3–11 In addition to the operating modes, the 8116A offers 4 control modes for modulating or controlling the output signal i.e. FM, AM, PWM, VCO. Table 3–1 shows which control mode can be combined with which operating mode. In the event of the operator selecting an erroneous combination e.g. E.WID and FM, the 8116A automatically displays ERROR and the E.WID and FM LED's will flash. Similarly, in NORM mode, when the operator makes incompatible timing settings (e.g. width greater than frequency) the 8116A displays ERROR.

Table 3–1. Operating/Control Mode Combinations

Mode / Modulate	NORM	TRIG	GATE	E.WID	I.SWP	E.SWP	I.BUR	E.BUR
FM	•	•	•	–	•	•	•(2)	•
AM	•	•	•	•(1)	•	•	•(2)	•
PWM	•(1)	•(1)	•(1)	–	•(1)	•(1)	–	•(1)
VCO	•	•	•	–	–	–	•	•

• = All waveforms
•(1) = Pulse waveform only
•(2) = All waveforms except pulse
– = Error combination

3–12 PARAMETERS

3–13 Figure 3–2 (Timing) and Figure 3–3 (Output Levels) illustrate the output signal parameters of the standard 8116A. A description of the various parameter-setting controls is given in Figure 3–1.

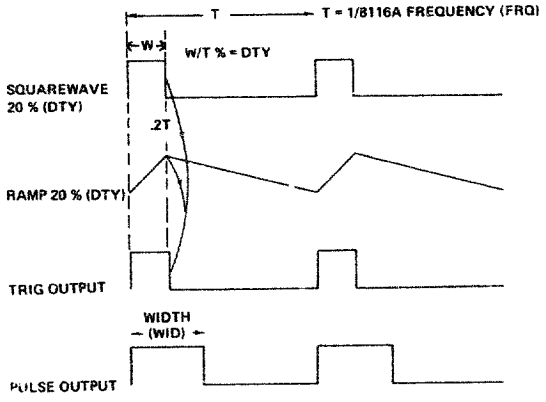

Figure 3–2. Timing Parameters

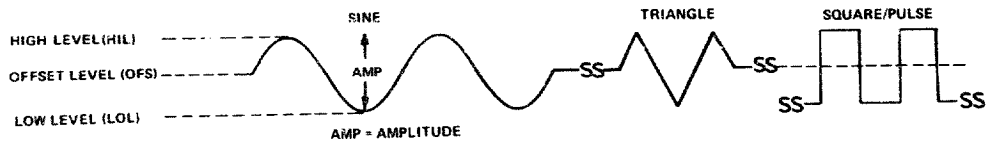

Figure 3–3. Output Level Parameters

3–14 As described in Figure 3–1, the parameter selection of the amplitude/offset keys is user-dependent. With any change to the HIL or LOL settings, the 8116A automatically calculates and stores the new amplitude and offset values.

3–15 Option 001 mode parameters are explained and illustrated under the respective mode description.

3–16 VERNIER / RANGE OPERATION

3–17 The vernier comprises 3 rocker-switches corresponding to the 3 display digits. Incrementing/decrementing a display digit is accomplished by pressing the upper/lower switch section respectively. (Continuous pressing causes continuous increment/decrement of the related display digit).

3–18 The RANGE key is also a rocker-switch for multiplying/dividing the displayed value by factor 10. For the offset parameter, pressing the key twice provides a quick means of setting 0 V.

3–19 AUTO VERNIER OPERATION

3–20 In NORM mode only, all parameters can be automatically incremented/decremented with selectable resolution. To activate AUTO VERNIER operation, first select the parameter to be incremented/decremented, then press the AUTO key. AUTO VERNIER can now be started by pressing any of the VERNIER keys.

3–21 There are 3 conditions, any of which causes an AUTO VERNIER 'wait' state i.e. AUTO VERNIER active (key LED lit), but no increment/decrement takes place. The conditions are:

1. timing error exists
2. at instrument specification limits e.g. frequency 50 MHz
3. at output level limits set via the LIMIT key.

AUTO VERNIER switch-off is accomplished by any of the following:

1. external signal to the EXT INPUT connector
2. pressing any key other than the vernier keys
3. pressing the AUTO key.

3–22 LIMIT OPERATION

3–23 Maximum high (HIL) and low (LOL) levels into 50 Ohm can be set to protect the device under test. Pushing the LIMIT key sets the currently active high and low levels as the 8116A output limits – which cannot be exceeded as long as LIMIT operation is active (key LED lit).

3–24 EXTERNAL TRIGGERING

3–25 Five pushbuttons, a trigger level adjust and BNC connector (EXT INPUT) facilitate external triggering of the 8116A. The function of the individual pushbuttons in the various external triggering modes is described in the following.

3–26 –90°

3–27 With TRIG, GATE or E.BUR (Opt. 001) mode selected, and output waveform set to sine or triangle, pressing this pushbutton shifts the start phase to –90°. As a result, haversine and havertriangle signals can be generated by the 8116A.

3–28 Trigger Slopes

3–29 Positive or negative slope is selectable for triggering on the signal applied to the EXT INPUT connector. With no slope selected (both key LED's off), the EXT INPUT is switched off.

3–30 Triggering level on the selected slope is set via the LEVEL adjust.

3–31 Note that in E.SWP mode (Opt. 001), two trigger pulses may be required. If the 8116A is not set to the start frequency (STA) i.e. STA key LED not illuminated, the first trigger pulse sets the 8116A to the STA frequency. The second trigger pulse then starts the sweep.

3–32 MANUAL

3–33 In external trigger modes, the 8116A can be triggered manually via the MAN pushbutton:

TRIG Mode. Each operation of the MAN key generates one output cycle, cycle time being determined by the 8116A frequency setting.

GATE Mode. The 8116A outputs continuously for as long as the MAN key is depressed. Frequency is determined by the 8116A frequency setting.

