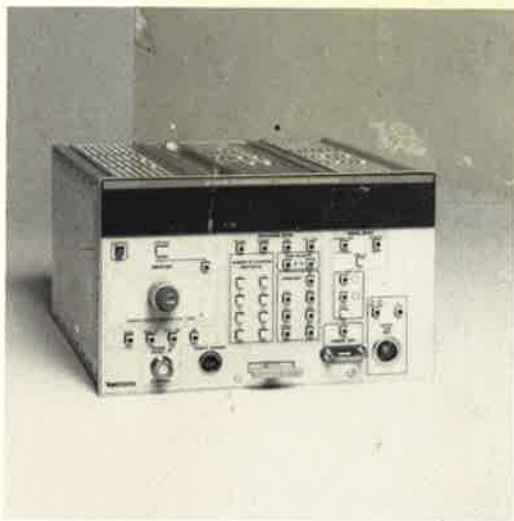


Tektronix[®]
COMMITTED TO EXCELLENCE


**CG 551AP/CG 5001
PROGRAMMABLE
CALIBRATION
GENERATOR**



REFERENCE GUIDE

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INTRODUCTION

The TEKTRONIX CG 551AP/CG 5001 Programmable Calibration Generator is a source of six different types of output signals. These signals are used to calibrate and check the various performance characteristics of oscilloscopes.

All of the instrument functions and output signals are programmable via high level or low level commands sent over a general purpose interface bus (GPIB), which is specified in the IEEE 488-1975 Standard.

INTERFACE FUNCTION SUBSETS

Function	Subset	Capability
Source Handshake	SH1	Complete: CG 551AP allows a settling time on the GPIB data lines before asserting DAV. T_1 in the standard : $\geq 2 \mu s$.
Acceptor Handshake	AH1	Complete.
Basic Talker	T6	Responds to Serial Poll. Untalk if My Listen Address (MLA) is received.
Basic Listener	L4	Unlisten if My Talk Address (MTA) is received.
Service Request	SR1	Complete.
Remote-Local	RL1	Complete.
Parallel Poll	PP0	Does not respond to Parallel Poll.
Device Clear	DC1	Complete.
Device Trigger	DT1	Complete.
Controller	C0	No Controller function.
Bus Drivers	E1	Open collectors.

SETTING COMMAND SUMMARY

- | | | | |
|----|---|----|---|
| 1 | OPC ON or OPC OFF | 16 | POS or NEG |
| 2 | REM ON or REM OFF | 17 | FREQ DC or FREQ <numeric>
CHOP ON or CHOP OFF |
| 3 | VAR or FXD | 18 | MODE FE or MODE FASTEDGE
DSP ON or DSP OFF
DLY ON or DLY-OFF
LOOP ON or LOOP OFF |
| 4 | U/D <numeric>
V/D <numeric>V
A/D <numeric>A
S/D <numeric>S | 20 | LOOP ON or LOOP OFF |
| 5 | PCT <±value> or FXD
INC or DEC | 21 | MODE SLWD or MODE SLEWED
HOLD <number>
CS ON or CS OFF
MODE MKRS or MODE MARKERS
NM ON or NM OFF
MAG X1 or MAG X10 |
| 6 | TRIG ON or TRIG OFF | 22 | RSHF or SHFT <+value>
LSHF or SHFT <-value>
ZSHF or SHFT - |
| 7 | TRIG NORM | 23 | OUT ON or OUT OFF |
| 8 | TRIG X.1 | 24 | LDZ 50 or LDZ HI |
| 9 | TRIG X.01 | 25 | |
| 12 | MODE V or MODE VOLTAGE | 26 | |
| 13 | MODE CUR or MODE CURRENT | 27 | |
| 14 | MULT <number> | 28 | |
| 15 | MODE EDGE
DSP ON or DSP OFF | | |

QUERY COMMAND SUMMARY

Query	Response	Description
CSET?	<message unit>	Returns changed settings information. Value is "NONE" if settings have not changed.
DSPL?	<message unit>	Returns present units/division and dut percent error.
ERR?	<nr1>	Returns number codes for error conditions. If no errors, response is ERR ∅.
ID?	TEK/CG 551AP, V79.1, LLL; or ID TEK/ CG 5001, V79.1, Fxx;	Returns identity of instrument.
PCT?	<message unit>	Returns present dut percent error.
READ?	<message unit>	Returns present units/division and dut percent error after operator presses CONTINUE key.
RPT?		CG 551AP repeats last message sent.
SET?	<message unit>...	Returns settings of instrument.
SRQ?		Returns reason for Service Request.
TSET?	NULL	Returns null message.
U/D?	<nr3>	Returns present units/division.

VERS? H<IDVVCCCC> Most significant byte of ROM base address, version number, and 16-bit checksum.

INTERNAL PARAMETER COMMANDS

DT ON	Front panel settings executed after receipt of GET message.
DT OFF	Front panel settings executed after receipt of EOI.
INIT	Sets instrument to power up default state.
OPC ON or OPC OFF	Controls generation of SRQ for operation complete when the CONTINUE button is pressed. Powers up with OPC OFF. See Fig. 3.
MASK or UMSK	Masks or unmask errors 1, 2, or 3.
REM ON or REM OFF	Controls generation of SRQ when INST ID button is pressed. Powers up with REM ON. See Fig. 3.

