

Operators' Manual
for
Monroe Electronics, Inc.
Model 257D
Portable Electrostatic Fieldmeter

P/N 0340176
257D/100
071007

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Specifications and procedures subject to change without notice

Section 1

SPECIFICATIONS:

Features:

- Battery or line operation
- Two ranges: ± 2 kV/cm and ± 20 kV/cm
- Remote probe for easy monitoring of hard-to-reach locations.
- Chopper stabilized, fed-back design for accurate measurements in ionized environments
- Recorder output for unattended monitoring

Specifications:

- Ranges:** ± 2 kV/cm and ± 20 kV/cm
- Sensitivity:** 1 V/cm and 10 V/cm, respectively
- Static accuracy:** Better than 5% of reading
- Drift:** <30 V/cm/hour, non-cumulative after 30 minute stabilization, referred to input
- Noise:** <10 V/cm rms, 0 – 200Hz, referred to input
- Response speed:** 250 ms 10% to 90% (typical)
- Analog output:** 1/10,000th of input, <10 Ω impedance
- Battery:** Built-in, re-chargeable, gel-type, 12 V, 1.2 AH, >8 hours with backlight on – charging system on-board, <6 hours re-charging time
- DC power:** Power adapter supplied:
Input: 100 – 240 VAC/ 47 to 63 Hz/400mA
Output: 18 VDC/840mA
- Dimensions:** 10 $\frac{1}{2}$ "D x 6 $\frac{3}{8}$ "W x 2 $\frac{5}{8}$ "H
(26.7 x 16.2 x 6.7 cm)
- Weight:** 2 lbs., 6 oz. (1.1kg)
- Instrument operating environment:**
25°C, ± 10 °C, 0-85% RH non-condensing
- Probe:** 1036F-5, 1 $\frac{3}{4}$ "D x 1 $\frac{1}{4}$ "H (4.4 x 3.2 cm), 8 oz. (0.2kg)
with 10 ft. (3m) cable – optional extension cable up to 1000 ft. (300m) permitted
- Probe operating environment:** –30°C to +100°C, 0-85% RH non-condensing
- Industry approvals:**
Probe approved by Factory Mutual Research Corporation as intrinsically safe for use in Class I, Division 1, Groups C and D hazardous locations when used with approved IS barriers
CE approvals pending
- Accessories included:** Carrying case
Alligator clip with boot
Banana patchcord
AC power supply
Manual

Section 2

GENERAL INFORMATION

The Model 257D Portable Electrostatic Fieldmeter measures electrostatic field (potential gradient) in kilovolts per centimeter. Using the probe-to-surface separation as a calibration factor, it may also be used to measure surface voltage.

The instrument utilizes all solid-state components including modern integrated and hybrid circuits.

It may be operated from its internal re-chargeable battery system or optionally from AC power lines. All essential operating controls are located on the instrument's front panel. A rear panel-mounted BNC connector provides an analog output for monitoring. A standard banana jack and mating cable with clip is provided for grounding purposes. The carrying case has storage space for the probe, manual and accessories.

Applications:

One major application of the Model 257D is the monitoring of electrostatic charge accumulation. As charge increases on the surface of a material, the electrostatic field in the vicinity also increases proportionately. Thus the Model 257D reliably provides an output signal proportional to the surface charge accumulation while making NO PHYSICAL CONTACT to the material being monitored.

Other applications include:

- Monitoring the effectiveness of static elimination equipment
- Atmospheric electricity measurements.
- High voltage DC transmission terminal measurements
- Monitoring of coating, capping or filling processes

Section 3

INSTALLATION

A. Portable Operation:

The Model 257D Portable Electrostatic Fieldmeter is designed primarily for portable operation. Since electrostatic field measurements are made with respect to ground be sure to connect the ground cable to a known good ground.

B. Power Line Operation:

An AC power adapter is supplied with each Model 257D. When the adapter is plugged into the receptacle on the rear of the instrument and an appropriate power source, the instrument will resort to line operation and the battery will automatically be charged as necessary. The ground cable must still be used as in **(A)**.

C. Installation of Probe:

The probe is normally connected directly to the instrument via the DB-9 connector recessed into the rear panel.

