



PC 950 Probe Colorimeter
User Manual

Description

The PC 950 probe colorimeter measures the optical transmittance, absorbance, and concentration of liquids. The fiber optic probe allows measurements to be taken directly from containers, and measurements can be made at different wavelengths by changing plug-in filters.

Functions are selected by a front panel keypad, and readings and settings are displayed on an alphanumeric LED display. An RS-232 serial port connection provides data to a remote PC. Two analog output signals drive a strip chart recorder (0.0 V 1.0 V) and/or a 4 mA 20 mA current loop for industrial applications.

Control Keys

ON

Turns the instrument on.

OFF

Turns the instrument off

MODE

Selects the operating mode. Successive key presses set the instrument from Transmittance to Absorbance, to Concentration, to Setup, and back to Transmittance.

ZERO

Calibrates to zero absorbance (100.0% transmittance)

ENTER

In Setup, ENTER either enters a submenu or allows parameter settings to be stored. In Concentration, ENTER saves the current concentration coefficient in memory.



Increases a setting value; in Concentration it increases the concentration coefficient and, thus, the reading.



Decreases a setting value; in Concentration it decreases the concentration coefficient and, thus, the reading.

RETURN

Causes the menu to back up one level during Setup.

Instrument Operation

Before turning on the PC 950, select and install the appropriate filter for the test that will be conducted. Install the fiber optic probe into the lamp and filter holder, making sure the knurled screws are finger-tight to prevent relative motion between fiber optic and the instrument.

ON/OFF

Press the ON key to start. When the PC 950 is first turned on, it displays PC 950, followed by the firmware revision, and then enters the Transmittance mode and autozeros itself. It is now ready for operation; when operation is complete, turn the PC 950 off by pressing OFF.

TRANSMITTANCE OPERATION

Transmittance displays the optical transmittance of a measured sample from 0.0 to 100.0. The transmittance display format is T 100.0.

Take a reading, zero the instrument to 100% T (0.0 A) by placing the instrument probe in a reference liquid (standard) or distilled water (depending on the procedure) and pressing ZERO. The instrument should now read T 100.0 (absorbance value of zero).

Place the probe in the sample to be measured, and its transmittance value can be read on the LED display.

ABSORBANCE OPERATION

Absorbance displays the optical absorbance of a measured sample from 0.000 to 2.000, corresponding to transmittances of 100.0% to 1.0%, respectively. Absorbance is calculated as the negative base 10 logarithm of transmittance $[-\text{LOG}_{10}(T)]$. The Absorbance display format is A 0.000.

To display absorbance, press MODE until the Absorbance display format appears.

Take a reading, zero the instrument as done in the Transmittance mode.



In Absorbance the instrument should read A 0.000. Note that the ZERO control affects all instrument modes, and zeroing in any of the modes has the same effect.

Place the probe in the sample to be measured, and its absorbance value can be read on the LED display.

CONCENTRATION OPERATION

The Concentration mode displays the concentration of a measured sample. Concentration is calculated by multiplying the absorbance reading by a coefficient, which is set by calibrating with a sample of a known concentration and then adjusting the instrument to display that concentration. To accommodate a very wide range of values, the decimal point of the display can also be set using Setup.

To calibrate concentration, first zero the instrument as described above. Then set the instrument to Concentration mode using the MODE key. The Concentration display format is C 0000.

Place the probe in a sample of known concentration. For example, if the reference solution concentration is 20.0 and its absorbance is 0.300,  and  should be pressed until a reading of C 0200 appears. Press ENTER to store this setting.

To change the decimal point to read C 020.0, see Setup Operation on the following pages.

Place the probe in a sample to be measured, and its concentration value can be read from the display.

Setup Operation

Setup allows a user to set the following instrument parameters: concentration decimal point display position, serial port baud rate, measurement averaging, and lamp voltage setting. In addition, the instrument can be reset to its factory default settings.

To enter Setup, press MODE until SETUP appears on the display. Press ENTER: The display will display AVERAG, which is the display to enter the Average Setting mode. To change the average setting, press ENTER. To set another parameter, press \uparrow or \downarrow until that parameter is displayed, and then press ENTER. Other parameters are AVERAG, CON DP, BAUD, LAMP V, and TEST. When the desired setting for the parameter is displayed, pressing ENTER sets that parameter, and the setting will remain in nonvolatile memory when the unit is turned off or the power is removed.

RETURN allows the unit to return to Setup without changing any settings. This can be used to view possible settings and the current setting. The first setting displayed in a menu is the current setting.