NOTES

BUS ADDRESS AND MESSAGE TERMINATORS

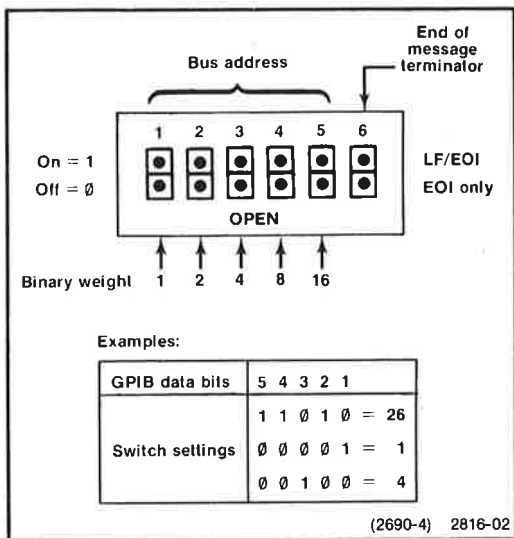


Fig. 2. Address and message terminator switches.

1. Address 31 effectively disconnects CG 551AP from the GPIB.
2. Output message terminators:
 - a. EOI ONLY position— < ; > with EOI asserted.
 - b. LF/EOI position— < ; > < CR > then < LF > with EOI asserted.

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3. Input message terminators:
 - a. LF/EOI position—assertion of EOI with last data byte or <LF>.
 - b. EOI only position—assertion of EOI with last data byte.
4. If CG 551AP is addressed to talk with nothing to say, response is \$FF with EOI asserted.
5. Set message terminator to EOI ONLY for low level messages (low level EOI data byte is the checksum byte).

NOTES

UNITS/DIV AND VARIABLE COMMANDS

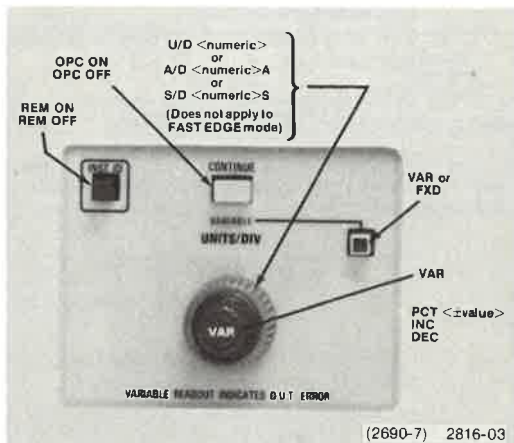


Fig. 3. UNITS/DIV, VARIABLE, INST ID, and CONTINUE functions.

NOTE

The DT ON and DT OFF commands are applicable to all setting commands related to the front panel. See Internal Parameter Commands.

- A/D <numeric>A** Sets mode to CURRENT and sets units per division.
- S/D <numeric>S** Sets selected timing mode (MARKERS or SLEWED EDGE) to the appropriate units per division.

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U/D <numeric>	Sets desired units per division.
V/D <numeric> V	Sets mode to VOLTAGE and desired units per division.
VAR	Turns on percent error (%) display.
FXD	Sets 0.0% error and turns off display.
PCT <value>	Sets desired percent error variable. Plus values for HIGH or FAST, minus values for LOW or SLOW.
INC	Adds 0.1 to error variable for HIGH or FAST, subtracts 0.1 for LOW or SLOW.
DEC	Subtracts 0.1 from error variable for HIGH or FAST, adds 0.1 for LOW or SLOW.
DSP ON or DSP OFF	Enable (on) or disables (off) variable display for the EDGE or FAST EDGE modes.

Examples for <numeric>:

1 or 1E0 = 1

1K or 1E+3 = 1 kilo

1Meg or 1E+6 = 1 Meg

5M or 5E-3 = 5 milli

2U or 2E-6 = 2 micro

NOTE

Lower case alphas interpreted as upper case.

AMPLITUDE MODE COMMANDS

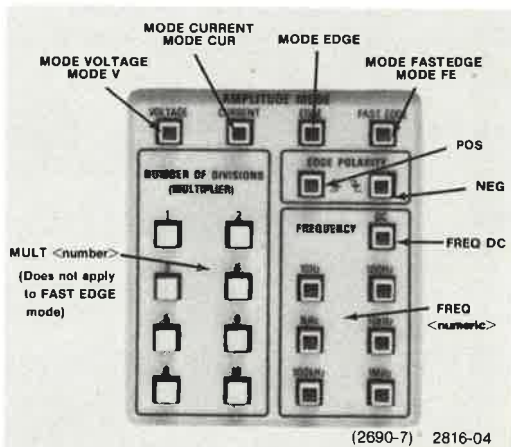


Fig. 4. AMPLITUDE MODE functions.

**MODE V or
MODE
VOLTAGE**

Sets instrument to VOLTAGE mode.

**MODE CUR or
MODE
CURRENT**

Sets instrument to CURRENT mode.

MODE EDGE

Sets instrument to EDGE mode.

**MODE FE or
MODE
FASTEDGE**

Sets instrument to FAST EDGE mode if Pulse Head is connected.

MULT<number>

Sets NUMBER OF DIVISION (MULTIPLIER). Not applicable to FAST EDGE mode.

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POS or NEG	Sets edge polarity for EDGE and FAST EDGE modes. Polarity not selectable for the 1.2 V to 100 V range.
FREQ DC	Sets OUTPUT level to dc.
FREQ <numeric>	Sets OUTPUT signal to desired frequency.
CHOP ON or CHOP OFF	CHOP OFF sets OUTPUT level to 0 V. CHOP ON restores normal frequency output.
DLY ON or DLY OFF	DLY ON sets delayed trigger for FAST EDGE mode. DLY OFF sets normal trigger mode.
MASK <number>	Mask error so that SRQ will not be sent. Number (error) can be 1, 2, or 3.
UMSK <number>	Unmasks error (number 1, 2, or 3) that was masked.