E.SWP Mode (Opt. 001). MAN key operation starts the sweep only if the 8116A is set to the start frequency (STA) i.e. STA key LED illuminated. Otherwise, MAN key must be pressed twice; the first time to reset the 8116A to STA, the second to start the sweep.

E.BUR Mode (Opt. 001). Each operation of the MAN key triggers a burst output.

3–34 1 CYCLE (OPTION 001)

3–35 In TRIG, GATE and E.BUR modes, each operation of this key generates a single cycle at the 8116A output.

3–36 STANDARD PARAMETER SET

3–37 The Standard Parameter Set is available for two reasons. Firstly it serves to overcome RAM corruption, should it occur as a result of battery charge deterioration, by giving an error-free display at switch-on. Secondly, when incompatible mode selection causes an error condition (i.e. E.WID and Sine), the instrument may be switched OFF then ON again to revert to the Standard Parameter Set, thus overcoming any condition previously displayed. The Standard Parameter Set is as follows:

NORM	ON
FRQ (active)	1.00 kHz
DTY	50 %
HIL	+0.5 V
LOL	–0.5 V
	ON

Selecting I.SWP mode gives:

STA	1.00 kHz
STP	100 kHz
SWT	50 ms
MRK	1.00 kHz
DTY	50 %
HIL	+0.5 V
LOL	–0.5 V

Selecting I.BUR mode gives:

RPT	100 ms
BUR	1
FRQ	1.00 kHz
DTY	50 %
HIL	+0.5 V
LOL	–0.5 V

Selecting E.BUR withdraws the RPT parameter from the display mnemonics.

Selecting Pulse mode makes WID available (500 µs).

The Standard Parameter Set can be accessed when the 8116A is operating on the HP-IB by sending the command:

CLR 7 (BASIC) CLEAR 7 (HPL)

3–38 CONTROL MODES

3–39 The 8116A output signal can be modulated (AM, FM, PWM) or controlled (VCO) by applying a signal to the CTRL INPUT connector. Table 3–1 indicates the permitted operating mode/control mode combination, a brief description of each control mode being given in the following. For specification details in each mode – see Table 1–2.

3–40 FREQUENCY MODULATION (FM)

3–41 The 8116A's output can be frequency modulated by applying a signal to the CTRL INPUT connector.

3–42 AMPLITUDE MODULATION (AM)

3–43 The 8116A's output can be amplitude modulated by applying a signal to the CTRL INPUT connector. A ground symmetrical modulating signal provides a modulation of 0–100 %. 200 % modulation (DSBSC) can also be obtained. Figure 3–4 illustrates 100 % modulation and DSBSC.

3–44 PULSE WIDTH MODULATION (PWM)

3–45 In pulse mode, the 8116A's output can be pulse width modulated by applying a signal to the CTRL INPUT connector. Pulse width modulation is available in any one of 8 non-overlapping decade ranges, as illustrated in Figure 3–5.

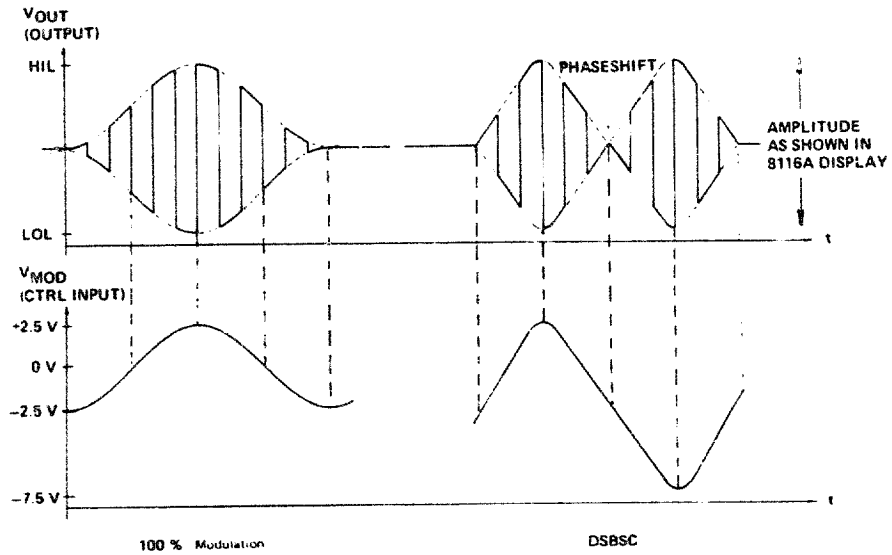

Figure 3–4. Amplitude Modulation

4–10 FREQUENCY

SPECIFICATION

1.00 mHz to 50 MHz

(1 mHz to 999 kHz for 10 % and 90 % duty cycle)

(1 mHz to 9,99 MHz for 20 % and 80 % duty cycle)

Accuracy in Norm input mode:

% of setting	Pulse mode or 50 % duty cycle	≠ 50 % duty cycle
1 mHz to 99,9 kHz	± 3 %	± 3 %
100 kHz to 9,99 MHz	± 5 %	± 10 %
10 MHz to 50 MHz	± 5 %	–

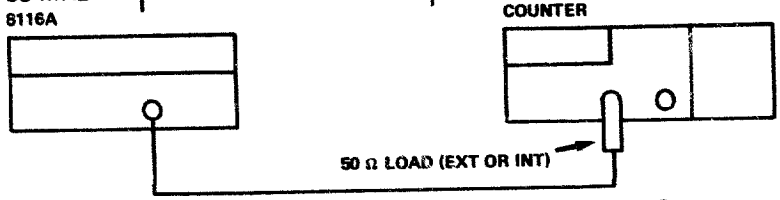

Figure 4–1. Test Setup for Frequency, Burst and Sweep

EQUIPMENT

Counter
Cable Assembly BNC (61 cm)
Feedthrough Termination 50 Ω (if necessary)

