



OPERATOR'S MANUAL

for the

TDA-100A Penetrometer

Version 1



**Air Techniques International
Division of Hamilton Associates, Inc
11403 Cronridge Drive
Owings Mills, MD 21117 USA
TEL 410-363-9696
FAX 410-363-9695
www.atitest.com**





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1. INTRODUCTION

This Installation, Operation, and Maintenance manual provides information and procedures for installation, setup, operation, and maintenance of the Model TDA-100A Mono-dispersed Aerosol Penetrometer.

2. APPLICABLE DOCUMENTS

- A. D 2986-95A, American Society for Testing and Materials
- B. 30 CFR 11, NUREG 0041, MIL-STD-282
- C. American National Standards Institute, N101.1 - 1972
- D. American National Standards Institute, ANSI/ASME N510 - 1980

3. REQUIREMENTS

- A. Clean, dry, compressed air at 80 PSI with a flow rate of 10 actual cfm
- B. Stable electrical power at 115 VAC, 60 Hz @ 6 amps (Surge protection required). 220 VAC, 50 HZ @ 3 amps optional
- C. Ventilation hood, 3 by 3 feet, to be suspended over the unit with an air flow of 150 to 300 cfm
- D. Temperature controlled environment: 68 to 85 degrees Fahrenheit recommended
- E. Humidity controlled environment: 50% \pm 20 % relative humidity recommended



4. DESCRIPTION

4.1. EQUIPMENT SPECIFICATIONS

Table 1. Equipment Specifications

Feature	Details
Dimensions	<ul style="list-style-type: none"> • Width: 30 inches • Height: 48 inches • Depth: 30 inches
Input Power	<ul style="list-style-type: none"> • 115 VAC, 60 Hz, 6A <li style="text-align: center;">Or • 230 VAC, 50 Hz, 3A
Compressed Air	<ul style="list-style-type: none"> • 283.16 LPM @ 5.6 kg/cm² • 10 actual cfm @ 80 PSI
Aerosol Generation	<ul style="list-style-type: none"> • Thermal generation using DOP, PAO, or equivalent • Diameter 0.2 micrometer mean • Geometric standard deviation < 1.3 • Concentration 10 to 200 milligrams per cubic meter
Aerosol Detection	<ul style="list-style-type: none"> • Near forward light scattering • 0.0001 to 200 milligrams per cubic meter • Full flow through detector, 10 to 120 LPM • Efficiencies to 99.9999%
Filter Test Flow Measurement	<ul style="list-style-type: none"> • NIST Traceable Mass Flow meter • 10 to 120 LPM \pm 0.5%
Pressure Measurement	<ul style="list-style-type: none"> • Electronic pressure transducer • Accuracy \pm 0.5% of full scale • 0 to 200 millimeters water column
Automation and Data Management	<ul style="list-style-type: none"> • Dedicated microprocessor system



4.2. OVERVIEW

The TDA-100A Mono-dispersed Aerosol Penetrometer tests filter media, filter canisters, and mask components, in accordance with MIL-STD-282 and ASTM D2986-95A. The TDA-100A generates 0.3 micron mean diameter near-mono-dispersed aerosol with a standard deviation of less than 1.3, measures and controls the aerosol particle size and concentration, and measures the percentage of aerosol penetration for the component under test.

4.3. MAJOR COMPONENTS

The major components of the TDA-100A system include the Penetration and Particle Size (PPS) controller unit, the aerosol generator, the mechanical analyzer, the light scattering chamber, the mixing chamber, the vacuum pump, the purge vacuum, the air-operated chuck, the electronics enclosure, and the mass flow meter. Each major component is described in a subparagraph below.

4.3.1. PPS Controller

The microprocessor that monitors and controls the operation of the TDA-100A is located inside the electronics enclosure. The microprocessor interfaces with the user through the displays on the Penetration and Particle Size (PPS) Controller Unit front panel. The controller system provides the following functions.

- A. User interface displays, indicators, and switches - The front panel of the controller provides display screens for user prompts and selectable options, readouts for specific functions, indicator lamps for system status, and switches for selectable options. The front panel features are described in detail in paragraph 4.5.1.



- B. Self-Adjusting particle size control - The quick response sizing circuit in the controller continually monitors particle size and adjusts for deviations instantly. The particle size analyzer must be calibrated at initial startup when the system is up to operating temperature. If the particle size does not meet specifications, the controller puts the system into an idle state and waits for the particle size to return to specification so that no testing can be performed while the particle size does not meet specifications.
- C. User-friendly interface for calibrating the electronic owl - The controller automatically calibrates the electronic owl at startup. At system startup, the controller prompts the user to initiate the calibration cycle during the setup routine.
- D. Auto-calibration for percent penetration - The controller automatically calibrates the light scattering chamber at startup and at a system specified count time. At system startup, the controller prompts the user to initiate the calibration cycle during the setup routine.
- E. Alert/Alarms with specific set points - Alert/Alarm set points are possible for indicating maximum or minimum change in pressure differential across the test component (ΔP), percent penetration, and sample flow. When activated, an alarm light is provided to indicate alarm status and the function screen displays the failure type.
- F. External outputs for user interface - The controller has external connections for interfacing with the users ancillary equipment. The outputs are transistor type (open connector). Two are the configurable alarm type and the third is active when the system is operational (system ready) but is not active if the particle size does not meet specification requirements or if the system is calibrating.
- G. RS-232 output for data and display - The RS-232 port will output to any computer with a standard communications package. The controller outputs front panel data each time the screen is refreshed (once per second).

4.3.2. Electronics Enclosure

The electronics enclosure houses the electrical and electronics. The front panel of the enclosure contains the power on/off buttons and indicator, the test flow control, and emergency stop button. The rear panel contains the user interface and power connections and the main circuit breaker.



4.3.3. Aerosol Generator Assembly

The aerosol generator assembly is located on a slide-out shelf that is accessed by opening the rear cabinet door. The aerosol generator assembly comprises a liquid reservoir, band heater, vapor heater, and particle size heater. The vapor stream flows at a rate of 30 liters per minute through the vapor heater, and then flows into the aerosol generator and over the surface of the liquid that is maintained between 160 and 175 degrees Centigrade by the band heater. Adjusting the temperature of the diluent air stream controls the particle size of the aerosol. The diluent air stream bypasses the aerosol generator at a flow rate of 120 liters per minute and joins the vapor stream on the outlet side (T-section) of the generator to produce a near-mono-dispersed aerosol.

The aerosol is passed into a mixing chamber for stabilization. During testing, aerosol flows from the mixing chamber to the chuck or test fixture and through the component under test. An aerosol is continually generated when the penetrometer is operating. Since testing is intermittent, the excess aerosol is exhausted from the mixing chamber to the exhaust connection on the right side of the cabinet.

A component under test is subject to a concentration of aerosol of approximately 100 micrograms per liter.

4.3.4. Mechanical Analyzer

The mechanical analyzer is located in the top of the machine and is accessed by removing the top panel of the cabinet. The mechanical analyzer measures aerosol particle size by the degree of polarization of a light beam that passes through a sample of the aerosol. The analyzer measures light-angle polarization from 0 to 50 degrees using four Polaroid and three condensing lenses.

4.3.5. Light Scattering Chamber

The light scattering chamber is located in the top of the unit and is accessed by removing the top panel of the cabinet. The light scattering chamber measures the percent of aerosol penetrating the component under test. The chamber is a forward light scattering device, approximately 5 by 5 by 20 inches in size with ultra-flat black interior finish.

4.3.6. Mixing Chamber/Reservoir

The mixing chamber assembly, located at the rear of the slide-out shelf, encloses baffles, and ports for exhaust, sample inlet, and test sample. The assembly mixes and stores the aerosol before it enters the chuck assembly to ensure that particles are evenly dispersed.



4.3.7. Vacuum Pump

The vacuum pump is a pneumatic, low noise type. It is capable of delivering up to 120 slpm.

4.3.8. Air Operated Chuck

The air operated chuck assembly houses the component under test. The compressed air to the chuck is regulated to 30 PSI. There are many adaptations and possibilities for various chuck and test fixtures which enable testing of a great variety of samples ranging from flat material to highly complex respirator filters or canisters.

4.3.9. Mass Flow meter

The mass flow meter is located inside the TDA-100A cabinet, in the upper section above and behind the slide-out shelf. The flow meter determines the flow rate of the test flow, and is calibrated for 10 to 120 LPM.

4.4. SAFETY FEATURES

- A. When the chuck is closed, one of CHUCK CLOSE pushbuttons on the sides of the controller unit can be pressed to open the chuck. This feature is provided to allow the chuck to be opened in emergency or unusual situations. Normally the chuck opens automatically.
- B. The EMERGENCY STOP button on the front panel of the electronics enclosure is pressed to immediately remove power and air from the TDA-100A, and twisted, then pulled to allow the machine to be restarted.
- C. The fully enclosed TDA-100A cabinet isolates the user from moving parts, electrical components, and thermal hazards.

4.5. CONTROLS, INDICATORS, GAUGES, AND VALVES

4.5.1. Controls, Indicators, Gauges, and Valves, Front of Unit

Table 2. Controls, Indicators, Gauges, and Valves, Front of TDA-100A

Item	Description
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Item	Description
Audible Alarm	<ul style="list-style-type: none"> • Emits audible sounds (beeps) to alert the user of fault and error conditions
Power Indicator	<ul style="list-style-type: none"> • Glows white when power is on • Located between power on and off buttons
Power Off Button	<ul style="list-style-type: none"> • Red pushbutton • Located on front panel of electronics enclosure • Pressed to turn power off to everything except the cool-down timer
Power On Button	<ul style="list-style-type: none"> • Green pushbutton • Located on front panel of electronics enclosure • Pressed to turn system power on
3-Way Vacuum Valve (Optional)	<ul style="list-style-type: none"> • Allows vacuum to be diverted from chuck to an external accessory such as a respirator test bench
CHUCK CLOSE Switches (2)	<ul style="list-style-type: none"> • Located on the sides of the controller unit • Pressed and held simultaneously to close the chuck (System prompts the user when to close the chuck.) • Chuck open function available for emergency or unusual conditions • Either switch pressed to open the chuck
Function Screen	<ul style="list-style-type: none"> • Four-line, 20-character alphanumeric display • Displays prompts that require operator response • Displays labels for menu options • Displays system status • Displays error messages
Function Switches A, B, C, and D	<ul style="list-style-type: none"> • Located on PPS controller front panel • Pressed to select the menu option labeled directly above it on the function screen.
EMERGENCY STOP button	<ul style="list-style-type: none"> • Pushed to immediately remove power and air from the machine • Twisted and pulled to allow the machine to be restarted



Table 2. Controls, Indicators, Gauges, and Valves, Front of TDA-100A, Continued

Item	Description
FAIL Indicator	<ul style="list-style-type: none"> • Located on PPS controller front panel • Glows red when a test fails
FAULT Indicator	<ul style="list-style-type: none"> • Located on PPS controller front panel • Glows yellow when a system error or fault occurs • Glows yellow to indicate the system is waiting for the generator to reach the preset temperature requirement • Glows yellow to indicate the system is waiting for the preset air pressure requirement • Flashes yellow when particle size is out of tolerance
READY Indicator	<ul style="list-style-type: none"> • Located on PPS controller front panel • Glows green to indicate controller is ready to start a test cycle
% PENETRATION Readout	<ul style="list-style-type: none"> • 5-digit display • Located on PPS controller front panel • Displays percent penetration set points • Displays percent penetration during testing • Displays set points and readouts for sample time • Displays set points and readouts for load time • Displays set points and readouts for cycles to calibration • Displays set points and readouts for open time • Displays set points and readouts for gravimetric function • Displays heater range in maintenance mode when waiting for particle size
RESISTANCE Readout	<ul style="list-style-type: none"> • Located on PPS controller front panel • Displays resistance set point • Displays resistance during testing • Displays mechanical analyzer phototube voltages during maintenance mode
TEST FLOW Readout	<ul style="list-style-type: none"> • Located on PPS controller front panel • Displays test flow set point • Displays test flow during test • Displays mechanical analyzer phototube voltages during maintenance mode



**Table 2. Controls, Indicators, Gauges, and Valves, Front of TDA-100A,
Continued**

Item	Description
TEST FLOW Control	<ul style="list-style-type: none">• Located on the front panel of the electronics enclosure• Rotated to adjust test flow during the setup and maintenance routines



**Table 3. Controls, Indicators, Gauges, and Valves,
Viewed From Rear of TDA-100A**

Item	Description
Chuck Close Speed Control Valve	<ul style="list-style-type: none"> • Located on the top of the chuck air cylinder • Controls speed at which the upper chuck jaw moves when the chuck closes • Turned clockwise to decrease speed • Turned counterclockwise to increase speed
Chuck Open Speed Control Valve	<ul style="list-style-type: none"> • Located on the bottom of the chuck air cylinder • Controls speed at which the upper chuck jaw moves when the chuck opens • Turned clockwise to decrease speed • Turned counterclockwise to increase speed
Chuck Purge Valve	<ul style="list-style-type: none"> • Located inside the cabinet • Normally set 1/4 turn counterclockwise to allow the chuck to be automatically purged on a continuous basis • Chuck will not close if chuck purge valve is closed
Coarse Vapor Flow Adjustment	<ul style="list-style-type: none"> • Located behind flow panel • Used in conjunction with vapor flow adjustment control to set the level of the VAPOR FLOW meter • Factory-set and should not be changed without consulting the manufacturer's technical representative
CYLINDER PRESSURE gauge	<ul style="list-style-type: none"> • Located on the flow panel • Registers the air pressure in the air cylinder set by the cylinder pressure regulator (30 PSI)



Item	Description
Cylinder Pressure Regulator	<ul style="list-style-type: none"> • Located on the flow panel • Regulates the air pressure in the line feeding into the CYLINDER PRESSURE gauge
Diluent Flow meter	<ul style="list-style-type: none"> • Located on the flow panel • Float indicates the level of the diluent flow through the aerosol generator • Measures in SCFH • Range 0-400 SCFH • Flow adjustment knob at the bottom of the flow meter allows adjustments to the flow level • Setting should be maintained at 80 ± 5 slpm
Diluent Flow meter Adjustment Control	<ul style="list-style-type: none"> • Located below the DILUENT FLOW meter • Used to adjust the amount of diluent flow
DILUENT PRESSURE Gauge	<ul style="list-style-type: none"> • Located on the flow panel • Monitors diluent line pressure coming from the diluent pressure regulator within the system prior to the diluent flow meter and the T-section from the generator tank • Pressure not to exceed 10 PSI, not less than 4 PSI • Pressure at or below 3 PSI sounds an alarm
Diluent Pressure Regulator	<ul style="list-style-type: none"> • Located on the flow panel • Works in conjunction with the vortex tube and DILUENT FLOW meter to control diluent flow pressure into the T-section coming off the generator tank. (Aerosol is formed where the diluent flow meets the vapor flow in the T-section.) • Setting is factory-set and should not be changed without consulting the manufacturer's technical representative



Item	Description
LIQUID TEMPERATURE Controller	<ul style="list-style-type: none"> • Located on the flow panel • Used to set the temperature of the fluid in the generator tank reservoir • Displays the preset temperature on a green LCD display • Displays the actual temperature on a red LCD display • Factory-set and should not be adjusted on site • Temperature setting between 160 and 175 degrees Fahrenheit
MAIN BREAKER Switch	<ul style="list-style-type: none"> • Located on the rear panel of the electronics enclosure • Removes system power
Sight Glass for Aerosol Liquid	<ul style="list-style-type: none"> • Located behind flow panel and viewed through a cutout in the panel • Shows the level of liquid in the aerosol generator tank • Level should be maintained between lines on sight glass rod to ensure there is enough liquid to produce aerosol
Standard Lamp Air Cylinder Adjustment Valves (2)	<ul style="list-style-type: none"> • Located above the slide-out shelf, against the cabinet side panel • Used to adjust the speed at which the standard lamp is automatically raised and lowered during the setup and maintenance routines
Test Flow Balance Valve	<ul style="list-style-type: none"> • Used to eliminate fluctuation of the test flow, observed when the chuck initially closes • Located above the flow panel, toward the front of the unit, behind the reference filter
Vacuum gauge	<ul style="list-style-type: none"> • Located above and to the right of the flow panel



Item	Description
Vapor Flow meter	<ul style="list-style-type: none"> • Located on the flow panel • Float indicates the level of the vapor flow through the aerosol generator • Measures in SCFH. • Ranges from 5 to 50 slpm at 35 psig • Setting should be maintained at 20 ± 2 slpm
Vapor Flow meter Adjustment Control	<ul style="list-style-type: none"> • Located below the VAPOR FLOW meter • Used in conjunction with the coarse VAPOR REGULATOR (behind the flow panel) to adjust the level of the VAPOR FLOW meter
Vortex Tube Adjustment Set Screw	<ul style="list-style-type: none"> • Located under the muffler on the top of the vortex tube • Unscrew muffler to access • Works in conjunction with Diluent pressure regulator and DILUENT FLOW meter to control diluent temperature into flow-thru heater of the generator tank • Factory-set and should not be changed without consulting the manufacturer's technical representative



4.5.2. Controls, Indicators, Gauges, and Valves, Top of Unit

The controls, indicators, gauges, and valves are located under the top panel of the TDA-100A. They are listed in Table 4.

Table 4. Controls, Indicators, Gauges, and Valves, Under Top Panel of TDA-100A

Item	Description
Sample Flow Valve	<ul style="list-style-type: none"> • Located on the sample flow filter • Used adjust the sample flow to the mechanical analyzer
Mechanical Analyzer 29-Degree Speed Adjustment Set Screw	<ul style="list-style-type: none"> • Located on the side of the 29/45 degree cylinder • Used to adjust the smoothness of the movement of the vernier on the mechanical analyzer to adjust polarized lens settings to 29 degrees during the setup and maintenance routines • Factory-set and should not be changed without consulting the manufacturer's technical representative
Mechanical Analyzer 45-Degree Speed Adjustment Set Screw	<ul style="list-style-type: none"> • Located on the end of the 29/45 degree cylinder • Used to adjust the smoothness of the movement of the vernier on the mechanical analyzer to adjust polarized lens settings to 45 degrees during the setup and maintenance routines. • Factory-set and should not be changed without consulting the manufacturer's technical representative



4.5.3. Controls, Indicators, Gauges, and Valves, Right Side of Unit

Table 5. Controls, Indicators, Gauges, and Valves, Right Side of TDA-100A

Item	Description
Air Drain Valves (2)	<ul style="list-style-type: none"> • Located on the bottom of the air pressure gauge assembly and on air filter assembly • Used to drain liquid from the air pressure gauge and air filter assemblies
Balance (BAL) Trim pot	<ul style="list-style-type: none"> • Located on the lower edge of the analyzer/output board • Used to adjust the balance of phototubes A and B in the mechanical analyzer
Dip Switches	<ul style="list-style-type: none"> • Described in paragraph 4.6
Exhaust Drain Cap	<ul style="list-style-type: none"> • Used to drain aerosol condensate from exhaust line
EXHAUST Line Back Pressure Valve	<ul style="list-style-type: none"> • Located behind the electronics enclosure • Used to maintain a back pressure of the mixing chamber of about 3.5 inches water column to prevent total evacuation of the mixing chamber
Light Scattering Chamber (LSC) Trimpot	<ul style="list-style-type: none"> • Located on the lower edge of analyzer/output board • Used to adjust the gain of the light scattering chamber phototube during the computerized maintenance routine
MAIN AIR Pressure Gauge	<ul style="list-style-type: none"> • Located below electronics enclosure • Registers air pressure coming into the system through the main air pressure regulator
MAIN AIR Pressure Regulator	<ul style="list-style-type: none"> • Located on top of MAIN AIR pressure gauge • Regulates air pressure entering the system from factory or plant airline.
Particle Size Gain (CELL) Trimpot	<ul style="list-style-type: none"> • Located on the lower edge of the analyzer/output board • Used to adjust the particle size gain
STANDARD LAMP ADJUST Control	<ul style="list-style-type: none"> • Located beside the analyzer/output board • Used to adjust the intensity of the standard lamp during the computerized maintenance routine
System Cool-Down Timer	<ul style="list-style-type: none"> • Located in electronics enclosure • 1-second to 10-hour timer • Keeps the plant air or solenoid valve open after power is turned off, allowing air to flow through the system and cool it down • Factory-set at 45 minutes



4.6. FUSES

There are three fuses in the TDA-100A unit. The fuses are mounted in the electronics enclosure and accessed from the back panel of the enclosure.

4.7. DIP SWITCHES

The PPS controller employs a bank of miniaturized dipswitches to enable or disable certain functions and displays from the front panel controls and indicators. The switch module is mounted inside the electronics enclosure on the lower printed circuit board assembly. The switch positions are factory-set and should only be changed upon recommendation of the manufacturer's technical staff.

NOTE

The position number represents the position of the switch in the switch bank. The switch bank is numbered from left to right.