NOTES

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VOLTAGE (AMPLITUDE MODE) LIMITS

U/D	NUMBER OF DIVISIONS (MULTIPLIER)								
	1	2	3	4	5	6	8	10	
10 μ V		NA							
20 μ V									
50 μ V									
.1 mV									
.2 mV									
.5 mV			10 Hz – 10 kHz						
1 mV									
2 mV									
5 mV									
10 mV									
20 mV									
50 mV									
.1 V									
.2 V			DC – 100 kHz 5 V limit for 50 Ω						
.5 V									
1 V									
2 V									
5 V									
10 V					DC – 10 kHz No 50 Ω Load				
20 V									
50 V									

2816-05

Fig. 5. VOLTAGE mode limits.

EDGE (AMPLITUDE MODE) LIMITS

U/D	NUMBER OF DIVISIONS (MULTIPLIER)							
	1	2	3	4	5	6	8	10
5 mV	■	■	■					
10 mV	■							
20 mV								
50 mV								
.1 V								
.2 V							■	■
.5 V								
1 V		■						
2 V								
5 V								
10 V								
20 V							■	■

50 Ω Load
10 Hz \rightarrow 1 MHz
+ or - edge polarity

No 50 Ω Load
10 Hz \rightarrow 100 kHz
+ edge polarity only

Fig. 6. EDGE mode limits.

CURRENT (AMPLITUDE MODE) LIMITS

U/D	NUMBER OF DIVISIONS (MULTIPLIER)							
	1	2	3	4	5	6	8	10
1 mA								
2 mA								
5 mA								
10 mA								
20 mA								
50 mA								
100 mA								

2816-06

Fig. 7. CURRENT mode limits.

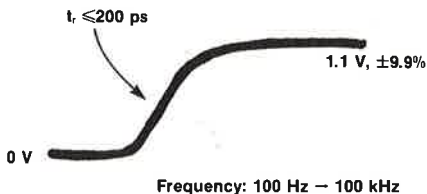
FAST EDGE (AMPLITUDE MODE) LIMITS

Fig. 8. FAST EDGE mode limits.

PROGRAMMING NOTES

TIMING MODE COMMANDS

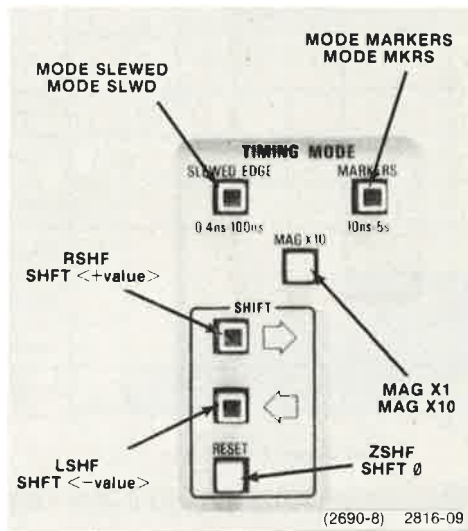


Fig. 9. TIMING MODE functions.

EDGE
 <number>

Sets number of slewed edges generated during one cycle.

CS ON or CS OFF

Sets continuous slewing for SLEWED EDGE mode or restores normal slewing mode.

HOLD<number>

SLEWED EDGE mode only. Change trigger period in $0.82 \mu\text{s}$ increments ($.5 \text{ ns/div} - 100 \text{ ns/div}$) or in $1.02 \mu\text{s}$ increments (0.4 ns/div). Number can be $-1, 0, +1, +2, \text{ or } +3$.

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LSHF	Decrements SLEWED EDGE shift counter by 1.
MAG X1 or MAG X10	Sets time/division magnifier to X1 or X10.
MODE MKRS or MODE MARKERS	Sets instrument to MARKERS mode.
MODE SLWD or MODE SLEWED	Sets instrument to SLEWED EDGE mode.
NM ON or NM OFF	Reduces MARKERS pulse width by a factor of 10 or restores normal pulse width.
RSHF	Increments SLEWED EDGE shift counter by 1.
SHFT<value>	Sets SLEWED EDGE shift counter to + or - value. Value range is as follows: .4 ns/Div— -25 to +25. .5 ns/div— -99 to +99. 1 ns/div— -99 to +99. 2 ns/div— -99 to +99. 5 ns/div— -99 to +99. 10 ns/div— -40 to +40. 20 ns/div— -20 to +20. 50 ns/div— -10 to +20. .1 μ s/div— -5 to +20.
SHFT \emptyset or ZSHF	Resets SLEWED EDGE shift counter to \emptyset

MARKERS MODE LIMITS

U/D	High Level	Low Level (NAK)	Low Level (SYN)
10 ns • •	10E-9 • •	\$05 • •	\$02 \$05 • •
.1 μ s • •	.1E-6 • •	\$08 • •	\$02 \$08 • •
1 μ s • •	1E-6 • •	\$0B • •	\$02 \$0B • •
10 μ s • •	10E-6 • •	\$0E • •	\$02 \$0E • •
.1 ms • •	.1E-3 • •	\$11 • •	\$02 \$11 • •
1 ms • •	1E-3 • •	\$14 • •	\$02 \$14 • •
10 ms • •	10E-3 • •	\$17 • •	\$02 \$17 • •
.1 sec • •	.1E0 • •	\$1A • •	\$02 \$1A • •
1 sec • •	1E0 • •	\$1D • •	\$02 \$1D • •
5 sec • •	5E0 • •	\$1F • •	\$02 \$1F • •
Trigger Rates		(NAK)	(SYN)
NORMAL ON		\$80	\$8A
RATE \div 10		\$81	\$9A
RATE \div 100		\$83	\$AA

2816-10

Fig. 10. MARKERS mode limits.

