Victoreen 190
Survey and Count Rate Meter

Instruction Manual

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General Information

1.1 Product Description

Model 190 is a portable, battery-operated general-purpose survey meter for use with most scintillation and Geiger-Mueller (GM) radiation detector, proportional counting probes, and neutron probes. The design combines CMOS microprocessor technology, automatic range changing, and a Liquid Crystal Display (LCD) into an easy to use instrument. Refer to Figure 1-1 for a general view.

The Model 190 is housed in a lightweight, plastic case designed for portability and durability. Measurement results are indicated on the front panel LCD. The display includes:

Figure 1-1. Model 190 Top View

- A 51 element analog bar graph near the top of the display to provide real time response.

- A scale multiplier, located below the bargraph relates the analog bargraph full scale to the units displayed.

- Detector range bargraph consisting of five horizontal bars that indicate the quantity of the dynamic range of the detector in use.

- A 16 character alphanumeric display that (1) provides a digitized average of the bargraph value or integrated reading with elapsed time, and (2) displays operational information (e.g., such as response time changes or changes in the units of the display).

- A backlight, activated by either of two front panel switches that provides for operation in dark environments.

The analog bargraph emulates an analog meter movement and is especially useful in survey applications. The digitized value is intended for quantitative analysis and data logging applications where an interpretation of the average reading of the analog bargraph is required.

The following controls are available from the front panel:

- Light (2) activates the LCD backlight.

- Mode changes the display units.

- Log, if activated, logs currently displayed data or changes current location identifier, depending on the currently active logging mode (i.e., timed or manual logging).

NOTE

The optional Infrared Communicator, Model 190-1A, is required to activate the Log function.

- Rate/Integ toggles the alphanumeric display between the digitized rate value and the integrate value.
- Resp Time changes the response time on the first range or resets the integrate value and elapsed time (if pressed and held for three seconds).
- Audio toggles the click output associated with counting events in the detector on/off and acknowledges alarms.
- On/Off turns instrument power on/off when permitted by the microprocessor (i.e., when Logging is inactive or all logged data has been uploaded to a computer).

The batteries (four) are housed in a separate compartment accessed from the instrument back panel. <u>All four</u> 9-volt alkaline batteries <u>are required to operate the unit</u> for approximately 200 hours. Visual and audible low battery indications are provided whenever battery power is low (four minute intervals for the audible and continuous for the visual after a battery test).

Communication with the Model 190 is accomplished through an optional infrared two-way adapter, Model 190-1A, which mounts at the top of the instrument. The adapter provides positive keying with the instrument for stable connection and communication.

1.2 Specifications

Radiation Detected: Alpha, Beta, Gamma, or X-ray depending on detector used.

Operating Rang: Rate Mode: CPM: 0-100; 0-1000; 0-10,000; 0-100,000; 0-1,000,000, and 0-10,000,000. **CPS:** 0-1, 0-10, 0-100, 0-1000, 0-10,000, 0-100,000, and 0-166,666. **µR/hr, mR/hr, R/hr, µSv/hr, mSv/hr, Gy/hr, dpm, Bq/cm2, & µCi/cm2: Integrate Mode: Counts:** 0-100,000,000; displayed as 4 digits up to 9999 counts, 3 digits plus a K (for thousand) or an M (for Million) at higher counts. **Seconds:** 0-65535; displayed as 4 digits up to 9999 seconds, 3 digits in minutes and tenths of minutes above 9999 seconds. **µR, mR, R, cts, d, µSv, mSv, Bq, & µCi:** depends on conversion factor of the probe used.

Accuracy: Within 10% of reading between 10% and 100% of full-scale indication on any range, exclusive of energy response.

Ranges: Six (6) decades are available for calibration; the number of usable decades is detector dependent.

Deadtime Correction: Provided above 1000 CPM.

Jam Detection: Adjustable level for determining jam condition; provided in probe adapter modules.

Alarm: Can be set on any decade at 10% to 100% (in increments of 10%) of full scale.

Detector Probes: Part No.: 489-4, 489-35, 489-50, 489-55, 489-60, 489-110C, 491-30, 491-40, 493-50, 425-110A, 425-200, 489-120, 489-200, RP-1 & PRN

> **NOTE**
>
> The Model 190 may be ordered with a BNC probe adapter (P/N 190070) to allow for compatibility with other manufacturer's probes.

Warm-up Time: 15 seconds (diagnostic testing).

Response Time(Bargraph): Selectable; 24, 12, 6, and 3 seconds.

24 second response time selected:

Scale	Range (CPM)	Response (seconds)
1	0-100	24
2	0-1000	12
3	0-10K	3
4	0-100K	1.5
5	0-1M	1.5
6	0-10M	0.7

12 second response time selected:

Scale	Range (CPM)	Response (seconds)
1	0-100	12
2	0-1000	6
3	0-10K	3
4	0-100K	1.5
5	0-1M	1.5
6	0-10M	0.7

6 second response time selected:

Scale	Range (CPM)	Response (seconds)
1	0-100	6
2	0-1000	3
3	0-10K	1.5
4	0-100K	1.5
5	0-1M	0.7
6	0-10M	0.7

3 second response time selected:

Scale	Range (CPM)	Response (seconds)
1	0-100	3
2	0-1000	1.5
3	0-10K	0.7
4	0-100K	0.7
5	0-1M	0.7
6	0-10M	0.7

Front Panel Controls

Eight push-button switches: LIGHT (2): either activates the LCD backlight;

MODE: Changes the display units;

LOG: Stores currently displayed data or changes current location identifier, depending on the currently active logging mode;

RATE/INTEG: Toggles the alphanumeric display between the digitized rate value and the integrate value;

RESP TIME: Changes the response time on the first range or resets the integrate value and elapsed time;

AUDIO: Toggles the click output associated with counting events in the detector, turns Audio on/off, and acknowledges alarm conditions;

ON/OFF: Turns instrument power on/off when permitted by the microprocessor (i.e., when data logging is inactive or all logged data has been read by a PC).

Internal Controls

Main unit: LCD contrast adjustment and +5 V Power Supply, Probe adapter modules: probe high voltage, threshold, and detector jam current controls

Environmental Effects

Operating temperature range: 14 °F to 140 °F (-10 °C to 60 °C) with alkaline batteries.

Relative humidity range: 0 to 95% non-condensing.

Temperature dependence: Less than 5% of full scale change in the reading when the operating temperature is in the 20 °C to 50 °C range.

Batteries

Four 9-volt batteries installed provide up to 200 hours of continuous operation.

