



Simplifying NDT

OPERATION MANUAL



EDISON - 1M ULTRASONIC THICKNESS GAUGE

Manufactured & Marketed By :

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ProbeDT-201(H)	

All possible care has been taken in the preparation of this operation manual. If you find any errors or would like to make suggestions for improvement to this operation manual, then please write to:

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OP 13(1)

Instructions for using High Temperature Probe DT-201(H)

Temperature measuring range 0°C to 150°C

1. First couple the probe on 5mm reference & do zeroing.
2. Apply high temp couplant on probe (suitable for 300°C)
3. Check on material of which thickness is to be measured,(do not place probe for long time on hot surface-it should be only @ 5 seconds.)
4. Immediately Dip the probe coupling surface in cold water.(if available use chilled water)
5. Repeat check as per requirement following step-2,3,4.
6. Afterwards clean the surface of probe thoroughly and store it.
7. This will help to keep the Probe in good condition.

SPECIAL NOTE:

ON COUPLING AT HIGH TEMP SURFACE THE THICKNESS SHOWN ON M/C WILL BE DIFFERENT DUE TO DIFFERENCE IN ULTRASOUND VELOCITY.SET AS PER GIVEN REFERENCE EXAMPLE

e.g.:

2.0mm Thickness will show approx. 2.5mm when measuring at high temp.Under this condition set m/c reading to 2.0mm and continue measurement. You will get actual reading. (Refer operating manual “unknown velocity” calibration.)

Specification of Probes

Probes	Freq. MHz	Contact Face Dia.	Range (In Steel)		Accuracy	Application
			Flat Surface	Cylindrical Surface		
DT 201	5	12.5 mm	2 to 200 mm	2 to 200 mm with OD 45 mm and more.	± 0.1 mm upto 60mm ± 0.5% above 60mm	General Purpose, Ideal For tubes, Vessels, Plates etc.
DT 212	10	9 mm	1 to 25 mm	2 to 25 mm with OD 25mm and more.	± 0.1 mm	Small dia. Tubes, thin plates etc.
DT 203	2	24 mm	5 to 300 mm	5 to 300 mm with OD 100mm and more.	± 1% above 50mm	Attenuative material like casting etc.
DT 201(H)	5	12.5 mm	4 to 50 mm	5 to 50 mm with OD 100mm and more.	± 0.1 mm	General purpose but at elevated surface temperature up to 150°C.

Note: The range mentioned above is for Mild Steel, heat-treated, machined and at Room Temperature.
This range is affected by sound attenuation in material, surface temperature, surface roughness etc.

Introducing Edison-1M

The Modsonic EDISON-1M is a hand held microcontroller based Ultrasonic Thickness Gauge. It can store 2000 reading with Unique ID. Metric Imperial selection. It operates on only two AA type batteries and is simple in usage.

How an Ultrasonic Thickness Gauge Works ?

An Ultrasonic thickness gauge is a "TRANSIT TIME MEASURING DEVICE" working on 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.

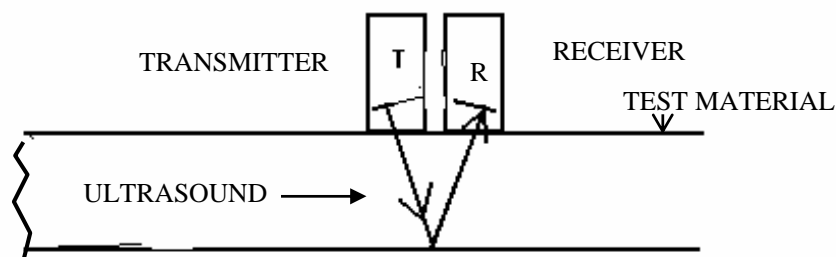
The sound pulse will continue to travel through the material until it reaches a material of substantially different physical characteristic from the test material (e.g. air). The air then acts as a transmission barrier to ultrasound, hence it is reflected back to the transducer.

The time required by ultrasound burst to make round trip of the test material is accurately measured by the highly stable clock inside the instrument.

The instrument then determines the thickness of the test material by multiplying the velocity with time and dividing it by 2. (The time is measure for to and fro distance).