SLEWED EDGE MODE LIMITS

U/D	High Level	Low Level (NAK)	Low Level (SYN)		MAG X10
.4 ns	.4E-9	\$00	\$02	\$00	NA
.5 ns	.5E-9	\$01	\$02	\$01	NA
1 ns	1E-9	\$02	\$02	\$02	NA
2 ns	2E-9	\$03	\$02	\$03	NA
5 ns	5E-9	\$04	\$02	\$04	X
10 ns	10E-9	\$05	\$02	\$05	X
20 ns	20E-9	\$06	\$02	\$06	X
50 ns	50E-9	\$07	\$02	\$07	X
.1 μ s	.1E-6	\$08	\$02	\$08	X

TRIGGER OUTPUT: Trigger period greater than 3.5 μ s. Use external triggering for oscilloscope. RATE \div 10 and RATE \div 100 not available. Trigger output cannot be turned off in SLEWED EDGE mode.

2816-11

Fig. 11. SLEWED EDGE mode limits.

TRIGGER OUTPUT COMMANDS

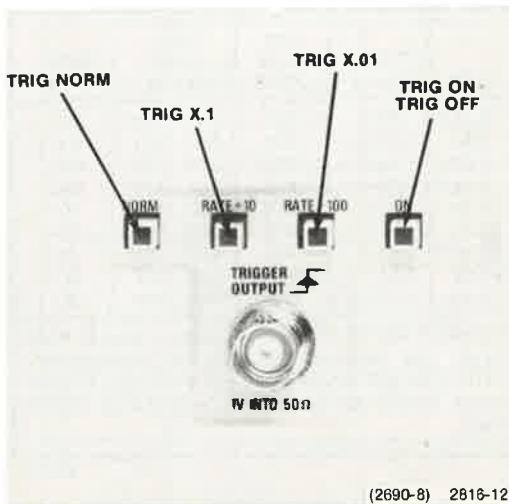


Fig. 12. TRIGGER OUTPUT functions.

**TRIG ON or
TRIG OFF**

Turns TRIGGER OUTPUT on or off. Output cannot be turned off when instrument is in SLEWED EDGE mode.

TRIG NORM

Sets trigger rate same as output frequency.

TRIG X.1

Sets trigger rate to one-tenth output frequency (except slewed edges).

TRIG X.01

Sets trigger rate to one-hundredth output frequency (except slewed edges).

OUTPUT COMMANDS

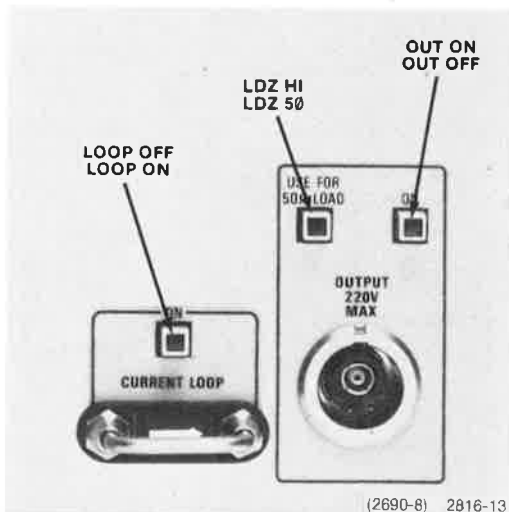


Fig. 13. CURRENT LOOP and OUTPUT functions.

**OUT ON or
OUT OFF**

Turns main OUTPUT connector on or off.

LDZ HI

Turns off USE FOR 50 Ω LOAD function and informs instrument to compensate for high impedance load.

LDZ 50

Turns on USE FOR 50 Ω LOAD function and informs instrument to compensate for 50 Ω load.

**LOOP ON or
LOOP OFF**

Turns CURRENT LOOP on or off.

COMPARATOR COMMANDS

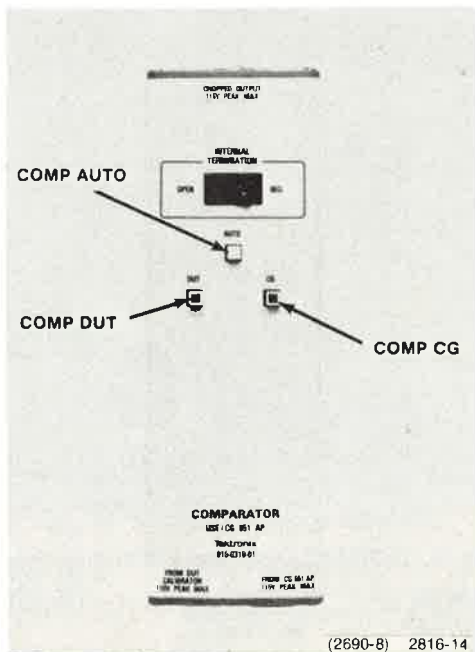


Fig. 14. COMPARATOR functions.