Readout

Backlit liquid crystal display includes:

Theory of Operation

2.1 General Circuit Description

A block diagram of the circuit of the Model 190 is shown in Figure 2-1. The CMOS microprocessor is a TI 7000 series microprocessor, capable of addressing 64k bytes of memory. A 32k byte PROM contains the operating program and an 8k byte RAM provides storage for operational and data logging information. The microprocessor addresses the display via two display drivers. The microprocessor senses the keypad directly, with the exception of the ON/OFF switch. The communications is direct from the microprocessor through its ports, light emitting diodes, and photosensitive transistors. The microprocessor reads and writes to both EEPROMs and reads count data directly from the probe adapter module

A probe adapter module connection is provided on the back of the instrument. The probe adapter module retains the calibration information for a specific probe and contains high voltage and threshold adjustments for the probe. A portion of the circuit in the probe adapter module provides an adjustable threshold for current drain through the detector. This circuit is used to detect a jam condition in the detector and to signal the instrument. The pulse shaping circuit in the module accepts a wide range of detector input amplitudes and pulse decay times.

Communication with the Model 190 is accomplished through an infrared two-way adapter that mounts at the top of the instrument. The infrared receiver and transmitter are viewed through two small holes in the upper edge of the decal covering the LCD.

2.2 Operational Considerations and Applications

Control and Configuration

The Model 190 makes use of two data bases for operation; one is stored in an EEPROM on the main circuit board and one is stored in an EEPROM in the probe adapter module. The instrument EEPROM determines which set of configuration and control data codes will be used to define the operating modes. These codes may be user-modified with the optional Communicator (P/N 190-1A) to tailor the instrument for a specific application.

For example, any or all of the front panel buttons may be disabled or the unit may be configured to operate in only one Display Mode. Refer to the Instruction Manual provided with the Communicator for further details.

Display Calculations

The Model 190 retains all data internally as both counts and counts per minute. All other displays are calculated from these data sets and stored calibration information in the EEPROMS, allowing the operator the capability to switch back and forth between the various display modes without affecting the database used for calculations.

The counts per minute mode does not require a calibration adjustment because its time base is based on the highly accurate crystal clock of the microprocessor. All other displayed values (e.g., mR/h and Sv/h) can be derived from the counts per unit time value if a suitable calibration constant is used.

Above 384,000 CPM, the counts in a time slot are counted and the value multiplied by the appropriate factor to determine the actual count rate, which may cause a reduced accuracy specification on the fifth and sixth scales.
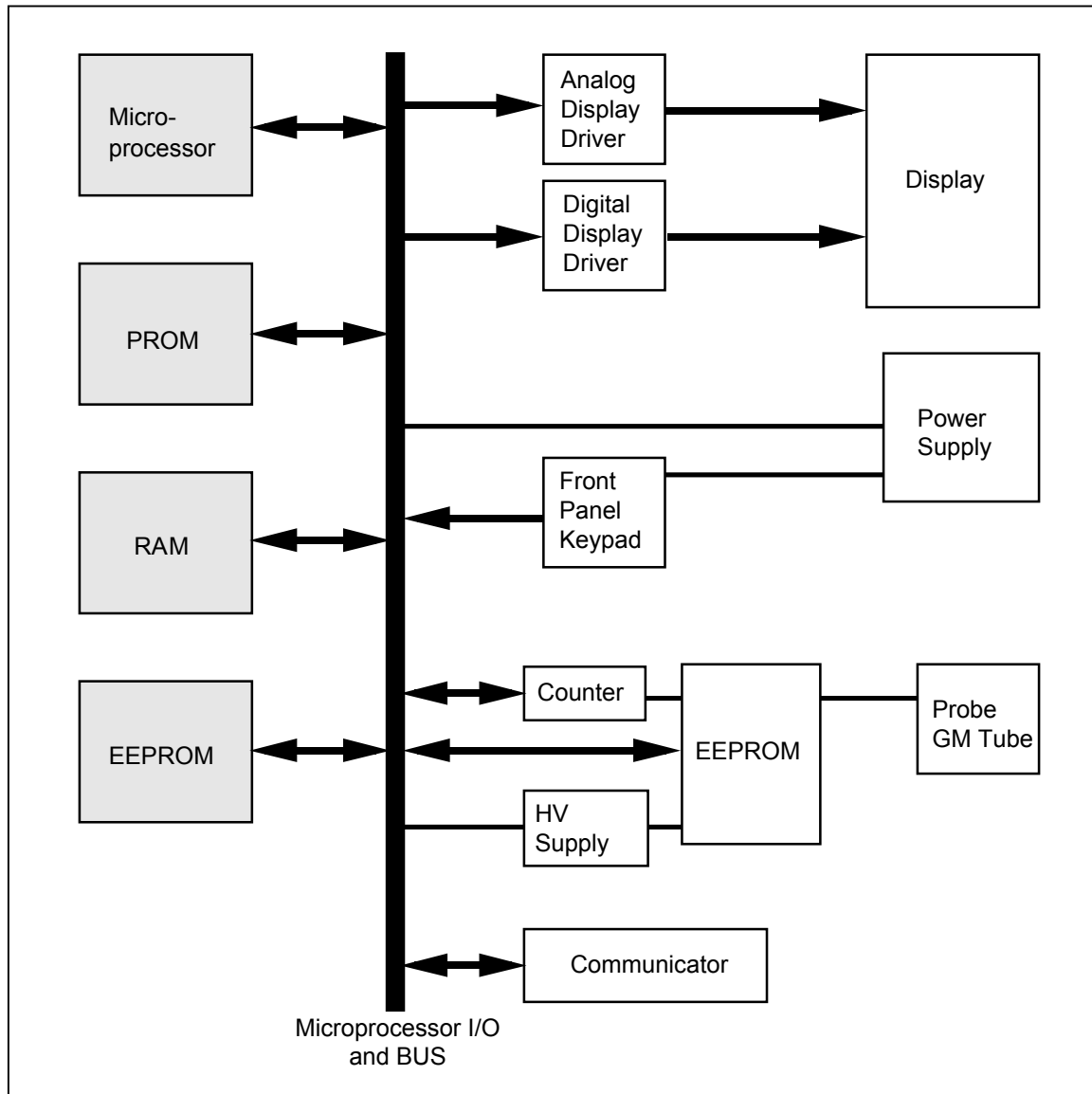

Figure 2-1. Model 190 Block Diagram

Deadtime Effects

The deadtime correction is limited to a maximum multiplier of 3.7 above 10^6 counts per minute (cpm) 5.4 from 10^5 to 10^6 cpm, and 1.6 from 10^4 to 10^5 cpm. Larger correction factors are permitted at higher count rates because of increased counting statistics. The display will indicate "OVER RANGE" if the deadtime correction is greater than the values listed. This typically happens only on scale 6. In the event of an overrange indication due to the deadtime, the bar graph portion of the display continues to function and may be used to observe increased or decreased radiation even though numerical values are not displayed. The bargraph displays relative values in this mode.

