# User Guide

## Elcometer NDT

## Model MTG2 & MTG4
### Ultrasonic Material Thickness Gauges

# elcometer NDT

## CONTENTS

For the avoidance of doubt, please refer to the original English language version.

Gauge Dimensions: 145 x 73 x 37mm (5.7 x 2.87 x 1.46") - without transducer

Gauge Weight: 210g (7.4oz) - including batteries, without transducer

Material Safety Data Sheets for the ultrasonic couplant supplied with the Elcometer MTG2 & MTG4 and available as an accessory, are available to download via our website:

Elcometer Ultrasonic Couplant Material Safety Data Sheet:

www.elcometer.com/images/stories/MSDS/Elcometer_Ultrasonic_Couplant_Blue.pdf

Elcometer Ultrasonic Couplant (High Temperature) Material Safety Data Sheet:

www.elcometer.com/images/stories/MSDS/elcometer_ultrasonic_couplant_hi_temp.pdf

# 1 GAUGE OVERVIEW



1      LED Indicators - Red (left), Green (right)

2      LCD Display

3      Softkeys

4      On/Off Key

5      Zero Disk

6      Transducer Connection Point

7      USB Data Output Socket (below cover)

8      Battery Compartment (¼ turn open/close)

9      Wrist Strap Connection

# 2 BOX CONTENTS

- Elcometer NDT Ultrasonic Material Thickness Gauge
- 5MHz 1/4" Potted Right Angle Dual Element Transducer (MTG2 only)
- Ultrasonic Couplant; 120ml (4fl oz Bottle)
- 2 x AA Batteries
- Protective Case
- Wrist Harness
- Screen Protector
- Test Certificate
- User Guide

# 3 USING THE GAUGE

a   Power: Batteries or USB - including battery life indicator

b   Measurement Mode - P-E: Pulsed Echo; E-E: Echo/Echo ThruPaint™ (MTG4)

c   Calibration Method (MTG4)

d   Calibration: Sound-Velocity (MTG4)

e   Reading Stability Indicator

f   Measurement Units - mm, Inch

g   Menu Softkey

h   Reading Value

# 4 GETTING STARTED

## 4.1  FITTING THE BATTERIES

Each gauge is supplied with 2 x AA alkaline batteries.

**To insert or replace the batteries:**

1   Lift the latch on the battery compartment cover and rotate anti-clockwise to remove the cover.

2   Insert 2 batteries taking care to ensure correct polarity.

3   Refit the cover and rotate the latch clockwise to close.

The battery condition is indicated by a symbol in the top right of the display (⬜⬛):

▸ Full symbol (orange) = batteries at full capacity

▸ Empty symbol (red, flashing) = batteries at lowest sustainable level

## 4.2  CONNECTING A TRANSDUCER

1   Align the red dot on the transducer plug with the red dot on the base of the gauge.

2   Push the transducer into the gauge, ensuring that the connector is fully engaged.

All dual element transducers which can be connected directly to the base of an MTG gauge - see Section 12.1 'Transducers' on page 11 - are 'intelligent' transducers and will be identified automatically by the gauge. Details of the transducer connected can be viewed at any time via Menu/About/Transducer Information.

A transducer adaptor is available which enables other Elcometer 'non-intelligent', dual element transducers and other manufacturers' transducers, to be used with the Elcometer MTG product range - see Section 12.4 'Transducer Adaptor' on page 15.

**4.3 SELECTING YOUR LANGUAGE**
1    Press and hold the ON/OFF button until the Elcometer logo is displayed.
2    Press Menu/Setup/Language and select your language using the ↑↓ softkeys.
3    Follow the on screen menus.

To access the language menu when in a foreign language:
1    Switch the gauge OFF.
2    Press and hold the left softkey and switch the gauge ON.
3    Select your language using the ↑↓ softkeys.

**4.4 SCREEN SETTINGS**
A number of screen settings can be defined by the user via Menu/Setup/Screen Settings including:

•    **Screen Brightness;** This can be set to 'Manual' or 'Auto' - the brightness is adjusted automatically using the gauge's ambient light sensor.
•    **Screen Timeout;** The display will dim if inactive for more than 15 seconds and will go 'black' if inactive for the period defined. Press any key or tap the gauge to awaken it. The gauge can also be set to switch off automatically after a user defined period of inactivity via Menu/Setup/Gauge Auto Off. The default setting is 5 minutes.