PROCEDURE

1. Connect equipment as shown in Figure 4–1.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	SQUARE
DUTY CYCLE	50 %
CTRL	OFF
AMPL	1 V
OFFSET	0 V
OUTPUT MODE	NORM

3. Set counter to frequency measurement.

4. Set 8116A frequency and verify counter frequency reading as follows:

8116A setting	Counter reading
50.0 MHz	50.0000 MHz ± 2500 kHz
10,0 MHz	10.0000 MHz ± 500 kHz
10,0 kHz	10.0000 kHz ± 300 Hz
1,0 kHz	1.00000 kHz ± 30 Hz

5. Set 8116A frequency and verify counter period reading as follows:

8116A setting	Counter reading
1.00 Hz	1.00000 s ± 33.3 ms
100 mHz	10.00000 s ± 333 ms

PERFORMANCE TESTS

4–11 PULSE WIDTH (pulse mode)

SPECIFICATION

10 ns to 999 ms
Accuracy ± 5 % of setting ± 2 ns

EQUIPMENT

Counter
Cable Assembly BNC
Sampling oscilloscope
Feedthrough Termination (if necessary)

PROCEDURE

1. Connect equipment as shown in Figure 4–1.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	PULSE
CTRL	OFF
FRQ	1 MHz
AMP	1 V
OFS	0 V

3. Set counter to TI, COMA, CH A +, CH B –, Trig level 0 V.

4. Set 8116A width /frequency as shown and verify counter width reading.

FREQUENCY	WIDTH	COUNTER READING
1 MHz	100 ns	93 ns – 107 ns
100 KHz	1 µs	948 ns – 1052 ns
1 KHz	100 µs	95 µs – 105 µs
10 Hz	1 ms	995 µs – 1050 µs
1 Hz	500 ms	475 ms – 525 ms

5. Connect the equipment as shown in Figure 4–6.

6. Set 8116A as follows:

FRQ	10.0 MHz
WID	8.0 ns

7. Set sampling scope such that one cycle fills the display. Verify that width is between 7.5 and 10 ns.

PERFORMANCE TESTS

4–12 BURST (Option 001 only)

SPECIFICATION

A pre-programmed number of output cycles is generated on receipt of an input trigger signal or manual command, min time between bursts: 100 ns. Burst length: 1 to 1999 cycles. Frequency up to 40 MHz.

EQUIPMENT

Counter
Cable Assembly BNC (61 cm)
Feedthrough Termination 50 Ω (if necessary).

PROCEDURE

1. Load Burst number 816 into 8116A.

2. Set 8116A as follows:

INPUT MODE	EXT BURST
FUNCTION	SQUARE
DUTY CYCLE	50 %
CTRL	OFF
FRQ	10 kHz
AMPL	1 V
OFFSET	0 V
BURST	816
OUTPUT MODE	NORM

3. Use Figure 4–1 test setup and set counter to START.

4. Press 8116A's MAN button and verify that counter now displays the set number (816) of output cycles. (5345A reading will be 815, since first pulse arms the counter).

PERFORMANCE TESTS

4–13 AMPLITUDE AND OFFSET

SPECIFICATION

Amplitude and offset are independently variable within the following two level windows.

Level window	± 800 mV	± 8.00 V
Amplitude range	10.0 mVpp to 99.9 mVpp	100 mVpp to 16.0 Vpp
Ampl. resolution	3 digits	3 digits
Ampl. accuracy*	± 5 % (0.45 dB)	± 5 % (0.45 dB)
Repeatability	Factor 4 better than accuracy	
Offset range	0 to ± 795 mV	0 to ± 7.95 V
Offset resolution	3 digits (best case 100 μV)	3 digits (best case 1 mV)
Offset accuracy	± 0.5 % of setting ± 1 % of amplitude ± 2 mV	± 0.5 % of setting ± 1 % of amplitude ± 40 mV
Repeatability	Factor 4 better than accuracy	

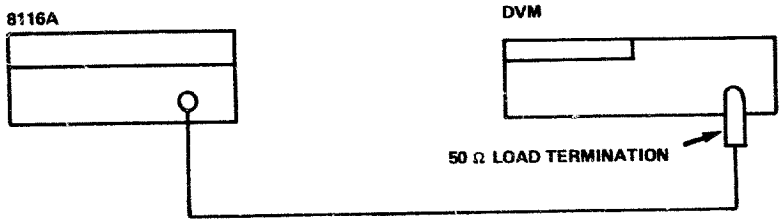

Figure 4–2. Test Setup for Amplitude and Offset

EQUIPMENT

Digital Voltmeter (RMS)
Cable Assembly BNC (1 x 61 cm)
Feedthrough Termination 50 Ω

If total error is > ± .5 % of nominal, note deviation and take into account during measurement.

PROCEDURE

1. Connect the equipment as shown in Figure 4–2.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	SINE
DUTY CYCLE	50 %
CTRL	OFF
FRQ	1,0 kHz
OFFSET	0 V
OUTPUT MODE	NORM

PERFORMANCE TESTS

AMPL	FUNCTION	DVM Reading *
8.00 V	Sine	2,69 – 2,97 V
	triangle	2,19 – 2,43 V
	square	3,8 – 4,2 V
3.00 V	Sine	1,008 – 1,114 V
	triangle	0,823 – .909 V
	square	1,425 – 1,575 V
1.00 V	Sine	0,336 – 0,372 V
	triangle	0,275 – 0,303 V
	square	0,475 – 0,525 V
100 mV	Sine	33,6 – 37,1 mV
	triangle	27,4 – 30,3 mV
	square	47,5 – 52,5 mV

3. Set 8116A to NORM mode, Amplitude 100 mV.

4. Using best DVM resolution, measure the dc voltages for the following 8116A settings:

OFFSET	DVM Reading *
7.5 V	7,421 – 7,578 V
5.00 V	4,934 – 5,066 V
3.00 V	2,944 – 3,056 V
1.00 V	0,954 – 1,046 V
100 mV	58 mV– 142 mV

* last digit rounded

PERFORMANCE TESTS

4–14 SINE CHARACTERISTICS

SPECIFICATION

Total Harmonic Distortion (THD): < 1 % (–40 dB),
(10 Hz to 50 kHz)

Harmonic Signals: More than 34 dB below fundamental (50 kHz to 1 MHz).
More than 23 dB below fundamental (1 MHz to 50 MHz, > 20 mVpp to 8 Vpp.)

