range is between +10°C and 40°C.

Input/Output Connectors

Only equipment that complies with EN(IEC) 60601 (Medical Equipment), EN(IEC) 60950 (IT Equipment) or EN(IEC) 61010 (Laboratory Equipment) should be connected to the D360R-4 input/output connectors.

Disconnection & Siting

The D360R-4 may be isolated from mains supply by uncoupling the appliance coupler or by disconnecting the mains plug. The operator should ensure that access to the appliance coupler and mains plug is maintained in all normal use.

Electrical Interference

The D360R-4 has been tested to all of the immunity requirements of EN60601-1-2:2015. Whilst the control systems of the D360R-4 were unaffected and safety not compromised, features of the D360R-4 make it inherently sensitive to RF fields. Certain precautions should be taken when installing medical electrical equipment:-

- This unit should NOT be used near radio transmitters as RF equipment can affect medical electrical equipment. If any 'strange' behaviour of the unit is noted, discontinue use immediately and refer to a qualified EMC engineer.
- The D360R-4 should not be used adjacent to or stacked with other equipment. If such use is required, then the behaviour of the amplifier should be monitored to confirm normal operation in this configuration.
- All cables (except electrode leads) connected to the D360R-4 should be no longer than 3 metres in length.

Cleaning Maintenance & Servicing

If the amplifier requires cleaning, it should be unplugged from the mains power supply and wiped with a damp cloth.

This equipment does not require any regular maintenance but in the absence of in-house biomedical engineering tests, Digitimer recommends that all our products designed for human use are returned to the factory for inspection and re-testing every 2 years. Please contact us for a reference number and instructions before despatching the unit.

As no parts of the D360R-4 are expected to wear out the only limitation to the service life is likely to be the ongoing ability to replace electronic components that may randomly fail and damage sustained during normal use. The components chosen are used conservatively and are all well-established parts, so availability can be expected for many years. However, a life expectancy of 10 to 15 years may be useful for lifespan planning purposes.

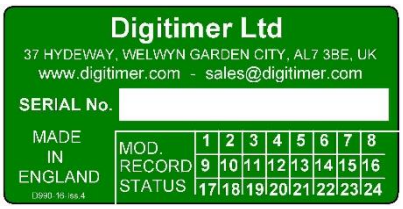
Before each use, the case and all leads should be inspected for any damage. The equipment (or the leads) should be sent for repair or replaced if any damage is found.

For all servicing requirements please contact Digitimer, who can advise on best course of action.

Environmental Considerations

This unit does not produce any waste. As with all electronic devices, at the end of its life it should be disposed of by a registered waste contractor who is made aware of its nature. As part of our legal obligation, Digitimer Limited is a registered EEE producer. Our WEEE registration number is WEE/BJ0052TQ. For further information relating to the correct method of disposal of any of our equipment, which carries this symbol , please contact us.

Modification Status



The green and white serial number label affixed to the rear of each D360R-4 contains the unique serial number of that unit. This serial number should be quoted whenever technical support is requested from Digitimer or one of our representatives.

The D360R-4 amplifier system has serial numbers of the following format: D360R-4-xx (main unit) D360R-4-H/S-xx (preamplifier headstage).

The lower section of the label contains the "MOD. RECORD STATUS" (Modification Record Status) which indicates the build status of the unit and any modifications that have been subsequently performed to the unit.

Unpacking

After unpacking the D360R-4 from the shipping carton, please inspect each piece for any sign of shipping damage. Please contact the carrier and your distributor, or Digitimer Limited, immediately if there is any damage. Do NOT dispose of the shipping carton, as the carrier will want to examine it in order to process a damage claim. Digitimer Limited and their distributors insure all shipments to cover shipping damage.

It is also advisable to keep the shipping carton in the event that the instrument needs to be returned for service.

Supplied Components & Accessories

- D360R-4 Main amplifier unit.
- D360R-4 H/S headstage.
- Amplifier to headstage inter-connection cable (2m long).

- Mains power lead/cord.
- Signal output cable – 9-way male "D"connector to 4x BNC (D990-35)
- USB connection cable (D-USBF).
- Operator's manual (this document).
- Test record sheet.
- Windows compatible D360R-4 Client Software (supplied on USB Stick).

Please note that the USB cable supplied is specifically for use with the D360R-4. USB cables from other suppliers are NOT suitable for use with this amplifier and may result in increased EMC emissions or decreased EMC immunity.

Optional Accessories

The D360R-4 may be supplied with 1.5mm DIN42802 touch-proof plugs for electrode lead fabrication or electrodes, but the D360R-4 input sockets are compatible with a wide variety of commercially available electrodes.

Mains Connections

The D360R-4 is shipped complete with a safety tested mains lead (fitted with a suitable moulded mains plug) to most countries. This instrument MUST be Earthed/Grounded.

If the mains plug supplied is not suitable please advise Digitimer of the correct plug for your country.

As it is not possible to obtain certain moulded mains plugs in the UK we will supply a mains lead with a British plug in these cases.

Mains Plug Connections

If you have to remove the fitted plug to connect your own plug, the connections are:-

- Line or Hot - Brown
- Neutral – Blue
- Earth or Ground – Green/Yellow

A mains plug should be used which is so constructed that if the lead is pulled the earth/ground wire cannot come into contact with the line or neutral pins. This instrument MUST be Earthed/Grounded.

Mains Plug Fuse

If it is possible to fit a fuse into the mains plug, this should be of the correct style and be rated at 3Amps.

Mains Voltage Selector

The D360R-4 mains voltage selector should be correctly configured for the local mains voltage supply. Two voltage options are available (230V and 115V) and these are selected by adjusting the "Voltage Selector" on the rear panel of the D360R-4.

The notch filter settings of the D360R-4 auto-selects for 50Hz or 60Hz, depending on the characteristics of the AC supply frequency. If a D360R-4 is moved to a location where the local mains frequency is different, the Notch Filter will automatically switch to the correct frequency

Mains Inlet Fuses

Check that the correct fuses are inserted for your supply voltage. The factory setting is 230V and the alternative is 115V.

