OPERATION MANUAL

MODEL 5000

CYPHER
SURVEY METER

October 1999

Rev A

Health Physics Instruments
330 D South Kellogg Ave.
Goleta, CA 93117

Table of Contents

Specifications

A. Mechanical

Size overall: 7.5 in. (19 cm) L x 4.2 in. (10.7 cm) W x 4.45 in. (11.3 cm) H w/o probe holder. Gasketed splashproof aluminum enclosure. Top panel is milled and anodized with nonerasable nomenclature. Bottom painted. LCD window is acrylic. ***Weight:*** 2.25 lb. (1 kg) with batteries.

External controls: 4 pushbuttons (Power, Mode, *, and Δ) Power button when held down for 5 seconds resets the microprocessor.

Internal controls: 1 push-button for entry into calibrate mode.

Internal construction: Circuit board hinges for easy access. Batteries are mounted on an aluminum panel in nylon holders. ICs are socketed. All components are standard types.

B. Electrical

Detectors: Accepts GM, proportional and scintillation probes.

Display: 2 line x 16 character alphanumeric supertwist LCD with backlight. Backlight may be timed or on/off. Contrast adjustable from front panel.

Audio: Built in piezo beeper at 2.4 kHz. Setable to beep at every 1, 8, 64 or 2048 counts. May be switched to off, soft or loud.

Single Channel Analyzer: may be switched in or out. Threshold, window & gain digitally set from front panel, internally or both. Gain has three settings, Threshold and window 200 settings.

High voltage: Adjustable from 300 to 2000 Volts for GM and proportional detectors. 300 to 1600 Volts for Scintillators with 100 meg voltage divider. Actual measured HV can be displayed on the screen.

Saturation detector: Measures high voltage current and will show off scale on the highest range if saturation is detected. This is software adjustable for each detector.

Batteries: 6 AA cells for 200 hour life. May be adopted for 9 volt batteries. Battery condition displayed at turn on and turn off. Low battery warning during operation. Instrument will automatically turn off when batteries are too low for proper operation. May be set for auto turn off.

Calibration and parameter storage: Data stored in permanent memory for minimum of 40 years. Batteries not required for storage.

C. Operational

Modes: 5 modes available, not all need be used; Rate, Integrate, CPM or CPS, Scaler, and a user defined rate mode. Rate, Integrate, CPM and User mode all have separate calibration. Calibration, setup, and maintenance mode also available. All except User are standard on delivery.

Units: rem, rad, R, Gy, Sv, Bq, dis, cts, CPM, CPS. Time base: /s, /m, /h Prefix: f,p,n,u,m,K,M,G,T and none. One 6 letter user defined unit/timebase that may be set to any 6 alphanumeric characters.

User defined keys: *, and Δ are user defined soft keys for each mode. Power and Mode buttons are also used as soft keys for some functions.

Menu selection: Simple to operate. Single level menus. Mode button will access all normal modes quickly and easily.

Rate mode: Shows numeric value of rate with user selected units and timebase. Updated every second. Prefix automatically selected but may be preprogrammed. Limited to 3 significant digits. Autoranging w/range hold. Bargraph also displayed if desired.

CPM/CPS mode: Same as rate mode except units are CPM or CPS. May also be programmed as cnts/m or cnts/s.

Integrate mode: Shows Integrated dose or counts in user configured units. Also shows integration time.

Scaler mode: Shows counts up to 6 digits. Count time variable from 1 sec to 99 hours or continuous with timer. Beeps when timed out if beeper turned on.

Softkey * and D key: User defined for rate, CPM/CPS and user modes. Choices include: Light, Beeper, Hold/Reset, TC, contrast, buzzer divider, detector number, mode selection, and Range Hold.

Bargraph: Moving digital pointer on background of scale markings. Updated 10 times every second. Full scale of 2.5, 5 or 10 and 5 decade log are user selectable. Bargraph width is 2.2 in (5.6 cm). Markings for each scale are user changeable from inside the instrument. Supplied with many different scales. Full scale markings are actively shown on the display in the proper units & prefix but may be turned off.

Detectors: Accepts 3 different detectors. Each detector is setup with its own setup which includes: modes, calibration, deadtime, saturation, display, window, threshold, high voltage.

Additional setup options: Display exchange 1st and 2nd lines, time to range up, time to range down, min. range, max. range, decimal point-prefix change limit. Auto turn-off time.

D. Response

Range from detector: 0.1 to 1,000,000 CPM without deadtime correction.

Accuracy: Within 1% or 2 digits for count rates from 1 to 1,000,000 CPM. Timebase is crystal controlled. Radiation accuracy is dependent on probe.

Time constant: Dynamically set depending on count rate but has settings of short, medium and long.

Dead time correction: Corrects up to 4 times actual rate. May be independently set on or off for each mode.

E. Environmental

Temperature range: -5 °C to 50 °C

Temperature dependence: HV ± 2%, Rate ±1%, over temp range.

Humidity range: 0 to 95% non condensing. Instrument may be in taken through the condensing phase with the addition of a desiccant pack.

II. Introduction

The model 5000 Cypher is a highly functional instrument. It can be user adapted to many uses. It may of course be used in general surveying, but it will also find use in counting labs, medical applications and non technical radiation monitoring. The Cypher handles all of these tasks simply and with minimum operator training because the instrument can be tailored to the specific application; from a sophisticated full featured professional tool to a simple one button meter.

The standard instrument with factory settings has simple menu's and 2 front panel Quick-keys. For more demanding applications the menu's can be increased to 3 menus or reduced to none for simple applications. Some of the features are:

- Deadtime correction
- Automatic Power Off
- Linear or Log Bargraph
- Autorange with minimum and maximum scales.
- Saturation Detector
- Ratemeter, Integrator and Scaler.
- Easy active calibration and setup.
- Averaged reading with dynamically set time constant.
- Sealed metal case with out of the way cable connector

NOTE: The Abbreviation CPM/S is used in this manual when referring to CPM or to CPS. When reference is to CPM, it also includes CPS if the instrument is set to the CPS internal timebase.

III. Quick Start

This section is a quick review of how to operate the instrument and how to change menus, modes and functions. Each one is discussed in detail in the individual sections. This section assumes that the instrument is programmed with the factory settings.

Turn the instrument on and off by pushing the **POWER** button. The normal operation starts after the first 2 menus.

The ∗ button turns the light on and off. The Δ button turns the beeper on and off. Try both of them. You will have to shield the display from room light to see the backlight, but it is very visible in the dark.

If the display does not have a bargraph on the bottom line push **MODE** to display the first Function Menu. Then repeatedly push the **MOD** softbutton (really the Δ button) until **CPM** is on the line above **MOD**. Then push the **NXT** softbutton twice. The display should now show **CPM** on the top line and have a bargraph on the bottom line.

Next switch to the Rate Mode to see what it will look like. Push **MODE** to display the first Function Menu. Then repeatedly push the **MOD** softbutton until **RTE** is on the line above **MOD**. Then push the **NXT** softbutton twice. This is the Rate Mode. It has radiation units and a bargraph just like the CPM mode.

Now lets try the Scaler Mode. Push **MODE** to display the first Function Menu. Then repeatedly push the **MOD** softbutton until **SCL** is on the line above **MOD**. Then push the **NXT** softbutton twice. This is the Scaler Mode. Push the **RUN** softbutton to start it running. Push it again to stop, and again to reset.

You change the time by pushing the softbutton **TME**. The ← and ↑ softbuttons change the time, the **RST** softbutton resets the time to zero. Push the **OK** softbutton when the time is what you want. The Integrate Mode is accessed in the same way as the other modes.

The Function Menus offers other choices besides changing the Mode. Pushing MODE shows the first Function Menu. The choices here are: **RH^{H}** or Range Hold on and off, **TC** or Time Constant fast, medium and slow, and of course the **MOD** or Mode for CPM, rate, integrate and scaler. The second Function Menu is reached by pushing the **NXT** softbutton. It has Set LCD for changing the LCD contrast, Light on, off and timed, and Buzzer on, off or soft.

This concludes the section on Quick Start. See the sections that follow for a detailed description on all the functions available on the Cypher.

IV. User Interface

The Cypher has only 4 controls on the front panel. They reduce the complexity on the front panel and, through the use of menus, control the operation of the instrument.

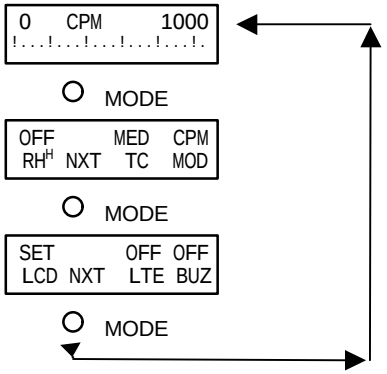
A. Buttons

There are 4 momentary buttons on the front panel. Push the **POWER** button to turn the instrument on and push it again to turn it off. The two buttons on the right side marked Δ and ∗ are Quick-keys; they will quickly do a preprogrammed function. The Δ button is the light on/off and the ∗ button is the beeper on/off. The **MODE** button accesses the various menus.

B. Using Menus

Pushing the **MODE** button will change the display to the first Function Menu. Pushing it again will take you to the second Function Menu, and pushing it again will take you back to normal operation. This is all the menus there are for normal operation. The **NXT** softbutton means next.

Each Function Menu has its own display. The buttons below the menu selections are changed to represent the Menu choices above them. These are called softbuttons. The word on the bottom line of the display is the new function of the button. The word on the top line of the display is the current setting of that function. Pushing the button will change the setting, and thus the top word. Repeatedly pushing the button will scroll though all the possibilities of that button. Below is a list of the various menus. Each item is described in the appropriate section.



Push MODE to display the 2 Function Menus and also to return to the normal display. This is all the menus for normal operation.

FUNCTION			
MENU NAME	**MENU**	**CHOICES**	**MENU DESCRIPTION**
Range Hold	RN^{H}	OFF	No Range Hold
		HLD	Range Hold on
Time Constant	TC	Range Hold	Set to Slow
		MED	Set to Medium
		FST	Set to Fast
Mode	MOD	CPM	Counts Per Minute Mode
		RTE	Rate i.e. mR/h Mode
		INT	Integrate Mode
		SCL	Scaler Mode
Display Contrast	LCD	SET	Set LCD; Shows another display
Light	LTE	OFF	Light turned off
		TME	Light on and timed
		ON	Light turned on
Beeper	BUZ	OFF	Beeper off
		SFT	Beeper on soft
Window	WIN	OUT	MCA Disabled
		IN	MCA Turned On
Deadtime	DTM	OFF	Deadtime Turned Off
		ON	Deadtime Turned On
Detector #	DET	1	Adjusted for Detector #1
		2	Adjusted for Detector #2
		3	Adjusted for Detector #3
Hold	HLD	ON	Instrument on Hold
		OFF	Normal Operation
Beep Divider	DIV	1	Divide by 1
		8	Divide by 8
		64	Divide by 64
		2K	Divide by 2048

The Function Menus on the top half of the table are delivered with the Cypher. The remaining, in the shaded area, may be programmed by using the Custom Settings Mode.

V. Operation

The following is a description of the instrument. When it is new from the factory, it has the factory presets installed. Not all of the functions are available in these presets. Individual programming may change some or all of these functions.

A. Turn On And Off

The Cypher is easy to turn on, just push the **POWER** button. Pushing it once will turn the instrument on and pushing it again will turn the instrument off. There are two turn on displays, the first will show the version number of the software, 4 places of user text, and the hours remaining on the battery. The second will show the function of the two Quick-keys.

If the batteries are too weak it will not turn on. If it tries to turn on and immediately turns off, it may also be due to weak batteries. The instrument will automatically turn off whenever the batteries are too weak to power the instrument.

If the instrument detects a fault in the memory, it will show **FAILURE #1** in the display. If this occurs see the section on Maintenance.

The turn off display shows the hours remaining on the batteries. If the instrument has less than 8 hours, it will beep three times to indicate that the batteries should be changed.

B. Emergency Reset And Contrast

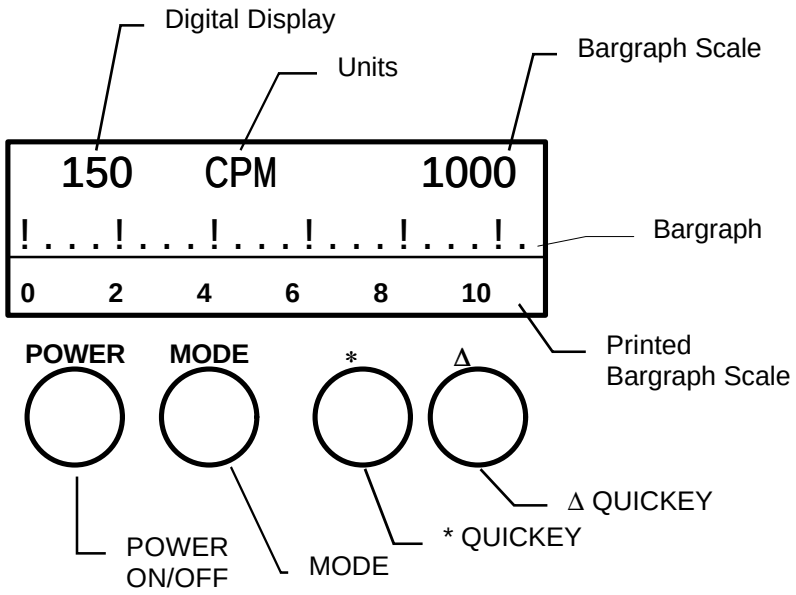
If the batteries are good and the instrument will not turn on, it is possible that the instrument is actually turning on but the contrast is set too light or dark. To do an emergency contrast setting, turn the instrument on while holding down the Δ button. Wait 2 seconds then release the button. Then hold down the Δ button if the display is too light. If the display is too dark, then hold down the ∗ button. Continue to hold the button down until the display shows a normal contrast and the contrast menu. Then push the **NXT** softbutton to resume normal operation.

The instrument can be reset by holding down the **POWER** button for 10 seconds or until the display blanks, then releasing it. This is a cold start for the microprocessor. It will reset the instrument which should then show the turn on display. This can be done at any time to reset the instrument.

C. Quick Keys

The Quick-keys are the ∗ button and the Δ button. Their use is shown on the second startup display. They perform their function quickly without a menu. The ∗ Quick-key is the light button. It is an alternate action button and will turn the light on if it is off, and off if it is on. The light, unless turned on by the Function Menus, is timed and will automatically turn off in 25.4 seconds.

The Δ Quick-key is the beeper button. It is an alternate action button and will turn on the beeper if it is off, and off if it is on. The loudness of the beeper is determined by the beeper selection in the Function Menus.



VI. Modes

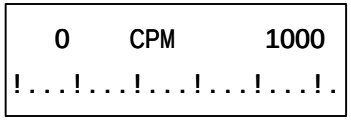
Below is a description of the different modes. Change between the modes by using the **MOD** softbutton in the Function Menu. Press **MODE** to view the first Function Menu.

A. CPM And Rate

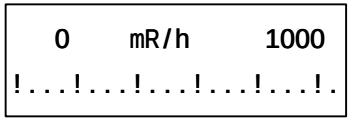
The CPM and rate display can be identified by the bargraph on the bottom line. The top line shows the digital rate, prefix, units and timebase and the full scale of the bargraph. The bargraph is on the bottom line and below that is the printed scale for the bargraph.

The bargraph pointer is updated ten times a second. This makes it smooth and continuous. The numeric display is updated every second. The instrument autoranges; when it goes past full scale it will range up and when it gets to 80% of the lower scale, it will range down. The numeric display shows a maximum of 3 significant figures.

The bargraph full scale figure on the top right indicates the full scale of the bargraph. If it displays 1000 and the units are KCPM, then full scale is 1000 KCPM. The minor divisions would then be 800,600,400, and 200 KCPM. If there is a small **H** to the left of the bargraph full scale figure, then the scale is on Range Hold. Consult the Function Menu for changing Range Hold. If the battery is low, the word **LBAT** will flash on the top right of the display every 12 seconds.



