353 PRECISION ALTIMETER TESTER
OPERATING INSTRUCTIONS

The Model 353 provides Altitude, Rate of Climb (R of C), and Leak testing at the stroke of a key. It is microprocessor based and its accuracy is ± 0.02% of full scale including all effects of linearity, repeatability, **hysteresis and temperature** over the range of 23 ºF to 122 °F. Altitude can be displayed in feet or meters and R of C in fpm or mpm. Resolution is to the nearest foot or meter. Other display options include user selectable pressure units of inches of Mercury, mm of Mercury or millibars. Included is a feature for leak testing of aircraft altimeter systems.

TABLE OF CONTENTS

F/N 353:440-3
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KEYPAD FUNCTIONS

ON/OFF & BACKSPACE KEY

Turns the tester on and then turns it off from the **Measure Mode**. Also serves as a backspace key ← when editing in the **Program Mode.** The backspace function takes the user out of a programmable register without changing the previous setting. Pressing this key repeatedly will return the user to the **Measure Mode** and then shut off the tester.

LEAK & UP ARROW KEY

In the **Measure Mode** activates and deactivates the **LEAK** function per FAR 91.411 guidelines. After an aircraft's static system is evacuated to desired level, **LEAK** starts a 120 second settling time countdown (reduce settling time in 30 sec increments by pressing **LEAK** again). A 60 second leak test follows displaying starting altitude in upper right and current altitude in upper left. Leak in FPM or MPM is displayed after test period. Up arrow ↑ key is used to scroll through the programmable registers when the unit is in the **Program Mode**. Once a programmable register is selected the up arrow ↑ can be used to edit that register.

R of C & DOWN ARROW KEY

In the **Measure Mode** activates and deactivates the Rate of Climb function. R of C is displayed on top line with instantaneous altitude remaining on bottom. The time period over which the R of C is calculated can be adjusted to user preference through the **Program Mode.** Down arrow ↓ key is used to scroll through programmable registers with the unit in the **Program Mode**. Once a programmable register is selected the down arrow ↓ can be used to edit that register.

PRGM & ENTER KEY

Puts the tester into **Program Mode** (with prompt for password if **Lockout** is set) from **Measure Mode**. When in the **Program Mode**, pressing this key selects the programmable register to be edited . After the register has been edited, pressing the PRGM key enters the new setting into the tester's non-volatile memory. This key also acts as a forward space → key when editing user input such as the header name.

MEASURE MODE

The **Measure Mode** is the tester's start up mode. Measured altitude or absolute pressure is displayed in user selected units.

PROGRAM MODE

The **Program Mode** is used to configure the tester for **Measure Mode** operation. The configurable registers that are found in the **Program Mode** are Units Select, Damp Rate Select, User Info Select, Contrast Select, R of C Rate Select and Exit. The tester can be put into the **Program Mode** at any time during **Measure Mode** operation by pressing the PRGM key (if **Lockout** is set, the correct code must be entered when prompted - see page 13 for **Lockout** instructions). The top line of the display will read "PROGRAM MODE". The bottom line will read "UNITS SELECT". Press the up or down arrow keys to scroll through the **Program Mode** to the desired register.

UNITS SELECT

The standard engineering units available on the Precision Altimeter Tester are the following:

1. FEET
2. INCHES OF Hg
3. MM OF Hg
4. METERS
5. MILLIBARS

To change engineering unit of measure the tester should be "ON" and in the **Measure Mode**. Then use the following steps:

Keystroke	Display
1. Press PRGM key.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
2. Press ENTER key (right ➜ arrow).	Top line reads "UNITS SELECT" and bottom shows current engineering unit.

3. Press up ↑ or down ↓ arrow key until desired engineering unit is displayed.	Engineering units on bottom line of display change.
4. Press ENTER key (right → arrow) to select engineering unit.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
5. Press the backspace ← arrow key.	Display returns to **Measure Mode** in new engineering unit.

