AGTRON PROCESS ANALYZER
M-45 Digital OWNERS MANUAL

Special Applications
Abridged Spectrophotometer

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Printed in USA
Issued 11.13.91

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1.0 GENERAL DESCRIPTION & INSTALLATION

The M-45 Agtron Process Analyzer is an abridged spectrophotometer designed to measure specific spectral characteristics. It provides accurate and repeatable measurements for color homogeneous products.

1.1 Application

The AGTRON M-45 Process Analyzer is intended for color homogeneous liquids, pastes, powders, creams, small particulates and samples of uniform geometry. The unit is operated by placing a sample cup containing the product over the **2" diameter** viewing aperture and measuring the product's monochromatic reflectance at the desired spectral line. A front panel switch permits easy selection of **red**, **green**, **blue**, or **yellow** spectral investigation of the product.

The **M-45** is calibrated using reference reflectance disks. The numerical reading on the meter is a quantitative comparison of the product sample relative to the calibration standards. Process assessment is made quickly and easily without the necessity of highly technical operations, mathematical or graphic correlations, special color reference standards, or complex sample preparation.

1.2 Principles of Operation

The most significant feature of all AGTRON instruments is that all AGTRONs of a given model (i.e. - M Series) read alike.

The capability of the M-45 to provide accurate and repeated measurements is based on uniformly illuminating a sample at a low angle of incidence. The reflected energy represents the average characteristics of the sample. The reflected light is passed through a narrow band pass filter, and focused through one of four interference filters onto the photodiode sensor. The photodiode provides a signal whose level is proportional to the amount of monochromatic light reflected from the sample. Light reflectance at the selected wavelength is read out on the digital display.

As in any averaging operation, the accuracy increases with the number of samples, and with the total sample area. Therefore, if the product is irregular and/or non-color homogeneous, it may be advisable to use the Agtron Process Analyzer Model **M-35** Wide Area Viewer. Very repeatable readings from irregular and non-color homogeneous samples are obtainable from the **M-35.**

1.3 Arrival Inspection & Customer Obligations

This equipment has received a careful final inspection. It has been packaged securely to insure delivery without damage or loss of any parts. **Please save the box and packing.** At the time of delivery, please inspect the equipment for damage or shortage. If damages or shortages have occurred, record such on the freight bill and have the driver sign. Unpack the equipment within ten (10) days. If any concealed damage is found, notify the delivering carrier so that they may return to inspect it. Fill out any inspection report that they furnish.

If the unit needs to be returned, please call Agtron for a Return For Repair number (RFR). This will speed up processing of your instrument. Send AGTRON a copy of the inspection report and a claim will be filed on your behalf. We will notify you of the outcome of damage or loss claims and assist you in every way.

Your AGTRON is warranted for one year from the date of shipment. See the warranty statement at the back of this OWNERS MANUAL for details. Our **warranty** covers parts and labor. It is the customer's responsibility to pay the freight. If the unit was damaged upon receipt, this freight will be covered by the shipper if a proper claim has been filed.

1.4 Installation Requirements

Avoid direct air impingement by air-conditioning outlets. In some installations where line noise is a problem, it may be necessary to use a line filter. Consult the factory for recommendations.

1.5 Operating Controls

All controls are located on the front panel of the instrument. There are no internal calibration adjustments required. The functions of the operating controls follows:

OPERATING CONTROLS

Control	Function
Power Switch	Turns instrument on/off.
Spectral Selector	Selects desired color mode.
ZERO Control KNOB (upper panel)	This control is used for coarse adjustment to zero the meter with the darker calibration disk. Factory setting is 5.50.
STANDARDIZE Control KNOB (upper panel)	This control is used for coarse adjustment to set the maximum meter reading, using a lighter disk than that used for zeroing. Factory setting is 0.40.
ZERO Knob (upper panel- lower)	Used for fine adjustment. Set this control at mid-range and rough out with **ZERO** Control knob. Minor adjustments are then made with this Vernier. Factory setting is 1.00.
STANDARDIZE Knob (upper panel-lower)	Used for fine adjustment in the same manner as the **ZERO** knob. Factory setting is 1.00.
CALIBRATION Switch	This control is to used when expanding the scale. The switch should be in the DOWN position for a "normal" scale (00 Disk at 00 / 90 Disk at 90 or 100). The switch should be in the UP position when performing scale expansion.

Note: **Scale expansion** detail in **Section 1.9 & 2.0**

1.6 Sample Selection - A sufficient number of samples must be prepared so that the **lightest** and **darkest** samples **acceptable** for quality control are included. Consistency and care in selecting and preparing the samples are the key to accurate process assessment.