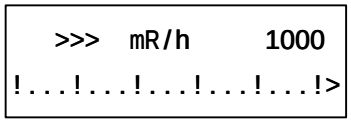
CPM RANGE



RATE RANGE

1. Overrange

If the rate value is too high, it will show > > > in the display. It will show dashes if the rate display is over its range and waiting to change ranges. The bargraph will also show > when it reaches the right hand end of the display.



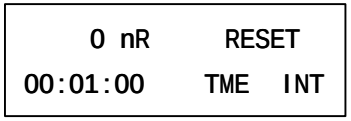
OVERRANGE INDICATION

B. Integrate

The integrate display shows the numeric level and current status of the instrument on the top line. On the bottom line it shows the time and the function of the two right hand keys. The **TME** softbutton will set the time and the Δ button controls the status. The Quick-keys are disabled in this mode.

Repeatedly pushing the Δ button will cycle through integrate **INT**, stop **STP** and reset **RST**. When the instrument is running, the numeric value and the time will update every second When it is stopped the display is frozen. When it is reset the integrated value is reset and the time is preset.

The time can work both as a timer or as an integration timer. If the time is set to 0, then the timer will count up. If it is set to some value other than zero, then it will count down. When it gets to zero it will stop the instrument and beep if the beeper is turned on. If the battery is low, the word **LBAT** will flash on the top right of the display every 12 seconds.



INTEGRATE RANGE

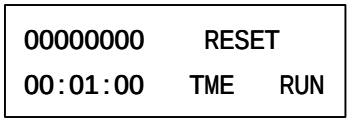
C. Scaler

The scaler display shows the counts, and current status of the instrument on the top line. On the bottom line it shows the time and the function of the two right hand keys. The **TME** softbutton will set the time and the Δ button controls the status. The Quick-keys are disabled in this mode.

Repeatedly pushing the Δ button will cycle through run **RUN** stop **STP** and reset **RST**. When the instrument is running, the numeric value and the time will update ten times a second. When it is stopped the display is frozen. When it is reset the counts and the time are reset.

The time can work both as a timer or as a clock. If the time is set to 0, then the timer will count up. If it is set to some value other than zero, then it will count down. When it gets to zero it will stop the instrument and beep if the beeper is turned on.

If the battery is low, the word **LBAT** will flash on the top right of the display every 12 seconds.



SCALER

D. Setting The Time

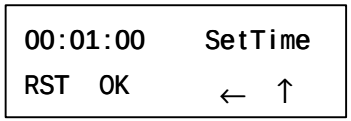
The time can be set in both the integrate mode and the scaler mode. Push the **TME** softbutton when in either of these mode to access the Time Setting Mode. The time is set separately for the integrate and scaler and is stored separately in permanent memory. If you turn the instrument off or change modes the time will be remembered.

The left side of the display shows the time in HOURS:MINUTES:SECONDS. The right hand top shows the word **SETTIME** to let you know that this is the Set Time Mode. The bottom left softbutton is **RST**. This resets the time to 00:00:00. The ← softbutton moves the cursor one digit to the left. The ↑ softbutton increments the digit that has the cursor under it. Move the cursor to the digit you want and

increment it to the number you want. When the time is set to the correct value, push the **OK** softbutton to get back to the mode.

If the time is set to a number other than zero, then the time will count down and stop at zero. If the time is set to zero, then it will start counting up and will continue up to 99:59:59 whereby it will reset and continue counting up.

If you set 68 minutes in the display, when you change to the Integrate Mode or Scaler Mode, the time will be recalculated to the correct hours: minutes: seconds. In this case it would show: 01:08:00, which is the same as 68 minutes. This works for seconds also. The cursor will be on minutes when entering the Time Setting Mode because most settings are in minutes.



SET TIME

E. User

The User Mode is not turned on with the Factory Settings, it is a special mode for users who want a rate mode in addition to the CPM/S and mR/h/mSv/h modes. It is only a Rate Mode and cannot be used in the integrate mode or scaler mode. The units that are in the display will probably be in those chosen by the User. They can be any conventional unit or any 5 characters. An example of this mode's use would be to display any special units that are not normally available. See the section on Custom Settings for adding this function.

VII. Function Menus

The Function Menus are the only way to change the operation of the instrument. For example, they allow you to darken the contrast of the LCD, adjust the time constant and change the mode from CPM to Scaler. There are only 2 Function Menus. Push **MODE** from normal operation, and the first Function Menu will be displayed. Push **MODE** again and the second Function Menu will appear. Push **MODE** again and you will be back to normal operation. ***Pushing the MODE button repeatedly will always get you back to normal operation.***

The following functions are in the Function Menus. The first 6 of these are programmed in the Factory Settings as delivered, the remaining may be enabled using the Custom Settings Mode.

A. RH ^{H} Range Hold

Range hold will keep the CPM Mode and the Rate Mode range in the same range; thus keeping it from going up or down a range. It is useful when surveying for low count rates when you do not want to wait for the instrument to range up to a higher range for a hot spot. A small ^{H} will appear on the top right hand side of the display indicating the Range Hold is in effect. The choices for the Range Hold are:

OFF Range Hold is turned off.
HLD Range Hold is turned on and the instrument will not range up or down a range. The ^{H} in the display turns on.

B. TC Time Constant

The Time constant controls how fast the bargraph will move to a new value and how fast the digital display will home in on a new value. It does not work in the Integrate or Scaler Modes. The instrument automatically adjusts the time constant depending on the level of the radiation. It is slow on low rates, and fast on high rates. The Time Constant setting modifies these automatic setting to be slower or faster. The choices for the Time Constant are:

SLO The Time Constant is slow.
MED The Time Constant is medium.
FST The Time Constant is fast.

C. MOD Mode

The mode controls which mode the instrument is operating in. The previous section describes each mode in detail. The choices are:

CPM This is the CPM Mode.
RTE This is the Rate Mode.
INT This is the Integrate Mode.
SCL This is the Scaler Mode
USR User Mode (not factory installed).

D. LCD Liquid Crystal Display Contrast Setting

The LCD controls the contrast of the display. There is only one choice and it is **SET**. Pushing it will change to a new display The best setting is as dark as possible before the squares show. The choices of this menu are:

LT To lighten: push and hold down.
DK To darken: push and hold down
NXT When the contrast is correct, push this button.

E. LTE Backlight on the display

This controls the backlight on the display. The backlight is not very visible in daylight but is very visible in low light. The choices are:

OFF The backlight is off.
TME The backlight is timed. This turns the backlight on for 25 seconds. After the 25 seconds it will automatically turn itself off. The time is stopped when in the Function Menus.
ON This will turn on the backlight until it is turned off.

F. BUZ Beeper Control

This controls the beeper. The beeper has 2 functions. In the CPM Mode or Rate Mode the beeper will, if turned on, beep on every input pulse. In the Integrate Mode or Scaler Mode, the beeper will, if turned on, beep when the timer counts down to zero to signal that the counting is finished. The choices are:

OFF The beeper is off.
SFT The beeper is turned on and the loudness is soft.
ON The beeper is turned on and the loudness is set to the highest level.

If the beeper is set to **SFT** then that is the loudness for the beeper. The front panel ∗ Softkey, used for beeper on/off, will only turn the beeper on to the loudness set in the Function Menu.

The following settings are not enabled when the instrument is set at the factory. See the section on Custom Settings Mode.

G. WIN Window

This controls the window in and out. If the window is in then the instrument is a single channel analyzer. If the window is out, then the instrument will count pulses that are above the discriminator. The choices are:

OUT The window is out
IN The window is in

This is set for each detector and each detector has its own window in/out setting.

H. DTM Deadtime

Deadtime correction is used to compensate for the loss of counts at high count rates. The actual deadtime calibration and constant is set in the instrument at the time of calibration. The choices are:

IN This mode has deadtime correction
OUT This mode has no deadtime correction.

The deadtime correction is turned on and off independently for each mode.

I. DET Detector

The instrument will accept 3 detectors. This controls which set of detector constants are in effect. This effects the calibration, high voltage, deadtime, display, etc. The choices are:

1 Use the constants for Detector 1
2 Use the constants for Detector 2
3 Use the constants for Detector 3

The instrument will prompt the user to remove the old detector and to install the new detector.

J. HLD Hold

This puts the instrument on hold. **HOLD** is displayed on the top right hand corner of the display. The numeric number is held, but the bargraph continues to function. The choices are:

ON Freezes the numeric display
OFF Normal operation

K. DIV Divider for Beeper

The counts from the detector can be divided by 1,8,64 or 2048 before they are sent to the beeper. This is useful where the beeper may otherwise be saturated or sound like it is on continuously. The choices are:

1 Counts
8 Counts
64 Counts
2K Counts

L. CAL Calibrate Mode

This mode is used to put the instrument into the Calibrate Mode. See the section on Calibrate Mode for more information. The choices are:

OFF Normal operation
ON Instrument in Calibrate Mode

VIII. Operational

A. Detector Connection

The detector is connected to the instrument through the BNC located on the end of the handle. This location puts the cord out of the way so it will not interfere with the operation of the instrument. You may change the detectors without turning the power off, however it is usually a good idea to do so. Alternate connectors may be installed.

B. LOW BATTERY

When the battery is low and has less than 8 hours remaining, the word **LBAT** flashes in the upper right hand corner. It flashes every 12 seconds. It does not flash in the Function Menus.

C. *Battery Change*

When the batteries are too low as indicated on the turn on menu, or the turn off menu, then it is time to change them. The instrument uses 6 type AA "penlight" (ANSI L40 IEC LR6) cells. These can be any type of battery except lithium. (If you want to use lithium, use 3 ea. 3 volt lithium AA cells and 3 dummy AA batteries). The hours that are displayed at turn on and turn off are calculated for alkaline batteries. Carbon-zinc batteries will not give the correct time.

The batteries are located inside the instrument. Access is by removing the bottom case. To change the batteries, remove the bottom of the enclosure by twisting the twist-lock connectors on each end of the instrument counter-clockwise. This should release the bottom of the instrument. Remove it and turn the instrument over. There are the 6 AA cells. Remove the existing batteries, and replace them with new ones. Replace the bottom of the enclosure.

If the batteries have leaked into the bottom of the instrument, wash the case bottom thoroughly with soapy water, then with clear water. Dry it and replace it on the instrument. Do not wash the circuit board. The battery holders may need to be cleaned with a dampened cloth or sponge.

D. Adjust (Simple way to change some settings)

Adjust is a method of changing the settings for the detector without using the Setup Menus. It is designed to allow quick field adjustments without cumbersome button pushing. The Adjust Menu is accessed by pushing the ∗ and Δ buttons at the same time. If adjust is turned on the Adjust Menu will be displayed. Adjust can be set to operate in either all modes, or just the scaler mode.

Adjust allows simple adjustment of the High Voltage, Discriminator, Window, Window in/out and Gain. This is an interactive adjustment that is made while looking at the count rate.

1. Turning Adjust On And Off

Adjust is turned on and off in the Setup Menu and is under **Front Panel** ***7**. It has 2 choices, the first is for all modes, and the second is for just the scaler mode.

2. Using Adjust

The display has the function name in the upper left hand, the value of the function in the center of the display, and the count rate display in the upper right. The Count rate display is the number of counts in 0.1 second. The **NXT** softbutton changes to the next function, and the ↓ and ↑ softbuttons will increment or decrement the value of the function. Hold them down until the function is at the desired level. The Mode button will return to normal operation.

HV or High voltage will change the High Voltage. The display number will bounce about ±30 volts. Be careful not to increase the high voltage above the limit of the detector.

DISCR or Discriminator is the setting for the discriminator. It can be set from 0 to 255 but is linear from 0 to 100.

WIN or Window is the setting for the window. It can be set from 0 to 255

GAIN is the setting for the gain. It can be set to 0,1 or 2. 0 is the lowest gain and is used for GM detectors. 2 is the highest gain and is used for scintillators.

WINDOW IN or OUT controls the action of the window. If it is set to IN, then the instrument is working as a single channel analyzer.

If you want to use the SCA with a scintillator to look at a peak, we recommend that you set the gain to 2, the window to IN and to 30. Set the DISCR to some value below 100 that is meaningful for the energy you are using. The range of the setting is from 0 to 255 but it is linear only from 0 to 100. It is best if the counting region is set between 50 and 100. With CS 137 which has a peak of about 630 KeV, we could put it in channel 63 which would calibrate the instrument directly in KeV. Set the discriminator to the value, that puts the window in the middle of the peak. In this case the window is 30 and half of 30 is 15. Reduce the discriminator by 15 from 63 to 48 which centers the peak on the window.

Place a check source that has an energy peak that is centered in the window on the scintillator and adjust the high voltage until the count rate in the right top is the highest. Start at a low high voltage of 400 volts and raise it slowly. Each time you adjust the high voltage wait a second for the reading to stabilize. You should be able to go beyond the peak and see the count rate decrease but be cautious of increasing the high voltage beyond the limit of the detector.

If you do not have a check source that is the same energy as the energy you want to detect you can still calibrate the scintillator and instrument as mentioned above then move the window to the appropriate region. It would probably be a good idea to increase the window setting just to be sure to get all the counts.

E. Deadtime Correction

The Factory settings turn on the deadtime correction only in the Rate Mode, and the Integrate Mode. It is turned off in the CPM/S mode, and the Scaler Mode.

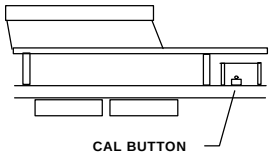
IX. Radiation Calibration

The instrument is calibrated digitally. There are no trimmers to adjust. The values that adjust the calibration are stored in EEPROM memory for 40 years.

There are two adjustments for each detector that effect the calibration. The instrument is adjusted by changing the calibration factor with exponent, and the deadtime. Only the Rate Mode and the Integrate Mode need to be calibrated, however the CPM/S Mode and the Scaler Mode should also be checked for proper operation. The scaler should only be verified, it has no calibration data associated with it, except for deadtime which is turned off for this mode with the factory settings. The first operation is to verify proper operation of the CPM modes and the Scaler Modes. The second is to calibrate the Rate and Integrate Ranges.

A. Changing The Display To Calibrate Mode

The CPM, Rate and Integrate ranges all have Calibration Factors and Exponents associated with them. The scaler does not have a Calibration Factor. The Calibration Factor for the CPM Range is usually set to 1.00. In addition there is a deadtime associated with the detector that, if turned on, corrects for deadtime losses in the detector. In order to change these factors it is necessary to enter into the Calibration Mode. The following instructions will show the necessary steps.



1. Turn on the instrument with the **MODE** button pushed down. If this does not result in the words **Calibration *1** in the display then the Front Panel Calibration Adjust has been disabled and it is necessary to use the internal one. Open the case, and push down on the **CAL** push button (top right hand side of the circuit board under the display) while turning the instrument on. The words **Calibration *1** should be on the

2. Push the **OK** softbutton and the Cypher will resume normal operation with the radiation value on the top line, and the calibration factor on the bottom line.

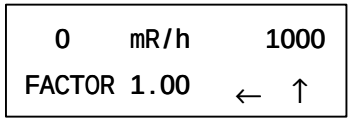
3. The softbuttons change the numeric value in the bottom line of the display. The ← Softbutton will move the cursor over 1 place and the ↑ softbutton will increase the value of the number positioned over the cursor. Using the two buttons, you can change the value of the displayed item in the bottom line. The value in the top line will change along with the changes in the bottom line.

4. In the Rate and CPM modes, the item on the bottom line can be changed by pushing **MODE** then the ↓ or ↑ softbuttons until the item description is what you want to change or do. Then push the **MODE** button to return to the calibration. If you do not push the ↓ or ↑ softbuttons the normal function menus will be displayed when you push the **MODE** button.

5. In the Integrate Range the softbuttons are already in use. Pushing **MODE** repeatedly will show the three factors followed by the normal Function Menus. These factors are adjusted just like the ones in the CPM and Rate Modes.

6. There are 3 adjustments to be made, the Calibration Factor, the Exponent and the Deadtime. The Calibration Factor and Exponent form a number that determines the value on the display. They should be thought of as one number in exponential form. Changing the Calibration Factor and Exponent changes the value on the display at all doserates. Increasing the number will increase all the readings in that Mode. Decreasing it will decrease the reading.

