

PLOT OUTPUT OPTIONS:

| Type of Plot | Code | | | | |
|----------------------------------------------------------------|---------------------|---------------------|---------------------|--------------------|--------------------|
| | S | G | H | Y | Z |
| R-I plot of S,G,H,Y, or Z parameter | S _{ij} | G _{ij} | H _{ij} | Y _{ij} | Z _{ij} |
| R-I plot of reciprocal of S,G,H, Y, or Z parameter | 1/S _{ij} | 1/G _{ij} | 1/H _{ij} | 1/Y _{ij} | 1/Z _{ij} |
| F-Y plot of magnitude of S,G,H, Y, or Z parameter | SM _{ij} | GM _{ij} | HM _{ij} | YM _{ij} | ZM _{ij} |
| F-Y plot of reciprocal of magnitude of S,G,H,Y, or Z parameter | 1/SM _{ij} | 1/GM _{ij} | 1/HM _{ij} | 1/YM _{ij} | 1/ZM _{ij} |
| F-Y plot of magnitude in db | SDB _{ij} | GDB _{ij} | HDB _{ij} | — | — |
| F-Y plot of reciprocal of magnitude in db | 1/SDB _{ij} | 1/GDB _{ij} | 1/HDB _{ij} | — | — |
| F-Y plot of phase of S,G,H,Y, or Z parameter | SP _{ij} | GP _{ij} | HP _{ij} | YP _{ij} | ZP _{ij} |
| R-I plot of Γ MS | GMS | | | | |
| R-I plot of Γ ML | GML | | | | |
| F-Y plot of K | K | | | | |
| F-Y plot of G A MAX | GAMAX | | | | |
| F-Y plot of G U MAX | GUMAX | | | | |
| F-Y plot of delay | DELAY | | | | |
| F-Y plot of input VSWR | IVSWR | | | | |
| F-Y plot of output VSWR | OVSWR | | | | |

Print Output Options:

| Code | Output |
|-------|--------------------------------------------------------------------|
| SRI | S-matrix for overall circuit in real-imaginary form |
| SMP | S-matrix for overall circuit in magnitude-phase |
| SDB | Same as SMP except S ₁₂ and S ₂₁ in db |
| GRI | G-matrix for overall circuit in real-imaginary form |
| GMP | G-matrix for overall circuit in magnitude-phase |
| GDB | Same as GMP except G ₁₂ and G ₂₁ in db |
| HRI | H-matrix for overall circuit in real-imaginary form |
| HMP | H-matrix for overall circuit in magnitude-phase |
| HDB | Same as HMP except H ₁₂ and H ₂₁ in db |
| YRI | Y-matrix for overall circuit in real-imaginary form |
| YMP | Y-matrix for overall circuit in magnitude-phase |
| ZRI | Z-matrix for overall circuit in real-imaginary form |
| ZMP | Z-matrix for overall circuit in magnitude-phase |
| AMP | K, G A MAX, G U MAX, Γ MS, Γ ML |
| FIL | Loss, return loss, and delay in forward direction |
| IVSWR | Input VSWR |
| OVSWR | Output VSWR |
| GT | Transducer gain |

MAP OUTPUT OPTIONS:

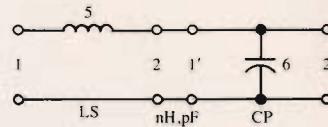
| Type of Plot | Variable to be Mapped |
|---------------------------------------------|----------------------------------|
| Map Load: Γ in or 1/ Γ in | Load Impedance, Z _L |
| Map Source: Γ out or 1/ Γ out | Source Impedance, Z _S |
| Map S: S _{ij} or 1/S _{ij} | Internal Series Impedance, Z |
| Map P: S _{ij} or 1/S _{ij} | Internal Parallel Impedance, Z |
| i = 1, 2, 3, 4 | |
| j = 1, 2, 3, 4 | |

EXAMPLE

Cascade (CAS) Construction:

The following example illustrates the cascade (CAS) connection of two 2-ports:

