Megger

WWW.MEGGER.COM

Time Domain Reflectometers

TDR2000/3 - TDR 2000/3P - CFL535G
TDR2010

User Guide

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 from the Megger website

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

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. **When not in use remove the battery from the instrument** A Li-Ion battery starts losing power as soon as connected to a drain. Removing from the instrument will ensure health is maintained.
4. **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.
5. **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.

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

For further information about disposal of the product consult your local Megger company or distributor or visit your local Megger website

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 Megger Ltd.

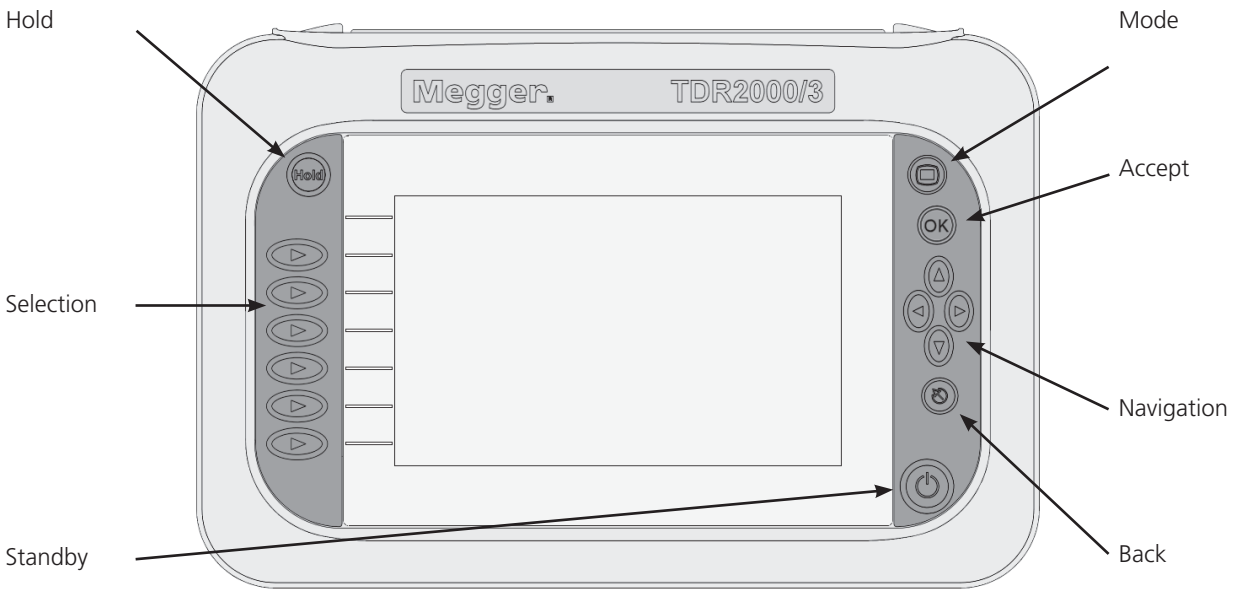
For disposal of batteries in other parts of the EU contact your local Megger branch or distributor.

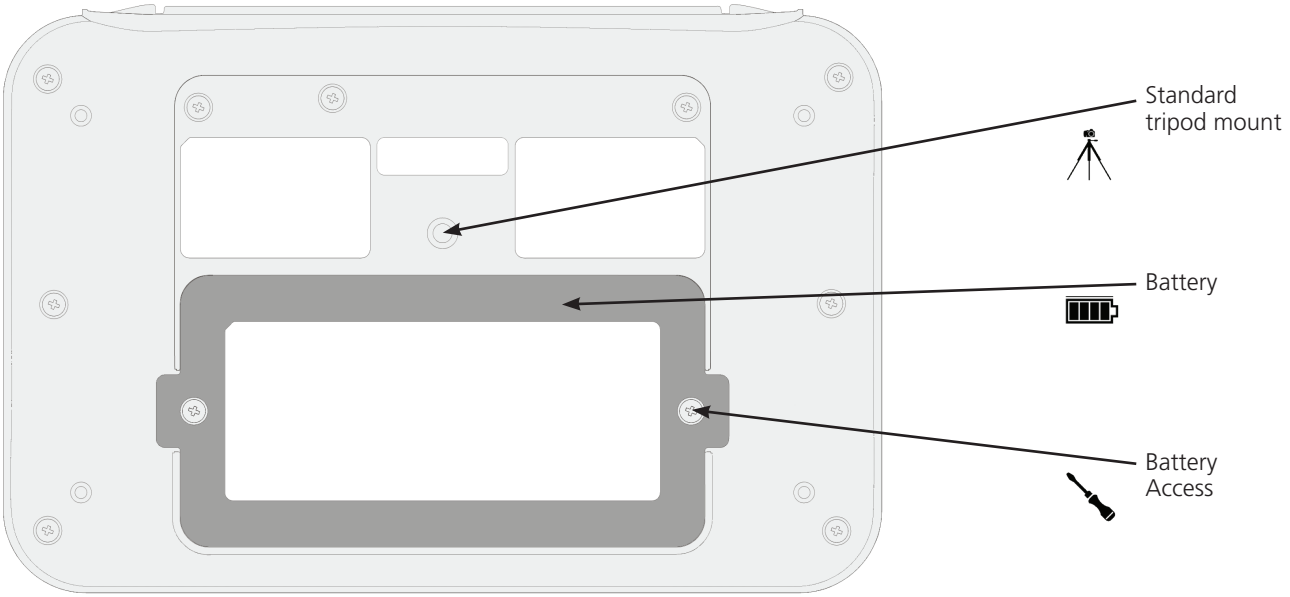
Megger is registered in the UK as a producer of batteries.