Probe mounting requirements for electrostatic field determinations vary with the nature of the desired measurement. In general, it is best to mount the probe 1 cm from the material under test – so long as the input signal remains less than 20kV/cm. The Model 1036F-5 is calibrated for 20kV/cm at 1cm spacing.

The backside of the probe assembly is electrically isolated from the rest of the probe. A pair of #4-40 threaded inserts are provided for attaching the probe to a user provided mount. It is recommended that, if possible, the probe be mounted “looking” downward to minimize the possibility of contamination entering the aperture.

The probe may also be hand held at its base for survey measurements. At full scale reading, the operator should take care when making measurements as the probe may arc to the surface under test.

D. Output:

A BNC connector is provided for an analog output. This output is 2 volts for full-scale reading (1/10,000th of 20,000 volts). The output impedance is less than 10Ω and is capable of driving capacitive loads

E. Grounding:

A standard banana jack is provided at the rear of the instrument for grounding purposes. A wire cable (supplied) must be connected to a known good ground for accurate measurements.

Section 4 OPERATION

The **POWER**, **BACKLIGHT** and **RANGE** switches on the front panel are *push/push toggles* and need to be depressed for at least a half second for the unit to respond. The **TEST** switch is a *momentary*. Pressing the **POWER** switch once turns power ON and pressing a second time turns power OFF. Pressing the **TEST** switch performs a system test and releasing it resumes normal operation.

- A. **POWER** – Press for ON, press for OFF –performs this function for either AC or battery operation.
- B. **BACKLIGHT** – At power up, in both AC and DC operation the backlight and status light are on. Subsequent pressing of the backlight button will cycle as follows:
 Both Off
 Status Light Only
 Backlight Only
 Backlight and Status Light
- C. **RANGE** – Toggles between 2 kV/cm and 20 kV/cm range. Normally, start with the high range and increase sensitivity for better resolution if the field is less than 2 kV/cm.
- D. **TEST** – In a normally functioning system when this button is pressed, the meter and output will immediately go to a significantly more negative value than the measured value and then return to the measured value when the button is released.
- E. **ZERO** – This 10-turn potentiometer zeros the instrument to accommodate offsets generated in the probe. Total span is equivalent to about 300 volts when the probe is immersed in a zero field. It should be set to produce an indicated value of zero (with the probe in a zero field). See Section 6 for more details.
- F. **STATUS** – The STATUS light is a tri-color (and OFF) LED.

AC Power, Unit ON		LED Green
DC Power, Unit ON	Battery OK	LED Amber
DC Power, Unit ON	Low Battery	LED Alternates Red/Green

When a low battery condition (< 10.5v DC operation) is detected the display backlight will blink ON and OFF for 5 minutes and then the unit will shut down.

When in AC operation and power OFF, if charge > 100ma the status light will blink yellow if it is on. Pressing the backlight switch will toggle it ON/OFF.

Section 5

MAINTENANCE

Precautions:

User maintenance should normally be limited to keeping the instrument clean and free from physical damage. Store the instrument in its protective carrying pouch when not in use.

Cleaning:

Fingerprints and other contaminants may be removed from the case with a clean lint-free cloth or sponge saturated with warm water and a small amount of mild detergent then thoroughly wrung out. Solvents and harsh abrasive cleaners should be avoided. See Section 6 for information about probe cleaning.

Battery:

Need for battery charging is indicated when the STATUS light begins to flash an alternating red/green signal. The instrument will continue to operate from an AC power source while simultaneously charging the battery. The battery should be removed if the unit is to be stored for an extended period of time.

Calibration:

Calibration is not a user function and is beyond the scope of this manual. Calibration information is available from the factory. Monroe Electronics recommends annual calibration and/or when the instrument is damaged or repaired or where called for more often by contract. We offer repair and calibration services for a fee.

Section 6

PROBE INFORMATION

A. General:

It must be emphasized that the critical elements of these probes (gradient cap and vibrating electrode) must be kept free from contaminants, e.g., dust, adsorbents, etc. The materials of which these elements are made were very carefully chosen to minimize contact potential and any foreign matter which will cause relative electrical activity when combined with relative motion will tend to cause drift and measurement errors.

