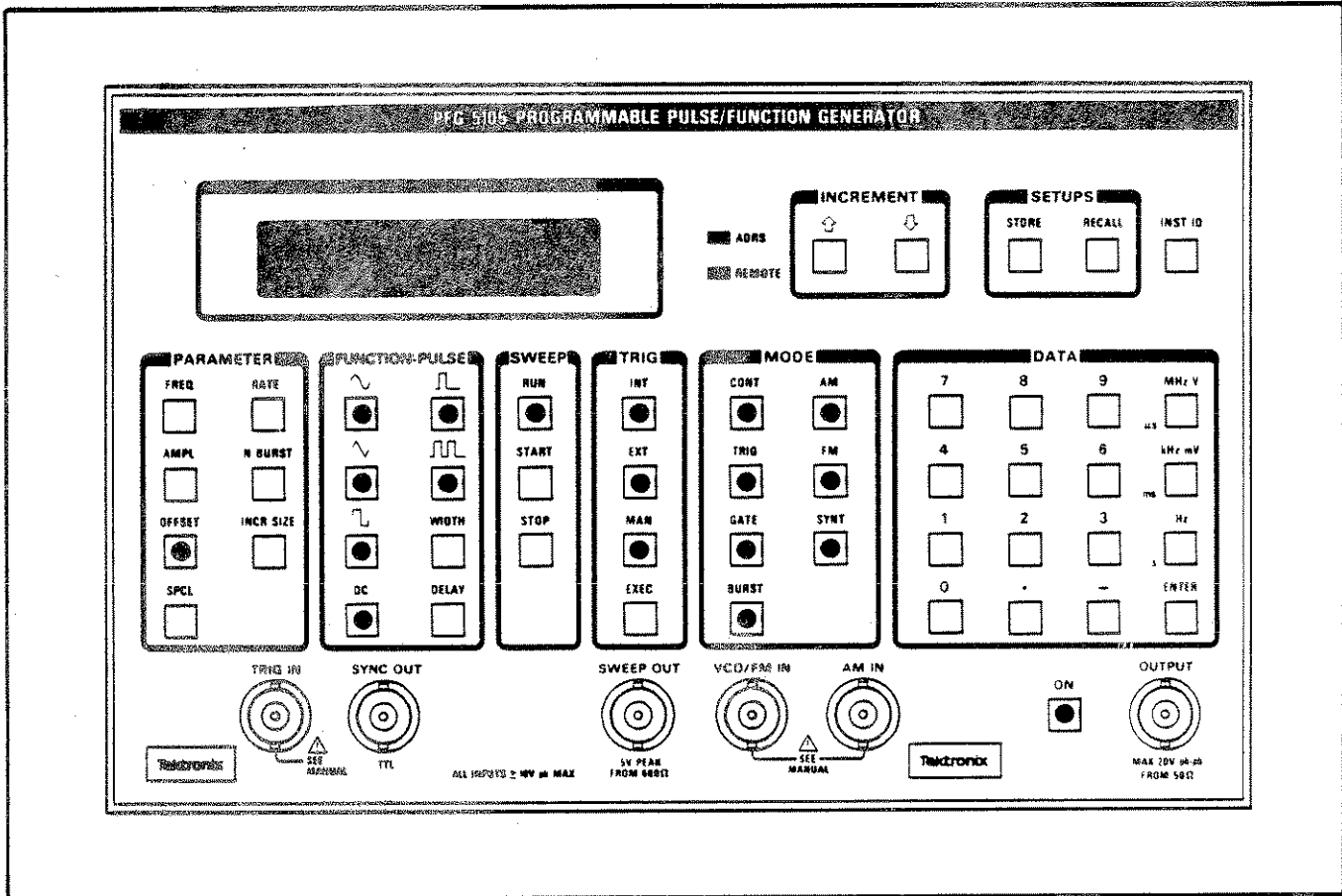


PFG 5105/5505 Instrument Interfacing Guide



This interfacing guide is designed to help you get started, as quickly and easily as possible, using the PFG 5105/5505 Programmable Function Generator with a GPIB controller. This guide tells you how to program the Tektronix PEP 301 and 4041 controllers to communicate with the PFG 5105/5505. Sample programs are included.

This guide does not take the place of the operators manual or other documentation supplied with the PFG 5105/5505 and your controller. More complete information in these other documents will assist you in gaining the full benefit from the programmable and manual capabilities of your function generator.

Setting Up the PFG 5105/5505 for GPIB Operation

Connecting Controller

Connect a GPIB cable between the function generator and the controller. The program examples in this guide assume that the PFG 5105/5505 and controller are the only instruments on the bus. For detailed information about connecting the GPIB controller, refer to the PFG 5105/5505 Instruction Manual.

Displaying the GPIB Address and Terminator

The PFG 5105/5505 primary address is displayed in the LCD display when you press the INST ID button. The current setting of the GPIB terminator is displayed below the address. The message terminator switch is set for EOI or LF with EOI (no decimal point indicates EOI-only). See your controller documentation for its requirements.

The PFG 5105/5505 is supplied from the factory set to an address of 8 and to EOI-only for the message terminator.

Changing the GPIB Address and Terminator

To change the GPIB address, enter SPCL function code 240 on the keypad, then press the ENTER key. The current address is shown in the display window. Press the INCREMENT up- or down-arrow keys to select the new GPIB address.

To change the terminator, enter SPCL function code 241, then press the ENTER key. The current terminator is shown in the display window. Press the INCREMENT up- and down-arrow keys to toggle between displayed terminators.

Valid primary addresses include the range of 0 to 30. (31 effectively disables the PFG 5105/5505 from communicating on the GPIB.) If your controller reserves an address for itself, do not set the PFG 5105/5505 to that address. The Tektronix 4041 and PEP 301 default to address 30 on power-up, but may be programmed to use any primary address. The PFG 5105/5505 ignores secondary addressing.

EOI-only is recommended as the message terminator for use with Tektronix controllers. EOI-or-LF is recommended for use with Hewlett-Packard controllers. (In the latter position, the PFG 5105/5505 still recognizes EOI as a terminator and transmits EOI concurrently with the LF character to terminate a message.)

Programming the PFG 5105/5505 PFG 5105/5505 Power-On

Self Test. When powered on, the PFG 5105/5505 microprocessor performs a diagnostic routine (self test) to check the functionality of the ROM and RAM. If no ROM or RAM error is found, the microprocessor goes on to check the functionality of the other instrument hardware.

If a ROM or RAM error is found, an error code is displayed in the front-panel display. The function generator will not respond to input from the front panel or the GPIB interface. Internal errors detected after the ROM and RAM tests have passed will be reported to both the front panel and the GPIB. The function generator will respond to input and attempt to function in spite of the error. An error code may be removed from the display by pressing the INST ID key, by starting a numeric entry, by incrementing the selected parameter, by pressing the clear key, or by a transition into the remote state (REMS).

Power-on Settings. When the self test is finished, the function generator enters the local state (LOCS) with default settings as shown in Table 1.

Table 1
POWER-ON DEFAULT SETTINGS

AM	OFF
AMPLITUDE	5 V
DC	0 V
DCYCLE	0
DELAY	0
DT	OFF
FM	OFF
FRQLCK	ON
FRQSTART	1 Hz
FRQSTOP	1200 Hz
FREQUENCY	1 kHz
FUNCTION	SINE
MODE	CONT
NBURST	2
OFFSET	0 V
OUTPUT	OFF
PERIOD	1 ms
RATE	10 μ s
RNGLCK	OFF
RQS	ON
SWEEP	OFF
TRIG	MAN
USEREQ	OFF
WIDTH	0.5 ms

Power-on SRQ. The SRQ line on the GPIB is also asserted unless the GPIB address is set to 31 (ignore GPIB commands). If the function generator is polled by the controller, the status byte returned will be "0100 0001" (65 decimal; power-on SRQ).

