6-5-10. PROGRAM EXAMPLES

This paragraph introduces program examples for controlling the 4195A via HP-IB, with an HP 9000 Series 300 computer.

Example 1: Measurement Example using Network measurement function

Example 2: Data Transfer
- (1) Using ASCII format
- (2) Using Binary 64 bit format
- (3) Using Binary 32 bit format

Example 3: Hard Copy
- (1) Using Plot mode
- (2) Using Print mode
- (3) Using Dump mode

Example 4: Setting up a User Program

Example 5: Setting up a Programmed Points Table

NOTE

Before running the following programs, use the '**HP-IB address**' softkey to set the 4195A's HP-IB address to **17**.

Example 1: This program configures the system to measure the -3 dB Bandwidth of a 450 MHz Band-Pass Filter, and to print out the Insertion Loss, and the -3 dB Band Width.

Program Listing:

```
10    ! MEASUREMENT AND ANALYSIS EXAMPLE
20    !
30    Ads=717
40    REMOTE Ads
50    CLEAR Ads
60    !
70    Mask=2 ! Bit 1 enables SRQ interrupts.
80    Status_byte_rqs=2 ! Bit 1 enables End of sweep bit of 4195A.
90    !
100   !********** SET UP THE MEASUREMENT CONDITION **********
110   !
120   OUTPUT Ads;"FNC1"
130   OUTPUT Ads;"RST"
140   OUTPUT Ads;"RQS=";Status_byte_rqs
150   OUTPUT Ads;"CMT'';SWM2"
160   OUTPUT Ads;"PORT1;GPP1;DSP1"
170   OUTPUT Ads;"SWP1;CENTER=450MHZ;SPAN=20MHZ"
180   !
190   !********** TRIGGER **********
200   !
210   ON INTR 7 GOTO 250
220   OUTPUT Ads;"SWTR6"
230   ENABLE INTR 7;Mask
240   GOTO 240
250   OFF INTR 7
260   OUTPUT Ads;"CLS"
270   !
280   !********** ANALYSIS **********
290   !
300   OUTPUT Ads;"SCL2;AUTO;SCL1;AUTO"
310   OUTPUT Ads;"MCF4;MKMX;DLCURS=-3DB;DELT1;WIDTH1"
320   !
330   !********** INPUT DATA **********
340   !
350   OUTPUT Ads;"WID?"
360   ENTER Ads;Wid
370   OUTPUT Ads;"MKRA?"
380   ENTER Ads;Il
390   !
400   !********** DISPLAY THE DATA **********
410   !
420   PRINT "-3dB BAND WIDTH (Hz) =",Wid
430   PRINT "INSERTION LOSS (dB) =",Il
440   !
450   LOCAL Ads
460   END
```

Line Number	Description
70	**MASK** is used to enable the Service Request interrupts.
80	**Status_byte_rqs** is used to enable the 4195A's End of sweep bit.
120	Select the Network measurement function.
130	Initialize the 4195A for a Network measurement.
140	Enable bit 1 (**EOS**: End of Sweep bit) of the 4195A's status byte.
150	Clear the comment area, and select the Single sweep mode.
160	Select input port T1/R1, measurement parameter T/R(dB)-θ, and Rectangular X-A&B display format.
170	Set the measurement range (sweep range).
210 - 250	Trigger the sweep measurement, and wait until it is completed (until a service request from the 4195A is generated).
260	Clear the 4195A's status byte.
300	Auto scale the data displayed on the 4195A's screen.
310	Select the "o&LCRS mode", moves the **o** marker to a maximum point, and move the Line Cursor to the position 3 dB less than the o marker's position.
350 - 380	Store the -3 dB Bandwidth in variable *Wid*, and the insertion loss in variable *Il*.
420 - 430	Print the -3 dB Bandwidth and the Insertion Loss.

Example 2: The 4195A has three data output formats; FMT1, FMT2, and FMT3 (refer to paragraph 6-5-5). A program example will be given for each of these formats. In the FMT2 format (binary 64-bit data output), the measurement data is contained in the lower 8-bytes of the 12 data bytes transmitted by the 4195A. In the FMT3 format (binary 32-bit data output), the measurement data is contained in the lower 4-bytes of the 8 data bytes transmitted by the 4195A. The following programs use only the lower 8 or 4 data bytes.

(1) ASCII format (FMT1)

Program Listing:

```
10    ! DATA TRANSFER WHEN USING THE ASCII FORMAT (FMT1)
20    !
30    OPTION BASE 1
40    DIM A(401)
50    Ads=717
60    REMOTE Ads
70    !
80    OUTPUT Ads;"FMT1;A?"
90    ENTER Ads;A(*)
100   !
110   FOR I=1 TO 401
120   PRINT "A(";I;")=",A(I)
130   NEXT I
140   !
150   LOCAL Ads
160   END
```

Line Number	Description
80	Select the ASCII format, and transmit data in the A register through the output buffer of the 4195A.
90	Store the data sent from the 4195A, in variable A.
110 - 130	Print variable A.

(2) Binary 64-bit format (FMT2)

Program Listing:

```
10    ! DATA TRANSFER WHEN USING THE BINARY 64 BIT FORMAT (FMT2)
20    !
30    OPTION BASE 1
40    DIM Junk$[4]
50    REAL A(401)
60    !
70    ASSIGN @Ads TO 717;FORMAT ON
80    REMOTE @Ads
90    !
100   OUTPUT @Ads;"FMT2;A?"
110   ENTER @Ads USING "#,4A";Junk$
120   ASSIGN @Ads;FORMAT OFF
130   ENTER @Ads;A(*)
140   !
150   FOR I=1 TO 401
160   PRINT "A(";I;")=",A(I)
170   NEXT I
180   !
190   LOCAL @Ads
200   END
```

Line Number	Description
70	Set the I/O path between the controller and the 4195A with the **FORMAT ON** attribute, the 4195A can only receive data in the **ASCII** format.
100	Select the Binary 64-bit data output format, and output data in the A register through the 4195A's output buffer.
110	Store the upper 4-bytes of the data sent from the 4195A, in Junk$. This data is not measurement data, so it is not used.
120	Set the I/O path between the controller and the 4195A to the **FORMAT OFF** attribute, the binary 64-bit data format is the same data format used by HP 9000 series 300 computers.
130	Store the lower 8-bytes of data in variable A. The lower 8-bytes of data A are binary 64-bit data.
150 - 170	Print variable A.

(3) Binary 32-bit format (FMT3)

Program Listing:

```
10    !(3) DATA TRANSFER WHEN USING THE BINARY 32 BIT (FMT3)
20    !
30    OPTION BASE 1
40    INTEGER A(802),Upper,Lower,I
50    REAL Aa(401)
60    DIM Junk$[4]
70    ASSIGN @Ads TO 717;FORMAT ON
80    REMOTE @Ads
90    !
100   OUTPUT @Ads;"FMT3;A?"
110   ENTER @Ads USING "#,4A";Junk$
120   ASSIGN @Ads;FORMAT OFF
130   ENTER @Ads;A(*)
140   !
150   FOR I=1 TO 401
160     Upper=A(I*2-1)
170     Lower=A(I*2)
180     IF Upper=0 AND Lower=0 THEN
190       Aa(I)=0
200     ELSE
210       Exp=SHIFT(SHIFT(Upper,-1),8)
220       Tem=SHIFT(SHIFT(Upper,-9),9)
230       Low=Lower
240       IF Lower<0 THEN Low=65536+Lower
250       Man=Tem*2^16+Low
260       Aa(I)=DROUND(SGN(Upper)*(2^(Exp-127)+Man*2^(Exp-150)),6)
270     END IF
280     PRINT "A(";I;")=";Aa(I)
290   NEXT I
300   !
310   LOCAL @Ads
320   END
```

Line Number	Description
70	Set the I/O path between the controller and the 4195A with the **FORMAT ON** attribute, the 4195A can only receive data in the **ASCII** format.
100	Select the Binary 32-bit data output format, and move the data the A register to the 4195A's output buffer.
110	Store the upper 4-bytes of the data sent from the 4195A in Junk$. This data is not measurement data, so it is not used.
120	Set the I/O path between the controller and the 4195A to the **FORMAT OFF** attribute, this data is not in the **ASCII** format.

