

MODEL #210

i n t e r l o o p

706 Charcot Avenue • San Jose, California 95131
(408) 922-0520

HPIL IO INTERFACE

FEATURES:

- ▶ TTL-compatible IO from HPIL
- ▶ 4 8-bit output ports, 2 8-bit input ports
- ▶ 8 analog input channels
- ▶ On-board analog reference, offset, and -12v converter
- ▶ HPIL-readable DIP switch
- ▶ Byte and Bit output operation
- ▶ 7 time increments counters
- ▶ 7 event counters

APPLICATIONS:

- ▶ Robotics
- ▶ Automated equipment
- ▶ Process control and monitoring

DESCRIPTION

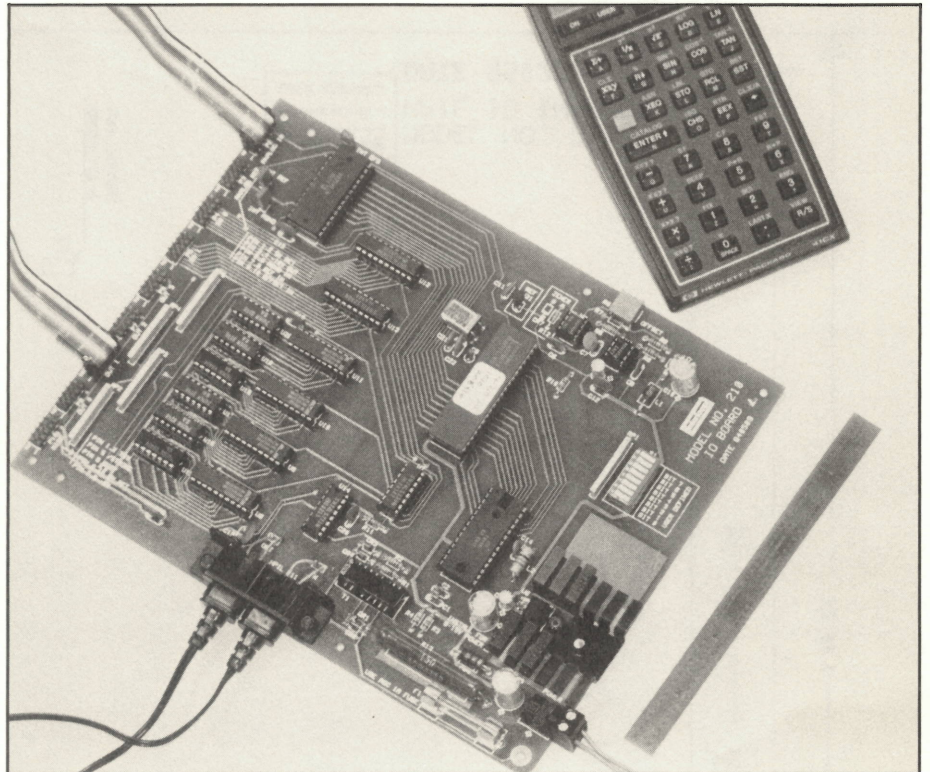
The INTERLOOP model #210 IO Interface allows the OEM a method of controlling a complex system via HPIL. The 32 output lines can be used as byte outputs, bit outputs, or output together as a 32-bit group. In addition, one 8-bit port may be used as a centronics-compatible port.

Two TTL-compatible input ports are also included, and an 8-bit DIP switch mounted on the board is readable from HPIL for user-defined use.

The IO interface also contains an analog input section, giving 8-bit resolution on 8 analog input channels. An on-board DC-DC converter generates a -12v power supply (accessible off-board) for analog reference and other circuitry.

The Model #210 incorporates 7 time increment counters and 7 event counters. The possible time increment command range is from .00067 seconds to .01224 seconds. These counters consist of 2 bytes or 16 bits which give a total capacity of 65,536 counts before rolling over.

The Model #210 is an unpackaged, OEM PC board.



SPECIFICATIONS:

Meets electrical and mechanical specifications on HPIL.