The Registration number is BPRN00142.

For Further information see www.megger.com

Megger



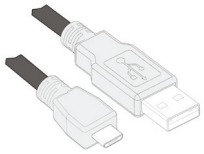


Li-Ion

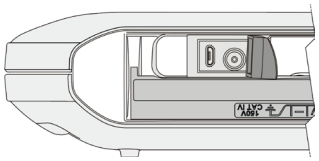
11.1 V, 5.2 Ah

WEEE

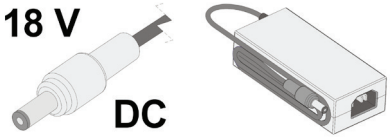
Connectivity



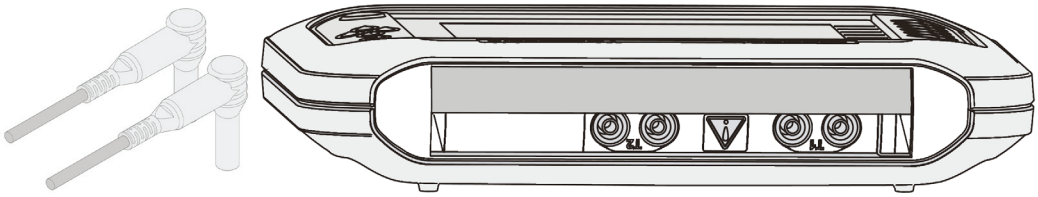
Used for PC connectivity



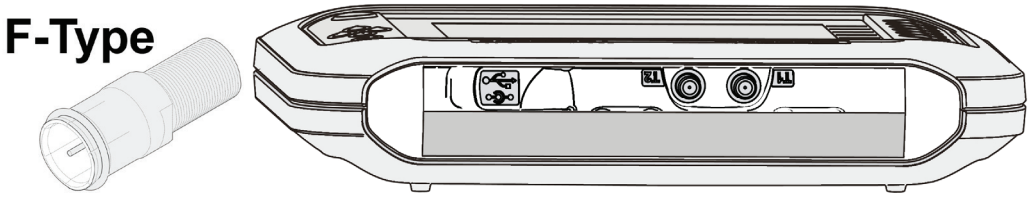
Lift cover for access – avoid stressing



Power lead dependant on region

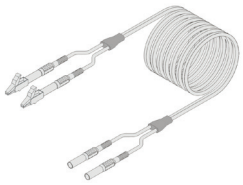


The main connectivity is made via standard 4 mm test leads plugged into the dual channel ports



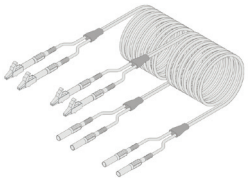
Using the supplied adapter, connectivity can also be made to the dual F-type ports. Other standard push-on adapters also fit.

Accessories



6231-652

Single miniature clip lead set 4mm



6231-654

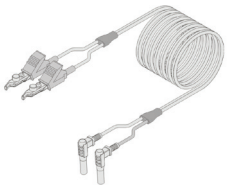
Dual miniature clip lead set 4mm

1002-015

Single Fused test leads

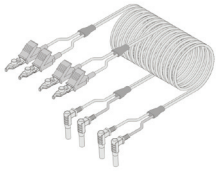
1002-136

Dual Fused test leads



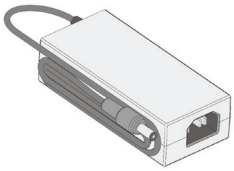
6231-655

Bed of Nails Test Leads (1 Pair)



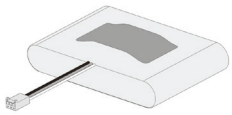
6231-653

Bed of Nails Test Leads (2 Pairs)



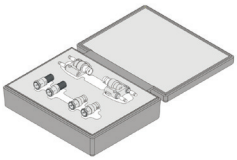
1003-352

Mains Charger



1002-552

Replacement Battery



1003-218

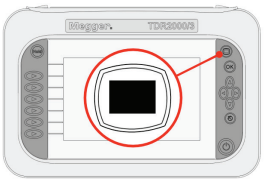
Terminal adaptor kit

There are various mounting and carrying options for the TDR20xx series to ensure the user can position their instrument securely and efficiently.

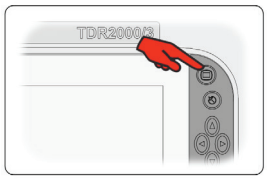
Mode

The TDR20xx 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.