1.7 Color Mode Selection - The Process Analyzer measures spectral reflectance in four color modes. Choose the color mode with the highest degree of spectral activity. (i.e. - Choose the color mode with the greatest degree of change from the lightest to the darkest acceptable product.)

1.8 Initial Calibration Procedure - (allow 45 min. warm up)

Start with calibration on the **00** and **90** disks to establish the general range of readings for several product samples under various preparation conditions. When a specific procedure has been established, the **M-45** can be recalibrated to expand the scale and obtain more accurate readings (see Section 2.6).

1. Select the desired spectral mode.

2. Place the **00** Calibration Disk on the viewing window and adjust the **ZERO** control knob to a meter reading of "**0**".

3. Place the **90** Calibration Disk on the viewing window and adjust the **STANDARDIZE** control knob to a meter reading of "**90**".

4. **Repeat steps 2, and 3 until the readings coincide.**

The unit is now ready for normal operation. Place sample cup with prepared sample on viewing window and record meter reading.

1.9 Scale Expansion

Subtle changes in product characteristics can be amplified on the M-45 without loss of accuracy through a technique called **scale expansion.** This is particularly helpful to differentiate between products that appear to be identical in color but are known to have definite differences in spectral signature due to process.

2.0 Scale Expansion - Recalibration - an example: Assume that ten samples of a product are prepared and the instrument is calibrated with **00** and **90** disks adjusted to "**0**" and "**90**". The test results are as follows:

Sample Number:	1	2	3	4	5	6	7	8	9	10
GTRON Reading:	3	7	9	6	**2**	11	**13**	5	10	4

Now select the lowest AGTRON meter reading (the darkest sample) which in the foregoing example, is "**2**"; and the highest AGTRON meter reading (the lightest sample) which in the same example is "**13**". The AGTRON value of the darkest and lightest samples which are acceptable as quality control limits are thus established. The AGTRON **M-45** be calibrated using disks other than **00** and **90** to **expand the scale.**

From these known **AGTRON** values, select disks for future tests. In this example, use Disk **00** for the "**0**" setting, and Disk **24** for the "**100**" setting. Disk **00** is darker then the darkest sample, and disk **24** is lighter than the lightest sample. The number indicates only the approximate reflectance level of the disks. With AGTRON recalibrated in this manner, the samples will now read as follows:

Sample Number:	1	2	3	4	5	6	7	8	9	10
AGTRON Reading:	12	27	35	24	**8**	43	**51**	20	39	16

The readings are now expanded across the range of the meter, giving easily measurable separations between each of the samples.

2.1 Time Saving Techniques:

The selected disks become **calibration standards**. Once the calibration standards are identified **it will not be necessary to repeat the 00 - 90 calibration**.

A great deal of time can be saved recalibrating the **M-45** if the vernier numbers are recorded for each color mode and scale expansion normally used.

2.2 Translucent or Transparent products can be graded using a transmission method of testing. Place **spacer ring** in sample cup and pour liquid in sample cup to bring level about 1/4-inch above top of spacer ring. Place **transmission disk** on top of spacer ring, seating firmly. Visually inspect bottom of sample cup to ascertain that no bubbles have formed or air has become trapped. Place **sleeve** around cup. The unit is now ready for normal operation. Take AGTRON readings in the normal manner.

2.3 Test Procedure for Calibration Disks and Inter-Instrument Agreement

In facilities where several M-45's are used it is important to ensure that the measurements taken on any of the instruments are the same. Several factors can affect the performance:

- **Lamp deterioration**
- **Internal optical misalignment**
- **Accumulated dust or dirt**
- **Deterioration or variations in the calibration disks**

The following procedure outlines a method of determining the performance of both the instrument and the calibration disks. You will need the following:

- (1) each **00** Agtron reference calibration disk
- (1) each **90** Agtron reference calibration disk
- (1) each **44** or **50** or **56** Agtron reference calibration disk

  Note: These must be vault disks that are in like new condition and should never be used for normal production calibration.

- The **00** and **90** disks assigned to the unit that are used for its production calibration.

STEP I: Be sure the instruments is warmed up at least **2 hours before beginning.** Record the Agtron Serial Number of the unit being evaluated.

STEP II: Select the desired spectral mode.

STEP III: Place the **00 Reference Calibration Disk** on the viewing window and adjust the **ZERO** control knob to a meter reading of "**0**".

STEP IV: Place the **90 Reference Calibration Disk** on the viewing window and adjust the **STANDARDIZE** control knob to a meter reading of "**90**".

STEP V: **Repeat steps 2 and 3 until the readings coincide.**

STEP VI: Place the Mid-scale reference calibration disk (44/50/56) on the viewing window and record the Agtron reading

STEP VIII: Place the **00** and **90 production calibration disks** on the viewing window and record the Agtron readings.

