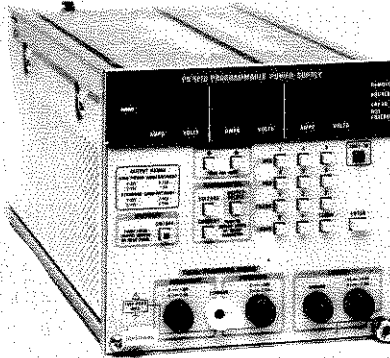


**PS 5010  
PROGRAMMABLE  
POWER  
SUPPLY**



3402-1

**REFERENCE GUIDE**

# TABLE OF CONTENTS

	Page
<b>SECTION 1 OPERATING INSTRUCTIONS</b>	
Controls, Connectors and Indicators .....	1
<b>SECTION 2 PROGRAMMING</b>	
Introduction .....	7
Interface Commands .....	8
Command Format .....	9
Argument Format .....	9
Delimiters .....	10
Commands by Function .....	10
Commands and Descriptions .....	13
Sending Interface Control Messages .....	17
Power On Settings .....	19
Talker Listener Program For 4050-Series Controllers .....	20
Talker Listener Program For 4040-Series Controllers .....	21
<b>SECTION 3 ERROR CODES</b>	
Front Panel Display Error Codes .....	23
Serial Poll and Error Query Response .....	24
Bus Error Codes and Serial Poll Response .....	24
Abnormal Conditions .....	24
Normal Conditions .....	26

## SECTION 1

### OPERATING INSTRUCTIONS

#### Controls, Connectors and Indicators

(See Fig. 1-1)

The PS 5010 TEKTRONIX Programmable Power Supply has two modes of operation. In the entry mode a supply is selected and the voltage and current limits for that supply can be changed. In this mode, the selected supply's display is bright and the others are dim.

In the operating mode all displays are bright. The voltage limit is displayed when a supply is in constant voltage mode. Likewise, the display indicates the current limit value if the supply is in the constant current mode.

The actual operating mode, constant voltage or constant current, is determined by the limit values and load impedances. For more detailed information on operational modes and display functions, see the Operating Instructions section in the PS 5010 Instruction manual.

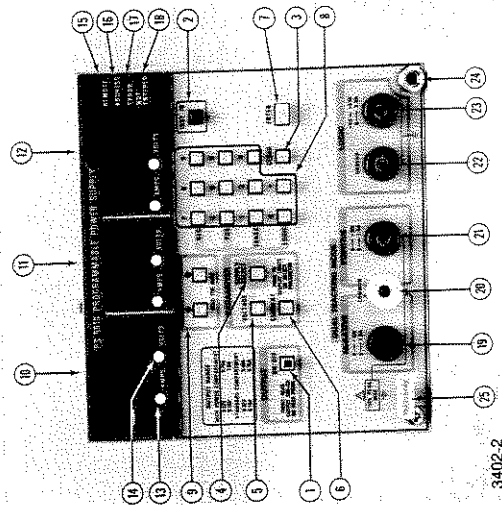


Fig 1-1. Front panel controls and connectors.

® **Controls, Connectors and Descriptions**

**Controls and Connectors**

**Entry Mode**

	<b>Operating Mode</b>	<b>Entry Mode</b>
① OUTPUT	Turns all outputs on or off.	Turns all outputs on or off.
② INST ID	Displays instrument address while pressed. Sends SRQ if User Request (USEREQ) is enabled.	Displays instrument address while pressed. Sends SRQ if User Request (USEREQ) is enabled.
③ CLEAR	Cancels SUPPLY SELECT keystroke (brightens all displays).	The selected supply returns to the previous entry if the ERROR light or NOT ENTERED light is flashing. Cancels SUPPLY SELECT keystroke if the NOT ENTERED light is off.
④ SUPPLY SELECT	Allows a supply to be selected for entry mode.	Allows selection of another supply.

**Controls, Connectors and Descriptions (cont.)**

4

- ⑤ **VOLTAGE** Displays the voltage limits of all three supplies. Places the selected supply into the voltage entry mode.
- ⑥ **CURRENT** Displays the current limits of all three supplies. Places the selected supply into the current entry mode.
- ⑦ **ENTER** Nonfunctional. Completes a change in the voltage or current. (Not required when using INCREMENT.)
- ⑧ **0 through 9 and period** Buttons NEG (7), POS (4), TRACK (1) or LOGIC (0) select supplies for entry mode. Other buttons are nonfunctional. Numeric key pad for entering voltages and currents.
- ⑨ **INCREMENT** Nonfunctional. Increases or decreases the absolute value of the selected voltage or current.

