

FLUKE®

Biomedical

Victoreen® 190I

Survey Meter

Operators Manual

**Fluke Biomedical
Radiation Management Services**

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Section 1

Introduction

1.1 Product Description

The 190I is a portable, battery-operated general-purpose survey meter for use with an internal Geiger-Mueller (GM) radiation detector. The design combines CMOS microprocessor technology, automatic range changing, and a Liquid Crystal Display (LCD) into an easy to use instrument.

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

- 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, 190I-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 four (4) batteries are housed in a separate compartment accessed from the instrument back panel. All four 9-V alkaline batteries are required to operate the unit 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).

CAUTION

To avoid possible damage to the instrument, all four batteries must be in place.

Communication with the 190I is accomplished through an optional infrared two-way adapter, Victoreen 190I-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 Range	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, & Bq/cm²: depends on conversion factor of the probe used. 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, μSV, & mSv: 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 scale.	Can be set on any decade at 10% to 100% (in increments of 10%) of full scale.
Detector	Internal Geiger-Mueller Tube
Warm-up Time	15 seconds (diagnostic testing)
Response Time (Bargraph)	Selectable; 24, 12, 6, and 3 seconds.

24-second response time selected:		
<u>Scale</u>	<u>Range (CPM)</u>	<u>Response (seconds)</u>
1	0-100	24.0
2	0-1000	12.0
3	0-10K	3.0

4	0-100K	1.5
5	0-1M	1.5
6	0-10M	0.7

12-second response time selected:

<u>Scale</u>	<u>Range (CPM)</u>	<u>Response (seconds)</u>
1	0-100	12.0
2	0-1000	6.0
3	0-10K	3.0
4	0-100K	1.5
5	0-1M	1.5
6	0-10M	0.7

6-second response time selected:

<u>Scale</u>	<u>Range (CPM)</u>	<u>Response (seconds)</u>
1	0-100	6.0
2	0-1000	3.0
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:

<u>Scale</u>	<u>Range (CPM)</u>	<u>Response (seconds)</u>
1	0-100	3.0
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

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
operation.

Four 9 V batteries installed provide up to 200 hours of continuous

Readout

Backlit liquid crystal display includes:

- 51 element analog bar graph display
- Scale multiplier indication
- 16 character alphanumeric display
- Detector range bargraph

Construction

Molded plastic case

Dimensions

9.0 x 3.6 x 2.0 in (23 x 9.2 x 5.0 cm)

Weight

1 lb 10 oz (740 grams) with four batteries installed

Options

Communicator: P/N 190I-1A

1.3 Receiving Inspection

Upon receipt of the package:

1. Inspect the cartons (s) and contents for damage. If damage is evident, file a claim with the carrier and notify Fluke Biomedical, 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 order.

NOTE

If any of the listed items are missing or damaged, notify Fluke Biomedical.

1.4 Storage

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

1.5 Battery Installation/Replacement

Four 9 V batteries are supplied with the 190I. The battery compartment is located on the back of the instrument. The compartment will hold up to four batteries but only one battery is necessary to operate the instrument. Use the following procedure to install/replace the batteries:

CAUTION



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



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.

NOTE

The unit may make beeping sounds while inserting the batteries.

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

1.6 Power

The 190I is powered using four 9 V batteries. The batteries (four) are housed in a separate compartment accessed from the instrument back panel. All four 9 V batteries are required to operate the unit 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).

1.7 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 1-2).

Each of the 51 elements in the bargraph represents 2% of the scale span. The analog bar graph is divided into five 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.

The scale multiplier, located below the bargraph, relates the display units to the displayed bargraph value.

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 1901-1A Communicator.

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

1.8 Internal Controls

WARNING



An electrical shock hazard exists between the high voltage supply and ground.

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 190I 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 it is not recommended 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 1-1 for RP1 location.