Low Battery Indications

Once every 256 seconds the instrument checks the amount of energy remaining in the batteries. When the values reach a threshold, the instrument simultaneously displays a LOW BATTERY message and sounds the sounder for a minimum of one second. The amount of time remaining before the unit stops operating depends on previous use of the instrument. If the instrument is used for longer continuous periods of time, there will be a slower decrease in available battery life at the battery end point; if the instrument is on for shorter periods of time, the battery fails more precipitously at the battery end point.

NOTE

The display may prematurely indicate a low battery if the count rate is high and/or the backlight and/or Alarm are operational simultaneously.

Response Times

The response times stated in Specifications in Section 1 - Introduction apply to the bargraph display. Since the digital data is updated only once each second, a filter is used to smooth the readings. There is approximately two seconds additional response time (10-90% of change) for the digital display.

Range Changing

A hysteresis is built into the range changing of the Model 190 to prevent excessive range changing near a range change threshold. In addition, internal readings above 10% of the current full scale are allowed for one full second prior to downscaling. Any reading above the current full scale will cause a range change to the next higher scale.

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Section 3

Operation

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3.1 Unpacking and Inspection

Upon receipt of the unit:

1. Inspect the carton(s) and contents for damage. If damage is evident, file a claim with the carrier and notify Cardinal Health, Radiation Management Services at 440.248.9300.
2. Remove the contents from the packing material.
3. Verify that all items listed on the packing list have been received and are in good condition.

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NOTE

If any of the listed items are missing or damaged, notify
Cardinal Health at 440.248.9300.

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3.2 Storage

If the unit is to be stored prior to use, pack it in the original container(s), if possible, and store in an environment free of corrosive materials, fluctuations in temperature and humidity, and vibration and shock.

3.3 Battery Installation/Replacement

Four 9-volt alkaline batteries are supplied with the Model 190. The battery compartment is located on the back of the instrument. The compartment will hold up to four batteries. All four batteries must be in place for proper operation and to avoid damage to the instrument. Use the following procedure to install/replace the batteries:

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CAUTION

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To prevent battery leads from shorting on the battery compartment's conductive coating, Ensure that all four batteries are INSTALLED at all times.

<div align="center">

CAUTION

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Unit power must be left ON and batteries replaced one at a time to prevent data loss when the log mode is activated and logged data is to be retrieved.

1. Loosen the two-quarter turn fasteners securing the battery compartment cover to the back panel.
2. Remove the battery compartment cover to gain access to the batteries.

3. Replace the batteries one at a time, observing proper polarity (refer to Figure 3-1)

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NOTE

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The unit may make beeping sounds while inserting the batteries.

4. Replace the battery compartment cover, securing it with the two-quarter turn fasteners.
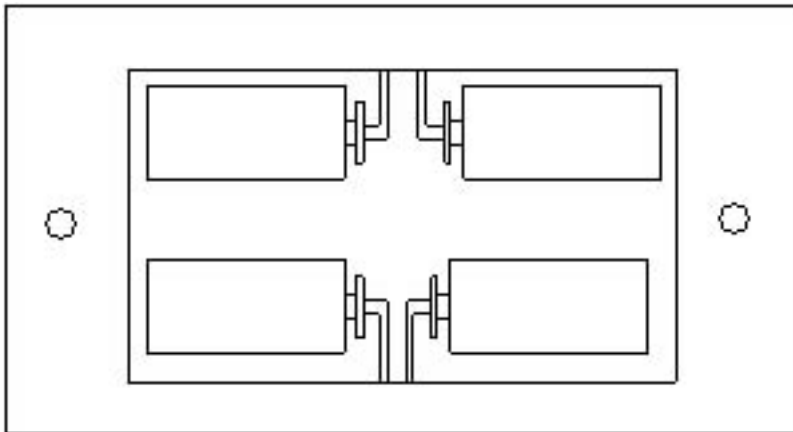

Figure 3-1. Battery Installation (For 190AC and 190F only three 9-volt batteries are installed.)

3.4 Probe Holder Installation

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WARNING

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Extreme caution should be used when connecting the probe to the meter. Improper connection may result in injury, damage to the instrument, or damage to the probe.

1. Attach the included Velcro strap through the strap slot in the mounting bracket.

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NOTE

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Two Velcro straps are included. Use the strap that fits the type of probe being utilized.

2. Attach the blade type-mounting bracket to the Model 190 Survey Meter, by performing the following:
   a. Remove and discard screw (B) from the Model 190.
   b. Place the bracket in the correct position on the Model 190.

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CAUTION

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Do not use the long screw (B), removed from the Model 190, in screw position (A). Doing so will damage the instrument.

   c. Use the .63" screw included with the kit to secure in screw hole (A).

d. Use the 1 1/2" screw included with the kit to secure in screw hole (B).
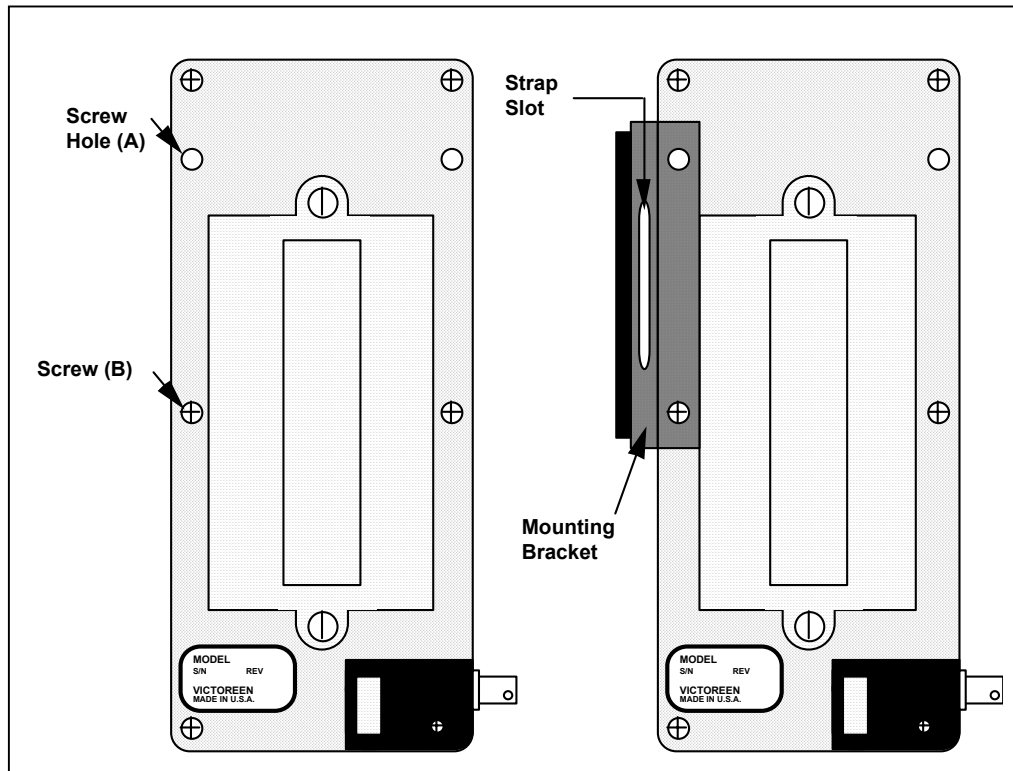