Line Number	Description
130	Store the lower 4-bytes sent from the 4195A in variable A (INTEGER). The lower 4 bytes are Binary 32-bit data. This data is entered every 2 bytes.
160 - 170	Store the upper 2-bytes of the binary 32-bit data in variable **Upper**, and the lower 2-bytes in variable **Lower**.
180 - 190	If **Upper**= 0 and **Lower**= 0, store 0 (zero) in variable **Aa**.
210 - 250	If **Upper**≠ 0 or **Lower**≠ 0, store the exponent part in **Upper** in variable **Exp**, the fractional part in **Upper** in variable **Tem**, and the fractional part in **Lower** in variable **Low**. Store the complete fractional part in variable **Man**.
260	Store the arranged data in variable **Aa**. The equation used to arrange the data, is described in paragraph 6-5-5.
280	Print variable **Aa**.

Example 3: The 4195A can plot, print, or dump the measurement data without an external controller (refer to paragraph 5-13). The following tells how to plot, print, and dump measurement data, via HP-IB.

(1) Plot (CPYM1)

Program Listing:

```
10    ! COPY DISPLAY BY "PLOT MODE" (CPYM1)
20    !
30    !********** INITIAL SETTING **********
40    !
50    INTEGER Select_code,Ads_4195a,Ads_plotter,Hp_4195a
60    Select_code=7
70    Ads_4195a=17
80    Ads_plotter=5
90    Hp_4195a=Select_code*100+Ads_4195a
100   !
110   Mask=2          ! Bit 1 enables SRQ interrupts.
120   Status_byte=8   ! Bit 3 enables End bit of 4195A.
130   !
140   ! (( PLOT AREA ))
150   !
160   P1x=2000        ! P1x is left of plot area
170   P1y=800         ! P1y is bottom of plot area
180   P2x=9200        ! P2x is right of plot area
190   P2y=7200        ! P2y is top of plot area
200   !               ( where 1 count is 0.025 mm )
210   !
220   REMOTE Hp_4195a
230   OUTPUT Hp_4195a;"RQS=";Status_byte
240   !
250   !********** PLOT GRATICULE **********
260   !
270   ON INTR Select_code GOTO End_plot
280   !
290   OUTPUT Hp_4195a;"CPYM1"
300   OUTPUT Hp_4195a;"PLTF1;SCLP1"
310   OUTPUT Hp_4195a;"PSCALE=";P1x;",";P1y;",";P2x;",";P2y
320   OUTPUT Hp_4195a;"SENDPS"
330   SEND Select_code;UNL TALK Ads_4195a LISTEN Ads_plotter DATA
340   WAIT .5
350   OUTPUT Hp_4195a;"COPY"
360   SEND Select_code;UNL TALK Ads_4195a LISTEN Ads_plotter DATA
370   !
380   ENABLE INTR Select_code;Mask
390   DISP "WAITING FOR PLOT"
400   GOTO 400
410   !
420 End_plot:  !
430   OFF INTR Select_code
440   OUTPUT Hp_4195a;"CLS"
450   DISP "PLOT COMPLETED"
460   END
```

Line Number	Description
70 - 90	Set the HP-IB addresses of the peripherals.
110	**Mask** is used to enable the Service Request interrupts.
120	**Status_byte** is used to mask the 4195A's status byte.
230	Bit 3 (END bit) of the 4195A's status byte is enabled.
290 - 320	Selects the 'plot mode', 'plot all', 'P1 P2 normal', and sets the plot area. Plot scale data is put in the 4195A's output buffer.
330	Configure the 4195A as a Talker, and the plotter as a Listener. Transmit plot scale data from the 4195A to the plotter.
340	Wait until the plot scale data is received by the plotter.
350	Send the "**COPY**" command to the 4195A. The 4195A outputs the data through its output buffer.
360	Configure the 4195A as a talker, and the plotter as a Listener. Transmit the data from the 4195A to the plotter.
380 - 400	Wait until the copy is completed (a service request from the 4195A is generated).
440	Clear the 4195A's status byte.

(2) Print (CPYM2)

Program Listing:

```
10    ! COPY MEASURED DATA BY "PRINT MODE" (CPYM2)
20    !
30    !********** INITIAL SETTING **********
40    !
50    INTEGER Select_code,Ads_4195a,Ads_prntr,Hp_4195a
60    Select_code=7
70    Ads_4195a=17
80    Ads_prntr=1
90    Hp_4195a=Select_code*100+Ads_4195a
100   !
110   Mask=2          ! Bit 1 enables SRQ interrupts.
120   Status_byte=8   ! Bit 3 enables End bit of 4195A.
130   !
140   REMOTE Hp_4195a
150   OUTPUT Hp_4195a;"RQS=";Status_byte
160   !
170   !********** PRINT DATA **********
180   !
190   ON INTR Select_code GOTO End_print
200   !
210   OUTPUT Hp_4195a;"CPYM2"
220   OUTPUT Hp_4195a;"COPY"
230   !
240   SEND Select_code;UNL TALK Ads_4195a LISTEN Ads_prntr DATA
250   ENABLE INTR Select_code;Mask
260   DISP "WAITING FOR PRINT"
270   GOTO 270
280   !
290 End_print:  !
300   OFF INTR Select_code
310   OUTPUT Hp_4195a;"CLS"
320   DISP "PRINT COMPLETED"
330   END
```

Line Number	Description
150	Enable bit 3 (END bit) of the 4195A's status byte.
210	Select the print mode.
220	Send the "**COPY**" command to the 4195A, the 4195A outputs the data through its output buffer.
240	Configure the 4195A as a Talker, and the printer as a Listener. Transmit the data from the 4195A to the printer.
250 - 270	Wait until the copy is completed (a service request from the 4195A is generated).
310	Clear the 4195A's status byte.

(3) Dump (CPYM3)

Program Listing:

```
10    ! COPY DISPLAY BY "DUMP MODE" (CPYM3)
20    !
30    !********** INITIAL SETTING **********
40    !
50    INTEGER Select_code,Ads_4195a,Ads_prntr,Hp_4195a
60    Select_code=7
70    Ads_4195a=17
80    Ads_prntr=1
90    Hp_4195a=Select_code*100+Ads_4195a
100   !
110   Mask=2          ! Bit 1 enables SRQ interrupts.
120   Status_byte=8   ! Bit 3 enables End bit of 4195A.
130   !
140   REMOTE Hp_4195a
150   OUTPUT Hp_4195a;"RQS=";Status_byte
160   !
170   !********** DUMP DISPLAY **********
180   !
190   ON INTR Select_code GOTO End_dump
200   !
210   OUTPUT Hp_4195a;"CPYM3"
220   OUTPUT Hp_4195a;"COPY"
230   !
240   SEND Select_code;UNL TALK Ads_4195a LISTEN Ads_prntr DATA
250   ENABLE INTR Select_code;Mask
260   DISP "WAITING FOR GRAPHICS DUMP"
270   GOTO 270
280   !
290 End_dump:  !
300   OFF INTR Select_code
310   OUTPUT Hp_4195a;"CLS"
320   DISP "GRAPHICS DUMP COMPLETED"
330   END
```

Line Number	Description
150	Enable bit 3 (END bit) of the 4195A's status byte.
210	Select the dump mode.
220	Send the "**COPY**" command to the 4195A, the 4195A puts the data in its output buffer.
240	Configure the 4195A as a Talker, and the printer as a Listener. Transmit the data from the 4195A to the printer.
250 - 270	Wait until the copy is completed (a service request from the 4195A is generated).
310	Clear the 4195A's status byte.

