Eagle Plus
Desktop MCA

User's Manual

9238038C

ISO 9001
SYSTEM
CERTIFIED

CE

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The information in this document describes the product as accurately as possible, but is subject to change without notice.

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Table of Contents

1. Introduction

The Eagle Plus MCA is operated entirely by software, with all settings and adjustments made from Genie™ 2000's on-screen menus. This lets you maintain multiple system setups, downloading the required configuration from your PC as needed. The system is ready for routine sample analysis simply by calling up predefined calibration/setup files.

This manual describes the steps to be performed in setting up your Eagle for operation with Genie 2000.

1. You must have Genie 2000 V3.0b or later installed on your system (page 8).

2. If you've been using Genie 2000 V3.0, you must install the Update (page 9).

3. Now you'll have to install the Eagle Plus drivers (page 9).

4. With the software installed, your next step is to define a Genie 2000 MCA Input Definition (MID) file for your Eagle Plus (page 13).

5. When actively using the Eagle with Genie 2000, you'll be able to change some of the MID file's operating parameters in real time. Refer to Chapter 6, "The MCA Adjust Screens".

For important operating information, please refer to Appendix C, "Notes on Eagle Plus Operation" on page 52.

For detailed description of the Genie-2000 software refer to the *Genie-2000 Operations Manual*.

2. Indicators and Connectors

This chapter describes the Front Panel Indicators, the Rear Panel Connectors and how to connect the Eagle's cables for typical operation.

Front Panel Indicators

The Eagle's front panel has four LED indicators to indicate operating information, an informational display and a push button to toggle through the display pages.

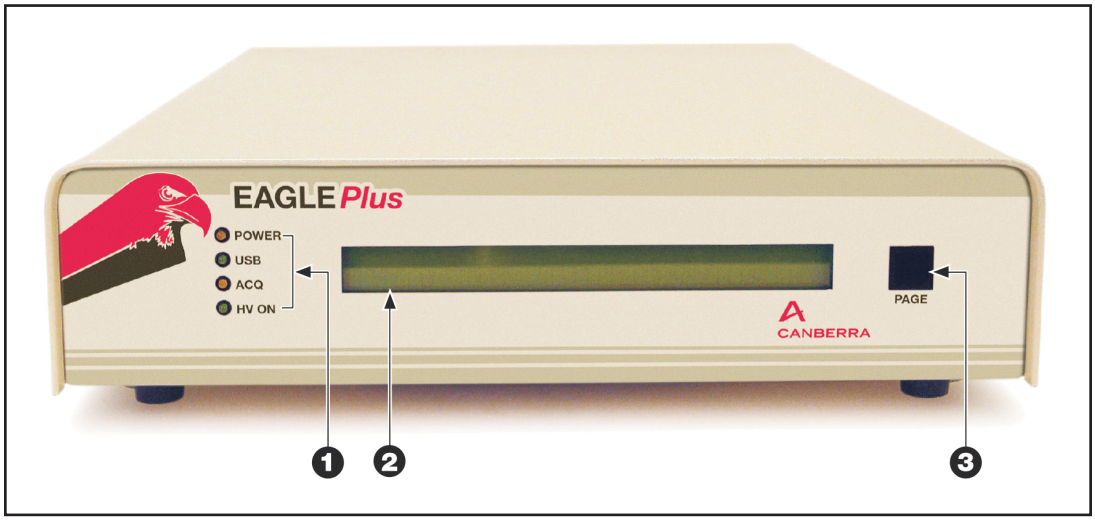

Figure 1 Front Panel Indicators

LED Indicators ①

The front panel's four LED indicators indicate significant Eagle operating functions.

Power

Indicates that the Eagle's rear panel power switch is on.

USB

Indicates that the USB cable is connected to a PC.

Acquiring

Indicates that the Eagle is acquiring data.

HV

Eagle 5004 only. Blinks as the high voltage ramps up to its preset operating value. Stops blinking when the high voltage reaches its preset value.

Display ②

The four pages of the dot-matrix display provide further information on the Eagle.

Display Page 1

Page 1 shows the current date and time.

Display Page 2

Page 2 indicates the instrument's serial number.

Display Page 3

Page 3 lists the instrument's:

- Model number.
- High voltage type.
- Firmware version number.

Display Page 4

Page 4 displays:

- The current operating mode (PHA or MCS).
- Whether data is acquiring or stopped.
- The current high voltage setting.
- When data acquisition is active, the count rate and elapsed true time are also shown.

Pushbutton ③

The momentary pushbutton shows each of the display pages, one at a time.

Eagle 5002 Rear Panel Connectors

The Eagle 5002's rear panel has several types of data connectors. Each is described below. The Eagle 5004's connectors are described on page 5.

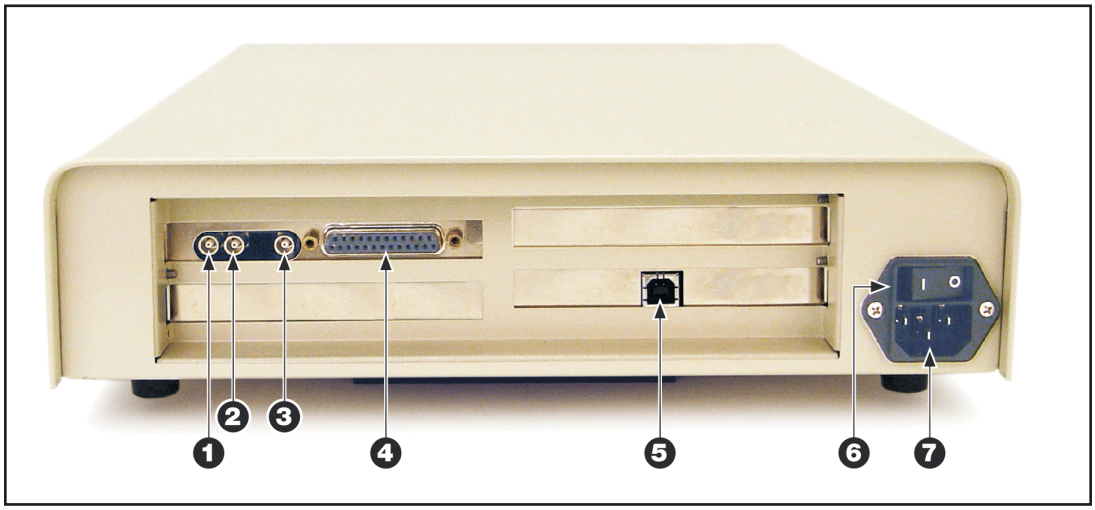

Figure 2 Eagle 5002 Rear Panel Connectors

LEMO Connectors

The supplied LEMO-to-BNC or LEMO-to-SHV adapter cables allow you to use your existing BNC or SHV cables with these connectors or you can connect LEMO cables directly connected to these connectors. Refer to Appendix E, Pinouts, for details.

Signal In ①

Accepts input from the detector or from an external preamplifier or amplifier

Amp Out ②

Provides the on-board amplifier's output signal to, for instance, an oscilloscope.

Pulser Out/Coincidence In ③

Pulser output or Coincidence input.

Data I/O Connector ④

Refer to Appendix E, Pinouts, for details.

USB Connector ⑤

This connector transfers data and commands between the Eagle and the host computer.

Power Switch and Power Connector ⑥ ⑦

Plug the power cord into the Power Connector ⑦ and turn the Eagle on with the Power Switch ⑥.

Eagle 5004 Rear Panel Connectors

The Eagle 5004 has two connector panels, upper and lower. The Eagle 5002's connectors are described on page 4.

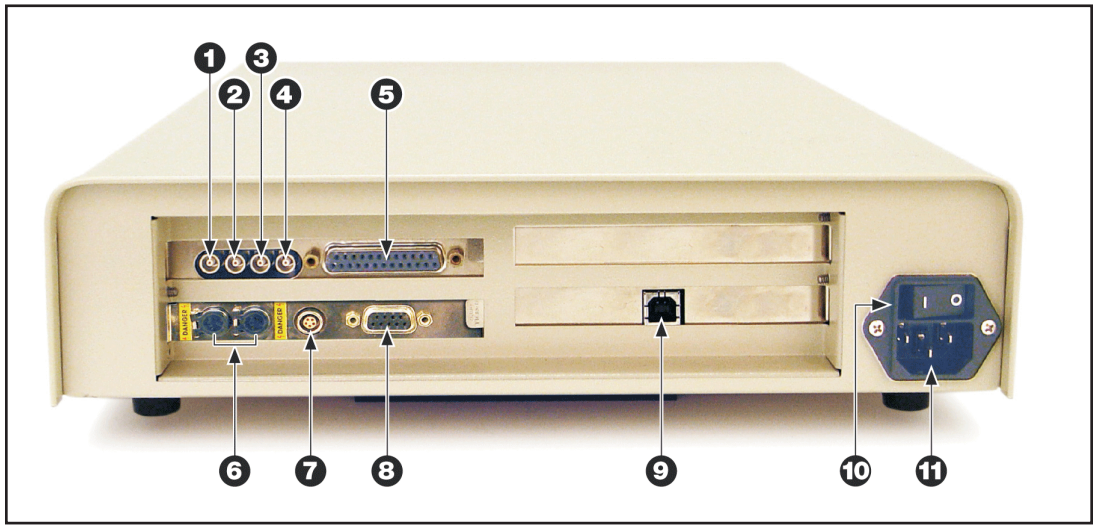

Figure 3 Eagle 5004 Rear Panel Connectors

Upper Connector Panel

The Upper Connector Panel has several data connectors,

LEMO Connectors

The supplied LEMO-to-BNC or LEMO-to-SHV adapter cables allow you to use your existing BNC or SHV cables with these connectors or you can connect LEMO cables directly to these connectors. Refer to Appendix E, Pinouts, for details.

Signal In ①

Accepts input from the detector, an external preamplifier or an amplifier

Amp Out ②

Provides the on-board amplifier's output signal to, for instance, an oscilloscope.

Inhibit In ③

Accepts the inhibit signal from a pulsed optical or a transistor reset preamplifier.

Pulser Out/Coincidence In ④

Pulser output or Coincidence input.

Data I/O Connector ⑤

Refer to Appendix E, Pinouts, for details.

Lower Connector Panel

The Lower Connector Panel has two high voltage (SHV) connectors, a LEMO connector for LN2 signals and a preamp power connector.

HV Connectors ⑥

Provide positive (left Lemo) and negative (right Lemo) high voltage for a germanium detector.

Multipin LEMO ⑦

Accepts the inhibit signal from a germanium detector's LN2 sensor to inhibit the output of the internal High Voltage Power Supply. Refer to Appendix E, Pinouts, for details.

Preamp Power ⑧

Supplies power to the detector's preamplifier. Refer to Appendix E, Pinouts, for details.

USB Connector ⑨

This connector transfers data and commands between the Eagle and the host computer.

Power Switch and Power Connector ⑩ ⑪

Plug the power cord into the Power Connector ⑪ and turn the Eagle on with the Power Switch ⑩.

3. Software Installation

Before you can use the Eagle Plus with your computer, you'll have to install Genie™ 2000 V3.0b, or later, and the Eagle Plus driver.

- If Genie 2000 V3.0b, or later, is already on your system, do not install it again. Go to "Installing the Eagle Driver" on page 9.

- If Genie 2000 V3.0 is on your system, go to "Installing the Genie 2000 Update" on page 9.

Installing Genie 2000

1. Refer to Appendix A, *Software Installation*, in the *Genie 2000 Operations Manual* for information on basic system requirements, installing basic and optional Genie 2000 software, installing network components, and installing the security key.