Insert BAMP Cassette
Press: LOAD, EXECUTE
Press: RUN, EXECUTE



BEGIN ?LS 5
NEXT ?CP 6
NEXT ?SMP
NEXT ?I

| | 11 | 12 | 21 | 22 |
|-------|-------|-------|-------|-------|
| FREQ. | 1.000 | 0.654 | 0.757 | 0.654 |
| MAG | 154.7 | 72.0 | 72.0 | 115.7 |
| ANG | | | | |

EDIT,RUN.WRITE, OR STOP?S

Comments:

- Printed S-parameters are for ports 1 and 2', the two ports of the composite 2-port.
- The order in which 2-ports enter the circuit description determines the order in which they are connected. LS is the first 2-port, and CP is the second.
- BAMP connects port 1 of the second 2-port (CP) to port 2 of the first (LS). In general, BAMP builds up a 2-port from source to load if port 1 of the composite 2-port is connected to the source and port 2 is connected to the load.

BAMP 30 SYSTEM CONFIGURATION

Hardware:

- 9830 Calculator
- 7904 Words RWM, Option 276

ROM:

- 11271B Plotter Control
- 11274B String Variables
- 11279B Advanced Programming 1

Peripherals:

- 9862A Plotter
- 9866A Thermal Page Printer

Software:

| Description | Part Number |
|-------------------|-------------|
| Complete Pac | 09830-71103 |
| Manual | 09830-71102 |
| Program Cassette | 09839-71102 |
| BAMPDF Cassette | 09839-71103 |
| DEV Data Cassette | 09839-71104 |

EDITING

GENERAL FORM EXAMPLE

List circuit file

| | | |
|-----------------------|-----------------------|---------------------------------------------------------|
| EDITOR ?LIS-11, 12 | EDITOR ?LIS-20, 70 | Lists lines 11 through 12 (20 through 70 in example) |
| EDITOR ?LIS- 11 | EDITOR ?LIS-50 | Lists from line 11 (from 50 in example) |
| EDITOR ?LIS | EDITOR ?LIS | Lists from line 10 |

Change frequencies

| | |
|------------------------------|-----------------------------------------------|
| EDITOR ?STEP f1, f2, f3 | |
| EDITOR ?ESTEP f1, f2, n | |
| EDITOR ?I f1, f2, f3, ... | I1 is number of record containing frequencies |

Construct DEV data file

| | |
|----------------------------------------------------|--|
| EDITOR ?FILE | |
| The circuit must be run before data can be stored. | |

Change units and program parameters

| | |
|-------------------------|--|
| EDITOR ?O M ZR 75 NF | |
|-------------------------|--|

Insert new line

| | |
|------------------------------|-------------------------|
| EDITOR ?line number entry | EDITOR ?35 RP 10 SER |
|------------------------------|-------------------------|

line number is an integer greater than 11 and less than 12 where 11 and 12 are the lines between which the new line is inserted. In the specific example, 2-port RP 10 SER goes into line 40, 40 goes to 50, etc.

Delete a line

| | |
|-------------------------|---------------|
| EDITOR ? line number | EDITOR ?40 |
|-------------------------|---------------|

line number must be a multiple of 10. In the specific example, old line 50 goes into 40, old 60 into 50, etc.

Change a line

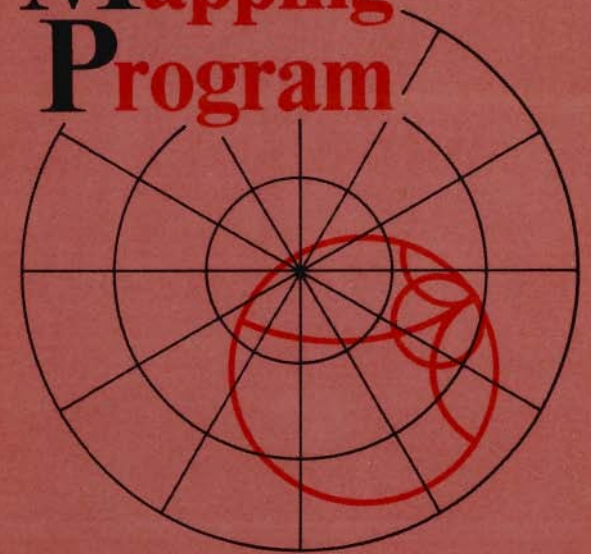
| | |
|----------------------------------|-------------------------------|
| EDITOR ?line number new entry | EDITOR ?30 PTCP 1000 5 2.5 |
|----------------------------------|-------------------------------|

line number must be a multiple of 10.