PFG 5105/5505 Command Messages

Commands are provided to control PFG 5105/5505 settings, cause PFG 5105/5505 actions, or request information. These commands are listed in Table 2. PFG 5105/5505 commands begin with a header—a word or abbreviation that describes the function implemented. The command may include one or more arguments, which are delimited from the header by a space; multiple arguments are delimited by a comma. PFG 5105/5505 commands can be combined in a message by separating the com-

mands with the message unit delimiter (semicolon). Either upper or lower-case ASCII characters are accepted.

NOTE

For all GPIB operations and commands, the PFG 5105 and the PFG 5505 respond in exactly the same fashion. For example, when queried for instrument identification (ID?), the PFG 5505 responds with "PFG 5105."

Table 2
PFG 5105/5505 Programming Commands

Header	Argument	Description
AM	<ON|OFF>	The ON argument causes the function generator to use the signal applied to the AM IN connector to amplitude-modulate the output signal. The OFF argument disables amplitude modulation.
AM?		Returns the status of the amplitude-modulation mode. Response: AM ON;, or AM OFF;
AMPLitude	<amplitude in volts>	Sets peak-to-peak output voltage (into 50Ω) to the value stated by the argument. Power-on/default setting is 5 V. The range is 10 mV to 9.99. If the argument is 0, only the OFFSET voltage is output.
AMPL?		Returns current output amplitude. Response: AMPL <volts>;
DC	[<volts>]	Selects dc output at the current value of the DC parameter, or at the level specified by the optional argument. The power-on setting is 0 V.
DC?		Returns the current setting of the DC output function. The range is -4.99 to +4.99 Vdc; the response is in NR2 format. Response: DC <volts>;
DCYCLE	<% duty cycle> | 0	Turns on and off the duty cycle mode and sets the duty cycle parameter. When in duty cycle mode, the width is changed to give the output pulse a constant duty cycle with changes in period. Entering a new width parameter via GPIB command or front panel button removes the instrument from duty cycle mode.
DCYCLE?		Returns duty cycle setting. Response is DCYCLE <% duty cycle>;, or DCYCLE 0 (duty cycle mode off).
DELAY	<delay> [:<units>]	Sets the delay time from the trigger point to the first pulse, if the instrument is in single pulse mode; or sets the delay time between the first pulse and the second pulse if the instrument is in double pulse mode. If no time unit is specified, the default unit is seconds. The power-on default is 0 seconds. The range of delay time is 40 ns to 99.9 ms.
DELAY?		Returns the value of the delay parameter in seconds. Response is DELAY <delay>;

Table 2 (Cont)

Header	Argument	Description
DISPlay	<parameter>	Changes the display window to show the parameter specified in the argument and its current value. Parameters: FREQUENCY, AMPLITUDE, OFFSET, WIDTH, FRQSTART, DELAY, FRQSTOP, NBURST, or RATE.
DISPlay?		Returns the parameter that is currently shown in the display window. Response: FREQ;, AMPL;, OFFS;, WID;, FRQSTART;, DELAY;, FRQSTOP;, NBUR;, or RATE;
DT	TRIG	Triggers the function generator on receipt of <GET> interface message to output a one-cycle waveform if in TRIG mode, or a burst of cycles if in BURST mode.
	GATE	Toggles the gate setting on or off on receipt of <GET> when in GATE mode. Can be overridden by an external gate. (This is a software gate.)
	SET	Causes the function generator to wait for <GET> before updating to new settings.
	OFF	Allows the function generator to update its settings without waiting for <GET>. Disables TRIG and GATE <GET> functions. GET is disabled. DT OFF is the power-on setting.
DT?		Queries the Device Trigger function. Response: DT GATE;, DT SET;, DT TRIG;, or DT OFF;.
ERRor? or EVENT?		Returns an error code matching the last SRQ that was polled with RQS ON, or the oldest error in the error queue if RQS is OFF. ERR 0 (nothing to report) is returned if there are no errors in the error queue. Response: ERR <num>; or EVENT <num>; depending on which query was sent.
ERRM?		Returns the error code and associated text shown in the front panel window. The returned code and text matches the last SRQ that was polled with RQS ON, or the oldest error in the error queue if RQS is OFF. ERR 0 is returned if there are no errors in the error queue. Response: <error #>, <error message>;
FM	<ON|OFF>	The ON argument causes the function generator to use the signal applied to the VCO/FM IN connector to control the output frequency, allowing frequency modulation. The OFF argument disables frequency modulation.
FM?		Returns frequency-modulation mode status. Response: FM ON;, or FM OFF;

Table 2 (Cont)

Header	Argument	Description
FREQuency	<freq>[:<units>]	Sets output frequency to the argument value. Power-on/default setting is 1 kHz. Range is 0.12 Hz to 12.00 MHz. The programmed value will round to the nearest increment of the generator. Default units: Hz. Units can be HZ (Hertz), KHZ, MHZ, S, MS, US, or NS. Frequency is specified in 4 digits in normal mode; 5 digits in synthesizer mode.
FREQ?		Returns the current output frequency. Response: FREQ <freq>;.
FRQLck	ON	Enables internal software control of the output frequency. The power-on setting is FRQLCK ON.
	OFF	Disables internal software control of the output frequency.
FRQLck?		Returns the status of the frequency lock mode. Response: FRQL ON;, or FRQL OFF;.
FRQSTART	<freq>[:<units>]	Sets the sweep start frequency (4-digit resolution). The start frequency must be greater than the stop frequency. Default units is Hz. Power-on/default setting is 1 Hz.
FRQSTART?		Returns the sweep start frequency in Hz. Response: FRQSTART <freq>;.
FRQSTOP	<freq>[:<units>]	Sets the sweep stop frequency (4-digit resolution). Power-on/default setting is 1200 Hz.
FRQSTOP?		Returns the stop frequency in Hz. Response: FRQSTOP <freq>;.
FUNcTion	SINE	Selects the sine waveform for output. This is the power-on/default setting.
	SQUare	Selects square waveform for output.
	TRIAngle	Selects triangle waveform for output.
	DC	Selects DC output at the current value of the DC parameter.
	SPULSE	Selects single pulse mode.
	DPULSE	Selects double pulse mode.
FUNC?		Returns the output waveform selection status. Response: FUNC SINE;, FUNC SQUARE;, FUNC TRIANGLE;, FUNC DC;, FUNC SPULSE;, or FUNC DPULSE;.
HELP?		Returns all PFG 5105/5505 commands.
ID?		This command will return identification information for the function generator in the form: ID TEK/<model number>,<Tek Codes and Format version>,<firmware version>,<installed options>;. i.e., TEK/PFG5105,V81.1,F1.0,OPT02;
INIT		Restores all settings to the power-on state except stored settings.

