INSTRUCTION MANUAL

MODEL 6030/6025

LOW LEVEL AREA MONITOR

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Version 1

Health Physics Instruments

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Fuse at ½ A Slo Blow 5 x 20 mm

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I. INTRODUCTION

The Model 6030/6025 Area Monitor is designed to measure low levels of gamma and neutron radiation. It has several alarms and trip points that are user set. The front panel display shows the radiation level and the status of the instrument. The detector is model number 6030 and the display/readout is model number 6025.

II. OPERATION

The operation of the 6030/6025 is very simple. The first line of the display shows the radiation level from the detector. It is updated every second. The second line shows the integrated dose and is updated every second. The lights on the front panel also show the status of the alarms. The front panel controls reset the integrated dose, set the alarm levels, and change the operational parameters.

When the instrument is first turned on there is a wait until the instrument stabilizes. The number of seconds remaining until normal operation begins is shown on the display along with the version number of the software. The detector may take longer than the wait period to completely stabilize to background levels, however this should not effect the alarms because the level is close to background.

III. INSTALLATION

The 6030/6025 is easily installed. It consists of 2 parts, the detector unit (6030) and the display or readout unit (6025). There is a single 4 wire connection between the two and a short cable is supplied with the instrument.

The detector and display can be remoted up to 100 feet. If you wish to use a longer cable you will need to assemble your own cable. The connectors at each end of the cable are crimp type that can be easily assembled in the field. We recommend Belden 8723 cable. This is a 2 pair shielded cable. For short distances any 4 conductor cable will work. For longer distances or if it is used in a noisy environment we recommend a shielded cable. The connectors are wired the same on both ends of the cable.

After setting up the instrument, review the section on ALARMS to know how to change the alarm configurations, on SETUP to know how to change the alarm and zero settings, and on FRONT PANEL to know how to operate the controls on the front panel.

DETECTOR

The detector is installed by first fixing the detector mounting bracket. The detector unit may be mounted in any orientation. It is best if the side of the detector faces the radiation source. The detector sets into the mounting bracket and is held in place with the two thumbscrews. Plug one end of the cable into the circular connector on top of the detector.

DISPLAY

Plug the cable from the detector into the smaller circular connector on the back of the unit. Plug the power cable into the back of the unit and the other end into the wall (110 VAC 60 Hz). Turn the instrument on using the on-off switch on the back panel of the display. The display should turn on and show the warm-up time counting down.

DETECTOR AND DISPLAY CONNECTIONS

Small circular connector on the back of the display and on the top of the detector.

PIN #	DESCRIPTION	WIRE COLOR To Display
1	DATA	WHITE
2	DATA	GREEN
8	+12 VDC	RED
9	GROUND	BLACK AND SHIELD

I/O CONNECTIONS

Large circular connector on the back of the display.

PIN #	DESCRIPTION
1	RELAY N.C. (opens on alarm and power off)
2	RELAY COMMON
3	RELAY N.O. (closes on alarm and power off)
4	EXTERNAL RESET SWITCH
8	TXD FOR RS232
9	RXD FOR RS232 (Not used)
10	GROUND FOR RS232
13	+12 VOLTS (not used)
14	GROUND for External Reset Switch

CONNECTOR PART NUMBERS

This table lists the connectors that mate with the connectors in the 6030/6025. All are plastic and made by AMP.

PART	SMALL CIRCULAR CONNECTOR	LARGE CIRCULAR CONNECTOR
CONNECTOR PLUG	AMP 20678081 13-9 std	AMP 206044 17-14 rev
CABLE CLAMP	AMP 206966-1	AMP 206070-1
CONTACTS	AMP 661094 (socket)	661074 (pin)

INTERFERENCE

Interference can cause annoying false alarms. The most likely cause of interference is from noisy AC switches and lamp dimmers. Plugging the offending product into a line filter can often eliminate the interference.

CONTACT CLOSURE FOR EXTERNAL ALARM

The contact closure from the internal relay is on pins 1,2 and 3 of the large circular connector on the rear of the display. Normally an external alarm would be connected between pin 2 and 3. This alarm operates in the fail-safe mode. If you were to remove power to the display, the relay would open closing contacts on pin 2 and 3. If you are using this relay in a interlock system, connect it between pin 1 and 2. Contacts rated 0.5 A 115 VAC, 1 A 24 VDC resistive.

RS232

An RS232 output is available between pin 9 (TXD) and pin 10 (ground) of the large circular connector on the rear of the display. The RXD (pin 8) is not supported with this software.

EXTERNAL INTEGRATOR RESET BUTTON

If you want an external reset button for the integrate range, connect a N.O. switch between pin 4 and 14 on the large circular connector on the back of the display. Push the button when you want to reset the integrated dose. You should hold the button down for 1 second to assure that the integrate range is reset. To test this connection see Maintenance Mode.

IV. FRONT PANEL

The front panel of the display contains the LCD display, the alarm LEDs, the beeper, and the four pushbuttons.

The LCD shows the radiation level on the top line and the integrated dose on the bottom line. There is a dot on the right hand side of the display that flashes every second to show that the instrument is functioning. There is no overrange indication. The maximum level is shown on the calibration report.

There are 4 LED lights along the bottom of the front panel. Their action and colors are from left: unused, red-alarm1, yellow-alarm2, and green-no alarms and no fail. The factory settings use the red LED for the alarm, the yellow LED for a warning and the green LED to indicate that all is OK.

The 4 pushbuttons control the setting of the alarms, the fail and turn on delays, and resetting the integrated dose. Pushing the MENU button will cycle through the two possible settings. The first display allows resetting the integrated dose and the second allows setting the alarm levels and other alarm and operational parameters.

To reset the dose, push MENU until the display shows “Integrated Dose?” Then push both YES buttons at the same time. The settings menu works the same way. Push MENU until the display shows “SETTINGS?” Then push both YES buttons at the same time. See the section on ALARMS and SETTINGS for more information.

V. ALARMS

There are 4 alarms built into the instrument. All are based on the radiation level and all are adjustable both for the level and for their control over the indicators and relays. The only thing that is not adjustable is their priority.

Alarm 1, 2, and 3 all trip if the count level exceeds the alarm setting. The Fail alarm occurs if there are no counts from the detector for a preset time. Each alarm has different settings, and each alarm is designed to look at a different part of the level. Each alarm may be individually turned off if it is not needed by setting the trip level to 0. Alarm 1, 2, and 3 all have several settings associated with them. The different parts of the settings are:

1. TRIP SET This is the alarm level. This setting is a number that is compared with the level from the detector.

2. DELAY This is the number of intervals that the alarm must be consecutively activated to actually trip the alarms.

3. PAUSE This is the number of seconds after the level has decreased below the trip set that the alarm will remain activated. It is used to keep the alarm on longer than one second. It is usually set around 10 seconds.

ALARM ACTIVATION

Alarms 1, 2, and 3 work in the following manner. When the level rises above the tripset, the delay counts down every interval period from its preprogrammed level. When it reaches zero it turns the alarm on. Until the alarms are activated if the level decreases below the tripset, the delay will reset to its preprogrammed level. This helps to keep noise from tripping the alarm. The pause works like the delay in that it too counts down every second from its preprogrammed level once the level drops below the tripset. When it reaches zero the alarms will be deactivated for that alarm. If other alarms are still activated they will continue to be activate. If during the pause period the level rises above the tripset again, even for one interval, the pause will be reset to the preprogrammed level. Thus once activated the alarms will stay on for at least the pause period following the last occurrence of a trip. This helps to keep the alarms from cycling on and off in a marginal situation.

ALARM 1

This alarm has the highest priority. It trips if the level rises above the tripset. It is usually setup to trip the front panel RED LED and to activate the relay and beeper. When tripped it will show ALARM 1 on the second line of the CHECK DISPLAY. It is usually set with the highest alarm level, a short delay and a 10 second pause.

