

OPERATING AND PROGRAMMING MANUAL

8180A
DATA GENERATOR
(Including Options 001 and 002)
And
8181A
DATA GENERATOR
EXTENDER
(Including Option 001)

This manual applies directly to all instruments.

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HERRENBERGER STR. 110, D-7030 BOBLINGEN
FEDERAL REPUBLIC OF GERMANY



SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GENERAL – This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

OPERATION – BEFORE APPLYING POWER comply with the installation section. Additionally, the following shall be observed:

Do not remove instrument covers when operating.

Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers and devices connected to it should be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible, and when inevitable, should be carried out only by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or perform any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

To prevent CRT implosion, avoid rough handling or jarring of the instrument. Handling of the CRT shall be done only by qualified maintenance personnel using approved safety mask and gloves.

SAFETY SYMBOLS



The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.



Indicates dangerous voltages.



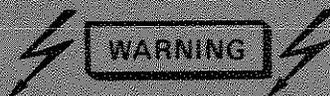
Earth terminal

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.



Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

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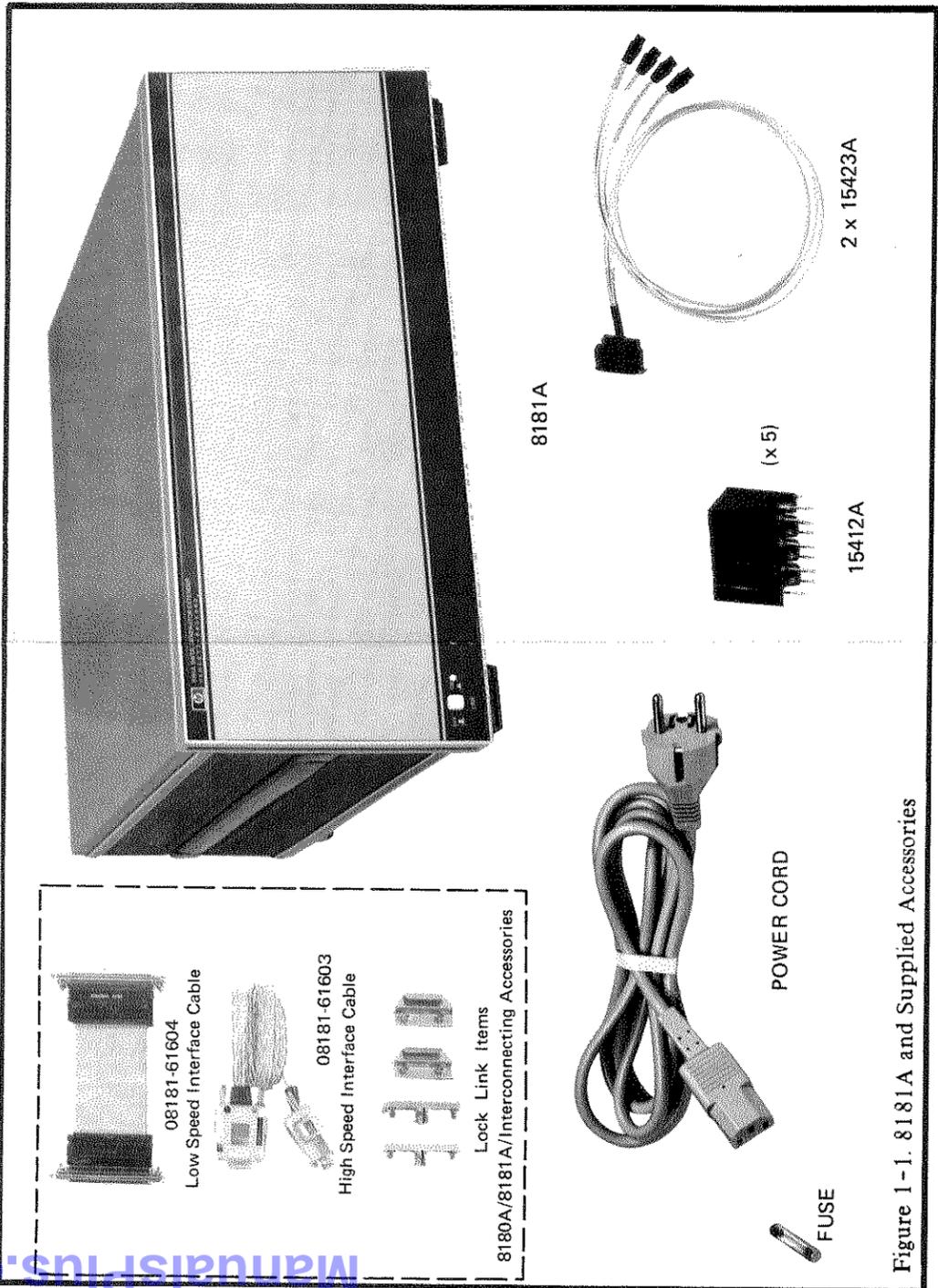


Figure 1-1. 8181A and Supplied Accessories

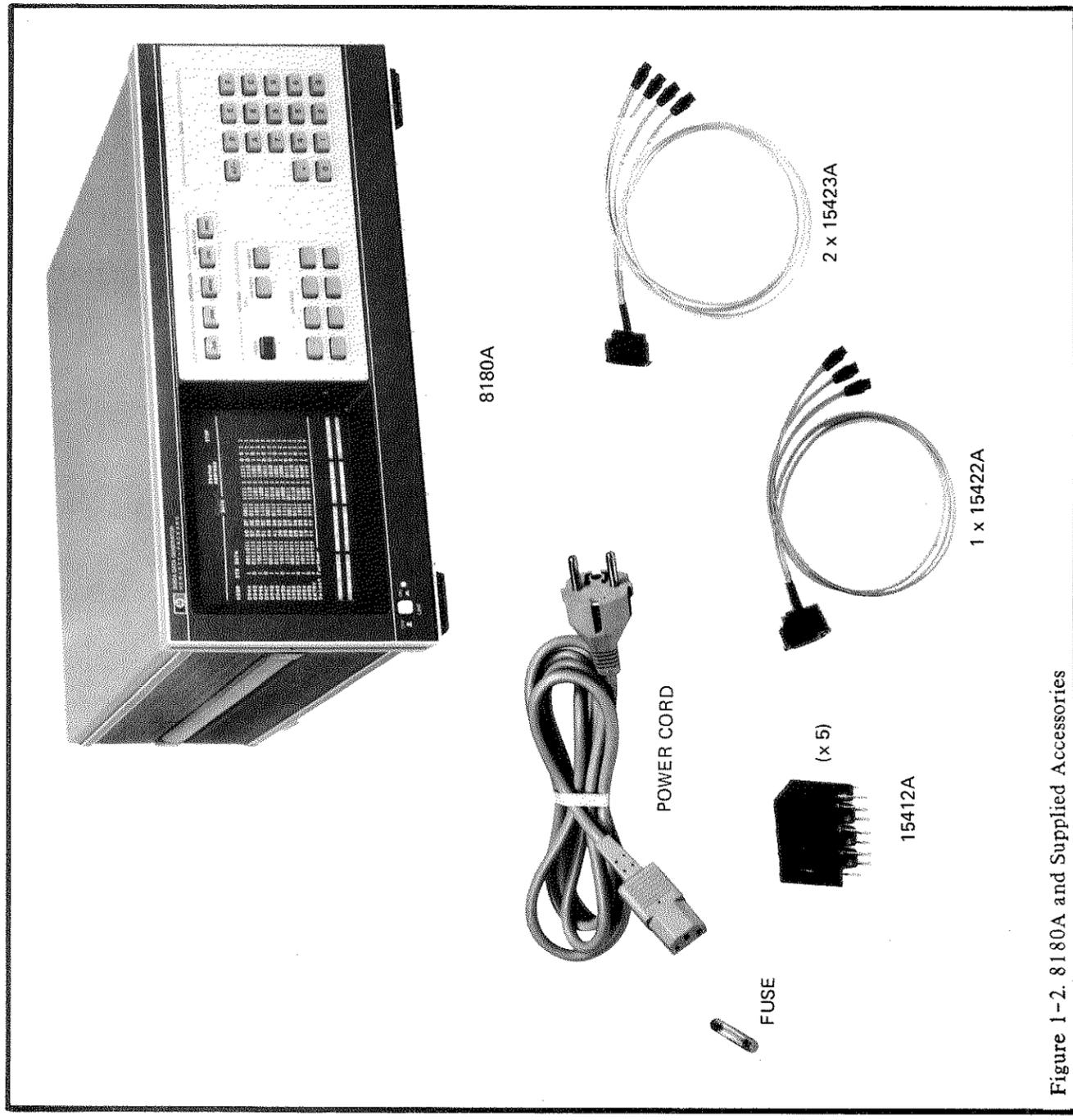


Figure 1-2. 8180A and Supplied Accessories

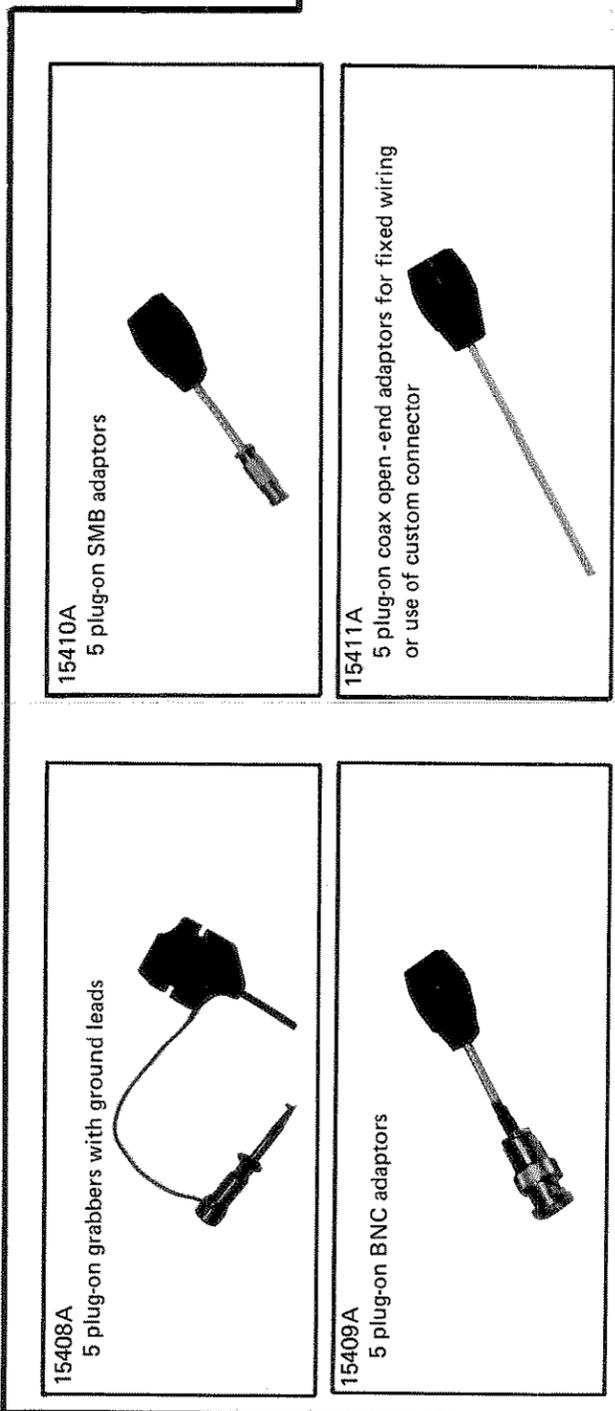
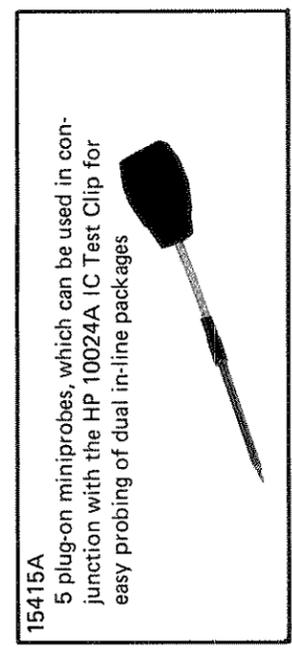
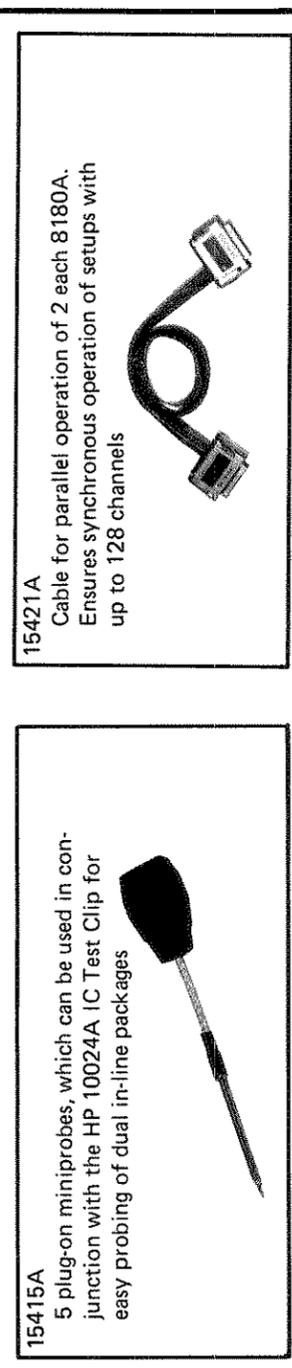


Figure 1-3. Available Connector Accessories ! NOTE: Accessories - 15412A, 15422A and 15423A are also separately available)



SECTION 1

GENERAL INFORMATION

1-1 INTRODUCTION

This Operating Manual contains information required to install, operate and test the Hewlett-Packard Models 8180A and 8181A. (Service related information is located in the corresponding sections of the complete manual set).

Figures 1-1, 1-2, and 1-3 show the two main-frames, the accessories supplied with each and those available. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-2 SPECIFICATIONS

Instrument specifications for both the 8180A and the 8181A are listed in Table 1-2. These specifications are the performance standards or limits against which the instruments are tested.

1-3 SAFETY CONSIDERATIONS

The Models 8180A and 8181A are Safety Class 1 instruments (instruments with an exposed metal chassis that is directly connected to earth via the power supply cable).

Before operation, the instruments and manual, including the red safety page, should be reviewed for safety markings and instructions. These must then be followed to ensure safe operation and to maintain the instruments in a safe condition.

1-4 INSTRUMENTS COVERED BY THE MANUAL

Attached to the rear of each instrument is a serial number plate (Figure 1-4). The first four digits of the serial number only change when there is a significant change to the instrument. The last five digits are assigned to instruments sequentially. The contents of this manual apply directly to the instrument serial number quoted on the title page (or to all instruments if stated). For instruments with higher serial numbers, refer to the Manual Change sheets supplied with this manual. In addition to change information, the Manual Change sheets may contain information for correcting any errors in the manual.

To keep this manual as up-to-date and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Change supplement. The supplement for this manual is identified by a print date and part number, both of which appear on title page. Complimentary copies of the supplement are available from Hewlett-Packard.

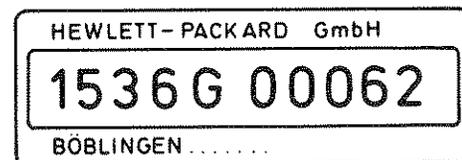


Figure 1-4. Serial Number Plate

1-5 DESCRIPTION

The 8180A/8181A is a modular, high speed (50MHz) programmable data generator for the stimulation of multi-channel digital circuits. The 8180A is a stand-alone data generator with the capability of controlling up to two 8181A Data Generator Extenders. By combining the 8180A/8181A with the 8182A Data Analyzer a complete stimulus/response system for ac-parametric hardware analysis of digital IC's, boards and modules is realised. The 8180A/8181A has an operating concept based around a CRT and softkeys which is designed to simplify operation. Programming over the HP-IB* is straightforward since every parameter can be directly accessed.

*Hewlett-Packard Interface Bus, Hewlett-Packard's implementation of IEEE Standard 488 "Standard Digital Interface for Programmable Instrumentation.

A summary of the 8180A/8181A features is as follows:

1Hz-50MHz data rate.

8-64 NRZ-channels.

up to 8 RZ-channels and two clocks, all with 100ps resolution for delay and width.

1 kbit memory/channel, non-volatile

-2V to +17V into open (-2V to +5.5V into 50 Ohm with 10 mV resolution)

<3.5 ns transition times for TTL, typically 1.5 ns for ECL.

comfortable data pattern editing; convenient softkey operation

full HP-IB programmability.

Possible 8180A/8181A configurations:

The 8180A Data Generator contains up to 16 data channels. A data channel extension possibility is provided by adding up to two 8181A Data Generator Extenders. Each extender contains up to 24 data channels. The complete data generator configuration is controlled via the 8180A and contains up to 64 parallel data channels in total. Also, two 8180A Data Generators can be synchronized, allowing the configuration to be expanded up to 128 channels

1-6 OPTIONS

8180A Options

The standard 8180A Data Generator contains 8 parallel NRZ data channels, 1 strobe channel and 2 clock outputs.

Option 001 features 4 additional NRZ data channels (includes 15423A and 15412A).

Option 002 features 4 additional RZ data channels (includes 15423A and 15412A). The delay and width are individually programmable for each channel. Also, NRZ mode is selectable; delay remains active.

Possible configurations for the 8180A:

8180A standard (8 x NRZ)

8180A + 1 x # 001 (12 x NRZ)

8180A + 2 x # 001 (16 x NRZ)

8180A + 1 x # 002 (8 x NRZ + 4 x RZ)

8180A + 2 x # 002 (8 x NRZ + 8 x RZ)

8180A + 1 x # 001 + 1 x # 002 (12 x NRZ + 4 x RZ)

8180A Options (Continued):

907 Front Handle Kit (Part No. 5061-0090)

908 Rack Flange Kit (Part No. 5061-0078)

909 Rack Flange and Front Handle Combination (Part No. 5061-0084)

910 Additional Complete Manual Set (includes 8181A Data Generator Extender information; Part No. 08180-90000)

916 Additional Operating Manual (includes 8181A Data Generator Extender information; Part No. 08180-90006; sub-set of Opt. 910)

Retrofit Options:

81801A 4 NRZ data channels (includes installation at HP service office; 1 x 15423A and 1 x 15412A)

81802A 4 RZ data channels (includes installation at HP service office; 1 x 15423A and 1 x 15412A)

8181A Options

The standard 8181A Data Generator Extender contains 8 NRZ data channels. The number of channels can be incremented with multiples of Option 001 up to 24 channels (8181A + 4 x # 001). (RZ data channels cannot be installed in the 8181A).

001 Additional 4 NRZ data channels (includes 1 x 15423A and 1 x 15412A)

907 Front Handle Kit (Part No. 5061-0090)

908 Rack Flange Kit (Part No. 5061-0078)

909 Rack Flange and Front Handle Combination (Part No. 5061-0084)

Retrofit Options:

81801A 4 NRZ data channels (includes installation at HP service office; 1 x 15423A and 1 x 15412A)

1-7 ACCESSORIES SUPPLIED

8180 Accessories

The 8180A is supplied complete with the following items (see Figure 1-2)

ITEM	HP PART NUMBER
5A fuse for 230V operation	2110-0010
one fitted and one supplied	
10A fuse for 115V operation	2110-0051
1A fuse (250V)	2110-0007
Power Cable	(see Figure 2-2)
1 x Cable-set for Clock 1, Clock 2 and strobe output	15422A
2 x Cable-set for 4 data channels	15423A
1 x set of 20 solder-in receptacles	15412A
See figure below for details of drilling clearances required etc.	15412A

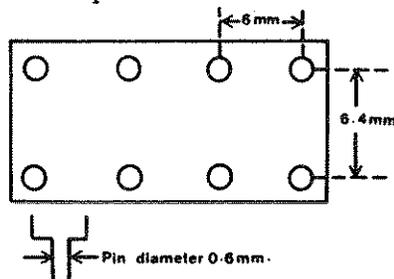


Figure 1-4. 15412A Dimension Details

8181A accessories (see Figure 1-1)

The 8181A is supplied with the same items as the 8180A (apart from no 15422A cable), plus the interconnecting items as shown.

1-8 ACCESSORIES AVAILABLE

Electrical Accessories

In addition to the cable sets supplied with the instruments, various other connector and probe accessories are available for use with each of them.

These are illustrated in Figure 1-3 and (including those supplied as standard) are:

ITEM	HP PART NUMBER
Set of 5 Plug-on grabbers with ground leads	15408A
Set of 5 Plug-on BNC adaptors	15409A
Set of 5 Plug-on SMB adaptors	15410A
Set of 5 Plug-on coax open end adaptors for fixed wiring or use of custom connector	15411A
Set of 5 plug-on miniprobes which can be used in conjunction with the HP 10024A Clip for easy probing of dual-in line packages.	15415A
Cable for parallel operation of 2 8180A's. Ensures synchronous operation of setups with up to 128 channels.	15421A

Mechanical Accessories (see Figure 1-5)

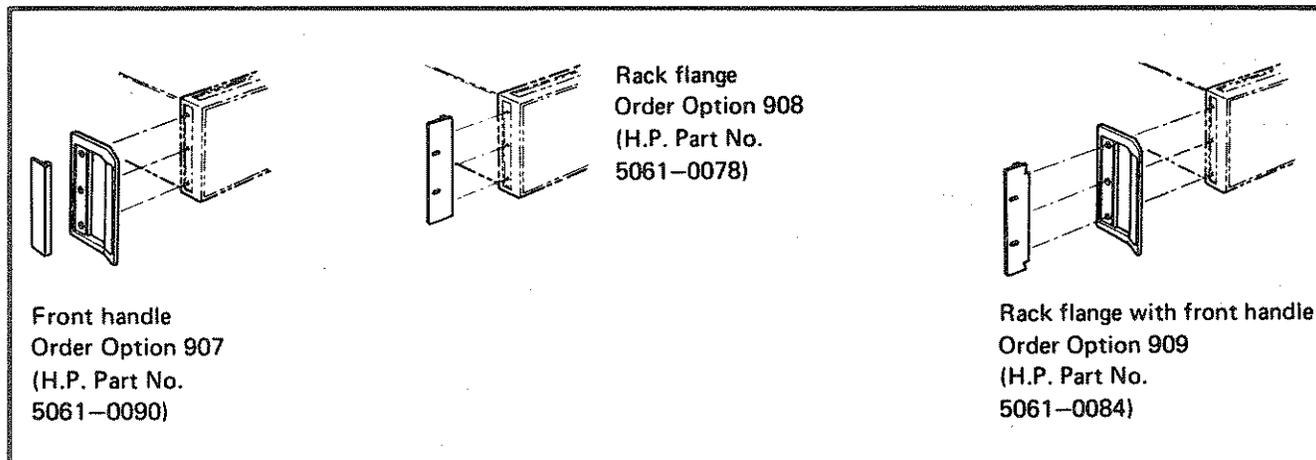


Figure 1-5. Available Rack Mounting Accessories

ITEM	HP PART NUMBER	1-9 RECOMMENDED TEST EQUIPMENT
Rack Flange Kit	5061-0078	Equipment required to maintain the 8180A/8181A is given in Table 1-1. Alternative equipment may be substituted, provided that it meets or exceeds the critical specifications listed in the table.
Rack Flange and Front Handle Combination	5061-0084	
Front Handle Kit	5061-0090	

Table 1-1 Recommended Test Equipment

INSTRUMENT	RECOMMENDED MODEL	REQUIRED CHARACTERISTIC	USE
Universal Counter	HP 5335A	Time Interval A to B; > 50MHz	A P
Plug-on BNC Adapter	HP 15409A		A P T
Clock and Strobe Cable Set	HP 15422A		A P T
Oscilloscope Probes x 2	HP 1725A HP 10017A	275 MHz Bandwidth 1 ns/ Div.	A P T
Data Cable Set	HP 15423A		A P T
Time Mark Generator		Time Mark 2ns	A P
Digital Voltmeter	HP 3456A	1 mV Resolution	A P T
AC Current Amplifier	1111A		A T

Table 1-1 Recommended Test Equipment Continued

INSTRUMENT	RECOMMENDED MODEL	REQUIRED CHARACTERISTIC	USE
Current Probe	1110B		A T
BNC to dual banana plug	PN 1251-2277		A P
Signature Multimeter	HP 5005A		P T
Pulse Generator	HP 8007B	50 MHz/10 Hz Variable Transition Times	A P
BNC-Tee (2 ea)	P.N. 1250-0781		A P
BNC to BNC Cable Assy (2 ea)	HP 11170C	50 Ohm, 122 cm	A P
BNC (f) to BNC (f) Adapter	PN 1250-0080		A P
BNC to BNC Cable Assy (2 ea)	HP 11170A	50 Ohm, 30 cm	A P
Sampling Oscilloscope with Accessories	TEK 7603 with 7T11 and S-3A		P T
HP 85F			T
Delay Line	08180-61636		A
Removal Tool	1251-2170		T
Adjustments Cover	08180-04103		A
Extender Boards:	08180-66551/52 08180-66553/54/56		A T T

8180A DATA GENERATOR SPECIFICATIONS

Specifications are valid at the end of the supplied 1.5 m long cables and for the operating temperature range from 0°C to 50°C.

Memory Size

The memory depth is 1024 bit per channel. The memory width is 8 channels for the 8180A standard. It can be increased up to 16 channels by adding channel expansion options.

The first and last address, between which data will be read out, are settable without restrictions within the memory.

Outputs

The instrument has 8 to 16 data outputs (depending on options), 2 clock outputs and 1 strobe output. Clock pulses are generated with each period. One clock can be selected to remain active in breakstate. The strobe output can be selected to be the instrument's reference clock, or to be a separate data channel useful for external device triggering and as an internal break signal. The output impedance for all outputs is 50 Ohm. All outputs can be enabled or disabled in common. Selection of normal or complement is possible for each output independently.

Data and Clock Outputs

4 pairs of programmable high and low levels can be set up. Any high/low level pair can be assigned to any output. 50 Ohm and high impedance load condition is selectable in common.

Strobe Output

The strobe output can be selected to be a NRZ data channel or to be the reference clock.

TTL and ECL levels are selectable.

Levels apply when driving into 50 Ohm load. (voltages double, if no load connected)

TTL setting:

High level ≥ 2.4 V

Low level ≤ 0.2 V

ECL setting:

High level ≥ -0.9 V

Low level ≤ -1.6 V

Pulse width in clock mode: 10 ns \pm 3 ns

Programmed load condition	from 50 Ohm into 50 Ohm (voltages double, if no load connected)	from 50 Ohm into high impedance (≥ 10 kOhm)
High level range	-1.5 V to +5.5 V	-1.0 V to +17.0 V
Low level range	-2.0 V to +5.0 V	-2.0 V to +16.0 V
Resolution	3 digits (best case 10 mV)	3 digits (best case 20 mV)
Amplitude range	0.5 V to 5.5 V	1.0 V to 17.0 V
Level accuracy after	20 ns settling time ± 0.5 % of level ± 3 % of amplitude ± 30 mV (add ± 30 mV for amplitudes < 0.7 V)	40 ns settling time ± 0.5 % of level ± 3 % of amplitude ± 60 mV (add ± 60 mV for amplitudes < 1.5 V)
Level accuracy after	1 ms settling time ± 0.5 % of level ± 30 mV (add ± 30 mV for amplitudes < 0.7 V)	1 ms settling time ± 0.5 % of level ± 60 mV (add ± 60 mV for amplitudes < 1.5 V)
Transition time (10 % - 90 %)	< 3.0 ns + amplitude x 0.2 ns	< 3.0 ns + amplitude x 0.5 ns
Typical transition time for ECL levels (20 % - 80 %)	1.5 ns	---
Preshoot, Overshoot, Ringing	$< \pm 10$ % of amplitude	$< \pm 10$ % of amplitude

Inputs

The instrument has a RUN (GATE), BREAK, STOP and EXTERNAL CLOCK input. All inputs are edge triggered and can be enabled or disabled independently. Positive or negative slope is independently selectable.

- Input impedance:** 50 Ohm or 100 kOhm selectable.
- Threshold range:** -10.0 V to +10.0 V
- Threshold resolution:** 100 mV
- Threshold accuracy:** ± 3 % of programmed value ± 50 mV
- Threshold overdrive:** > = 100 mV
- Max input voltage:** ± 10 V into 50 Ohm, ± 20 V into 100 kOhm
- Min amplitude:** 250 mVpp
- Min pulse width at threshold:** 8 ns

Timing

Timing specifications are valid for operation into 50 Ohm.

Skew and delay specifications are valid for the 50 % points of a signal with 2.5 V amplitude. For different amplitudes:

Delay changes with $\frac{0.2 \text{ ns} \times (\text{amplitude} - 2.5 \text{ V})}{V}$

Skew increases with $\frac{0.2 \text{ ns} \times |\text{amplitude} - 2.5 \text{ V}|}{V}$

Delay is measured with respect to the strobe output (clock mode), TTL setting, 50 % point of amplitude.

Clock and Data Frequency

- Range:** 1.05 Hz to 50 MHz (20 ns to 950 ms)
- Resolution:** 3 digits
- Accuracy:** ± 5 % of progr. value
- Repeatability:** Factor 4 better than accuracy
- Max jitter:** 0.2 % + 100 ps

Skew: < = 2 ns for NRZ data channels and RZ data channels progr. for zero delay.

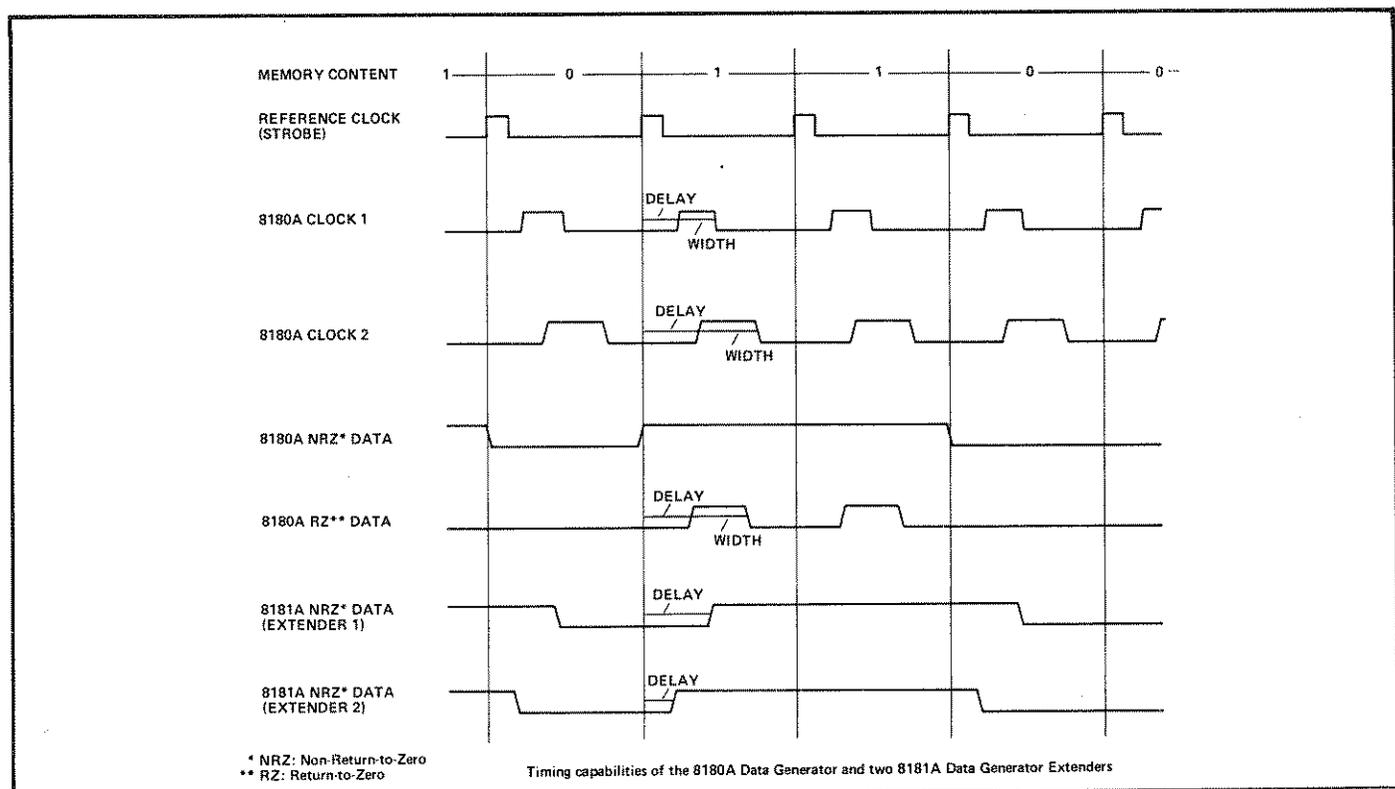
For Clocks and Option 002 (RZ data channels).