HOW IT WORKS

PROBE (DUAL ELEMENT)



Specification of Main Unit

Applicable Materials	: Steel, Cast Steel, Cast Iron, Aluminum Other Metals, Hard Plastic, Glass Ceramic etc.
Measuring Range	: 1 mm to 300 mm. (Specified range depends on test material, transducer, surface and temperature.)
Probe	: Dual crystal Transmitter Receiver type.
Key Pad	: Sealed tactile type.
Velocity	: 1000 mt/sec to 9999 mt/sec. 0393 to 3936 *100 inch/sec.
Display	: 4 Digit LCD. It displays Thickness, Velocity, Battery check, Coupling check, Stored readings with Ids.
Resolution	: 0.1 mm/0.01 inch.
Accuracy	: $\pm 0.1\text{mm}$ (up to 60mm) {for standard $\pm 0.5\%$ (Above 60mm) probe DT 201 }
Memory	: 2000 readings with 4 digits ID.
RS-232 Port	: Available for connectivity to PC/Printer.
V path Correction	: Built-in for better Accuracy.
Calibration	: One step Calibration.(for Steel).
Battery	: Two Penlite (AA) Dry cells or NiMH.
Operating time	: 18 to 20 hours.(with alkaline batteries).
Low Battery	: Indication by Blinking of LCD.
Auto Power off	: 3 minutes after switched on/last reading.
Size	: 125(H) X 65(W) X 30(T) in mm.
Weight	: 225 Grams (With batteries).
Housing	: ABS Plastic moulded.

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 EDISON-1M if you are not going to use it for a long time.

Areas of Application

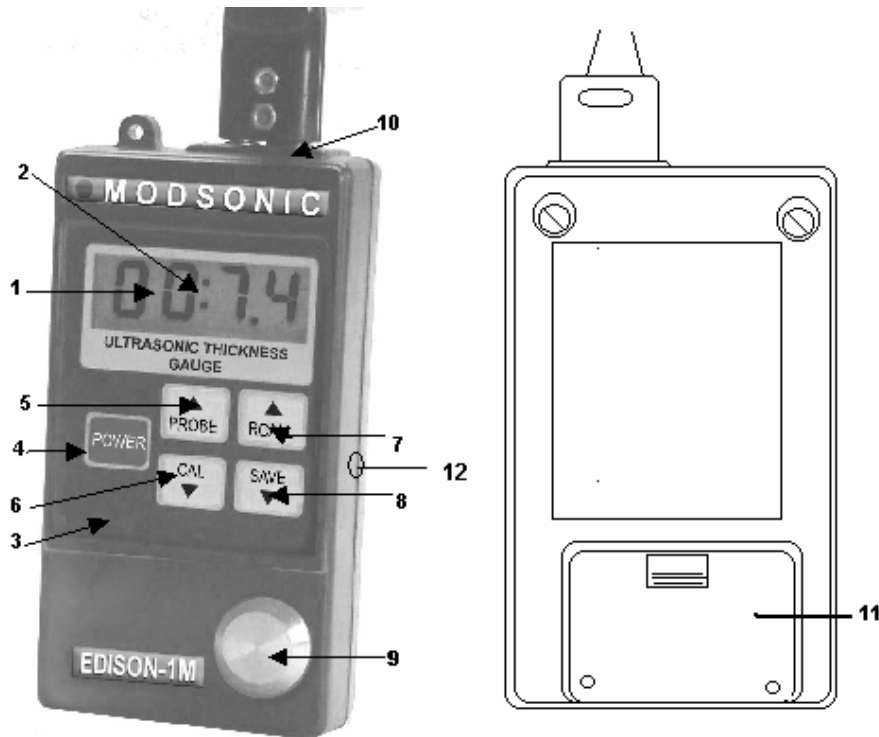
Metals, Plastic, Glass, Ceramic or virtually any other material which satisfactorily conducts ultrasound and has a parallel (or concentric) surface can be gauged for the thickness.

A major application of this gauge is for assessing wall thinning due to corrosion/erosion.

Some Typical Application Areas Include:

- | | |
|---------------------------------|-------------------------|
| 1) Heat Exchanger Tubing | 2) Pressure vessels |
| 3) Casting | 4) Forgings |
| 5) Boilers | 6) Pipe/Tubing |
| 7) Machined Parts | 8) Axles/Rails/Wheels |
| 9) Storage Tanks | 10) Streamlines |
| 11) Flanges | 12) Ship hulls/Decking |
| 13) Airframe (Aircraft windows) | 14) Plates/Slabs/Blooms |
| 15) Billets/Bars | 16) Plastic Sheet/Pipes |
| 17) Rolls | 18) Glass Plates |
| 19) Beams | 20) Extrusions |
| 21) Castings | 22) Bridges |

Parts and Controls of EDISON-1M



- 1 LCD : It is 4 Digit display, It displays thickness reading, Battery check, Probe coupling indication, Velocity Reading ID etc.
- 2 Probe Coupling Indication : When probe coupling between probe and test material is proper at that time colon disappears.
- 3 Key board : Completely sealed tactile key board has five different keys for the operation.