Mains Voltage	Correct Fuse
115V (100-120V)	T 315mA L (250V, 5x20mm)
230V (200-240V)	T 200mA L (250V, 5x20mm)

If replacing these fuses, please ensure the correct size, rating and type is used.

Product Registration

For a speedy response to all your questions now and in the future, please take time out to register your new D360R-4 amplifier at www.digitimer.com/register now! Product registration permits us to quickly advise you of any safety matters or new product information. This web address is your point of contact for all questions regarding the D360R-4. The contents of this site are now growing rapidly, so please bookmark it so that you can visit it regularly to check out the new items.

Why Register Your Purchase?

Digitimer periodically offers enhancements and firmware updates to our products. Without product registration, users of our products may miss out on announcements of important enhancements to the products that they are using. Digitimer Limited does not make our customer list available to anyone else. Any information that you provide to us is strictly confidential.

How to Register Your Purchase

Product registration can be accomplished in two ways. You may fill out and mail in the product registration/warranty card supplied with each Digitimer Limited product. You may also register on-line at our www.digitimer.com/register website.

Product Announcement Mailing List

Digitimer has E-mailing lists which we use as our primary outlet for announcements of new products, product enhancements and product updates. We strongly recommend that all users of our products sign up for the list that is most appropriate to their area of interest. E-mail is kept to a minimum and list membership is kept in the strictest confidence. Only Digitimer Limited can send mail to members of our e-mailing lists.

You may join the D360R-4 mailing list through our www.digitimer.com/register website.

Contact Addresses

Manufacturer

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D-65193 Wiesbaden
Telephone: 0611 185 1944
Fax: 0611 185 1946

Please contact Digitimer for information regarding representation in other countries.

Specifications

Safety

The D360R-4 has been designed to meet all of the electrical requirements of IEC 60601-1, ensuring safety in a human research environment. This includes but is not limited to:

- Input circuit is fully electrically isolated.
- Creepage and clearance meets or exceeds the minimum requirements.
- All inputs are single fault condition safe.

Power requirements

Mains requirements: 120/240AVC (Switch selected) 50/60 Hz

Headstage

The headstage is a small remote pre-amplifier to which the operator connects the electrodes from the subject to the amplifier. The amplifier head stage is small enough to be attached to a subject to permit partial mobility should this be required. The headstage is connected to the main amplifier using a 2m multi-way cable with plastic Lemo Redel connectors at both ends. The cable is symmetrical allowing it to be connected either way round.

- Differential Channel Input (+ve [ref] –ve[act]) for all channels (Red & Blue 1.5mm DIN42802 touch-proof sockets); inputs are connected to COM when a channel is disabled (Off).
- 100MΩ Input impedance
- Independent channel enable
- Single COM reference input (1.5mm touch-proof DIN42802 sockets).

Deblock

The deblock is a means to remove excessive DC from the low pass series capacitors which in certain situations could block the signal. The de-block can be applied in using the PC Application, a button press on the headstage or using a precise TTL sync voltage connected to an input BNC on the device's rear panel.

The deblock parameters are applied to all channels

TTL BNC Input (2 modes)

- Timed 0.1ms – 10ms (0.1 steps) – Triggered on rising edge of TTL BNC input.
- Manual – Deblock active for the time TTL BNC input is held high.

Deblock button on headstage, applied whilst button depressed.

Deblock can be applied using the Client Software or API.

Analogue Channels

- Maximum Channels : 4
- CMRR : ≥90dB

The following channel parameters can be independently controlled:

- Gain : x100 – x3,000,000 (10mV/V – 0.33µV/V)

  80 gains from x100 to x3,000,000

- Low Cut Filter: 0.05 Hz – 255 Hz

  0.05 – 2.5 Hz (0.01 Hz Steps)

  5 – 62.0 Hz (0.25 Hz Steps)

  62 – 255 Hz (1.0 Hz Steps)

- High Cut Filter: 20 Hz – 25,500 Hz

  20 – 1300 Hz (5 Hz Steps)

  1300 – 25,500 Hz (100 Hz Steps)

All parameters are accurate to within ±5%

- Notch Filter (50/60 Hz) auto-detected based on mains frequency

  In/Out

Outputs

Analogue channel outputs (max. ±10V) are via a 9 pin HD connector on the rear panel. An interface lead is supplied with each amplifier which breaks-out individual channels to 1 m BNC terminated cable for connection to chosen acquisition interface.

Software

Supplied D360R-4 Client Software compatible with Windows10 (32/64bit) and above.

Physical Size

- Headstage : 134 x 76 x 39 mm, weight : 255g (approximate)
- Amplifier : 228 x 242 x 111 mm, weight : 2890g

EU Declaration of Conformity

DECALARTION OF CONFORMNITY

according to ISO/IEC Guide EN45014

Manufacturer's Name: Digitimer Limited

Manufacturer's Address: 37 Hydeway
Welwyn Garden City
Hertfordshire
AL7 3BE
England

as the manufacturer of the apparatus listed, declare that the product:

Product Name: 4 Channel Amplifier / Filter
Model Number: D360R-4
Product Options: All

confirms to the following Standards:

BS EN IEC 61000-6-1:2019
BS EN 61000-6-3:2007 + A1:2011
BS EN 61010-1:2010 + A1:2019

The products herewith comply with the requirements of:

the EMC directive 2014/30/EU
the LV directive 2014/35/EU

The product was tested in a typical configuration.

Issued on: 13th September 2021

Authorised by:

John P. Cooper, Technical Director

File Ref: N:\Cad\DESIGN\DIGI\D360R-4\D360R-4v2\DM\D360R-4-DoCv1.docx

Warranty Information

Limited Warranty

Digitimer Limited warrants to the first purchaser, for a period of one year from the date of purchase, that this Digitimer instrument (hereafter referred to as the "Product") will be free from defective workmanship and materials, and agrees that it will, at its option, either repair the defect or replace the defective Product or part thereof at no charge to the purchaser for parts and labour. The Product must be returned to Digitimer Limited, carriage paid and insured. Digitimer Limited will return the Product, carriage paid and insured, in the most appropriate method as determined by Digitimer Limited. If a faster shipping service is desired by the customer, any additional special delivery expenses must be paid by the customer.

