Programming Manual

GPIB & RS232C Bench Top Equipment

Protek GPIB & RS232C

Bench Top Programming Manual

Protek

Safety Regulations

1. Do not touch any part of high voltage circuit or make any unnecessary high voltage measurements. Do not remove the top or bottom covers of this unit unless you are a qualified service person. Remove the power from this unit before removing the top and bottom covers.

2. When servicing this unit, the work area should be free from any electrical hazards. The floor and workbench where the unit is operated should be insulated and free from any exposed high voltage conductors. Remove any source of water or other conductive liquids in the working area.

3. Connect this unit only to a 3-prong AC outlet, which conforms to electrical safety, codes. Do not use any adapters to connect this unit to an AC receptacle.

4. Before operating or servicing this instrument, read the instruction manual and fully understand the operating procedures. If you are servicing the unit, check the circuit you are testing for high voltage.

5. Do not use this device in a room alone; be sure there are other people in the vicinity of your work area in case of an emergency arises. Have emergency telephone numbers posted in the work area in case a quick response is necessary.

Contents

General Introduction

This section describes how to remotely control all instrument functions and how to download and upload waveform data using either the RS-232C or GPIB interface. It is necessary to read the section on how to set the GPIB address or RS232 parameters on the 2714A if you have already installed a GPIB card and the required software on your computer. Included are an overview of remote control, a complete tabulation and explanation of control commands.

To set GPIB address

Each device on the GPIB (IEEE-488) interface must have a unique address. You can sot the address of the equipment to any value between 0 and 30.

How to set the address of the equipment

1. Press the Menu button.
2. Select the **Equip** mode to display the equipment setup mode.
3. Press **Edit** button to display "the movement cursor (<)".
4. Move "the movement cursor (<)" to GPIB address setup field.
5. Press (⇳) button to change the "(<) movement mode" to "(◄) correction mode".
6. Select the address by turning the rotary dial. (0-30).
7. Press F5 button to exit.

Before sending commands

Whether you use RS-232C or GPIB as the communication interface to the equipment, you should examine the following.

For RS-232C

1. Check the cable connection.
   Make sure the proper end (PC or Instrument) of the cable supplied is connected **to the** respective ends.

   PC-to-PC COM port Instrument
   to RS-232 connector

2. Setup the PC Port.
   Select a COM port on the PC. Make sure that the baud rate and other interface parameters are set to the same parameters as the equipment.

For GPIB

1. Check the cable connection.
2. Set up the GPIB board on the PC to a proper setting.
3. Make sure that the GPIB address set on the PC matches the equipment address.

1. RS232C Overview

Introduction

RS-232 is an industry-standard method of sending data back and forth between two pieces of equipment. With the equipment, a computer can remotely control the instrument, download waveform data and upload waveform data. This overview explains the interface requirements, instrument setup, how to verify communications.

Interface Requirements

All IBM (or IBM compatible) personal computers (PCs) should be equipped with at least on serial interface port. It may be either a 9-pin DB-9 or a 25-pin DB-25 connector. An 8-foot 9-pin cable is included with the instrument. Most any software, which defines communication protocols, may be used. This includes the programming languages Quick Basic, GW Basic, Visual Basic, Quick C, Turbo C and Turbo C+ + . Communications programs such as ProComm, a "shareware" version, arc also usually acceptable.

RS232C Specifications

Baud Rate	9600, 4S00, 2400, 1200 (option)
DATA LENGTH	8 BIT
START BIT	1 BIT
STOP BIT	1 BIT
PARITY BIT	NONE

2. RS232C Communication

Hardware and Software requirement:

1) IBM PC/XT/AT (8088,80286, 80386, 80486) or Compatible Computer.
2) Microsoft Windows VER 3.1 or Windows 95, 98
3) Serial Port for Connection with Instrument.

