

Digitimer

D501

Isolated Temperature Monitor



OPERATOR'S MANUAL

CE

For Research Use Only

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Product Registration

Please take time to register your new product.

You can even do it online at:-

www.digitimer.com/register

Contact Addresses

Manufacturer

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Please contact Digitimer for information regarding representation in other countries.

Product Registration

For a speedy response to all your questions now and in the future, please take time to register your new D501 Isolated Temperature Monitor at www.digitimer.com/register now! Product registration permits us to advise you quickly of any safety matters or new product information. This web address is your point of contact for all questions regarding the D501. 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 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 online 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.

Regulatory Information

The D501 is compliant with the following standards:-

- IEC 61010-1:2010+AMD1:2016 : Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.
- IEC 61000-6-2:2016, EMC : Generic standards – Immunity for Industrial Environments.
- IEC 61000-6-4:2018, EMC : Generic standards – Emission standard for Industrial Environments.

Device Safety

Although the D501 is NOT certified to any standards within IEC 60601, it has been designed to meet the following:-

- IEC 60601-1 Section 8 : Protection against electrical HAZARDS from ME EQUIPMENT (where applicable).

Excluding:-

- 8.5.2.3 – The thermistor is fitted with a ¼” plug with exposed conductors, however, the thermistor provides >10kV dielectric isolation between the contacts and the subject.
- 8.5.5 – The device has not been designed to be defibrillator proof.
- 8.6 – The equipment has been designed for connection to information technology equipment (ITE).

Introduction & Intended Use

The **Digitimer D501 Isolated Temperature Monitor** allows continuous monitoring of temperatures during human or animal physiological research. Featuring USB power and digital temperature data transfer to a Windows PC, the D501 also has a large backlit LCD screen allowing visual monitoring of temperature. The D501 is supplied with a USB cable and a compact, 5mm diameter, cable-mounted disc thermistor (part code D501-PROBE). This thermistor is easily attached to the skin, either using micropore tape or by placing it under the non-conductive portion of a self-adhesive electrode.

The D501 was originally developed to allow researchers to record human skin temperature during neurophysiological studies including examinations of muscle and nerve excitability, specifically when using QtracW threshold tracking software.

Data obtained from physiological studies can be highly temperature dependent, and because a QtracW protocol can take 10-15 minutes to complete, differences in subject temperature or changes during a protocol can greatly influence experimental results. By recording skin temperature alongside excitability measurements, temperature differences/changes can potentially be controlled for, or at least checked for significant deviation during a recording.

Recent enhancements to the QtracW software mean the Digitimer D501 is identified as soon as it is connected to the host PC and temperatures may be recorded throughout an experimental protocol, with no user intervention beyond placement of the thermistor on the subject.

The ability to continuously record temperature alongside excitability data also means that research studies specifically investigating the effect of cooling or heating on axonal excitability are more readily accomplished.

Built-in isolation to medical device standards ensures that it is safe to use in human research studies, however, the D501 is NOT a medical device and is intended and marketed specifically for research applications including those involving human subjects.

Although the D501 has been developed for use with QtracW software, it is easily incorporated into other applications where continuous temperature monitoring is required in a safe, electrically isolated manner. Please contact Digitimer if you have an interest in doing this.

Unpacking your D501 Isolated Temperature Monitor

Your D501 was delivered in packaging intended to protect it against damage in shipment. It would be advisable to keep this material in case you need to relocate or return your D501 to Digitimer for repair in the future.

Carefully unpack the D501 and accessories, inspecting each for any transit damage as you do so. Please immediately report any damage to Digitimer or your supplier.

Supplied Accessories

The D501 Isolated Temperature Monitor is supplied with the following accessories:-

- One compact 5mm x 3mm disc thermistor probe (part code D501-PROBE).



- One USB-A to USB-B cable, length 1.5m.



Cleaning, Maintenance & Servicing

D501 Main Unit Cleaning

If the D501 requires cleaning, it should be unplugged from the computer and wiped with a damp cloth. We expect standard hospital-grade antiseptic equipment wipes to be suitable for cleaning, but recommend testing on small areas before cleaning the whole device.

D501 Thermistor Probe Cleaning/Disinfection

The D501 Thermistor probe may be disinfected and sanitized by washing in 3% hydrogen peroxide or 70% isopropanol. 70% ethanol is nearly as effective, but 100% alcohols are less germicidal. Dakin’s solution (sodium hypochlorite in neutral buffer) is also suitable. Brief immersion of the probe in detergent solutions is not harmful. Activated dialdehyde solutions, such as Cidex, are also effective. Probe plugs and connectors should not be immersed. The thermistor probes are NOT suitable for boiling, autoclaving or EtO sterilisation.