This warranty does not apply to shipping damage. Digitimer Limited fully insures all shipments. Any claims of damage upon receipt must be filed with the carrier and Digitimer Limited immediately.

This warranty does not apply to any exterior appearance item of the Product which has been damaged or defaced, which has been subjected to misuse and abuse, abnormal service or handling, or which has been altered or modified in design or construction.

This warranty does not apply to any interconnection cables supplied with the Product.

This warranty does not apply if any unauthorised repairs, modifications or alterations have been made to the Product.

No sales organisations, other than Digitimer Limited itself, are authorised to make any warranties other than those described above, or to extend the duration of any warranties beyond the time period described above on the behalf of Digitimer Limited. If Digitimer Limited agrees to such a modification of this warranty, Digitimer will furnish a modified copy of this agreement, which must be presented if a claim is being made under these modified terms.

Obtaining Warranty Service

Warranty service of this Product can be obtained by returning the Product, carriage paid and insured, to Digitimer Limited, or the Distributor from whom the equipment was purchased. Prior authorisation before shipping the product is advised for the most expedient service.

Product change or discontinuation

Digitimer reserve the right to discontinue any instrument or to change its specification without notice, and without responsibility for incorporating changes in instruments already sold.

Section 2 - Hardware Overview

Tour of the Hardware

Front Panel Components

1. Power LED (Green)

The power LED is illuminated when the D360R-4 is connected to a live power supply and switched on via the rear panel On/Off switch.

2. Error LED (Amber)

Normally extinguished, the error LED provides the operator with information that can indicate a fault or communication problem. The LED normally flashes several times following Power ON and is then unlit.

If the amber LED continues to flash or starts to flash during use, then this is likely to indicate that the headstage is missing or there is a headstage communication problem, possibly due to cable damage. Please check the headstage cable for damage and confirm the headstage is correctly connected.

If the error persists, contact Digitimer or our representative for further guidance.

If the headstage is not connected OR becomes disconnected, the D360R-4 disconnects itself from the USB port. This means that the D360R-4 Client Software will reset and wait for the headstage to be re-attached.

3. Headstage Connection Socket

The headstage connection socket allows the D360R-4 headstage to be connected to the main amplifier using the supplied 2m long inter-connection cable.

Headstage Components

1. Headstage power LED (Green)

The power LED is illuminated when the D360R-4 headstage is receiving power from the main amplifier.

2. COMMON (COM) electrode input socket

1.5mm DIN42802 male socket for connection to Common electrode.

3. Pair of electrode input sockets

One of four pairs of 1.5mm DIN42802 male sockets for connection to Active (ACT) and Reference (REF) electrodes during differential recording.

4. Deblock button

Manually engages the deblock function for the duration of the button press. Used to stabilise the amplifier input after electrode placement or movement.

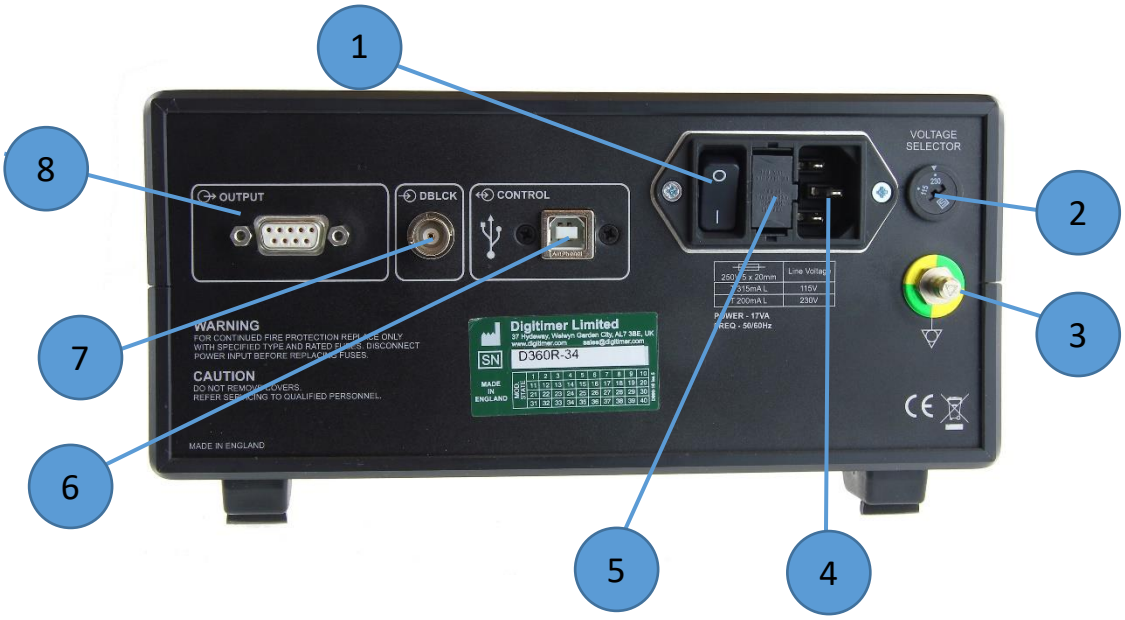
5. Amplifier connection socket

The headstage connection socket allows the D360R-4 headstage to be connected to the main amplifier using the supplied 2m long inter-connection cable.

Main Amplifier Front Panel & Headstage Printed Symbols

	Main amplifier power indicator	+	Reference electrode connection
	Caution, consult accompanying documents.	-	Active electrode connection
	Signal input connection.	COM	Common electrode connection
	Connection to D360R-4 headstage		Type BF applied part
	Consult operator documentation (this manual) before use of this equipment.		Headstage power indicator

Rear Panel Components



1. Power On/Off Switch

Two position rocker switch

2. Mains Voltage Selector

Selectable between 115V and 230V. Ensure appropriate mains fuses are fitted before powering on.

3. Potential Equalisation Connector (PEC)

Earth/Ground reference for unit and bonding point. This is to be used when the earth/ground conductor in the mains cord of all units in use cannot be relied upon or is not available.