2. Insert the Genie 2000 Software Distribution CD into your CD-ROM drive.

3. Select the **Install Genie 2000** button on the Basic Spectroscopy Installation screen (Figure 4) and follow the prompts on the screen.

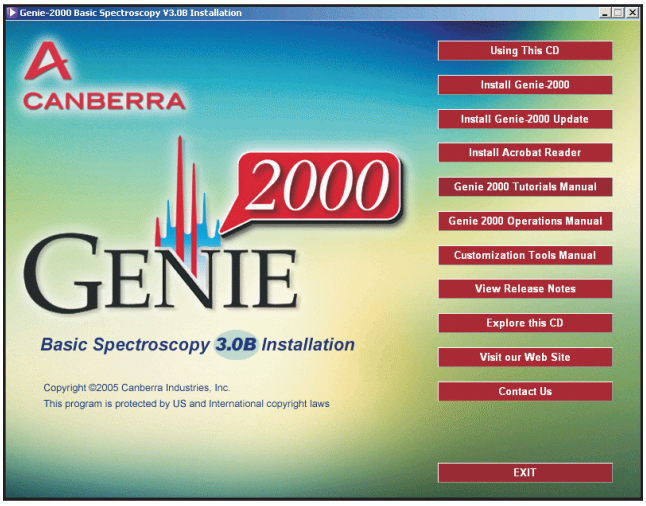

Figure 4 The Software Installation Screen

Installing the Genie 2000 Update

With Genie 2000 V3.0 installed, select the **Install Genie 2000 Update** button on the Software Installation Screen (Figure 4) and follow the prompts on the screen.

Note: The Genie 2000 Update button is available only if Genie 2000 V3.0 is installed on your system. It is not available for V2.1 or earlier or V3.1 or later.

Installing the Eagle Driver

This chapter describes how to install the Eagle Plus driver. The procedure is for Windows 2000 with Windows XP differences discussed in "Windows XP Driver Installation" (page 11).

Windows 2000 Driver Installation

With Genie 2000 V3.0b or later installed on your system, you'll now install the Eagle Plus driver file: EagleMCA.inf.

1. With the Genie 2000 CD still in the drive, plug your Eagle into one of your computer's USB ports.

2. The Found New Hardware Wizard (Figure 5) will start automatically. Click the Wizard's **Next** button.

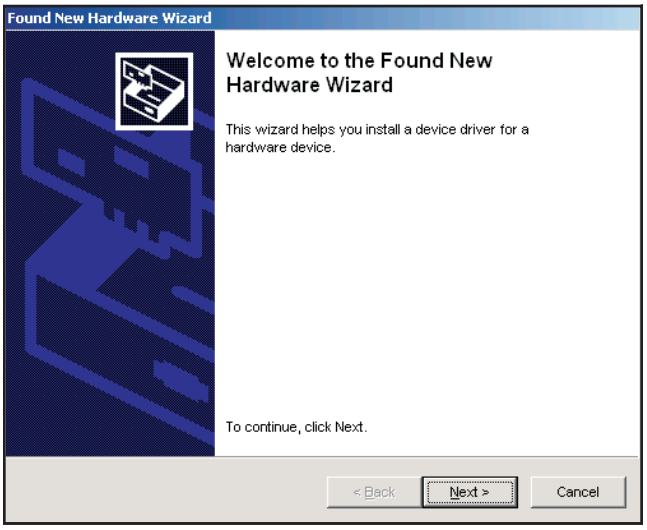

Figure 5 The Found New Hardware Wizard

3. On the next screen (Figure 6), select the Search for a Suitable Driver button.

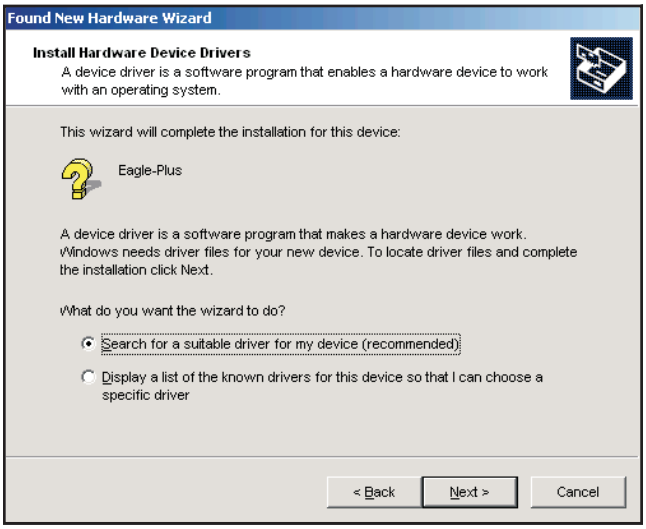

Figure 6 The Install Hardware Device Drivers Screen

4. In the Locate Driver Files Screen (Figure 7), check CD-ROM Drives.

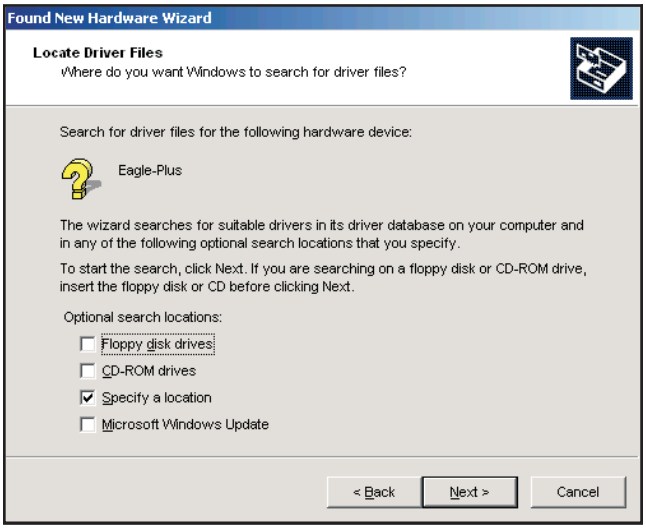

Figure 7 The Locate Driver Files Screen

5. The next screen (Figure 8) asks you to browse the Genie 2000 CD for the first driver file, G2kV*x.yz*\EagleUSB\EagleMCA.inf, where *x* is 3, 4, etc., *y* is 0, 1, 2, etc. and *z*, if present, is a, b, etc. For example, G2kV3.1a.

Figure 8 Browsing for the Driver File

6. The next screen confirms the driver's path and file name. Click **Next** to continue.

7. The final screen verifies that the driver has been installed. Click the **Finish** button.

Windows XP Driver Installation

For Windows XP, the installation routine is only slightly different from the Windows 2000 installation.

1. With the Genie 2000 CD still in the drive, connect a USB cable between your Eagle Plus's USB port and one of your computer's USB ports.

2. Go to the EagleUSB folder on the software distribution CD.

3. There is no file to choose, only the folder is specified under XP.

Installing Additional Eagles

Depending on your operating system and configuration, each Eagle Plus on your system may have to be registered as a separate USB device. If this is the case, you'll be asked to supply the Eagle Plus driver (EagleMCA.sys).

To register the new Eagle Plus:

1. Insert your Genie 2000 CD into your computer's CD drive.
2. Verify the displayed path, or browse for the correct one.
3. Click on OK.
4. Follow the onscreen instructions.

Your computer will remember which USB devices have been registered. Detaching a USB device then reattaching it later does not require another installation of the driver.

4. Defining the Eagle Plus

The first step in using your Eagle Plus MCA is to create an MCA Input Definition (MID).

MID Wizard or MID Editor?

For most cases, you'll use the MID Wizard in the next section to help you set up your Input Definition quickly and easily. If your Input Definition is more complex than the MID Wizard was designed to handle (such as special device settings), you'll use "MCA Input Definition Editor" on page 20 to create or change your definition.

The MID Wizard

To use the MID Wizard, open the Genie™ 2000 folder and select the MID Wizard icon.

Beginning the Definition

Defining the operating parameters for the Eagle Plus MCA is a several-step process, each of which is detailed in the paragraphs that follow.

Step 1 – Selecting the MCA

You'll see a list of supported MCAs, as shown in Figure 9. Click on the USB MCAs plus sign to expanded its list, select either Eagle Series 5002 (2K memory) or Eagle Series 5004 (4K memory), then press **Next** button.

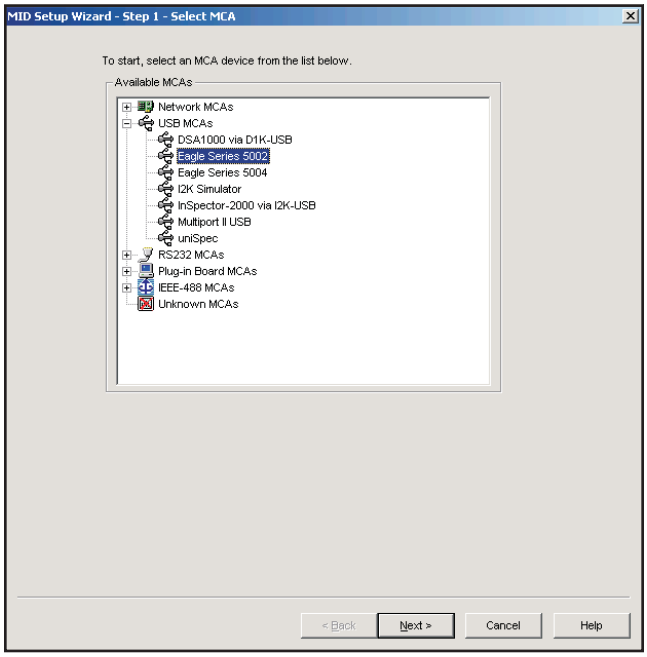

Figure 9 Selecting the MCA

Step 2 – Configuring the MCA

The next screen (Figure 10) lets you define the MCA.

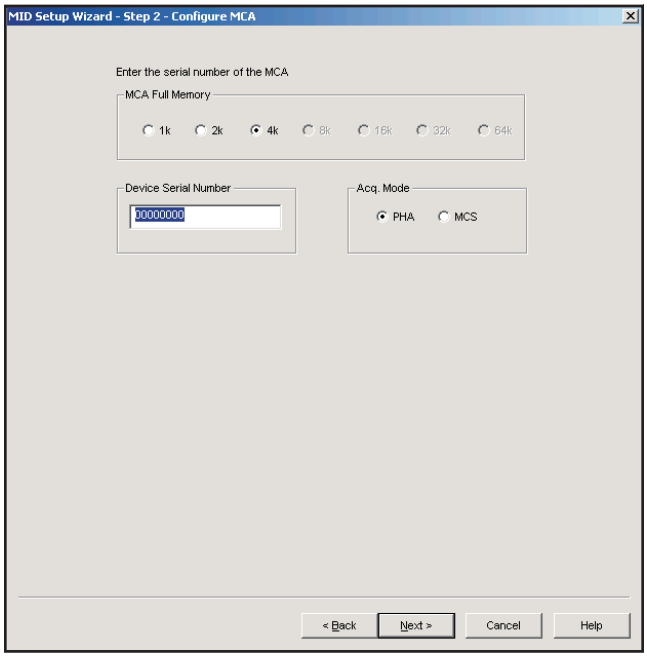

Figure 10 Configuring the MCA

MCA Full Memory

Select the MCA's memory size.

- Series 5002: 1k or 2k.
- Series 5004: 1k, 2k or 4k.

Device Serial Number

Type in the MCA's eight-digit serial number. You'll find this on page two of the Eagle's front panel display. Use only the eight-digit numeric portion of the serial number.

Acquisition Mode

Select PHA or MCS.