Delay

- Range:** 0.0 ns to 950 ms
- Resolution:** 3 digits (best case 100 ps)
(exception: 90.0 ns to 100 ns and 990 ns to 1.00 μs, 2 digits)
- Accuracy:** ± 5 % of programmed value ± 1 ns
- Repeatability:** Factor 4 better than accuracy
- Max jitter:** 0.2 % + 150 ps
- Max delay:** 90 % of period - 18 ns

Width

- Range:** 10.0 ns to 950 ms
- Resolution:** 3 digits (best case 100 ps)
- Accuracy:** ± 5% of programmed value ± 1 ns
- Repeatability:** Factor 4 better than accuracy
- Max jitter:** 0.2 % + 150 ps
- Max width:** 90 % of period - 8 ns



8181A DATA GENERATOR EXTENDER SPECIFICATIONS

The 8181A Data Generator Extender is controlled via the 8180A Data Generator. The instrument state, the cycle mode, the clock rate, the clock source, the output state (enable/disable), the first and last address are the same as in the 8180A.

Memory Size

The memory depth is 1024 bit per channel. The memory width is 8 channels for the 8181A standard. It can be increased up to 24 NRZ channels by adding channel expansion options.

Outputs

The instrument has 8 to 24 data outputs (depending on options). The output impedance for all outputs is 50 Ohm. Selection of normal or complement is possible for each output independently. Output characteristics are the same as for the 8180A's data outputs. The 8181A shares the high/low level pairs with the 8180A.

Timing

The 8181A's NRZ format data channels can all be delayed in common.

Skew: ≤ 2 ns

Delay specifications are as the 8180A RZ data channels. Delay is measured between the 8180A's strobe output (clock mode) and the mid point between the 8181A's NRZ data channels skew.

PARALLEL OPERATION

Synchronous parallel operation of two 8180A Data Generators is possible with the 15421A cable.

The skew measured across both 8180A's increases by 1 ns.

All other output and timing specifications remain as described for 8180A and 8181A.

For operating limitations, please refer to Section 3 - Parallel Operation

HP-IB CAPABILITY

The 8181A programming is performed via the 8180A's HP-IB interface.

All data, parameters and modes are programmable via HP-IB. Interface functions implemented are:

SH1, AH1, L4, SR1, RL1, T6, PP0, DC1, DT1, C0, E2

By means of a specific command, the display of the 8180A may be used as a format free, general purpose alphanumeric display.

Times are measured by programming with the HP 9826A computer and remote message page of 8180A active.

Programming Times

(time for 8180A to receive, verify and execute message, typical).

Period: 45 ms

Delay, Width: 10 ms

Level: 12 ms

Transfer Times

(time for 8180A to receive message, typical)

Character transfer time for ≤ 255 characters: $\leq 60 \mu\text{s}$ /character.

Number of characters per command: 4–6 for modes
6–11 for levels and timing

Data Memory Load Time

(time for 8180A to receive, verify and execute message, typical).

a. **formatted (HEX), 16 channels x 1024 bit:** 10 s
formatted (HEX), 64 channels x 1024 bit: 30 s

b. **unformatted, 16 channels x 1024 bit:** 400 ms
unformatted, 64 channels x 1024 bit: 900 ms

Data, Parameters and Modes Storage Capability (non-volatile)

1 active operating data/parameter/mode set

3 programmable parameter/mode sets

1 standard parameter/mode set

9 first/last address pair sets

After eight hours of continuous operation, batteries maintain all stored data, parameters and modes up to 3 weeks with instrument switched off.

GENERAL (8180A and 8181A)

Recalibration period: 1 year

Warm-up time: 30 min.

Environmental:

Storage temperature: -40°C to 75°C

Operating temperature: 0°C to 50°C

Max operating humidity at 40°C: 95 % R.H.

Video output: Composite video signal, negative SYNC

1.0 Vpp into 75 Ohm

(Recommended monitor HP 82913A)

Power:

8180A: 115/230 V rms +10 %, -22 %;
48-66 Hz; 800 VA max, 460 W max

8181A: 115/230 V rms +10 %, -22 %;
48-66 Hz; 700 VA max, 410 W max

Weight:

8180A: Net 19.0 kg (42 lbs)
Shipping 26.0 kg (58 lbs)

8181A: Net 18.5 kg (41 lbs)
Shipping 23.5 kg (52 lbs)

Dimensions: 178 mm high, 426 mm wide, 500 mm deep
(7 x 16.8 x 19.7 in)



SECTION 2

INSTALLATION

WARNING

The instruments weigh 19.0 kg (42 lbs) - 8180A and 18.5 kg (41 lbs) - 8181A. Care must be exercised when lifting to avoid personal injury.

2-1 INTRODUCTION

This section provides installation instructions for the 8180A and the 8181A and their accessories. It also includes information about initial inspection and damage claims, preparation for use, packaging, storage and shipment.

2-2 INITIAL INSPECTION

Inspect the shipping container for damage. If the container or cushioning is damaged, it should be kept until the contents of the shipment have been checked for completeness, and the instrument has been verified mechanically and electrically. The contents of the shipment should be as shown in Figures 1-1 and/or 1-2 plus any accessories that were ordered with the instrument(s). Procedures for checking the electrical operation are given in Section 3. If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Hewlett-Packard Office. Keep the shipping materials for carriers inspection. The HP office will arrange for repair or replacement without waiting for settlement.

2-3 PREPARATION FOR USE

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, connectors etc).

2-4 Power Requirements

The instruments both require a power source of 115/230 V rms (+10% -22%) at a frequency of 48 - 66 Hz single phase. The maximum power consumptions are: 8180A - 460 W (800 VA), 8181A - 410 W (700 VA).

2-5 Line Voltage Selection

CAUTION

BEFORE SWITCHING ON ANY OF THE INSTRUMENTS, make sure that they are set to the local line voltage.

Figure 2-1 provides information for line voltage and fuse selection:

VOLTAGE	230 V	115V
FUSE	5 A	10 A



Figure 2-1 Switch settings for Line Voltages

2-6 Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate a.c. power receptacle, this cable grounds the instrument cabinet. The type of power cable shipped with each instrument depends upon the country of destination. Refer to Figure 2-2 for the part number of the power cable available.

WARNING

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on.

- If this instrument is to be energised via an autotransformer for voltage reduction, ensure that the common terminal is connected to the grounded pole of the power source.*

b) The power cable plug shall only be inserted into a socket outlet provided with a protective ground contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

c) Before switching on the instrument, the protective ground terminal of the instrument must be connected to the protective conductor of the power cable. This is verified by checking that the resistance between the instrument chassis and the frontpanel and the ground pin of the power cable is zero Ohms.

The following work should be carried out by a qualified electrician and all local electrical codes must be strictly observed.

If the plug on the cable does not fit the power outlet, or the cable is to be attached to a terminal block, cut the cable at the plug end and re-wire it. The colour coding used in the cable will depend on the cable supplied (see Figure 2-2).

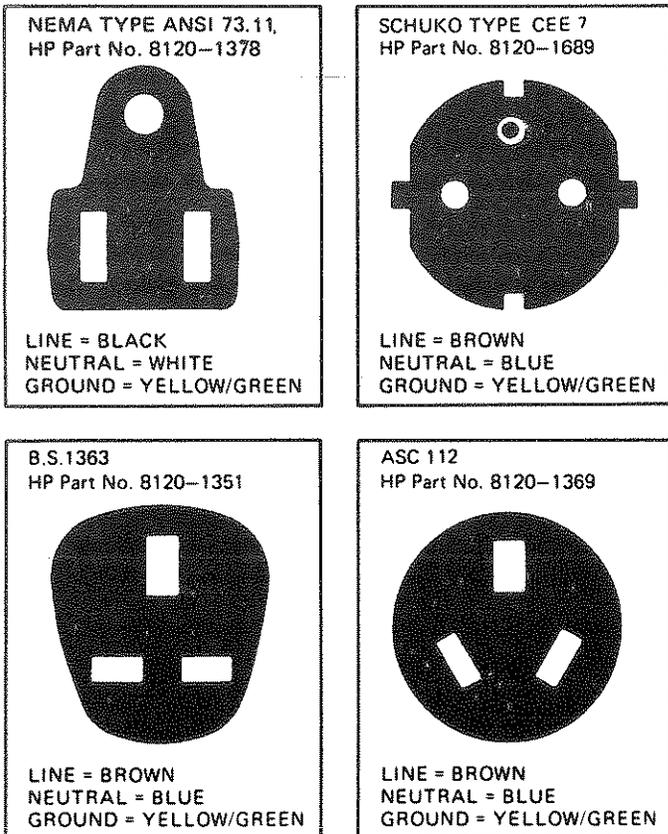


Figure 2-2. Power Cables Available: Plug Identification

If a new plug is to be connected, it should meet local safety requirements and include the following features:

- Adequate load-carrying capacity (see table of specifications in Section 1).

- Ground connection.

- Cable clamp.

2-7 HP-IB Connector

The rear panel HP-IB connector (Fig 2-3), is compatible with the connector on Cable Assemblies 10833A, B, C and D. If a cable is to be locally manufactured, use connector male, HP part number 1251-0293.

2-8 HP-IB Logic Levels

The 8180A HP-IB lines use standard TTL logic, the levels being as follows:

True = Low = digital ground or 0V dc to 0.4V dc,

False = High = open or 2.5V dc to 5V dc.

All HP-IB lines have LOW assertion states. High states are held at 3.0V d.c. by pull-ups within the instrument. When a line functions as an input, approximately 3.2mA of current is required to pull it low through a closure to digital ground. When a line functions as an output, it will sink up to 48mA in the low state and approximately 0.6mA in the high state.

CAUTION

NOTE: Isolation, the HP-IB line screens are not isolated from ground.

2-11 CLAIMS FOR DAMAGE

If physical damage is evident or if the instrument does not meet specification when received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office. The Sales/Service Office will arrange for repair or replacement of the unit without waiting for settlement of the claim against the carrier.

2-12 Storage and Shipment

The instrument can be stored or shipped at temperatures between minus 40 deg C and plus 75 deg C. The instrument should be protected from temperature extremes which may cause condensation within it.

If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag showing owner, return address, model number and full serial number and the type of service required. The original shipping carton and packing material may be re-usable, but the Hewlett-Packard Sales/Service Office will also provide information and recommendations on materials to be used if the original packing is no longer available or re-usable. General instructions for re-packing are as follows:

1. Wrap instrument in heavy paper or plastic.
2. Use strong shipping container. A double wall carton made of 350-pound test material is adequate.
3. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside container. Protect control panel with cardboard.
4. Seal shipping container securely.
5. Mark shipping container **FRAGILE** to encourage careful handling.
6. In any correspondence, refer to instrument by model number and serial number.

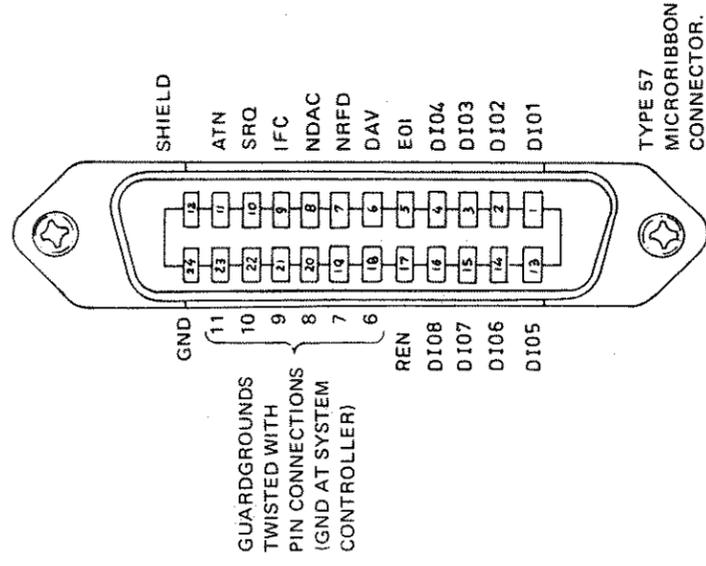


Figure 2-3. HB-IB Connector

2-9 Operating Environment

The operating temperature limits are zero degrees C to 50 degrees C. The specifications also apply over this range.

2-10 FRONT HANDLE/RACK MOUNTING

Figure 1-4 and paragraph 1-8 give the possible handle/rack mounting configurations. If handles are fitted and subsequently need to be removed, the plastic trim must first be taken off as shown in Figure 2-4.

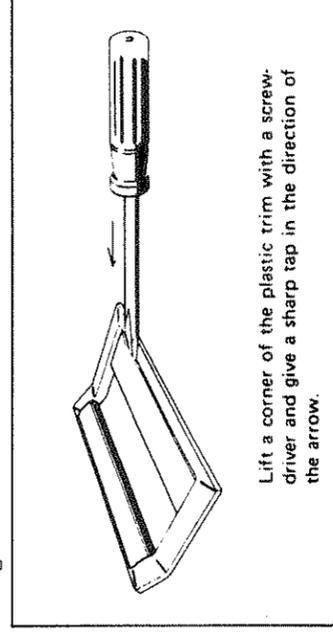
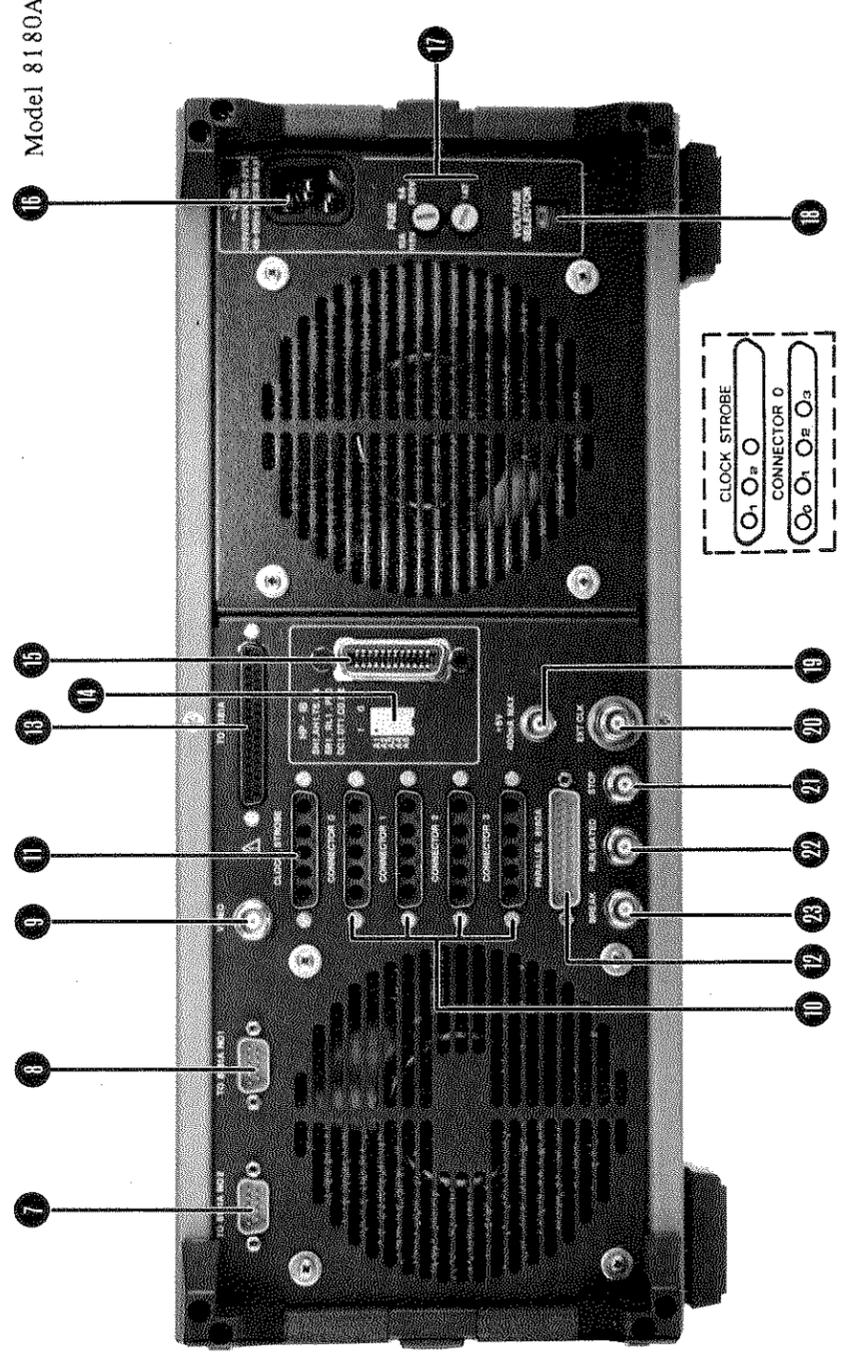
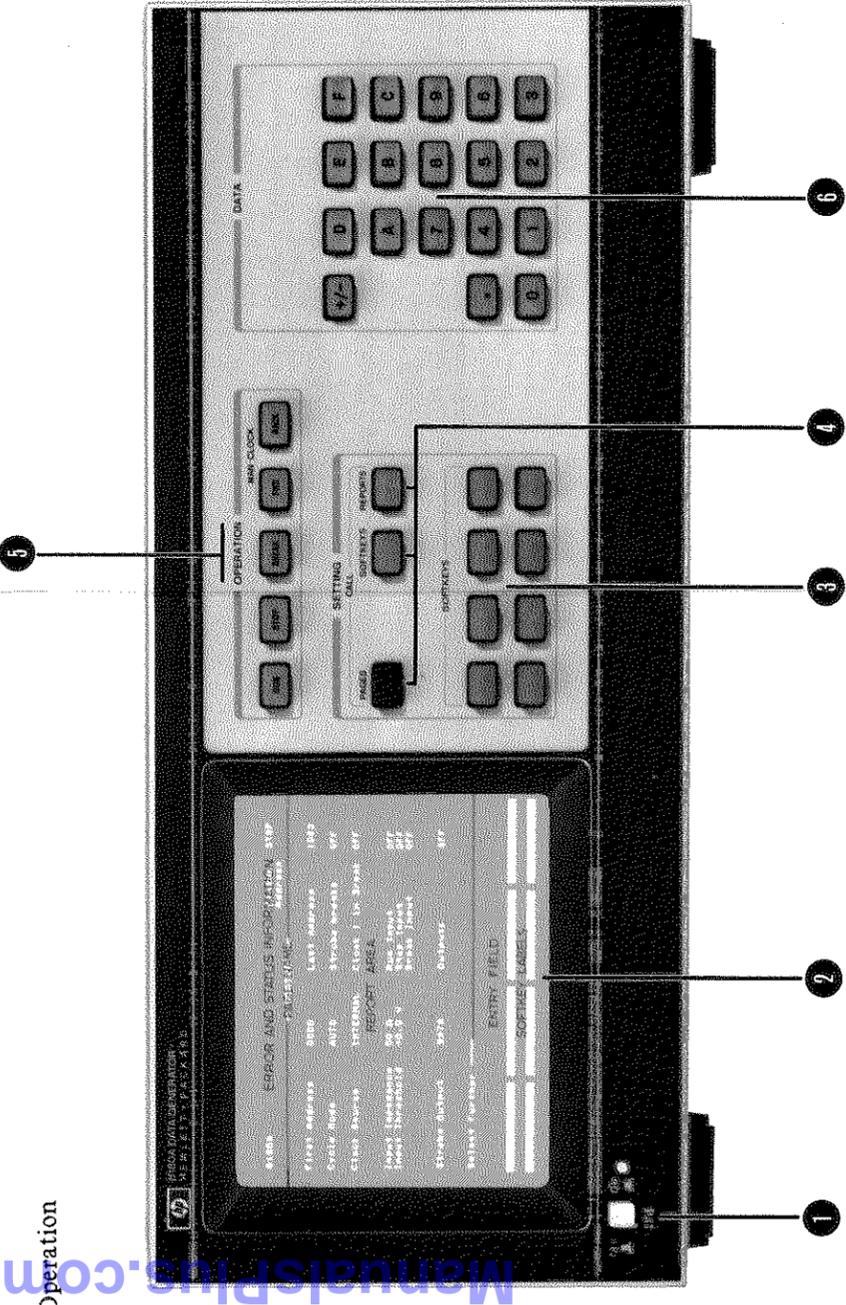


Figure 2-4. Removing Plastic Trim



- 1 LINE power on/off pushbutton switch with ON indicator lamp.
- 2 7 inch CRT screen for displaying PAGES and also error and status details. An overview of a typical display format is shown, further details of the PAGE display are given in the PAGE CONTROL section.
- 3 SOFTKEYS - eight keys with variable functions which are used to access PAGES and all instrument settings. They can also be used for new value entry depending on the type of setting. Their current function is shown by the SOFTKEY LABELS displayed in the bottom portion of the screen.
- 4 "CALL" keys - enable recall of PAGES menu - via (CALL) PAGES key, and mixing of PAGE REPORTS and SOFTKEYS via (CALL) SOFTKEYS and REPORT keys.
- 5 Instrument OPERATING keys - RUN, STOP and BREAK - control the three instrument operating states and (MAN CLOCK) FWD and BACK enable either manual clock generation - FWD or manual stepping forward or backward through addresses after a "BREAK" initiation - FWD and BACK.
- 6 DATA keys - these enable new parameter values and output data to be entered and include: hexadecimal, octal and binary input as well as decimal entry capability. Only those keys currently appropriate for the entry type are enabled.
- 7 and 8 connectors providing synchronising output signals for two Data Generator Extenders.
- 9 VIDEO output for connection of a video monitor.

Connector Number Details

- 10 CONNECTORS 0, 1, 2 and 3 providing a possible total of sixteen data output channels including up to 8 timing (RZ) channels. Timing channel outputs are provided only from CONNECTORS 0 and 1. The actual channel output numbers are shown in CONNECTOR 0 drawing and are same for 1, 2 and 3. NOTE: all connector housings fitted but number of "filled" housings depends on number of channels installed.
- 11 Connector providing CLOCK 1, CLOCK 2 and STROBE output signals (with actual outputs as shown by numbers within diagram).
- 12 Connector for interfacing a second 8180A for extending the number of output channel capabilities.
- 13 Connector for interfacing to the first of two possible 8181A Data Generator Extenders (connection to second extender made via first one).
- 14 Switch for setting the 8180A HP-IB address.
- 15 HP-IB interface connector
- 16 Power line voltage receptacle 17 Fuses, one for current overload protection (dependent on selected Line voltage - 5 A for 230 V or 10 A for 115 V) and one for excessive Line voltage protection.
- 18 Line voltage selector sliding switch to be set to local line voltage
- 19 BNC connector providing 5 V, 400 mA power source for use as required.
- 20 BNC connector for connecting external clock source.
- 21 BNC connectors for connecting external RUN (or GATE enable control), STOP and BREAK control signals.

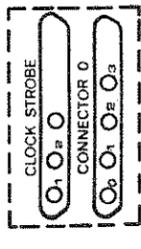


Figure 3-1 8180A Controls, Connectors and display.

SECTION III

OPERATING

3-1 INTRODUCTION

This section explains the functions of controls, connectors and display of the 8180A and provides operating and programming information. Most of this information is also relevant to the 8181A, but additional data specific to its operation is included in a separate sub-section. Information concerning parallel operation of two 8180A's is also included.

The operating information is presented under the following main headings:

- a) **Operating Instructions.** This includes a general overview, basic description of PAGES and "Getting Started" information, descriptions of: memory features, operating states, parallel operation, 8181A operation, "on the fly" parameter changes, and error messages explanation.
- b) **Quick Reference Information.** This includes a quick locator index for parameters and operating modes (front panel operation), a table of reset and Standard Parameter Set conditions and values, a comprehensive description of each PAGE'S features and a list of all HP-IB commands and associated information for programming purposes.
- c) **Programming Information.** This includes address assignment, listener and talker modes description, ASCII and binary data transfers and simple programming examples for individual PAGES. Also included is a list of all HP-IB commands, mnemonics and other related information.

3-2 SPECIAL OPERATING POINTS

The following steps must be taken before applying power to an 8180A or 8181A:

CAUTION

- a) *Read safety summary at the front of this manual.*
- b) *To avoid instrument damage, ensure that the VOLTAGE SELECTOR switch is set correctly for the local line voltage. If it is necessary to change the setting at any time, the instrument must be switched off and the power cable disconnected.*

WARNING

If any change is made to the VOLTAGE SELECTOR switch setting, the line fuse must also be changed. Before changing either of the rear panel fuses, switch the instrument off and disconnect the power cable.

- ⚠** Maximum allowable external voltage at output connectors: -10V - +18V.

3-3 CONTROLS, CONNECTORS AND DISPLAY

A brief explanation of the function of the 8180A front and rear panel controls, connectors and display is given in Figure 3-1. This should be read prior to continuing with the following paragraphs and also referred to as necessary when reading the operating instructions. (Details of the 8181A connectors are given at the end of the main operating section).

NOTE: Output Cables - Connector Identification. The output cables supplied with the 8180A (also applicable to the 8181A) have color and number markings to identify each output signal. They are explained as follows:

The four discrete connectors of output cable 15423A are coded: 0/black, 1/red, 2/yellow and 3/blue respectively, to identify the corresponding four channels.

The three discrete connectors of cable 15422A (8180A only) are coded: C1/black, C2/red and 0/yellow (Strobe) to identify the clock and strobe signals respectively.

3-4 OPERATING INSTRUCTIONS

All instrument settings can be set either via the front panel controls (local operation), or programmed using the HP-IB (remote operation). Local operation is explained in the following paragraphs. For remote operation, refer to the "PROG/HP-IB" section (blue register). Within the text, exact frontpanel legends e.g. "PAGE", are used where helpful. Also, these and SOFTKEYS, are identified by bold typeface e.g. "Clock", where specific operation is described.

3-5 Operating Concept

The operating concept of the 8180A is based on a "layered menu" principle as illustrated in Figure 3-2. The instrument settings (parameters, operating conditions etc.) are itemised over seven "PAGES" each of which is sub-divided or layered (hence layered menu) and contains a group of related items (e.g., timing related-TIMING PAGE). A PAGE display comprises two main areas: **REPORT** and **SOFTKEY**.

The **REPORT** can contain a combination of parameter values, operating conditions or output data (logic code) depending on the PAGE.

The **SOFTKEY** area includes an entry field and the current softkey labels or function identifiers.

The PAGES and settings are accessed via "SOFTKEYS", these are a group of eight, front panel mounted keys, whose functions are variable (non-permanently defined). Following access of the required setting, entry of the parameter value, operating condition or data is made via either the SOFTKEYS or DATA keys depending on the type of setting.

3-6 Power Up and Initial Conditions

Press the **LINE** switch. Do not press any other front panel key. After a few seconds' delay (during which the cooling fans start up and ON indicator illuminates), note the initial condition display. This is divided into two areas:

The upper one (above the the dividing line) contains current status (and possibly error) data. The lower, PAGE selection area contains the **SELECT PAGE** prompt and the PAGES menu.

NOTE: If an error message is displayed, refer to 3-8.

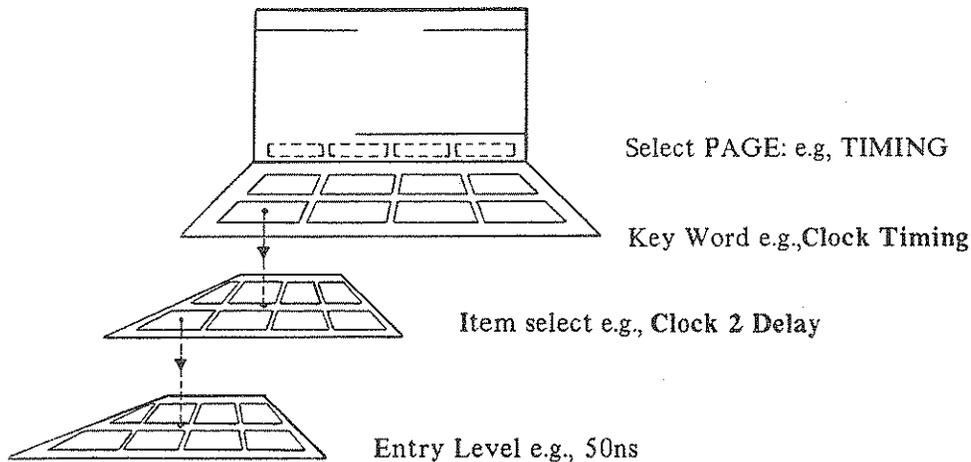


Figure 3-2 HP 8180A Operating Concept

Before making a PAGE selection note the details within the upper area. These include, at the extreme right-hand side, the current 8180A operating status (at present "STOP"), space for the microprocessor "busy" indication (a white square whenever "busy"), and space for the data output address. This at present empty since data has not yet been output.

The flashing warning: "Outputs Off" occurs because the 8180A (or 8181A) outputs are automatically disabled at instrument switch on.