   The Deadtime corrects for deadtime losses that occur in all pulsed detectors. If the Deadtime is turned on, then the Deadtime number will effect the readings at high count rates. At low count rates, the change is insignificant.



CALIBRATE DISPLAY

B. Calibration, Exponent And Deadtime Factors

The Calibration, Exponent and Deadtime Factors are all used in the Calibration of the instrument. The Calibration and Exponent are in reality one number. This number is used to increase and decrease the value of the calibration. If the calibration is 10% too low then it is necessary to increase the Calibration Factor 10%.

The combination of Calibration Factor and Exponent are, in reality, a number in scientific notation. A Calibration Factor of 6.35 and an exponent of 2 is in scientific notation 6.35×10^2. The Calibration Factor should be set in the range of 1.00 to 9.99. Raise and lower the exponent to compensate if it is necessary to go beyond these limits. For Example, if the Calibration Factor is 9.5 and the Exponent is 3 then an increase of 10% would be $9.5 \times 1.1 = 10.45$. This is not in the range of 1.00 to 9.99 so decrease the Calibration Factor by 10 and add one to the exponent which would be 1.04 with an exponent of 4. The same is true of the other direction. If the Calibration Factor is 1.24 and the Exponent is 3 and it is necessary to decrease it by 30% then 1.24 would be reduced to .868. This is below 1.00 so decrease the exponent by 1 to 2 and increase the Calibration Factor by 10 to 8.68.

The range of the Exponent is from -40 to +40. In reality it should never be necessary to set it over the range of -8 to +8.

The deadtime is in units of microseconds. It should be close to the value specified by the manufacturer of the detector. Its value is from 0 to 999 µS. It will be adjusted during the calibration.

C. Detectors

Each detector will have to be checked in all modes for proper operation. To change detectors:

Select the detector you want to calibrate from the **DET** function in the Function Menu. From normal operation push **MODE** then the ↓ or ↑ softbuttons until **DET** is displayed, then push the **DET** softbutton until the required detector number is displayed.

If there is no **DET** function in either the function menus or the Quick-keys, then there is only 1 detector to calibrate. To add more detectors see the section on Custom Settings Menu.

D. CPM & Scaler Mode Check

1. Turn on the instrument by pushing the POWER button. If the units of CPM are not displayed in the display, then push MODE. Repeatedly push the MOD softbutton until CPM is displayed above MOD. Then push the NXT softbutton twice. CPM should now be the units in the display.

2. Connect a pulsar to the detector connector on the end of the handle. Set the pulse height to the nominal value for the detector in use or increase the level until a steady reading is obtained. The Cypher should be very accurate because it is crystal controlled.

3. Check the values at 20% and 80% of full scale for all ranges.

4. If the reading is higher that the pulsar at high rates, then the deadtime correction is turned on. If it is lower not all the counts may be counted. Try turning up the level on the pulsar.

5. Change the mode to Scaler and accumulate a 1 minute count at known low and high rates. This will check both the scaler and the timer.

6. Note the values on the calibration report.

E. Rate Mode Calibration

1. Enter into the Calibrate mode as discussed above in Changing The Display To Calibrate Mode.

2. Change to the Rate Mode. If the Rate Mode is not displayed, then push **MODE**. Repeatedly push the **MOD** softbutton until **RTE** is displayed above **MOD**. Then push the **NXT** softbutton twice. The Rate Units should now be in the display.

3. Expose the detector to a radiation field that is at the lower end of the sensitivity of the detector. Change the Calibration Factor and Exponent until the reading is correct.

4. Expose the detector to a field that is at the upper end of the sensitivity of the detector. Adjust the Deadtime until the reading is correct.

5. Repeat steps 3 and 4 until both settings are correct.

6. Expose each range/decade at 20% and 80% of full scale. Note the readings on the calibration report.

7. Turn the instrument off by pushing the POWER button when finished.

F. Integrate Mode Calibration

1. Enter into the Calibrate mode as discussed above in Changing The Display To Calibrate Mode.

2. Change to the Integrate Mode. If the integrate Mode is not displayed, then push **MODE**. Repeatedly push the **MOD** softbutton until **INT** is displayed above **MOD**. Then push the **NXT** softbutton twice. The Integrate range should now be in the display. Read section G. below to determine if you want to use the Rate Range Calibration Factor to set the Integrate range Calibration Factor.

3. Expose the detector to a known dose in a radiation field that is at the lower end of the sensitivity of the detector.

4. Change the Calibration Factor and Exponent. Repeat step 3 until the reading is correct.

5. Expose two lower ranges at 80% of full scale. Note the readings on the calibration report. (The deadtime correction is already set in the Rate Mode.)

6. Turn the instrument off by pushing the POWER button when finished.

G. Cal factor for Integrate Range and Rate Range

The rate range calibration factor can be used to set the integrate range. If you are satisfied with the rate range calibration you may be able to use the rate range calibration factor as the basis for calculating the integrate range calibration factor. You may also choose to calibrate them independently.

If the integrate range is in the same prefix-units as the rate range then the rate range Calibration Factor can be used in calculating the integrate range Calibration Factor. If the rate range is in mR/h and the integrate range in mR then they are considered to have the same units.

Divide the rate range Calibration Factor with Exponent by 60 if the internal timebase is in CPM and by 3600 if the internal timebase is in CPS. Use this new calibration Factor and Exponent for the integrate range. If you use this Calibration Factor, then the rate range and integrate range will have the same calibration.

X. Setting Up a New Detector

When the detector is changed, another detector added or the instrument was ordered without a detector, it is necessary to configure the instrument to operate properly with the detector. This section discusses the procedures to change the current settings for the new detector.

A. General

The instrument is modified to accept the new detector by changing several parameters included in the list below. Some of these must be changed. Some may be left in the default values. The items marked with a * are accessible from the Detector Setup Menu.

1. Bargraph type
2. Calibration Factor and Exponent *
3. Deadtime *
4. Discriminator *
5. Display Type
6. Gain *
7. High Voltage *
8. Inverted/normal display
9. Modes for the detector
10. Prefix, *
11. Range hi/low limit *
12. Range Up/down time
13. Saturation *
14. Time constant
15. Timebase for each mode
16. Units *
17. Window *
18. Window in/out *

The units, prefix and timebase that are selected for the display are only displayed. These values do not directly change the calibration. Changing the prefix from m to µ will not change the sensitivity of the instrument. It will only change the prefix on the display. The numbers on the display will remain the same. To change the sensitivity of the instrument it is necessary to change the Calibration Factor and Exponent.

A good method of understanding the setup of a detector is to think of a traditional survey instrument with a meter. The scale behind the meter, the range switch and the calibration adjustment screwdriver adjust set the instrument sensitivity. The scale could be removed and replaced. The new scale could have very different units. That in itself would not calibrate the instrument, you would still have to change the calibration adjustment with a screwdriver to obtain a correct reading. The Cypher is very similar. The Units, Prefix and Timebase are just like the printed scale. Changing them will not change the reading. It still will have to be adjusted with the Calibration Factor and Exponent which can be thought of as the screwdriver adjust.

The big difference between the Cypher and a traditional instrument is that the Cypher will automatically select the next higher or lower prefix when it needs to change ranges rather than relying on the range switch.

There are 2 ways to setup the detector. If it is listed under the Preset Detector Menu then you could choose one of those for setup. If it is not listed, you will need to go through all the following steps. Alternatively you could use one of the presets and then modify it.

B. *User Mode*

The User Mode is programmed just like the Rate Mode, except it is called **USR** in the MOD function menu. To turn it on, use the Mode Lockout in the Custom Settings Menu.

C. *Determining The Different Settings*

The Calibration Factor, Exponent, Prefix, Units, Timebase, and Range limits all need to be calculated for each detector. The high voltage, discriminator, gain and saturation also need to determined. Use the Detector Worksheet in the Appendix as a guide to this operation. It is a good idea to determine the settings that you want to use for the detector before programming the Cypher

We recommend changing the Calibration Factor and Exponent of only the rate and integrate ranges. The Calibration of the CPM/S range can be changed but it may be confusing to a user and difficult in calibration. However it may be changed if necessary. The scaler does not have a calibration. In the following descriptions we will use a GM Pancake Detector as an example.

1. Basic Detector Information

a) Detector 1, 2 or 3

The Cypher can change between detector 1, 2 or 3. This is done using the Function Menus or through one of the Quick-keys. The Detector that is in use, or selected, is the detector whose variables will be changed. If there is no DET function in the Function Menus or DET Quick-key, then there is only one detector, detector #1.

b) CPM or CPS Internal Timebase

Turn the instrument on and look at the first word on the display. If it is **HPI** then the instrument has the internal timebase set to CPM, If it is **HPIs**, then the internal timebase is in CPS. To change the timebase see the section on Programming: Internal Timebase. When shipped from the factory the timebase is in CPM. In general the CPM internal timebase is used for conventional units and the CPS internal timebase is used for SI units.

c) Detector Sensitivity

Obtain the sensitivity of the detector from the specification sheet. The example detector has a sensitivity of 2100 CPM/mR/h.

d) Deadtime

The Deadtime value should be listed in the detector specification sheet. Note this value on the worksheet. The Example GM detector has a deadtime of 100 µSec or 100 x 10^{-6} Sec.

2. Rate Ranges

a) Units

Determine the rate units that you want the instrument to operate in. The choices are: cnt, REM, rad, R, Sv, Bq, Gy, dis, CPM, CPS, or User programmed. This is the basic unit and does not include the prefix such as m or µ. For example the basic unit of a pancake GM detector is R and not mR. It could also be in rad. Note the units in the space provided on the worksheet and also the corresponding number from the table on the worksheet.

b) Prefix

Determine the prefix for the main rate range of the instrument. If you want the instrument to work in µR/h then the basic units would be µ. This assumes that the detector works in that range. Don't try to set the instrument to read in R/h when the basic units should be µR/h. For example the Pancake GM detector would want to read in mR/h. µR/h would result in the display being too large a number, and R would result in it being too small a number. Note the prefix and the corresponding number from the table in the worksheet.

c) Timebase

Select the timebase of /h,/m or /s. If you need another timebase, use the User setting under Units. Note the timebase and the corresponding number from the table in the worksheet.

d) Calibration Factor and Exponent

1. If the internal time base is set to CPM then determine the CPM/prefix-units/timebase. For example for a pancake detector that should read in mR/h, determine the CPM/mR/h. This is 2100 CPM/mR/h. If this number is below .1 CPM/prefix-units/timebase or above 10,000 CPM/prefix-units/timebase, then think about changing the prefix up or down to compensate. A detector with 50,000 CPM/mR/h has the prefix set too high. It should be reduced to 50 CPM/µR/h in which case the prefix would be µ.

   If the internal time base is set to CPS then determine the CPS/prefix-base/timebase units. For example for a pancake detector that should read in µGy/h, determine the CPS/µGy/h which is 3.5 CPS/µGy/h. If this number is below 0.01 CPS/prefix-units/timebase or above 1000 CPM/prefix-units/timebase, then think about changing the prefix up or down to compensate.

   Take the reciprocal of the number and convert to scientific notation. For example 1/2100 = 0.000476 = 4.76×10^{-4}. The formula is:

   1/(sensitivity in prefix-units/timebase)

   This is the calibration number. In the example, 4.76 is the Calibration Factor, and -4 is the Exponent. The range of the Exponent is from -10 to +10. If it is beyond this range, change the prefix and recalculate the Calibration Factor and Exponent. Note these values in the worksheet.

e) *Calculating the Maximum Level*

The Maximum Range is calculated from the maximum level that can be displayed with the detector which is determined by its deadtime.

1. Calculate the maximum level in CPM or CPS that can be used for the detector. If the deadtime correction is turned on the instrument can be operated at a higher rate than if it is turned off. The instrument will count up to 1 million CPM or 16,666 CPS with deadtime off.

   The formula is below. There are 4 possibilities, with and without deadtime, and CPM and CPS timebases. Choose the correct one for your application. The Deadtime is usually turned on for Rate Ranges. Deadtime is in seconds (15 µsec is 15×10^{-6} Sec). Note the values on the worksheet. For example with a CPM timebase and the deadtime of 100 µSec turned on, the highest level for the GM pancake detector would be: $204/100 \times 10^{-6} = 2{,}040{,}000$ CPM

   ***CPM** Timebase*
   Deadtime off: Highest level (CPM) = 46.3/deadtime
   Deadtime on: Highest level in (CPM) = 204/deadtime

   ***CPS** Timebase*
   Deadtime off: Highest level (CPS) = .772/deadtime.
   Deadtime on: Highest level (CPS) = 3.4/deadtime

2. Calculate the maximum level that can be displayed on the instrument by multiplying the maximum level times the Calibration Factor. Note the value on the worksheet.

   Max Level in Units = Max Level in CPM/CPS x Calibration Factor.

   For the example this would be $2{,}040{,}000 \times 4.76 \times 1^{-4} = 971$ mR/h

   This figure can be helpful in determining the maximum range that can be used with the detector.

f) Determining the Minimum and Maximum Ranges

Now it is necessary to determine the minimum and maximum range. The instrument will calculate and display the appropriate value. At high doserates, when the detector becomes saturated, the display will instantaneously show full scale. If the instrument can use only a small portion of the top scale, it may be better to limit use of that top scale. Likewise at very low count rates, if the bottom scale will be at nearly full scale from background, then that scale is useless. This setting helps to determine the minimum and maximum scales to use. For defaults, the Range Low Limit can be set to 0 and the Range Hi Limit can be set to +5. This can be corrected interactively in actual use in the Detector Setup Menu.

To understand the table below, imagine that the basic units and prefix which have been set from the above steps are in the three places marked 0 in the column marked Range With Prefix Units . The three spaces marked -1 in Range with units would have the next lower prefix, and the 3 spaces marked +1 would have the next higher prefix. The Cypher will automatically select the higher and lower prefix, but you have already set the starting point from the prefix-units/timebase settings made in the above steps.

There are 2 reasons for setting an upper range. The first is that when the instrument detects saturation or too many counts, it will make the Range Hi Limit the range that is shown with the overrange indicators. The other reason is to keep

from switching to a high range if only a small portion of it can be used because of saturation or deadtime losses.

The maximum level has been calculated above. Find which range would be the maximum range based on the above calculations. Set the Range Hi Limit to the next higher range. Note the value on the worksheet.

The GM example is shown in the Example column. It has the units-prefix/timebase of mR/h (which was the chosen basic units and prefix) in the three locations marked 0 under Range With Prefix-Units.

With the GM detector example, the maximum range as calculated above is 971 mR/h. 971 would be displayed on as XXX as shown in row 10. Since it is almost at the end of the range, it is best to leave that range whole. The Range Hi Limit would be set to +3 for this example.

The lower range is best to calculate and would correspond to about 600 CPM or 10 CPS Full Scale. If the range goes lower than this, then it may not be usable. The calculation is:

Lowest Count Rate x Calibration Factor

Where the Lowest Count Rate is 600 CPM if the internal timebase is CPM or 10 CPS if the internal timebase is in CPS. For the example this would be 600 x 4.76 x 1^{-4} = 0.286 mR/h. This would be on range -1 on Detector Setup. The Range Low Limit would be set to -1 in the Detector Setup Menu.

f	DETECTOR SETUP	DISPLAY FROM…	DISPLAY TO…	RANGE WITH PREFIX-UNITS[2]	EXAMPLE GM Detector
1	-7	.1	.999µ	-2	
2	-6	1	9.99µ	-2	
3	-5	10	99.9µ	-2	
4	-4	100	999µ	-2	
5	-3	.001	.00999	-1	uR/h
6	-2	.01	.0999	-1	uR/h
7	-1	.1	.999	-1	uR/h
8	0	1	9.99	0	mR/h
9	+1	10	99.9	0	mR/h
10	+2	100	999	0	mR/h
11	+3	1K	9990	+1	R/h
12	+4	10K	99.9K	+1	R/h
13	+5	100K	999K	+1	R/h
14	+6	1M	9.99M	+2	
15	+7	10M	99.9M	+2	
16	+8	100M	999M	+2	

[1] The Row is used for identification purposes only. [2]This column represents the prefix. The three places marked 0 would have the basic prefix-units/timebase. The three marked -1 would have the next lower prefix-units/timebase. The three marked +1 would have the next higher prefix-units/timebase. See the example column.