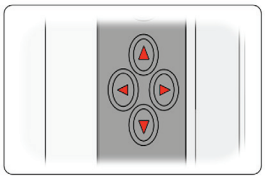
Selecting Mode



Change mode

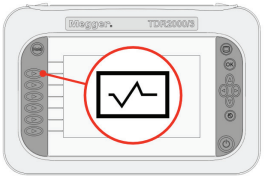


Press to select

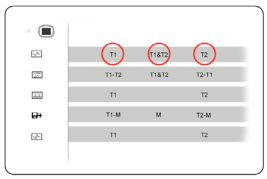


Use cursor keys

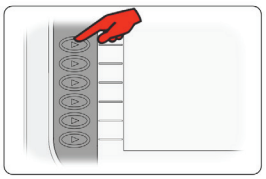
Choosing a mode



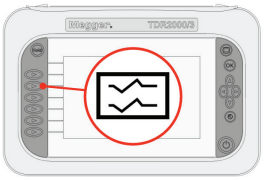
Single Channel mode



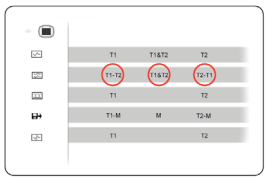
Choose T1 or T2



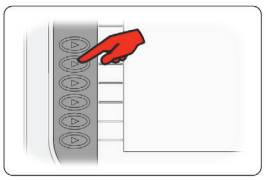
Press key indicated to change



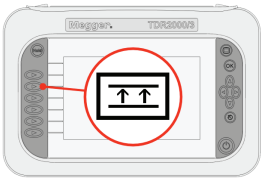
Dual Channel mode



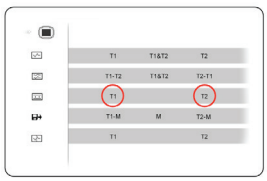
Choose T1-T2, T2-T1, T1&T2



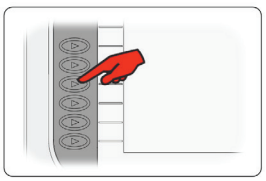
Press key indicated to change



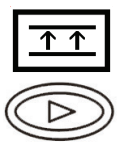
Crosstalk

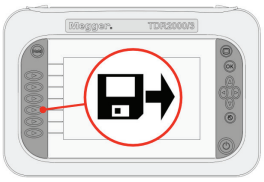


Choose T1 or T2

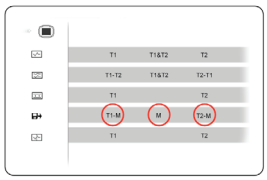


Press key indicated to change

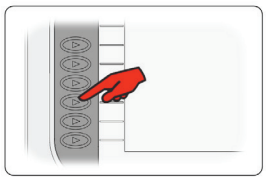




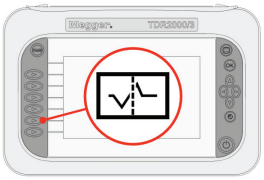
Load saved trace



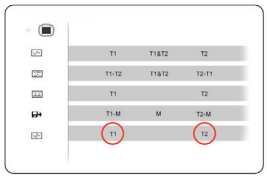
Choose T1-M, T2-M, M



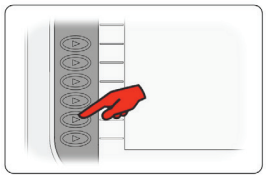
Press key indicated to change



Intermittent mode



Choose T1 or T2

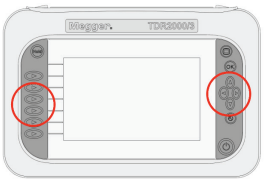


Press key indicated to change

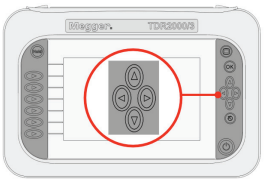
General

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

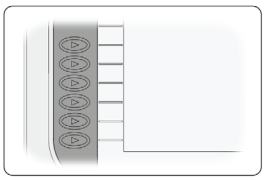
The instrument is also able to save and preview traces, enabling the user to maintain a database of information for downloading to a PC to create reports or to use in other custom applications



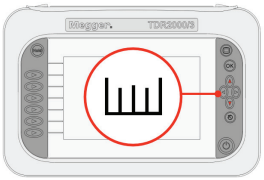
Navigation



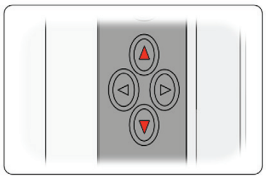
Use cursor keys

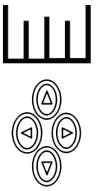


Use soft keys to select



Range



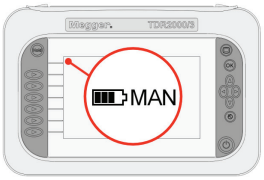


10, 25, 50, 100, 200, 400 m, 1, 2, 4, 8, 16, 20 km
30, 75, 150, 300, 600, 1200, 3000, 6000, 12000, 24000, 48000 ft
(30 km 98,000 ft VP 0.99)

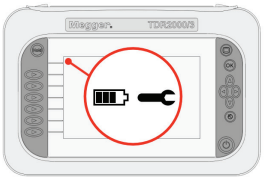
The currently selected range is shown at top right of the screen

Operational state

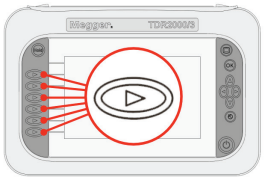
The current operational state is shown at the top left of the screen and identifies the current operational setting for the chosen screen. Icons displayed are specific to the function.