Step 3 – Configuring the Detector

The Step 3 screen (Figure 11) asks you to configure the detector.

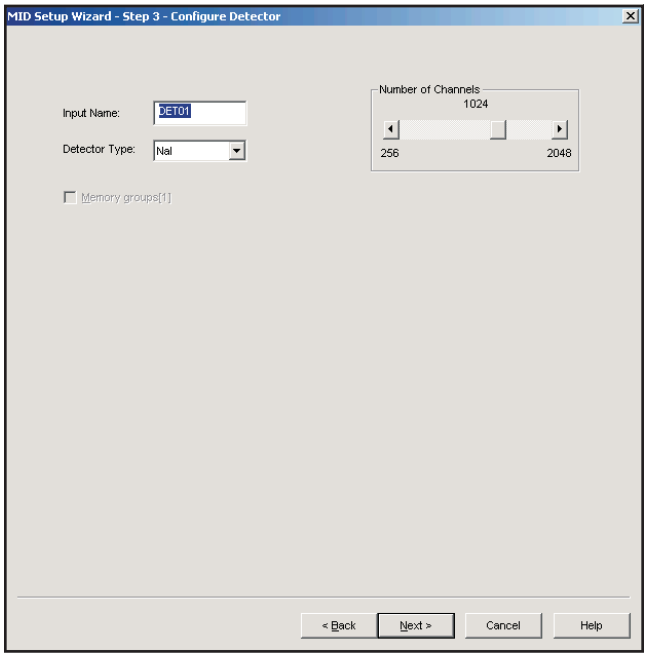

Figure 11 Configuring the Detector

Detector Name

The default, DET01, can be changed to a more meaningful name.

Detector Type

Specify the type of detector you're using, Ge, Alpha or NaI.

Number of Channels

Use the slider to set the number of memory channels assigned to this MCA.

Memory Groups

This parameter is grayed out because the Eagle does not support memory groups.

Step 4 – Selecting the External Modules

Step 4 (Figure 12) lets you specify the Amplifier and HVPS being used with the Eagle.

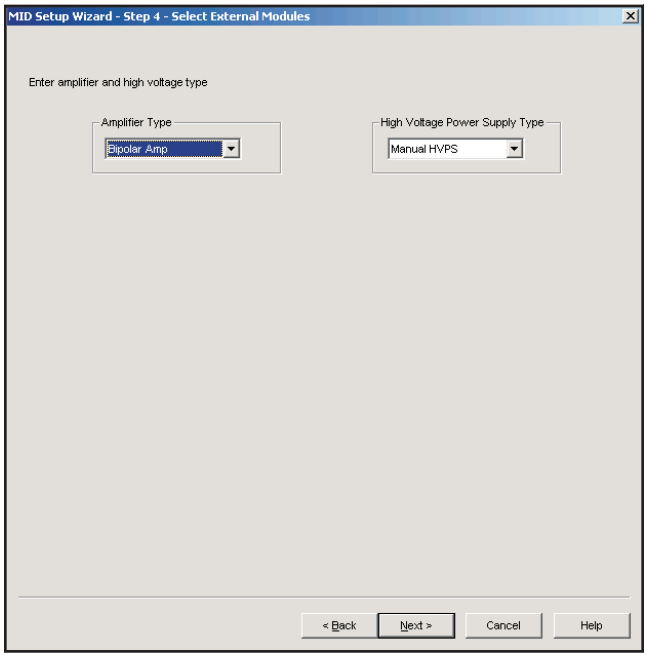

Figure 12 Selecting the External Modules

Amplifier Type

Set this parameter to match the output of your system's amplifier.

- Eagle 5002: Bipolar or External.
- Eagle 5004: Bipolar, Unipolar, Gated Integrator or External.

High Voltage Type

Set this parameter to match your system's High Voltage Power Supply. To use an external power supply, select Manual HVPS or select AHV-2PC HVPS (Ge) or BB-200 HVPS (NaI Tube Base).

Step 5 – Not Used

You won't see the MID Wizard Step 5 screen; it is not used when setting up an Eagle Plus MCA.

Step 6 – Configuring the HVPS

You'll see Step 6 (Figure 13) only if you selected the AHV-2PC or BB-200 in Step 5 as the High Voltage Type. If you selected Manual HVPS, you'll see Step 7 instead.

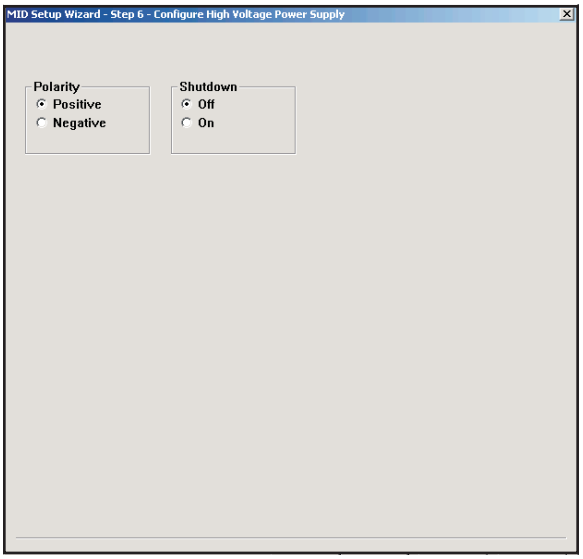

Figure 13 Configuring the HVPS

Polarity

Match the power supply's output Polarity to the detector's requirements.

Shutdown

Enables/disables HVPS shutdown for any of the HV shutdown sources (External Input Shutdown, LN2 Input Shutdown and Leakage Input Shutdown), depending on the related Registry Key Enable Mask settings (see the *Registry Keys and Definitions* table on page 53.

Step 7 – Reviewing the Definition

Step 7 (Figure 14) lets you review a summary of the Input Definition and asks you to enter the definition's MID FileName.

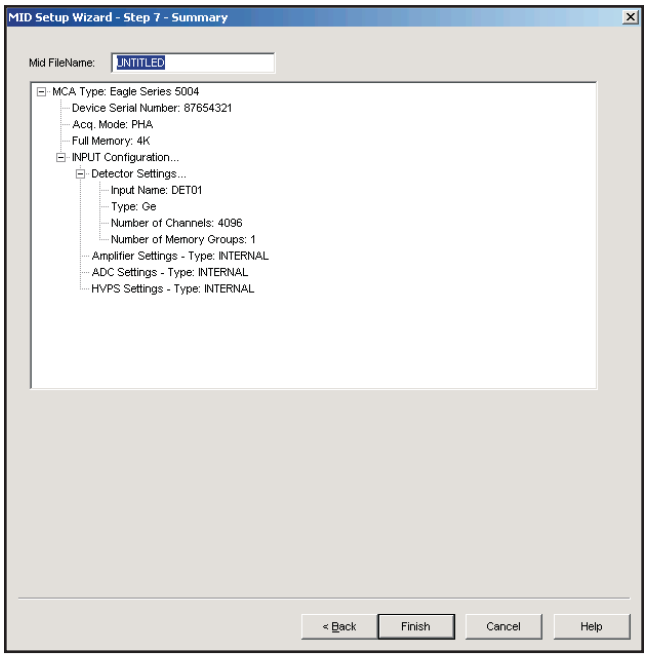

Figure 14 A Typical Definition Summary

Ending the Definition

To complete the Definition, select **Finish**. The input that you just defined will be stored as an MID file named FileName.MID in the ?:\Genie2k\MIDFiles directory.

The Input Name field at the top of Figure 14 defaults to UNTITLED, which you'll probably want to change to something more meaningful. If the name you enter is the same as that of an existing MID file, the system will ask if you want to overwrite the existing file.

Finally, you'll be asked if you would like to define another input. Answer **Yes** to define another MID file or **No** to close the Wizard.

The MCA Input Definition Editor

Most users will not need to use the MCA Input Definition (MID) Editor, an application which allows you to create, edit, and manage input definitions. For most users, the facilities provided in the MID Wizard are sufficient.

You'll have to use the MID Editor only if you want to change any of the parameters from their default values. The editing procedure is described in "Editing an MCA Definition" in the MCA Input Definition chapter of the *Genie-2000 Operations Manual*. That chapter also has detailed information on using the MID Editor.

Opening the MID Editor

Go to Start | Programs | Genie 2000 | MCA Input Definition Editor to launch the MID Editor (Figure 15).

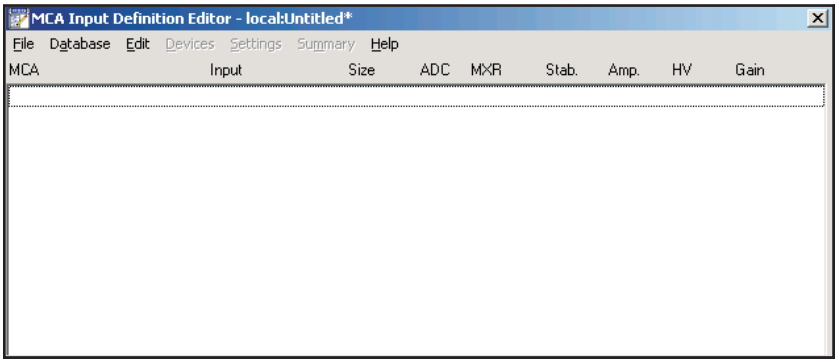

Figure 15 The MID Editor

To select the Eagle Plus as the MCA to be set up, select **Edit | Add MCA** to see the Add MCA list.

Double click on **USB MCAs** to expand its list, then select either **Eagle Series 5002** or **Eagle Series 5004** (Figure 16). Now click the **Add** button then the **Done** button.

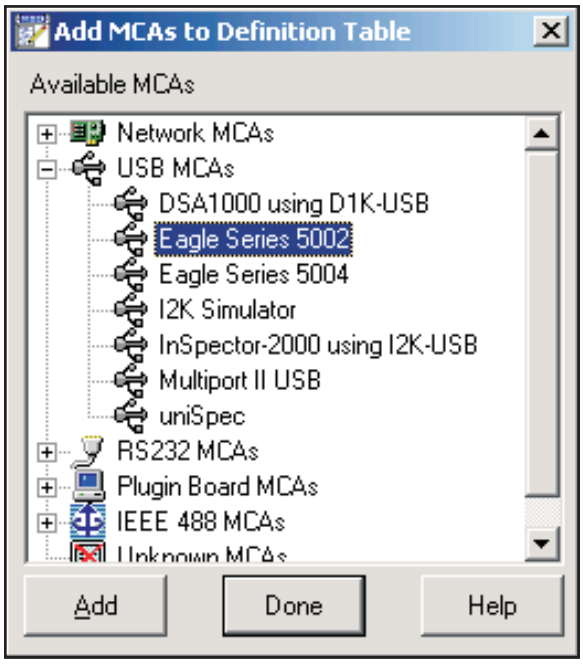

Figure 16 Adding the MCA

The Devices

Make sure the MCA entry in the MID Editor is still highlighted, then select **Devices** from the MID Editor's menu bar. There is a command in the menu (Figure 17) for each of the hardware sections of the MCA.

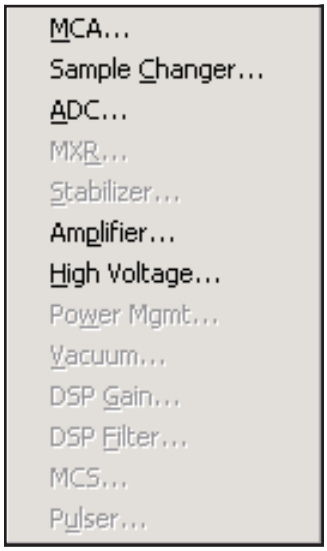

Figure 17 The Device Setup Menu

MCA

The MCA dialog (Figure 18) is where you enter the MCA's serial number, set the MCA's full memory, the number of ADCs and the acquisition mode.