ALARM 2

This alarm is identical to alarm 1 except it has the second highest priority. It is usually setup to trip the front panel YELLOW LED and to not activate the relay and beeper. It is used with a short delay and a 10 second pause. When tripped it will show ALARM 2 on the second line of the check display.

ALARM 3

This alarm has the third highest priority. It is usually not activated but can be used for any additional configuration. For example, it could be set to a very low level with a long delay to look for slowly changing levels. When tripped it will show ALARM 3 on the second line of the CHECK DISPLAY.

FAIL

This alarm is used to indicate that the detector is not functioning. It turns off the alarms and indicators and shows FAILURE in the display. It will not activate the relay because there is no known hazard. This alarm will activate if there are no counts from the detector for a number of seconds. The number of seconds is the only setting. When tripped it will show FAIL on the second line of the CHECK DISPLAY.

PRIORITY

The following table shows the priority of the alarms. Alarm 1 has the highest priority which means it will supersede the lower priority alarms. Fail has the lowest priority because if the instrument fails, it obviously has no counts and cannot set the other alarms.

Alarm 1 Highest Priority
Alarm 2
Alarm 3
Fail Lowest Priority

NO ALARM

The NO ALARM condition is usually used with the GREEN LED turned on, the relay and beeper turned off and the display showing OK on the second line of the CHECK DISPLAY.

FACTORY SETTINGS

The following table lists the factory settings for the alarms.

ALARM	USE	DELAY	PAUSE	RED LED	YELLOW LED	GREEN LED	RELAY	BEEPER
1	High Levels	0	10	ON	OFF	OFF	ON	ON
2	Warning	0	10	OFF	ON	OFF	OFF	OFF
3	Not used							
FAIL	Detector Failure	N/a	N/a	OFF	OFF	OFF	OFF	OFF
Normal	No Trip	N/a	N/a	OFF	OFF	ON	OFF	OFF

CHECK DISPLAY OR VIEWING THE ALARM CONDITIONS

The CHECK DISPLAY shows the pause and trip status on the 2nd line of the LCD during normal operation by pushing the right hand push-button. When the push-button is down, the status of the three alarms will be displayed on the LCD.

When both right hand buttons are pushed at the same time, then the display changes to three groups of characters/digits. Each represents an alarm and are in the following order from left to right: alarm 1, alarm 2, alarm 3 and the fail time. If an alarm is off its values will be displayed as *--.

The first character of each group is an '*' if the alarm is not tripped and a 'T' if the alarm is tripped. The next number is a 2 digit hex number of either the delay or the pause. If the alarm is not tripped then it is the delay. If the alarm is tripped then it is the pause.

This example will use alarm 1. Assume that the delay is set to 5 and the pause is set to 8. Normally, with no trip it would read '*05'. The '*' indicates it is not tripped and the '05' is the delay. If the level was brought higher than the tripset then the delay would start to count down every interval period until it reached zero. This shows the delay period. If the level were to decrease below the trip set during the time it was counting down, then the delay would revert back to its level which is 5. When the delay reaches zero, the indicator will change from a '*' to a 'T' to indicate it has been tripped, and the alarms will be set. The display will then show 'T8' and will continue to show 'T8' until the level is brought down below the tripset. When the level is brought below the tripset, the pause will start counting down, decreasing by 1 every second. When it reaches zero, the 'T' will change back to a '*' and the alarms will be set to the no alarm condition.

The fail time is a hex value of the seconds remaining before the fail mode will be activated. It will start counting down if there is a failure. When it reaches zero it sets the alarms to the fail setting.

VI. SETUP

The instrument has been setup with its preset values. These values are programmed into the EEPROM (changeable permanent memory). They can be changed by the user. This section shows how to change these presets. APPENDIX I contains blank forms for recording your settings. We recommend that you copy this page and use it to figure out your changes.

The setup mode is different from the normal operation of the instrument. To enter into the setup mode first push MENU twice then the two YES buttons at the same time. ***NOTE:*** To exit this mode, keep pushing the MENU button until you have cycled through all of the choices.

The buttons on the control panel will do the following:

MENU (left hand button) will bring up the next item to adjust. Repeatedly pushing the MENU button will cycle through all the adjustments.

RESET (left of center button) is not used.

UP(right of center button) will move the arrow on the bottom line from one digit to the next. Every time it is pushed the arrow will move left to the next digit. When it gets to the last digit it will jump to the first digit.

DOWN (far right hand button) will increment the digit that the arrow points to. Every time the button is pushed the digit will increase.

It only takes a few seconds of playing with the buttons to understand how they function.

Some adjustments have 3 digits and some have 4. The adjustments with 3 digits have a maximum setting of 255. If they are set above 255 they will actually be set to 255. The bottom line of the display reminds you that they have a maximum value of 255. The four digit adjustments have no restrictions, they can be adjusted from 00.00 to 99.99.

Repeatedly pushing the MENU button will cycle the display through all of the adjustments. After the last adjustment the program will go back to normal operation. Most of the settings are saved in EEPROM after the last item which is the fail-safe time, consequently if you are part way through changing the settings and decide you don't want the new values you can turn power off then back on or if the top cover is removed push the reset button (S1) which is under the ribbon cable to the display.

The following is a list of the parameters in the order that they are seen on the display along with the factory presets. The letters A1, A2 etc. refer to alarm 1, alarm 2 etc. DELAY A2 is the delay value for alarm 2.

Presets @255	
ZERO	60
TRIPSET 1	1.00
TRIPSET A2	0.80
TRIPSET A3	0
DELAY A1	1
DELAY A2	1
DELAY A3	10
PAUSE A1	10
PAUSE A2	10
PAUSE A3	10
Alm Setup A1	137
Alm Setup A2	137
Alm Setup A3	4
No alm Setup	2
Start Time	255
Fail Time	100

Please read the section on the alarms to become familiar with the action of the alarms. All of the parameters are reviewed below. You must cycle through all of the parameters to get back to a normal display.

PRESET

Set this value to 255 if you want all of the adjustments to be reset to their factory preset values. If you do not want the factory preset settings, then push MENU again to go to the next item.

ZERO

This is the value that is subtracted from the reading from the detector. The level in the detector is elevated above zero. See the calibration section.

TRIPSET

This is the alarm level. This setting is a 4 digit number that is compared with the reading from the detector.

DELAY

This is the number of intervals that the alarm must be consecutively activated to actually trip the alarms.

PAUSE

This is the number of seconds after the level has decreased below the trip set that the alarm will remain activated. It is used to keep the alarm on longer than one interval. It is usually set around 10 seconds. It can be set longer but it usually is determined by how long the beeper (or external alarm) needs to be on to arouse someone that there is a problem.

ALM SETUP (ALARM SETUP)

This is a number that is used to set the condition of the alarms, indicators and external outputs. There are 4 setups, one for each of the three alarms and one for no alarms. Below is a description of the alarms, indicators and external outputs. Each can be set to only two values, 0 or 1. Following the descriptions is the method used to calculate the values and to determine the decimal value.

RELAY

This controls the relay. The contacts of the relay are brought out to the large circular connector. When the relay is set to 0, the relay is closed. When the relay is 1, the relay is open. The relay is operated in the fail-safe mode (OFF actually energizes the relay). The signal to control the relay is also routed to pin 8 on P4 on the main circuit board in the display.

P4:5

This is pin 5 on plug P4 which is located on the main circuit board in the display. When the relay is set to 1 then this pin is high. This pin has no normal function and is not used in normal operation of the monitor.

P4:6

This is pin 6 on plug P4 which is located on the main circuit board in the display. When P4:6 is set to 1 then this pin is high. This pin has no normal function and is not used in normal operation of the monitor.

P4:7

This is pin 7 on plug P4 which is located on the main circuit board in the display. When P4:7 is set to 1 then this pin is high. This pin has no normal function and is not used in normal operation of the monitor.