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## 4.5  SELECTING THE MEASUREMENT MODE - MTG4

The MTG2 has one measurement mode, 'Pulsed Echo'.  The MTG4 has two measurement modes 'Pulsed Echo' and 'Echo-Echo ThruPaint™'.  For an explanation of the different modes, see Table 1: Measurement Modes.

To select the measurement mode (MTG4), press Menu/Setup/Reading/Measurement Mode.

| TABLE 1: MEASUREMENT MODES | | |
|---|---|---|
| Measurement Mode | Icon | Description |
| Pulsed Echo (PE) | P-E | The total thickness from the base of the transducer to the material density boundary (typically the back-wall) is measured.  Suitable for measurement of materials between 0.63mm and 500mm (0.025" to 19.999")[a] thick. |
| Echo-Echo ThruPaint™ (EE) | E-E | A coating of up to 2.0mm (0.08") thick is ignored and the material thickness from the top surface of the material to the material density boundary (typically the back-wall) is measured.  Suitable for measurement of materials between 5mm and 25.4mm (0.200" to 1")[a] thick. |

*Note:  The gauge should be re-calibrated when the measurement mode is changed - see Section 7 'Calibrating your Gauge' on page 8.  The calibration icon will flash intermittently to indicate that re-calibration is required.*

## 4.6  SELECTING THE MEASUREMENT UNITS

The gauges can display readings in mm or Inch.  To select the measurement units, press Menu/Setup/Units.

[a]  Thickness range is dependent on the material being measured and the transducer used.

# 5 SETTING THE ZERO POINT

Setting the zero point for the transducer is important.  If the zero point is not set correctly, all measurements will be inaccurate.

The gauge will remember the last zero point.  It is generally a good idea however, to set the zero point whenever the gauge is switched on, and when a different transducer is used.  This will ensure that the zero point is correct.

**To set the zero point:**

1    Plug the transducer into the gauge ensuring that the connector is fully engaged.
   ‣ The wearface of the transducer should be clean and free of any debris.
2    Press the On/Off button to switch the gauge on.
3    Press Menu/Calibration/Zero Set and apply couplant to the zero disk.
4    When prompted, press the transducer on to the zero disk, making sure it is flat against the surface.
   ‣ The display will show a thickness value which is constantly updating.  The stability of the reading is indicated on the stability bar to the right of the display.  A valid reading has a stability of 5 or more.
5    Remove the transducer from the zero disk.  The last reading is held on screen.  If not representative, repeat Step 4.
   ‣ Excessive use of couplant can result in a distorted reading when the transducer is removed from the surface.
6    Press 'Zero' to set the zero point.

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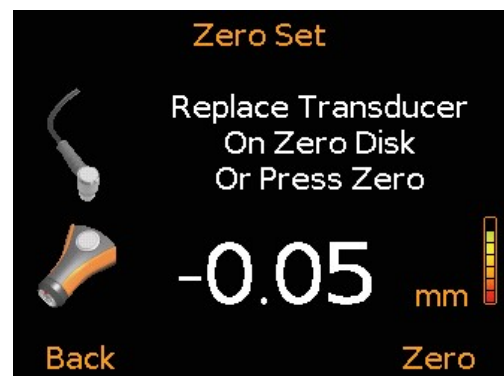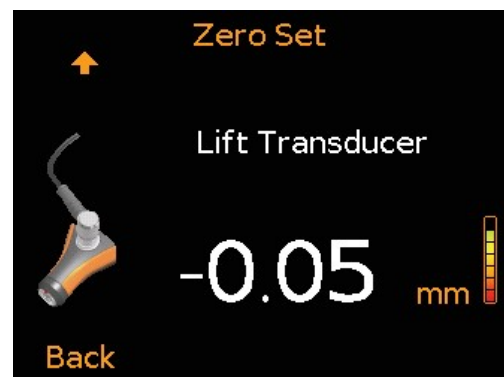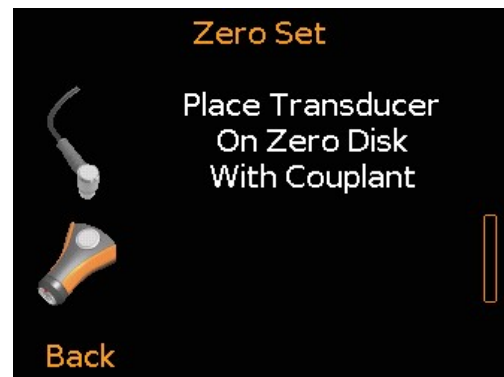
In order for the gauge to make accurate measurements, it must be set to the correct sound-velocity for the material being measured.