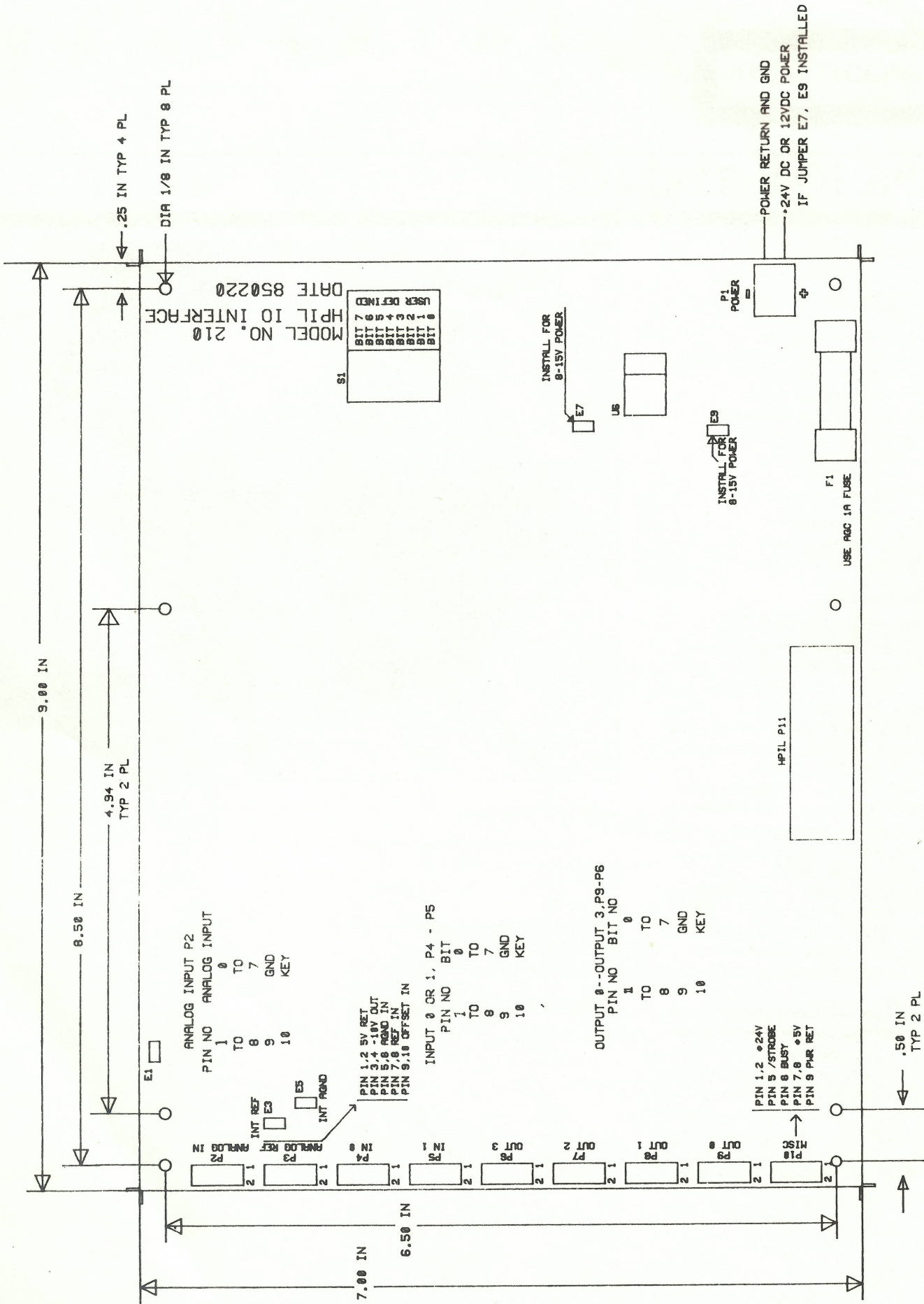
DIGITAL INPUTS: TTL compatible (74LS244).

OUTPUT PORTS: TTL compatible (7406 w/4.7k pullup).

ANALOG INPUTS: 0-6.9, approx. 10k Zin.

POWER REQ.: 8-24V, .5 Amps

DATE: 870121





i n t e r l o o p

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MODEL 210 HPIL IO INTERFACE COMMAND LIST

OUTPUT PORT COMMANDS

<Bpnnn> BYTE-Outputs a byte to specified output port.
<Snt> SET BIT-Set a bit of specified output port.
<Cnt> CLEAR BIT-Clears a bit of OUT 0-3
<Hnnn> HIGH-Used with Low command, allows bit#7 of output 3 to toggle with a continuous pulse rate.
<Lnnn> LOW-See HIGH command.
<Oaaaabbbbccccddd>OUT ALL-Outputs all four bytes of output with one command.