Figure 3-2   Probe Holder Installation

3.5 Adapter Module Installation/Replacement

The Model 190 is shipped with a MHV compatible adapter module, (unless BNC compatibility was requested on the purchase order). If a probe was ordered with the instrument, it is connected to the probe adapter. Use the following procedure to replace a probe and adapter:

1. Loosen the captive Philips screw from the top panel of the adapter.
2. Unplug the probe adapter module (with detector, is applicable) from the unit.
3. Plug the replacement adapter and detector into the unit, being careful not to damage the connector pins. It may be necessary to tilt the adapter slightly when plugging it into the unit.

NOTE

We recommend that the probe be secured to the mating probe adapter receptacle using heat shrink tubing.

4. Secure the Philips screw located on the top panel of the adapter.

3.6 Power

The Model 190 is powered using four 9-volt alkaline batteries. The batteries (four) are housed in a separate compartment accessed from the instrument back panel. <u>All four</u> 9-volt alkaline batteries <u>are required to operate the unit</u> for approximately 200 hours. Visual and audible low battery indications are provided whenever battery power is low (four minute intervals for the audible and continuous for the visual after a battery test).

3.7 Readout

Measurement results are indicated on the front panel LCD. The display includes an analog bargraph, scale multiplier, detector range bargraph, and a 16 character alphanumeric display (refer to Figure 3-3).

Each of the 51 elements in the bargraph represents 2% of the scale span. The analog bar graph is divided into 5 sections with scale notations of 0, 2, 4, 6, 8, and 10. The scale sections are marked by longer bars. The bars are arranged in an arc with a radius of 3.75 inches (9.5 cm.). Scale length is 2 inches (5 cm.).

The 51 element analog bargraph, located near the top of the display, provides real time response. It is designed to emulate an analog meter movement, making it especially useful in survey applications. The 16 character alphanumeric display at the bottom of the LCD displays units, an average digitized value of the reading, error messages, integrated value (with elapsed time), operational parameters (e.g., response time), low battery indication, probe type and serial number, and data logging information.

A scale multiplier, located below the bargraph relates the analog bargraph full scale to the units displayed.

The detector range bargraph consists of five horizontal bars that indicate the decade of the dynamic range in cpm of the detector in use. Most detectors will cover a dynamic counting range of five decades. A few detectors (e.g., those with short dead times) can reach the sixth decade of operation. The sixth decade is indicated by all five bars being lit.

> **NOTE**
>
> The bargraph may be disabled using the Model 190-1A Communicator.

In the Alarm condition, the entire display blinks on and off with a period of two seconds.

3.8 Internal Controls

> **CAUTION**
>
> Use extreme care and ensure that you are properly grounded prior to opening the unit for voltage adjustments. Failure to comply could destroy the instrument.

Display Contrast Adjustment (RP1)

The Model 190 display is designed for optimum viewing at approximately 60° from the plane of the display and directed toward the bottom of the instrument. The Display Contrast Adjustment (RP1) is factory set for optimum viewing and Cardinal Health does not recommend that it be further adjusted. However; if the display contrast requires adjustment, turn RP1 to vary the angle of maximum contrast of the 16-character display. The contrast for the upper part of the display is fixed. Refer to Figure 3-4 for RP1 location.

Voltage Adjustment (RP2)

A +5 volt adjustment is provided on the main circuit board. Refer to Figure 3-3 for adjustment location. Use the following procedure:

1. Connect the - lead of a DVM to the groundside of R18.
2. Connect the + lead of the DVM to Z10-12.
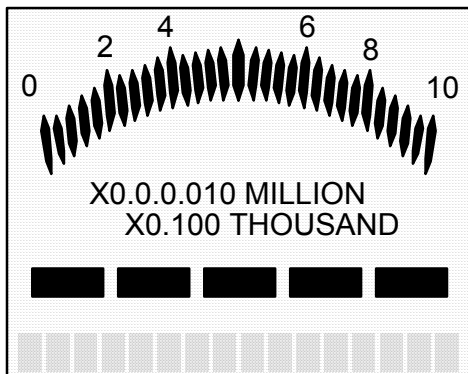3. Adjust RP2 for 5.00 volts $\pm$0.02 volts.

