User's Manual
SD345 Spectrascope III
Part Three
(S/N 180 and On)

Legacy Manual

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moved to the right or left. Values in HZ, KCPM or ORDERS will be referenced to the frozen line cursor.

RESET Touch Control

Resets the cursor to the beginning of the trace.

UPPER Touch Control

Places the cursor on the upper trace when the analyzer is in a dual display mode.

LOWER Touch Control

Places the cursor on the lower trace when the analyzer is in a dual display mode.

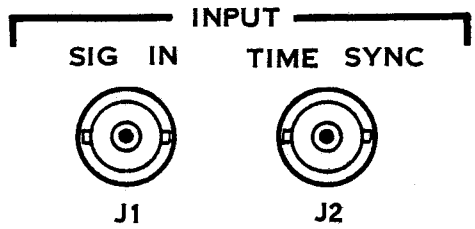
3.2.7 PWR Push Button/Indicator

Push to turn instrument power ON or OFF; lighted when on.

3.3 REAR PANEL FUNCTIONAL DESCRIPTION

Figure 3-2 is a rear view of the SD345. The following paragraphs briefly describe the function of each of the rear-panel connectors, switches, and power input components.

3.3.1 INPUT Group



SIG IN BNC Connector (J1)

Accepts the input analog data signal for analysis. Connected in parallel with the front-panel INPUT BNC connector.

TIME SYNC BNC Connector (J2)

Accepts external TTL level sync pulse for initiating the data load for Time Sync Averaging and Sync Spectrum functions.

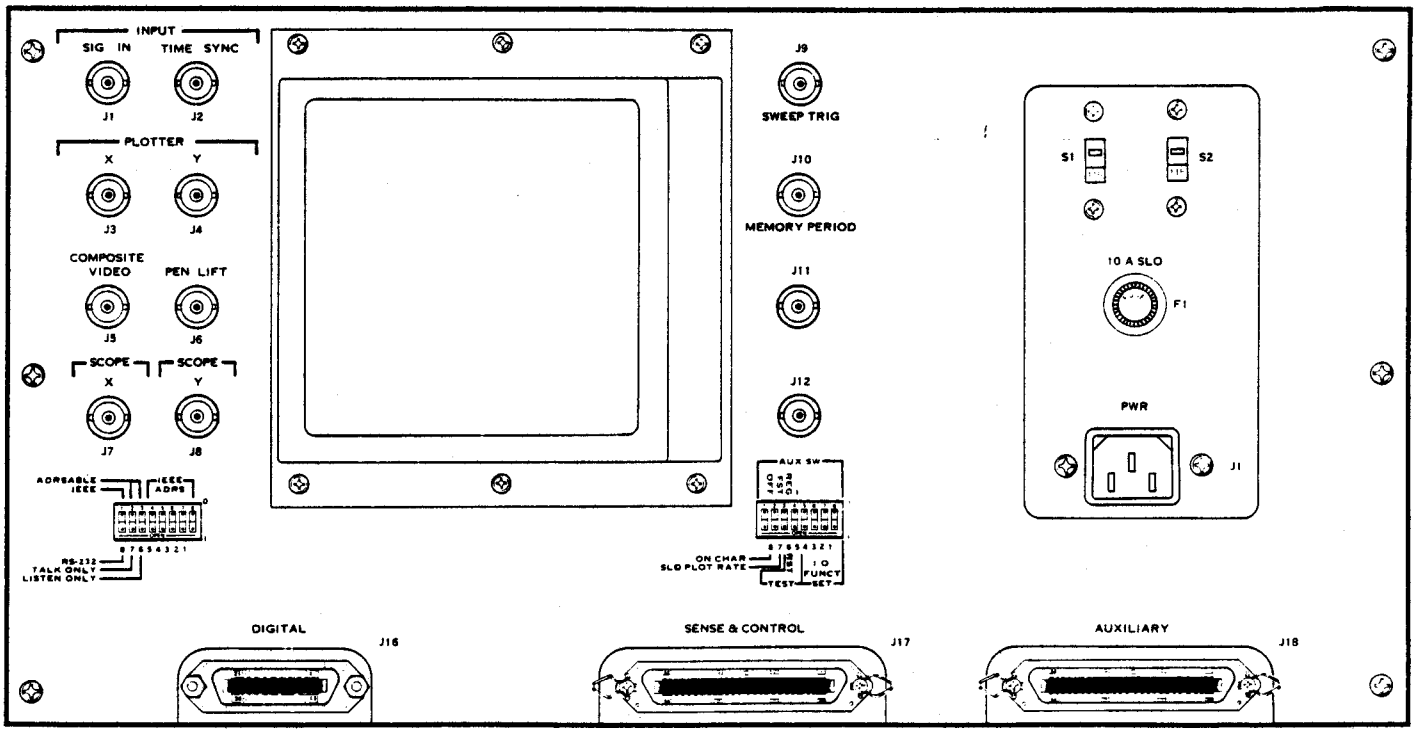
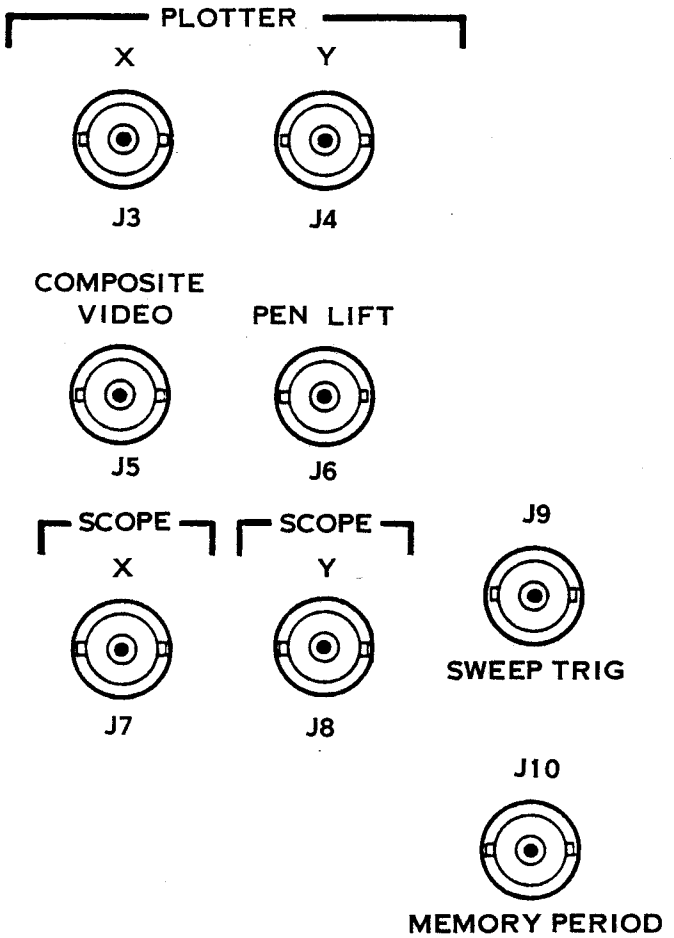


Figure 3-2. Model SD345 Rear Panel.

3.3.2 Output Group



PLOTTER X BNC Connector (J3)

Provides the X-axis output signal for an external X-Y recorder. When the FUNCTION group SPECT or M1,2 mode is selected, X-axis output corresponding to cursor location is available at this output.

PLOTTER Y BNC Connector (J4)

Provides the Y-axis output signal for an external X-Y recorder. When the FUNCTION group SPECT or M1,2 mode is selected, X-axis output corresponding to cursor location is available at this output.

COMPOSITE VIDEO BNC Connector (J5)

Provides a composite video signal for use with an external raster scan display or video hard copy recorder that requires a composite signal.

PEN LIFT BNC Connector (J6)

Provides contact closure to lower the pen on the X-Y recorder when the front-panel PLOTTER group START touch control is depressed.

SCOPE Y BNC Connector (J7)

Provides the Y-axis output signal for an external X-Y display unit.

SCOPE X BNC Connector (J8)

Provides the X-axis output signal for an external X-Y display unit.

SWEEP TRIG BNC Connector (J9)

Provides retrace blanking for an external X-Y display unit.

MEMORY PERIOD BNC Connector (J10)

Provides a TTL compatible pulse once every memory period for use with the SD25-80-1 and the TEK 611 oscilloscope or on equipment that requires sweep information be written only once every memory period.

3.3.3 Miscellaneous Group

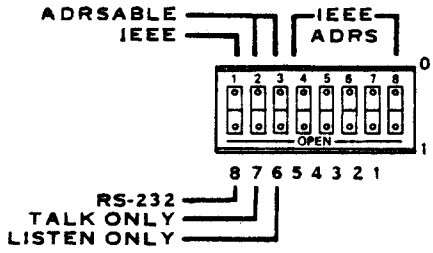
DIP Switches

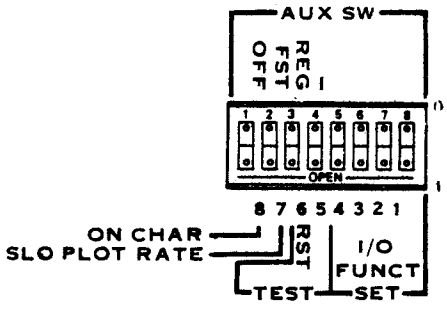
NOTE

There are two DIP switches located on the rear panel. Each of these switches actually consists of eight separate switches. Any labeling on the switches themselves should be disregarded. Any reference to the labeling of these switches refers to the labeling on the rear panel.

IEEE ADRS Switches (Switches 1 through 5)

These switches are used to select the IEEE address. The 0 and 1 located to the right of the switches denotes whether the switch is in the logical high or low position. Switch 1 represents the LSB of the address and the address is set up in positive true format, that is, the 1 position represents a binary '1' and the 0 position represents a binary '0'.





ADRSABLE/TALK ONLY/LISTEN ONLY Switches (Switches 6 and 7)

These switches select between the ADDRESSABLE, TALK ONLY, or LISTEN ONLY modes as follows:

SW7	SW6	
0	0	ADDRESSABLE
1	0	TALK ONLY
0	1	LISTEN ONLY
1	1	INVALID

IEEE/RS232 Switch (Switch 8)

This switch selects between IEEE and RS 232 operation.

NOTE

Switches 1 through 8 on the IEEE DIP Switch and switches 1 through 4 on the AUX SW DIP Switch are used only with units that have the '-3' Option installed. A brief explanation for the '-3' Option can be found in paragraph 1.5.3, Section I of this manual. Expanded information on the operation of these switches can be found in the '-3' Option Manual (Document No. 21188700) which is included with the '-3' Option.

AUX SW/ I/O FUNC SET Switches (Switches 1 through 4)

These switches are used to select the address to be used when the equipment is in the TALK ONLY or LISTEN ONLY modes of operation. The 0 and 1 located to the right of the switches denotes whether the switch is in the logical high or low position. Switch 1 represents the LSB of the address and the address is set up in positive true format, that is, the 1 position represents a binary '1' and the 0 position represents a binary '0'.

AUX SW/TEST Switches (Switches 5 and 6)

These switches are test functions. Information concerning the operation of these switches is contained in the Service Manual. When the equipment is not being tested or serviced, switches 5 and 6 should both be in the logical high position.

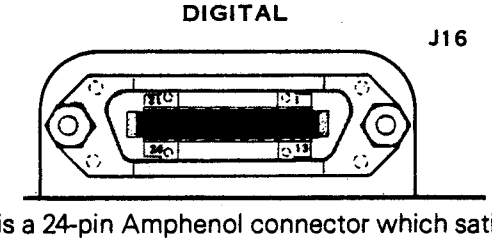
AUX SW/FST/SLO PLOT RATE Switch (Switch 7)

This switch selects plotter speed. If the 1/3 Octave Option is used while plotting, use only the SLO PLOT RATE position of this switch.