Table 6. Dip Switch Settings

Position #	Dip Switch	State/Function
1	Maintenance	<ul style="list-style-type: none"> • Off - Enter computerized Maintenance Mode by depressing and holding function key A when turning unit on • On - Maintenance Mode when turning unit on
2	Factory use only	
3	Factory use only	
4	Automatic	<ul style="list-style-type: none"> • Off - Normal operation • On - Remote operation by a personal computer or PLC
5	Chuck Close	<ul style="list-style-type: none"> • Off - No audible beep when CHUCK CLOSE switches are engaged • On - Audible beep when CHUCK CLOSE switches are engaged
6	Chuck Close Latch	<ul style="list-style-type: none"> • Off - No audible beep for chuck close latch • On - Audible beep at chuck close latch



Position #	Dip Switch	State/Function
7	Automatic Zero	<ul style="list-style-type: none"> • Off - Disables automatic zero • On - Enables automatic zero
8	Bypass Fault Display	<ul style="list-style-type: none"> • Off - Disables fault message to function screen • On - Displays fault messages to function screen

5. INSTALLATION

5.1. UNPACKING

A. Carefully unpack and remove TDA-100A unit from shipping crates. If the equipment has been damaged in transit, notify the shipper immediately.

B. Verify that the following items are present:

- 1) TDA-100 Unit
- 2) Power cable
- 3) Installation, Operation, and Maintenance Manual
- 4) Chuck adapters, if ordered
- 5) Aerosol agent, if ordered
- 6) Spare Parts Kit, if ordered

C. If any of the above listed items are missing, contact the manufacturer immediately.

5.2. PREPARATION FOR INSTALLATION

A. Prepare a level space approximately 5 by 5 feet in size in a clean, temperature and humidity-controlled area.



NOTE

High ambient temperatures may create particle instability. Temperature should be maintained between 68 and 85 degrees Fahrenheit. Humidity should not exceed 50 percent.

NOTE

A dirty environment may cause maintenance problems. Leakage may occur if dirt particles get caught in the solenoid valve seats. Unstable penetration readings may occur if dirt particles get caught in the scattering chamber.

- B. Provide a clean dry source of compressed air to installation area.

NOTE

The air compressor should be capable of delivering 10 cfm of air at no less than 80 psig. Air temperature should be between 60 and 90 degrees Fahrenheit (70 to 75 degrees is recommended.) It is highly recommended that a water trap and pressure regulator be installed between the plant airline and the TDA-100A air inlet.

- C. Provide a 115 ± 5 VAC, 60 Hz voltage source to installation area.

NOTE

Maximum current drain does not exceed 6 amps at 115V, 60 Hz. A separate breaker is recommended for stable machine operation. The transformer can be rewired to facilitate a 230 VAC input. Consult the manufacturer.

- D. Install a ventilation hood, approximately 3 by 3 feet in size, suspended over the unit with airflow of 150 to 300 cfm.



5.3. INSTALLATION

- A. Position the TDA-100A unit in the prepared space.

NOTE

The TDA-100A unit should be positioned so that the rear cabinet door can be fully opened to allow the slide-out shelf to be pulled out.

- B. Connect air pressure line to the air pressure regulator on the right side of the unit. The connection is 0.375-18 National Pipe thread.
- C. Connect power cable to the power inlet on the right side of the unit.
- D. Connect a 3/4-inch or larger exhaust pipe to the exhaust port on the right side of the unit.

CAUTION

Do not pipe exhaust into a negative pressure exhaust system.

NOTE

The exhaust pipe should vent into an exhaust duct or hood rather than to the outside to prevent choking off of the exhaust by phthalic anhydride crystals that often form during the winter months when the warm aerosol meets a cold exhaust line.

- E. Connect remote control input device to the user interface port, if required.
- F. Connect data collection device to RS-232 port, if required.

6. SETUP

- A. Fill aerosol generator with liquid aerosol agent.
-



NOTE

Instructions for filling the aerosol generator are in paragraph 12.1.

- B. Install chuck adapters or test fixtures as required for component to be tested.
- C. Ensure that 3-way vacuum valve, if installed, is pointing up.
- D. Adjust main air pressure regulator for a reading of 80 PSI on the main air gauge.
- E. Press green power on button.
- F. Adjust the VAPOR flow adjustment to achieve a reading of 40 ± 5 SCFH (20 LPM) on the VAPOR FLOW meter.

NOTE

The accuracy of the flow meters was verified using a calibrated gas meter and the results were plotted on curves. The curves are included in Appendix B of this manual.

- G. Adjust the DILUENT flow meter adjustment control to achieve a reading of 165 ± 5 SCFH (80 LPM) on the DILUENT FLOW meter

NOTE

For testing flows higher than 85 LPM, adjust vapor for 65 SCFH (30 LPM) and diluent for 250 SCFH (120 LPM). This will increase the total flow to allow testing up to 120 LPM.

- H. Adjust test flow to mechanical analyzer.

NOTE

Instructions for adjusting test flow are in paragraph 12.3.

- I. Adjust exhaust line back pressure valve as follows:
-

- 1) Disconnect analyzer smoke line from mixing chamber.
- 2) Connect a magnahelic or manometer to the smoke line port to measure backpressure in the mixing chamber.
- 3) Adjust exhaust line backpressure valve for a measurement of 4.5 inches water column.
- 4) Disconnect test equipment and reconnect analyzer smoke line to mixing chamber.

7. OPERATION

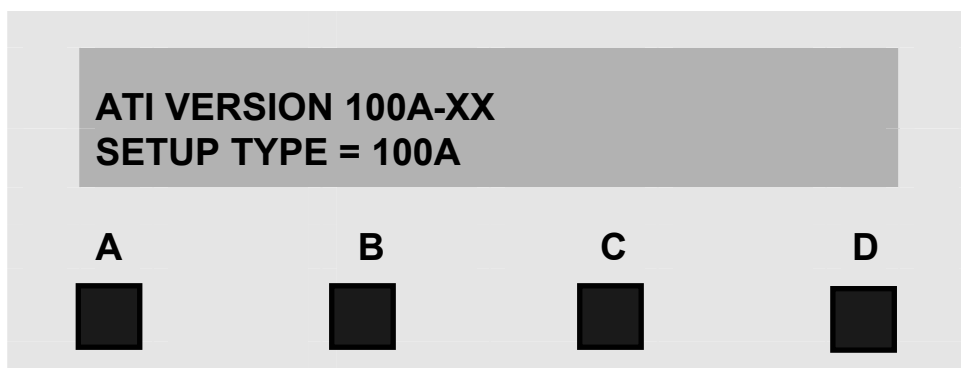
7.1. STARTUP

- A. Check level in the liquid sight glass and refill aerosol generator if necessary.

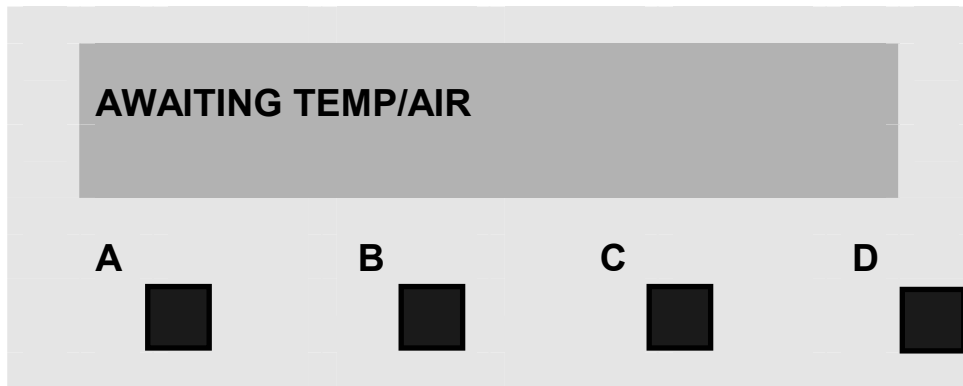
NOTE

Open the rear cabinet door and view the sight glass through the cutout in the flow panel. The liquid viewed in the sight glass should be between the two fill lines. Paragraph 12.1 contains instructions for filling the aerosol generator.

- B. Press green POWER ON button.
- C. Observe that white power indicator illuminates.
- D. Observe that yellow FAULT indicator on PPS controller unit front panel illuminates.
- E. Observe that the system version screen is displayed on the function screen on the controller unit front panel, followed by the AWAITING TEMP/AIR message (Menu 1).



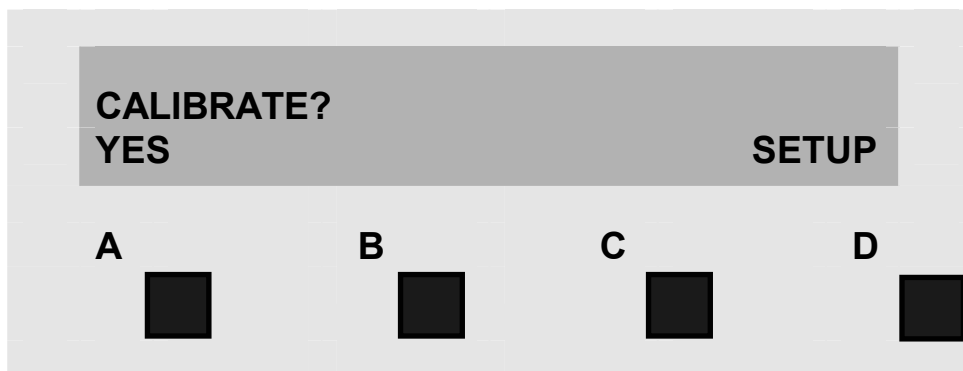
Menu 1. Version Screen



Menu 1. AWAITING TEMP/AIR Message

NOTE

The AWAITING TEMP/AIR message indicates that the controller is waiting for the system to reach a preset temperature requirement (between 160 and 165 degrees Centigrade). The preset temperature is displayed (in green) on the bottom line of the display panel of the LIQUID TEMPERATURE controller. The actual temperature is displayed (in red) on the top line. When the preset and actual temperatures are within 3 degrees, the system displays Menu 2. The display of Menu 2 indicates that the system is ready to advance to the calibration or setup routine, as described in paragraph 7.2, TEST MODE.





Menu 2. Opening Screen



7.2. TEST MODE

NOTE

This section provides step-by-step instructions for using the menus displayed on the PPS controller unit function screen. APPENDIX A, MENU MAP, can be used as a quick-reference guide.

A. Perform one of the following:

- 1) Press D (SETUP) button on opening screen (Menu 2) to begin setup and display initial setup screen (Menu 3); proceed to paragraph 7.2.1, SETUP MODE.
- 2) Press A (YES) button on opening screen (Menu 2) to begin calibration. And display the first calibration screen (Menu 23); proceed to paragraph 7.2.2, CALIBRATION MODE.

NOTE

The system must be calibrated following power-up before the system will advance to operating mode. Setup can be performed before or after calibration.

7.2.1. Setup Mode

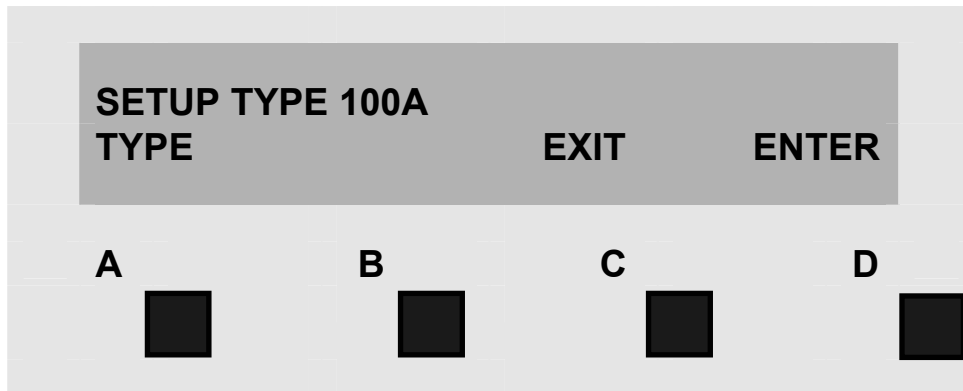
The display of Menu 4 indicates that the system is ready to proceed with the setup routine.

NOTE

If security is set, setup cannot be accessed.

NOTE

Menu 3 is displayed when the SETUP menu option is selected from Menu 2. The menu provides three options: TYPE allows the setup type to be selected (must be done if default settings are to be entered); EXIT redisplayes Menu 2; and, depressing ENTER allows the user to proceed to set test parameters for the type displayed on the top line of the screen.

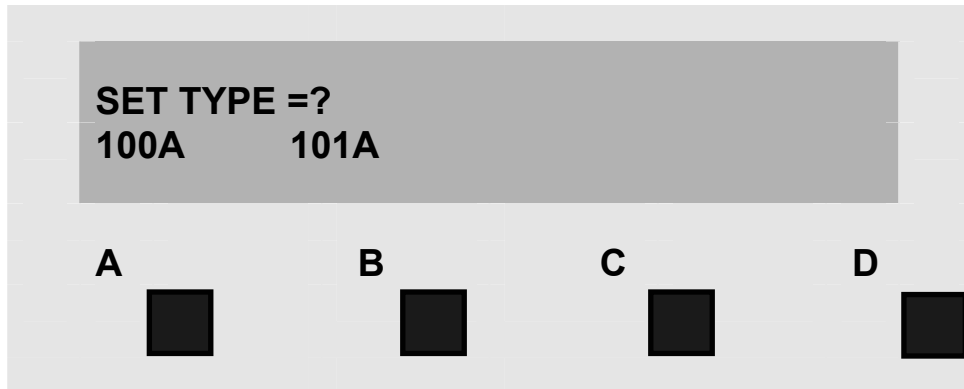
**Menu 3. Initial Setup Screen**

B. Perform one of the following actions:

- 1) Press D (ENTER) button to display % PENETRATION Prompt (Menu 9 or 10) and proceed to paragraph 7.2.1.2, SETUP MODE - OPERATOR ENTRY.
- 2) Press A (TYPE) button to display SET TYPE prompt (Menu 5).

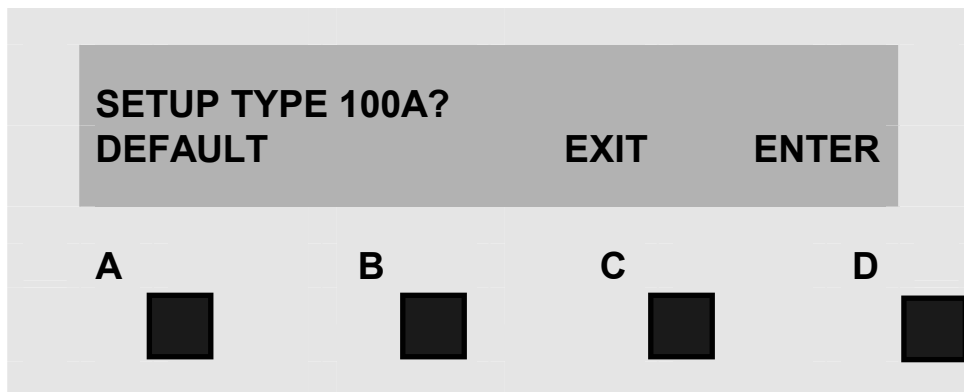
NOTE

Menu 5 allows the setup type to be selected. The 101A menu option is selected when the TDA-101 test bench is in use. The test bench is available as an optional accessory to the TDA-100A for testing leaks in face pieces of both full and half mask respirators. Consult the manufacturer for details.



Menu 4. Opening Setup Screen

C. Press "A" (100A) button to display Menu 6.



Menu 5. Setup Type Prompt

NOTE

EXIT (Menu 6) redisplay Menu 2.



B. Perform one of the following actions:

- 1) Press A (DEFAULT) button to display LOAD DEFAULTS prompt (Menu 7) and proceed to paragraph 7.2.1.1, SETUP MODE - LOAD DEFAULTS.
- 2) Press D (ENTER) button to display % PENETRATION Prompt (Menu 9 or 10) and proceed to paragraph 7.2.1.2, SETUP MODE - OPERATOR ENTRY.

7.2.1.1. Setup Mode - Load Defaults

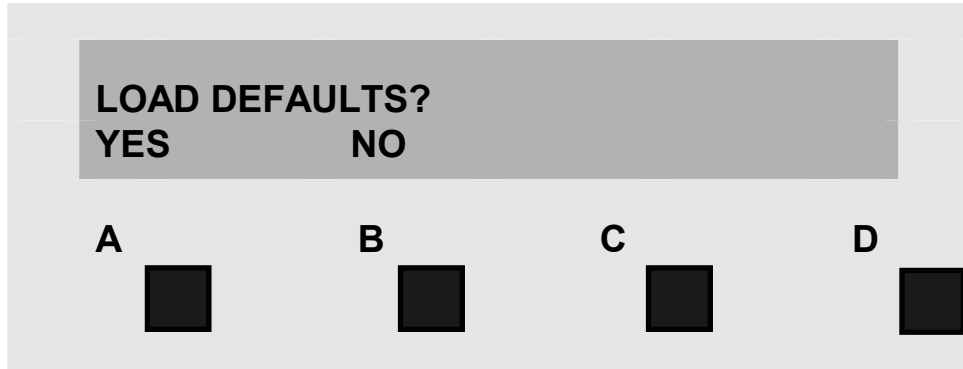
NOTE

The current factory-set default values are listed in Table 7.

Table 7. Default Parameter Values

Default Parameter	Default Value	Unit
% Penetration	.030	Percentage
Cycles to Cal	150	Counts
Flow Tol. (Test Flow)	-----	Disabled
Load Time	5.0	Seconds
Open Time	1.0	Seconds
Resistance	40.0	MM H ₂ O
Sample Time	1.0	Seconds

- A. Press A (DEFAULT) button on Menu 6 to display LOAD DEFAULTS prompt (Menu 7).

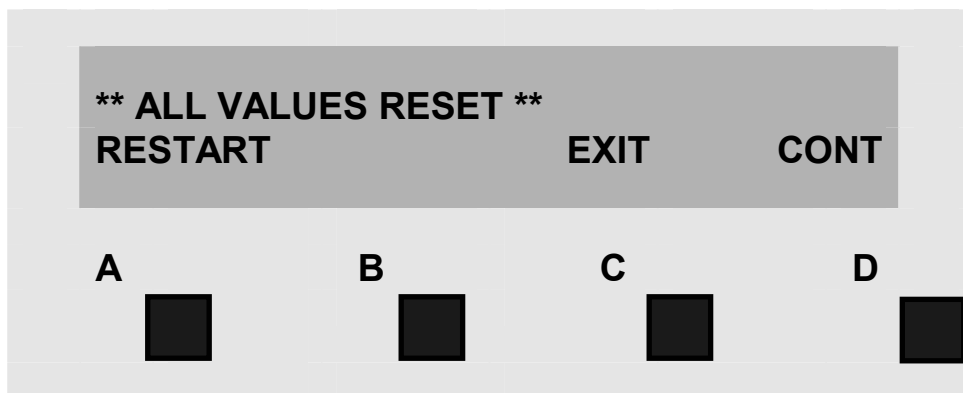


Menu 6. LOAD DEFAULTS Prompt

NOTE

The NO menu option on Menu 6 redisplay Menu 3.

- B. Press A (YES) button to continue; the system loads the default values and displays the message **** ALL VALUES RESET **** (Menu 8).



Menu 7. ALL VALUES RESET Message



C. Perform one of the following actions:

- 1) Press A (RESTART) button to restart program without setting default values.
- 2) Press C (EXIT) button or D (CONT) button to redisplay Menu 3.

NOTE

When the CONT option is selected, all test setup parameters are set to the factory default values listed in Table 7. In addition, the particle size heater is adjusted to 50% of its output. This heater setting speeds up temperature changes required to attain a specific particle size.

7.2.1.2. Setup Mode - User Entry

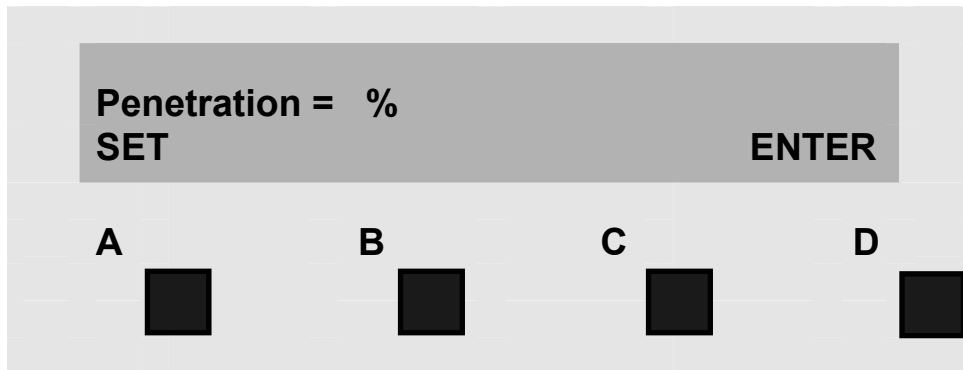
A. Press D (ENTER) button on Menu 3 to start setup program.

