USER'S MANUAL

EASZ-TG11 ULTRASONIC THICKNESS GAUGE

ISSUE 1

EASZ-TG11
USER'S MANUAL

EASTERN ENERGY SERVICES PTE LTD.
METERING AND INDUSTRIAL PRODUCTS

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IMPORTANT NOTICE

It is very important that you read and fully understand this manual before attempting to use your TG11 thickness meter. It provides instruction in the basic set-up and operation of the TG11.

WARNING
PLEASE READ AND UNDERSTAND THIS MANUAL. IMPROPER USE CAN LEAD TO ERRONEOUS RESULTS OR DAMAGE TO THE THICKNESS GAUGE

All statements, technical information and recommendations contained in this manual are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using the product you should determine its suitability for your intended use. You bear all risk in connection with the use of this product.

You are reminded that all warranties as to merchantability and fitness for purpose are excluded from the contract under which the product has been supplied to you. The seller's only obligation in this respect is to replace such quantity of the product proved to be defective.

NEITHER THE SELLER NOR THE MANUFACTURER SHALL BE LIABLE EITHER IN CONTRACT OR TORT FOR DIRECT OR INDIRECT LOSS OR DAMAGE (WHETHER FOR LOSS OR PROFIT OR OTHERWISE), COSTS, EXPENSES OR OTHER CLAIMS FOR CONSEQUENTIAL OR INDIRECT COMPENSATION WHATSOEVER (AND WHETHER CAUSED BY THE NEGLIGENCE OF THE COMPANY, ITS EMPLOYEES OR AGENTS OR OTHERWISE).

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INTRODUCTION

The TG11 is a hand held microcontroller based ultrasonic thickness gauge. It operates on two AA type batteries and is very easy to use.

Please read this manual and follow the instructions carefully in order to get the best use out of the instrument.

How an Ultrasonic Thickness Gauge Works

An Ultrasonic thickness gauge is a "TRANSIT TIME MEASURING DEVICE" working on a pulse-echo principle.

A burst of ultrasound is generated by striking a piezo-electric crystal of the transducer with an electrical pulse.

The sound then travels through the delay line of transducer across the layer of ultrasonic couplant and is then transmitted into the material being measured.

The sound pulse will continue to travel through the material until it reaches a material of a substantially different physical characteristic from the test material (e.g. air). The air then acts as a transmission barrier to ultrasound, hence it is reflected back to the transducer.

The time required by an ultrasound burst to make a round trip through the test material is accurately measured by the highly stable timing mechanism inside the instrument.

The instrument then determines the thickness of the test material by multiplying the velocity with time and dividing it by 2.

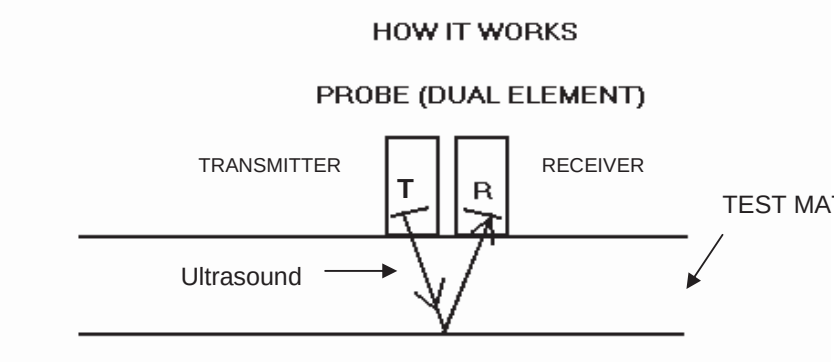

Fig 1: Diagram Ultrasonic testing principle

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AREAS of APPLICATION

Metals, plastic, glass, ceramic or virtually any other material which satisfactorily conducts ultrasound and has a parallel (or concentric)surface can be gauged for the thickness. A major application of this gauge is for assessing wall thinning due to corrosion / erosion.

Typical application areas Include:

- Heat Exchanger
- Tubing
- Pressure vessels
- Casting
- Forgings
- Boilers
- Pipe
- Machined Parts
- Axles / Rails / Wheels
- Storage Tanks
- Steamlines
- Flanges
- Ship hulls / Decking
- Airframe (Aircraft windows)
- Plates / Slabs / Blooms
- Billets / Bars
- Plastic Sheet / Pipes
- Rolls
- Glass Plates
- Beams
- Extrusions
- Bridges