AUX SW/OFF/ON CHAR Switch (Switch 8)

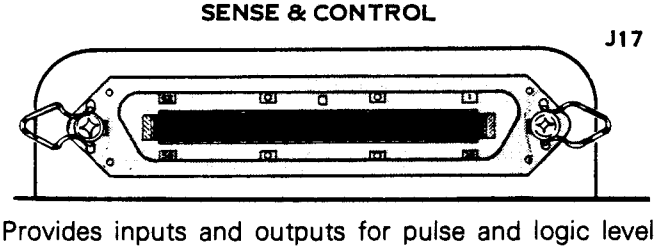
This switch turns the raster scan display alphanumerics (all the numbers and letters) on or off. The grid display and any input information displayed will remain.

DIGITAL Multipin Connector (J16)



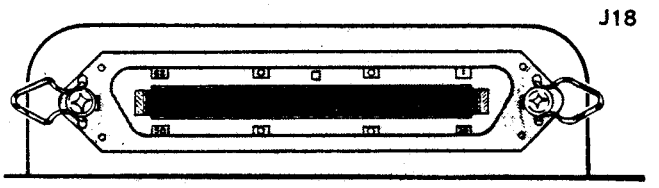
This is a 24-pin Amphenol connector which satisfies the requirements of Section 4 of IEEE Std. 488-1978. It provides interconnect to the GPIB. Refer to Table 3-1 for pin assignments.

SENSE & CONTROL Multipin Connector (J17)



Provides inputs and outputs for pulse and logic level control for the REMOTE mode of operation. Refer to Table 3-2 for pin assignments.

AUXILIARY Multipin Connector (J18)



Provides outputs for TEK 4632 Hard Copy Recorder and for an external raster scan display and Signature Ratio Adapter. Refer to Table 3-3 for pin assignments.

Table 3-1. DIGITAL Connector (J16) Pin Assignments.

Pin	Assignment
1	DI01
2	DI02
3	DI03
4	DI04
5	E01
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	GND A
13	DI05
14	DI06
15	DI07
16	DI08
17	REN
18	GND B
19	GND B
20	GND B
21	GND B
22	GND B
23	GND B
24	GND B

Table 3-2. SENSE & CONTROL Connector (J17) Pin Assignments.

Pin	Assignment
1	GND B
2	$\overline{\text{REMOTE PLOTTER RESET}}$
3	$\overline{\text{REMOTE MEM HOLD}}$
4	$\overline{\text{REMOTE AVG ERASE}}$
5	$\overline{\text{REMOTE + 1 AVG}}$

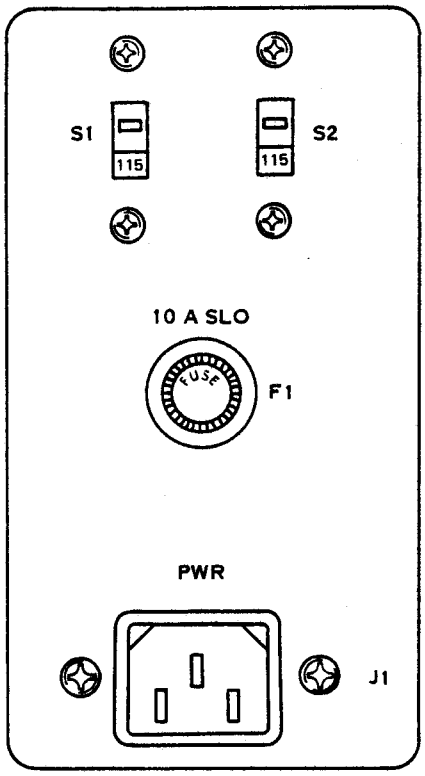
Table 3-2. SENSE & CONTROL Connector (J17) Pin Assignments. (Continued)

Pin	Assignment
6	$\overline{\text{REMOTE PLOTTER START}}$
7	DI05
8	DI01
9	DI03
10	DI02
11	DI04
12	DI06
13	RETRACE BLANK
14	$\overline{\text{REMOTE MEM TRANS}}$
15	END OF PLOTTER SWEEP OUT
16	$\overline{\text{REMOTE MEMORY UPDATE}}$
17	SWEEP RATE FEEDBACK DISABLE
18	SPARE
19	SCOPE X
20	$\overline{\text{REMOTE AVG START}}$
21	$\overline{\text{REMOTE BUFFERED}}$
22	SEL EXT SAMPLE
23	DC NORM/ACOUSTIC WTG
24	SYNC
25	CHASSIS GND
26	GND B
27	DATA TERMINAL READY
28	REQUEST TO SEND
29	TRANSMITTED DATA
30	RING INDICATOR
31	$\overline{\text{DI07}}$
32	$\overline{\text{SD346 OPER}}$
33	DI08
34	RECEIVED LINE SIGNAL DETECTOR
35	DATA SET READY
36	CLEAR TO SEND
37	RECEIVED DATA
38	TRANS COMPL BUFF
39	LINE CURSOR
40	PLOTTER SWEEP OUT
41	$\overline{\text{REMOTE TRANS ARM/RELEASE}}$
42	SINE DITHER DISABLE
43	OUT 1
44	SCOPE Y
45	DISPLAY REQUEST
46	MEM PERIOD
47	EXT TRANS CAPT TRIG
48	EXT SAMP FREQ
49	DISABLE F/P TRANS TRIGGER
50	SPARE

Table 3-3. AUXILIARY Connector (J18) Pin Assignments.

Pin	Assignment
1	GND A
2	VIDEO
3	GND A
4	SPARE
5	GND A
6	HORIZ DRIVE
7	GND A
8	SPARE
9	SPARE
10	GND A
11	SPARE
12	GND A
13	SPARE
14	SPARE
15	SPARE
16	HORIZ BLANK
17	SPARE
18	SPARE
19	SPARE
20	SPARE
21	SPARE
22	SPARE
23	SPARE
24	SPARE
25	SPARE
26	SPARE
27	SPARE
28	SPARE
29	SPARE
30	SPARE
31	SPARE
32	SPARE
33	SPARE
34	SPARE
35	SPARE
36	SPARE
37	SPARE
38	SPARE
39	SPARE
40	SPARE
41	SPARE
42	SPARE
43	SPARE
44	SPARE
45	SPARE
46	SPARE
47	SPARE
48	SPARE
49	SPARE
50	SPARE

3.3.4 Power Group



115/230 Switches (S1 and S2)

Provides switching of primary power input circuits for either 115 Vac or 230 Vac operation. Proper input voltage to be applied shows in windows. Both switches must always be in the same position.

Fuseholder (F1)

Accepts 3AG type SLO-BLO fuse, 10A.

PWR Connector (J1)

Accepts 3-wire plug and cable for applying 115/230 Vac, 47-65 Hz primary input power. Center terminal is chassis ground. Belden No. 17250 power cord is supplied for 115 Vac operation.

3.4 PRELIMINARY POWERING

The SD345 is designed to operate on either 115 Vac or 230 Vac, therefore, before applying power to the instrument, the following steps should be accomplished.

a. Check the rear panel transformer slide switches to ensure that they are in the proper position for the line voltage to be used. Both switches must be in the same position.

c. Ensure that the cooling fan air inlet is free from obstructions.

d. Low line voltage operation is explained in paragraph 2.4.1 subparagraph c.

After the proper voltage and fuse have been selected, insert the power cord and connect it to the primary power source. Depress the front-panel POWER push button/indicator. The indicator should light indicating that the instrument is ON.

3.5 FRONT PANEL CONTROL FAMILIARIZATION

The following paragraphs contain information to familiarize the operator with the front-panel controls and crt alphanumerics prior to operational checkout.

3.5.1 Initial POWER ON Condition

Figure 3-3 is an illustration of the Initial POWER ON display. The spectrum information displayed in Figure 3-3 is shown as an example and will not appear during Initial POWER ON unless an input signal is applied to the instrument. Figure 3-4 is an illustration of the Initial POWER ON Condition. This condition can be modified as explained in the paragraph for the PANEL STORE Touch Control located on page 3-7.

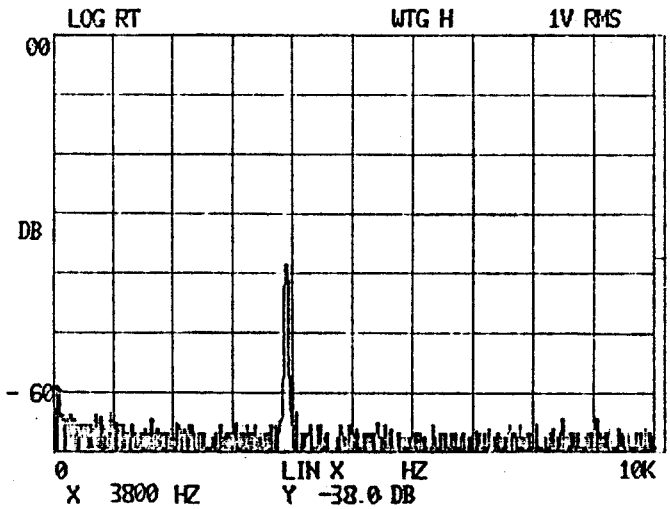


Figure 3-3. Initial POWER ON Display.