3-7 OPERATORS CHECKS

During power-up, an automatic self test routine is performed. Any failure detected will result in an error message being displayed within the central screen area. Also, a flashing "HARDWARE" message will be displayed in the upper one. Details of the possible error messages are as follows:

3-8 Error Messages on Power Up

- 1) EXTENDER POWER DOWN
- 2) PARAMETER DESTROYED
STANDARD SET RECALLED
- 3) MODULE BOARD FAILED
- 4) TIMING BOARD FAILED
- 5) CLOCK OSCILLATOR FAILED
- 6) ADDRESS COUNTER FAILED
- 7) STATUS CONTROL FAILED
- 8) ROM FAILED
- 9) RAM FAILED
- 10) DISPLAY RAM FAILED
- 11) KEYBOARD FAILED
- 12) INTERFACE FAILED

In the event of any of the above error messages, except (2) occurring, it is recommended that the user contact the nearest Hewlett Packard Sales/Service Office. However the following points should first be noted:

- a) Error (1) is significant only if an 8181A Data Generator Extender is being used and it may be due to the fact that although connected, it is not switched on. If the message occurs, a softkey - Continue - is presented, this should be pressed if the user wants to continue with PAGE selection.
- b) Error (2) can be due to more than three weeks non-use of the 8180A (see specifications and STORE/RECALL PAGE description). Error (2) can also be due to a LABEL (see OUTPUT PAGE description) high level having been set lower than the low level when the 8180A was previously used. Switching the instrument off in this condition causes the current parameter set to be destroyed.
- c) Error (11) can be due to a sticking front-panel key (make a visual check) or if a key was pressed during power up.
- d) Error (12) is significant only for HP-IB operation.

The 8180A automatically recalls the complete parameter and data set which was current at switch off whenever power is re-enabled.

3-9 PAGE CONTROL

The PAGE MENU, as available either after instrument power on (or by pressing the "PAGES" key), is indicated by softkey labels. A brief description of the contents of each page follows. Detailed descriptions are given in the Quick Reference Information sub-section.

CONTROL - General instrument operational settings including: First/Last Addresses, Cycle Modes, Break Control, Clock Source, External Inputs, Strobe Output, Output on/off.

TIMING - All timing related parameters including: Frequency, Period, for Clock and data channels; Delay, Width for Clocks; and, for 8180A's with Timing Options: Delay and Width Channel Timing parameters.

OUTPUT - Outputs on/off, Labels-High/Low level setting, Labels allocation, Channel Configuration (for display purposes).

DATA - All data entry (logic code) and editing features.

STORE/RECALL -Parameter sets and Address sets storage and recall, also Standard Parameter Set Access.

MISCELLANEOUS - Access to Autoexit and Brightness settings and Report of these, information on Remote (HP-IB Interface) and installed Hardware-Data/Timing channels and installed (active) connectors.

MACRO DATA - A store of up to sixteen "lines" of data, 8-64 bits long (depending on number of installed channels), user settable for copying to the DATA PAGE as required.



3-10 GETTING STARTED

To select any page, press the appropriate softkey, for example select the CONTROL page via the top left-hand one. Note the display configuration, this comprises the two areas already described - REPORT and SOFTKEY - their boundaries are as follows:

The REPORT area, headed by the page name (in this case CONTROL) extends down to the "Select Further" prompt and shows the current REPORT items. Only those items which can currently be assigned new values will be displayed.

The SOFTKEY area, extending from the "Select Further" prompt down to the bottom of the screen, includes the Entry Field area (at present empty) and the current SOFTKEY labels. These labels show the first layer of the CONTROL PAGE menu and are called the Key Words. A close look at the labels and the REPORT content will show the direct connection between them, e.g., the top line of the REPORT includes First and Last Address details, these correspond to the first two SOFTKEY labels reading left to right etc.

If you now want to practise making settings and quickly get familiar with the operating concept, a good way to start is by recalling the Standard Parameter Set. You can then use these as the basis for setting new parameter values, operating conditions etc.

NOTE: If, whilst practising, any type of flashing error indication appears on the screen, refer to: "OPERATOR ERRORS AND WARNING MESSAGES". This is right at the end of the Operating section (in front of the QUICK LOCATOR)

To get started, press the following softkeys:

- 1) STORE/RECALL
- 2) Rcl Std Set
- 3) EXECUTE

A complete set of known values has now been allocated to all parameter and operating conditions. (A table, listing all of these (Standard Parameter Set) values, is given in the Quick Reference Information, page 3R-4).

The Standard Parameter Set can be recalled at any time, if you want to get back to a known starting point.

To recall the set, just press the following keys/softkeys:

PAGES (front panel key)
 STORE/RECALL
 Rcl Std Set
 EXECUTE.

To continue with "GETTING STARTED", the next step is to select the CONTROL page. To do this, press the following keys/softkeys:

PAGES
 CONTROL

The CONTROL page defines general instrument operating conditions. The conditions for standard settings are as given in Figure 3-3 and Table 3-1.

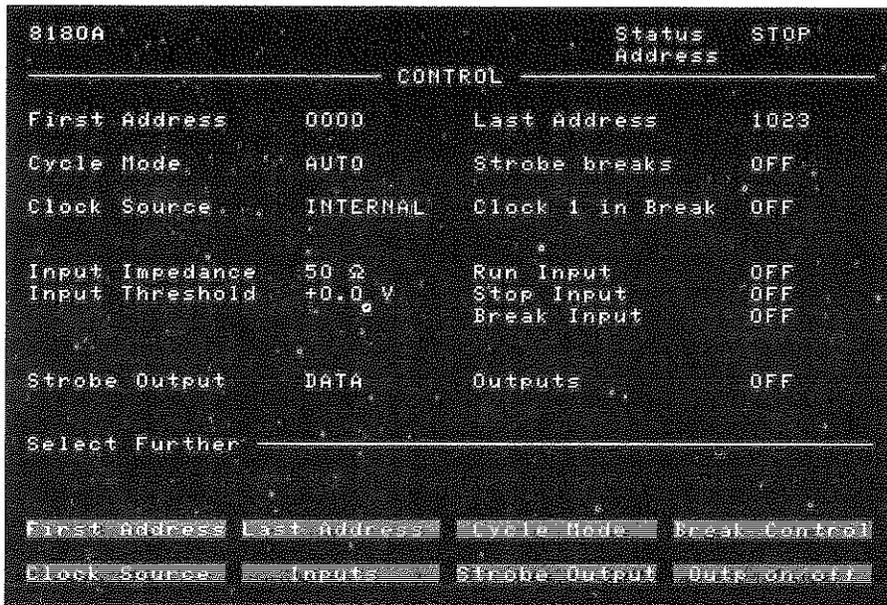


Figure 3-3. Control Page (Standard Settings)

Table 3-1 CONTROL PAGE Std Param Vals

Parameter or Setting Title	Standard Parameter Set Value
First Address	0000
Last Address	1023
Cycle Mode	AUTO
Strobe breaks	OFF
Clock Source	INTERNAL
Clock 1 in Break	OFF
Input Impedance	50 Ohm
Input Threshold	+0.00 V
Run Input	OFF
Stop Input	OFF
Break Input	OFF
Strobe Output	DATA
Outputs	OFF

You will have noticed that as soon as the value reached 0001, a **DECREMENT** softkey appeared. It was missing before because First Address lower than 0000 is not possible. Note also, that the value can be incremented in single steps or the softkey can be continuously pressed.

Now change the First Address to 0020 via the front panel **DATA** keys.

Note that numeric values can be entered either by **INCREMENT/DECREMENT** softkeys, or via the front panel **DATA** keys.

Now press **EXIT** ↑, the Control page keywords will again be displayed. Practise changing some of the other settings via their softkeys. You will see that some keywords give access to further selections. By pressing the **EXIT** softkey once for each "arrowhead" indicated you will get back to the keywords.

Practise changing some of the **REPORT** items by pressing the corresponding softkeys. As an example, change the First Address (address where data outputs will start when RUN initiated) to 0009, by pressing softkeys:

- 1) **First Address**
- 2) **INCREMENT**, until 0009 appears in the Data Entry (and Report) areas.

By viewing the Strobe, and one or both Clock outputs, on an oscilloscope, you can note the effect of changing some of the other parameters. Figure 3-4 shows the relationship between some 8180A/81A output signals and associated settings. It also shows which PAGE to access to change the setting's value.

Note the various parameter values shown in the Report area and practise changing some of them. As an example, to change the Clock Frequency from the standard value of 10 MHz to 12 MHz, pressing the following keys/softkeys:

Frequency
1 and 2 (DATA keys)
MEGAHERTZ

As a further example, call up the TIMING PAGE by pressing:

Now press EXIT ↑

PAGES (front panel key)
TIMING

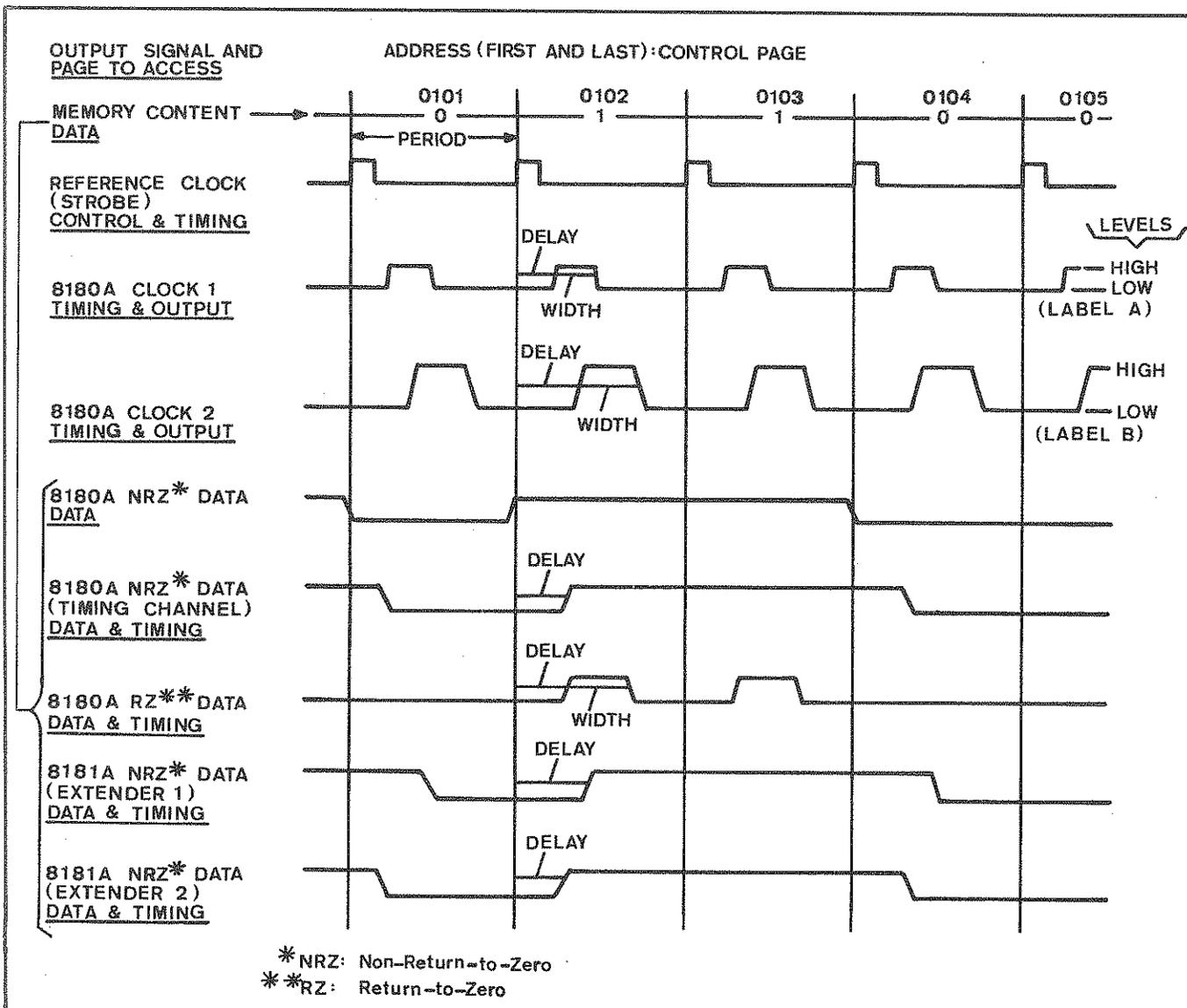


Figure 3-4. Examples of 8180A/8181A Settings and associated PAGES.

To change Clock 1 Delay to 2 ns, first press softkeys:

Clock Timing
Clock 1 Delay

then, either:

INCREMENT until 02.0 ns reached, or enter "2" via **DATA** keys and press units softkey:

NANOSEC

Now press **EXIT** ^^ twice, to get back to the keywords.

It is possible, that while practising making **TIMING PAGE** value changes, you will attempt a setting which causes an error indication. Either, determine the reason (see explanations at end of Operating section) and set a new, valid value or, recall the Standard Set. It is obviously better if you are able to clear an error condition by making a new "acceptable" setting.

Once you are familiar with the basic operating concept, either continue reading the following paragraphs or, turn to the Quick Reference Information. The following paragraphs describe 8180A/81A operating states etc. The Quick Reference Information provides more detailed explanation of **PAGE** use and control. It also includes descriptions of all **PAGES** features.

3-11 MEMORY FEATURES

These include the ability to store and recall the following via the **STORE/ RECALL PAGE**:

- (a) 3 programmable parameter/mode sets
- (b) 9 first/last address pair sets
- (c) 1 standard parameter set.

The complete currently active parameter and data set is automatically stored on 8180A switch off and recalled on switch on. In addition to the above, the **MACRO DATA PAGE** enables up to 16* complete "lines" of data (logic code) to be operator set and stored for recall when entering logic code on the **DATA PAGE**. It is used as part of the line editing procedure for fast setting up (or copying) of one or more lines of data to the **PAGE**. * (8-64 bits long depending on number of installed channels)

An example of the use of the **STORE/RECALL PAGE** can be shown by selecting the **CONTROL PAGE** and changing the First and Last Addresses. (This was described in the "GETTING STARTED" section).

Now, press the (CALL) "SOFTKEYS" key followed by: **STORE/RECALL**. Then, press **Sto Param** and, to store the new set as Set 2, press "2" (**DATA KEYS**) followed by **EXECUTE**.

By recalling the Standard Parameter Set, and then Parameter Set 2, you can confirm that the "new" set has been stored. Do this by checking the **CONTROL PAGE REPORT** details for each recall condition.

NOTE: Recall of any Parameter set (including Standard) causes the 8180A to go to the "STOP" state with "Outputs Off".

Standard Parameter Set

This can be used as the basis for setting up the 8180A to output data. It is only necessary to set actual data and the operating states if the other values are acceptable. The contents of the set is listed in the Quick Reference Section together with additional information concerning power up reset conditions etc.

3-12 INSTRUMENT STATES

The 8180A has three operating states - **RUN**, **STOP AND BREAK**. They can be initiated either via the corresponding front panel keys or external control inputs and are operative for all cycle modes except under the following "GATED" cycle mode conditions:

- (a) In either **GATED** mode, irrespective of clock source, all **BREAK** related functions are disabled including both methods of **BREAK** control, and the front panel **RUN** key is disabled.
- (b) In either **GATED** mode, if the clock source is **INTERNAL** or **EXTERNAL**, then only the **STOP** key is active.
- (c) In either **GATED** mode, if the clock source is **MANUAL** then only **STOP** and **MANUAL FWD** keys are active.

State	When operative
<p>RUN data is output (generated) after:</p>	<p>manual operation of RUN external RUN signal (HP-IB -> Group Execute Trigger (GET))</p>
<p>STOP data generation is stopped with the last word's NRZ data remaining at the outputs, and the RZ data returning to logic false after the programmed delay and width. When RUN is initiated after stop, data generation begins from the First Address. (If in either of the "INIT" modes, it begins from Address zero)</p>	<p>after: power on manual operation of STOP external STOP signal at end of SINGLE cycle at end of GATED cycle (HP-IB -> Device Clear (DCL,SDC))</p>
<p>BREAK as for STOP except that when "RUN" initiated after BREAK, data generation begins from current address this can have been changed via "MAN CLOCK" FWD or BACK keys.</p>	<p>after: manual operation of BREAK external BREAK internal BREAK from STROBE channel if condition enabled (when a "1" in STROBE channel, then BREAK occurs).</p>

NOTE: If the FWD or BACK keys are operated then data at the outputs will change
State diagram Figure 3-5 shows the interaction between the three instrument states.

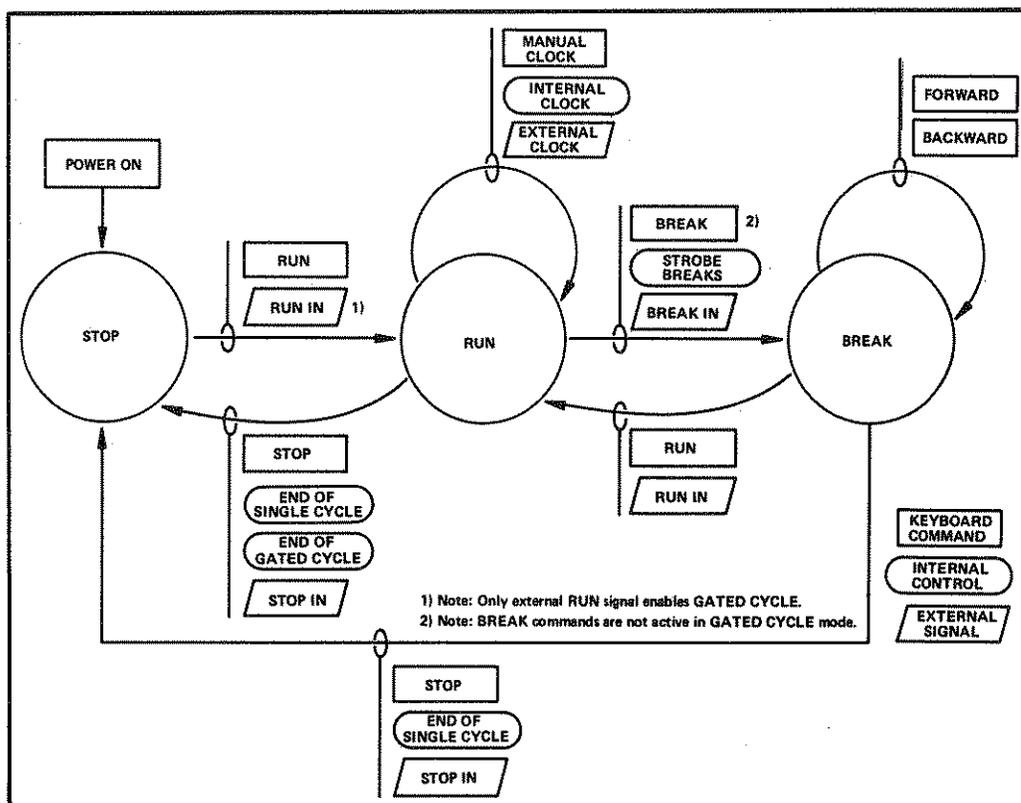


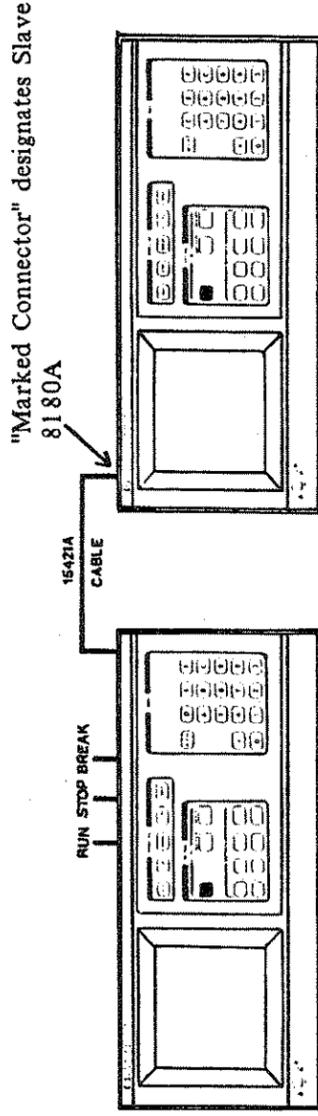
Figure 3-5. States Interaction

3-13 PARALLEL OPERATION OF TWO 8180A's

By interconnecting two 8180A's via the 15421A cable, synchronous parallel operation is possible. The two instruments are operated in a "master-slave" configuration. The following diagram illustrates the setup and how the operating commands for both 8180A's are given via the master.

NOTE: It is recommended that both 8180A's be switched off whenever interconnecting or disconnecting them.

As mentioned in the specifications, the skew measured across both 8180A's increases by 1ns. All other output and timing specifications remain as described for the 8180A (and the 8181A's if connected).



MASTER

Master/Slave Configuration

SLAVE

The slave 8180A is determined by the 15421A cable. One of the connectors has an identifying mark and whichever 8180A is connected to this end is designated the "slave".

There are some operating restrictions and differences for parallel operation (compared to single), and these are described in the following paragraph.

SPECIFICATIONS

3-14 Restrictions Concerning Both Master and Slave

- 1) Back-stepping ("BACK" after a BREAK initiation) is not allowed.
- 2) Initialization cycle modes (INIT+AUTO, INIT+GATED) are not allowed.
- 3) Operating commands: RUN, STOP and BREAK can only be made via the master, irrespective of command source (front panel, external input or via HP-IB). The current state for both instruments is displayed only by the master.
- 4) The "Strobe breaks" function, if required, can only be set via the master.
- 5) Operating frequency (or period) and clock source can only be set at the master. Note however, if RZ=50% (timing parameter) is set at the slave, the resulting width value will be determined by its own frequency setting which is not necessarily the same as the master's (unless operator set).
- 6) For the following three settings: First and Last Addresses and Cycle Mode, the instruments should be stopped prior to making the required change to avoid any non-defined output status.

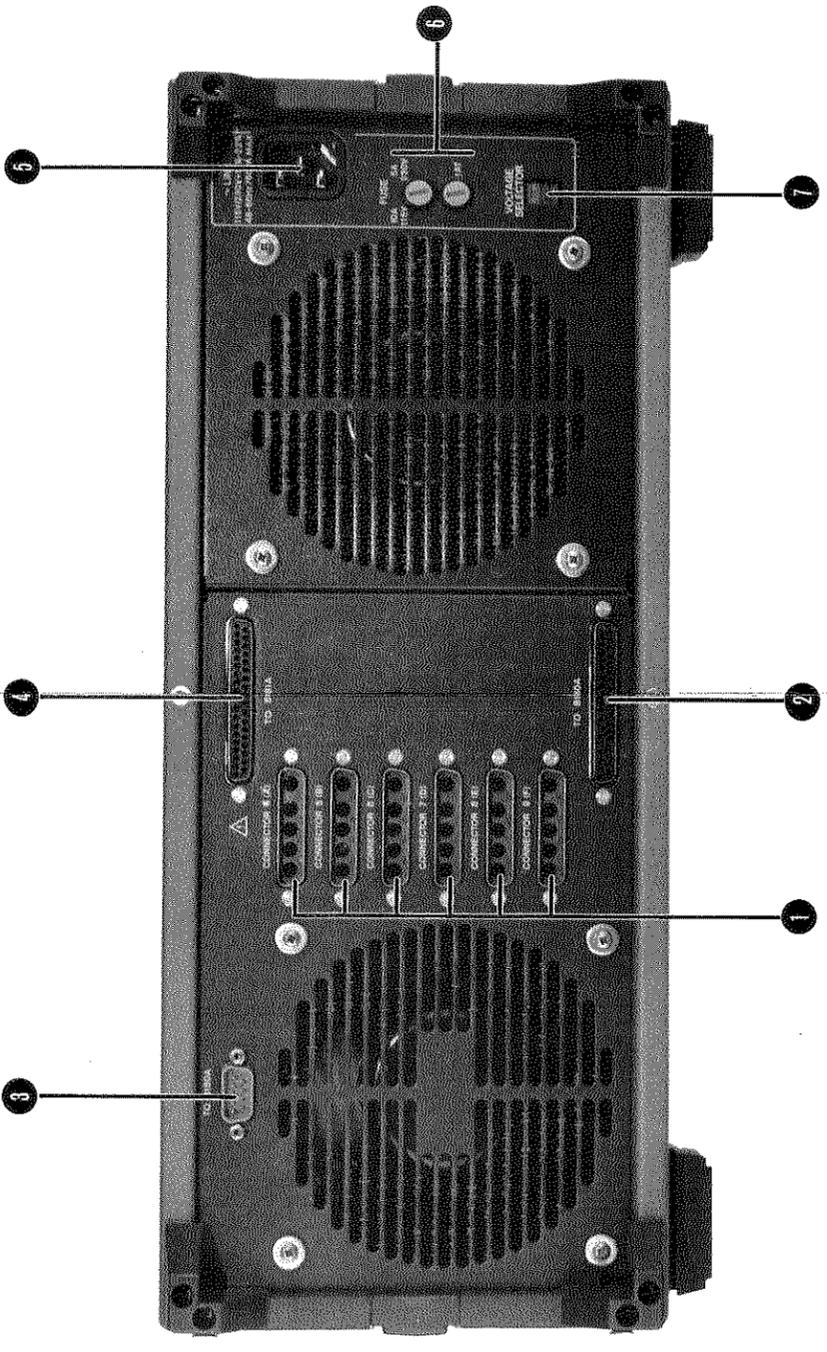
NOTE:

The First and Last Addresses and Cycle Mode (to be set in each 8180A) should be set the same for each instrument.

3-15 Restrictions Concerning only the Slave 8180A

- 1) During timing parameter changes involving a range change, the clock signal is not interrupted (as it is in the master), which means that temporary non-defined conditions will occur.
- 2) Data changes cannot be made "on the fly" and the master must be stopped before changing slave data.
- 3) Error detection of frequency/related settings e.g., delay exceeds value allowed by current period, can only be practically achieved via HP-IB programming (since the operative frequency is derived via the master 8180A). It is possible to manually enter the required frequency into the slave 8180A, for reference purposes etc. if wished.

NOTE: The connection of 8181A's to either the master or the slave does not cause any limitations to either instruments' operation.



NOTE: There is only one front panel mounted control - the LINE power on/off pushbutton switch with ON indicator lamp.

The rear panel details are as follows:

- 1 Connector 4-9 (A-F) providing a possible total of twenty four data output channels. Individual connectors are given a number or a letter identifier depending on whether the 8181A functions as Extender 1 or 2. The data output channel connectors from Extender 1 are 4-9 and from Extender 2 are A-F.
NOTE: all connector housings are fitted but number of "filled" housings depends on number of channels installed. Channel output numbers are allocated as shown:
0 1 2 3 4 5 6 7 8 9 A B C D E F
- 2 Connector for interfacing the 8181A to the controlling 8180A.
- 3 Connector for interfacing the 8180A synchronizing output signals.
- 4 Connector for interfacing a second 8181A (via the first) to the 8180A.
- 5 Power line voltage receptacle.
- 6 Fuses, one for current overload protection (dependent on the selected line voltage: 5A for 230V or 10A for 115V) and one for excessive line voltage protection.
- 7 Line voltage selector sliding switch to be set to local line voltage.

Figure 3-6 8181A Controls and Connectors

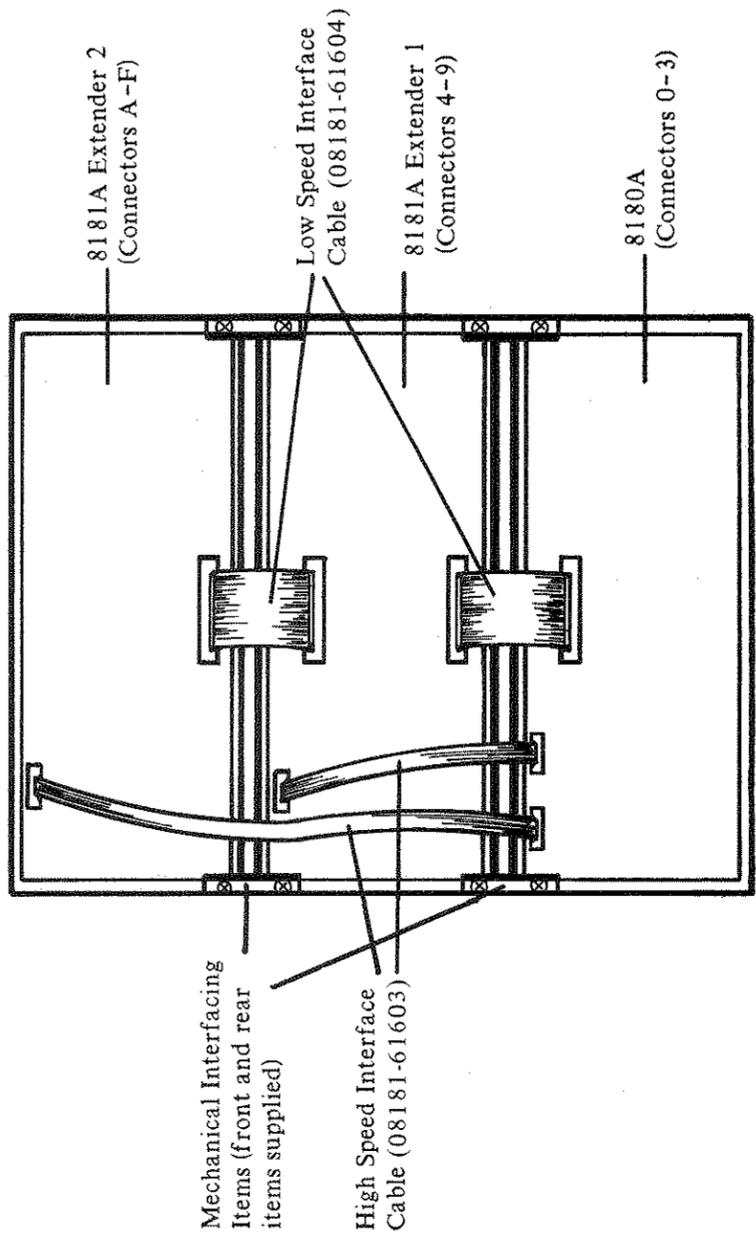


Figure 3-7. 8180A/8181A Interconnections and Connector Numbers Identification.

3-16 8181A DATA GENERATOR EXTENDER

3-17 General

Either one, or two, 8181A's may be interfaced with an 8180A Data Generator. The following functions of the resulting system will then be exactly as set for the 8180A and will automatically apply to the 8181A (s) without operator action:

State, cycle mode, clock rate, clock source, output state and first and last addresses.

All other settings for the 8181A(s) are also made via the 8180A but with their own values set as required. Note, when switched off, an 8181A stores only data (logic code), all of its other parameters are stored by the controlling 8180A.

The operating procedure for an 8180A/8181A system is very similar to that for the 8180A. The instruments must first be interconnected electrically and, ideally, mechanically with the items supplied with the 8181A. They are shown in Figure 1-1 and the interconnecting procedure is as follows:

3-18 INTERCONNECTING PROCEDURE

NOTE: It is recommended that each of the instruments be switched off whenever interconnecting or disconnecting them.

Refer first to Figure 3-6 for a brief explanation of the connectors and controls noting the output connectors' alpha-numeric identifiers and the references to Extenders 1 and 2. The cables should be connected as shown in Figure 3-7. If only one 8181A is to be fitted then ignore the references to Extender 2.

3-19 OPERATION

Switch on the 8180A then the 8181A (s), the system is now ready for use. Whenever an 8181A is switched off (or on) during system operation, a reset cycle is initiated and the 8180A display will revert to the "power up" status. If an 8181A is switched off, an error message (see paragraph 3-8) will be displayed. Press the **Continue** softkey to re-enable page selection.

As mentioned above, there are no significant differences for Extender operation. In effect you now have an 8180A with an increased channel count, each of the new 8181A channels can be given a common delay value via the **TIMING PAGE**. Reference to the **DATA** and **OUTPUT PAGES** will enable the corresponding settings to be made.