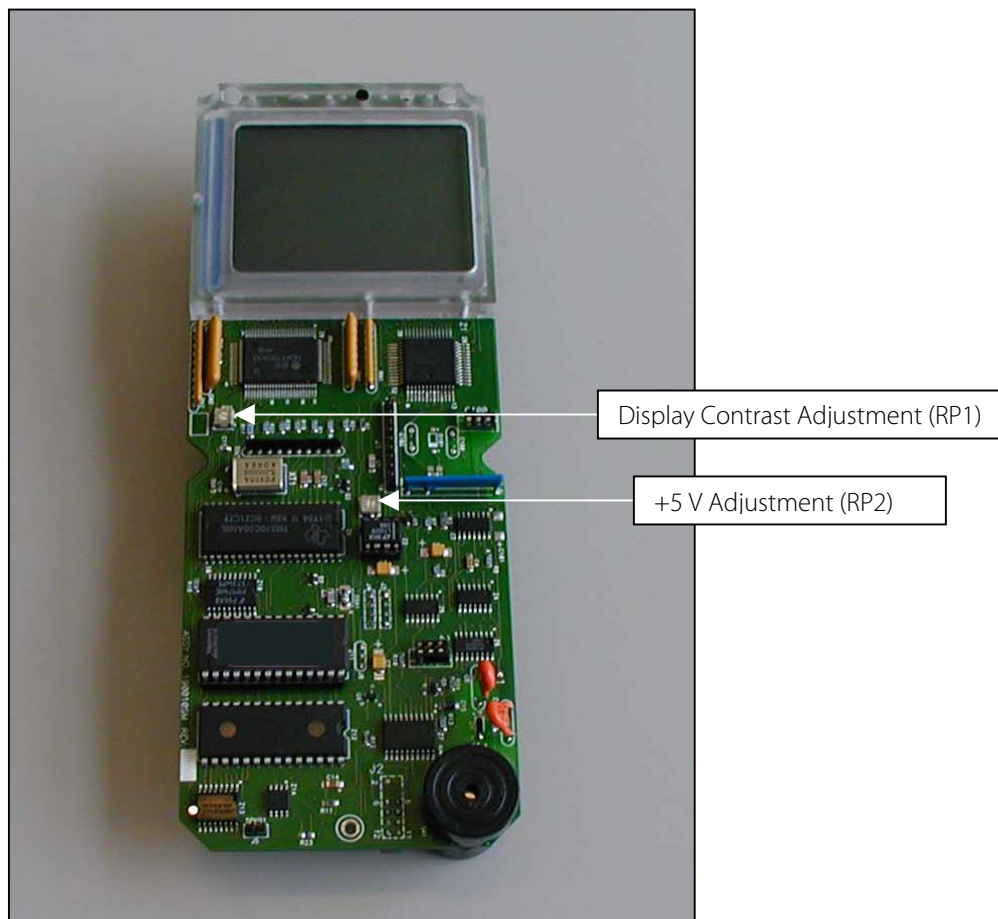*Figure 3-3. Model 190 Display*

Figure 3-4.   Display Contrast (RP1) and +5 (RP2) Adjustment Locations

Probe Adapter Module Adjustments

The probe adapter module has high voltage (RP3), detector sensitivity (RP2), and detector jam current (RP1) adjustments located within it. Use the following procedure to make the appropriate adjustments:

1. Loosen the Philips screw on the top panel of the adapter.
2. Unplug the adapter from the unit.
3. Remove the flat head screw from the bottom panel of the adapter.
4. Remove the top panel of the adapter to gain access to the inner components.

> **CAUTION**
>
> There is a potential shock hazard when the adapter cover is removed and the unit is operating. Use an insulated screwdriver when making adjustments, being careful not to touch any of the components other than the potentiometers specified.

5. Plug the adapter back into the Model 190 with the component side of the circuit board exposed.

> **NOTE**
>
> It may be necessary to tilt the adapter slightly when attempting to plug it into the unit.

6. Make the required voltage, threshold, and jam current adjustments as outlined in the following paragraphs.

> **NOTE**
>
> The Model 190 must be turned ON while making the probe adapter adjustments.

7. When the adjustments are completed, unplug the adapter from the unit.
8. Position the back panel on the adapter.
9. Replace the flat head screw removed in step 3.
10. Plug the adapter back into the unit.
11. Secure adapter to unit by tightening the captive screws located on the top panel of the adapter.

3.9 HIGH VOLTAGE ADJUSTMENT

> **NOTE**
>
> Determine which module you have (surface mount or non-surface mount) before continuing, and ensure that the correct figure is referenced.

Refer to Figure 3-5 for location of the high voltage adjustment (RP3). Use the following procedure to adjust the detector high voltage:

1. Turn unit power OFF.
2. Locate the 3-pin jumper connector JP1 (refer to Figure 3-5 for jumper location).

3. Position the jumper as required for either a surface mount or non-surface mount module by referring to Figure 3-6.

4. Connect either a DVM with a high resistance probe (> 100Mohm) or an electrostatic voltmeter to the MHV or BNC connector.

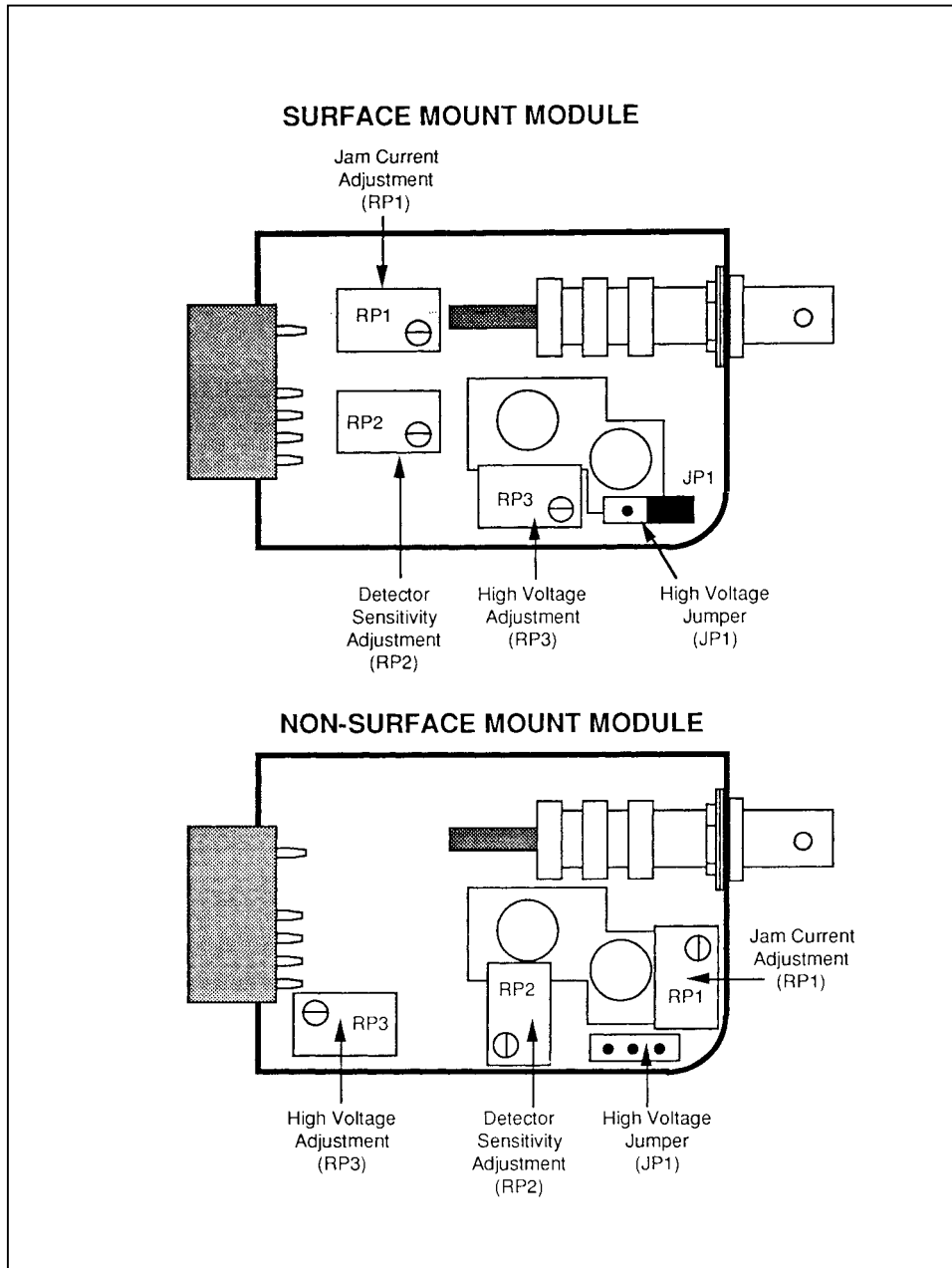5. Turn the Model 190 on.