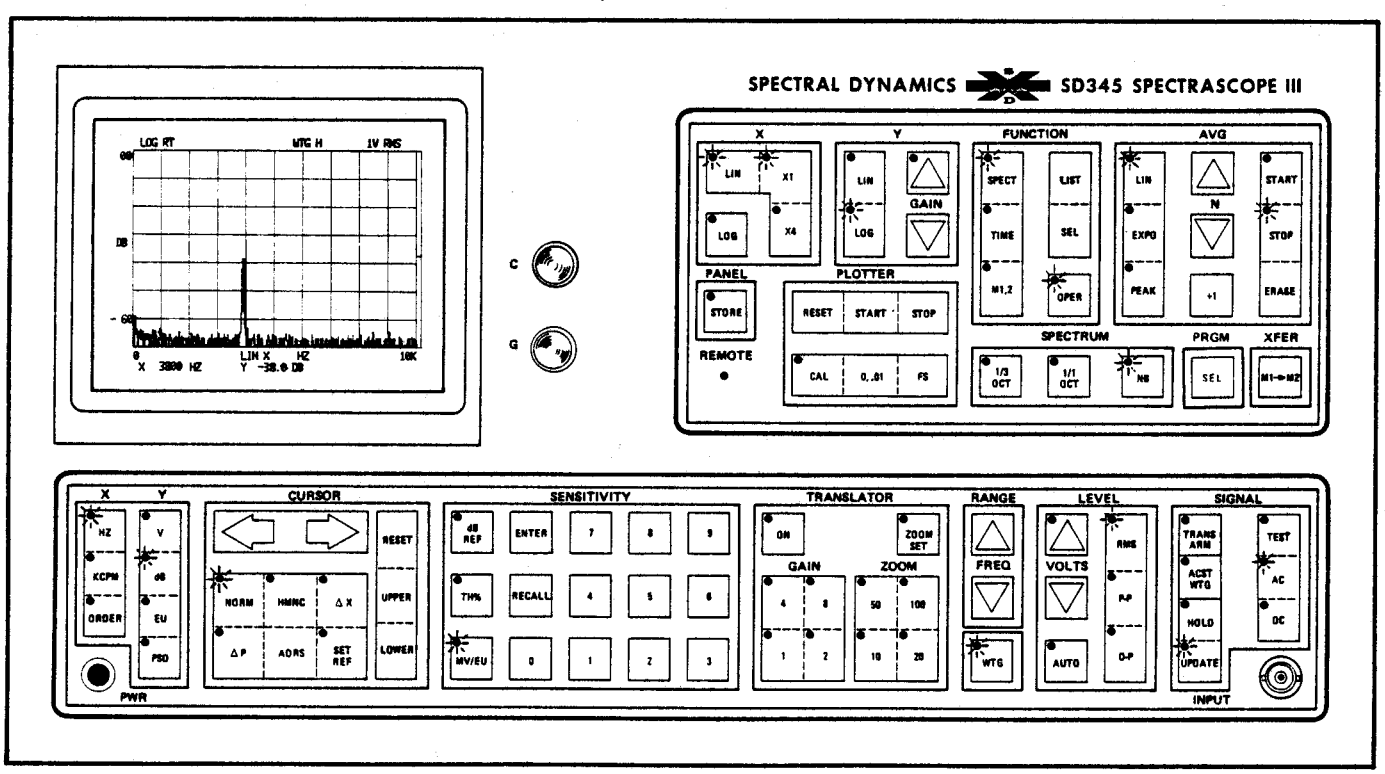
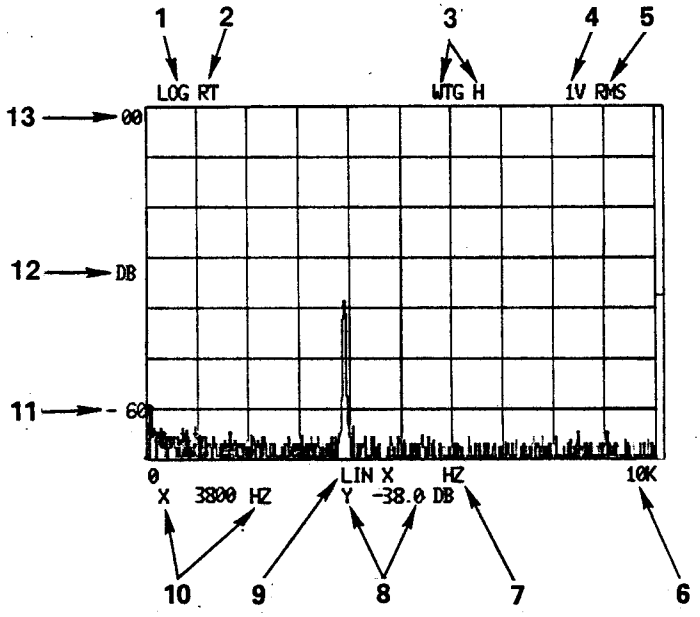


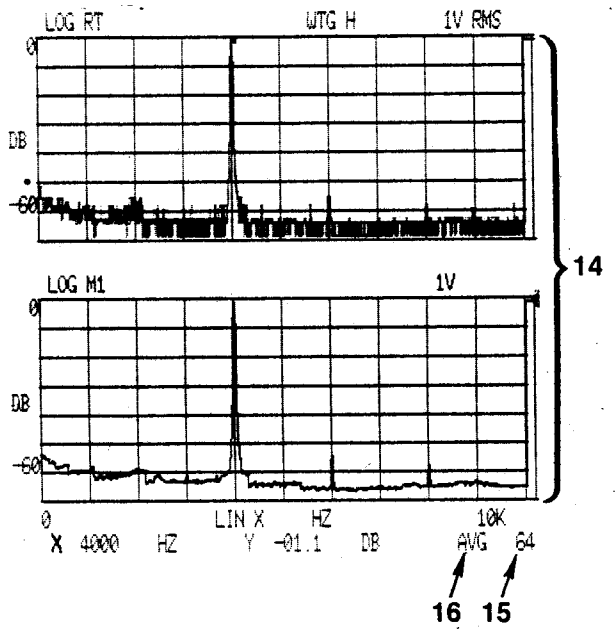
Figure 3-4. Front panel description of the Initial POWER ON Condition. LEDS with this indication ☼ should be lighted during Initial POWER ON.

3.5.2 Display and Control Familiarization

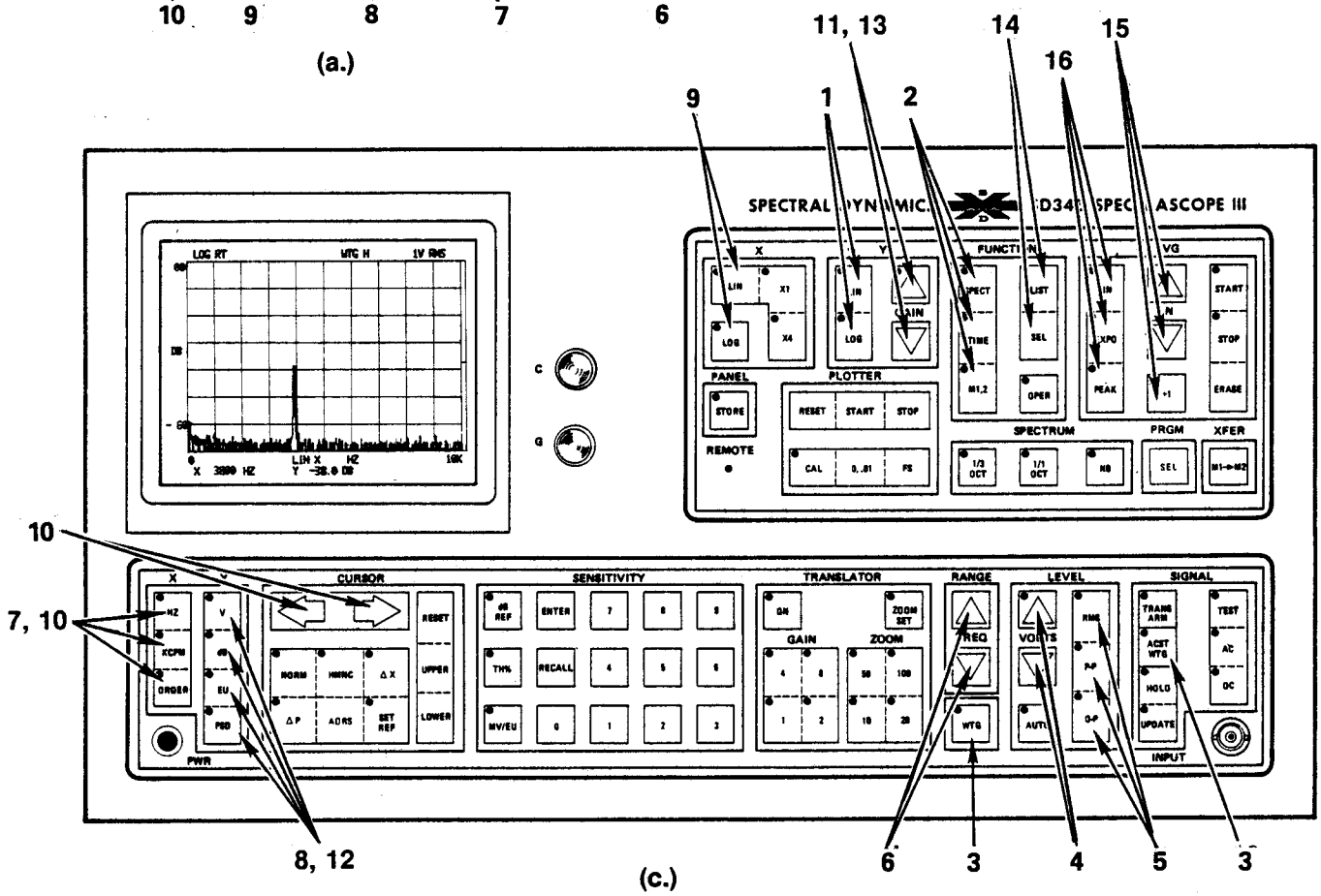
Figure 3-5 and Table 3-4 are provided to familiarize the operator with the function and display capabilities of the equipment.



(a.)



(b.)



(c.)

Figure 3-5. CRT Alphanumerics and Related Front-Panel Controls.

Table 3-4. Description of Figure 3-5a, b & c.

Display Information	Display Variation
1. Y-axis format of the spectrum information.	LIN or LOG
2. Representation of the display.	RT-Real Time M1-Active averager memory M2-Storage memory TIME-Input memory TIME AVG-Synchronous Time Averaging SYNC SPECT-Synchronous Spectrum
3. Weighting selected.	H-Hanning R-Rectangular ACT-Acoustic
4. Input level selected.	Eleven full scale ranges from 10mV to 20V in 1,2,5 sequence.
5. Voltage level measurement parameter.	RMS, O-P, P-P
6. Analysis frequency range or memory period.	Sixteen full scale ranges from 1 Hz to 100 kHz in 1,2,5 sequence. When the display is in the TIME mode, the full scale memory period displayed will be the reciprocal of the resolution of the full scale analysis range. For example, if the TIME mode is selected when the instrument is in the 10 kHz analysis range, the full scale memory period will be 40 milliseconds. The resolution in the 10 kHz analysis range is: 10 kHz/400 lines of resolution = 25 Hz. The reciprocal of 25 Hz = 1/25 = 40 mS.
7. X-axis display parameter.	Hz-X axis display information in Hertz. KCPM-X axis display information in kilocycles per minute. ORDER-Harmonic relationships in orders. SECONDS-Time in seconds or milliseconds.
8. Value at the Y-axis position of the cursor.	V-Volts dB-Decibels EU-Engineering units PSD-Power spectral density represented by EU^2/Hz.
9. X-axis format of the spectrum information.	LIN or LOG
10. Value at the X-axis position of the cursor.	Hz-X axis value in Hertz. KCPM-X axis value kilocycles per minute. ORDER-Cursor position in orders. MSECOND-Cursor position in milliseconds or seconds.

Table 3-4. Description of Figure 3-5a, b & c. (Continued)

Display Information	Display Variation
11. Scaled grid line corresponding to the selection described in **12.**	A numerical value in V, dB, EU or PSD.
12. Y-axis display parameter.	V-Y axis display information in Volts. dB-Y asix display information in decibels. EU-Y axis display information in engineering units. PSD-Y axis display information of power spectral density.
13. Full scale display value of the Y-axis parameter.	A numerical value in V, dB, Eu or PSD.
14. Example of a dual display combination.	Example is the SPECT mode, LIST combination 5. (refer to Figure 3-6, example **9.**)
15. Number of spectra averaged.	2 through 1024 ensembles in binary sequence or 1 through 1024 ensembles utilizing the +1 mode.
16. Averager Mode.	RT-Real Time AVG-Linear summation EXPO-Exponential PK-Peak