Different types of material have different sound-velocities. For example, the velocity of sound through steel is 5920m/s (approximately 0.233in/μs) and the velocity of sound through aluminium is 6350m/s (approximately 0.248in/μs).

Setting the calibration is crucial for the gauge to function correctly. The calibration procedure should be performed when the measurement mode, transducer and / or material type is changed.

The MTG2 is pre-calibrated for steel only - the calibration cannot be adjusted by the user. The MTG4 has a choice of calibration methods, see Table 2: Calibration Methods.

To select the calibration method (MTG4), press Menu/Calibration/Cal Method.

| TABLE 2: CALIBRATION METHODS | | |
|---|---|---|
| **Calibration Method** | **Icon** | **Description** |
| 1 Point | ↓ | This is the simplest and most commonly used calibration procedure. After setting the zero point - see Section 5 'Setting the Zero Point' on page 6 - a reading is taken and adjusted on an uncoated sample piece of test material of a known thickness. Once the thickness has been entered and confirmed, the derived sound-velocity is displayed. |
| Material | n: | Calibration using the sound-velocity of a material, selected from a pre-defined list of materials stored in the gauge. |
| Factory Calibration | | Calibration using the default factory calibration of the standard sound-velocity for steel, 5920m/s (approximately 0.233in/μs). |

### 7.1 USING 1 POINT CALIBRATION

This procedure requires an uncoated sample piece of the material being measured, the exact thickness of which is known (from having been measured by some other means) or a calibration standard - see Section 12.2 'Calibration Standards' on page 13.

1    Plug the transducer into the gauge ensuring that the connector is fully engaged.
    ‣ The wearface of the transducer should be clean and free of any debris.
2    Press the On/Off button to switch the gauge on.
3    Press Menu/Calibration/Cal Method and select '1 Point'.
    ‣ If '1 Point' is already selected - the calibration method currently selected is indicated by the icon to the right of the display - simply press Menu/Calibration/Calibrate.
4    The user will be prompted to perform a 'Zero Set' to set the zero point of the transducer, which is recommended before calibrating the gauge - see Section 5 'Setting the Zero Point' on page 6.
5    When prompted, apply couplant to the uncoated sample or calibration standard.
6    Press the transducer on to the uncoated sample or calibration standard, making sure it is flat against the surface.
    ‣ The display will show a thickness value which is constantly updating.  The stability of the reading is indicated on the stability bar to the right of the display.  A valid reading has a stability of 5 or more.
7    Remove the transducer from the uncoated sample or calibration standard.  The last reading is held on screen.  If not representative, repeat Steps 5-6.
    ‣ Excessive use of couplant can result in a distorted reading when the transducer is removed from the surface.
8    Press 'Adjust' and using the ⬆⬇ softkeys, adjust the reading to the known thickness value, followed by 'Set' to set the value.
    ‣ Pressing 'Escape' at any time will exit the calibration procedure without calibrating the gauge.
    ‣ The derived sound-velocity will be displayed to the right of the display, below the calibration method icon.

*Note:  One point calibration must be performed on material with the paint or coating removed.  Failure to remove the paint or coating prior to calibration will result in inaccurate readings.*

**7 CALIBRATING YOUR GAUGE - MTG4 (continued)**

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## 7.2  USING MATERIAL CALIBRATION

The gauge is calibrated using the known sound-velocity of a material as selected by the user from a pre-defined list stored in the gauge. This calibration method is useful if uncoated sample test pieces of known thicknesses are not available.

1     Press the On/Off button to switch the gauge on.

2     Press Menu/Calibration/Cal Method and select 'Material'.
  ‣ If 'Material' is already selected - the calibration method currently selected is indicated by the icon to the right of the display - simply press Menu/Calibration/Calibrate.

3     Use the ↑↓ softkeys to highlight the required material followed by 'Select'.
  ‣ Pressing 'Escape' at any time will exit the calibration procedure without calibrating the gauge.
  ‣ The sound-velocity of the material selected will be displayed to the right of the display, below the calibration method icon.

