Megger

TDR2000/3 - TDR2000/3P - CFL535G
TDR2010 - TDR2050

Time Domain Reflectometers

User Guide

For all units released after 2014. If your instrument differs significantly from this guide then please use the guide supplied with your instrument or call technical services for advice.

Contents

1. Safety Warnings and Battery Information

Safety warnings must be observed during use

NOTE - THE INSTRUMENT MUST ONLY BE USED BY SUITABLY TRAINED AND COMPETENT PERSONS

Users of this equipment and/or their employers are reminded that National Health and Safety Legislation requires them to carry out valid risk assessments of all works so as to identify potential sources of danger and risk.

Please refer to the full list of safety warnings for further information. This was supplied in the box your instrument arrived in or can also be found on the support CD and is downloadable.

CAT II

Measurement category II: Equipment connected between the electrical outlets and the user's equipment.

CAT III

Measurement category III: Equipment connected between the distribution panel and the electrical outlets.

CAT IV

Measurement category IV: Equipment connected between the origin of the low-voltage mains supply and the distribution panel.

Measurement equipment may be safely connected to circuits at the marked rating or lower.

1.1 Battery information

This instrument runs on a Lithium Ion battery which should be maintained to maximise health, reliability and longevity. There are a few simple things that you can do to help maintain your battery health and power potential.

1. **Allow your battery to charge fully before using the instrument.** Fully charging the battery before use will ensure it can perform at peak performance and make maintaining performance easier.
2. **Keep your battery charged up whenever possible while in use.** A Li-Ion battery prefers frequent top-ups and should never be left in a flat state for extended periods as this can cause permanent damage.
3. **Maintain a charge during storage.** If your battery is to be stored for extended periods maintain a charge of 40%, allowing for some discharge and maintaining the protection circuit.
4. **Store your battery in a cool, dry place.** Li-ion batteries can get stressed when exposed to heat which can reduce its life. Do not store above 30°C (86°F) for extended periods.

1.2 WEEE Directive

The crossed out wheeled bin symbol placed on Megger products is a reminder not to dispose of the product at the end of its life with general waste.

Megger is registered in the UK as a Producer of Electrical and Electronic Equipment. The Registration No is WEE/HE0146QT.

1.3 Battery disposal

The crossed out wheeled bin symbol placed on the batteries is a reminder not to dispose of them with general waste at the end of their life.

This product contains the following batteries Li-ion rechargeable battery.

They are located under the battery cover at the rear of the instrument.

They can be safely removed by following the instructions in the battery replacement section of this guide.

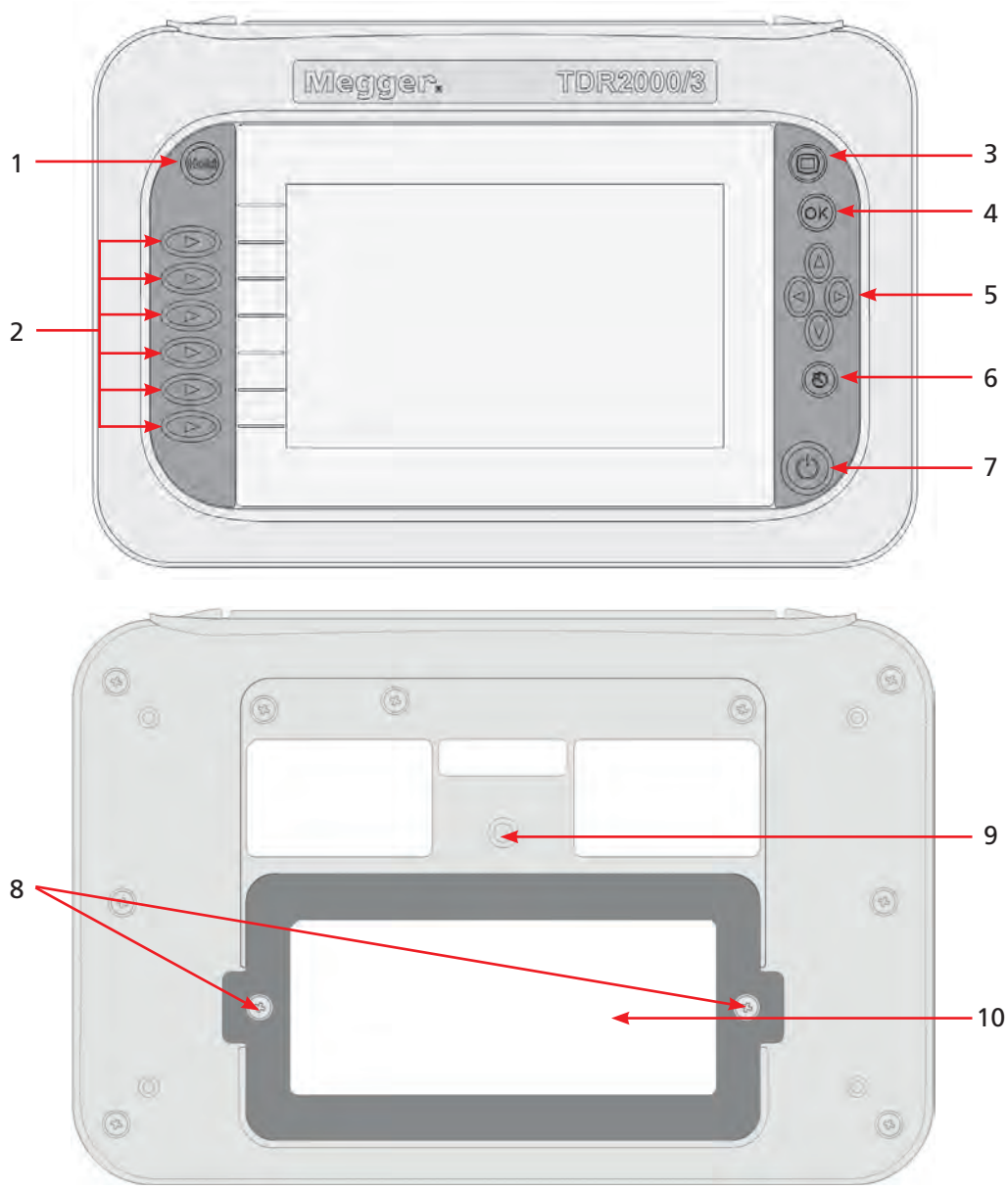
Spent Li-ion batteries packs are classified as Industrial Batteries. For disposal in the UK contact. For disposal of batteries in other parts of the EU contact your local branch or distributor.