Therefore, it is recommended that:

1. Probes be constantly purged even when not in use, if this is practical.
2. Probes be kept tightly covered when not in use and are not being purged to prevent contamination. A covering such as a plastic bag or aluminum foil may be used. Do NOT cover the sensitive aperture with adhesive tape.
3. Probes be cleaned only to the degree and frequency necessary to achieve the required stability.
4. Gradient caps NOT be removed for cleaning unless absolutely essential.
5. Major cleaning and reconditioning be performed by the factory.

B. Sensitivity:

Full-scale sensitivity for any properly standardized probe/instrument combination is dependent upon the gradient cap on each probe. Thus, the full-scale sensitivity for any given system can be determined by inspecting the gradient cap on the probe. Each gradient cap is stamped with a number and this number can be related to the sensitivity of the probe. With some possible exceptions, probes intended for use with the Model 257D will be stamped with the digit "5" to indicate that the sensitivity is 20 kV/cm.

Probes are standardized at the factory in a uniform electric field between two relatively large metal plates. Once standardized in this manner, they may be interchanged at will.

C. Mounting:

Probe mounting requirements for electrostatic field determinations will vary somewhat with the nature of the desired measurement. In general, it will be best to mount the probe as near as is practical to the surface to be monitored – so long as the input signal remains less than the full-scale sensitivity of the probe. For example, mount at one centimeter, if feasible. It is recommended that, where possible, the probe be mounted "looking" downward in order to minimize the probability of contaminants entering the aperture in the face.

The Model 1036F-5 probe may be held by hand to make rough measurements or

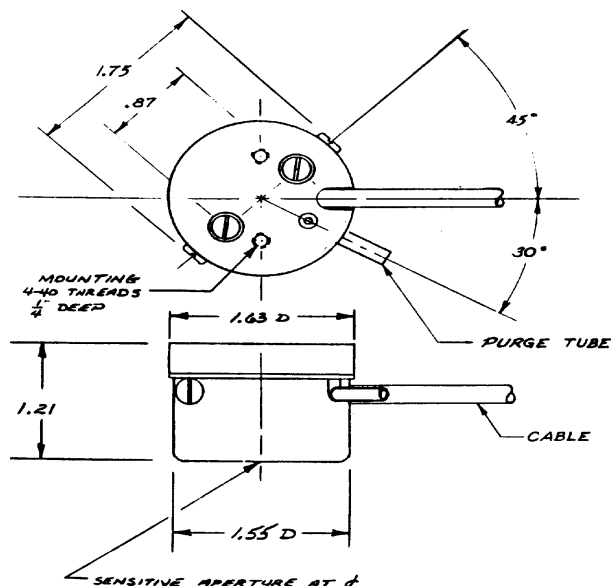


Figure 6-1

mounted by means of two threaded inserts installed in the back plate. Please refer to outline drawing Figure 6-1 for location. Care must be exercised when selecting screw length. The tapped holes in the inserts are blind holes. They will accommodate five full #4-40 threads. Some additional mounting options are friction clamps, adhesives or double-sided tape. The metal body of the probe is internally connected to instrument ground and should not normally be connected to any other ground.

D. Geometry:

All type 1036 probes are shipped from the factory standardized in a "perfect parallel field" using a fixture similar to that shown in Figure 6-2 consisting of two flat rigid metal plates which are parallel and separated by a distance "d" and have side dimensions of at least 5d. The ground plate has a hole in its center just large enough to provide clearance around the probe so that the probe does not make contact with the plate. A calibrating voltage is applied to the gradient plate to establish a reference field in the volume between the plates. Once standardized in this manner, they may be interchanged at will.

Since a true uniform field does not usually occur in most practical measurement situations, partly due to the introduction of the grounded probe itself, one must either:

1. Attempt to better the geometry by establishing a grounded plane, through which the fieldmeter probe can view the field under consideration,
2. Establish a correction factor for the data, or
3. Accept relative data. In many cases, this is perfectly acceptable practice once a fixed geometry is established.

