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STRUMENTI & SERVIZI
per il sistema qualità



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MACH-I

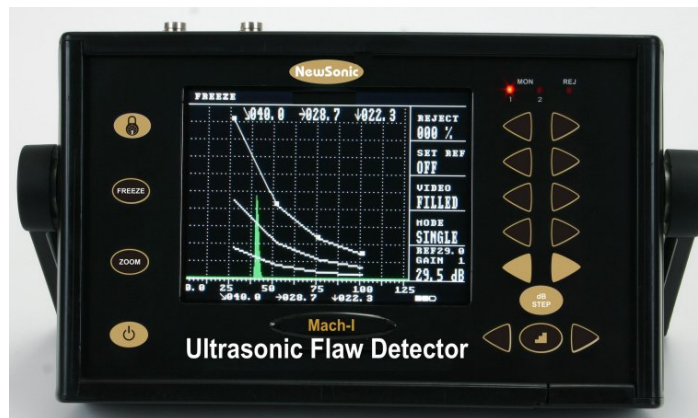
OPERATING MANUAL

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1.0 Mach-I Introduction

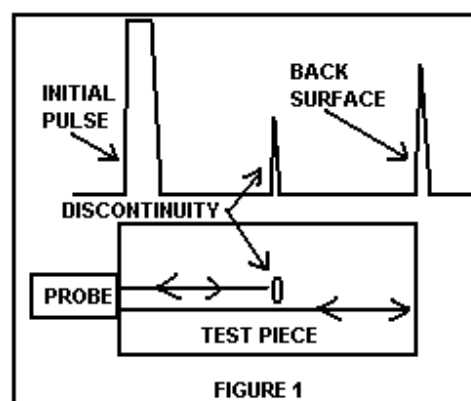
The Mach-I is a portable, compact, lightweight and user friendly Digital Ultrasonic Flaw Detector. The Mach-I has a COLOR LCD display which provides a wide viewing angle and allows for fast scanning speeds. The Mach-I's fully charged battery gives continuous operation of eight hours and charging time is just 2 to 3 hours. A-scan trace pattern can be directly printed out on a conventional PC printer having serial port interface or can be transferred to a PC via RS232 Serial port for storage of data.



2.0 Ultrasonic Flaw Detector Basics

The Mach-I is a single channel ultrasonic testing instrument used for the inspection of homogeneous materials for the presence of inclusions, porosity and other discontinuities that can affect the performance of material and components. It can also be used for thickness gauging of homogeneous materials, requiring access from only one side of the test piece. High frequency sound (ultrasonic sound) waves are introduced into the test material or part from a transducer/probe that is usually coupled to the test piece by water or other suitable coupling liquid. The transducer converts electric signals to ultrasound and vice versa. A short burst of ultrasound is introduced into test material so some or all of the energy is reflected by discontinuities. The reflection of the ultrasound energy is a function of the ratio between the acoustic impedance of the discontinuity and the base material. The greater the impedance ratio the more sound energy will be reflected. The principle of ultrasonic testing is shown in figure 1. It shows the ultrasonic energy generated in the test piece and resulting instrument display.

Thickness gauging with the Mach-I operates on the principle of the time-of-flight



measurement. This principle utilizes the precise timing of the transit time of a short burst of ultrasound energy through a material under test. The ultrasound waves travel to the far side of the test piece and reflect back to the transducer/probe and a measurement is obtained.

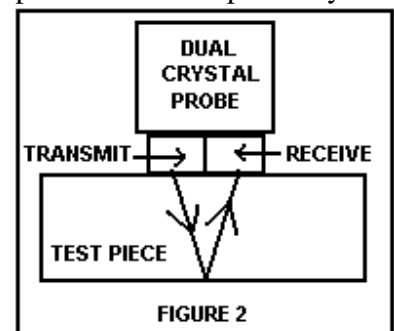
Transducers

Basically three types of transducers/probes are available for different types of applications:

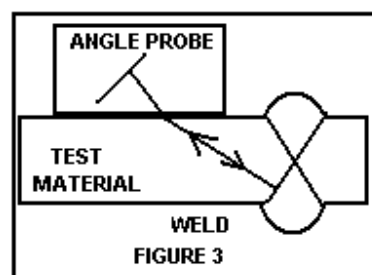
1. **Straight beam Probe (Normal probe)**
2. **TR probe (Dual crystal probe)**
3. **Angle beam Probe**

1. Straight beam Probe: A straight beam probe introduces ultrasound normal to the test piece surface utilizing longitudinal or compression waves. Straight beam probes are used primarily for flaw detection and thickness gauging (ref. Figure 1.).

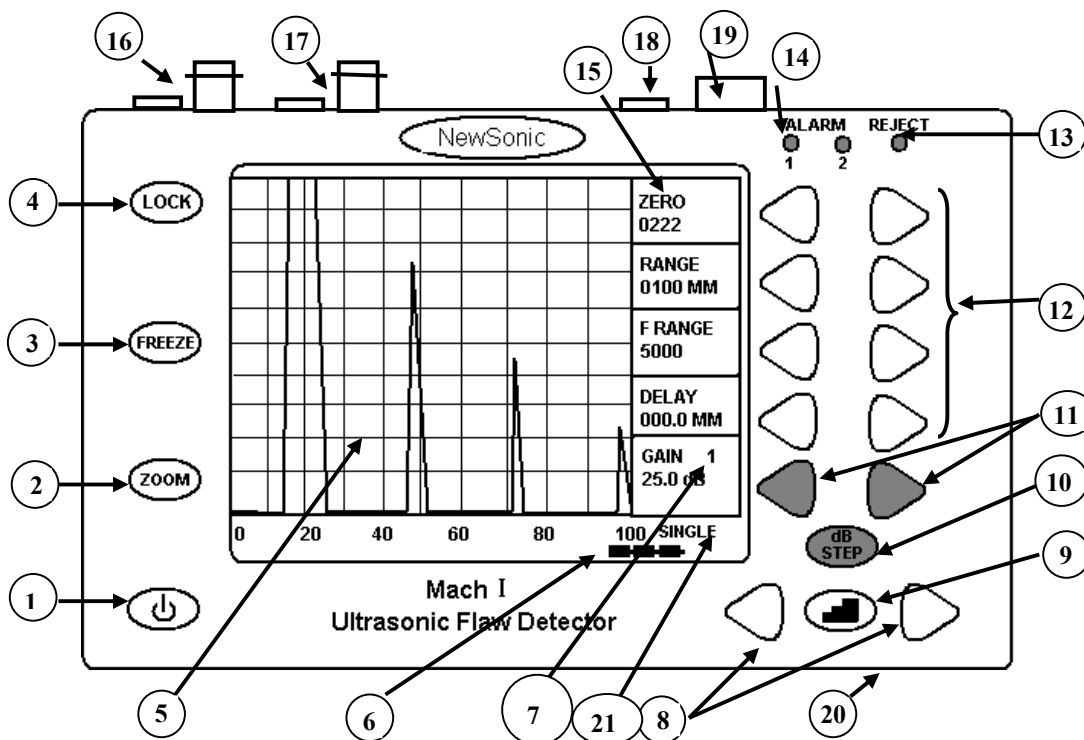
2. Dual probe: A dual probe contains separate transmitting and receiving elements (as shown in Figure 2) usually mounted on delay lines. This design improves near surface resolution by separating the initial pulse from the received echoes. Dual probes are suitable for thickness gauging of pitting and corrosion and are also better for near surface resolution.



3. Angle Beam Probe: An angle beam probe introduces ultrasound at an angle to the surface of the test piece. In most angle beam probes, the wave energy is mode converted from a longitudinal wave to a shear wave by the refraction principle. These probes are suitable for inspection of welds. The reason for this is its ability to position the transducer/probe away from the weld bead yet propagate energy into the weld zone. Another reason to use angle beam testing on welds is to position the sound beam more normal to the expected discontinuities since the flaws in welds are usually perpendicular to the test piece (except porosity). Figure 3 shows the principle of angled beam weld testing.