©



④

Negative supply display

Indicates output parameter value or limit value.

Bright when entering values.

Positive supply display

Indicates output parameter value or limit value.

Bright when entering values.

Logic supply display

Indicates output parameter value or limit value.

Bright when entering values.

AMPS

Indicates the displayed parameter is amperes. Flashing AMPS light indicates displayed current is not actual output current.

Indicates the displayed parameter is amperes. Flashing AMPS light indicates displayed current is not actual output current.

VOLTS

Indicates the displayed parameter is voltage. Flashing VOLTS light indicates displayed voltage is not actual output voltage.

Indicates the displayed parameter is voltage. Flashing VOLTS light indicates displayed voltage is not actual output voltage.

5

**Controls, Connectors and Descriptions (cont.)**

- ⑮ REMOTE Illuminated when instrument is in remote state (controller programmable) via GPIB.
- ⑯ ADDRESS Indicates the instrument is addressed by a controller as a talker or listener via GPIB.
- ⑰ ERROR Illuminated when an attempt is made to enter an out-of-range value from the numerical keyboard.
- ⑱ NOT ENTERED Indicates value in intensified display(s) is not entered.
- ⑲ NEGATIVE supply output terminal.
- ⑳ Floating supply common terminal.
- ㉑ POSITIVE supply output terminal.
- ㉒ LOGIC supply ground (chassis ground) terminal.
- ㉓ LOGIC supply positive output terminal.
- ㉔ Ground binding post.
- ㉕ Plug-in release latch.

®





**SECTION 2****PROGRAMMING****Introduction**

The TEKTRONIX PS 5010 Programmable Power Supply is the source of a positive and negative floating voltage as well as a nominal +5 V ground referenced logic supply voltage. All supplies can be programmed for voltage or current from the front panel or via the GPIB in accordance with IEEE Standard 488-1978 (see Table 2-1).

**Table 2-1**  
**IEEE 488 INTERFACE FUNCTION SUBSETS**

<b>Function</b>	<b>Subset</b>
Source Handshake	SH1
Acceptor Handshake	AH1
Basic Talker	T6
Basic Listener	L4
Service Request	SR1
Remote-Local	RL1
Parallel Poll	PP0
Device Clear	DCL
Device Trigger	DT1
Controller	C0

Interface Commands

All PS 5010 functions are programmable via high level commands sent over the General Purpose Interface Bus (GPIB). See Fig. 2-1. The PS 5010 GPIB address and message terminator may be set by qualified service personnel. Refer qualified service personnel to the Maintenance section of the instruction manual. The PS 5010 is shipped with the GPIB address set to decimal 22 with EOI as message terminator.

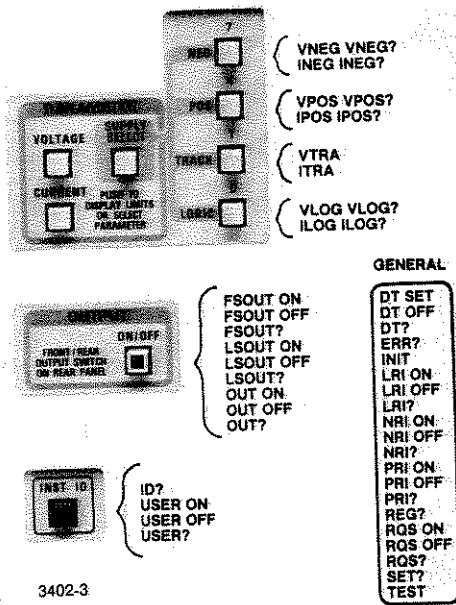


Fig. 2-1. Bus commands and relationship to the front panel.

**Command Format**

Each command consists of a header, usually followed by an alpha or numeric argument.

Examples:

```
VPOS 3.5  
RQS ON  
SET?
```

Send all commands with a space between the header and argument. Additional formatting characters (CR, LF, and SP) may be added between the space and the argument.

**Argument Format**

The PS 5010 accepts the following numeric arguments <numbers>.