NOTE

The ENTER menu option displays the PENETRATION prompt (Menu 9 or 10). The % PENETRATION readout initially displays the default percent penetration value or the last value set by the user. If the default setting for percent penetration is DSBL (disabled), a dashed line (-----) will be displayed.

NOTE

When the % PENETRATION readout contains a value, the first PENETRATION prompt will appear with the menu options shown in Menu 9. When the % PENETRATION readout contains a dashed line (disabled), the first PENETRATION prompt will appear with the menu options shown in Menu 10. For this discussion, it is assumed that Menu 9 is displayed first.



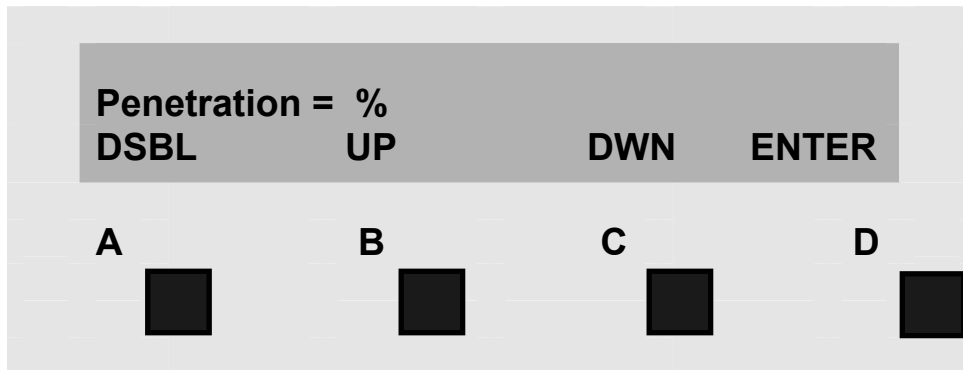
Menu 8. PENETRATION Prompt

B. Perform one of the following actions as required:

- 1) Press D (ENTER) button on Menu 8 to accept the percent penetration value displayed on the % PENETRATION readout and display the RESISTANCE prompt (Menu 10 or 11).
- 2) Press A (SET) button to enter a new percent penetration value.

NOTE

The SET menu option (Menu 9) displays Menu 10. The UP/DWN menu options (Menu 10) are used to change the penetration value displayed on the % PENETRATION readout. The maximum setting is 100% and the minimum setting is .0001%. Once set, any percent penetration that exceeds this range will result in a failure.



Menu 9. PENETRATION Prompt - Value Select

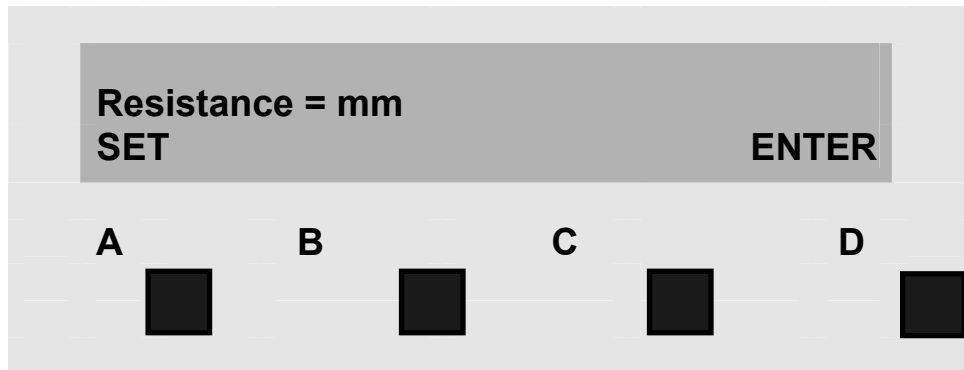
NOTE

The DSBL button disables the penetration failure alarm and redispays Menu 9.

- C. Use the B (UP) and C (DWN) buttons (Menu 9) to change the penetration fail point value displayed on the % PENETRATION readout to the desired percentage, then press the D (ENTER) button to enter the value into the system and display the RESISTANCE prompt (Menu 11 or 12).

NOTE

When the RESISTANCE readout contains a value, the first RESISTANCE prompt will appear with the menu options shown in Menu 11. When the RESISTANCE readout contains a dashed line (disabled), the first RESISTANCE prompt will appear with the menu options shown in Menu 12. For this discussion, it is assumed that Menu 11 is displayed first.



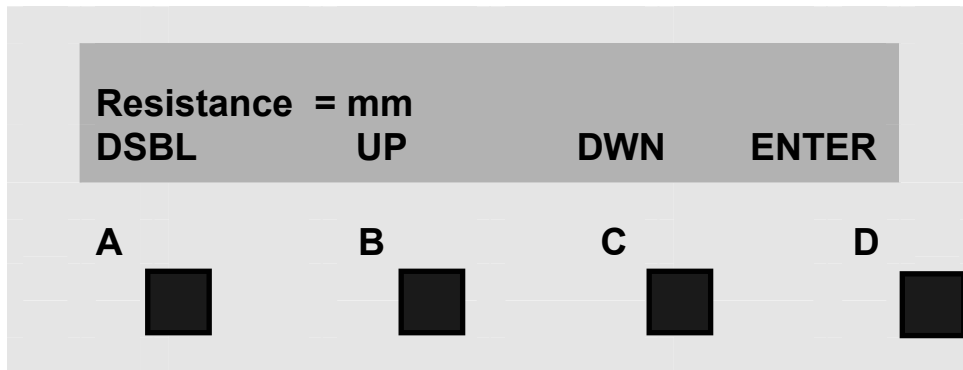
Menu 10. RESISTANCE Prompt

D. Perform one of the following actions as required:

- 1) Press D (ENTER) button to accept the resistance value displayed on the RESISTANCE readout and display the FLOW TOL prompt (Menu 13 or 14)
- 2) Press A (SET) button enter a new resistance value.

NOTE

The SET menu option of Menu 11 displays Menu 12. The RESISTANCE readout initially displays the default resistance value or the last value set by the user. If the default setting has been disabled, a dashed line (-----) will be displayed. The UP/DWN menu options are used to change the resistance value in increments of 1.0 mm. The maximum setting is 250.0 mm and the minimum setting is 1.0 mm. Once set, any resistance reading exceeding this value will result in a failure.



Menu 11. RESISTANCE Prompt - Value Select

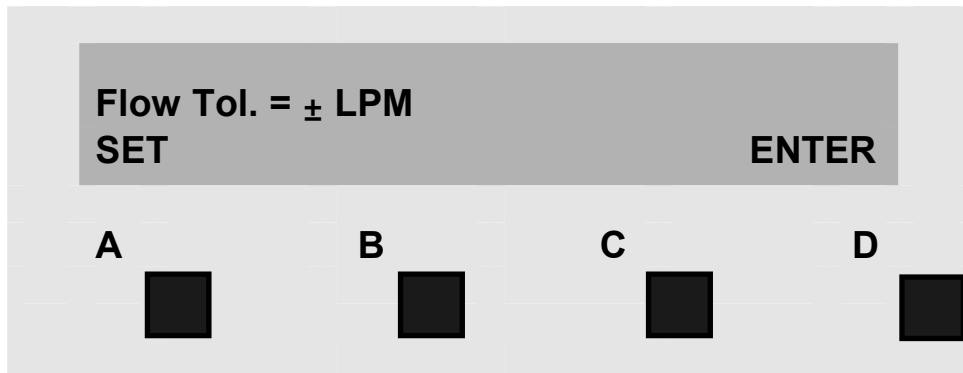
NOTE

The DSBL button disables the resistance failure alarm and redispays Menu 10.

- E. Use the B (UP) and C (DWN) buttons to change the resistance fail point displayed on RESISTANCE readout to the desired value, then press the D (ENTER) button to enter the value into the system and display the FLOW TOL prompt (Menu 13 or 14).

NOTE

When the TEST FLOW readout contains a value, the first FLOW TOL prompt will appear with the menu options shown in Menu 13. When the TEST FLOW readout contains a dashed line (disabled), the first FLOW TOL prompt will appear with the menu options shown in Menu 14. For this discussion, it is assumed that Menu 13 is displayed first.



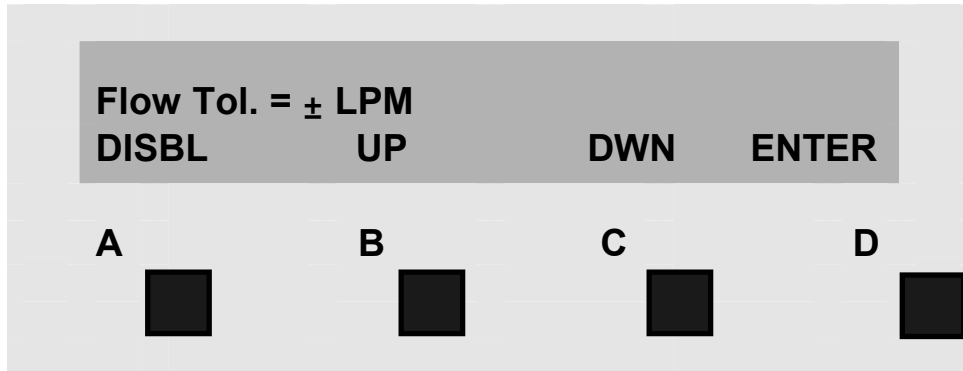
Menu 12. FLOW TOL Prompt

F. Perform one of the following actions as required:

- 1) Press D (ENTER) button to accept the flow tolerance value displayed in the TEST FLOW readout and display the LOAD TIME prompt (Menu 15 or 16.)
- 2) Press A (SET) button to change the flow tolerance value.

NOTE

The SET menu option on Menu 12 displays Menu 13. The TEST FLOW readout initially displays the default flow tolerance value or the last value set by the user. If the default setting has been disabled, a dashed line (-----) will be displayed. The UP/DWN menu options are used to change the flow tolerance value in increments of 1 LPM. The flow tolerance range is 1.0 to 10.0 LPM. Flow tolerance is the amount of variation allowed above and below the set flow rate. An excursion of the flow rate outside the set flow rate plus and minus the flow tolerance will result in a failure.



Menu 13. FLOW TOL Prompt - Value Select

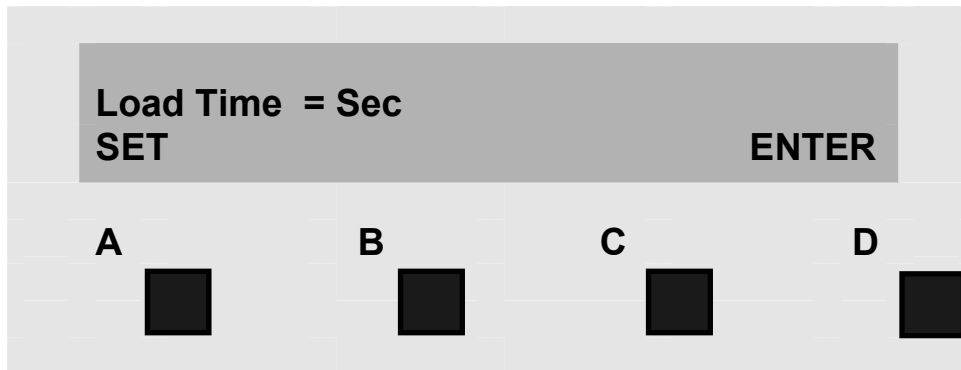
NOTE

The DSBL button disables the flow tolerance alarm and redispays Menu 12.

- G. Use the B (UP) and C (DWN) buttons to change the flow rate tolerance displayed on the TEST FLOW readout to the desired value, then press the D (ENTER) button to enter the value into the system and display the LOAD TIME prompt (Menu 15 or 16).

NOTE

When the % PENETRATION readout contains a value, the first LOAD TIME prompt will appear with the menu options shown in Menu 15. When the % PENETRATION readout contains a dashed line (disabled), the first LOAD TIME prompt will appear with the menu options shown in Menu 16. For this discussion, it is assumed that Menu 15 is displayed first.



Menu 14. LOAD TIME Prompt

H. Perform one of the following actions as required:

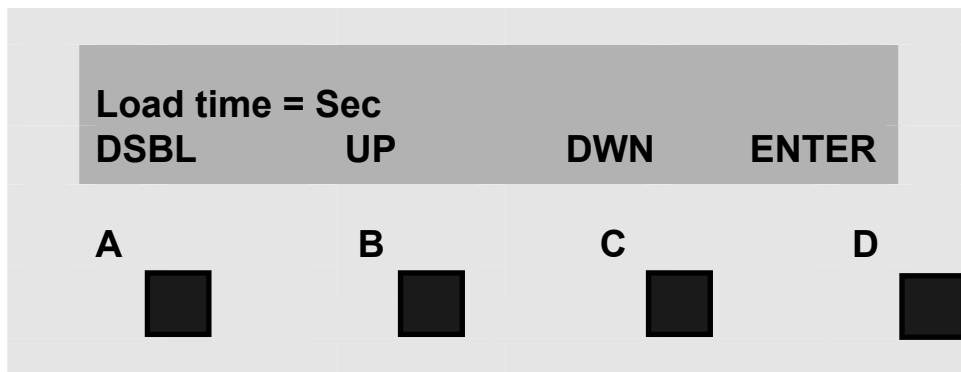
- 1) Press D (ENTER) button to accept the load time value displayed in the % PENETRATION readout and display the SAMPLE TIME prompt (Menu 17 or 18).
- 2) Press A (SET) button to change the load time value.

NOTE

The SET menu option of Menu 15 displays Menu 16. The % PENETRATION readout initially displays the default load time value or the last value set by the user. If the default setting has been disabled, a dashed line (----) will be displayed. The UP/DWN options of Menu 15 allow load time to be changed in 1-second increments. Load time is selectable from 1 to 120 seconds. Load time is the time after the chuck is closed before a sample test is displayed. This time allows the aerosol to stabilize.

NOTE

With flows greater than 10 liters, the load time must be checked for stabilization by performing the following test without filter with sample time adjusted for maximum (3600 seconds). 1) Observe % PENETRATION and note the time required for stabilization. 2) Open chuck (and cancel test) by pressing one CHUCK CLOSE button. 3) Add the necessary load time (above its maximum 120 seconds) to the sample time.



Menu 15. LOAD TIME Prompt - Value Select

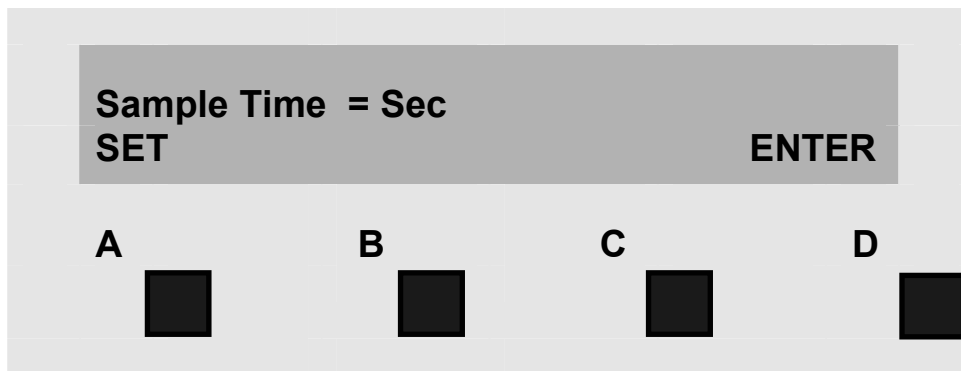
NOTE

The DSBL menu option enables auto-load and redispays Menu 15. In auto-load, the system will wait until the penetration stabilizes before displaying test readings.

- I. Perform one of the following actions:
 - 1) Press D (ENTER) button to accept the load time displayed on the % PENETRATION readout and display the SAMPLE TIME prompt (Menu 17 or 18).
 - 2) Use the B (UP) and C (DWN) buttons on Menu 15 to change the load time displayed on the % PENETRATION readout to the desired value, then press the D (ENTER) button to enter the value into the system and display the SAMPLE TIME prompt (Menu 17 or 18).

NOTE

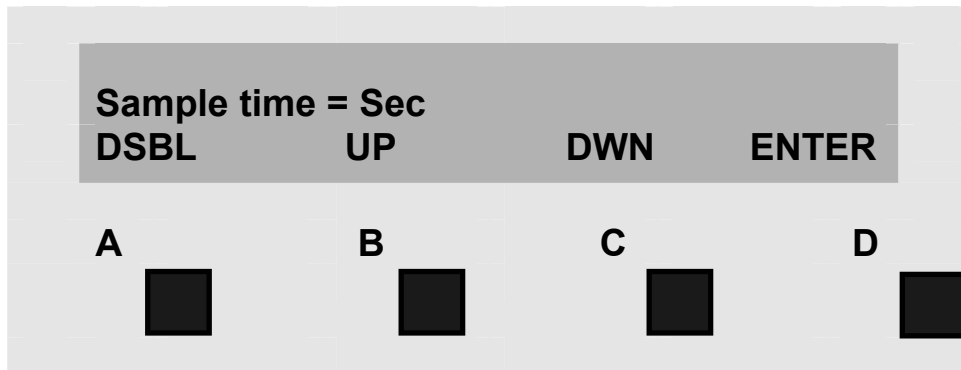
When the % PENETRATION readout contains a value, the first SAMPLE TIME prompt will appear with the menu options shown in Menu 17. When the % PENETRATION readout contains a dashed line (disabled), the first SAMPLE TIME prompt will appear with the menu options shown in Menu 18. For this discussion, it is assumed that Menu 17 is displayed first.

**Menu 16. SAMPLE TIME Prompt**

- J. Perform one of the following actions as required:
- 1) Press D (ENTER) button to accept the sample time value displayed in the % PENETRATION readout and display the OPEN TIME prompt (Menu 19 or 20).
 - 2) Press A (SET) button to change the sample time value.

NOTE

The *SET* menu option of Menu 17 displays Menu 18. The % *PENETRATION* readout initially displays the default sample time value or the last value set by the user. If the default setting has been disabled, a dashed line (----) will be displayed. The *UP/DWN* options of Menu 18 change the sample time in 1-second increments. The sample time range is from 1.0 to 3600.0 seconds. Sample time is the time that the system tests the sample, displays resistance, test flow, and percent penetration after the load cycle is completed and before releasing the chuck, enabling it to open.



Menu 17. SAMPLE TIME Prompt

NOTE

The *DSBL* menu option enables continuous testing and redispays Menu 17. In continuous testing, the test continues until the user manually opens the chuck using one of the *CHUCK CLOSE* buttons.

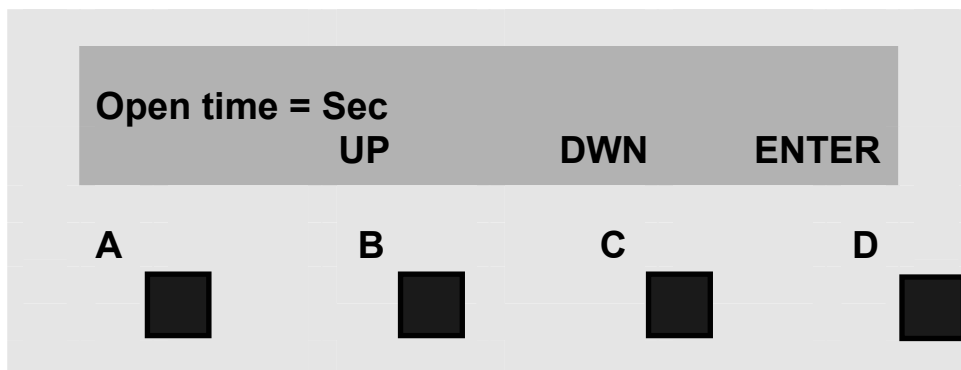
K. Perform one of the following actions:

- 1) Press D (ENTER) button to accept the sample time value displayed in the % *PENETRATION* readout and display the *OPEN TIME* prompt (Menu 19).
 - 2) Use the B (UP) and C (DWN) buttons on Menu 18 to change the sample time displayed on the % *PENETRATION* readout to the desired value,
-

then press the D (ENTER) button to enter the value into the system and display the OPEN TIME prompt (Menu 19).

NOTE

The % PENETRATION readout initially displays the default open time value or the last value set by the user. If the default setting has been disabled, a dashed line (-----) will be displayed. The UP/DWN options of Menu 18 change the open time in 1-second increments. The open time range is from 1.0 to 360.0 seconds. Open time is the time interval between the chuck releases at the end of a test until the system is ready to test again.