3.0 Mach-I Controls



1. **POWER Key** The Mach-I can be switched ON and OFF using this key.
2. **ZOOM Key** By pressing the Zoom key, A-Scan expands to full screen. Menu parameters disappear from the LCD and only A-Scan is displayed. By pressing any other key, A-Scan is restored to normal size and menu parameters appear again.
3. **FREEZE Key** By pressing the Freeze key once, A-Scan is frozen. Pressing the key a second time selects Peak Freeze mode. In the Peak Freeze mode, the Mach I holds an echo dynamic pattern which is helpful for an angle beam inspection (in order to locate peak signals).
4. **LOCK Key** By pressing the Lock key, all function keys are locked which prevents accidental pressing of any key. To unlock the function keys, simultaneously press the Hot Key (9) and the Lock Key (4).
5. **LCD Screen** Displays A-Scan Trace pattern and Menu Parameters.
6. **Battery Status** The display of three full cells indicates that the battery is fully charged. As battery strength decreases, the Battery Status indicator will show a diminishing number of cells.

7. **Gain Step Display** The Gain Step Display displays Gain Step value. This value can be changed by using the dB STEP Key (10). Pressing the Db STEP Key changes the dB step sequence in increments of 0.5, 1, 2, 6, 12 and 20.
8. **Menu Keys** By using these keys the Menu can be changed.
9. **Hot Key** When the Hot Key is pressed simultaneously with any other parameter key, the change in value takes place in larger steps.
10. **dB STEP Key** Any gain step of 0.5, 1, 2, 6, 12 or 20 dB can be selected using this key.
11. **GAIN UP/DN** Gain can be increased or decreased using these keys in the step selected by dB STEP key.
12. **UP/DN key** Respective parameters can be increased or decreased using these keys.
13. **REJECT LED** Reject function activation is indicated by this LED.
14. **Gate LED** The Gate LED's provide visual indication of Gate alarm preset conditions. (LED 1 and LED 2 represent Gate 1 and Gate 2 respectively).

15. **Parameter Values** All function (parameter) values are displayed in this area of LCD.
16. **RX Connector** Probes are connected to the Mach I receiver through this connector. (Choice of BNC or LEMO)
17. **TX Connector** Probes are connected to the Mach I transmitter through this connector. (Choice of BNC or LEMO)
18. **Charge Connector** Connect the charger here.
19. **RS-232 Connector** Serial interface connector.
20. **Battery Compartment** The Mach I battery is fitted in this compartment.
21. **Mode Status Indicator** Mode selection SINGLE or DUAL is displayed here.

4.0 Operating Detail

The Mach-I is a user friendly, menu driven Ultrasonic Flaw Detector. To access any parameter, various menus are available. Details of all menus and parameters are below.

First menu is the Mach I's basic menu. In this menu, basic functions of an Ultrasonic Flaw Detector like Range, Zero Offset, Delay and Gain functions are covered.

ZERO 2200
RANGE 005.00
VEL I/S 0.2330
DELAY 000.0
REF 25.0 GAIN 1 25.0 dB

ZERO Calibrates artificial zero of the probe.

RANGE The required test range can be set directly in terms of inches (mm). The range available for steel is from 0.5 in to 200 inches (10 to 5000mm). It steps through 0.5,1,2,5, 10, 15, 20, 25, 30, 50, 100, 150, and 200 inches by pressing the Hot key or in steps of 0.2 inches (10, 25, 50, 100, 125 ,200, 300, 500, 1000, 2000, 3000, 4000, and 5000 mm or in steps of 1 mm).

VELOCITY The required velocity can be set directly in terms of inches/us (m/sec). By pressing the Hot Key it steps through preset values. In fine mode mode 0.0001 inches/us (1 meter/second).

DELAY Partial Range can be set using these keys. Exact shift/delay in inches (mm) is displayed at the bottom.