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PARTS & CONTROLS

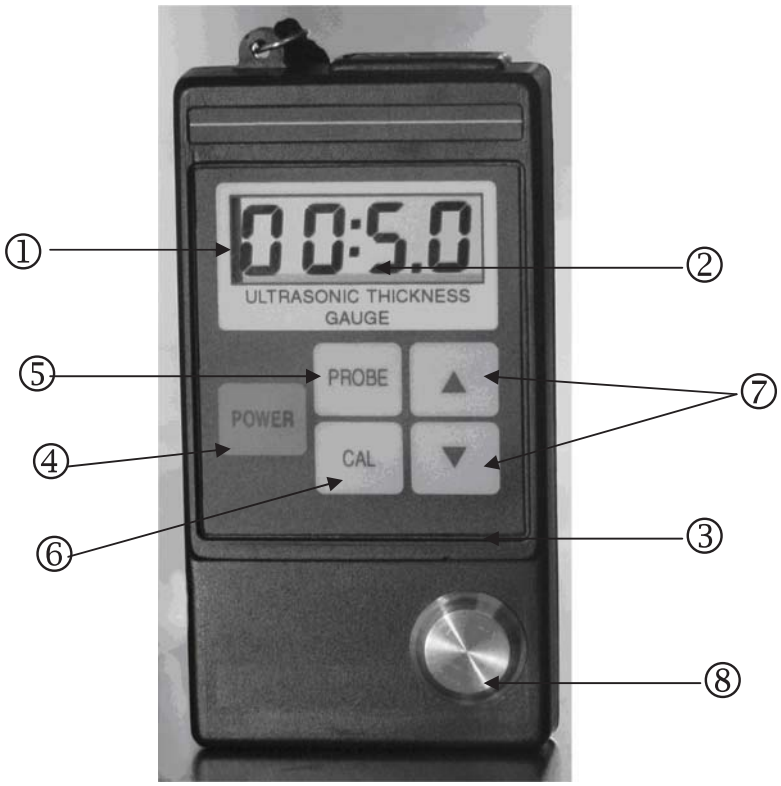

Fig 2 : TG11 *(front view)*

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KEY TO PARTS AND CONTROLS

① **LCD**
A 4 digit display, displaying all readings, battery indicator, probe coupling indicator, velocity etc.

② **PROBE COUPLING INDICATOR**
When the probe coupling between the probe and test material is ready and correct – the colon symbol displays.

③ **KEYBOARD**
Completely sealed keyboard containing the 5 operation keypads.

④ **POWER**
Switches the instrument on and off.

⑤ **PROBE**
For probe recognition, zero adjustment.

⑥ **CAL Key**
Used for the calibration of known/unknown velocity material.

⑦ **"▲" or "▼" keys**
Used during calibration process to increase or decrease value.

⑧ **CALIBRATION BLOCK**
Used for probe recognition (zero adjustment).

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START-UP

1. Switch off unit.

2. Press hold down up scroll key.

3. Switch on unit with POWER key.

4. The decimal point will flash between inch and mm positions. Release up scroll key, then press it again to select the correct mode.

5. Press down scroll key to lock mode.

This enables the gauge to be switched between imperial and metric measuring.

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CALIBRATION

The calibration process sets up the zero point of the probe and the velocity of the Ultrasound within the target material.
Calibration methods are described as below.

Calibration for Steel
This is the simplest calibration method. It sets the probe zero point and adjusts the velocity to that of mild steel, 5920 m/sec.

Procedure
- Apply couplant to the calibration block and couple probe firmly on it. When a stable reading is displayed on LCD, press the "PROBE"' key.
- After one or two seconds the LCD will display 005.0 which indicate that calibration is complete.

The TG11 is now ready for use on steel.

Calibration for material with Known Velocity

Procedure
- Perform calibration for steel as in step A above.
- Press "CAL" key twice. LCD will display 5920 velocity of the steel.
- Using “σ” or “τ” keys to set the LCD equivalent to the known ultrasound velocity of the test material.

For the above procedure, coupling the probe to the calibration block is not required

The TG11 is now ready for use.

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Calibration for material with Unknown Velocity

To be used if the Ultrasound Velocity of the test material is unknown, but the actual thickness of the test material is known:

Procedure

- Perform calibration for steel as in step A above.
- Apply some couplant to the test material and couple probe firmly on it.
- When a stable reading is displayed on LCD remove the probe.
- Press CAL key so probe-coupling indication disappears.
- Using "σ" or "τ" keys to set the display reading to the actual thickness of the test material.
- Now couple probe to the unknown velocity material.
- The LCD should display actual thickness. If not, then further repeat above procedure.

Note: When the probe is changed, recalibration will be required.

Calibration settings are retained by the TG11, however if the instrument is not used for long time it may be appropriate to check and even re-calibrate the gauge.

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GAUGING TECHNIQUES

Clean Surfaces

Prior to gauging, always remove any dirt, loose scale, corrosion, particles, flaking paint or other foreign substance from the material surface.
Otherwise measurement accuracy may be hindered.

