

# ***PG4000A***

## Digital Stimulator Instruction Manual

©2005 Cygnus Technology, Inc.

### **Cygnus Technology, Inc.**

P.O.Box 219

Delaware Water Gap, PA 18327

Tel: (570) 424-5701

Fax: (570) 424-5630

Email: [sales@cygnustech.com](mailto:sales@cygnustech.com)

web: [www.cygnustech.com](http://www.cygnustech.com)

## **Warranty**

Cygnus Technology, Inc. warrants to the original purchaser that its stimulus isolation unit, model **PG4000A**, and the component parts thereof, will be free from defects in workmanship and material for a period of one year from the date of purchase.

**Exclusion:** This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repair.

This warranty is void if the serial number is altered, defaced or removed.

During the warranty period, Cygnus Technology, Inc. will, without charge, repair or replace, at its option, defective product or component parts. The customer is responsible for delivery charges to Cygnus. We will pay for return shipping via our normal methods (UPS ground), the customer will be charged for any special handling such as express delivery. Please see the service return section for further information.

## **Disclaimer**

***THIS EQUIPMENT IS NOT INTENDED TO BE USED, AND SHOULD NOT BE USED IN HUMAN EXPERIMENTATION, NOR SHOULD THIS INSTRUMENT BE APPLIED TO HUMANS IN ANY WAY.***

## **Service**

In the event that service is required please contact our service department ([service@cygnustech.com](mailto:service@cygnustech.com)). We will attempt to diagnose and isolate the problem. Sometimes the problem can be corrected through consultation with the user's technical personnel or by Cygnus supplying replacement parts.

If the item must be returned please contact the service department for a RMA number and instructions. For returns the instrument must be adequately packaged and shipped prepaid. We ask that an explanatory note describing the problem and listing a contact person be included inside the shipping container. We will inspect the item and contact the customer if we feel there are issues that affect warranty repair. For non-warranty service, please include information on obtaining a purchase order for any charges that may accrue. Also clearly indicate the return shipping address and any special handling requests.

We will promptly repair and return the item via our normal shipping method (UPS ground). Any other charges such as express delivery are the customer's responsibility and may require additional payment.

## **Safety Issues**

There are no outstanding safety issues involving the PG4000A.

Please be certain that the correct line voltage is selected. The voltage is determined by a small jumper board behind a clear sliding window on the power entry module on the back panel. The selected voltage should be visible on the board. See below for the procedure to change the line voltage.

**NOTE:** If the user encounters **unexpected behavior** of the instrument do not continue use. Please contact Cygnus for a consultation before proceeding.

## INTRODUCTION

The PG 4000A is a digital stimulator/pulse generator with 4 channels which may be used independently or in combination.

Primary parameter settings are made by means of a smoothly rotating optical encoder wheel. This feature, combined with the digital LCD display, makes obtaining precise settings easier than with the use of an analog potentiometer but without the awkwardness of digital thumbwheel or keypad switches.

### Key Features:

**Pulse trains** may be generated in 2 ways:

1. Pulse trains can be generated by using two channels, one providing train delay and envelope width, the other channels being gated to provide pulse width and interpulse interval.
2. Pulse trains can also be generated using the built-in Train Mode feature. In this mode, channels CH1 and CH3 and/or CH2 and CH4 can be combined to give one output with control of trigger source, train delay, pulse width, pulse interval, and number of pulses.

**Nonvolatile memory:** The PG 4000A can store and recall up to 8 different instrument setups (all parameters) with the press of a button.

**Digital Display:** All parameters are continuously displayed on a LCD. It is not necessary to scan through a display list to see a setting.

**RS 232 computer interface included.** All parameters selectable remotely.

**Dynamic Resolution Encoder:** a time-saving feature in which the resolution of the encoder wheel changes in response to the speed at which the wheel is turned.

## **Front panel:**

### **1. Power Switch**

In the "On" mode, the power switch lamp is illuminated.

### **2. Main Control Wheel**

All parameters are set by turning the control. The parameter selected is highlighted by the blinking cursor on the display.

### **3. Pulse/Train Mode Switch**

This switch alternates the channel pair between independent pulse and combined train mode. The selected mode is indicated by LEDs.

### **4. Memory Switch**

Pressing the Memory pushbutton switch accesses the memory store/recall screen which replaces the normal parameter screen. From here you can store or recall any of eight different pulse or train patterns. The top line of the screen will display R1 to R8 (Recall) and the bottom line will display S1 to S8 (Store). The parameter switches for channels two and four allow you to store settings, while the parameter switches for channels one and three allow you to recall settings.

Press the Memory switch again to exit and the display will revert to parameter mode.