GAIN STEP Gain step value can be set by using the GAIN STEP key. It adjusts dB in steps of 0.5, 1, 2, 6, 12 or 20 dB.

GAIN Gain can be increased or decreased as per value of step by using GAIN UP/DN keys. For setting of REF (Reference) gain refer DAC Setting.

FIRST MENU EXAMPLE

•Mach-I calibration procedure for 4 inch test range using single element (Normal) probe

1. Set the required range to 4 inches using RANGE UP/DN keys.
2. Couple the probe on 1 inch thickness of V1 reference block and set first echo at 1 inch using ZERO UP/DN keys.
3. Set 4th echo at 4 inches using VELOCITY UP/DN keys, if required.
4. Repeat steps 2 and 3 until both the echoes are at their respective positions.
5. Amplitudes of the echoes can be varied using GAIN keys.

Second Menu covers GATE 1 functions.

GATE 1 Gate can be changed to PLOGIC, NLOGIC, DAC, DAC -6, DAC-14, trigger, EXPAND or OFF.

PLOGIC When PLOGIC is selected, the Gate is triggered if an echo is present within the gate and its height is equal to or crosses the set threshold level.

NLOGIC When NLOGIC is selected, the MONITOR is triggered if there is no echo within the gate or the height is lower than the threshold level.

DAC If DAC is turned ON and DAC is selected and if an echo signal equals or crosses the DAC curve then the gates trigger.

DAC-6 If DAC is turned ON 6/14 and DAC-6 is selected then if any echo signal Crosses the DAC-6 dB curve then the gates trigger.

DAC-14 If DAC is turned ON 6/14 and DAC-14 is selected then if the echo signal equals or crosses the DAC-14 dB curve then the gates trigger.

EXPAND When EXPAND is selected, the Scale expansion is activated and the

GATE 1
OFF
START
1.500
END
5.000
LEVEL
040 %
REF 25.0
GAIN 1
25.0 dB

GATE width is expanded to Full-screen width for a magnified view.

START The Gate starting position can be set using START UP/DN keys. Using these keys, Gate start can be directly set in terms of inch/mm.

END Gate End position can be set using END UP/DN keys. Using these keys Gate end can be directly set in terms of inch/mm.

LEVEL Gate Threshold Level can be directly set in terms of the percentage of Full Scale Height (FSH).

SECOND MENU EXAMPLE

- **Set up gate to trigger when any echo crosses the 50% FSH between 1.0 in. and 4.0 inches.**

1. In the Gate setting, select PLOGIC using GATE UP/DN keys.
2. Set Gate START to 1.0in. using START UP/DN keys.
3. Set Gate END to 4.0in. using END UP/DN keys.
4. Set Gate LEVEL to 50% using LEVEL UP/DN keys.

Third Menu covers GATE 2 functions.

GATE 2 Gate can be changed to PLOGIC, NLOGIC, or OFF.

PLOGIC When PLOGIC is selected, the Gate is triggered if an echo is present within the gate and its height crosses the set threshold level.

NLOGIC When NLOGIC is selected, the Gate is triggered if there is no echo within the gate or the height is lower than the threshold level.

START Gate starting position can be set using START UP/DN keys. Using these keys, Gate start can be directly set in terms of in/mm.

END Gate End position can be set using END UP/DN keys. Using these keys the Gate end can be directly set in terms of in/mm.

LEVEL Gate Threshold Level can be directly set in terms of the percentage of the Full Scale Height (FSH).

GATE 2
OFF
START
2.000
END
5.000
LEVEL
050 %
REF 25.0
GAIN 1
25.0 dB

Fourth Menu covers Memory storage/recall and Trace printout functions.

MEMORY Memory function can be selected A SCAN or SET-UP using MEMORY UP/DN keys.

MEM NO Desired memory location can be selected using MEM NO UP/DN keys. When changing the Memory No, If Data is stored and valid, then an asterisk (“*”) will be displayed next to MEM NO.