P4:8

This is pin 8 on plug P4 which is located on the main circuit board in the display. When P4:7 is set to 1 then this pin is high. This pin has no normal function and is not used in normal operation of the monitor.

RED LED

This is the front panel red LED. If the RED LED is set to 1 then the LED is on.

YELLOW LED

This is the front panel yellow LED. If the YELLOW LED is set to 1 then the LED is on.

GREEN LED

This is the front panel green LED. If the GREEN LED is set to 1 then the LED is on.

BUZZER

This is the front panel buzzer. If BUZZER is set to 1 then the buzzer is turned on and emits a loud continuous beep.

DECIMAL

The following table is a compilation of the settings of all the parts of the alarm setup. The value is a decimal value that is calculated from the results of the table. The line of one's and zero's on a row is actually a binary number. This number is converted to decimal and that is the decimal number. For example the first line of the table below shows:

alarm * * * 0 11 0 0

If you change the * to zeros it becomes the number 00001100. This is a binary number. To find its decimal equivalent, look at the binary to decimal conversion table in the appendix. Look at the first binary column from the left and about 13 numbers down. You should find the number 00001100. Next to it is the number 12. This is the decimal conversion. 0001100 in binary is 12 in decimal. This decimal number is the number you enter into the alarm setup.

The following is a table that shows the normal operation of the instrument as it is setup using the factory presets.

	P4:8	P4:7	P4:6	RELAY and P4:5	BEEPER	RED LED	YELLOW LED	GREEN LET	DECIMAL VALUE
Alarm 1	*	*	*	0	1	1	0	0	12
Alarm 2	*	*	*	1	0	0	1	0	18
Alarm 3	*	*	*	1	0	0	0	0	16
No Alarm	*	*	*	1	0	0	0	1	17
FAIL	0	0	0	1	0	0	0	0	16

- *Setting does not matter for normal operation. We suggest each of these be set to 0.

The decimal calculations assume that the items marked * are set to 0.
FAIL is only show for information purposes, it is not changeable.

START TIME

When the instrument is turned on it waits before going into normal operation. This gives time for the instrument to stabilize. The display shows the seconds counting down until normal operation. The start time is the starting number for the countdown. It can also be thought of as the start delay. If it is set to a low number the detector may not stabilize in time causing the alarms to trip.

FAIL TIME

If the display does not receive a signal from the detector it will show a failure in the display. The fail time is the number of seconds after the last signal before the instrument will activate the failure mode. If the fail time is set to 60 seconds, it will take 60 seconds after the detector fails before the instrument will display FAILURE. The factory setting is 30. The detector should send a signal representing 0.01 mR/h at least every second if it is operating normally.

TURNING THE ALARMS OFF

Each of the alarms can be turned off. To turn off alarm 1, 2 or 3, set the tripset to zero.

VII. RS232 SERIAL OUTPUT

The serial output only sends RS232 data. It does not receive data.

SIGNON MESSAGE

At turn-on the instrument sends a signon message then a packet of data. The message is:

```
HPI 6030 VER 1.0
000064 000050 000000 00 00 00 00 00 00
```

The version number of the software is shown on the first line.

The data on the second line from left to right:

1 XXXXXX 3 hex digits Alarm trip level for alarm 1
space
2 XXXXXX 3 hex digits Alarm trip level for alarm 2
space
3 XXXXXX 3 hex digits Alarm trip level for alarm 3
space
4 XX XX 2 hex digits separated by a space. The first is the delay. The second is the pause. Both are for alarm 1.
space
5 XX XX 2 hex digits separated by a space. The first is the delay. The second is the pause. Both are for alarm 2
space
6 XX XX 2 hex digits separated by a space. The first is the delay. The second is the pause. Both are for alarm 3

SERIAL STREAM

Every second the display sends out a packet of data via the RS232 serial output. The packet is the data at the time it was sent and should look like:

000001 0000000000 00

the data from left to right is:

1 XXXXXX 3 hex digits Counts per second from detector. The same value as on the display. When converted to decimal add decimal point 2 digits from the right: X.XX mR/h.

2 XXXXXXXXXX 5 hex digits integrated dose. When converted to decimal add decimal point 2 digits from the right: X.XX mR.

3 XX 1 hex digit This is the status byte. See below for a description.

STATUS BYTE

The status byte consists of 8 bits. The bits are represented as follows: Bit 0 is the LSB and bit 7 is the MSB. Only bits 0 thru 4 are used. Use the lookup table in the appendix to change from hex to binary.

BIT FUNCTION

0 0=no trip, 1=trip for alarm 1
1 0=no trip, 1=trip for alarm 2
2 0=no trip, 1=trip for alarm 3
3 0=no fail, 1=fail

VIII. CALIBRATION

The instrument has three adjustments for calibration, two are for the zero and the other is the calibration adjust.

ZERO ADJUSTMENT

The detector is biased above zero, i.e. when it is exposed to no radiation it still sends a signal to the display. The display digitally subtracts a zero offset value from this level. This is the value that is shown on the LCD. It is possible to show the level without the zero offset subtracted from the reading by pushing the right hand button and holding it down. The level on the top line is the level without the zero subtracted. The right hand number on the bottom line is the zero offset value. It can be changed through the setup menu. The factory setting is 0.60 mR/h.

There are two ways to approach the zero adjustment. The first is to adjust the zero offset in the SETUP menu to the factory setting of 0.60 mR/h then adjust the zero trimmer in the detector until the normal display shows a value above zero, then to slowly back it off to zero. The second is to leave the zero adjustment in the detector where it is and adjust the zero offset in the display until the display shows zero. There is some noise on the signal and either adjustment is made to just eliminate any reading when the detector is not exposed to any radiation. It is a good idea to monitor the zero for a few minutes to make sure it is correct.

We recommend a combination of the two. First set the zero offset in the display to 0.60 mR/h. Then adjust the zero trimmer in the detector until the display just reads zero most of the time. Then use the zero offset as a fine adjustment if you need to. The zero offset in the display should be set somewhere from 0.30 to 0.80 mR/h. If it is set too low then the fail may not work properly. If it is set too high then the reading may drift. Remember that if the instrument is reset to the factory settings then the zero offset will be set to 0.60 mR/h.

You can check the zero adjustment by integrating for several hours in the Maintenance Mode. The integrated dose (mR) will show you where the zero is set because Maintenance Mode removes the zero offset from both the rate and integrate ranges. It is always best to let the instrument sit for several hours before adjusting the zero.

CALIBRATION PROCEDURE

Figure 1 shows the locations of the adjustments on the circuit board in the detector housing.

1. Connect the display to the detector and turn the instrument on. Wait for the stabilization period to end.

2. Check and adjust zero by adjusting either the zero in the detector or the zero offset in the display or both. See the ZERO ADJUSTMENT section above.

3. Expose the detector to a known quantity of radiation. Adjust the calibration adjust in the detector until the reading in the CHECK DISPLAY is the correct value.

4. Check zero and readjust if necessary. Alternate between step 2 and 3 until both zero and the calibration are correct.

5. Check at least 1 point on every decade. (1, 10, 100 mR/h)

6. Continue to expose the detector to higher and higher levels until the display reaches a maximum, usually from 100 to 300 mR/h. Note this maximum level on the calibration report.

7. The integrate range should be checked. Do not exceed the maximum dose rate. There are 2 ways to check this range. The first is to turn time the source and the second is to time the exposure after the instrument is reading the correct rate. For the first method of timing the source, wait for the exposure rate to drop to zero before starting the exposure (and timer). After the timer has timed out and exposure stopped, wait for the exposure rate on the display to return to 0 before taking the exposure numbers from the display. You want the ramp up and down.

For the second method, expose the instrument to the calibrated rate and wait for the rate display to stabilize. Reset the integrated dose and start your timer. When the time is up, read the dose on the fly.