RS232C Cable Pin Connection

Instrument	Computer		
D-sub 9-Pin Male	D-sub 9-pin Female	D-sub 25-Pin Female	Pin Name
2	2	3	Rx
3	3	2	Tx
4	4	20	DTR
7	7	4	RTS

Installation of Supplied Software

1) Insert the supplied diskette into the Drive A. (or B).
2) Select File from the Program Manager screen, and then select Run.
3) Type A:\ (or B:\) Setup.exe. Then ENTER.
4) If you are using Windows 95/98 click the mouse on MY computer ICON, then
   Floppy Drive A icon. When the menu is displayed click on SETUP.EXE.
5) Monitor Program will be installed and create a directory named **"Model No."**
   automatically in Hard Disk.

Communication with PC

1) Start the program by clicking the mouse on the icon.
2) Click on the **[SetUp]** button to open the setup dialog. Then select appropriate
   Serial Port and Baud Kate and click on the **[OK]** button
3) Click on the S TIME button and type in the appropriate sampling lime.
4) Click the "START" button with mouse to start the program.
   [Start]: Starts the program.
   [**Stop]:** Stops the program.

3. GPIB (IEEE-488.2) Overview

Introduction

The instrument conforms to the Institute of Electrical and Electronics Engineers (IEEE) Standard 488.2-1987. The specific implementation of IEEE-488.1 includes the following functions and subsets:

Interlace Function	Subset
Source Handshake	SH1
Acceptor Handshake	AH1
Talker	T6
Listener	L4
Service Request	SR1
Remote Local	RL1
Parallel Poll	PP0
Device Clear	DC1
Device Trigger	DT1
Controller	C0
Electrical Interface	E1

To facilitate programming, a brief overview of the IEEE-488.2 Standard (as it specifically applies to the instrument) is provided.

For a more detailed discussion of these topics, a copy of IEEE Standard 488.2-1987 may be obtained from:

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017

4. GPIB Port

Standard IEEE-488 connector for connecting multiple devices to the GPIB interface.

*Note
The total cable length should be less than 25m (80ft) and the maximum number of device connections (including controller) is 15,

* GPIB Example
Figure below is an example of connecting multiple, devices to the GPIB port.

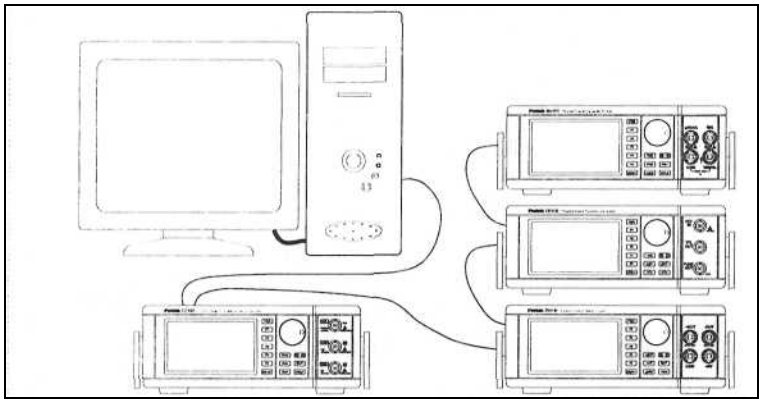

Figure. Example of connecting the connector

GPIB cable PIN number and signal

Pin number	IEEE standard	Pin number	IEEE Standard
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI	17	REN
6	DAV	18	GND (6)
7	NRFD	19	GND (7)
8	NDAC	20	GND (8)
9	IFC	21	GND (9)
10	SRQ	22	GND (10)
11	ATN	23	GND (11)
12	Shield	24	Logic GND

5. Status and Event Registers

There are four required status or event registers. They are:

1) Standard Event Status Enable (ESE) Register
2) Standard Event Status (HSR) Register
3) Service Request Enable (SRE) Register
4) Status Byte (STB)

The following diagram shows how the registers are related to each other. These registers indicate device status, and allow the programmer to specify which device events will enable a service request.