Example 4: This program sets up the User Program which is the User Program sample introduced in paragraph 6-4-9, Example 1.

Program Listing:

```
10    ! USER PROGRAM DOWNLOAD
20    !
30    Ads=717
40    REMOTE Ads
50    OUTPUT Ads;"SCRATCH"
60    !
70    OUTPUT Ads;"PROG""10 CMT'RIPPLE MEAS.'"""
80    OUTPUT Ads;"PROG""20 FNC1"""
90    OUTPUT Ads;"PROG""30 RST"""
100   OUTPUT Ads;"PROG""40 GPP1;PORT1"""
110   OUTPUT Ads;"PROG""50 CENTER=100MHZ;SPAN=500KHZ"""
120   OUTPUT Ads;"PROG""60 SWTRG"""
130   OUTPUT Ads;"PROG""70 MCF2;MKR=99990000;SMKR=100010000"""
140   OUTPUT Ads;"PROG""80 ARSTR;ANA1"""
150   OUTPUT Ads;"PROG""90 MKACT1;MKMX"""
160   OUTPUT Ads;"PROG""100 MKACT0;MKMN"""
170   OUTPUT Ads;"PROG""110 DELT1"""
180   OUTPUT Ads;"PROG""120 R1=DMKRA"""
190   OUTPUT Ads;"PROG""130 DISP'RIPPLE(DB)=',R1"""
200   OUTPUT Ads;"PROG""140 END"""
210   !
220   LOCAL Ads
230   BEEP
240   DISP "USER PROGRAM DOWNLOAD IS COMPLETE"
250   END
```

Line Number	Description
40	Set the 4195A to remote.
50	Clear the 4195A's ASP edit page.
70 - 200	Enter the User Program on the 4195A's ASP edit page, by using the "**PROG**" command.

Example 5: This program sets up a Programmed Points Table. The table set up in this example, is same as the table set up by the User Program in paragraph 6-4-9, Example 3.

Program Listing:

```
10    ! PROGRAMMED POINTS TABLE DOWNLOAD
20    !
30    Ads=717
40    REMOTE Ads
50    CLEAR Ads
60    !
70    OUTPUT Ads;"CPL1"
80    OUTPUT Ads;"PTN=1"
90    OUTPUT Ads;"PTCLR"
100   OUTPUT Ads;"PTSWP1"
110   !
120   Freq=190000000
130   !
140   FOR I=1 TO 401
150     OUTPUT Ads;"POINT=";Freq
160     IF I<101 OR I>300 THEN
170       Freq=Freq+80000
180       GOTO 220
190     ELSE
200       Freq=Freq+20000
210     END IF
220   NEXT I
230   !
240   LOCAL Ads
250   BEEP
260   DISP "PROGRAMMED POINTS TABLE DOWNLOAD IS COMPLETE"
270   END
```

Line Number	Description
70	Select the Couple mode to enter the RBW value to be coupled to the frequency (the Programmed Points Table must be set up with the sweep points, and the value of the Resolution Band Width).
80	Select Programmed Points Table number 1.
90	Clear table 1.
100	Set frequency sweep mode for Programmed Points Table 1.
150	Set the value indicated by **Freq** to the sweep point, by using the "**POINT**=" command.
160 - 180	If the number of points is less than 101, or greater than 300, add 80000 to **Freq**, and go to line 160.
190 - 210	If the number of points is between 101 and 300, add 20000 to **Freq**.

NOTES

APPENDIX E

COMMAND LIST

Appendix E lists the 4195A's control commands in alphabetical order. The register-type commands (syntax type #2) are not listed in the following table, but are listed in the Registers List in Appendix F.

Syntax type numbers in the list correspond to the syntax type number in the following Syntax Number Quick Reference and that in Table 6-1.

Syntax Number Quick Reference

Syntax Number	Syntax Name	Description
1	Header only type	Does not have selection option.
2	Register type	Equal sign and single value follows.
3	Cal. Std. type	Equal sign and two values follows.
4	POINT type	Equal sign and two values follows. One value is optional.
5	PSCALE type	Equal sign and four values follows.
6	String data type	Character string follows.
7	DISP type	Character string or register name follows.
8	PROG type	Character string start with line number follows.
9	Select type	One or two digit select number follows.
10	INPUT type	Register name follows.
11	OUTPUT type	Register name or eight digit binary expression follows.
12	EDIT type	Line number (optional) follows.
13	Define Math type	Equal sign and math definition follows.
14	LMX type	Array register name in a pair of parenthesis follows.

NOTE

A black triangle (►) indicates that the select-type command is selected by the default settings. A bullet (•) indicates that the command cannot be multi-statement programmed.

- A -

	Command	Syntax	Key	Description
•	ABTCAL	1	'ABORT CAL'	Aborts progressing calibration measurement.
•	ABTCMP	1	'ABORT COMPEN'	Aborts progressing impedance compensation measurement.
▶	ANA0	9	'PART ANA on **off**'	Turns off partial analysis.
	ANA1	9	'PART ANA **on** off'	Turns on partial analysis.
	ARSTR	1	'STORE ANA RNG'	Specifies the partial analysis range by the current o and * markers positions.
•	AUDF	1	'EXIT UDF edit'	Aborts editing the user defined function (UDF) or the sweep end function, and exits from the editor.
	AUTO	1	'AUTO SCALE'	Changes the display scale properly to the data.

- B -

No commands beginning with B.

- C -

	Command	Syntax	Key	Description
▶	CALT0	9	'CAL NONE'	Selects no-calibration type.
	CALT1	9	'NORMLIZE (OPEN)'	When in Network, S11, or S22 configuration, selects normalize (OPEN) calibration type.
			'NORMLIZE (THRU)'	When in S21 or S12 configuration, selects normalize (THROUGH) calibration type.
			'ONE PORT FULL CAL'	When in the impedance configuration, selects one port full calibration type.
	CALT2	9	'ONE PORT PART CAL'	When in Network, S11, or S22 configuration, selects one port partial calibration type.
			'NORM&ISN CAL'	When in S21 or S12 configuration, selects normalize & isolation calibration.

	CALT3	9	'ONE PORT FULL CAL'	When in Network, S11, or S22 configuration, selects one port full calibration type.
	CALT4	9	'NORMLIZE (THRU)'	When in Network configuration, selects normalize (THROUGH) calibration type.
	CALT5	9	'NORM&ISN CAL'	When in Network configuration, selects normalize & isolation calibration type.
•	CAT	1	'CAT'	Displays micro flexible disc contents file catalog.
►	CHRZ1	9	'Z0 **50**Ω 75Ω'	Selects 50Ω characteristic impedance.
	CHRZ2	9	'Z0 50Ω **75**Ω'	Selects 75Ω characteristic impedance.
	CLS	1	---	Clears the HP-IB status byte.
►	CMPT0	9	'COMPEN NONE'	Turns off impedance compensation.
	CMPT1	9	'0S OFFSET'	Selects only 0S offset compensation.
	CMPT2	9	'0Ω OFFSET'	Selects only 0Ω offset compensation.
	CMPT3	9	'0S&0Ω OFFSET'	Selects both 0S and 0Ω offset compensation.
	CMT	6	'COMMENT'	Displays a character string in the comment area of the CRT.
	CMT?	1	---	Stores the comment contents into the HP-IB output buffer.
•	CONT	1	'CONT'	Continues a paused user program (ASP).
•	COPY	1	'COPY start' 'COPY abort'	Starts or aborts the hard copy operation.
►	CORR0	9	'CORRECTN on **off**'	Turns off correction.
	CORR1	9	'CORRECTN **on** off'	Turns on correction.
	CPL0	9	**AUTO** off	RBW setting is fixed at a specified bandwidth.
►	CPL1	9	**AUTO** on	RBW setting is automatically selected by other settings.