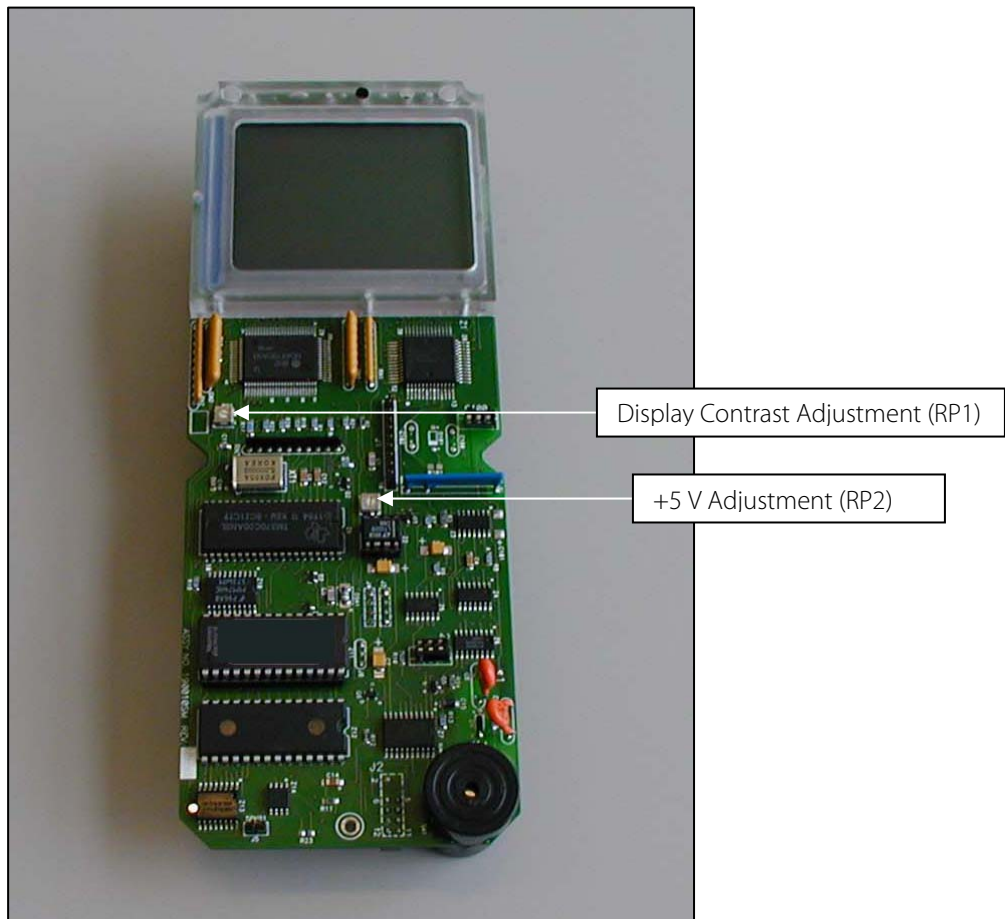


Figure 1-1. RP1 Location

Voltage Adjustment (RP2)

A +5 volt adjustment is provided on the main circuit board. Refer to Figure 1-2 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 $5.00\text{ V} \pm 0.02\text{ V}$.

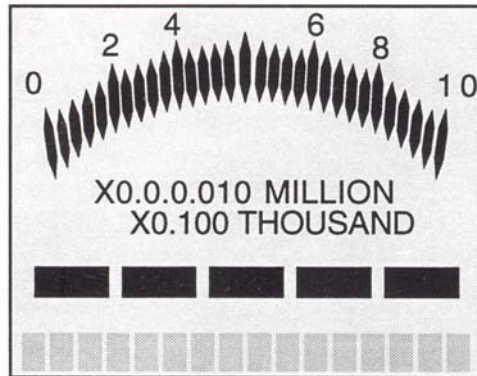


Figure 1-2. 190I Display

1.9 External Controls

The 190I has eight external front panel pushbutton 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 and are discussed in detail in Section 2, - Operation.

The four operational pushbuttons and their functions are:

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

NOTE

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 pushbuttons 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.

1.10 Operational Checkout

1. Install the batteries as outlined in Section 1.5, Battery Installation/Replacement.
2. Turn the instrument on by pressing the ON/OFF button on the front panel.
3. Observe the following:
 - a. All segments of the display should come on for approximately one second.

NOTE

If the display does not come on at all, replace the batteries and try again. If a partial display is visible, contact Fluke Biomedical 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 EEPROM and display the Probe Model Number and Serial Number, or a portion of it.

NOTE

In the event that the internal EEPROM was not properly read, an error message will be displayed (i.e., "INT EEPROM FAIL"). Contact Fluke Biomedical for further Instructions.

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

NOTE

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

4. 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*

NOTE

When the Instrument is shipped, it has been initialized and calibrated at the factory. The CPM, CPS, mR/hr, or Sv/hr modes are the only modes available.