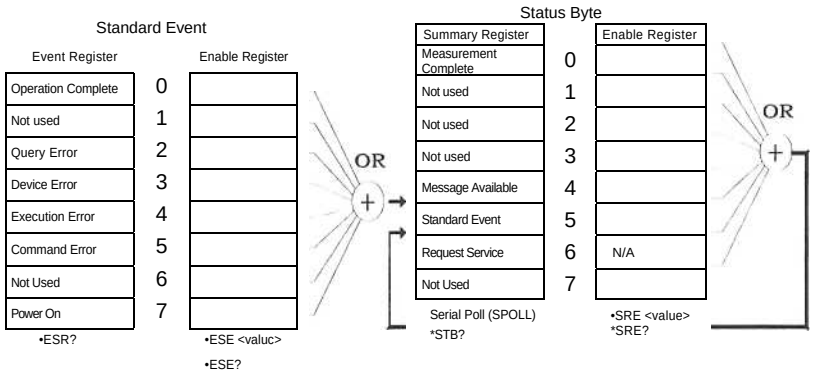

Diagram. Status and Event Registers

6. Command Set

Common command

Commands can be divided into two major categories: common commands and instrument specific commands. Instrument specific commands are detailed in next section. Common commands are defined by the standard, and, among other things, are used to manage status registers and synchronization. The following is a list of common commands as implemented in the instrument:

Command	Description
*CLS	Clear Status
*ESE (GPIB ONLY)	Standard Event Status Enable
*ESE?	Standard Event Status Enable
*ESR?	Standard Event Status Registe
*IDN?	Identification Query
*OPC	Operation Complete
*OPC?	Operation Complete Query
*RST	Reset
*SRE (GPIB ONLY)	Service Request Enable
*SRE?	Service Request Enable Query
*STB?	Status Byte Query
*TRG	Trigger Command
*TST?	Self-Test Query
*WAI	Wait-to-Continue
*OPT?	System Option Query

Verification of Communication

After the PC and the instrument have been connected together and programmed for compatible interface parameters, the interface should be tested for proper operation. To test the interface, type the following: *IDN?

The instrument should identify itself with the following:
Model NO, V.x.xx
(x.xx represents the current firmware revision number.)

Command set (RS232 & GPIB)

Command Set		
Command	Limits	
	Min	Max
*CLS		
*ESE (GPIB only)	0	255
*ESE?	0	255
*ESR?	0	255
*SRE?	0	255
*SRE?	0	255
*SRE?	0	255
*IDN?		
*RST		
*TRG		
*TST?		
*WAI		
*SRE?		
*OPC?		
*OPT?		

7. Command or Query message terminator

In order for the device to recognize the end of a command or query message, a special terminator is required.

CR LF CR represents carriage return and is an ASCII 0D (CHR$(13) for basic),
LF represents line feed and is an ASCII 0A (CHR$(10) for basic).

Command Execution examples

Example 1: To set Function to FREQ A and date time to 1S You would send the following program message:

F	0	;	G	10	CR	LF

Example 2: How to get the response from a query message If you send a query message below

MD	?	CR	LF

You would get the response below from a query message.

-	1	9	.	9	9	9	9	CR	LF

C3100 Commands

Command Set

Command Set			
Command sot Name	Command	Format	Command description (Variables)
Function	F	F0	F0=FREQ A F1=FREQ B F2=FREQ C F3=A→B F4=TOT.A F5=A/B F6=A-B F7=DTY.A F8=RPM A
		F?	Function query
Gate Time	G	G0	G0=50mS G10=1S G1=100mS G11=2S G2=200mS G12=3S G3=300mS G13=4S G4=400mS G14=5S G5=500mS G15=6S G6=600mS G16=7S G7=700mS G17=8S G8=800mS G18=9S G9=900mS G19=10S
		G?	Gate time query
Trigger level	TA	TA0	-99~+99
	TB	TA?	Trigger level query
Slope	SA	SA0	0(+),1(-)
	SB	SA?	Slope query
Coupling	CA	CA0	0(DC),1(AC)
	CB	CA?	Coupling query
Attenuator	AA	AA0	0(*1),1(*10)
	AB	AA?	Attenuator query
Low pass Filter	LA	LA0	0 (NOR), 1 (LPF)
	LB	LA?	Low pass filter query
Go to local (RS232C Only)	GTL	GTL	Remote disable
Request Measurement	RM	RM?	Request Measurement query

Command Features

The following examples will illustrate the specific features of the instrument remote programming commands using RS-232 or GPIB. All commands are executed immediately.

