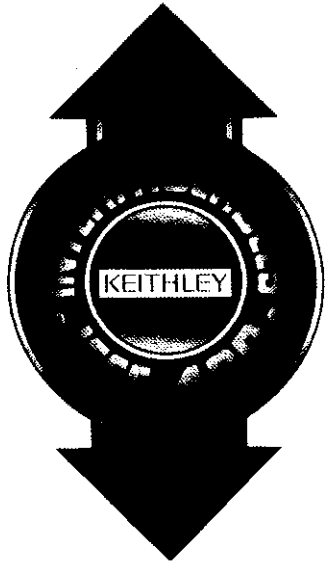
Reference & Program Instructions



Model 775 Programmable Counter/Timer

INTRODUCTION

This reference and programming guide contains information on IEEE-488 programming. Where applicable, typical uses and examples for the various operating modes are included.

IEEE-488 information includes a list of commands that can be used to program the instrument over the IEEE-488 bus and simple programs for popular IEEE-488 controllers.

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IEEE-488 PROGRAMMING

DEVICE-DEPENDENT COMMANDS

FUNCTION	
F0	Frequency on channel A
F1	Frequency on channel B
F2	Period on channel A
F3	Period average on channel A
F4	Time interval from A to B
F5	Pulse on channel A
F6	Frequency on channel C

COUPLING	
AC0	DC coupled on channel A
AC1	AC coupled on channel A
BC0	DC coupled on channel B
BC1	AC coupled on channel B

ATTENUATOR	
AA0	x1 attenuator on channel A
AA1	x10 attenuator on channel A
BA0	x1 attenuator on channel B
BA1	x10 attenuator on channel B

FILTER	
AF0	Filter Off on channel A
AF1	Filter On on channel A
BF0	Filter Off on channel B
BF1	Filter On on channel B

SLOPE	
AS0	Positive slope on channel A
AS1	Negative slope on channel A
BS0	Positive slope on channel B
BS1	Negative slope on channel B

TRIGGER LEVELS	
ALn	Set trigger level for channel A
BLn	Set trigger level for channel B n=(sign)d.ddE(sign)d d=digit

RATE	
S0	One-shot on T or GET
S1	Normal. 3 readings per second.
S2	Fast. 25 readings per second.
S3	Dump. 140 readings per second.

GATE TIME	
Gn	Set the gate time in seconds. n=dE(sign)d d=digit
GU	Set gate time to user gate.

DELAY TIME	
Wn	Set the delay time in seconds. n=dE(sign)d d=digit
WU	Set delay time to user delay.

DELAY	
I0	Delay disabled
I1	Delay enabled

DISPLAYED DIGITS	
Nn	Set maximum displayed digits (n=3 to 9)

TRIGGER	
T	One-shot in S0 mode

EOI	
K0	EOI enabled
K1	EOI disabled

SRQ MASK	
M0	SRQ disabled
M1	SRQ on overflow
M2	SRQ on self-test done
M8	SRQ on reading done
M16	SRQ on ready
M32	SRQ on error

TERMINATOR	
Y0	CR LF
Y1	LF CR
Y2	CR
Y3	LF
Y4	No terminator

DISPLAY MODE	
D0	Display the measurement
D1	Display the gate time
D2	Display the delay time
D3	Display the trigger level
D4abcX	Display the ASCII message "abc"

DATA FORMAT	
P0	Readng with prefix, without leading zeros
P1	Reading without prefix, without leading zeros
P2	Reading with prefix, with leading zeros
P3	Reading without prefix, with leading zeros

SELF TEST	
J	Test ROM, RAM

DATA CONTROL	
B0	Send measurement data string
B1	Send gate time data string
B2	Send delay time data string
B3	Send trigger level A data string
B4	Send trigger level B data string

STATUS WORD	
U0	Send operating mode status
U1	Send error status

EXECUTE	
X	Execute other device-dependent commands

DEFAULT CONDITIONS (POWER UP/SDC/DCL)

Mode	Value	Status
Function	F0	Frequency on channel A.
Coupling	AC0	DC coupled on channel A.
Attentuator	AA0	*x1 attenuator on channel A.*
Filter	AF0	Filter off on channel A.
Slope	AS0	Positive slope on channel A.
Coupling	BC0	DC coupled on channel B.
Attenuator	BA0	x1 attenuator on channel B.
Filter	BF0	Filter off on channel B.
Slope	BS0	Positive slope on channel B.
Delay	I0	Delay disabled.
Display Mode	D0	Display the measurement.
Data Format	P0	Reading with prefix, without leading zeros.
Displayed Digits	N9	Set maximum displayed digits to 9.
EOI	K0	EOI enabled.
SRQ Mask	M0	SRQ disabled.
Rate	S1	Normal 3rdgs per second.
Terminator	Y0	CR LF
Gate Time	G0	One second gate time.
Delay Time	W0	One second delay time.
Trigger Level	AL0	0V
Trigger Level	BL0	0V
Terminator	CR LF	