3.5.3 Display Combination Selection

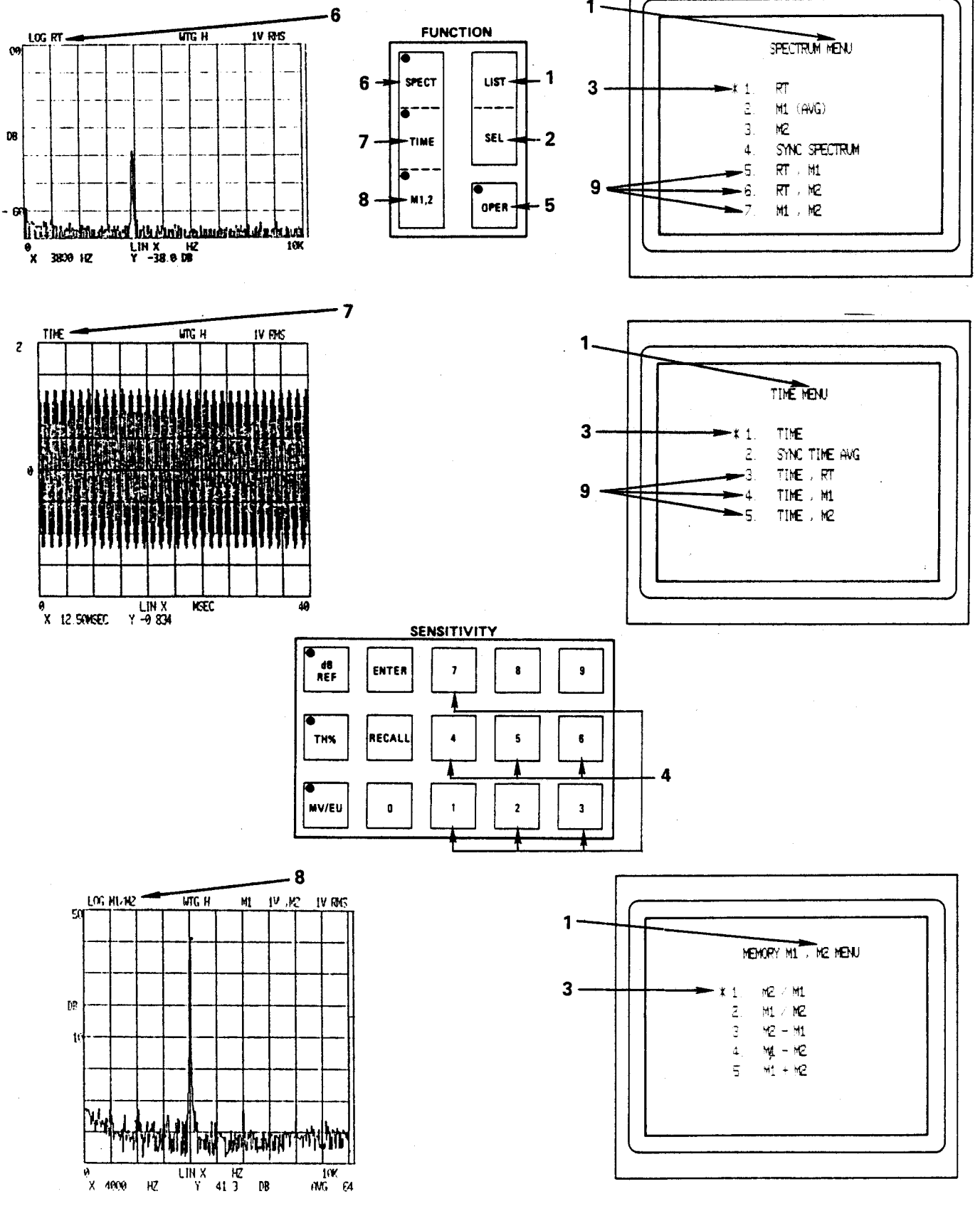


Figure 3-6. CRT Display Combinations and Controls.

1. One of the LEDS on touch controls **6, 7** or **8** will always be lighted. When LIST is depressed, the MENU information displayed will correspond to the lighted LED on touch controls **6, 7** or **8.**

2. The SEL touch control sequences through MENU selection without displaying the MENU and without random selection. For example, if the instrument is in the SPECT mode and it is desired to change from display 2 to display 1, the SEL touch control will have to be stepped from 2 through 7 and then to 1.

3. The asterisk indicates the display function that is selected. Changing the selection in the LIST or the SEL modes will move the asterisk to the display function selected by the operator.

4. When a MENU is displayed, SENSITIVITY keyboard numbers 1 through 7 are used to select the corresponding item on the MENU display.

5. After MENU selection is accomplished, depress the OPER touch control to display the desired information.

6. Depress this touch control to select the SPECT mode. There are seven different displays that can be selected in the SPECT mode. Selection can be performed by two methods. One is the LIST function (refer to **1**). The other method is the SEL function (refer to **2**).

7. Depress this touch control to select the TIME mode. There are five different displays that can be selected in the TIME mode. Selection can be made in the same manner as described in the SPECT mode.

8. Depress this touch control to select the MEMORY M1, M2 mode. There are five different displays that can be selected in this mode. Selection can be made in the same manner as described in the SPECT mode.

9. Dual display combinations.

NOTE

Use the LIST mode to display stored M1 and M2 information. *DO NOT* use the SEL mode to display stored M1 and M2 information.

3.5.4 SENSITIVITY Selection

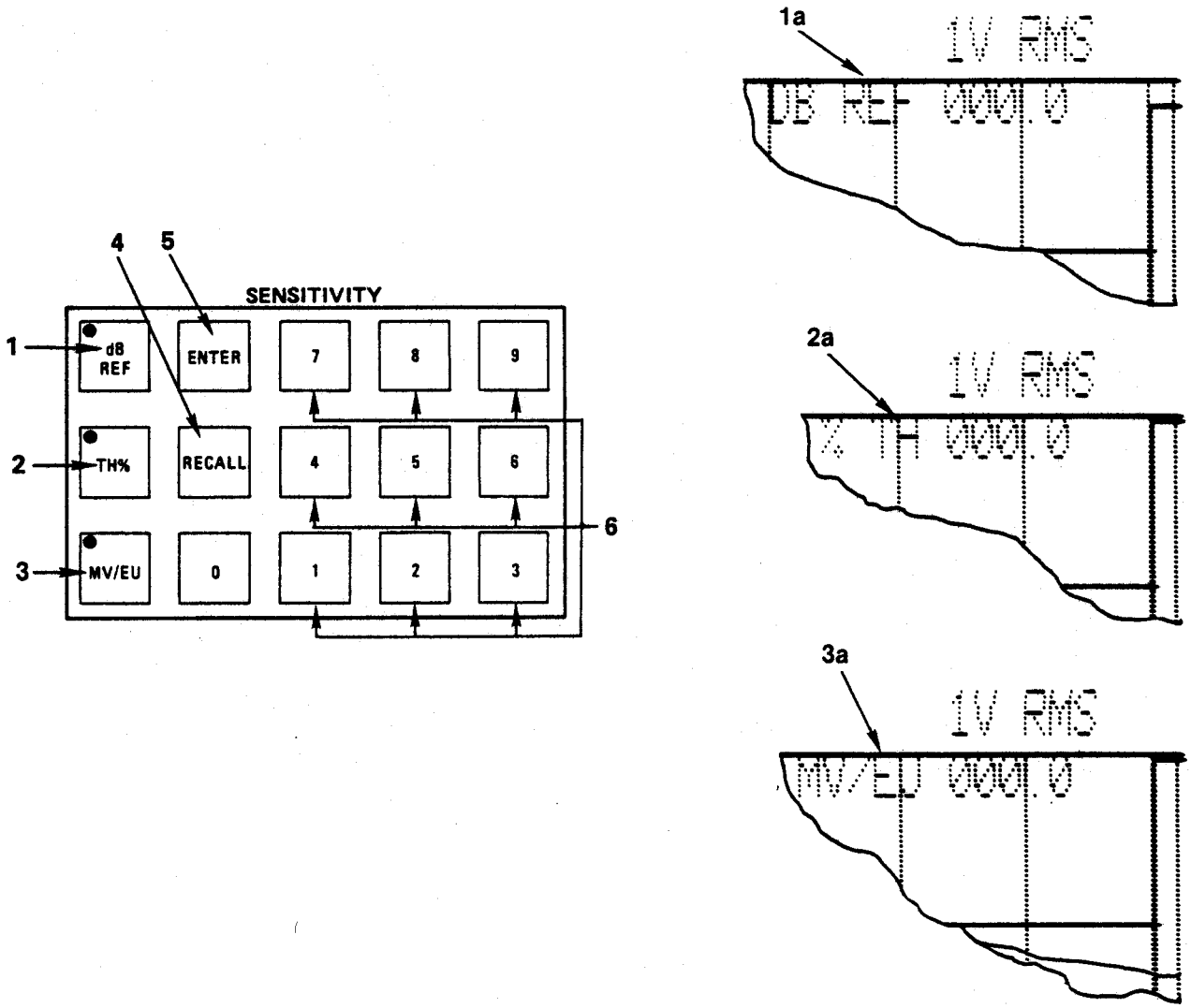


Figure 3-7. SENSITIVITY Group Touch Controls and Portions of the CRT Display.

1. This touch control is used to select dB reference at any point on the display. Depressing this control will light the LED on the dB REF control and the display will appear as shown in Figure 3-7, example **1a**. Move the cursor to the desired reference point and select the dB value via the keyboard numbered controls (refer to **6**). This is accomplished as follows: If it is desired to reference the selected point to 40 dB, depress the dB REF control, depress the number four on the keyboard and depress the zero twice. The display as illustrated in Figure 3-7, example **1a**, will now read dB REF 040.0. When this is accomplished, depress the ENTER control. The crt grid scaling will change to conform with the selected dB reference (refer to Figure 3-5a, **11, 12, 13**) and the information as illustrated in Figure 3-7, **1a** will disappear from the display after a few moments. If it is desired to recall the value entered, depress the dB REF control and then the RECALL control. dB REF cannot be selected while in the TIME, RT dual display mode of operation (refer to Figure 3-6).

2. This touch control is used to select threshold percentage for the transient capture function. Depressing this control will light the LED on the TH% control and the display will appear as shown in Figure 3-7, example **2a**. Selection, entering, recalling and changing values is the same as described in **1.**

3. This touch control is used to select transducer sensitivity in units of mV/EU. Depressing this control will light the LED on the mV/EU control and the display will appear as shown in Figure 3-7 example **3a.** Selection, entering, recalling and changing values is the same as described in **1.**

4. This touch control is used to recall the values selected by **1, 2,** or **3**. This is accomplished by first depressing controls **1, 2,** or **3**, and then by depressing the RECALL control. If the operator desires to change the selected sensitivity values, depress the dB REF, TH% or mV/EU touch controls, select the new value on the keyboard, then depress the ENTER touch control.

5. This touch control is used to enter the sensitivity values selected for functions **1, 2,** or **3**. After the desired values have been selected, depress the ENTER control.