CPYM1	9	'PLOT mode'	Selects plot hard copy mode.
CPYM2	9	'PRINT mode'	Selects print hard copy mode.
► CPYM3	9	'DUMP mode'	Selects raster graphics dump hard copy mode.
CPYM4	9	'color DUMP mode'	Selects color graphics dump hard copy mode.
CRAV	1	'LCURS→ AVRG'	Moves the line cursor to the average value.
CRMN	1	'LCURS→ MIN'	Moves the line cursor to the minimum data value.
CRMX	1	'LCURS→ MAX'	Moves the line cursor to the maximum data value.

- D -

Command	Syntax	Key	Description
DCOFF	1	**OFF/ABORT**	Turns off the dc source.
► DEG	1	'PHS UNIT **deg** rad'	Selects the degree angle mode.
► DELT0	9	'Δmode on **off**'	Turns off the Δmode.
DELT1	9	'Δmode **on** off'	Turns on the Δmode.
DF1	6	'fctn 1'	Defines user defined function #1.
DF2	6	'fctn 2'	Defines user defined function #2.
DF3	6	'fctn 3'	Defines user defined function #3.
DF4	6	'fctn 4'	Defines user defined function #4.
DF5	6	'fctn 5'	Defines user defined function #5.
DFA	6	'fctn A'	Defines the sweep end function #A.
DFB	6	'fctn B'	Defines the sweep end function #B.
DFC	6	'fctn C'	Defines the sweep end function #C.
DISP	7	'DISP'	Displays a character string, **Rn** register data or both on the system message line of the CRT.

DISP?	1	---	Stores the **DISP**layed character string, **Rn** register data or both into the HP-IB output buffer.
DMA	13	'DEFINE MATH A'	Defines user math A equation.
DMB	13	'DEFINE MATH B'	Defines user math B equation.
DPA0	9	'TRACE A on **off**'	Turns off trace A.
► DPA1	9	'TRACE A **on** off'	Turns on trace A.
DPB0	9	'TRACE B on **off**'	Turns off trace B.
► DPB1	9	'TRACE B **on** off'	Turns on trace B.
► DSP1	9	'rectan X-A&B'	Selects the rectan X-A&B display format.
DSP2	9	'rectan A-B'	Selects the rectan A-B display format.
DSP3	9	'TABLE'	Selects the table display format.
DSP4	9	'SMITH'	Selects the Smith chart display format.
DSP5	9	'POLAR'	Selects the polar chart display format.

- E -

Command	Syntax	Key	Description
EDIT	12	'EDIT'	Initiates the user program (ASP) editor.
► EQC1	9	'CKT A'	Selects equivalent circuit analysis model A.
EQC2	9	'CKT B'	Selects equivalent circuit analysis model B.
EQC3	9	'CKT C'	Selects equivalent circuit analysis model C.
EQC4	9	'CKT D'	Selects equivalent circuit analysis model D.
EQC5	9	'CKT E'	Selects equivalent circuit analysis model E.

• EQCAL	1	'CALC EQV para'	Calculates the equivalent circuit parameters of the equivalent circuit analysis.
• EQDSP	1	'EQV CKT'	Displays equivalent circuit model selection screen.
ERR?	1	---	Stores the error number string data (being stored in the ERR register) to the HP-IB output buffer.

- F -

Command	Syntax	Key	Description
• FCHRS	1	'SIMULATE f-char'	Simulates frequency response of the specified equivalent circuit model and equivalent circuit parameter.
▶ FMT1	9	---	Selects ASCII output format of the HP-IB.
FMT2	9	---	Selects HP-IB IEEE-64 bit floating point output format.
FMT3	9	---	Selects HP-IB IEEE-32 bit floating point output format.
▶ FNC1	9	'NETWORK'	Selects the Network configuration.
FNC2	9	'SPECTRUM'	Selects the Spectrum configuration.
FNC3	9	'IMPEDANCE'	Selects the Impedance configuration.
FNC4	9	'S11'	Selects the S11 configuration.
FNC5	9	'S21'	Selects the S21 configuration.
FNC6	9	'S12'	Selects the S12 configuration.
FNC7	9	'S22'	Selects the S22 configuration.
FORMAT	1	'format DISC'	Formats a flexible disc (initialization).

- G -

	Command	Syntax	Key	Description
•	GET	6	'GET'	Gets data from a flexible disc.
▶	GPP1	9	'T/R-θ (dB)' 'R2/R1-θ (dB)	Selects the amplitude-ratio (in dB). & phase-difference measurement format.
	GPP2	9	'T/R-θ' 'R2/R1-θ'	Selects the amplitude-ratio & phase-difference measurement format.
	GPP3	9	'T/R Re-Im' 'R2/R1 Re-Im'	Selects the amplitude-ratio (real-imaginary) measurement format.
	GPP4	9	'T/R-τ (dB) 'R2/R1-τ (dB)'	Selects the group-delay measurement format.
	GRT0	9	'GRTCL on **off**'	Turns off the display graticule.
▶	GRT1	9	'GRTCL **on** off'	Turns on the display graticule.

- H -

	Command	Syntax	Key	Description
▶	HADM1	9	'ADDRE-SSABLE'	Sets the 4195A HP-IB definition to the addressable mode.
	HADM2	9	'TALK only'	Sets the 4195A HP-IB definition to the talk only mode.

- I -

	Command	Syntax	Key	Description
	ID?	1	---	Stores the device identification string data to the HP-IB output buffer.
▶	IMP1	9	'|Z|-θ'	Selects the |Z|-θ impedance measurement format.
	IMP2	9	'R-X'	Selects the R-X impedance measurement format.

	IMP3	9	'Ls-Rs'	Selects the Ls-Rs impedance measurement format.
	IMP4	9	'Ls-Q'	Selects the Ls-Q impedance measurement format.
	IMP5	9	'Cs-Rs'	Selects the Cs-Rs impedance measurement format.
	IMP6	9	'Cs-D'	Selects the Cs-D impedance measurement format.
	IMP7	9	'|Y|-θ'	Selects the |Y|-θ impedance measurement format.
	IMP8	9	'G-B'	Selects the G-B impedance measurement format.
	IMP9	9	'Lp-Rp'	Selects the Lp-Rp impedance measurement format.
	IMP10	9	'Lp-Q'	Selects the Lp-Q impedance measurement format.
	IMP11	9	'Cp-Rp'	Selects the Cp-Rp impedance measurement format.
	IMP12	9	'Cp-D'	Selects the Cp-D impedance measurement format.
	INPUT	10	'INPUT'	Stores the 8-bit input data into a **Rn** register.
▶	IRNG1	9	'NORMAL'	Selects the normal IF range.
	IRNG2	9	'Lo DISTN'	Selects the low-distortion IF range when in Spectrum configuration.
			'Hi SENS'	Selects the high-sensitivity IF range when in Network/S-parameter/ Impedance configuration.
	IRNG3	9	'Hi SENS'	Selects the high-sensitivity IF range when in Spectrum configuration.
•	ISNCAL	1	'ISOLATN'	Initiates the isolation calibration measurement.