Megger is registered in the UK as a producer of batteries.

The Registration number is BPRN00142.

Icon	Description
	Caution: refer to User Guide
	Equipment complies with current UKCA directives
	Equipment complies with current EU directives
	Equipment complies with current “C tick” requirements
	Do not dispose of in the normal Waste stream

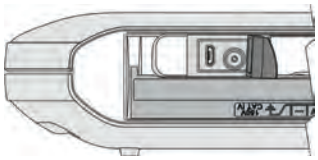
2. Features



Item	Description	Item	Description
1	Hold	6	Back
2	Selection	7	Standby
3	Mode	8	Battery Access
4	Accept	9	Standard tripod mount
5	Navigation	10	Battery

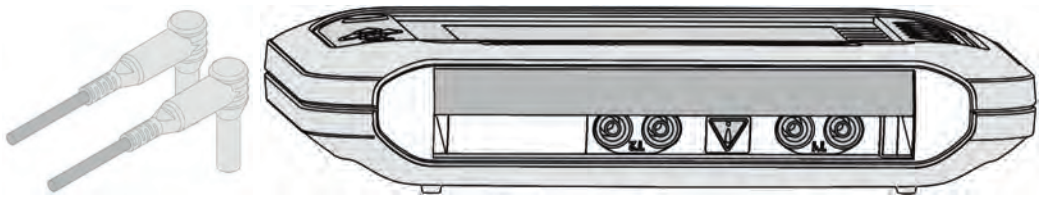
3. Connectivity

Used for PC connectivity.

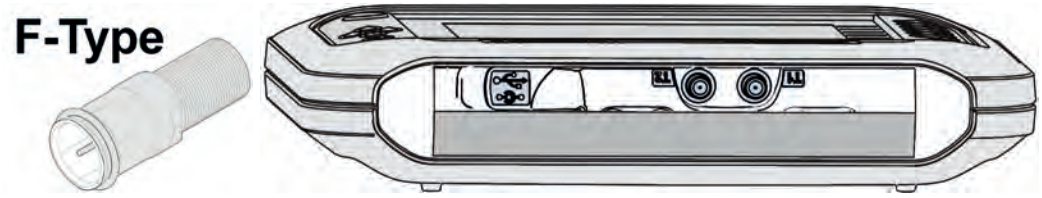


Lift cover for access – avoid stressing.

Power lead dependant on region.



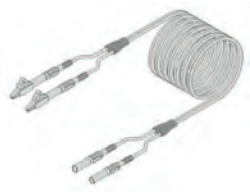
The main connectivity is made via standard 4 mm test leads plugged into the dual channel ports.



Using the supplied adapter, connectivity can also be made to the dual F-type ports. Other standard push-on adapters also fit.

Not available on TDR2050.

4. Accessories



6231-652

Single miniature clip lead set 4mm

1002-015

Split conductor single Fused test leads (1 pair)

1002-136

Split conductor dual Fused test leads (2 pair)

6231-655

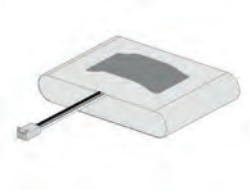
Bed of Nails Test Leads (1 Pair)

6231-653

Bed of Nails Test Leads (2 Pairs)

1003-352

Mains Charger

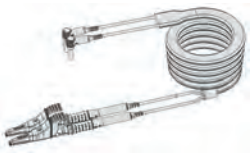


1002-552

Replacement Battery

1003-218

Terminal adaptor kit



1006-511

Retractable sheath fused test lead

(1 pair)

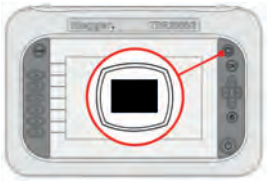
5. Mounting Possibilities

There are various mounting and carrying options for the TDR2000 series to ensure the user can position their instrument securely and efficiently.

6. Mode

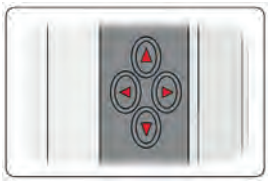
The TDR2000 series can be set up to work for several different applications. This will allow the user to specify how the instrument receives, processes and displays test readings. The testing options for each mode are shown on the line adjacent to the icon for the specific mode.