Menu 18. OPEN TIME Prompt - Set Value

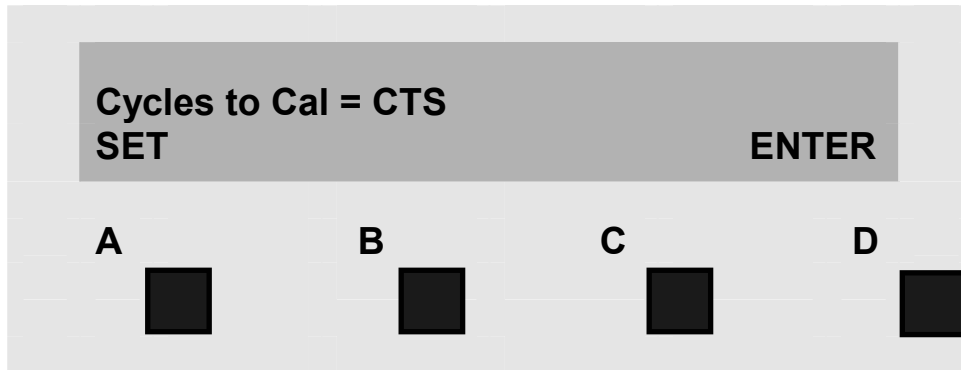
L. Perform one of the following actions:

- 1) Press the D (ENTER) button on Menu 19 to accept the open time value displayed on the % PENETRATION readout and display the CYCLES TO CAL prompt (Menu 20 or 21).

- 2) Use the B (UP) and C (DWN) buttons on Menu 19 to change the open time value displayed on the % PENETRATION readout to the desired value, then press the D (ENTER) button to enter the value into the system and display the CYCLES TO CAL prompt (Menu 20 or 21).

NOTE

When the % PENETRATION readout contains a value, the first CYCLES TO CAL prompt will appear with the menu options shown in Menu 20. When the % PENETRATION readout contains a dashed line (disabled), the first CYCLES TO CAL prompt will appear with the menu options shown in Menu 21. For this discussion, it is assumed that Menu 20 is displayed first.

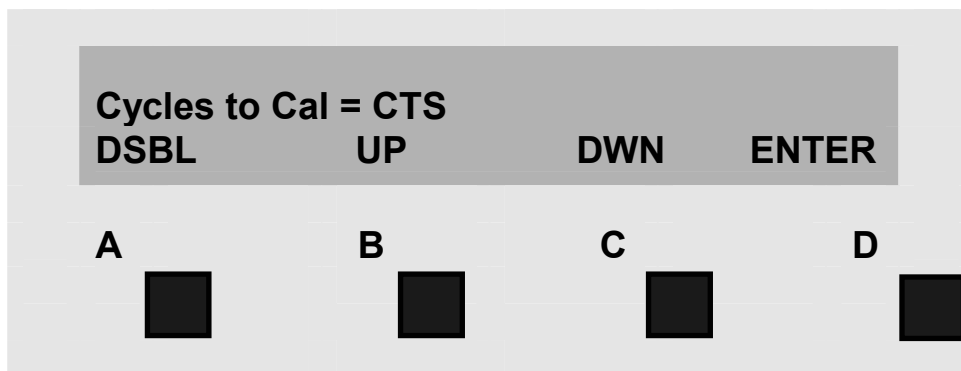
**Menu 19. CYCLES TO CAL Prompt**

K. Perform one of the following actions:

- 1) Press D (ENTER) button on Menu 20 to accept the cycles to calibration value displayed on the % PENETRATION readout and display CONCENTRATION prompt (Menu 22).
- 2) Press A (SET) button on Menu 20 to change CYCLES TO CAL value.

NOTE

The SET menu option of Menu 19 displays Menu 21. The % PENETRATION readout initially displays the default CYCLES TO CAL value or the last value set by the user. If the default setting has been disabled, a dashed line (----) will be displayed. The CYCLES TO CAL value determines the number of cycles that can be run before the system prompts the user to perform a recalibration. If the cycles to calibration function are disabled, the system never prompts the user for recalibration. The UP/DWN options of Menu 20 change the cycles to calibration value in 1-cycle increments. The range is 1 to 9999 cycles.



Menu 20. CYCLES TO CAL Prompt - Change Value

N. Perform one of the following actions:

- 1) Press A (DSBL) button to disable the cycles to calibration function and redisplay Menu 20.

NOTE

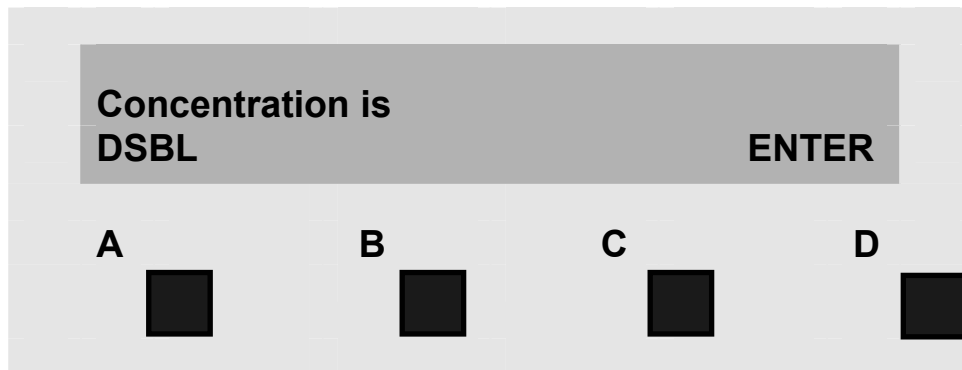
When the cycles to calibration function is disabled, the system never prompts for calibration.

- 2) Press D (ENTER) button to accept the CYCLES TO CAL value displayed in the % PENETRATION readout and display Menu 22.

- 3) Press B (UP) and C (DOWN) button to change the CYCLES TO CAL value displayed in the % PENETRATION readout, then press the D (ENTER) button to enter the value into the system and display Menu 22.

NOTE

Menu 22 allows the user to disable or enable the CONCENTRATION function. This function, when enabled, allows the user to monitor the concentration of the aerosol stream during testing. The concentration setup is done during the computerized maintenance mode (paragraph 11, steps O through Q). The concentration value is displayed in $\mu\text{g/l}$ in the % PENETRATION readout. If the value is not within the established set points the system will flash a fault message.



Menu 21. CONCENTRATION Prompt

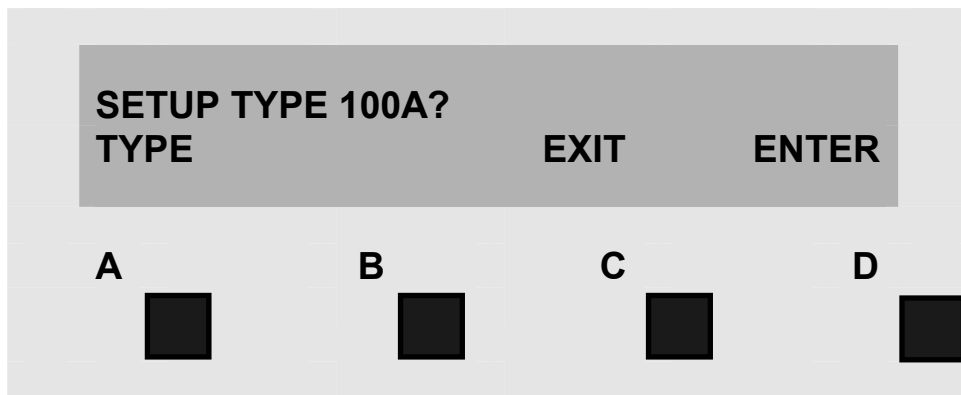
O. Perform one of the following actions:

- 1) Press A (DSBL) button (changing label to SET) to enable the CONCENTRATION function, then press D (ENTER) button to display the next menu (Menu 23).
- 2) Press D (ENTER) button to disable the CONCENTRATION function and display the next menu (Menu 23).

NOTE

When the *ENTER* option is selected from Menu 21, the system displays Menu 22. This menu provides three options:

- *TYPE* allows the user to select the standard 100A setup or the optional 101-test bench setup.
- *ENTER* allows the user to recycle through the setup procedure.
- When *EXIT* is selected, the system remembers its status from before setup and returns to it. If calibration was not completed prior to setup, the system initiates the calibration routine (paragraph 7.2.2) by displaying Menu 24. Calibration must then be completed before the system will advance to operating mode. If calibration was completed prior to setup, the system will advance to operating mode (paragraph 7.2.3) by displaying the *START CYCLE* prompt (Menu 36).

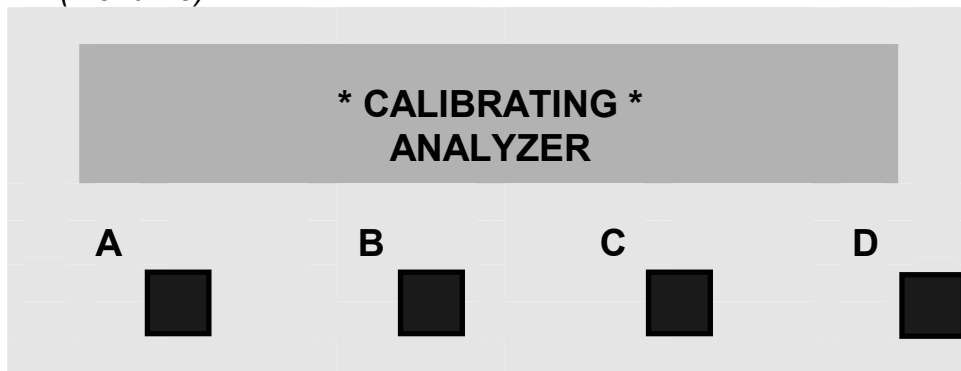


Menu 22. SETUP Menu

7.2.2. Calibration Mode

NOTE

Calibration is the process whereby the TDA-100A system is calibrated to test a product. When the system is being calibrated for the first time following power-up, the system advances to calibration mode when the user selects the YES option from Menu 2. When setup is completed before calibration, the system advances to the calibration routine when the user selects the EXIT option from Menu 22. The system acknowledges both menu choices with a short beep and displays the CALIBRATING ANALYZER message (Menu 23).

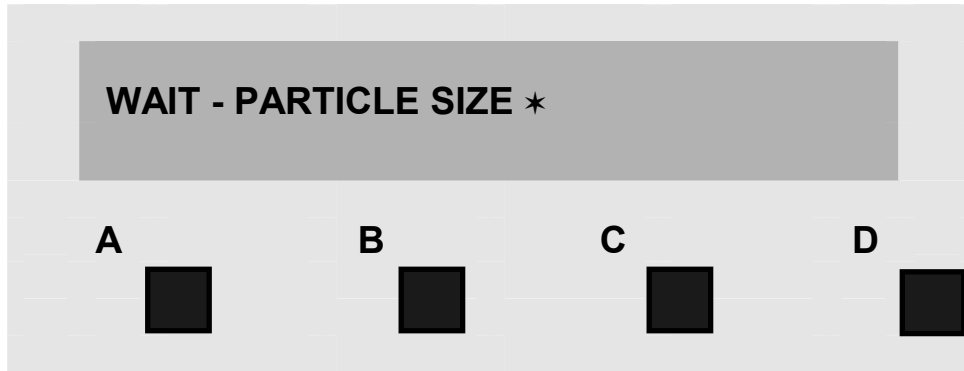


Menu 23. CALIBRATING ANALYZER Message

NOTE

The CALIBRATING ANALYZER message indicates the following automatic calibration sequence is occurring:

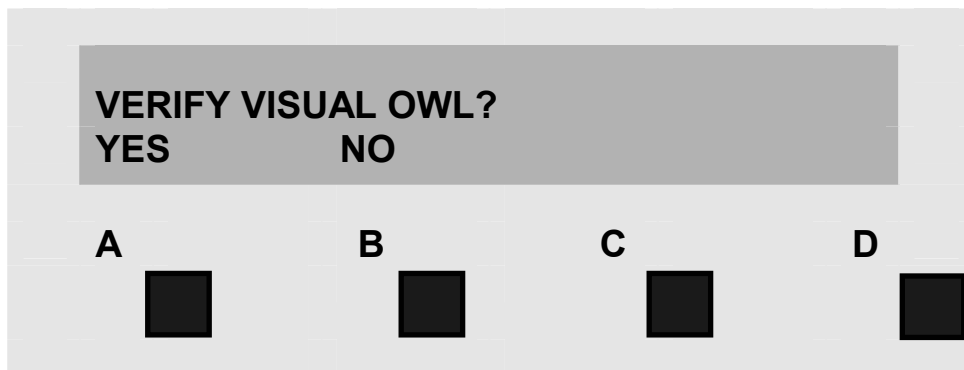
- *Analyzer is set to 45 degrees (smoke is clear).*
- *Standard lamp is inserted.*
- *Analyzer is set to 29 degrees.*
- *Standard lamp is raised.*
- *Smoke line is connected.*
- *If particle size has not been reached, the yellow FAULT light flashes and the message WAIT PARTICLE SIZE (Menu 24) is displayed.*
- *When particle size is reached, the system displays the VERIFY VISUAL OWL prompt (Menu 26).*



Menu 24. WAIT - PARTICLE SIZE Message

NOTE

*From this point on, as long as the TDA-100A is operational, the system will occasionally display the * symbol to the right of the display screen, indicating that the system is actively monitoring particle size. When the particle size loop is on, the * will be displayed even if messages are being displayed. The * display will end each time the comparison cycle is finished.*



Menu 25. Verify Visual Owl Prompt

NOTE

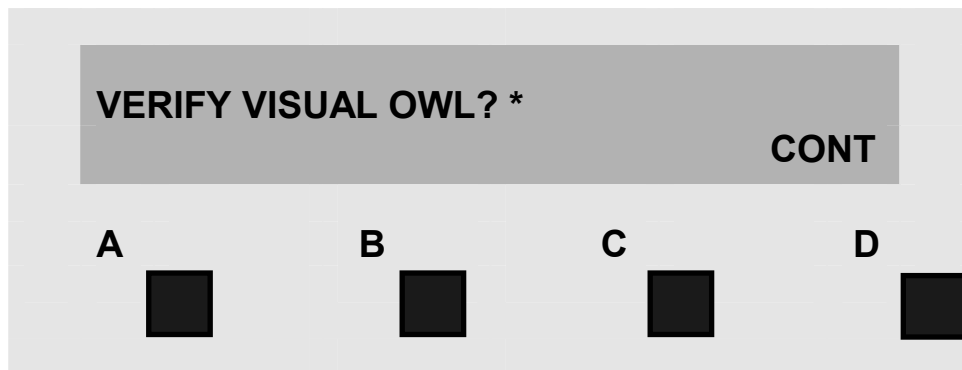
The YES option of Menu 26 allows the user to verify particle size through the use of a visual owl. The NO option allows the user to bypass this verification and proceed to set test flow (step B).

A. To verify particle size using the visual owl:

- 1) Press A (YES) button (Menu 26).

NOTE

The system displays Menu 27 and lowers the standard lamp to allow the user to remove it.

**Menu 26. VERIFY VISUAL OWL - Continue**

- 2) Remove standard lamp thumbscrew and pull out standard lamp.
 - 3) Insert visual owl in standard lamp port.
 - 4) While viewing the viewing field through the eyepiece, adjust the visual owl until the Intensity the viewing fields are equal.
 - 5) Check the position of the visual owl pointer and proceed as follows:
-

- a. If visual owl pointer is not at 29 ± 3 , remove visual owl from standard lamp port and reinstall standard lamp, then return mechanical analyzer to manufacturer for calibration.

NOTE

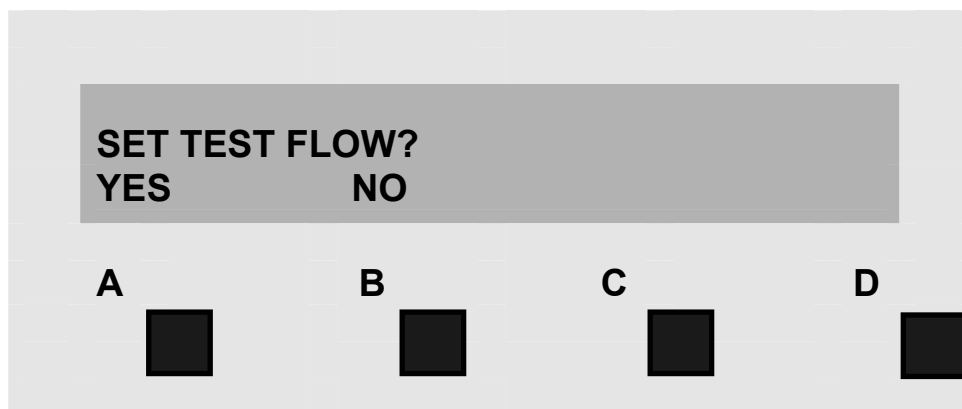
Consult the manufacturer for instructions on removing the mechanical analyzer from the TDA-100A unit.

- b. If visual owl pointer is 29 ± 3 , remove visual owl from standard lamp port and reinstall standard lamp, then continue with next step of this procedure.

- 6) Press D (CONT) button (Menu 26) to continue.

NOTE

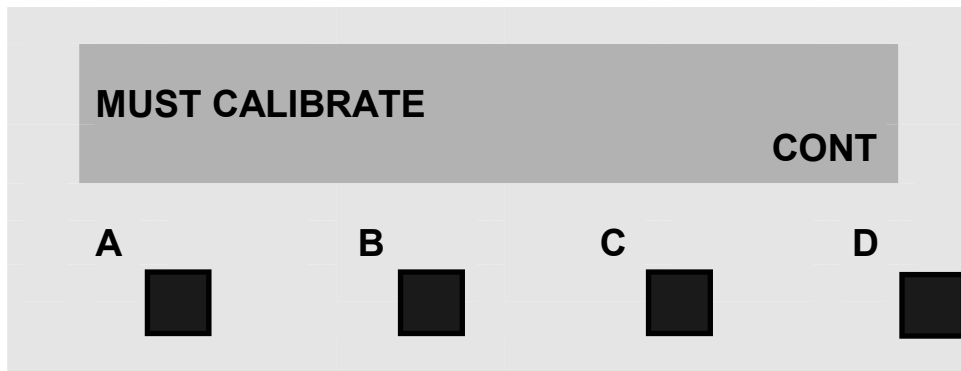
If particle size has not been reached, the yellow FAULT light will flash and the message WAIT PARTICLE SIZE (Menu 24) will display. No further progress will be allowed until the proper particle size has been reached. When this occurs, the system acknowledges with a short beep and displays Menu 27. This menu prompts the user to initiate the procedure for adjusting the proper flow for testing.



Menu 27. SET TEST FLOW Prompt

NOTE

If the test flow routine has been completed, the NO option on Menu 27 advances the program to the CAL PENETRATION routine (Menu 31, step E). If the test flow routine has not been completed, the NO option produces the MUST CALIBRATE message (Menu 29). The CONT option on Menu 29 redisplay Menu 28.

**Menu 28. MUST CALIBRATE Message**

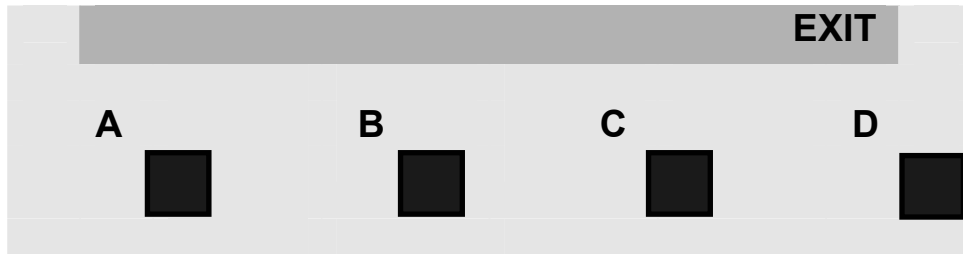
B. Press A (YES) button on Menu 27 to continue.

NOTE

The user is prompted to place the test component in the chuck and manually close the chuck (Menu 29).



FILTER IN - CLOSE



Menu 29. FILTER IN - CLOSE Prompt

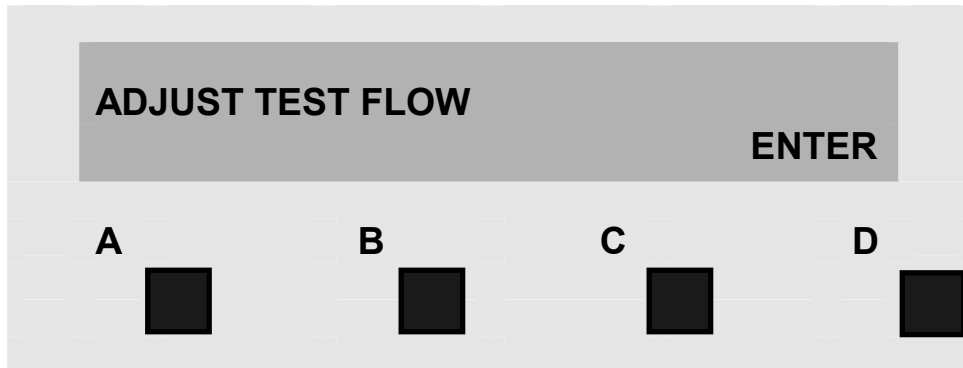
NOTE

The EXIT option on Menu 29 redisplay Menu 27.

- C. Place the test component in the chuck.
- D. Simultaneously press both CHUCK CLOSE buttons and hold buttons until chuck is fully closed and latched.

NOTE

When the chuck is latched, the system prompts the user to adjust the test flow (Menu 30).



