SERIES 7100 HpGe DETECTOR SYSTEM
Instruction Manual

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Instruction Manual

Section 1

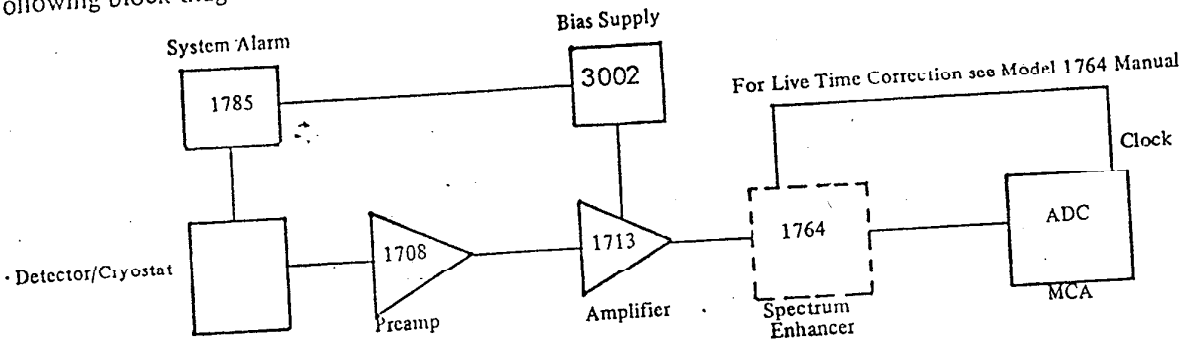
SYSTEM OPERATING INSTRUCTIONS

1.1 GENERAL

The following instructions pertain to a system made up of a Canberra detector and linear electronics. If you are using other equipment for part of the system, please check for compatibility of power, cabling, signal polarities, etc., before applying power to the system.

1.2 SETUP

The following block diagram shows a typical system:



☐ 1. Install the NIM modules in a standard NIM bin.

☐ 2. Connect the Model 1713 to the Model 1708 with the 15-pin power/signal cable provided.

☐ 3. Connect the Model 3001 High Voltage output to the Model 1713 Bias Voltage input.

☐ 4. Interconnect the Model 1785 or Model 1786 to the bias supply as outlined in the instructions for that model.

☐ 5. Interconnect the Model 1713 to the Model 1764 with the 9-pin cable furnished with the Model 1764. If a Model 1764 is not used with the system, connect the Model 1713 rear panel BNC output directly to the ADC input.

☐ 6. Connect the Model 1764 signal output to the ADC input.

1.3 CHECKOUT

☐ 1. Read the test data sheet for details on amplifier settings, etc., before proceeding.

☐ 2. With the detector bias voltage set to 0 volts, turn bin power on.

☐ 3. Monitor the signal at input test point on the Model 1713 with an oscilloscope. The DC voltage at this point should be about −12 volts.

☐ 4. Slowly increase the detector bias voltage (100 volt steps). Observe the sawtooth waveform at the input test point. The range of this signal is from -2.0 volts +1.5 volts and the frequency should diminish slowly between bias voltage changes, approaching the reset times given on the test data sheet. After 500 volts is applied, you may apply voltage in 500 volt steps.

☐ 5. If conditions appear normal, increase the bias voltage to the recommended value, which is listed in the test data sheet.

☐ 6. Remove the protective cryostat window cover and place an Fe-55 source in front of the detector window. Observe the sawtooth frequency increase. Position the source so that the sawtooth frequency is not more than about 10/sec.

☐ 7. Observe the 1713 test point output with an oscilloscope. For standard systems the front panel controls should be set as follows:

Polarity - Non Inverting (for positive output)
Baseline Restorer - Low
Coarse Gain - 1000
Shaping - Consult test data sheet
Pole/Zero - Fully counter clockwise for use Pulsed-Optical Feedback preamplifiers. See Sec. 4.3 of 1713 Manual for instructions on systems having RC feedback preamplifiers.