TIMER COMMAND

<Tnnn> Sets global time increment and sets reading mode.

INPUT PORT COMMANDS

TIME READING MODE: Returns string that includes 7 timer values and 7 event counter values.

DATA READING MODE: Returns string that includes input port values(2 bytes present value and 2 bytes latched value) and A to D converter values (8 channels, 1 byte per channel)

HP71 ex: ENTER :1;A\$

OTHER COMMANDS

SST or SEND STATUS-When SST is received the model 210 sends a single byte showing status of BUSY line, status of bit 7 output port 3, and then sends 4 more bytes representing the ports.

SEND DEVICE ID(SDI) - Sends message: IL210

INTERFACE CLEAR - Removes talker or listener status.

DEFAULT ADDRESS - Defaults to loop address of 07 on power up.

DEVICE CLEAR - Sets output ports to logic 0 and the command buffer is cleared.

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

FILE:D206809 (880318)

DASH HISTORY:

-0 TO -1

add semicolon as terminator(;), reset HPIL chip on auto address not unlisten, remove (cr)(lf) from the send status output, add pulse (H & L) command

-1 TO -2

replaces 1 mH inductor with larger 1.2 mH inductor for more -12V current

PC BOARD CONFIGURATION:

PC Board #: 4210,206302

Processor #: 510,208429

*** ALL EXAMPLES SHOWN ARE FOR THE HP71 COMPUTER with a Model #210-2 connected as the first device.

Accessory ID number of the Model 210 using Processor #208429+ is E2 HEX. The HP71 command is DEVAID(X) when X = the position of the device on the loop.

1.0 COMMAND FORMAT

Listen commands are sent as ascii bytes, and are terminated with the first receipt of a <lf>, <;>, or an ENDxx byte. Characters must be entered in uppercase, and numeric data must be ACI numerals 0-9 or the data will be ignored.

Example: OUTPUT :1;'S32;C01' This will set pin#2 of connector P6 to 5 volts.

Talk commands are simply the interface commands, i.e. SDA, SST,SDI. The Model#210 responds to these commands by sending the appropriate data followed by a <cr>, <lf>, and EOT.

Note: The SST or Send Status does not send <cr> or <lf>.

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

Example: SFLAG -23 @ ENTER :1 ;A\$ @ GDISP A\$

This will show IN0, IN1, the A/D converter values and the dip switch setting as columns of dots on the HP71 display. SFLAG -23 should be done once. It causes an ENTER statement to terminate on the receipt of an HPIL END byte.

Before accepting any of these commands, the IO controller must be properly addressed as a talker or listener as appropriate. ENTER, OUTPUT and SPOLL will automatically take care of talker and listener addressing.

Additional characters before <lf> or <;> are ignored but trailing characters start the next command.

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

2.0 LISTEN COMMANDS

2.1 Byte command

This command outputs a byte to specified output port.

Syntax: Bpnnn where p is a OUT number 0-3
nnn is a three digit number evaluated as an
ascii byte

Example: OUTPUT :1;'B1020'
This will set bit#2&4 high and the rest low on OUT 1
(connector#P8.)

2.2 Set bit command

This command sets a specified bit of OUT 0-3.

Syntax: Snt where n is an OUT number 0-3
t is a bit number 0-7

Example: OUTPUT :1;'S12;S14'
This will set bit#2&4 high and leave the rest as they were
on OUT 1.

2.3 Clear bit command

This command clears a bit of OUT 0-3.

Syntax: Cnt where n is an OUT number 0-3
t is a bit number 0-7

Example: OUTPUT :1;'C35;S35;C35'
This command will pulse bit#5 of OUT 3 to 5 volts for less
then .003 seconds. (pin#6 connector#P9)

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REFERENCE MANUAL

2.4 High command

id bit #7 & il pin 8

This command in conjunction with the Low command, allows bit #7 of OUT 3 to toggle with a continuous pulse rate. It can be used to do proportional control for a heater. When the Model #210 is cleared or on power up the high command and low command are set to 0.

The first High or Low command with a non 0 value puts bit #7 to that state. The first High or Low command of 0 puts bit #7 to the opposite state.

Syntax: Hnnn where nnn is a three digit number evaluated as 0-255.