Function Command Execution examples

Example 1: To set FREQ A
You would send the following program message:
→ F0

Example 2: To set FREQ B
You would send the following program message:
→ F1

Trigger Command Execution examples

Example 1: To set Trigger level A 30
You would send the following program message:
→ TA30

Example2. To set Trigger level B 30
You would send the following program message:
→ TB30

More in one line
It is allowed to combine multiple commands and/or queries with their respective data into one single line. To combine multiple commands and queries with their respective data, a separator must be used. The semicolon (;) is used as a separator between commands and/or queries. This separator is officially called a "program message unit separator". The followings are the examples to combine multiple commands and/or queries.

Example 1: To set Func A, Trigger level A 30
You would send the following program message:
→ F0;TA30

Example 2: To set Func A, trigger level B, Slope A+
You would send the following program message:

→ F0;TB30;SA0

B4100 Commands

Command set

Command Set			
Command set Name	Command	Format	Command description (Variables)
Function	FUN	FUN0	FUN0=DCV FUN1=ACV FUN2=OHM FUN3=BEEP FUN4=DIODE FUN5=FRQ FUN6=DCuA FUN7=DCmA FUN8=DCA FUN9=ACuA FUN10=ACmA FUN11=ACA
		FUN?	Function query
Range	RGE	RGE0	Each function has respective ranges. (Refer to Range description)
Hold	HLD	HLD0	HLD0=NOR HLD1=HOLD
Measurement Data	MD	MD?	Measurement data query
Go to local (RS232C Only)	GTL	GTL	Remote Disable

Range description

Range Command Set			
Range Name (Function)	Command	Format	Command Description (Variables)
DCV (FUN0)	RGE	RGE0	RGE0=2V RGE1=20V RGE2=200V RGE3=1000V RGEA=AUTO (A is capital)
		RGE?	Range query
ACV (FUN1)	RGE	RGE0	RGE0=2V RGE1=20V RGE2=200V RGE3=1000V RGEA=AUTO (A is capital)
		RGE?	Range query
OHM (FUN2)	RGE	RGE0	RGE0=200Ω RGEl=2kΩ RGE2=20kΩ RGE3=200kΩ RGE4=2MΩ RGE5=20MΩ RGEA=AUTO (A is capital)
		RGE?	Range query
BEEP (FUN3)	RGE	RGE0	RGE0=2kΩ
DIODE (FUN4)	RGE	RGE0	RGE0=2V
FRQ (FUN5)	RGE	RGE0	RGE0=200Hz RGE1=2kIIz RGE2=20kHz RGE3=200kHz RGE4=2MHz RGEA=AUTO (A is capital)
		RGE?	Range query
DCuA (FUN6)	RGE	RGE0	RGE0=200uA
DCmA (FUN7)	RGE	RGE0	RGE0=200mA
DCA (FUN8)	RGE	RGE0	RGE0=10A
ACuA (FUN9)	RGE	RGE0	RGE0=200uA
ACmA (FUN10)	RGB	RGE0	RGE0=200mA
ACA(FUNll)	RGE	RGE0	RGE0=10A

Command Features

The following examples will illustrate the specific features of the instrument remote programming commands using RS-232 or GPIB. All commands are executed immediately.

FUN Command Execution examples

Example 1: To set **DCV**
You would send the following program message:
→ **FUN0**

Example 2: To set **FRQ**
You would send the following program message:
→ **FUN5**

HLD Command Execution examples

Example 1: To freeze the screen
You would send the following program message:
→ **HLD1**

Example2. To resume your measurement
You would send the following program message:
→ **HLD0**

More in one line

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Example 1: To setup DCV, **20V**
You would send the following program message:
→ **FUN0;RGE1**

Example 2: To setup **OHM,** AUTO
You would send the following program message:
→ **FUN2;RGEA**