## 7.3  USING FACTORY CALIBRATION

Press Menu/Calibration/Factory Calibration to restore the default factory calibration setting of the standard sound-velocity for steel, 5920m/s (approximately 0.233in/µs).

## 8 TAKING A READING

### 8.1  BEFORE YOU START

1     Press the On/Off button to switch the gauge on.

2     Connect a transducer to the gauge.
  ‣ All dual element transducers which can be connected directly to the base of an MTG gauge - see Section 12.1 'Transducers' on page 11 - are 'intelligent' transducers and will be identified automatically by the gauge. If using other Elcometer 'non-intelligent', dual element transducers or other manufacturers' transducers, a transducer adaptor is required - see Section 12.4 'Transducer Adaptor' on page 15.

3     Select the measurement mode (MTG4) - see Section 4.5 on page 5.

4     Set the zero point of the transducer - see Section 5 on page 6.

5     Calibrate the gauge (MTG4) - see Section 7 on page 8.

6     Prepare the test surface - see Appendix 1 on page 17.

# 8 TAKING A READING (continued)

## 8.2 TAKING A READING

1 Apply a small amount of couplant to the test surface.

2 Press the transducer into the couplant, making sure it is flat against the surface.

▸ Moderate pressure on the top of the transducer using the thumb or index finger is sufficient; it is only necessary to keep the transducer stationary and seated flat against the surface of the material.

3 The display will show a value which is constantly updating. The gauge will take 4 readings per second when the transducer is in contact with the surface of the material.

▸ The stability of the reading is indicated on the stability bar to the right of the display. A valid reading has a stability of 5 or more. If the stability indicator has fewer than 5 bars showing or the numbers on the display seem erratic, make sure there is an adequate film of couplant beneath the transducer, and that the transducer is seated flat against the material. If the condition persists, it may be necessary to select a different transducer (size or frequency) for the material being measured.

4 The last reading is held on screen when the transducer is removed from the surface.

# 9 MENU STRUCTURE - MTG4
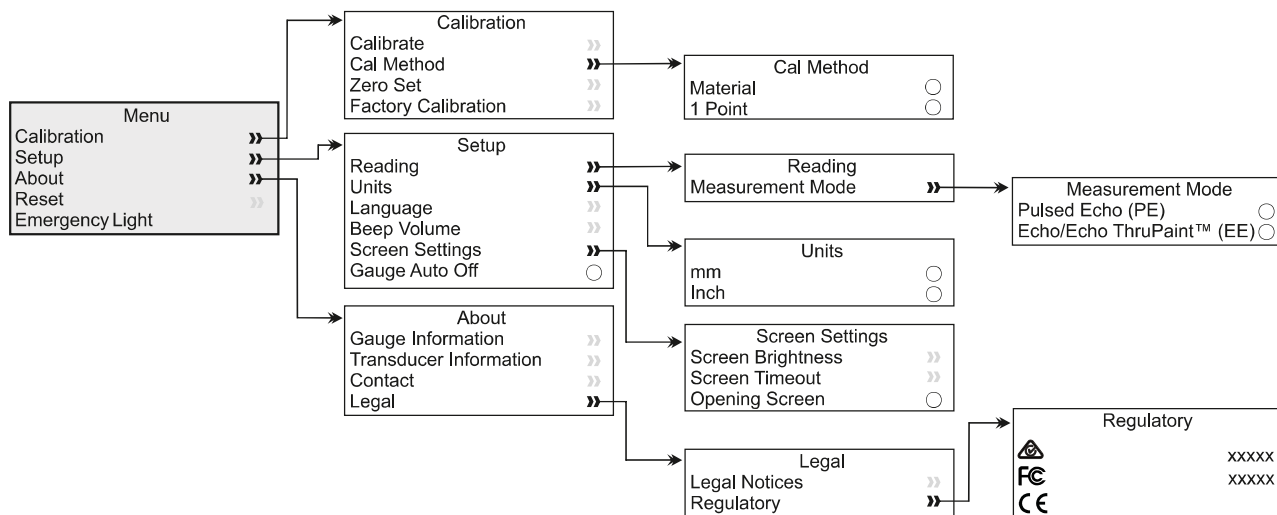
# 10 MENU STRUCTURE - MTG2
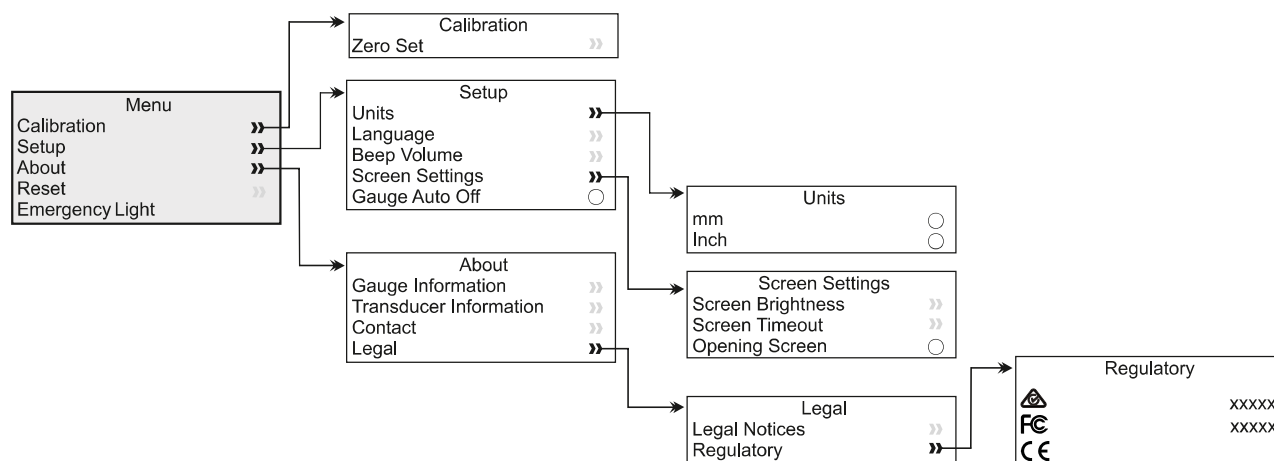