- 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, Victoreen 190I-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.

NOTE

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.

NOTE

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 190I-1A Communicator for further details.

1.11 Warnings and Cautions

WARNING



An electrical shock hazard exists between the high voltage supply and ground.

CAUTION



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

CAUTION



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.

The equipment described in this manual is intended to be used for the detection and measurement of ionizing radiation. It should be used only by persons who have been trained in the proper interpretation of its readings and the appropriate safety procedures to be followed in the presence of radiation.

Although the equipment described in this manual is designed and manufactured in compliance with all applicable safety standards, certain hazards are inherent in the use of electronic and radiometric equipment.

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Section 2 Operation

2.1 Operation

Operation of the 190I consists of:

1. If necessary, battery installation/replacement (as outlined in Section 1.5, Battery Installation/Replacement).
2. Turning instrument power on by pressing the ON/OFF button. The 190I is ready for operation in the defined default mode of operation.
3. Setting the response time, selecting display units, and selecting operational mode using the front panel pushbuttons are outlined in the following paragraphs.

Changing the Response Time (Resp Time)

The 190I 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 190I-1A Communicator.

NOTE

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

Resetting the Integrate Value (Resp Time)

If the instrument is in the Integrate Mode and the reset integrator is enabled via the optional 190I-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 190I-1A Communicator.

Changing the Operation Mode (Mode)

The 190I factory default Operational Mode is C/MIN. Using the optional 190I-1A Infrared communicator; default settings can be changed/programmed into the 190I. Features and pushbuttons can also be locked-out to set up the 190I 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. Sv/H MODE
5. Gy/H MODE

NOTE

If the detector 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.

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

2.2 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 190I-1A communicator.

2.3 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 190003 Instruction Manual provided with the 190-1A Communicator and 94190C00-200 software 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

2.4 Remote Communication (Optional)

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

NOTE

For remote communication, use the 190-1A Communicator and the 94190C00-200 software provided.

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

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Section 3

Theory of Operation

3.1 General Circuit Description

A block diagram of the circuit of the 190I is shown in Figure 3-1. 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 the internal EEPROM and reads count data directly from the GM tube or from the counter (when the count rates are too high to handle each count individually). Calibration and operational information is stored in the internal EEPROM.

Communication with the 190I 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.

3.2 Operational Considerations and Applications

Control and Configuration

The 190I uses a database, stored in the EEPROM on the main circuit board, for operation. The EEPROM is used to define the operating modes through a set of configuration and control codes. 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 190I 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.

NOTE

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.