During cleaning the probe should be handled gently. When wiping clean, hold the probe in one hand at the sensing tip and wipe the probe and lead wire toward the plug end. Excessive pressure could stretch the covering and break the internal wires, which would destroy the probe.

Maintenance & Recalibration

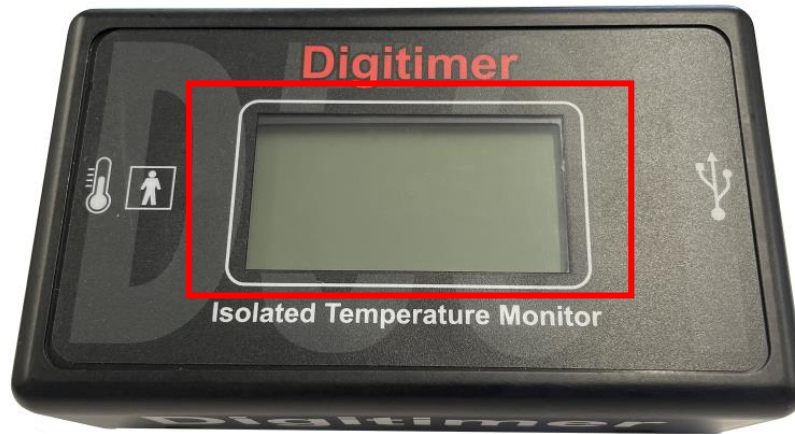
There is no requirement for ongoing preventative maintenance or re-calibration, but before each use, the D501, thermistor probe and USB cable should be inspected for damage.

Digitimer can provide a routine back-to-base recalibration service if there is a perceived requirement.

Servicing

Damaged thermistor probes or USB cables are not repairable. If the D501 itself develops a fault or is damaged, it may be repairable by return to Digitimer Limited. For all servicing or support requirements please contact Digitimer or our local representative, who can advise on best course of action.

Hardware & Connections Overview



Front Panel View

LCD Screen – displays the temperature or other information icons



Left Side Panel View







Thermistor Probe Connection Socket



Right Side Panel View

USB-B (PC) Connection Socket

D501 Front Panel Labelling & On-screen Warning Icons

D501 Front Panel Labelling	
	Thermistor Probe Connection Socket (isolated).
	USB Type B socket for power and data connection to host PC via supplied USB cable.
On-screen Warning Icons	
	<p>Thermistor Not Detected</p> <p>Check thermistor probe is connected. If the error persists, consider replacing the probe, as this error may indicate a fault with the probe or its connection cable.</p>
	<p>Upper Temperature Limit Exceeded</p> <p>The measured temperature has exceeded the upper calibration limit of 50°C and a reliable temperature value cannot be displayed. The D501 only operates between 0°C and 50°C.</p>
	<p>Lower Temperature Limit Exceeded</p> <p>The measured temperature has dropped below the lower calibration limit of 0°C and a reliable temperature value cannot be displayed. The D501 only operates between 0°C and 50°C.</p>
	<p>Calibration Data Corruption</p> <p>Power cycle once (unplug and reconnect USB cable) and if the error persists contact Digitimer to request a repair as this error indicates an unrecoverable data corruption error.</p>

Specifications

Connections

Input	¼” jack socket (for thermistor probe connection)
Output	USB-B (for host PC connection)

Display 50mm x 25mm backlit LCD

Displayed Temperature 0°C to 50°C, in 0.1°C increments.

Accuracy ±0.1°C.

Safety

Designed to meet:-

- IEC 60601-1 Section 8 : Protection against electrical HAZARDS from ME EQUIPMENT (where applicable)

Excluding:-

- 8.5.2.3 – The thermistor is fitted with a ¼” plug with exposed conductors, however, the thermistor provides >10kV dielectric isolation between the contacts and the subject.
- 8.5.5 – The device has not been designed to be defibrillator proof.
- 8.6 – The equipment has been designed for connection to information technology equipment (ITE).

Weight 425g (main unit)

Dimensions 122mm (W) x 40mm (H) x 75mm (D) (excluding feet)

Installation

Hardware Connection

When connected to a Windows PC, the D501 is automatically detected and there is no requirement for any additional software or drivers to be installed.