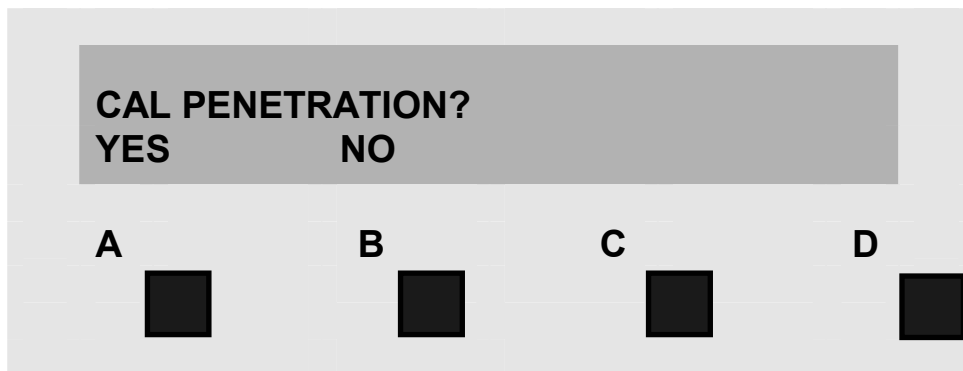
Menu 30. ADJUST TEST FLOW Prompt

- E. Rotate the TEST FLOW control on the front panel of the electronics enclosure until the desired flow rate is registered on the TEST FLOW readout; allow the reading to stabilize, then press D (ENTER) key (Menu 30).



NOTE

The test flow should be set to the flow required by the test component in the chuck. Normal settings are typically 16, 32, 42.5, and 85 LPM. (Higher test flows are available from the manufacturer upon request.) The system accepts the entered test flow rate setting, sounds a warning beep, opens the chuck, and displays Menu 31.



Menu 31. CAL PENETRATION Prompt

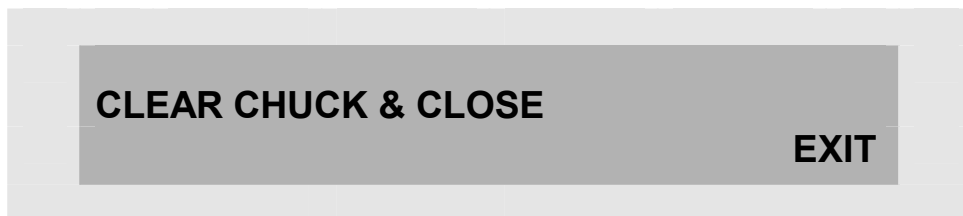
NOTE

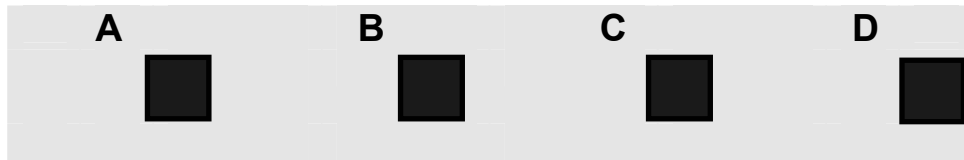
The NO option on Menu 32 displays the MUST CALIBRATE message (Menu 28).

F. Press A (YES) button to continue.

NOTE

The YES option on Menu 32 displays the CLEAR CHUCK & CLOSE prompt (Menu 32).





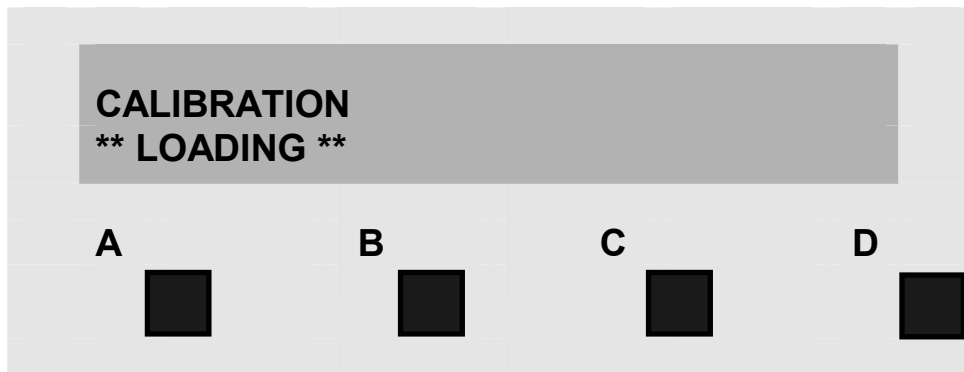
Menu 32. CLEAR CHUCK & CLOSE Prompt

NOTE

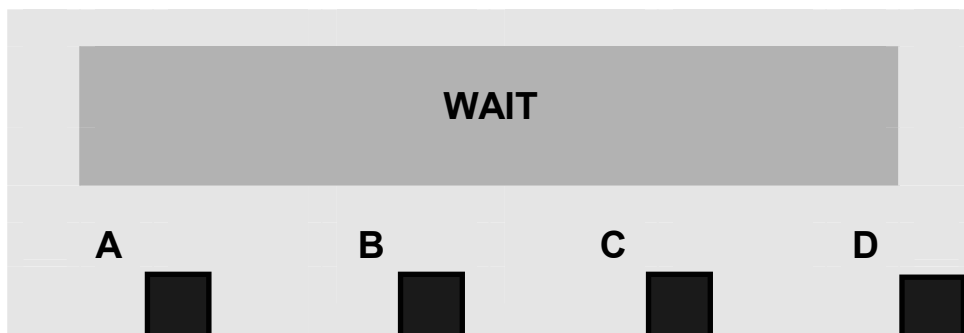
The EXIT option on Menu 32 redispays Menu 31.

NOTE

When the chuck is latched, the system displays the CALIBRATION LOADING message (Menu 33), followed by the WAIT message (Menu 35). The CALIBRATION loading message indicates that vacuum and aerosol are being applied. The WAIT message indicates that the system is purging.



Menu 33. CALIBRATION LOADING Message

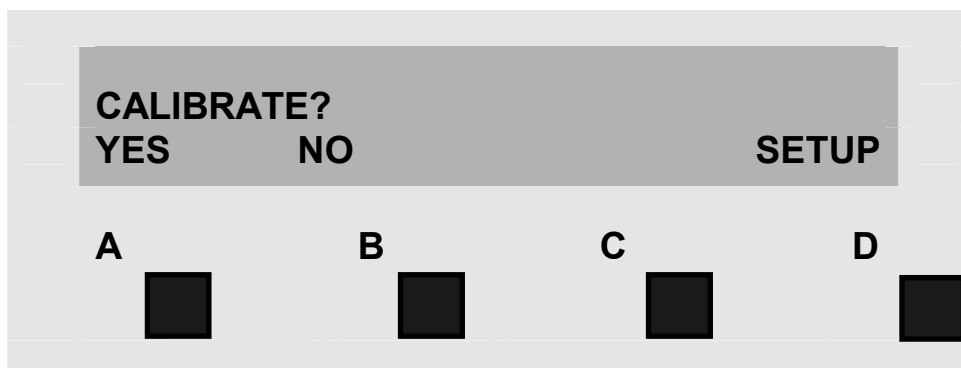


Menu 34. WAIT Message

NOTE

When the purge is complete, the system sounds an audible warning, opens the chuck, and redisplay the CALIBRATE prompt (Menu 35) This menu is similar to Menu 2, but now the system will remember its status prior to the calibration just performed and will respond to user selections as follows:

- If the NO menu option is selected, the program will display the START CYCLE menu (Menu 36) and advance to the operating mode routine (paragraph 7.2.3, OPERATING MODE).*
- If the YES menu option is selected, the system will recycle through the calibration routine. This time the user will be prompted to select a particular calibration procedure: CALIBRATE ANALYZER, CALIBRATE TEST FLOW, and CAL PENETRATION. At the completion of the recalibration cycle, the system will redisplay Menu 35.*
- If the SETUP menu option is selected, the system will redisplay the initial SETUP screen (Menu 3) and return to the SETUP mode routine (paragraph 7.2.1).*



Menu 35. CALIBRATE Prompt

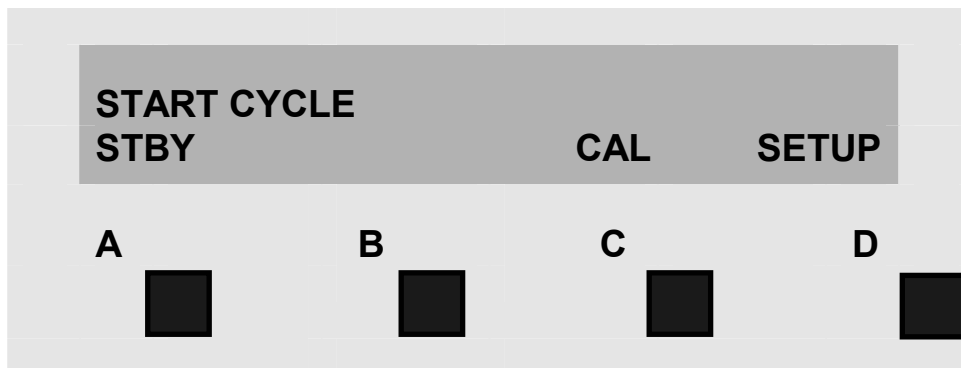
7.2.3. Operating Mode

The system enters operating mode by displaying the START CYCLE prompt (Menu 36). This menu is displayed only when the calibration routine is completed and the user selects one of the following menu options: YES from the CALIBRATION prompt (Menu 35) which is displayed when the calibration routine is completed, or EXIT from the SETUP menu (Menu 22) which is displayed at the end of the setup routine. Operating mode can be entered at the end of the setup routine only if calibration was completed prior to setup.

NOTE

Menu 36 provides three options, all of which are ignored to continue with operating mode. The menu is redisplayed after each test and is used to exit operating mode to another mode as follows:

- *If the STBY menu option is selected, the program will display Menu 41 and advance to the standby mode routine (paragraph 7.2.4).*
- *If the CAL menu option is selected, the system will display the CALIBRATION menu (Menu 23) and return to the calibration mode routine (paragraph 7.2.2).*
- *If the SETUP menu option is selected, the system will redisplay the initial SETUP screen (Menu 3) and return to the setup mode routine (paragraph 7.2.1).*



Menu 36. START CYCLE Prompt

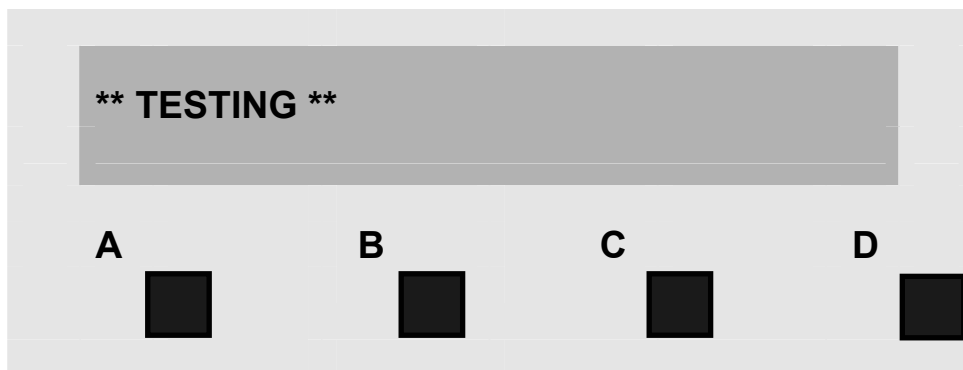
- A. When ready to proceed with testing, place the test component in the chuck and press and hold both CLOSE CHUCK buttons until the chuck is closed and latched.

NOTE

*When the chuck is latched, the system displays the **LOADING** message (Menu 37) indicating that vacuum and aerosol are being applied. When the loading cycle is completed, the system displays the **TESTING** message (Menu 38) indicating that the system is determining test readings, displaying them at the appropriate readouts on the controller unit front panel, and updating the displays once per second.*



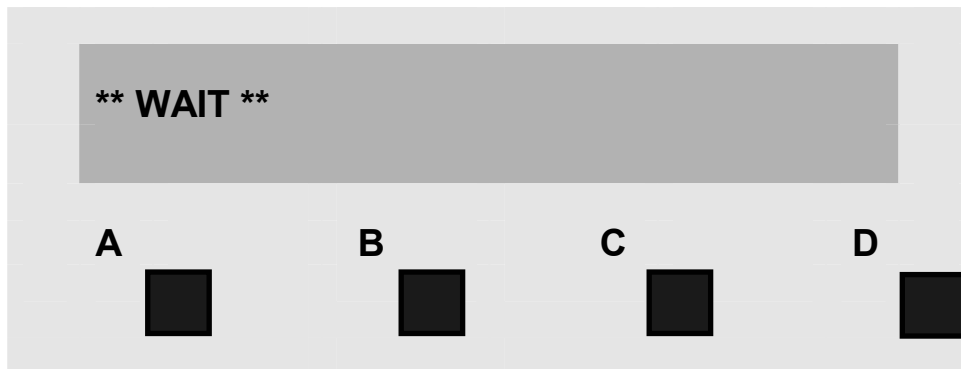
Menu 37. LOADING Message



Menu 38. TESTING Message

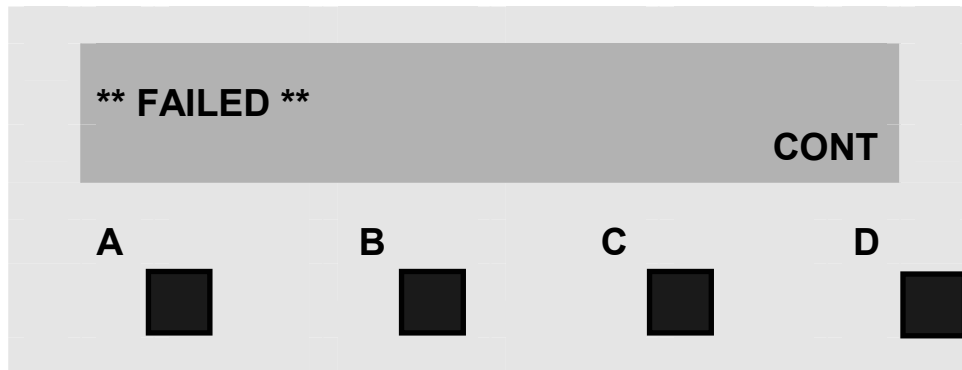
NOTE

When the test component has remained under test for the preset time period, the system sounds a warning, displays the WAIT message (Menu 39), and opens the chuck.

**Menu 39. WAIT Message**

- B. Perform one of the following actions based on the displays and indicators on the controller unit front panel:
- 1) If the test component passed, the test green READY illuminates and the system redisplayes the START CYCLE menu (Menu 36). To continue:
 - a. Ignore START CYCLE menu options.
 - b. Remove test component from chuck.
 - c. Place another test component of the same type in the chuck.
 - d. Close chuck as described in step A to continue from that point.
 - 2) If the test component has failed any of the preset parameters, the red FAIL indicator illuminates, and the fail alarm sounds, and the FAILED message (Menu 40) is displayed. The readout displaying the failed parameter will flash continuously for a few seconds to attract the user's attention. To continue:
 - a. Press D (CONT) button to display the START CYCLE menu.
 - b. Remove failed test component from chuck.

- c. Place another test component of the same type in chuck.
- d. Close chuck as described in step A to continue from that point.



Menu 40. FAILED Message

7.2.4. Standby Mode

Standby mode allows the user to place the system in an idle state during short breaks from operating mode. The standby mode is implemented from Menu 36 that is displayed when the system is ready to start a test cycle.

- A. Wait until the beginning of a test cycle when Menu 36 is displayed.
- B. Press A (STBY) button (Menu 36) to display the STANDBY menu (Menu 41).

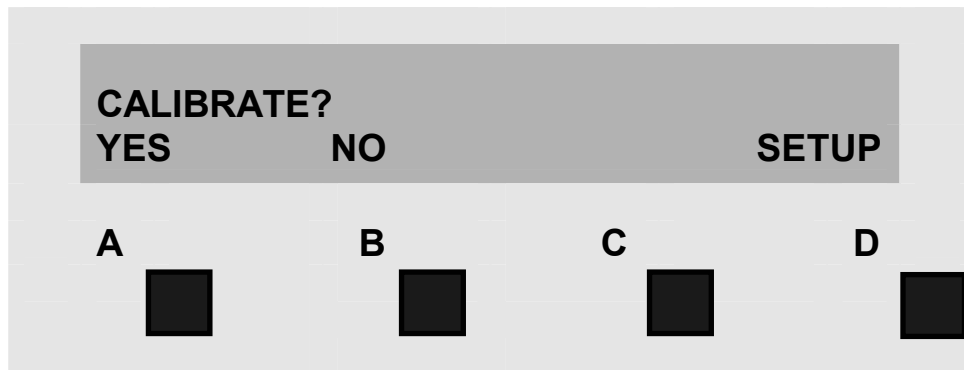


Menu 41. STANDBY Menu

- C. When ready to resume testing, press D (CONT) button.

NOTE

The CALIBRATE prompt (Menu 42) is displayed. This menu gives the user the options of selecting calibration or setup and returning to those procedures. The NO menu option is used to return to operating mode and continue testing.

**Menu 42. CALIBRATE Prompt**

- D. Press B (NO) button (Menu 43) to redisplay START CYCLE menu (Menu 36) and continue testing as follows:
- 1) Ignore START CYCLE menu options.
 - 2) Remove test component from the chuck.
 - 3) Place another test component of the same type in the chuck.
 - 4) Close chuck as described in paragraph 7.2.3, step A and continue from that point.

7.3. SHUTDOWN

- A. Place system in standby mode (paragraph 7.2.4).
- B. Wait at least 15 seconds.
- C. Press red power off switch on front panel of electronics enclosure.



8. SCHEDULED ROUTINE MAINTENANCE

NOTE

Scheduled maintenance is based on an 8-hour operating day. If operating time is increased, maintenance should be increased as well.

8.1. DAILY

- A. Check the level of liquid in the aerosol generator sight glass and refill as needed.

NOTE

The level of the liquid in the aerosol generator should not exceed the upper level mark on the sight glass and should not be allowed to fall below the low level mark. Instructions for filling the aerosol generator are in paragraph 12.1.

- B. Check for liquid in the main air regulator/filter and main air HEPA filter; drain as necessary through the air drain valves.

8.2. MONTHLY

- A. Clean the mechanical analyzer lenses.

NOTE

Instructions for cleaning the mechanical analyzer lenses are in paragraph 12.3.

- B. Drain the aerosol generator, while unit is hot, and refill with fresh liquid.



CAUTION

Use extreme caution when draining aerosol generator as the liquid is very hot.

- C. Clean the screen in the lint trap located at the bottom of the chuck assembly.

8.3. BI-MONTHLY

- A. Replace test flow filter (located under top panel of unit).
- B. Replace sample flow filter (located under top panel of unit).
- C. Drain mixing chamber reservoir.

NOTE

The mixing reservoir drain plug can be accessed by reaching under the unit at the front, lower left-hand corner.

8.4. BI-YEARLY

- A. Change the three air supply filters in the main air HEPA filter assembly
- B. Change the filter in the main air pressure regulator/filter.

8.5. YEARLY

- A. Clean light scattering chamber cone and lens, then align scattering chamber.

NOTE

Instructions for cleaning the light scattering chamber cone and lens and for aligning the scattering chamber are in paragraphs 12.4 and 12.6, respectively.

- B. Replace light scattering chamber cell lamp.



NOTE

Instructions for replacing the light scattering chamber cell lamp are in paragraph 12.5.

- C. Replace reference filter.
- D. Return mechanical analyzer to manufacturer for cleaning and recalibration.

NOTE

Consult the manufacture for instructions when removing the mechanical analyzer from the unit.

- E. Return mass flow meter to manufacturer for calibration

NOTE

Instructions for removal and replacement of the mass flow meter are in paragraph 12.7.



9. TROUBLESHOOTING

Table 8. Troubleshooting

Problem	Probable Cause	Corrective Action
Chuck does not stay closed when CHUCK CLOSE buttons are pressed.	<ul style="list-style-type: none"> • CHUCK PURGE valve is closed. 	Open CHUCK PURGE valve at least one-quarter turn.
System will not accept set analyzer to 29 when calibrating analyzer.	<ul style="list-style-type: none"> • Setting is not exactly 29 degrees. • Analyzer is malfunctioning. 	<ul style="list-style-type: none"> • Verify setting is exactly 29. • Exit calibration procedure, clear analyzer T-Section, and restart calibration. • Run maintenance routine.
System will not accept standard lamp down command when calibrating analyzer.	<ul style="list-style-type: none"> • Smoke is in analyzer T-Section. • Analyzer is malfunctioning. 	<ul style="list-style-type: none"> • Clear smoke from T-Section. • Exit calibration procedure, clear analyzer T-Section, and restart calibration. • Clean glass lenses in analyzer (paragraph 12.3) and run maintenance routine (paragraph 11)
Controller is inoperative.	<ul style="list-style-type: none"> • Power rocker-switch on rear panel is in off position. • Unit is not plugged in. • Line fuse is defective. 	<ul style="list-style-type: none"> • Check power switch position and turn on if necessary. • Plug power cord into power inlet located on rear panel of electronics enclosure. • Replace fuse.