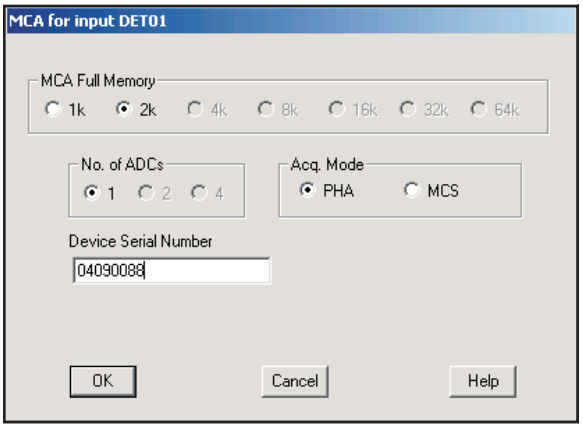

Figure 18 The MCA Device Setup Dialog

MCA Full Memory

The memory sizes supported by the Eagle are listed in the following table.

Model	Supported Memory Sizes		
Eagle 5002	1k	2k	
Eagle 5004	1k	2k	4k

No. of ADCs

The Number of ADCs is fixed at 1.

Acq. Mode

Choose the Acquisition Mode for this MCA: PHA or MCS.

Device Serial Number

Type in the MCA's eight-digit serial number. You'll find this on page two of the Eagle's front panel display. Use only the eight-digit numeric portion of the serial number.

Sample Changer

The Sample Changer screen (Figure 19) lets you change None to LPT Sample Changer. No other parameters can be changed.

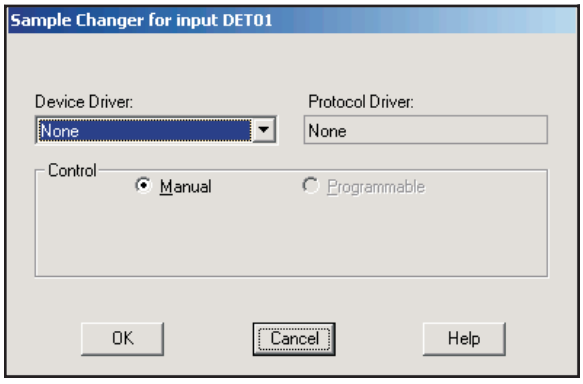

Figure 19 The Sample Changer Dialog

ADC

The ADC screen (Figure 20) is for information only; its parameters cannot be changed.

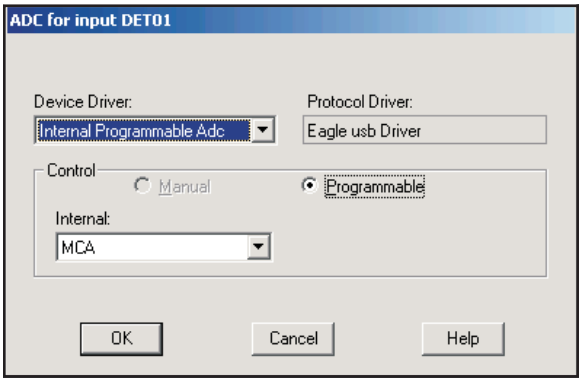

Figure 20 The ADC Dialog

Amplifier

In the Amplifier dialog (Figure 21), the Device Driver list specifies the type of amplifier input. No other parameters can be changed.

- Eagle 5002: Bipolar Amp or External Amp
- Eagle 5004: Bipolar Amp, Unipolar Amp, Gated Integrator or External Amp.

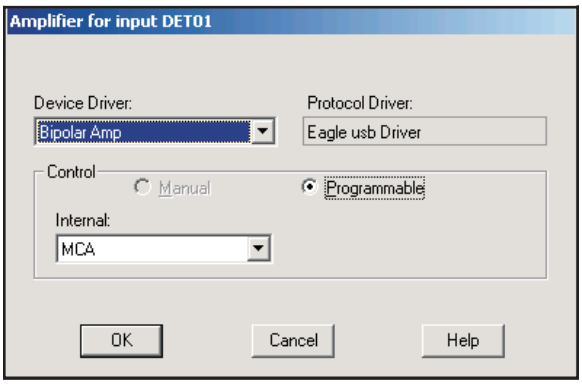

Figure 21 The Amplifier Dialog

High Voltage

The High Voltage dialog (Figure 22) specifies the High Voltage Power Supply.

- Manual HVPS
- AHV-2PC HVPS (Ge)
- BB-200 HVPS (NaI Tube Base).

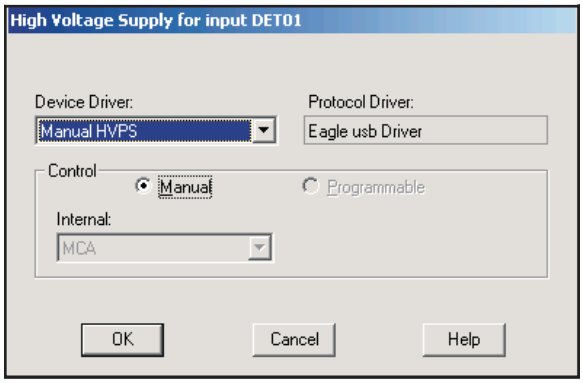

Figure 22 The High Voltage Dialog

The Settings

The commands in the Settings menu, shown in Figure 23, set the MCA's operating parameters. The MCS menu option will not be available unless MCS mode has been selected in the MCA device settings.

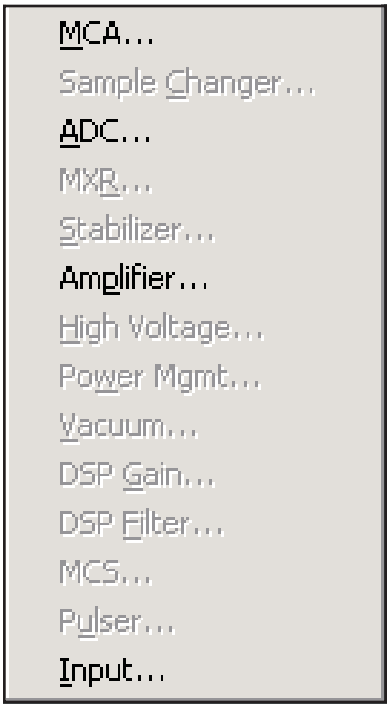

Figure 23 The Settings Menu

Most of these parameters are adjustable both here in the Settings dialog and in the Adjust dialog in the Gamma Acquisition and Analysis application. Some are adjustable only in the Settings dialog. The description of each parameter specifies where the controls can be changed.

MCA

The **MCA** device has no adjustable controls at this level.

ADC

The **ADC** Settings dialog shown in Figure 24 sets the initial operating parameters for the Eagle's programmable ADC.

Since many of the ADC's Scroll Bar controls may need to be changed often in the course of daily work, they can be adjusted both here and in the Gamma Acquisition and Analysis application.

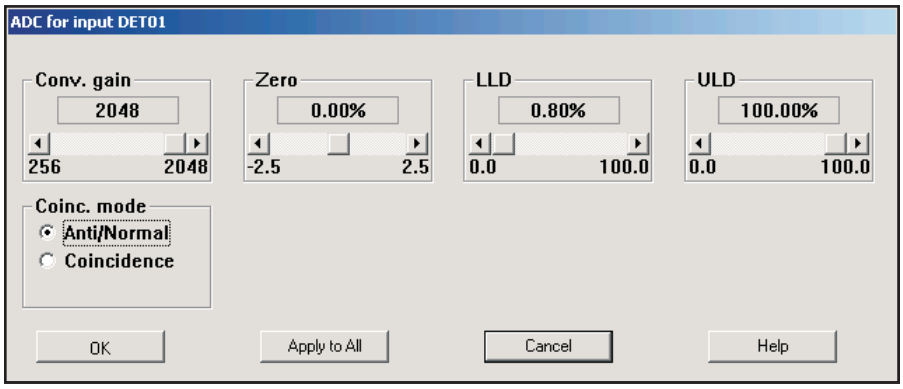

Figure 24 ADC Settings Dialog

Conv. Gain

This control sets the Conversion Gain of the ADC. Clicking on either of the arrows at the ends of the Scroll Bar will change the gain by a factor of two. The upper limit of the Conversion Gain depends on the installed Eagle Plus hardware, as follows:

Series 5002:	2048 channels
Series 5004:	4096 channels

This control is available both here and in the Gamma Acquisition and Analysis application.

Zero

This control sets the ADC Zero offset over the range of ±2.5% of full scale. This control is available both here and in the Gamma Acquisition and Analysis application.

LLD and ULD

The ADC's Lower Level Discriminator (LLD) can be set from 0.0% to 100.0% of the ADC's full-scale input. The ADC's Upper Level Discriminator (ULD) can be set from 0.0% to 100.0% of the ADC's full-scale input. Both controls are available here and in the Gamma Acquisition Analysis application.

The window between the ULD and the LLD limits the energy range to be considered by the ADC. For example, setting the ULD at 90% and the LLD at 10.0% means that only the pulses between 10.0% and 90% of full scale will be converted by the ADC.

Coinc. Mode

This control sets the ADC's input gating to either **Anti/Normal** mode or **Coincidence** mode.

Amplifier

Selecting Amplifier will pop up the Dialog Box shown in Figure 25. Though many of the Amplifier controls can also be adjusted in the Gamma Acquisition and Analysis application, the Preamp Type and Inhibit polarity can be changed only in this Dialog Box.

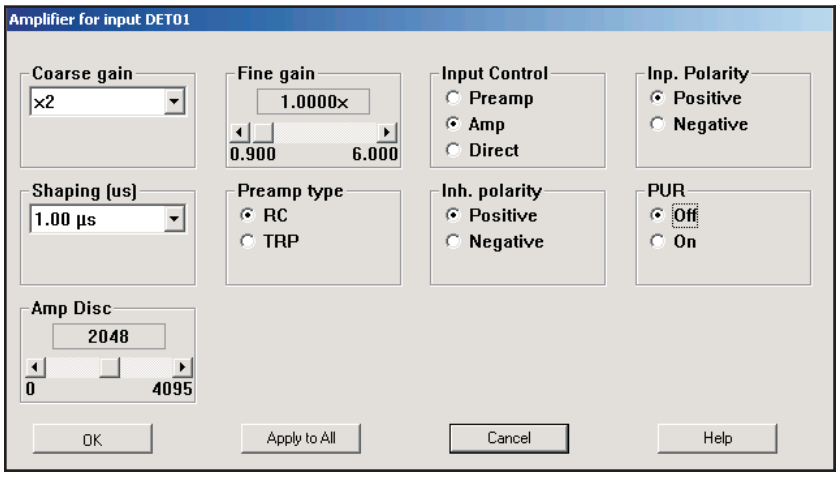

Figure 25 The Amplifier Setting Dialog

Amplifier Gain

Two controls are used to set the amplifier's gain: Coarse Gain and Fine Gain. The total gain is the product of the two settings. Both controls are available at run time.

Coarse Gain

The **Coarse gain** can be set to x2, x10, x50 or x250.

Fine Gain

The **Fine Gain** is adjustable from 0.900 through 6.000.

Input Control

This control, which selects the path of the input signal, has three settings: Preamp, Amp and Direct.