6. Adjust RP3 for the required voltage.

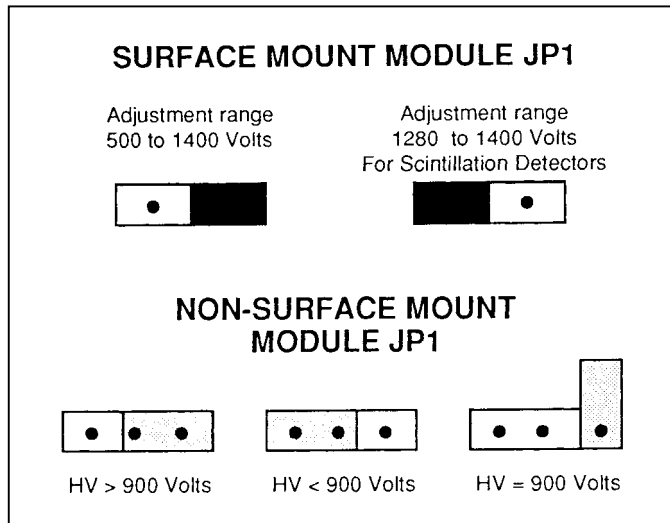Figure 3-5. Probe Adapter Adjustments

Figure 3-6. High Voltage Jumper Positioning

3.10 DETECTOR SENSITIVITY ADJUSTMENT

Refer to Figure 3-5 for location of the detector sensitivity adjustment (RP2). The adjustment is factory set to 80 mV. If necessary, use a variable amplitude pulse fail generator and turn RP2 counterclockwise to increase sensitivity.

3.11 JAM CURRENT ADJUSTMENT

Refer to Figure 3-5 for location of the jam current adjustment (RP1). Use the following procedure to adjust the jam current:

1. Adjust RP1 fully counter-clockwise.
2. Bring the detector to a high-count rate until the reading begins to drop with increasing intensity.
3. Adjust RP1 clockwise until the jam message appears on the display.

> **NOTE**
>
> An overrange message may occur during this adjustment, indicating that the probe has reached the limit of its deadtime correction; in this case, the jam message may be set to appear above overrange.

3.12 Changing the Response Time (Resp Time)

The Model 190 response time may be changed by pressing the front panel **Resp Time** push-button. When **Resp Time** is pressed, the next response time will be selected and the following will appear on the alphanumeric display:

RESPONSE IS XX S

XX is 24, 12, 6, or 3 seconds, corresponding to the newly selected response time.

The **Resp Time** button may be pressed as necessary to scroll through and select the desired response time. The **Resp Time** button may be disabled via the Model 190-1A Communicator.

The response time displayed is for the lowest range. Refer to Specifications in Section 1 - General Information for corresponding response times on other ranges.

3.13 Resetting the Integrate Value (Resp Time)

If the instrument is in the Integrate Mode and the reset integrator is enabled via the optional Model 190-1A Communicator, the integrate value may be reset by pressing and holding the **Resp Time** button for three seconds. The integrate values will reset to zero; the response time will not change. The integrate reset function may be disabled via the Model 190-1A Communicator.

3.14 Changing the Operation Mode (Mode)

The Model 190 factory default Operational Mode is C/MIN. Using the optional Model 190-1A Infra-red communicator, default settings can be changed/programmed into the Model 190. Features and push buttons can also be locked-out to set up the Model 190 in a user-defined mode of operation. The Operational Mode may be changed by pressing the front panel **Mode** push-button. The next available mode will then be displayed corresponding to the newly selected Mode. The **Mode** button may be pressed as necessary to scroll through and select the desired Mode, and includes the following:

1. COUNTS/MIN MODE
2. COUNTS/SEC MODE
3. mR/H MODE
4. Bq/cm^2 MODE
5. µCi/cm^2 MODE
6. DPM MODE
4. Sv/H MODE
5. Gy/H MODE

If the probe has not been initialized and calibrated (either at the factory or via the operational infrared communicator), the CPM and CPS modes are the only modes available. Also, the mCi/sqcm, Bq/sqcm, and dpm modes require an additional special calibration performed with the probe.   Refer to section 5 - Calibration for further details.

All but one of the Operational Modes may be disabled via the Model 190-1A Communicator; one default mode must be enabled for the instrument to operate properly.

Changing the Display Mode (Rate/Integ)

The front panel **Rate/Integ** button toggles the alphanumeric display between the digitized rate value and the integrate value. Press **Rate/Integ** to automatically change the display mode.

The **Rate/Integ** button may be disabled (and the display mode fixed) via the optional Model 190-1A Communicator.

Logging Displayed Data (Log)

If the Data logging function is selected to be operational (via the optional Communicator), currently displayed data will be stored for future retrieval.   The procedure for logging data depends on the Log Mode (Manual or Timed, with or without location identifiers, as selected via the communicator).

NOTE

The Log Mode is always inactive when the unit is turned on and data logging can only be activated through the optional Communicator. If the Log Mode has not been activated, a NOT IN LOG MODE message will be displayed when the Log button is pressed. When in the data logging mode, the instrument ON/OFF button is in active and the instrument will stay on until the data has been retrieved. Refer to the Instruction Manual provided with the communicator for further information and instructions.