Rough or Grooved surfaces.

For very rough surfaces or grooved surfaces a high viscosity couplant, like grease, is recommended.
With a grooved surface, couple probe in such a way so that the probe cross-talk barrier is at a right angle to the grooved direction.

Couplant

For the smooth surface suitable couplant is machine oil or even water is sufficient but for the rough surface high viscosity couplant like grease is recommended.
In high temperature material special couplant is available from EESIFLO.

Gauging on cylindrical surface

On a cylindrical surface probe normality and probe cross-talk orientation is important.

To determine normality, rock the coupled probe back and forth along the curved surface direction on the material surface and use the minimum thickness reading, as this represents probe normality.

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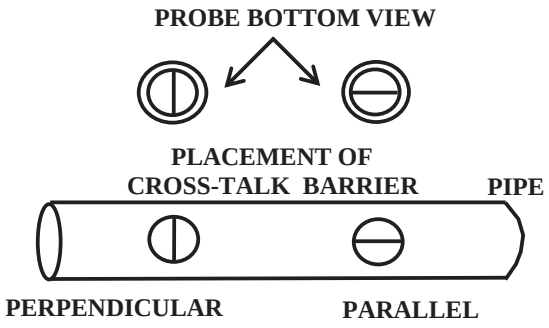
Selection of probe cross talk barrier orientation depends on the material surface diameter. On large surface diameter, orient the probe so that its barrier is perpendicular to the cylindrical axis of the material. On smaller diameter, initially orient the probe barrier both perpendicular to and parallel with material cylindrical axis and then use the direction that gives smaller thickness readout.



Non Parallel Surface

The surface on either side of a section must be relatively parallel or concentric in order to obtain a satisfactory ultrasound echo for a thickness reading. Non parallel or tapered surface will yield either less accurate or possibly no reading at all.

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Materials & Temperature Effects

Both the dimensions and ultrasound velocity of a material changes with temperature, which in turn affects calibration. Normally, the effect can be ignored for the modest changes in ambient temperature but its always good practice to re-calibrate when a noticeable change in ambient temperature occurs.

The situation becomes more complex when the material temperature is considerable different than ambient. One solution is to calibrate on a reference sample at same temperature as the material. Another solution is to calibrate on a reference sample at ambient temperature and then add an experimentally derived correction factor for the temperature of the material.

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Velocity Coding Table

Approximate ultrasonic velocity values for a variety of common Industrial materials.

Materials	Velocity Metres/second
Acrylic Resin	2670
Aluminium	6320
Brass, Nanal	4430
Bronze, Phosphor	3530
Cast Iron	4600
Copper	4660
Glass, Window	6790
Inconel	5720
Iron	5900
Magnesium	6310
Monel	6020
Nickel	5630
PE	2340
PVC	2400
Quartz Glass	5570
Steel Casting	5850
Steel Mild	5920
Steel, 4330	5850
Steel, 303 CRES	5660
Titanium	6070
Zinc	4170
Zirconium	4650

Note: These reported ultrasonic velocities are only approximations due to effects of chemical and physical variations.

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Battery Care and Use

Low Battery indication is provided by blinking of the LCD. After blinking it can operate for half an hour. Then recharging or charging of batteries is required.

The TG11 operates on any AA type dry cell or alkaline batteries or on Ni-Cd batteries. When using Ni-Cd batteries operator should charge the batteries before its first use and before any significant measurement project.

Precautions

- Avoid shock to instrument or probe.
- Wipe the couplant off the probe and calibration block after use.
- Plug and unplug cables with care. Check polarity.
- Replace any probe which is malfunctioning or showing excessive or uneven wear.
- Remove the batteries from TG11 if you are not going to use it for a long time.

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TG11 Specifications

Applicable Materials:	Steel, Cast Steel, Cast Iron, Alumium, Other Metals, Hard plastics, Glass, Ceramics etc
Measuring Range:	1mm to 300mm
Probe:	Dual crystal Transmitter Receiver type
Key Pad:	Sealed tactile type
Velocity:	1000 m/sec to 9999 m/sec
Display:	4 Digit LCD
Resolution:	0.1 mm
Accuracy:	± 0.1mm (below 60mm) ± 0.3% (Above 60mm)
V path Correction:	Built-in for better Accuracy
Calibration:	One step Calibration
Battery:	Two Penlite (AA) Dry cells or Ni-Cd.
Operating time:	18 to 20 hours (with alkaline batteries)
Low Battery:	Indication by blinking of LCD
Auto Power Off:	3 minutes delay
Size:	125(H) X 65(W) X 30(T)mm
Weight:	200 Grams (with batteries)
Housing:	ABS moulded Plastic

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