4. Mains Inlet Socket (IEC 60320-C14)

For connection to mains socket via supplied mains cable.

5. Mains Fuse Holder

Ensure fuses are correct rating for the local voltage supply and match the voltage selector setting.

6. USB Socket

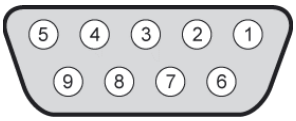
For connection to host Windows PC using supplied USB cable.

7. Deblock Input (BNC)

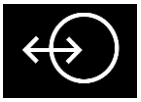
For TTL gated or triggered deblock of the amplifier.

8. Signal Output Connector

Signal output connector (female) for use with supplied 9-way "D" to 4 BNC cable.

External view of Signal Output Connector	Pin	Function
	1	Channel 1 Output
	6	Channel 2 Output
	2	Channel 3 Output
	7	Channel 4 Output
	3	Ground
	All other pins are unused	

Rear Panel Symbols

O	Off (power) - Indicates OFF position of Mains Power switch.		Equipotentiality Connector.
I	On (power) - Indicates ON position of Mains Power switch.		Input – signal input connector.
	Control Input – USB socket for connection to computer.		Digitimer is a WEEE registered manufacturer. Contact us for advice relating to disposal of this device.
	Input – Control Input		Digitimer have declared that this equipment complies with European CE marking (LVD and EMC)
	Output - signal output connector.		

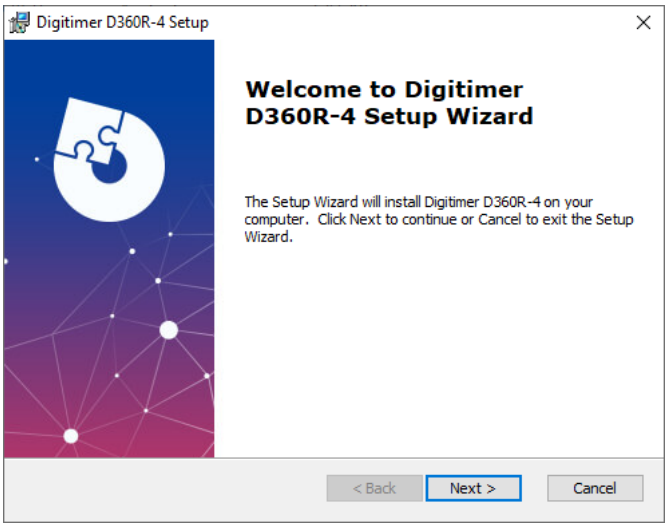
Section 3 – Software & Hardware Installation

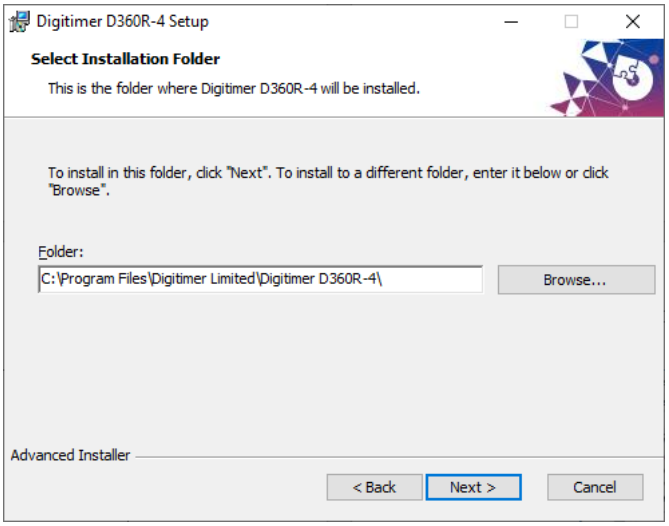
Software Installation

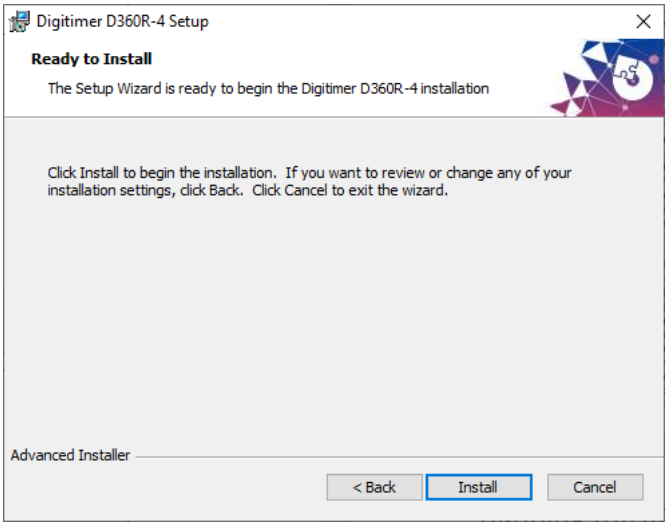
The D360R-4 Client Software provides the virtual front panel for the amplifier, allowing the operator to configure, save and recall amplifier settings and de-block the electrode inputs. The D360R-4 Amplifier will not function correctly until it is connected to a personal computer which is running the D360R-4 Client Software.

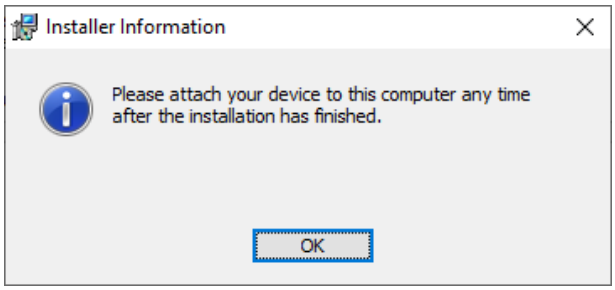
The Client Software is supplied on a USB flash drive. The latest software is also available from the Digitimer website. Digitimer periodically releases new versions of this software so it is recommended that you register your purchase so that we can advise you of future updates.