- J -

No commands beginning with J

- K -

No commands beginning with K

- L -

Command	Syntax	Key	Description
LBL1	6	'fctn1 KEY LBL'	Defines the user-defined-function #1 softkey label.
LBL2	6	'fctn2 KEY LBL'	Defines the user-defined-function #2 softkey label.
LBL3	6	'fctn3 KEY LBL'	Defines the user-defined-function #3 softkey label.
LBL4	6	'fctn4 KEY LBL'	Defines the user-defined-function #4 softkey label.
LBL5	6	'fctn5 KEY LBL'	Defines the user-defined-function #5 softkey label.
LBLA	6	'fctnA KEY LBL'	Defines the sweep-end-function #A softkey label.
LBLB	6	'fctnB KEY LBL'	Defines the sweep-end-function #B softkey label.
LBLC	6	'fctnC KEY LBL'	Defines the sweep-end-function #C softkey label.
• LDCAL	1	'LOAD'	Initiates the load calibration measurement.
• LDNSTD=	3	'LOAD CAL STD'	Enters the Load calibration standard's calibrated values.
LMN	14	'LMN'	Moves the o and * markers to the local-minimum points.
LMX	14	'LMX'	Moves the o and * markers to the local-maximum points.

- M -

Command	Syntax	Key	Description
• MAX	---	'MAX(,)'	Returns the maximum value.
MCF0	9	'off'	Turns the MARKER function off.
▶ MCF1	9	'o MKR'	Selects the o MARKER mode.
MCF2	9	'o&* MKRS'	Selects the o and * MARKERS mode.
MCF3	9	'LINE CURSOR'	Selects the LINE CURSOR mode.
MCF4	9	'oMKR & LCURS'	Selects the o-LCURS mode.

•	MIN	---	'MIN(,)'	Returns the minimum value.
▶	MKACT0	9	'active oMKR***MKR**'	Selects the active marker to * MARKER.
	MKACT1	9	'active **oMKR***MKR'	Selects the active marker to o MARKER.
▶	MKACT2	9	'active **LCRS**'	Selects the LCURS to active.
▶	MKCR1	9	'LCURS **forA**forB'	Selects the LCURS reading object to data A.
	MKCR2	9	'LCURS forA**forB**'	Selects the LCURS reading object to data B.
	MKCTR	1	'MKR→ CENTER'	Changes the CENTER value with the MARKER point value.
	MKEXP	1	'MKRS→ SPAN'	Expands the sweep span specified by MARKERS to full screen width.
	MKMN	1	'MKR→ MIN'	Move the marker to the minimum data point.
	MKMX	1	'MKR→ MAX'	Move the marker to the maximum data point.
	MKREF	1	'MKR→ REF'	Changes the display scale (top value) with the marker reading value.
	MKSP	1	'MKR→ STOP'	Changes the STOP value with the MARKER point value.
	MKST	1	'MKR→ START'	Changes the START value with the MARKER point value.
▶	MTHA0	9	'MATH→A on **off**'	Turns off User Math A function.
	MTHA1	9	'MATH→A **on** off'	Turns on User Math A function.
▶	MTHB0	9	'MATH→B on **off**'	Turns off User Math B function.
	MTHB1	9	'MATH→B **on** off'	Turns on User Math B function.

- N -

	Command	Syntax	Key	Description
►	NOISE0	9	'NOISE on **off**'	Turns off the Noise Marker reading.
	NOISE1	9	'NOISE **on** off'	Turns on the Noise Marker reading.
	NXTPK	1	'NEXT PEAK'	Moves the marker to the next lower peak.

- O -

	Command	Syntax	Key	Description
•	OPNCAL	1	'OPEN'	Initiates the Open calibration measurement.
•	OPNSTD=	3	'OPEN CAL STD'	Enters the Open calibration standard's calibrated values.
	OUTPUT	11	'OUTPUT'	Outputs 8-bit data to the 8-BIT INPUT/OUTPUT connector.

- P -

	Command	Syntax	Key	Description
►	PEXT0	9	'PORT EXT on **off**'	Turns off the port extension.
	PEXT1	9	'PORT EXT **on** off'	Turns on the port extension.
	PHS1	9	'θ DISP normal'	Measures the phase angle within the range of ±180° (wrap-around).
	PHS2	9	'θ DISP expand'	Measures the phase angle continuously (no wrap-around).
►	PLTF1	9	'ALL'	Specifies the plotted item to all.
	PLTF2	9	'GRCTL & DATA'	Specifies the plotted item only to graticule and traces.
	PLTF3	9	'DATA only'	Specifies the plotted item only traces.
•	POINT=	4	---	Enters program point table data without using the editor.

► PORT1	9	'T1/R1'	When in other than spectrum configuration selects T1 measurement referenced to R1. S1 is also selected. For S11 configuration, this is the default setting.
		'R1'	When in spectrum configuration selects R1 input.
PORT2	9	'T2/R1'	When in other than spectrum configuration selects T2 measurement referenced to R1. S1 is also selected. For S21 configuration, this is the default setting.
		'T1'	When in spectrum configuration selects T1 input.
PORT3	9	'R2/R1'	When in other than spectrum configuration selects R2 measurement referenced to R1. S1 is also selected.
		'R2'	When in spectrum configuration selects R2 input.
PORT4	9	'T1/R2'	When in other than spectrum configuration selects T1 measurement referenced to R2. S2 is also selected. For S12 configuration, this is the default setting.
		'T2'	When in spectrum configuration selects T2 input.
PORT5	9	'T2/R2'	When in other than spectrum configuration selects T2 measurement referenced to R2. S2 is also selected. For S22 configuration, this is the default setting.
• PPAUSE	1	'PAUSE'	Pauses the running User Program (ASP).
► PPM0	9	'PROG SWP on **off**'	Turns off the Program Point Measurement.
PPM1	9	'PROG SWP **on** off'	Turns on the Program Point Measurement.
PRMA	6	'A PRMTR LBL'	Registers the User Math A label.
PRMB	6	'B PRMTR LBL'	Registers the User Math B label.

	PROG	8	---	Enters User Program statement lines without using the editor.
	PSCALE=	5	'PLOT AREA'	Enters plot size data.
•	PSTEP	1	'STEP'	Single steps the next line of the User Program (ASP).
•	PSTOP	1	'STOP'	Stops a running User Program (ASP).
	PTCLR	1	'TABLE ALL CLEAR'	Clears data from a program points table.
	PTEND	1	'set end'	Exits from the program points table editor.
	PTSET	1	'PROG TBL set up'	Enters the program points table editor.
	PTSRT	1	'SORTING'	Sorts the measurement points data in the program points table.
►	PTSWP1	9	'SWP select'	Selects frequency as the sweep parameter for a program points measurement.
	PTSWP2	9	'SWP select'	Selects dc bias as the sweep parameter for a program points measurement.
	PTSWP3	9	'SWP select'	Selects OSC LEVEL (V) sweep parameter for a program points measurement.
	PTSWP4	9	'SWP select'	Selects OSC LEVEL (dBm) sweep parameter for a program points measurement.
	PTSWP5	9	'SWP select'	Selects OSC LEVEL (dBμV) sweep parameter for a program points measurement.
•	PURGE	6	'PURGE'	Purges a file from the flexible disc.
►	PWR0	9	'SOURCE off'	Turns off the tracking generator.
	PWR1	9	'SOURCE CH1'	Selects S1 output as the tracking generator output.
	PWR2	9	'SOURCE CH2'	Selects S2 output as the tracking generator output.