ACTION Required functions like SAVE, RECALL, SEND, PRINT or DELETE, DETAIL can be selected using ACTION UP/DN keys. When DETAIL is selected it shows NOTE data of Stored A Scan. It can be scrolled by pressing MEM NO UP/DN keys.

ENTER By pressing the Right side key of the ENTER, the ACTION selected is performed. By pressing the Left side key, the NOTE Menu will be displayed and the Side text menu will be changed for text editing.

MEMORY
A SCAN
MEM NO *
001
ACTION
RECALL
NOTE
ENTER
REF 25.0
GAIN 1
25.0 dB

FOURTH MENU EXAMPLE

● **To SAVE current Calibration and A scan in Memory number 3.**

1. Get required pattern to be stored. Press FREEZE key.
2. Select A SCAN using Memory UP/DN keys.
3. Set MEM NO to 3 using MEM NO UP/DN keys.
4. Set ACTION to SAVE using ACTION UP/DN keys.
5. Then press NOTE/ENTER Left key so Note menu will be displayed. If required, then edit it and exit from note menu.
6. Then press NOTE/ENTER Right key to store A Scan. By pressing Right key Current Calibration, A Scan pattern and Note DATA will be stored at memory number 3.

Note: If data is already stored at this location, then the message will be displayed on the LCD screen as “OVER WRITE DATA” “YES - PRESS HOT KEY”, “NO – PRESS ANY KEY”.

OPERATOR: ABC	
JOB DETAIL: NIL	
DEFECT DETAIL: NIL	
REMARK: NIL	

Fifth Menu covers Reject of unwanted signals, Set Reference, Video setting and Testing mode selection function.

REJECT For the reject of unwanted signals. Using REJECT UP/DN keys, the rejection level can be set as required. It can be set directly in terms of percentage of FSH. Activation of this function is indicated by REJ LED (13).

POWER Hi or Low Pulser power can be selected using POWER UP/DN keys.

DAMPING Probe Damping Hi/Low can be selected using DAMPING UP/DN keys.

MODE Test Mode for the use of Single or Dual Crystal probes can be selected MODE UP/DN keys.

REJECT 000 %
POWER LOW
DAMPING LOW
MODE SINGLE
REF 25.0 GAIN 1 25.0 dB

Sixth menu covers the required functions for DAC curve.

DAC OFF
CURSOR 001
POINT 001
PRESS ENTER
REF 25.0 GAIN 1 25.0 dB

DAC DAC setting can be switched to DRAW, ON or OFF using DAC UP/DN keys. DRAW mode, peak points of echo signals are selected.

REF Gain When DAC DRAW is selected and if gain is changed, then that gain value is stored as a Reference gain. ON mode, the selected peak points are digitally connected to form a DAC curve. ON 6/14 mode, -6dB DAC and -14dB DAC will be also displayed. OFF mode, DAC curve will not be displayed.

CURSOR The position of the Cursor can be set using CURSOR UP/DN keys. To select any peak of the echo signal, move the cursor on the echo signal and then press the SET UP/DN key. POINT value is automatically incremented to indicate the next point.

POINT Indicates how many points are selected to draw the DAC curve.

PRESS Press SET UP/DN keys to accept the peak points selected by the CURSOR.

SIXTH MENU EXAMPLE

● **To digitally draw DAC curve to join four peaks of the echo signals using 1.0 inch thick reference block and a range of 5.0 inches.**

1. Set Gain so that all four peaks are visible on the LCD screen above 5% FSH.
2. Set DAC to DRAW using DAC UP/DN keys.
3. Move cursor using CURSOR UP/DN keys to cover the first echo.
4. Press SET UP/DN key to accept it and Point No. is incremented automatically.
5. Repeat above two steps for second, third and fourth echo.

> Set DAC to ON using DAC UP/DN key. Now DAC Curve will be displayed on LCD.

Note: Cursor does not need to touch the echo for selection and acceptance of the peak point.

Seventh menu covers the required functions for Thickness/Distance measurements.