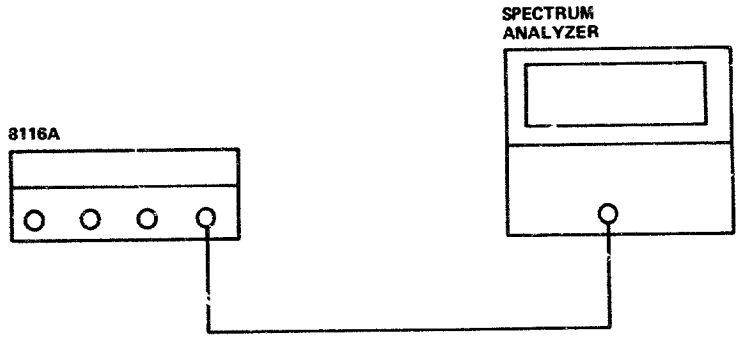

Figure 4–3. Test Setup for Sine Characteristics

EQUIPMENT

Spectrum analyzer
Cable assembly BNC (1 x 61 cm)

PROCEDURE

1. Connect the equipment as shown in Figure 4–3.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	SINE
DUTY CYCLE	50 %
CTRL	OFF
FRQ	1 kHz
AMPL	8 V
OFFSET	0 V
OUTPUT MODE	NORM

3. Tune spectrum analyzer for minimum display amplitude. Adjust gain so that fundamental corresponds to 0 dB. Verify that the 2nd and 3rd harmonics do not exceed the –42 and –47 dB levels, respectively.

PERFORMANCE TESTS

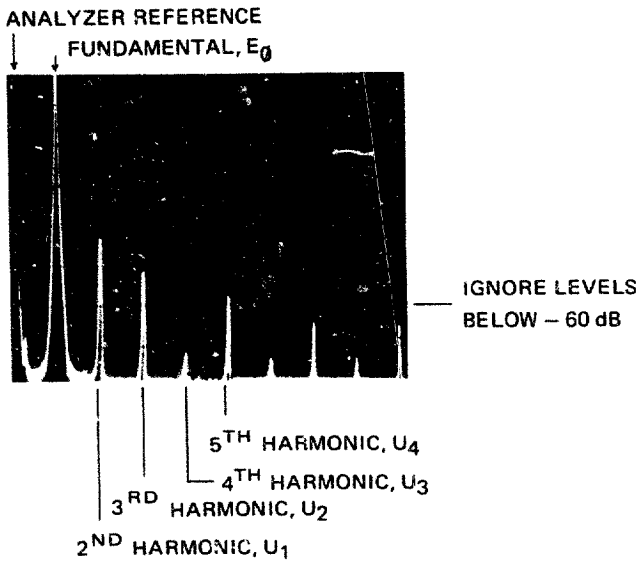

Figure 4–4. Typical Spectrum Analyzer Display at 1 KHz

The value of harmonics may differ between instruments.

4. Verify that THD $< 1\%$

$$THD = \frac{\sqrt{E_1^2 + E_2^2 + E_3^2 + \ldots\ldots\ldots}}{E_0} \cdot 100\,\%$$

where E_0 = fundamental voltage amplitude and E_1, E_2 etc are the 2nd, 3rd etc harmonic amplitudes.

When the harmonics are expressed in dB the formula becomes:

$$THD = \sqrt{10^{\frac{A_1}{10}} + 10^{\frac{A_2}{10}} + 10^{\frac{A_3}{10}} + \ldots\ldots\ldots} \cdot 100\,\%$$

where A_1 = first harmonic in dB etc.

5. Set 8116A FRQ to 50 MHz.

6. Tune spectrum analyzer for minimum display amplitude. Adjust gain so that fundamental corresponds to 0 dB. Verify that no harmonics exceed the –23 dB level.

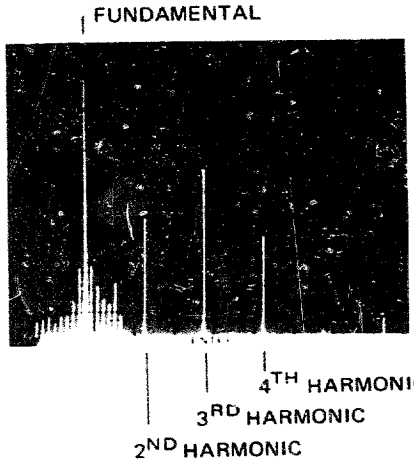

Figure 4–5. Typical Spectrum Analyzer Display at 50 MHz, NORM

The value of harmonics may differ between instruments.