READING AVERAGE SETTING AVERAG This setting is used to change the number of display readings per second. The instrument averages one or more measurements. The settings are AVE 1, AVE 4, and AVE 16 for 1, 4, and 16 measurements, respectively. Each measurement is 1/4 of a second, which results in readings of every 1/4 second, 1 every second, and 1 every 4 seconds. Lower averaging results in faster response time (readings per second) and slightly higher noise (reading-to-reading variation). Higher averaging results in slower response

time and lower noise. The factory default setting is AVE 4 or 1 reading per second.

CONCENTRATION DECIMAL POINT SETTING CON DP

This setting is used to change the display position of the decimal point in the Concentration mode. This conveniently allows you to display concentration in XXXX., XXX.X, XX.XX, or X.XXX. The factory default setting is XXXX.

SERIAL PORT BAUD RATE SETTING BAUD

This setting is used to change the serial communication baud rate. The settings are B 4800, B 9600, and B19200 for 4800, 9600, and 19200 baud, respectively. The factory default setting is B 9600 or 9600 baud.

LAMP VOLTAGE SETTING LAMP V

This setting is used to change the lamp voltage setting to one of three settings: LAMP H, LAMP M, or LAMP L, referring to lamp voltages of high (6.5 V), medium (6.0 V), and low (5.5 V), respectively. High can cause the lamp to wear out prematurely, which would require more frequent lamp replacement. High is used when solutions are optically dense or a selected filter is optically dense. Low is used when a filter is optically transparent. Medium is the default setting.

TEST /FACTORY DEFAULT SETTING TEST

Use this setting to reset the instrument to its factory default settings. Select the only choice, RESET, and hit ENTER. The unit will be reset to its factory settings.

Setup Operation

SERIAL PORT OPERATION

The RS-232 serial port can be used to obtain measurement data or to control the instrument settings. P2, a 25-pin D connector, is provided at the rear of the instrument. To connect the instrument to a PC, connect a serial cable with a 25-pin male to the colorimeter and a 9-pin or 25-pin male (depending on the serial port on the PC) to the PC end. These cables are available at computer suppliers.

Use a serial communication program such as Windows[®] HyperTerminal[®] or Kermit to establish communications. Make sure the correct COM port is being used. Set up the baud rate of the communications program to match the instrument. The default setting is 9600 baud. Set up the hardware flow control (handshake) to NONE. With these settings made and the colorimeter on and connected to the PC, colorimeter values will be displayed on the computer screen.

The output data is the same as the front panel display. The table below shows the output data format.

| Mode | Output Data Format |
|----------------|--------------------|
| Transmittance | Tra XXX.X |
| Absorbance | Abs X.XXX |
| Concentration* | Con XXXX |
| Setup | No output |

* Concentration the decimal point is in the same position as the front panel display.

Serial Input

The instrument responds to single character ASCII commands in the same way it responds to keypad keys. The ASCII commands to which the instrument responds are listed in the following table:

| ASCII Input | Key or Command |
|-------------|----------------------|
| m | MODE |
| z | ZERO |
| e | ENTER |
| r | RETURN |
| u | UP |
| d | DOWN |
| n | ON |
| f | OFF |
| h | Display help |
| y | Factory test |
| g | Exit factory test |
| t | Set to Transmittance |
| a | Set to Absorbance |
| c | Set to concentration |

ANALOG OUTPUTS

Two analog outputs are provided from the colorimeter: 0.0 V 1.0 V and 4 mA 20 mA, which are both proportional to the transmittance readings of the instrument. These outputs are provided from pins on P2, the 25-pin female D connector.

The 0.0 V 1.0 V output can be used to drive an analog strip chart recorder or other data acquisition system. Its output impedance is nominally 750 ohms; care should be taken not to load the output with less than 1 M ohm. 0.0 V represents a transmittance value of 0%, and 1.0 V represents a transmittance value of 100%.

The 4 mA 20 mA output can be used to drive an industrial control system or other data acquisition system. Typically, one would load the 4 mA 20 mA output with a 100 ohm 200 ohm resistor to ground to obtain a proportional voltage. 4.0 mA represents a transmittance value of 0%, and 20 mA represents a transmittance value of 150%.