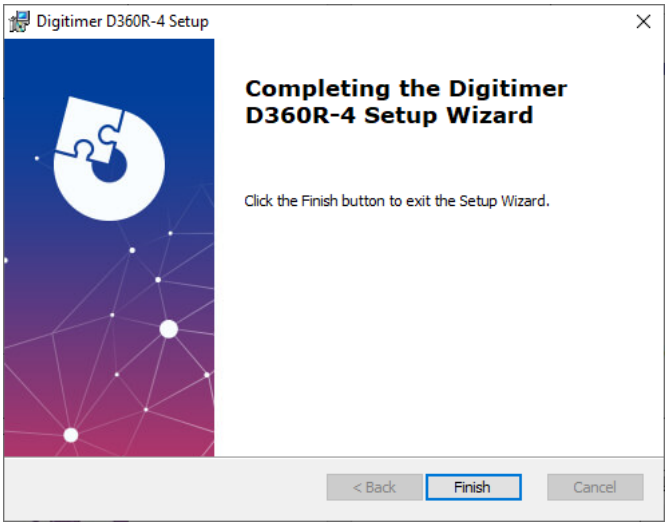
1. Insert the supplied flash drive into a spare USB port or download a copy from www.digitimer.com.
2. Browse to the external drive or download location within Windows Explorer
3. Double-click on the D30R-4 Client Software installation file to initiate installation, following the on-screen instructions illustrated below.











4. Click Finish to complete the software installation and move onto the hardware connections.

Hardware Installation

Do NOT proceed with hardware installation until the Windows Client Software has been installed on the host PC.

1. After ensuring the D360R-4 is set to the correct local voltage and the correct mains fuses are installed and the power switch is set to Off, connect the mains lead (power cord) between a power socket and the mains inlet socket on the D360R-4.

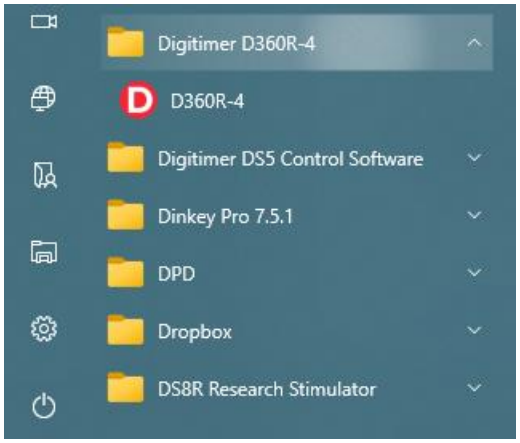
2. Connect the signal output cable between the "D" connector on the rear of the D360R-4 and the signal inputs on the data acquisition system or signal conditioner (e.g. our D400 50/60Hz Mains Noise Eliminator).

3. Connect the supplied USB cable between the D360R-4 and a spare USB port on the host computer

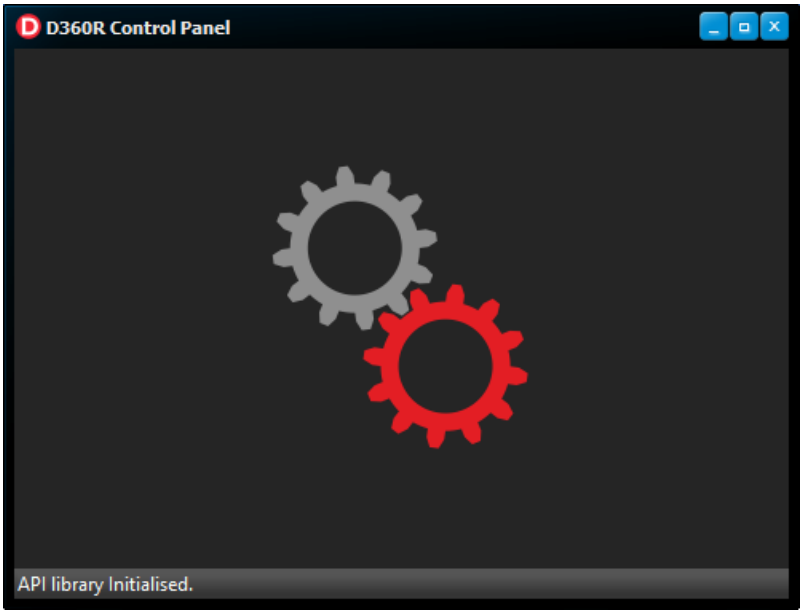
4. Moving to the front of the amplifier, connect the D360R-4 H/S headstage via the 2m long headstage connection cable. Push connect the cable between the headstage and the main amplifier, taking care to ensure the black arrow-marked key-ways are aligned with the white polarising mark on the sockets (see below). On the headstage the socket and white polarising mark is rotated 180 degrees, so it may be easier to invert the headstage during cable connection.

IMPORTANT NOTE: To remove the plug, gently pull on the outer collar of the plug as it is removed from the socket, as shown below, in order to disengage the locks and prevent damage. **NEVER** rotate or pull on the cable/other parts of the plug assembly.