6.1 Selecting Mode



Change mode

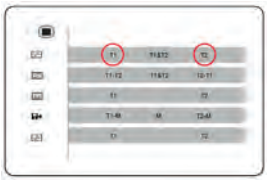
Press to select



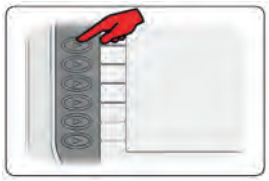
Use cursor keys

6.2 Choosing a mode

Single Channel mode

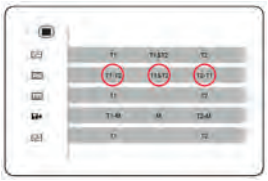


Choose T1 or T2

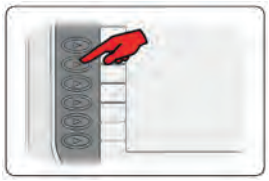


Press key indicated to change

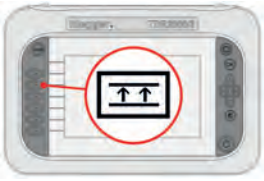
Dual Channel mode

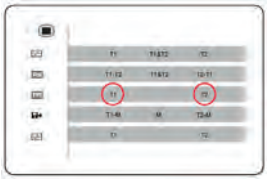


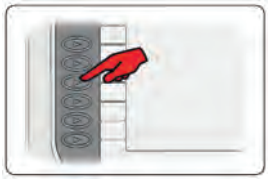
Choose T1-T2, T2-T1, T1&T2

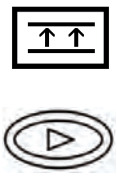


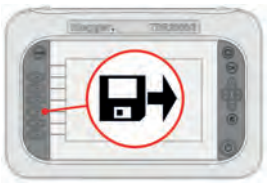
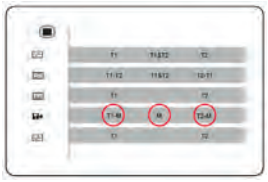
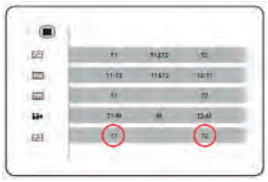
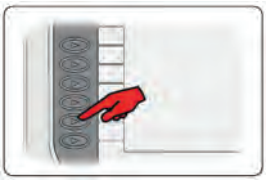
Press key indicated to change







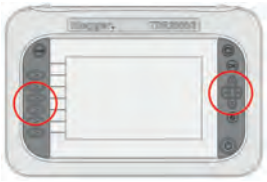


Crosstalk	Choose T1 or T2	Press key indicated to change
 Load saved trace	 Choose T1-M, T2-M, M	 Press key indicated to change
 Intermittent mode	 Choose T1 or T2	 Press key indicated to change

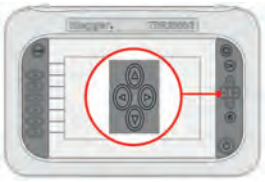
7. General

General functions are available from the main screen and be accessed using the left and right navigation keys and appropriate selection buttons.

The instrument is also able to save and preview traces, enabling the user to maintain a database of information for downloading to a PC to create reports or to use in other custom applications.

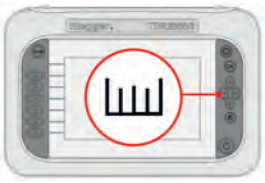


Navigation



Use cursor keys

Use soft keys to select



Range

10 m min to 20 km max in 11 steps (30 - 60,000 ft)

The currently selected range is shown at top right of the screen

7.1 Operational state

The current operational state is shown at the top left of the screen and identifies the current operational setting for the chosen screen. Icons displayed are specific to the function.

Current operational state. Currently in Manual operation

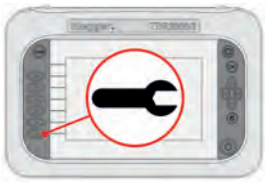
Current operational state. Currently in Setup operation

Change current state using the appropriate button

8. Setup

The user has the ability to change various settings for the live trace ranging from the velocity factor to the gain applied to the trace. These settings can be accessed via the setup icon.

8.1 Accessing Setup



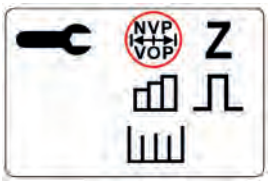
Press to select

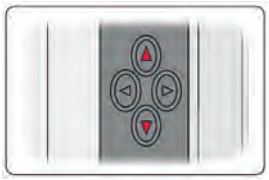
Automatic mode

Manual mode

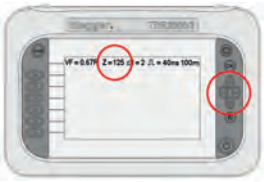
8.2 Adjusting the Setup Options

Velocity Factor

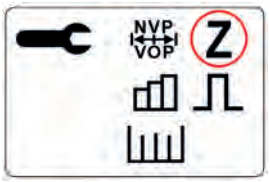


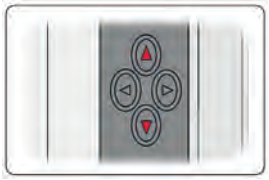


Use the up and down cursors to set the Velocity Factor to match the cable under test.