NOTE: If the Standard Parameter Set is recalled, the Extender data channels are coded in Hexadecimal to enable all channels to be displayed on the screen.

If two 8181A's are connected in the system, then a reset cycle is initiated whenever either of them is switched on. However, only when both of them have been switched off is a further reset cycle initiated.

3-20 "ON THE FLY" CHANGES

This is of more significance for remote, (HP=IB) rather than local operation, but is, in principle also applicable to front panel operation.

When a parameter value (or operating condition etc.) is changed, with the 8180A in RUN status, there are slight differences in the subsequent status depending on the type of change. The following list details these differences under their appropriate page titles.

NOTE: An "on the fly" change is one whereby, when the change is made, it is executed on the occurrence of the immediately following clock cycle with no disruption of instrument status. Even if the new value or setting is the same as the old one (i.e., no change), it is still considered to be a "change".

CONTROL PAGE

<u>Parameter/Operating Condition changed</u>	<u>Effect of Change</u>
First/Last Address AUTO or INIT+AUTO, RUN or address zero	8180A goes to STOP irrespective of cycle mode, then if (F.A./L.A.) in AUTO or INIT+AUTO, RUN is automatically restarted from either F.A. (for AUTO) or address zero (INIT+AUTO)
Cycle Mode	8180A goes to STOP.
Strobe Breaks	1) if to OFF: no change. 2) if to ON: then 8180A goes to STOP.
Clock 1 in Break	on the fly.
Clock Source	data outputs "delayed" for short time then continued.
Input Impedance	on the fly.
Input Threshold	on the fly.
Run, Stop, and Break Inputs	all three external inputs disabled for short time if any one changed. (NOTE: change of active slope [pos/neg] can change operating state).
Strobe Output	on the fly.
Outputs on/off	on the fly.

TIMING PAGE

Parameter/Operating Condition changed

Effect of Change

Frequency or Period	1)	If no RZ=50% channels(or clock outputs) and no range changes involved (see table below),then on the fly; however, allow time for increase of period over a few clock cycles if new frequency much lower than old. If range change, then clock signals interrupted, data output signals terminated and restart after short delay.
	2)	If RZ=50% outputs, then as for (1) but with possible range change depending on value of period/2.
Delay or Width	1)	If no range changes, then on the fly but with possible short time lag (a few clock cycles) for new width or delay to slowly change.
	2)	If range changes then clock signals interrupted etc. as for Frequency/Period above.
Format		Clock interrupted and restarts from next address.

Table 3-1 Range Data (applicable to Clock and Data channels)

Delay	Period/Width
0.0 - 89.9 ns	10.0 ns - 99.9 ns
090 ns - 989 ns	100 ns - 999 ns
0.99 us - 9.98 us	1.00 us - 9.99 us
9.99 us - 99.9 us	10.0 us - 99.9 us
100 us - 999 us	
1.00 ms - 9.99 ms	
10.0 ms - 99.9 ms	
100 ms - 999 ms	

OUTPUT PAGE

Load Impedance	outputs temporarily disabled then re-enabled with new values but as clock not interrupted, address will have changed.
Levels (High or Low)	on the fly with slow rise (or fall) to new value.
Labels	as for Levels

OUTPUT PAGE continued

Parameter/Operating
Condition changed

Effect of Change

Polarity

on the fly.

Channel Configuration

no effect on status or outputs since this is a "display change".

DATA PAGE

any DATA change

sequence is: (1) external I/Ps disabled, (2) BREAK initiated, (3) data changed, (4) return to original state, (5) external I/Ps re-enabled.

STORE/RECALL PAGE

STORE

no effect on status or outputs.

RECALL

Parameter Set or Standard Set, STOP plus outputs OFF.

Address Set: as for First or Last Address change.

MISCELLANEOUS PAGE

no effect on status or outputs.

MACRO DATA PAGE

no effect on output until data copied from PAGE, then as for DATA PAGE

3-21 OPERATOR ERRORS AND WARNING MESSAGES

It is possible that while practising entering values and operating modes, the operator may make a value change which results in either a "flashing E" or a "VALUE OUT OF RANGE" error indication being displayed. The significance of any such error messages and other warnings is explained as follows.

3-22 Error Indication

a) Flashing: "E" indication

This condition occurs when a value entry is made which either exceeds the maximum allowable value (for maintenance of specifications) e.g. Width or Delay too large for current Period, in the case of timing related settings or, causes the specified maximum or minimum amplitude range to be exceeded in the case of Label related settings. For either of these error conditions, as well as a flashing "E" appearing adjacent to the error value, a flashing "TIMING" (for Delay or Width) or "SWING" (for Labels) warning will appear at the top of the report display area.

Examples of timing related error conditions:

- 1) If frequency = 10MHz (so period = 100 ns) and Clock1 Width is set to 85 ns, then "E" will occur since for period = 100 ns, width should not exceed 82 ns. (90% of Period - 8 ns according to specifications)



- 2) For same frequency value, if Clock2 Delay is set to 74 ns then "E" will occur since maximum allowable value is 72 ns (90% of Period - 18 ns).

Example of a Label related error condition:

If Label A Low Level = -0.30 V and High Level is changed from +0.20 V to +0.19 V then "E" will occur since minimum allowed amplitude is 0.5 V (from 50 Ohm into 50 Ohm).



Note that, for any "E" condition, the error value may appear at the output(s) but the associated specification accuracy will no longer apply.

b) "VALUE OUT OF RANGE"

This warning occurs when an attempt is made to set a value (via the data keys) outside its own specified range, e.g., Last Address greater than 1023 or Width less than 10 ns. This type of error can be avoided by noting the range limits which are shown in the PAGE Entry Fields wherever a parameter "ENTER NEW VALUE" condition is currently active. The screen display examples given within this section show typical range limit values. Note that for this type of error condition, the 8180A will not accept the new value (it retains the old one) and values exceeding specified maximum or minimum will not be output. Examples of when this type of error condition will occur are: a Clock Width setting less than 10 ns or a Label Low Level less than -2.0V, the resulting error displays would be as shown below.

```

ENTER NEW VALUE _____ VALUE OUT OF RANGE _____
Clock 1 Width [10.0ns 999ns]          8. _ ns
  
```

```

ENTER NEW VALUE _____ VALUE OUT OF RANGE _____
Label # Low Level [-2.0V +5.0V]       -2.1_ V
  
```

3-23 WARNING MESSAGES

Flashing: "Outputs Off"

This is a reminder that the outputs have been disabled either due to direct operator action or as part of the 8180A power up sequence.

Flashing: "Clock" indication.

If an external clock source is being used and the resulting input frequency is too high (exceeds 50 MHz), then a flashing warning "CLOCK" will appear in the top left-hand corner of the CRT display.

Flashing: "Value exceeds Frequency Resolution" or "Value exceeds 20 mV Resolution"

If a period value is entered which would cause the frequency resolution of 3 digits to be exceeded, the value will not be accepted. Similarly, if for a Load Impedance = OPEN, a voltage level is entered which exceeds the allowable 20 mV resolution, it will not be accepted. For either case, a warning will be displayed.

Flashing: "Run Input Off"

If either of the "GATED" cycle modes is selected, the Run Input is off and the 8180A outputs are enabled, then a flashing warning "Run Input Off" appears at the top of the display as a reminder that the 8180A cannot run.

Flashing: "Dupl Chnl in Segment" If, when making a change to the displayed Channel Configuration, a channel is entered for a second (or further) time into a Segment, the warning "Dupl Chnl in Segment" will flash. This warning will remain flashing until either, the channel(s) concerned are deleted or, the cursor is shifted to a new segment.

Flashing: "Display incomplete" This warning appears, at the top right-hand side of the DATA display, if the complete display configuration cannot be accommodated within the available area, i.e., one or more columns of data are "hidden" from view at the extreme right-hand side. If data entry is in progress, it is recommended that both of the above mentioned conditions are corrected prior to further entries to avoid any confusing results later.

PARAMETER AND OPERATING MODES QUICK LOCATOR

The following index enables any 8180A parameter, operating mode or setting, (REPORT item) to be quickly located at the appropriate PAGE(S). This is done by cross-referencing it to a PAGE and KEYWORD. An example of this is shown below:

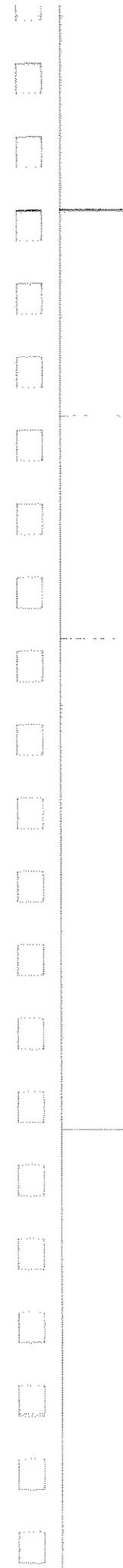
To change **Clock 1 Delay**:

- 1) Check under "Clock Related Settings", Clock(1 or 2) Delay is listed.
- 2) The appropriate PAGE is TIMING.
- 3) The required KEYWORD (to access the item) is Clock Timing.

ITEM	PAGE	KEYWORD (if not as ITEM)
ADDRESS related		
First Address	CONTROL	First Address
Last Address	CONTROL	Last Address
Top Address	DATA	Top Address
Limit Address	DATA	Edit (then Line Edit)
Address Code	DATA	Edit
Address Sets	STORE/RECALL	Rcl/Sto Addresses
TIMING related-General (for Clock Timing see Clock related)		
Frequency	TIMING	Frequency
Period	TIMING	Period
CLOCK related (including clock timing)		
Clock (1 or 2) Delay	TIMING	Clock Timing
Clock (1 or 2) Width	TIMING	Clock Timing
Clock (1 or 2) Format	TIMING	Clock Timing
Clock Output (Level/Polarity)	OUTPUT	Clock Output
Clock Source	CONTROL	Clock Source
Clock 1 in Break	CONTROL	Break Control
TIMING related-Channels (Option 002)		
Delay	TIMING	Chnl Timing
Format	TIMING	
Width	TIMING	
All Channel Delay	TIMING	
All Channel Width	TIMING	
All Channel Format	TIMING	
TIMING related - Extenders		
Delay (1 or 2)	TIMING	Extender 1 (2)

DISPLAY edit related - all edit features (including "Data related") are available via "Edit" on the DATA page, some are available on other pages also, e.g. Chnl Config - OUTPUT and MACRO DATA pages.

ITEM	PAGE	KEYWORD (if not as ITEM)
DATA related		
Clear all Data Data	DATA DATA	Edit (then Clear & Set) Set all Edit " "
Clear Channel Channel	DATA DATA	Edit (then Channel Edit Set Edit " "
STROBE related		
Strobe Output (clk/data) Strobe breaks (OFF/ON) Strobe Level Strobe Polarity Clear Strobe (data)	CONTROL CONTROL OUTPUT OUTPUT DATA	Strobe Output Break Control Strobe Level Strobe Polar Edit (then Clear & Set)
OUTPUT related		
Load Impedance (value) Output on/off Level (High/Low Label values) Label (and polarity) allocation Label (and polarity) allocation	OUTPUT OUTPUT OUTPUT OUTPUT OUTPUT	Load Imp Outp on/off Level Clock Output Chnl Label
EXTERNAL Inputs etc.		
Run, Stop, Break Threshold, Impedance	CONTROL CONTROL	Inputs Inputs



RESET AND RECALL STANDARD SET CONDITIONS

Table 3-2 shows, for each PAGE, in column (4), the Standard Parameter Set values together with conditions at 8180A switch on (3). It also shows which settings are stored as part of any parameter set (5). Remember that the complete current parameter and data set is auto-stored at switch off. Reset occurs when for example, an 8181A which forms part of the system is switched off.

Table 3-2. Reset and Recall Standard Set Conditions

(1)	(2)	(3)	(4)	(5)
Parameter or Setting Title	If Option/ Extender related then: (YES)	At "Switch on" or "Reset" Status (as auto-stored unless stated)	Standard Parameter Set Value	Part of Parameter Set ? Y = YES
		CONTROL PAGE		
First Address			0000	Y
Last Address			1023	Y
Cycle Mode			AUTO	Y
Strobe breaks			OFF	Y
Clock Source			INTERNAL	Y
Clock 1 in Break			OFF	Y
Input Impedance			50 Ohm	Y
Input Threshold			+ 0.0 V	Y
Run Input			OFF	Y
Stop Input			OFF	Y
Break Input			OFF	Y
Strobe Output			DATA	Y
Outputs		OFF	OFF	OFF for any Param Set recall
		TIMING PAGE		
Clock Frequency			10.0 MHz	Y
Clock Period			100 ns	Y
Clock 1 Delay			00.0 ns	Y
Clock 1 Format			RZ	Y
Clock 1 Width			40.0 ns	Y
Clock 2 Delay			50.0 ns	Y
Clock 2 Format			RZ	Y
Clock 2 Width			10.0 ns	Y
Extender 1 Delay	YES		00.0 ns	Y
Extender 2 Delay	YES		00.0 ns	Y
Channel 0-0 Delay thru to	YES		00.0 ns	Y
Channel 1-3 Delay	YES		00.0 ns	Y
Channel 0-0 Format thru to	YES		NRZ	Y
Channel 1-3 Format	YES		NRZ	Y
Channel 0-0 Width thru to	YES		50.0 ns	Y
Channel 1-3 Width	YES		50.0 ns	Y

Table 3-2 Reset and Recall Standard Set Conditions continued

(1) Parameter or Setting Title	(3) At "Switch on or Reset" Status (as auto-stored unless stated)	(4) Standard Parameter Set Value	(5) Part of Parameter Set ? Y = YES
OUTPUT PAGE			
Load Impedance Clock 1 Label Clock 1 Polarity Clock 2 Label Clock 2 Polarity Strobe Level Strobe Polarity		50 ohm LABEL A NORMAL LABEL A NORMAL ECL NORMAL	Y Y Y Y Y Y
Label A High Level Label A Low Level Label B High Level Label B Low Level Label C High Level Label C Low Level Label D High Level Label D Low Level		+0.25V -0.25V +5.00V +0.00V -0.80V -1.80V +2.40V +0.80V	Y Y Y Y Y Y Y Y
Channel Configuration *see NOTES 1 and 3 at end of table.	All "not installed" connectors deleted. If display configuration would now be empty, then following details will apply: "Channel 0-0 displayed, BINARY coded, Entry-YES"	Standard Config', all "not installed connectors" deleted. (see NOTE1 at end of table)	Y but as for (3)
Channel Label Channel Polarity		ALL A ALL NORMAL	Y Y
DATA PAGE			
Top Address Address Code Channel Edit Cursors	0000 First channel of	DEC as for (3)	Y as for (3)
Copy Macro Copy Macros Insert and Delete Line Copy and Move Line	F to Top Address 0-F to Top Address Top Address Top Address to Last Address Last Address HORIZONTAL	} as for(3)	
Limit Address Entry Mode			
MISCELLANEOUS PAGE			
Autoexit	OFF		

HP-IB Commands Reset Status

Title	At "Switch on	If HP-IB Address changed
BSA	0000	0000
BTR	1	1
BSC	0/Max	0 / Max
LIN	1	1
ISR	1	1
FSR	1	1
TLK	1	1

NOTES:

1. Standard Configuration details (maximum configuration of 64 channels shown):

```

Connector:      FFFFFFFE DDDCCCCBBBAAAA 99998888
Channel:        32103210 3210321032103210 32103210
Label:          AAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAA

continued      7777666655554444 3333 2222 1111 0000
                3210321032103210 3210 3210 3210 3210
                AAAAAAAAAAAAAAAAA AAAAA AAAAA AAAAA AAAAA
    
```

First 4 Segments are configured in HEX. Last four Segments in BINARY All Segments: Entry-YES

2. Change at HP-IB Address

A Change of the HP-IB Address Switch is accepted only if the 8180A is not in Remote, Listen or Talk mode.

3. Explanation of installed and not installed connectors etc.

Installed connectors are those connectors which have channel groups connected to them, that is, the corresponding boards are installed or Extenders connected. The minimum number of installed connectors in either an 8180A (or an 8181A) is 2. Therefore, in an 8180A, 8 channels are always available, even though not necessarily always used or displayed. Only installed connectors can be used (or displayed).

"Not installed" connectors means those connectors (or channel Groups) not presently installed in, or connected to, an 8180A or 8180A/8181A system. If, before last switch off, the configuration included only channels from say Extender 1, which has since been switched off or disconnected, then the displayed configuration will revert to the "default" of Channel 0-0 etc.



PAGES - HOW TO USE THEM

The following section gives more information concerning PAGE control and then detailed descriptions of all PAGES. The descriptions include: each PAGE'S main features, how to access them and what they mean.

NOTE: The term "value entry, when used in the PAGE descriptions, can mean either a numerical value, a specific condition or a mode.

The words shown under "GIVES ACCESS.."e.g, "value entry", **AUTO** etc. show the condition arrived at directly after KEY WORD selection. The words within brackets () excluding (value entry) show the result of further SOFTKEY operations.

NOTE: (Applicable to several PAGES) if DATA keys are used for a numeric integer entry then entry can be with or without all leading zeroes. Without all leading zeroes **ENTER NUMBER** must be pressed, e.g. 0012 or 12 + **ENTER NUMBER**.

A softkey label comprising all capitals (upper case letters) e.g., **INSERT CHNL**, means that the setting is available or operative immediately after softkey operation. A label with only initial capitals, e.g. **Clock Level**, indicates that further softkey operations are necessary to access the required setting.

For each PAGE, a detailed block diagram showing softkey distribution and an example of the display (for a 16 channel 8180A including 8 timing) is included. Where the PAGE display details will differ when 8181A's are connected, an additional display example is included. For the **TIMING**, **OUTPUT** and **DATA** PAGES, these are on a separate fold-out page at the end of the **MACRO DATA PAGE** section.

NOTE: Abbreviations are used on the block diagrams to indicate the types of entry etc, they are explained as follows:

DS - means a Direct Select entry
NR- means a Numeric Real entry
NI - means a Numeric Integer entry

The meaning of them is explained later under "Types of Entry".

PAGE Exiting

Before continuing with more practise of page usage, note that selection of another one can be made at any time simply by pressing the front panel (CALL) "**PAGES**" key. This results in exit from the current page and redisplay of the PAGE menu. It can be done irrespective of 8180A current operating status.

PAGE REPORT/SOFTKEYS Mixing

The two remaining keys within the "**SETTING**" group are (CALL) "**SOFTKEYS**" and "**REPORTS**". These enable the report of one PAGE to be combined with the softkeys of another (or just the recall of softkeys or reports to make changes or check settings).use of this feature can be shown by selecting the **CONTROL PAGE**, pressing (CALL) "**SOFTKEYS**" and selecting the **STORE/RECALL SOFTKEYS**. This enables you to call up and check, by reference to the **CONTROL PAGE REPORT**, the details of the stored Sets and using them as required. Obviously, any combination that you want can be configured.

The following video print shows an example of **REPORT/SOFTKEYS** mixing: (**CONTROL REPORT** and **STORE/RECALL SOFTKEYS**).

8180A		Status Address	STOP 0217
CONTROL			
First Address	0000	Last Address	1023
Cycle Mode	AUTO	Strobe breaks	OFF
Clock Source	INTERNAL	Clock 1 in Break	OFF
Input Impedance	50 Ω	Run Input	OFF
Input Threshold	+0.0 V	Stop Input	OFF
		Break Input	OFF
Strobe Output	DATA	Outputs	OFF
Select Further			
Rcl Parameter	Rcl Addresses	Rcl Std Set	
Sto Parameter	Sto Addresses		

CONTROL

STORE/RECALL

Example of Report/Softkeys Mixing

REPORT ENTRIES

Any of the 8180A menu items can be easily accessed and changed. Upon PAGE selection, the report displays only those items which, under the current operating conditions, can be assigned new values.

Types of Entry

There are two distinct types of REPORT entry possible - Numerical and Direct Select. Numerical entries can be made either via the INCREMENT/DECREMENT SOFTKEYS or the DATA keys. Direct Select entries can be made only via the SOFTKEYS (the DATA keys are disabled).

NUMERICAL entries include:

"Real", Integer and output data (logic code).
 Entry Level SOFTKEYS which include a specific numerical value eg., Load Impedance: 50 Ω (on the OUTPUT PAGE), are considered to be a direct select type rather than numerical since the value is fixed. Examples of all the entry types will now be shown together with how to make them.

DIRECT SELECT

For an example of this type of entry, select the CONTROL PAGE and press Cycle Mode. The current mode is shown and direct selection of a new one is made simply by pressing the appropriate softkey.

ENTER NEW VALUE

Cycle Mode AUTO

AUTO SINGLE GATED INCREMENT

INIT-AUTO EXIT

Direct Select Entry Example

NUMERIC Entry - REAL:
(TIMING PAGE example)

An example of a Numeric-Real entry can be shown by first selecting the TIMING PAGE and pressing **Frequency**, the parameter title, operating limits and current value will now be seen in the Entry Fields and also the "ENTER NEW VALUE" prompt. To change the value, use either the **INCREMENT/DECREMENT SOFTKEYS** or the **DATA** keys. If the **DATA** keys are used, at value entry completion a units **SOFT KEY** e.g., **MHz** must be pressed. Failure to do this will mean that the value will not be accepted.



Numeric entry REAL Example

NUMERIC Entry - INTEGER:
(CONTROL PAGE example)

An example of this type of entry has already been covered in the "GETTING STARTED" section, - changing the First Address. The Last Address is changed in a similar manner.

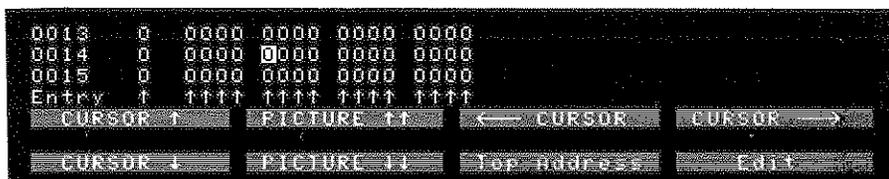


Numeric Entry INTEGER Example

NUMERIC Entry - Output data:

(DATA PAGE example)

For an example of this, press the PAGES key then DATA. The REPORT area shows, in the first column, the addresses, then the Strobe data content and finally the actual output data (or logic code). Control of the CURSOR and/or PICTURE is best understood by making a few practise moves, the main point to be remembered is that PICTURE↑↑ shifts the current sixteen displayed lines up and replaces them with the next sixteen numerically higher group. (PICTUREvv enables the opposite Sequence).



Numeric Entry Output Data Example

To change the value, first move the cursor to the required change position, note that as it is moved across the screen, when it lies on a binary coded data channel, the channel number (connector and channel) is displayed in the top right hand corner of the REPORT area. Data can now be entered by pressing the appropriate DATA keys. The operative keys depend on which data entry code has been selected, for example if binary, then only 0 and 1, if octal then 0 -7 etc.

The Output data example shows the cursor positioned for changing the data at address 0014 in a binary coded data channel. The arrows directly below the last line of data, and to the left of the word "Entry", indicate that data entry or change is allowed in each channel. (Further details of this and other relevant information is given in the DATA PAGE description - blue register.

CONTROL PAGE

KEY WORD	GIVES ACCESS TO xxxx, DETAILS ARE:
First Address	(value entry) address where data outputs start, enter value either via INCREMENT/DECREMENT or DATA keys.
Last Address	(value entry) address where data generation completed, value entry as for First Address above.
Cycle Mode	<p>AUTO data generated continuously from First to Last Address.</p> <p>INIT + AUTO data generated from address 0 to First Address, then continuously from First to Last Address.</p> <p>SINGLE data generated once only from First to Last Address.</p> <p>GATED Data generation starts when RUN input goes logic true and remains active only while RUN true. When RUN goes false, generation continues to Last Address then stops.</p> <p>INIT + GATED Data generation starts when RUN input goes logic true and remains active only while RUN true. Data generated once from address 0 to First Address then continuously generated from First to Last Address. When Run goes false, generation continues to Last Address then stops. NOTE: In both of the GATED modes, all "BREAK" related functions are disabled.</p>
Break Control	<p>Strobe Breaks if ON, then each time a 1 is present in the STROBE data a "BREAK" occurs in data generation at that address. MAN CLOCK keys can then be used to step forward or back. Strobe output mode (DATA/CLOCK) not important</p> <p>Clock in Break enables CLOCK 1 to remain active during "BREAK".</p>
Clock Source	Value Entry selectable INTERNAL, EXTERNAL POS' or NEG' SLOPE or MANUAL (MANUAL via MAN CLOCK FWD Key).
Inputs	<p>Clock Source see KEY WORD: Clock Source</p> <p>RUN, STOP, BREAK explained in "STATES", selectable OFF or ON positive or negative slope.</p>

Impedance

50 Ohm or 100 kOhm selectable, common for all inputs

Threshold

common to all inputs, to enter new value via DATA keys, VOLT Softkey must be pressed for completion.

Strobe Outputs

(value entry)

Data or Clock selectable. Strobe Output can be used either as an additional NRZ data channel or as a reference clock output.

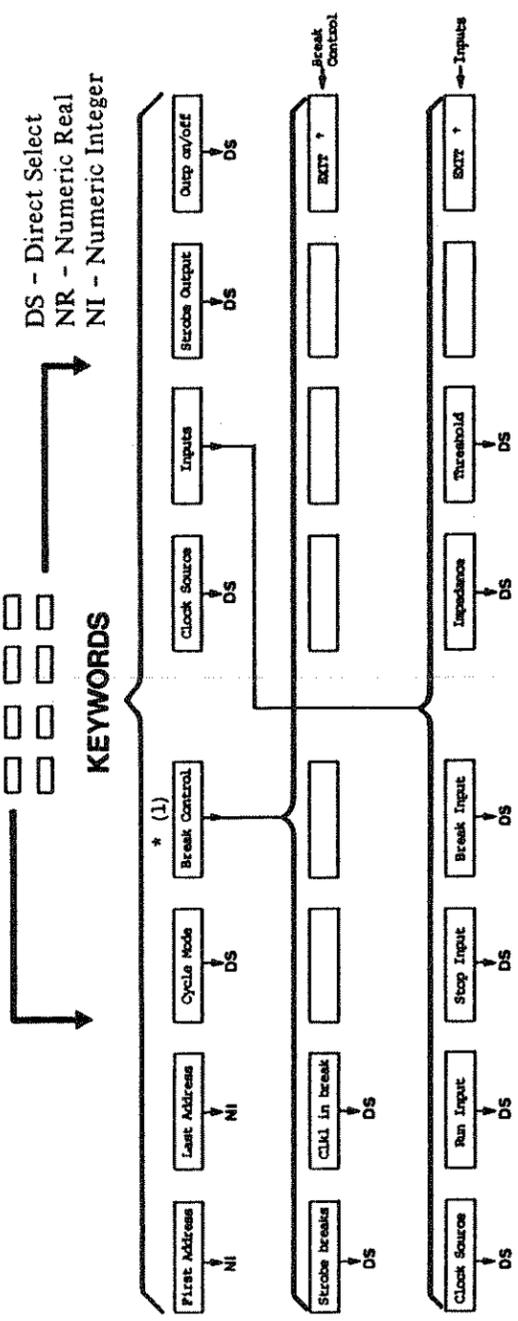
Outputs on/off

(value entry)

all outputs automatically off until enabled on. When enabled, then all Outputs are on. Warning at top of screen goes off when Outputs enabled. **NOTE:** Recall of any Parameter Set (including Standard) will also cause the Outputs to be disabled.



8180A CONTROL		Status Address	STOP
First Address	0000	Last Address	1023
Cycle Mode	AUTO	Strobe breaks	OFF
Clock Source	INTERNAL	Clock 1 in Break	OFF
Input Impedance	50 Ω	Run Input	OFF
Input Threshold	+0.0 V	Stop Input	OFF
		Break Input	OFF
Strobe Output	IATA	Outputs	OFF
Select Further			
First Address	Last Address	Cycle Mode	Break Control
Clock Source	Inputs	Strobe Output	Outp on/off



*** 1) Break Control**

If a "GATED" Cycle Mode is selected then all "Break" related functions are disabled. The corresponding report area details and softkey labels including: Break Control, Strobe breaks, Clk1 in break and Break Input will be blank.

TIMING PAGE

NOTE: Channel timing details apply only to instruments fitted with Option 002. Extender 1 and 2 details apply only if 8181A(s) are connected.

KEY WORD

GIVES ACCESS TO xxxx, DETAILS ARE:

Frequency
(value entry)
when entering new value via DATA keys, a "Units" softkey must be pressed for completion.

Period
(value entry)
as for Frequency. **NOTE:** For both Frequency and Period, if EXTERNAL Clock active (therefore INTERNAL disabled) the displayed INTERNAL values e.g., Period useful for confirming EXTERNAL Clocks compatibility with Delay, Width etc.

Clock Timing

Delay (Clk 1 or 2)
referenced to STROBE output, a "units" softkey must be pressed for completion. Error warning: "E" when Delay exceeds 90% period - 18ns.

Format (Clk 1 or 2)
RZ or RZ=50%, RZ allows delay and width control, for RZ=50%: width=50% period, Clock width entry facility deleted.

Width (Clk 1 or 2)
Width value variable but error warning "E" if Width exceeds 90% of period - 8ns.