# 11 UPGRADING YOUR GAUGE

Gauge firmware can be upgraded to the latest version by the user via ElcoMaster®, as it becomes available.  ElcoMaster® will inform the user of any updates when the gauge is connected to the PC with an internet connection.

# 12 SPARES & ACCESSORIES

## 12.1 TRANSDUCERS

The transducers listed below are compatible with the MTG product range[b].  They are potted - the transducer cable is permanently fixed to the transducer head - right angle, dual element, 'intelligent' transducers and when connected, will be automatically identified by the gauge.

The MTG2 is supplied complete with a 5.0MHz, 1/4" transducer (TXC5M00CP-4).  A transducer is not supplied with the MTG4 and must be ordered separately.  When choosing a transducer, the frequency, diameter and material under test should be considered.

[b] As the MTG2 is pre-calibrated for steel, only those transducers suitable for measuring on steel can be used with this gauge.

# 12 SPARES & ACCESSORIES (continued)

| Part Number | Frequency | Diameter | Suitable for Measuring | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | C/I | P | T/P | G/F | T/G | S | G | A | T |
| TXC1M00EP-2 | 1.0MHz | 1/2" | ✓ | ✓ | | ✓ | | | | | |
| TXC2M25CP-2 | 2.25MHz | 1/4" | ✓ | ✓ | | | ✓ | | | | |
| TXC2M25EP-2 | 2.25MHz | 1/2" | ✓ | ✓ | | | ✓ | | | | |
| TXC3M50EP-1† | 3.5MHz | 1/2" | ✓ | ✓ | | | ✓ | | | | |
| TXC5M00BP-4† | 5.0MHz | 3/16" | | | ✓ | | | ✓ | ✓ | | |
| TXC5M00EP-3 | 5.0MHz | 1/2" | | | ✓ | | | ✓ | ✓ | | |
| TXC5M00EP-4† | 5.0MHz | 1/2" | | | ✓ | | | ✓ | ✓ | | |
| TXC5M00CP-4 | 5.0MHz | 1/4" | | | ✓ | | | ✓ | ✓ | | |
| TXC5M00CP-6† | 5.0MHz | 1/4" | | | ✓ | | | ✓ | ✓ | | |
| TXC5M00CP-8# | 5.0MHz | 1/4" | | | ✓ | | | ✓ | ✓ | | |
| TXC7M50BP-3† | 7.5MHz | 3/16" | | | ✓ | | | ✓ | ✓ | ✓ | |
| TXC7M50CP-4‡ | 7.5MHz | 1/4" | | | ✓ | | | ✓ | ✓ | ✓ | |
| TXC7M50CP-5† | 7.5MHz | 1/4" | | | ✓ | | | ✓ | ✓ | ✓ | |
| TXC10M0BP-1 | 10.0MHz | 3/16" | | | | | | ✓ | | ✓ | ✓ |
| TXC10M0CP-4 | 10.0MHz | 1/4" | | | | | | ✓ | | ✓ | ✓ |