Example: OUTPUT 1;"LO10;H090"

This will give a 90% on time pulse every 100 time increments.

Note: The status of bit #7 can be checked on the first status byte bit #1.

Example: IF BIT(MOD(SPOLL(1),256),1)THEN BEEP

Computer beeps when bit #7 of OUT 3 is high.

2.5 Low Command

See 2.4 High command

Syntax: Lnnn where nnn is a three digit number evaluated as 0-255

2.6 Out all command

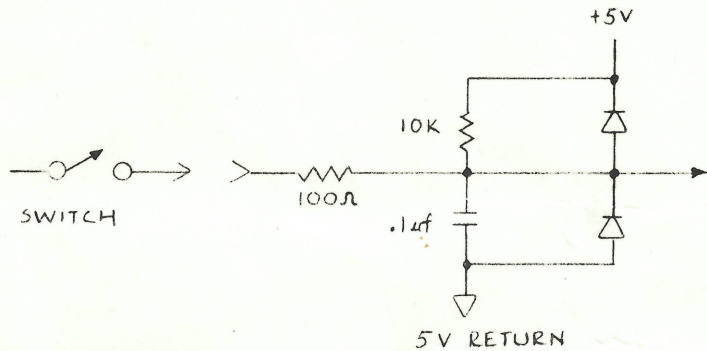
This command allows you to output all four bytes of output with one command.

Syntax: Oaaabbbcccd where aaa,bbb,ccc,ddd are three digit numbers evaluated to an ascii byte in order of OUT 0,1,2&3

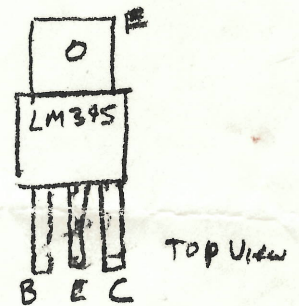
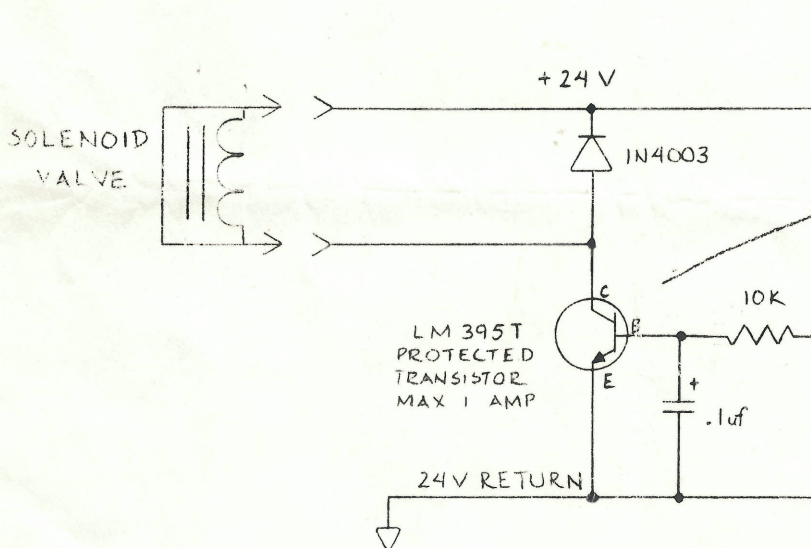
Example: OUTPUT :1;'0255000255255'

This will set all bits of OUT 0,2,3 to a high state and all bits of OUT 1 to a low state.

APPLICATION			REVISION			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVE	



CONNECT TO ANY PIN #1 - #7 OF INPUT PORT ON MODEL 200-1 OR MODEL 210



CONNECT TO ANY PIN #1 - #7 OF OUTPUT PORT ON MODEL 200-1 OR MODEL 210

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:

FRACTIONS DECIMALS ANGLES
 ± .XX ± ±
 .XXX ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS DATE

DRAWN JOHN 850520

CHECKED



2000-7 WYATT DR
 SANTA CLARA, CA. 95054
 (408) 986-9707

CIRCUIT FOR INPUT AND OUTPUT PORTS FOR MODEL 200-1 OR MODEL 210

SIZE	CODE IDENT NO.	DRAWING NO.
A		2242

SCALE	SHEET	OF
-------	-------	----

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

2.7 Timer command

The Model#210 incorporates 7 time increment counters and 7 event counters. Unless commanded otherwise, once every .010 seconds the input ports are read, this is a time increment of .010 seconds (read time is less than .000001 sec.). Immediately after a read, a count is added to the appropriate time increment counter if the input pin is found to be low and the prior read found it to be low also. A count is also added to the appropriate event counter if the prior read found the input pin high. These counters consist of 2 bytes or 16 bits which give a total capacity of 65536 counts before rolling over. These counters are only reset at power-up.