The above table shows the range of the instrument. The 2nd column contains the values that are used in the Detector Setup Menu. These correspond to the values in the 3rd and 4th column that show the range of the instrument. The 5th column is the change in prefix up or down from the selected nominal value.

3. Integrate Range

The setup of the integrate range is similar to the rate range. There are fewer choices in this mode.

a) Calibration Factor and Exponent using Rate Range.

If the integrate range is in the same prefix-units as the rate range then the same Calibration Factor can be used in calculating the integrate range Calibration Factor. If the rate range is in mR/h and the integrate range in mR then they are considered to have the same units.

Divide the Calibration Factor with Exponent by 60 if the internal timebase is in CPM and by 3600 if the internal timebase is in CPS. This is the new calibration Factor and Exponent for the integrate range. Mark the Units, Prefix, Calibration Factor and Exponent on the worksheet.

b) Calculating the Calibration Factor and Exponent

If the integrate range is not in the same prefix-units as the rate range, then you need to determined the basic units and prefix that you will want to use.

Calculate the basic prefix-unit per counts.

For example, if the GM pancake detector is to read in mR then do this in 2 steps. First calculate the counts/mR.

(2100 Counts/Min/mR/h) x (60 min/hr) = 126,000 counts/mR

Then calculate the mR/counts by taking the reciprocal.

1/126,000 = .000,007,93 or 7.93 x 10^{-6}

7.93 x 10^{-6} is the Calibration Factor and Exponent, 7.93 is the Calibration Factor, and -6 is the Exponent. Mark the Units, Prefix, Calibration Factor and Exponent on the worksheet.

c) *Range High and Low Limits*

Set the Range High to +8. Set the Range Low to -4. This range will usually be low enough to change with the first few counts. If you want it to be less sensitive, then change to -3 or -2.

4. Overall Detector Settings

The Detector needs its own settings of High Voltage, Discriminator, Gain, and Saturation to function.

a) High Voltage

The High voltage is usually set by either using the recommended voltage from the manufacturer or by plotting the plateau. Either method will work.

To plot the plateau:

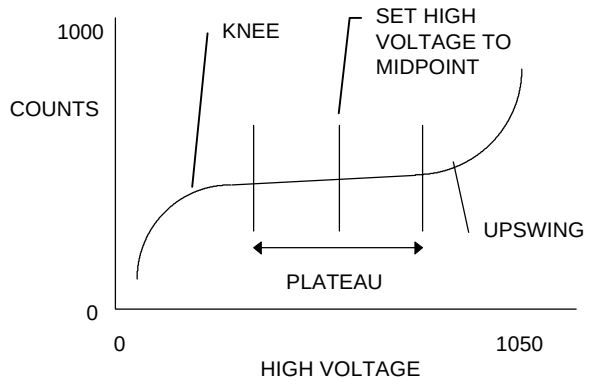
1. Expose the detector in a fixed geometry to a medium intensity radiation source.

2. Slowly raise the high voltage until the detector begins to count. You may need to adjust the discriminator before this step.

3. Raise the high voltage in uniform steps of 50 volts. At each step note the radiation intensity on the CPM/S range. ***Do not go above the maximum voltage for the detector***.

4. Plot the High voltage vs. counts on a graph.

5. Adjust the high voltage in the instrument to the value that corresponds to midway on the plateau. If there is no upswing, then adjust it above the knee.



GRAPH OF HIGH VOLTAGE VS COUNTS

b) Discriminator

The Discriminator is set by lowering the value to the point where the instrument will count from noise, then raising it past the point where it stops counting. Check for double counting at low count rates. Lower the gain or raise the discriminator to correct this problem.

c) Gain

The gain is set depending on the type of detector. We recommend setting it to 0 for GM detectors, and 1 or 2 for Scintillation and proportional detectors. The gain can be set at 0,1 or 2. 0 is the lowest gain and 2 is the highest. Check the discriminator setting after changing the gain.

d) Saturation

The saturation detector is used to prevent a saturated detector from reading 0 on the display. Set it to 0 to turn it off. To adjust the setting in Detector Setup Mode:

1. Reduce the Saturation to zero.

2. Expose the detector to sufficient radiation so the reading is at the top of the highest scale.

3. Raise the saturation until the reading shows off scale.

4. Lower the saturation by 10%.

e) Window

If the window is not used, set it to 255 in case it is accidentally turned on. If the window is to be used to turn the instrument into a Single Channel Analyzer, it should be set to the region of interest. This is usually set with a check source. The discriminator can be set from 0 to 255. The window can be set from 0 to 255. The range of the pulses is from 0 to 100. Adjust the window to the desired height, then move it up or down using the discriminator. The window is always above the discriminator. Once it is adjusted, it can be turned on or off without changing the window setting.

5. Other variables and settings

The bargraph type, display type, inverted or normal display, modes for each detector, and range up and down times can be reviewed under the Custom Settings section.

6. Programming the Setup Value

The values on the worksheet may be programmed into the instrument in either of 2 ways. The first and easiest way is to use the Detector Setup Menu. This is an interactive mode that shows the count rate as well as the settings for each of the above items.

The other way is to use the Custom Settings Menu which allows programming into the locations in EEPROM. This is more complicated and involves looking up the locations of each item in the list. We recommend using the Detector Setup Menu. Remember that the Detector that is selected using the Function Menu will be the detector whose parameters you are saving or changing. See the individual sections on how to use these Menus.

If you have problems with the programming and the instrument is functioning in an unpredictable manor, you can revert back to the factory settings under the Setup Menu, however the values for the previous calibration will be lost.

7. Log Bargraph

If you have a Log Bargraph the Range Low Limit sets the low end of the bargraph. Set the Range High Limit as you would if using a normal bargraph The with the log bargraph, the digital display will change ranges at each decade.

XI. Programming

The following sections discuss programming the instrument. It is important to understand the setup of the instrument before actually performing it.

A. Instrument and Detector Settings

There are 2 basic kinds of settings in the Cypher. The first is the Instrument Settings. These are settings that effect the operation of the instrument. This includes the display and the buttons. The other type of setting is the Detector Setting. These effect the operation of the detector and include the calibration data, high voltage setting and discriminator.

B. Programming the Cypher

The Cypher is highly programmable. There are many different items about its operation that can be changed. There are 4 basic ways to program the instrument.

1. Use the factory settings. This is the simplest way. The instrument is setup with all the important operating parameters and settings. It takes no time and will handle most situations.

2. Use a preset setting available from the Preset Instrument Menu. This is a number of instrument types that are pre-programmed. It sets up the instrument for a specific use. This takes a small amount of understanding and time.

3. Use the Custom Settings menu and configure the instrument to your exact liking. This is the hardest way of programming and takes some understanding of the instrument as well as some time. It will result in an instrument tailored to your application or to your specifications.

4. Use a Combination of the above. Use a Preset Instrument Menu but then customize it to meet your needs. You won't have to program all the variables but will still be able to customize it to your needs.

C. Instrument and Detector Variables

The Setup Menus will change the variables inside the instrument. These variables control the function of the instrument. There are several types:

1. Variables that change the instrument rather than the detector and are considered part of the instrument. For example, the beeper on/off, the full scale bargraph, and the button definitions.

2. Variables that change with Detector 1, 2 or 3. These fall into two groups:

    1. Those that change with the Mode such as the Calibration, the Units, the Timebase, and the Bargraph type.

    2. Those that do not change with the Mode and are considered part of the detector. Examples are the High Voltage, The Discriminator, and the Deadtime.

D. Internal Timebase

The Cypher has two choices for an internal timebase: CPM (Counts Per Minute) or CPS (Counts Per Second). This changes the basic units that the instrument works in internally. It actually calculates the values in .1 CPS or .01 CPM.

If it is set to CPM and then programmed with the Instrument Setup, Detector Setup or Factory Setup menus, the instrument will be in conventional units and the rate range will probably read in mR/h. If it is set to CPS and then programmed with one of the 3 Setup menus, the instrument will be in SI units.

The CPM or CPS range has its own calibration and can be programmed in any units desired. It is designed to be used with CPM/S and that is the nomenclature in the Function Menu. If the instrument is in CPM and the Calibration Factor and Units for that range are changed to read in CPS instead of CPM, then the reading will not be exactly correct. The Calibration Factor has only 3 places of accuracy, Thus 100 CPS may read only 99 CPS.

One of the choices with the **MOD** softbutton in the Function Menu during normal operation is CPM. If you want this to be CPS then you must choose the CPS internal timebase. If you want it to be CPM then you must choose the CPM internal timebase. Changing this will also change the calibration of the Rate Range, the Integrate Range, and the User Range. This is because these rely on the internal timebase for their calculations to make the CPM or CPS range read correctly.

There are several reasons to choose CPM or CPS:

1. To make the MOD softbutton selection of CPM or CPS

2. To calibrate the Rate, Integrate and User Ranges in units of CPM or CPS.

3. To Set the Preset Detector Menus to work in Conventional or SI units.

4. To Set the Preset Instrument Menus to work in Conventional or SI units.

5. To make the CPM or CPS range read correctly with a Calibration of 1.00.

To change the internal timebase, use the Setup Menu item , **CPM/CPS/SI *6;** see the section on Setup Menus form more information.

XII. Setup Menus

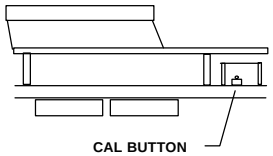
The Setup Menus are special menus that are different than the normal operation of the instrument. These menus allow adjustment and setting of all the variables in the instrument. These include for example, the button definitions, the calibration values, the operating displays, the detector settings and the defaults.

A. Accessing The Setup Menus

These menus are not available in any of the normal operating modes. There are 2 ways to enter into the Setup Menus. The first method, which is always available is to push a switch on the inside of the case. The second method is through the front panel, but it may be user disabled. The two methods are:

1. METHOD 1 INTERNAL BUTTON

1. If the instrument is on, turn it off.
2. Remove the bottom of the case by twisting the Twist Lock fasteners counter-clockwise.
3. Next to the right hand side of the display on the main circuit board is a small push-button marked **CAL**. Hold down this button while you are turning on the instrument. The display should show the first Setup Menu.



2. METHOD 2 EXTERNAL BUTTON

1. If the instrument is on, turn it off.
2. Push the **MODE** button and hold it down, then push the **POWER** button. Continue to hold down the **MODE** button until the Setup Menu appears. If the regular turn on menu appears instead, then the front panel has been disabled and it is necessary to use the internal button in Method 1

B. Scrolling Through The Setup Menus

The Setup Menu is the main menu that directs you to several other menus or operations. The top line of the display shows the selection that is offered followed by a number. Each item is numbered and has a * before the number to identify it. The bottom line contains the ↑ softbutton and ↓ softbutton and the **ok** softbutton. Push the ↑softbutton to go to the next item on the list. Push the ↓ softbutton to go to the pervious item on the list. When you have the selection that you want, push the **ok** softbutton. The screen will then change to the new item.

*C. * Setup Menu Selection*

The following is a list of menu selections in Setup. Each selection has a * followed by a selection number to make it easier to find. If a Softbutton is labeled * this means that pushing it will get back to this menu.

The * menu selections and their definitions are listed below.

1. Calibrate *1

This is the menu to change the calibration of the instrument. Please see the Calibration and Detector Setup Menus for a full understanding of how to use this menu. Also see the section on Calibration to understand the settings. It is used to change the following: Calibration Factor, Exponent, and Deadtime.

2. Detector Setup *2

This is the menu to change both the calibration of the instrument and the setup of the detector. Please see the section on Detector Setup Menu for a complete description of this menu. It is used to change the following: Calibration Factor, Exponent, Deadtime in/out, Deadtime, High Voltage, Saturation, Window in/out, Window, Discriminator, Gain, Range High Limit, Range Low Limit, Units, Prefix, and Timebase

3. Preset Instrument *3

This is the menu to preset the instrument parameters . Please see the section on Preset Instrument Settings for a complete description of this menu. The choices are selected for various needs or jobs. The list is: Standard, Only Rate, Only CPM/S, Contamination, Surveyor, Technician, Laboratory, Medical, Professional, and All. These change the look of the display, time constant, count time, power on time, function menus and the softbuttons.

4. Preset Detector *4

This is the menu to preset the detector parameters. Please see the section on Preset Detector Settings for a complete description of this menu. The choices are selected for various detector types. These change the beeper divide, gain, discriminator, window, deadtime, high voltage, saturation and window in/out.

5. Custom Settings *5

This is the menu to change individual memory locations in the EEPROM that in turn program the instrument. All of the instrument variables are stored in the EEPROM. This menu allows complete access to all the possible changes and setups in the instrument. It allows you to change everything changeable about the instrument. Please see the section on Custom Settings for a complete description of this menu.

6. CPM/CPS/Si *6

This is the menu to change the internal timebase from CPM to CPS. It also changes the front panel Level 1 Function Menu **MOD** softbutton selection from **CPM** to **CPS**. Internally the instrument calculates the basic rates from counts per minute or counts per second. This control changes that setting. If this setting is in CPS then any presets for Preset Instrument or Preset Detector will be in SI units.

If you want CPM, answer yes to the question **CPM Timebase?**. For more information see the section on Programming: Internal Timebase.

7. Front Panel *7

The Calibration and Setup Menus can be reached through the front panel or internally. This menu changes the access from the front panel. It also turns on and off the **Adjust Menu** for the Quick-keys. The choices are: **Front panel on/off**, **Adjust on/off** for all modes or for just the scaler. See the Operational section for more information on Adjust. If you want to be able to calibrate the instrument from the front panel push yes. If you want to be able to access the Adjust from all modes then push yes to the next question, and if you want to adjust only in the scaler mode push yes to the next question and no to the previous question.

8. Automatic Turn Off *8

The instrument has the capability to automatically turn itself off if it is not in use. This menu turns that capability on and off. If you want the instrument to automatically turn off then push yes. This will automatically turn it off after the time that is programmed into the instrument. The default value is 108 minutes. See and power time in Custom Setting section for more information on setting the value.

9. High Voltage Calibrate *9

The high voltage is displayed in several menus. This is a measured high voltage. This menu adjusts the calibration of the high voltage measurement so the value will be displayed correctly. It does not change the value of the high voltage. See the section on Maintenance for more information.

10. High Voltage Setting *10

This menu will adjust the setting of the high voltage. It allows you to preset the value of the high voltage for a particular detector without having to go into any other Menu. The top line of the display shows, after the **HV**:, the actual measured value of the high voltage. The number after the **Fac**: is the high voltage factor which is a number that the instrument uses to set the high voltage. It is also the number that is put into the memory to represent that high voltage. Select which detector you want to change using the **det** softbutton. The choices are detector 1, 2 or 3. Use the ↓ or ↑ softbuttons to change the value of the factor which in turn raises and lowers the actual high voltage. Save the data by pushing the **sav** softbutton after which the menu will change back to the * or Setup Menu. To change another detector, just push the **ok** softbutton.

11. Maintenance *11

This menu will allow adjustment of several parameters without changing their permanent values. The adjustments include high voltage, lld, uld, saturation, gain, light, beeper, divisor, and battery. In addition it will allow the use of a monitor program. See the section on Maintenance for more information.

12. Factory Setting *12

This setting is used at the factory to preset the instrument. The settings are the same as the **Standard Instrument Preset** combined with the Pancake GM detector. In addition it sets up and programs all the other parameters such as contrast, user characters, and current mode to start the instrument operation off properly. See the section on Factory Settings in Maintenance.

XIII. Calibration Menu and Detector Setup Menu

The Calibration Menu and the Detector Menu allow interactive changes to be made to the instrument. This permits changing many settings or variables while looking at an operating instrument. The Calibration Menu is used in changing the calibration of the instrument during routine calibrations. The Detector Setup Menu is used for changing the settings, variables and parameters when, adding a new detector or changing an existing detector.

The two modes function exactly the same except that the Calibration Mode sets only the Calibration Factor, Exponent and the Deadtime while the Detector Setup Mode sets the Calibration Factor, Exponent, Deadtime in/out, Deadtime, High Voltage, Saturation, Window in/out, Window, Discriminator, Gain, Range High Limit, Range Low Limit, Units, Prefix, and Timebase.