PERFORMANCE TESTS

4–15 PULSE CHARACTERISTICS

SPECIFICATION

Transition times (10 % to 90 %): < 6 ns

Preshoot/Overshoot/Ringing: ± 5 %

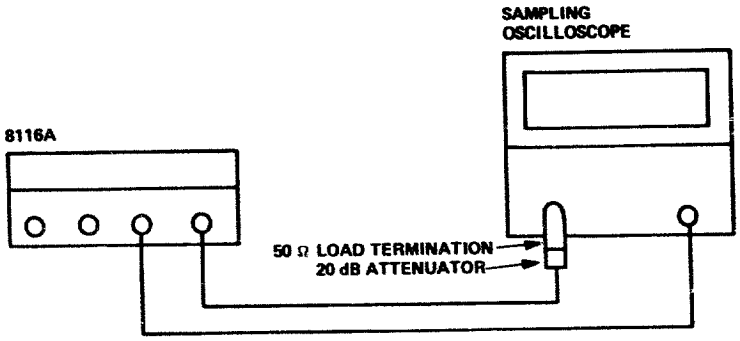

Figure 4–6. Test Setup for Pulse Characteristics

EQUIPMENT

Sampling oscilloscope
Cable assembly BNC (2 x 61 cm)
Feedthrough termination 50 Ω
Power attenuator 20 dB, 20 W

PROCEDURE

1. Connect the equipment as shown in Figure 4–6.

2. Set the 8116A as follows:

INPUT MODE	NORM
FUNCTION	SQUARE
DUTY CYCLE	50 %
CTRL	OFF
FRQ	1 MHz
AMPL	8 V
OFFSET	0 V
OUTPUT MODE	NORM

3. Set scope so that one cycle fills the display and measure:

leading edge (risetime)	⩽ 6 ns
trailing edge (risetime)	⩽ 6 ns
preshoot	⩽ ± 5 % of amplitude *
overshoot and ringing	⩽ ± 5 % of amplitude *

* note possible sampling error

PERFORMANCE TESTS

4–16 TRIGGER, GATE and E.WIDTH PERFORMANCE

SPECIFICATION

Trig: pos. ext input pulse ⩾ 10 ns wide generates one output cycle.
Sensitivity: 500 mVpp
Gate: Ext. signal enables oscillator. First output cycle synchronous with active trigger slope.
Last cycle always completed.
E.Width: External signal will be shaped to determine output pulse width and period. (Pulse mode only).
Max. input: ± 20 V
Input impedance: 10 kΩ typical

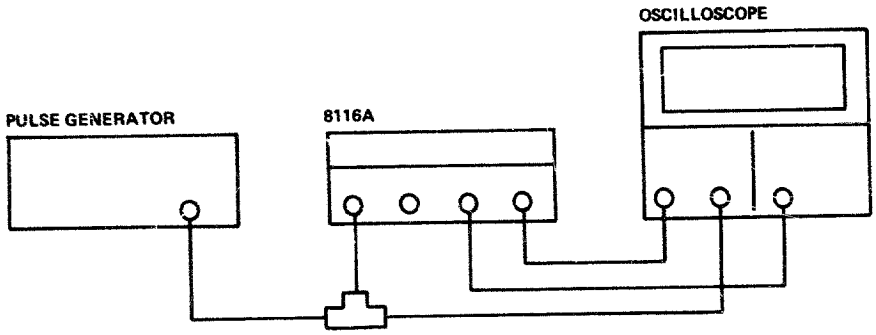

Figure 4–7. Test Setup for Burst Gate and Trigger Performance

EQUIPMENT

Pulse generator
Oscilloscope
Cable assembly (3 x 61 cm, 2 x 30 cm)
BNC Tee,
Feedthrough termination 50 Ω

PROCEDURE

1. Connect the equipment as shown in Figure 4–7.

2. Set the 8116A as follows:

INPUT MODE	TRIG
FUNCTION	SINE
DUTY CYCLE	50 %
CTRL	OFF
FRQ	60 KHz
AMPL	1 V
OFFSET	0 V
OUTPUT MODE	NORM
EXT INPUT	⊰

PERFORMANCE TESTS

3. Set ext. function generator for output pulse approx 50 μs wide, rep. rate 10 kHz, baseline zero or more negative, pulse top + 1 V. Adjust 8116A trigger input level for correct trigger. Verify that each trigger pulse generator one complete output cycle (Figure 4–8).

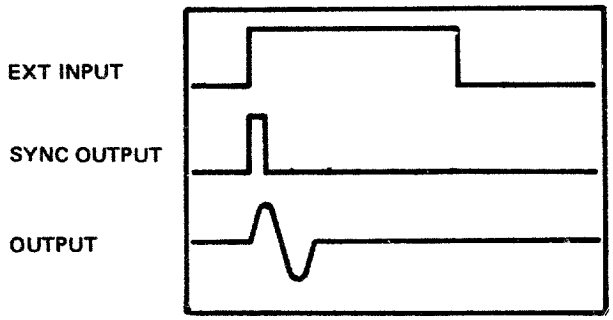

Figure 4–8. Example of correct trigger operation

4. Set 8116A to GATE mode. Verify that each positive gate releases a burst of output cycles and that each cycle is complete (Figure 4–9).

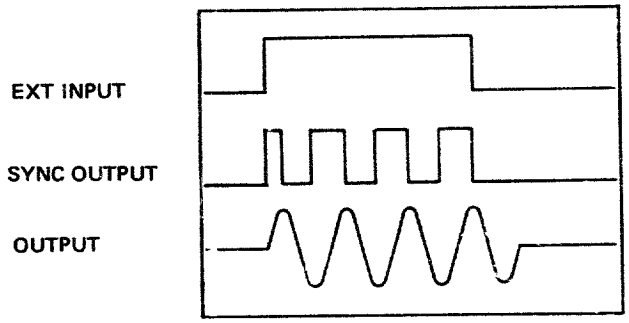

Figure 4–9. Example of correct gate operation

5. Set 8116A waveform to PULSE and mode to E.WIDTH. Verify that each external pulse releases a pulse of same width.

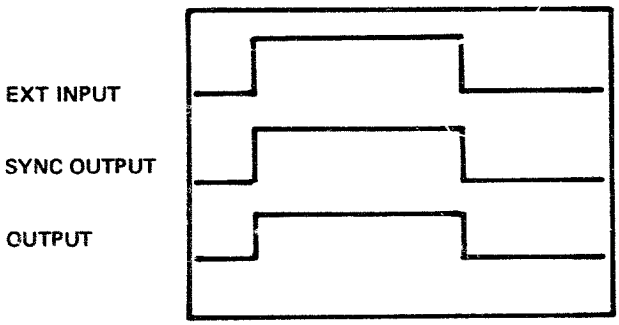

Figure 4–10. Example of correct E.Width operation

PERFORMANCE TESTS

4–17 FM

SPECIFICATION

Output is frequency modulated by an external voltage applied to a rear panel BNC, 1 V modulates 1 % deviation.