Key
C/I = Cast Iron          P = Plastics          T/P = Thin Plastics
G/F = Glass Fibre        T/G = Thin Glass Fibre   S = Steel
G = Glass                A = Aluminium          T = Titanium

† Coating thickness, high damped transducer utilising ThruPaint™ technology. Suitable for use with 'Echo-Echo ThruPaint™' measurement mode only - see Section 4.6 'Selecting the Measurement Mode' on page 5.
# High temperature transducer, suitable for measuring hot surfaces up to 343°C (650°F).
‡ Extra resolution transducer with increase near surface resolution, ideal for use on thin substrates.

Other transducers are available which can be connected to MTG gauges using a transducer adaptor - see Section 12.4 'Transducer Adaptor' on page 15. For a complete list of transducers, visit elcometerndt.com

## 12 SPARES & ACCESSORIES (continued)

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## 12.2 CALIBRATION STANDARDS

Available as a set or individually, allowing users to select the most appropriate thicknesses for their application, Elcometer calibration standards are manufactured from 4340 steel[c] to a tolerance of ±0.1% of the nominal thickness.

Calibration standard sets and individual standards are supplied complete with calibration certificate.

| Description | Sales Part Number |
|---|---|
| Calibration Standard Set;<br>Nominal Thickness: 2 - 30mm (0.08 - 1.18")[d] | T920CALSTD-SET1 |

*Comprising of nominal thicknesses; 2, 5, 10, 15, 20, 25 & 30mm (0.08, 0.20, 0.39, 0.59, 0.79, 0.98 & 1.18")[d], complete with holder and calibration certificate.*

| | |
|---|---|
| Calibration Standard Set;<br>Nominal Thickness: 40 - 100mm (1.57 - 3.94")[d] | T920CALSTD-SET2 |

*Comprising of nominal thicknesses; 40, 50, 60, 70, 80, 90 & 100mm (1.57, 1.97, 2.36, 2.76, 3.15, 3.54 & 3.94")[d], complete with holder and calibration certificate.*

| | |
|---|---|
| Calibration Standard Holder<br>*for thicknesses up to 100mm (3.94")[d]* | T920CALSTD-HLD |

*Note:  Elcometer recommends that Calibration Standards are wrapped in anti-corrosion film when not in use.*

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[c]  Calibration standards manufactured in other materials are available on request.  Contact Elcometer for further information.
[d]  Imperial values for information purposes only.  Calibration standards are manufactured and measured in millimetres.

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## 12 SPARES & ACCESSORIES (continued)

| INDIVIDUAL CALIBRATION STANDARDS | | | | | |
|---|---|---|---|---|---|
| **Part Number** | **Nominal Thickness** | | **Part Number** | **Nominal Thickness** | |
| | **mm** | **inch[d]** | | **mm** | **inch[d]** |
| T920CALSTD-2 | 2 | 0.08 | T920CALSTD-40 | 40 | 1.57 |
| T920CALSTD-5 | 5 | 0.20 | T920CALSTD-50 | 50 | 1.97 |
| T920CALSTD-10 | 10 | 0.39 | T920CALSTD-60 | 60 | 2.36 |
| T920CALSTD-15 | 15 | 0.59 | T920CALSTD-70 | 70 | 2.76 |
| T920CALSTD-20 | 20 | 0.79 | T920CALSTD-80 | 80 | 3.15 |
| T920CALSTD-25 | 25 | 0.98 | T920CALSTD-90 | 90 | 3.54 |
| T920CALSTD-30 | 30 | 1.18 | T920CALSTD-100 | 100 | 3.94 |

*Note: Elcometer recommends that Calibration Standards are wrapped in anti-corrosion film when not in use.*

## 12.3 ULTRASONIC COUPLANT

For the gauge to work correctly, there must be no air gap between the transducer and the surface of the material being measured.  This is achieved by using a couplant.