- Select **Direct** to use an external amplifier instead of the internal amplifier.
- If you're using an external preamplifier, select **Amp** to connect the input signal to the internal amplifier, then to the ADC.
- If you're using no external electronics, select **Preamp** to connect the input to the internal preamplifier, then to the internal amplifier, then to the ADC.

Inp. Polarity

This control matches the polarity of the input signal to the internal amplifier.

Shaping

This control, available both here and in the Gamma Acquisition amd Analysis application, sets the internal amplifier's shaping time constant.

Preamp Type

This control specifies the preamplifier type: **RC** (RC coupled) or **TRP** (transistor reset preamp). This control can only be changed here in the Settings dialog.

For TRP operation, please note the following:

1. For optimum performance the **Pole/Zero** setting will automatically be forced to 0 (zero) therefore the **Pole/Zero** setting will have no effect at run-time.
2. Both the preamp's Inhibit signal polarity and Input signal polarity must be set to match the preamp's specifications. Both controls are available in the MID Editor. Only the Input polarity control is available at run time.

Inh. Polarity

If you're using a reset-type preamplifier, such as a TRP, the polarity of the preamp's Inhibit output signal connected to the Eagle Plus hardware must be selected here to **Positive** or **Negative** in accordance to the preamplifier's specifications.

PUR

This control turns the amplifier's Pileup Rejector (PUR) **On** or **Off**. When PUR is on, a Live Time correction is performed for pulses that are piled up and rejected. This is reflected by the increase in dead time.

Canberra recommends turning the PUR **On** when measuring high count rates. When used with very low count rates (<100 cps) the PUR should be turned off. The PUR threshold is adjusted with the Amp Disc control.

Amp Disc

This control should be set above the system noise level to prevent false triggering and to prevent noise pulses from being processed; the range is from 0 to 4095. When setting the Amp Discriminator, the PUR should be on, acquisition enabled, and the input rate should be within the 1000 to 2000 cps range.

To start, set the control at maximum while observing the system dead time. Clear data as necessary to get an accurate reading of the dead time.

Next, continue to reduce the setting until a sharp increase in dead time is observed, then set the discriminator threshold approximately 10% to 20% above the current setting.

High Voltage

The High Voltage command sets the parameters for the High Voltage Power Supply. If the Manual HVPS was selected, this command will not be available.

Figure 26 shows the settings for the AHV-2PC power supply.

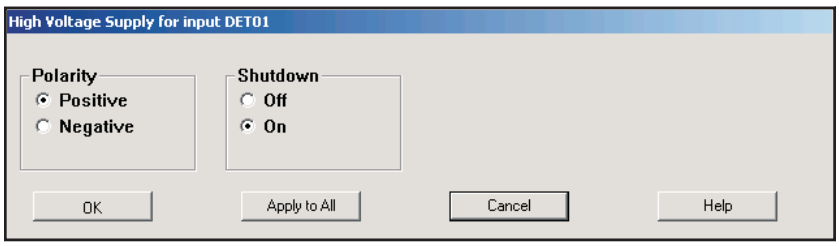

Figure 26 Setting the AHV-2PC Power Supply

Polarity

The **Polarity** setting on the AHV-2PC can be set to **Positive** or **Negative** and as such will determine which output Lemo-HV connector will be used. This control is not available at run-time.

Shutdown

The **Shutdown** setting enables (**On**) or disables (**Off**) the power supply's external input signals that are capable of shutting down the high voltage power supply. These include LN_2 Sensor, Leakage Current, and External Shutdown. This control is available here and at run-time.

MCS

There are no adjustable controls for the MCS device. Adjustable controls are available at run-time (see page 40).

Input

The **Input** command, Figure 27, is used to change the name of the Input and define the Input. These commands are not available in the Gamma Acquisition and Analysis application.

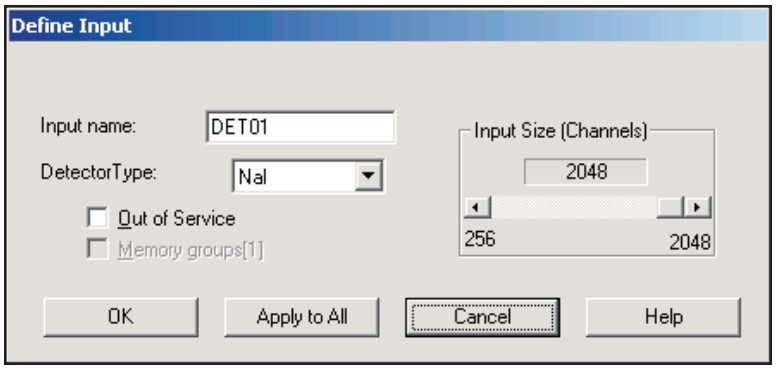

Figure 27 The Define Input Dialog

Input Name

The default DET*nn* name is initially assumed as the name for your Input. But since it is displayed in an Input name text box, you can easily change the name by clicking on the current name to select it, then typing in the new name, which can be up to eight characters long. This is the name by which the detector is referred to in all applications.

Detector Type

Use this drop-down list to select the type of detector to be used with this MCA; this also assigns appropriate default values to the spectrum display and analysis parameters.

Input Size

This parameter defaults to the number of channels that you selected during the MCA Device setup. To use less than the maximum available memory, slide the Scroll Bar to select the size you want.

Out of Service

Select the Out of Service check box when the MCA or its front end electronics are temporarily disconnected from the system. Though the MCA will still be listed in your MCA Definition File, it will not be available for data acquisition.

Saving and Loading the Input Definition

Having completed a definition, the next step is to save it in a disk file so it can be used in the future. Use the **Save** and **Save as** commands under the **File** menu to save the definition.

After having saved the definition, the next step is to load it into the run-time database so that it can be used by the Genie2000 applications. Use the **Load To** command to load the definition.

Refer to the “MCA Input Definition” chapter of the *Genie 2000 Operations Manual* for additional information regarding saving and loading definition files, as well as editing existing files.

5. System Setup

This chapter explains how to connect and configure your Eagle Plus System.

Other chapters in the manual explain how to:

- Install the Genie™ 2000 software on your PC. (“Software Installation” on page 8.)
- Create an Eagle Plus definition so it can communicate with Genie 2000. (“Defining the Eagle Plus” on page 13.)
- Adjust the controls for the hardware, such as the Amplifier, via Genie 2000. (”The MCA’s Adjust Screens” on page 37.)

The Eagle 5002 System

The Eagle 5002, designed for NaI detectors, uses the external Model BB-200 Tube Base with its internal high voltage power supply and charge sensitive preamplifier.

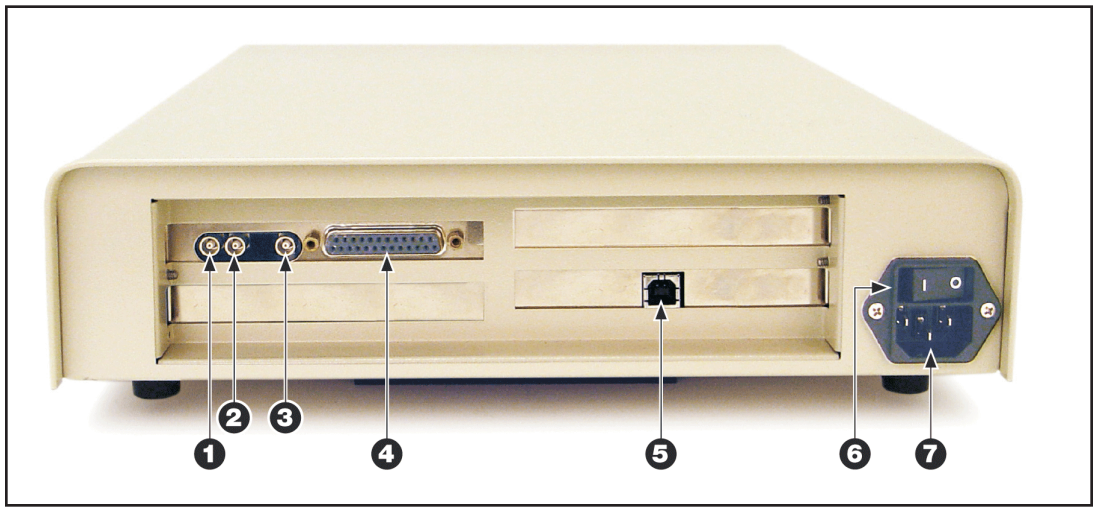

Figure 28 The Eagle 5002’s Connectors

Connecting the Eagle 5002 System

- Connect the supplied 3 m interface cable between the BB-200’s 9-pin Power connector and the Eagle 5002’s 25-pin Data I/O connector ④.

- Connect the supplied USB interface cable between your PC's USB connector and the Eagle's USB connector ⑤ .

- Connect the power cord to the Eagle's Power Connector ⑦.

Using the Eagle 5002 System

When you have completed the connections, you can apply power to the system. Turn on the Eagle 5002 with its Power Switch ⑥ the turn on the BB-200 with its On/Off switch.

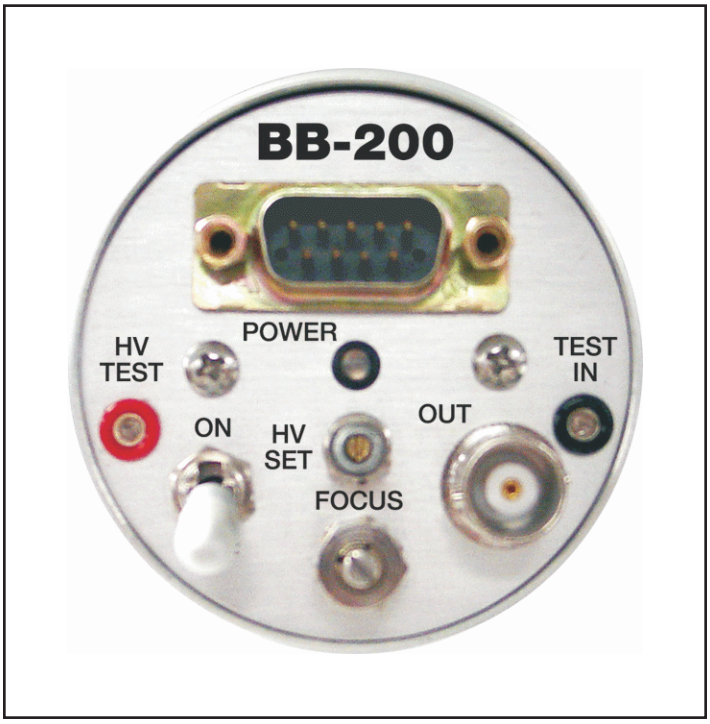

Figure 29 BB-200 Front Panel

Data Acquisition and Analysis

Data acquisition and analysis are controlled via the Genie 2000 software. Refer to the *Genie 2000 Tutorials Manual* and *Genie 2000 Operations Manual* for more information.

The Eagle 5004 System

The Eagle 5004, designed for Ge detectors, has a built-in high voltage power supply.