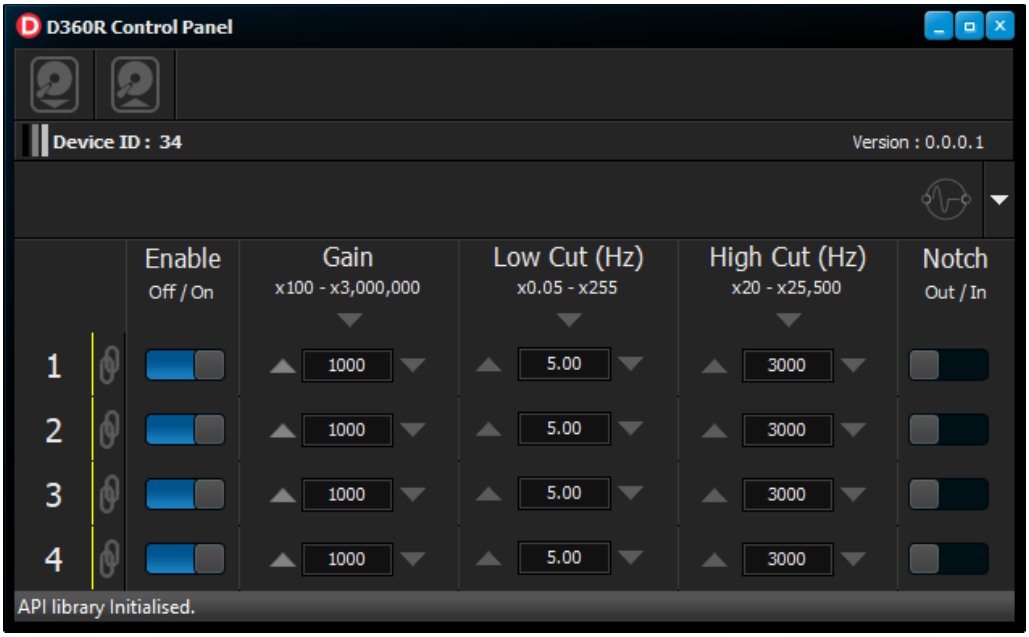
5. Once all cable connections have been made, power On the D360R-4 using the switch on the rear panel of the main amplifier.
6. To run the software, locate and click on the D360R-4 entry in the Windows Start Menu or double-click on the desktop shortcut.



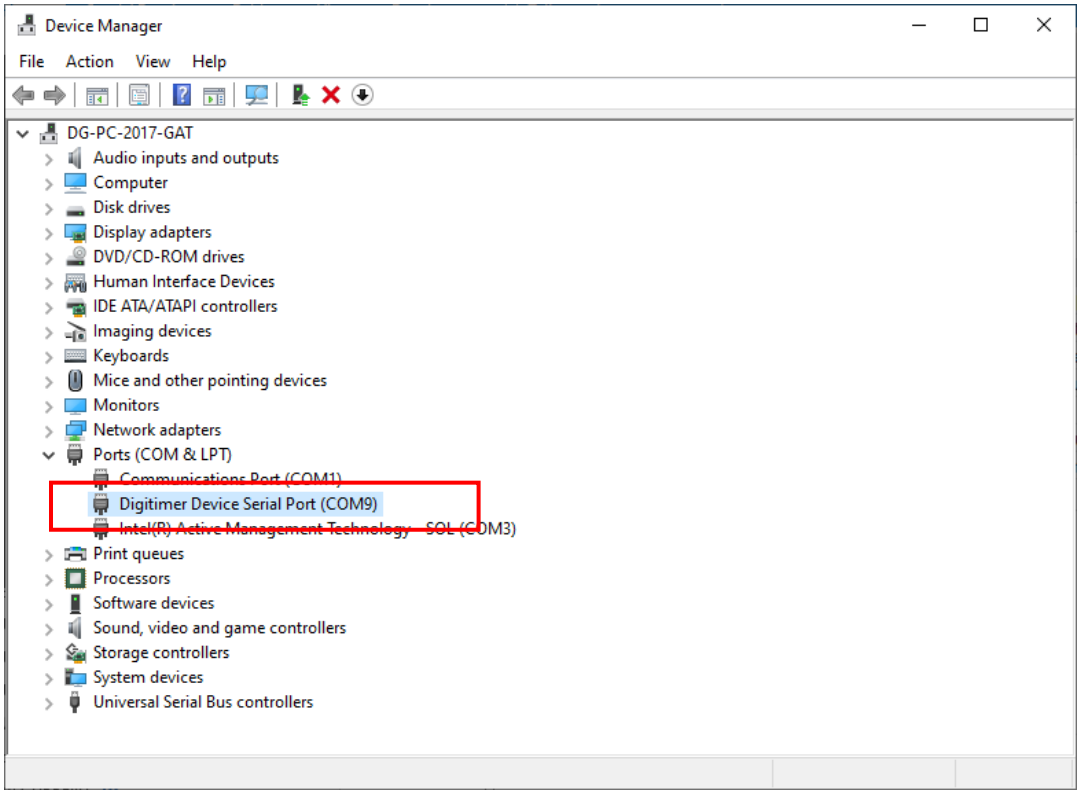
7. The D360R-4 Client Software should start, initially showing the "spinning gears" screen below.



8. Once a D360R-4 is detected and communication with the host PC established, the Control Panel should become populated with the settings of the connected amplifier(s).