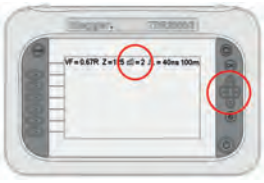
Impedance



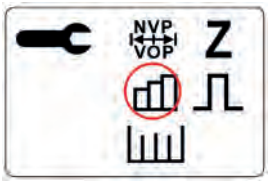


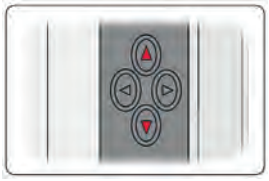
Use the up and down cursors to adjust the impedance for the cable under test.

*Only available in manual operation (see page 13).



Gain

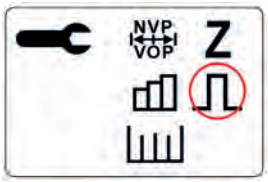


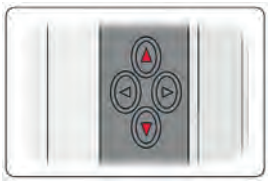


Use the up and down cursors to alter the gain to adjust visible disturbances on trace.

*Only available in manual operation (see page 13).

Pulse width

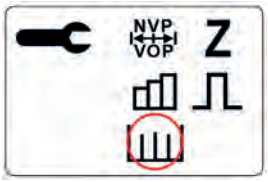


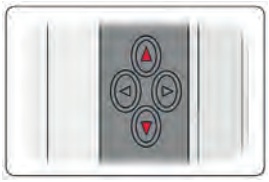


Use the up and down cursors to change the instrument pulse width.

*Only available in manual operation (see page 13).

Cable Range



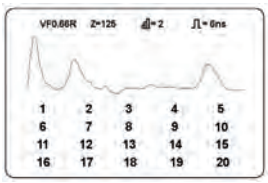


Use the up and down cursors to change the length of the cable under test.

8.3 Saving Current Trace

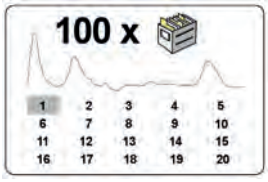
Save

Preview



Selected trace displayed

Manage Memory



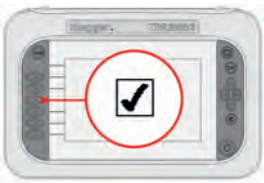
Use cursor keys

Selecting the tick saves the results to the selected memory location and the bin deletes the result from the selected memory location

9. Trace tagging

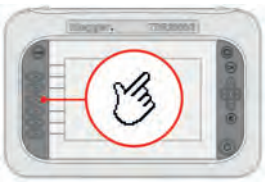
Trace Tagging is only available on the TDR2010 and TDR2050 models. Trace Tagging allows the user to add a name to all saved traces. This could be the circuit ID, building name or any other identifying text the user wishes to save with the trace.

A text string of up to 32 alphanumeric characters can be stored against each trace and this can consist of upper case letters including accents.



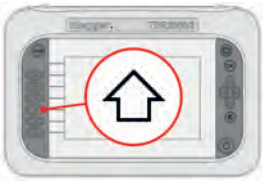
This function is activated when choosing a memory location to save a trace to

Use the navigation buttons to select a letter and the soft keys to action

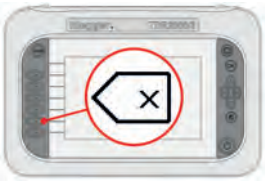


Press the hand icon to add the currently selected character

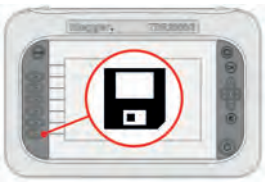
You can also press the OK button to accept the selection



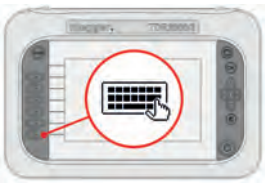
Press the shift icon to change the keyboard to the extended characters

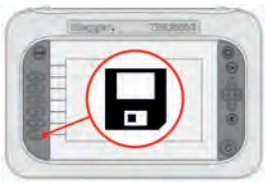


Press the backspace icon to delete the last character



Once all characters have been chosen, press the save icon to complete the save process





You can edit a current trace tag either when you save a trace, or when you are choosing a trace for a memory mode function.

Once you enter edit mode, simply use the technique for new trace tags in the previous section.

When you have finished editing, press the save icon to complete the edit and save your changes.

10. Trace functions (TDR2050 only)

TDR2050 has a suite of trace tools which provide additional test capabilities. These can be found in the Trace Tools menu item.

Press to access Trace Tools

Choose required function

10.1 Standard trace function

The standard trace function allows the instrument to be set up to work as a standard pulse TDR. This function should be chosen to turn off other trace functions.

Standard trace function

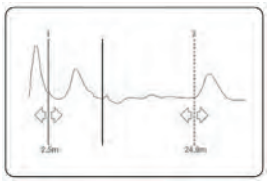
Change settings as required

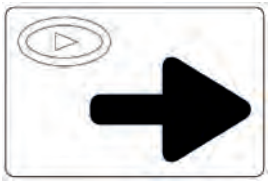
Press to choose another trace function

10.2 AutoFind

AutoFind allows the automatic detection of disturbances along the result trace, making it easier to target disturbances amongst a noisy trace.

On TDR2000/3 and TDR2010 this function is available from the main screen.