Table 2 (Cont)

Header	Argument	Description
MODE	BURST	Selects the burst trigger mode. When a trigger occurs, a burst of the programmed output signal is produced; the number of cycles is determined by the NBURST parameter. All trigger modes apply.
	CONT	Selects the continuous output mode. Trigger events are ignored. CONT is the power-on setting.
	GATED	Selects the gated trigger mode. Output is generated while the manual button is pushed or the trigger/gate input is enabled. If the gate signal on the trigger input is removed in the middle of a cycle, the cycle is completed. Sending <GET> will toggle the gate on or off.
	TRIG	Selects the triggered output mode. One cycle of the output signal occurs for each trigger event. Trigger sources include an external trigger, internal trigger, manual trigger, or Group Execute Trigger <GET> over the GPIB bus.
	SYNT	Selects the frequency lock mode (Option 02, synthesizer). If this mode is selected and the function generator does not have the synthesizer option installed, an execution error will be reported.
MODE?		Returns mode status. Response: MODE CONT;, MODE TRIG;, MODE BURST;, MODE SYNT;, or MODE GATE;.
NBURst	[< # cycles>]	Sets the number of cycles that will be output in the burst mode. The default setting is 2 when NBURST is selected without an argument. The power-on setting is NBURST 2.
NBURst?		Returns the current number of cycles set for the NBURST command. Response: NBUR <# cycles>;
OFFSet	< volts >	Sets the output open-circuit offset voltage to the stated argument value in volts. Argument 0 turns the offset off. The power-on/default setting is 0 V.
OFFSet?		Returns the current offset setting. Response: OFFS <volts>;.
OUTput	ON	Connects the PFG 5105/5505 output signal to the front-panel connector. OUTPUT OFF is the power-on/default setting.
	OFF	Disconnects the PFG 5105/5505 output signal from the front-panel connector. Output is terminated into 50Ω.
	FLOAT	Disconnects the main output signal from the front panel OUTPUT connector and terminates it into a high impedance (floating).
OUTput?		Returns the output signal status. Response is OUT ON;, OUT OFF;, or OUT FLOAT;.

Table 2 (Cont)

Header	Argument	Description
PERIOD	<period>[:<units>]	Changes the period of the output waveform. It is an alias for the FREQUENCY parameter. Power-on/default setting is 1 ms.
PERIOD?		Returns the period value set by the period parameter. Response is PERIOD <period>;
PRELEVel	<TTL|CMOS|ECL>	Sets the amplitude and offset for an output of the following levels: 1) TTL, 0 to 3 V; 2) CMOS, 0 to 4.99 V; 3) ECL, -0.8 to -1.8 V. Amplitude and offset can then be modified to make changes from the pre-defined levels.
RATE	<rate>[:<units>]	Sets the internal trigger interval. This trigger is used in a number of operations including internal trigger and sweep rate. Default units: S (seconds). Units can be S, MS or US. The power-on setting is 10 ms.
RATE?		Returns the current internal trigger interval. Response: RATE <rate>;. Units are returned as S or H based on the units of the last command sent.
RECall	<bufnum>	Sets the PFG 5105/5505 to the settings stored in the front panel buffer specified by the argument, except that the RQS, DT, and USER settings remain unchanged. Argument options are 0 to 99; location 0 contains the INIT settings; this location cannot be changed.
RNGLCK	<ON|OFF>	Locks or unlocks the frequency range. When RNGLCK ON is sent, the frequency is locked to the current range. Only RNGLCK OFF releases the frequency lock.
RNGLCK?		Returns the RNGLCK status. Response: RNGLCK ON;, or RNGLCK OFF;
RQS	ON	Enables the service request operation. If RQS is ON, errors are reported at the end of command execution; if OFF, errors are queued until an error query is sent or RQS is turned back on. Errors are reported in the order acquired. The power-on setting is RQS ON.
	OFF	Disables all service requests.
RQS?		Returns the status of the RQS setting. Response: RQS OFF; or RQS ON;.
SEND?	<bufnum>[, <bufnum>]...	Returns the stored settings from the specified buffer(s) from 0 to 99. Response: STOR <num>:<binblk>[, <num>:<binblk>]...;
	ALL	Returns the contents of all stored setting locations, beginning with buffer 0. Response: STOR ALL:<binblk>...<binblk>;.

Table 2 (Cont)

Header	Argument	Description
SET?		Returns all instrument settings that can be set and queried, except stored front panel settings. See SEND?.
STORE	<bufnum>[:<binblk> [,<bufnum>:<binblk>]]...	Saves the current front panel settings in a specified buffer(s) (<bufnum>) for later recall. Buffer 0 is a read-only buffer that contains the power-on settings. Optionally stores the settings data defined in <binblk> in the specified buffer, <num>: 1-99. Multiple arguments are allowed if connected by a comma. If <num> is greater than 99 or less than 1, or if <binblk> is longer or shorter than required, or if <binblk> has a bad checksum byte, an execution error is reported.
	ALL:<binblk>...<binblk>	Sequentially stores each front panel setup defined in <binblk> in a setting buffer, beginning with buffer 1. Each <binblk> packet sends one front panel setup to one buffer.
SWEEP	ON	Turns on the sweep. The power-on setting is SWEEP OFF.
	OFF	Disables the sweep operation.
SWEEP?		Returns the selected sweep output status. Response: SWEEP ON; or SWEEP OFF;
TRIG	INT	Selects an internal trigger for the trigger source. The power-on setting is TRIG MAN.
	EXT	Selects an external trigger (TRIG IN connector) for the trigger source.
	MANual	Selects manual trigger as trigger source.
TRIG?		Returns the trigger source setting. Response: TRIG INT;, or TRIG EXT;.
TEST?		Executes internal checkout routines. Failure produces error code in the response. A response of 0 indicates that the test was successful; 1 indicates a failure. Response: TEST 0; or TEST 1;. <i>During the test, the GPIB port remains active.</i>
USERReq	ON	Enables SRQ when INST ID front panel button is pressed. The power-on/default setting is USER OFF.
	OFF	Disables SRQ when INST ID front panel button is pressed.
USER?		Returns the status of the USER REQUEST setting. Response: USER ON;, or USER OFF;.

Table 2 (Cont)

Header	Argument	Description
WIDTH	<width> [:<units>]	Sets the width of the output pulses. If the units parameter is omitted, the default unit is seconds. The range of the width time argument is 40 ns to 99.9 ms. In duty cycle mode, the existing width value is replaced by the value calculated by the duty cycle function. If a width command is issued, the instrument exits duty cycle mode.
WIDTH?		Returns the value of the width parameter in seconds. (The width value will be calculated by the duty cycle function when the function generator is in duty cycle mode.) Response: WID <width>;

SPCL Function Codes

SPCL function codes are selected from the front panel of the PFG 5105/5505. To invoke a SPCL function, enter the three-digit SPCL code (shown below) on the key panel and press ENTER. Use the keys indicated in the SPCL function description to modify the function. Press any FUNCTION key to exit the SPCL function mode and change the display.

SPCL

Code	Description
100	Displays the product type, product version number and firmware version number.
210	Selects the pulse generator period as a time or frequency entry. Press an INCREMENT key to change the units selection.
220	Changes the intensity and back-lighting level. INCREMENT up- and down-arrow keys increase or decrease character intensity. ENTER key toggles between ON and OFF.
230	Selects Frequency lock mode. INCREMENT keys select ON or OFF.
240	Allows changing the GPIB address. INCREMENT keys change the address.
241	Allows changing the GPIB termination. INCREMENT keys toggle between terminators.
260	Range lock (to enable external wide sweep). INCREMENT keys toggle from ON to OFF.
270	Downloads demo setting into settings buffers 90-99. (See Table 3.) This overwrites any setting in these buffers.
410	Enters duty cycle mode. When a duty cycle of 10-80% is entered, the PFG 5105/5505 will

change width to maintain the duty cycle as the period changes. A width entry removes the instrument from the duty cycle mode.

- 420 Allows a predefined level to be set. The INCREMENT keys select one of the following: TTL (0 to 3 V); CMOS (0 to 4.99 V); ECL (-0.8 to -1.8 V. The AMPL/OFFSET value can be used to modify the pre-defined levels.

Calibration

- 510 Calibration routines (38 settings). This special function is intended for service personnel only.