STEP IX: Repeat STEP II through VIII for the three remaining color modes and record the data.

2.4 CARE FOR UNIT AND ACCESSORIES:

1) CALIBRATE THE INSTRUMENT EVERY 4 TO 6 HOURS OR WHENEVER TEST RESULTS ARE QUESTIONABLE:
Agtrons can drift slightly with time. Experience shows that recalibrating once per shift is adequate. If test results don't seem right, first check the calibration, then repeat the test.

2) ALWAYS LEAVE THE POWER ON AND KEEP THE AGTRON AND TEST AREA AS FREE FROM DUST AS POSSIBLE:
The Agtron is designed for continuous duty, and leaving the power on at all times maximizes performance and increases bulb life. Dust is a leading cause of electronic equipment failure. While the Agtron is quite well protected, keeping it clean will help performance and longevity.

3) DO NOT LEAVE A CALIBRATION DISK OVER THE VIEWING WINDOW WHEN NOT USING THE AGTRON.
Two things happen when a disk is stored on the instrument. One, the UV light from the source discolors the disk and causes premature aging. Second, the constant reflected light shortens the life of the electronics.

4) CALIBRATION DISKS MUST BE KEPT CLEAN AND FREE OF SCRATCHES, SCUFFS AND CRACKS.
Surface alterations of calibration disks will change the reflectance properties of the disk. A severely marred disk surface will read quite different from a new one.

Keep the disks in their original box, or in a rack protecting the face of the disk from light and scratches.

New Agtron disks will have the handle molded from the same material as the disk. It will also be a more durable plastic.

5) SAMPLE CUPS MUST BE CLEAN AND FREE FROM CRACKS OR EXCESSIVE SCRATCHING.
Soil and glass imperfections cause reading errors. Cups which are dirty or scratched can easily cause reading errors of 2 to 3 units.

6) DO NOT CLEAN CALIBRATION DISKS AND SAMPLE CUPS WITH METAL UTENSILS OR ABRASIVE CLEANERS.
Both the plastic disks and optically clear sample cups are soft and scratch easily. Clean with warm water and a mild soap and dry with a clean cloth.

7) FILL THE SAMPLE CUP WITH ENOUGH PRODUCT TO COVER THE BOTTOM.
Light from the room should not be able to penetrate through the sample to the photo-detector. Proper fill can be checked by holding a disk over the sample and noting the reading, then note the reading without covering the sample, if the readings differ then there is not enough sample in the cup.

8) ROOM TEMPERATURE SAMPLES YIELD THE BEST RESULTS.
When trying to read hot samples, moisture can condense around the particles on the glass. This is noticeable as the reading keeps changing.

2.5 General Comments:

- **(XX.X)** number on the display indicates the degree of change or of process. The lower the number, the darker the product.

- Coarse/rough adjustments made with the upper **ZERO** and **STANDARDIZE** control knobs on the face panel.

- Fine adjustment made with the lower **ZERO** and **STANDARDIZE** control knobs.

- The glass top viewing window should be kept clean, and care should be taken to prevent liquids from entering the unit.

- A great deal of time can be saved recalibrating the M-45 if the vernier numbers are recorded for each color and scale expansion normally used.

- Vault calibration disks are used for instrument and disk evaluation. They should not be used during normal operation and should be stored in their boxes.

- If during normal operation you cannot calibrate the instrument, turn Control Knob counterclockwise to the stop and then back to factory setting or to the setting you have noted for your calibration standards and recalibrate.

2.6 Recommended Service

Your new Agtron Process Analyzer has been designed to provide years of trouble free service. To ensure correct operation, we recommend the unit be returned to Agtron for cleaning, relamping, recalibration, and performance certification every 3 to 5 years. Please contact the sales or service department for details.

WARRANTY
and
Return for Repair Procedures

Agtron Inc. warrants this product to be free of defects in material and workmanship for a period of one year from date of purchase (date of invoice). This warranty is valid only to the original customer.

This warranty does not extend to Agtron equipment used for other than its intended application, to external appearance or damage resulting from improper installation, line voltage, alteration, misuse, neglect, or abuse.

Agtron equipment requiring warranty repair should be returned under a Return For Repair authorization number (RFR) provided by Agtron and repackaged in the original shipping container and packing materials. Warranty repairs must be accompanied by a copy of the original sales invoice as proof of date of purchase. The customer must pay return freight and insure the unit for full value. Agtron will not assume the responsibility for any shipping damage; Agtron will pay the return freight.

Unit returned for service should not include additional hardware, instruction manual, or other inclusions.