Syntax: *Tnnn* where *n* is a three digit number evaluated as 000-255.

This command provides two functions if T000 is sent all following Send Data commands return the 13 bytes as shown in Table A (see sect 3.2 SDA). If *Tnnn* is sent where *nnn* is greater than 000 then all following Send Data Commands return the 28 bytes as shown in Table B (see sect 3.2 SDA).

The *nnn* part of the *Tnnn* command sets the time increment that will be used until a new one is sent. This increment is .000048 seconds times the *nnn* value.

Example:

command	time increments	notes
T000		only changes data sent to Table A type data.
T018	.000864 sec	shortest usable time inc.
T021	.0010 sec	
T209	.0100 sec	power-up setting
T250	.0120 sec	
T255	.01224 sec	max time inc.

On power-up the time increment of 209 or .010 sec is set and the T000 mode is enabled (see table A in sect 3.2).

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

3.0 TALK COMMANDS

When sending data, all outputs will be terminated by <cr>,<lf>, and EOT.

3.1 SST

If a send status interface function is received after being addressed as a talker, the Model#210 will respond with five bytes.

The bits in the first byte decode as follows:

- bit 0 -- BUSY line associated with output OUT 0.
- bit 1 -- This bit will be set if bit 7 of output 3 is set and cleared if not.
- bit 2 -- This bit is set only at power-up then cleared after the first SST read.

Example: S=SPOLL(1) @ GDISP CHR\$(MOD(S,256))

In the HP71 display the first column of dots will represent the bits of the first status byte.

The second through fifth bytes are copies of the output ports 0-3, sent to allow the controller to read what OUT 0-3 are set to.

Note: this command may send unprintable bytes.

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MODEL 210-2 HPIL IO INTERFACE

REFERENCE MANUAL

3.2 SDA

If a Send Data (SDA) command is received, the Model#210 will respond with a string of bytes and a <cr><lf>. They have the following meaning:

Table A: This table is used if the last Tnnn command was T000

byte 1	--	IN0, bits 0-7 = pins #1-#8, connector#P6
byte 2	--	IN1, bits 0-7 = pins #1-#8
byte 3	--	IN0, latched data*
byte 4	--	IN1, latched data*
byte 5	--	Analog input 0 a/d value; pin#1, connector#P2
byte 6	--	Analog input 1 a/d value; pin#2
byte 7	--	Analog input 2 a/d value; pin#3
byte 8	--	Analog input 3 a/d value; pin#4
byte 9	--	Analog input 4 a/d value; pin#5
byte 10	--	Analog input 5 a/d value; pin#6
byte 11	--	Analog input 6 a/d value; pin#7
byte 12	--	Analog input 7 a/d value; pin#8
byte 13	--	Value of the dipswitch on the card

Example: ENTER :1;A\$ @ DISP NUM(A\$[5])

This will display the value of the analog input 0 (pin#1 connector#P2). 0 volts=0, 3.45 volts=128, 6.9 volts=255

Example: ENTER :1;A\$ @ DISP NUM(A\$[13])

This will read the dipswitch on the card.

Note *: latched data means that if any input pin is pulsed low for a time longer than the current ^{101 Sec} time increment it's bit will be cleared in this byte and set after the byte is sent. This allows momentary events to be captured when the control computer is not reading data.

Table B: This table is used if the last Tnnn command was not T000. The first byte of each counter contains the lower order bits.