Sending Messages to the PFG 5105/5505

Controllers. A GPIB controller, such as the Tektronix 4041 or PEP 301 system, is needed to send messages to the PFG 5105/5505.

IBM Personal Computers (PC) and some PC compatible computers can be used as GPIB controllers by installing the Tektronix GPIB User's Resource Utility (GURU II) software/hardware package.

For the PEP 301 programming examples the GURU II software must be initialized. For an example of the exact program lines to use for the GURU initialization, see the Sample Utility Program on page 14. Refer to your GURU II documentation for more specific information.

PEP 301:

```
200 WRT$="FUNC SQUARE;FREQ 6.7,OUTON"
210 CALL IBWRT (8D%,WRT$)
```

4041:

```
180 PRINT #8:"FUNCT SQUARE;FREQ 6.7E+6;OUT ON"
```

Table 3
DEMO SETUPS

DEMO	SETUPS	PARAMETER					FUNCTION-PULSE			SWEEP		TRIG	MODE	OUT
	RECALL	FREQ	RATE	AMPL	OFFSET	NBURST	FUNCTION	WIDTH	DELAY	START	STOP			
Basic Sinewave	90	1 MHz		1 V	0 V							INT	CONT	ON
	91	1 MHz	100 μ s	1 V	0 V	10						INT	BURST	ON
	92		1 μ s	1 V	0 V			1 μ s	10 μ s			INT	TRIG	ON
	93		1 μ s	3 V	1.5 V			100 ns	0 μ s			INT	TRIG	ON
	94	1 MHz		2 V	2 V							INT	CONT	ON
Slow Sweep (1 kHz to 10 kHz)	95		5 ms ²	1 V	0 V					1 kHz	10 kHz ³	INT	CONT	ON
Fast Sweep (100 kHz to 10 MHz)	96		20 μ s ⁴	1 V	0 V					100 kHz	10 MHz ³	INT	CONT	ON
Setups Requiring External Signal Source														
VCO (FM)	97	10 MHz ⁵		1 v	0 v							INT	CONT FM	ON
Delayed Pulse	98	⁶		1 V	0 V			40 ns	1 μ s			EXT	TRIG	ON
Amplitude Modulation	99	1 MHz ⁷		1 V	0 V							EXT	CONT FM	ON

- 1 Demo setups loaded by pressing
- 2 1.28 seconds per sweep
- 3 Press to start sweep
- 4 5.12 ms per sweep
- 5 A 0-5 volt input at the VCO/FM IN connector effects a 10 kHz-12 MHz frequency range. For VCO mode, RANGE LOCK (accessed thru SPCL 260) is turned OFF
- 6 With 1 msec delay, external trigger (TTL levels) rate to TRIG IN connector should not exceed about 800 kHz.
- 7 A 5 volt p-p (-2.5 V to +2.5 V) input to the AM IN connector effects 100% modulation (output ranges from 0 V to 2 V)

A useful variation assigns the PFG 5105/5505 address to a variable and inserts that variable in the print statement in place of the number for the address. This works with either the PEP 301 or 4041 and allows you to change the program to work with the PFG 5105/5505 set to other addresses by changing only the statement that assigns the variable.

PEP 301:

```
200 DEVICE$="TEKDEV1"
210 CALL IBFIND (DEVICE$,BD$)
220 V%=8
230 CALL IBPAD (BD%,V%)
```

4041:

```
200 PFG=8
210 PRINT #AFG:"FUNCT SQUARE;FREQ 6.7E+6;OUT ON"
```

Here's how to use the 4041 OPEN statement to allow such flexibility with a logical unit (LU) number instead of available for the PFG 5105/5505 address:

```
230 OPEN #100:"GPB(PRI=8):)
240 PRINT #100:"FUNCT SQUARE;FREQ 6.7E+6;OUT ON"
```

The PFG 5105/5505 command message inside the quote marks is the same for all of the above examples. The rest of each example varies to match the statement syntax designed into each controller as shown in Table 4. This suggests that once you understand your controller's input/output statements, it's just a matter of plugging in the PFG 5105/5505 commands you need.

Table 4
Controller Print/Output Statements

CONTROLLER	STATEMENT
PEP 301 BASIC	WRT\$=RQS CALL IBWRT (BD%,WRT\$)
4041 BASIC	PRINT #5:"RQS ON"
HP-85 BASIC	OUTPUT 705;"RQS ON"
FLUKE 1720A BASIC	PRINT @5%"RQS ON"
HP 9826 BASIC	OUTPUT 705;"RQS ON"

A message to a GPIB device is contained within the controller's GPIB output statement. The statement is composed of three parts: the keyword, the address or logical unit number, and the device-dependent message. All the statements shown in the table send the same standard Tektronix Codes & Formats message (RQS ON) that enables SQR interrupts. All send the message to an instrument with primary address 5. The difference lies in the syntax of the statement for a particular controller.

Getting PFG 5105/5505 Settings Information

PFG 5105/5505 queries include a ? as the last character of the command (such as SET?, FREQ?, or ID?) and prepare the instrument for data output, but do not start such output. The PFG 5105/5505 waits until it sees its talk address to begin sending the requested data. This is accomplished by the INPUT statement.

PEP 301:

```
290 WRT$="FUNC?"
300 CALL IBWRT (BD%,WRT$)
310 RD$=SPACE$ (250)
320 CALL IBRD (BD%,FNCTIONS$)
```

4041:

```
290 INPUT #8 PROMPT "FUNC?":FNCTIONS$
```

All instrument settings can be obtained in one message. Just dimension a string large enough (200 characters) and input the settings string.

PEP 301:

```
330 SETTING$=SPACE$ (250)
340 WRT$="SET?"
350 CALL IBWRT (BD%,WRT$)
360 CALL IBRD (BD%,SETTING$)
370 PRINT SETTING$
```

4041:

```
330 DIM SETTING$ TO 250
340 INPUT #8 PROMPT "SET?":SETTING$
```

You can restore the settings you input from the PFG 5105/5505 by sending back the settings string.

PEP 301:

```
380 CALL IBWRT (BD%,SETTING$)
```

4041:

```
340 PRINT #7:SETTING$
```

Using PFG 5105/5505 Interrupts

Programmable interrupts are provided in the PFG 5105/5505 to inform the controller of asynchronous events such as command errors, syntax errors, or instrument events. The status bytes returned in response to an error query (ERR? or EVENT?) are shown in Table 3. The error query obtains more detail in the case of abnormal events. For instance, in the case of a command error, was it a problem with a header, argument, or delimiter? You can find out from the error code.

The error messages defined in Table 5 are returned as arguments to the ERR? or EVENT? query.

**Table 5
BUS ERROR CODES**

ABNORMAL CONDITIONS

Description	Bus Response to ERR?
NOTHING TO REPORT	0
COMMAND ERRORS (100)	
SRQ byte = 97 decimal	
Command header error	101
Header delimiter error	102
Command argument error	103
Argument Delimiter Error	104
Missing argument	106
Invalid message unit delimiter	107
Checksum error	108
Bytecount error	109
EXECUTION ERRORS (200)	
SRQ byte = 98 decimal	
Command not executable in local	201
Settings lost due to rtl	202
Output buffer full	203
Settings conflict	204
Argument out of range	205
<GET> ignored	206
AMPL/OFST conflict	250
Bad set buffer	255
Sweep operation error	261
Synthesizer option not installed	262
Pulse error	263
NBURST count out of range	270
Rate out of range	271
Frequency out of range	273
Amplitude out of range	274
Offset out of range	275
Sweep Start frequency out of range	276
Sweep Stop frequency out of range	277
DC out of range	280
Width out of range	281
Delay out of range	282
Pulse mode. Width + delay > (0.9 x period)	283
Pulse mode. Period - (width + delay) <= 40 ns	284
Double pulse. Delay <= width	285
Double pulse. Delay <= (width + NI)	286
Synthesizer illegal data	290
INTERNAL ERRORS (300)	
SRQ byte = 99 decimal	
Save RAM failure	340
Synthesizer out of lock	350

Table 5 (Cont)
BUS ERROR CODES
NORMAL CONDITIONS

Description to EVENT?	Bus Response Poll	Response to Serial
SYSTEM EVENTS (400)		
Power on	401	65
Operation Complete	402	66
User Request	403	67
INTERNAL WARNING (600)		
Low battery condition	650	
Output overload	660	

STORED BUFFER ERRORS (800)

801- This error is returned if some error exists in
 899 a binary block packet used in sending Binary Block data to a stored settings buffer. The buffer number at which the error occurs is equal to the error number minus 800.