The Calibration and the Detector Setup Menus will change the parameters specific to the instrument and to the detector. Some of the variables are specific to the instrument and detector and some are specific to only the detector. Changing the Range High Limit will change the values for the selected Mode for that detector. If the current mode is the Rate Mode and detector 1 is the current detector, then only the Rate mode for detector 1 will be changed. Likewise changing the high voltage while detector 1 is selected will change the high voltage only on detector 1.

The Calibration Factor, Exponent, Range Hi and Low Limit, Units, Prefix and Timebase are all Mode and Detector specific. The High Voltage, Deadtime, Saturation, Window, Discriminator and Gain are only detector specific and will not change with mode.

The following describes how to enter into the Calibration Mode or the Detector Setup Mode using the Calibration and Detector Setup Menus.

1. Turn on the instrument with the **MODE** button pushed down. If this does not result in the words **Calibration *1** in the display then the Front Panel Calibration Adjust has been disabled and it is necessary to use the internal one; open the case, and push down on the **CAL** push button (top right hand side of the circuit board under the display) while turning the instrument on. The words **Calibration *1** should be on the display.

2. If you want the Calibration Mode Push the **OK** softbutton. If you want the Detector Setup Mode, then push the ↑ softbutton until **DET SETUP *2** is in the display, then push the **OK** softbutton. The Cypher will resume normal operation with the count rate value on the top line, and the calibration factor on the bottom line.

3. The softbuttons change the numeric value in the bottom line of the display. The ← Softbutton will move the cursor over 1 place and the ↑ softbutton will increase the value of the number positioned over the cursor. Using the two buttons, you can change the value of the displayed item in the bottom line. The value in the top line will change along with the new value in the bottom line.

4. In the Rate and CPM modes, the item on the bottom line can be changed by pushing **MODE** then the ↓ or ↑ softbuttons until the item description is what you want to change or do. Then push the **MODE** button to return to the calibration. If you do not push the ↓ or ↑ softbuttons the normal function menus will be displayed when you push the **MODE** button.

5. In the Integrate Range the softbuttons are already in use with controlling the display. Pushing **MODE** repeatedly will show the factors followed by the normal Function Menus. These factors are adjusted just like the ones in the CPM and Rate Modes.

6. After changing the items to the values that you want, you can either turn the instrument off or select Norm Operation from the choice of setup menu items.

XIV. Preset Instrument Menu

The Preset Instrument is used to setup the instrument, not the detector, for specific applications or uses. It is provided as a quick method to setup the instrument. We expect that most people will continue to use the factory settings however we also offer these choices.

A. Settings

1. Standard

This is the same settings as those received from the factory. It will provide the most usable functions for only 1 detector.

2. Rate Only.

This is for use as a survey meter to measure Dose Rate. It only functions in that mode and is a minimum instrument. It needs little or no operator training because it only displays dose rate. Its normal use would be with a gamma probe.

3. CPM Only.

This is used as a contamination meter. It only functions in that mode and is a minimum instrument. It needs little or no operator training because it only displays CPM. Its normal use would be with a pancake GM detector.

4. Contamination.

This is intended as a contamination meter for those with some radiation training. It has a CPM rate range as well as a scaler. It would normally be used with a pancake GM detector.

5. Surveyor.

This is intended to be used as a general replacement GM instrument. It has CPM and Rate ranges.

6. Technician.

This is useful for technical personnel. It has CPM, Rate, and Scaler. It also changes the Δ Quick-key to Range Hold. It will accept 2 detectors.

7. Laboratory.

This is useful for laboratory use where many people will be using it. It has CPM, Rate and Scaler modes and only 1 Function Menu.

8. Medical.

This is intended for Medical contamination and surveys. It has Rate and CPM ranges and only 1 Function Menu.

9. Professional.

This is for the Professional who knows what they are doing. It has the 4 standard Modes of CPM, Rate, Int, and Scaler. The Δ Quick-key is used for Range Hold and it will accept 3 detectors.

10. All.

This turns on almost all the functions. It has 3 Function Menus and 3 detectors.

The Preset Instrument Setup changes the following variables. Please note that they may reprogram some items such as contrast that may need adjusting.

VARIABLE	Standard	Rate Only	CPM Only	Contam-ination	Surveyor
Front Panel Enable	on	off	off	on	on
Auto Off Time	off	on	on	off	off
∗ Softkey	light	light	light	light	light
Δ Softkey	beep	beep	beep	beep	beep
Function Menu 1 Left	RH	-	-	LCD	LCD
Function Menu 1 Center	TC	-	-	TC	TC
Function Menu 1 Right	Mode	-	-	Mode	Mode
Function Menu 2 Left	LCD	-	-	-	-
Function Menu 2 Center	Light	-	-	-	-
Function Menu 2 Right	Beep	-	-	-	-
Function Menu 3 Left	-	-	-	-	-
Function Menu 3 Center	-	-	-	-	-
Function Menu 3 Right	-	-	-		-
Detector Number	1	1	1	1	1
VARIABLE	**Tech-nician**	**Labora-tory**	**Medical**	**Proffess-ional**	**All**
Front Panel Enable	on	on	on	on	on
Auto Off Time	off	off	off	off	off
∗ Softkey	light	LCDt	TC	light	light
Δ Softkey	beep	beep	beep	RH	beep
Function Menu 1 Left	LCD	Win	LCD	beep	RH
Function Menu 1 Center	TC	beep	Beep	TC	beep
Function Menu 1 Right	Mode	Mode	Mode	Mode	Mode
Function Menu 2 Left	Beep	-	-	LCD	LCD
Function Menu 2 Center	Det#	-	-	Win	TC
Function Menu 2 Right	Light	-	-	Light	Light
Function Menu 3 Left	-	-	-	-	Win
Function Menu 3 Center	-	-	-	-	DT
Function Menu 3 Right	-	-	-	-	Det#
Detector Number	2	1	1	3	3

All have the following settings: Deadtime is set to on for Rate and Integrate, and to off for all other modes, The Bargraph is set on, the Digital Rate is on, the Display is normal and the flash barscale is off, Auto Power Off is set to 108 min, Buzzer is set to loud, on all ranges, on on rate ranges, and off on integrate/scaler.

B. *Programming*

Using a Preset Instrument setting will change the variables listed below. To program the Cypher using the Preset Instrument settings do the following:

1. Enter into the Setup Menu by turning on the instrument with the **MODE** button pushed down. If this does not result in the words **Calibration *1** in the display then the Front Panel Calibration Adjust has been disabled and it is necessary to use the internal one; open the case, and push down on the **CAL** push button (top right hand side of the circuit board under the display) while turning the instrument on. The words **Calibration *1** should be on the display.

2. Using the ↓ or ↑ softbuttons, repeatedly push them until **Preset Instrument *3** is visible. Push the **ok** softbutton. Using the ↑ softbutton, repeatedly push it until the desired instrument setup name is displayed. Then push the **sav** softbutton. It will show that it is programming and then go back to the Main Setup Menu. Pushing **MODE** will now go back to normal operation. Push the ∗ softbutton to go back to the Setup Menu.

XV. Preset Detector Menu

The Preset Detector is used to setup the detector, not the instrument, for a specific class or type of detector. It is provided as a quick method to come close to the optimum settings for a specific detector, especially if you are adding or changing detectors.

A. Settings

1. Pancake GM.

This is for 2" diameter Pancake GM detectors that operate at 900 volts.

2. Thinwall GM.

This is for GM detectors that have a thin wall. These often have a sliding shield for Gamma measurements.

3. Thin End GM

This is for GM detectors that have a thin end window. They are usually about 1" Diameter and are used for Gamma and Alpha/Beta contamination.

4. 1x1NaI.

This is for NaI scintillators coupled to a photomultiplier. This is a good starting point for any 900 volt scintillator.

5. Alpha Scint.

This is for alpha scintillators.

6. Neutron Prop.

This is for proportional detectors. The most common use is with moderated BF3 detectors

B. *Programming*

Programming the Cypher using a Preset Detector setting will reprogram the variables listed below. If the detector has already been calibrated, then the settings will be changed. If you want to save the existing settings, we recommend writing them down from the Detector Setup Menu. To program the Cypher using the Preset Detector settings do the following:

1. Disconnect the current detector.

2. Enter into the Setup Menu by turning on the instrument with the **MODE** button pushed down. If this does not result in the words **Calibration *1** in the display then the Front Panel Calibration Adjust has been disabled and it is necessary to use the internal one; open the case, and push down on the **CAL** push button (top right hand side of the circuit board under the display) while turning the instrument on. The words **Calibration *1** should be on the display.

3. Using the ↓ or ↑ softbuttons, repeatedly push them until **Preset Detector *4** is visible. Push the **ok** softbutton. Using the ↑ softbutton, repeatedly push it until the desired instrument setup name is displayed. Push the **1det** softbutton to select which detector you want these settings to program. Then push the **sav** softbutton. It will show that it is programming and then go back to the Main Setup Menu. Push the ∗ softbutton to go back to the Setup Menu. Pushing **MODE** will now go back to normal operation.

4. Reconnect the new detector.

This table contains the defaults that are programmed into the Cypher with the Preset Detector Menu. The Presets change the following variables. Please note that they may reprogram some items such as time constant that may need adjusting.

	Internal Time-base setting	Pan-cake GM & Factory	Thin-wall GM	Thin end GM	1x1 Nal Scin-tillator	alpha Scin-tillator	Neutron Pro-portinal
RATE MODE							
Cal & Exponent	CPM	4.76 -4	8.33 -4	4.57 -4	5.00 -3	2.63 -0	2.00 -2
Prefix,Units,Tbase	CPM	5,3,1	5,3,1	5,3,1	4,3,1	6,0,2	5,1,1
Display,Bar Type	CPM	4,1	4,1	4,1	4,1	4,1	4,1
Lo,Hi Range Lim	CPM	-1,+3	-1,+3	-1,+2	0,+5	+2,+7	+2,+5
Up, Down Time	CPM	0,0	0,0	0,0	0,0	0,0	0,0
Time Constant	CPM	1	1	1	1	1	1
INTEGRATE							
Cal & Exponent	CPM	7.93 -6	1.33 -5	7.56 -6	8.33 -5	6.00 -3	3.33 -4
Prefix,Units	CPM	5,3	5,3	5,3	4,3	6,0	5,1
Lo, Hi RangeLim	CPM	-4,8	-4,8	-4,8	-4,8	-4,8	-4,8
RATE							
Cal & Exponent	CPS	2.85 -1	5.00 -1	2.73 -1	3.00 -3	2.63 0	1.20 1
Prefix,Units,Tbase	CPS	4,4,1	4,4,1	4,4,1	4,4,1	6,0,3	4,4,1
Display,BarType	CPS	4,1	4,1	4,1	4,1	4,1	4,1
Lo,Hi Range Lim	CPS	-1,+5	-1,+4	-1,+3	-1,+2	+2,+5	+2,+5
Up, Down Time	CPS	0,0	0,0	0,0	0,0	0,0	0,0
Time Constant	CPS	1	1	1	1	1	1
INTEGRATE							
Cal & Exponent	CPS	7.94 -5	1.38 -4	7.58 -5	8.33 -7	7.94 -5	3.33 -3
Prefix, Units	CPS	4,4	4,4	4,4	4,4	6,0	4,4
Lo,Hi Range Lim	CPS	-4,8	-4,8	-4,8	-4,8	-4,8	-4,8
ALL MODES							
High Voltage	n/a	900	900	900	900	900	900
Gain	n/a	0	0	0	1	1	2
Discriminator	n/a	80	80	80	80	80	80
Window	n/a	max	max	max	max	max	max
Window in/out	n/a	out	out	out	out	out	out
HV Saturation	n/a	0	0	0	0	0	0
Deadtime usec	n/a	100	100	200	15	15	10
Beeper Divider	1	1	1	1	3	1	1
	Internal Time-base setting	Pan-cake GM & Factory	Thin-wall GM	Thin end GM	1x1 Nal Scin-tillator	alpha Scin-tillator	Neutron Pro-portinal

XVI. Custom Settings Menu

The Custom Settings is used to change the individual items in the instrument. It can change any variable. It programs by numbers and does not show the name of the variable. It is necessary to refer to the tables below to determine the location of the variable, and the setting for that variable. A description of the variables follows the tables.

A. Programming

To program the variable, first determine the variable or variables that you want to change. Locate the location of that variable in the following table, then determine the value or setting of the variable from the section Description of Custom Settings. Finally program the new value into that location using the Custom Settings Menu.

NOTE: Some of the variables are only for the instrument, some are for the detector, and some are for the detector and each mode. One is for the instrument and the mode.

1. Disconnect the current detector during this operation if you are changing the high voltage and the new voltage may damage the detector.

2. Enter into the Setup Menu by turning on the instrument with the **MODE** button pushed down. If this does not result in the words **Calibration *1** in the display then the Front Panel Calibration Adjust has been disabled and it is necessary to use the internal one; open the case, and push down on the **CAL** push button (top right hand side of the circuit board under the display) while turning the instrument on. The words **Calibration *1** should be on the display.

3. Using the ↓ or ↑ softbuttons, repeatedly push them until **Custom Settings *5** is visible. Push the **ok** softbutton.

4. The display will now show **Loc Data** on the top line and numbers on the bottom line. These stand for location and data. The location is the place in EEPROM memory that holds the data. The data is the value that is stored in that location. Data and location have values from 0 to 255. The 3 digit number under **Loc** is the current location. The 3 digit number under **Data** is the data for that location.

   The right hand softbuttons change the numeric value of the data or location. The ← Softburtton will move the cursor over 1 place and the ↑ softbutton will increase the value of the number positioned over the cursor. Using the two buttons, you can change the value of either the location or the data.

   The **POWER** button, is a softbutton even though it is not marked. Pushing it will move the cursor from the Location value to the Data value. If the Data has been changed, pushing the **POWER** button will save the data. ***This is the only way to save the data***. The display will show the programming message.

   Pushing both right hand softbuttons down simultaneously will change the softbuttons from ← and ↑ to ↓ and ↑. In this configuration the softbutton will raise and lower the value of the 3 digit number that is above the cursor. This makes it easier to increase or decrease values, or to scroll through memory.

5. When you are finished, push the **POWER** button to save the last change then push the **MODE** button to return to the Main Setup Menu.

6. It is a good idea to recalibrate or at least check the operation of the instrument to make sure you did not inadvertently change an important variable.

B. Locations of Variables

The tables below show the values in each of the locations. The first table covers locations 0 to 36. The second table covers locations 25 to 27 and 48 to 255.

Locatio	Name	Description
0	Check	Contains Adiust. Power off . EEPROM check value
1	Stats	Buzzer on/off and loud
2	Detector. #	Current detector number set to 0 for detector 1. 1 for detector 2 & 2 for det 3
3	Cur rent Mode	Current mode of instrument. 0=CPM/S.1=Rate.2=User.3=Int.4=Scaler
4	Contrast	Default is 160
5	Time Int3	Time for integrate range 3rd Digit. Set to 0
6	Time Int2	Time for integrate range 2nd Digit. Set to 0
7	Time Int1	Time for integrate range 1st Digit Set to 60
8	Time Scl3	Time for scaler 3rd Digit. Set to 0
9	Time Scl2	Time for scaler 2nd Digit. Set to 0
10	Time Scl1	Time for scaler 1st Digit. Set to 60
11	Not Used	
12	DT on/off	Deadtime on/off for each Mode
13	Detector Max	Detectors that can be used. Set to 1 for 1. 2 for 2 and 3 for 3
14	Power Time	Time before auto turn off. Set to 0 for no turn off.
15	CPM/CPS	Internal Timebase and Sets SI units for Instrument and Detector Setup.
16	* Button	Softkey definition
17	Δ Button	Softkey definition
18	Function Mnu 1L	Function Menu softbutton definition for 1st menu left button
19	Function Mnu 1C	Function Menu softbutton definition for 1st menu center button
20	Function Mnu 1R	Function Menu softbutton definition for 1st menu right button
21	Function Mnu 2L	Function Menu softbutton definition for 2nd menu left button
22	Function Mnu 2C	Function Menu softbutton definition for 2nd menu center button
23	Function Mnu 2R	Function Menu softbutton definition for 2nd menu right button
24	Function Mnu 3L	Function Menu softbutton definition for 3rd menu left button
25	Function Mnu 3C	Function Menu softbutton definition for 3rd menu center button
26	Function Mnu 3R	Function Menu softbutton definition for 3rd menu right button
27	User1	User Units and Timebase 1st character
28	User2	User Units and Timebase 2nd character
29	User3	User Units and Timebase 3rd character
30	User4	User Units and Timebase 4th character
31	User5	User Units and Timebase 5th character
32	HV Cal	Calibration number for High Voltage. Preset to 94
33	Power User1	User character at turn on display. 1st digit.
34	Power User2	User character at turn on display. 2nd digit.
35	Power User3	User character at turn on display. 3rd digit.
36	Power User4	User character at turn on display. 4th digit.