- Q -

	Command	Syntax	Key	Description
	QUIT	1	'QUIT editor'	Exits from the user program editor.
	QVAL	1	'Q VALUE'	Calculates the Quality factor value at the line cursor.

- R -

	Command	Syntax	Key	Description
	RAD	1	'PHS UNIT deg **rad**'	Selects the radian angle mode.
•	RCAT	1	'RECOV. files'	Displays recoverable file catalog of the flexible disc.
•	RECOVER	6	'RECOVER'	Recovers purged file from the flexible disc.
	REFRD	1	'o REF read'	Reads reference marker's value.
•	RESAVED	6	'DATA'	Resaves register data.
•	RESAVEP	6	'PROGRAM'	Resaves User Program (ASP).
•	RESAVES	6	'STATE'	Resaves the instrument settings.
•	RESAVET	6	'PROG TABLE'	Resaves the program points table.
	REV?	1	---	Stores the firmware revision code string data into the HP-IB output buffer.
	RST	1	**PRESET**	Sets the 4195A controls to default settings.
•	RUN	1	'RUN'	Runs the User Program (ASP).

- S -

	Command	Syntax	Key	Description
▶	SAP1	9	'dBm'	Selects dBm as the Spectrum measurement unit.
	SAP2	9	'dBμV'	Selects dBμV as the Spectrum measurement unit.

	SAP3	9	'V'	Selects V as the Spectrum measurement unit.
	SAP4	9	'dBm/Hz'	Selects dBm/Hz as the Spectrum measurement unit.
	SAP5	9	'dBμV/Hz'	Selects dBμV/√Hz as the Spectrum measurement unit.
	SAP6	9	'μV/√Hz'	Selects μV/√Hz as the Spectrum measurement unit.
•	SAVED	6	'DATA'	Saves register data to the flexible disc.
•	SAVEP	6	'PROGRAM'	Saves User Program to the flexible disc.
•	SAVES	6	'STATE'	Saves Instrument settings to the flexible disc.
•	SAVET	6	'PROG TABLE'	Saves the program points table to the flexible disc.
▶	SCL1	9	'SCALE **forA** forB'	Selects the active scale change data to data A.
	SCL2	9	'SCALE forA **forB**'	Selects the active scale change data to data B.
▶	SCLP1	9	'P1,P2 normal'	Specifies the plotting area by all display area.
	SCLP2	9	'P1,P2 GRCTL'	Specifies the plotting area by the graticule area.
	SCRATCH	1	'SCRATCH'	Erases the User Program from the work area.
▶	SCT1	9	'SCALE **lin** log'	Selects the linear display scale.
	SCT2	9	'SCALE lin **log**'	Selects the logarithmic scale display.
▶	SEFA0	9	'A'	Turns off Sweep End Function A.
	SEFA1	9	'**A**'	Turns on Sweep End Function A.
▶	SEFB0	9	'B'	Turns off Sweep End Function B.
	SEFB1	9	'**B**'	Turns on Sweep End Function B.

▶	SEFC0	9	'C'	Turns off Sweep End Function C.
	SEFC1	9	'**C**'	Turns on Sweep End Function C.
	SEND	6	'SEND'	Stores specified character string to HP-IB output buffer.
	SENDPS	1	'SEND P1,P2'	Sends plotting area command to the plotter.
•	SHTCAL	1	'SHORT'	Initiates the short calibration measurement.
•	SHTSTD=	3	'SHORT CAL STD'	Enters the short calibration standard's calibrated values.
▶	SPC0	9	'VIEW C on **off**'	Turns off superimpose C data display.
	SPC1	9	'VIEW C **on** off'	Turns on superimpose C data display.
	SPCHG	1	'A,B→→C,D'	Swaps data in A and B with data in C and D array registers, respectively.
▶	SPD0	9	'VIEW D on **off**'	Turns off superimpose D data display.
	SPD1	9	'VIEW D **on** off'	Turns on superimpose D data display.
▶	SPI1	9	'RL-θ'	When in S11 or S22 configuration, selects return-loss measurement.
	SPI2	9	'Γ-θ'	When in S11 or S22 configuration, selects reflection coefficient (amplitude and phase) measurement.
	SPI3	9	'Γx-Γy'	When in S11 or S22 configuration, selects reflection coefficient (real and imaginary) measurement.
	SPI4	9	'SWR-θ'	When in S11 or S22 configuration, selects SWR measurement.
	SPSTR	1	'STORE A,B→C,D'	Stores data in A and B registers into C and D array registers, respectively.
	SRSTR	1	'STORE SWP RNG'	Specifies the partial sweep range.

	SSCL1	9	'SCALE comp 2.0'	Compresses the Smith chart scale to 2.0.
▶	SSCL2	9	'SCALE normal'	Selects the normal Smith chart scale.
	SSCL3	9	'SCALE exp 0.2'	Expands the Smith chart scale to 0.2.
	SSCL4	9	'SCALE exp 0.1'	Expands the Smith chart scale to 0.1.
	STB?	1	---	Stores the status-byte's string data into the HP-IB output buffer.
	STDDSP	1	'CAL STD modify'	Displays registered calibration standards calibrated data.
▶	STRG0	9	'STORAGE on **off**'	Turns the storage display off.
	STRG1	9	'STORAGE **on** off'	Turns on the storage display.
▶	SWD1	9	'DIRECTION **up** down'	Selects upward sweep.
	SWD2	9	'DIRECTION up **down**'	Selects downward sweep.
▶	SWM1	9	'CONT mode'	Selects continuous sweep.
	SWM2	9	'SINGLE mode'	Selects single sweep.
	SWM3	9	'MANUAL mode'	Selects manual point sweep.
▶	SWP1	9	'FREQ'	Selects frequency sweep.
	SWP2	9	'DC BIAS (V)'	Selects dc bias sweep.
	SWP3	9	'OSC LVL (V)'	Selects OSC LEVEL (V) sweep.
	SWP4	9	'OSC LVL (dBm)'	Selects OSC LEVEL (dBm) sweep.
	SWP5	9	'OSC LVL (dBμV)'	Selects OSC LEVEL (dBμV) sweep.
▶	SWR0	9	'PART SWP on **off**'	Turns off partial sweep measurement.
	SWR1	9	'PART SWP **on** off'	Turns on partial sweep measurement.
▶	SWT1	9	'TYPE **lin** log'	Sweeps linearly.
	SWT2	9	'TYPE lin **log**'	Sweeps logarithmic step.
•	SWTRG	1	**TRIGGER RESET**	Resets the sweep measurement and restarts the sweep.

- T -

	Command	Syntax	Key	Description
•	THRCAL	1	'THRU'	Initiates the Through calibration measurement.
►	TRGM1	9	'TRG MODE **int** ext'	Selects internal trigger mode.
	TRGM2	9	'TRG MODE int **ext**'	Selects external trigger mode.
•	TRIG	1	'PT MEAS TRIG'	Triggers each one point measurement.

- U -

Command	Syntax	Key	Description
UDF1	1	'1'	Executes User Defined Function #1.
UDF2	1	'2'	Executes User Defined Function #2.
UDF3	1	'3'	Executes User Defined Function #3.
UDF4	1	'4'	Executes User Defined Function #4.
UDF5	1	'5'	Executes User Defined Function #5.
UNITA	6	'A UNIT LBL'	Enters User Math A unit label.
UNITB	6	'B UNIT LBL'	Enters User Math B unit label.