MEASURE MEASURE setting can be switched to ON or OFF using the MEASURE UP/DN keys. In ON mode it will display thickness /distance of the echo signal which is inside the gate. In OFF mode it will not display thickness/distance.

X-OFF Set X-OFF value to same as Angle probe index point to Front face distance so Surface Distance displayed on LCD will be the distance from the angle probe front face to the defect position.

ANGLE Value to be set as per Angle of the probe. If angle value is greater than zero and Measure is set to ON then Surface and Depth of the defect are calculated and displayed on the LCD.

THICK Thickness value should be set as per the thickness of the test piece, so as to enable in calculation of depth/distance accounting for multiple skips.

MEASURE OFF
X-OFF 0.000
ANGLE 000 DEG
THICK 4.000
REF 25.0 GAIN 1 25.0 dB

SEVENTH MENU EXAMPLE

● **To measure Sound path, Surface and Depth distance when 45 deg. probe is used.**

1. Go to GATE 1 menu and enable Gate to PLOGIC/NLOGIC.
2. Set Gate START and Gate END value so defect signal is within the GATE.
3. Set Gain or Threshold so height of the echo/defect is beyond the GATE.
4. Go to measure menu and set MEASURE to "ON".
5. Set angle value to 45 DEG. using angle UP/DN keys.
6. Set appropriate THICK value so it can account multiple skips for DEPTH distance calculation.

Eighth menu covers the required functions for Thickness/Distance measurements.

TRIGGER FLANK
HUD OFF
SET REF OFF
UNIT INCHES
REF 25.0 GAIN 1 25.0 dB

TRIGGER Select Measurement point to trigger by FLANK or by PEAK.

HUD When Heads Up Display is ON then Thickness/Distance will be displayed in a large font at the top of the LCD display.

SET REF To set any A-scan pattern as a reference, achieve reference pattern, then set SET REF ON, so reference pattern is displayed in the background for easy comparison. A-scan Pattern From Memory location can be recalled and set as a reference.

UNIT To set Measurement/Calibration Units. Inches or Metric can be selected by pressing UNIT UP/DN keys.

Note: When changing UNIT, Calibration will be changed.

Ninth Menu covers miscellaneous functions, which are described below.

CLOCK OFF
COLOR 005
VIDEO ENVELOPE
BRIGHT 050 %
REF 25.0 GAIN 1 25.0 dB

CLOCK Clock can be switched ON or OFF using CLOCK UP/DN keys. If CLOCK is set to ON then date and time will be displayed at the bottom of A-Scan.

COLOR LCD Color combination can be selected using COLOR UP/DN keys.

VIDEO Echo signals can be selected to appear as line (ENVELOPE) or solid (FILLED) using VIDEO UP/DN keys. In ENVELOPE mode, echo signals appear similar to an Analog Ultrasonic Flaw Detector. In FILLED mode the echo signals look solid for better visibility.

BRIGHT Brightness of LCD can be adjusted for better visibility using the BRIGHT UP/DN keys. Set to Low brightness indoors for longer battery life.

Tenth menu covers the functions for HORN and Key Beep Setting.

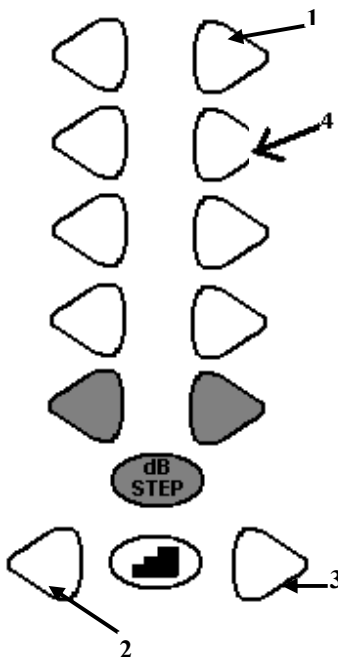
HORN OFF
BEEP ON
REF 25.0 GAIN 1 25.0 dB

HORN Horn can be switched ON or OFF using HORN UP/DN keys. When the horn is switched ON, it produces an audible alarm each time the gate is triggered.