In the manual mode, displayed data is logged by pressing the front panel Log button. The following message will appear in the alphanumeric display:

Data logging in manual mode. ready

In the timed mode, data is logged at specific intervals. The following message will appear in the alphanumeric display:

Data logging in timed mode. ready

Remote Communication (Optional)

Communication with the Model 190I and Model 190 is accomplished via the Model 190I-1A Communicator that plugs into top of the instrument.

NOTE

For remote communication, use the Model 190-1A Communicator and the 94190C00 software provided.

For additional information and operation of remote communications, refer to the 190003 instruction manual provided with the Model 190-1A.

3.15   External Controls

The Model 190 has eight external front panel push-button controls. The front panel controls include four functional buttons and four operational buttons. The functional buttons include including Mode, Log, Rate/Integ, and Resp Time, effect the daily operation of the unit.

The four operational push buttons and their functions are:

- Light (2) activates the LCD backlight.
- Audio toggles the click output on/off and acknowledges an alarm condition.

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NOTE

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The click output is associated with counting events in the detector

On/Off toggles instrument power on/off when allowed by the microprocessor.

The four functional push buttons are as follows:

- **Mode** changes the display units.
- **Log**, when pushed momentarily, logs currently displayed data or changes current location identifier, depending on the currently active logging mode; when pressed and held for three seconds, and a logging with locations mode is active, Log changes the label.
- **Rate/Integ** toggles the alphanumeric display between the digitized rate value and the integrate value.
- **Resp Time** changes the response time on the first range or resets the integrate value and time.

3.16 Operational Checkout

1. Install the batteries as outlined earlier in this Section (Battery Installation/Replacement).
2. Install the probe holder kit as outlined earlier in this Section (Probe Holder Kit Installation).
3. Install the probe and adapter as outlined earlier in this Section (Probe and Adapter Installation).
4. Turn the instrument on by pressing the ON/OFF button on the front panel.
5. Observe the following:

   a. All segments of the display should come on for approximately one second.

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NOTE

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If the display does not come on at all, replace the batteries and try again. If a partial display is visible, contact Cardinal Health at 440.248.9300 for further instructions.

   b. The display will blank and display the version number of the software in the alphanumeric display.
   c. The unit will read the internal and external EEPROMs and display the Probe Model Number and Serial Number, or a portion of it.

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In the event that the internal and external EEPROMS were not properly read, an error message(s) will be displayed (i.e., "INT EEPROM FAIL" and/or "EXT EEPROM FAIL"). Contact Cardinal Health at 440.248.9300 for further instructions.

    d.   The instrument will then begin to operate in the selected mode.

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The instrument is factory set with all buttons operational and the CPM and mR/H modes selected. (The Log Mode is inactive.)

6.   Test each button of the instrument, as follows:

    a.   Press each LIGHT button to cause the display backlight to turn on. (The backlight may not show up in a bright environment.)

    b.   Press the MODE button to toggle the available display modes that were enabled during calibration. The current mode will be displayed briefly on the 16-character alphanumeric display. An example:

- COUNTS/MIN MODE
- COUNTS/SEC MODE
- mR/H MODE

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│    NOTE     │
└─────────────┘
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If the probe has not been initialized and calibrated (either at the factory or via the optional infrared communicator), the CPM and CPS modes are the only modes available. In addition, the mCi/sqcm, Bq/sqcm, and dpm modes require an additional special calibration performed with the probe. Refer to section 5 - Calibration for further details.

    c.   Press the LOG button to log displayed data. If the Log Mode has been activated, the following should appear in the alphanumeric display:

        LOGGING DATA

If the Log Mode has not been activated, the following message will be displayed:

        NOT IN LOG MODE

The Log Mode can only be activated using the optional Communicator, Model 190-1A. Refer to the Instruction Manual supplied with the Communicator for details.

    d.   Press the RATE/INTEG button to toggle the alphanumeric display between the Rate Mode and the Integrate Mode.

    e.   Press the RESP TIME button to toggle the available response time selections. The new selection is displayed in the alphanumeric display as follows:

        RESPONSE IS XX S

        where XX is the currently active first scale response time.

<div style="border:1px solid black; display:inline-block; padding:4px 20px;">**NOTE**</div>

If the instrument is in the Integrate Mode, press and hold the RESP TIME button for three seconds. The integrate values should reset to zero without changing the response time.

f.   Press the AUDIO button to toggle on or off the click from the speaker associated with each count from the detector. The clicks from the speaker have a one to one correspondence with counts from the detector up to 3200 cpm. For counts above 3200 cpm, there is a transition from clicks to a steady tone.

g.   Press the ON/OFF button to turn the instrument off.

<div style="border:1px solid black; display:inline-block; padding:4px 20px;">**NOTE**</div>

If the instrument is in the Log Mode, the unit can be turned OFF only after all logged data has been read from the internal RAM using the communications software. Refer to the Instruction Manual provided with the Model 190-1A Communicator for further details.

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Maintenance

4.1 Maintenance

Cardinal Health recommends the following maintenance and troubleshooting procedures for the Model 190:

> **NOTE**
>
> Table 4-1 lists recommended spare parts. Schematics, assembly drawings, and complete parts lists are provided in Appendix A.

1. Battery replacement as outlined in Section 3 - "Operation" when *LOW BATTERY* appears in the alphanumeric display and/or the audio low battery indication is activated.

> **NOTE**
>
> If the LOW BATTERY message remains displayed after replacing the batteries, check the detector high voltage (RP3) as outlined in Section 3 - "Operation". If the message is still displayed, contact Cardinal Health at 440.248.9300 for further instructions.

2. If a problem occurs with the printed circuit board, case, or audible alarm transducer, the suspect part is easily replaceable. Refer to Table 4-1 for a list of Replacement parts.
   a. The printed circuit board has all but the PROM, RAM, and the microprocessor soldered into the board.
   b. The case and modules are molded plastic and may require replacement due to contamination.
   c. The speaker and its gasket are open to the surface of the instrument, to allow audible indications to be clearly heard, and may therefore require replacement due to contamination.
3. If the problem is isolated to the probe or module, refer to Section 3 - Operation for replacement procedures.
4. If the problem cannot be isolated or corrected using the above procedures, contact Cardinal Health at 440.248.9300 for further instructions.