- COMP AUTO** Sets comparator to chop between CG 551AP and device under test.
- COMP DUT** Sets comparator to straight-through mode for device under test output.
- COMP CG** Sets comparator to straight-through mode for the CG 551AP output.

PROGRAMMING NOTES

TALKER/LISTENER PROGRAMS

```

LIST
100 ON SRQ THEN 190
110 DIM A$(200)
120 PRINT "ENTER SETTING(S) OR
      QUERY COMMANDS:"
130 INPUT C$
140 PRINT @4:C$
150 IF POS(C$,"?",1)=0 THEN 120
160 INPUT @4:A$
170 PRINT A$
180 GO TO 120
190 POLL X,Y;4
200 PRINT "SRQ STATUS BYTE:";Y
210 RETURN

```

Comments

- 100 Informs controller of SRQ handler.
- 110 Dimensions response string length.
- 120 Prompts user to input commands.
- 130 Loads high level commands from keyboard.
- 140 Commands are sent to the instrument at GPIB address 4.
- 150 Command is checked to see if it was a query.
- 160 If command was a query, get the response. A\$ is the response.
- 170 Print response to user.
- 190 SRQ subroutine.
- 210

NOTE

Only one query command per command string allowed.
Set CG 551AP end of message terminator to EOI only.

2690-5

Fig. 15. Talker/Listener program (TEKTRONIX 4050-Series).

TALKER/LISTENER PROGRAMS

```

0:  din  A$[150]
1:  dev  "cg",701
2:  ren  7
3:  oni  7,"srq"
4:  eir  7
5:  ent  "command-
    ",A$
6:  cmd  7,"?"
7:  wrt  "cg",A$
8:  if  pos(A$,
    "?")>0;red "cg"
    ,A$;prt A$;prt
9:  cmd  7,"_?"
10:  gto  5
11:  "srq":rds(70
    1)→A;cmd 7,"_";
    prt "srq",A;
    eir 7;iret

```

Comments

The 9825A must be configured with String, General I/O, and Extended I/O Rompack.

Set the CG 551AP end of message terminator to the LF position.

2690-6A

Fig. 16. Simple handler for HP 9825A Desktop Calculator.

SENDING INTERFACE CONTROL MESSAGES (TEKTRONIX 4050-series)

1. Talk Address Group (TAG)

WBYTE @ A: causes CG 551AP to talk.

WBYTE @ 95: causes CG 551AP to untalk.

A = 64 + address (0-30). Address 31 causes CG 551AP to untalk.

2. Listen Address Group (LAG)

WBYTE @ A: causes CG 551AP to listen.

WBYTE @ 63: causes CG 551AP to unlisten.

A = 32 + address (0-30). Address 31 causes CG 551AP to unlisten.

3. Address Command Group (ACG)

WBYTE @ A, 1, 63: Go to Local (MLA, GTL, UNL).

WBYTE @ A, 4, 63: Selected Device Clear
(MLA, SDC, UNL).

WBYTE @ A, 8, 63: Group Execute Trigger
(MLA, GET, UNL).

A = MLA = 32 + address (0-30).

1 = GTL, 4 = SDC, and 8 = GET.

63 causes CG 551AP to unlisten (UNL).

NOTE

Parallel Poll Configure (PPC) and Take Control (TCT) are not implemented in the CG 551AP.

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4. Universal Command Group (UCG)

WBYTE @ A, 17, 63:

WBYTE @ 17: LLO (Local Lockout).

First command sets CG 551AP to RWLS if REN is true. Second command sets CG 551AP to LWLS.

WBYTE @ 20: DCL (Device Clear).

WBYTE @ 24: SPE (Serial Poll Enable).

WBYTE @ 25: SPD (Serial Poll Disable).

NOTE

Parallel Poll Unconfigure (PPU) is not implemented in the CG 551AP.

5. Secondary Command Group (SCG)

WBYTE @ A: Not implemented; ignored by CG 551AP.

A = 96 + address (0-30).

RESPONSE TO INTERFACE CONTROL MESSAGES

DCL (\$14)— Device Clear. This interface message causes the CG 551AP to respond as follows:
Clear talk errors and displayed error codes.

Mask errors 1, 2, and 3.

Set all changed settings.

Resets pending settings, repeatable queries, present query, pending READ? query, the response to SRQ? query, pending GET message, and all SRQ's except the power on service request and the busy bit.

Go to the following system command default settings: OPC OFF, DT OFF (DT0), RQS ON, and REM ON.

GET (\$08)— Group Execute Trigger. If the CG 551AP is in the DT1 mode, decoded setting commands are buffered but not executed until the receipt of the GET message. DT1 mode is set by the DT ON command.

GTL (\$01)— Go to Local. Causes the CG 551AP to go to a local state. In a local state, device-dependent messages continue to be accepted by the instrument; only those commands that do not affect the state of the front-panel controls are executed, such as a query command.

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- LLO (\$11)—** Local Lockout. If the CG 551AP is in the Remote State (REMS), this message causes the instrument to lock out all front-panel controls. If in the Local State (LOCS), this message causes the instrument to lock out all front-panel controls as soon as the instrument is set to a remote state.
- SDC (\$04)—** Selected Device Clear. Same as DCL message.
- SPE (\$18),—
SPD (\$19),—** Serial Poll Enable and Serial Poll Disable; configures instrument for serial poll capability.
- IFC
(Uniline)—** Interface Clear. This message resets the CG 551AP interface functions only; it does not affect the operating modes. Untalks and Unlistens all instruments on the bus.