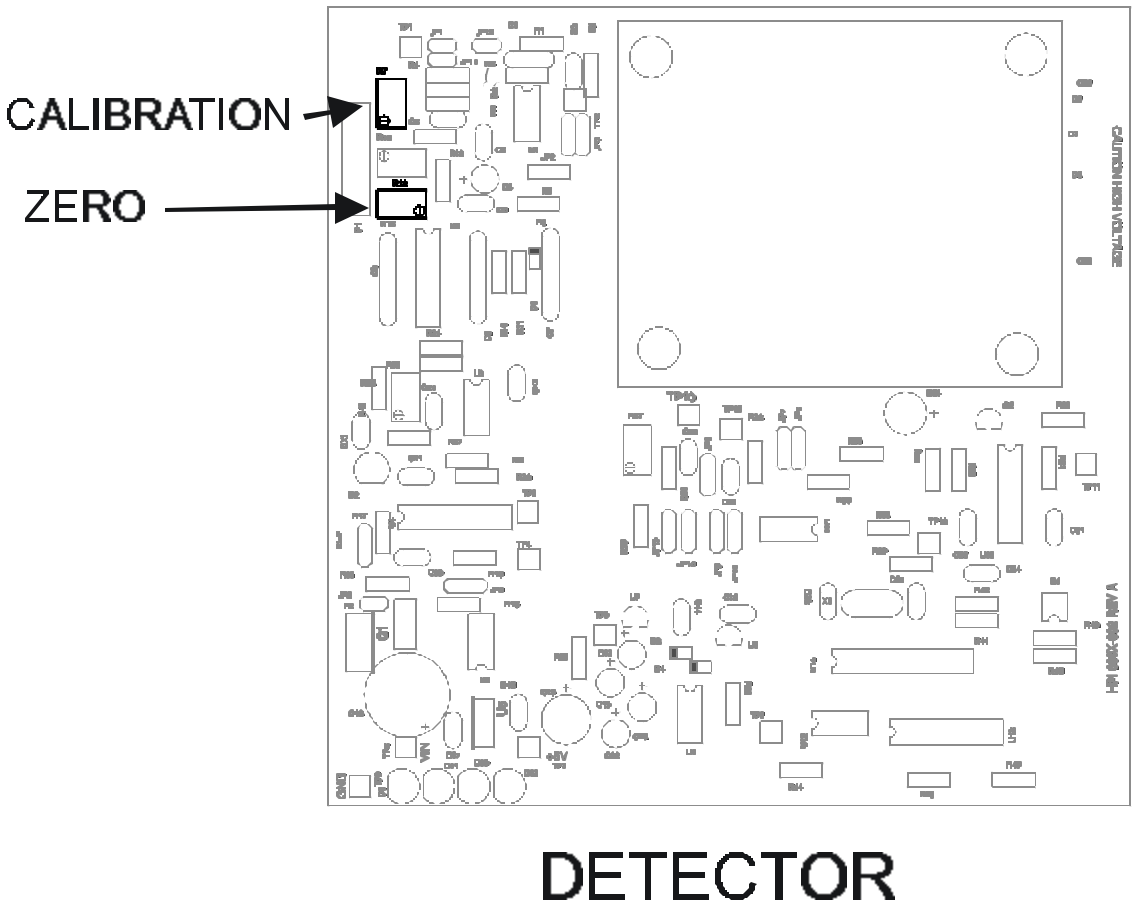


Figure 1 Calibration And Zero Adjustment Locations

IX. MAINTENANCE

This section discusses the circuit of the instrument and any adjustments that may be needed. It also describes a test mode for checking out the instrument.

SHORTCUTS & OPERATIONAL HINTS

The 6030/25 has several shortcuts.

Push the RESET button on the front panel of the display during the warm-up period to cancel the warm-up period.

Pushing the right hand button during normal operation to see the status and to see the zero offset.

Pushing the two right hand buttons together during normal operation to show the status of the alarms and fail.

Push the RESET button on the control panel during normal operation to cancel the local buzzer.

Push the DOWN BUTTON and keeping it on during power up will enter the maintenance mode.

If you have the complete cover off of the display, the reset button (S1) on the top of the circuit board can be used to abort the setup routine. Just push it while in the setup routine. You can also abort the setup routine by turning off the power.

If you are testing the alarms and the noise is too loud, put a piece of tape over the beeper. It will not make it quiet but it will reduce the volume.

ZERO DRIFT

If you notice the zero drifting change the zero offset in the SETUP Menu to compensate. Remember you want the reading on the display to read zero most of the time if there is only background radiation. You can see where the zero is by looking at the CHECK DISPLAY. It is best to let the instrument warm up for a day or so before adjusting zero.

FUSE

The fuse is located in the socket for the line cord. Remove the line cord and pry out the fuse holder. Replace the fuse with a 5 x 20 mm fuse rated at ½ A slow blow. Fast-acting will also work in an emergency however we have found that they occasionally blow because of the type of load.

LCD CONTRAST

The LCD contrast is on the large circuit board in the display. Remove the top cover and turn R2 to adjust the contrast. It is located under the ribbon cable that goes to the LCD display .

DESICCANT

The desiccant is inside the electrometer housing in the detector box. It only needs to be replaced if the zero is excessively high or erratic.

FAILURE 1

If the display should show FAILURE 1 this indicates that the eeprom is defective and that all of the settings including the alarm levels and zero offset may be corrupted. You can try to re-program the eeprom to the factory settings by pushing MENU. This will change the display to the setup menu. Then try setting the preset settings. If it still shows FAILURE 1 then replace the eeprom and repeat with the factory settings.

ADJUSTMENTS

The zero and gain adjustments for the detector are covered in the calibration section.

HIGH VOLTAGE ON DETECTOR CIRCUIT BOARD

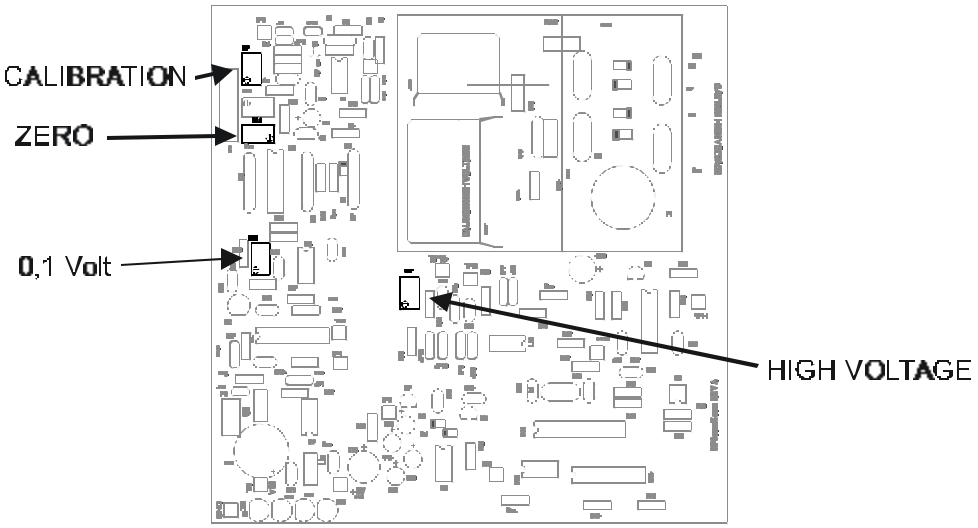
The high voltage for the detector is adjusted on the circuit board with R37 to –800 volts. Use a high impedance voltmeter (>10E12 ohm) to measure the voltage at the junction of C27 and R30.

NEGATIVE VOLTAGE ON DETECTOR CIRCUIT BOARD

The negative voltage for the preamp electrometer is adjusted to 0.1 volt. Place a voltmeter between ground and pin 6 of U9. Adjust R26 until the voltage is 0.1 volt.