Location Det#1	Location Det#2	Location Det#3	Mode	Name	Description
37	38	39	Mode[1]	Mode Lockout	Determines which modes in

48	112	176	CPM	Cal High	Part of Calibrate Number Digit
49	113	177	‘	Cal Low	Part of Calibrate Number Digit
50	114	178	‘	Exponent	Exponent
51	115	179	‘	Prefix	Base Prefix
52	116	180	‘	Units	Base Units
53	117	181	‘	Timebase	Base Timebase
54	118	182	‘	Disp Type	Display Type. Where D.point is
55	119	183	‘	Barg Type	Bargraph Type
56	120	184	‘	Range Lo Limit	Limit for ranging down
57	121	185	‘	Range Hi Limit	Limit for ranging up
58	122	186	‘	Range Up Time	Time to range up
59	123	187	‘	Range Dn time	Time to range down
60	124	188	‘	Time Constant	Time Constant
61	125	189	‘	Display Confg	Configure the Display
62	126	190	RATE	Cal High	Part of Calibrate Number Digit
63	127	191	‘	Cal Low	Part of Calibrate Number Digit
64	128	192	‘	Exponent	Exponent
65	129	193	‘	Prefix	Base Prefix
66	130	194	‘	Units	Base Units
67	131	195	‘	Timebase	Base Timebase
68	132	196	‘	Disp Type	Display Type. Where D point is
69	133	197	‘	Barg Type	Bargraph Type
70	134	198	‘	Range Lo Limit	Limit for ranging down
71	135	199	‘	Range Hi Limit	Limit for ranging up
72	136	200	‘	Range Up Time	Time to range up
73	137	201	‘	Range Dn Time	Time to range down
74	138	202	‘	Time Constant	Time Constant
75	139	203	‘	Display Confg	Configure the Display
76	140	204	USER	Cal High	Part of Calibrate Number Digit
77	141	205	‘	Cal Low	Part of Calibrate Number Digit
78	142	206	‘	Exponent	Exponent
79	143	207	‘	Prefix	Base Prefix
80	144	208	‘	Units	Base Units
81	145	209	‘	Timebase	Base Timebase
82	146	210	‘	Disp Type	Display Type. Where D point is
83	147	211	‘	Barg Type	Bargraph Type
84	148	212	‘	Range Lo Limit	Limit for ranging down
85	149	213	‘	Range Hi Limit	Limit for ranging up
86	150	214	‘	Range Up Time	Time to range up
87	151	215	‘	Range Dn Limit	Time to range down
88	152	216	‘	Time Constant	Time Constant
89	153	217	‘	Display Confg	Configure the Display
90	154	218	INTGRT	Cal High	Part of Calibrate Number Digit
91	155	219	‘	Cal Low	Part of Calibrate Number Digit
92	156	220	‘	Exponent	Exponent
93	157	221	‘	Prefix	Base Prefix
94	158	222	‘	Units	Base Units
95	159	223	‘	Disp Type	Display Type. Where D point is
96	160	224	‘	Range Lo Limit	Limit for Type ranging down
97	161	225	‘	Range Hi Limit	Limit for ranging up
98	162	226	‘	Display Confg	Configure the Display
99	163	227		Not Used	
100	164	228		Not Used	
101	165	229	DET[2]	Beep Divider	Divider for beeper
102	166	230		Gain	Gain
103	167	231	‘	Discriminator	Discriminator
104	168	232	‘	Window	Window
105	169	233	‘	Deadtime	Deadtime
106	170	234	‘	High Voltage	High Voltage
107	171	235	‘	Saturation	Saturation
108	172	236	‘	Window in/out	Window in or out

NOTES [1] Setting for the instrument with detector. [2]Settings for Detectors not for modes.

C. *Description of Custom Settings*

The following descriptions are in alphabetical order.

1. ∗ Button

This selects the function of the ∗ button.:

∗ AND Δ QUICK-KEY BUTTON DEFINITIONS	
Setting	Function of ∗ and Δ button
0	No function, button will do nothing
1	Light on/off
2	Buzzer on/off
3	Time Constant Set
4	Contrast
5	Range Hold
6	Hold/Reset/Run. display in hold
7	Buzzer Divider., Sets buzzer divider
8	Detector Set. Chngs to det 1, 2 or 3
9	Mode Change, changes the Mode

2. Δ Button

This selects the function of the Δ button and has the same choices as the ∗ button.

3. Adjust

See Check

4. Bargraph Type

This is the full scale value of the bargraph. It allows four choices for full scale on the bargraph. This will not change the calibration of the instrument but will alter when the range change occurs. The Digital display will change ranges to keep the bargraph on scale. 10 (Setting 1) is usually used for full scale, however for different applications any of the others are equally applicable.

The 5 decade log display is a quasi log with linear values between the decades. Each decade is represented and each decade is linear. This mode will make the digital display change ranges the same as type 1. Change the bargraph scale inside the instrument (located above the display under the window) if you change this value.

The log bargraph is set with the Range Lo Limit as the beginning of the range.

BARGRAPH TYPE			
Setting	Type	Setting	Type

1	1,10,100,1000,1K	3	.25,2.5,25,250,2.5K
2	.5,5,50,500,5000	4	5 decade Log

5. Beeper Divider

The beeper divider divides the pulses from the detector before sending them to the beeper. This is useful with detectors that have higher count rates such as scintillators. It is hard to distinguish changes in beep rate when the beeper is on almost all of the time. Setting the divider to a higher number will reduce the number of beeps and make changes more apparent.

BEEPER DIVIDER			
Setting	Divider	Setting	Divider
0	1	2	64
1	8	3	2048

6. Cal High/Low

This is the value of the Calibration Factor on all modes except the scaler. It is set for each detector and each mode. It is best set in the Calibrate or Detector Setup Menu. It is in reality a two byte HEX number. The High byte and low byte make up the complete calibrate number. It is set from 100 to 999. This is 100 times greater than the value in the display in the Calibrate Mode because the program takes care of the difference. To set it to 1.00 in the Calibrate Display, set Cal High to 0 and Cal Low to 100. To set it to 5.00 in the Calibrate Display, set Cal High to 1 and Cal Low to 2440.

7. Check

This location contains the settings for several variables.

ADJUST on and off for scaler and for other ranges. No turns the adjust off and Yes turns it on. This can also be set by the menu **Front Panel *7** of the Setup Menu.

POWER OFF Turns the power off automatically after the time specified in Power Off Time. Set to no to turn off the automatic power off. If you want it to turn off automatically set it to yes. This can also be set by the menu **Front Panel *7** of the Setup Menus.

FRONT PANEL CALIBRATE Turns on and off the Front Panel Calibrate. Set to No if you want to have to open the instrument to change the calibration. Set it to yes if you want access to the calibration adjustments through the front panel. This can also be set by the menu **Front Panel *7** of the Setup Menus.

CHECK TABLE				
Setting	Adjust Scaler	Adjust All modes	Auto Power Turnoff	Front Panel Calibrate
10	No	No	No	No
26	No	No	No	Yes
42	No	No	Yes	No
58	No	No	Yes	Yes
74	No	Yes	No	No
90	No	Yes	No	Yes
106	No	Yes	Yes	No
122	No	Yes	Yes	Yes

CHECK TABLE				
Setting	Adjust Scaler	Adjust All modes	Auto Power Turnoff	Front Panel Calibrate
138	Yes	No	No	No
154	Yes	No	No	Yes
170	Yes	No	Yes	No
186	Yes	No	Yes	Yes
202	Yes	Yes	No	No
218	Yes	Yes	No	Yes
234	Yes	Yes	Yes	No
250	Yes	Yes	Yes	Yes

8. Contrast

Sets the contrast of the instrument. This is normally set with the Contrast adjustment **LCD** softbutton. It is preset to 160 in the Factory Setting. If this is incorrectly set it may be impossible to read the LCD. If that is the case use the Emergency Contrast Adjustment.

9. CPM/CPS Internal Timebase

This selects the internal timebase of the instrument. There are 2 choices, CPM (Counts per minute) or CPS (Counts per second). If this is set to CPM and then programmed with the Instrument Setup, Detector Setup or Factory Setup menus, the instrument will be in conventional units and the rate range will probably read in mR/h. If it is set to CPS and then programmed with one of the 3 Setup menus, the instrument will be in SI units. Set this to 0 for Conventional Units, and 1 for SI units or use one of the choices in the Setup Menus.

There is another reason for using CPM or CPS. One of the choices with the **MOD** softbutton in the Function Menu during normal operation is CPM. If you want this to be CPS then you must choose the CPS internal timebase. If you want it to be CPM then you must choose the CPM internal timebase. If you change this setting, then you must recalibrate the instrument. For more information see the section on Programming: Internal Timebase.

10. Current Mode

This is the current mode. Set it to a mode that is currently in use. Also see Mode Lockout.

CURRENT MODE TABLE					
MODE	CPM/S	RATE	USER	INTEGRATE	SCALER
SETTING	0	1	2	3	4

11. deadtime

This should be the Deadtime for the detector and if the Deadtime is turned on, will correct for dead time losses at high count rates. Set it in microseconds from 0 to 255.

12. Detector

This is the current detector that is in use. It determines which detector is in use not how many detectors. Set to 0 if you have only 1 detector. Set it to 0 if you

have several detectors and use the DET softbutton in normal operation to change the value. Its value is changed every time the detector number is changed.

13. Detector Max

This limits the number of detectors that can be selected by the DET softbutton in a Function Menu. Set it to 1 for 1 detector, 2 for 2 detectors, and 3 for 3 detectors.

14. Discriminator

This setting may also be though of as a threshold. It should be set high enough that there are no counts from noise. It may be set from 0 to 255 but is linear only from 0 to 100. It is best set interactively in the Detector Setup Menu.

15. Display Configuration

Changes the look and feel of the display. The Bargraph can be turned on and off as can the Numeric Display in the CPM/S, Rate and User modes. The Display can be set to normal with the bargraph on the bottom or it can be inverted with the bargraph on the top. The Bargraph scale can be set to flash.

DISPLAY CONFIGURATION					
Setting		Bargraph	Rate Numbers	Normal/Invert	Flash Barg S.
0	128*	off	off	normal	No flash
1	129*	on	off	normal	No flash
2	130*	off	on	normal	No flash
3	131*	on	on	normal	No flash
4	132*	off	off	inverted	No flash
5	133*	on	off	inverted	No flash
6	134*	off	on	inverted	No flash
7	135*	on	on	inverted	No flash
8	136*	off	off	normal	Flash
9	137*	on	off	normal	Flash
10	138*	off	on	normal	Flash
11	139*	on	on	normal	Flash
12	140*	off	off	inverted	Flash
13	141*	on	off	inverted	Flash
14	142*	off	on	inverted	Flash
15	143*	on	on	inverted	Flash

16. Display Type

There are 4 display types. They change the way the data changes the prefix when it changes ranges. The 4 types and their settings are:

1. This is engineering format. The units change every 3 decades.

2. This extends the engineering format up 1 so that a prefix change will not occur when the value moves above 999. For example instead of going from 999 mR/h to 1.00 R/h this will go from 999 mR/h to 1000 mR/h with a constant zero in the right hand digit. On the next higher decade change the prefix will change.

3. This extends the engineering format down 1 decade so that a prefix change will not occur when the value goes below 100. For example instead of going from 1.00 mR/h to 999 uR/h the display would go from 1.00 mR/h to .999 mR/h. On the next lower decade the display would change the prefix.

4. This is a combination of 2 and 3 where the span of one prefix will be extended up and down 1 decade. This is usually the recommended setting.

DISPLAY TYPE			
Setting	Type	Setting	Type
1	Engineering format	3	Down 1 decade
2	up 1 decade	4	Up & Dn 1 Decade

17. Dt On/Off

Use the same table as in Mode Lockout. This controls if the deadtime is turned on or off for each Mode. If it is set to ON then the deadtime is turned on. The common setting is 10 which turns the deadtime correction on only for the Rate and Integrate modes.

18. Exponent

This is the value of the Exponent in the instrument. It is a positive and negative number that rolls negative at 255. Thus 0 is zero, 5 is +5 and 252 is -4. It is best set in the Calibrate or Detector Setup Menu.

EXPONENT TABLE			
Setting	Exponent	Setting	Exponent
1	1	0	0
2	2	255	-1
3	3	254	-2
4	4	253	-3
5	5	252	-4
6	6	251	-5
7	7	250	-6
8	8	249	-7
9	9	248	-8
10	10	247	-9

19. Front Panel Calibrate

See Check

20. Function Menus

There are 12 different possibilities for the Function Menus. These are the softbuttons. 1L refers to the 1st Function Menu after you push the MODE button and the L refers to the left hand softbutton (really the MODE button). C is the center softbutton(really the ∗ button) and R is the right softbutton (really the . Δ button). There are therefore 3 possible Function Menus each with 3 possibilities. If a complete function menu is programmed with 0 in all three locations, then the previous Function Menu will be the last one displayed.

FUNCTION MENU SOFTBUTTON DEFINITIONS	
Setting	Function
0	None. Display will be blank and Softbutton will do nothing
1	Light on/off/timed
2	Buzzer on/off/soft

3	Time Constant slow/medium/fast
4	Contrast adjustment
5	Range Hold which keeps the same range
6	Hold Freezes the numeric display
7	Beeper Divider. Set to 1,8,64 or 2048 counts/beep
8	Detector number. Changes the number of the current detector.
9	Deadtime in/out Choose for each mode
10	Mode selects from CPM/S, Rate, User, Intgrt, Scaler
11	Calibrate Changes to calibrate mode
12	Window Turns window on or off

21. Gain

This sets the gain of the preamp. Any gain may be used with any detector without damage to the instrument. We generally recommend lower gain with GM detectors.

GAIN		
Setting	Gain	Use
0	Low	GM
1	Medium	Scintillators
2	High	Proportional/Scintillator

22. High Voltage

This is the actual high voltage setting. Set it from 0 to 255. The value of the high voltage is 9.8 volts per unit. This is an approximate setting. Check the actual setting for each detector in the Calibration or Setup Menu.

HIGH VOLTAGE SETTINGS 9.8 Volts/unit of setting This table has some common settings for high voltage.	
Setting	Volts
45	450
71	700
92	900
143	1400
173	1700

23. High Voltage Cal

This is a factor that calibrates the high voltage displays in the Cypher. It does not change the value of the actual high voltage. This is best set in the High voltage Calibrate Setup Menu. Its nominal value is 90. See the Maintenance section for details on setting this variable.

24. Mode Lockout

This determines which modes can be displayed. Set it to off if it is a mode you do not want. Set it to on if it is a mode you want to be able to choose with the **MOD** softbutton. The common setting is 27 which turns on all the Modes except the User Mode. The Current Mode should be set to one of the modes that is on.