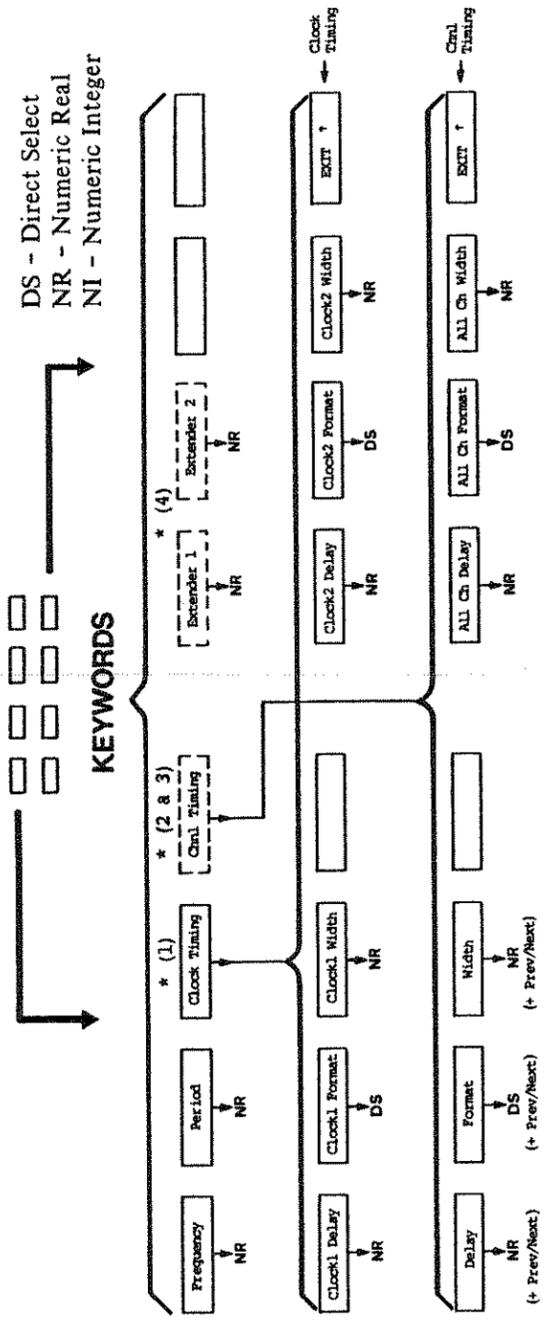
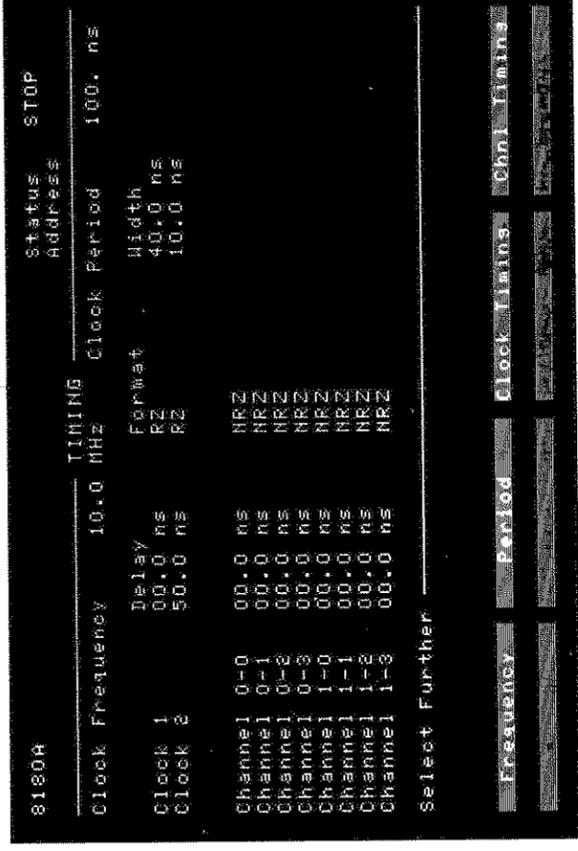
Chnl Timing

Delay, Format, Width
For all three parameters, the details areas for Clock Timing except each channel can be separately called up via Next Channel, Prev Channel softkeys and NRZ Format is possible. Also all channels can be given same Delay, Format and Width by using All Ch xxxx softkeys. If NRZ Format selected then the Width entry function is deleted (as it is for RZ=50%).

Extender 1

(value entry)- delay
All of the 8181A's (NRZ format) data channels can be given a common delay value, referenced to the STROBE output.
as for Extender1.

Extender 2



- * 1) Clock Timing
If RZ=50% format is selected, then no width entry is possible for the corresponding clock signal. The associated softkey labels will be blank.
- * 2) Channel Timing
If the 8180A is not fitted with "timing channels" (Option 002) then no channel timing related functions will be available and bottom row of softkeys in above figure are not be applicable.
- * 3) Channel Timing
If either RZ=50% or NRZ format selected for a channel, then no width entry is possible for it.
If "All Ch Format" is either RZ=50% or NRZ then the both channel width related softkeys will be blank. As long as at least one channel has RZ format then the width softkeys labels are present.
- * 4) Extender 1 and 2
"Extender" softkeys apply only if 8181A's fitted, (for delay settings only)

OUTPUT PAGE

KEY WORD

GIVES ACCESS TO xxxx, DETAILS ARE:

Load Impedance

(value entry)

Selection of **50 Ohm** or **OPEN** changes the output voltage level capability of the 8180A. See specification for details.

Outp on/off

(value entry)

All outputs are normally off until enabled on, warning at top of screen goes off when outputs enabled.

Level

General points

Four voltage level pairs or Labels A, B, C and D are available and each output channel must have a Label assigned to it. Label consists of a High and a Low level with the level limits being shown in the Entry Field as each Label is called up via **NEXT** Label to define its levels. To select either Low or High Level (for value changing) press **Low** ↔ **High**. Value entry can be via either **DATA** keys (remember **VOLT**) or **INCREMENT/DECREMENT**. If wished, direct inputting of TTL or ECL levels may be made but **EXECUTE** must then be pressed. For assignment of Labels to clock and channel outputs see "Clock Outputs" and "Chnl Label" **KEY WORDS**.

Clock Outputs

Level and Polarity

These enable voltage levels to be assigned (in the form of Labels) to each clock signal via **Labelx** and polarity via **NORMAL** or **COMPLEMENT**.

Strobe Level

TTL or ECL Strobe

The Strobe Level can be set to TTL or ECL (see Specification).

Strobe Polar

NORMAL or **COMPLEMENT**

The Strobe Polarity can be set to **NORMAL** or **COMPLEMENT**. The polarity has no effect on the "Strobe breaks" function.

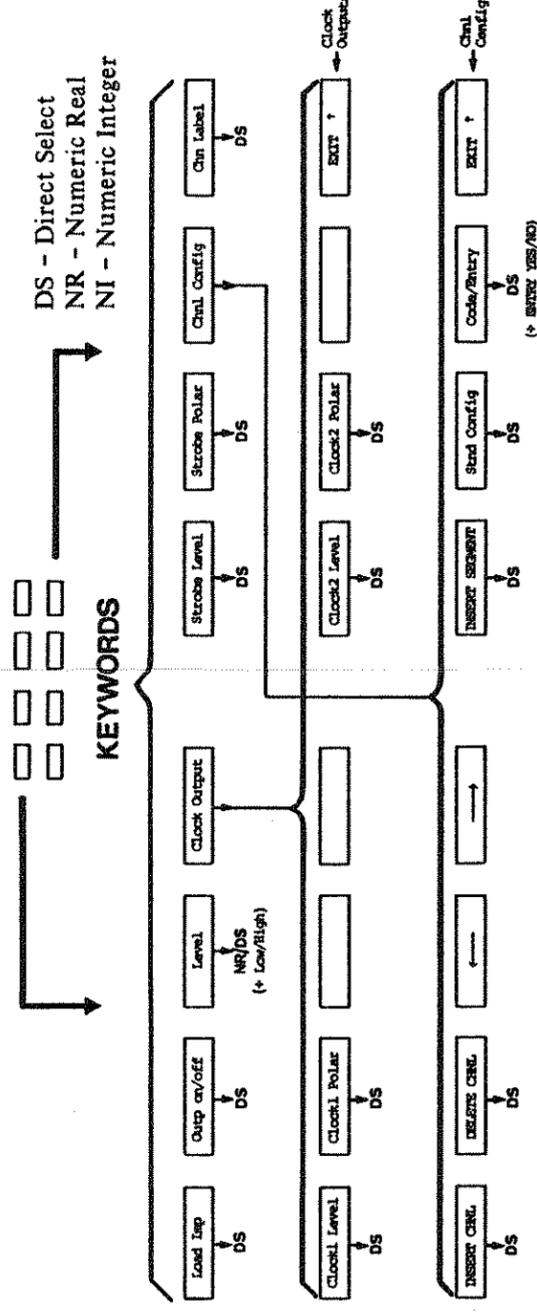
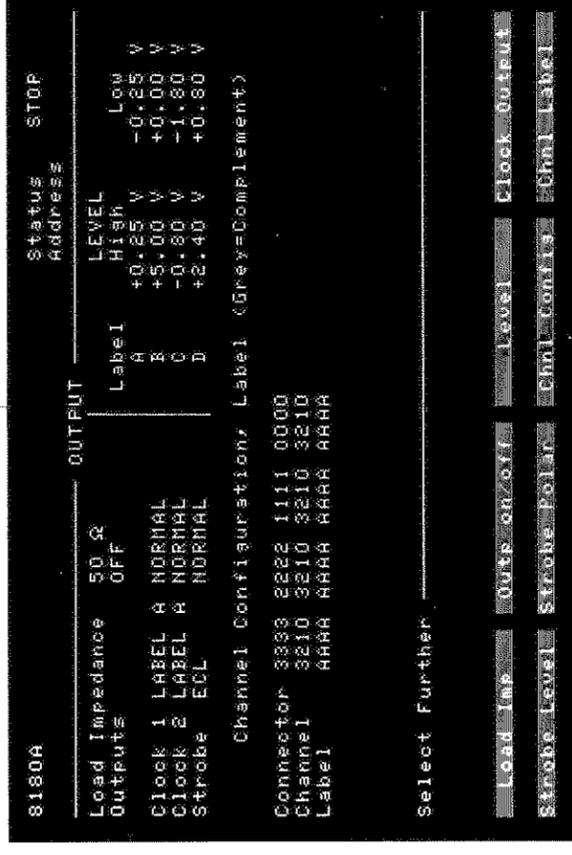
Chnl Config

See **DATA PAGE**

Chnl Label

General points

The softkeys here enable assignment of **NORMAL** or **COMPLEMENT** and also Labels. To assign a Label, select the required channel (by cursor movement) then press one of the four applicable **DATA** keys - **A**, **B**, **C**, or **D**. The ←← softkey enables quick return to lefthand side.



DATA PAGE

NOTE: If the "fast reload" feature is being used (when programming) and a clock signal is required during BREAK, use the AUTO cycle mode, not SINGLE cycle.

The following **CURSOR** and **PICTURE** softkeys enable the **CURSOR** to be positioned as required for change of data (logic code) value. Enter data by pressing **DATA** keys, auto-(movement) of **CURSOR** after data entry is determined by **Entry Mode SOFTKEY**, see (**KEY WORD**;) Edit features.

KEY WORD	GIVES ACCESS TO xxxx, DETAILS ARE:
CURSOR ↑	enables CURSOR to be moved vertically upwards, either "step by step" or hold key down for continuous movement. When CURSOR at top of screen, further operation causes roll of data and address display.
CURSOR ↓	as for CURSOR ↑ except when at bottom of screen, further operation causes roll of data and address display.
PICTURE ↑↑/↓↓	operation causes currently displayed sixteen lines to be replaced by next sixteen numerically higher (PICTURE ↑↑) or lower (PICTURE vv) group. Step by step or continuous operation possible.
← CURSOR →	enables horizontal movement of CURSOR left or right. When CURSOR → at limit of travel it jumps to beginning of next lower line, ← CURSOR jumps to end of next higher line for same condition.
Top Address	(value entry) enables the address at top of screen (and therefore complete group) to be changed to any required value, either via INCREMENT/DECREMENT or DATA keys. (This enables a new display of data to be quickly called up).
Edit	Address Code enables the code for address selection and display to be chosen from OCT , HEX , or DEC . Clear & Set, includes: (Clear and Set Data, Clear Strobe) enables all channels whether currently displayed or not to be cleared and set i.e., all current data to be replaced by 0's or 1's. Strobe can be cleared.

NOTE: All following Channel Edit functions are active only between **First and Last Addresses**.

Channel Edit, includes:

(**Clear, Set, Copy Channel**)

enables discrete channels to be cleared and set, individual channels to be copied simply by moving the two cursors to required positions and pressing **EXECUTE**. The **← →** softkeys control the movement of **Entry Field** and **REPORT** area cursors.

DATA PAGE (continued)

- KEY WORD** GIVES ACCESS TO xxxx, DETAILS ARE:
- Edit** (Channel Edit continued)
- (continued) (Channel PRBS)
P.R.B.S.(Pseudo Random Binary Sequence) enables a different random binary pattern to be set in each channel. The same pattern will always appear in a channel whenever P.R.B.S. is enabled.
- (Up Counter and Down Counter)
enables a count up or down sequence to be set on data segments.
- Edit** **Line Edit - includes:**
(Copy-Macro)
enables discrete lines of data which have been set up on the **MACRO DATA PAGE** to be copied to any **DATA PAGE** line. The Macro number can be entered only via the **DATA** keys after pressing **PREV FIELD** to enable number entry. The currently active number entry area is shown in inverse video (black digits on white background). Operation of **NEXT FIELD** gives access to Line number entry, this can be made via **INCREMENT/DECREMENT** or **DATA** keys. **EXECUTE** must be pressed for completion of the copy function.
- (Copy Macros)
this functions in a similar manner to Copy Macro, except that a group of two or more Macros (limit sixteen) may be copied as a "block" to a group of consecutive addresses (e.g., 0001-0005). Here, the Macro numbers are entered (via **DATA** keys) by using the **PREV FIELD** and **NEXT FIELD** softkeys as necessary, to enable entry. Line number entry is enabled by **NEXT FIELD** and can be via **INCREMENT/DECREMENT** or **DATA** keys. Note that only the first Line number of the group is entered, the others are automatically allocated depending on the Macro group size. The other operating details are as for Copy Macro.
- (Insert Line) (See also "Limit Address")
this enables additional ("set to zero") lines to be inserted (one by one) in front of the address entered (remember that address 1021 for example, is in front of 1022). The data of the entered line number, and all successive ones, is therefore "moved" forward one line when **EXECUTE** is pressed. Line number entry is either via **INCREMENT/DECREMENT** or **DATA** keys. The number of lines which may be inserted without loss of original data depends on how far behind the Last Address the Limit Address is. E.g., if Last Address = 0160 and Limit Address = 0170 then 10 lines may be inserted without original data loss. The Limit Address can be used to ensure that certain lines of data (those behind the limit line) cannot be destroyed by new line insertions.

DATA PAGE (continued)**KEY WORD**

GIVES ACCESS TO xxxx, DETAILS ARE:

Edit**Line Edit** continued:**(Delete Line)** (See also "Limit Address")

this enables specific lines of data to be deleted so that the original subsequent lines are all moved back to fill the vacant area. Line number entry is as for "Insert Line". Note also the significance of Limit Address as a safeguard for data when deleting lines; lines numerically higher than the limit cannot be "moved back".

(Copy Line)

this enables lines to be copied to other addresses. The active entry area is controlled by the **NEXT FIELD/PREV FIELD** softkeys.

(Move Line)

This enables a line of data be moved from one address to another. The moved line will be transferred to the new line, and the original lines will therefore all be "pushed forward or back" one line, depending on the "Move" direction. E.g., A data segment contains sequential decimal coded data, with 02 at address 0002 and 06 at 0006. Line 0002 is then moved to 0006, now 02 will be seen at address 0006 and 06, 05, 04 and 03 will each have moved back one position.

(Limit Address)

This is normally used in conjunction with the **Insert** and **Delete Line** functions, to safeguard data situated "behind" the Limit Address. When it is made numerically greater than the Last Address, by for example, 10 lines, this is then the number of Line insertions that are possible without loss of currently active data.

Edit**CHECKSUM**

This enables a check to be made at any time on whether the data has been changed. When the softkey is pressed, a number is displayed. If at any time the current data is changed, the value of the number shown when the softkey is again pressed, will be different.

Entry mode

This enables either, the direction in which the cursor automoves after data entry or, whether it should be "held", to be selected.

DATA PAGE (continued)

KEY WORD

GIVES ACCESS TO xxxx, DETAILS ARE:

Edit
(continued)

Chnl Config (also applicable to OUTPUT and MACRO DATA PAGES)

This includes various features which allow the following to be done:

Enables the displayed data configuration (not the actual output configuration) to be arranged as wanted for best PAGE effect. The cursor movements are controlled by the ← → softkeys. Change of Connector or Channel numbers of each Data Segment (a segment consists of one or more columns of data separated by blank columns) is made via the DATA keys. The currently changeable segment is highlighted by one line being in inverse video in the REPORT area.

NOTE: See (Code/Entry) for explanation of ↑ under data segments
The features available include the following:

(INSERT CHNL)

enables additional channels to be added to existing Data Segments by moving the cursor to the required position and pressing **INSERT CHNL**. Note the difference between making an insertion within a segment or at the end. Within the Segment the same connector number and "reduced by one" channel number will occur e.g., if present configuration

is:	and insert made	
2222	here, then result is:	22222
3210		32110

The flashing warning: "Dupl Chnl in Segment" occurs due to double occurrence as shown. Channel and connector numbers can be changed if wished via the DATA keys.

If insert made at end of segment e.g.,

2222	result is:	22221	
3210		32103	and no warning.

Note difference in new channel (1) and connector numbers (3) in second example.

STORE/RECALL PAGE

GENERAL

This PAGE enables storage and recall of various parameter and address sets. As an aid to quick identification of each of the three possible parameter sets, the First and Last Addresses and Frequency are displayed in the REPORT area. For each of the Address sets, both addresses are displayed to aid identification.

Recall of Address sets can be very useful when it is necessary to make quick changes of First and Last Address values.

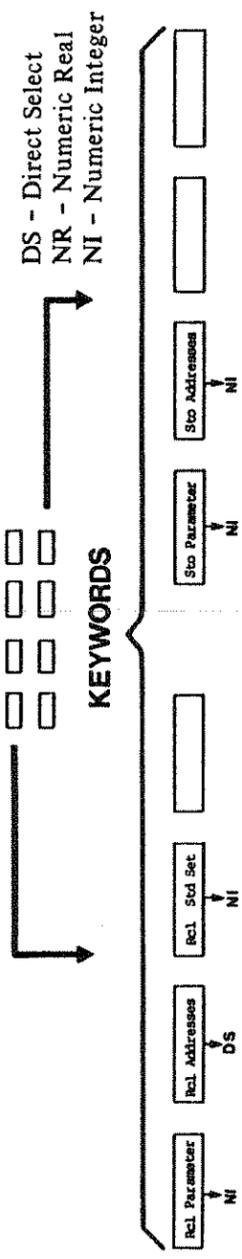
NOTE: Recall of any parameter set (including Std Set) causes the 8180A to go into the STOP state. If, on attempted recall of an address or parameter set, the message: "DESTROYED" appears on the screen, it can mean either: a) There is nothing stored due to the instrument being new or repaired, or b) the storage batteries are discharged, or both.

If the storage batteries are discharged (see also section under "DISPLAYED ERROR MESSAGES") due to more than three weeks non-usage of the 8180A, then, it is only necessary to operate the instrument for a short time to enable the memory storage facilities. (See specifications for more details). In the case of a new or repaired instrument where memory is "empty", as soon as "Store" functions are used, then the corresponding memory locations will be filled.

KEY WORD GIVES ACCESS TO xxxx, DETAILS ARE:

- Rcl Parameter** (value entry)
a value either, 1, 2, or 3 - must be entered followed by EXECUTE. The corresponding Parameter Set will then be recalled and replace the previous parameter and mode set. 8180A will go to "STOP" state.
- Sto Parameter** (value entry)
this enables the complete current parameter and operating mode set to be stored. Simply, press a number(1, 2 or 3) then EXECUTE.
- Rcl Addresses** (value entry)
as for Rcl Parameter except number between 1 and 9 to be entered and only First and Last addresses replaced.
- Sto Addresses** (value entry)
as for Sto Parameter, except number between 1 and 9 to be entered and only First and Last addresses stored.
- Rcl Std Set** (value entry)
No number entry necessary, only EXECUTE or REFUSE. If EXECUTE then current parameter set will be replaced by the Standard Set. 8180A will go to "STOP" state.

8180A				Status	STOP
STORE/RECALL			Address	Address	
Parameter	First Address	Last Address	Frequency		
Parameter 1	0254	0240	2.45 MHz		
Parameter 2	0002	0240	1.00 MHz		
Parameter 3	0000	0240	1.00 MHz		
Addresses 1	1000	1023			
Addresses 2	0512	0611			
Addresses 3					
Addresses 4					
Addresses 5					
Addresses 6					
Addresses 7					
Addresses 8					
Addresses 9					
Select Further					
Rcl Parameter Rcl Addresses Rcl Std Set					
Sto Parameter Sto Addresses					



* 1) Recall of any parameter set (including Std Set) causes the 8180A to go in to the STOP state.

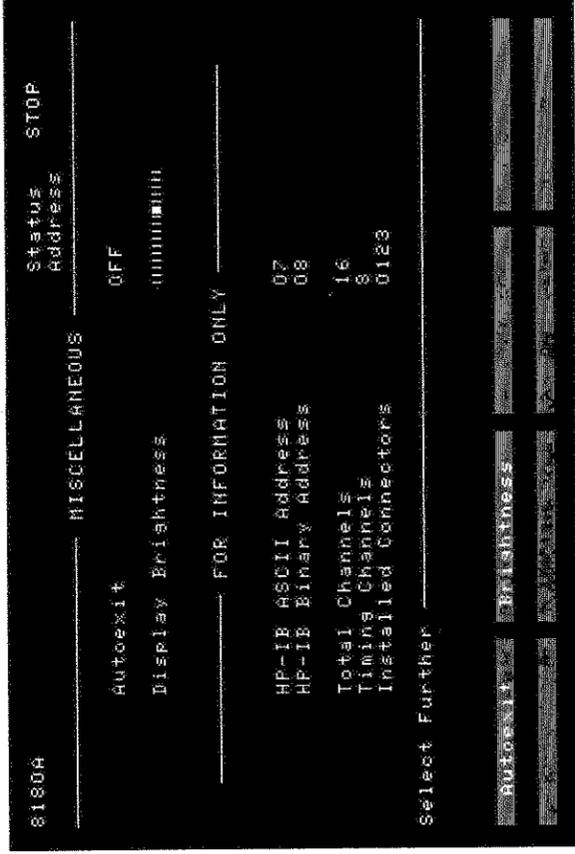
MISCELLANEOUS PAGE

General

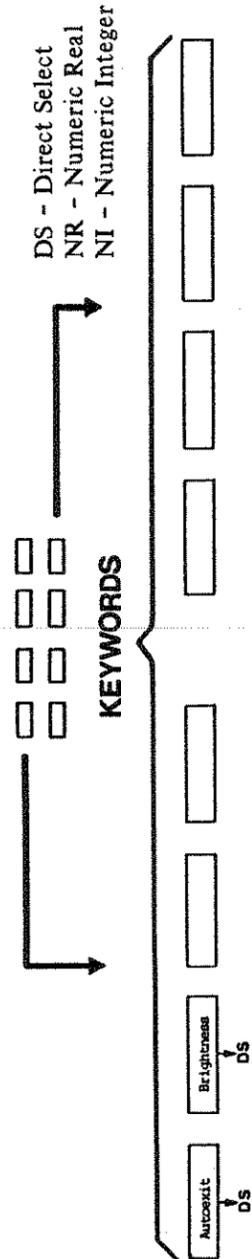
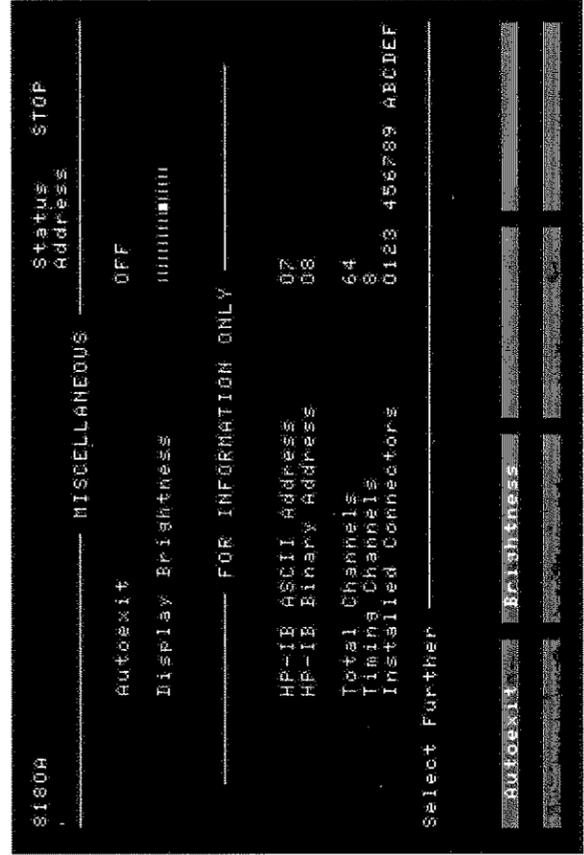
This PAGE does not include any parameter settings, operating modes etc, it is basically an information display PAGE with only two "variable" settings. These are:

- 1) **Autoexit** - this, when selected (ON) means that each time a new parameter value or operating mode is entered (not via INCREMENT DECREMENT), then the sequence is as if EXIT is pushed. This means that the previous softkey level is presented. hence: Autoexit.
 - 2) **Brightness** - this softkey enables the brightness of the display to be varied within set limits.
- The remaining REPORT details include:
 HP-IB interface information, more information on this will be found in the HP-IB Commands section of this manual.

The last three lines within the REPORT area, show general information concerning the total number of channels installed, how many of these are Timing Channels, and which are the Installed Connectors i.e., which rear panel connectors will provide output signals.
NOTE: Timing Channels, when installed, are always at Connectors 0 and 1.



Display Example if 2-8181A's also connected.



PROGRAMMING INFORMATION

P-1 General

The following provides useful information and examples (based on the HP 9826A or 36A) in BASIC, on programming the 8180A. A complete list of HP-IB commands is given at the end of the Programming Information Section.

Although all the examples are valid for either calculator, the following point should be noted: The HP9826A screen width is 50 characters whereas a line of information from the 8180A screen is 55. Therefore, for the "talker mode" examples a 9836A is recommended.

The 8180A can operate as a talker or a listener and has 2 remote modes of operation, these are:

ASCII Mode -in which data, parameter and mode settings are transferred over the HP-IB as serial ASCII bytes. The ASCII message is then interpreted by the 8180A and executed accordingly.

Binary Mode -for fast transfer of binary data between the HP-IB system controller and the 8180A or vice-versa.

A description of the listener and talker functions in each of these modes will be given. This information is generally restricted to 8180A specifics, and for detailed bus information, the user should refer to one of the following publications:

IEEE Interface Standard 488-1975
ANSI Interface Standard MC1.1
HP Publication 59401-90030
HP Publication 5952-0058

P-2 Address Assignment

When operating on the HP-IB, two address must be reserved for 8180A use; the first is for ASCII-byte transfer, and the second for binary data transfer. Both addresses are determined as follows by the setting of the rear panel HP-IB switch:

ASCII address = the actual switch setting, (factory preset to decimal 07)
Binary address = the ASCII address + 1 (decimal 08 for factory setting above)

At switch on, the 8180A checks address bits A1 through A5 of the rear panel switch, to determine its current addresses, and displays both on the MISCELLANEOUS PAGE. Call it up to check the value if wished.

If it is necessary to change the addresses and the 8180A is not connected to a controller, just change the bit settings of the rear panel switch as required. If it is connected to a controller, first ensure that the 8180A is in local mode, then proceed as above. For both cases, the new address will be activated instantly.

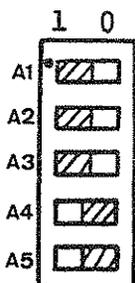
Table P-1 lists all possible addresses on the bus. **Note:** if the rear panel address switch is set to decimal 30, no binary transfer can take place since address 31 is not allowed. The message "HP-IB Binary Address ILLEGAL" will then be displayed on the MISCELLANEOUS PAGE.

Table P-1. Available Addresses (ATN true)

Available Addresses (ATN true)										
Data bus (D IO lines)				Address in ASCII						
Fixed		Selectable			Talk	Listen				
8	7	6	5	4			3	2	1	DEC
O	T	L	0	0	0	0	0	0	@	SPACE
O	T	L	0	0	0	0	1	1	A	!
O	T	L	0	0	0	1	0	2	B	"
O	T	L	0	0	0	1	1	3	C	#
O	T	L	0	0	1	0	0	4	D	\$
O	T	L	0	0	1	0	1	5	E	%
O	T	L	0	0	1	1	0	6	F	&
O	T	L	0	0	1	1	1	7	G	'< --- 8180A set to this address
O	T	L	0	1	0	0	0	8	H	(at factory.
O	T	L	0	1	0	0	1	9	I) (decimal 7)
O	T	L	0	1	0	1	0	10	J	* (binary address=8)
O	T	L	0	1	0	1	1	11	K	+
O	T	L	0	1	1	0	0	12	L	,
O	T	L	0	1	1	0	1	13	M	-
O	T	L	0	1	1	1	0	14	N	.
O	T	L	0	1	1	1	1	15	O	/
O	T	L	1	0	0	0	0	16	P	0
O	T	L	1	0	0	0	1	17	Q	1
O	T	L	1	0	0	1	0	18	R	2
O	T	L	1	0	0	1	1	19	S	3
O	T	L	1	0	1	0	0	20	T	4
O	T	L	1	0	1	0	1	21	U	5 <--- Usually controller address
O	T	L	1	0	1	1	0	22	V	6
O	T	L	1	0	1	1	1	23	W	7
O	T	L	1	1	0	0	0	24	X	8
O	T	L	1	1	0	0	1	25	Y	9
O	T	L	1	1	0	1	0	26	Z	:
O	T	L	1	1	0	1	1	27	[;
O	T	L	1	1	1	0	0	28	\	<
O	T	L	1	1	1	0	1	29]	=
O	T	L	1	1	1	1	0	30	^	>
O	T	L	1	1	1	1	1	31	-	? <--- Forbidden settings.

UNT, UNL commands.

L = 1 for listen address, 0 for talk address
 T = 1 for talk address, 0 for listen address



HP-IB address settings on 8180A rear panel switch.
 (factory setting of decimal 7 shown)

P-3 Service Request (SRQ)

Briefly, if any of the "front panel operation" type errors is made (see Sectn.3) or, for one of the following reasons, an attempt is made to put the 8180A into an error condition, it will respond by making a service request. **Reasons include:** an incorrectly formatted statement or syntax error, a "not possible" command (hardware required not installed), or operator action via the SRQ softkey. Any of these will result in the SRQ control line of the HP-IB being set true and the warning: SRQ being displayed at the top of the 8180A display area. To acknowledge the SRQ (and delete the warning from the display), the 8180A should be "polled" by using the serial poll sequence or, for the 9826A, by typing:

SPOLL(707) and pressing EXECUTE.

The 8180A will then, for either case, put a status byte on the data bus (DIO 0-8) and a number will be displayed on the 9826A. From this number the actual type of error condition can be determined.

A list of all Service Request Messages and an example of how to "decode" a displayed number is given in the HP-IB Commands list.

P-4 Local, Remote and Local Lockout

To return the 8180A to local control (from remote), several possibilities exist, they include, sending the GTL command (SEND 7; CMD 01), commands specific to the 9826A e.g. LOCAL 707, initiating the 8180A power-up reset cycle etc. To avoid the possibility of data transmission being interrupted, which can happen if the 8180A is returned to local via the front LOCAL softkey, it is recommended that local lockout be set to disable the softkey.

This can be implemented either by, using a 9826A specific command e.g., LOCAL LOCKOUT 707, or sending CMD 11(HEX), (typed as decimal 17). Local Lockout remains in effect until the 8180A is returned to the local state by switching off and on, or by sending a 9826A specific command.

P-5 Notes on Programming

The following paragraphs will demonstrate the basic principles of programming the 8180A, the examples included are based on the HP 9826A (desk top) computer and BASIC as the programming language. The examples demonstrate the operation of the 8180A in the listener and talker modes. These are the modes in which it can be operated once remote has been initiated. The first examples will demonstrate the listener functions. The list of HP-IB commands, and related information, should be referred to as necessary since they are an integral part of the programming procedure.