- Signed or unsigned integers, including zero. Unsigned integers are interpreted to be positive. Examples: +1, 2, 3, -1, -10.
- Signed or unsigned decimal numbers. Unsigned decimals are interpreted to be positive. Leading zeros may be deleted. Examples: -3.2, +5.0, 1.2, .8, 28.7.
- Numbers expressed in scientific notation. Examples: +1.0E-2, -1.E+1, 0.E+0.

## PS 5010—Programming

The PS 5010 sends a decimal number for query responses. (Error messages are integers.)

Alpha arguments must be sent as listed in the command list.

### Delimiters

The following message delimiters are used to punctuate commands to the PS 5010:

Delimiter	Placement
<space>	After header
<semicolon>	After message unit (command)

Examples:

VPOS 10;  
VPOS?  
IPOS .60; VPOS 10; OUT ON;

Table 2-2  
PS 5010 COMMANDS BY FUNCTION

#### Instrument Commands

ILOG 2.3  
ILOG?  
VLOG 5.1  
VLOG?

INEG .4  
INEG?  
VNEG 26.7  
VNEG?

IPOS.3  
IPOS?  
VPOS 3.2  
VPOS?

ITRA .35  
VTRA 18.1

**Input Output Commands**

OUT ON  
OUT OFF  
OUT?

FSOUT ON  
FSOUT OFF  
FSOUT?

LSOUT ON  
LSOUT OFF  
LSOUT?

**Instrument Status Commands**

REG?

LRI ON  
LRI OFF  
LRI?

NRI ON  
NRI OFF  
NRI?

PRI ON  
PRI OFF  
PRI?

RQS ON  
RQS OFF  
RQS?

USER ON  
USER OFF  
USER?

**System Commands**

DT SET  
DT OFF  
DT?

ERR?

ID?

INIT

SET?

TEST



Table 2-3  
PS 5010 COMMANDS AND DESCRIPTIONS

Header	Argument	Description
DT	SET	Instrument waits for GET to update settings.
DT	OFF	Instrument updates without GET message.
DT?		Returns DT SET; or DT OFF;
ERR?		Returns error code for most recent event reported by serial poll when RQS is ON. With RQS OFF, it returns the highest priority status.
FSOUT	ON	Connects floating supplies to output terminals.
FSOUT	OFF	
FSOUT?		Returns FSOUT ON; or FSOUT OFF;
ID?		Returns ID TEK/PS5010, V79.1 FXX with XX the firmware version.
ILOG	<number>	Sets the logic supply current limit.
ILOG?		Returns ILOG <number>;
INEG	<number>	Sets the negative floating supply current limit.

INEG?		Returns INEG <number>;
INIT		Resets instrument settings to the power on state (see Table 2-4).
IPOS	<number>	Sets the positive floating supply current limit
IPOS?		Returns IPOS <number>;
ITRA	<number>	Sets both the positive and negative floating supplies current limits.
LRI	ON	Enables the logic supply regulation interrupt.
LRI	OFF	
LRI?		Returns LRI ON; or LRI OFF;
LSOUT	ON	Connects the logic supply to the output terminals.
LSOUT	OFF	
LSOUT?		Returns LSOUT ON; or LSOUT OFF;
NRI	ON	Enables the negative floating supply regulation interrupt.
NRI	OFF	
NRI?		Returns NRI ON; or NRI OFF;
OUT	ON	Connects all supplies to their output terminals.





OUT	OFF	
OUT?		Returns FSOUT ON; or FSOUT OFF; and LSOUT ON; or LSOUT OFF;.
PRI	ON	Enables the positive floating supply regulation interrupt.
PRI	OFF	
PRI?		Returns PRI ON; or PRI OFF;.
REG?		Returns REG <number>, <number>, <number>... Sequence is neg,pos,logic. Numbers are 1=voltage, 2=current, 3=unregulated.
RQS	ON	Enables instrument to generate service requests.
RQS	OFF	Disables all service requests.
RQS?		Returns RQS ON; or RQS OFF;.
SET?		Returns all instrument settings that can be queried (see Table 2-4).
TEST		Returns 0 or error code corresponding to ROM with a checksum error.
USER	ON	Enables SRQ when INST ID button is pressed.

@

P	USER	OFF	
	USER?		Returns USER ON; or USER OFF;.
I	VLOG	<number>	Sets logic supply voltage limit.
	VLOG?		Returns VLOG <number>;.
	VNEG	<number>	Sets negative floating supply voltage limit.
	VNEG?		Returns VNEG <number>;.
	VPOS	<number>	Sets positive floating supply voltage limit.
	VPOS?		Returns VPOS <number>;.
	VTRA	<number>	Sets positive and negative floating supplies to the same voltage limit.