6. The keyboard numbered touch controls have a dual function capability. The first function is to select values to be entered for dB reference, threshold percentage, or transducer sensitivity in mV/EU. The second function is described in paragraph 3.5.3, example **4.**

3.5.5 CURSOR Group Functions

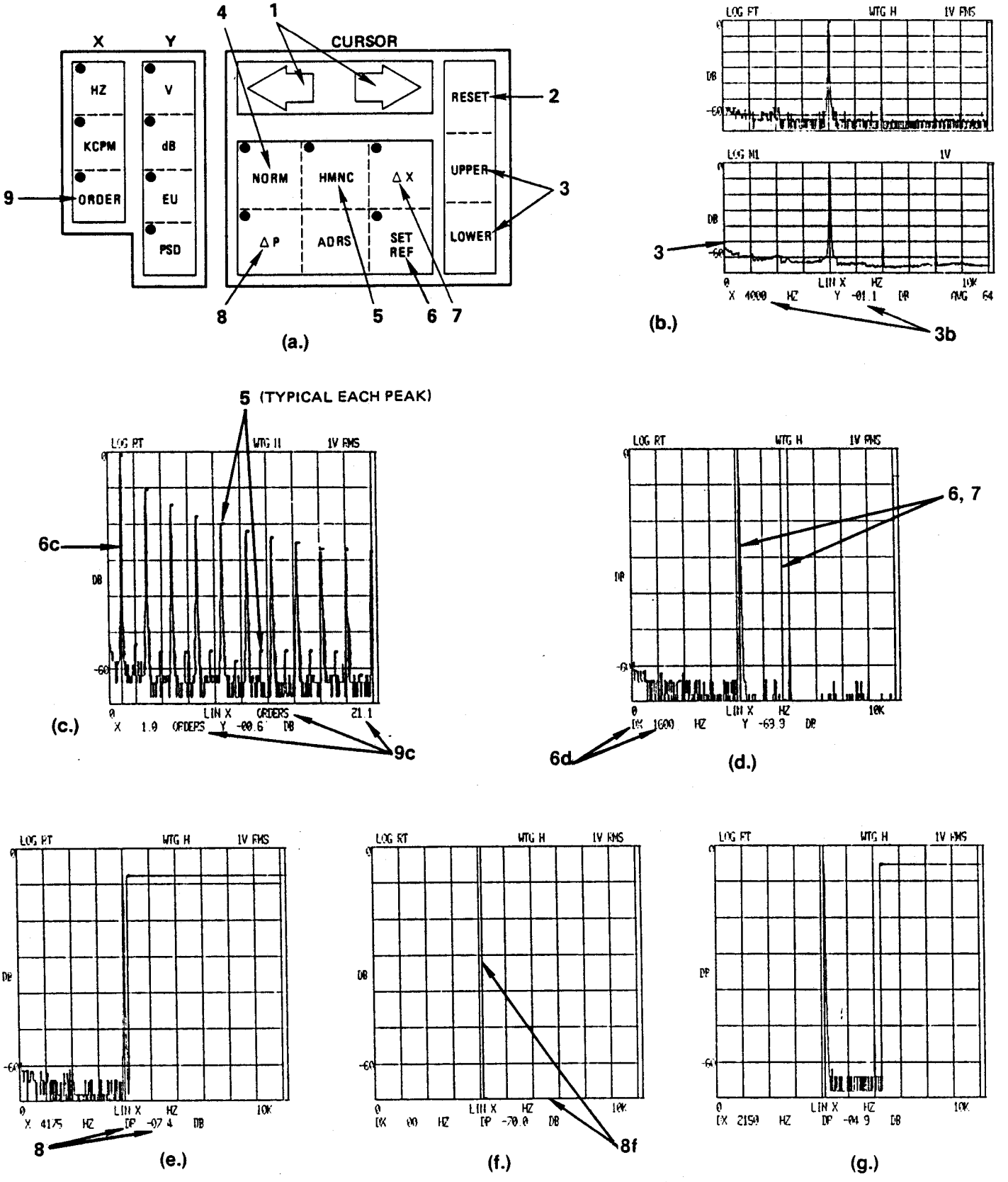


Figure 3-8. CURSOR Group Controls and Related Display Functions.

1. These touch controls move the cursor (intensified dot) to the left or right. Depressing either control once will move the cursor one cell to the left or right depending on which of the pointed controls are depressed. Depressing either one of the controls without releasing will cause a line cursor to appear and move in the desired direction until the control is released. As soon as the control is released, the line cursor will disappear.

2. This touch control resets the cursor to cell 1.

3. These touch controls place the cursor (intensified dot) on either the upper or lower trace in a dual display mode (refer to Figure 3-8b, **3**). When the cursor control is held in the depressed position, a line cursor will appear and move on both traces. The alphanumeric information on the bottom of the display will reflect value changes only for the trace where the cursor (intensified dot) is located (refer to Figure 3-8b, **3b**).

4. This touch control places the cursor (intensified dot) in the normal mode of operation.

5. This touch control places an intensified dot at all multiples of the cursor location (refer to Figure 3-8c, **5**). In most cases the intensified dots will not be perfectly aligned with the harmonics. To permit more precise alignment, the fundamental cursor now has a finer resolution of 256 parts per cell. Alignment can be achieved by moving the cursor control as required. After alignment is accomplished, depress the SET REF control (refer to Figure 3-8a, **6**). This freezes the positions of the intensified dots and a line cursor appears at the fundamental (refer to Figure 3-8c, **6c**). The line cursor (intensified dot plus vertical line) can now be moved to any of the 400 cell locations. Orders referenced to fundamental can now be read out on the crt alphanumerics (refer to Figure 3-8c, **9c**) by depressing the ORDER touch control (refer to Fiogure 3-8a, **9**).

6. The SET REF touch control is used in the harmonic mode as described in **5** and in the ΔX mode as described in **7.**

NOTE

Prior to using the ΔX mode, the CURSOR Group X units, Hz touch control must be depressed.

7. This touch control can be used in conjunction with the normal **4**, harmonic **5** and ΔP **8** modes. The ΔX, ΔP combination will be discussed in explanation **8.** When ΔX is selected in the NORM mode, a permanent line cursor will appear with the intensified dot. If SET REF is not depressed, the instrument will be in the NORM mode with a permanent line cursor. If SET REF is depressed after ΔX is depressed, the line cursor will become frozen at its present position and another line cursor accompanied by the intensified dot will appear when the cursor is moved to the left or right (refer to Figure 3-8d, **6, 7**). The X-axis value will be referenced to the frozen line cursor and the X-axis cursor values will be designated DX representing the difference between the frozen line cursor and the movable line cursor (refer to Figure 3-8d, **6d**). The ΔX mode can also be utilized while the instrument is in the HMNC, SET REF mode. This is accomplished as follows: After performing the functions as described in **5**, move the cursor to the desired point on the display. Depress ΔX. The SET REF LED will go out. Depress SET REF. The SET REF LED will come back on. ΔX will not function as described in the NORM mode. To go back to the original HMNC, SET REF condition, depress SET REF then depress HMNC. The instrument will return to the original HMNC, SET REF setting. Note that while in the ΔX NORM, ΔX HMNC or ΔX ΔP modes that HZ, KCPM and ORDERS will read zero at the frozen cursor position.

8. This touch control provides a summation of the rms value of the power level of all the displayed information to the left of the cursor regardless of its position on the display (refer to Figure 3-8e). The Y-axis cursor value will be designated DP representing the rms value of the displayed spectrum information (refer to Figure 3-8e, **8**). Moving the cursor will vary the power level. The ΔX mode can also be used in conjunction with ΔP. This is accomplished as follows: Position the cursor at the desired location. Depress ΔX, SET REF and ΔP in that order. The display will appear as a solid vertical line and a solid horizontal base line as shown in Figure 3-8f, **8f**. Moving the cursor to the right will cause the display to appear as shown in Figure 3-8g.

9. This touch control displays the X-axis location of the cursor in terms of its harmonic relationship to the fundamental component when the instrument is in the harmonic mode of operation (refer to Figure 3-8c).

3.5.6 Operational Notes

The following subparagraphs contain answers to some of the most often asked questions concerning the operation of the SD345.

a. If the cursor is located in cell 1 and the CURSOR Group ORDER touch control is selected, the full scale annotated order number is not correct and should be ignored. Correct full scale orders are annotated for cells 2 through 400.

b. The full scale EU and PSD may not correspond to the full scale voltage depending upon the MV/EU sensitivity entered. The analyzer will select the closest and correct full scale EU or PSD value in a 1, 2, 5 sequence. In all cases, the data is correctly scaled.

c. PSD is always scaled for rms data. For valid PSD readouts, the data must always be collected with the Input Group RMS touch control selected. PSD cannot be selected in the Integrate or Differentiate modes.

d. The level of the Overall signal is always calculated, displayed and scaled for rms. Therefore, the level of the Overall signal height will be lower in displayed amplitude than the highest narrowband spectrum peak when the O-P or P-P Input Level parameter is selected.

e. If the Digital Translator ('-1' Option) is installed and used in the Time mode, the translated time domain cursor readouts should be ignored.

f. EU and PSD scaling and cursor readouts are not valid if no value for MV/EU is entered after Power On. If a self test is performed after Power On, 10 MV/EU is the default sensitivity and is automatically selected and entered.

g. Time mode display with the TH% selected — The cursor readouts always indicate data values at the threshold crossing regardless of where the cursor is located. Select MV/EU to read any part of the displayed time mode waveform with the cursor.

h. Sensitivity values for dB REF, TH% and MV/EU are not retained in the PANEL STORE mode. These values must be re-entered after Power On.

i. LOG X Display — The display freezes whether in SINGLE or DUAL display mode when PLOTTER RESET is depressed. The display does not freeze when LIN X1 is selected.

j. If LIN X4 expansion is required while plotting, select LIN X4 before selecting PLOTTER RESET. If PLOTTER RESET is selected first, the display freezes and data is not expanded, yet the X-axis annotation will say that it is. PLOTTER RESET freezes the X4 display. If PLOTTER START, STOP and START are depressed in that sequence, the plotter will move all the data through the X4 display window.

k. PSD cannot be selected in the P-P or O-P modes. The RMS mode must be selected for PSD. Also, after PSD is selected, the P-P and O-P modes cannot be selected.

l. Full scale grid annotation and data trace position on the display will not change between certain successive Input Level changes when displaying dB REF. The transition points are *data dependent.*

m. Crt annotation reads DBR to the left of the grid when dB REF is selected.

n. During active LIN averaging, if the average number is reduced it can cause an improperly normalized display.

o. Grid annotation is limited to E-9 (1×10^{-9}) and readouts/scaling to E±11 ($1 \times 10^{\pm 11}$). The general rule is: TRY TO KEEP READOUTS TO E±11, AND BE CAUTIOUS OF READOUTS OUTSIDE THIS RANGE.

p. The Integration mode is disabled for the Translator and 1/3 Octave Options.

q. No Translated KCPM readouts.

r. Frequency and Translated annotation are not stored with M1 or M2 data.

s. DB REF cannot be set in the FUNCTION group, M1,2 mode.

t. Changing the Input Level or Analysis Range during averaging will cause erroneous data.

u. Time Mode — Translated — Displays all of the imaginary components of the zoom (Translated) time data, and SEC/MSEC alphanumeric readout is meaningless.

v. If the Average function is in progress, and the Menu is used to step through the displays, the average can be lost. There is no interlock between Time/Spectrum data.

w. Integration andΔP are incompatible.

x. Digital overall and integration are incompatible, and therefore overall is set to a small number.

y. The intensified dots that appear when ORDERS are selected do not appear when the Translator Option is used.

3.6 OPERATIONAL CHECKOUT

The following paragraphs contain an operational checkout of the Model SD345. The procedures should be accomplished before and after calibration or maintenance is performed. It is also recommended as a performance check upon receipt of the instrument. The operator should become thoroughly familiar with the front and rear panel descriptions given in this section before performing the operational checkout.

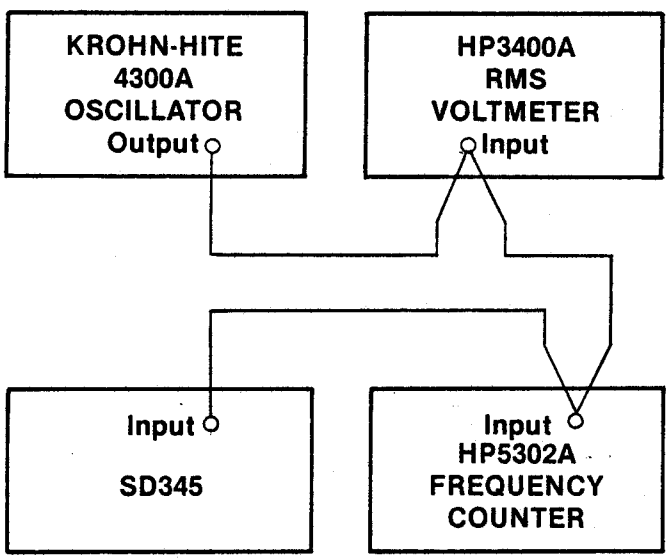
3.6.1 Setup

Equipment required for the checkout is given in Table 3.5. Instruments with equal or better operational characteristics may be substituted.