P-6 Listener Functions

Each PAGE of the 8180A has a command to call it up - a **Menu Select** command. **PAG1** for example, identifies the Control PAGE. More significant are each PAGE'S unique set of commands which enable all of the associated settings to be made, these can be parameter, mode or data settings depending on the particular PAGE. In addition to the PAGE related commands, there are Operation commands such as RUN, STP etc. which control 8180A operating status, and Universal commands. (All of these are detailed in the list of HP-IB Commands)

P-7 Programming Examples

With the 8180A and the 9826A interconnected (via an HP-IB cable), and the BASIC program loaded, a simple example of a one line "program" can be demonstrated by typing the following line into the 9826A:

```
OUTPUT 707;"PAG1 RSS" (then press EXECUTE)
```

Explanation:

OUTPUT

This prepares the 9826A to output data (any command etc.)

707

This is the device selector, it includes the interface select code for the internal HP-IB - 7. and the 8180A ASCII address - 07.

"PAG1 RSS"

This calls up the Control PAGE and recalls the Standard Parameter Set. The Control PAGE report details will be set accordingly.

Example 1: Control PAGE Settings

This example shows how to call up the Control PAGE, recall the Standard Parameter Set, and then change the value of some settings.

```
10 Gen=707
20 OUTPUT Gen;"PAG1"
30 OUTPUT Gen;"RSS"
40 OUTPUT Gen;"FAD 0002 LAD 0010"
50 OUTPUT Gen;"CYM2, CLK2, OUT2"
60 OUTPUT Gen;"THR +0.987V"
70 END
```

Explanation of specific lines:

- 10 This enables the abbreviation Gen to be used in the program lines instead of having to type 707. (707 can of course be used instead if wished)
- 20 puts the 8180A in the remote listen mode and instructs it to display the Control PAGE.
- 30 recalls the Standard Parameter Set
- 40 sets the First and Last Addresses values to 0002 and 0010 respectively.
- 50 CYM2 - sets the Cycle Mode to SINGLE CYCLE; CLK2 - sets Clock Source to EXTERNAL and POS SLOPE; OUT2 - sets the Outputs ON.
- 60 sets Input Threshold to +0.9 V (two significant digits only)

If the "program" does not work, ensure that the HP-IB cable is properly connected

Any of the PAGES can be called up and standard settings made, by using the same type of statement.

In practise, a proper program will include several lines or statements and some examples to demonstrate how to use some of the commands will now be given. As will be seen, actual printouts of the programs are used to clarify format and syntax required etc.

It is recommended that the programs be "stepped" through first (via the STEP key on the 9826A) and the resulting changes in the 8180A display details observed. Note, PAGE settings can be changed without always first calling up the PAGE as is done in the following examples.

Example 2: Timing PAGE Settings

This example shows how to call up the Timing PAGE, recall the Standard Parameter Set, and change the value of some timing parameters.

```

10 Gen=707
20 OUTPUT Gen;"PAG2"
30 OUTPUT Gen;"RSS"
40 OUTPUT Gen;"DEL 1C 10NS, WID 2C 30NS"
50 OUTPUT Gen;"DEL 01 10NS, DEL 02 20NS"
60 END

```

Explanation:

10,20—as for previous example except Timing PAGE called up.

30 as for " "

40 DEL 1C - Clock 1 Delay (set to 10 ns), WID 2C - Clock 2 Width (to 30 ns).

50 DEL 01 - Channel 0-1 Delay (set to 10 ns), (Delay Channel 0-2 to 20 ns).

Example 3: Output PAGE Settings

This example shows how to change Label Level values, set up a new channel configuration, and assign Labels and Polarity to connectors and channels.

```

10 Gen=707
20 OUTPUT Gen;"PAG3"
30 OUTPUT Gen;"RSS"
40 OUTPUT Gen;"HILA 4.3V, LOLA 0.4V"
50 OUTPUT Gen;" CAS BY 03 02 01 00: ADS ON 13 12 11 10;
ADS HY 23 22 21 20"
60 OUTPUT Gen;"LBB 03 LBC 12"
70 OUTPUT Gen;"COM 03,COM 02,COM 01.NOR 00. COM 13"
80 END

```

Explanation:

40 HILA 4.3V - Label High Level set to 4.3V, (Low Level set to 0.4V)

50 CAS - all segments (data channels) deleted and, (BY) a new Binary coded segment added with data entry allowed (Y) in it, the new segment will be:

03 02 01 00 - Connector 0, channels 0-3,

ADS ON - add a segment, octal coded (O), data entry not allowed (N),

13 12 11 10 Connector 1, channels 0-3,

ADS HY - add a segment, hex coded (H), data entry allowed (Y),

23 22 21 20 - Connector 2, channels 0-3,

ADS HY 23... - add a segment, hex coded etc.

60 LBB 03 - Label B assigned to Connector 0, channel 3;

LBC 12 - Label C assigned to Connector 1, channel 2.

70 COM 03 - channel 3 of Connector 0 is set to Complement polarity etc.,

NOR 00 - channel 0 of Connector 0 is set to Normal polarity.

Example 4: Data PAGE Settings

This example shows how to set up a new channel configuration (same principle as for Output PAGE example) and then set up various data patterns

```

10  Gen=707
20  OUTPUT Gen;"PAG 4,CLD,CLS"
30  OUTPUT Gen;"CAS BY 23 22 21 20;ADS BN 13 12 11 10;
    ADS HY 03 02 01 00;"
40  OUTPUT Gen;"FAD 0016 LAD 0020"
50  OUTPUT Gen;"TAD 0008"
60  OUTPUT Gen;"SCD 23 SCD 20 DNC 3"
70  PAUSE
80  OUTPUT Gen;"TSA 0009 CHD 22 0 1 0 1 "
90  OUTPUT Gen;"TSA 0014 FOR 1 1111 B"
100 END

```

Explanation:

- 20 PAG4,CLD,CLS - Data PAGE called and all channel and strobe data cleared, (including channels not currently displayed).
- 30 all segments (data channels) deleted from display and a new configuration set up, see Output PAGE example for explanation.
- 40 new address values set.
- 50 TAD 0008 - Top address of display set to 0008.
- 60 SCD 23 - set all data (between FAD and LAD) of Connector 2 channel 3;
SCD 20 - " " " 2 " 0.
- 70 PAUSE - if in RUN the CONTINUE key should be pressed, (in STEP ignore),
- 80 TSA 0009 - Transfer Start Address = 0009,
CHD 22 0101 - data entered into channel 2 of Connector 2.
- 90 TSA 0014 - Transfer Start Address - 0014,
FOR 1 1111 B - This is a formatted entry, the data following "FOR" must correspond exactly with the actual channel configuration, including Entry YES-NO and the data code of each segment. The first 1 sets the Strobe channel at address 0014, the next 1111 group sets the data bits of the first segment at address 0014 to binary 1111, the following B sets the third segment to hex B. The second segment is not changed since NO Entry is defined.

P-8 Fast Binary Transfer

This mode, also called the "fast reload data mode", enables data to be transferred extremely quickly to or from an 8180A/8181A and a suitable, high I/O rate, controller. An example to show how much faster this mode can be compared to the normal one is as follows:

Normal mode - formatted (HEX) data, 16 channels X 1024 bits: 10 s

Fast Binary - unformatted data, 16 channels X 1024 bits: 400 ms

Example of Fast Binary Transfer

The following program example illustrates fast binary data transfer both to and from the controller and the 8180A. For the transfer from controller to 8180A, examples of two different transfer connector configurations are given but with the same displayed connectors being maintained. To clarify the transfer of data from the 8180A back to the controller, the program includes a statement to "print" (display) the data, which is stored. Refer to BINARY TRANSFER commands (in HP-IB COMMANDS list) for further information if necessary.

Example 5: Fast Binary Transfer Controller to 8180A and vice-versa.

```

10     Gen_ascii=707
20     Gen_binary=Gen_ascii+1
30     OUTPUT Gen_ascii;"PAG4,CLD,CLS,TAD 0"
40     OUTPUT Gen_ascii;"CAS DY 23 22 21 20;ADS DY 03 02 01 00;"
50     DIM Buffer$(15)
60     FOR N=1 TO 15
70     Buffer$(N)=CHR$(N)
80     NEXT N
90     OUTPUT Gen_ascii;"BSC 0/1,BSA 0,BTR 1"
100    OUTPUT Gen_binary;Buffer$ END
110    PAUSE
120    OUTPUT Gen_ascii;"CLD,BSC 0/3,BSA 0"
130    OUTPUT Gen_binary;Buffer$ END
140    PAUSE
150    DIM A$(15)
160    OUTPUT Gen_ascii;"BSC 0/1,BSA 0"
170    ENTER Gen_binary USING "-K,%,#";A$
180    FOR N=1 TO 15
190    PRINT USING "5X,DD";NUM(A$(N);1)
200    NEXT N
210    END

```

Explanation of transfer from controller to 8180A

- 10,20 Instead of defining separate ASCII and binary address values (reason for binary address explained in paragraph 3-23), line 20 enables the 9826A to fix the binary value, in accordance with the ASCII one. Therefore, if the ASCII address is ever changed, the binary one is automatically corrected. You can, if wished, directly define the binary address as 708.
- 30,40 These types of statements have already been explained in previous examples. Note that the top address in the display is 0 and the new displayed channel configuration consists of channels of connectors 0 and 2, decimal coded. (see Display Result 1)
- 50,60,
70,80 These statements allocate storage in the controller for the data which is to be transferred etc. The data consists of the numbers 1 - 15 converted into binary.
- 90 Defines the start and stop connectors (channels) for data transfer - BSC 0/1 - connectors 0 and 1, and at which address to start - BSA 0. A transferred data byte is always eight bits, therefore a minimum of 2 connectors (each having 4 channels) must always be defined. Note that in the example the transfer connectors differ from the displayed ones.
- 100 Outputs data to 8180A, "END" causes the 8180A output data to change and the display to be updated. Note that only connector 0 segments change, connector 2 is not included within the transfer group. Also, in this example, even if connector 1 was displayed no change would occur in its data since the second 4 bits of each byte transferred are always all 0. (See Display Result 2)

- 110 PAUSE is included to enable the user to observe the next step clearly. If only single transfer from controller to 8180A required then make line 110 "END".
- 120 This clears all data and sets up a new transfer connector configuration of connectors 0 and 3
- 130 data output and display updated.(See Display Result 3) Note the difference in the 8180A display, compared to that for the previous transfer. Since connectors 0 and 3 specified in line 120, connectors 1 and 2 are also,by definition included within the group (see page P-19 for further explanation of BSC command if necessary).
The data transferred is now "distributed over" connectors 0 and 2 because the new transfer group is now 16 bits wide (for previous case it was only 8) and the last 4 bits of each byte (all 0's) are at connectors 1 and 3.

Display Result 1 (BSC 0/1)				Display Result 2 (BSC 0/3)				Display Result 3			
ADDR	STR	DATA		ADDR	STR	DATA		ADDR	STR	DATA	
0000	F	0	00 00	0000	F	0	00 01	0000	F	0	02 01
0001		0	00 00	0001		0	00 02	0001		0	04 03
0002		0	00 00	0002		0	00 03	0002		0	06 05
0003		0	00 00	0003		0	00 04	0003		0	08 07
0004		0	00 00	0004		0	00 05	0004		0	10 09
0005		0	00 00	0005		0	00 06	0005		0	12 11
0006		0	00 00	0006		0	00 07	0006		0	14 13
0007		0	00 00	0007		0	00 08	0007		0	00 15
0008		0	00 00	0008		0	00 09	0008		0	00 00
0009		0	00 00	0009		0	00 10	0009		0	00 00
0010		0	00 00	0010		0	00 11	0010		0	00 00
0011		0	00 00	0011		0	00 12	0011		0	00 00
0012		0	00 00	0012		0	00 13	0012		0	00 00
0013		0	00 00	0013		0	00 14	0013		0	00 00
0014		0	00 00	0014		0	00 15	0014		0	00 00
0015		0	00 00	0015		0	00 00	0015		0	00 00

Note: in all 3 above Display Results, displayed connectors are 0 and 2.

Example of Transfer back to Controller (part of main program)

140	PAUSE	Display Result 4
150	DIM A\$(15)	1
160	OUTPUT Gen_ascii;"BSC 0/1,BSA 0"	3
170	ENTER Gen_binary USING "-K,%,#";A\$	5
180	FOR N=1 TO 15	7
190	PRINT USING "5X,DD";NUM(A\$(N:1))	9
200	NEXT N	11
210	END	13
		15
		0
		0
		0
		0
		0
		0
		0

Explanation of transfer back.

150 as for line 50

160 defines from which connectors data to be transferred.

170 data transferred with required image specifiers, (refer to a BASIC manual) briefly, significance of these is : K - Freefield Entry; % - terminate on EOI (or end of file); # - Suppresses all statement terminators.

180, statements to enable data transferred back to controller to be displayed
 190, on its screen. See Display Result 4 and note how the "contents" of
 200 connectors 0 and 1 are transferred back.

P-9 Talker Modes

The 8180A can send data messages of various types when in remote and addressed to talk. A complete description of the six available "Talker" modes is given in the list of HP-IB commands. Some actual program examples of them follow. The first example is for Talker mode 1 (TLK1) and the others follow sequentially through from TLK2 to TLK6. Note: the comments/explanations for these examples are included within the program lines but are identified by a preceeding "!", they have no function in the actual program operation.

Example 1: Status - (TLK 1)

```

10 PRINTER IS 1
20 Gen=707
30 OUTPUT Gen;"TLK1"
40 ENTER Gen;A$
50 PRINT A$
60 END
70 !TLK1: ENTERS THE 8180A STATUS AS FOLLOWS:
80 !W,XXXX,Y,Z. W=0:STOP; W=1:RUN; W=2:BREAK
90 !XXXX=ACTUAL ADDRESS IN SELECTED CODE
100 !IF NO ADDRESS THEN -1 DISPLAYED
110 !Y=HIGHEST CONNECTOR
120 !Z=NUMBER OF TIMING BOARDS (EACH BOARD HAS
130 !4 RZ CHANNELS

```

Example 2: Learn Mode - (TLK 2)

```
10 PRINTER IS 1
20 Gen=707
30 OUTPUT Gen;"TLK2"
40 DIM B$(8)[70]
50 FOR I=1 TO 8
60 ENTER Gen;B$(I)
70 PRINT B$(I)
80 NEXT I
90 END
100 !TLK2: ENTERS ALL STORED PARAMETER SETTINGS
110 !INTO A STRING ARRAY B$(1) TO B$(8) EACH
120 !70 CHARACTERS DEEP.
130 !NOTE: THIS INFORMATION IS COMPRESSED AND NOT
140 !INTERPRETABLE BY THE USER. IT IS ONLY FOR
150 !STORAGE PURPOSE ON A MASS STORAGE DEVICE
160 !AND FOR FAST RESTORAGE INTO THE GENERATOR.
170 !DO NOT CHANGE A CHARACTER OF THIS SEQUENCE.
```

Example 3: Display Information - (TLK 3)

```
10 PRINTER IS 1
20 Gen=707
30 DIM C$[100]
40 OUTPUT Gen;"TLK3,LIN1"
50 FOR J=1 TO 26
60 ENTER Gen;C$
70 PRINT C$[1,50]
80 NEXT J
90 END
100 !TLK3: ENTERS ALL DISPLAY INFORMATION OF A
110 !SELECTED PAGE.
140 !LIN: DEFINES THE FIRST LINE (1-26).
```

Example 4: Formatted Data - (TLK 4)

```
10 PRINTER IS 1
20 Gen=707
30 OUTPUT Gen;"TLK4 TSA3"
40 FOR K=1 TO 5
50 DIM D$[100]
60 ENTER Gen;D$
70 PRINT D$
80 NEXT K
90 END
100 !TLK4: READS THE DATA MEMORY FORMATTED I.E.
110 !ACCORDING TO THE ACTUAL CHANNEL CONFIGURATION
120 !AND THE CODING.
130 !TSA3:DEFINES THE TRANSFER START ADDR AS 0003
140 !IN THIS CASE DATA OF ADDRESS 0003 TO 0007
150 !IS TRANSFERRED.
```

Example 5: Data Page Format - (TLK 5)

```
10 PRINTER IS 1
20 Gen=707
30 OUTPUT Gen;" RSS TLK5"
40 FOR L=1 TO 5
50 DIM E$[100]
60 ENTER Gen;E$
70 PRINT E$
80 NEXT L
90 END
100 !TLK5:THE GENERATOR TALKS A STRING FOR EACH
110 !CHANNEL SEGMENT. THE STRING CONTAINS CODING
120 !INFORMATION AND ENTRY YES/NO INFORMATION
130 !PLUS THE CHANNEL CONFIGURATION.
140 !ANOTHER STRING CONTAINS ADDRESS COUNTER
```

Example 6: String Error Detection - (TLK 6)

```
10 PRINTER IS 1
20 Gen=707
30 OUTPUT Gen;"FAD 10 LAD 100 CYM 6 CLK1"
40 OUTPUT Gen;"TLK6"
50 ENTER Gen;F$
60 PRINT F$
70 END
80 !TLK6: IF AN SRQ OCCURS, TLK6 WILL SEND A
90 !MESSAGE CONTAINING A NUMBER. THIS NUMBER
100 !INDICATES THE CHARACTER POSITION IN THE
110 !OUTPUT STRING WHICH CAUSED THE ERROR.
120 !IN THIS CASE THE NUMBER IS 20. THE 20TH
130 !CHARACTER IS 6. CYM 6 DOES NOT EXIST.
```

8180 A HP-IB COMMANDS

HP-IB Addresses

The 8180A has two HP-IB Addresses, the ASCII Address is selectable by the Rear-Panel-Switch, (factory setting is decimal 7) and the Binary Address is the ASCII Address + 1. All commands have to be sent to the ASCII Address and binary data can be transferred through the binary Address. Both Addresses are displayed on the Miscellaneous Page.

Device Commands Definition

GENERAL: All Alphabetical characters may be sent upper or lower case. Commands may be separated by a Blank, a Comma, a Semicolon, a <CR><LF> sequence, and End Message or nothing, unless otherwise noted. Commands are sent to the ASCII Address.

DEVICE COMMANDS: Every device command consists of three letters which then, except for Type E commands, must be followed by further information - a single digit or a numeric value plus, where applicable, units.

STANDARD NUMBER FORMAT: The standard number has the following format:
<N spaces><sign><M spaces><J digits><.K digits><L spaces><E<sign><P digits>>

N,M,K,L = any positive value including zero
 J = 0 to 99;
 J+K = 1 to 99
 P = 1 to any value, but the value of <P digits> < 100
 Not relevant digits of J+K are cut off (no rounding)

Type E *DIRECT EXECUTING COMMANDS :*
 This message is executed without any following information.

Type S *DIRECT SELECT COMMANDS :*
 This command must be followed by a numeric digit to select the subfunction.

Type I *INTEGER COMMANDS :*
 The command must be followed by a number which can be only in standard number format (Type I1); or, (Type I2) by a number in either standard format if the DEC function is selected or a Hex. number if HEX is selected, or an Octal number if OCT is selected.

NOTE :

If a command is shown with one or more full stops following it e.g., FAD... , UPC...etc., this indicates that one or more further characters (numeric or alphabetical) have to be included, depending on the Type of command.

Type R *REAL COMMANDS :*

This command must be followed by a number in standard number format and one of the following units:

HZ, KHZ or MHZ (Type R1) ; value only pos.
NS, US or MS (Type R2) ; only pos.
V (Type R3) ; value pos. or neg.

Type C *CHANNEL COMMANDS :*

This command must be followed by a channel number in the form
<Connector><Channel>

- a) where for (TypeS C1, C2, and C3) Connector is a hex character defining the Connector, Channel is a digit between 0 and 3 defining the channel,
- b) or (only TypeS C2 and C3) Connector is a digit 1 or 2 defining the clock channel, Channel is the letter C
- c) or (only Type C3) Connector is a digit 1 or 2 defining the Extender (8181A), Channel is the letter X

Type M *MACRO COMMANDS :*

This Command must be immediately followed by a hex character defining the Macro.

MULTIPLE COMMANDS :

If more than one Type is specified at a command, the command must be followed by all Types separated with the letter between the Types.

Commands of the CONTROL Page

First Address	(Type I2) includes STP, if not CYM1 and RUN	FAD...
Last Address	(Type I2) includes STP, if not CYM1 and RUN	LAD...
Cycle Mode	(Type S) includes STP	[CYM]
	Auto	CYM1
	Single	CYM2
	Gated	CYM3
	Init+Gated	CYM4
	Init+Auto	CYM5
Strobe Breaks	(Type S)	[STB]
	Off	STB1
	On	STB2
Clock Source	(Type S)	[CLK]
	Internal	CLK1
	External pos. slope	CLK2
	External neg. slope	CLK3
	Manual	CLK4
Clock 1 in break	(Type S)	[CAB]
	Off	CAB1
	On	CAB2
Input Impedance	(Type S)	[IMP]
	50 Ohm	IMP1
	100 kOhm	IMP2
Input Threshold	(Type R3)	THR...V
Run Input	(Type S)	[RUI]
	Off	RUI1
	On pos. slope	RUI2
	On neg. slope	RUI3
Stop Input	(Type S)	[SPI]
	Off	SPI1
	On pos. slope	SPI2
	On neg. slope	SPI3
Break Input	(Type S)	[BRI]
	Off	BRI1
	On pos. slope	BRI2
	On neg. slope	BRI3
Strobe Output	(Type S)	[STO]
	Data	STO1
	Clock	STO2
Outputs ON/OFF	(Type S)	[OUT]
	Off	OUT1
	On	OUT2

Commands of the TIMING Page

Clock Frequency (Type R1) changes PER also	FRQ...
Clock Period (Type R2) changes FRQ also	PER...
Delay of Clock or Extender or Channel (Type C3 R2) e.g. DEL 12 17 ns = Delay Conn 1 chann 2 17 ns DEL 2C 14 ns = Delay Clock 2 14 ns	DEL...
Format of Clock or Channel (Type C2 S) e.g. FMT 1C 1 = Format Clock 1 RZ FMT 02 2 = Format Channel 0-2 RZ=50%	FMT...
Width of Clock or Channel (Type C2 R2)	WID...

Commands of the OUTPUT Page

Load Impedance (Type S) _____ 50 Ohm Open	[LIM] LIM1 LIM2
Outputs On/Off	[OUT]
High Level (modified Type R3) e.g. High Level Label A = 4.3 V	HIL...V HILA 4.3V
Low Level (modified Type R3) e.g. Low Level Label D = -2.00 V	LOL...V LOLD -2V
Select Label for Channel or Clock (Type C2) e.g. Label B on connector 6 Channel 2	LBx LBB62
Normal Polarity for Channel or Clock (Type C2)	NOR
Complement for Channel or Clock (Type C2)	COM
Strobe Level (Type S) _____ TTL ECL	[STL] STL1 STL2
Strobe Polarity (Type S) _____ Strobe Polarity Normal Strobe Polarity Complement	[SPO] SPO1 SPO2
Clear and add Data Segment (See DATA page)	CAS...
Add Data Segment (See DATA page)	ADS...
Set Standard Configuration (See DATA page)	SSC
Strobe Yes Entry (Type E)	SYE
Strobe No Entry (Type E)	SNE

Commands of the DATA Page

- Start Address for Data Transfer (Type I2) TSA....
- Formatted Data (Data must be in the same format as displayed
on the data page with no "NO ENTRY" Segments) FOR....
- e.g. `FOR 0 A3 4DE3 5F C257 0011 0001 1010 1101`
- The FOR statement must be limited by a "," or ";" or <CR><LF>
After the delimiter the TSA Counter is automatically incremented, so that the next FOR Statement without a new TSA Statement enters data at the next address.
- Enter Channel Data (Type C1+Data). Select Address with TSA and
then send CHD+Channel number + data (0 or 1) for one or more
addresses. CHD....
- e.g. `TSA123 CHD03 00101`
- Set Standard Configuration (Type E) SSC
This commands sets standard Configuration on the Data Page.
- Clear and add Segment to Data Page (Special Type) CAS....
[m=1 to 16]. This Statement deletes all data channels and makes a
new segment containing 1 to 16 channels. The channel numbers
must be separated by " " and preceded by two characters defining
Segment Coding and Entry.
1. Character must be B (binary), D (decimal), H (hex) or O (octal).
2. Must be N (no Entry) or Y (yes Entry). Every blank must be
followed by a valid channel number, the command must be terminated with a ",", ";" or <CR>.
E.g. `CAS HY 43 42 41 40 30;` = Clear Data Page and make one
segment containing whole connector 4 and channel 30, in hex
coding with Entry "YES".
- Add segment to Data page (Special Type) ADS....
Same as CAS, but configuration is not cleared, that means
the segment is added to the present configuration.

Commands of the DATA Page continued

Address Coding Octal _____ (Type E) _____	OCT
Address Coding Hexademical (Type E)	HEX
Address Coding Decimal (Type E)	DEC
No entry on Strobe _____ (Type E) _____	SNE
Entry on Strobe (Type E)	SYE
Copy Macro (Type M/12) Changes TAD too	CMA...
Copy Macros (Type M/M/12) Changes TAD too	CMS...
Data Page Top Address (Type I2)	TAD...
Clear Data _____ (Type E) _____	CLD
Set Data (Type E)	SED
Clear Strobe (Type E)	CLS
Clear Channel Data _____ (Type C1) _____	CCD..
Set Channel Data (Type C1)	SCD..
Up Counter (Type I1) I = Segment number	UPCI
Down Counter (Type I1) I = Segment number	DNCI
PRBS on Channel (Type C1)	PRB..
Copy Channel (Type C1/C1)	COC../..
Insert Line _____ (Type I2) Changes TAD also _____	ILI...
Delete Line (Type I2) Changes TAD also	DLI...
Limit Address (Type I2/I2) Changes TAD also	LMA...
Copy Line (Type I2/I2) Changes TAD also	COL../..
Move Line (Type I2/I2) Changes TAD also	MOV../..

Commands of the MACRO DATA Page

Macro Data (Type M + same data format as the FOR Command). **MAC**
 There is no automatic Incrementation of the Macro

Commands of the STORE/RECALL Page

Recall Standard Set **RSS**
 The RSS message does (x = all possibilities): STP, FAD0, LAD1023, CYM1, STB1, CLK1, THROV, IMP1, RUI1, SPI1, BRI1, STO1, STL2, OUT1, PER100NS, DEL1CONS, FMT1C1, WID1C40NS, DEL2C50NS, FMT2C2, WID2C10NS, DEL (all Channels)0NS, FMT (all Channels)3, WID (all Channels) 50 NS, DEL (all Extender) 0NS; LIM1, HILA.25V, LOLA-.25V, HILB5V, LOLB0V, HILC-.8V, LOLC-1.8V, HILD2.4V, LOLD.8V, LBAxx, NORxx, SSC

Store to Parameter Set (Type S); Digit = Set Number (1 to 3) **PSS.**

Recall Parameter Set (Type S); Digit = Set Number (1 to 3) **PSR.**
 The stored parameters are recalled and STP, OUT1 is executed.

Store to Address Set (Type S); Digit = Set Number (1 to 9) **ASS.**

Recall Address Set (Type S); Digit = Set Number (1 to 9) **ASR.**
 The stored addresses are recalled.

Commands for BINARY TRANSFER

Select Connectors to transfer Binary Data Transfer (Type S/S) **BSC./.**
 First Digit selects the start connector of the word Second Digit selects the stop connector of the word odd and even digits are the same (one Byte=two connectors) 2. Digit must be greater or equal to 1. Digit Example: BSC 0/7 Word consists of 4 Bytes; First contains Data of Connectors 0 and 1, fourth of Connectors 6 and 7

Start Address for Binary Data Transfer (Type I2) **BSA...**

Select Binary Transfer (Type S)

Transfer Data
Transfer Strobe Data

[BTR]
BTR1
BTR2

The BSC, BSA and BTR Commands are send to the ASCII Address. In the BTR1 Mode, Data coming in through the Binary Address is stored in the Data Memory from the BSA Address to the Bytes defined by the BSC Command. The transfer terminates at Address Change, Remote Change or EO1 received. (EO1 is recommended). Next transfer starts again at BSA. In the BTR2 Mode Data is stored in the Strobe Memory from Address 0 to 1023, where one byte contains data for 8 addresses (DI01 of the first word goes to Address 0, DI08 to Address 7 and so on). The transfer terminates under the same conditions as BTR1. Data at the Outputs and on the Data page changes in both modes after transfer termination.

A Binary Transfer has to contain at least 2 bytes.

Commands of the REMOTE MESSAGE Page

Select Line to display [4-23] or talk [1-26] (Type I1)

LIN...

Display Text in Remote Message Page until <CR>.

DSP...

After the DSP command the LIN value will be automatically incremented. Information will be lost with next PAG or REP command.

OPERATION Commands

Run (Type E)

RUN

Stop (Type E)

STP

Break (Type E)

BRK

Manual Clock Forward (Type E)

FWD

Manual Clock Back (Type E)

BCK

Stop and Run (Type E)

SRU

Update Status and Address information (Type E)

UPD

(done automatically every 50 ms, if processor is not busy)

MENU Selecting Commands

Select Page	(Type S) Control Page Timing Output Page Data Page Store/Recall Page Miscellaneous Page Macro Data Page	[PAG] PAG1 PAG2 PAG3 PAG4 PAG5 PAG6 PAG7
Select Report	(Type S). Same as PAG, but will not effect the Softkeyset after returning to local.	[REP]
Remote Message Report (Type S)		REP8
Select Softkeyset	(Type S). Same as PAG, but will only effect Softkeyset after returning to local.	[KEY]

UNIVERSAL Commands

NOTE: For all of these commands the attention bus line (ATN) must be "true".

Go to Local	GTL(\$01)
Selective Device Clear (same as STP)	SDC(\$04)
Group Execute Trigger (same as RUN, but execution within 10 us, if impossible then SRQ 15 will occur).	GET(\$08)
Local Lockout	LLO(\$11)
Device Clear (same as STP)	DCL(\$14)
Serial Poll Enable	SPE(\$18)
Serial Poll Disable	SPD(\$19)

SERVICE REQUEST Messages (Status Byte)

STATUS BYTE	TITLE
	(DIO line high significance)
DIO 8	Status is Break (updating every 50 ms or at UPD)
DIO 7	Request Service
DIO 6	Hardware or Compatibility Error
DIO 5	Status is Run (updating every 50 ms or at UPD)
DIO 4-1	Last Error Message (see list below for details)
4321	
0 (0000)	User Service Request from the SRQ Key
1 (0001)	Syntax Error
2 (0010)	Unexpected Unit
3 (0011)	Statement not complete (missed number or unit)
4 (0100)	String not terminated
5 (0101)	Range Overflow
6 (0110)	Illegal Sign
7 (0111)	Illegal Unit
8 (1000)	Hardware not installed
9 (1001)	Illegal Channel Number
10 (1010)	Entry not allowed
11 (1011)	Formatter Error
12 (1100)	Parameter Set Destroyed
13 (1101)	Timing Incompatibility Error
14 (1110)	Level Incompatibility Error (Swing Error)
15 (1111)	GET either not at all, or not immediately executed

Example of SRQ interpretation:

If, after polling, the number 99 is displayed by the controller, this can be related to the status bytes DIO 1 to DIO 8 as shown below. The data input/output lines (DIO 1 to DIO 8) equate to an 8 bit binary number. It is only necessary to convert the number displayed after polling to its 8 bit binary equivalent to enable the high DIO lines to be identified.