Press to choose AutoFind

Cursor snaps to disturbance

Press for next disturbance

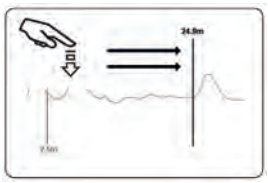
To cancel the next disturbance feature, press the back button to return to the main screen

The Trace Tools icon will then show

Press choose another trace function

10.3 FindEnd

The FindEnd function allows the automatic detection of the end of the cable. On busy or noisy cables this may need to be repeated.



Press to choose FindEnd

Automatically positions a cursor at the detected end of the current cable

Press to repeat detect end.

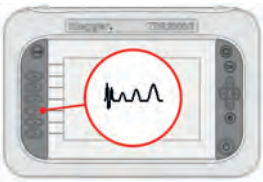
To cancel the repeat detect end feature, press the back button to return to the main screen

The Trace Tools icon will then show

Press choose another trace function

10.4 Distance dependent gain - DDG

DDG counteracts the effects of signal loss on a cable by gradually increasing the gain along the trace result. DDG is suitable for longer length cables and is available on ranges of 1000m and above.



Distance dependent gain

Adjust DDG.

Single press increments by 0.1 dB

Press and hold increments by 0.5 DB

Press choose another trace function

10.4.1 Step TDR feature

The injected signal is started and then maintained at the same level giving a constant signal. The receiver is also constantly set to receive any reflections. This function is ideal for near-end testing as it is more sensitive than a Pulse TDR due to the constant signal. The Step TDR function is only suitable for shorter length cables and is available on ranges up to and including 500m.

Step TDR function activation

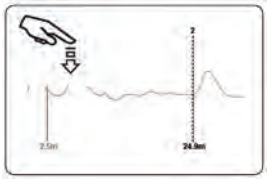
Change settings as for pulse TDR

Press choose another trace function

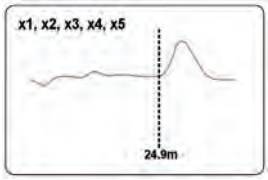
11. Zoom

The zoom capabilities are limited by the range chosen and only zoom modes suitable for the chosen ranges are displayed.

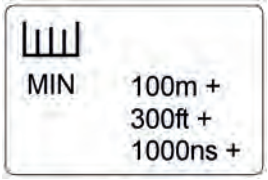
Zoom function



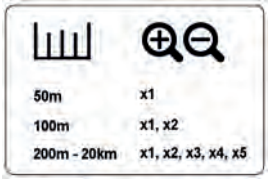
Press to select



Zooms at cursor position



Minimum range



Range/Capability

12. Advanced

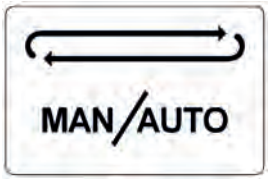
The TDR2000 series have two methods of operation. Both options allow the user to set operational parameters.

In Manual operation the user has full control over the settings in use for the cable under test. In Automatic operation the TDR sets the appropriate impedance to the cable and suggests gain and pulse width settings. Expert Function allows auto detection of faults on the live traces.

12.1 Manual and Automatic operation

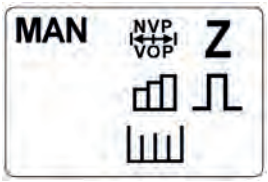
Manual/Automatic

Press to swap modes

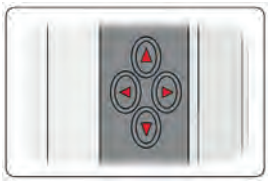


Changes with each press

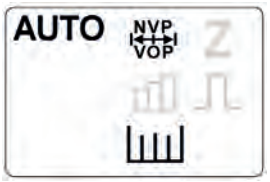
Manual



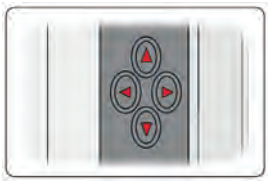
Adjustable in this mode



Automatic



Adjustable in this mode



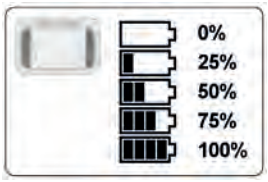
NOTE: Auto in DDG only performs AutoZ; not ‘auto settings’

13. Battery

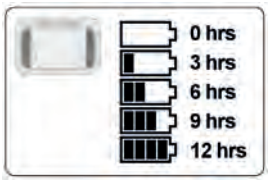
The TDR2000 series have built in intelligent charge management technology so that the maximum charge rate is maintained, meaning a longer battery life is possible.

13.1 Battery information

Battery state



Capacity



Typical life remaining

Warnings

Charging

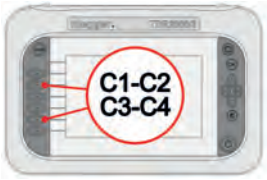
Charging paused

Charged

14. Results

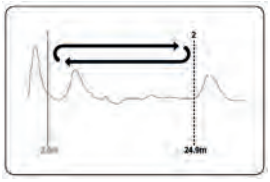
The cursor lines on the TDR2000 series allow the user to identify disturbances at strategic points to determine distances and positions of potential faults on the trace.