1. Connect the supplied thermistor probe (D501-PROBE) to the $\frac{1}{4}$ " socket on the left side of the D501. Ensure the plug is fully inserted as shown below.



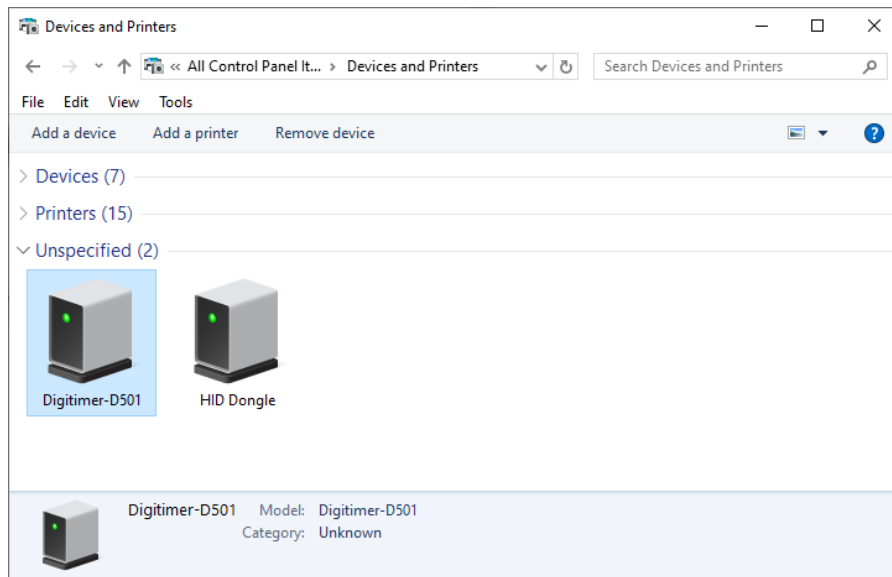
2. Connect the USB-B end of the supplied USB cable to the USB-B socket on the right of the D501 and the other end to a standard USB-A port on your Windows PC. Ensure the plug is fully inserted as shown below.



3. Confirm successful connection by checking the LCD screen is illuminated and displaying a temperature value, which changes when the thermistor is warmed.



4. If the LCD screen fails to illuminate and remains blank, this may indicate that the D501 is not receiving adequate power. Check the PC is powered ON and try a different USB port or an externally powered USB hub.
5. Once the D501 is connected and displaying a temperature, you can verify successful installation via Windows “Control Panel” under “Devices and Printers”, where the Digitimer D501 is listed in the “Unspecified” section.



6. If required the status of the D501 hardware and drivers can be interrogated, by right-clicking and selecting “Properties”, as with any third-party hardware connected to a Windows PC.

Thermistor Probe Placement

The method of fixation is primarily determined by the location of the measurement site, but generally speaking and for the purposes of measuring human skin temperatures, the thermistor may be easily attached to the subject with strips of microporous surgical tape.

When studying axonal excitability the thermistor may be placed under the non-conductive outside edge of a self-adhesive stimulating electrode (cathode), as illustrated below. This allows the temperature to be measured as closely as possible to the nerve of interest.