Deviation: ± 5 % max

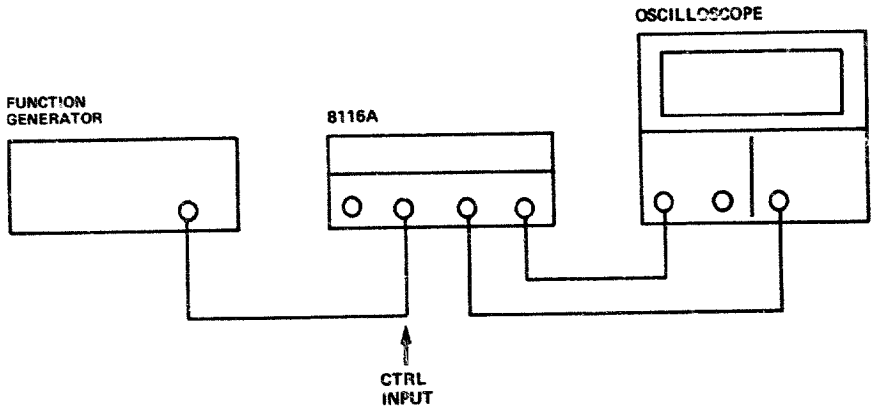

Figure 4–11. Test Setup for FM

EQUIPMENT

Oscillator
Oscilloscope
Cable assembly BNC (3 x 61 cm)

PROCEDURE

1. Connect the equipment as shown in Figure 4–11.

2. Set oscillator to 10 kHz, 2 Vpp

3. Set oscilloscope to 0,1 µs/div timebase, Magnification X10

4. Set the 8116A as follows:

INPUT MODE	NORM
FUNCTION	SQUARE
DUTY CYCLE	50 %
CTRL	FM
FRQ	1 MHz
AMPL	1 V
OFFSET	0 V
OUTPUT MODE	NORM

5. Check the delayed sweep for a typical jitter of 2 div ± 10 %.

PERFORMANCE TESTS

4–18 AMPLITUDE MODULATOR

SPECIFICATION

Modulating Frequency: dc to 1 MHz (–3 dB).
Input impedance: 10 kΩ typical.
Envelope Distortion: (dc to 50 kHz mod. freq. in Normal mode only.)

Carrier	Modulation		Distortion
⩽ 1 MHz	0 to 90 %		< 1 %
> 1 MHz	0 to 30 %	<	< 3 %

Carrier Frequency Deviation: < 0.01 %, 0 to 30 % modulation.

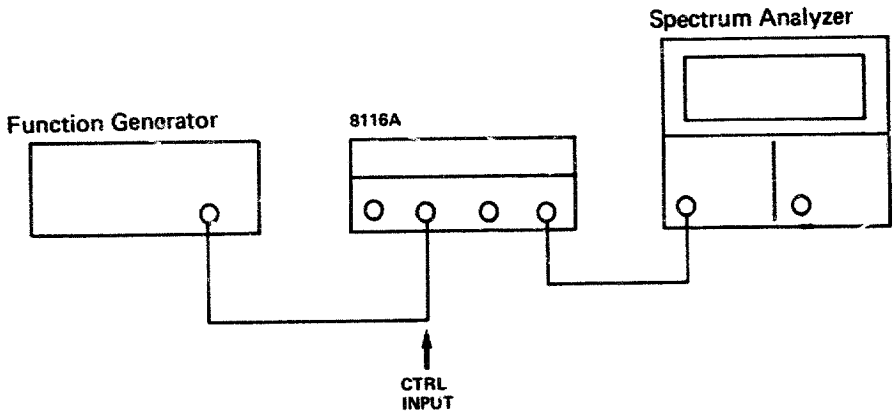

Figure 4–12. Test setup for AM

EQUIPMENT

Function Generator
spectrum analyzer

PROCEDURE

1. Connect the equipment as shown in Figure 4–12.

2. Set the 8116A as follows:

INPUT MODE	NORM
FUNCTION	SINE
DUTY CYCLE	50 %
CTRL	AM
FRQ	10 kHz
AMPL	1 V
OFFSET	0 V
OUTPUT MODE	NORM

3. Set Function Generator to 2 kHz and 4.5 Vpp amplitude, with 0.25 V offset.

4. Adjust the spectrum analyzer to display the 10 kHz carrier and the lower sideband frequency down to the 2 kHz modulating frequency. All harmonics should be at least 42 dB lower than the modulation sidebands.

PERFORMANCE TESTS

4–19 PULSE WIDTH MODULATION

SPECIFICATION

Pulse Width ratio: 10:1 max.
Sensitivity: > ± 6 V for ratio 1:10
Pulse Width ranges: 10 ns to 1 s in eight non-overlapping decade ranges.