14.1 Cursors and measurements

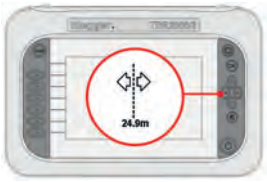


Cursor choice

Press to select



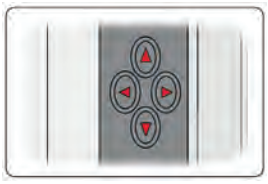
Swap between cursors



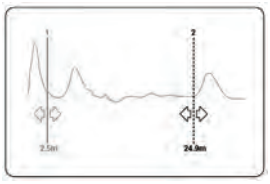
Cursor movement

C1-C2 Trace 1
(Single Trace Mode)

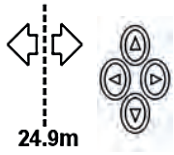
C3-C4 Trace 2
(Dual Trace Mode)



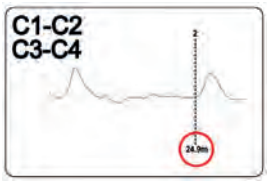
Use cursor keys



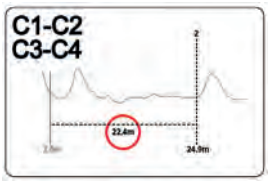
Cursor position on trace



Distance measurement



Distance to cursor

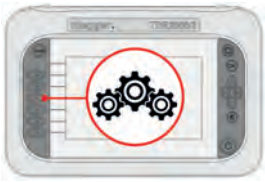


Delta measurement

15. Tools

When in the Setup screen, access can be made to a selection of user tools. Within the tools function the user can change basic settings and locate current instrument setup information.

Adjustable setting include Volume, Standby, Units of measure, NVP formats, Colour scheme, Brightness and Language.



Preferences

Use cursor keys

Up/Down to select

Left/Right to change

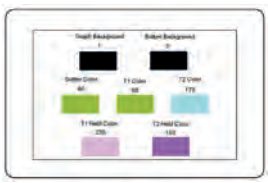
Help

Use cursor keys

Function information

Custom

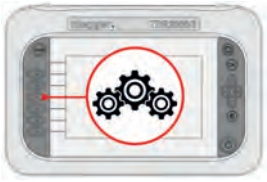
Press to select



Left/Right to select

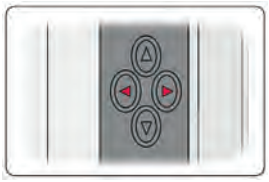
Up/Down to change

16. Colour schemes



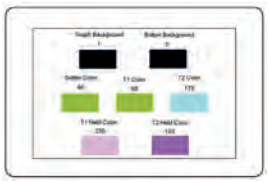
Press the preferences icon to access the system preferences screen

There are a number of colour schemes available as standard, plus additional custom schemes where you can set your own

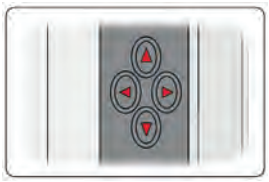


Use the left and right navigation buttons to change the current scheme

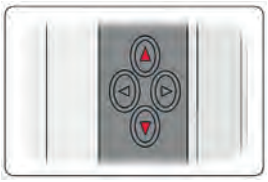
You can use the current scheme as a basis for a custom scheme by pressing the custom scheme pallet icon



From here you can change any of seven elements that make up all screens



Use the left and right navigation buttons to choose an element



Use the up and down navigation buttons to change the colour for the chosen element

Once finished setting your colours, press either the custom 1 or custom 2 icons to save that scheme. The scheme currently stored in that custom slot will be overwritten.

After saving your custom scheme, press the back button to return to the main screen

17. Glossary

17.1 Appendix A

17.1.1 Function

	Mode
	Single channel mode
	Dual channel mode
	Intermittent mode
	Crosstalk
	Save
	Load saved trace
C1-C2 C3-C4	Cursor controls
	Zoom function
	Help
	Preferences
	Settings
AUTO MAN	Auto/Manual choice
	Press for next fault
	Delete
	Accept
	Preview
T1	Trace 1
T2	Trace 2
M	Memory
Z	Impedance
	Gain
	Pulse Width
	Range
	Edit Trace Tag
	Select current character
	Shift character set
	Backspace delete
	Complete and save

17.1.2 Trace Functions

	Trace Functions
	FindEnd
	Standard Trace
	DDG
	AutoFind function
	Step Trace

17.1.3 Preferences

 Speaker	NVP VOP Velocity format	 Brightness
On/Off	Ratio	1 - 10
	m/µs	
 Power down timer	ft/µs	 Language
1, 5, 10 min, Never		English
		Dutch
m ft µs Unit of measurement	 Colour scheme	Swedish
Meters	Default/Outdoor	Spanish
Feet	Scheme 1 - 6	Italian
Nanoseconds	Custom 1 - 2	German
		French