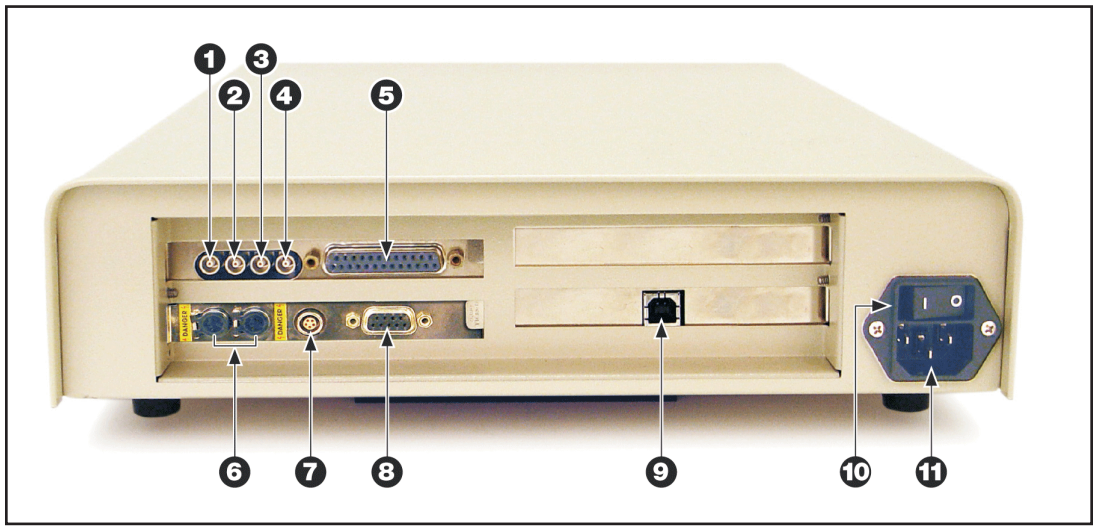

Figure 30 The Eagle 5004's Connectors

Connecting the Eagle 5004

- Connect the detector preamp's Output connector to the Eagle 5004's Input connector ①.
- Connect your detector preamp's HV In connector to the Eagle 5004's Positive (left LEMO) or Negative (right LEMO) HV connector ⑥.

CAUTION Be sure you connect the output of the proper polarity (positive or negative) to your detector. Using the wrong polarity can damage your detector.

- Connect your detector's Preamp Power connector to the Eagle 5004's Preamp Power connector ⑧.
- Connect your PC's USB connector to the Eagle's USB connector ⑨.
- Connect the power cord to the Eagle's Power Connector ⑪.

Using the Eagle 5004 System

When you have completed the connections, you can apply power to the system. Turn on the Eagle 5004 with its Power Switch ⑩.

Data Acquisition and Analysis

Data acquisition and analysis are controlled via the Genie 2000 software. Refer to the *Genie 2000 Tutorials Manual* and *Genie 2000 Operations Manual* for more information.

6. The MCA's Adjust Screens

The MCA Adjust Screens, which allow you to adjust the Eagle Plus's run-time controls are available after you have defined an MCA Input Definition (MID), as described in the "Defining the Eagle Plus" chapter (page 13).

Accessing the Adjust Screens

Start the "Gamma Acquisition and Analysis" program from the Genie™ 2000 folder.

- Open the detector (datasource) you just defined
- Select **File | Open Datasource**, then select **Detector** in the Type box.
- Next, select the datasource file and click on **Open**.
- In Genie 2000's menu bar, select the **MCA | Adjust** option.
- The Adjust dialog screen will open.

As adjustments are made in the dialog box, the new values are sent to the MCA. To save the adjustments to the datasource's CAM file, use the Gamma Acquisition and Analysis application's **File | Save** command so that the next time this datasource is selected, the proper setting will be loaded into the MCA.

The **Next** and **Previous** buttons at the left side of the Adjust screen are used to move to the next (or previous) page of the controls when there are more control elements than will fit in the basic box.

Note: If you get a "Required Hardware Unavailable" error, you may have selected the wrong datasource for the instrument or the serial number you entered in the MID file definition is not correct.

If you get a "Hardware Verification Error", there is a mismatch between the MID Definition setup and the hardware configuration. You can choose to accept or not accept the verification error in the associated dialog box. If you select No, a RED error box will appear in the top left corner of the Gamma Acquisition and Analysis window. To determine the source of the verification error, open the Status Page by clicking **MCA | Status** in the Genie 2000 menu bar. The problem item will be marked with an asterisk (*).

Each of the following sections describes the Eagle Plus MCA parameters that can be changed in the Gamma Acquisition and Analysis (GAA) application's Adjust dialog. To change a parameter, click on **MCA | Adjust** in the GAA's Main Menu, then select the control for the parameter you want to change.

A description of the device's controls can be found in "MCA Input Definition Editor" on page 20. Those controls that are only available at run-time are described in this section.

ADC Settings

The ADC Settings screen (Figure 31) contains the **Conversion Gain**, **Zero**, **LLD** and **ULD** run-time parameters. These are identical to the settings in the MID editor.

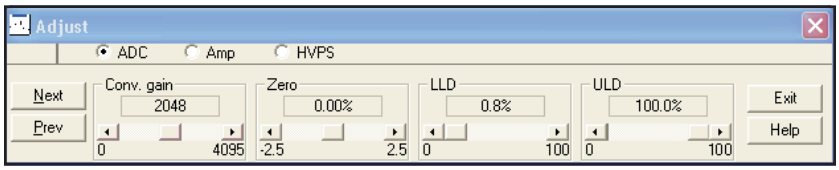

Figure 31 Adjusting the ADC Settings – Page 1

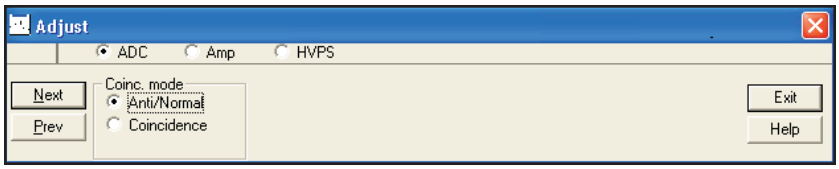

Figure 32 Adjusting the ADC Settings – Page 2

Amplifier

The Amplifier's run-time controls spread among three dialog pages, as shown in Figures 33, 34, and 35. The **Pole/Zero**, **Pulser**, and **Pulser Energy** are run-time parameters that were not accessible in the MID Editor.

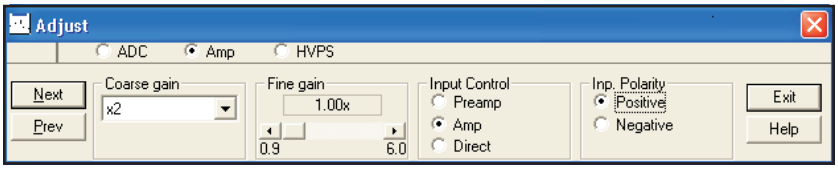

Figure 33 Adjusting the Amplifier Settings – Page 1

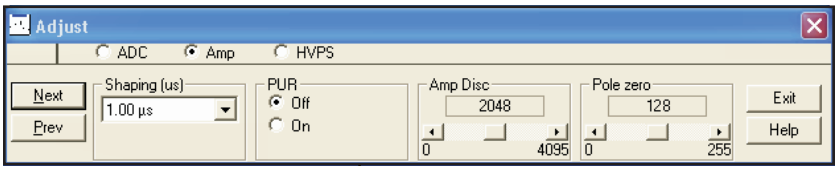

Figure 34 Adjusting the Amplifier Settings- Page 2

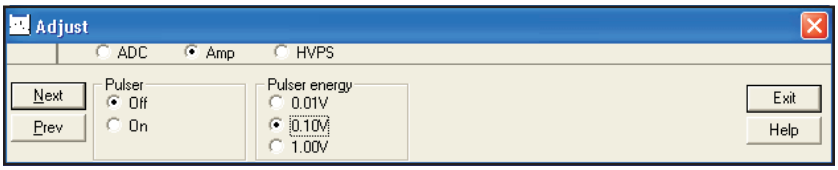

Figure 35 Adjusting the Amplifier Settings- Page 3

Pole/Zero

Sets the internal amplifier's pole/zero parameter.

Pulser and Pulser Energy

These settings apply to the Eagle Plus's internal test pulser. The Pulser can be enabled (**On**) or disabled (**Off**), and if enabled its amplitude can be set to 0.01V, 0.1V, or 1.0V.

High Voltage Power Supply

Both the **Status** and **Voltage** are run-time parameters that were not available during the MID Editor session. **Shutdown** enables/disables HVPS shutdown for any of the HV shutdown sources (External Input Shutdown, LN2 Input Shutdown and Leakage Input Shutdown) - depending on the related Registry Key Enable Mask settings (see page 53).

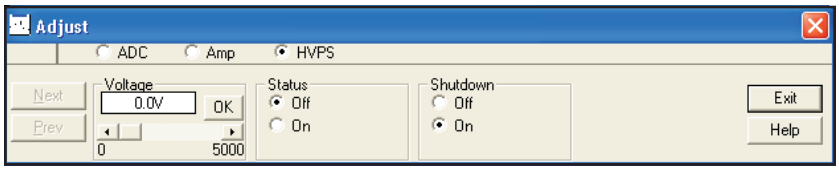

Figure 36 Settings for the HV Power Supply

The output voltage will ramp at approximately 50 volts/sec. While ramping, the HVPS Adjust dialog will remain locked as indicated by **Wait** in its status box.

MCS

The MCS adjust dialog (Figure 37) with associated run-time parameters will appear only if MCS acquisition mode was selected during the MID Editor session.

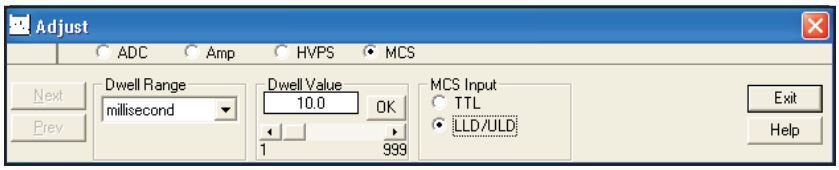

Figure 37 Adjust Screen MCS Settings

The **Dwell Time** can be set to integer values ranging from 1µs to 999 s over three ranges. The **Dwell Range** can also be set to **External** if an external dwell pulse is to be used.

The **MCS Input** mode can be set to **TTL** to count external TTL pulses, or **LLD/ULD** to count events between the ADC's LLD and ULD energy window.

Adjustments to the MCS run-time parameters must be made with acquisition off. Changes to parameters made during acquisition will be ignored.

Acquire Setup Screen

Preset conditions and external start/stop operations are set up through the PHA Acquire Setup screen (Figure 38) or MCS Acquire Setup screen (Figure 39).