Table 3-5. Equipment Required

Name	Model No.	Manufacturer
Oscillator (Signal Gen.)	4300A	Krohn-Hite
RMS Voltmeter	3400A	Hewlett Packard
Frequency Counter	5302A/5300A	Hewlett Packard

a. Interconnect the test equipment to the instrument as shown below:



b. Apply power to all units and allow approximately fifteen minutes warm-up time before proceeding.

c. Select the controls on the SD345 as indicated below:

RANGE, FREQ	10K
VOLTS	1
LEVEL	RMS
SENSITIVITY GROUP	MV/EU
DISPLAY Y-GAIN	LOG (Left side of graticule should read 0 and −60 dB. If this condition is not displayed, depress the GAIN controls until the proper attenuation is displayed.)
DISPLAY X-GAIN	LIN, X1
CURSOR GROUP	NORM
AVG N	16 (The selected number of averages is not displayed in SPECTRUM MENU, combination 1. To display the average number selected, select SPECTRUM MENU, combination 2. The number of averages will appear in the lower right cornor of the crt just below the selected frequency range. After the proper number of averages has been selected, return to SPECTRUM MENU, combination 1.)

d. Adjust the crt Contrast and Grid controls for the best presentation.

e. Adjust the Signal Generator to provide a 4 kHz sine wave at 1 Vrms ±30 mVrms.

f. Insure that SPECTRUM MENU combination 1 is selected and observe a full scale spectrum display on the crt with the overall signal displayed at the extreme right.

g. Carefully adjust the frequency of the input signal for a symmetrical display. Re-adjust the amplitude of the input signal to 1 Vrms ±30 mVrms.

3.6.2 Linearity Check

a. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the spectrum on the crt display. Depress the CURSOR group Y units V control. Observe that the alphanumeric Y-axis value reads 1.000 Vrms (0.970 to 1.030 Vrms).

b. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the overall signal on the crt display. Observe that the alphanumeric Y-axis value reads 1.000 Vrms (0.970 to 1.030 Vrms).

c. Select the 10 Vrms range via the LEVEL, VOLTS controls. Depress the CURSOR group RESET control to reset the cursor to the start of the trace. Depress the CURSOR group Y units dB control. Utilizing the DISPLAY Y GAIN controls, step through all seven GAIN positions and observe that the alphanumeric Y-axis values read as shown in Table 3-6.

Table 3-6. GAIN Selection

GAIN Selection	Graticule Reading	Y-Axis Value
0 dB Gain-Display	0 dB to -60 dB	Below -60 dB
10 dB Gain-Display	-10 dB to -70 dB	Below -60 dB
20 dB Gain-Display	-20 dB to -80 dB	Below -60 dB
30 dB Gain-Display	-30 dB to -90 dB	Below -60 dB
10 dB Atten-Display	+10 dB to -50 dB	-60 dB
20 dB Atten-Display	+20 dB to -40 dB	-50 dB
30 dB Atten-Display	+30 dB to -30 dB	-40 dB

d. Readjust the Signal Generator for an output of 10mVrms. Select the 0.01 Vrms range via the LEVEL, VOLTS controls. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the spectrum on the crt display.

e. Refer to Table 3-7 and for the first three positions of the VOLTS control (0.01V, 0.02V, and 0.05V), compare the alphanumeric display reading (refer to paragraph 3.5.2, example 8) with that listed in the SPECTRUM column of the table.

f. Return the VOLTS control to the 0.01 Vrms range. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the overall signal on the crt display. Repeat step e, comparing the alphanumeric display reading with that listed in the OVERALL column on the table.

g. Return the VOLTS control to the 0.01 Vrms range. Operate the CURSOR LEFT/RIGHT control to the left until the X-axis value reads 4200 Hz (200 Hz to the right of the input signal). Depress the CURSOR group P control. Repeat step e, comparing the alphanumeric display reading with that listed in the P column on the table.

h. Depress the CURSOR group NORM control.

i. Readjust the Signal Generator for an output of 100 mVrms. Select the 0.1 Vrms range scale via the LEVEL, VOLTS controls. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the spectrum on the crt display.

Table 3-7. Spectrum, Overall and ΔP Linearity

Volts	Atten	Spectrum	Overall	ΔP
(10 mV input)				
0.01	0 dB	0.0 dB ± 0.2 dB	0.0 dB ± 0.2 dB	0.0 dB ± 0.2 dB
0.02	-6 dB	-06.0 dB ± 1.0 dB	-06.0 dB ± 1.0 dB	-06.0 dB ± 1.0 dB
0.05	-14 dB	-14.0 dB ± 1.0 dB	-14.0 dB ± 1.0 dB	-14.0 dB ± 1.0 dB
(100 mV input)				
0.1	0 dB	0.0 dB ± 0.2 dB	0.0 dB ± 0.2 dB	0.0 dB ± 0.2 dB
0.2	-6 dB	-06.0 dB ± 1.0 dB	-06.0 dB ± 1.0 dB	-06.0 dB ± 1.0 dB
0.5	-14 dB	-14.0 dB ± 1.0 dB	-14.0 dB ± 1.0 dB	-14.0 dB ± 1.0 dB
1	-20 dB	-20.0 dB ± 1.0 dB	-20.0 dB ± 1.0 dB	-20.0 dB ± 1.0 dB
2	-26 dB	-26.0 dB ± 1.0 dB	-26.0 dB ± 1.5 dB	-26.0 dB ± 1.5 dB
5	-34 dB	-34.0 dB ± 1.0 dB	-34.0 dB ± 3.0 dB	-34.0 dB ± 3.0 dB
10	-40 dB	-40.0 dB ± 1.0 dB	-40.0 dB ± 3.0 dB	-40.0 dB ± 3.0 dB
20	-46 dB	-46.0 dB ± 1.0 dB	-46.0 dB ± 3.0 dB	-46.0 dB ± 3.0 dB

j. Refer to Table 3-7 and for the last eight positions on the VOLTS control (0.1V, 0.2V, 0.5V, 1V, 2V, 5V, 10V, and 20V), compare the alphanumeric display reading (refer to paragraph 3.5.2, example 8) with that listed in the SPECTRUM column of the table.

k. Return the VOLTS control to the 0.1 Vrms range. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the overall signal on the crt display. Repeat step j, comparing the alphanumeric display reading with that listed in the OVERALL column on the table. For each of the last three voltage ranges, (5V, 10V, and 20V), insure that the AVG group LIN control is depressed (LED lighted) and then initiate averaging by first depressing the ERASE control and then the START control.

l. Return the VOLTS control to the 0.1 Vrms range. Operate the CURSOR LEFT/RIGHT control to the left until the X-axis value reads 4200 HZ (200 Hz to the right of the input signal). Depress the CURSOR group P control. Repeat step j, comparing the alphanumeric display reading with that listed in the P column on the table.

m. Depress the CURSOR group NORM control.

3.6.3 Alphanumeric Display (Hz and KCPM) Check

a. Insure that the SIGNAL group UPDATE control is selected (LED lighted).

b. Depress the SIGNAL group TEST control.

c. In the PLOTTER group, depress the CAL control and then the FS control.

d. For each selection of the RANGE, FREQ controls, place the CURSOR group X units controls first in the HZ position and then in the KCPM position. Observe the alphanumeric display readings (refer to paragraph 3.5.2, example 10.) in each frequency range selection and compare them with the readings listed in the FULL SCALE column of Table 3-8.

e. Depress the PLOTTER group CAL control once to remove the CAL, FS signal. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the TEST signal fundamental on the crt display.

f. For each selection of the RANGE, FREQ controls, place the CURSOR group X units controls first in the Hz position and then in the KCPM position. Observe the alphanumeric display

Table 3-8. Alphanumeric Display Readings (Hz and KCPM)

Freq Range	Full Scale		Test Sig Fund		Cell 1	
	Hz	KCPM	Hz	KCPM	Hz	KCPM
100K	100000	6000	64000	3840	250	15
50K	50000	3000	32000	1920	125	7.5
20K	20000	1200	12800	768	50	03
10K	10000	600.0	6400	384.0	25	1.5
5K	5000.0	300.00	3200.0	192.00	12.5	0.75
2K	2000	120.0	1280	76.8	05	0.3
1K	1000.0	60.00	640.0	38.4	2.5	0.15
500	500.00	30.000	320.00	19.200	1.25	0.075
200	200.0	12.00	128.0	7.68	0.5	0.03
100	100.00	6.000	64.0	3.84	0.25	0.015
50	50.000	3.0000	32.000	1.9200	0.125	0.0075
20	20.00	1.200	12.80	0.768	0.05	0.003
10	10.000	0.6000	6.400	0.3840	0.025	0.0015
5	5.0000	0.3000	3.2000	0.1920	0.0125	0.0007
2	2.000	0.1200	1.280	0.0768	0.005	0.0003
1	1.000	0.0600	0.6400	0.0384	0.0025	0.0001

readings (refer to paragraph 3.5.2, example 10.) in each frequency range selection and compare them with the readings listed in the TEST SIG FUND column of Table 3-8.

g. Depress the CURSOR group RESET control to reset the cursor to cell 1.

h. For each selection of the RANGE, FREQ controls, place the CURSOR group X units controls first in the HZ position and then in the KCPM position. Observe the alphanumeric display readings (refer to paragraph 3.5.2, example 10.) in each frequency range selection and compare them with the readings listed in the CELL 1 column of Table 3-8.

3.6.4 Alphanumeric Display (ORDERS) Check

a. Depress the SIGNAL group AC control to remove the test signal.

b. Select the 20K analysis range via the RANGE, FREQ controls. Adjust the signal generator to provide a square wave at 950 Hz ± 3 Hz.

c. Select the 0.1 Vrms range via the LEVEL, VOLTS controls and adjust the output of the signal generator to approximately 100 mVrms (no overload indicated on the LED located on the upper left corner of the Display Y GAIN touch control).

d. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the fundamental on the crt display. Depress the CURSOR group HMNC control and observe that intensified dots appear at all multiples (harmonics) of the cursor location.

e. Operate the CURSOR LEFT/RIGHT control left or right to place all the intensified dots on the peaks of their associated harmonics. (In this mode, the cursor will move at a rate of 1/256 times normal speed for finer resolution.)

f. Depress the CURSOR group SET REF control to freeze the dots. Observe that a vertical line cursor appears along with the intensified dot on the peak of the fundamental.

g. Depress the CURSOR group X units ORDER control and observe that the alphanumeric display reads 1.0 ORDERS (refer to Figure 3-8, example 9c).

h. Depress the Display X group X4 control and observe that the crt display expands 12.5 percent of the X-axis spectrum on either side of the cursor. Depress the Display X group X1 control.

i. Operate the CURSOR LEFT/RIGHT control to move and accurately position the line cursor so that it coincides with the intensified dot on the peak of the second harmonic (order). Observe that the alphanumeric display reads the correct order (2.0). (The second harmonic will be the low signal between the first and third. The odd harmonics will have the highest amplitude.)

j. Repeat step i for each of the 21 harmonics (orders) on the crt display and in each case observe that the alphanumeric display reads the correct order.

3.6.5 Alphanumeric Display (V) Check

a. Depress the following controls as indicated:

PLOTTER GROUP	CAL, FS
DISPLAY X GROUP	LIN, X1
CURSOR GROUP	NORM
CURSOR GROUP Y UNITS	V
CURSOR GROUP X UNITS	HZ

b. For each position of the LEVEL, VOLTS control, compare the alphanumeric display readings with the readings listed in the CAL, FS column of Table 3-9.

NOTE

Values with the indication E-1 or E1 indicate scientific notation. For example: 5.00 E-4 translates to 5×10^{-4} and 2.00 E3 translates to 2×10^{3}.

Table 3-9. Alphanumeric Display Readings (V).