Front Panel Error Codes

The following error codes are shown in the instrument display window:

Error	Description
010	Incorrect syntax
011	Increment step error
012	Increment limit
013	Decrement limit
014	Increment/decrement error
015	SPCL Function/Mode does not exist
016	Mode conflict
020	Not implemented
204	Settings conflict
205	Out of range
250	AMPL OFST conflict
255	Illegal settings
261	Sweep operation error
262	Synthesizer not installed
271	RATE out of range.
273	FREQ out of range
274	AMPL out of range.
275	OFFSET out of range
280	DC out of range
281	Width out of range
282	Delay out of range

Error	Description
283	Pulse mode. Width+delay > (0.9 x period)
284	Pulse mode. Period-(width+delay) <= 40 ns
285	Double pulse. Delay ≤ width
286	Double pulse. Delay ≤ (width + NI)
290	Synt illegal parameter
302	System error
350	Synthesizer out of lock
650	Low battery
660	Output overload

SRQ Handlers

Here are typical SRQ handlers that alert you to a reporting instrument's address, status, and error code with a message on your console. The error code is helpful during debugging because it identifies the specific command or execution problem should one occur.

PEP 301:

```

1540 ' ***** ERROR ROUTINE
*****
1550 IF IBSTAX >= 0 AND BD% >= 0 AND IBSTAX <
&H4000 AND IBERR% <> 6 THEN RETURN
1560 IF BD% < 0 THEN PRINT "device not installed -
use IBCONF then reboot"
1570 IF IBSTAX > 0 AND IBSTAX >= &H4000 THEN PRINT
"timeout"
1580 IF IBERR% = 6 THEN PRINT "timeout"
1590 PRINT "gpib error " ; IBERR%
1600 IF IBERR% = 0 THEN PRINT "DOS error device not
installed"
1610 IF IBERR% = 1 THEN PRINT "function requires
GPiB-PC to be CIC"
1620 IF IBERR% = 2 THEN PRINT "no listener on write
function"
1630 IF IBERR% = 3 THEN PRINT "GPiB-PC not
addressed correctly"
1640 IF IBERR% = 4 THEN PRINT "invalid argument to
function call"
1650 IF IBERR% = 5 THEN PRINT "GPiB-PC not system
controller as required"
1660 IF IBERR% = 6 THEN PRINT "I/O operation aborted"
1670 IF IBERR% = 7 THEN PRINT "non-existent GPiB-PC
board"
1680 IF IBERR% = 10 THEN PRINT "I/O started before
previous operation completed"
1690 IF IBERR% = 11 THEN PRINT "no capability for
operation"
1700 IF IBERR% = 12 THEN PRINT "file system error"
1710 IF IBERR% = 14 THEN PRINT "command error
during device call"
1720 IF IBERR% = 15 THEN PRINT "serial poll status
byte lost"
1730 IF IBERR% = 16 THEN PRINT "SRQ stuck in on
position"
1740 INPUT "[ENTER] TO CONTINUE" ; A$
1750 RETURN
    
```

4041:

```

120 On srq then gosub dopoll
130 Enable srq
140 !
150 !
660 !
670 !
680 !
690 Stop
700 Dopoll: poll stabyt,addr;8
710 Input #addr prompt "ERR?":errnum
720 Print "STATUS=";stabyt,"ADDRESS=";addr,
    "ERROR=";errnum
730 Resume
    
```

PFG 5105/5505 Response to Interface Messages

The following program sequences show various interface messages transmitted to the PFG 5105/5505.

PEP 301:

```

120 ' PFG 5105/5505 PRIMARY ADDRESS 8
130 '
140 BD$="GPIB0"
150 CALL IBFIND (BD$,BD%)
160 ID$="TEKDEV1"
170 CALL IBFIND (ID$,DEV%)
180 V%=8
190 CALL IBPAD (DEV%,V%) 'CHANGE ADDRESS TO 8
200 RETURN
210 CMD$=CHR$ (V%+32) ' SEND LISTEN ADDRESS,
    MLA
220 CALL IBCMD (BD%,CMD$)
230 RETURN
240 CMD$=CHR$ (UNL) ' SEND UNLISTEN, UNL
250 CALL IBCMD (BD%,CMD$)
260 RETURN
270 CMD$=CHR$ (V%+64) ' SEND TALK ADDRESS
280 CALL IBCMD (BD%,CMD$)
290 RETURN
300 CMD$=CHR$ (UNT) ' SEND UNTALK
310 CALL IBCMD (BD%,CMD$)
320 RETURN
330 ' SEND DEVICE CLEAR
340 CMD$=CHR$ (20)
350 CALL IBCMD (BD%,CMD$)
360 RETURN
370 ' SEND MLA, SELECTED DEVICE CLEAR,UNL
380 CALL IBCLR (DEV%)
390 RETURN
400 LLO$=CHR$ (17) ' SEND LOCAL LOCKOUT
410 CALL IBCMD (BD%,LLO$)
420 RETURN
430 ' SEND MLA, GO TO LOCAL, UNL
440 CALL IBLOC (BD%)
450 RETURN
460 CMD$="?_" ' SEND MLA, GROUP EXECUTABLE
    TRIGGER, UNL
470 CALL IBCMD (BD%,CMD$)
480 CMD$ (8) + "?_"
490 CALL IBCMD (BD%,CMD$)
500 RETURN
    
```

4041:

```

140 Pri_addr=8 ! *** PFG 5105/5505 Primary address
    ***
150 !
160 Listen: wbyte atn(pri_addr+32) ! Send Listen
    Address MLA
170 Return
180 Unlisten: wbyte atn(unl) ! Send Unlisten UNL
190 Return
200 Talk: wbyte atn(pri_addr+64) ! Send Talk Address
210 Return
220 Untalk: wbyte atn(unt) ! Send Untalk
230 Return
240 Devclear: wbyte dcl ! Send Device Clear
250 Return
260 Selctclr: wbyte sdc(pri_addr),atn(unl)
270 ! Send MLA, Selected Device Clear, UNL
280 Return
290 Lockout: wbyte llo ! Send Local Lockout
300 Return
310 Gtlocal: wbyte gtl(pri_addr),atn(unl)
320 ! Send MLA, Go to Local, UNL Trigger, UNL
330 Return
340 Trigger: wbyte get (pri_addr)
350 ! Send MLA GET, UNL
360 Return
370 Loclstat: wbyte ren(0),ren(1)
380 ! Pulse unassert REN line
390 Return
    
```

The PFG 5105/5505 responds to DCL and SDC by clearing its I/O Buffer and any unexecuted setting commands in its Pending Settings Buffer, along with any errors or events waiting to be reported (except power-on).

GET causes previously received settings to be executed or triggers outputs in TRIGGER, GATE, or BURST modes when the instrument receives the message while listen addressed. GET is used after the DT command has been sent.