BEEP Key press will be acknowledged by sound if BEEP is selected to ON. Key press will be silent when set to OFF.

5.0 Time/Date, Factory Defaults

5.1 Time/Date. Keep key 1 pressed and switch ON Mach-I. After display of menu parameter, release Key 1 and again press key 1 so Time setting menu will be displayed. Next, set the correct time by pressing the UP/DN parameter key. Then press Key 2 to store/set correct time to value set as per display. Press key 3 to exit/cancel time setup.



5.2 Factory Default Calibration set-up

In the Mach-I, the last calibration set-up remains stored. The Mach-I will utilize the last calibration set-up at start up. However, if the stored calibration becomes corrupted, the unit will start with the factory default calibration set up. To recall the factory default calibration set-up, press and hold Key 4. Next turn on the Mach-I. After the unit displays menu parameters, release key 4.

6.0 Printer Interface

The Mach-I can print a copy of A-Scan patterns with full calibration set-up values. This requires a conventional PC printer having a Serial Communication connector. The printer should be an IBM-PC compatible with the serial port – Serial printer EPSON FX/LQ type is recommended.

Printer settings are below:

Baud Rate	9600	Parity bit	None
Data Bits	8	Stop Bits	1

To print out trace pattern, follow these steps.

- Connect Serial cable (supplied with Mach-I) between connector (20) of Mach-I and serial printer.
- Switch ON Serial PC printer.
- Switch ON Mach-I.
- Get the required Trace pattern and freeze using Freeze key (3).
- Using Menu key go to memory menu (6).
- Using ACTION UP/DN key select “PRINT”.
- Press ENTER UP/DN key to initiate printing.

For Interface with PC Using Serial port refer to Help.txt file supplied in Software CD.

7.0 Power Supply

The Mach-I is powered by a Lithium-Ion battery pack (Mach001) which is fitted in Mach-I using two screws. It electrically connects to Mach-I via two internal terminal contact points. With fully charged battery pack, Mach-I can operate continuously for eight hours under typical operating conditions. The battery pack can be charged when inside Mach-I by connecting Battery charger Mach002 to the connector (19). Alternatively, the battery pack can be charged outside Mach-I which allows uninterrupted use of Mach-I using multiple battery packs.

Battery Charging

The battery Charger (Mach002) supplied with Mach-I is a special quick-charge charger. The charging time is 2.5 hours. The Mach002 battery charger is suitable for use with mains supply from 100 to 240 volts AC/50/60 Hz. The LED on charger illuminates to indicate power on. When the battery voltage is low (discharged condition) the LED glows RED. When the battery is almost charged, the LED turns to YELLOW. When the battery is fully charged, the LED glows GREEN. The output voltage from the charger is 16.4 Volts DC. The charging current is constant at 2.0 Amps.

8.0 Precautions

- Avoid shock to the Mach-I and probes.
- Avoid High-Energy electrical static sources (welding equipment) which can cause erratic operational behavior in sensitive digital equipment.
- Wipe couplant off probes and Mach-I after each use.
- When battery pack is out-of Mach-I, keep battery contacts away from metal objects.
- Never heat the battery pack (Mach001) nor throw into a fire.

9.0 Technical Specifications

Test Range	: 0.500 in to 200 in (10 mm to 5 meter) (in steel). In Hot Key mode it has 13 preset values. In fine mode it is adjustable in steps of 0.2 in (1mm).
Velocity	: 0.0400 in/ μ s to 0.4000 in/ μ s (1000 m/sec to 9999 m/sec). In Hot Key mode it has 7 preset values. In Fine Mode it is adjustable in steps of 0.0001 in/ μ s (1 met/sec)
Delay	: Variable from 0 to 100 in (0 to 3000 mm). In Hot Key mode 0.2 in (5 mm). In Fine mode 0.002 in (0.5mm).
Gain	: 100dB calibrated gain adjustable in 0.5, 1, 2, 6, 12 or 20 dB steps.
Rejection	: 0 to 80%FSH with LED indicator.
Rectification	: Full-wave rectified with filtering.
Frequency	: Broad Band amplifier 0.5 MHz. to 10MHz.
Test Modes	: Pulse echo and Transmit/Receiver.
Pulser	: 350 Volt Negative Spike with Hi/Low power selection.
Damping	: Probe Damping Hi/Low selection.
Connectors	: BNC and LEMO (Size 1) both are provided.