Current operational state. Currently in Automatic operation



Current operational state. Currently in Setup operation

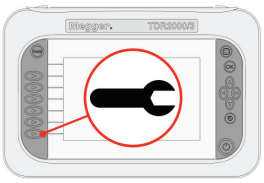


Change current state using the appropriate button

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.

Accessing Setup

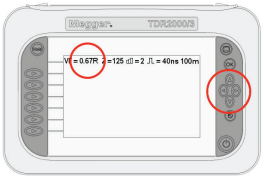


Press to select

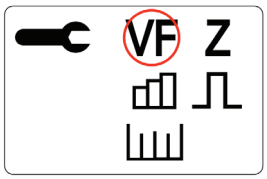
Automatic mode

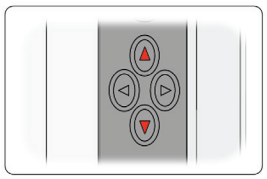
Manual mode

Adjusting the Setup Options

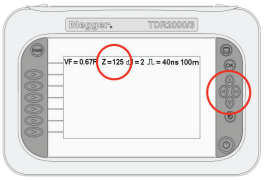


Velocity Factor

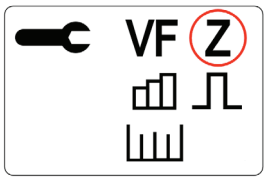


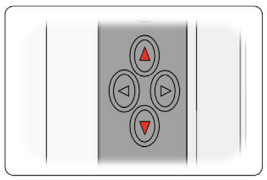


Use the up and down cursors to set the Velocity Factor to match the cable under test



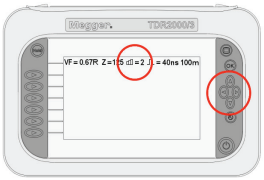
Impedance



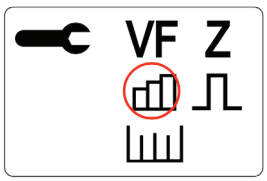


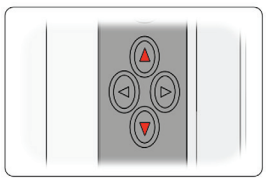
Use the up and down cursors to adjust the impedance for the cable under test

*Only available in manual operation (see page 13)



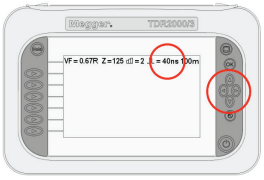
Gain



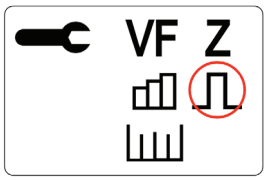


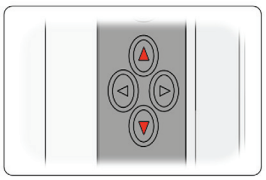
Use the up and down cursors to alter the gain to adjust visible disturbances on trace

*Only available in manual operation (see page 13)



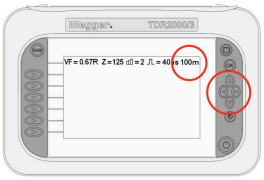
Pulse width



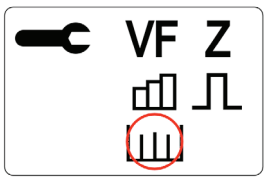


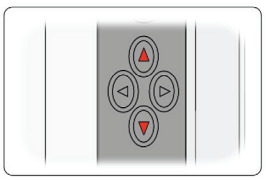
Use the up and down cursors to change the instrument pulse width

*Only available in manual operation (see page 13)