Level, Volts	CAL, FS	CAL, 0,.01
0.01	1.00 E-2	1.00 E-4
0.02	2.00 E-2	2.00 E-4
0.05	5.00 E-2	5.00 E-4
0.1	0.100	1.00 E-3
0.2	0.200	2.00 E-3
0.5	0.500	5.00 E-3
1	1.000	1.00 E-2
2	2.000	2.00 E-2
5	5.000	5.00 E-2
10	10.00	0.100
20	20.00	0.200

c. Depress the PLOTTER GROUP 0,.01 control.

d. For each position of the LEVEL, VOLTS control, compare the alphanumeric display readings with the readings listed in the CAL, 0,.01 column of Table 3-9.

3.6.6 Alphanumeric Display (dB) Check

a. Insure that the PLOTTER group CAL, 0,.01 controls are selected. Depress the CURSOR group Y units dB control. Observe that the Y-axis value reads −40.0 dB.

b. Depress the Display Mode Y, LIN control and observe that the Y-axis value reads −70.0 dB. Depress the Display Mode Y, Log control.

c. Depress the PLOTTER group FS control and observe that the Y-axis value reads 0.0 dB.

d. Refer to paragraph 3.5.4 Example 1 and enter the following values for dB reference and observe that the Y-axis values as described in paragraph 3.5.2 Example 8, match the SENSITIVITY reference settings as described in paragraph 3.5.4 Example 1 and 1a:

1. 0.0 to 1.0 in steps of 0.1
2. 1.0 to 10.0 in steps of 1.0.
3. 10.0 to 100.0 in steps of 10.0.

e. In the LEVEL, VOLTS group, select the 20V range and insure that the RMS control is selected.

f. On the SENSITIVITY group keyboard, select and enter a dB reference of 200.0.

g. For each selection of the VOLTS control, compare the alphanumeric Y-axis value and upper graticule reading with the dB REF given in the following table:

Volts	dB Ref
20	200.0
10	194.0
5	188.0
2	180.0
1	174.0
0.5	168.0
0.2	160.0
0.2	154.0
0.05	148.0
0.02	140.0
0.01	134.0

Alphanumeric Display (EU) Check

a. Depress the following controls:

CURSOR GROUP Y UNITS	EU
SENSITIVITY GROUP	MV/EU
SENSITIVITY KEYBOARD	001.0 (Refer to paragraph 3.5.4 for selecting and entering values.)
PLOTTER GROUP	CAL, FS

b. For each of the VOLTS ranges, compare the Y axis alphanumeric readings with the EU readings given in the CAL, FS column of Table 3-10.

c. Depress the PLOTTER group 0,.01 control. For each of the VOLTS ranges, compare the Y axis alphanumeric readings with the EU readings given in the CAL, 0,.01 column of Table 3-10.

Table 3-10. Alphanumeric Display Readings (EU).

Volts	CAL, FS	CAL, 0,.01
0.01	10.00	200.0
0.02	20.00	0.200
0.05	50.00	0.500
0.1	100.0	1.000
0.2	200.0	2.000
0.5	500.0	5.000
1.0	1000	10.00
2.0	2000	20.00
5.0	5000	50.00
10.0	1.00 E4	100.0
20.0	2.00 E4	200.0

d. Select 1 Vrms via the LEVEL, VOLTS controls. Depress the PLOTTER group CAL, FS controls. For each SENSITIVITY selected via the SENSITIVITY KEYBOARD as shown in the following table, compare the Y axis alphanumeric display

readings with the readings listed in the second column of the following table:

Sensitivity (mV/EU)	EU Reading
0.0	1000
0.5	1000
1.0	1000
2.0	500.0
3.0	500.0
4.0	500.0
5.0	200.0
6.0	200.0
10.0	100.0
20.0	50.00
50.0	20.00
100.0	10.00
200.0	5.000
500.0	2.000

e. Depress the PLOTTER group CAL control once to remove the CAL, FS signal.

f. Select and enter a value of 001.0 for MV/EU via the SENSITIVITY KEYBOARD.

g. Adjust the signal generator to provide a 4KHz sine wave at 1 Vrms ± 0.005 Vrms. Carefully adjust the frequency of the signal generator for a symmetrical spectrum display. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the spectrum on the crt display.

h. For each setting of the SENSITIVITY KEYBOARD controls shown in the following table, compare the alphanumeric display readings with the listed EU readings. As each new SENSITIVITY selection is made, observe the automatic attenuation of the spectrum on the crt display. This automatic attenuation is designed to achieve full scale of 1,2,2.5,4 or 5 sequence.

NOTE

The amount of attenuation can be observed by switching the CURSOR group Y units controls between dB and EU.

Sensitivity (mV/EU)	Alphanumeric Y Axis Values	
12.3	81.30	(79.60 to 83.00)
23.4	42.70	(41.70 to 43.70)
34.5	29.00	(28.40 to 29.60)
45.6	21.90	(21.40 to 22.40)
56.7	17.64	(17.24 to 18.00)
67.8	14.75	(14.45 to 15.05)
78.9	12.67	(12.37 to 12.97)
89.0	11.24	(10.94 to 11.54)
90.1	11.10	(10.80 to 11.40)
109.0	9.170	(8.970 to 9.370)
210.0	4.760	(4.660 to 4.860)
321.0	3.120	(3.060 to 3.180)
432.0	2.310	(2.260 to 2.360)
543.0	1.842	(1.802 to 1.882)
654.0	1.529	(1.499 to 1.559)
765.0	1.307	(1.277 to 1.337)
876.0	1.141	(1.120 to 1.163)
987.0	1.013	(0.993 to 1.033)

i. Depress the CURSOR group Y units dB control. Observe that the Y axis alphanumeric display reads 0.0.

3.6.7 Analysis Mode Check

a. Refer to paragraph 3.5.3 and select SPECTRUM MENU combination 5. (Dual display of RT and M1.)

b. Depress the SENSITIVITY group MV/EU control and the CURSOR group X units HZ control.

c. Insure that the AVG group LIN and STOP controls are selected (LED lighted). Depress the ERASE and then the START controls and observe that the averaged information from the upper trace is transferred to the lower trace.

d. Disconnect the input signal and observe that the crt display continues to display the values held in M1.

e. With the input signal disconnected, depress the AVG group ERASE control. Observe that the information on both traces appears as a baseline.

f. Depress the SIGNAL group TEST control.

g. Depress the AVG group START control. Observe that the number of averages as displayed below the lower trace starts at one and counts to the number of averages selected and

then stops. Observe that the LED located on the STOP control is lighted and the LED on the START control has gone out.

h. Depress the AVG group ERASE, PEAK and START controls in that order. Observe that the information displayed in M1 is updated with only higher values.

i. Depress the SIGNAL group AC control. Observe that the LED on the TEST control goes out and the upper trace appears as a baseline. Also observe that the previously averaged information is present on the lower trace.

j. Reconnect the signal generator and observe that the 4KHz signal appears on both traces. (Lower trace will still have the TEST signal displayed.) Insure that the cursor is on the peak of the spectrum on the upper trace. This is accomplished by depressing the CURSOR group UPPER control and then utilizing the CURSOR LEFT/RIGHT control to position the cursor on the peak of the spectrum.

k. In the AVG group, depress the LIN and ERASE controls. For each selected number of averages on the following table, observe the time required for the LED on the STOP control to light. Averaging must be initiated for each number of averages selected. This is accomplished by first depressing the ERASE control and then the START control.

Avg N	Lin Avg Time (Approx)
32	7 Sec.
64	13 Sec.
256	52 Sec.

3.6.8 LIN Y-GAIN Check

a. Refer to paragraph 3.5.3 and select SPECTRUM MENU combination 1. (Single display of RT.) Adjust the signal generator to provide a 4KHz sine wave at 0.25 Vrms ±5 mVrms.

b. Select the 1 Vrms range scale via the VOLTS, LEVEL controls. Select V via the CURSOR group Y-units control.

c. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the spectrum on the crt display.

d. Depress the Display Mode Y, LIN control. Step through all four positions provided by the GAIN touch controls. (X1, X2, X5, and X10.) Observe that the Y-axis values read 0.25 Vrms ±5 mVrms in all four positions of the Display Y GAIN controls.

3.6.9 Time Mode Check

a. Select the controls on the SD345 as indicated below:

RANGE, FREQ	10K
VOLTS	1
LEVEL	RMS
FUNCTION GROUP	TIME MENU, COMBINATION 1. (Refer to paragraph 3.5.3 for MENU selection.)
CURSOR GROUP X UNITS	HZ
CURSOR GROUP Y UNITS	dB
SIGNAL GROUP	UPDATE, AC

b. Adjust the signal generator to provide a 100Hz sine wave at 1 Vrms ± 30 mVrms.

c. Depress the SIGNAL group HOLD control and observe that the CRT displays approximately four cycles of the 100Hz sine wave.

3.6.10 Arithmetic Function (M1,2) Check

a. Select the controls on the SD345 as indicated below:

RANGE, FREQ	10K
VOLTS	1
LEVEL	RMS
FUNCTION GROUP	SPECTRUM MENU, COMBINATION 1. (Refer to paragraph 3.5.3 for MENU selection.)

CURSOR GROUP (Y UNITS)	V
AVG N	16 (The selected number of averages is not displayed in SPECTRUM MENU, combination 1. To display the average number selected, select SPECTRUM MENU, combination 2. The number of averages will appear in the lower right corner of the crt just below the selected frequency range. After the proper number of averages has been selected, return to SPECTRUM MENU, combination 1.)

b. Adjust the Signal Generator to provide a 4KHz sine wave at 0.5 Vrms ±2 mVrms.

c. Operate the CURSOR LEFT/RIGHT control to place the cursor on the peak of the spectrum on the crt display. Carefully readjust the Signal Generator amplitude control until the Y-axis value on the SD345 crt display reads 0.5 Vrms ± 2 mVrms.

d. Refer to paragraph 3.5.3 and select SPECTRUM MENU, combination 5. (Dual display of FT and M1.)

e. Initiate averaging by selecting the following controls in the indicated sequence: LIN, ERASE, and START. Observe that the averaging takes place on the lower trace (M1). When averaging is completed, transfer the cursor from the peak of the spectrum on the upper trace to the peak of the spectrum on the lower trace utilizing the CURSOR group UPPER and LOWER touch controls. Insure that the spectrum amplitude Y-axis value still reads 0.5 Vrms ± 2 mVrms.

f. Refer to paragraph 3.5.3 and select SPECTRUM MENU, combination 7. (Dual display of M1 and M2.)

g. Depress the XFER, M1 M2 control and observe that the information on the upper trace is transferred to the lower trace.

h. Select the FUNCTION group M1,2 mode and for each combination of the MEMORY M1, M2 MENU, compare the Y-axis values with the values listed on Table 3-11a.

i. Return the display to SPECTRUM MENU, combination 1 and readjust the Signal Generator amplitude for an output of 1 Vrms. Repeat steps d through g, replacing the voltage values in steps d through g with 1 Vrms ± 2mVrms. Do not depress the XFER, M1 M2 controls as the 0.5 Vrms signal in M2 is going to be arithmetically combined with the 1 Vrms signal.

j. Select the FUNCTION group M1,2 mode and for each combination of the MEMORY M1, M2 MENU, compare the Y-axis values with the values listed on Table 3-11b.