LLO locks out the operator from restoring local (front-panel) control when the instrument is under remote control.

GTL restores local control if the instrument receives the message while listen addressed.

See the PFG 5105/5505 Instruction Manual for a full discussion of how the instrument responds to interface messages.

Sample Utility Program (BASICA)

```
10 '*****
20 '***** PFG 5105/5505 PULSE OUTPUT UTILITY PROGRAM V 1.0 *****
30 '*****
40 '
50 ' BY BRUCE VIRELL, MPD MARKETING, 11-28-88
60 ' COPYRIGHT (C) 1988, TEKTRONIX, INC. ALL RIGHTS RESERVED. THIS SOFTWARE
70 ' IS PROVIDED ON AN AS IS BASIS WITHOUT WARRANTY OF ANY KIND, AND IS NOT
80 ' SUPPORTED BY TEKTRONIX.
90 '
100 ' THIS SOFTWARE MAY BE REPRODUCED IN WHOLE OR IN PART WITHOUT PRIOR
110 ' PERMISSION. COPIES MUST INCLUDE THE ABOVE COPY RIGHT AND WARRANTY
120 ' NOTICE.
130 '
140 ' REQUIRED EQUIPMENT: PFG5105/5505 TMS000 SERIES MAINFRAME, GPIB CABLING.
150 '
160 ' PC REQUIREMENTS:
170 ' TEKTRONIX PEP 301, IBM PC, XT, AT, PORTABLE PC, OR COMPATIBLE.
180 ' IBM 5153 COLOR DISPLAY, OR EQUIVALENT, OR A COMPOSITE VIDEO MONITOR
190 ' (COLOR OR MONOCHROME).
200 ' S3FG100 GURU II HARDWARE/SOFTWARE & BASICA, WITH IBM PC DOS 2.0 OR
210 ' HIGHER OR MS-DOS 2.02 OR HIGHER.
220 '
230 ' PROGRAM PURPOSE:
240 ' SEL1: FACILITATE PULSE OUTPUT WAVEFORMS VIA IEEE 488.
250 ' SEL2: TALKER/LISTENER PROGRAM WHICH SENDS INSTRUMENT COMMANDS.
260 ' SEL3: QUILTS BASICA PROGRAM AND RETURNS TO DOS.
270 '
280 ' OPERATING PROCEDURE:
290 ' CONNECT SYSTEM CONTROLLER VIA GPIB CABLE, TO THE MAINFRAME. POWER ON
300 ' PFG5105/5505, (MUST BE SET FOR FACTORY GPIB PRIMARY ADDRESS OF 8).
310 ' CONNECT OSCILLOSCOPE TO PFG OUTPUT FOR WAVEFORM VIEWING.
320 '
330 ' VARIABLES:
340 ' IBINIT1 = MEMORY LOCATION (BASICA WORKSPACE - SIZE(BIB728.M)+SIZE(BIB.M))
350 ' IBINIT2 = IBINIT1 + 3
360 ' DEVICE$ = TEKDEV1, IBCONF DRIVER FOR TEKTRONIX INSTRUMENTATION
370 ' WRT$ = COMMAND VARIABLE SENT TO PFG VIA IBWRT ROUTINE
380 ' RD$ = VALUE RETURNED FROM PFG REQUESTED VIA IBRD ROUTINE
390 ' SPACE$(xx) = DIMENSIONS STRING VARIABLE SIZE
400 ' AMPL$ = STRING VARIABLE NAME FOR AMPLITUDE VALUE
410 ' PWIDTH$ = STRING VARIABLE NAME FOR PULSE WIDTH VALUE
420 ' PERIOD$ = STRING VARIABLE NAME FOR PERIOD VALUE
430 ' DCYC$ = STRING VARIABLE NAME FOR DUTY CYCLE VALUE
440 ' V% = PFG 5105/5505 PRIMARY ADDRESS, 8
450 ' BD% = V%, PFG 5105/5505 PRIMARY ADDRESS
460 ' SPR% = STATUS BYTE RETURNED VIA IBRSP ROUTINE
470 ' IBSTA% = STATUS WORD RETURNED VIA EACH FUNCTION CALL
480 ' IBERR% = ERROR BIT RETURNED VIA EACH FUNCTION CALL
490 '
500 ' GURU II CALL ROUTINES:
510 ' IBWRT = SENDS COMMANDS TO PFG
520 ' IBRD = RETURNS PARAMETERS FROM PFG
530 ' IBRSP = PERFORMS SERIAL POLL OF PFG
```

```

540 ' IBPAD = CONVERTS IBCONF ADDRESS TO 8
550 '
560 ' REFER TO GURU II DOCUMENTATION FOR A COMPLETE LISTING.
570 '
580 '*****
590 'GURU II/ PEP 301 CALL ROUTINE LINES 620-670 MUST BE INCLUDED IN PROGRAM
600 '*****
610 '
620 CLEAR ,59455! '= BASICA workspace - (size(bib728.m) +size(bib.m))
630 IBINIT1 = 59455! 'same
640 IBINIT2=IBINIT1+3
650 BLOAD "bib.m",IBINIT1 '*** LOAD ASSEMBLY LANGUAGE ROUTINES TO IBINIT1.**
660 CALL IBINIT1(IBFIND,IBTRG,IBCLR,IBPCT,IBSIC,IBLOC,IBPPC,IBBNA,IBONL,IBRSC,IBSRE,IBRSV,IBPAD,IBSAD,IBIST,
IBDMA,IBEOS,IBTMO,IBEOT,IBRDF,IBWRTF,IBTRAP)
670 CALL IBINIT2(IBGTS,IBCAC,IBWAIT,IBPOKE,IBWRT,IBWRTA,IBCMD,IBCMDA,IBRD,IBRDA,IBSTOP,IBRPP,IBRSP,IBDIAG,
IBXTRC,IBRDI,IBWRTI,IBRDIA,IBWRTIA,IBSTA%,IBERR%,IBCNT%)
680 '*****
690 '***** PFG SYSTEM INITIALIZE *****
700 '*****
710 DEVICE$="TEKDEV1" 'SELECT TEKDEV1 GURU DRIVER
720 CALL IBFIND (DEVICE$,BD%)
730 V%=8 'PFG5105 ADDRESS
740 CALL IBPAD (BD%,V%) 'SET TEKDEV1 ADDRESS TO 8
750 GOSUB 2020 'CHECK FOR GPIB ERROR
760 ID$="GPIBO" 'SET GPIB TO BOARD LEVEL
770 CALL IBFIND (ID$,GP%)
780 CALL IBCLR (BD%) 'INTERFACE CLEAR
790 GOSUB 2020 'CHECK FOR GPIB ERROR
800 WRT$="INIT" 'INIT COMMAND
810 CALL IBWRT (BD%,WRT$) 'INITIALIZE PFG
820 GOSUB 2020 'CHECK FOR GPIB ERROR
830 COLOR 15,1 'SET PC SCREEN COLOR
840 CLS 'CLEAR SCREEN
850 PRINT"*****"
860 PRINT"***** PFG 5105/5505 UTILITY PROGRAM V1.0 *****"
870 PRINT"*****"
880 KEY(1) OFF:ON KEY(1) GOSUB 1050:KEY(1) ON 'ENABLE KEY F1
890 KEY(2) OFF:ON KEY(2) GOSUB 1810:KEY(2) ON 'ENABLE KEY F2
900 KEY(3) OFF:ON KEY(3) GOSUB 1020:KEY(3) ON 'ENABLE KEY F3
910 KEY(4) OFF:ON KEY(4) GOSUB 2340:KEY(4) ON 'ENABLE KEY F4
920 KEY(5) OFF:KEY(6) OFF:KEY(7) OFF 'DISABLE OTHER KEYS
930 KEY(8) OFF:KEY(9) OFF:KEY(10) OFF 'DISABLE OTHER KEYS
940 '***** SCREEN PROMPTS *****
950 LOCATE 7,27 'CLEAR SCREEN & LOCATE
960 LOCATE 7,27:PRINT"SELECTION MENU" 'SCREEN PROMPTS
970 LOCATE 9,20:PRINT"F1) PFG PULSE OUTPUT ROUTINE"
980 LOCATE 11,20:PRINT"F2) PFG TALKER LISTENER ROUTINE"
990 LOCATE 13,20:PRINT"F3) PFG INITIALIZE"
1000 LOCATE 15,20:PRINT"F4) QUIT & RETURN TO DOS"
1010 GOTO 880
1020 WRT$="INIT" 'PFG INIT COMMAND
1030 CALL IBWRT(BD%,WRT$) 'INITIALIZE PFG
1040 RETURN
1050 CLS 'CLEAR PC SCREEN
1060 ON ERROR GOTO 2250 'CHECK SYSTEM ERROR