99 = 64 + 32 + 3 = 01100011; this identifies the following high DIO lines:

	*	*				*	*
DIO 8	DIO 7	DIO 6	DIO 5	DIO 4	DIO 3	DIO 2	DIO 1
0	1	1	0	0	0	1	1

In effect, the 4 least significant bits identify the actual error as:

3 - Statement not complete (missed number or unit)

Incompatibility Service Request Control

Enable SRQ 13 and 14, set SRQ if Error at command
 Disable SRQ 13 and 14

[ISR]
ISR 1
ISR 2

Front Panel Service Request Control

Enable SRQ 0
 Disable SRQ 0

[FSR]
FSR 1
FSR 2

TALKER Modes

Six ASCII Talker Modes are available (selected by the TLK (Type S)) command:

8180A Status	<p>8180A Output: w,xxxx,y,z w is Status; 0=STOP, 1=RUN, 2=BREAK xxxx is Actual Address in the selected Address Code y is Hex digit, defining the highest Connector z is number of Timing Boards</p>	TLK1
Learn Mode	<p>Arrange a String Array of (8) [70] and fill this by sending TLK2 to the 8180A and then reading eight times from the 8180A. By sending this array without modification and in the same order, you can re-store the parameter setting, which was current at the time of reading the string. By re-storing the data, Parameter Set 3 will be loaded with this setting (old information lost). Don't change any parameters while reading the actual information.</p>	TLK2
Display Information	<p>Select the first Line with the LIN command, then the display is sent line by line. Channel Labels are sent in lower case letters, if channel is Complement.</p>	TLK3
Formatted Data	<p>8180A Output: TSA 0000 ; FOR 0 45 6AFE 3A FD1B 0000 1100 1100 0010 This Output can be used to directly restore the data, if there are no "NO ENTRY" Segments in the Data Page:</p>	TLK4
Data Page Format	<p>The 8180A talks first a CAS Segment, then a ADS Segment for every additional segment, and at last OCT, DEC or HEX and SYE or SNE.</p>	TLK5
Number of Character in String, where Error was detected	<p>8180A Output: SRQ 013 (valid for Strings with max. 255 Ch.)</p>	TLK6
<hr/>		
Binary Talking	<p>Fast binary stimulus data transfer Fast binary strobe data transfer</p> <p>the inverse function of Binary listening. The 8180A must be configured with the BSA, BTR and BSC commands and then outputs, or talks, data or strobe data. The last data byte of address 1023 is sent with EOI.</p>	<p>[BTR] BTR1 BTR2</p>

INTERFACE Functions

The following Interface Functions are implemented:

SH1 AH1 L4 SR1 RL1 T6 PP0 DC1 DT1 C0 E2

ALPHABETIC INDEX of Commands

A	ADS, ASR, ASS
B	BCK, BRI, BRK, BSA, BSC, BTR
C	CAB, CAS, CCD, CHD, CLD, CLK, CLS, CMA, CMS, COC, COL, COM, CYM
D	DCL, DEC, DEL, DLI, DNC, DSP
F	FAD, FMT, FOR, FRQ, FSR, FWD
G	GET, GTL
H	HEX, HIL
I	ILI, IMP, ISR
K	KEY
L	LAD, LBxx LIM, LIN, LLO, LMA, LOL
M	MAC, MOV
N	NOR
O	OCT, OUT
P	PAG, PER, PRB, PSR, PSS
R	REP, RSS, RUI, RUN
S	SCD, SDC, SED, SNE, SPD, SPE, SPI, SPO SRU, SSC, STB, STL, STO, STP, SYE
T	TAD, THR, TLK, TSA
U	UPC, UPD
W	WID

SECTION 4

PERFORMANCE TESTS

4-1 INTRODUCTION

4-2 The test procedures detailed in this section are for electrical performance of 8180A and 8181A units using the instrument specifications of Table 1-2 as performance standards. Access to the interior of the instruments is not necessary for any of the following tests.

4-3 EQUIPMENT REQUIRED

4-4 Equipment necessary for performance testing is listed in Table 1-1, Recommended Test Equipment. Alternative test equipment may be substituted for recommended models, provided that it satisfies the critical specifications given in the table.

4-5 TEST RECORD

4-6 When carrying out the performance tests, a tabulated record of all the tested specifications and their acceptable limits should be maintained by the operator.

Test results recorded at incoming inspection will provide a reference for periodic calibration, troubleshooting and after-repair testing.

4-7 PERFORMANCE TESTS

4-8 During any performance test, all shields and connecting hardware must be in place. All tests are designed to verify the published specifications. It is recommended that tests be performed in the sequence given, and that all data be recorded on a test record.

4-9 Each test is arranged in the order that its specification appears in Table 1-2. Note that the instrument should be given a 30 minute warmup period before the commencement of any of the following tests.

4-10 CYCLE MODES / RUN / STOP / BREAK / FWD / BACK TESTS**DESCRIPTION**

For testing the different cycle modes a low frequency (10Hz) is used to be able to follow the address changes in the 8180A display.

The external gate signal is simulated by changing the threshold level of the RUN (GATE) input.

First and last address detection at maximum speed is tested separately.

1. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
2. CLOCK FREQUENCY 10 Hz (PAGES > Timing > Frequency > 10 > Hertz)
3. LAST ADDRESS 100. (PAGES > Control > Last Address > 100 > Enter Number)

AUTO CYCLE TEST

4. Press RUN and check that the 8180A starts with address 0000 (upper right corner of the display) counts up to address 0100 and continues with address 0000.

BREAK; FWD; BACK; STOP TEST

5. Press BREAK. The 8180A should switch to Break.
6. Increment and decrement addresses by pressing FWD and BACK. Note: Addresses can be decremented up to the first address.
7. Press RUN. The 8180A should start one address after the Break Address.
8. Press STOP and RUN. The 8180A should start with the First Address.

SINGLE CYCLE TEST

9. Program 8180A SINGLE CYCLE (PAGES > Control > Cycle Mode > Single)
10. Press RUN and check that the 8180A starts at address 0000 and stops at address 0100.

GATED CYCLE TEST

11. GATED CYCLE; RUN (GATE) INPUT ON; THRESHOLD +5V (PAGES > Control > Cycle Mode > Gated > Exit > Inputs > Run Input > On $\sqrt{\quad}$ > Exit > Threshold > 5 > Volt)
12. Set threshold voltage to -5V (-5 > Volt) The 8180A should run between address 0000 and 0100 as in auto cycle.
13. Set the threshold voltage back to +5V (5 > Volt) The 8180A should complete the last cycle and stop at address 0100.

INIT + GATED CYCLE TEST

14. Program INIT + GATED (PAGES > Control > Cycle Mode > Init + Gated)
15. FIRST ADDRESS 30 (PAGES > Control > First Address > 30 > Enter Number)

16. INPUT THRESHOLD +5V (PAGES > Control > Inputs > Threshold > 5 > Volt)
17. Program the threshold voltage to -5V (- 5 > Volt) and check that the 8180A starts with address 0000 runs up to address 0100 and continues cycling between address 0030 and 0100.
18. Set threshold voltage back to +5V (5 > Volt) The 8180A should complete the last cycle and stop at address 0100.

INIT + AUTO CYCLE TEST

19. Program INIT + AUTO (PAGES > Control > Cycle Mode > Init + Auto)
20. RUN INPUT OFF (PAGES > Control > Inputs > Run Input > Off)
21. Press **RUN** and check that the 8180A starts at address 0000, runs up to address 0100 and continues cycling between address 0030 and 0100.

Note: To repeat the whole sequence press STOP and RUN again.

4-11 LAST ADDRESS (ADDRESS DIFFERENCE COUNTER) TEST

DESCRIPTION

This test insures correct programmability of the address difference counters and proper operation up to 50 MHz.

1. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
2. CLOCK FREQUENCY 50 MHz (PAGES > Timing > Frequency > 50 > Megahertz)
3. SINGLE CYCLE (PAGES > Control > Cycle Mode > Single)
4. LAST ADDRESS 1 (PAGES > Control > Last Address > 1 > Enter Number)
5. Press **RUN** and check that the 8180 stops at address 0001.
6. Change Last Address to 2 (2 > Enter Number) press **RUN** and check cycle length.
7. Repeat single cycle test with following Last Address settings:
8; 16; 32; 128; 256; and 512.

4-12 STROBE BREAK (STROBE DIFFERENCE COUNTER) TEST

DESCRIPTION

Correct programmability and proper strobe difference counter function at 50 MHz is ensured with this test. After setting the strobe breaks, the instrument is stepped from Break to Break.

1. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
2. CLOCK FREQUENCY 50 MHz (PAGES > Timing > Frequency > 50 > Megahertz)
3. CLEAR STROBE (PAGES > Data > Edit > Clear & Set > Clear Strobe > Execute)
4. STROBE BREAKS ON (PAGES > Control > Break Control > Strobe Breaks > On)
5. ENTRY MODE VERTICAL; HOLD CURSOR (PAGES > Data > Edit > Entry Mode > Vertical > Hold Cursor > Exit > Exit)
6. TOP ADDRESS 0000. STROBE BIT to 1 (Top Address > 0 > Enter Number > Exit > 1)
7. Using the Cursor softkey move cursor to address 0001 and set strobe bit high by pressing the 1 key in the DATA entry field.
8. Set strobe bits to high in following addresses as described in step 7: 1; 2; 4; 8; 16; 32; 64; 128; 256; and 512.
9. Press **STOP** and **RUN**. The 8180A should be in Break at address 0000.
10. Press **RUN** again and the 8180A should Break at address 0001.
11. Check that the 8180A breaks at addresses 2; 4; 8; 16; 32; 64; 128; 256 and 512 and 0 each time after pressing **RUN** again.

4-13 INTERNAL CLOCK FREQUENCY TEST

SPECIFICATION

Accuracy: +/-5% of programmed value.

DESCRIPTION

The strobe output signal programmed as clock is used to measure the internal clock generator accuracy. Clock timing errors coming up with standard set programmed and 50 MHz have no influence on the strobe output.

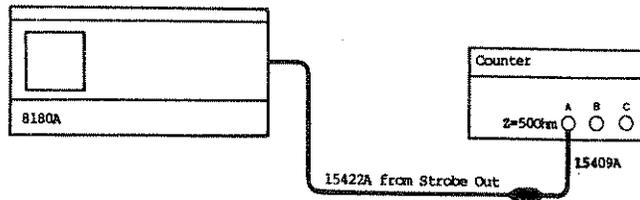


Figure 4-1 Clock Frequency Test Setup

EQUIPMENT

Universal Counter	HP 5335A
Plug-on BNC Adapter	HP 15409A
Clock and Strobe Cable Set	HP 15422A

INTERNAL CLOCK FREQUENCY TEST

1. Set counter trigger level to +1.2V and channel A input (z) to 50 Ohm.
2. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
3. STROBE LEVEL TTL (PAGES > Output > Strobe Level > TTL)
4. STROBE OUTPUT CLOCK; OUTPUTS ON (PAGES > Control > Strobe Output > Clock > Exit > Outp on/off > On)
5. FREQUENCY 50 MHz (PAGES > Timing > Frequency > 50 > Megahertz)
6. Connect equipment as shown in figure 4-1 and press RUN.
7. Check 8180A internal clock generator at following frequencies for specifications.

8180A programmed to:	Min.	Max.
50.0 MHz	47.50 MHz	52.50 MHz
25.0 MHz	23.75 MHz	26.25 MHz
10.0 MHz	9.50 MHz	10.50 MHz
9.99 MHz	9.49 MHz	10.49 MHz
3.0 MHz	2.85 MHz	3.15 MHz
1.0 MHz	0.95 MHz	1.05 MHz
1.05 Hz	1.00 Hz	1.10 Hz

4-14 CLOCK AND DATA SKEW TEST

SPECIFICATION

Skew: ≤ 2 ns for clock and data channels.

DESCRIPTION

The test uses the least significant bit pattern (copied to all data channels) of a down counter to measure the skew in reference to the strobe clock output. Clock and Data Delay are set to zero independent of the installed timing channels. This test uses TTL levels for all outputs and is valid also for the 8181A NRZ data channels.

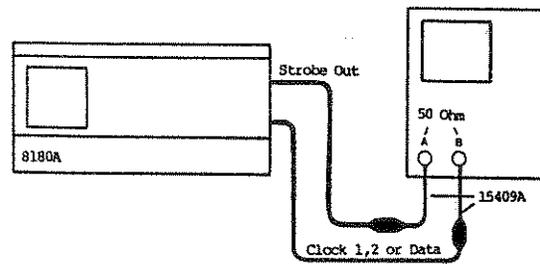


Figure 4-2 Skew Test Setup

EQUIPMENT

Oscilloscope (275 MHz)	HP 1725A
Plug-on BNC Adapter (2ea)	HP 15409A
Clock and Strobe Cable Set	HP 15422A
Data Cable Set	HP 15423A

1. Set oscilloscope channel A and B to .5V/DIV; 50 Ohm; Timebase 10ns/DIV x 10; ALTERNATE; Trigger Channel B.
2. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
3. LABEL A TTL; STROBE TTL (PAGES > Output > Level > TTL Levels > Execute > Exit > Strobe Level > TTL)
4. CLOCK 1 FORMAT RZ = 50%; CLOCK 2 DELAY 0 ns FORMAT RZ = 50% (PAGES > Timing > Clock Timing > Clock 1 Format > RZ = 50% > Exit > Clock2 Delay > 0 > Nanosec > Exit > Clock 2 Format > RZ = 50%)
5. DOWN COUNTER (PAGES > Data > Edit > Channel Edit > Down Counter > -> [until the cursor is on least significant data segment] > Execute > Exit)
6. Press Copy Channel, move gray shaded cursor with the left -> to channel 00 and press Execute softkey.

7. Move bright cursor by using the right -> softkey to the next channel, then press Execute to copy the high-low pattern of channel 00 to the next channel.
8. Repeat step 7 until all channels show the high-low pattern of channel 00 .
9. Program STROBE OUTPUT CLOCK; OUTPUTS ON (PAGES > Control > Strobe Output > Clock > Exit > Outp on/off > On)
10. Connect equipment as shown in Figure 4-2 and press RUN.
11. Connect in turn Clock 1,Clock 2 and all Data channels to oscilloscope channel B input. Then check skew for +/- 1ns referenced to the positive going edge of the Strobe Clock, measured at 50% of amplitude.

Note: Take possible oscilloscope interchannel delay into account.

4-15 CLOCK 1, CLOCK 2 DELAY TEST

SPECIFICATION

Accuracy: +/-5% of programmed value +/-1 ns

DESCRIPTION

The clock delays are referenced to the strobe clock output signal. Up to 10ns delay settings are measured with a calibrated oscilloscope. Differences between scope and counter measurement results at 10 ns are compensated by offsetting the counter. [2] = Clock 2

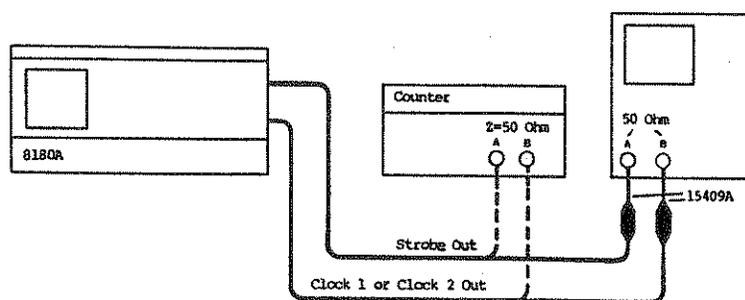


Figure 4-3 Clock Delay Test Setup

EQUIPMENT

Universal Counter	HP 5335A
Oscilloscope	HP 1725A
Clock, Strobe Cable Set	HP 15422A
Plug-on BNC Adapter (2ea)	HP 15409A
Time Mark Generator	

Set Counter to:

Trigger level A and B + 1.2V
 Time A → B
 Auto Trigger OFF
 Gate Mode MIN
 Channel A and B $\sqrt{\quad}$, Z = 50 Ohm
 Statistics MEAN

1. Program 8180A STANDARD SET
(PAGES > Store/Recall > Rcl Std Set > Execute)
2. PERIOD 1 us (PAGES > Timing > Period > 1 > Microsec)
3. LABEL A TTL; STROBE TTL (PAGES > Output > Level > TTL Levels > Execute > Exit > Strobe Level > TTL)
4. CLOCK 1 FORMAT RZ=50%; CLOCK 2 DELAY 0ns FORMAT RZ=50%
(PAGES > Timing > Clock Timing > Clock 1 Format > RZ=50% > Exit > Clock 2 Format > RZ=50% > Exit > Clock 2 Delay > 0 > Nanosec)

5. STROBE OUTPUT CLOCK; OUTPUTS ON (PAGES > Control > Strobe Output > Clock > Exit > Outp on/off > On)
6. CLOCK 1 [2] DELAY IN SOFTKEY AREA (PAGES > Timing > Clock Timing > Clock 1 [2] Delay)
7. Using the time mark generator, first check the oscilloscope time base accuracy in the 10 ns / DIV x 10 range and note time base error. Take time base error and possible interchannel delay error into account.
8. Connect equipment as shown in figure 4-3 press RUN and trigger the oscilloscope to channel A (strobe clock).
9. Using the increment softkey check step linearity up to 10.0 ns.
10. At 10.0 ns delay setting measure the delay between strobe and clock signal (at 50% of amplitude) and note value.
11. Connect Strobe and Clock to the counter as shown in figure 4-3.
12. Program counter offset so that the value measured in step 10 is displayed.

Example: Measured delay (step 10) is 9.3 ns. The counter shows 10.5 ns. Press OFFSET > CHS > 1.2 > EEX > CHS > 9 > ENTER. The counter should display 9.3 ns.

13. Check clock delay programming at following settings:

Delay Setting	Min.	Max.
30.0 ns	27.5 ns	32.5 ns
89.9 ns	84.4 ns	95.4 ns
90.0 ns	84.5 ns	95.5 ns
300 ns	284 ns	316 ns

14. Change 8180A CLOCK PERIOD to 200ms and check delay at:
(PAGES > Timing > Period > 200 > Millisec > Exit > Clock Timing > Clock 1 [2] Delay)

Delay Setting	Min.	Max.
989 ns	938.5 ns	1039.5 ns
100 ms	95 ms	105 ms

15. Repeat steps 6 to 14 with Clock 2 connected and check for the same specifications.

4-16 CLOCK 1 , CLOCK 2 WIDTH TEST

SPECIFICATION

Accuracy: +/- 5% of programmed value +/- 1 ns

DESCRIPTION

The clock width is measured at 50% of amplitude. To get accurate results in width ranges from 10ns to 100ns an oscilloscope with calibrated time base is used. Higher width ranges are tested with the counter.

[2] = Clock 2

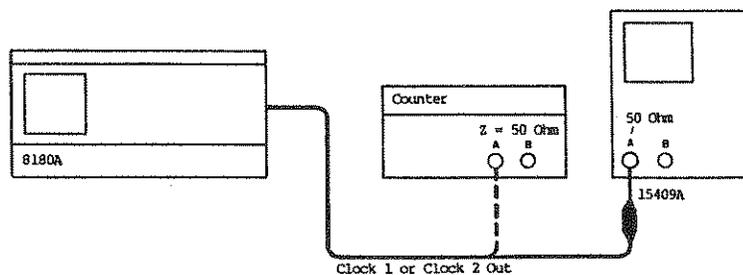


Figure 4-4 Clock Width Test Setup

EQUIPMENT

Universal Counter	HP 5335A
Oscilloscope	HP 1725A
Clock, Strobe Cable Set	HP 15422A
Plug-on BNC Adapter	HP 15409A
Time Mark Generator	

Set Counter to:

Trigger Level A and B +1.2V
 Time A -> B
 Gate Mode MIN
 Common A; Z=50 Ohm

Channel A 

Channel B 

1. Program 8180A STANDARD SET
(PAGES > Store/Recall > Rel Std Set > Execute)
2. Period 1us (PAGES > Timing > Period > 1 > Microsec)
3. LABEL A TTL (PAGES > Output > Level > TTL Level > Execute)
4. OUTPUTS ON (PAGES > Output > Outp on/off > On)
5. CLOCK 1 WIDTH 10 ns (PAGES > Timing > Clock Timing > Clock 1 Width > 10 > Nanosec)

6. Using the time mark generator check first the oscilloscope time base accuracy in the 10 ns/DIV x 10 and 10 ns/DIV range. Note error and take time base error into account.
7. Connect Clock 1 [2] output to the oscilloscope A input as shown in figure 4.4 and press **RUN**.
8. Measure the clock width at 50% of amplitude. Limit: 8.5 ns to 11.5 ns
9. Set the trailing edge of the clock pulse to the left horizontal graticule line and check step linearity when incrementing the width to 20 ns.
10. Check clock width at following settings:

Width Setting	Min.	Max.
30.0 ns	27.5 ns	32.5 ns
99.0 ns	93.0 ns	105 ns
100 ns	94.0 ns	106 ns

11. Change 8180A CLOCK PERIOD to 200ms
(PAGES > Timing > Period > 200 > Millesec > Exit > Clock Timing > Clock 1 [2] Width)

12. Connect Clock output to counter channel A and check:

Width Setting	Min.	Max.
300 ns	284 ns	316 ns
999 ns	948 ns	1050 ns
100 ms	95.0 ms	105 ms

13. Repeat steps 7 to 12 with Clock 2 connected and check for the same specifications.
-

4-17 OPTION 002 TIMING CHANNEL DELAY TEST

SPECIFICATION

Accuracy: +/- 5% of programmed value +/- 1 ns.

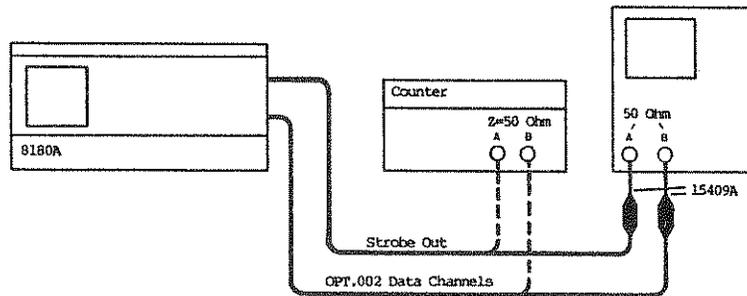


Figure 4-5 Delay Test Setup

EQUIPMENT

Universal Counter	HP 5335A
Oscilloscope	HP 1725A
Clock, Strobe Cable Set	HP 15422A
Plug-on BNC Adapter (2ea)	HP 15409A
Data Cable Set	HP 15423A
Time Mark Generator	

Set Counter to:

Trigger Level A and B +1.2 V
 Time A -> B
 Auto Trigger OFF
 Gate Mode MIN
 Channel A and B $\sqrt{\quad}$, Z=50 Ohm

1. Program 8180A STANDARD SET
(PAGES > Store/Recall > Rcl Std Set > Execute)
2. PERIOD 1us (PAGE > Timing > Period > 1 > Microsec)
3. LABEL A TTL. STROBE TTL (PAGES > Output > Level > TTL Levels > Execute > Exit > Strobe Level > TTL)
4. SET DATA (PAGES > Data > Edit > Clear & Set > Set Data > Execute)
5. STROBE OUTPUT CLOCK; OUTPUTS ON (PAGES > Control > Strobe Output > Clock > Exit > Outp on/off > On)
6. Using the time mark generator check first the oscilloscope time base accuracy in the 10ns/DIV x 10 and 10ns/DIV range. Note error and take time base error and possible interchannel delay error into account.

7. Connect equipment as shown in Figure 4-5 and press **RUN**.

NRZ FUNCTION TEST

8. Check all OPT. 002 channels (timing channels) listed on the timing page for a static TTL high level (>+2V).
9. Set ALL CHANNEL FORMAT RZ (PAGES > Timing > Channel Timing > All Ch Format > RZ)

DELAY TEST

10. ALL CHANNEL DELAY 10 ns (PAGES > Timing > Chnl Timing > All Ch Delay > 10 > Nanosec)
11. Vary ALL CHANNEL DELAY as listed below and check in turn all OPT. 002 channels for specifications after each delay change.

All Channel Delay Setting	Min.	Max.
10.0 ns	8.5 ns	11.5 ns
30.0 ns	27.5 ns	32.5 ns
89.9 ns	84.4 ns	95.4 ns
90.0 ns	84.5 ns	95.5 ns

12. Change CLOCK PERIOD to 200ms, connect counter and measure delay for all channels at:
(PAGES > Timing > Period > 200 > Millisec > Exit > Chnl Timing > All Ch Delay)

All Channel Delay	Min.	Max.
300 ns	284 ns	316 ns
989 ns	938.5 ns	1039.5 ns
100 ms	95 ms	105 ms

4-18 OPTION. 002 TIMING CHANNEL WIDTH TEST

SPECIFICATION

Accuracy: +/-5% of programmed value +/-1 ns

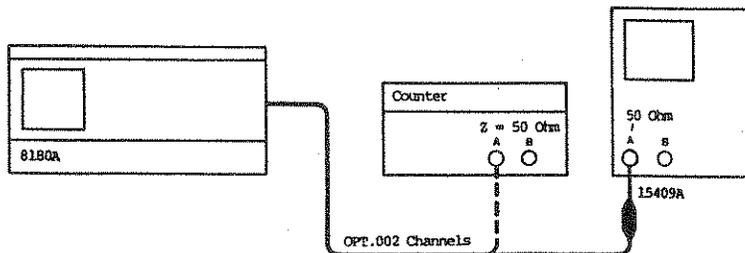


Figure 4-6 Width Test Setup

EQUIPMENT

Universal Counter	HP 5335A
Oscilloscope	HP 1725A
Data Cable Set	HP 15423A
Plug-on BNC Adapter	HP 15409A
Time Mark Generator	

Set Counter to:

Trigger Level A and B +1.2V
 Time A -> B
 Auto Trigger OFF
 Gate Mode MIN
 Common A; Z=50 Ohm

Channel A

Channel B

1. Program 8180A STANDARD SET
(PAGES > Store/Recall > Rcl Std Set > Execute)
2. PERIOD 1 us (PAGES > Timing > Period > 1 > Microsec)
3. LABEL A TTL; OUTPUTS ON (PAGES > Output > Level > TTL Levels > Execute > Exit > Output on/off > On)
4. SET DATA (PAGES > Data > Edit > Clear & Set > Set Data > Execute)
5. ALL CHANNEL WIDTH 10 ns
(PAGES > Timing > Chnl Timing > All Ch Format > RZ > Exit > All Ch Width > 10 > Nanosec)

6. Using the time mark generator check first the oscilloscope time base accuracy in the 10ns/DIVx10 and 10ns/DIV range and note error. Take time base error into account.
7. Connect equipment as shown in Figure 4-6 and press RUN.
8. Measure the WIDTH at 50% of amplitude and check, in turn, all OPT.002 Channels for each width setting as listed below.

All Channel Width Setting	Min.	Max.
10.0 ns	8.5 ns	11.5 ns
30.0 ns	27.5 ns	32.5 ns
99.0 ns	93.0 ns	105 ns
100 ns	94.0 ns	106 ns

9. Change 8180A CLOCK PERIOD to 200 ms
(PAGES > Timing > Period > 200 > Millisec > Exit > Chnl Timing > All Ch Width)

10. Connect counter as shown in Figure 4-6 and check width for all OPT. 002 channels as listed.

All Channel Width Setting	Min.	Max.
300 ns	284 ns	316 ns
999 ns	948 ns	1050 ns
100 ms	95.0 ms	105 ms

4-19 DATA HIGH / LOW LEVEL ACCURACY TEST

SPECIFICATION

Level accuracy: +/- 0.5% of level +/- 60mV (add +/- 60mV for amplitudes < 1.5V)

DESCRIPTION

High and low level accuracy is measured with a digital voltmeter. All data channels are set to NRZ. For measuring the high level all data are set to high. Low level is measured with data cleared (low).

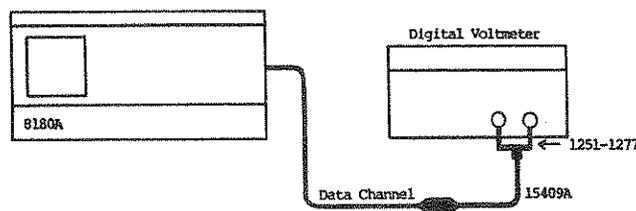


Figure 4-7 Level Accuracy Test Setup

EQUIPMENT

Digital Voltmeter	HP 3456A
BNC (f) to dual banana Plug	P.N. 1251-2277
Plug-on BNC Adapter	HP 15409A
Data Cable Set	HP 15423A

HIGH LEVEL ACCURACY TEST

1. Program 8180A STANDARD SET (PAGES > Store/Recall > Rel Std Set > Execute)
2. SET DATA (PAGES > Data > Edit > Clear & Set > Set Data > Execute)
3. LOAD IMPEDANCE OPEN (PAGES > Output > Load Imp > Open)
4. OUTPUTS ON (PAGES > Output > Outp on/off > On)
5. LABEL A LOW LEVEL -2V, HIGH LEVEL -1V
(PAGES > Output > Level > Low <-> High [to low] > -2 > Volt > Low <-> High [to high] > -1 > Volt)
6. Connect equipment as shown in Figure 4-7 and press RUN

7. Measure output voltage with following high level settings:

High level Setting	Min.	Max
-1.00 V	-0.875 V	-1.125 V
0.00 V	-0.060 V	+0.060 V
+1.00 V	+0.875 V	+1.125 V
+5.00 V	+4.375 V	+5.085 V
+17.0 V	+16.86 V	+17.15 V

8. Repeat step 7 for all data channels.

LOW LEVEL ACCURACY TEST

9. CLEAR DATA (PAGES > Data > Edit > Clear & Set > Clear Data > Execute)

10. Set LABEL A HIGH LEVEL +17V, LOW LEVEL -2V (PAGES > Output > Level > Low <-> High [to high] > 17 > Volt > Low <-> High [to low] > -2 > Volt)

11. Measure output voltage with following low level settings:

Low Level Setting	Min.	Max.
-2.00 V	-1.930 V	-2.070 V
-1.00 V	-0.935 V	-1.065 V
0.00 V	-0.060 V	+0.060 V
+1.00 V	+0.875 V	+1.125 V
+16.0 V	+15.86 V	+16.14 V

12. Repeat step 11 for all data channels.

4-20 20 MHz MEMORY TEST

DESCRIPTION

The 8180A memory can be tested with a Signature Multimeter up to 20 MHz. Start/ Stop conditions for the 5005A are established with a high bit in the strobe channel. A pseudo random binary sequence which can be generated for each channel is used as test pattern.