To insert or delete a sequence of lines:

- Make a list of insertions or deletions with line numbers based on current listing.
- Work from highest to lowest number.

Basic Analysis and Mapping Program



**HP 9830A
CALCULATOR-AIDED DESIGN SYSTEM**

HEWLETT  PACKARD

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

2-PORTS SPECIFIED BY PARAMETERS

| 2-Port | Name | Parameter(s) | 2-Port | Name | Parameter(s) |
|--------------------------------------|------|--------------|--------|------|------------------------|
| Lumped, Passive, Reciprocal Elements | | | | | |
| | RP | r | | TF | $1 \text{ or } z1, z2$ |
| | RS | r | | PTCP | r, l, c |
| | LP | l | | PTCS | r, l, c |
| | LS | l | | STCP | r, l, c |
| | CP | c | | STCS | r, l, c |
| | CS | c | | | |

| Lumped, Active Elements | | | | | |
|-------------------------|------|----------------|----------------------|------|------------------------------|
| | VDVS | $a(Re), a(Im)$ | | CDVS | $a(Re), a(Im)$ |
| | VDCS | $a(Re), a(Im)$ | | CDCS | $a(Re), a(Im)$ |
| Nonreciprocal Element | | | | | |
| | GY | r | Distributed Elements | | |
| | | | | TL | $\sqrt{lc}, len, v, c, r, g$ |
| | | | | WG | fc, len |

GENERAL FORM OF INPUT:

BEGIN? name parameter value(s) connection

NEXT? name

- NOTES: 1) connection can precede parameter value(s).
 2) Input parameter values in order shown in Table.
 3) TEL can substitute for any parameter value.
 4) Underline indicates user response.

FIXED 2-PORTS

| 2-Port | Name | 2-Port | Name | 2-Port | Name |
|--------|------|--------|------|--------|------|
| | OPE | | THRU | | SHO |

INPUT:

NEXT? name

2-PORT CHARACTERIZED BY S-PARAMETERS



INPUT:

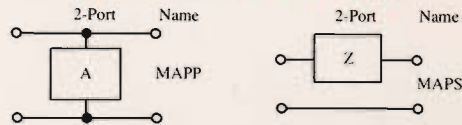
BEGIN?

DEV k connection name of data file

NEXT?

- NOTES: 1) k is an integer between 1 and 9. Devices must be numbered, but order is unimportant.
 2) Order of connection and name of data file can be reserved.
 3) If no data file is specified, then you are prompted for DEV data at a later point in the program.
 4) If the same DEV is used more than once, then the name of data file, if any, need be given only the first time that DEV is input.

2-PORTS USED FOR MAPPING



INPUT:

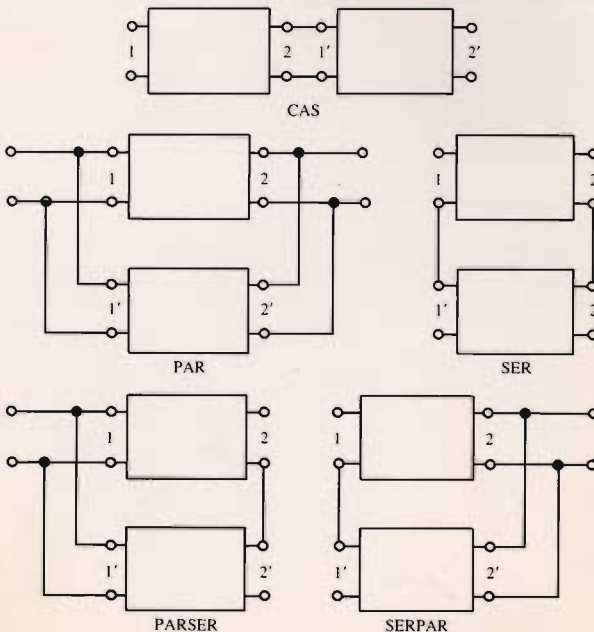
BEGIN?

name connection

NEXT?