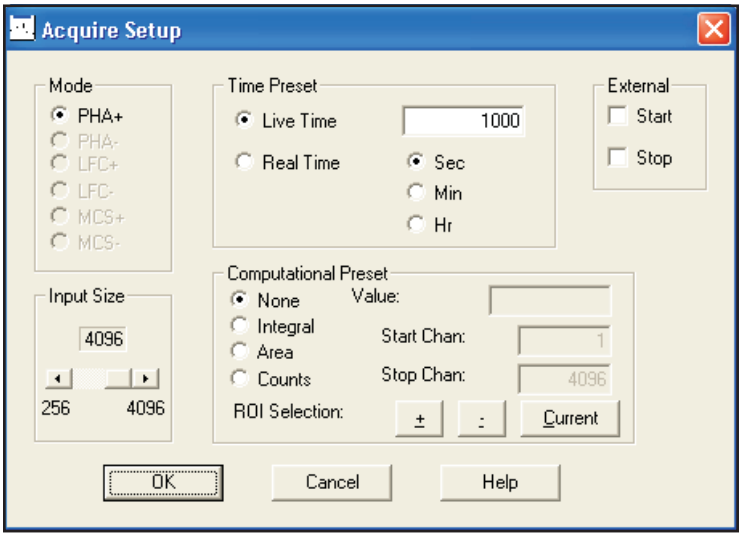

Figure 38 Acquire Setup for PHA

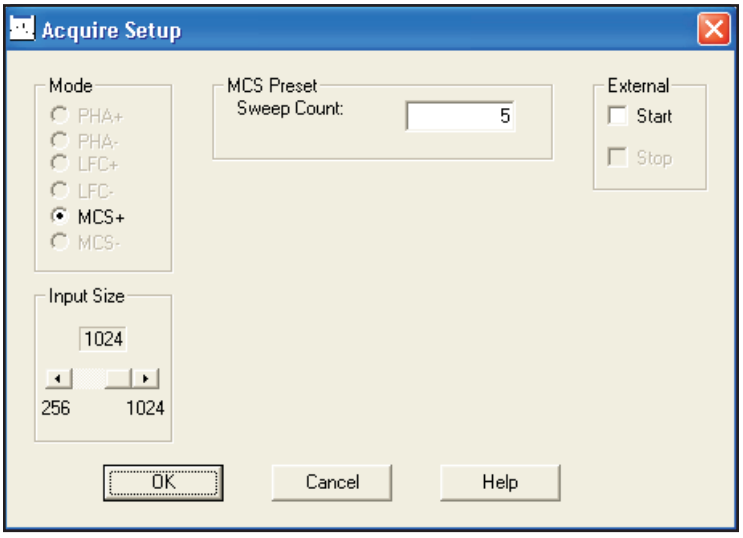

Figure 39 Acquire Setup for MCS

A. Eagle Specifications

Inputs/Outputs

SIGNAL – Input from detector, external preamplifier, or external amplifier; LEMO® connector or BNC with adapter.

AMPLIFIER OUT – 0–2.5 V output for use with an external oscilloscope, LEMO connector or BNC with supplied adapter.

PULSER OUT or COINCIDENCE/ANTI-COINCIDENCE IN – LEMO connector or BNC with supplied adapter.

INHIBIT – Input from pulsed optical or transistor reset preamps (5 V TTL, active high or low, software controlled), LEMO connector or BNC with supplied adapter (EAGLE-4K only).

I/O SIGNALS (DB-25) – Output signals: Linear gate, SCA, HV power ON and HV set; Input signals: Start/stop, MCS pulse and advance, dead time, reject, and HV status.

SAMPLE CHANGER CONTROL – Via parallel port on host PC.

HVPS – EAGLE-2K: included in supplied PMT Base; EAGLE-4K: via LEMO connector or SHV with supplied adapter.

HVPS INHIBIT – Via LEMO connector or BNC with supplied adapter on multi-pin LEMO external input (EAGLE-4K only).

PREAMP POWER – 9-pin Amphenol Connector, ±12 V dc, ± 24 V dc (EAGLE-4K only).

DATA INTERFACE – Rear Panel, 12 Mbits/s Full Speed USB interface, hot pluggable.

POWER – Rear panel 3-prong connector, 86-264 V 50/60 Hz autosensing input; 17 VA for EAGLE-2K, 20 VA for EAGLE-4K.

Front Panel Indicators

POWER – Yellow LED indicates that the power is on.

USB – Green LED confirms that the USB connection to the computer is properly established.

ACQUIRING – Yellow LED indicates that the unit is currently acquiring data.

HV – Green LED: Green LED indicates that the HVPS is on. It also means that the voltage has properly ramped up to the preset voltage value, and that the sensors for detector protection have not been engaged (for Eagle-4K). When HV is turned on, the voltage ramps up slowly for detector protection. This ramping-up process is indicated by the blinking LED. Once the preset voltage value is achieved, it stops blinking.

Display

The front panel LCD screen displays various kinds of information over four different pages. The displayed page changes each time the PAGE button located on the right of the LCD screen is pressed. Following is the type of information presented in each page.

- Page 1 – Displays the Custom ID, the current date and time. Date and time are set up automatically as they synchronize with the computer clock.
- Page 2 – Displays the Product Name and its Serial Number.
- Page 3 – Displays the information about its components MCA, HVPS, and the firmware version.
- Page 4 – Displays the information regarding data acquisition, i.e., the mode type (PHA or MCS), voltage value, count rate and true time.

Performance

PHA Mode

CHANNELS – Selections of 256, 512, 1024, 2048 or 4096 channels. (2048 channel limit for EAGLE-2K).

SPECTRUM SIZE – From 256 up to maximum ADC gain, $\pm 2 \times 10^9$ counts per channel.

PRESET TIME RANGE – Live or true time: 1 ms to 2^{32}-1 ms (approx. 49 days).

TIME RESOLUTION – Live or true time: 0.001 second (1 ms).

MCS Mode

CHANNELS – Selections of 256, 512, 1024, 2048, or 4096 channels. (2048 channel limit for EAGLE-2K).

CONTROL – Internal using analog pulses that are between LLD and ULD, or high speed external TTL signal up to 12 MHz rate.

DWELL TIME – 1 µs to 999 s per channel.

HVPS

VOLTAGE LIMIT – Sets maximum voltage limit of voltage range selected.

STATUS – ON, OFF; sets the HVPS ON or OFF.

VOLTAGE – Allows adjustment of the HVPS output over the voltage range selected by the HV module type and voltage limit selections.

HVPS RESET – Resets a power supply fault, after a fault condition has occurred.

EAGLE-2K(BB-200 PMT Based) –

- Voltage Range – Continuously adjustable positive HV output from 0 or 500–2000 V.
- High Voltage Drift – 0.01%/°C.
- Control – Locking ON/OFF toggle switch on tube base; HV settings adjusted via Genie™ 2000 software.

EAGLE-4K –

- Voltage Range – Continuously adjustable HV output from ± 0–5000 V with 200 µA current capability at 5000 V.
- High Voltage Ramp Up – Automatic HV ramp up or down at 50 V/s to protect detector and preamplifier.
- Control – Settings adjusted via software.
- Ripple and Noise – <5 mV RMS.
- Stability – <0.01%/hr, 0.02%/8 hr.
- Regulation – <0.01% for line and load changes.

Amplifier

OVERALL GAIN RANGE (ALL TYPES) – 2–1375, coarse gain of x2, x10, x50, x250, fine gain range of x0.9 through x6.0; 14 bit resolution.

Bipolar (EAGLE-2K and EAGLE-4K)

- Spectroscopy grade bipolar shaping, ideal for scintillation detectors.
- Bipolar shaping amplifier time constants – EAGLE-2K has 0.5, 1, or 2 µs; EAGLE-4K has 0.25, 0.5, 0.75, 1, 2, 3, or 4 µs.

Unipolar (EAGLE-4K)

- Spectroscopy grade unipolar shaping, ideal for HPGe detectors.
- Active gated BLR (baseline restoration) and PPR/LTC (pulse pile-up rejector/live time correction) circuits for excellent high count rate performance.
- The PUR threshold is adjusted with the Amp Disc control.
- Pulse pair resolution – as low as 250 ns, leading or trailing edge rejection.
- Gaussian shaping time constants – 0.25, 0.5, 0.75, 1, 2, 3, or 4 µs.
- Noise – 4 µV for unipolar output referred to input at 4 µs time constant, 7 µV at 2 µs time constant (gain >100).
- Spectrum broadening – <10% FWHM for ^{60}Co at 1.33 MeV at 85% of full scale, 1-100 kcps, unipolar output, 2 µs time constant (detector dependent).
- Spectrum peak shift – <0.02% full-scale for ^{60}Co at 1.33 MeV at 85% of full scale, 1-100 kcps, unipolar output, 2 µs time constant (detector dependent).

Gated Integrator (EAGLE-4K)

- Best performance with HPGe detectors that are provided with transistor reset preamplifiers.
- Shaping time constants for gated integrator (GI) mode – 0.25, 0.5, 0.75, or 1 µs.
- GI time constant peak integration widths are optimized to give the best possible detector FWHM resolution, no user adjustments are needed.
- FWHM resolution performance at 0.25 – 0.5 µs GI is similar to traditional unipolar Gaussian shaping at 1-2 µs time constant, but with much higher data throughput.
- Can process count rates up to 300,000 cps before reaching the point of diminished output with GI time constant at 0.25 µs (detector dependent).

System Test Pulser

TRI-LEVEL OUTPUT AMPLITUDE – Exponential decay, designed for system setup and basic diagnostics only.

SIGNAL – To external preamplifier test input (0.01 V), main shaping amplifier (0.1 V), or direct to ADC (1 V).

FIXED PULSE RATE – Approximately 1 kcps, 0.1 µs rise time, 100 µs decay time.

ADC

EAGLE-2K – 2k gain/memory 2.5 µs ADC, differential non-linearity <0.60%.

EAGLE-4K – 4k gain/memory 800 ns ADC, differential non-linearity <0.65%.

ADC TYPE – Fixed conversion time ADC with linearization enhancement circuit for excellent non-linearity performance.

SMART (Simultaneous Memory Add-1/Release Technology) ADC has effective zero dead time add-1 into memory, physical add-1 into memory (typical) 188 ns.

DRIFT – <0.005%/°C, integral non-linearity less than 0.025% full scale.

SOFTWARE CONTROL – ADC gain from 256 channels up to the ADC maximum gain, lower level discriminator (LLD), upper level discriminator (ULD), and dc zero level.

LOWER LEVEL DISCRIMINATOR (LLD) – Can be set from 0.0% to 100.0% of the ADC's full-scale input.

UPPER LEVEL DISCRIMINATOR (ULD) – Can be set from 0.0% to 100.0% of the ADC's full-scale input.

ADC ZERO OFFSET – Adjustable over ±2.5% of full scale.

EXTERNAL DIRECT INPUT – External direct input to ADC, range 0-10 V (optionally 0-5 V), unipolar (positive) or bipolar (positive lobe leading).

COINCDENCE MODE – Sets ADC input gating to either Coincidence or Anticoincidence mode.

Preamplifier Support (EAGLE-4K)

TYPE – Supports preamplifier types: TRP (transistor reset preamp) or RC (RC coupled).

INHIBIT POLARITY – Selects either active high or active low reset preamp inhibit polarity.

USB Interface

Full Speed USB interface for host communication; rear panel USB Series B connector. A 3 m (10 ft) USB cable is provided.

Physical

EAGLE DESKTOP UNIT SIZE – Approximately 30.48 x 8.41 x 40.31 cm (12 x 3.31 x 15.87 in.) (W x H x D).

EAGLE DESKTOP UNIT WEIGHT – 5.6 kg (12.3 lb).

EAGLE-2K PMT BASE FORM AND SIZE – Cinch-Jones 3M-14 PMT socket that plugs directly onto a standard 14 pin PMT base – 12.8 cm (5.04 in.) long, not including connectors; 5.8 cm (2.3 in.) diameter.

EAGLE-2K PMT BASE WEIGHT – 0.2 kg (0.5 lbs).

OPERATING TEMPERATURE – 5 to 45 °C (40 to110 °F); storage: 0 to 60 °C (32 to 140°F).

OPERATING HUMIDITY – 0–80% relative, non-condensing.

Ordering Information

EAGLE-2K – Includes Desktop Unit and PMT Base, USB Interface Cable, 3 m (10 ft) Desktop Unit to PMT Base (DB-25 to DB-9) Cable, LEMO to BNC adapters, and a LEMO to LEMO cable.

EAGLE-4K – Includes Desktop Unit, USB Interface Cable, LEMO to SHV and LEMO to BNC adapters, and a LEMO to LEMO cable.

REQUIRED SOFTWARE – Both models require S500 or S502 Genie 2000 Basic Spectroscopy Software V3.0B or later (not included).