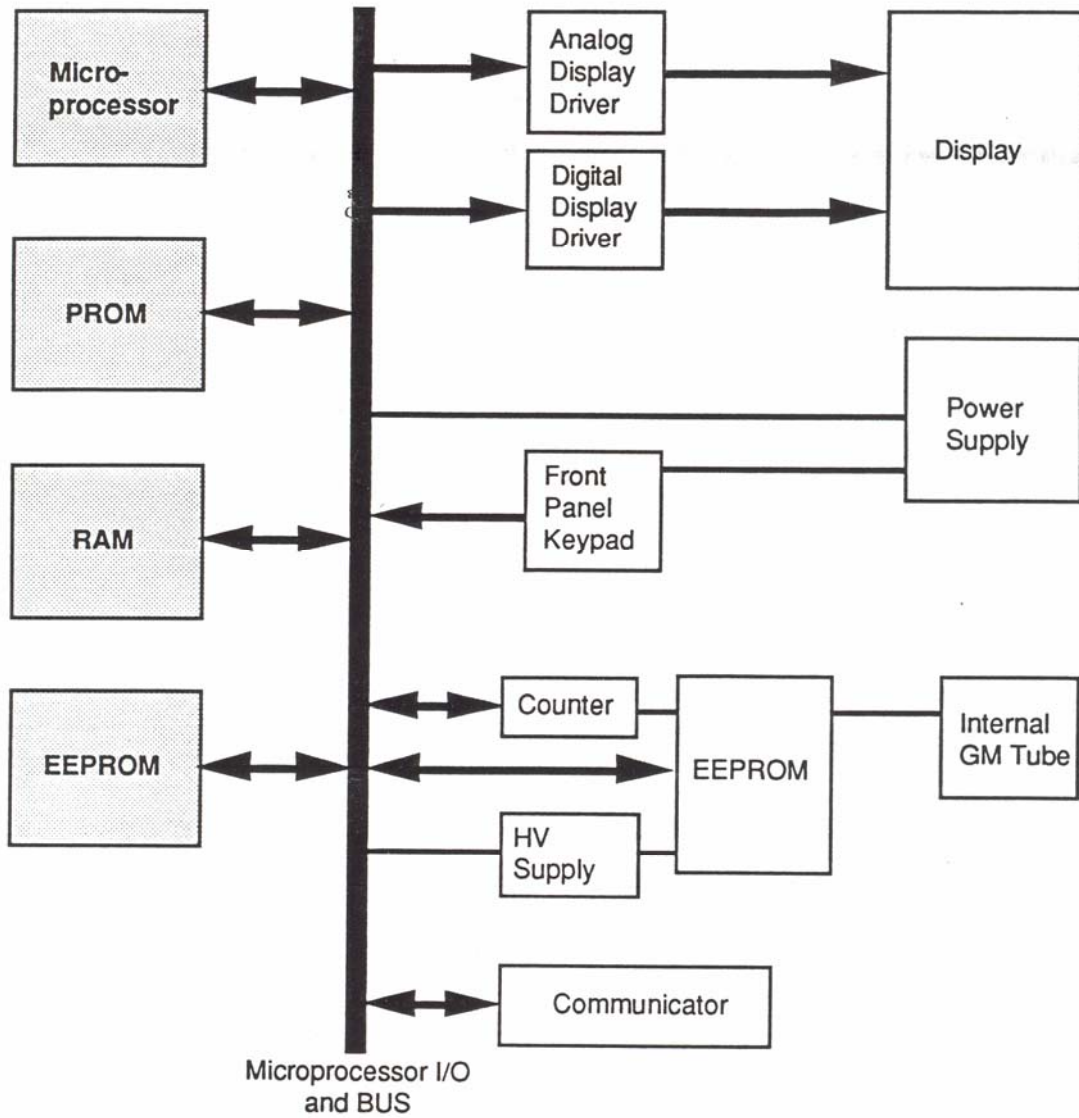


Figure 3-1.1901 Block Diagram

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 190I 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 down-scaling. Any reading above the current full scale will cause a range change to the next higher scale.

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Section 4

Maintenance, Troubleshooting, and Calibration

WARNING



An electrical shock hazard exists between the high voltage supply and ground.

4.1 Maintenance and Troubleshooting

It is recommended that the following maintenance and troubleshooting procedures for the 190I:

NOTE

Section 4.2 lists recommended spare parts. Schematics, assembly drawings, and complete parts lists are provided in the Appendix A.

1. Battery replacement as outlined in Section 1.5, Battery Installation/Replacement, 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, contact Fluke Biomedical 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 Section 4.2 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 1 for replacement procedures.
4. If the problem cannot be isolated or corrected using the above procedures, contact Fluke Biomedical for further instructions.

4.2 Recommended Spare Parts

<u>Part Number</u>	<u>Description</u>
190080	Case
190010	Main Circuit Board Assembly
190021	Case Top
190026	Display Window Decal
190027	Membrane Switch Decal
190033	Battery Plate
91-11-1	¼ Turn Fastener (2)
190031	Case Bottom
190023	Battery Cover
190035	Battery Cover Gasket
46-114	O-Ring
5-7111	Flat Washer (5)
149036	Transducer Screen
67-115	Connector
190015	Keypad Assembly
5-1154	Phillips Screw (5)
5-1153	Phillips Screw
5-1151	Case Screw (8)
5-1152	Screw (2)
16-48	Battery Strap (4)
91-11-2	Retainer for ¼ Turn Fastener (2)
31-82	Housing
36-110	Terminal

4.3 Calibration

Calibration data is stored in the instrument EEPROM. If required, calibration data 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.

Appendix A

Applicable Drawings and Bill of Materials

A.1 Applicable Drawings

<u>Part Number</u>	<u>Description</u>
190013	190I Schematic
191005	190I Assembly
191010	Main Circuit Board Assembly

A.2 Applicable Bill of Materials

<u>Document Number</u>	<u>Description</u>
191005	190I Assembly
191010	Main Circuit Board Assembly

**Fluke Biomedical
Radiation Management Services**

6045 Cochran Road
Cleveland, Ohio 44139
440.498.2564

www.flukebiomedical.com/rms