POWER SUPPLY READJUSTMENT

The 12 VDC 110/220 Volt power supply located under the circuit board in the display is readjusted for an output of 11 volts. This reduces the power dissipation of the regulators on the display and detector boards.



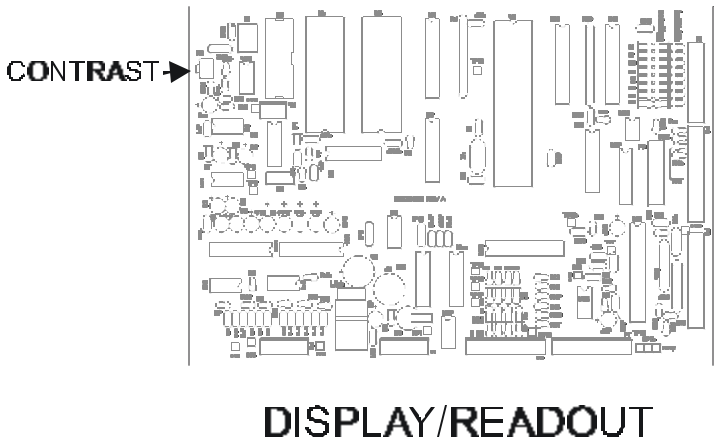


Figure 2 Adjustment Locations

MAINTENANCE MODE

This is a special display that allows you to monitor the rate, integrate, maximum and minimum level of the detector.

Use this mode to check the zero reading from the display. You can enter this mode and let it sit for a day or two to check both the maximum and minimum level. This shows if there is excessive noise in the display. The integrated dose can also show if the average is too high. Remember to mentally subtract the zero offset from the readings, both rate and integrate.

To enter into Maintenance Mode, hold down the DOWN button while you turn on the display.

The display shows the radiation level on the top line of the LCD followed by the maximum level since reset. The bottom line shows the integrated dose followed by the minimum level since reset. The radiation level, and minimum and maximum levels all read in mR/h. The integrated dose is in mR.

All levels are actual levels without the zero offset subtracted from the readings.

When the external integrate reset button is pushed, the lower right hand digit will change to a * .

Pushing RESET will reset the minimum and maximum levels.

Pushing the UP button will activate the relay.

Pushing the MENU button will cycle through the alarms and annunciators.

TESTING DISPLAY

The display alarms and annunciators can be tested by pushing down the MENU button on the front panel. When it is held down the instrument will cycle through 10 different annunciators in the following

order:

Green LED
Yellow LED
Red LED
Front panel buzzer
Relay and P4:5
All off
P4:6
P4:7
P4:8
All lights on

The cycle will then repeat as long as the MENU button is held down. (P4 is not available except on the circuit board.)

X. CIRCUIT DESCRIPTION

GENERAL

The detector sends a frequency to the display that depends on the radiation level. The frequency can vary from 0 to about 20,000 Hz. Each Hz represents 0.01 mR/h. The zero of the electrometer is also biased up from absolute zero. Thus with no radiation the detector has a signal of 0.60 mR/h. A frequency of 360 Hz from the detector is thus displayed as 3.00 mR/h; 360 is 3.60 mR/h and subtract the zero offset of .60 results in 3.00. The signal between the detector and the display is based on a RS485 driver and is a complimentary signal, i.e. both signal lines change state.

DETECTOR

The detector measures a small amount of current from the ion chamber and creates a frequency output. The detector needs a high voltage supply to function properly.

The detector V1 is a 3 liter three terminal ion chamber. Ionizing radiation produces ion pairs inside the detector that are collected on the center signal portion of the detector. This current is integrated onto U101, an electrometer amplifier with a high value feedback resistor (R101). The negative ion chamber current makes the output of the electrometer move positive. The input filter C104 and R 103 smooth any peak transients from pulsed radiation.

The output of the electrometer goes from 0 volt to 4 volts. U1 acts as a buffer amplifier and it buffers the voltage to frequency converter U2. The output of U2 goes to U4:A which is a pulse generator. The pulse from U4:A is sent to the 75176 line driver and then to the cable to the readout.

The high voltage power supply is a switching type generating -800 volts. U10 is an oscillator that feeds the one-shot U10B. The output of this one-shot turns on Q2 creating a pulse in the primary of T1. The secondary of T2 feeds a voltage quadrupler. The high voltage is measured by U11:A which turns the one-shot on and off to regulate the voltage. R48, R30 and C27 and C37 form a filter to remove any ripple from the high voltage. U11:B monitors the high voltage and turns off the output signal if the HV falls too low.

DISPLAY

The display measures the frequency from the detector, subtracts background using software, and sets the alarms and relays according to the settings in memory. It contains the line power supply to power the detector and itself.

The display is controlled by the microprocessor, U3. U1 is an address latch that separates the address and data. U5 is the LCD display. U2 is the EEPROM that stores the variables. U8 is the address decoder for the LCD and for the input latch U19 and the output latch U18. The relay is connected directly to the microprocessor through U9:D and Q1. This is done to make the relay fail-safe. If the microprocessor is reset either by power on or by the watchdog timer U4, then the output pin P33 (~INT) will float high opening the relay. U7 is a space for extra RAM should it be needed.

U12 and U13 are RS232 and RS485 outputs respectively.

U18 is an output latch that feeds the output buffers U16 and U17 this drives the front panel LED's. U19 is an input latch for the pushbuttons and for the external reset switch. U21 is an A/D converter. U24 is a DAC.

The incoming pulses from the detector go to U26 and then to the microprocessor U3 where they are counted.

R1 adjusts the contrast. U4 is a watchdog timer for the MPU and it needs a pulse on P1.0 (clock) at least every second to keep the watchdog from timing out and resetting the microprocessor.

U10 is a 5 volt regulator and U11 generates a negative 5 volts for the LCD.

U20 is an optocoupler that separates the external reset signal from the internal circuit board. It is used to reset the integrator.

MODIFICATIONS

Not all of the parts on the circuit board and schematic are included in this model. They are included for future changes or to allow this circuit board to be used in different ways The detector board has a place for U14, a microprocessor. The designators marked A on the circuit boards are the same as designators marked without an A.

The display has more options. It includes jumpers for RS232 and RS485 inputs and outputs on both the communications lines and the data lines from the detectors. The lines from the detector are designed to accept pulses or serial data from the detector. The watchdog can be disabled by removing JP1. This board also contains an ACD, a DAC, and extra outputs and inputs that are not used. You may want to consult the factory if you need any of these enabled or changed because several are software dependent.

XI. APPENDIX I

USER TABLES

The blank tables below are useful to determine how you want the alarms setup. Copy it and fill it out not only for ease of programming, but also for your records.