18. Trouble Shooting

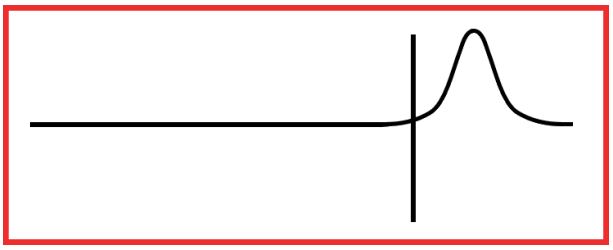
18.1 Appendix B

Fault	Problem
Solution	
Instrument won't turn on	Battery not charged up
Plug in charger and charge for 6 hours.	
Instrument won't charge	Battery not functioning (Flashing charge icon)
Contact your local Megger dealer for a replacement battery.	
Instrument won't charge	Charger not functioning (LED)
Contact your local Megger dealer for a replacement charger.	
Instrument keeps turning itself off	Battery not sufficiently charged
Plug in charger and charge for 6 hours	
Instrument keeps turning itself off	Standby set too low
Access user settings and change standby time.	
Display not visible	Colour settings incorrect
Access user settings and change colours.	
Display not visible	Instrument in power save mode
Press standby button to return to display.	
Distance to fault is inaccurate	Incorrectly set Velocity Factor
Check VF value for the cable under test and change settings.	
Can't set Velocity Factor	Cable Velocity Factor unknown
Test a known length of cable to determine Velocity Factor.	
VF, Impedance, Gain, Pulse inaccessible	Instrument set to Automatic
Press the escape button and then change to manual.	
Instrument keeps ticking	Dual input function chosen
Ticking is normal due to relays switching input.	

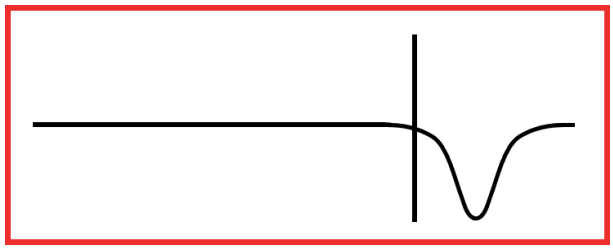
Fault	Problem
Solution	
Instrument keeps ticking on single input	Incorrect connection to cable under test
End of cable not determined so unable to reach max range.	
Buttons not responding	Keypad error
Contact for repair.	
Can't see end of cable on trace	Wrong range chosen
From main screen press up navigation button to extend range.	
Can't see fault I know is there	Gain set too low
In manual mode select and change gain with navigation buttons.	
The trace is very noisy	Gain set too high
In manual mode select and change gain with navigation buttons.	
No trace even though leads connected	Leads plugged in to wrong channel
Connect test leads to correct channel.	
Instrument not uploading/downloading	USB cable damaged or wrong type
Use only genuine Megger cable and check before connecting.	
Instrument won't download data	No saved results on TDR
Take readings and save results before download.	
TraceXpert won't load up	Incorrect or unstable installation
Obtain correct user rites if required and re-install TraceXpert.	
TraceXpert won't install on PC	Incompatible operating system
TraceXpert is compatible with Windows XP, Vista, 7 and 8.	

19. Common fault traces

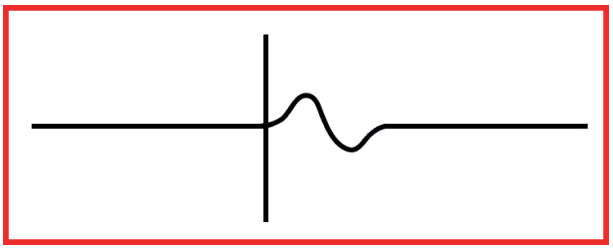
19.1 Appendix C



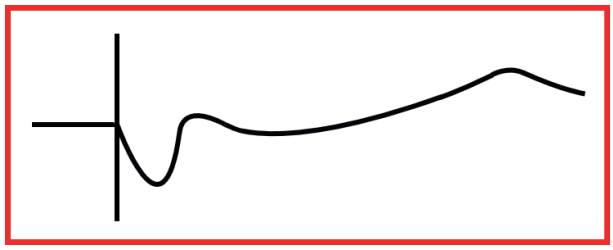
Open conductor



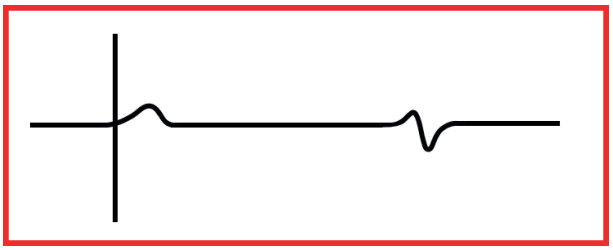
Shorted conductor



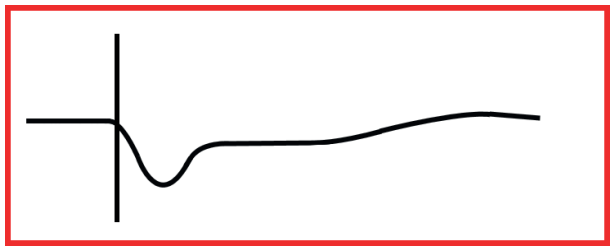
Cable splice/joint



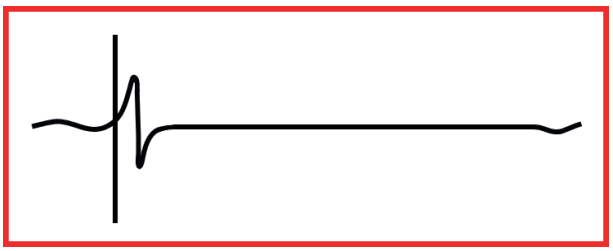
T-joint



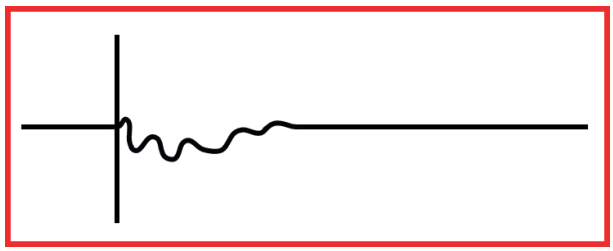
Bridge tap



Spilt/resplit



Wet splice



Water ingress

20. Specifications

Except where otherwise stated, this specification applies at an ambient temperature of 20ºC