```

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```
1070 PRINT"*****"
1080 PRINT"***** PULSE OUTPUT PROGRAM V1.0 *****"
1090 PRINT"*****"
1100 LOCATE 6,25:PRINT" SELECTION MENU" 'SCREEN PROMPTS
1110 LOCATE 8,25:PRINT"1) WIDTH/PERIOD CONTROL
1120 LOCATE 10,25:PRINT"2) DUTY CYCLE/PERIOD CONTROL"
1130 LOCATE 12,25:PRINT"3) RETURN TO MAIN MENU"
1140 LOCATE 14,25:INPUT;SEL$
1150 IF SEL$="3" THEN 830
1160 IF SEL$="" THEN 1100
1170 WRT$="FUNC SPULSE;TRIG INT;MODE CONT" 'PFG SETUP FOR PULSE
1180 CALL IBWRT(BD%,WRT$) 'SEND COMMAND
1190 GOSUB 2020 'CHECK GPIB ERROR
1200 IF SEL$="2" THEN 1490
1210 PRINT
1220 PRINT
1230 INPUT"ENTER PULSE WIDTH IN SECONDS, IE <40E-9>:";PWIDTH$
1240 IF PWIDTH$="" THEN 1230
1250 IF VAL(PWIDTH$)<4E-08 OR VAL(PWIDTH$)>.0999 THEN PRINT"INVALID PARAMETER: WIDTH MUST BE >40 nS AND <99.9
ms":GOTO 1230
1260 INPUT"ENTER PERIOD IN SECONDS, IE <200E-9>:";PERIOD$
1270 IF PERIOD$="" THEN 1260
1280 IF VAL(PERIOD$)<8.300001E-08 OR VAL(PERIOD$)>83 THEN PRINT"INVALID PARAMETER: PERIOD MUST BE >83 nS OR
<83 S":GOTO 1260
1290 IF VAL(PWIDTH$)>.9*VAL(PERIOD$) THEN PRINT"INVALID PARAMETERS: WIDTH >.9 * PERIOD":GOTO 1220
1300 PRINT"ENTER THE DESIRED PULSE AMPLITUDE IN VOLTS, IE <1.02>"
1310 PRINT"OR SELECT ONE OF THE FOLLOWING PREDEFINED LEVELS"
1320 PRINT"<C> FOR CMOS LEVELS"
1330 PRINT"<E> FOR ECL LEVELS"
1340 PRINT"<T> FOR TTL LEVELS"
1350 INPUT AMPL$
1360 IF AMPL$="" THEN 1350
1370 IF AMPL$="C" OR AMPL$="c" THEN AMPL$="PRELEVEL CMOS"
1380 IF AMPL$="E" OR AMPL$="e" THEN AMPL$="PRELEVEL ECL"
1390 IF AMPL$="T" OR AMPL$="t" THEN AMPL$="PRELEVEL TTL"
1400 IF LEFT$(AMPL$,1)("<" OR RIGHT$(AMPL$,1)="V" OR RIGHT$(AMPL$,1)="v" THEN PRINT"INCORRECT SYNTAX":GOTO
1350
1410 AMPLIT$="AMPL "+AMPL$
1420 WRT$="WIDTH "+PWIDTH$+";PERIOD "+PERIOD$+";"+AMPLIT$+";OUT ON;"
1430 PRINT:PRINT " COMMANDS SENT":PRINT
1440 CALL IBWRT(BD%,WRT$) 'PFG PULSE COMMANDS
1450 GOSUB 2020
1460 INPUT"<ENTER> RETURN TO MENU";A$
1470 GOTO 840
1480 END
1490 '***** DUTY CYCLE ROUTINE *****
1500 PRINT:PRINT
1510 INPUT"ENTER DESIRED PERIOD, IE <.2E-9>:";PERIOD$
1520 IF PERIOD$="" THEN 1260
1530 IF LEFT$(PERIOD$,1)("<" THEN PRINT"INCORRECT SYNTAX":GOTO 1510
1540 IF VAL(PWIDTH$)<4E-08 OR VAL(PWIDTH$)>.0999 THEN PRINT"INVALID PARAMETER: WIDTH MUST BE >40 nS AND <99.9
ms":GOTO 1510
1550 INPUT"ENTER DESIRED DUTY CYCLE, IE <50>:";DCYC$
1560 IF DCYC$="" THEN 1550
1570 IF LEFT$(DCYC$,1)("<" THEN PRINT"INCORRECT SYNTAX":GOTO 1550
1580 IF VAL(DCYC$)<10 OR VAL(DCYC$)>80 THEN PRINT"INVALID PARAMETER: DUTY CYCLE MUST BE >10 OR <80":GOTO 1550
```