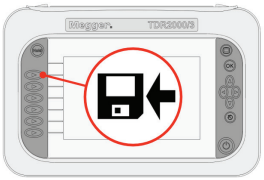
Cable Range



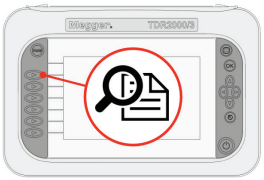


Use the up and down cursors to change the length of the cable under test

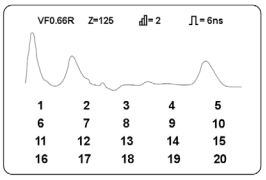
Saving Current Trace



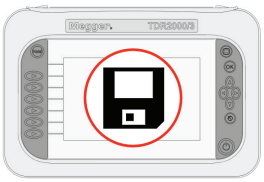
Save



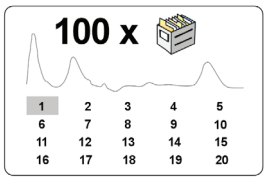
Preview



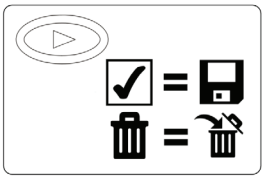
Selected trace displayed



Manage Memory



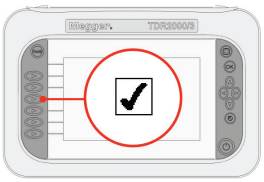
Use cursor keys



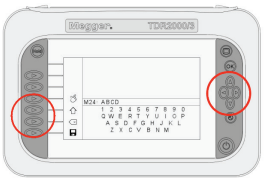
Selecting the tick saves the results to the selected memory location and the bin deletes the result from the selected memory location.

Trace Tagging

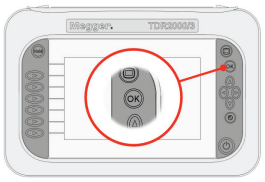
Trace Tagging is only available on the TDR2010 model.



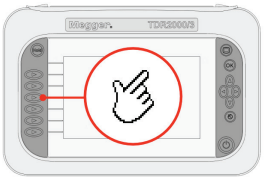
This function is activated when choosing a memory location to save a trace to



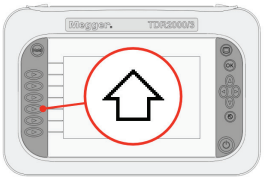
Use the navigation buttons to select a letter and the soft keys to action



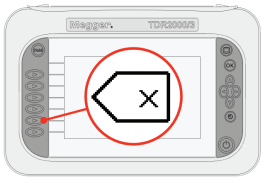
You can also press the OK button to accept the selection



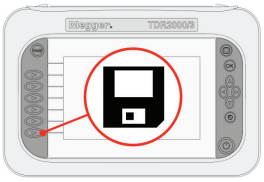
Press the hand icon to add the currently selected character



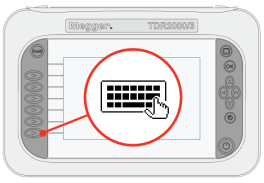
Press the shift icon to change the keyboard to the extended characters

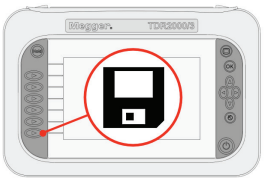


Press the backspace icon to delete the last character



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





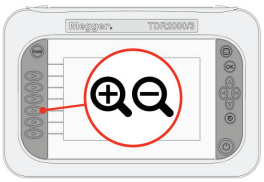
You can edit a current trace tag either when you save a trace, or when you are choosing a trace for a memory mode function.

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

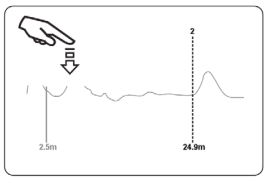
When you have finished editing, press the save icon to complete the edit and save your changes.

Zoom

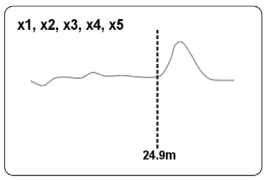
The zoom capabilities are limited by the range chosen and only zoom modes suitable for the chosen ranges are displayed.



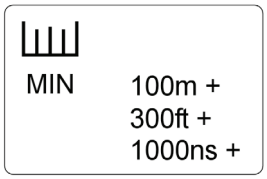
Zoom function



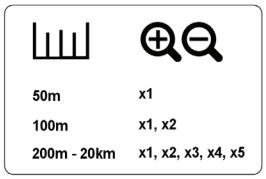
Press to select



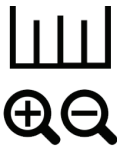
Zooms at cursor position



Minimum range



Range/Capability

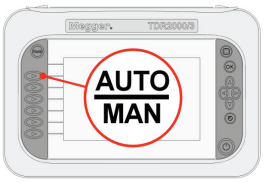


Advanced

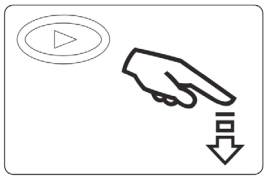
The TDR20xx series has two methods of operation. Both options allow the user to set operational parameters.

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.