10. FAULT AND ERROR MESSAGES

A fault occurs when system operation is interrupted. The user is alerted to a fault condition by the sounding of an audible alarm, illumination of the yellow FAULT light on the controller unit, and the display of an error message.

An error message may direct the user to run the maintenance routine or reset the system. In some instances, a CONT menu option is available to clear the message after the fault is corrected. The system will then display the appropriate menu screen to restore operation and the FAULT light will go out.

Table 9. Fault and Error Messages

Message	Probable Cause	Corrective Action
ANALYZER MAINTENANCE	<ul style="list-style-type: none"> Cell lamp is burned out. T-Section lenses are dirty. Aerosol concentration has drifted. 	<ul style="list-style-type: none"> Replace cell lamp in analyzer. Clean T-Section lenses (paragraph 12.3) Run maintenance routine.
ANALYZER SMOKE? CONT	<ul style="list-style-type: none"> Aerosol line is not connected to port. No aerosol in aerosol line. 	<ul style="list-style-type: none"> Reconnect aerosol line to analyzer port Check liquid level and refill as necessary. Press CONT button to return to start of current procedure.
AWAITING SYSTEM AIR	<ul style="list-style-type: none"> System is awaiting system air 	<ul style="list-style-type: none"> Check external air supply. Check air disconnect at rear of unit Check air pressure regulator setting and adjust if necessary for 80 PSI.
CANCEL DURING TEST CONT	<ul style="list-style-type: none"> Manual CHUCK CLOSE switches interrupted test. 	<ul style="list-style-type: none"> Press CONT button to return to start of current procedure.


Table 9. Fault and Error Messages, Continued

Message	Probable Cause	Corrective Action
AWAITING TEMPERATURE	<ul style="list-style-type: none"> • Generator temperature is below set point. • Heaters have no voltage. 	<ul style="list-style-type: none"> • Check LIQUID TEMPERATURE Controller SET 1 set point. •
CHECK SYSTEM TEMPAIR	<ul style="list-style-type: none"> • System air is lost or below set requirement • Generator temperature is below set point. 	<ul style="list-style-type: none"> • Turn power switch to the off position, • Check air disconnect at rear of unit, and turn power switch on. • Turn Controller power switch to the off position, check external air supply, readjust air pressure regulator if necessary, and turn power switch on.
CHECK VACUUM	<ul style="list-style-type: none"> • The system has lost vacuum. 	<ul style="list-style-type: none"> • Check the vacuum system.
CHUCK SWITCH ERROR CONT	<ul style="list-style-type: none"> • CHUCK CLOSE switches not pressed simultaneously • Dip switch 4 in wrong position 	<ul style="list-style-type: none"> • Press CONT button. • Press both CHUCK CLOSE switches simultaneously and hold until chuck is fully closed and latched. • Check position of dipswitch 4 (See Table 4.)
LTC INPUT PROBLEM	<ul style="list-style-type: none"> • Excessive gain in analyzer phototubes • Exceeding maximum flow rating of mass flow meter • Sample resistance exceeding 200 mm water column 	<ul style="list-style-type: none"> • Run computerized maintenance procedure. • Readjust test flow. • Consult manufacturer.

Table 9. Fault and Error Messages, Continued

Message	Probable Cause	Corrective Action
CONCENTRATION	<ul style="list-style-type: none"> • Liquid level low • Liquid temperature changed 	<ul style="list-style-type: none"> • Check liquid level and refill as necessary. • Verify liquid temperature.
HEATER RANGE	<ul style="list-style-type: none"> • Incoming air too hot or too cold 	<ul style="list-style-type: none"> • Adjust vortex tube to cool or heat diluent air as required (consult manufacturer).
CHUCK OBSTRUCTION CONT	<ul style="list-style-type: none"> • The chuck encountered an obstruction that prevented it from closing. • A sample is present during a penetration recalibration • Chuck is not sealing properly. 	<ul style="list-style-type: none"> • Remove obstruction. • Remove sample • Check chuck for proper seal. • Press CONT button to return to start of current procedure.
AWAITING PARTICLE SIZE	<ul style="list-style-type: none"> • Aerosol particle size is out-of-tolerance. 	<ul style="list-style-type: none"> • Wait until the system detects the tolerance is within spec and returns to start of current procedure.
LSC MAINTENANCE	<ul style="list-style-type: none"> • Lamp in scattering chamber is defective. 	<ul style="list-style-type: none"> • Replace lamp in scattering chamber.
SYSTEM ERROR	<ul style="list-style-type: none"> • General system fault. 	<ul style="list-style-type: none"> • Turn power switch to off. • Wait approximately 2 minutes. • Turn power switch to on. • If problem persists, turn power switch to off and contact the manufacturer.



11. TDA-100A COMPUTERIZED INTERNAL MAINTENANCE ROUTINE

The computerized internal maintenance routine provides the user with menu-driven procedures for mechanical analyzer and light scattering chamber maintenance. The maintenance mode menus can be entered two ways as described in paragraphs 11.1 and 11.2.

11.1. ENTERING MAINTENANCE MODE AT POWER-UP

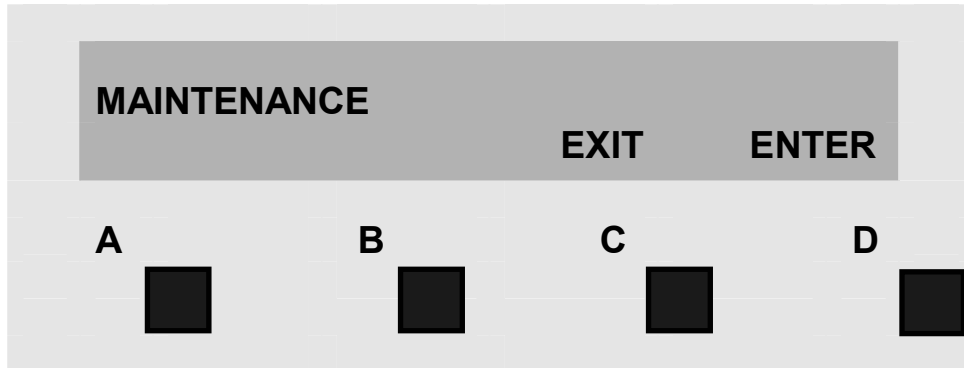
NOTE

Unit must be up to temperature to enter maintenance mode.

- A. Press red POWER OFF switch on front panel of electronics enclosure.
- B. Press and hold the A function button on the PPS Controller Unit front panel.
- C. Continuing to hold the A function button, press green POWER ON switch: white indicator light should illuminate.
- D. Continuing to hold the A function button, observe the function display screen.
- E. Release the A function button when the AWAITING AIR/TEMP message is displayed.

NOTE

*The opening MAINTENANCE menu (Menu 43) is displayed.
The EXIT menu option allows the user to exit maintenance mode and return to operating mode (Menu 2).*



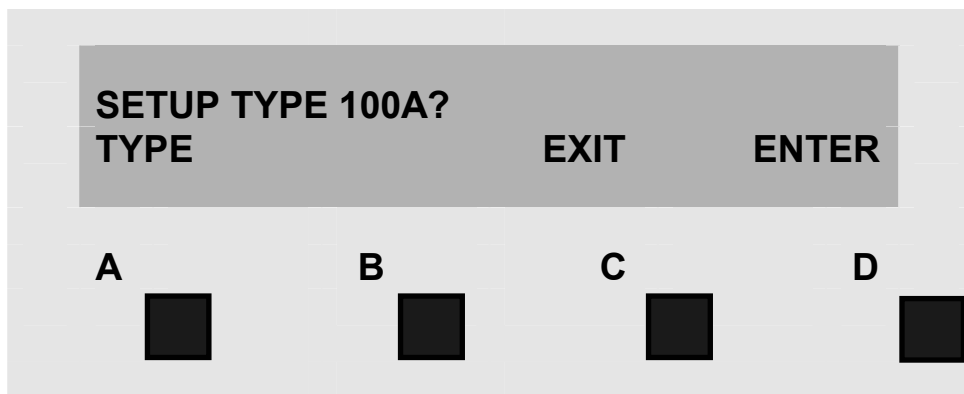
Menu 43. Opening MAINTENANCE Menu

F. Proceed to paragraph 11.3 to continue with maintenance mode.

11.2. ENTERING MAINTENANCE MODE FROM RUN MODE

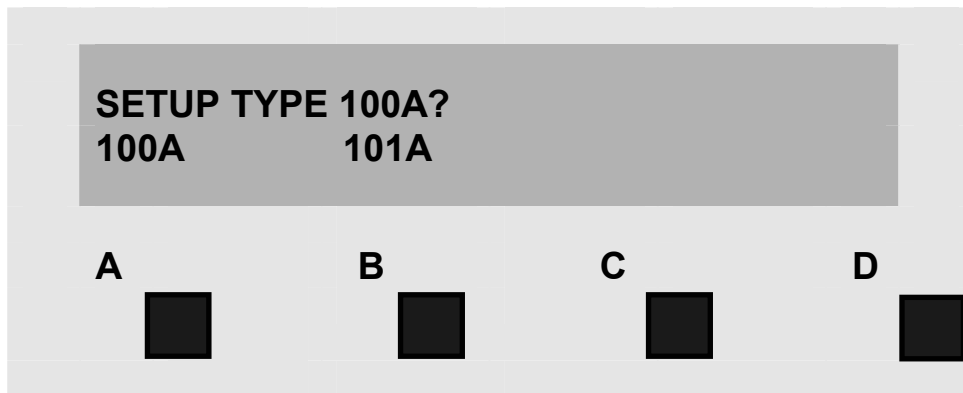
NOTE

Menu 45 must be displayed.



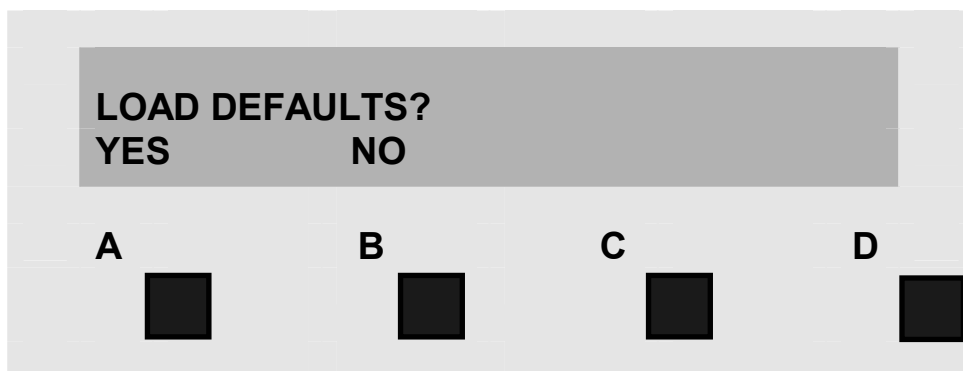
Menu 44. Initial Setup Screen

- A. Press A (TYPE) button to display Menu 46.



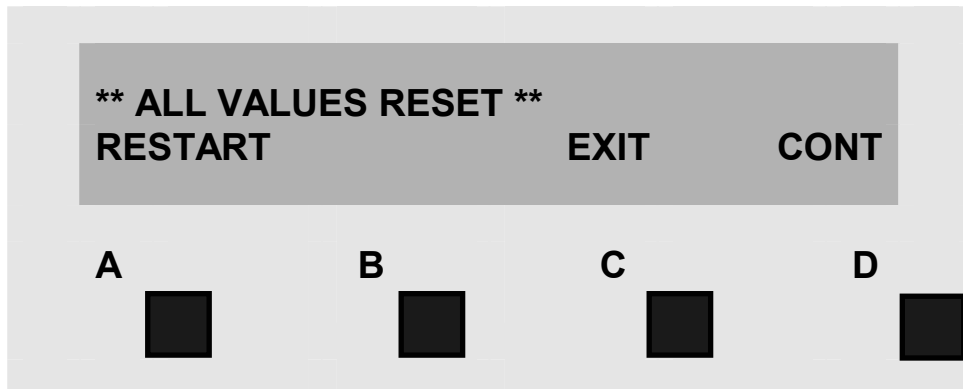
Menu 45. SETUP TYPE Prompt

- B. Press "A" (100A) button on Menu 46 to display LOAD DEFAULTS prompt (Menu 47).



Menu 46. LOAD DEFAULTS Prompt

- C. Press "A" (YES) button to continue: the system displays the message ** ALL VALUES RESET** (Menu 48).



Menu 47. ALL VALUES RESET Message

- D. Press A (RESTART) button, release button, then immediately press it again.
- E. Release the A button when the WAIT TEMP/AIR message is displayed.

NOTE

The opening MAINTENANCE menu (Menu 43) is displayed.

- F. Proceed to paragraph 11.3 to continue with maintenance mode.

11.3. MAINTENANCE MODE ROUTINE

- A. Press D (ENTER) key on Menu 44 to display the ANALYZER MAINTENANCE menu (Menu 49).

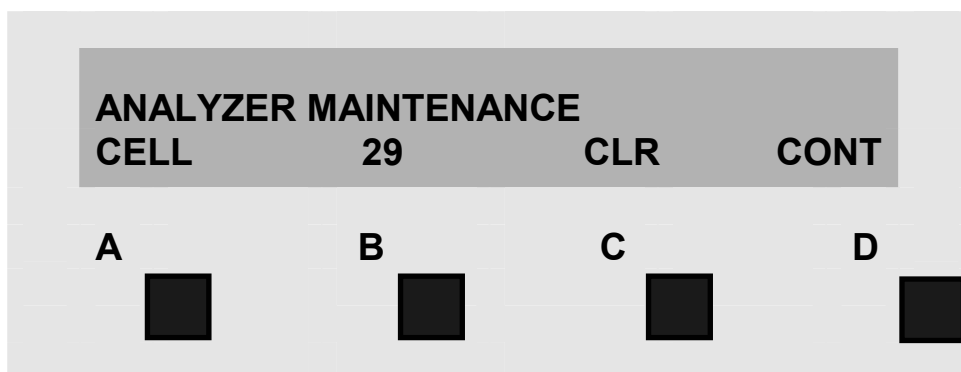
NOTE

The ANALYZER MAINTENANCE menu allows the user to set up the mechanical analyzer for automatic maintenance. The menu provides the following options:

- *CELL indicates the mechanical analyzer cell lamp is on. Pressing the CELL key toggles the label from CELL to STD, indicating the standard lamp is inserted into the analyzer.*
- *"29" indicates the mechanical analyzer is set to 29 degrees. Pressing the 29 key toggles the mechanical*

analyzer to 45 degrees and changes the label from 29 to 45.

- CLR indicates the aerosol smoke to the analyzer is off. Pressing the CLR key toggles the aerosol smoke to on and the label is changed to SMK.
- CONT accepts the mechanical analyzer conditions set by the other three menu options. The system implements the conditions and displays the next menu screen.



Menu 48. ANALYZER MAINTENANCE Menu, Initial Settings

B. Perform one of the following actions.

- 1) To adjust particle size gain, ignore all Menu 49 options, and proceed to step C.

NOTE

Step C provides the first of a series of procedural steps starting with mechanical analyzer adjustments and progressing to mechanical analyzer calibration, LSC maintenance, and gravimetric test.

- 2) To peak phototubes, press A (CELL) button and proceed to step E.

NOTE

Particle size gain adjustment parameters are displayed on the RESISTANCE (phototube A), and TEST FLOW

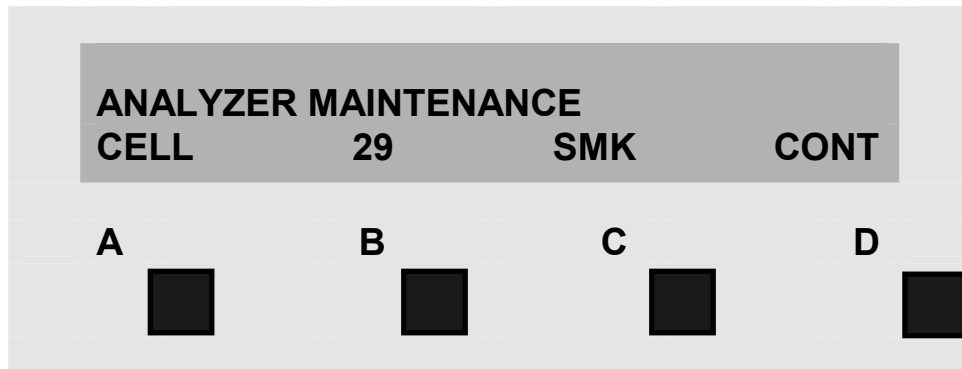
(phototube B) readouts on the front panel of the PPS controller unit.

C. To adjust particle size gain:

- 1) Press the C (CLR) button on the ANALYZER MAINTENANCE menu to toggle CLR to SMK and (if necessary) press A (STD) button to toggle STD to CELL (as shown in Menu 50).

NOTE

The system automatically turns on the aerosol smoke and turns the cell lamp on. The mechanical analyzer remains set to 29 degrees.



Menu 49. ANALYZER MAINTENANCE Menu - Particle Size Gain Settings

- 2) Remove cover panel from electronics enclosure.



-
- 3) Adjust "CELL" trimpot until the RESISTANCE and TEST FLOW readouts display voltages between 1.6 and 2.1 or, if the readouts are not balanced, adjust for an average reading of 2.0.

WARNING

To avoid personal injury, do not allow hands or other body parts to touch electrical components. High voltages are present on the analyzer/output board. Use a non-conductive screwdriver to adjust the CELL trimpot.

NOTE

To calculate an average reading, total the two displayed readings and divide by 2.

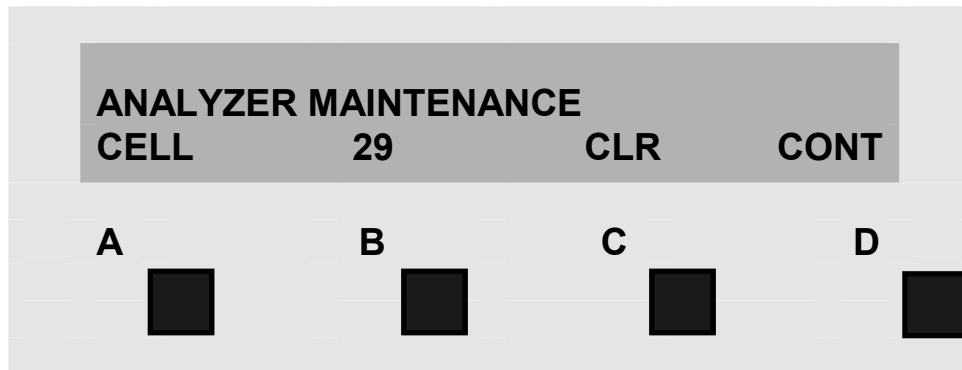
- 4) Proceed to next step and check straylight.

D. To check straylight:

- 1) Press the C (SMK) button on the MECHANICAL ANALYZER menu to toggle SMK to CLR (as shown in Menu 50).

NOTE

The system automatically removes aerosol smoke from the T-Section of the mechanical analyzer. The cell lamp remains on (CELL) and the mechanical analyzer remains set to 29 degrees.



Menu 50. ANALYZER MAINTENANCE Menu - Straylight Check Settings

- 3) Allow approximately 5 to 10 seconds for the T-section to clear.
- 4) Perform one of the following actions:
 - a. If the voltages displayed on the RESISTANCE and TEST FLOW readouts are less than .03, proceed to step F to adjust standard lamp.
 - b. If the voltages displayed on the RESISTANCE and TEST FLOW readouts are greater than .03, clean mechanical analyzer lenses.

NOTE

Instructions for cleaning the mechanical analyzer lenses are in paragraph 12.2.

- E. To peak the phototubes:

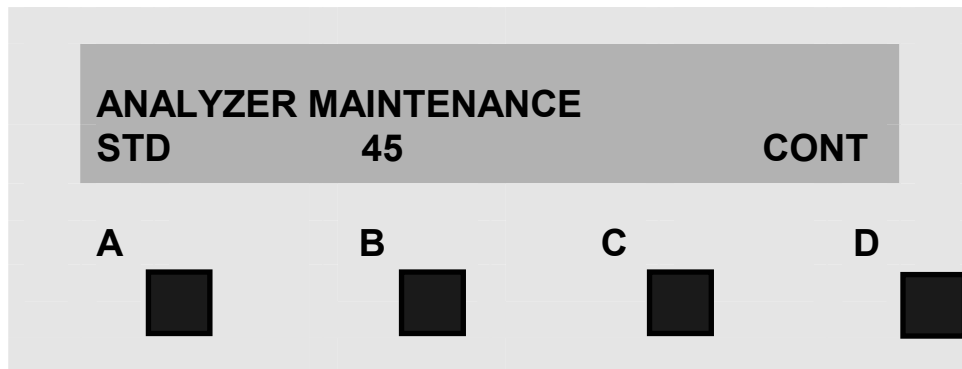
NOTE

The phototubes are peaked before leaving the factory and should never need to be peaked again. If the phototubes are replaced, the new phototubes will need to be peaked.