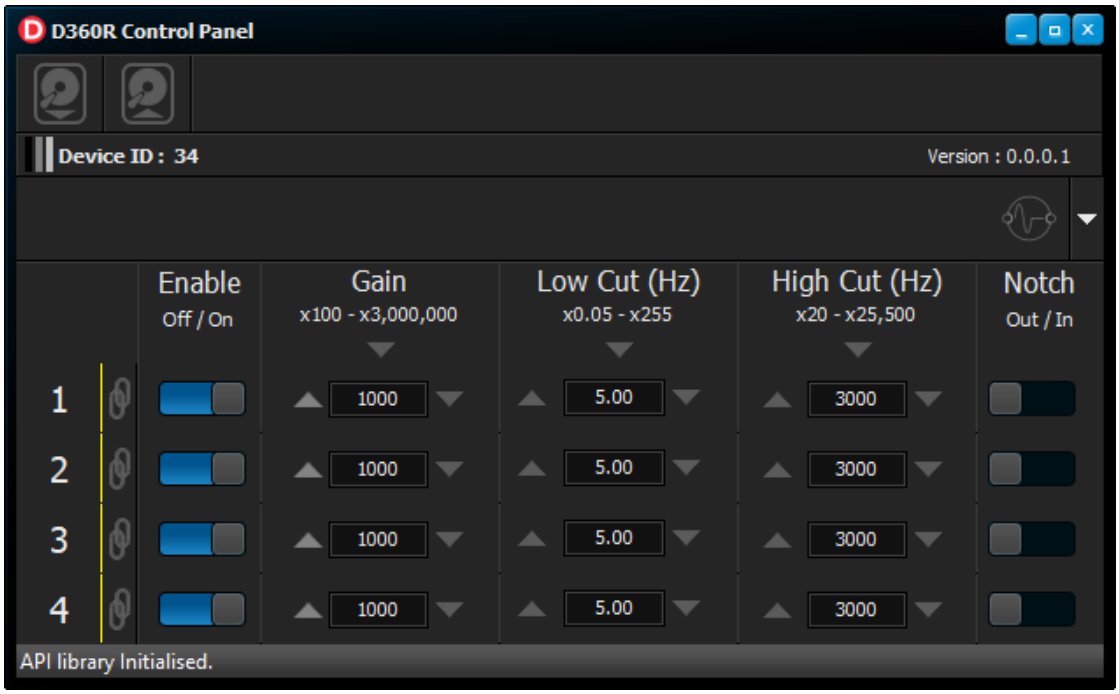


9. If the amplifier front panel does not load, check the power/error LEDs, cable connections and try an alternative USB port.
10. Correct installation of the D360R-4 may be confirmed by examining the device entry in Windows Device Manager, where it should be listed under Ports as a "Digitimer Device Serial Port" (see below).



11. For any unresolved installation problems, please contact Digitimer or our local representative for guidance. Please supply information relating to device serial number, software version and the operating system.

Section 4 – Navigating the D360R-4 Control Software



Overview

The D360R-4 Client Software is a virtual front panel for the D360R-4 amplifier and provides the operator with control over the amplifier settings. The features of the D360R-4 Control Panel are detailed within this section.

Near the top of the Control Panel, the Device ID (serial number) is given along with the version of the Client Software. Below are the controls for that device.

If more than one D360R-4 is connected to the same host PC, each Device ID and settings will be displayed.

The D360R-4 features persistent settings, which means they remain the same when the amplifier is powered off and back on again.

D360R-4 Control Panel

Channel Enable/Disable Switches

Associated with each channel is a slider switch, which turns individual channels On or Off.

In the screenshot opposite, the upper channel is turned On, while the lower channel is Off.

It is important to turn off any unused channels, as open circuit electrode inputs can introduce interference into active channels.

Channel Linking

Channel linking allows multiple channels to share gain and filter settings settings.

Clicking on the "link" icon associated with more than one channel links the settings for those channels.

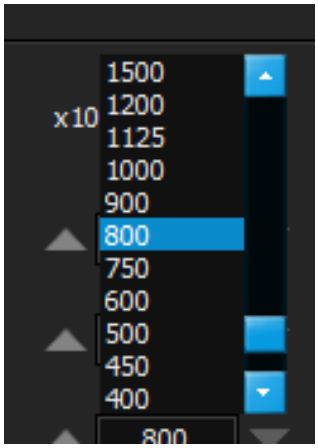
Note that the settings of the last channel to be linked will determine the settings of the linked group.

Clicking on the link icon again will unlink that channel from the group. Linked channels are hi-lighted by a yellow link icon.

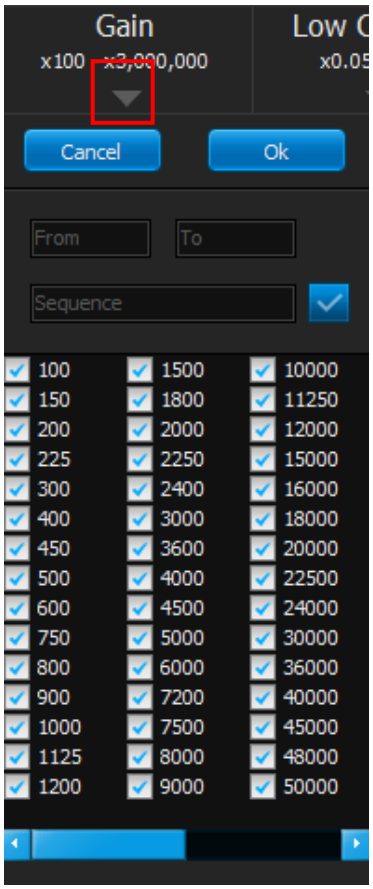
Gain Settings

The D360R-4 provides the operator with multiple methods for adjusting the amplifier gain and also allows the list of available gains to be customized.

The gain of each channel is adjustable from x100 to x3,000,000. Gain is adjusted incrementally using up and down arrows on either side of the current value.



Clicking on the numerical gain setting value, opens a drop-down list of "favourite" gain options, allowing a specific gain value to be selected more easily.



Clicking on the downward pointing arrow located immediately below the Gain header, opens the menu opposite. Here, the operator can select or deselect particular gain settings or even specify sequences of gains over a particular range.

For instance by selecting a range of 100 to 5000 and a sequence of the format 1,3,5,9 and clicking the blue tick icon, results in gains of 100, 300, 500, 900, 1000, 3000, 5000 being added to the favourites.

Note that favourite gains will now populate the dropdown list when the operator clicks on the current gain setting value.

Favourite gains are globally available and will appear under all channels for that amplifier.

Low Cut Filter Settings

The Low Cut filter (2nd order Butterworth) setting for each channel is adjustable between 0.05Hz and 255Hz.

As with the amplifier gain, the filter settings can be adjusted incrementally or selected from the dropdown list of pre-selected favourites.

High Cut Filter Settings

The High Cut filter (2nd order Butterworth) setting for each channel is adjustable between 20Hz and 25,500Hz.

As with the amplifier gain, the filter settings can be adjusted incrementally or selected from the dropdown list of pre-selected favourites.

Notch Filter Settings

The D360R-4 has a built in notch filter which is intended for removal of 50Hz or 60Hz mains noise from signals of interest.

The notch filter is enabled using a slider switch associated with each channel.

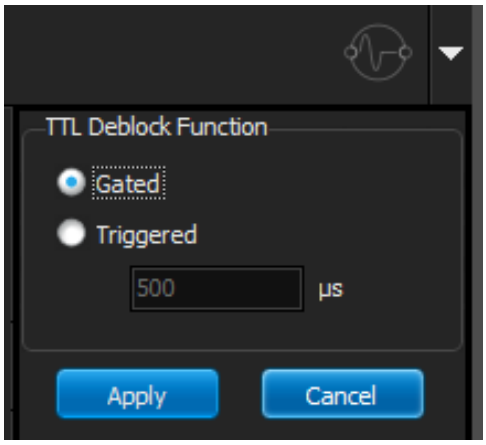
Note that amplifiers automatically set the notch to 50Hz or 60Hz depending on the local mains supply frequency.