DATE_____ SERIAL NUMBER_____ _____

LOCATION _____BY_____

ALARM SETUP

	P4:7	P4:6	P4:5	RELAY	BEEPER	RED LED	YELLOW LED	GREEN LET	DECIMAL VALUE
Alarm 1									1
Alarm 2									2
Alarm 3									3
No Alarm									4

ENTER THE DECIMAL NUMBERS FROM THE DECIMAL VALUE BOXES ABOVE INTO THE SETUP BOXES BELOW

SUMMARY OF SETTINGS

	TRIPSET	DELAY	PAUSE	SETUP
ALARM 1				1
ALARM 2				2
ALARM 3				3
NO ALARM				4

START TIME _____

FAIL TIME _____

.APPENDIX II

DECIMAL/HEX/BINARY
CONVERSION TABLE

DEC	HEX	BINARY
0	00	00000000
1	01	00000001
2	02	00000010
3	03	00000011
4	04	00000100
5	05	00000101
6	06	00000110
7	07	00000111
8	08	00001000
9	09	00001001
10	0A	00001010
11	0B	00001011
12	0C	00001100
13	0D	00001101
14	0E	00001110
15	0F	00001111
16	10	00010000
17	11	00010001
18	12	00010010
19	13	00010011
20	14	00010100
21	15	00010101
22	16	00010110
23	17	00010111
24	18	00011000
25	19	00011001
26	1A	00011010
27	1B	00011011
28	1C	00011100
39	1D	00011101
30	1E	00011110
31	1F	00011111
32	20	00100000
33	21	00100001
34	22	00100010
35	23	00100011
36	24	00100100
37	25	00100101
38	26	00100110
39	27	00100111
40	28	00101000
41	29	00101001
42	2A	00101010
43	2B	00101011
44	2C	00101100
45	2D	00101101
46	2E	00101110
47	2F	00101111
48	30	00110000
49	31	00110001
50	32	00110010
51	33	00110011
52	34	00110100
53	35	00110101
54	36	00110110
55	37	00110111
56	38	00111000
57	39	00111001
58	3A	00111010
59	3B	00111011
60	3C	00111100
61	3D	00111101
62	3E	00111110
63	3F	00111111
64	40	01000000
65	41	01000001
66	42	01000010
67	43	01000011
68	44	01000100
69	45	01000101
70	46	01000110
71	47	01000111
72	48	01001000
73	49	01001001
74	4A	01001010
75	4B	01001011
76	4C	01001100
77	4D	01001101
78	4E	01001110
79	4F	01001111
80	50	01010000
81	51	01010001
82	52	01010010
83	53	01010011
84	54	01010100
85	55	01010101
86	56	01010110
87	57	01010111
88	58	01011000
89	59	01011001
90	5A	01011010
91	5B	01011011
92	5C	01011100
93	5D	01011101
94	5E	01011110
95	5F	01011111
96	60	01100000
97	61	01100001
98	62	01100010
99	63	01100011
100	64	01100100
101	65	01100101
102	66	01100110
103	67	01100111
104	68	01101000
105	69	01101001
106	6A	01101010
107	6B	01101011
108	6C	01101100
109	6D	01101101
110	6E	01101110
111	6F	01101111
112	70	01110000
113	71	01110001
114	72	01110010
115	73	01110011
116	74	01110100
117	75	01110101
118	76	01110110
119	77	01110111
120	78	01111000
121	79	01111001
122	7A	01111010
123	7B	01111011
124	7C	01111100
125	7D	01111101
126	7E	01111110
127	7F	01111111
128	80	10000000
129	81	10000001
130	82	10000010
131	83	10000011
132	84	10000100
133	85	10000101
134	86	10000110
135	87	10000111
136	88	10001000
137	89	10001001
138	8A	10001010
139	8B	10001011
140	8C	10001100
141	8D	10001101
142	8E	10001110
143	8F	10001111
144	90	10010000
145	91	10010001
146	92	10010010
147	93	10010011
148	94	10010100
149	95	10010101
150	96	10010110
151	97	10010111
152	98	10011000
153	99	10011001
154	9A	10011010
155	9B	10011011
156	9C	10011100
157	9D	10011101
158	9E	10011110
159	9F	10011111
160	A0	10100000
161	A1	10100001
162	A2	10100010
163	A3	10100011
164	A4	10100100
165	A5	10100101
166	A6	10100110
167	A7	10100111
168	A8	10101000
169	A9	10101001
170	AA	10101010
171	AB	10101011
172	AC	10101100
173	AD	10101101
174	AE	10101110
175	AF	10101111
176	B0	10110000
177	B1	10110001
178	B2	10110010
179	B3	10110011
180	B4	10110100
181	B5	10110101
182	B6	10110110
183	B7	10110111
184	B8	10111000
185	B9	10111001
186	BA	10111010
187	BB	10111011
188	BC	10111100
189	BD	10111101
190	BE	10111110
191	BF	10111111
192	C0	11000000
193	C1	11000001
194	C2	11000010
195	C3	11000011
196	C4	11000100
197	C5	11000101
198	C6	11000110
199	C7	11000111
200	C8	11001000
201	C9	11001001
202	CA	11001010
203	CB	11001011
204	CC	11001100
205	CD	11001101
206	CE	11001110
207	CF	11001111
208	D0	11010000
209	D1	11010001
210	D2	11010010
211	D3	11010011
212	D4	11010100
213	D5	11010101
214	D6	11010110
215	D7	11010111
216	D8	11011000
217	D9	11011001
218	DA	11011010
219	DB	11011011
220	DC	11011100
221	DD	11011101
222	DE	11011110
223	DF	11011111
224	E0	11100000
225	E1	11100001
226	E2	11100010
227	E3	11100011
228	E4	11100100
229	E5	11100101
230	E6	11100110
231	E7	11100111
232	E8	11101000
233	E9	11101001
234	EA	11101010
235	EB	11101011
236	EC	11101100
237	ED	11101101
238	EE	11101110
239	EF	11101111
240	F0	11110000
241	F1	11110001
242	F2	11110010
243	F3	11110011
244	F4	11110100
245	F5	11110101
246	F6	11110110
247	F7	11110111
248	F8	11111000
249	F9	11111001
250	FA	11111010
251	FB	11111011
252	FC	11111100
253	FD	11111101
254	FE	11111110
255	FF	11111111

XII. Parts List

The designators marked A on the circuti boards are the same as designators marked without an A.

DISPLAY READOUT

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
R1	1		10K	Resistor Network, 1/4W, 5%, CF		SBC3-001 Display
R2	1		20K	Trimmer, 1T		SBC3-001 Display
R3	1		10K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R4	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R5	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R6	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R7	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R8	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R9	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R10	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R11	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R12	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R13	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R14	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R15	0		0 Ohm	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R16	1		0 Ohm	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R17	1		0 Ohm	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R18	1		0 Ohm	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R19	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R20	1		10K	Resistor network, 1/4W, 5%, CF		SBC3-001 Display
R21	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R22	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R23	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R24	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R25	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R26	1		1K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R27	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R28	1		10K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R29	1		510	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R30	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R31	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R32	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R33	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R34	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R35	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R36	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R37	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R38	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R39	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R40	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R41	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R42	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R43	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R44	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R45	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R46	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R47	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R48	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
R49	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R50	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R51	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R52	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R53	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
R54	1		100K	Resistor, 1/4W, 5%, CF		SBC3-001 Display
R55	0			Resistor, 1/4W, 5%, CF		SBC3-001 Display
C1	1		22 pF	Capacitor, mono ceram		SBC3-001 Display
C2	1		22 pF	Capacitor, mono ceram		SBC3-001 Display
C3	1		0.47 uF	Capacitor, mono ceram		SBC3-001 Display
C4	1		470 uF	Capacitor, Electro		SBC3-001 Display
C5	1		33 uF	Capacitor, Tantalum		SBC3-001 Display
C6	0					SBC3-001 Display
C7	0					SBC3-001 Display
C8	1		33 uF	Capacitor, Tantalum		SBC3-001 Display
C9	1		33 uF	Capacitor, Tantalum		SBC3-001 Display
C10	1		1 uF	Capacitor, Tantalum		SBC3-001 Display
C11	1		1 uF	Capacitor, Tantalum		SBC3-001 Display
C12	1		1 uF	Capacitor, Tantalum		SBC3-001 Display
C13	1		1 uF	Capacitor, Tantalum		SBC3-001 Display
C14	0					SBC3-001 Display
C15	0					SBC3-001 Display
C16	0					SBC3-001 Display
C17	0					SBC3-001 Display
C18	0					SBC3-001 Display
C19	0					SBC3-001 Display
C20	0					SBC3-001 Display
C21	0					SBC3-001 Display
C22	0					SBC3-001 Display
C23	0					SBC3-001 Display
C24	0					SBC3-001 Display
C25	0					SBC3-001 Display
C26	0					SBC3-001 Display
C27	0					SBC3-001 Display
C28	0					SBC3-001 Display
CX1	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX2	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX3	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX4	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX5	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX6	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX7	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX8	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX9	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
CX10	1		0.1 uF	Capacitor, mono ceram		SBC3-001 Display
D1	0					SBC3-001 Display
D2	0					SBC3-001 Display
D3	0					SBC3-001 Display
D4	0					SBC3-001 Display
D5	1	1N4148		Diode, fast switching		SBC3-001 Display
D6	1	1N4148		Diode, fast switching		SBC3-001 Display