### SENDING INSTRUMENT MESSAGES

Bus communications are performed through use of the controller input and statements. ASCII (see Fig. 2-2) commands are transmitted using the PRINT statements. The PS 5010 is factory set to address 22.

PRINT @22:"SET?"

ASCII replies are received by the controller using input statements.

INPUT @22:A\$



## SENDING INTERFACE CONTROL MESSAGES

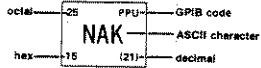
Bus interface control messages are sent as low level commands through the use of WBYTE and RBYTE controller commands. For the following commands, A=32 plus the instrument address, and B=64 plus the instrument address.

Listen	WBYTE @ A:
Unlisten	WBYTE @ 63:
Talk	WBYTE @ B:
Untalk	WBYTE @ 95:
Unlisten-untalk	WBYTE @ 63, 95:
Device clear (DCL)	WBYTE @ 20:
Selective device clear (SDC)	WBYTE @ A, 4:
Go to local (GTL)	WBYTE @ A, 1:
Remote with lockout	WBYTE @ A, 17, 63:
Local lockout of all instruments	WBYTE @ 17:
Group execute trigger (GET)	WBYTE 2 A, 8:

0	NUL	DLE	SP	0	@	P	\	70	D	
10	10	16	20	32	40	50	60	80	96	112
1	SOH	DC1	!	1	A	Q	a	q		
11	11	17	21	33	41	51	61	81	97	113
2	STX	DC2	"	2	B	R	b	r		
12	12	18	22	34	42	52	62	82	98	114
3	ETX	DC3	#	3	C	S	c	s		
13	13	19	23	35	43	53	63	83	99	115
4	EOT	DC4	\$	4	D	T	d	t		
14	14	20	24	36	44	54	64	84	100	116
5	ENO	NAK	%	5	E	U	e	u		
15	15	21	25	37	45	55	65	85	101	117
6	ACK	SYN	&	6	F	V	f	v		
16	16	22	26	38	46	56	66	86	102	118
7	BEL	ETB	'	7	G	W	g	w		
17	17	23	27	39	47	57	67	87	103	119
8	GET	CAN	(	8	H	X	h	x		
18	18	24	28	40	48	58	68	88	104	120
9	HT	EM	)	9	I	Y	i	y		
19	19	25	29	41	49	59	69	89	105	121
10	LF	SUB	*	10	J	Z	j	z		
20	20	26	30	42	50	60	70	90	106	122
11	VT	ESC	+	11	K	[	k	[		
21	21	27	31	43	51	61	71	91	107	123
12	FF	FS	,	12	L	\	l	\		
22	22	28	32	44	52	62	72	92	108	124
13	CR	GS	-	13	M	]	m	]		
23	23	29	33	45	53	63	73	93	109	125
14	SD	RS	>	14	N	^	n	^		
24	24	30	34	46	54	64	74	94	110	126
15	SI	US	/	15	?	UNT	?	RUBOUT		
25	25	31	35	47	55	65	75	95	111	127
16	16	32	36	48	56	66	76	96	112	128
17	17	33	37	49	57	67	77	97	113	129

ADDRESSED COMMANDS UNIVERSAL COMMANDS LISTEN ADDRESSES TALK ADDRESSES SECONDARY ADDRESSES OR COMMANDS

KEY TO CHART



3402.4

Fig. 2-2. ASCII & IEEE 488 (GPIB) Code Chart

These commands are for the TEKTRONIX 4050-Series controllers and representative for other controllers.

#### Power On Settings

At power on or when the INIT command is executed, instrument settings are initialized as indicated in Table 2-4.

Table 2-4  
POWER ON SETTINGS

Header	Argument
VPositive	0.0
IPositive	0.4
VNegative	0.0
INegative	0.4
VLOGic	5.0
ILOGic	1.0
FSOUTput	OFF
LSOUTput	OFF
PRI	OFF
NRI	OFF
LRI	OFF
RQS	ON
USEReq	OFF
DT	OFF

If an internal error is found, an error code is displayed in the front-panel readout. See Table 3-1 for error codes.