- Freeze/Peak Freeze** : A Scan freeze and Peak Freeze available. In Peak freeze it holds echo dynamic pattern which is useful for angle beam probe to locate peak signal.
- Gates** : Dual gates adjustable in 1% of Screen width with Positive/Negative Logic, Gate Expand modes.
- Gate Expand** : Expands Range to width of the gate.
- A-Scan memory** : 200 Trace Patterns can be stored, recalled, printed or transferred to PC via RS-232 serial port.
- Calibration Set-up** : 50 different calibration set-ups can be Stored and Recalled.
- Software** : Using “NewSoft TFT” software A-Scan with calibration set-ups can be transferred to PC via RS-232 serial link for storage in PC or printing.
- Printer Attachment** : IBM compatible Printer having serial port can be directly attached to main unit for printing of stored A-Scan waveform with calibration data.
- Display** : High brightness Color TFT LCD Display. Display area 320 x 240 pixel (122 x 92 mm). Eleven different color scheme options.
- Full Screen** : By pressing Zoom key A-Scan can be displayed in Full Screen area.

- Reference A-Scan** : Reference A-Scan pattern of standard test object can be saved and recalled in the background for easy comparison during testing.
- DAC** : DAC curve can be entered using minimum 2 to maximum 10 points and then digitally drawn with -6dB and -14dB DAC curves. DAC curve can be set as flaw monitor gate.
- Digital Readout** : Thickness/Depth can be displayed in digital readout when using a normal probe. Beam path, Surface Distance and Depth are directly displayed when angle probe is in use.
- Update Rate** : 50 Hz.
- Power** : Lithium-Ion Battery pack 14.4 VDC, 4AH, gives 8 hours continuous operation from fully charged battery.
- Charger** : Input voltage 100 to 240 VAC. Charge status indicators provided.
- Temperature** : 32° 131° F (0 to 55° C).
- Size** : 5.98 in H x 10.04 in W x 2.76 in D (152 x 255 x 70 mm).
- Weight** : 5.07 lbs (2.3 kg.) with Battery.

Menu Tree

First Menu	ZERO	RANGE	VEL	DELAY
Second Menu	GATE 1	START	END	LEVEL
	OFF			
	PLOGIC			
	NLOGIC			
	DAC			
	DAC -6			
	DAC -14			
	EXPAND			
Third Menu	GATE 2	START	END	LEVEL
	OFF			
	PLOGIC			
	NLOGIC			
Forth Menu	MEMORY	MEM NO	ACTION	NOTE
	SET-UP		RECALL	
			SAVE	
			DELETE	
	A SCAN		RECALL	
			SAVE	

			SEND	
			PRINT	
			DELETE	
			DETAIL	
Fifth Menu	REJECT	POWER	DAMPING	MODE
		LOW	LOW	SINGLE
		HIGH	HIGH	DUAL
Sixth Menu	DAC	CURSOR	POINT	PRESS
	OFF			ENTER
	DRAW			
	ON			
	ON 6/14			
Seventh Menu	MEASURE	X-OFF	ANGLE	THICK
	OFF			
	ON			
Eighth Menu	TRIGGER	HUD	SET REF	UNIT
	FLANK	SND PTH	OFF	INCHES
	PEAK	DEPTH	ON	METRIC
		SURF D		
		ALL		
Ninth Menu	CLOCK	COLOR	VIDEO	BRIGHT

	OFF		ENVELOP	
	ON		FILLED	
Tenth Menu		HORN	BEEP	
		OFF	OFF	
		ON	ON	