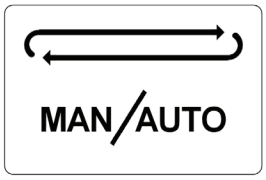
Manual and Automatic operation



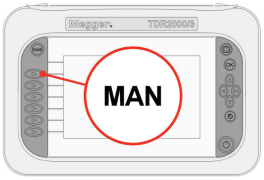
Manual/Automatic



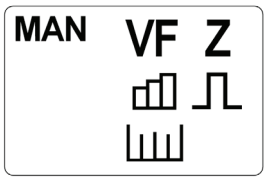
Press to swap modes



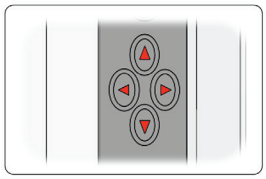
Changes with each press

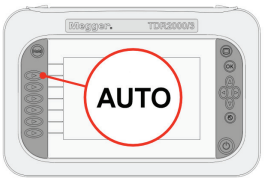


Manual

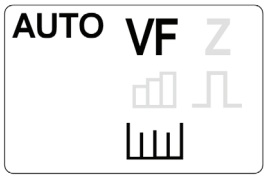


Adjustable in this mode

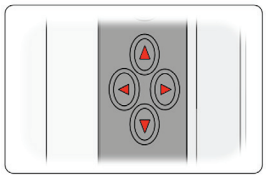




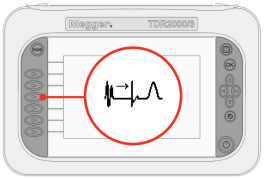
Automatic



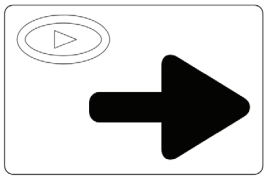
Adjustable in this mode



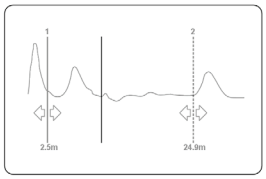
Auto Find



Auto find



Press for next disturbance

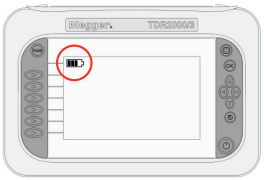


Cursor snaps to disturbance

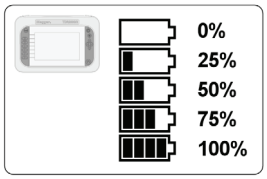
Battery

The TDR20xx series has built in intelligent charge management technology so that the battery never overheats and maximum charge rate is maintained, meaning a longer battery life is possible.

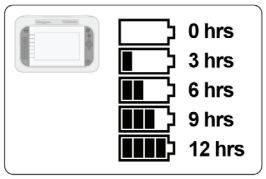
Battery information



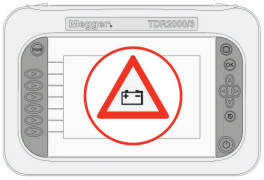
Battery state



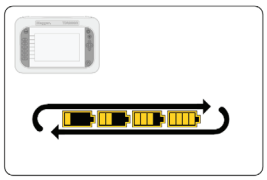
Capacity



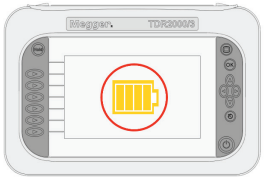
Typical life remaining



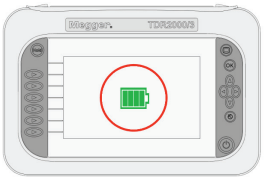
Warnings



Charging



Charging paused

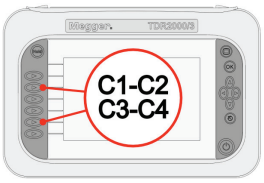


Charged

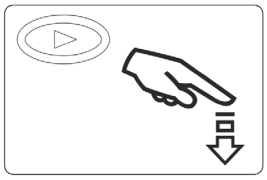
Results

The cursor lines on the TDR20xx series allow the user to identify disturbances at strategic points to determine distances and positions of potential faults on the trace.

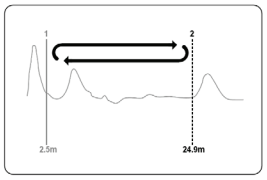
Cursors and measurements



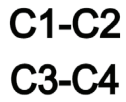
Cursor choice

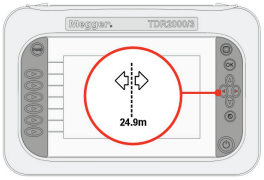


Press to select



Swap between cursors

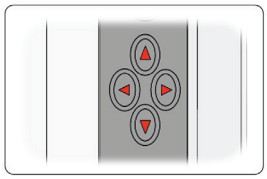




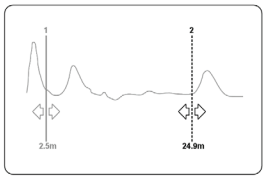
Cursor movement

C1-C2 Trace 1
(Single Trace Mode)

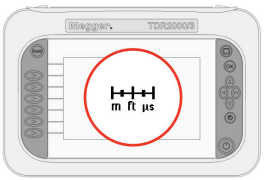
C3-C4 Trace 2
(Dual Trace Mode)



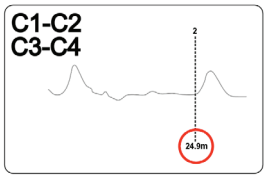
Use cursor keys



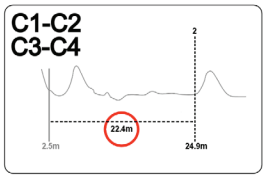
Cursor position on trace



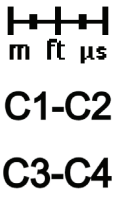
Distance measurement



Distance to cursor



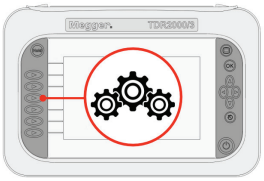
Delta measurement



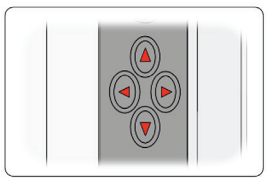
Tools

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.