A 120ml (4fl oz) bottle of couplant is supplied as standard with each gauge, other sizes are available to purchase separately.

| Description | Sales Part Number |
|---|---|
| Ultrasonic Couplant; 120ml (4fl oz) | T92015701 |
| Ultrasonic Couplant; 300ml (10fl oz) | T92024034-7 |
| Ultrasonic Couplant; 500ml (17fl oz) | T92024034-8 |
| Ultrasonic Couplant; 3.8l (1 US Gallon) | T92024034-3 |
| Ultrasonic Couplant - | T92024034-9 |
| High Temperature; 60ml (2fl oz) | |

*For use with high temperature transducers up to 510°C (950°F) - see Section 12.1 'Transducers' on page 11.*

[d] Imperial values for information purposes only.  Calibration standards are manufactured and measured in millimetres.

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# 12 SPARES & ACCESSORIES (continued)

## 12.4 TRANSDUCER ADAPTOR

This adaptor allows dual element, 'non-intelligent' transducers from Elcometer - see Section 12.1 'Transducers' on page 11 - and other manufacturers' transducers with Lemo connectors, to be used with the MTG product range.

Simply plug the adaptor into the transducer connection point at the base of the gauge to connect any 'non-intelligent', dual element transducer and follow the on-screen instructions.

| Description | Sales Part Number |
|---|---|
| Transducer Adaptor | T92024911 |

## 13 TECHNICAL SPECIFICATION

| Model | MTG2 | MTG4 |
|---|---|---|
| Thickness Range[a] | Pulsed Echo: 0.63 - 500mm (0.025 - 19.999")<br>Echo-Echo ThruPaint™ (MTG4 only):<br>5.00 - 25.40mm (0.200 - 1") | |
| Velocity Range | 1250 - 10,000m/s (0.0492 - 0.3937in/µs) | |
| Accuracy | ±1% or 0.1mm, whichever is the greater<br>(±1% or 0.01", whichever is the greater) | |
| Resolution | 0.1mm (0.01") | |
| Measurement Rate | 4 Hz (4 readings per second) | |
| Operating Temperature | -10 to 50°C (14 to 122°F) | |
| Power Supply | 2 x AA batteries | |

[a] Thickness range is dependent on the material being measured and the transducer used.

## 13 TECHNICAL SPECIFICATION (continued)

| Model | MTG2 | MTG4 |
|---|---|---|
| Battery Life<sup>e</sup> | Approximately 15 hours | |
| Gauge Weight | 210g (7.4oz) - including batteries, without transducer | |
| Gauge Dimensions | 145 x 73 x 37mm (5.7 x 2.87 x 1.46") - without transducer | |
| Can be used in accordance with:  ASTM E 797, EN 14127, EN 15317 | | |

## 14 LEGAL NOTICES & REGULATORY INFORMATION

The Elcometer MTG2 & MTG4 meet the Electromagnetic Compatibility Directive.

The Elcometer MTG2 & MTG4 are Class B, Group 1 ISM equipment according to CISPR 11.

Group 1 ISM product: A product in which there are intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.

Class B product are suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

The USB is for data transfer only and is not to be connected to the mains via a USB mains adapter.

The ACMA compliance mark can be accessed via: Menu/About/Legal/Regulatory

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

   -- Reorient or relocate the receiving antenna.
   -- Increase the separation between the equipment and receiver.
   -- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
   -- Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.

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All other trademarks acknowledged.

<sup>e</sup> When in continuous reading mode at a reading rate of 4 Hz, using alkaline batteries.  Lithium or rechargeable batteries may differ.

## 15 APPENDIX 1: PREPARING THE TEST SURFACE

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The shape and roughness of the test surface are of paramount importance when carrying out ultrasonic thickness testing. Rough, uneven surfaces may limit the penetration of ultrasound through the material and result in unstable, and therefore unreliable measurements.

The surface being measured should be clean, and free of any small particles, rust or scale. The presence of such obstructions will prevent the transducer from seating properly against the surface.

Often, a wire brush or scraper will be helpful in cleaning surfaces. In more extreme cases, a rotary sander or grinding wheels may be used, though care must be taken to prevent surface gouging, which will inhibit proper transducer coupling.

Extremely rough surfaces, such as the pebble-like finish of some cast iron, will prove most difficult to measure. These kinds of surfaces act on the sound beam like frosted glass acts on light, the beam becomes diffused and scattered in all directions.

In addition to posing obstacles to measurement, rough surfaces contribute to excessive wear of the transducer, particularly in situations where the transducer is 'scrubbed' along the surface.