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 of battery is required.

EDISON-1M operates on any AA type dry cell or Alkaline batteries or on NiMH batteries.

When using NiMH batteries operator should charge the batteries before it's first use and before any significant measurement project.

Charging Instruction

- > EDISON-1M is supplied with the NiMH Battery charger
it can charge any number of batteries at a time.
(Maximum 4 Nos.)
- > Charging time is 5 to 8 hours depending on number and state of cells but before first use charge for 14-16 hours to achieve full charge.
- > It is advisable to remove the batteries from the charger after they are charged.

All NiMH batteries can suffer from "memory" effect which results in loss of capacity. This occurs when batteries are kept for a long time without charge / discharge process. So it is recommended the batteries should be regularly charged and discharged for better life.

Note: 2 Nos stand by NiMH batteries are supplied to enable the user to have uninterrupted operation.

Velocity Coding Table

Approximate Ultrasonic Velocity values for a variety of common Industrial materials.

Materials	Velocity Mt/sec.	Velocity Inch/sec.
Acrylic Resin	2670	1051*100
Aluminium	6320	2488*100
Brass, Nanal	4430	1744*100
Bronze, Phosphor	3530	1389*100
Cast Iron	4600	1811*100
Copper	4660	1834*100
Glass, Window	6790	2673*100
Inconel	5720	2251*100
Iron	5900	2322*100
Magnesium	6310	2484*100
Monel	6020	2370*100
Nickel	5630	2216*100
PE	2340	921*100
PVC	2400	944*100
Quartz Glass	5570	2192*100
Steel Casting	5850	2303*100
Steel Mild	5920	2330*100
Steel, 4330	5850	2303*100
Steel, 303 CRES	5660	2228*100
Titanium	6070	2389*100
Zinc	4170	1641*100
Zirconium	4650	1830*100

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

- 4 Power : To switch the instrument ON/OFF.
- 5 Δ / PROBE key : For the probe recognition (Zero adjustment). Or Increase/Decrease Parameters value.
- 6 CAL / V key : Calibration key is used for the calibration for known/unknown velocity material. Or Increase Decrease Parameters value.
- 7 Δ / RCALL Key : Used to Recall reading. OR Increase/Decrease Parameter s value.
- 8 SAVE / V Key : Used to save reading. OR Increase/Decrease Parameters value.
- 9 Calibration Block : Used for probe recognition (Zero adjustment).
- 10 Probe Cable connector : Probe is connected to the main unit through this connector.
- 11 Battery compartment : Contains two AA type Rechargeable/Dry cell battery.
- 12 RS-232 Port : Available for connectivity to PC/ Printer

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.

A> 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 mt/sec (2330 *100 Inch/Sec).

Procedure

> Apply couplant to the calibration block (9) and couple probe firmly on it, When stable reading is displayed on LCD then press "Λ/ PROBE"(5) key .

> After one or two seconds LCD display 005.0 which indicates that calibration is completed.

(If Imperial is selected then LCD display 00.19)

EDISON-1M is now ready for use on steel. If a different material is to be tested follow next calibration procedure.

B> Calibration for material with Known Velocity.

If the Ultrasound velocity of the test material is different from the steel 5920 mt/sec metric (2330 *100 Inch/sec in Imperial) and material Ultrasound velocity is known then follow the below given steps.

Procedure

- > Perform calibration for steel as in step A above.
- > Press "CAL/ V"(6) key twice. LCD will display 5920 mt/sec (2330 *100 inch/sec) velocity of the steel.
- > Using "Λ/RCALL"(7) or "SAVE /V" (8) keys set velocity on LCD as per the known Ultrasound velocity of the test material.