### **5. Auxiliary Switch**

This key allows access to the auxiliary square wave channel. The display changes to show the square wave period. Pressing the parameter button above the displayed period alternates the selection between the units and the prescaler. The setting is varied using the main control wheel. The square wave period is variable from 20 microseconds to 99.9 seconds. Pressing the switch again causes the display to revert to parameter mode.

### **4. Parameter Switches**

There are 8 parameter switches to the right of each of the 2 pulse/train mode switches. Each switch selects two functions for each parameter. The two functions of each parameter are activated by toggling the parameter switches and are described below. The LCD shows 4 sets of parameters, one set for each channel. The values of each parameter are shown below the appropriate switches for channels 1 and 3, and above the switches for channels 2 and 4. The blinking cursor shows which parameter can be modified by turning the encoder wheel. Pressing the appropriate switch toggles between the two parameter functions, as shown by the cursor movement. The parameters for pulse and train modes are described below.

## **Pulse Mode**

**1. Trigger Switch** Pushing the button alternates between trigger mode selection and trigger source selection.

- Trigger Mode
  - + Trigger on positive-going edge of trigger pulse
  - - Trigger on negative-going edge of trigger pulse
  - H Continuous pulses while trigger pulse high (on)
  - L Continuous pulses while trigger pulse low (off)

Channels set with Trigger Mode H or L will generate a continuous train of pulses as long as the trigger level is maintained high (on) or low (off) as appropriate. the

(+) and (-) trigger modes generate single pulses only on the rising or falling edges of the trigger pulses respectively ("edge" triggering).

- Trigger Source selections
  - Channel 1
  - Channel 2
  - Channel 3
  - Channel 4
  - External
  - Manual
  - Internal auxiliary square wave generator

**2. Delay Switch** This parameter sets the time delay between the trigger and the first pulse, and, in the case of a series of pulses, between onsets of successive pulses. The two functions selected by the button are:

- Counts: Three digits from 002 to 999
- Multiplier or Resolution which is expressed in term of 10 to the Nth power micro seconds ranging from N=1 (10 micro Sec./Count) to N=5 (100 mSec./Count) giving a minimum and maximum delay from 20 usec up to 99.9 msec.

**3. Width** This parameter determines the pulse width. The functions are same as Delay above.

#### **4. Amplitude**

- I. Pulse Polarity + or -
- II. Three digits with each unit corresponding to 10 mV with a maximum voltage ranging from 0V to 9.99V.

### **Train Mode**

#### PARAMETER SELECTION AND CONTROL

The same two-part parameter selection and control applies to the Train Mode as described for the Pulse Mode. In Train Mode for channels 1 and 3 combined, the output is on channel 1; for channels 2 and 4 combined the output is on channel 2. This mode is selected by pressing the Pulse/Train pushbutton switch of the associated channels. Subsequently pressing this switch will allow you to alternate between Pulse and Train Modes. Trigger, Delay, Width, Amplitude, Interval, and Number, as labeled below (the parameter switches), are available in this mode.

Example. CH. #1 and CH. #3 in Train Mode

Trigger - Same as in Pulse Mode

Delay - Is the Train Delay

Width - Same as in Pulse Mode

Amp - Same as in Pulse Mode

Interval - Interval between pulses in the train

Number - Number of pulses in the train

**Aux On/Off Switch**

This is used to switch on or off the Auxiliary signal from the Output BNC terminal. The square wave period is variable from 20 microseconds to 99.9 seconds.

**Channel On/Off Switches**

These can be used to switch out the Output BNC of the desired channel. As soon as the channel is triggered, green light will light up. Then it will change to red as long as the pulse is on.

**Channel Sum Switch**

This is an analog sum of the two corresponding channels. Note: It is possible to saturate the summing channel if the magnitude of the sum exceeds 12 Volts.

**Manual Trigger Switch****External Trigger Input**

REAR PANEL:

Auxilliary Pulse Drive Pin  
Assignments

Pin	Output
A	CH2
B	CH1
D	CH3
E	CH4
H	GROUND

3. RS 232 Interface

## RS Interface

### Port Settings

9600 baud  
No parity  
8 databits  
2 stopbits  
Full duplex

Pin Output  
1 = Chassis ground  
2 = Transmit (output)  
3 = Receive (input)  
7 = Ground

### RS 232 COMMUNICATION FORMAT

A simple command to the serial line can control the function of the PG 4000. All commands are started with the @ sign.

1. P command - Command for pulse mode
  - @P1 - set CH1 and 3 to the pulse mode
  - @P2 - set CH2 and 4 to the pulse mode
2. T command - Command for train mode
  - @T1 - set CH1 and 3 to the train mode
  - @T2 - set CH2 and 4 to the train mode
3. W command - Command for writing parameters
  - @W0+1230123012300
  - After W, 14 numbers and one sign are required. Note: spaces in place of zeros are not acceptable.