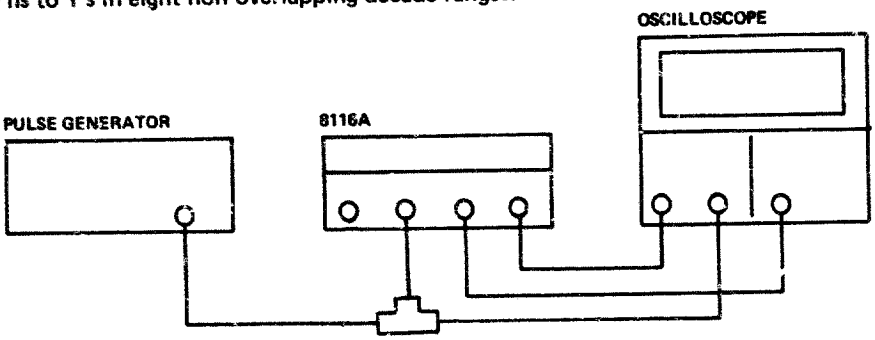

Figure 4–13. Test setup for PWM

EQUIPMENT

Realtime scope
Pulse Generator
Cable Assembly BNC (4x61 cm)
BNC Tee

PROCEDURE

1. Connect equipment as shown in Figure 4–13.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	PULSE
CTRL	PWM
HIL	1.0 V
LOL	0.0 V
OUTPUT MODE	NORM

3. Set the Pulse Generator as follows:

FUNCTION	SINE
FREQUENCY	1 Hz
AMPLITUDE	12.0 Vpp
OFFSET	0.0 V

4. Select the settings shown for each test in the following Table. Verify that the 8116A Pulse Width varies with the amplitude of the signal applied to the CTRL INPUT within the given limits.

NOTE: When a width value is selected, the 8116A displays the value corresponding to a 0 V CTRL input WITHIN THE DECADE RANGE OF THE SELECTED WIDTH VALUE.
e.g. Decade = 100 ns to 1.0 us, display reads 550 ns

8116A WIDTH			SCOPE	
FREQUENCY	DECADE RANGE	DISPLAY	MIN. WID	MAX. WID
1 MHz	10 ns – 100 ns	55 ns	10 ns	100 ns
100 kHz	100 us – 1.0 ms	550 us	100 us	1.0 ms
100 Hz	100 ms – 1.0 s	550 ms	100 ms	1.0 s

PERFORMANCE TESTS

4–20 DUTY CYCLE (sine, triangle, square)

SPECIFICATION

Range: 10 % to 90 % (1 mHz to 999 kHz)
20 % to 80 % (1 MHz to 9.99 MHz)
Accuracy: ± 0.5 digits (1 mHz to 999 kHz)
± 3.0 digits (1 MHz to 9.99 MHz)

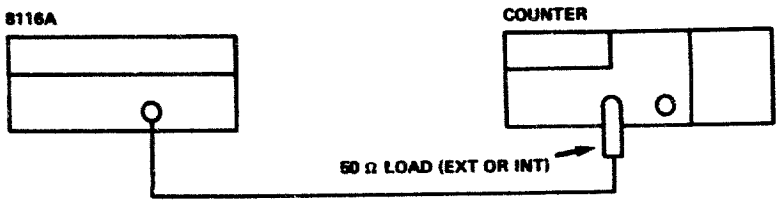

Figure 4–14. Test setup for Duty Cycle

EQUIPMENT

Counter
Cable Assembly BNC (1 x 61 cm)

PROCEDURE

1. Connect the equipment as shown in Figure 4-14.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	SQUARE
CTRL	OFF
AMP	1.0 V
OFS	0.0 V
OUTPUT MODE	NORM

3. Set the counter to DTY CY A. Set 8116A duty cycle / frequency as shown and verify counter duty cycle readings.

FREQUENCY	DUTY CYCLE	COUNTER READING
1 Hz	10 %	9.5 % to 10.5 %
	50 %	49.5 % to 50.5 %
	90 %	89.5 % to 90.5 %
1 kHz	10 %	9.5 % to 10.5 %
	50 %	49.5 % to 50.5 %
	90 %	89.5 % to 90.5 %
9.99 MHz	20 %	17.0 % to 23.0 %
	50 %	47.0 % to 53.0 %
	80 %	77.0 % to 83.0 %

PERFORMANCE TESTS

4–21 SWEEP (Opt. 001 only)

SPECIFICATION

Logarithmic sweep for all waveforms up to full range (1 mHz to 50 MHz) between selected start and stop frequency. Sweep time per decade selectable in 1–2–5 sequence between 10 ms and 500 s.

EQUIPMENT

Realtime scope
Pulse Generator
Cable Assembly BNC (3 x 61 cm)

PROCEDURE

1. Connect equipment as shown in Figure 4–7.

2. Set the 8116A as follows:

INPUT MODE	E.SWP
FUNCTION	SINE
CTRL	OFF
STA	10 kHz
STP	10 MHz
SWT	2 s/decade
MRK	1.0 MHz
AMPLITUDE	1.0 V
OFFSET	0.0 V
OUTPUT MODE	NORM

3. Connect the X-OUTPUT of the 8116A to channel B of the Scope. Set the channel B vertical scale to 1.0 V/division and the scope timebase to 50 us/division. Verify that the frequency of the displayed sinewave is 10 kHz.

4. Press the MAN pushbutton on the 8116A frontpanel and confirm that
   a) the 8116A displays IP
   b) the frequency of the displayed signal increases
   c) the amplitude of the X-OUTPUT gradually rises from 0 V to 4.5 V, during the sweep time (6 seconds).

5. Adjust the scope timebase to 50 ns/division and verify that the frequency of the displayed sinewave is 10 MHz.

6. Set the 8116A to trigger from the positive-going edge of the external input signal. Set the Signal Generator as follows:

INPUT MODE	PULSE
FREQUENCY	1.0 Hz
WIDTH	500 ms

7. Verify that the operation of the 8116A output conforms with steps 3, 4 and 5 above.

8. Disconnect the X-OUTPUT of the 8116A from the scope and connect the MARKER OUTPUT in its place. Disconnect the 8116A external input trigger, and press MAN to return to the start frequency. Press MAN again to begin the sweep, and note that the MARKER OUTPUT switches instantaneously when the marker frequency (1 MHz) has been reached (4 seconds after the sweep was initiated).