DAMP RATE SELECT

Adjustable damping is available to steady the display when measuring pulsating altitude or pressure. The Precision Altimeter Tester has damping rates of 0.1, 0.2, 0.5, 1, 2, and 5 seconds. Damping is done by averaging new data from the pressure sensor against previously collected data. The microprocessor collects data from the sensor every 0.1 seconds. When set at 0.1 seconds, the display updates every 0.5 seconds showing the current 0.1 second pressure reading. When set at 5 seconds, the display updates every 0.5 seconds showing the average of the previous 5 seconds readings. Therefore, at this setting it takes 5 seconds from the time pressure is changed until the tester displays the actual applied pressure.

To set the damp rate:

Keystroke	Display
1. From the **Measure Mode**, press the PRGM key.	Top line reads "PROGRAM MODE" bottom line reads "UNITS SELECT".
2. Press the up ↑ arrow key.	Bottom line reads "DAMP RATE SELECT".
3. Press ENTER key (right → arrow).	Top line reads "DAMP RATE SELECT", bottom line reads current damp rate.
4. Press the up ↑ or down ↓ arrow keys to change to desired rate.	Bottom line shows new damp rate in seconds.
5. Press ENTER key (right → arrow).	Selects damp rate, top line reads "PROGRAM MODE", bottom line reads "UNITS SELECT".
6. Press the backspace ← arrow key.	Returns to **Measure Mode.**

AUTO SHUT-OFF

Enabling the Auto Shut-Off feature allows the tester to turn itself off after a user selected period of keypad inactivity. Selectable options include DISABLED, 10 Minutes, 20 Minutes, 30 Minutes, 45 Minutes and 60 Minutes. Disabling this feature limits the tester to being turned off by using the ON/OFF key only. Units are shipped from the factory with the Auto Shut-Off set for 10 Minutes. To change the auto shut-off setting, follow the steps below.

Keystroke	Display
1. From the **Measure Mode**, press the PRGM key.	Top line reads "PROGRAM MODE", bottom line reads "UNITS SELECT".
2. Press up ↑ arrow key twice.	Top line reads "PROGRAM MODE", bottom line reads "USER INFO SELECT".
3. Press ENTER key (right → arrow), then up ↑ arrow key three times.	Top line reads "AUTO SHUT-OFF", bottom reads "ENTER TO SELECT".
4. Press ENTER key (right → arrow), then the up ↑ or down ↓arrow keys until desired shut-off time is shown.	Top line reads "AUTO SHUT-OFF", bottom line toggles to "DISABLED", "10 MINUTES", "20 MINUTES", "30 MINUTES", "45 MINUTES" and "60 MINUTES".
5. Press ENTER key (right → arrow).	Desired Auto Shut-Off time is selected, top line reads "AUTO SHUT-OFF", bottom reads "ENTER TO SELECT".
6. Press the backspace ← arrow key twice.	Returns to **Measure Mode.**

USER INFO SELECT

The User Info Select register is designed to provide the user with information on the hardware and software in the tester. This register stores information on the sensor's serial number, software version, date of last calibration, Auto Shut-Off status and the instrument Start-Up Header. This Header appears on the top display line when the tester is turned on. The second line displays the Full Scale of the tester in the last engineering units selected. The factory setting of the Header is "MERIAM INSTR." but can be edited to show a custom alpha-numeric string as desired by the user. To view or configure any Unit Info Select register, follow the keystrokes listed below.