LOW LEVEL CONTROL CHARACTERS

Control Character		
Hex Code	ASCII Name	Description
\$15	NAK	All settings command followed by 13 nonspaced bytes of position dependent setting information, ending with checksum with EOI asserted (15 bytes total).
\$16	SYN	An item command followed by individual bytes to set specific settings (not all 13 pieces of setting information required), ending with checksum and EOI asserted.
\$11	DC1	Query all settings command. Response is <\$15> <13 bytes of settings> <checksum—EOI>.
\$12	DC2	Query changed settings command. Response same as for \$11 query.
\$13	DC3	Low level form of READ? query, but response is in high level format.

POSITION DEPENDENT LOW LEVEL COMMANDS

Send in the order listed; after NAK (\$15)

Order	Setting	Hexadecimal Value			
1	EDGE	\$00	Positive edge		
	POLARITY	\$FF	Negative edge		
2	FRE- QUENCY	\$00	DC		
		\$01	10 Hz		
		\$02	100 Hz		
		\$03	1 kHz		
		\$04	10 kHz		
		\$05	100 kHz		
		\$06	1 MHz		
3	UNITS/ DIV	\$00	.4E-9	\$11	1E-3
		\$01	.5E-9	\$12	.2E-3
		\$02	1E-9	\$13	.5E-3
		\$03	2E-9	\$14	1E-3
		\$04	5E-9	\$15	2E-3
		\$05	10E-9	\$16	5E-3
		\$06	20E-9	\$17	10E-3
		\$07	50E-9	\$18	20E-3
		\$08	.1E-6	\$19	50E-3
		\$09	.2E-6	\$1A	.1E0
		\$0A	.5E-6	\$1B	.2E0
		\$0B	1E-6	\$1C	.5E0
		\$0C	2E-6	\$1D	1E0
		\$0D	5E-6	\$1E	2E0
		\$0E	10E-6	\$1F	5E0
		\$0F	20E-6		
		\$10	50E-6		
4	NUMBER OF DIVISIONS (MUL- TIPLIER)	\$01	1		
		\$02	2		
		\$03	3		
		\$04	4	\$07 and \$09	
		\$05	5	not allowed	
		\$06	6		
		\$08	8		
		\$0A	10		

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- | | | |
|----|--------------------------------|--|
| 5 | USE FOR
50 Ω
LOAD | \$00 Hi-Z, 50 Ω Off.
\$FF 50 Ω On. |
| 6 | SHIFT | 2's complement number for
shift position, -128_{10} to
$+127_{10}$. |
| 7 | MAG X10 | \$00 Off (Normal, Mag X1)
\$FF On |
| 8 | MODES | \$00 CURRENT
\$01 VOLTAGE
\$02 EDGE
\$03 FAST EDGE
\$04 SLEWED EDGE
\$05 MARKERS |
| 9 | CURRENT
LOOP | \$00 Off
\$FF On |
| 10 | OUTPUT | \$00 Off
\$FF On |
| 11 | Trigger | <p>8 7 6 5 4 3 2 1</p> <p>1 0 0 0 0 0 X X ON</p> <p>0 0 0 0 0 0 X X Off</p> <p>X 0 0 0 0 0 0 0 NORMAL</p> <p>X 0 0 0 0 0 0 1 RATE \div10</p> <p>X 0 0 0 0 0 1 1 RATE \div100</p> <p>e.g., for NORMAL, ON, byte = \$80
for RATE \div10, ON, byte = \$81</p> |
| 12 | VARIABLE | \$00 Off (fixed)
\$FF On |
| 13 | Error
Variable
Setting | <p>Use 2's complement number
-99_{10} to $+99_{10}$.</p> <p>\$FF \rightarrow \$9D = $-0.1 \rightarrow -9.9$
(LOW or SLOW)</p> <p>\$01 \rightarrow \$63 = $+0.1 \rightarrow +9.9$
(HIGH or FAST)</p> |

LOW LEVEL ITEM COMMANDS

Send in any order; after SYN (\$16)

Setting	Value
EDGE POLARITY	Basic Form \$X0, where X conveys polarity information. \$F0 Negative edge \$00 Positive edge
FREQUENCY	Basic Form \$X1, where X indicates decade. \$01 DC \$11 10 Hz \$21 100 Hz \$31 1 kHz \$41 10 kHz \$51 100 kHz \$61 1 MHz
UNITS/DIV	This is a two byte command. \$02 \$00 .4E9 \$02 \$01 .5E9 \$02 \$1F 5E0
NUMBER OF DIVISIONS (MULTIPLIER)	\$13 1 Division \$23 2 Divisions . . \$73 and \$93 not allowed
USE FOR 50 Ω LOAD	\$A3 10 Divisions \$F4 50 Ω ON \$04 Hi-Z, 50 Ω Off

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SHIFT		This is a two byte command where XX is hexadecimal representation of the 2's complement number indicating shift value.
	Basic Form	\$05 XX. \$05 \$FF => SHFT -1 (left) \$05 \$02 => SHFT 02 (right)
MAG X10	Basic Form	\$X6 \$F6 On \$06 Off (NORMAL, MAG X1)
Modes	Basic Form	\$X7 \$07 CURRENT \$17 VOLTAGE \$27 EDGE \$37 FAST EDGE \$47 SLEWED EDGE \$57 MARKERS
CURRENT LOOP	Basic Form	\$X8 \$F8 ON \$08 OFF
OUTPUT	Basic Form	\$X9 \$F9 ON \$09 OFF

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Trigger Rates

Basic Form \$XA, where X=MSB, A=LSB

X = MSB		LSB			
Trigger Output	Rate			A	
ON = 1	0	0	0	1	0 1 0
OFF = 0	0	0	1	1	0 1 0
	0	1	0	1	0 1 0

Examples:

\$8A TRIG ON, NORMAL
 \$9A TRIG ON, RATE ÷ 10
 \$AA TRIG ON, RATE ÷ 100

VARIABLE

\$FB ON
 \$0B Off (fixed)

Error Variable

Basic Form \$0C XX.