MODE LOCKOUT AND DT ON/OFF TABLE					
Setting	**CPM/S**	**RATE**	**USER**	**INTEGRATE**	**SCALER**
0	off	off	off	off	off
1	on	off	off	off	off
2	off	on	off	off	off
3	on	on	off	off	off
4	off	off	on	off	off
5	on	off	on	off	off
6	off	on	on	off	off
7	on	on	on	off	off
8	off	off	off	on	off
9	on	off	off	on	off
10	off	on	off	on	off
11	on	on	off	on	off
12	off	off	on	on	off
13	on	off	on	on	off
14	off	on	on	on	off
15	on	on	on	on	off
16	off	off	off	off	on
17	on	off	off	off	on
18	off	on	off	off	on
19	on	on	off	off	on
20	off	off	on	off	on
21	on	off	on	off	on
22	off	on	on	off	on
23	on	on	on	off	on
24	off	off	off	on	on
25	on	off	off	on	on
26	off	on	off	on	on
27	on	on	off	on	on
28	off	off	on	on	on
29	on	off	on	on	on
30	off	on	on	on	on
31	on	on	on	on	on

25. Power Off

See Check

26. Power Time

This is the timer for the automatic turn off. It sets in increments of 25.5 seconds and can be set from 0 to 255. It is preset to 255 which is 108 minutes. This means that the instrument will automatically turn off in 108 minutes after the last button has been pushed.

27. Power User 1 Thru 3.

This allows any 3 characters to be displayed on the right hand side of the LCD at turn-on. See the ASCII table under User below for the setting of the character. Power User 1 is the left hand character.

28. Prefix

The prefix is the starting point for all the modes except the Scaler.

PREFIX TABLE			
Setting	Prefix	Setting	Prefix
0	a atto	7	K kilo
1	f femto	8	M mega
2	p pico	9	G giga
3	n nano	10	T tera
4	u micro	11	P penta
5	m milli	12	E exa
6	none		

29. Range Hi/Lo Limits

This sets the limits of the display, both upper and lower limits. It has the value from 119 to 136 with 128 in the center. Set this to keep the detector from being too sensitive and to keep it from going into a high scale that may not be usable because of saturation or excessive deadtime losses. Set Range Hi to one value higher than you want to use, Range Lo to the actual range you want to use.

RANGE HI/LO TABLE Center is the point of calculation for the calibration. Higher means the ranges with more counts. Lower means the ranges with fewer counts. (Table values assuming type 1 Display.)			
Setting	Range (decade)	Setting	Range (decade)
128	X.XX **Center**	127	XXX
129	XX.X	126	XX.X
130	XXX	125	X.XX
131	X.XX	124	XXX
132	XX.X	123	XX.X
133	XXX	122	X.XX
134	X.XX	121	XXX
135	XX.X	120	XX.X
136	XXX **Higher**	119	X.XX **Lower**

30. Range Up/Dn Time

This is the number of seconds that it takes the rate ranges to change ranges. The value set is the number of seconds. It is normally set to 0. Setting the Up Time to 3, for example will delay moving up a range for 3 seconds.

31. Saturation

This is useful to check if the detector is in saturation or drawing too much current. It should be set interactively with the detector under the Setup Menu. Its range is from 0 to 255. If it is set too high, it could cause the instrument to read off scale on all ranges with no detector.

32. Stats

This controls the beeper status. It is normally set and adjusted by the BUZ softbutton depending on the Mode. The loud/soft adjustment also effects the Quick-key when it is set to beeper on/off. Set the loud/soft correctly if you want the Quick-key to be soft or loud and you have no BUZ softbutton. Set this if you have no BUZ softbutton.

STATS TABLE				
Setting	Beeper Volume Int/Scaler	Beeper int/scaler	Beeper volume all rate ranges	Beeper all rate ranges
0	soft	off	soft	off
1	soft	off	soft	on
2	soft	off	loud	off
3	soft	off	loud	on
4	soft	on	soft	off
5	soft	on	soft	on
6	soft	on	loud	off
7	soft	on	loud	on
8	loud	off	soft	off
9	loud	off	soft	on
10	loud	off	loud	off
11	loud	off	loud	on
12	loud	on	soft	off
13	loud	on	soft	on
14	loud	on	loud	off
15	loud	on	loud	on

33. Time Constant

This sets the speed of the bargraph and the rate of change of the display. It is also set by the TC softbutton.

TIME CONSTANT			
Setting	Time Constant	Setting	Time Constant
0	Fast	2	Slow
1	Medium		

34. Time Int

This is the setting of the time for the time in the integrate range. It is set by the integrate range. Time Int1 is the MSB of a 3 byte HEX number. Each portion of the number is presented in decimal. The 3 byte number is the number of seconds that are in the display. It is preset to 60 which makes the display turn on with 60 seconds or 1 minute. There would normally be no reason to change this setting.

35. Time Scl

This is the setting of the time for the scaler. It is set by the time in the scaler. Time Scl1 is the MSB of a 3 byte HEX number. Each portion of the number is presented in decimal. The 3 byte number is the number of seconds that are in the display. It is preset to 60 which makes the display turn on with 60 seconds or 1 minute. There would normally be no reason to change this setting.

36. Timebase

This has 4 possible settings and sets the characters in the display. Changing this does not change the calibration.

TIMEBASE TABLE			
Setting	Timebase	Setting	Timebase

0	none	2	/m
1	/h	3	/s

37. Units

The units select which units are used in all modes except the Scaler.

UNITS TABLE			
Setting	Units	Setting	Units
0	cnt	6	Gy
1	REM	7	dis
2	rad	8	CPM
3	R	9	CPS
4	Sv	10	user 1 thru 5
5	Bq		

38. User 1 Thru 5

This allows any characters to be used for the units and timebase. If user is chosen under Units then these 5 characters will occupy the space for units and timebase. They are normal ASCII characters. Each one needs to be programmed with its own character. User 1 is the left hand character.

ASCII CHARACTER TABLE							
#[1]	CH[2]	#[1]	CH[2]	#[1]	CH[2]	#[1]	CH[2]
32	(space	48	0	64	@	80	P
33	!	49	1	65	A	81	Q
34	“	50	2	66	B	82	R
35	#	51	3	67	C		S
36	$	52	4	68	D	84	T
37	%	53	5	69	E	85	U
38	&	54	6	70	F	86	V
39	‘	55	7	71	G	87	W
40	(	56	8	72	H	88	X
41	)	57	9	73	I	89	Y
42	*	58	:	74	J	90	Z
43	+	59	;	75	K	91	[
44	,	60	<	76	L	92	Y
45	-	61	=	77	M	93	]
46	.	62	>	78	N	94	^
47	/	63	?	79	O	95	_

[1] Setting, [2] Character

There are settings from 0 to 255, however they are not normal ASCII characters. If you need a strange character, please contact the factory.

39. Window

This sets the size of the window. It may be set from 0 to 255. If the Window is turned on, pulses that are larger than the discriminator but smaller than the Window plus Discriminator will be counted. For example, if the discriminator is set to 30 and the Window to 60 then pulses in the range of 30 to 90 will be counted. Pulses from 0 to 30 and from 90 to 255 will not be counted. It is best set interactively in the Detector Setup Menu. Pulses range from 0 to around 100.

40. WINDOW IN/OUT

This turns the window in and out. If it is set to in, then only counts that have a pulse height within the window will be counted. If it is out, any pulse larger than the Discriminator will be counted.

XVII. Customizing the Cypher

The Cypher may be customized by changing the variables. The operation of the instrument is very programmable. The section on the Custom Menu describes each of the variables. The Description of Custom Setting Menu shows all the possible settings for the Cypher. We offer the following tips and suggestions on how to change the instrument to meet your particular needs.

A. *Buttons*

Probably the most useful changes to the instrument revolve around the buttons. This includes both the Quick-keys and the Function Menus. They both can be modified to meet your needs.

The Quick-keys are the buttons that are on the right hand side of the panel and are active during CPM/S, Rate and User Modes. These are also referred to as the ∗ and Δ Quick-keys. They are factory set to Beeper and Light, which are probably the most generic uses of the controls on a survey meter. There are 7 other choices that are available. If you do not need the light or beeper, then you may consider using either button for either the Range Hold, Hold or contrast. The other options are listed under the ∗ or Δ Buttons in Custom Settings.

There are 2 Function Menus with the factory settings. All of the functions may not be necessary. If you do not need all of the functions, you could change to 1 Function Menu. This may be simpler for some people to understand because it only involves one screen change. Alternatively you could change to 3 Function Menus if you need more capability.

The location of the functions within the Function Menu can also be changed. Each of the three locations above the three right hand buttons is available for any of the functions. If you are left handed and use the MODE button frequently, consider moving it to the left hand side of the instrument. (Changing location 18 from 5 to 10 and location 20 from 10 to 5 in the Custom Menu will swap the **MOD** and **RH^{H}** .) We usually put the most used functions on the first menu.

B. Display

The display is the other part of the instrument that can be customized to fit your needs. Particularly important is the full scale range of the bargraph. We have it set at 10 for the factory settings, however many survey meters have 50, 500, and 5000 CPM full scale primarily to put background counts from pancake GM detectors farther up the scale. If you wanted to emulate one of these meters, change the Bargraph Type to 2 in Custom Setup. There also is a 2.5, 25, 250 and 2500 full scale available.

If you are using the instrument in areas where the bargraph may confuse some people, you can turn it off by setting the bargraph to off in Display Configuration in the Custom Setup Menu. Just read the current value, look at the table and find out the current settings. Then look for the same settings but with the bargraph off and change the data to the new value.

We also offer the choice of normal or inverted display with the bargraph on top. This may be useful for some applications where you need 2 different bargraph scales, perhaps one a log scale for mR/h and one a linear scale for CPM.

The Range Up and Down Time allow the instrument to dwell on a range without going up or down a range quickly. The Range Up Time would be useful for contamination surveying near background where there are hot spots. It would keep the range from going to the next higher range quickly. It may be set to 2 or 3 seconds. Likewise you may be using the detector in high radiation levels and not want it to range down during a momentary dip in radiation. In this case increasing the Range Down Time would be useful. Set both of these in the Custom Setting Menu.

C. Modes

The modes can be turned on or off. This allows the instrument to function in whatever capacity you want. If you do not need a scaler or an integrate range, turn them off using the Mode Lockout in the Custom Settings. There is also a User Mode that can be programmed in any rate units you want. Use the Mode Lockout in the Custom Settings Mode to turn on this mode. Then program it in the Setting Up a New Detector section for the units, prefix, etc., just the same as the rate range.

The CPM/S range can also be changed into any units. It does not have to be used for CPM/S

D. Internal Time Base

The internal timebase of the Cypher can be in Counts per Minute or in Counts per Second. In general, CPM is used with conventional units, and CPS is used with SI units. See the section on Programming: Internal Timebase for more information.

E. Detector

There are a maximum of 3 detectors that can be used with the Cypher if each needs its own set of settings. Of course, any number can be used with the same settings. For example, many GM detectors use the same high voltage and all should be used on the CPM/S range. However all would not read correctly with the Rate Range. To add detectors you will need to either make a DET Function Menu or Soft Button. In addition you will need to set the Detector Max. See section above on Buttons.

F. Printed Bargraph scale

The printed bargraph scale is between the window and the display. It contains the numbers for the scale for the bargraph. The Appendix contains a copy of many different bargraph scales for various bargraphs. To install a scale:

1. Remove the bottom case from the instrument.
2. Remove the two screws that hold the front of the circuit board to the spacers. These are reached through the slot in the battery mounting plate. The circuit board with batteries should fold away from the front panel.
3. Remove the old scale.
4. Cut out the new scale using scissors. Add a small piece of double stick tape to the back and stick it to the LCD using the old scale as an example.
5. Replace the scale in the instrument. Replace the screws and bottom case.

XVIII. Maintenance

This section covers the adjustments of the instrument to maintain it in working order. For additional information on repairing the Cypher, please consult the Repair and Operation manual. It includes a complete circuit description, parts list, exploded views, and schematic.

A. High Voltage Calibration

The high voltage displays on the Cypher are actually measured rather than just calculated. This measurement system may need calibration. The calibration is simple and straightforward.

1. Connect a high voltage high impedance meter with >10,000 megohm input resistance to the external connector on the handle. The meter should be capable of measuring 2000 Volts DC.
2. Turn the instrument on in the Setup Menu and change it to the **HV Calibrate *9** Menu. Press ok to change into the HV calibrate display.
3. Measure the high voltage with the external voltmeter.
4. Using the ↑ and ↓ softbuttons change the **Cal**: number until the **HV:** is as close as possible to the measured high voltage.
5. Push the **ok** softbutton to save the value. Push the **POWER** button if you do not want to change the calibration.

B. Maintenance Mode

This mode is useful for checking the operation of the instrument when it is needed for repair. Each item is used for checking some part of the instrument. Please refer to the Operation and Repair Manual for more information.

If you do decide to change the settings with this menu, remember to disconnect the detector in case the high voltage changes. This mode does not change any stored value.

C. Failure in Display

If the display says FAILURE, then the EEPROM has failed. This may mean that is it corrupted or that it is not working. In any case you should try to reprogram it which may preserve many of the settings.

1. Turn the instrument on after the display shows **Failure #1**, push the internal **CAL** button on the main circuit board, under the right hand side of the display. The display will change to the Setup Menu.
2. Advance the menus using the ↑ or ↓ softbutton until the displays shows the **Custom Set *5** . Then push **OK**. Push the **POWER** button to change the cursor to the Data. Use the ← and ↑ softbuttons to change the Data to 26. Then push the **POWER** button then the **MODE** button twice.
3. If the display shows a normal turn on, then the EEPROM was only corrupted a little, and it would be wise to check the calibration and operation of the instrument. If it shows a **Failure #1**, then the EEPROM is defective and should be replaced.

D. Installing a New EEPROM

When installing a new EEPROM it is necessary to program it to the default values. It will show **Failure #1** in the display until it is programmed.

1. Turn the instrument on after the display shows **Failure #1**, push the internal **CAL** button on the main circuit board, under the right hand side of the display. The display will change to the Setup Menu.
2. Advance the menus using the ↑ or ↓ softbutton until the display shows the **Factory Set *12**. Then push **OK**, answer the question on CPM or CPS, and then Yes to **Are you sure?.** It will take 30 seconds to program the entire EEPROM.
3. After it is done programming, push the Mode button to resume normal operation.
4. Check the new EEPROM by turning the instrument on and off. If it turns on without the failure warning, then it has been programmed.
5. The instrument will now need to be completely recalibrated.

E. Factory Settings

To program the instrument with the factory settings:

1. Turn on the instrument with the **MODE** button pushed down. If this does not result in the words **Calibration *1** in the display then the Front Panel Calibration Adjust has been disabled and it is necessary to use the internal one; open the case, and push down on the **CAL** push button (top right hand side of the circuit board under the display) while turning the instrument on. The words **Calibration *1** should be on the display.
2. Advance the menus using the ↑ or ↓ softbutton until the display shows the **Factory Set *12**. Then push **OK**, answer the question on CPM or CPS, and then Yes to **Are you sure?.** It will take 30 seconds to program the entire EEPROM.
3. After it is done programming, push the Mode button to resume normal operation.
4. The instrument will now need to be completely recalibrated.

XIX. Questions & Problems

There are many questions and problems that can occur with the Cypher. We recommend reading the pertaining sections to try to understand the instrument. Most problems will occur because of incorrect programming.

Q*: I programmed the instrument using the custom settings and now I get gibberish on the display when I cycle through the second screen of the Function Menu.*

A: The gibberish is a result of an improper programming choice in the Custom Settings. If the choice is not among those that are in the tables, then the instrument will choose a non existing choice and print gibberish on the display. Look at the numbers in locations 18 through 26 using the Custom Settings Menu. The selections should be in the range from 0 to 12.

Q: I want to use 2 detectors but I can't figure out how to change to the second detector.

A: If you can't change the detectors this means that you don't have the DET function in the Function Menu. You will need to add it by changing one of the selections in location 18 through 26 in the Custom Settings Menu. These locations correspond to the left, center and right buttons of the first, second and third Function Menus. To see what the current choices are, look them up in the chart of Function Menu Definitions chart, and then change one of the locations. You will change it to an 8 which is the detector selector. Incidentally you probably are not using all three Function Menus and your choice will be either to change one of the existing softbuttons to this function or to add it to a new Function Menu by adding a Function Menu to location 24, 25 or 26.

Q: Is the Cypher available in different languages?

A. It currently is available only in English. However if you purchase the Operation and Maintenance Manual it includes a list of the words that are used in the Cypher. If you write the words and abbreviations that you want in the table provided, we will change the program. There is a small fee for this service.