Application Specific Guidance

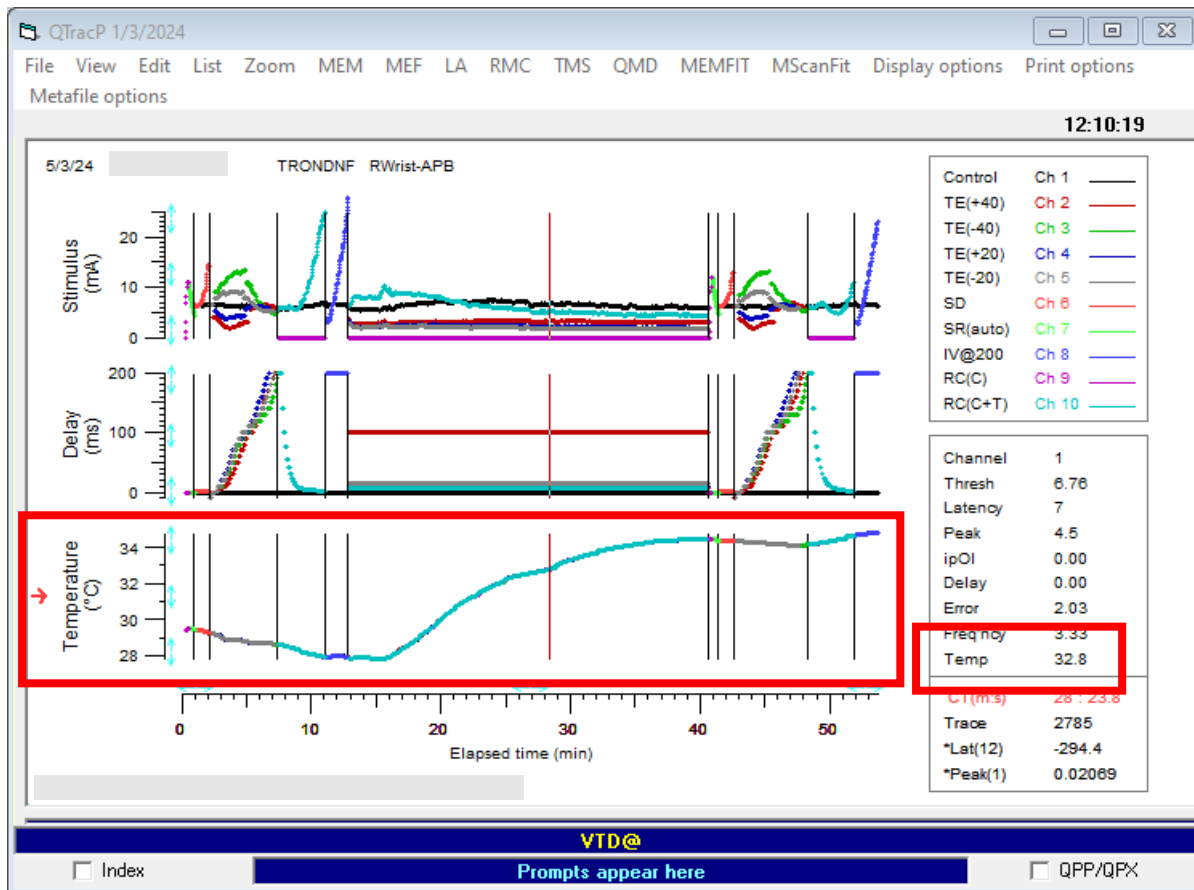
Using the D501 with QtracW Software

If you intend to use the D501 with the QtracW threshold tracking software, recent versions of the QtracS program will automatically recognise connection of the D501 and display the temperature in °C.

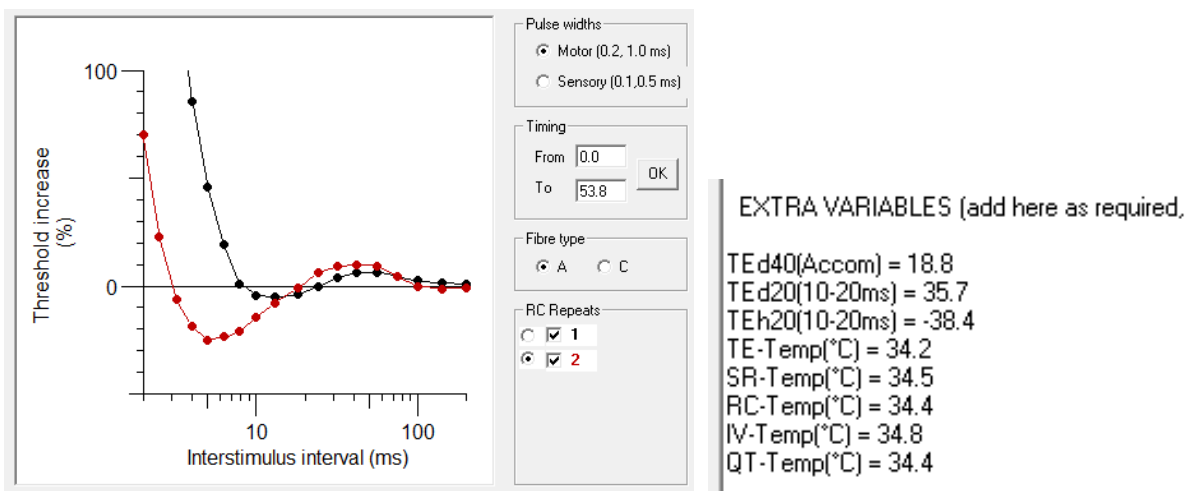
For situations where a temperature is not displayed in QtracS, the table below illustrates the relationship between the D501 display icons and the QtracS temperature field text.