Items Supplied with Standard Unit

Main Unit	Edison-1M	1 Nos.
Probe (General purpose)	DT 201	1 Nos.
Probe Cable	DT 231	1 Nos.
DATA Cable	EDI 232	1 Nos.
Interface Software CD	EDI-CD01	1 Nos.
Battery Charger	ET-245	1 Nos.
Rechargeable NiMH Batteries	ET-341	4 Nos.
Protective Case	ET-271	1 Nos.
Carrying/Storage case	DT-273	1 Nos.
Operating Manual	OP-13	1 Nos.
Test & Calibration Certificate		

Optional Probes and accessories

<u>Items</u>	<u>Code</u>
Special probe for smaller diameter surface	DT 212
Special probe for highly attenuative material	DT 203
Special probe for elevated surface temperature	DT 201(H)
Step Block	VW
Data Printer for Edison-1M	EDI-PRN01
Couplant (Elevated surface temperature)	CHT

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.

Material Temperature Effects

Both the dimension and ultrasound velocity of a material change with temperature, which in turn affects calibration. Normally, the effect can be ignored for the modest changes in ambient temperature but it's 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.

(For the above procedure B, coupling of probe to calibration block is not required).

EDISON-1M is now ready for the use on same material Whose velocity is set.

C> Calibration for material with Unknown Velocity.

If the Ultrasound Velocity of the test material is unknown but the actual thickness of the test material is known than follow the below given steps.

Procedure

- > Perform calibration for steel as step A above.
- > Apply some couplant to the unknown velocity material and couple probe firmly on it, When stable reading is displayed on LCD then Uncouple the probe.
- > Press “CAL/ V”(6) key so probe coupling indication disappears.
- > Using “A / RCALL”(7) or “SAVE / V” (8) keys set display reading to actual thickness of the test block . (on which test material probe is coupled for performing above step).
- > Further couple probe to the unknown velocity material, Now LCD should display actual thickness. If not, then further repeat above procedure.

EDISON-1M is now ready for the same material whose velocity is same.

- Note:** i When probe is change then recalibration is required.
- ii Calibration is retained in EDISON-1M but if after long time EDISON-1M is switched ON at that time calibration checking or recalibration is recommended. Also refer Gauging Techniques.

Memory Usage of Edison-1M

For to use memory of Edison-1M different function as per below.

- A> Store Reading.
- B> Recall stored Reading.
- C> Overwrite stored Reading.
- D> Transfer Stored Reading to Pc/Printer.
- E> Clear Memory

A> Store Reading

In Edison-1M Reading can be stored with Individual ID (Identification), means Each Reading Can be stored with appropriate ID. There is a two way to assign ID to Reading as per below.

i> Auto ID

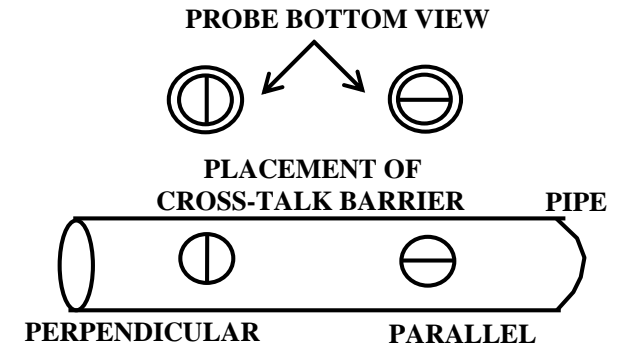
ii> Special ID Different than Auto

- i> **Auto ID** After getting Reading Press " SAVE/ V " (8) key so Edison-1M momentary Display "SAVE " on LCD and It Stores reading, But in this case Reading is stored with ID whose ID is just grater then the previous Reading.
- e.g. If the ID of Previous Reading is 1500 then ID of next reading will be $1500+1$ means 1501.

In Auto ID technique saves time of operator and save Reading With incremental ID. But if it is required to save reading with not incremental ID Then follow step ii.

- ii> **Special ID Different than Auto** After getting Reading Press "SAVE/ V "(8) key so Edison-1M momentary Display "SAVE" on LCD, Then immediately press further "SAVE/ V "(8) key, now LCD Start blinking of one digit (After pressing "SAVE/ V "(8) key (Edison-1M displayed on LCD is the ID of previous reading) Now blinking digit can be set by " Δ /PROBE" (5) key or using by "CAL/ V" (6) key now switch over to next digit

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.



Gauging Techniques

Clean Surface

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).

For Excessive Surface Roughness or grooved surface.

For very rough surface or grooved surface high viscosity couplant like grease is recommended. In grooved surface couple probe in such a way so the probe cross-talk barrier is at 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 Modsonic. Refer Probes and accessories.