Keystroke	Display
1. From the **Measure Mode**, press the PRGM key.	Top line reads "PROGRAM MODE". Bottom line reads "UNITS SELECT"
2. Press the up ↑ arrow key two times.	Bottom line changes to "USER INFO SELECT"
3. Press the ENTER key (→).	Bottom line shows S/N.
4. Press the up ↑ arrow key.	Software version number shown.
5. Press the up ↑ arrow key.	Manufacture date shown.
6. Press the up ↑ arrow key.	Top line reads "AUTO SHUT OFF", bottom reads "ENTER TO SELECT". See steps on page 5.
7. Press the up ↑ arrow key.	Top line reads "LOCKOUT CODE", bottom reads "ENTER TO SELECT". See steps on page 13.
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8. To edit the Header, press the up ↑ arrow key .	Top line reads “HEADER NAME”, bottom line reads “MERIAM INSTR.”, cursor flashes at bottom left.
9. Press the up ↑ or down ↓ arrow keys to set the alpha-numeric value.	Displays a number between 0 and 9, a letter from A to Z, / or a blank space.
10. Press ENTER key (right → arrow) to accept the selected value.	Cursor advances one space to right.
11. Repeat steps 11 and 12 until the desired Header is shown.	
12. If an error is made, press the back ←arrow key until cursor is over the incorrect value. Follow step 9 - 11 to correct. Press the right → arrow to advance the cursor without changing values.	Corrected value is displayed.
13. When Header is complete press the PRGM key to advance cursor to line end.	Cursor flashes at bottom right.
14. Press ENTER key (right → arrow).	Top line reads “PROGRAM MODE” bottom reads “UNITS SELECT”.
15. Press the backspace ← arrow key.	Returns to **Measure Mode.**

CONTRAST SELECT

The Contrast Select register allows the user to adjust the character contrast of the LCD display to provide the best visibility for the ambient conditions. If during the contrast adjustment an error is made pressing the backspace ← key returns the display to the previous contrast setting. To adjust the contrast follow the keystrokes below:

Keystroke	Display
1. From the **Measure Mode** press the PRGM key.	Top line reads "PROGRAM MODE" bottom reads "UNITS SELECT".
2. Press the up ↑ arrow key three times.	Bottom line reads "CONTRAST SELECT".
3. Press ENTER key (right → arrow).	Top line reads "CONTRAST ADJUST", bottom line shows a numeric value.
4. Press up ↑ arrow to decrease contrast or down ↓ arrow to increase the contrast.	LCD lightens or darkens depending on value set.
5. Press the PRGM key.	Accepts selected setting, top line reads "PROGRAM MODE", bottom reads "UNITS SELECT".
6. Press backspace ← arrow key.	Returns to **Measure Mode.**

R OF C RATE SELECT

The R of C Rate Select feature allows the user to customize the time period over which the Rate of Climb is calculated. When testing for rapidly changing climb, short time periods are desirable. Longer periods yield the most stable display for calibrating climb indicators. To change the R of C Rate, follow the keystrokes listed below.

Keystroke	Display
1. From the **Measure Mode** press the PRGM key.	Top line reads "PROGRAM MODE" bottom reads "UNITS SELECT".
2. Press the up ↑ arrow key four times.	Bottom line reads "R of C RATE SELECT".
3. Press ENTER key (right → arrow).	Top line reads "R of C RATE SELECT" bottom line reads value
4. Press up ↑ or down ↓arrow key to select the desired Rate.	Bottom line shows R of C Rate in seconds.
5. Press ENTER key (right → arrow).	Accepts new R of C Rate , top line reads "PROGRAM MODE", bottom reads "UNITS SELECT".
6. Press backspace ← arrow key.	Returns to **Measure Mode.**

CHANGING THE BATTERY

The tester is powered by a 9 volt alkaline (or lithium) battery. When the output of the battery under load drops below 6.5 volts the display flashes "LOW POWER DETECT" and "REPLACE BATTERY". To replace the battery locate the battery compartment in the bottom rear of the tester. Push down on the small rectangular area on the battery cover and slide the cover out the bottom of the unit. Pull the battery connector off the battery terminals. Plug the new battery into the connector and install in the compartment. Slide the battery cover on until the locking clip locks into the tester housing.