## TALKER LISTENER PROGRAMS

Talker Listener Program For 4050-Series  
Controllers

```
100 REM PS5010 TALKER/LISTENER PROGRAM
110 REM PS5010 PRIMARY ADDRESS = 22
120 INIT
130 ON SRQ THEN 240
140 DIM A$(200)
150 PRINT "ENTER MESSAGE(S): ";
160 INPUT C$
170 PRINT @22:C$
180 REM CHECK FOR QUERIES
190 IF POS(C$,"?",1)=0 THEN 150
200 REM INPUT FROM DEVICE
210 INPUT @22:A$
220 PRINT A$
230 GO TO 150
240 REM SERIAL POLL ROUTINE
250 POLL X,Y;22
260 PRINT "STATUS BYTE: ";Y
270 RETURN
```

This sample program allows a user to send any of the commands listed in Table 2-3 to the PS 5010 and to receive the data generated.

Talker Listener Program For 4040-Series  
Controllers

```
100 Rem PS5010 TALKER/LISTENER PROGRAM
110 Rem PRIMARY ADDRESS = 22
120 Init all
130 On srq then gosub srqhdl
140 Enable srq
150 Dim respons$ to 200
160 Input prompt "ENTER MESSAGE(S): ":message$
170 Print #22:message$
180 Rem CHECK FOR QUERIES
190 If pos(message$,"?",1) then goto 260
200 Rem CHECK FOR 'TEST' COMMAND
210 If pos(message$,"TEST",1) then goto 260
220 Goto 160
230 Rem INPUT FROM DEVICE
240 Rem LLSET? sends non-printable ASCII data
250 Rem in binary block format
260 Input #22:respons$
270 Print "RESPONSE: ";respons$
280 Goto 160
290 Rem SERIAL POLL ROUTINE
300 Srqhdl: poll stb,pri
310 Print "STATUS BYTE: ";stb
320 Resume
330 End
```

This sample program allows a user to send any of the commands listed in Table 2-3 to the PS 5010 and to receive the data generated.

NOTES





## SECTION 3

### ERROR CODES

Table 3-1

#### FRONT-PANEL DISPLAY ERROR CODES

System error	302
Math pack error	303
System RAM error	340
System RAM error (low nibble)	341
C000 ROM placement error	372
D000 ROM placement error	373
E000 ROM placement error	374
F000 ROM placement error	375
C000 ROM checksum error	392
D000 ROM checksum error	393
E000 ROM checksum error	394
F000 ROM checksum error	395
Signature analysis mode <sup>a</sup>	521

<sup>a</sup>Refer to the PS 5010 Instruction Manual

### SERIAL POLL AND ERROR QUERY RESPONSE

**Command error** indicates the instrument cannot implement or understand a command. Instrument settings do not change.

**Execution error** indicates nonexecution due to present state or out of range.

**Internal error** indicates a hardware error.

The bus reports both normal and abnormal events via the interrupt process, if enabled by RQS ON.

Table 3-2

### BUS ERROR CODES AND SERIAL POLL RESPONSE

Description	ABNORMAL CONDITIONS	
	Bus Response to ERR?	Response to Serial Poll
Command Errors		
Command header error	101	97 or 113
Header delimiter error	102	97 or 113
Command argument error	103	97 or 113
Argument delimiter error	104	97 or 113
Missing argument	106	97 or 113
Invalid message unit delimiter	107	97 or 113
Binary block checksum error	108	97 or 113
Binary block byte counter error	109	97 or 113

## Execution Errors

Command not executable in local mode	201	98 or 114
Return to local, new settings pending lost	202	98 or 114
I/O buffers full, output dumped	203	98 or 114
Settings conflicts	204	98 or 114
Argument out of range	205	98 or 114
Group execute trigger ignored	206	98 or 114

## Internal Errors

System error	302	99 or 115
Math pack error	303	99 or 115

## NORMAL CONDITIONS

Description	Bus Response to ERR?	Response to Serial Poll
System Events		
Power on	401	65 or 81
User request	403	67 or 83
Device Dependent Events		
Negative supply goes to constant voltage mode	721	197 or 213
Negative supply goes to constant current mode	722	198 or 214
Negative supply goes to unregulated mode	723	199 or 215
Positive supply goes to constant voltage mode	724	201 or 217
Positive supply goes to constant current mode	725	202 or 218
Positive supply goes to unregulated mode	726	203 or 219
Logic supply goes to constant voltage mode	727	205 or 221
Logic supply goes to constant current mode	728	206 or 222
Logic supply goes to unregulated mode	729	207 or 223

Table 3-3

STATUS BYTE BITS DEFINITION