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TIME INCREMENT COUNTERS

Time increment counts accumulate when the appropriate input pin is low for longer than the current time increment.

byte 1-2 is for Data bit 0 or pin 1 of INO
byte 3-4 is for Data bit 1 or pin 2 of INO
byte 5-6 is for Data bit 2 or pin 3 of INO
byte 7-8 is for Data bit 3 or pin 4 of INO
byte 9-10 is for Data bit 4 or pin 5 of INO
byte 11-12 is for Data bit 5 or pin 6 of INO
byte 13-14 is for Data bit 6 or pin 7 of INO

EVENT COUNTERS

Events are counted each time the appropriate pin is high then goes low.

byte 15-16 is for Data bit 0 or pin 1 of INO
byte 17-18 is for Data bit 1 or pin 2 of INO
byte 19-20 is for Data bit 2 or pin 3 of INO
byte 21-22 is for Data bit 3 or pin 4 of INO
byte 23-24 is for Data bit 4 or pin 5 of INO
byte 25-26 is for Data bit 5 or pin 6 of INO
byte 27-28 is for Data bit 6 or pin 7 of INO

Example:

```
OUTPUT :1;'T209'@ENTER :1;A$  
DISP NUM(A$[15])+NUM(A$[16])*256  
This will display the current count value of pin#1  
connector#P4.
```

3.3 SDI

If the send device ID is received, the Model #210 will respond with the following ascii message:

```
IL210<cr><lf>
```

Example:

```
D=DEVADDR('IL210')@DISP D  
The address of the first Model#210 will be displayed.
```

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

3.4 DCL, SDC

If the device clear or selected device clear message is received, the OUT 0-3 will be set to logic '0' and the command buffer will be cleared.

Example: CLEAR :1

3.5 IFC

If an interface clear message is received talker and listener status will be cleared.

Example: SEND IFC

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MODEL 210-2 HPIL IO INTERFACE
REFERENCE MANUAL

4.0 INTERFACE FUNCTIONS

4.1 Functions implemented

The Model#210 is designed to meet the interface functions of HPIL as specified by Hewlett-Packard. Specifically, the Model#210 implements the following functions:

R, D, AH, SH, CO, T1, T2, T3, L1, SRO, RLO, AA1, PDO, PPO, DC2, DTO, DDO.

4.2 DEFAULT ADDRESS

The Model#210, upon power-up or upon receipt of an auto- address unconfigure (AAD), defaults to as address of 7.

```

10 ! 0229900 (860103)
20 ! INTERLOOP Model#210 IO INTERFACE (EXAMPLE PROG)
30 ! Program name:IL210EX for the HP71 computer
40 !
50 SFLAG -23 @ ENDLINE CHR$(0)&CHR$(13)&CHR$(10)
60 DESTROY A$,S$,A,I,C,S,W,P
70 RESTORE IO
80 B=DEVADDR("IL210") @ IF B>0 THEN DISP USING "'IL210 is dev#',DDD";B @ WAIT 1
@ GOTO 'MENU'
90 DISP "No IL210 on the loop" @ END
100 !
110 'MENU': DISP "Do?(Gdisp,Atod,Toggle)"
120 IF NOT KEYDOWN THEN 120
130 IF KEYDOWN THEN 130
140 BEEP 2000,.1
150 ON 1+POS('GAT',UPRC$(KEY$)) GOSUB 'MENU',"GDISP","ATOD","TOGGLE"
160 GOTO 110
170 !
180 'GDISP':
190 ENTER :B ;A$ @ I=I+1
200 GDISP A$&CHR$(0)&CHR$(0)&CHR$(255)&CHR$(MOD(I,255))&CHR$(255)
210 IF NOT KEYDOWN THEN 190
220 RETURN
230 !
240 'ATOD':
250 DISP "Which chan.(0-7)?"
260 IF KEYDOWN THEN 260
270 IF NOT KEYDOWN THEN 270
280 C=MIN(7,MAX(0,NUM(KEY$)-48))
290 ENTER :B ;A$ @ A=NUM(A$[5+C])
300 DISP USING "'Analog chan ',D,' = ',ZZZ ";C,A
310 IF KEYDOWN THEN RETURN
320 GOTO 290
330 !
340 'TOGGLE': S$="CLR?SET?"
350 DISP "Port(OUT 0-3)?"
360 IF KEYDOWN THEN 360
370 IF NOT KEYDOWN THEN 370
380 P=MIN(3,MAX(0,NUM(KEY$)-48))
390 DISP "Bit(0-7) or All?"
400 IF KEYDOWN THEN 400
410 IF NOT KEYDOWN THEN 410
420 I=NUM(UPRC$(KEY$)) @ W=MIN(7,MAX(0,I-48))
430 IF I=65 THEN 'TOGALL'
440 DISP USING "'OUT ',Z,' Bit#',Z,' =',Z,' ',4A";P,W,S=0,S$[S*4+1,S*4+4]
450 BEEP 2000,.1
460 IF KEYDOWN THEN 460
470 IF NOT KEYDOWN THEN 470
480 IF UPRC$(KEY$)#'Y' THEN RETURN
490 IF S=0 THEN OUTPUT :B USING "'C',Z,Z";P,W @ GOTO 510
500 OUTPUT :B USING "'S',Z,Z";P,W
510 S=MOD(S+1,2) @ GOTO 440
520 'TOGALL':
530 DISP USING "'OUT ',Z,' =',ZZZ,' ',3A,' All?'" ;P,(S=0)*255,S$[S*4+1,S*4+3]
540 BEEP 2000,.1
550 IF KEYDOWN THEN 550
560 IF NOT KEYDOWN THEN 560
570 IF UPRC$(KEY$)#'Y' THEN RETURN
580 IF S=0 THEN OUTPUT :B USING "'B",Z,ZZZ";P,0 @ GOTO 600
590 OUTPUT :B USING "'B",Z,ZZZ";P,255 @ GOTO 600
600 S=MOD(S+1,2) @ GOTO 530