20.1 General

Specfication	Detail
Range	Up to 20000m with a minimum resolution of 0.1m (Maximum range dependent on cable type)
Accuracy	±1% of range ± 1 pixel at 0.67 VF
Note- The measurement accuracy is for the indicated cursor position only and is conditional on the velocity factor being correct	
Resolution	1% of range
Input Protection	This instrument complies with IEC61010-1 to protect the user in the event of connection to live systems. TDR2050 is rated at 600 V CAT IV whilst all other models are rated at 150 V CAT IV. TDR2050 is specifically designed to allow use on energised systems up to the rated voltage. All models are designed for use on de-energised systems and Megger fused leads must be used on power cables and fused leads must be used if the potential voltage between terminals could exceed 300 V or when connected to CATIV systems.
Output pulse	Up to 20 volts peak to peak into open circuit. Pulse widths determined by range, cable and model used.
Gain	Set for each range with user selectable steps (in Manual operating mode)
Velocity Factor	Variable from 0.2 to 0.99 in steps of 0.01
TX Null	Automatic mode
Trace Tagging	32 alphanumeric characters chosen from upper case letters including accents
Colour schemes	Selectable TDR2000/3 x2 TDR2010, TDR2050 x8 Custom TDR2000/3 x1 TDR2010, TDR2050 x2
Step TDR	Eliminates the Dead Zone effect.
DDG	Available in ranges 1000 m and above Adjust DDG. Single press increments by 0.1 dB Press and hold increments by 0.5 DB
Cable Impedance	TDR2000/3 and TDR2010: 25, 50, 75, 100, 125 ohm + AUTO TDR2050: 25, 50, 75, 100, 140 ohm + AUTO
Power Down	User programmable auto power off timer 1, 5, 10 minutes or off
Batteries	Li-Ion rechargeable battery with 12 hours typical life
Safety	IEC61010-1 compliant for live systems. TDR2050 600 V CATIV All other models 150 V CAT IV or 300 V CAT III. EN60950-1, EN61010-1, UN38.3 and EN62133
EMC	Complies with Electromagnetic Compatibility Specifications BS EN 61326-1, B min. for all immunity tests
Mechanical	The instrument is designed for use indoors or outdoors and is rated to IP54

Case Dimensions	290 mm (11.4 inches) x 190 mm (7.5 inches) x 55 mm (2.2 inches)
Instrument weight	1.7 kg (3.8lbs)
Case material	ABS
Display	800 x 480 pixel WVGA colour graphics LCD, viewable in external environments, user selectable colour schemes
Connectors	19mm spaced. Four 4mm-safety terminals and two F connectors. Other standard push on adapters will fit. F connectors not available on TDR2050

20.2 Test leads

Specfication	Detail
TDR2000/3, TDR2010	2 m 2 pair 4 mm shrouded connector to miniature crocodile clips
TDR2000/3P, TDR2050	2 pairs retractable sheath Fused test lead set
CFL535G	2 pair Bed-of-Nails lead set

20.3 Environmental

Specfication	Detail
Operational Temperature	-15°C to +50°C (5°F to 122°F)
Storage Temperature	-20°C to 70°C (-4°F to 158°F)
Charging Temperature	0°C to 40°C

21. Repair and warranty

If the protection of an instrument has been impaired it should not be used, but sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the instrument shows visible damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been exposed to severe transport stresses.

New instruments are covered by a two year warranty from the date of purchase by the user, the second year being conditional on the free registration of the product. You will need to log in, or first register and then login to register your product. The second year warranty covers faults, but not recalibration of the instrument which is only warranted for one year. Any unauthorised prior repair or adjustment will automatically invalidate the warranty.

These products contain no user repairable parts and if defective should be returned to your supplier in original packaging or packed so that it is protected from damage during transit. Damage in transit is not covered by this warranty and replacement/repair is chargeable.

Megger warrants this instrument to be free from defects in materials and workmanship, where the equipment is used for its proper purpose. The warranty is limited to making good this instrument (which shall be returned intact, carriage paid, and on examination shall disclose to their satisfaction to have been defective as claimed). Any unauthorised prior repair or adjustment will invalidate the warranty. Misuse of the instrument, from connection to excessive voltages, fitting incorrect fuses, or by other misuse is excluded from the warranty. The instrument calibration is warranted for one year.

This Warranty does not affect your statutory rights under any applicable law in force, or your contractual rights arising from a sale and purchase contract for the product. You may assert your rights at your sole discretion

22. Calibration, service and spare parts

For service requirements for Megger Instruments contact your local distributor or authorised repair centre.

Megger operates fully traceable calibration and repair facilities, ensuring your instrument continues to provide the high standard of performance and workmanship you expect. These facilities are complemented by a worldwide network of approved repair and calibration companies to offer excellent in-service care for your Megger products.

Details of your Authorised Service Centre is available by contacting and giving details of your location.

23. Declaration of Conformity

Hereby, Megger Instruments Limited declares that radio equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directive 2014/53/EU. Other equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directives 2014/30/EU and 2014/35/EU where they apply.