This is a two byte command where XX is the hex equivalent of the 2's complement representation of the desired value for the error variable multiplied by 10.

Examples:

\$0C \$FF PCT
 -0.1
 \$0C \$63 PCT
 9.9

STATUS BYTE INFORMATION

Introduction

The CG 551AP status byte (reported to the controller when the instrument is serial polled) contains the following information:

- Bit 8 — System status = 0 (most significant bit).
- 7 — Service requested = 1;
service not requested = 0.
- 6 — Abnormal condition = 1;
normal condition = 0.
- 5 — Busy decoding, executing, or waiting to complete READ? query operation = 1;
normal = 0.
- 4 — Encoded system status.
- 3 — Encoded system status.
- 2 — Encoded system status.
- 1 — Encoded system status.

Normal Condition System Status

The following status bytes are returned under normal operating conditions:

8	7	6	5	4	3	2	1	
0	1	0	X	0	0	1	0	— Operation complete, CONTINUE button pressed.
0	0	0	0	0	0	0	0	— Nothing to report.
0	1	0	X	0	0	0	1	— Power-on condition.
0	1	0	X	0	0	0	0	— SRQ query request (INST ID button was pressed).

The power-on condition cannot be cleared by the Device Clear (DCL or SDC) message. The power-on request for service (rsv) is cleared only by handshaking out the status byte to the controller.

The SRQ query request is similar to the ERR query request. The controller should send SRQ? to retrieve the status byte.

Abnormal Condition Status

Abnormal conditions (errors) are reported before other status (except when replaced by the power-on condition). There are three abnormal condition status bytes; they are:

8	7	6	5	4	3	2	1	
0	1	1	X	0	0	0	1	— Command error.
0	1	1	X	0	0	1	0	— Execution error.
0	1	1	X	0	0	1	1	— Internal error.

Command error indicates that the instrument has received a command which it cannot understand or implement under any circumstances. The command will not affect the state of the instrument.

Execution error indicates that the instrument has received a command which it understands, but cannot execute due to present state of the instrument or the command is out of instrument range.

Internal error indicates that the instrument is uncalibrated or has detected a hardware failure; error may result from the self-test routine.

CG 551AP ERROR MESSAGES

NOTE

Error messages 11, 12, 95 through 98, and the read only memory (ROM) errors do not cause the CG 551AP to assert the SRQ line on the GPIB. All others will cause SRQ to be asserted except when they are prevented from doing so by a high level command, such as MASK or RQS OFF.

The error messages may be displayed and, when requested, reported to the GPIB controller.

Error Message	Description
61	Rom check error

CG 551AP Reference Guide

Error Message

- 1 Current overload, UNCAL.
- 2 Voltage overload, UNCAL.
- 3 Edge overload, UNCAL.
- 4 No pulse head attached; FASTEDGE command received from GPIB.
- 5 Accessory head shorted.

NOTE

Errors 1, 2, and 3 cause UNCAL to be displayed, but error message number is reported to the controller.

- 11 Stored ram memory failure.
- 12 General usage ram memory failure.
- 13 Error in saved settings, set to defaults.
- 14 Main loop out of lock.
- 15 Reference loop out of lock.
- 16 Offset loop out of lock.
- 17 Internal calibration constants out of cal. If in AMPLITUDE mode and this error was indicated at power on, a U will be displayed where /D would normally be displayed.

NOTE

Errors 11 and 12 will not allow operation of the CG 551AP after an error condition is indicated.

Error
Message

- 21 Invalid command keyword.
- 22 Combined decoded settings not executable.
- 23 Last response may not be repeated (RPT?).
- 24 Value error—argument not in range.
- 25 Format error—invalid use of semicolon.
- 26 Input buffer overflow (too many characters in message).
- 27 Invalid character in command.
- 28 Hex argument error.
- 31 Invalid command byte.
- 32 Invalid subcommand (invalid setting for MODE).
- 33 Invalid subcommand.
- 35 Format error.
- 36 Checksum error.
- 41 Unrecognized addressed command group (ACG) message.
- 43 System error (invalid error code).
- 44 Invalid output encoding.
- 45 Unrecognized universal command group (UCG) message.
- 46 Output request error.
- 47 Output buffer overflow.
- 51 1 V 50 Ohm DC Low SAC
- 52 1 V Hi-Z DC Low SAC
- 53 1 V 50 Ohm 1 kHz Low SAC
- 54 20 V Hi-Z DC High SAC
- 55 20 V Hi-Z 1 kHz High SAC
- 56 100 mA 50 Ohm DC Current Amplifier and Chopper

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Error Message

57	100 mA	50 Ohm	1 kHz	Current Amplifier and Chopper
81	+1 V	50 Ohm	DC	Low Edge Generator (Negative)
82	+1 V	50 Ohm	1 kHz	Low Edge Generator (Negative)
83	-1 V	50 Ohm	DC	Low Edge Generator (Positive)
84	-1 V	50 Ohm	1 kHz	Low Edge Generator (Positive)
85	-5 V	Hi-Z	DC	Mid Edge Generator (Positive)
86	-5 V	Hi-Z	1 kHz	Mid Edge Generator (Positive)
87	-20 V	Hi-Z	DC	High Edge Generator (Positive)
88	-20 V	Hi-Z	1 kHz	High Edge Generator (Positive)
91	1 sec timing accuracy with respect to 10 kHz reference frequency.			Count Down Circuit, Reference Divider.
92	.5 sec timing accuracy with respect to 10 kHz reference frequency.			Count Down Circuit, Reference Divider.
93	.2 sec timing accuracy with respect to 10 kHz reference frequency.			Count Down Circuit, Reference Divider.
94	Cannot perform timing accuracy tests.			TS1 Error Gates.