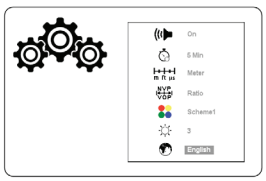
Adjustable setting include Volume, Standby, Units of measure, NVP formats, Colour scheme, Brightness and Language.



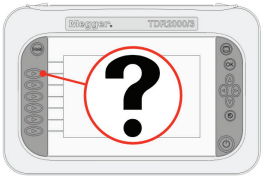
Preferences



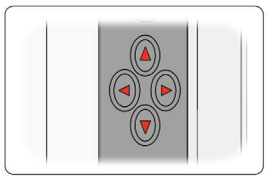
Use cursor keys



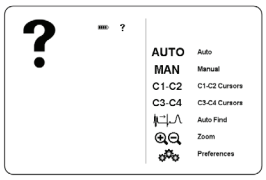
Up/Down to select
Left/Right to change



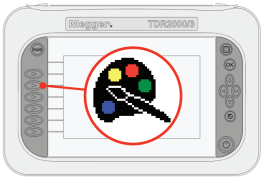
Help



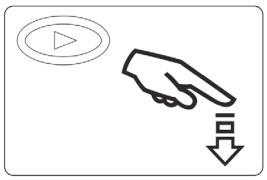
Use cursor keys



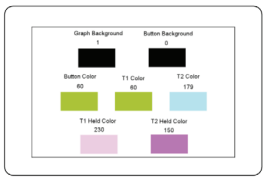
Function information



Custom

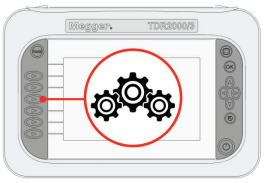


Press to select

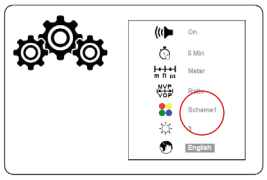


Left/Right to select
Up/Down to change

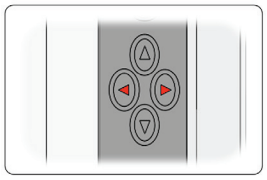
Colour Schemes



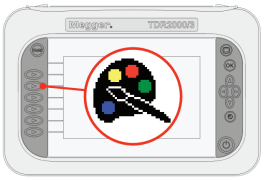
Press the preferences icon to access the system preferences screen



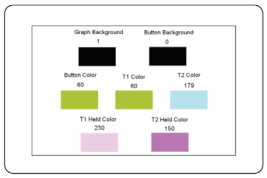
There are a number of colour schemes available as standard, plus additional custom schemes where you can set your own.



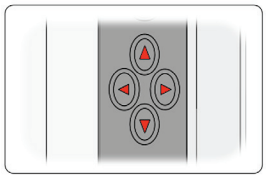
Use the left and right navigation buttons to change the current scheme



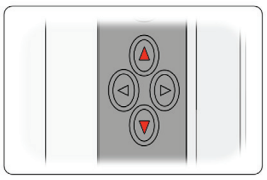
You can use the current scheme as a basis for a custom scheme by pressing the custom scheme pallet icon



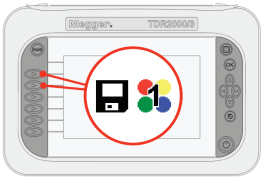
From here you can change any of seven elements that make up all screens



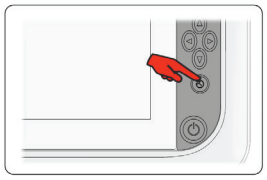
Use the left and right navigation buttons to choose an element



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

Glossary

Appendix A

Function		Function		Function	
	Single Channel mode		Delete		Preferences
	Dual Channel mode		Accept		Colour scheme
	Intermittent mode		Preview		Help
	Crosstalk		Mode	NVP VOP	Velocity Factor
	Save	C1-C2 C3-C4	Cursor controls	Z	Impedance
	Load saved trace		Tools		AutoFind function
	Gain	AUTO	Automatic operation		Pulse width
	Press for next fault	MAN	Manual operation		Range
	Zoom function				

TroubleShooting

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 (error message)
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	