9. Select I.SWP at the 8116A frontpanel. Verify that the internal sweep is running, and that the start, stop and marker frequencies, sweep time/decade and X-OUTPUT are identical to the previously set values.

PERFORMANCE TESTS

4–22 DC VOLTAGE (all waveform keys deactivated)

SPECIFICATION

Range: 0 V to ± 7.95 V
Resolution: 3 digits (best case 1 mV)
Accuracy: ± 0.5 % of setting ± 20 mV

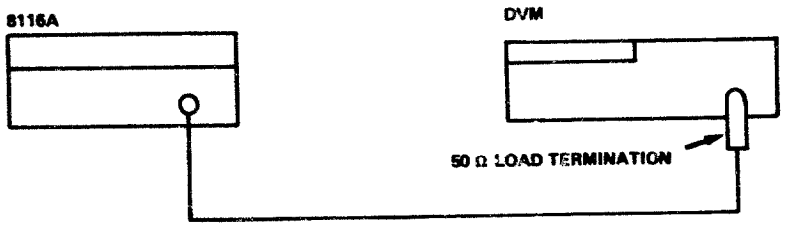

Figure 4–16. Test setup for DC Voltage

EQUIPMENT

Digital Voltmeter
Cable Assembly BNC (1 x 61 cm)

PROCEDURE

1. Connect the equipment as shown in Figure 4–16.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	OFF
CTRL	OFF
OUTPUT MODE	NORM

3. Set 8116A AMP and OFS values as shown and verify DVM reading.

AMP	OFS	DVM READING
+100 mV	+7.95 V	+7.890 V – +8.010 V
+100 mV	+5.00 V	+4.955 V – +5.045 V
+100 mV	+2.00 V	+1.970 V – +2.030 V
+100 mV	0.00 V	–0.020 V – +0.020 V
+100 mV	–2.00 V	–2.030 V – –1.970 V
+100 mV	–5.00 V	–5.045 V – –4.955 V
+100 mV	–7.95 V	–8.010 V – –7.890 V

PERFORMANCE TESTS

4–23 MAN, 1 CYCLE, LIMIT, COMPLEMENT and DISABLE OPERATION

FUNCTION AND CAPABILITY

MAN: Simulates external input.

1 CYCLE: (Opt. 001 only). Provides a single output period in TRIG, GATE and EXT BURST mode.

AUTO: In NORM mode, all parameters can be automatically incremented or decremented with selectable resolution. Pushing the AUTO button activates the AUTO vernier, which can then be started with the selected vernier key. AUTO vernier stop is accomplished by an external trigger input or pushing AUTO.

LIMIT: Maximum high and low levels into 50 Ohm can be limited to protect the device under test. Pushing the LIMIT key will set the limits to the actual levels, which then cannot be exceeded as long as the mode is active.

COMPL: Switch-selectable normal/complement output.

DISABLE: Relay disconnects all output circuitry.

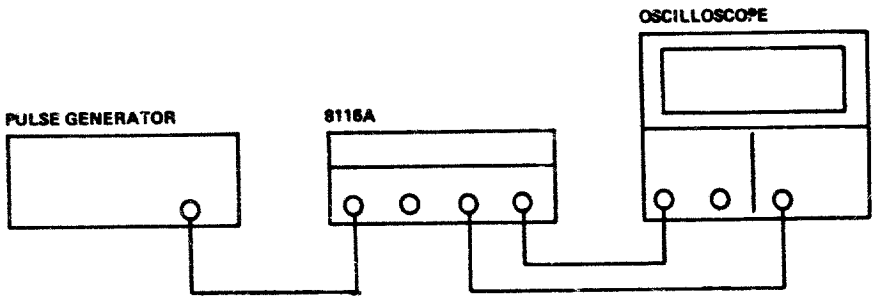

Figure 4–17. Test setup

EQUIPMENT

Realtime scope
Counter
Pulse Generator
Cable Assembly BNC (3 x 61 cm)

PROCEDURE

1. Connect equipment as shown in Figure 4–17.

2. Set 8116A as follows:

INPUT MODE	NORM
FUNCTION	SQUARE
CTRL	OFF
FREQUENCY	1 kHz
HIL	1.0 V
LOL	0.0 V
OUTPUT MODE	NORM
DUTY CYCLE	10 %

NOTE: The Autovernier acts upon the LAST selected parameter.

PERFORMANCE TESTS

3. Adjust the scope timebase to 0.2 ms/div and select AUTO at the 8116A frontpanel. Press the upper section of the right hand VERNIER key and verify that the duty cycle of the 8116A output is incremented to 90 %. Press the lower section of the left-hand VERNIER key and verify that the duty cycle decremented to 10 %. Deselect the AUTO pushbutton.

4. Press the COMPL pushbutton and verify that the 8116A output becomes inverted. Deselect the COMPL pushbutton.

5. Select DISABLE at the 8116A frontpanel and confirm that the output is withdrawn.

6. Make the following adjustments to the 8116A frontpanel settings:

INPUT MODE	EXT BURST
FUNCTION	PULSE
CTRL	OFF
BUR	123
FREQUENCY	100 Hz
WIDTH	5 us
AMP	4.0 V
OFS	0.0 V
OUTPUT MODE	LIMIT

7. Disconnect the scope and connect the counter in its place. Set the Counter to TOT A. Reset the counter and enable the GATE. Press MAN. Verify that the counter reads 123.

8. Deselect the EXT INPUT trigger and reset the counter. Press the 1 CYCLE key on the 8116A frontpanel. Confirm that the counter reading is 124. Reset the counter and press the MAN key on the 8116A frontpanel. Verify that the new counter reading is 123.

9. Select the AMP parameter on the 8116A frontpanel. Verify that pressing the VERNIER keys will not increase the amplitude of +4.0 V set previously. Similarly, when OFS is selected, verify that the previously set level of 0.0 V cannot be made more negative by action of the VERNIER keys.