- V -

	Command	Syntax	Key	Description
►	VFTR0	9	**VIDEO FILTER** off	Turns video filter off.
	VFTR1	9	**VIDEO FILTER** on	Turns video filter on.

- W -

Command	Syntax	Key	Description
▶ WIDTH0	9	'WIDTH on **off**'	Turns off width read-out.
WIDTH1	9	'WIDTH **on** off'	Turns on width read-out.

- X -

Command	Syntax	Key	Description
XDMP	1	'XREG DMP to TBL'	Copies the **X** register data into the program point table.

- Y -

No commands beginning with Y.

- Z -

Command	Syntax	Key	Description
• ZOCMP	1	'0Ω'	Initiates the 0Ω compensation data acquisition measurement.
• ZSCMP	1	'0S'	Initiates the 0S compensation data acquisition measurement.

- other -

Command	Syntax	Key	Description
• *REG_NAM?*	1	---	Stores the register data into the HP-IB output buffer. *REG_NAM* is any register name.

NOTES

APPENDIX F

REGISTER LIST

The HP 4195A's internal registers are listed in this appendix. Data can be read from all of the registers listed here. A black triangle (►) indicates that the resisters are read-only registers.

NOTE

The Multiple Registers are not listed in this appendix but are listed in appendix E. Data cannot be read from the Multiple Registers, so they are treated as commands rather than as registers.

ARRAY REGISTERS

1) DISPLAY/MEASUREMENT REGISTERS

Register	Description
A	The **A** register is a measurement data register and is displayed on the CRT as a bright yellow trace. When the 4195A is making a measurement, the data in register A is updated automatically.
B	The **B** register is a measurement data register and is displayed on the CRT as a bright cyan trace. When the 4195A is making a measurement, the data in register B is updated automatically.
C	The **C** register is a superimpose data register and when selected is displayed on the CRT as an unintensified yellow trace.
D	The **D** register is a superimpose data register and when selected is displayed on the CRT as an unintensified cyan trace.
► MA	The **MA** register is a measurement data register for data A. This register is used by the User Math function. This is a **read-only** register.
► MB	The **MB** register is a measurement data register for data B. This register is used by the User Math function. This is a **read-only** register.
► X	The **X** register stores the sweep point data. Because the data in this register is calculated data, the X register is a **read-only** register.

2) GENERAL PURPOSE REGISTERS

Registers **E, F, G, H, I, J, RA. RB, RC, RD, RE** and **RF** are general purpose registers.

3) CALIBRATION DATA REGISTERS

3-1) S11 and Network-Reflection Calibration

Register	Description
MFOR	The **MFOR** register is used to store the real components of the OPEN termination calibration measurement results.
MFOI	The **MFOI** register is used to store the imaginary components of the OPEN termination calibration measurement results.
MFSR	The **MFSR** register is used to store the real components of the SHORT termination calibration measurement results.
MFSI	The **MFSI** register is used to store the imaginary components of the SHORT termination calibration measurement results.
MFLR	The **MFLR** register is used to store the real components of the LOAD termination calibration measurement results.
MFLI	The **MFLI** register is used to store the imaginary components of the LOAD termination calibration measurement results.
TFOR	The **TFOR** register is used to store the real components of the OPEN termination theoretical calibration data.
TFOI	The **TFOI** register is used to store the imaginary components of the OPEN termination theoretical calibration data.
TFSR	The **TFSR** register is used to store the real components of the SHORT termination theoretical calibration data.
TFSI	The **TFSI** register is used to store the imaginary components of the SHORT termination theoretical calibration data.
TFLR	The **TFLR** register is used to store the real components of the LOAD termination theoretical calibration data.
TFLI	The **TFLI** register is used to store the imaginary components of the LOAD termination theoretical calibration data.

3-2) S21 and Network-Transmission Calibration

Register	Description
MFTR	The **MFTR** register is used to store the real components of the normalized (through) calibration measurement results.
MFTI	The **MFTI** register is used to store the imaginary components of the normalized (through) calibration measurement results.
MFIR	The **MFIR** register is used to store the real components of the isolation calibration measurement results.
MFII	The **MFII** register is used to store the imaginary components of the isolation calibration measurement results.

3-3) S12 Calibration

Register	Description
MRTR	The **MRTR** register is used to store the real components of the normalized (through) calibration measurement results.
MRTI	The **MRTI** register is used to store the imaginary components of the normalized (through) calibration measurement results.
MRIR	The **MRIR** register is used to store the real components of the isolation calibration measurement results.
MRII	The **MRII** register is used to store the imaginary components of the isolation calibration measurement results.

3-4) S22 and Impedance Calibration

Register	Description
MROR	The **MROR** register is used to store the real components of the OPEN termination calibration measurement results.
MROI	The **MROI** register is used to store the imaginary components of the OPEN termination calibration measurement results.
MRSR	The **MRSR** register is used to store the real components of the SHORT termination calibration measurement results.
MRSI	The **MRSI** register is used to store the imaginary components of the SHORT termination calibration measurement results.
MRLR	The **MRLR** register is used to store the real components of the LOAD termination calibration measurement results.
MRLI	The **MRLI** register is used to store the imaginary components of the LOAD calibration measurement results.

TROR The **TROR** register is used to store the real components of the OPEN termination theoretical calibration data.

TROI The **TROI** register is used to store the imaginary components of the OPEN termination theoretical calibration data.

TRSR The **TRSR** register is used to store the real components of the SHORT termination theoretical calibration data.

TRSI The **TRSI** register is used to store the imaginary components of the SHORT termination theoretical calibration data.

TRLR The **TRLR** register is used to store the real components of the LOAD termination theoretical calibration data.

TRLI The **TRLI** register is used to store the imaginary components of the LOAD termination theoretical calibration data.

3-5) Impedance Compensation

Register	Description
ZOR	The **ZOR** register is used to store the impedance measurement 0Ω offset compensation data.
ZOX	The **ZOX** register is used to store the impedance measurement 0Ω offset compensation data.
ZSG	The **ZSG** register is used to store the impedance measurement 0S offset compensation data.
ZSB	The **ZSB** register is used to store the impedance measurement 0S offset compensation data.

SINGLE REGISTERS

Register	Description
ADRS	The **ADRS** register is used to store the 4195A's HP-IB address. This register is battery backed-up. The range of values which can be stored in this register is an integer from 0 to 30.
ATR1	The **ATR1** register is used to store the attenuation value for the Channel 1 reference input. The range of values which can be stored in this register is an integer form 0 to 50 in steps of 10.
ATR2	The **ATR2** register is used to store the attenuation value for the Channel 2 reference input. The range of values which can be stored in this register is an integer from 0 to 50 in steps of 10.
ATT1	The **ATT1** register is used to store the attenuation value for the Channel 1 test input. The range of values which can be stored in this register is an integer from 0 to 50 in steps of 10.

ATT2 The **ATT2** register is used to store the attenuation value for the Channel 2 test input. The range of values which can be stored in this register in an integer from 0 to 50 in steps of 10.

BIAS The **BIAS** register is used to store the value for the dc source output voltage. The range of values which can be stored in this register is from -40 to +40 in steps of 0.01.

BTM The **BTM** register is used to store the bottom of display scale. The range of values which can be stored in this register is from -9.999E+37 to +9.998E+37.

CENTER The **CENTER** register is used to store the sweep parameter's CENTER value. The value range depends on the type of sweep parameter. For example, when in the frequency sweep mode, the range of values for this register is from +0.001 to +500E+06.