- 1) Press the A (CELL) button on the ANALYZER MAINTENANCE menu to toggle CELL to STD and the B (29) button to toggle 29 to 45 (as shown in Menu 52).

NOTE

The system automatically inserts the standard lamp into the analyzer and sets the analyzer to 45 degrees.

**Menu 51. ANALYZER MAINTENANCE Menu - Peak Phototube Settings**

- 2) Loosen wing nut on phototube A.
- 3) Rotate phototube A for highest reading on RESISTANCE readout.
- 4) Tighten wing nut on phototube A.
- 5) Loosen wing nut on phototube B.
- 6) Rotate phototube B for highest reading on TEST FLOW readout.
- 7) Proceed to next step to adjust standard lamp.

F. To adjust standard lamp:

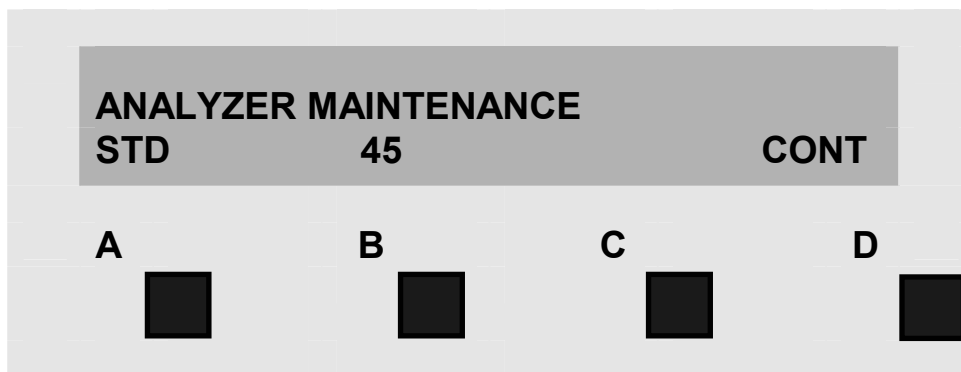
- 1) Perform one of the following based on the voltages displayed on the RESISTANCE and TEST FLOW readouts:
 - a. If the readings are between 2.4 and 2.9 and are not balanced, proceed to step G to balance settings.



- b. If the readings are not between 2.4 and 2.9, continue with the next step of this procedure.
- 2) If necessary, press the A (CELL) button on the ANALYZER MAINTENANCE menu to toggle CELL to STD and the B (29) button to toggle 29 to 45 (as shown in Menu 53).

NOTE

The system automatically inserts the standard lamp into the analyzer and sets the analyzer to 45 degrees. Smoke remains off.

**Menu 52. ANALYZER MAINTENANCE Menu -Particle Size Gain Settings**

- 3) Adjust STANDARD LAMP ADJUST control until the RESISTANCE and TEST FLOW readouts display a voltage between 2.4 and 2.9.

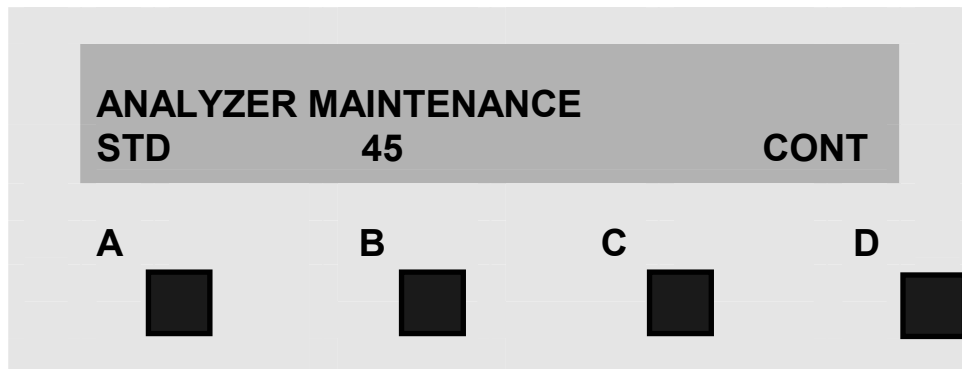
WARNING

To avoid personal injury, do not allow hands or other body parts to touch electrical components. High voltages are present around the standard gain potentiometer. Use a non-conductive screwdriver to adjust the potentiometer.

- 4) If the readings are not balanced, proceed to next step and balance settings.

G. To balance settings:

- 1) If necessary, press the A (CELL) button on the ANALYZER MAINTENANCE menu to toggle CELL to STD and the B (29) button to toggle 29 to 45 (as shown in Menu 49).



Menu 53. ANALYZER MAINTENANCE Menu -Balance Settings

- 2) Adjust balance (BAL) trimpot until the RESISTANCE and TEST FLOW readouts display voltages are equal.

WARNING

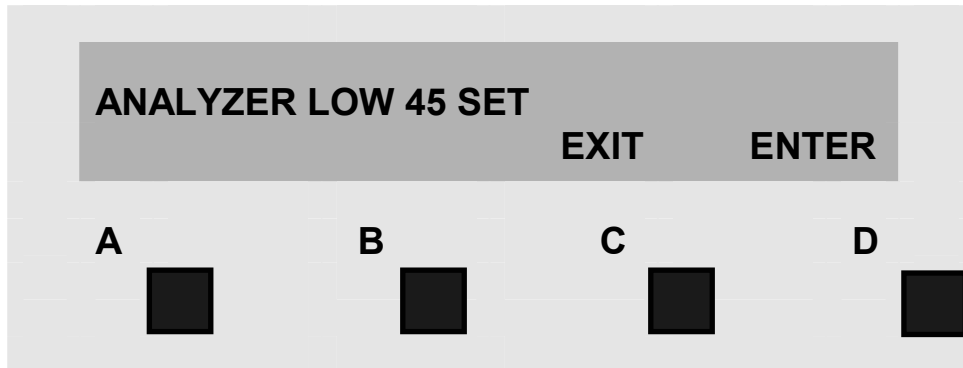
To avoid personal injury, do not allow hands or other body parts to touch electrical components. High voltages are present on the controller board. Use a non-conductive screwdriver to adjust the BAL trimpot.

- 3) Perform one of the following actions based on the voltage readings on the RESISTANCE and TEST FLOW readouts:
 - a. If the displayed voltages are balanced but are not between 2.4 and 2.9, return to step F and readjust standard lamp.
 - b. If the displayed voltages are balanced and are between 2.4 and 2.9, press D (CONT) button (Menu 54) to display Menu 55 and proceed to next step of this procedure.

H. Analyzer Low 45 Set:

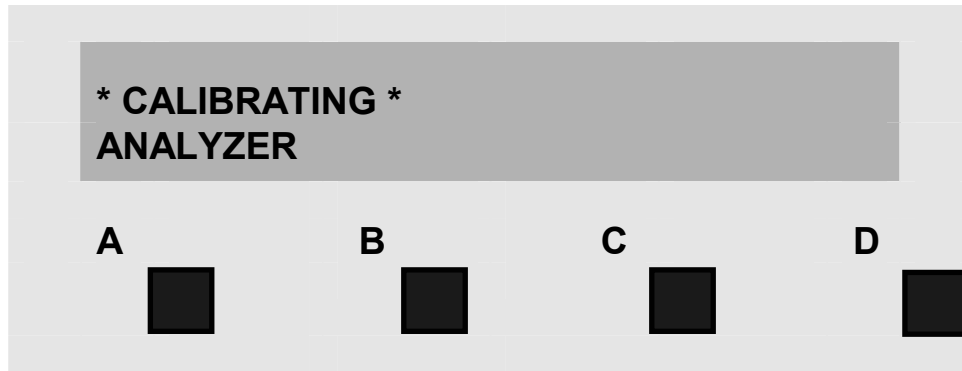
NOTE

Menu 55 informs the user that the analyzer is set to 45 degrees. The RESISTANCE and TEST FLOW readouts display the straylight readings of the mechanical analyzer phototubes. The "LOW" in ANALYZER LOW 45 SET indicates that the system will retain the low straylight readings and inform the user if the cell lamp goes out. The EXIT option of Menu 55 redispays Menu 44.



Menu 54. ANALYZER LOW 45 SET Menu

- 1) Press C (ENTER) button to display the CALIBRATING ANALYZER message (Menu 56).

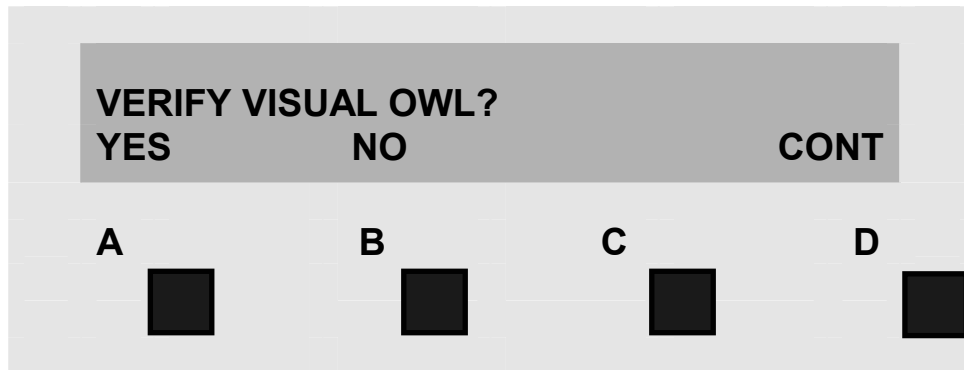


Menu 55. CALIBRATING ANALYZER Message

NOTE

The display of Menu 56 indicates that the automatic calibration is in progress as follows:

- *Analyzer is set to 45 degrees and the smoke is cleared.*
- *Standard lamp is inserted.*
- *Analyzer is set to 29 degrees.*
- *Standard lamp is raised*
- *Smoke line is connected.*
- *The system monitors particle size and displays the voltages for the A and B phototubes in the RESISTANCE and TEST FLOW readouts and the heater voltage in the % PENETRATION readout.*
- *If particle size is not achieved, the yellow FAULT indicator flashes and the system displays "WAIT PARTICLE SIZE" message (Menu 24).*
- *When particle size is achieved, the system displays the VERIFY VISUAL OWL prompt (Menu 56).*



Menu 56. VERIFY VISUAL OWL Prompt

NOTE

The YES option of Menu 56 allows the user to verify particle size through the use of a visual owl (step I). The NO option allows the user to bypass this verification and proceed to set test flow (step J).

I. To verify particle size using the visual owl:

1) Press "A" (YES) button (Menu 56).

NOTE

The system lowers the standard lamp to allow the user to remove it.

2) Remove standard lamp set screw and pull out standard lamp.

3) Insert visual owl in standard lamp port.

4) While viewing the viewing field in the visual owl through the eyepiece, adjust the visual owl until the intensity of both halves of the viewing field are equal.

- 5) Check the visual owl pointer position and proceed as follows:
- If visual owl pointer is not at 29 ± 3 , remove visual owl from standard lamp port and reinstall standard lamp, then return mechanical analyzer to manufacturer for calibration.

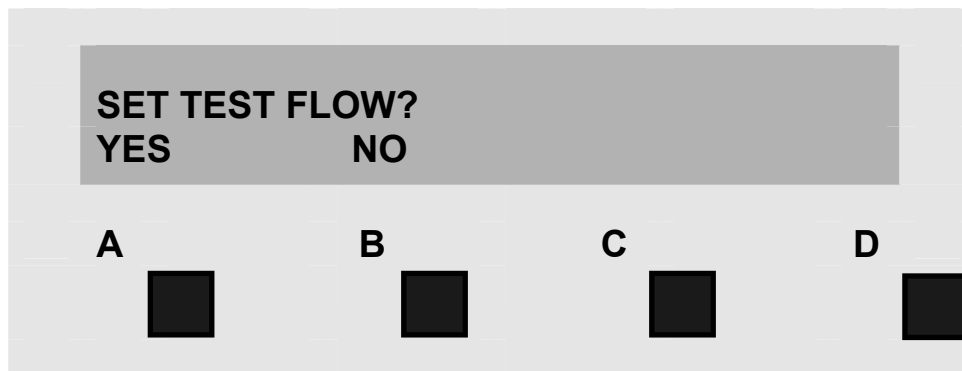
NOTE

Consult the manufacturer for instructions when removing mechanical analyzer from unit.

- If visual owl pointer is 29 ± 3 , remove visual owl from standard lamp port and reinstall standard lamp, then continue with next step of this procedure.
- 6) Press D (CONT) button (Menu 56) to continue.

NOTE

If particle size has not been reached, the yellow FAULT light will flash and the message WAIT PARTICLE SIZE (Menu 24) will display. No further progress will be allowed until the proper particle size has been reached. When this occurs, the system acknowledges with a short beep and displays Menu 58. This menu prompts the user to initiate the procedure for adjusting the proper flow for testing.



Menu 57. SET TEST FLOW Prompt

NOTE

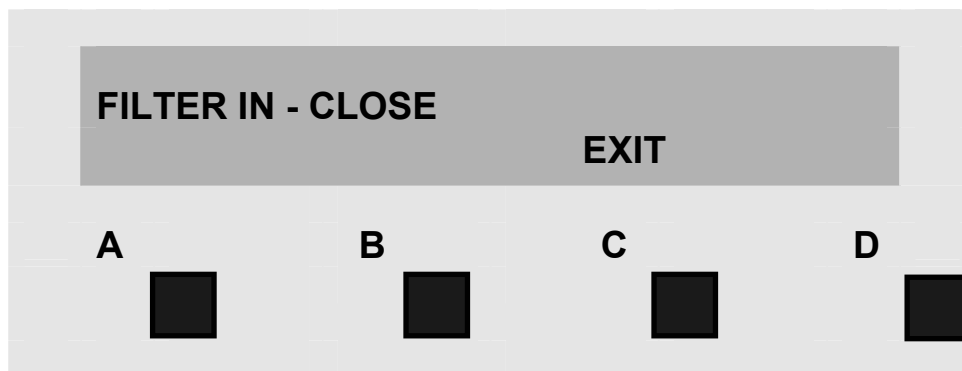
The NO option (Menu 58) displays the MUST CALIBRATE message (Menu 28) which is cleared by pressing the D (CONT) button. When the message is cleared, Menu 58 is redisplayed.

J. To set test flow:

- 1) Press A (YES) button on Menu 58.

NOTE

The system prompts the user to place a test component in the chuck and close the chuck (Menu 58). The EXIT option redisplay Menu 58.

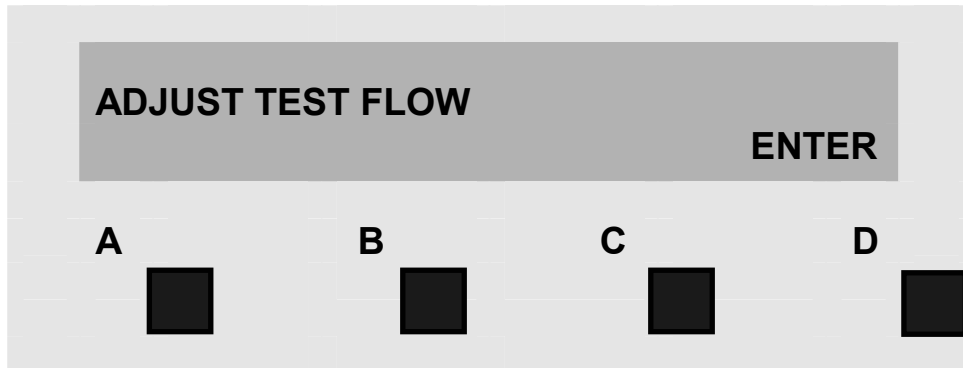


Menu 58. FILTER IN - CLOSE Prompt

- 2) Place test component in chuck.
- 3) Press both CHUCK CLOSE buttons and hold buttons until chuck is fully closed and latched.

NOTE

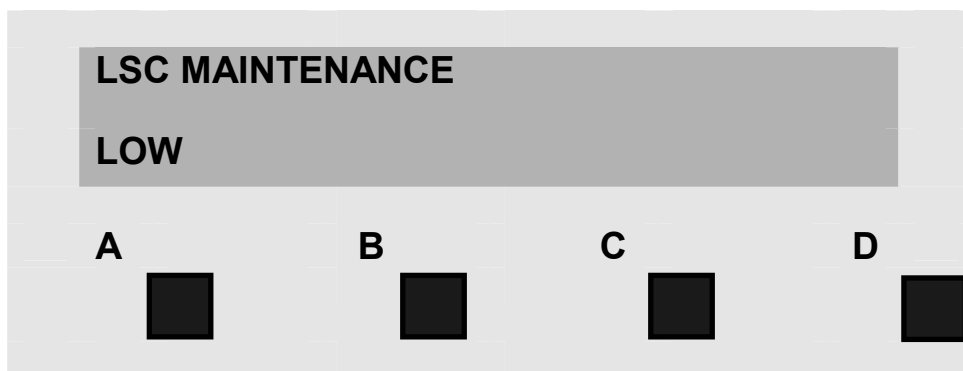
When the chuck is fully closed and latched, the system displays the ADJUST TEST FLOW prompt (Menu 59).

**Menu 59. ADJUST TEST FLOW Prompt**

- 4) Rotate TEST FLOW control (on front panel of electronics enclosure) to adjust the flow to the specifications of the test component; the test flow will be displayed on the TEST FLOW readout.
- 5) Press D (ENTER) button to load test flow value into the system.

NOTE

The system opens the chuck and displays Menu 60.

**Menu 60. LSC Maintenance Menu**



6) Proceed to next step and check LSC straylight.

K. To check LSC straylight:

1) Perform one of the following actions:

- a. If the voltage displayed on the % PENETRATION readout is greater than .03, clean the scattering chamber cone and lens as described in paragraph 12.4 and align the light scattering chamber as described in paragraph 12.6.
- b. If the voltage displayed on the % PENETRATION readout is less than .03, proceed to step L to peak the LSC phototube or to step M to adjust LSC gain.

L. To peak LSC phototube:

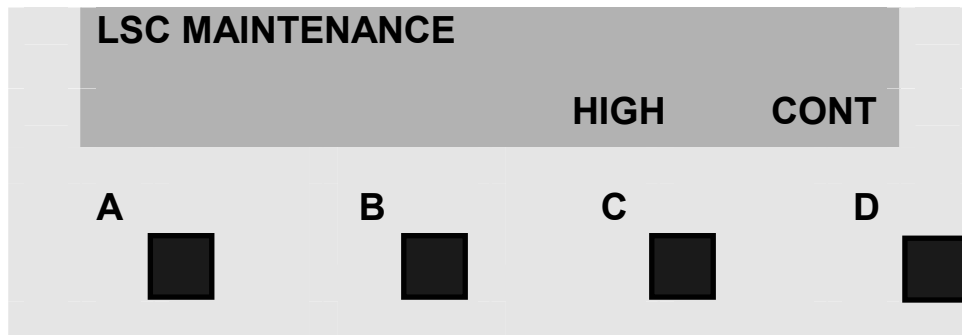
NOTE

The phototube is peaked before leaving the factory and should never need to be peaked again. If the phototube is replaced, the new phototube will need to be peaked.

- 1) Loosen wing nut on phototube.
- 2) Rotate phototube for highest reading on % PENETRATION readout.
- 3) Tighten wing nut on phototube.
- 4) Proceed to next step to adjust LSC gain.

M. To adjust LSC gain:

- 1) Press C (LOW) button on Menu 61 to toggle LOW button to HIGH as shown in Menu 62.
-



Menu 61. LSC MAINTENANCE Menu - LSC Gain Setting

NOTE

The chuck closes automatically and aerosol is introduced to the light scattering chamber.

- 2) Adjust light scattering chamber (LSC) trimpot until the % PENETRATION readout displays a voltage between 7.0 and 9.0.

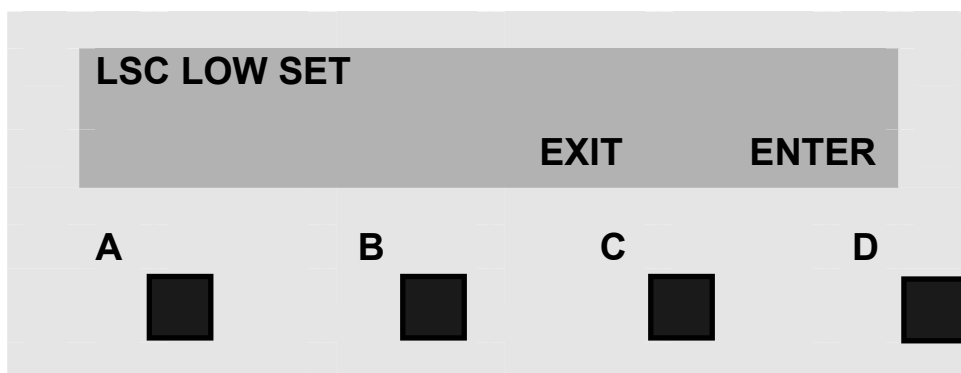
WARNING

To avoid personal injury, do not allow hands or other body parts to touch electrical components. High voltages are present inside the electronics enclosure. Use a non-conductive screwdriver to adjust the LSC trimpot.