```

```

10 ! 0230000 (860103)
20 ! INTERLOOP Model#210 IO INTERFACE (TIMER&COUNTER EXAMPLE PROG)
30 ! Program name:IL210EX1 for the HP71 computer
40 !
50 ! --Attach clip lead #1 between pin1 of OUT 0 and pin1 of IN 0
60 ! --Attach clip lead #2 to pin1 of IN 0
70 ! --When the other end of clip lead #2 is grounded (touched to pin9 of IN 0)
80 ! --the timer will increment & the counter will increase by one
90 ! --The 'G' command can show what the input port is doing (dots on the HP71
100 ! --display in the first column represent the bits of IN 0,black=High)
110 !
120 SECURE
130 SFLAG -23 @ ENDLIN CHR$(0)&CHR$(13)&CHR$(10) @ DELAY .1,0
140 DESTROY ALL @ B=DEVADDR("IL210") @ IF B<1 THEN DISP "No IL210 found" @ END
150 DISP USING "IL210 is dev#',"DDD":B
160 !
170 S=SPOLL(B) @ IF BIT(MOD(S,256),2)=1 THEN DISP "POWER UP RUN" @ BEEP
180 !
190 T0S="T000" @ T1S="T015" @ ! T015 GIVES THE SHORTEST TIME INCREMENT
200 R=.000048*15 @ ! time/increment in seconds
210 !
220 OUTPUT :B : "500" @ ! SET PIN1 of OUT0 HIGH use as a pull up for
230 ! PIN1 of IN0 (timer&counter No.0)
240 !
250 GOSUB 'ZERO' @ ! Get starting time&count,and start update timer#1
260 !
270 'MENU': DISP "Do?(Time,Count,Zero,G)" @ BEEP 3000,.1
280 IF NOT KEYDOWN THEN 280
290 BEEP 2000,.1
300 I=POS('TCZG',UPRC$(KEY$)) @ IF I<1 THEN GOTO 'MENU'
310 ON I GOSUB "TIME","COUNT","ZERO","GDISP"
320 GOTO 'MENU'
330 !
340 'TIME': CFLAG 0
350 OUTPUT :B :T1S @ ENTER :B :I1S @ OUTPUT :B :T0S @ ! Put a picture of all
360 ! timers&counters in I1S
370 CALL DT(0,I0S,I1S,T) @ T=T+T9 @ IF FLAG(0) THEN 340 @ ! Try again if update
380 ! has occurred
390 DISP USING "time=","DDDD.DDDD," sec":T*R
400 IF KEYDOWN THEN 'TIME'
410 RETURN
420 !
430 'COUNT': CFLAG 0
440 OUTPUT :B :T1S @ ENTER :B :I1S @ OUTPUT :B :T0S @ ! Put a picture of all
450 ! timers&Counters in I1S
460 CALL DC(0,I0S,I1S,C) @ C=C+C9 @ IF FLAG(0) THEN 430 @ ! Try again if update
470 ! has occurred
480 DISP USING "count=","DDDDDD":C
490 IF KEYDOWN THEN 'COUNT'
500 RETURN
510 !
520 'ZERO': OFF TIMER #1 @ OUTPUT :B :T1S @ ENTER :B :I0S @ OUTPUT :B :T0S
530 T9=0 @ C9=0
540 ON TIMER #1,R+65536-10 GOSUB 'UPDATE' @ ! run the update routine befor any
550 ! timers or counters can roll over
560 RETURN
570 !
580 'GDISP': DISP "Input bits displayed"
590 IF KEYDOWN THEN 590
600 ENTER :B :A$ @ GDISP A$ @ IF NOT KEYDOWN THEN 600
610 RETURN
620 !
630 'UPDATE': BEEP @ SFLAG 0 @ OUTPUT :B :T1S @ ENTER :B :I1S @ OUTPUT :B :T0S
640 CALL DT(0,I0S,I1S,T) @ T9=T9+T
650 CALL DC(0,I0S,I1S,C) @ C9=C9+C @ I0S=I1S
660 RETURN
670 !
680 SUB DT(N,I1S,I2S,D) @ B=N*2+1 @ ! N=timer(0-7),I1S=starting picture,
690 ! I2S=ending,D=time increments
700 D=NUM(I2S[B])+NUM(I2S[B+1])*256-NUM(I1S[B])-NUM(I1S[B+1])*256 @ IF D<0 THEN
D=D+65536
710 END SUB
720 !
730 SUB DC(N,I1S,I2S,D) @ B=N*2+15 @ ! N=counter(0-7),I1S=starting picture,
740 ! I2S=ending,D=counts
750 D=NUM(I2S[B])+NUM(I2S[B+1])*256-NUM(I1S[B])-NUM(I1S[B+1])*256 @ IF D<0 THEN
D=D+65536
760 END SUB