STATUS BYTE INTERPRETATION

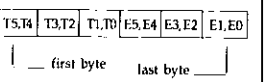
Bit Number	B7 (MSB)	B6	B5	B4	B3	B2	B1	B0 (LSB)
Inter-pretation	0	RQS	Error	Ready	Reading Done	0	Self-Test Done	Over-flow

STATUS WORD FORMAT

Command	Status Word Format*
U0	775 F AC AA AF AS BC BA BF BS I D P N K M S Y (CR LF)
U1	775 IDDC IDDCO GATEERROR SELFTEST 0 0 0 0 0 (CR LF)

*CR LF is normal terminator. The terminator may be changed (see Instruction Manual).

DUMP MODE SPECIFICATIONS

Device-depedent Command:	S3
Display During Dump:	bu,SY
Processing Time Between Measurements:	Less than 5.5msec (measurement processing and display are suppressed).
Data Transfer:	Controller speed dependent (2.75msec using PSI 80 controller).
Minimum Readings/Sec:	40 (with a gate time of 9.99999msec).
Maximum Readings/Sec:	140 (with a gate time of 100μsec).
Operational Functions Disabled During Dump:	Normal display, external trigger.
Data Format:	Packed BCD except terminator.
Output Format:	
Interpretation:	T5-T0=TIME REGISTER E5-E0=EVENT REGISTER
Gate Time Limits:	100μsec to 9msec with internal gate time. 100μsec to 9.99999msec with external gate time.
Overflow Indication:	999999 in either time or event registers. Overflow bit in the SPOLL byte is set, RQS in M1 mode.

DUMP MODE SPECIFICATIONS (CONT.)

Conditions that cause overflow:

1. Gate time longer than 9.99999msec.
2. In *FREQ A or B* and *PERIOD AVG* when maximum frequency x gate time is greater than 999,999, but under no condition should gate time be longer than 9.99999msec.
3. In TIME INTERVAL A to B, PERIOD A and PULSE A + delay time longer than 9.99999msec.
4. In FREQ C when frequency/256 x gate time is greater than 999,999.

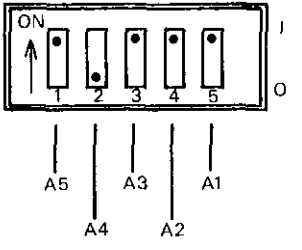
DUMP MODE (S3 RATE)
(Entered on HP-85)

PROGRAM	COMMENTS
	Program to exercise binary dump of 775.
10 D=723	
20 DIMG$[33],A$[11], A(8)	
30 REMOTE D	
40 INPUT G$	
50 OUTPUT D;G$	Configure 775 use "G.001S3X"for this example.
55 P=SPOLL (D)	
56 DISP''SPOLL='';P	B0 is OFLO bit.
60 ENTER D; A$	
61 FOR I=1 TO 6 @ A(I)=NUM (A$[I])@ NEXT I	Binary equivalent of BCD string.
64 I=1 @ GOSUB 200 @ T=R	Decimal time value.
66 I=4 @ GOSUB 200 @ E=R	Decimal event count.
68 F=10 ↑8*(E/T)	Calculate frequency.
70 DISP''FREQ='';F	
71 DISP''LSD OF RESOLUTION='';F/T	
80 GOTO 40	
200 R=0	Packed BCD to decimal conversion.
202 FOR N=2 TO 0 STEP -1	
210 R=R+(A(I+N) MOD 16+A (I+N) DIV 16*10)*10 ↑ (2*(2-N))	
225 NEXT N	
230 RETURN	

PRIMARY ADDRESS SELECTION

DESCRIPTION

The primary address of the Model 775 is set to 23 at the factory, but it may be changed to other values between 0 and 30 by setting the ADDRESS DIP switches to the correct values, prior to power up.



PROGRAMS

The following programs are written as a simple aid to the user and are not intended to suit specific needs. Detailed programming instructions may be found in the Model 775 Instruction Manual.

These programs allow you to send a device-dependent command string to the instrument and obtain and display the instrument data string on the computer CRT.

Note that faster controllers require a delay between configuring the Model 775 (ie F2X) and asking for a data string from the Model 775. This can be a 5msec wait or a serial poll of the "ready bit".

PROCEDURE

Prior to power up, set the address switches of the Model 775 to 23 and connect the Model 775 to the IEEE-488 computer interface.