If active mains noise removal methods, such as our D400 Multi-channel 50/60Hz Noise Eliminator are used, we recommend that the notch filter is not used.

Deblock Control

The deblock function rapidly removes excessive DC from the low pass series capacitors which in certain situations could block the signal of interest.

Such DC offsets may result from electrode placement/movement or electrical/magnetic stimulation pulses. TTL controlled deblock has been successfully employed to allow more rapid recovery from TMS pulses, in order to visualise short latency responses.



The deblock can be applied using three methods:-

1. Manually – pressing the DEBLOCK button on the headstage.
2. Mouse click or click and hold on the de-block icon within the software.

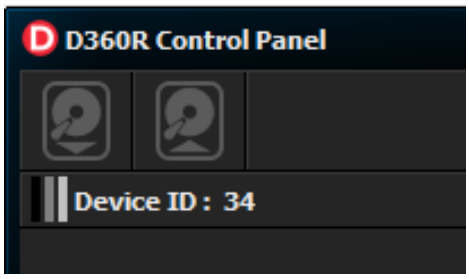
The amplifier is deblocked for the duration of the hardware button or mouse button press.

3. Using a precise TTL sync pulse connected to an input BNC on the rear panel. There are two modes:-

    - Gated On by duration of incoming TTL pulse.
    - Timed (100us – 10000us in 100us steps), triggering on rising edge of TTL BNC Input

TTL deblock settings are accessed by clicking on the downward arrow to the right of the deblock icon within the software.

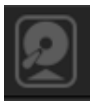
Loading and Saving Protocol Settings



The D360R-4 allows operators to save and recall amplifier settings which may be assigned to particular recording protocols.

Two icons located in the top left corner of the Control Panel may be used to Load or Save protocols.

A 30 character descriptive comment box is associated with saved protocols to aid identification.

	Load a previously saved protocol.
	Save current settings.

D360R-4 API Programmer's References

The D360R-4 Client Software includes an API that allows third party software to interface with and control the amplifier settings. Further documentation on this feature will be added to this section in due course.

Section 5 – Using the D360R-4 Amplifier

Introduction

The operator should now be familiar with the hardware connections necessary to attach the D360R-4 to the host computer/acquisition system and have an understanding of the D360R-4 Client Software. It is now appropriate to consider the steps required when preparing to make the first recordings.

These simple technical instructions relate to how the D360R-4 system is set up and do not replace appropriate training in clinical neurophysiological recording techniques. Any potential operators who are unfamiliar with such methodology should seek professional training before using the D360R-4.

Considerations for Use

Preparing the D360R-4 for Use

1. The operator should conduct a visual inspection of the D360R-4 and any associated hardware, in order to confirm that there is no damage to the equipment, which may cause an equipment failure or safety hazard.
2. The cable connections between the host computer, the D360R-4 and other system components should be checked.
3. The D360R-4 should be switched on at the mains socket and on the rear panel switch. The D360R-4 should be allowed to warm up for one hour before use. This stabilises the internal electronics and ensures drift-free recordings.
4. The D360R-4 Client Software should be started on the host computer.
5. Once the Client Software locates a D360R-4, the program should display information about the amplifier(s) connected to the host computer. If the software reports that a D360R-4 cannot be found, all connections and power switches should be double-checked. The software should automatically locate the D360R-4 once any necessary changes are made.

6. When the operator is satisfied that the amplifier is functioning correctly, the amplifier settings can be modified from within the software. If required, the settings can be loaded or stored for later recall.
7. The operator can now proceed to prepare the subject/recordings site(s) and connect the recording and common electrodes to the subject.

Electrode Selection

The D360R-4 Amplifier is a general purpose amplifier suitable for a range of applications, including electromyography (EMG), electroencephalography (EEG) and evoked potential (EP) recordings. The operator of the D360R-4 should ensure that electrodes are chosen which are suitable for the anatomical location and type of recordings being made. It is also advisable for all electrodes to be made from the same material, as large differences in electrode potentials can cause problems.

If in doubt, the D360R-4 operator should consult with electrode manufacturers/suppliers in order to identify the correct choice.

Skin Preparation

In order to lower the skin/electrode impedance, it is advisable to thoroughly clean the skin prior to undertaking neurophysiological recordings. Various commercial wipes, pastes and gels are available e.g. Weaver Nuprep, for removing surface contaminants, grease and the outer layers of skin, which can all contribute to poor signal to noise ratios.

Electrode Lead Routing

Electrode lead routing can also make a difference to the quality of the recordings. Lead wires should be as short as practically possible, be plaited together and where there is excess cable, loosely coiled near the headstage. Electrode leads should also be as static as possible, as movement artefacts will reduce signal quality. Avoid routing electrode leads near electrical cables or stimulation leads.

D360R-4 Shutdown Procedure

Once a study is complete, the subject should be disconnected from the amplifier either by removal of the electrodes or by unplugging the electrode leads from amplifier. The D360R-4 can then be switched off using the rear panel power switch. The D360R-4 Client Software will continue to run until the operator exits from the program according to the instructions in the previous chapter.

Troubleshooting

Please contact Digitimer or your local representative if you have any problems that cannot be solved by consulting this manual.

Bibliography

The D360R-4 is a new product, so at this time we do not have a bibliography for it. Please let us know if you publish any papers using the D360R-4 and if possible please send us a copy. We will be happy to add papers to this list.

When citing the D360R-4 amplifier in your papers please use the following text:-

D360R-4 4-Channel Isolated Amplifier/Filter (Digitimer Ltd, Welwyn Garden City, UK)

User Notes

Please use this space to add any notes relating to use of the D360R-4

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Welwyn Garden City
AL7 3BE
UK
Web: www.digitimer.com
Email: sales@digitimer.com

File Reference: N:\Docs\Company\Manuals\D360R-4\D360R-4-MAN_v2.docx

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