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Error Message

- | | | |
|----|------------------------------------|--|
| 95 | TS1 data register not functioning. | Data Registers, Slewing Data Register, Trigger Data Register, and Slewing Control. |
| 96 | TS2 data register not functioning. | Marker Data Register. |
| 97 | VS1 data register not functioning. | Reference Data Register, Data Isolators, and Floating Data Register. |
| 98 | VS2 data register not functioning. | Power On Test, Output Relay Control. |

NOTE

Errors 95 through 98 will not allow operation of the CG 551AP after error indication.

ASCII & IEEE 488 (GPIB) CODE CHART

BITS B7 B6 B5	0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
	CONTROL				NUMBERS SYMBOLS				UPPER CASE				LOWER CASE			
B4 B3 B2 B1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0 0 0 0	NUL	DLE	SP	0	@	P	'	p								
0 0 0 1	SOH	DC1	!	1	A	Q	a	q								
0 0 1 0	STX	DC2	"	2	B	R	b	r								
0 0 1 1	ETX	DC3	#	3	C	S	c	s								
0 1 0 0	EOT	DC4	\$	4	D	T	d	t								
0 1 0 1	ENQ	NAK	%	5	E	U	e	u								
0 1 1 0	ACK	SYN	&	6	F	V	f	v								
0 1 1 1	BEL	ETB	'	7	G	W	g	w								
1 0 0 0	BS	CAN	(	8	H	X	h	x								
1 0 0 1	HT	EM	)	9	I	Y	i	y								
1 0 1 0	LF	SUB	*	:	J	Z	j	z								
1 0 1 1	VT	ESC	+	;	K	[	k	{								
1 1 0 0	FF	FS	,	<	L	\	l	!								
1 1 0 1	CR	GS	-	=	M	]	m	}								
1 1 1 0	SO	RS	.	>	N	^	n	~								
1 1 1 1	SI	US	/	?	UNL	UN1	o	UBOUT (OELS)								

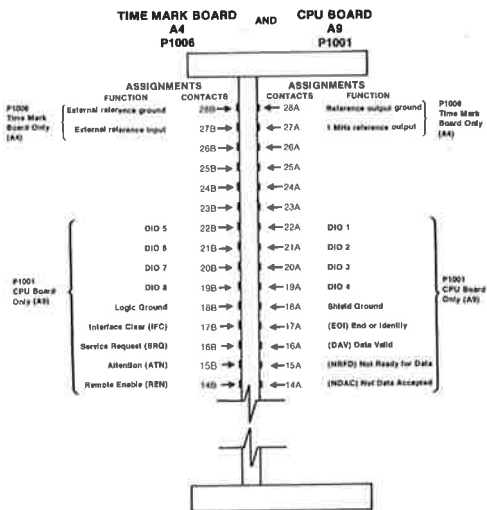
KEY

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

2690-10

Fig. 17. ASCII & IEEE 488 (GPIB) Code Chart.

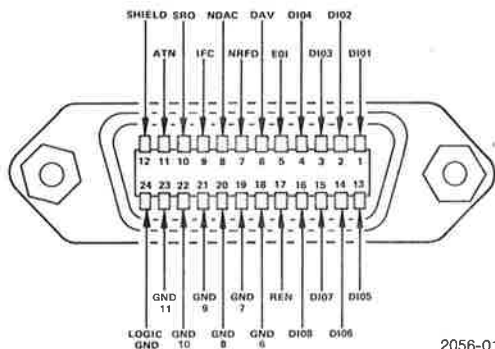
GPIB/TIME REFERENCE (REAR INTERFACE)



2815-68

Fig. 18. GPIB/Time Reference, rear interface connections.

GPIB CONNECTOR



2056-01

Fig. 19. Standard GPIB connector.

NOTE

Refer to IEEE Standard 488-1978 for more detailed information. The standard is published by the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, New York 10017.

PROGRAMMING NOTES

GPIB CONNECTOR

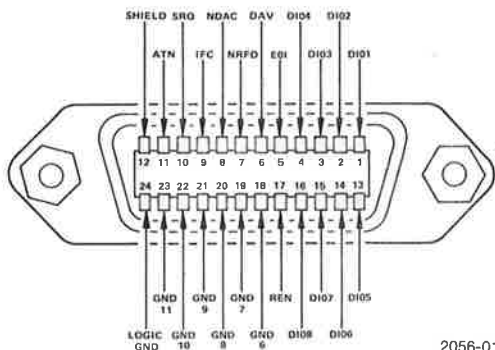


Fig. 19. Standard GPIB connector.

NOTE

Refer to IEEE Standard 488-1978 for more detailed information. The standard is published by the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, New York 10017.

PROGRAMMING NOTES