- 3) Perform one of the following actions:
 - a. If LSC has not been optically aligned, press C (HIGH) button and return to step K.
 - b. If LSC has been optically aligned, press D (CONT) button and proceed to next step.

NOTE

When ENTER is selected from Menu 62, the chuck opens automatically and Menu 63 is displayed.



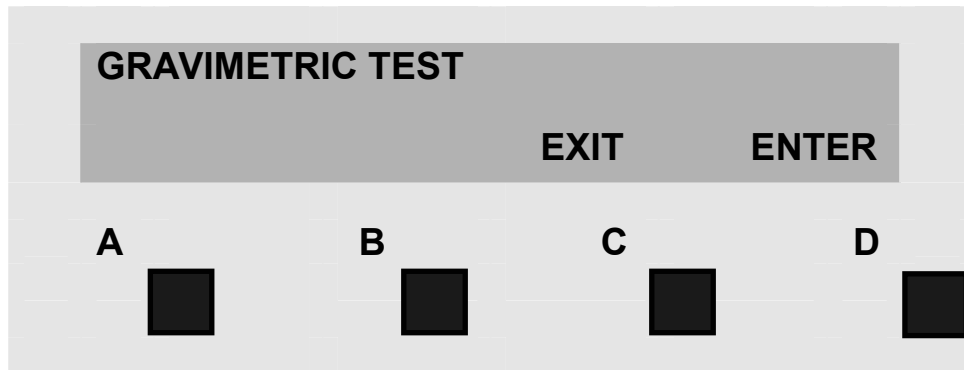
Menu 62. LSC LOW SET Menu

N. Perform one of the following actions:

- 1) Press C (EXIT) button to return to step K to repeat LSC adjustments.
- 2) Press D (ENTER) button to advance to gravimetric test (step O).

NOTE

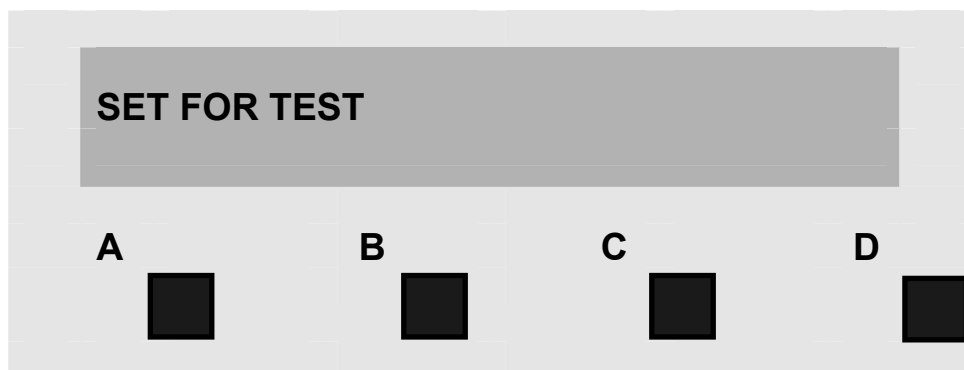
When the ENTER option is selected from Menu 63, the system sets the LSC low reading for controller reference and displays Menu 64. This menu allows the user to run the gravimetric test routine to verify concentration level. The EXIT option of Menu 64 bypasses the gravimetric test and returns to the beginning of the automatic maintenance routine with the display of the ANALYZER MAINTENANCE screen (Menu 48).



Menu 63. GRAVIMETRIC TEST Menu

O. To run gravimetric test:

- 1) Weigh a glass fiber filter sample (PN 66078, Gelman Sciences).
- 2) Loosen top of lint trap located on the bottom jaw of the chuck, place the filter sample in the lint trap, and tighten top.
- 3) Press D (ENTER) button to display SET FOR TEST message (Menu 65).

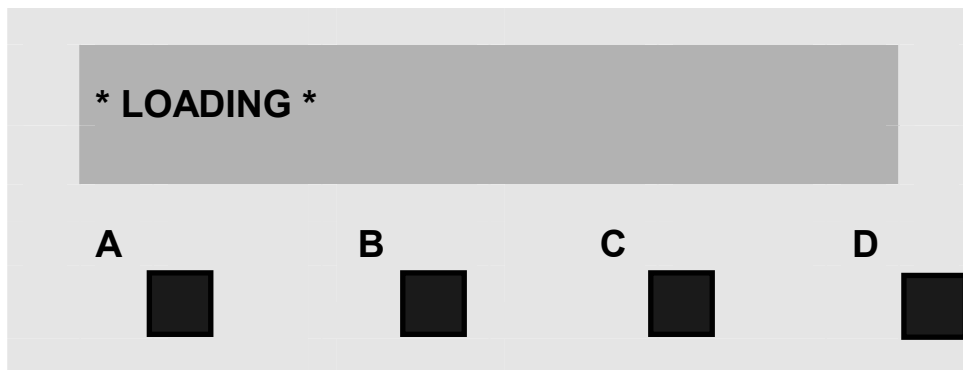
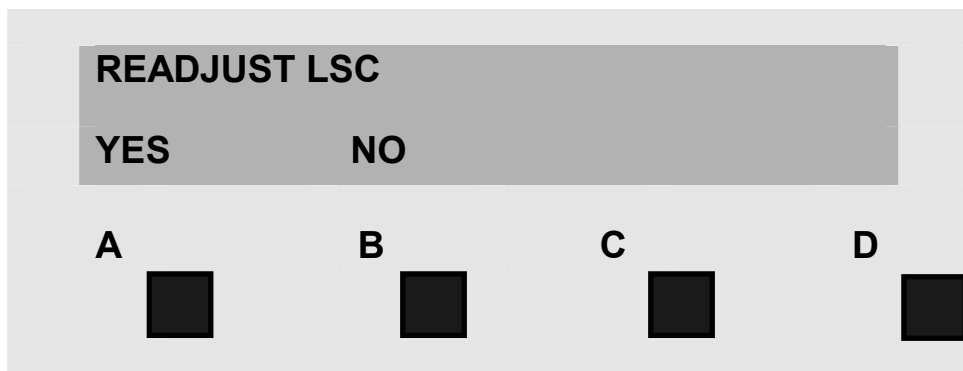


Menu 64. SET FOR TEST Message

- 4) Simultaneously press both CHUCK CLOSE buttons and hold the buttons until the chuck is fully closed and latched.

NOTE

The system displays the *LOADING* message (Menu 65). During the test, the controller will display the elapsed time on the *TEST FLOW* readout and the total flow of the test on the *% PENETRATION* readout. The total flow readout is constantly updated as the test proceeds. The elapsed time is registered as it counts up to 10 minutes in 0.1-minute increments. After 10 minutes, the system will stop the test, open the chuck, and display the *READJUST LSC* prompt (Menu 66).

**Menu 65. LOADING Message****Menu 66. READJUST LSC Prompt**

- 5) When Menu 67 is displayed, remove the filter sample from the lint trap.
- 6) Weigh the filter sample.



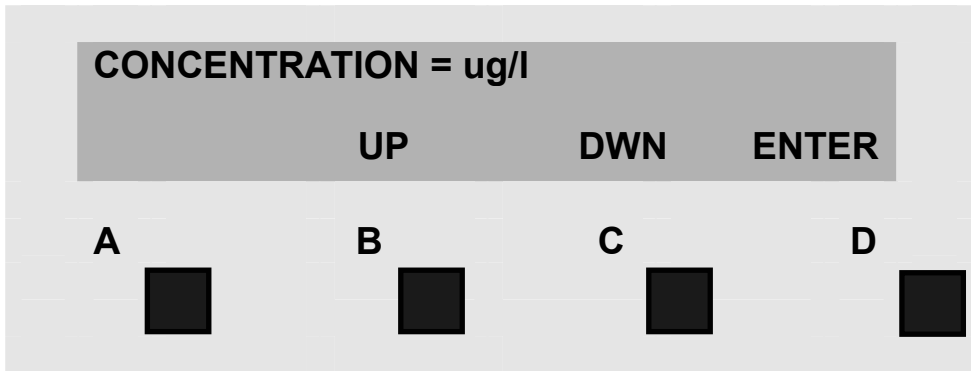
- 7) To determine aerosol pickup, calculate the difference between the weight of the filter sample before the test and after passing aerosol through it.
- 8) To determine concentration, divide aerosol pickup by the total flow.

NOTE

At the end of the test, total flow is displayed on the % PENETRATION readout.

Example:	Second weighed filter media	=	0.389 grams
	Pre-weighed filter media	=	0.357 grams
	Aerosol pickup (0.389 minus 0.357)	=	0.032 grams
	Total flow	=	320 liters
	Concentration (0.032 grams ÷ 320 liters)	=	0.0001 g/l
		Or	100 µg/l

- a. Press "A" (YES) button to redisplay Menu 63 and return to step N.
- b. Press B (NO) button to display Menu 67 and set concentration (next step).



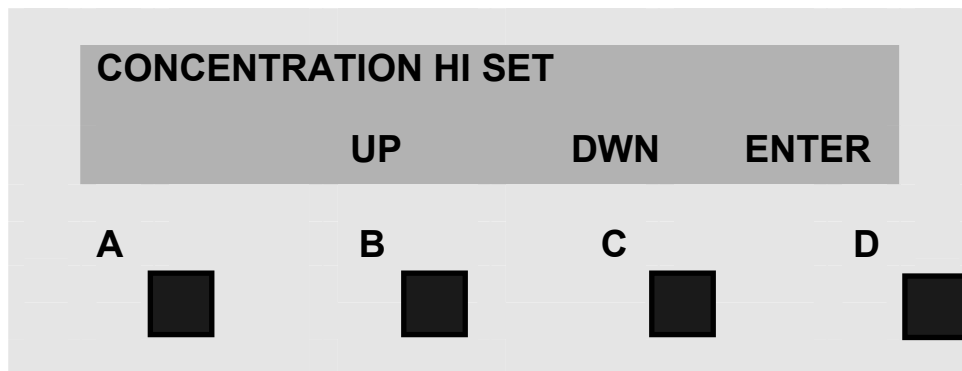
Menu 67. CONCENTRATION Prompt

- 9) Use B (UP) and C (DWN) buttons to enter the calculated concentration value into the % PENETRATION readout.

- 10) Press D (ENTER) button to load the displayed value into the system and display Menu 69.
- 11) Proceed to next step and set the high concentration limit for the concentration mode.

NOTE

The high concentration limit is the upper limit of the concentration range. The high limit can be set up to 10 µg/l above the calculated value.



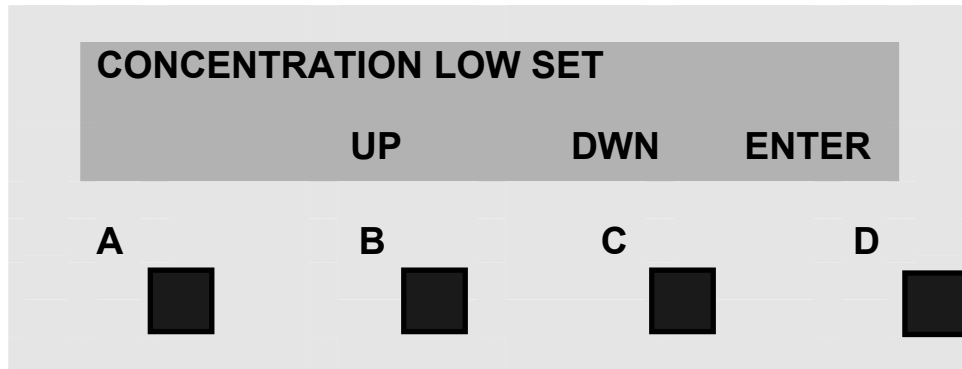
Menu 68. CONCENTRATION HI SET Prompt

P. To set maximum concentration limit:

- 1) Use B (UP) and C (DWN) buttons of Menu 69 to change the concentration value displayed in the % PENETRATION readout to desired value.
- 2) Press D (ENTER) button to load the displayed value in the system and display Menu 70.
- 3) Proceed to next step and set minimum concentration limit for the concentration mode.

NOTE

The low concentration limit is the lower limit of the concentration range. The low limit can be set up to 10 µg/l below the calculated value.

**Menu 69. CONCENTRATION LOW SET Prompt**

Q. To set minimum concentration limit:

- 1) Use B (UP) and C (DWN) buttons of Menu 70 to change the concentration value displayed in the % PENETRATION readout to desired value.
- 2) Press D (ENTER) button to load the displayed value in the system and redisplay Menu 48.
- 3) Return to the beginning of paragraph 11.3.



12. MAINTENANCE PROCEDURES

12.1. FILLING AEROSOL GENERATOR

NOTE

The liquid level in the generator tank should not be allowed to fall below the lower fill line on the sight glass. View the sight glass through the cutout in the flow panel.

- A. If unit is powered, press red POWER OFF switch on the front panel of the electronics enclosure.
- B. Disconnect the main airline from the main air pressure regulator on the right side of the unit.
- C. Open rear cabinet door.
- D. Remove shelf-retaining screw from the lower right side of the shelf.
- E. Slide shelf out.
- F. Pull yellow lever next to the aerosol generator to the upright position.
- G. Unscrew and remove fill cup cover.

CAUTION

The fill cup cover may be very hot. Exercise care to avoid burns.



-
- H. Pour DOP or PAO into the fill cup until the level in the sight glass reaches the upper fill line.
 - I. Replace fill cup cover.
 - J. Return yellow lever to its original position.
 - K. Push slide-out shelf in and replace shelf-retaining screw.
 - L. Close rear cabinet door.
 - M. Reconnect airline.
 - N. Press green POWER ON switch.

12.2. TEST FLOW FOR MECHANICAL ANALYZER ADJUSTMENT

The sample flow must be adjusted at initial setup of the TDA-100A and any time test flow is changed during operation. To perform the adjustment, the chuck must be open, the standard lamp must be removed from the mechanical analyzer, and the aerosol (smoke) line must be open to the analyzer sampling port.

NOTE

If the test flow is too high, the smoke stream will be erratic and will affect the particle size reading. If the flow is too low, and excess of smoke will pour out of the analyzer and will eventually coat the lenses in the analyzer, creating operation problems.

- A. Initiate the computerized internal maintenance routine as described in paragraph 11.1 or 11.2.
- B. Toggle the "A" and "C" function buttons on the controller unit front panel as necessary to change the Menu 48 labels on the function screen to A (CELL) and C (SMK).



NOTE

The B function button can be set to either 29 or 45.

- C. Remove top panel from TDA-100A cabinet.
- D. Remove standard lamp set screw and pull standard lamp out of the standard lamp port.
- E. View the smoke through the standard lamp port while rotating the sample flow valve counterclockwise (increasing flow).
- F. When the smoke begins to break up, adjust the sample flow valve clockwise (decreasing flow) until a steady stream of smoke is visible.
- G. Reinstall standard lamp and set screw.
- H. Reinstall top panel.
- I. Press D (CONT) button and continue with the maintenance routine.

12.3. CLEANING MECHANICAL ANALYZER FLAT AND FOCUSING LENSES

CAUTION

Do not attempt to clean the Polaroid lenses. Changing the rotation will alter calibration.

- A. Press red power off button.
 - B. Remove top panel from unit.
 - C. Set the vernier scale dial on the mechanical analyzer to 29.
 - D. At the phototube B end of the mechanical analyzer, observe that the zero/line on the alignment tube and the black line on the rotating cuff are aligned.
-



-
- E. Loosen the four mounting screws on the mounting plate under phototube B.

NOTE

When loosening the mounting plate, the gear rod may become disengaged. If it does, when lens cleaning is complete, the 29-degree mark must be aligned back to its original position before tightening the mounting plate screws.

- F. Loosen flat lens and focusing lens caps and slide them out of the way.
- H. Slide mounting plate toward the end of the analyzer to release pressure on the lenses to allow easier removal.
- I. Remove flat and focusing lenses.
- J. Wipe lenses clean with a clean lint-free cloth.
- K. Reinstall lenses in reverse order of removal.
- L. Slide the mounting plate back to its original position, making sure that the gear rod is engaged.
- M. Verify that the zero/line on the alignment tube and the black line on the rotating cuff are aligned: adjust the rotating cuff to align as necessary.
- N. Tighten mounting plate screws.
- O. Run the computerized maintenance routine (paragraph 11).

12.4. CLEANING LIGHT SCATTERING CHAMBER LENSES

- A. Press red power off button.
- B. Remove top panel from unit.
-



-
- C. Remove three thumbscrews securing light holder end plate to light barrel assembly and remove end plate.
 - D. Remove three battery nuts securing elbow extension to light barrel assembly and remove elbow extension.
 - E. Remove six screws securing lens end plate to cone and remove lens end plate.
 - F. Remove six screws securing light barrel assembly to cone and remove light barrel assembly.
 - G. Wipe outer lens on light barrel assembly with a clean, lint-free cloth to eliminate all foreign matter, taking care not to disturb rubber aperture.
 - H. Wipe lens and lens end plate with a clean, lint-free cloth to eliminate all foreign matter.
 - I. Visually inspect inside of cone for foreign matter or shiny spots.
 - J. If necessary wipe inside of cone with a clean, lint-free cloth to eliminate foreign matter.
 - K. Spray any shiny areas inside the cone with Krylon #1602 Ultra-Flat Black paint.

CAUTION

Do not spray paint on the lenses.

- L. Reassemble light scattering chamber in reverse order of disassembly.
- M. Align the light scattering chamber using the instructions in paragraph 12.6.

12.5. REPLACING CELL LAMP IN LIGHT SCATTERING CHAMBER

- A. Press red power off button.



-
- B. Remove top panel from unit.
 - C. Remove three thumbscrews securing light holder end plate to light barrel assembly and remove end plate.
 - D. Holding the end plate securely in one hand, pull the cell lamp straight out of its socket with the other.

CAUTION

When replacing the replacement cell lamp, be careful not to handle it with bare hands. Touching the surface of the bulb will leave a residue of body oil and acidic grit (a classic finger print) on the glass. This residue will react with the glass under the extreme heat produced by the bulb and may result in distortion of the light or early burnout of the bulb. Handle the bulb using any clean, soft tissue.

- E. Insert a new bulb into the socket, pushing it straight in until it is firmly seated.
- F. Reassemble light scattering chamber in reverse order of disassembly.
- G. Align the light scattering chamber using the instructions in paragraph 12.6.

12.6. ALIGNING LIGHT SCATTERING CHAMBER

- A. Perform the computerized maintenance routine outlined in paragraph 11 up to the display of Menu 61.
 - B. Loosen lock screw securing light assembly.
 - C. Rotate light assembly while moving it in and out until the lowest reading is displayed on the % PENETRATION readout.
 - D. Tighten lock screw.
 - E. Loosen three battery nuts on lens end plate.
 - F. Adjust lens end plate until the lowest reading is displayed on the % PENETRATION readout.
 - G. Tighten three battery nuts on lens end plate.
-



-
- H. Loosen three thumbscrews on light holder end plate.
 - I. Adjust light holder end plate until the lowest reading is displayed on the % PENETRATION readout.
 - J. Tighten three thumbscrews on light holder end plate.

NOTE

It is recommended that the alignment procedure be repeated twice for the lowest possible reading.

12.7. REMOVAL AND REPLACEMENT OF LIGHT SCATTERING CHAMBER

- A. Press red power off button.
- B. Remove top panel from unit.
- C. Disconnect electrical line to light at end of light scattering chamber.
- D. Remove cover panel from electronics enclosure.
- E. Disconnect electrical lines to phototube.
- F. Open rear cabinet door.
- G. Disconnect two tubing connections (under top panel assembly).
- H. Remove two mounting nuts (above tubing connections).
- I. Remove light scattering chamber from top of unit.
- J. Replace light scattering chamber in reverse order of removal.



12.8. REMOVAL AND REPLACEMENT OF MASS FLOWMETER

- A. Remove pneumatic connections to both sides of flow meter.
- B. Remove two mounting screws.
- C. Remove mass flow meter from module, taking care not to damage attached wires.
- D. Remove two screws from electrical connector.
- E. Separate flow meter from electrical connector.
- F. Reinstall mass flow meter in reverse order of removal.



13. SPARE PARTS KIT

The spare parts kit contains a one-year supply of the components listed in Table 10.

Table 10. Spare Parts Kit

Item	Part Number	Quantity
#36 mm HEPA Capsule	5500123	20
# In-coming air Filter	5500111	6
Phototube	T9B0-0129	2
LSC Gasket	T9B0-0157	2
1A Fuse	T15C-0324	5
Aerosol Agent DOP, 5 gal Or Aerosol Agent PAO, 5 gal	T100-0625 T000-0795	1 1
Containment Lens	T140-0205	4
Lamp, Quartz Halogen	T9B0-0307	10
Main Power Lamp	6500101	10
Standard Lamp	T2E0-0313	4
Status Lamp Bulb	6500102	6