RE-ZEROING PROCEDURE / MAINTENANCE RECOMMENDATIONS

To maintain the accuracy of the 353 Precision Altimeter Tester, periodic re-zeroing is recommended. Zero shift can occur in the absolute pressure sensor. While zero shift will not alter the calibration curve in any way, shift of sufficient magnitude can cause the indicated accuracy to fall outside of factory specification. Meriam recommends re-zeroing the 353 every sixty (60) days during seasonal use or after twenty-five (25) exposures to extreme temperature conditions (below 23° F or above 104° F). The maintenance procedure is given below.

Accurate values for elevation above sea level, outside air temperature and "corrected to sea level" barometric pressure will be needed to complete the re-zero procedure. Most certified repair stations will know their elevation above sea level. Temperature to ±3° F is adequate. The "corrected to sea level" barometric pressure should be obtained from the user's standard or from another reliable and accurate source. Never use station (uncorrected) barometer in the re-zero procedure.

To Re-zero, follow the procedure below. If a Lockout is set, performing step 2, below, will result in a Lockout prompt. The Lockout code will need to be input before access to the Re-zero is permitted. See page 13 for details.

Keystroke	Display
1.Turn unit on and allow 15 min. warm up. Vent pressure connection to atmosphere.	Measure Mode activated. Previously selected units and current value shown.
2.Press up ↑ and down ↓ arrow keys simultaneously.	Top line reads "ZEROING SOURCE", bottom line reads "SEA LEVEL PRESS."
3.Press right → arrow key to select this "ZERO SOURCE". For other zeroing options, see **OPTIONS** after Step 8 below.	Top line reads previously stored "ELEV", bottom line reads "CHANGE? YES".

4.a.To enter new ELEV, press right ➔ arrow key.Use up ↑ or down ↓ arrow keys to change the first position.Use right ➔ arrow key.Continue procedure until correct ELEV is shown.	Top line reads “ELEVATION VALUE:”, bottom line shows old value.Cursor flashes at first position while value is corrected, then moves to right once right ➔ arrow key is pressed.
4.b.To accept stored ELEV, use up ↑ or down ↓ arrow key to toggle to “NO” and press right ➔ arrow key.	“CHANGE? YES” changes to “CHANGE? NO” and previously stored ELEV is accepted.
5.Right ➔ arrow key completes ELEV screen.	Top line reads previously stored “TEMP”, bottom line reads “CHANGE? YES”.
6.To enter new TEMP, follow Step 4.a. To accept the TEMP displayed, follow Step 4.b.	Top and bottom lines read similar to 4.a. and 4.b. above.
7.Right ➔ arrow key completes TEMP screen.	Top line reads “SEA LEVEL VALUE:”, bottom line reads previously stored value.
8.To enter a new “SEA LEVEL VALUE”, follow Step 4.a. To accept displayed value, use right ➔ arrow key to finish.	Re-zero procedure is completed and display returns to Measure Mode.
OPTIONS	
A.At “ZEROING SOURCE” menu (see Step 3), use up ↑ arrow key to move to “FACTORY ZERO” source.	“FACTORY ZERO” is displayed. Upon use of right ➔ arrow key, the factory zero is restored.Display returns to Measure Mode.
B.Use up ↑ arrow key to move to “REF TO ABS ZERO”.Apply complete vacuum (<10 microns). Use right ➔ arrow key to finish.	“REF TO ABS ZERO” is displayed.Upon use of right ➔ arrow key - after complete vacuum is applied - a new zero is taken.

ACCURACY RECERTIFICATION / RECALIBRATION

The Precision Altimeter Tester's accuracy can be recertified using a ± 0.0035% of reading absolute deadweight tester. The tester should be checked at a minimum of four test points: 25%, 50%, 75% and 100% of the units range (900 mm Hg Abs.). Before performing the evaluation, perform the re-zeroing procedure (see Page 10) using the most accurate "corrected to sea level" barometric pressure possible and consider the following information.