Setup Operation

P2 PINOUTS

P2 is the female 25-pin D connector on the rear panel. It is used for both the serial port and the analog output functions. If only the serial port is required, a standard serial port cable can be used. If analog outputs are required, a special cable must be fabricated. If both serial ports and analog outputs are required, then a special cable must also be fabricated. The table below lists pins and their functions. All other pins are not connected.

| P2 Pin | Function |
|--------|-------------------------------------------|
| 1 | Serial port ground |
| 2 | Serial port to receive data input (RI) |
| 3 | Serial port to transmit data output (TX) |
| 5 | Clear to send (CTS) set to 0 (mark) |
| 6 | Data terminal ready (DIR) set to 0 (mark) |
| 7 | Serial port ground |
| 12 | Analog output ground return |
| 13 | Analog output ground return |
| 24 | Analog 0.0 V 1.0 V output |
| 25 | Analog 4 mA 20 mA output |

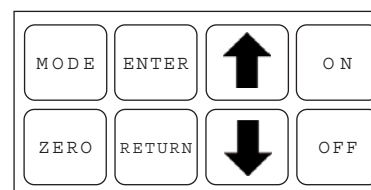
Technical specifications

| | |
|---------------------|-------------------------------------------------------------------------|
| Display resolution: | Transmittance 0.1%, Absorbance 0.001 units |
| Two analog outputs | 0 V 1 V DC 4 mA 20 mA |
| RS-232 output: | 25-pin |
| Power input: | 0.5 A, 12 V DC Transformer provided for either 110 V or 220 V A C |
| Dimensions: | 8.0 x 5.5 x 2.5 in/20.3 x 14 x 16.3 cm |
| Weight: | 3.2 lb/1.5 kg |

POWER OPTIONS

The PC 950 requires 12 V DC at 500 mA. The wall transformer provides this power from the AC line. Alternatively, 12 V DC power can be provided to the instrument. To power the instrument from 12 V, apply a source of 12 V via a 5.5 x 2.1 mm coaxial power connector. The center pin is positive and the outside is negative. The PC 950 requires a stable source of between 12.0 V DC and 14.0 V DC capable of providing 500 mA. The PC 950 is protected against reverse polarity.

Quick Reference Command Sheet



Key Operation

ON / OFF: Powers the unit on or off. ON displays the model and the firmware revision.

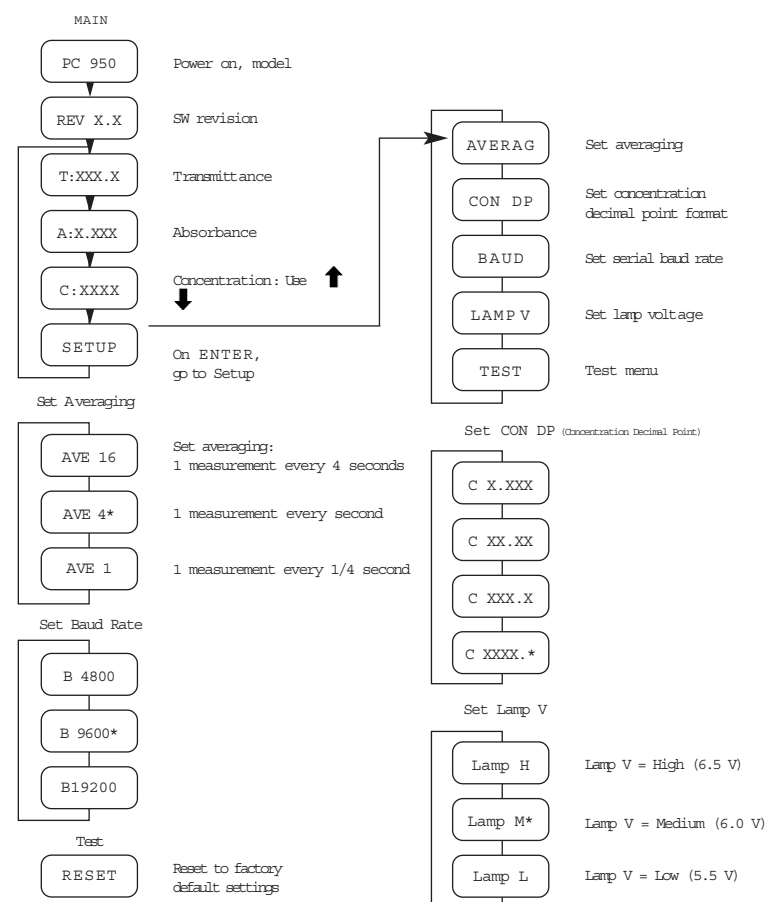
MODE: Selects the Operating mode in the main menu; scrolls down the menu.

ENTER: Goes to the submenu or saves settings. When entering a submenu, the current setting is displayed.

↑: Goes to the next higher menu item. In Concentration, value can be increased.

↓: Goes to the next lower menu item. In Concentration, value can be decreased.

RETURN: Returns to the higher level menu. RETURN RETURN will always return to the main menu.



*Factory default setting