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
D7	1	1N4148		Diode, fast switching		SBC3-001 Display
D8	1	1N4148		Diode, fast switching		SBC3-001 Display
D9	1	1N4148		Diode, fast switching		SBC3-001 Display
D10	1	1N4148		Diode, fast switching		SBC3-001 Display
D11	1	1N4148		Diode, fast switching		SBC3-001 Display
D12	1	1N4148		Diode, fast switching		SBC3-001 Display
D13	1	1N4148		Diode, fast switching		SBC3-001 Display
D14	1	1N4148		Diode, fast switching		SBC3-001 Display
D15	1	1N4148		Diode, fast switching		SBC3-001 Display
D16	1	1N4148		Diode, fast switching		SBC3-001 Display
D17	1	1N4148		Diode, fast switching		SBC3-001 Display
D18	1	1N4148		Diode, fast switching		SBC3-001 Display
D19	1	1N4148		Diode, fast switching		SBC3-001 Display
D20	1	1N4148		Diode, fast switching		SBC3-001 Display
D21	0					SBC3-001 Display
D22	0					SBC3-001 Display
D23	0					SBC3-001 Display
D24	0					SBC3-001 Display
D25	0					SBC3-001 Display
D26	0					SBC3-001 Display
D27	0					SBC3-001 Display
Q1	1	IRF530		FET, Power, N channel		SBC3-001 Display
U1	1	74HC573		Octal Latch		SBC3-001 Display
U2	1	24C02		EEPROM		SBC3-001 Display
U3	1	80C31BH		8 Bit Microprocessor		SBC3-001 Display
U4	1	MAX813L		Supervisor/Watchdog	Maxim	SBC3-001 Display
U5	1	DMC-16202NY-LY		LCD 2 x 16 Supertwist W/Backlight	Optrex	SBC3-001 Display
U6	1	27C256 W/Program		EPROM		SBC3-001 Display
U7	0					SBC3-001 Display
U8	1	74HC139		Address Latch		SBC3-001 Display
U9	1	74HC00		Quad NAND Gate		SBC3-001 Display
U10	1	LM2940-5.0		Volt Regulator	National Semi	SBC3-001 Display
U11	1	ICL7660		Volt Generator		SBC3-001 Display
U12	1	MAX232		RS232 Driver/PS	Maxim	SBC3-001 Display
U13	0					SBC3-001 Display
U14	0					SBC3-001 Display
U15	0					SBC3-001 Display
U16	1	DS2003		Buffer	National Semi	SBC3-001 Display
U17	0					SBC3-001 Display
U18	1	74HC574		Octal Latch		SBC3-001 Display
U19	1	74HC573		Octal Latch		SBC3-001 Display
U20	1	4N32P		Optocoupler		SBC3-001 Display
U21	0					SBC3-001 Display
U22	0					SBC3-001 Display
U23	0					SBC3-001 Display
U24	0					SBC3-001 Display
U25	0					SBC3-001 Display
U26	1	4013B		Flip Flop		SBC3-001 Display

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
U27	0					SBC3-001 Display
U28	0					SBC3-001 Display
S1	1	EVQ		Switch, Momentary		SBC3-001 Display
K1	1	G5V-1		Relay, SPDT	Omron	SBC3-001 Display
X1	1		7.3728 MHz	Crystal		SBC3-001 Display
X2	0					SBC3-001 Display

DETECTOR VFC BOARD

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
R1	0			Resistor, 1/4W, 5%, CF		6030U-001
R2	0			Resistor, 1/4W, 5%, CF		6030U-001
R3	1		10 Ohm	Resistor, 1/4W, 5%, CF		6030U-001
R4	0			Resistor, 1/4W, 5%, CF		6030U-001
R5	1		10 Ohm	Resistor, 1/4W, 5%, CF		6030U-001
R6	0			Resistor, 1/4W, 5%, CF		6030U-001
R7	1		100K	Trimmer, 20T, Top, 3/8		6030U-001
R8	1		8.06K	Resistor, 1/4W, 1%, MF		6030U-001
R9	0			Resistor, 1/4W, 5%, CF		6030U-001
R10	0			Resistor, 1/4W, 5%, CF		6030U-001
R11	0			Resistor, 1/4W, 5%, CF		6030U-001
R12	0			Resistor, 1/4W, 5%, CF		6030U-001
R13	0			Resistor, 1/4W, 5%, CF		6030U-001
R14	1		8.06K	Resistor, 1/4W, 1%, MF		6030U-001
R15	1		100K	Trimmer, 20T, Top, 3/8		6030U-001
R16				Resistor, 1/4W, 5%, CF		6030U-001
R17	1		10K	Resistor, 1/4W, 5%, CF		6030U-001
R18	1		1.5K	Resistor, 1/4W, 5%, CF		6030U-001
R19	0			Resistor, 1/4W, 5%, CF		6030U-001
R20	0			Resistor, 1/4W, 5%, CF		6030U-001
R21	0			Resistor, 1/4W, 5%, CF		6030U-001
R22	1		2K	Resistor, 1/4W, 5%, CF		6030U-001
R23	1		2K	Resistor, 1/4W, 5%, CF		6030U-001
R24	0			Resistor, 1/4W, 5%, CF		6030U-001
R25	1		10 Ohm	Resistor, 1/4W, 5%, CF		6030U-001
R26	1		100K	Trimmer, 20T, Top, 3/8		6030U-001
R27	1		100K	Resistor, 1/4W, 5%, CF		6030U-001
R28	0			Resistor, 1/4W, 5%, CF		6030U-001
R29	0		100 Ohm	Resistor, 1/4W, 5%, CF		6030U-001
R30	1	MOX300	200M	Resistor, 1/4W, 5%, CF	Victoreen	6030U-001
R31	1		430K	Resistor, 1/4W, 5%, CF		6030U-001
R32	1		2.7K	Resistor, 1/4W, 5%, CF		6030U-001
R33	1		1K	Resistor, 1/4W, 5%, CF		6030U-001
R34	1	MOX300	200M	Resistor, 1/4W, 5%, CF	Victoreen	6030U-001
R35	0			Resistor, 1/4W, 5%, CF		6030U-001
R36	1		499K	Resistor, 1/4W, 1%, MF		6030U-001