@W0+1230123012300

Bold, italic number corresponds to the channel number

0 - CH1  
1 - CH3  
2 - CH2  
3 - CH4

@W0+1230123012300

Bold, italic sign corresponds to the pulse polarity

+ positive  
- negative

@W0+1230123012300

Bold, italic numbers correspond to the pulse amplitude

000 to 999 - These must be three digit numbers.

@W0+1230123012300

Bold, italic number corresponds to the multiplier of the pulse width

0 - 10<sup>1</sup>

- 1 - 10<sup>2</sup>
- 2 - 10<sup>3</sup>
- 3 - 10<sup>4</sup>

@W0+1230**1230**12300

Bold, italic numbers correspond to the pulse width  
002 to 999 - These must be three digit numbers.

@W0+12301230**0**12300

Bold, italic number corresponds to the multiplier of the  
pulse delay

- 0 - 10\*\*1
- 1 - 10\*\*2
- 2 - 10\*\*3
- 3 - 10\*\*4

@W0+12301230**12300**

Bold, italic numbers correspond to the pulse delay  
002 to 999 - These must be three digit numbers.

@W0+123012301230**0**

Bold, italic number corresponds to the trigger source

- 0 - I
- 1 - E
- 2 - 1
- 3 - 2
- 4 - 3
- 5 - 4
- 6 - M

@W0+123012301230**0**

Bold, italic number corresponds to the trigger mode

- 0 - +
- 1 - -
- 2 - H
- 3 - L

W command under the Train mode:

In Train mode, the output of the second channel (i.e.,  
channels 3 and 4) will have the amplitude set for that  
channel until the end of the last pulse of the train. The  
following two lines set the train parameters for channels 1  
and 3:

@W0+1230123012300

@W1+0000003012300@T1

The following two lines set the train parameters for  
channels 2 and 4:

@W2+1230123012300

@W3+0000003012300@T2

@W0+1230123012300

@W1+0000003012300@T1  
Bold, italic numbers correspond to the channel number. When the first statement points out 1, this must CH3.

@W0+1230123012300  
@W1+0000003012300@T1  
Bold, italic sign and numbers do not have any meaning, but type like this.

@W0+1230123012300  
@W1+0000003012300@T1  
Bold, italic numbers correspond to the number of train pulses.

@W0+1230123012300  
@W1+0000003012300@T1  
Bold, italic number corresponds to the multiplier of the train pulse interval.  
0 - 10\*\*1  
1 - 10\*\*2  
2 - 10\*\*3  
3 - 10\*\*4

@W0+1230123012300  
@W1+0000003012300@T1  
Bold, italic numbers correspond to the train pulse interval 002 to 999. These must be three digit numbers.

@W0+1230123012300  
@W1+0000003012300@T1  
Bold, italic numbers do not have any meaning, but type like this.

@W0+1230123012300  
@W1+0000003012300@T1  
Bold, italic command means to set CH1 and CH3 to train mode.

---

#### PG4000 RS232 Interface Pin-Outs

Pin Number	Signal
1	No Connection
2	Transmit Data (output)
3	Receive Data (input)
4-5	No Connection
6	Data Set Ready (DSR)
7	Ground
8-19	No Connection
20	Data Terminal Ready

21-25 (DTR)  
No Connection

## PRINCIPLES OF OPERATION

The PG 4000A has two basic modes of operation, individual pulse mode and train mode. These modes are set using the Pulse/Train switches to the left of channels 1 and 2. The four stimulator channels are divided into two sets, channels 1 and 3, and channels 2 and 4. Each set of channels may be operated either in pulse or train mode. Setting channels 1 and 3 to pulse mode allows the two channels to be operated as independent stimulus channels, each with controllable trigger mode, pulse delay, width, and amplitude. In train mode, channels 1 and 3 are combined so that the delay and width parameters of channel 3 become the interpulse interval and number of pulses in the train, respectively, while the delay of pulse 1 becomes the delay to the onset of the pulse train from the trigger pulse. Only edge triggering is allowed in train mode (+ or -). In train mode, the train output is at the Ch 1 or Ch 2 BNC connectors. One could, for example, set channels 1 and 3 to train, and 2 and 4 to pulse mode. The Sum output of channels 1 and 2 might then be a single pulse (from channel 2) followed by a train of N pulses from channel 1.

In pulse mode, the parameters for each channel are trigger mode and pulse delay, width and amplitude. In the train mode, delay and width parameters of channels 3 and 4 are changed to interpulse interval and number of pulses in the train.