1. Use the User Unit Select option in **Program Mode** to match the Precision Altimeter Tester units to the deadweight tester units. Be sure to match the temperature reference of the deadweight tester to the Precision Altimeter Tester temperature reference (0° C for inches Hg and mm Hg units; Millibars has no temperature reference).

2. Correct the deadweight tester readings for ambient temperature when it is different from the reference temperature. The Precision Altimeter Tester does this automatically.

3. The local gravity where the evaluation is being performed must be corrected for on the deadweight tester. Standard gravity reference is 980.665 cm/sec/sec (45° north latitude at sea level).

4. Make sure there are no leaks in the system.

The evaluation described will confirm if the 353 is operating within its accuracy specification over the operating temperature range. An out of spec 353 should be returned to the factory for recalibration. No field recalibration is possible. Call your Meriam Instrument distributor or the factory for a Return Material Authorization (RMA) number.

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All 353 Precision Altimeter Testers recalibrated at the factory are returned with certificates of NIST traceability.

LOCKOUT SELECT

Enabling the Lockout feature prevents unauthorized users from making changes to the configuration of the tester. To enter **Program Mode**, or to **Re-Zero** the tester, the user must first enter the "password" (two-digit Lockout Code) when prompted, within about 40 seconds. An incorrect code (or timeout) will return the unit to **Measure Mode**. Any two-digit numeric code can be programmed. The factory Lockout Code of **00** disables the Lockout. To set the Lockout Code, follow the keystrokes listed below:

Keystroke	Display
1. From the **Measure Mode**, press the PRGM key. If the Lockout is set, enter the correct "password" when prompted.	Top line reads "PROGRAM MODE", bottom line reads "UNITS SELECT".
2. Press the up ↑ arrow key twice.	Bottom line reads "USER INFO SELECT".
3. Press ENTER key (right → arrow), then the up ↑ arrow key four times.	Top line reads "LOCKOUT CODE", bottom line reads "ENTER TO SELECT".
4. Press ENTER key (right → arrow), then press the up ↑ or down ↓ arrow keys to change to the first digit. Press the right → arrow key to proceed .	Bottom line shows old Lockout code. Cursor flashes at first position while value is changed, then moves to right position once right → arrow key is pressed.
5. Press ENTER key (right → arrow) when desired code is set. Lockout is activated.	Top line reads "LOCKOUT CODE", bottom line reads "ENTER TO SELECT".
6. Press the backspace ← arrow key twice.	Returns to **Measure Mode.**

PRODUCT SPECIFICATIONS

MODEL NUMBER AND RANGE:

353-AI0900	0-900 mm Hg Abs -2000 to +60000 feet

ALTITUDE: Exceeds FAR 43 Appendix E.

LEAK: Test function per FAR 91.411 guidelines:
(1) a 120 second settling time display.
(2) for the next 60 seconds the display holds the initial altitude and displays the current altitude.
(3) the final display shows the 60 second leak rate in feet or meters per minute

RATE OF CLIMB: Display exceeds ± 6000 feet per minute

NIST TRACEABLE ACCURACY:
± 0.02% of FS (FS.= 900 mm Hg Abs)

Equivalents:	± 7 feet at sea level	± 24 feet at 35,000 feet
	± 10 feet at 10,000 feet	± 77 feet at 60,000 feet
Zero Stability (twelve months)		± 0.05% of FS

TEMPERATURE : Storage: -40° to 140°F (-40° to 60°C)
Operating: 23° to 122°F (-5° to 50°C)

PRESSURE LIMIT: 4000 mm Hg Abs (~5 atm)

POWER: 9 volt Alkaline battery. 9 volt Lithium batteries can also be used and are recommended below 32 ºF (0 °C).

MEDIA COMPATIBILITY: Fluids compatible with 316ss.

DISPLAY: 5 significant digit LCD (0.25" high).
2 line x 16 alphanumeric characters

CONNECTIONS: 1/8" female NPT, 316ss.

ENCLOSURE: (6.5" x 3.6" x 2.25") ABS plastic case **WT:** 14 ozs.