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
R37	1		100K	Trimmer, 20T, Top, 3/8		6030U-001
R38	1		51K	Resistor, 1/4W, 5%, CF		6030U-001
R39	1		100K	Resistor, 1/4W, 5%, CF		6030U-001
R40	0			Resistor, 1/4W, 5%, CF		6030U-001
R41	0			Resistor, 1/4W, 5%, CF		6030U-001
R42	0			Resistor, 1/4W, 5%, CF		6030U-001
R43	0			Resistor, 1/4W, 5%, CF		6030U-001
R44	0			Resistor, 1/4W, 5%, CF		6030U-001
R45	0			Resistor, 1/4W, 5%, CF		6030U-001
R46	0			Resistor, 1/4W, 5%, CF		6030U-001
R47	0			Resistor, 1/4W, 5%, CF		6030U-001
R48	1		10M	Resistor, 1/4W, 5%, CF		6030U-001
R49	1		100 Ohm	Resistor, 1/4W, 5%, CF		6030U-001
R50	1		100K	Resistor, 1/4W, 5%, CF		6030U-001
R51	1		100K	Resistor, 1/4W, 5%, CF		6030U-001
C1	0					6030U-001
C2	1		0.1 uF	Capacitor, mono ceram		6030U-001
C3	1		10 uF	Cpacitor, Tantalum		6030U-001
C4	1		0.1 uF	Capacitor, mono ceram		6030U-001
C5	1		0.1 uF	Capacitor, mono ceram		6030U-001
C6	1		0.1 uF	Capacitor, mono ceram		6030U-001
C7	1		0.1 uF	Capacitor, polypropelyne		6030U-001
C8	1		0.022 uF	Capacitor, polypropelyne		6030U-001
C9	1		0.01 uF	Capacitor, polypropelyne		6030U-001
C10	1		0.01 uF	Capacitor, mono ceram		6030U-001
C11	0					6030U-001
C12	0					6030U-001
C13	1		0.1 uF	Capacitor, mono ceram		6030U-001
C14	1		0.1 uF	Capacitor, mono ceram		6030U-001
C15	0					6030U-001
C16	1		1000 uF	Capacitor, Electrolytic		6030U-001
C17	1		0.1 uF	Capacitor, mono ceram		6030U-001
C18	1		0.1 uF	Capacitor, mono ceram		6030U-001
C19	0					6030U-001
C20	1		100 uF	Capacitor, Tantalum		6030U-001
C21	1		0.1 uF	Capacitor, mono ceram		6030U-001
C22	1		100 uF	Capacitor, Tantalum		6030U-001
C23	1		0.022 uF 3kV	Capacitor, Disc Ceram		6030U-001
C24	1		100 uF	Capacitor, Tantalum		6030U-001
C25	1		0.022 uF 3kV	Capacitor, Disc Ceram		6030U-001
C26	1		0.022 uF 3kV	Capacitor, Disc Ceram		6030U-001
C27	1		0.022 uF 1.6kV	Capacitor, Polyproplene		6030U-001
C28	1		0.022 uF 3kV	Capacitor, Disc Ceram		6030U-001
C29	0					6030U-001
C30	1		0.001 uF	Capacitor, mono ceram		6030U-001

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
C31	1		100 pF	Capacitor, mono ceram		6030U-001
C32	0					6030U-001
C33	1		0.1 uF	Capacitor, mono ceram		6030U-001
C34	0					6030U-001
C35	0					6030U-001
C36	0					6030U-001
C37	1		0.05 uF 1.6kV	Capacitor, Polyproplene		6030U-001
						6030U-001
CX1	1		0.1 uF	Capacitor, mono ceram		6030U-001
CX2	1		0.1 uF	Capacitor, mono ceram		6030U-001
						6030U-001
D1	0					6030U-001
D2	0					6030U-001
D3	0					6030U-001
D4	0					6030U-001
D5	1	FR107	1 kV	Rectifier, Fast recovery		6030U-001
D6	1	FR107	1 kV	Rectifier, Fast recovery		6030U-001
D7	1	FR107	1 kV	Rectifier, Fast recovery		6030U-001
D8	1	FR107	1 kV	Rectifier, Fast recovery		6030U-001
D9	0					6030U-001
D10	0					6030U-001
D11	0					6030U-001
D12	0					6030U-001
T1	1	6030-T1		Transformer	HPI	6030U-001
U1	1	TLC271CP		Op Amp		6030U-001
U2	1	VFC121		Volt to Freq Converter	Burr Brown	6030U-001
U3	1	75176		RS485 Line Driver/Rcvr		6030U-001
U4	1	4538		Dual Mono		6030U-001
U5	1	LM2940		Volt Reg		6030U-001
U6	1	LM336-2.5		Volt Reference 2.5 V		6030U-001
U7	1	LM336-2.5		Volt Reference 2.5 V		6030U-001
U8	1	ICL7660		Volt Converter		6030U-001
U9	1	TLC271CP		Op Amp		6030U-001
U10	1	ICL7665		Dual Timer		6030U-001
U11	1	TLC27M2		Dual Op Amp		6030U-001
U12	0					6030U-001
U13	0					6030U-001
U14	0					6030U-001
U15	0					6030U-001

PREAMP ELECTROMETER BOARD

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
R101	1	104	5 x 10E10 Ohm	Hi Meg Resistor	Eltec	6030-006
R102	1		10 Ohm	Resistor, 1/4W, 5%, CF		6030-006
R103	1	MOX300	1000M	Resistor, 1/4W, 5%, CF	Victoreen	6030-006
R104	0					6030-006

R105	0					6030-006
R106	1		10 Ohm	Resistor, 1/4W, 5%, CF		6030-006
R107	1		100.0K	Resistor, 1/4W, 1%, MF		6030-006
R108	0					6030-006
R109	0					6030-006
R110	0					6030-006
C101	1		0.1 uF	Capacitor, Mono Ceram		6030-006
C102	1		100 pF	Capacitor, Polystyrene		6030-006
C103	1		10 uF	Capacitor, Tantalum		6030-006
C104	1		1000 pF	Capacitor, Polystyrene		6030-006
C105	1		0.1 uF	Capacitor, Mono Ceram		6030-006
C106	1		0.1 uF	Capacitor, Mono Ceram		6030-006
C107	1		10 uF	Capacitor, Tantalum		6030-006
U101	1	LMC6041		Op Amp	National Semi	6030-006
U102	0	4052B		SS Switch		6030-006
Q101	0					6030-006

DETECTOR CHASSIS

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
M1	1	6030-M1		Chassis Back Cover		
M2	1	6030-M2		Chassis Suround		
M3	1	6030-M3		Chassis Front Cover		
M4	1	6030-M4		Electrometer Box with Cover		
M5	1	1055-6030		Detector		
M6	1	6030-M6		Detector Mounting		
M7	1	6030-M7		Detector Straps		
M8	1	6030-M8		Electrometer Circuit Board Complete		
M9	1	6030-M9		VFC Circuit Board Complete		
M10	1	6030-M10		Cable Electrometer to VFC		
M11	1	6030-M11		Cable VFC to Circular Chassis		
M12	1	6030-M12		Desiccant		
M13	1	6030-M13		Mounting Bracket		
M14	2	6030-M14		Thumbscrews		

READOUT CHASSIS

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
M1	1	6025-M1		Chassis Back Cover		
M2	1	6025-M2		Chassis Bottom Cover		
M3	1	6025-M3		Chassis Front Cover		
M4	1	6025-M4		Chassis Top Cover		
M5	1	6025-M5		Power Supply w/MOV and Jumpers for 110VAC		
M6	1	6025-M6		SBC3 Large Circuit Board		
M7	1	6025-M7		LCD Display		

DESIGNATOR	QUAN	PART NUMBER	VALUE	DESCRIPTION	MFG	DRAWING NO.
M8	1	6025-M8		Push Button Circuit Board		
M9	1	6025-M9		Buzzer		
M10	1	6025-M10		Line Cord		
M11	1	6025-M11		Line Recepticle w/Fuse Holder		
M12	1	6025-M12		Power Switch		
M13	1	6025-M13		Rear Panel I/O Connector		
RX1	1		100 Ohm	Resistor 5W		
D1	1	6025-M14	Red	LED Annunciator w/Circuit Board		
D2	1	6025-M15	Yellow	LED Annunciator w/Circuit Board		
D3	1	6025-M16	Green	LED Annunciator w/Circuit Board		
Dx blank	1	6025-M17		BLANK LED Annunciator wo/Circuit Board		
M14	1	6025-M18		Wiring Harness w/Connectors		
M15	1	6025-M15		Cable LCD to Display PCB		
M16	1	6025-M16		Cable Push Button to Display PCB		
M17	1	6025-M17		Cable LED Annunciators to Display PCB		
M18	1	6025-M18		Cable 6025 to 6030 6' Long		
F1	1	6025-M19		Fuse 1/2 A 5 x 20 mm		

XIII. SCHEMATICS

The Schematics are on the following pages.