☐ 8. Adjust the 1713 gain for the desired pulse height output: For example, if the ADC full scale input voltage is 8 volts and you want to cover a 12 KeV range, then adjust the gain so that the 5.894 KeV line from Fe-55 has an amplitude of about 4 volts.

☐ 9. If no 1764 is used, collect a spectrum and check resolution.

☐ 10. If a 1764 is in the system continue as follows:

☐ 11. Take the Fe-55 source away from the Detector.

☐ 12. Put mode switch to Enhanced.

☐ 13. Depress the Fast Discriminator pushbutton and turn the fast signal discriminator clockwise until the meter deflects noticably to the right. Then turn the descriminator C.C.W. until the meter returns to 0 and flickers only one time per second, or so.

☐ 14. Repeat the above procedure for the slow signal discriminator.

☐ 15. Observe that the deadtime meter stays at 100% most of the time. This is a normal condition reflecting the fact that if a pulse is rejected by the 1764, it stops the clock until another pulse comes along to make up for the one rejected. With no source present it may take a considerable time for a replacement pulse to come along; hence the seemingly erroneous deadtime meter reading.

☐ 16. Replace the Fe-55 source and observe the deadtime meter return to a low % deadtime level. Watch it vary with the position of the source.

☐ 17. Now collect a spectrum and check system resolution.

☐ *18. 1764 Fast and Slow discriminators must be re-trimmed if amplifier gain or shaping are changed.*

1.4 TROUBLESHOOTING

SYMPTOM	CHECK
No output	1. System power 2. Loose cables 3. Physical damage 4. LN_2 level
MCA will not accumulate	1. MCA input signal requirements against amplifier output. MCA may have to be modified or different shaping time constant in amplifier may be used. 2. D.C. level of amplifier output 3. Lower Disc. Level of MCA.
Poor resolution	1. MCA input requirements especially if the Model 1764 is not being used. The Model 1413 output risetime may be too long for some old ADC's. 2. Look for 60Hz noise on amplifier signal. Ground loops can cause this. Plug all instruments into same AC power outlet. 3. Look for microphonic noise on amplifier signal. Vibration or audio noise can induce this. 4. Look for high frequency noise on amplifier signal. Sources of this can be noisy equipment nearby, radiating EMI fields and picked up by interconnecting cables.

If none of the above suggestions correct the problems, call the factory or your local sales office for advice.

5 DETECTOR SPECIFICATIONS AND TEST DATA

Detector Model _____ Cryostat Model _____ S/N _____

Detector Area _____ mm^2 Detector Thickness _____ mm

Window Thickness _____ mil Distance from Window _____ mm

Recommended Operating Voltage _____ Volts

Nominal Preamp Reset Rate _____ at quiescent (no source).

System Performance:

Radioisotope	Fe-55		
Energy	5.9keV		
Resolution (FWHM)	eV	eV	eV
Resolution (FWTM)	eV	eV	eV

hen otherwise noted, the data was taken with a Canberra Model 1713 Amplifier, Model 8100 MCA, d Model 3001 Bias Supply at a count rate of 1000 cts/sec or greater.

gital printouts on analog plots of the actual test spectra are shown on the following sheets.