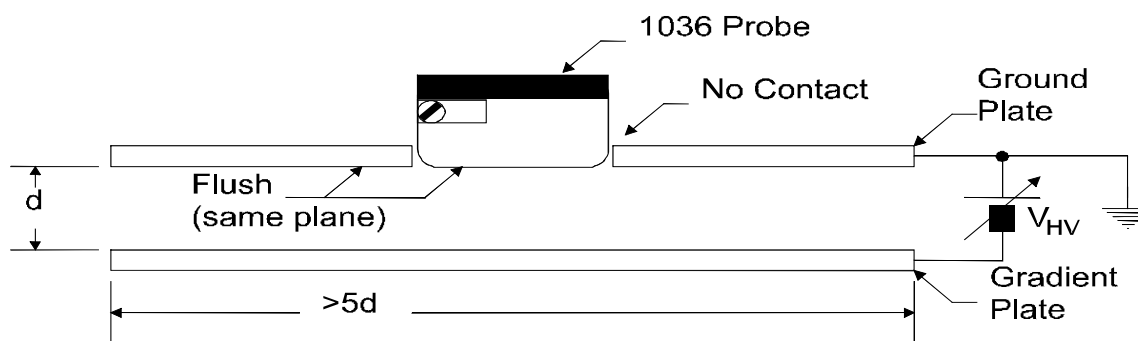


Figure 6-2

E. Cables:

Probes are normally equipped with 10 foot cables and subminiature D connectors which mate with a connector recessed in the back panel of the instrument. Extension cables are available in lengths up to 1000 feet – the maximum length permissible. These extension cables may be ordered in any length (up to 1000 feet) by part number 1036/12-*nn*, where *nn* is the length in feet.

F. Purging:

It can be demonstrated that any "contamination" present in the probe or in the vicinity of the measurement will have an adverse affect on performance, which will be exhibited as a DC offset that usually will drift with time. "Contamination", in this sense, refers to any time varying change in contents of the local environment around the probe and surface under measurement. Included are changes in the constituent gases of the atmosphere as well as aerosols and airborne particles.

The nature of this contamination effect is easily understood in the case of non-conducting solids or liquids, which can trap electrostatic charges on a sensitive surface. Less obvious is the influence of gaseous atmospheric constituents, which "contaminate" by altering the contact potentials between critical surfaces.

Constant purging of the type 1036 probe with clean dry air or an inert gas is recommended whenever practicable in order to prevent airborne contaminants from entering the aperture in the gradient cap and being deposited on the electrode thus creating undesired voltage offsets.

The air supply should meet Industrial Standards Association standard ISA/S7.3 (1975) or be filtered with a filter such as a Koby "Junior" filter available from Koby, Inc., 297 Lincoln Street, Marlboro, Massachusetts 01752. This filter will provide sufficient mechanical and chemical filtration for 1-4 probes under most conditions.

A complete probe purge kit, Model 1017/22G, is available for Model 1036F from Monroe Electronics. It includes a low volume long life air pump, mechanical and chemical filters and a supply of tubing. The pump is fully capable of 24-hour per day operation, thus keeping the probe ready for immediate use.

A purge gas inlet tube supplied with each 1036F probe may be installed in either of two positions, the choice of which is primarily a matter of convenience in routing of the hose carrying the purge gas. These consist of tapped holes, which exit at 90° to each other near the probe cable. If it is desired to move the purge tube to the other location, simply switch it with the Allen set screw plugging the other hole.

Gas pressure to the probe should be only great enough to produce a slight positive flow out of the probe and in no event should it exceed 14" of water column (½ psi).

G. Cleaning:

Recommended cleaning solvent is clean technical grade isopropyl alcohol used with a suitable applicator. Any use of non-approved solvent may degrade performance permanently requiring factory service.

Outside surfaces of the probe should first be wiped clean using a lint-free wiping tissue saturated in the solvent then the interior surfaces flushed through the aperture until no dirt or dust may be seen. The probe should then be allowed to drain and dry thoroughly. A 15 minute bake-out at 75°C is recommended to remove residual solvent.

Section 7

FIELDMETER REFERENCES

The following references are available from Monroe Electronics, Inc.

LT-18 ✕ MARK BLITSHTEN, The Simco Company, Inc., "*MEASURING THE ELECTRIC FIELD OF FLAT SURFACES WITH ELECTROSTATIC FIELDMETERS*"

Presented at the ELECTRO-STATICS SOCIETY OF AMERICA CONFERENCE ON ELECTRO-STATICS, June 20-22, 1984.