Enter the program as it is shown (comments are optional) and run the program. When prompted for input, type in a command string (eg. AS1X will select negative slope), and observe the results.

NOTE: If the Model 775 does not have an input signal (i.e. the gate is not running), no valid reading is available to send over the bus.

IBM XT or PC (Keithley 8573 GPIB Interface)

The following program sends a command string to the Model 775 and displays the reading on the computer CRT. The IBM PC computer must be equipped with the Keithley Model 8573 IEEE-488 interface and DOS 2.0. The Model 8573 software must be configured as described in the Model 8573 Instruction Manual.

DIRECTIONS

1. Type in BASICA on the computer keyboard to get into the IBM interpretive BASIC language.
2. Place the interface software disc in the default drive, type LOAD"DECL", and press the return key.
3. Add the lines below to lines 1-6 which are now in memory. Modify the address in lines 1 and 2, as described in the Model 8573 Instruction Manual.
4. Run the program and type in the desired command string.
5. The instrument reading string will then appear on the display.
6. To exit the program, type in EXIT at the command prompt and press the return key.

PROGRAM	COMMENTS
10 CLS	
20 NA$="GPIB0":CALL IBFIND (NA$,BRD0%)	Look up the controller *configuration.*
30 NA$="DEV1":CALL IBFIND (NA$,M775%)	Look up the device configuration.
40 V%=23:CALL IBPAD (M775%,V%)	Set 775 address to 23.
50 V%=1:CALL IBSRE(BRD0%,V%)	Set remote enable true.
60 INPUT"COMMAND":CMD$	Prompt for command string.
70 IF CMD$="EXIT" THEN 150	See if program is to be halted.
80 IF CMD$="" THEN 60	If null command string go back and get another.
90 CALL IBWRT(M775%,CMD$)	Address 775 to listen and send command string.
100 RD$=SPACE$(25)	Assign reading input buffer.
110 CALL IBRD(M775%,RD$)	Address 775 to talk and input reading string.
120 *RD$=LEFT$(RD$,IBCNT%)*	*Trim string to proper* size.
130 PRINT RD$	Display the reading on the CRT.
140 GOTO 60	Repeat.
150 V%=0:CALL IBONL(BRD0%,V%)	Close the controller file.
160 CALL IBONL(M775%,V%)	Close the device file.
170 END	

NOTE: If the Model 775 does not have an input signal (i.e. the gate is not running), no valid reading is available to send over the bus. In this case, the IBRD statement, in line 110, will time out after approximately 10 seconds.

APPLE II (APPLE Interface)

The program below obtains one reading from the Model 775 and displays the reading on the APPLE II screen, using an APPLE IEEE-488 interface.

DIRECTIONS

1. Enter the program below using the RETURN key after each line.
2. Type in RUN.

PROGRAM	COMMENTS
10 Z$=CHR$(26)	
20 INPUT ''TEST SETUP?'' ;B$	Enter programming command. (eg. B1X will return gate time)
30 PR#3	Send output to IEEE bus.
40 IN#3	Get input from IEEE bus.
50 PRINT ''RA''	Turn remote on.
60 PRINT ''MT?'';Z$;B$	Output programming command to 775.
70 PRINT ''LF1''	Linefeed on.
80 PRINT ''RDW'';Z$; INPUT'' '';A$	Read data from 775.
90 PRINT ''UT''	Untalk.
100 PR#0	Send output to CRT.
110 IN#0	Get input from keyboard.
120 PRINT A$	Display data string.
130 GO TO 20	Repeat
140 END	

NOTE: If conversion to numeric variable is desired, add the following:

124 A=VAL(MID$(A$,5,16))	Convert string to numeric value.
126 PRINT A	

HP 85

The program below obtains one reading from the Model 775 and displays the reading on the HP 85 CRT screen, using the 82937A GPIB interface and an I/O ROM.

DIRECTIONS

1. Depress SHIFT SCRATCH and then depress END LINE to erase previous program.
2. Enter program below using the END LINE key after each line is typed. (Type in line numbers.)
3. Depress the RUN key.

PROGRAM	COMMENTS
`10 DIM A$[25], B$[25]`	
`20 REMOTE 723`	Set to remote.
`30 DISP "TEST SETUP"`	Prompt for test setup.
`40 INPUT B$`	
`50 OUTPUT 723;B$`	Program the 775.
`60 ENTER 723;A$`	Get data from 775.
`70 DISP A$`	
`80 GO TO 30`	Repeat
`90 END`	

NOTE: If conversion to numeric variable is needed, change line 70 as follows:

```
70 DISP VAL(A$[5])
```

HP 9825A

The program below obtains one reading from the Model 775 and displays the reading on the HP 9825A using a 98034A HPIB interface and a 9872A extended I/O ROM.