Event	“Temp” field in QtracS	D501 Display Icon	Effect on data
D501 is not connected to the PC	???	<i>Not Applicable</i>	No temperature data
Thermistor not detected/unplugged	Probe?		Data points will be missed
Calibration Error	Cal.Err.		Data points will be missed
Temperature < 0°C	< 0°C		Data points will be clamped to 0°C
Temperature > 50°C	> 50°C		Data points will be clamped to 50°C

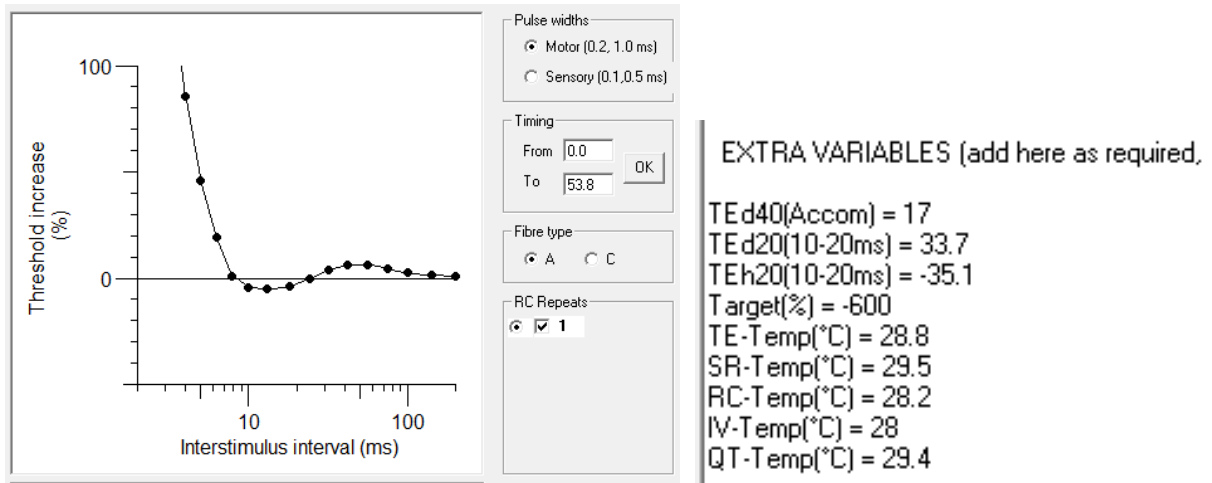
Temperature values are sampled throughout standard QtracS protocols, and stored alongside electrophysiological data. The example below, kindly provided by Prof. Martin Koltzenburg (University College London), illustrates the effect of subject warming on consecutive TROND recordings.



The temperature is plotted against elapsed time by V..@, and the temperature at a specific time by Temp at the bottom of the second data box on the right. Clicking on ‘MEM/Create MEM file’ compares the two recordings, e.g.:



By default, the latest of the two repeats is used for the MEM file, which has the temperatures of the different protocols added as EXTRA VARIABLES, as shown. To confine analysis to the first TROND recording, you can now simply limit the display to the first with e.g. in this case DE20, then:



N.B. The times at which the temperatures were recorded are given with the relevant waveform data, e.g. in this case: RECOVERY CYCLE DATA (7.5-11.1m)

For more detailed instructions relating to how temperature records may be visualised or plotted within QtracS and QtracP, please consult the QtracW documentation.

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.

Thermistor probes carry a one year warranty on workmanship and components. Damage through misuse and tampering is not covered. Probe life will vary from a few months to many years depending mainly on the amount of cable flexing. Normal life exceeds one year.

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 USB 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.

References

The D501 Isolated Temperature Monitor is a new product so we don’t have any publications that cite its use, however the following are extremely relevant to the D501 and its use in excitability recordings.

- Kiernan MC, Cikurel K, Bostock H. (2001) Effects of temperature on the excitability properties of human motor axons. *Brain* 124, 816-825.
- Kovalchuk MO, Franssen H, Scheijmans FEV, van Schelven LJ, van den Berg, LH, Sleutjes BTHM. (2019) Warming nerves for excitability testing. *Muscle Nerve* 60, 279-285.
- Tomlinson S, Burke D, Hanna M, Koltzenburg M & Bostock H. (2010). In vivo assessment of HCN channel current (I(h)) in human motor axons. *Muscle Nerve* 41, 247-56.

If you do publish research that makes use of the D501, please refer to it as the “D501 Isolated Temperature Monitor (Digitimer Ltd, Welwyn Garden City, UK)”.

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