DFREQ The **DFREQ** register is used to store the group-delay measurement aperture frequency. The aperture frequency is stored as a percent of frequency span. The range of values which can be stored in this register is from 0.5 to 100.0 in steps of 0.5.

DIV The **DIV** register is used to store the display scale division value. The range of values which can be stored in this register is from +5.000E-36 to +9.999E+37.

DLCURS The **DLCURS** register is used to store the difference value between the o marker (for A or B) and the Line Cursor position (height). The range of values which can be stored in this register is 0 and values between ±1E-37 to ±9.99999E+37.

DMKR The **DMKR** register is used to store the difference value (in the **X** register domain) between the o Marker and the * Marker. The range of values which can be stored in this register is from 0 to the SPAN value.

▶ DMKRA The **DMKRA** register is used to store the difference value (in the **A** register domain) between the o Marker and the * Marker. This is a **read-only** register.

▶ DMKRB The **DMKRB** register is used to store the difference value (in the **B** register domain) between the o Marker and the * Marker. This is a **read-only** register.

EQVCA The **EQVCA** register is used to store the Equivalent Circuit Analysis **Ca** capacitance value. The range of values which can be stored in this register is 0 and the values from ±1E-37 to ±9.99999E+37.

EQVCB The **EQVCB** register is used to store the Equivalent Circuit Analysis **Cb** capacitance value. The range of values which can be stored in this register is 0 and the values from ±1E-37 to ±9.99999E+37.

EQVL The **EQVL** register is used to store the Equivalent Circuit Analysis **L** inductance value. The range of values which can be stored in this register is 0 and the values from ±1E-37 to ±9.99999E+37.

EQVR The **EQVR** register is used to store the Equivalent Circuit Analysis **R** resistance value. The range of values which can be stored in this register is 0 and values from ±1E-37 to ±9.99999E+37.

► **ERR** The **ERR** register is used to store the error number. This is a **read-only** register.

FREQ The **FREQ** register is used to store the measurement frequency value for the DC Bias or OSC Level sweeps. The range of values which can be stored in this register is from +0.001 to +500E+06.

LCURS The **LCURS** register is used to store the line cursor position (height) value. The range of values which can be stored in this register is 0 and values from ±1E-37 to ±9.99999E+37.

►**LCURSL** The **LCURSL** register is used to store the value of the left most intersect point (in the **X** register domain). This is a **read-only** register.

►**LCURSR** The **LCURSR** register is used to store the value of the right most intersect point (in the **X** register domain). This is a **read-only** register.

MANUAL The **MANUAL** register is used to store the manual sweep point value. The range of values which can be stored in this register is from the START value to the STOP value.

MKR The **MKR** register is used to store the value of the o marker position (in the **X** register domain). The range of values which can be stored in this register is from the START value to the STOP value.

► **MKRA** The **MKRA** register is used to store the data A value specified with the o marker. This is a **read-only** register.

► **MKRB** The **MKRB** register is used to store the data B value specified with the o marker. This is a **read-only** register.

NOP The **NOP** register is used to store the number of sweep points. The range of values which can be stored in this register is an integer from 2 to 401.

► **NVAL** The **NVAL** register is used to store the noise value. This is a **read-only** register.

OSC1 The **OSC1** register is used to store the Channel 1 source amplitude value. The range of values which can be stored in this register depends on the amplitude level unit specified. For example, when the unit is dBm, the value range is -50 to +15 in steps of 0.1.

OSC2 The **OSC2** register is used to store the Channel 2 source amplitude value. The range of values which can be stored in this register depends on the amplitude level unit specified. For example, when the unit is dBm, the value range is from -50 to +15 in steps of 0.1.

PEP1 The **PEP1** register is used to store the Channel 1 port extension length value in cm. The range of values which can be stored in this register is from -999.99 to +999.99.

PEP2 The **PEP2** register is used to store the Channel 2 port extension length value in cm. The range of values which can be stored in this register is from -999.99 to +999.99.

PER1 The **PER1** register is used to store the Channel 1 reference input port extension length value in cm. The range of values which can be stored in this register is from -999.99 to +999.99.

PER2 The **PER2** register is used to store the Channel 2 reference input port extension length value in cm. The range of values which can be stored in this register is from -999.99 to +999.99.

PET1 The **PET1** register is used to store the Channel 1 test input port extension length value in cm. The range of values which can be stored in this register is from -999.99 to +999.99.

PET2 The **PET2** register is used to store the Channel 2 test input port extension length value in cm. The range of values which can be stored in this register is from -999.99 to +999.99.

► **PI** The **PI** register is used to store the approximate value for π, 3.141 592 653 59. This is a **read-only** register.

PTN The **PTN** register is used to store the program point table number. The range of values which can be stored in this register is an integer from 1 to 4.

► **QV** The **QV** register is used to store the Q value. This is a **read-only** register.

RBW The **RBW** register is used to store the resolution bandwidth setting. The values which can be stored in this register is 3, 10, 30, 100, 300, 1000, 3000, 10000, 30000, 100000, and 300000.

REF The **REF** register is used to store the top of the display scale. The range of values which can be stored in this register is from -9.998E+37 to +9.999E+37.

► **RLOSS** The **RLOSS** register is used to store the Return Loss value displayed on the Polar format display. This is a **read-only** register.

RQS The RQS register is for storing the bit mask data of the HP-IB status byte. The value range is 0 to 255 integer number.

Rn The **Rn** registers are general purpose single registers. Where **n** is 0 to 99. The range of values which can be stored in these registers is 0 and values from ±1E-37 to ±9.99999E+37.

SMKR The **SMKR** register is used to store the value of the * marker position (in the **X** register domain). The range of values which can be stored in this register is from the START value to the STOP value.

► **SMKRA** The **SMKRA** register is used to store the data A value specified with the * marker. This is a **read-only** register.

► **SMKRB** The **SMKRB** register is used to store the data B value specified with the * marker. This is a **read-only** register.

► **SMTHC** The **SMTHC** register is used to store the C (capacitance) value displayed on the Smith Chart display. This is a **read-only** register.

► **SMTHL** The **SMTHL** register is used to store the L (inductance) value displayed on the Smith Chart display. This is a **read-only** register.

► **SMTHR** The **SMTHR** register is used to store the R (resistance) value displayed on the Smith Chart display. This is a **read-only** register.

► **SMTHX** The **SMTHX** register is used to store the X (reactance) value displayed on the Smith Chart display. This is a **read-only** register.

SPAN The **SPAN** register is used to store the sweep parameter SPAN value. The range of values which can be stored in this register depends on the type of sweep parameter selected. For example, when the frequency sweep parameter is selected, the range of values which can be stored in this register is from +0.002 to +499 999 999.999.

ST The **ST** register is used to store the sweep time value.

START The **START** register is used to store the sweep parameter's START value. The range of values which can be stored in this register depends on the sweep parameter selected. For example, when the frequency sweep parameter is selected, the range is from +0.001 to +500E+06.

STEP The **STEP** register is used to store the sweep parameter's STEP value. The range of values which can be stored in this register depends on the sweep parameter selected, and the values previously set for START, STOP, CENTER, SPAN, and NOP.

STOP The **STOP** register is used to store the sweep parameter's CENTER value. The range of values which can be stored in this register depends on the sweep parameter selected. For example, when the frequency sweep parameter is selected, the value range is from +0.001 to +500E+06.

► **VSWR** The **VSWR** register is used to store the VSWR value displayed on the Polar format display. This is a **read-only** register.

► **WID** The **WID** register is used to store the width value (LCURSR minus LCURSL). This is a **read-only** register.

Z The **Z** register is used to store the numeric data value for display on the system message line.