- NOTE: In all of the above, connection is optional — CAS assumed, if none specified.

2-PORT CONNECTIONS



UNITS

| Quantity | Units & Code | Default | Options | |
|-------------|--------------|----------------|----------------|----------------|
| FREQUENCY | | Gigahertz GHZ | Hertz HZ | Kilohertz KHZ |
| | | | Megahertz MHZ | |
| RESISTANCE | | Ohms OH | Kilohms KO | Megohms MO |
| INDUCTANCE | | Nanohenries NH | Henrys H | Millihenrys MH |
| | | | Microhenrys UH | |
| CAPACITANCE | | Picofarads PF | Farads F | Microfarads UF |
| | | | Nanofarads NF | |
| LENGTH | | Centimeters CM | Meters M | Inches IN |

PROGRAM PARAMETERS

| Program Parameter | Default | Option & Input |
|------------------------------------|---------|----------------------------------------------------------------|
| REFERENCE IMPEDANCE | 50Ω | $-\infty < R < \infty, R \neq 0$ Z R r r in ohms, not KO |
| ANGULAR INCREMENT FACTOR | 5 | AIF > 0 AIF n no plot if n > 1000 |
| DOMAIN OF RESISTANCE (for mapping) | R ≥ 0 | $-\infty < R < \infty$ = (+ changes back to default) |

FREQUENCIES

EXAMPLES:

set of discrete frequencies
 NEXT? f1, f2, f3, ...

linearly stepped range
 NEXT? STEP f1, f2, f3 $f1 = \text{start frequency}$
 $f2 = \text{stop frequency}$
 $f3 = \text{frequency step}$

exponentially stepped range
 NEXT? ESTEP f1, f2, n $f1 = \text{start frequency}$
 $f2 = \text{stop frequency}$
 $n = \text{number of frequencies}$

Spaces may be substituted for commas.

COMMENTS:

Multiple frequency ranges can be specified using any combination of sets of discrete frequencies, linearly stepped ranges, and exponentially stepped ranges. All frequencies must be in one line of input.

AUXILIARY FUNCTIONS

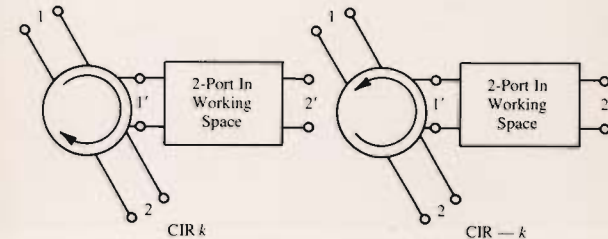
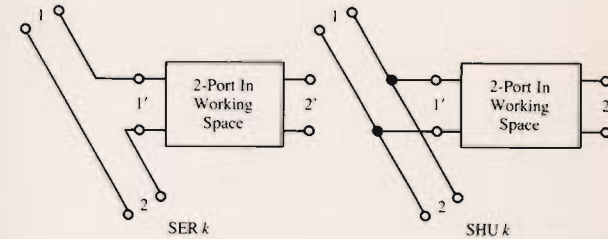
NEXT? HOLD k

HOLD k transfers the 2-port in working space to storage location k and clears the working space.

NEXT?SER k
 NEXT?SHU k
 NEXT?CIR ±k

Each of these does the following:

- 1) Transforms the 2-port in working space to a new 2-port as shown.
- 2) Transfers the new 2-port to storage location k , and
- 3) Clears the working space.



Port 2' inaccessible in all cases.

NEXT?USE ±k connection

Retrieves the 2-port in storage location k and inverts ports, if $-k$.

NOTE: In all of the above k is an integer between 1 and 10.

BAMP 30 OPERATING FLOWCHART