Q: I need 2 different scales for the bargraph. How do I do it.

A. The bargraph can be on the top or the bottom line. Use one range with the top line, and one with the bottom line. You will find it under Display Configuration. Make sure the scales are in place on top of the LCD.

Q: Why are there more Log printed bargraph scales than normal scales?

A. The log bargraph scales can start with any decade, that is why there are so many. Incidentally the log scale also can be configured in 2 ways. The scale can be though of as only the units, or the units with the prefix. Most of the supplied bargraph scales do not use the prefix for their value.

.***Q: When I use the highest CPM/S range and the reading is about mid scale, it then jumps off scale. I can't get it to read at the top end of the scale. Why not?***

A. There are 2 reasons for jumping off scale. If the instrument thinks that the detector is in saturation or if the instrument thinks that there are too many counts for the detector it will make it go off scale. Check the saturation setting, it may be too high. The instrument uses the deadtime setting to calculate how high it should go before showing off scale. It does this even though the deadtime is turned off. To show all the counts with no limits, set the saturation and deadtime to 0. This will turn them both off.

APPENDIX A WORKSHEET
DETECTOR SETUP

Detector Name	Detector Type
Detector Serial Number	1a Det will be DET1 ☐ DET2 ☐ DET3 ☐
1b Internal Timebase ☐ CPM ☐ CPS	1c Sensitivity (i.e. CPM/mR/h)
1d deadtime	
RATE RANGE	
2a Units: Setting:	2b Prefix: Setting:
2c Timebase: Setting:	
2d1 Calculate CPM/S per prefix-units/timebase	
2d2 Recriprocal of step 2d1 Calibration Factor:	Exponent
2e1 Max Level	
2e2 Max Level in display	
2f Max Range (Range Hi Limit)	
Min Range (Range Lo Limit)	
INTEGRATE RANGE	
3a Prefix: Setting:	Units: Setting:
Same as Rate? ☐ YES ☐ NO	If no use step 3b directly
If yes, Cal Factor x 60 (CPM) or 3600 (CPS) =	(put value below)
3b Calibration Factor	Exponent
OVERALL DETECTOR SETTINGS	**Either Calculate or use Detector Setup Menu interactively. Either way record value.**
4a High Voltage	
4b Discriminator	
4c Gain	
4d Saturation	
4e Window	

Program the above values using the Detector Setup Menu.

Use Tables below for determining the settings. You will need both the setting and the value.

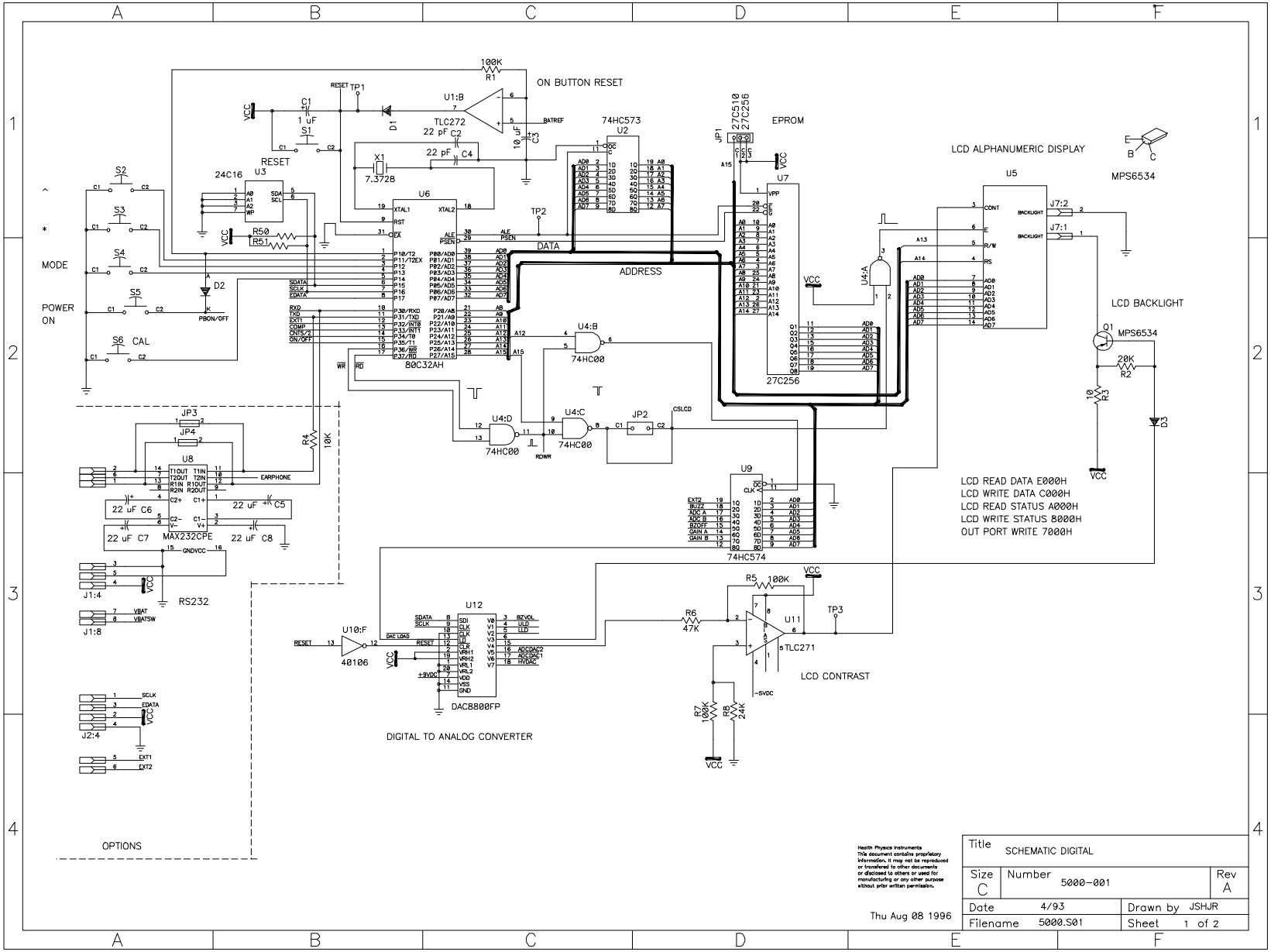
UNITS TABLE			
Setting	Units	Setting	Units
0	cnt	6	Gy
1	REM	7	dis
2	rad	8	CPM
3	R	9	CPS
4	Sv	10	user 1 thru 5
5	Bq		
PREFIX TABLE			
Setting	Prefix	Setting	Prefix
0	a atto	7	K kilo
1	f femto	8	M mega
2	p pico	9	G giga
3	n nano	10	T tera
4	u micro	11	P penta
5	m milli	12	E exa
6	none		
TIMEBASE TABLE			
Setting	Timebase	Setting	Timebase
0	none	2	/m
1	/h	3	/s

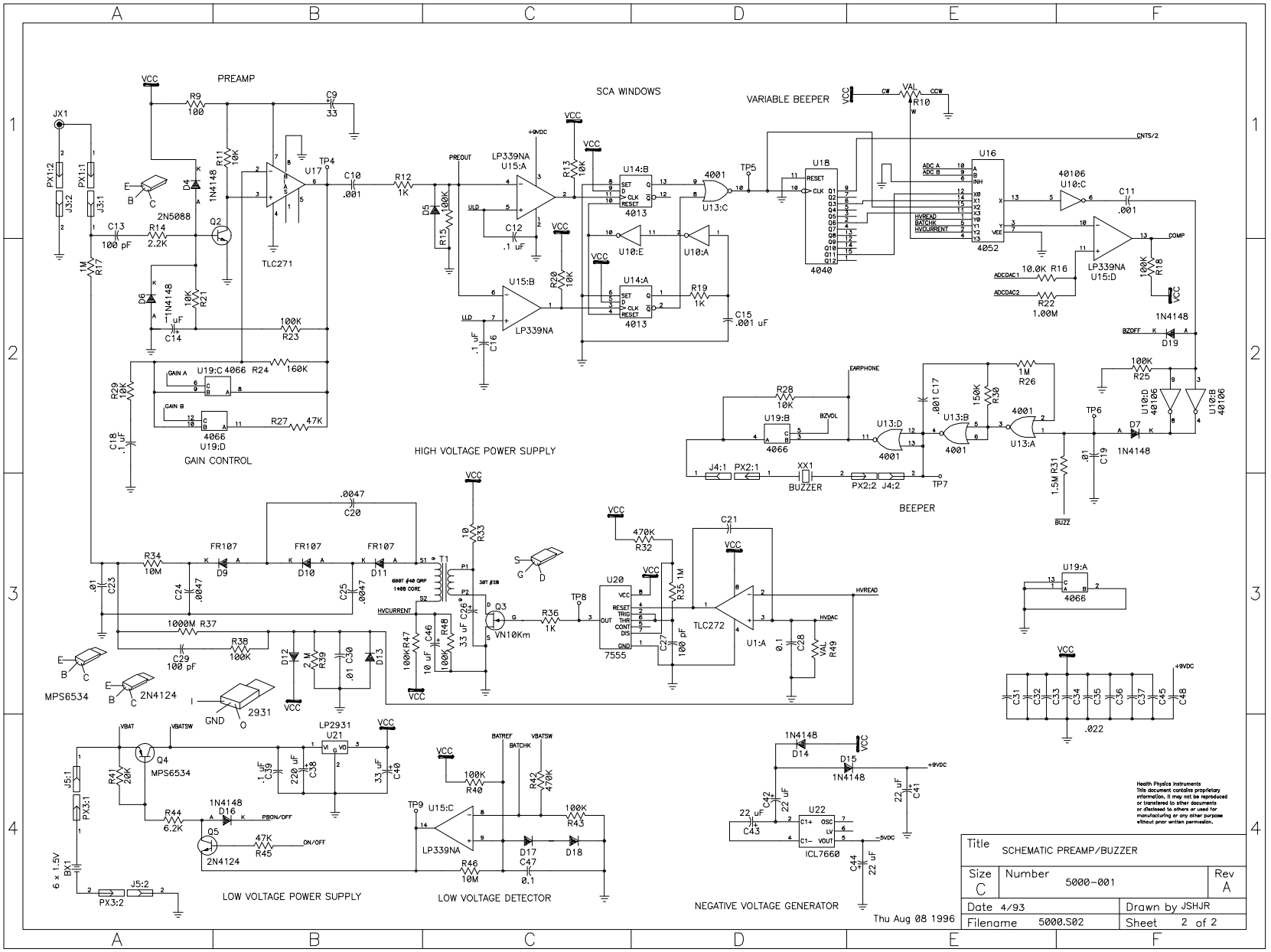
Fill out this table like the Example to determine the min. and max. range.

Remember the Maximum range is the range above the highest displayed.

f	DETECTOR SETUP	DISPLAY FROM.	DISPLAY TO.	RANGE WITH PREFIX-UNITS[2]	EXAMPLE GM Detector
1	-7	.1	.999µ	-2	
2	-6	1	9.99µ	-2	
3	-5	10	99.9µ	-2	
4	-4	100	999µ	-2	
5	-3	.001	.00999	-1	uR/h
6	-2	.01	.0999	-1	uR/h
7	-1	.1	.999	-1	uR/h
8	0	1	9.99	0	mR/h
9	+1	10	99.9	0	mR/h
10	+2	100	999	0	mR/h
11	+3	1K	9990	+1	R/h
12	+4	10K	99.9K	+1	R/h
13	+5	100K	999K	+1	R/h
14	+6	1M	9.99M	+2	
15	+7	10M	99.9M	+2	
16	+8	100M	999M	+2	

APPENDIX B SCHEMATICS




PREAMP
SCA WINDOWS
VARIABLE BEEPER
HIGH VOLTAGE POWER SUPPLY
GAIN CONTROL
BEEPER
LOW VOLTAGE POWER SUPPLY
LOW VOLTAGE DETECTOR
NEGATIVE VOLTAGE GENERATOR
TLC271
LP339NA
4013
4040
4052
4066
4001
7555
TLC272
ICL7660
2N5088
2N4124
MPS6534
VN10Km
2931
LP2931
BUZZER
Health Physics Instruments
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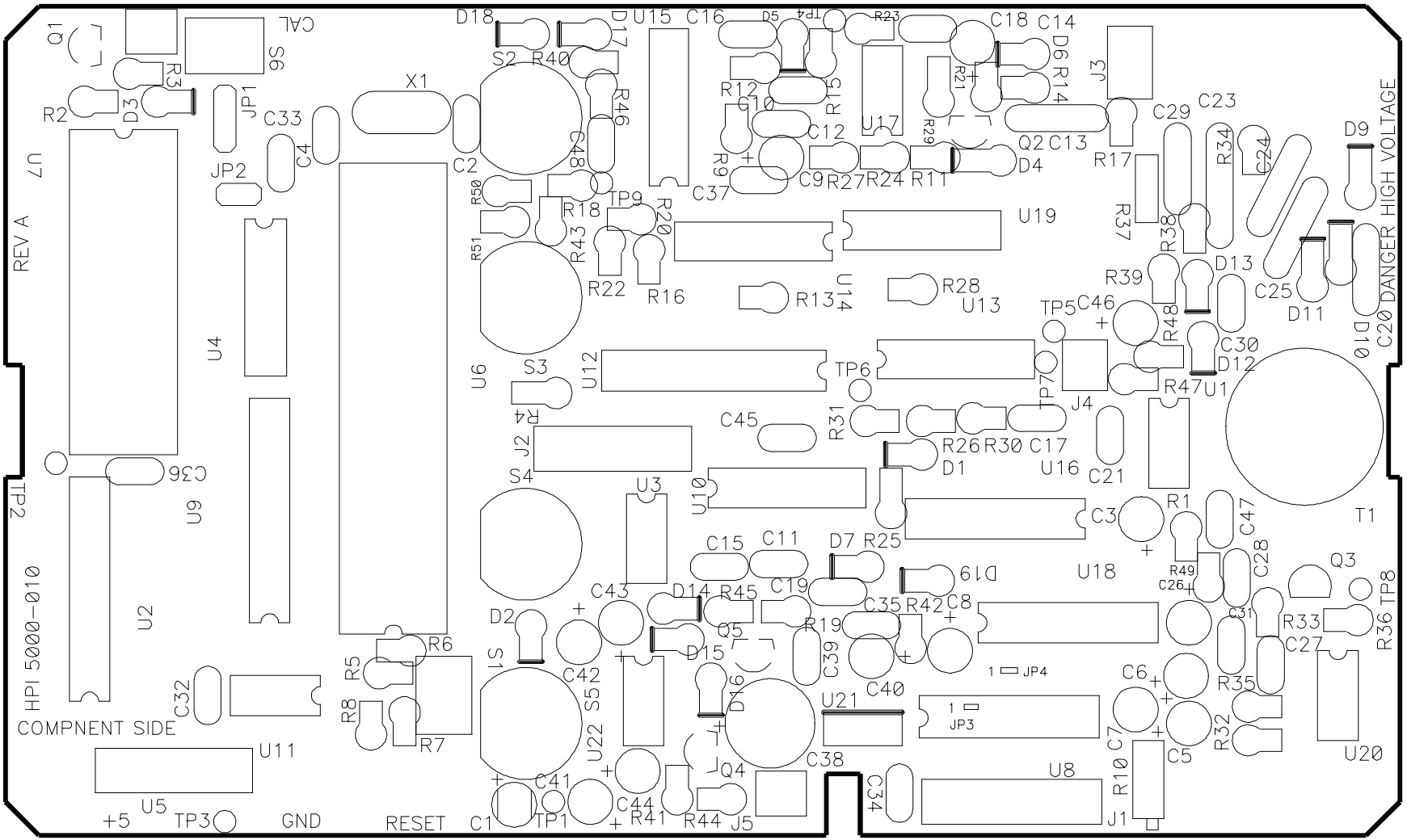
Title SCHEMATIC PREAMP/BUZZER
Size C
Number 5000-001
Rev A
Date 4/93
Drawn by JSHJR
Filename 5000.S02
Sheet 2 of 2
Thu Aug 08 1996

PARTS PLACEMENT



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