Gauging on cylindrical surface

On cylindrical surface probe normality and probe cross-talk orientation are 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.

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

to next digit press " Λ /RCALL" (7) key, so next digit starts blinking and that can be adjusted as per describe above. Once appropriate ID is set, then press "SAVE/ V " (8) key so current reading is stored with ID Displayed on LCD.

B> Recall stored Reading

For to Recall Stored reading on LCD, Press " Λ /RCALL" (7) Key so Edison-1M display Reading and ID (one by one) of last stored reading after releasing " Λ /RCALL" (7) key LCD will display ID of reading. For to Recall Stored reading in chronological (current to top) order press " Λ /RCALL" (7) and " Λ /PROBE" (5) key simultaneously so it will display one by one reading. (For ten reading LCD display Reading and ID one by one then it starts to display only ID. After realising and Re-pressing " Λ / PROBE" (5), " Λ /RCALL(7) " key it further restarts to display Reading and ID). For to Recall Stored reading in incremental (current to bottom) order press " Λ /RCALL" (7) and "CAL/ V"(6) key simultaneously so it will display one by one reading.

C> Overwrite stored Reading

For to overwrite any reading Recall that reading as per describe in Recall stored Reading (B) So LCD display ID of that reading, Then take Reading and Press "SAVE/ V " (8) key so LCD Display "SAVE" on LCD then immediately Press " Λ /RCALL" (7) key so it asks ID, IF You want to save with different ID then modify it else just press "SAVE/ V " (8) key so that reading gets overwrite. (For to modify ID, different ID can be set as per describe in (ii) Special ID Different then Auto procedure)

D> Transfer Stored Reading to PC/Printer

Stored data can be Transferred to PC or To the Serial printer directly.

Data Transfer to PC : For to transfer Stored reading to PC

- > Connect data cable from Edison-1M to PC on appropriate serial port.
- > Run EDISON.EXE file on PC.(IF the Programme is not installed on PC then refer Programme installation).
- > Press "Λ/RCALL"(7) key keep it press and press "SAVE/ V "(8) key simultaneously So LCD display "SEND".
- > " DATA TRANSFERING WAIT " message starts to blink on PC screen. (IF not then Refer Programme installation).
- > After transferring all reading PC will give "BEEP" Sound and Reading Display on PC Screen. (Maximum data transferring time 5 minutes)

Programme Installation

- > Copy all files from the supplied CD. (take care DLL file is also there for more detail read “Edison.txt” file using Notepad.
- > Run Edison.exe file.
- > On first run it will give Error message “Port selection file is Lost so select appropriate port” So select appropriate serial port Which is free and where data cable to be connected from Edison-1M.
- > Connect DATA cable from Edison-1M to PC at appropriate serial Port.
- > Transfer Data from Edison to PC refer Data Transfer to PC.

Data Transfer to Serial Printer

Data Can be Directly Transfer to Standard Serial printer Supplied by Modsonic Or to Other make (In other make Printer, it should be configure as per below)

Baud 1200
Parity None
Data length 8 bits
EXT/ACK Off

- > Connect cable from Edison-1M to Printer.
- > Press "Λ/RCALL" (7)key keep it press and press "SAVE/ V "(8) key simultaneously so LCD display "SEND".
- > At the end of the Report Printer will print "OVER".

E> Clear Memory

For clear all Reading follow as per below.

Press "Λ/PROBE" (5) key keep it press and press "SAVE/ V "(8) key, LCD Start to display "CLRA" then release "SAVE/ V "(8) and "Λ/PROBE" (5) key. Then Press "Λ/RCALL"(7) for conformation you really want to clear Memory. If You not press "Λ/RCALL" (7)key within short time then it don't clear memory and starts to display reading.

Metric Imperial Selection

In Edison 1M Imperial metric selection facility is available

For to select appropriate Gauging Unit follow below procedure.

- > Power OFF the Edison-1M.
- > Press “Λ/RCALL” (7) key keep it press and Switch ON Edison-1M.
- > Using “Λ/RCALL” (7) key set position of Decimal point.
If Decimal point position is “000.0” then metric unit is selected.
If Decimal point position is “00.00” then Imperial unit is selected.
(On LCD “0” is not displayed only decimal point will be displayed)
- > After setting appropriate unit press “SAVE/ V”(8) key for conformation.
- > Now Edison-1M is now ready for Gauging.