G5100 Commands

Command set

Command Set			
Command set Name	Command	Format	Command description (Variables)
Waveform	WFM	WFM0	WFM0=SINE WFM1=TRI WFM2=SQUARE
		WMF?	WAVEFORM query
Output	OUT	OUT0	OUT0=OFF OUT1=ON
		OUT?	OUTPUT query
Frequency	FRQ	FRQ1Hz	Frequency = 1Hz~15.00MHz
		FRQ?	Frequency query
Amplitude	AMP	AMP0	Amplitude=0~999
		AMP?	Amplitude query
Offset	OFS	OFS0	Offset=-999~+999
		OFS?	Offset query
Attenuator	ATN	ATN0	ATN0=OFF ATN1=ON
		ATN?	Attenuator query
Symmetry	SYM	SYM0	Symmetry=0~99.9
		SYM?	Symmetry query
Sweep	SWP	SWP0	SWP0=OFF SWP1=ON
		SWP?	Sweep query
	SWR	SWR0.05	Sweep rate =0.05~9.95 (Sweep rate step: 0.05)
		SWR?	Sweep rate query
	SWW	SWW0	Sweep width= 0~99
		SWW?	Sweep width query
Go to local (RS232C Only)	GTL	GTL	Remote disable

Command Features

The following examples will illustrate the specific features of the instrument remote programming commands using RS-232 or GPIB. All commands are executed immediately.

WFM Command Execution examples

Example 1: To set SINE waveform
You would send the following program message:
→**WFM0**

Example 2: To set **TRI** waveform
You would send the following program message:
→**WFM1**

FRQ Command Execution examples

Example 1: To set 1kHz
You would send the following program message:
→**FRQ1kHz**

Example 2: To set 10kHz
You would send the following program message:
→**FRQ10kHz**

Note:
* When you enter FRQ1.5kHz, the instrument generates 1.500kHz automatically.
* When you enter PRQ1.5MHz, the instrument generates 1.500MHz automatically.

More in one line
It is allowed to combine multiple commands and/or queries with their respective data into one single line. To combine multiple commands and queries with their respective data, a separator must be used. The semicolon (;) is used as a separator between commands and/or queries. This separator is officially called a "program message unit separator". The followings are the examples to combine multiple commands and/or queries.

Example 1: To generate **sine** waveform. **1kHz** You would send the following program message:

→**WFM0;FRQlkHz**

Example 2: To generate **sine** waveform. **1kHz,** Amplitude 5**0**

You would send the following program message:

→**WFM0;FRQlkHz;AMP50**

P6100 Commands

Command set

Command Set			
Command set Name	Command	Format	Command description (Variables)
Positive Output	P	PON	PON = Positive on (1) POF = Positive off (0)
		PON?	Positive output query
Positive voltage	PV	PV0	PV0~29.9
		PV?	Positive voltage query
Positive Ampere	PA	PA1	PA0~2.999
		PA?	Positive ampere query
Negative Output	N	NON	NON = Negative on (1) NOF = Negative off (0)
		NON?	Negative output query
Negative Voltage	NV	NV0	NV0~29.9
		NV?	Negative voltage query
Negative Ampere	NA	NA1	NA0~2.999
		NA?	Negative ampere query
Fixation output	F	FON	FON = fixation on (1) FOF = fixation off (0)
		FON?	Fixation query
Fixed current	FA	FA1	FA0~1.999
		FA?	Fixed current query
Tracking	T	TON	TON = Tracking on (1) TOF = Tracking off (0)
		TON?	Tracking query
Go to local (RS232C only)	GTL	GTL	Remote disable

Command Features

The following examples will illustrate the specific features of the instrument remote programming commands using RS-232 or GPIB. All commands are executed immediately.

PV Command Execution examples

Example 1: To set + 10.00V
You would send the following program message:
→ **PV10**

Example 2: To set + 15.00V
You would send the following program message:
→ **PV15**

PA Command Execution examples

Example 1: To set 1.000A
You would send the following program message:
→ **PA1**

Example 2: To set 2.000A
You would send the following program message:
→ **PA2**

More in one line
It is allowed to combine multiple commands and/or queries with their respective data into one single line. To combine multiple commands and queries with their respective data, a separator must be used. The semicolon (;) is used as a separator between commands and/or queries. This separator is officially called a "program message unit separator". The followings are the examples to combine multiple commands and/or queries.

Example 1: To set 10V, tracking on.
You would send the following program message:
→ **PV10;TON**

Example 2: To set Positive output off, Negative voltage 5V,
Negative current 1.0A
You would send the following program message:
→ **POF;NV5;NA1.0**