```



```

10 ! MACHINE CONTROL EXAMPLE name: MACH
20 !
30 'ID': ! Program name:MACH ID:D229800 (861013)
40 !
50 DISP "Here we go...." @ WAIT 3
60 SECURE @ DEF KEY "#43"," RUN MACH,OFF" @ ! User def of A
TTN key
70 STARTUP "RUN MACH" @ ! What to do when the HP71 turns on
80 USER ON @ ON ERROR GOTO 90 @ GOTO 100
90 CALL ERROR
100 RESET HPIL @ RESTORE IO @ DESTROY ALL
110 GOTO 160
120 !
130 'OFF': RESET HPIL @ USER OFF @ DISP "*** SYSTEM OFF ***" @ WAIT 1 @ BYE
140 RUN
150 !
160 ! BEGIN OPERATIONS -Sample main program
170 CALL START
180 OUTPUT :1 ;"M+00100"
190 IF BIT(MOD(SPOLL(1),256),0)=1 THEN DISP "RUNNING.." @ GOTO 190
200 FOR I=1 TO 22
210 ENTER :1 ;A$
220 GDISP A$
230 NEXT I
240 GOTO 180
250 !
260 SUB START @ ON ERROR GOTO 270 @ GOTO 280 @ ! Sample sub program
270 CALL ERROR
280 SFLAG -23
290 OUTPUT :1 ;"S0;PV01000;PC00100;PS00200;PB00400;PA00010"
300 END SUB
310 !
320 SUB ERROR @ BEEP @ ! Error recording & exit
330 A$=ERRM$ @ D$=DATE$&" "&TIME$ @ DISP A$
340 A1=ERRN @ A2=ERRL @ WAIT 2
350 ASSIGN #1 TO ELOG @ PRINT #1;A$,D$,A1,A2
360 RUN , 'OFF'
370 END SUB
380 !
390 SUB E @ ASSIGN #1 TO ELOG @ ! Last error check
400 READ #1;A$,D$,A1,A2 @ ! To use type CALL E <ret>
410 DISP A$
420 IF NOT KEYDOWN THEN 420
430 DISP USING "Error#",7D';A1
440 IF NOT KEYDOWN THEN 440
450 DISP USING "Line#",5D';A2
460 IF NOT KEYDOWN THEN 460
470 DISP "When "&D$
480 IF NOT KEYDOWN THEN GOTO 480
490 GOTO 410
500 END SUB
510 ! Turns 71 on & off by hitting attention key
520 ! Stores the last error by message, date, error#, & line number & turns off
the 71.
530 ! To get the last error message, hit attention key & type CALL E<ret>

```