```

1590 PRINT"ENTER THE DESIRED PULSE AMPLITUDE IN VOLTS, IE <1.02>"
1600 PRINT"OR SELECT ONE OF THE FOLLOWING PREDEFINED LEVELS"
1610 PRINT"<C> FOR CMOS LEVELS"
1620 PRINT"<E> FOR ECL LEVELS"
1630 PRINT"<T> FOR TTL LEVELS"
1640 INPUT AMPL$
1650 IF AMPL$="" THEN 1350
1660 IF AMPL$="C" OR AMPL$="c" THEN AMPL$="PRELEVEL CMOS"
1670 IF AMPL$="E" OR AMPL$="e" THEN AMPL$="PRELEVEL ECL"
1680 IF AMPL$="T" OR AMPL$="t" THEN AMPL$="PRELEVEL TTL"
1690 IF LEFT$(AMPL$,1)("<" OR RIGHT$(AMPL$,1)="V" OR RIGHT$(AMPL$,1)="v" THEN PRINT"INCORRECT SYNTAX":GOTO
    1640
1700 IF VAL(AMPL$)<.01 OR VAL(AMPL$)>9.99 THEN PRINT"INVALID PARAMETER: AMPLITUDE MUST BE >10mV OR
    <9.99V":GOTO 1640
1710 AMPLIT$="AMPL "+AMPL$
1720 WRT$="DCYCLE "+DCYC$+";PERIOD "+PERIOD$+";"+AMPLIT$+";OUT ON;"
1730 IF VAL(AMPL$)<.01 OR VAL(AMPL$)>9.99 THEN PRINT"INVALID PARAMETER: AMPLITUDE MUST BE >10mV OR
    <9.99V":GOTO 1350
1740 CALL IBWRT(BD%,WRT$)
1750 GOSUB 2020
1760 PRINT:PRINT " COMMANDS SENT":PRINT
1770 INPUT"<ENTER> RETURN TO MENU";A$
1780 GOTO 840
1790 END
1800 '
1810 CLS 'CLEAR SCREEN
1820 PRINT"*****"
1830 PRINT"***** PFG 5105/5505 TALKER/LISTENER PROGRAM V1.0 *****"
1840 PRINT"*****"
1850 LOCATE 5,1
1860 INPUT "ENTER MESSAGE(S),<ENTER> TO QUIT: ";WRT$ 'ENTER COMMAND
1870 IF WRT$="" GOTO 830
1880 CALL IBWRT (BD%,WRT$) 'SEND COMMAND
1890 GOSUB 2020 'CHECK FOR GPIB ERROR
1900 '***** INPUT FROM DEVICE *****
1910 IF RIGHT$(WRT$,1)="? " THEN 1920 ELSE 1960
1920 RD$=SPACE$(250) 'DIMENSION STRING FOR READ
1930 CALL IBRD (BD%,RD$) 'READ FORM INSTRUMENT
1940 PRINT:PRINT"MESSAGE RETURNED: "RD$ 'PRINT RETURNED MESSAGE
1950 GOSUB 2020 'CHECK FOR GPIB ERROR
1960 '***** SERIAL POLL *****
1970 CALL IBRSP (BD%,SPR%) 'CALL SERIAL POLL ROUTINE
1980 PRINT
1990 PRINT "RETURNED STATUS BYTE: ";SPR% 'PRINT RESPONSE
2000 PRINT:GOTO 1860
2010 '
2020 '***** ERROR LISTING *****
2030 '
2040 IF BD%<0 THEN PRINT "device not installed - use IBCONF then reboot"
2050 IF IBSTA%>=0 AND BD%>=0 AND IBSTA%<&H4000 AND IBERR%<>6 THEN RETURN 'no error to report
2060 IF IBSTA%>0 AND IBSTA%>=&H4000 THEN PRINT "timeout"
2070 IF IBERR%=6 THEN PRINT "timeout"
2080 PRINT "GPIB error ";IBERR%
2090 IF IBERR%=0 THEN PRINT "DOS error (is device installed?)"
2100 IF IBERR%=1 THEN PRINT "function requires GPIB-PC to be CIC
2110 IF IBERR%=2 THEN PRINT "no listener on write function

```

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```
2120 IF IBERR%=3 THEN PRINT "GPIB-PC not addressed correctly
2130 IF IBERR%=4 THEN PRINT "invalid argument to function call
2140 IF IBERR%=5 THEN PRINT "GPIB-PC not system controller as required
2150 IF IBERR%=6 THEN PRINT "I/O operation aborted
2160 IF IBERR%=7 THEN PRINT "non-existent GPIB-PC board
2170 IF IBERR%=10 THEN PRINT "I/O started before previous operation completed
2180 IF IBERR%=11 THEN PRINT "no capability for operation
2190 IF IBERR%=12 THEN PRINT "file system error
2200 IF IBERR%=14 THEN PRINT "command error during device call
2210 IF IBERR%=15 THEN PRINT "serial poll status byte lost
2220 IF IBERR%=16 THEN PRINT "SRQ stuck in on position
2230 IF HELP% THEN INPUT "[enter] to continue";A$
2240 RETURN
2250 '***** SYSTEM ERROR HANDLER *****
2260 PRINT"SYSTEM ERROR #";ERR
2270 IF ERR=53 THEN 2300
2280 PRINT"INCORRECT PATH"
2290 RESUME
2300 IF ERL=1320 THEN RESUME 1360 .
2310 IF ERL=1740 THEN PRINT"FILE NOT FOUND":FOR T=1 TO 999:NEXT T:RESUME 1630
2320 IF ERL=1710 THEN PRINT"FILE NOT FOUND":FOR T=1 TO 999:NEXT T:RESUME 1630
2330 RESUME
2340 SYSTEM
```

ASCII & GPIB CODE CHART

B7 B6 B5 BITS		0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
B4 B3 B2 B1		CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0	NUL	DLE	SP	0	@	P	'	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	\$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	|*
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL (RUBOUT)
		ADDRESSED UNIVERSAL COMMANDS		LISTEN ADDRESSES		TALK ADDRESSES		SECONDARY ADDRESSES OR COMMANDS (PPE)	

*1
| on some keyboards or systems

KEY

octal	25	PPU	GPIB code
	NAK		ASCII character
hex	15	21	decimal

Tektronix
COMMITTED TO EXCELLENCE

REF: ANSI STD X3. 4-1977
IEEE STD 488-1978
ISO STD 646-1973

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Utility Software is available from Tektronix, Inc. for TM 5000 instruments. This software consists of a set of subroutines and subprograms that perform common instrument functions over the GPIB such as data acquisition, front-panel setup, etc. These routines are designed to be easily integrated into your application programs. And since they are small and well documented, the routines are easy to modify to suit your particular applications. Refer to the current Tektronix Instrument Library Catalog for instrument options, ROM packs, and other required equipment.

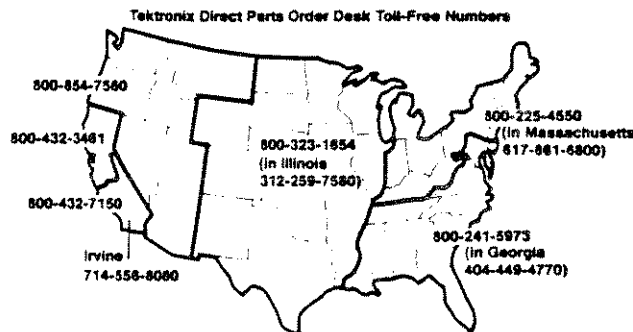
The following Software/Hardware was available when this Instrument Interfacing Guide was printed. Other software may be available; contact your local Tektronix Field Office for further information.

Description	Tektronix Part No.
TM 5000/4041 Utility Software	062-6958-01
Tek EZ-test 4041 360 K Floppy Disk	S45F010
Tek EZ-test PC 360 K Floppy Disk	S45F030
GURU II Users Resource Utility hardware/software package for PC	S3FG100

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Tektronix Instrumentation Software Library
Tektronix Australia Pty. Limited
Sydney
80 Waterloo Road
North Ryde, N.S.W. 2113

Canada

Tektronix Instrumentation Software Library
Tektronix Instrumentation Canada Ltd.
P.O. Box 6500
Barrie, Ontario
Canada L4M 4V3

Caribbean, Latin America, and Far East (except Japan)

Tektronix Instrumentation Software Library
Export Marketing
Tektronix, Inc.
P.O. Box 500
Beaverton, OR 97077
U.S.A.

Japan

Tektronix Instrumentation Software Library
Sony/Tektronix Corporation
9-3 Kitashinagawa-5
Tokyo 141 Japan

Program Library

The Tektronix Instrumentation Software Library includes over 200 software program listings for a variety of Tektronix programmable instruments and controllers. Low-cost Tekware Application Software is available (see Tekware Catalog #49W-6829).

The Library Catalog provides abstracts of the available software. Programs are available as ready-to-load media or as listings (see Catalog). For a copy of the latest catalog, contact your local Tektronix Field Office or representative and ask for the Tektronix Instrumentation Software Library Catalog. If you wish, you can contact the Library directly as follows:

Tektronix Software Application Library
Tektronix, Inc.
02-382
P.O. Box 500
Beaverton, OR 97077

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ing proves defective during the warranty period, Tektronix will provide a replacement in exchange for the defective medium. Except as to the media on which Software Products are furnished, Software Products are provided "as is" without warranty of any kind, either expressed or implied. Tektronix does not warrant that the functions contained in the programs will meet Customer's requirements or that the operations of the programs will be uninterrupted or error-free.

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