Table 4-1.   Recommended Spare Parts

Part No.	Description
190010SM	Main Circuit Board Assembly
190021	Case Top
190026A	Display Window Decal
190027	Membrane Switch Decal
190033	Battery Plate
91-11-1	1/4 Turn Fastener (2)
190031	Case Bottom
190023	Battery Cover
190035	Battery Cover Gasket
149036	Transducer Screen
67-115	Connector
190015	Keypad Assembly
5-1154	Phillips Screw (5) 6-19 X 1.25 PH
5-1153	Phillips Screw 6-19 X 0.50 FH
5-1151	PC Board Assembly Screw (3) 4-24 X .25 Hex HD
5-1152	Screw (2) Battery Plate 6-20 X .31 Hex HD
91-11-2	Retainer for 1/4 Turn Fastener (2)
190001K	Probe Holder Kit
190213	Bracket
190235	Stand
190007	Battery Cable Assembly (2)

Calibration

5.1 Calibration

The probe adapter modules carry the calibration data for the instrument. If the unit is shipped with a probe, the module is calibrated at the factory prior to shipment; otherwise, the module is shipped uncalibrated. The instrument itself does not require calibration.

If required, calibration data stored in the probe adapter may be changed using the optional Communicator, P/N 190-1A. Refer to the instruction manual supplied with the Communicator for further instructions and specific procedures for entering calibration data.

<div style="border:1px solid black; display:inline-block; padding:4px">**CAUTION**</div>

Avoid indiscriminately mating probes with an adapter module; otherwise damage to the instrument or probe or loss of stored calibration factors, parameters, and other operational information may occur. Cardinal Health recommends the use of heat shrink tubing to permanently connect the probe and adapter.

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Applicable Drawings and Bills of Materials

A.1 Applicable Drawings and Bills of Material

The following drawings and Bill of Materials are applicable to the Model 190 and contain proprietary information. If you require these drawings, please contact Cardinal Health at 440.248.9300.

Drawings

Drawing Number	Description
190013SM	Model 190 Schematic
191005	Model 190 Assembly
190010SM	Main Circuit Board Assembly

Bills of Material

Document Number	Description
191005	Bill of Materials, Model 190 Assembly
190010SM	Bill of Materials, Main Circuit Board Assembly

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Supplemental Data for the Model 190AC & 190F

B.1 Supplemental Data for the Model 190AC & 190F

Product Description

The Model 190F is a Model 190AC with a metal stand and an AC to 9 VDC power adapter module. The Model 190AC can be powered internally from three 9-volt DC batteries, or externally from AC through a power adapter module.

Specifications

The Model 190AC has all the features of a standard Model 190 plus the ability to be powered from AC via an appropriate power adapter, and a metal stand to hold the survey meter at a 60 degree angle for ease of viewing.

The metal stand is rugged, being made of formed and welded steel. The Model 190AC can be easily inserted and removed from this stand.

Dimensions:

The dimensions of the Model 190AC are the same as the Model 190. Refer to the specifications in Section 1.

The dimensions of the metal stand are: (W X H X D) 4" x 9.5" x 4.75" (10.2 X 24.3 X 12 cm).

Miscellaneous:

AC to DC Adapter Line Cord Length: 6 feet

Weight:

4.1 lbs. total (Model 190 + AC to DC adapter + metal stand) (1.86 kg)

Power Requirements:

Internal: Three 9-volt batteries

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CAUTION

</div>

To prevent battery leads from shorting on the battery compartment's conductive coating, ensure that all three batteries are INSTALLED at all times, even when using the adapter as power supply.

AC Power Converter

Part 14-409 (United States)

   Input 120 VAC, 60 Hz, 13W

   Output 9 VDC, 500 mA, Regulated

Part 14-434 (Europe)

    Input 230 VAC, 50 Hz, 84 mA, 18.6 VA

    Output 9 VDC, 780 mA, 7.02 VA, Regulated

Part 14-435 (United Kingdom)

- Input 230 VAC, 50 Hz, 19.1 VA
- Output 9 VDC, 780 mA, Regulated

Part 14-435, Part 14-416 (Australia)

Battery Lifetime

When powered from AC: Shelf life of the batteries

When powered from the batteries: minimum of 100 hours

Installation

Plug the 9-volt jack into the back of the Model 190AC and the AC to 9-volt DC adapter module into the AC outlet. Turn on the Model 190AC. Doing this in any other order will not damage the Model 190AC or the AC to DC converter module.

Removing the 9-volt DC power jack while the unit is on and powered from this source will not damage the 190AC or the adapter module.

The metal stand has holes in the base and back to permit permanent installation if desired.

Operational Procedure

The Model 190AC may be inserted or removed from the metal stand at any time.

There is no change in operational procedures from the Model 190. The Model 190AC will operate with the AC to 9 VDC adapter module installed and no 9-volt batteries.

Applications

Possible applications for the 190F are:

    Any environment where AC voltage is present and a survey meter is expected to be set up for active operation and ease of viewing on a fairly continuous basis.

    Frisker stations

    Portable Portal Monitors

Troubleshooting

Refer to Section 4 - Maintenance for troubleshooting procedures.

Service Information

General

The 190F contains three functional elements:

- Model 190AC Survey Meter
- AC to 9-volt DC Adapter Module
- Metal Stand

Circuit Description

Refer to the 190 and Model 190AC sections.

Calibration and Adjustments

For calibration and adjustments to the Model 190AC, refer to the Model 190 and 190AC sections of this manual.

Replacement Parts

Item	Part Number
Model 190AC	190AC
Metal Stand	190232
Ac to Dc Adapter Module	14-409 (120 VAC), United States
	14-434 (230 VAC), Europe
	14-435 (230 VAC), United Kingdom
	14-435 & 14-416, Australia
190 Manual	190001

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Adapter Bracket Assembly Kit Installation Instructions

C.1 Adapter Bracket Assembly Kit Installation Instructions

> **NOTE**
>
> You are not required to mount the adapter bracket assembly to the adapter stand. If you choose to mount the adapter bracket assembly to the adapter stand, please perform the following;

1. Remove the adapter bracket assembly kit from the plastic bag.
2. Ensure the following are included:

Item	Qty
Adapter bracket assembly (190235)	1
#6-32 Machine Screws	3
#6 Split Washers	3
# 6-32 Hex Nuts	3

3. Align the three holes on the side of the adapter bracket assembly (190235) with the three holes on the right side of the adapter stand (190213).
4. Mount the adapter bracket assembly to the adapter stand using the three sets of machine screws, washers, and nuts. Be sure to place the hex nuts on the inside of the stand. Hand tighten the screws using a screwdriver.
5. The frisker probe can be placed in the adapter bracket assembly clip.
6. Tension on the clip can be adjusted by widening or squeezing close the spring clip opening.

This completes the assembly instructions.

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Radiation Management Services

For additional information, please contact
Radiation Management Services business
of Cardinal Health at 440.248.9300.

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