Section 4

PREAMPLIFIER
Model 1708
Special

4.1 GENERAL

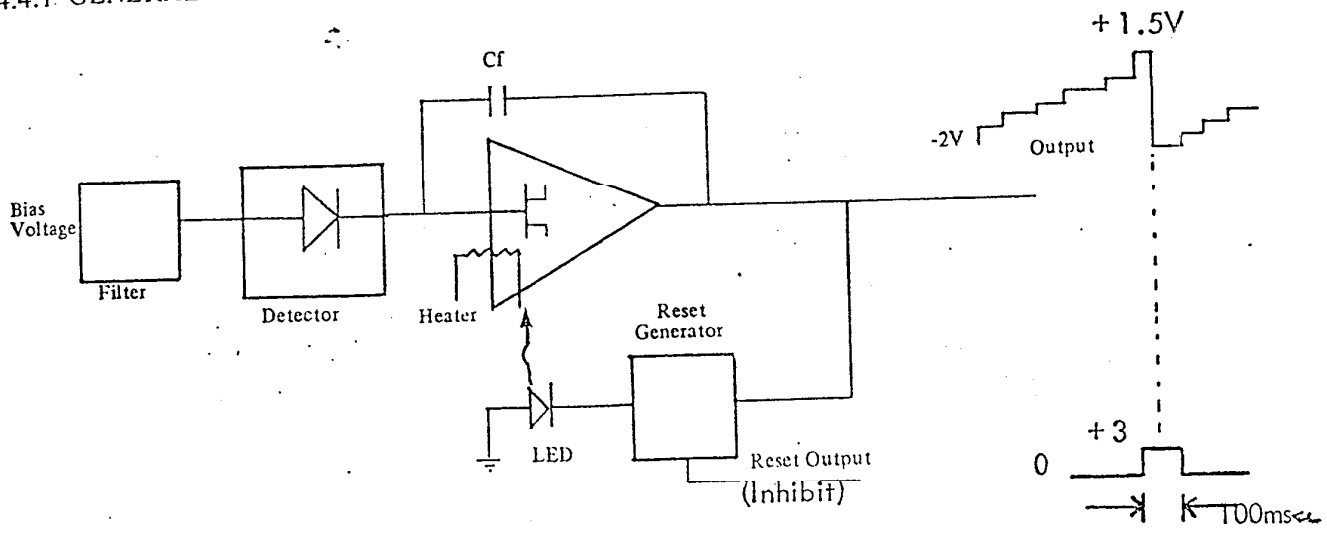
The Model 1708 Preamplifier is a cooled input FET charge sensitive amplifier which employs pulsed-optical feedback to enhance the low noise performance required for high resolution detector systems.

4.3 OPERATING INSTRUCTIONS

See System Operating Instructions in Section 1 of this manual.

4.4 THEORY OF OPERATION

4.4.1 GENERAL



Block Diagram, Model 1708

The block diagram shown above illustrates the basic circuit elements in the Model 1708. The amplifier has a cooled Field Effect Transistor (FET) whose temperature is finely adjusted for minimum noise by changing the current through the heater. The capacitative feedback (Cf) integrates the charge liberated in the detector by photon interaction and this produces a positive step voltage output proportional to the charge.

Successive photon interactions produce additional steps until the upper limit of the preamplifier output is reached. At this point, the reset generator fires, driving current through a light emitting diode which is optically coupled to the input FET. The resultant light pulse reduces the gate impedance momentarily and the feedback capacitor is then discharged returning the output voltage to -2V.

Section 7

DETECTOR SPECIFICATIONS AND PERFORMANCE DATA

7.1 SPECIFICATIONS

Model 71255E Serial Number 1278342R

The purchase specifications and therefore the warranted performance of this detector are as follow:

Energy	5.9 keV	122 keV	
Resolution [eV (FWHM)]			

Cryostat Description or Drw. No. if special 7600

7.2 PHYSICAL/PERFORMANCE DATA

Actual performance of this detector when tested is given below.

Active Diameter 5.6 mm

Active Area 100 mm^2

Thickness 5 mm

Distance from Window 5 mm

Window Thickness 0.051 mm

ELECTRICAL CHARACTERISTICS

Depletion Voltage (-)200 Vdc.

Recommended Bias Voltage (-)1000 Vdc.

Reset Rate at Recommended Bias 2.5 sec. (PO Preamp only)

Preamplifier Test Point Voltage at Recommended Bias N/A Vdc. (RC Preamp only)

RESOLUTION AND EFFICIENCY - With Amp. Time Constant of 12 microseconds.

Isotope	Fe^{55}	Co^{57}	Co^{57}		
Energy (keV)	5.9	6.4 *	122		
FWHM (eV))	177		515		
FWTM (eV))	336		968		

* Substitutes for Fe-55 in some cases where Fe-55 peaks are not well separated.

- Resolution 142eV FWHM @ 5.9keV using a Canberra Model 2008 Preamplifier. Above results obtained using customer's Model 1708 Preamplifier.