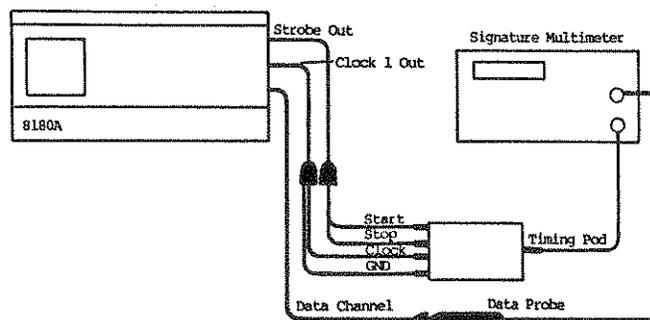


Figure 4-8 Memory Test Setup

EQUIPMENT

Signature Multimeter	HP 5005A
Data Cable Set	HP 15423A
Clock Strobe Cable Set	HP 15422A
Solder-in Receptacle	HP 15412A

1. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
2. CLOCK 1 FORMAT RZ 50 % DELAY 25 ns; CLOCK 2 DELAY 0 ns (PAGES > Timing > Clock Timing > Clock 1 Format > RZ = 50 % > Exit > Clock 1 Delay > 25 > Nanosec > Exit > Clock 2 Delay > 0 > Nanosec)
3. PERIOD 50 ns (PAGES > Timing > Period > 50 > Nanosec)
4. LOAD IMPEDANCE OPEN; LABEL A TTL (PAGES > Output > Load Imp > Open > Exit > Level > TTL Levels > Execute)
5. STROBE LEVEL TTL; OUTPUTS ON (PAGES > Output > Strobe Level > TTL > Exit > Outp on/off > On)
6. CLEAR STROBE (PAGES > Data > Edit > Clear & Set > Clear Strobe > Execute)
7. PRBS CHANNEL 00 (PAGES > Data > Edit > Channel Edit > Channel PRBS > -> [until PRBS channel 00 is displayed] > Execute > Exit)
8. COPY CHANNEL Press Copy Channel and using the -> softkey in the right half of the display move cursor until Copy Channel 00 to 00 is displayed.

9. COPY CHANNEL 00 to ALL OTHER CHANNELS Press (<-[right half of display] > Execute)
 10. Repeat step 9 until all other channels are loaded with the PRBS pattern.
 11. Set STROBE BIT to HIGH in address 0000 (PAGES > Data > Top Address > 0 > Enter Number > Exit > 1)
 12. Connect equipment as shown in Figure 4-8 and press RUN.
 13. Check all data channels for 46F9 signature.
-

6. Set Pulse Generator to:

Period approx.	1 ms
Width	.5 ms
Transition	5 us to 250 us
Amplitude	250 mVpp (into open)
Offset	ON

7. Adjust leading edge and trailing edge for a triangle waveform on the oscilloscope.

EXTERNAL CLOCK TEST

8. Connect equipment as shown in Figure 4-9 and press RUN. (BNC Cable A connected to Ext. Clock Input)

9. Set oscilloscope channel A to 50 mV/DIV, and using the pulse generator offset vernier, set the triangle waveform symmetrical to 0 Volt (center graticule line).

10. Set oscilloscope time base to 100 us and trigger to channel B (clock 1).

The trace should start between - 50 mV and + 50 mV vert. deflection.

11. Change EXTERNAL CLOCK SLOPE to 

(External )

The trace should start again between - 50 mV and + 50 mV vert. deflection.

EXTERNAL RUN AND BREAK TEST

12. Connect cable A to the Break input (cable B to Run input)

13. Set 8180A to CLOCK SOURCE INTERNAL; RUN INPUT ; BREAK INPUT 
(PAGES > Control > Inputs > Clock Source > Internal > Exit > Run Input

> On  > Exit > Break Input > On )

14. Set oscilloscope to ALTERNATE and trigger to channel A.

15. Measure the level of the triangle waveform at the point where clocks are generated (Run Input Threshold) and at the point where clock generation is stopped (Break Input Threshold).

Threshold Limit: +/- 50 mV

16. Set RUN INPUT ; BREAK INPUT 

(Exit > Run Input > On  > Exit > Break Input > On )

17. Measure the level of the triangle waveform where clock generation is stopped and started.

Threshold Limit: +/- 50 mV

EXTERNAL STOP TEST

18. Connect cable A to the Stop input (cable B to Run input).
19. Check threshold levels of the Stop input for both slopes as described in steps 15 to 17 for the Break input.
20. Set pulse generator triangle signal to approx. 8 Vpp amplitude symmetrical to 0 V. Check Clock, Run, Break and Stop input thresholds at + 2 Volt and - 2 Volt threshold settings as described in steps 5 and 7 to 19. (PAGES > Control > Inputs > Threshold > 2 [-2] > Volt)

Limits: 1.85 V to 2.15 V

Note: Check inputs only at one slope setting.

4-22 TRANSITION TIME/OVERSHOOT TEST

SPECIFICATION

Transition Time: $< 3.0 \text{ ns} + |\text{amplitude}| \times 0.2 \text{ ns}$

Preshoot, Overshoot, Ringing $< \pm 10\%$ of amplitude

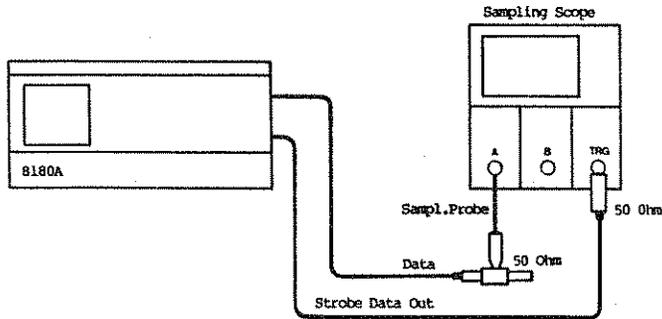


Figure 4-10 Transition Time/Overshoot Test Setup

EQUIPMENT

Sampling Oscilloscope with Accessories

Pulse Generator	HP 8007B
Clock Strobe Cable Set	HP 15422A
Data Cable Set	HP 15423A
BNC Cable Assy	HP 11170C

1. Program 8180A STANDARD SET (PAGES > Store/Recall > Rcl Std Set > Execute)
2. ADDRESS 0000 all bits HIGH; ADDRESS 0001 all bits LOW. (PAGES > Data > Top Address > > Enter Number > Exit > 1...[until strobe and all data in address 0000 are set to high] > 0...[until strobe and all data in address 0001 are set to low])
3. LAST ADDRESS 0001 (PAGES > Control > Last Address > 1 > Enter Number)
4. OUTPUT ON (PAGES > Output > Outp on/off > On)
5. LABEL A HIGH LEVEL -1 V; LOW LEVEL -2 V (PAGES > Output > Level > Low <-> High [High] > -1 > Volt > Low <-> High [Low] > -2 > Volt)
6. Connect equipment as shown in Figure 4-10 and press RUN.
7. Measure transition time from 10 % to 90 % of amplitude at all data channels. Specification: $t_r = < 3 \text{ ns}$
8. Change LABEL A HIGH LEVEL to + 2 V; LOW LEVEL to 0 V (PAGES > Output > Level > Low <-> High [High] > 2 > Volt > Low <-> High [Low] > 0 > Volt)
9. Measure preshoot, overshoot and ringing at all data channels.

Specification: $< \pm 10\%$ of amplitude.



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Hewlett-Packard Asia Ltd.
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G.P.O. Box 795
HONG KONG
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After Jan. 1, 1984
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Cable: HEWPACK HONG KONG

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Hewlett-Packard (Canada) Ltd.
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Liebigasse 1
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Tel: (222) 2365 110
Telex: 1 3 4425 HEPA A

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P.O.Box 999
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The Netherlands
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Hewlett-Packard S.A.
7, Rue du Bois-du-Lan
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Telex: 27835 hpse
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OTHER EUROPE

Hewlett-Packard S.A.
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OTHER INTERNATIONAL AREAS

Hewlett-Packard Co.
Intercontinental Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304
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Telex: 034-8300
Cable: HEWPACK

ANGOLA

Telectra
Empresa Técnica de Equipamentos
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Tel: 355 15,355 16
E,P

ARGENTINA

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M

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Liebigasse 1
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(Olarinluoma 7)

PL 24

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A,CH,CS,E,MP

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Boulevard de France

F-91035 EVRY Cedex

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Telex: 692315F

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Hewlett-Packard France

5, avenue Raymond Chanas

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Hewlett-Packard France
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Paris Porte-Maillot
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F-75782 PARIS CEDEX 16
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CH,MS,P

Hewlett-Packard France
124, Boulevard Touraine
F-64000 PAU
Tel: 16 (59) 80 38 02

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CH,E,MS,P*

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20, Chemin du Pigeonnier de la
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Tel: 16 (8) 771 20 22
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Tel: 16 (20) 91-41-25
Telex: 160124F
CH,E,MS,P*

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Geschäftsstelle
Keithstrasse 2-4
D-1000 BERLIN 30
Tel: (030) 24-90-86
Telex: 018 3405 hpbln d
A,CH,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Herrenberger Strasse 130
D-7030 BOBLINGEN
Tel: (7031) 14-0
Telex:

A,CH,CM,CS,E,MP,P
Hewlett-Packard GmbH
Geschäftsstelle
Emanuel-Leutze-Strasse 1
D-4000 DUSSELDORF
Tel: (0211) 5971-1
Telex: 085/86 533 hpdd d
A,CH,CS,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 DORTMUND-Aplerbeck
Tel: (0231) 45001

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 FRANKFURT 56
Tel: (0611) 50-04-1
Telex: 04 13249 hpffm d
A,CH,CM,CS,E,MP,P

Hewlett-Packard GmbH
Geschäftsstelle
Aussenstelle Bad Homburg
Louisenstrasse 115
D-6380 BAD HOMBURG
Tel: (06172) 109-0

Hewlett-Packard GmbH
Geschäftsstelle
Kapstadtring 5
D-2000 HAMBURG 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
A,CH,CS,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 HANNOVER 61
Tel: (0511) 5706-0
Telex: 092 3259
A,CH,CM,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 MANNHEIM
Tel: (0621) 70050
Telex: 0462105
A,C,E

Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 NEU ULM
Tel: 0731-70241
Telex: 0712816 HP ULM-D
A,C,E*

Hewlett-Packard GmbH
Geschäftsstelle
Ehhericherstr. 13
D-8500 NÜRNBERG 10
Tel: (0911) 5205-0
Telex: 0623 860
CH,CM,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Eschenstrasse 5
D-8028 TAUFKIRCHEN
Tel: (089) 6117-1
Telex: 0524985
A,CH,CM,E,MS,P

GREAT BRITAIN

See United Kingdom

GREECE

Kostas Karayannis S.A.
8 Omirou Street
ATHENS 133
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
A,CH,CM,CS,E,M,P
PLAISIO S.A.
G. Gerardos
24 Stournara Street
ATHENS
Tel: 36-11-160
Telex: 221871
P

GUATEMALA

IPESA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 314786
Telex: 4192 TELTRO GU
A,CH,CM,CS,E,M,P

HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPACK HONG KONG
E,CH,CS,P

CET Ltd.
1402 Tung Wah Mansion
199-203 Hennessy Rd.
Wanchia, HONG KONG
Tel: 5-729376
Telex: 85148 CET HX
CM
Schmidt & Co. (Hong Kong) Ltd.
Wing On Centre, 28th Floor
Connaught Road, C.

HONG KONG

CM
Tel: 5-455644
Telex: 74766 SCHMX HX
A,M

ICELAND

Elding Trading Company Inc.
Hafnarnvoli-Tryggvagotou
P.O. Box 895
IS-REYKJAVIK
Tel: 1-58-20, 1-63-03
M

INDIA

Computer products are sold through Blue Star Ltd. All computer repairs and maintenance service is done through Computer Maintenance Corp.

Blue Star Ltd.
Sabri Complex II Floor
24 Residency Rd.
BANGALORE 560 025
Tel: 55660
Telex: 0845-430
Cable: BLUESTAR
A,CH*,CM,CS*,E

Blue Star Ltd.
Band Box House
Prabhadevi
BOMBAY 400 025
Tel: 422-3101
Telex: 011-3751
Cable: BLUESTAR
A,M

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
BOMBAY 400 025
Tel: 422-6155
Telex: 011-4093
Cable: FROSTBLUE
A,CH*,CM,CS*,E,M

Blue Star Ltd.
Kalyan, 19 Vishwas Colony
Alkapuri, BORODA, 390 005
Tel: 65235
Cable: BLUE STAR
A

Blue Star Ltd.
7 Hare Street
CALCUTTA 700 001
Tel: 12-01-31
Telex: 021-7655
Cable: BLUESTAR
A,M

Blue Star Ltd.
133 Kodambakkam High Road
MADRAS 600 034
Tel: 82057
Telex: 041-379
Cable: BLUESTAR
A,M

Blue Star Ltd.
Bhandari House, 7th/8th Floors
91 Nehru Place
NEW DELHI 110 024
Tel: 682547
Telex: 031-2463
Cable: BLUESTAR
A,CH*,CM,CS*,E,M

Blue Star Ltd.
15/16-C Wellesley Rd.
PUNE 411 011
Tel: 22775
Cable: BLUE STAR
A

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
SECUNDERABAD 500 003
Tel: 72057
Telex: 0155-459
Cable: BLUEFROST
A,E

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthankuzhi
TRIVANDRUM 695 013
Tel: 65799
Telex: 0884-259
Cable: BLUESTAR
E

Computer Maintenance Corporation
Ltd.
115, Sarojini Devi Road
SECUNDERABAD 500 003
Tel: 310-184, 345-774
Telex: 031-2960
CH**

SALES & SUPPORT OFFICES

Arranged alphabetically by country

**INDONESIA**

BERCA Indonesia P.T.
P.O.Box 496/Jkt.
Jl. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL IA
Cable: BERSAL JAKARTA
P

BERCA Indonesia P.T.
P.O.Box 2497/Jkt
Antara Bldg., 17th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 21-344-181
Telex: BERSAL IA
A,CS,E,M

BERCA Indonesia P.T.
P.O. Box 174/SBY.
Jl. Kutei No. 11
SURABAYA
Tel: 68172
Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA
A*,E,M,P

IRAQ

Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 9B/3/7
BAGHDAD
Tel: 551-49-73
Telex: 212-455 HEPAlRAQ IK
CH,CS

IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 0001 608800
Telex: 30439
A,CH,CM,CS,E,M,P
Cardiac Services Ltd.
Kilmore Road
Artane
DUBLIN 5
Tel: (01) 351820
Telex: 30439
M

ISRAEL

Eidan Electronic Instrument Ltd.
P.O.Box 1270
JERUSALEM 91000
16, Ohaliav St.
JERUSALEM 94467
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL
A

Electronics Engineering Division
Motorola Israel Ltd.
16 Kremenetski Street
P.O. Box 25016
TEL-AVIV 67899
Tel: 3 88 388
Telex: 33569 Motil IL
Cable: BASTEL Tel-Aviv
CH,CM,CS,E,M,P

ITALY

Hewlett-Packard Italiana S.p.A.
Traversa 99C
Via Giulio Petroni, 19
I-70124 **BARI**
Tel: (080) 41-07-44
M

Hewlett-Packard Italiana S.p.A.
Via Martin Luther King, 38/III
I-40132 **BOLOGNA**
Tel: (051) 402394
Telex: 511630
CH,E,MS

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43G/C
I-95126 **CATANIA**
Tel: (095) 37-10-87
Telex: 970291
C,P

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio 9
I-20063 **CERNUSCO SUL NAVIGLIO**
(Milano)
Tel: (02) 923691
Telex: 334632
A,CH,CM,CS,E,MP,P
Hewlett-Packard Italiana S.p.A.
Via C. Colombo 49
I-20090 **TREZZANO SUL NAVIGLIO**
(Milano)
Tel: (02) 4459041
Telex: 322116
C,M

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco a
Capodimonte, 62/A
I-80131 **NAPOLI**
Tel: (081) 7413544
Telex: 710698
A,CH,E

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 **GENOVA PEGLI**
Tel: (010) 68-37-07
Telex: 215238
E,C

Hewlett-Packard Italiana S.p.A.
Via Pelizzo 15
I-35128 **PADOVA**
Tel: (049) 664888
Telex: 430315
A,CH,E,MS

Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 **ROMA EUR**
Tel: (06) 54831
Telex: 610514
A,CH,CM,CS,E,MS,P*

Hewlett-Packard Italiana S.p.A.
Via di Casellina 57/C
I-50018 **SCANDICCI-FIRENZE**
Tel: (055) 753863

Hewlett-Packard Italiana S.p.A.
Corso Svizzera, 185
I-10144 **TORINO**
Tel: (011) 74 4044
Telex: 221079
CH,E

JAPAN

Yokogawa-Hewlett-Packard Ltd.
152-1, Onna
ATSUGI, Kanagawa, 243
Tel: (0462) 28-0451
CM,C*,E

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei Bldg, 6F
3-1 Hon Chiba-Cho
CHIBA, 280
Tel: 472 25 7701
E,CH,CS

Yokogawa-Hewlett-Packard Ltd.
Yasuda-Seimei Hiroshima Bldg.
6-11, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: 82-241-0611

Yokogawa-Hewlett-Packard Ltd.
Towa Building
2-3, Kaigan-dori, 2 Chome Chuo-ku
KOBE, 650
Tel: (078) 392-4791
C,E

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi 82 Bldg
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
CH,CM,E

Yokogawa-Hewlett-Packard Ltd.
Asahi Shinbun Daiichi Seimei Bldg.
4-7, Hanabata-cho
KUMAMOTO, 860
Tel: (0963) 54-7311
CH,E

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614, Higashi-Shiokoji-cho
Karasuma-Nishiiru
Shiokoji-dori, Shimogyo-ku
KYOTO, 600
Tel: 075-343-0921
CH,E

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg
4-73, Sanno-maru, 1 Chome
MITO, Ibaraki 310
Tel: (0292) 25-7470
CH,CM,E

Yokogawa-Hewlett-Packard Ltd.
Sumitomo Seimei 14-9 Bldg.
Meieki-Minami, 2 Chome
Nakamura-ku
NAGOYA, 450
Tel: (052) 571-5171
CH,CM,CS,E,MS

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.,
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-6021
Telex: YHPOSA 523-3624
A,CH,CM,CS,E,MP,P*

Yokogawa-Hewlett-Packard Ltd.
27-15, Yabe, 1 Chome
SAGAMIHARA Kanagawa, 229
Tel: 0427 59-1311

Yokogawa-Hewlett-Packard Ltd.
Daiichi Seimei Bldg.
7-1, Nishi Shinjuku, 2 Chome
Shinjuku-ku, **TOKYO** 160
Tel: 03-348-4611
CH,E

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku **TOKYO** 168
Tel: (03) 331-611
Telex: 232-2024 YHPTOK
A,CH,CM,CS,E,MP,P*

Yokogawa-Hewlett-Packard Ltd.
Daiichi Asano Building
2-8, Odori, 5 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 25-7155
CH,CS,E

Yokogawa-Hewlett-Packard Ltd.
Yasuda Seimei Nishiguchi Bldg.
30-4 Tsuruya-cho, 3 Chome
YOKOHAMA 221
Tel: (045) 312-1252
CH,CM,E

JORDAN

Mouasher Cousins Company
P.O. Box 1387
AMMAN
Tel: 24907, 39907
Telex: 21456 SABCO JO
CH,E,M,P

KENYA

ADCCO Ltd., Inc., Kenya
P.O.Box 30070
NAIROBI
Tel: 331955
Telex: 22639
E,M

KOREA

Samsung Electronics HP Division
12 Fl. Kinam Bldg.
San 75-31, Yeoksam-Dong
Kangnam-Ku
Yeongdong P.O. Box 72
SEOUL
Tel: 555-7555, 555-5447
Telex: K27364 SAMSAN
A,CH,CM,CS,E,M,P

KUWAIT

Al-Khaldiya Trading & Contracting
P.O. Box 830 Safat
KUWAIT
Tel: 42-4910, 41-1726
Telex: 22481 Areeg kt
CH,E,M
Photo & Cine Equipment
P.O. Box 270 Safat
KUWAIT
Tel: 42-2846, 42-3801
Telex: 22247 Matin kt
P

LEBANON

G.M. Dolmadjian
Achrafieh
P.O. Box 165.167
BEIRUT
Tel: 290293
MP**
Computer Information Systems
P.O. Box 11-6274
BEIRUT
Tel: 89 40 73
Telex: 22259
C

LUXEMBOURG

Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 **BRUSSELS**
Tel: (02) 762-32-00
Telex: 23-494 paloben bru
A,CH,CM,CS,E,MP,P

MALAYSIA

Hewlett-Packard Sales (Malaysia)
Sdn. Bhd.
1st Floor, Bangunan British
American
Jalan Semantan, Damansara Heights
KUALA LUMPUR 23-03
Tel: 943022
Telex: MA31011
A,CH,E,M,P*

SALES & SUPPORT OFFICES

Arranged alphabetically by country

5



MAYLAISIA (Cont'd)

Protel Engineering
P.O.Box 1917
Lot 6624, Section 64
23/4 Pending Road
Kuching, SARAWAK
Tel: 36299
Telex: MA 70904 PROMAL
Cable: PROTELENG
A,E,M

MALTA

Philip Toledo Ltd.
Notabile Rd.
MRIEHEL
Tel: 447 47, 455 66
Telex: Media MW 649
E,P

MEXICO

Hewlett-Packard Mexicana, S.A.
de C.V.
Av. Periferico Sur No. 6501
Tepepan, Xochimilco
16020 MEXICO D.F.
Tel: 6-76-46-00
Telex: 17-74-507 HEWPACK MEX
A,CH,CS,E,MS,P
Hewlett-Packard Mexicana, S.A.
de C.V.
Ave. Colonia del Valle 409
Col. del Valle
Municipio de Garza Garcia
MONTERREY, Nuevo Leon
Tel: 78 42 41
Telex: 038 410
CH
ECISA
José Vasconcelos No. 218
Col. Condesa Deleg. Cuauhtémoc
MEXICO D.F. 06140
Tel: 553-1206
Telex: 17-72755 ECE ME
M

MOROCCO

Dolbeau
81 rue Karatchi
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerep
2 rue d'Agadir
Boite Postale 156
CASABLANCA
Tel: 272093, 272095
Telex: 23 739
P

NETHERLANDS

Hewlett-Packard Nederland B.V.
Van Heuven Goedhartlaan 121
NL 1181KK AMSTELVEEN
P.O. Box 667
NL1180 AR AMSTELVEEN
Tel: (020) 47-20-21
Telex: 13 216 HEPA NL
A,CH,CM,CS,E,MP,P
Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906VK CAPELLE A/D IJSSEL
P.O. Box 41
NL 2900AA CAPELLE A/D IJSSEL
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
A,CH,CS,E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV EINDHOVEN
P.O. Box 2342
NL 5600 CH EINDHOVEN
Tel: (040) 326911
Telex: 51484 hepae nl
A,CH**E,M

NEW ZEALAND

Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, AUCKLAND
Tel: 687-159
Cable: HEWPACK Auckland
CH,CM,E,P*

Hewlett-Packard (N.Z.) Ltd.
4-12 Cruickshank Street
Kilbirnie, WELLINGTON 3
P.O. Box 9443
Courtenay Place, WELLINGTON 3
Tel: 877-199
Cable: HEWPACK Wellington
CH,CM,E,P

Northrop Instruments & Systems Ltd.
369 Khyber Pass Road
P.O. Box 8602
AUCKLAND
Tel: 794-091
Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
P.O. Box 8388
CHRISTCHURCH
Tel: 486-928
Telex: 4203
A,M

Northrop Instruments & Systems Ltd.
Sturdee House
85-87 Ghuznee Street
P.O. Box 2406
WELLINGTON
Tel: 850-091
Telex: NZ 3380
A,M

NORTHERN IRELAND

See United Kingdom

NORWAY

Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 FYLLINGSDALEN (Bergen)
Tel: 0047/5/16 55 40
Telex: 16621 hpnas n
CH,CS,E,MS

Hewlett-Packard Norge A/S
Österndalen 16-18
P.O. Box 34
N-1345 ÖSTERÅS
Tel: 0047/2/17 11 80
Telex: 16621 hpnas n
A,CH,CM,CS,E,M,P

OMAN

Khimjil Ramdas
P.O. Box 19
MUSCAT
Tel: 722225, 745601
Telex: 3289 BROKER MB MUSCAT
P

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT
Tel: 734 201-3
Telex: 3274 BAHWAN MB

PAKISTAN

Mushko & Company Ltd.
1-B, Street 43
Sector F-8/1
ISLAMABAD
Tel: 51071
Cable: FEMUS Rawalpindi
A,E,M
Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
KARACHI 0302
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
A,E,M,P*

PANAMA

Electrónico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 63-6613, 63-6748
Telex: 3483 ELECTRON PG
A,CM,E,M,P

PERU

Cía Electro Médica S.A.
Los Flamencos 145, San Isidro
Casilla 1030
LIMA 1
Tel: 41-4325, 41-3703
Telex: Pub. Booth 25306
CM,E,M,P

PHILIPPINES

The Online Advanced Systems Corporation
Rico House, Amorsolo Cor. Herrera Street
Legaspi Village, Makati
P.O. Box 1510
Metro MANILA
Tel: 85-35-81, 85-34-91, 85-32-21
Telex: 3274 ONLINE
A,CH,CS,E,M
Electronic Specialists and Proponents Inc.
690-B Epifanio de los Santos Avenue
Cubao, QUEZON CITY
P.O. Box 2649 Manila
Tel: 98-96-81, 98-96-82, 98-96-83
Telex: 40018, 42000 ITT GLOBE
MACKAY BOOTH
P

PORTUGAL

Mundinter
Intercambio Mundial de Comércio
S.A.R.L.
P.O. Box 2761
Av. Antonio Augusto de Aguiar 138
P-LISBON
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M
Soquimica
Av. da Liberdade, 220-2
1298 LISBOA Codex
Tel: 56 21 81/2/3
Telex: 13316 SABASA
P

Telectra-Empresa Técnica de Equipamentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-LISBON 1
Tel: (19) 68-60-72
Telex: 12598
CH,CS,E,P

PUERTO RICO

Hewlett-Packard Puerto Rico
Ave. Muñoz Rivera #101
Esq. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800
Hewlett-Packard Puerto Rico
Calle 272 Edificio 203
Urb. Country Club
RIO PIEDRAS, Puerto Rico
P.O. Box 4407
CAROLINA, Puerto Rico 00628
Tel: (809) 762-7255
A,CH,CS

QATAR

Computeabia
P.O. Box 2750
DOHA
Tel: 883555
Telex: 4806 CHPARB
P
Eastern Technical Services
P.O.Box 4747
DOHA
Tel: 329 993
Telex: 4156 EASTEC DH
Nasser Trading & Contracting
P.O.Box 1563
DOHA
Tel: 22170, 23539
Telex: 4439 NASSER DH
M

SAUDI ARABIA

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
Thuobah
AL-KHOBAR
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
CH,CS,E,M
Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
Tel: 644 38 48
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH
CH,CS,E,M

Modern Electronic Establishment
Hewlett-Packard Division
P.O.Box 22015
RIYADH
Tel: 491-97 15, 491-63 87
Telex: 202049 MEERYD SJ
CH,CS,E,M
Abdul Ghani El Ajou
P.O. Box 78
RIYADH
Tel: 40 41 717
Telex: 200 932 EL AJOU
P

SCOTLAND

See United Kingdom

SINGAPORE

Hewlett-Packard Singapore (Sales)
Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
P.O. Box 58 Alexandra Rd. Post Office
SINGAPORE, 9115
Tel: 631788
Telex: HPSGSO RS 34209
Cable: HEWPACK, Singapore
A,CH,CS,E,MS,P



SALES & SUPPORT OFFICES

Arranged alphabetically by country

SINGAPORE (Cont'd)

Dynamar International Ltd.
Unit 05-11 Block 6
Kolam Ayer Industrial Estate
SINGAPORE 1334
Tel: 747-6188
Telex: RS 26283
CM

SOUTH AFRICA

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 120
Howard Place CAPE PROVINCE 7450
Pine Park Center, Forest Drive,
Pinelands
CAPE PROVINCE 7405
Tel: 53-7954
Telex: 57-20006
A,CH,CM,E,MS,P

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 37099
92 Overport Drive
DURBAN 4067
Tel: 28-4178, 28-4179, 28-4110
Telex: 6-22954
CH,CM

Hewlett-Packard So Africa (Pty.) Ltd.
6 Linton Arcade
511 Cape Road
Linton Grange
PORT ELIZABETH 6000
Tel: 041-302148
CH

Hewlett-Packard So Africa (Pty.) Ltd.
P.O.Box 33345
Glenstantia 0010 TRANSVAAL
1st Floor East
Constantia Park Ridge Shopping
Centre
Constantia Park
PRETORIA
Tel: 982043
Telex: 32163
CH,E

Hewlett-Packard So Africa (Pty.) Ltd.
Private Bag Wendywood
SANDTON 2144
Tel: 802-5111, 802-5125
Telex: 4-20877
Cable: HEWPACK Johannesburg
A,CH,CM,CS,E,MS,P

SPAIN

Hewlett-Packard Española S.A.
Calle Entenza, 321
E-BARCELONA 29
Tel: 322.24.51, 321.73.54
Telex: 52603 hpbee
A,CH,CS,E,MS,P

Hewlett-Packard Española S.A.
Calle San Vicente S/No
Edificio Albia II
E-BILBAO 1
Tel: 423.83.06
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Hewlett-Packard Española S.A.
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E-VALENCIA 10
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Hewlett-Packard Sverige AB
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S-22226 LUND
Tel: (046) 13-69-79
Telex: (854) 17886 (via Spånga
office)
CH

Hewlett-Packard Sverige AB
Östra Tullgatan 3
S-21128 MALMÖ
Tel: (040) 70270
Telex: (854) 17886 (via Spånga
office)

Hewlett-Packard Sverige AB
Västra Vintergatan 9
S-70344 ÖREBRO
Tel: (19) 10-48-80
Telex: (854) 17886 (via Spånga
office)
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Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
Box 19
S-16393 SPÅNGA
Tel: (08) 750-2000
Telex: (854) 17886
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Hewlett-Packard Sverige AB
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office)
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Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 BASEL
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Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
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ALTRINCHAM
Cheshire WA14 1NU
Tel: 061 928 6422
Telex: 668068
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Elstree House, Elstree Way
BOREHAMWOOD, Herts WD6 1SG
Tel: 01 207 5000
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Bridewell House
Bridewell Place
LONDON EC4V 6BS
Tel: 01 583 6565
Telex: 298163
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Hewlett-Packard Ltd.
Fourier House
257-263 High Street
LONDON COLNEY
Herts. AL2 1HA, St. Albans
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Pontefract Road
NORMANTON, West Yorkshire WF6 1RN
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REDHILL, Surrey RH1 1PS
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Hampshire SO3 3DQ
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Hewlett-Packard Ltd.
Eskdale Rd.
Winnersh, WOKINGHAM
Berkshire RG11 5DZ
Tel: 0734 696622
Telex: 848884
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Winnersh, WOKINGHAM
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847178
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Nine Mile Ride
Easthampstead, WOKINGHAM
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Hewlett-Packard Ltd.
Cardiac Services Building
95A Finaghy Road South
BELFAST BT10 0BY
Tel: 0232 625-566
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OMAHA, NE 68154
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GLEN ALLEN, VA 23060
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BELLEVUE, WA 98006
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SPOKANE, WA 99212
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4604 MacCorkie Ave.
P.O. Box 4297
CHARLESTON, WV 25304
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Hewlett-Packard Co.
150 S. Sunny Slope Road
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Tel: (414) 784-8800
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*Pablo Ferrando S.A.C. e I.
Avenida Italia 2877
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Telex: Public Booth 901
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VALENCIA
Tel: (041) 51 385
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*Field Technical Sales
45 Kelvin Road, North
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