Computer Requirements

The minimum computer requirements for Genie 2000 are:

- COMPUTER – Industry standard computer with a Pentium®-233 processor and CD-ROM drive is required.
- OPERATING SYSTEMS – Windows® 2000 or Windows XP.
- RAM – A minimum of 64 MB (Windows 2000) or 128 MB (Windows XP) is recommended, but in the Genie 2000 environment more memory will generally improve performance.
- HARD DISK – 100 MB free disk space for Genie 2000 software and sample data file storage.
- DISPLAY – VGA color, 800 x 600 resolution, minimum; 1024 x 768 recommended.

Consult the factory for assistance in configuring a system to the needs of your application.

B. BB-200 Tube Base Specifications

The Model BB-200 Tube Base/Preamplifier for 10-stage 14-pin photomultiplier NaI detectors has a built-in high voltage power supply. The internal charge sensitive preamplifier interfaces directly with the Eagle 5002's internal amplifier.

Inputs

POWER

+12V at 100 mA, maximum; 9-pin D-type connector.

TEST IN

Preamplifier test input signal; accepts positive or negative pulses, charge coupled to the preamplifier input; voltage gain to output is 0.02V/V, nominal; Z_{in} = 50 Ω; miniature bannana jack.

Outputs

OUT

This signal is available on both the OUT connector and pin 3 of the POWER connector. Negative pulses directly from the PMT anode or (depending on internal settings) positive pulses from the preamplifier, linearly proportional in the peak amplitude to charge delivered at the PMT anode; rise time <50 ns (preamplifier only); decay time ≈50 µs; charge sensitivity 5 mV/pC; output impedance 50 or 93 Ω (switch selectable, series connected); BNC.

HV TEST

0.5–2.0 V dc signal via HV TEST connector; corresponds to internal 500–2000 V high voltage; Z_{out} = 500 Ω; miniature bannana jack.

STATUS

TTL-compatible logic signal on pin 5 of the POWER connector; high when HV is functioning, low when it is not functioning.

Front Panel Controls

HV SET

Adjusts high voltage; range 500–2000V; 15-turn screwdriver adjusted potentiometer.

FOCUS

Adjusts voltage at the PMT grid for the best energy resolution; single-turn screwdriver adjusted locking potentiometer.

ON/OFF

Locking toggle switch.

Internal Controls

HV Power Supply Board

The HV Ref switch (SW1) on the HV power supply board selects the source of the HV reference voltage. In the MAN position, local reference (adjustable by means of the front panel HV SET control) is used. In the PGM position, an external reference (connected to pin 8 of the POWER connector) is used. The allowable voltage range is 0.6375 V to 2.55 V.

- The HV Ref switch is factory set to PGM.

Preamplifier Board

There are two switches on the preamplifier board. To use the internal preamplifier, SW1 must be set to the PREAMP IN position. When SW1 is set to PREAMP OUT, the internal preamplifier is not used and the PMT anode is connected directly to the front panel's OUT connector.

- This switch is factory set to PREAMP IN.

Switch SW2 allows setting the preamp output impedance to either 50 or 93 Ω. The setting should match the impedance of the cable used.

- This switch is factory set to 50 Ω.

C. Notes on Eagle Plus Operation

The AHV-2PC High Voltage Power Supply

The Eagle 5004's built-in AHV-2PC High Voltage Power Supply board's addressing switches must be set to the same settings as those of the MCA from which the power supply will be controlled. For example, if the MCA board is set for base 28X/bd#1 then the power supply must be set to 28X/bd#1.

Limitations of the Eagle Plus

The following limitations apply to the Eagle Plus

- Pole/Zero setting is supported in manual mode only. For optimum performance, an oscilloscope is required to correctly adjust the pole/zero for Unipolar and Gated modes. In Bipolar mode, the pole/zero setting is automatically set to midscale.
- The LN_2 level is not returned to the user interface.
- HVPS alarm annunciators for LN2, Leakage Current, and External Shutdown are not supported. External Shutdown signals are supported.
- PUR setting is supported in manual mode only. Adjustments for optimum performance are made using the system Dead Time as instructed by the procedure in the "MCA Input Definition Editor" section on page 20.
- Memory Groups are not supported.
- The amplifier's Input Control setting is displayed in the MCA Status Page and reports the output as: 0 = Preamp, 1= Amp, 2 = Direct.

D. Registry Defaults

Settings not included in the user interface have been placed under the following registry key:

HKEY_LOCAL_MACHINE\SOFTWARE\Canberra Industries, Inc.\Genie-2000 Environment\Eagle Plus

The default setting for any function can be changed using the operating system's registry editor. Refer to the operating system documentation for instructions on using the registry editor.

The following table indicates the functionality of each registry key.

CAUTION Registry edits should only be made by experienced users. Improper edits can render your entire system inoperative.

Registry Keys and Definitions

Registry Key	Default	Range	Definitions
AdcAboveUldPulse	0	0 = ignore pulses above ULD 1 = Add pulses above ULD in last channel	Store pulses above LLD threshold
AdcCoinActive	0	0 = active high coincidence 1 = active low coincidence	Coincidence Input Polarity
AdcCoinTrigger	0	0 = level sensitive coincidence 1 = edge triggered coincidence	Coincidence Method
AdcDead	0	0 = active low external dead time 1 = active high external dead time	Dead Time Input Polarity
AdcLinearGate	0	0 = active low linear gate output 1 = active high linear gate output	Linear Gate Polarity
AdcOffset	0	0 to 15 (See the following tables) High order ADC address bits (effect depends on ADC Gain)	ADC Offset

Registry Key	Default	Range	Definitions
AdcReject	0	0 = active low external reject 1 = active high external reject	Reject Input Polarity
AdcExtOffset	0	0 = internal offset 1 = external offset	External Offset
AdcXOffset	0	0 = active low offset 1 = active high offset	External Offset Polarity
McaXOut	0	0 = X Output low (0 V) while collecting 1 = X Output high (+5 V) while collecting	Output Polarity
McsExtAdvancePol	1	0 = active low external MCS channel advance 1 = active high external MCS channel advance	External MCS Advance Polarity
McsExtPulsePol	1	0 = active low external MCS pulse 1 = active high external MCS pulse	External MCS Pulse Polarity
AllowExternalInput Alarm	1	0 = no audible alarm for external input 1 = audible alarm for external input	
AllowLeakage Current Alarm	1	0 = no audible alarm for high leakage current 1 = audible alarm for high leakage current	
AllowLN2Sensor Alarm	1	0 = no audible alarm for low LN2 level 1 = audible alarm for low LN2 level	
AllowExternalInput ShutDown	1	0 = no HV shut down for external input 1 = HV shut down for external input	AHV-2PC HVPS External Input Shutdown Enable Mask
AllowLeakage CurrentShutDown	1	0 = no HV shut down for high leakage current 1 = HV shut down for high leakage current	AHV-2PC HVPS Leakage Input Shutdown Enable Mask
AllowLN2Sensor ShutDown	1	0 = no HV shut down for low LN2 level 1 = HV shut down for low LN2 level	AHV-2PC HVPS LN2 Input Shutdown Enable Mask

Port 8 [0C02] Write Gain/Offset

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	0	0	0	0	0	G2	G1	G0	0	O3	O2	O1	O0

B0-B3 Offset to ADC Channel Address (O0-O3), B5-B7 ADC gain (G0-G2).

ADC Offset Values

ADC Offset Value	B3	B2	B1	B0	4K ADC Gain	Offset	2K ADC Gain	Offset
–	x	x	x	x	4096	0	2048	0
0	x	x	x	0	2048	0	1024	0
1	x	x	x	1	2048	2048	1024	1024
0	x	x	0	0	1024	0	512	0
1	x	x	0	1	1024	1024	512	512
2	x	x	1	0	1024	2048	512	1024
3	x	x	1	1	1024	3072	512	1536
0	x	0	0	0	512	0	256	0
1	x	0	0	1	512	512	256	256
2	x	0	1	0	512	1024	256	512
3	x	0	1	1	512	1536	256	768
4	x	1	0	0	512	2048	256	1024
5	x	1	0	1	512	2560	256	1280
6	x	1	1	0	512	3072	256	1536
7	x	1	1	1	512	3584	256	1792

ADC Offset Value	B3	B2	B1	B0	4K ADC Gain	Offset	2K ADC Gain	Offset
0	0	0	0	0	256	0		
1	0	0	0	1	256	256		
2	0	0	1	0	256	512		
3	0	0	1	1	256	768		
4	0	1	0	0	256	1024		
5	0	1	0	1	256	1280		
6	0	1	1	0	256	1536		
7	0	1	1	1	256	1792		
8	1	0	0	0	256	2048		
9	1	0	0	1	256	2304		
10	1	0	1	0	256	2560		
11	1	0	1	1	256	2816		
12	1	1	0	0	256	3072		
13	1	1	0	1	256	3328		
14	1	1	1	0	256	3584		
15	1	1	1	1	256	3840		

E. Connector Pinouts

Preamp Power Connector

Used only on the Eagle 5004.

Pin	Signal name
1	Ground
2	Ground
3	Output
4	+12 V
5	BB-200: HV status output (High = HV OK, Low = HV low). AHV-2PC: Input; voltage proportional to leakage current from Ge detector; shuts down HV output when the volnntage exceeds 15 V.
6	–24 V
7	+24 V
8	BB-200: HV reference input (used when SW1 on HV board is in PGM position). AHV-2PC: LN Sensor Input and Adjustment, shuts down HV output when the LN sensor resistance falls below 2 kΩ.
9	–12 V

Data I/O Connector

Pin	Signal / Function
1	Optional +5 V (when jumper JP5 closed)
2	XOFF0, 10 kΩ pullup to +5 V; external offset bit 0 input
3	XOFF1, 10 kΩ pullup to +5 V; external offset bit 1 input
4	XOFF2, 10 kΩ pullup to +5 V; external offset bit 2 input
5	XOFF3, 10 kΩ pullup to +5 V; external offset bit 3 input
6	XSUSPND, 10 kΩ pullup to +5 V; suspend input
7	XINPUT, 10 kΩ pullup to +5 V; control input
8	XMCSPUL, 10 kΩ pullup to +5 V; MCS pulse input
9	XMCSADV, 10 kΩ pullup to +5 V; MCS advance input
10	XDEAD*, Dead time correction input
11	XCOINC*, Coincidence input
12	XREJ*, Reject input
13	XLG, Linear gate output
14 – 18	GND
19	XOUTPUT, Control output
20	XSCA (single channel analyzer output), 5 V TTL for events between LLD and ULD settings
21	+12VSW (+12 V switched output); Remote power: software switched 12 V DCxx 0.3 A max (fused) output to BB-200 HVPS
22	HVREF DC, reference voltage (0 to 2.55 V) to set external HV on BB-200 HVPS
23	HVSTAT, high voltage status input; logic level from BB-200 indicating that HVPS is OK
24	AIN analog input (signal from BB-200)
25	Analog ground

LEMO Connectors

J1 Signal In

Accepts input from the detector, an external preamplifier or an amplifier.

J2 Amp Out

Provides the on-board amplifier's output signal to, for instance, an oscilloscope. 0–10 V range. Output from on-board amplifier out, 0–2.5 V.

J3 Inhibit In (Eagle 5004 only)

Accepts the inhibit signal from a pulsed optical or a transistor reset preamplifier (5 V TTL, active high or low, software controlled).

J4 Puser Out/Coincidence In

Pulser output: 0.01, 0.1 or 1.0 V at ≈1 kcps, or Coincidence Input.

Multipin LEMO

Pins are numbered counterclockwise from the top.

Pin	Function
1	Ground
2	LN Sensor Input
3	External Disable
4	Analog In (–)
5	Analog In (+)

Notes

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