DIRECTIONS

1. Enter program below, using the STORE key after each line.
2. Depress the RUN key.

PROGRAM	COMMENTS
0 dim A$[20], B$[20]	To dimension data string.
1 dev ''775'', 723	Define Model 775 Channel A address.
2 rem ''775''	Set to remote.
3 ent ''TEST SETUP'',A$	Enter programming command.
4 wrt ''775'', A$	Output program command to Model 775 via IEEE bus.
5 WAIT 10	
6 red ''775'',B$	Read data from Model 775 via IEEE bus.
7 prt B$	Print data on hard copy printer.
8 gto 2	Repeat.

7 ''e''-B$[13,13];flt5	Convert to numeric value.
8 prt val(B$[5])	
9 gto 3	Repeat.

HP 9816

The following programs sends a command string to the Model 775, obtains a reading, displays it on the HP 9816 screen, using BASIC 2.0

DIRECTIONS

1. Type EDIT and press the EXEC key.
2. Type in the program below using the ENTER key after each line is typed.
3. Press the run key.

PROGRAM	COMMENTS
10 REMOTE 723	Set to remote.
20 INPUT "TEST SETUP", A$	Prompt for test setup.
30 OUTPUT 723;A$	Send command string to 775.
35 WAIT .01	10msec delay before read.
40 ENTER 723;B$	Get data string from 775.
50 PRINT B$	Display data string.
60 GO TO 20	Repeat.
70 END	

NOTE: If conversion to numeric variable is desired, change lines 40 and 50 as follows:

```
40 ENTER 723;B
50 PRINT B
```

DEC LSI 11

The program below obtains one reading from the Model 775 and displays the reading on the DEC LSI 11 microcomputer CRT terminal. The LSI 11 must be hardware configured with 16k words of RAM an IBV 11 IEEE interface. The software must be configured with IB software as well as the FORTRAN and the RT 11 operating system.

DIRECTIONS

1. Enter the program below, using the editor under RT 11 and the name IEEE.FOR.
2. Compile using the FORTRAN compiler as follows: FORTRAN IEEE
3. Link with the system and IB libraries as follows: LINK IEEE, IBLIB
4. Type RUN IEEE and depress the RETURN key.
5. The display will read "ENTER ADDRESS". (Enter 23).

PROGRAM IEEE	COMMENTS
PROGRAM IEEE	
INTEGER*2 PRIADR	
LOGICAL*1 MSG(80), INPUT (80)	
DO 2 I=1, 10	
CALL IBSTER (I,0)	!Turn off errors.
2 CONTINUE	
CALLIBSTER (15,5)	!Allow 5 error 15's.
CALL IBTIMO (120)	!Allow 1 sec. bus timeout.
CALL IBTERM (10)	!Set line feed as terminator.
CALL IBREN	!Turn remote on.
4 TYPE 5	
5 FORMAT (1X,'ENTER ADDRESS: ',$)	!Input the address.
ACCEPT 10, PRIADR	
10 FORMAT (I2)	
12 TYPE 15	
15 FORMAT (1X, 'TEST SETUP: ',$)	
CALL GETSTR(5,MSG,72)	!Get the test setup.
CALL IBSEOI(MSG,-1, PRIADR)	!Program the instrument.
18 I=IBRECV (INPUT,80, PRIADR)	!Get the data from the instrument (May require a 10msec wait).
INPUT(I+1)=0	
CALL PUTSTR (7, INPUT, '0')	
CALL IBUNT	!Untalk the instrument.
GO TO 12	!Repeat it.
END	

PET/CBM 2001

The program below obtains one reading from the Model 775 and displays the reading on the PET/CBM 2001 Series.

DIRECTIONS

1. Enter the program below using the RETURN key after each line.
2. Type RUN and depress the RETURN key.

PROGRAM	COMMENTS
10 OPEN 6,23	Open file 6, primary address 23.
20 INPUT ''TEST SETUP'' ;B$	Enter programming command. (eg. B1X will return gate time)
30 PRINT #6,B$	Output to the IEEE bus.
40 INPUT #6,A$	Read data from the Model 775 via IEEE bus.
50 IF ST=2 THEN 40	If time out, input again.
60 PRINT A$	Print data.
70 GO TO 20	Repeat

NOTE: If conversion to numeric variable is desired, omit line 70 and type the following:

70 A=VAL(MID$(A$,5,15))	Convert to numeric variable.
80 PRINT ''A='';A	
90 GO TO 20	Repeat

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