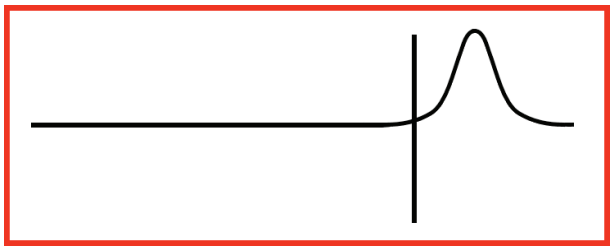
TroubleShooting

Appendix B

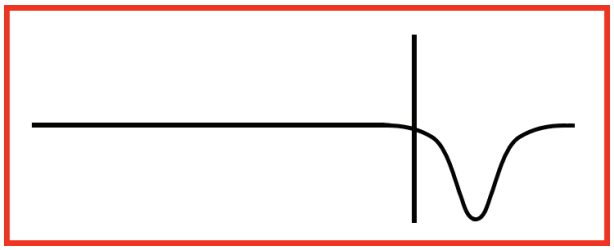
Fault	Problem
Solution	
Instrument keeps ticking on single input	Incorrect connection to cable under test
End of cable not determined so unable to reach max range	
Buttons not responding	Keypad error
Contact Megger for repair	
Can't see end of cable on trace	Wrong range chosen
From main screen press 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	

Common fault traces

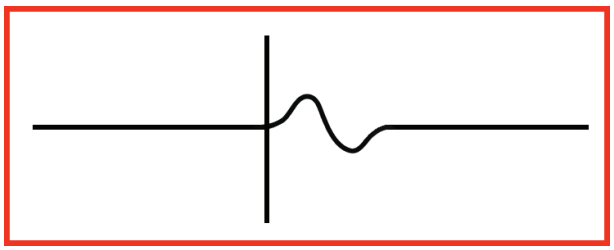
Appendix C



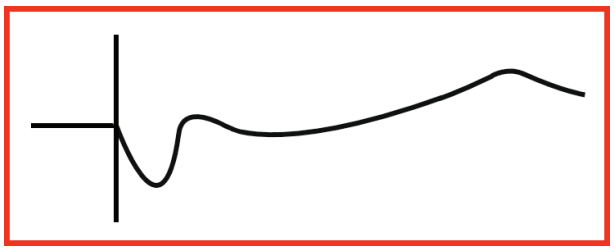
Open conductor



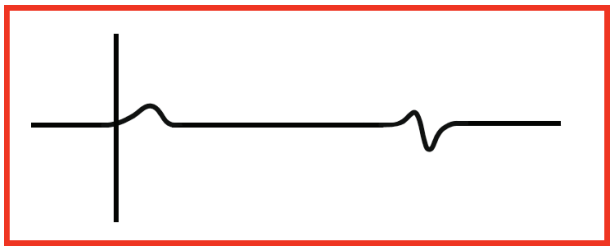
Shorted conductor



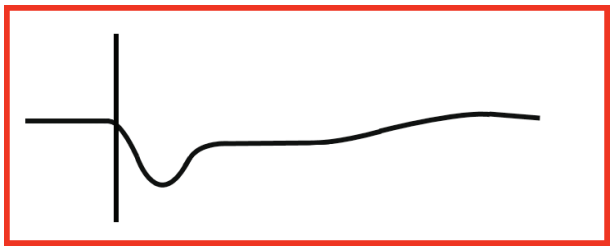
Cable splice/joint



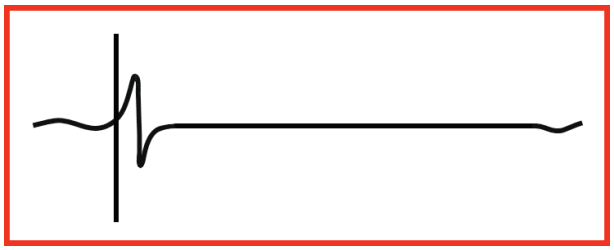
T-joint



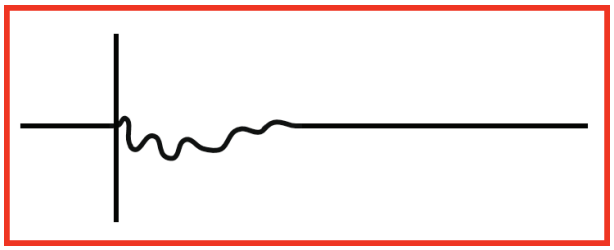
Bridge tap



Spilt/resplit



Wet splice



Water ingress

Specifications

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

General

Range	Up to 20000m with a minimum resolution of 0.1m
Accuracy	±1% of range ± 1 pixel at 0.67VF

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 up to 150 V CAT IV. This instrument is designed for use on de-energised systems but fused leads must be used if the potential voltage between terminals could exceed 300 V
Output pulse	Up to 20 volts peak to peak into open circuit. Pulse widths determined by range and cable
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
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, 150 V CAT IV or 300 V CAT III. EN60950-1, EN61010-3, 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	Four 4mm-safety terminals and two F connectors. Other standard push on adapters will fit

Test leads

TDR2000/3, TDR2010	2 m 2 x 4 mm shrouded connector to miniature crocodile clips
TDR2000/3P	2 x 1.5 m fused leads
CFL535G	2 x Bed-of-Nails lead set

Environmental

Operational Temperature	-15ºC to +50ºC (5ºF to 122ºF)
Storage Temperature	-20ºC to 70ºC (-4ºF to 158ºF)
Charging Temperature	0ºC to 40ºC

Megger

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TDR20003--TDR2010_UG_EN_V01