LT-19 ✕ WILLIAM E. VOSTEEN, Monroe Electronics, Inc., "*A REVIEW OF CURRENT ELECTROSTATIC MEASUREMENT TECHNIQUES AND THEIR LIMITATIONS*"

Presented at the ELECTRICAL OVERSTRESS EXPOSITION, April 24-26, 1984.

LT-21 ✕ R.G. CUNNINGHAM, Eastman Kodak Co., "*Use of Fieldmeters for Charge Measurements on Moving Webs*" in 1975 ANNUAL REPORT, CONFERENCE ON ELECTRICAL INSULATION AND DIELECTRIC PHENOMENA, NATIONAL ACADEMY OF SCIENCES pp. 13-20, 1978.

LT-22 ✕ A. VAN ROGGEN, E.I. du Pont de Nemours & Company, "*The Use of Electric Field Meters for Precision Measurements*" in 1972 ANNUAL REPORT, CONFERENCE ON ELECTRICAL INSULATION AND DIELECTRIC PHENOMENA, NATIONAL ACADEMY OF SCIENCES, pp. 9-16, 1973.

WARRANTY

Monroe Electronics, Inc., warrants to the Owners, this instrument to be free from defects in material and workmanship for a period of two years after shipment from the factory. This warranty is applicable to the original purchaser only.

Liability under this warranty is limited to service, adjustment or replacement of defective parts (other than tubes, fuses or batteries) on any instrument or sub-assembly returned to the factory for this purpose, transportation prepaid.

This warranty does not apply to instruments or sub-assemblies subjected to abuse, abnormal operating conditions, or unauthorized repair or modification.

Since Monroe Electronics, Inc. has no control over conditions of use, no warranty is made or implied as to the suitability of our product for the customer's intended use.

THIS WARRANTY SET FORTH IN THIS ARTICLE IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESS, IMPLIED OR STATUTORY INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. Except for obligations expressly undertaken by Monroe Electronics, in this Warranty, Owner hereby waives and releases all rights, claims and remedies with respect to any and all guarantees, express, implied, or statutory (including without limitation, the implied warranties of merchantability and fitness), and including but without being limited to any obligation of Monroe Electronics with respect to incidental or consequential damages, or damages for loss of use. No agreement or understanding varying or extending the warranty will be binding upon Monroe Electronics unless in writing signed by a duly authorized representative of Monroe Electronics.

In the event of a breach of the foregoing warranty, the liability of Monroe Electronics shall be limited to repairing or replacing the non-conforming goods and/or defective work, and in accordance with the foregoing, Monroe Electronics shall not be liable for any other damages, either direct or consequential.

RETURN POLICIES AND PROCEDURES

FACTORY REPAIR:

Return authorization is required for factory repair work. Material being returned to the factory for repair must have a *Return Material Authorization* number. To obtain an RMA number, call 716-585-2254 and ask for Customer Service.

Material returned to the factory for warranty repair must be accompanied by a copy of a dated invoice or bill of sale, which serves as a proof of purchase for the material.

Repairs will be returned promptly. Repairs are normally returned to the customer by UPS within ten working days after receipt by Monroe Electronics, Inc. Return (to the customer) UPS charges will be paid by Monroe Electronics on warranty work. Return (to the customer) UPS charges will be prepaid and added to invoice for out-of-warranty repair work.

EXPEDITED FACTORY REPAIR:

All material returned to the factory by air or by an overnight service will be expedited. Expedited factory repairs will be returned to the customer by the same mode of transportation by which the material was returned to the factory for repair (i.e., material returned to the factory by an overnight service will be returned to the customer by an overnight service).

NOTE: Return (to the customer) transportation expenses for expedited factory repairs will always be at the expense of the customer despite the warranty status of the equipment.

FACTORY REPAIRS TO MODIFIED EQUIPMENT:

Material returned to the factory for repair that has been modified will be not tested unless the nature and purpose of the modification is understood by us and does not render the equipment untestable at our repair facility. We will reserve the right to deny service to any modified equipment returned to the factory for repair regardless of the warranty status of the equipment.