Table 3-11a M1, 2 Arithmetic Functions

M1 = 0.5 Vrms Memory M1, M2 Function	M2 = 0.5 Vrms Y-Axis Value
1. M2/M1	1.0 V/V ± 3 mVrms
2. M1/M2	1.0 V/V ± 3 mVrms
3. M2 - M1	00 V
4. M1 - M2	00 V
5. M1 + M2	0.707 V ± 3 mVrms

Table 3-11b. M1, 2 Arithmetic Functions

M1 = 1.0 Vrms Memory M1, M2 Function	M2 = 0.5 Vrms Y-Axis Value
1. M2/M1	0.500 V/V ± 3 mVrms
2. M1/M2	2.000 V/V ± 12 mVrms
3. M2 - M1	00 V
4. M1 - M2	0.866 V ± 3 mVrms
5. M1 + M2	1.118 V ± 3 mVrms

3.7 OPERATOR MAINTENANCE

3.7.1 Introduction

Maintenance to be performed by the operator is limited to cleaning, visual inspection, periodic checks, and only limited trouble shooting.

3.7.2 Cleaning

Operator cleaning procedures involve only the exterior surfaces. When the instrument is operating, use only a dry cloth or soft brush. The SD345 is equipped with a LEXAN front panel. The following guidelines should be used in selecting a proper cleaning agent.

CAUTION

Only recommended cleaning agents should be used for cleaning the LEXAN front panel. Many commercial cleaning agents contain some form of halogenated, aromatic or ammoniated compounds. These agents will damage the LEXAN front panel and should not be used for cleaning.

The recommended cleaning agents are as follows:

Light cleaning: Denatured alcohol or a mild solution of soap and water.

Heavy cleaning: MS-260 cleaner for plastic, glass and metal. (Miller Stephenson Chemical Co., Inc.)

The following procedure should be performed at least once each month. If the instrument is being used in a dust-filled environment cleaning may be required each day.

CAUTION

Do not use any air source to remove dust.

a. Turn the instrument off and disconnect the AC power cord.

b. Using a soft brush, remove dust from the front panel and the face of the CRT. Remove dust from all connectors, slots, switches, and the vent fan foam filter on the rear panel.

c. Using the recommended cleaning agents, wipe the front panel and the face of the CRT.

3.7.3 Operator Checks

The table below lists some possible malfunctions that may be corrected by interpreting the front panel indications and taking the appropriate action.

The Front Panel Control Familiarization listed in paragraph 3.5 and the Operational Checkout listed in paragraph 3.6 can be performed to verify that the instrument is functioning properly.

If after performing the above checks, the instrument is not operating properly, notify maintenance personnel.

Malfunction Symptoms	Possible Cause
No Display and Power Pushbutton/Indicator is in the ON position but not lighted.	1. Loose power cord at wall receptacle or at rear of instrument. 2. Fuse is blown. 3. No power at wall receptacle.
No Display. Power Pushbutton/Indicator is in the ON position and the lamp is lighted.	1. CRT intensity is too low.
No Input Signal.	1. Input signal not connected or loose; Depress TEST to verify.
Input Signal and Grid but no Alphanumerics.	1. Rear-panel AUX SW SIP Switch, S2, position 1 is in the OFF position. (This switch turns the CRT Alphanumerics on and off.)

SECTION IV

CONCEPT OF OPERATION

4.1 GENERAL

Figure 4-1 shows the overall concept of operation of the Model SD345. The major functional sections of the instrument are controlled from the front panel, via the Z80 Microprocessor, through appropriate timing and control circuitry. Analog input data is conditioned, digitized, and written into Input Memory. All subsequent processing is handled digitally. In the digital sections, tri-state bussing is employed throughout. Digital-to-Analog converters in the Output Control and Display Section are used to generate analog output signals for the crt and an external X-Y plotter. The following paragraphs give a functional description of the SD345 based on Figure 4-1.

4.2 CONCEPT OF OPERATION

4.2.1 Timing and Input Control

The Timing and Input control circuits generate the basic timing for the entire instrument. In addition, they generate the clock for the Z80 Microprocessor control, the Input Section and the writing of data into the Input Memory. Upon demand by the Microprogram Control Section, the Timing and Input Control Section causes the

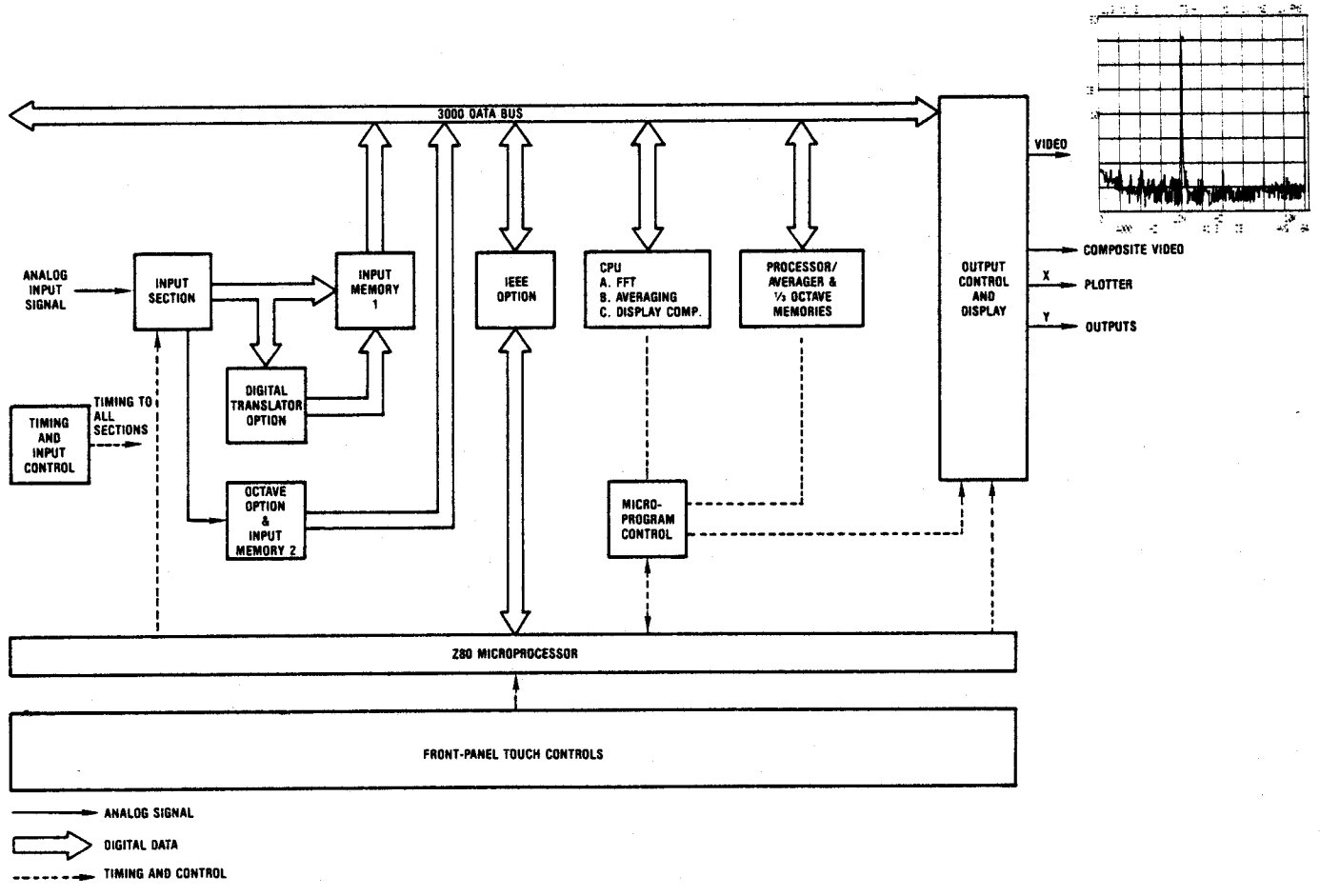


Figure 4-1. SD345 Concept of Operation.

Input Memory to transfer a block of stored digital information to the Processor Memory.

4.2.2 Input Section

The time-domain analog input signal is applied to the Input Section where it is either attenuated or amplified to provide a normalized signal to the Low Pass Filter. The Normalized Input Signal is passed through the low-pass filter so that components at higher frequencies cannot produce aliasing terms when analyzed in the frequency domain. The filtered analog signal is then amplified in the post-filter gain stage, sampled, and the samples are converted to a 10-bit digital word. This word sequence is a digital representation of the applied analog signal.

4.2.3 Input Memory

Alternate data samples from the Input Section are treated as "even" and "odd" samples. The "even" samples are used to produce the "real" part of a complex word and the "odd" samples are used to produce the "imaginary" part of the complex word. Consecutive "even" and "odd" samples are paired and stored in the 1024 X 10-bit Input Memory. The "even" samples are stored in the "real" section of the memory and the "odd" samples are stored in the "imaginary" section of the memory.

Figure 4-2 illustrates this operation. Paired samples are treated as complex words (i.e., $S_0 + jS_1$; $S_2 + jS_3$; $S_4 + jS_5$; etc.) For use by the CPU section.

Upon demand by the Microprogram Control Section, a block of 512 complex words will be transferred from the Input Memory to the Processor Memory for processing by the CPU section. The block that is transferred consists of the most recent samples of the input analog signal.

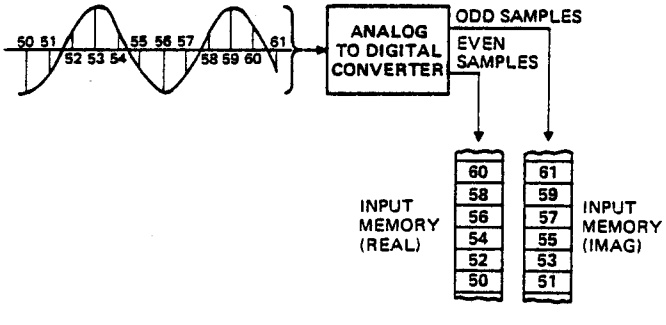


Figure 4-2. Input Memory Organization

4.2.4 Microprogram Control Section

This section provides the timing and control for controlling the Data Bus and for the processing functions performed by the CPU Section. It contains control PROM's which are capable of providing over 5000 24-bit machine language instructions. Front-panel Z80 Microprocessor control configurations, as well as the states of various circuits throughout the instrument, are monitored in order to control the sequence in which the instructions are fetched from the control PROM's.

4.2.5 CPU Section and Processor/Averager Memories

The CPU Section consists of a Central Processing Element (CPE) composed of seven bipolar 2-bit slices; a hardware multiplier; RAM lookup tables for Sine and Cosine; and PROM lookup tables for Weighting, Square Root, EU-PSD, LOG X and LOG Y. This section performs all the required arithmetic and logical functions for the following operations:

a. A high-speed implementation of the Fast-Fourier Transform (with or without weighting).

b. Averaging of the real-time data stored in Processor Memory.

c. Computations for CRT signal and Alphanumeric Display.

The Processor Memory is a 1024 × 14-bit memory whose function is to store data during processing by the CPU Section. It also serves as a storage memory for the transformed, rectangular, real-time data.

There are two Averager Memories. Averager Memory 1 is a 1024 × 11-bit memory whose function is to store averaged or peak information depending on the selected analysis mode (LIN or PEAK). Averager Memory 2 is also a 1024 × 11-bit memory whose function is to store the information from Averager Memory 1 for later use or for arithmetic functions between Averager Memory 1 and Averager Memory 2. An Extended Average Memory is used for performing floating point Sync Time Averaging.

When a block of data is transfered from the Input Memory, the CPU multiplies the data by a weighted function (Hanning or Rectangular) and stores the results in the Processor Memory. The CPU Section then computes the FFT. The resultant transformed data is then stored in the Processor Memory in rectangular format. Upon completion of processing, the contents of the Processor

Memory is available to the Output Memory for display purposes.

If either the LIN, EXPO, or PEAK mode has been selected, the CPU Section performs the selected operation on the real-time data from the Processor Memory and stores the results in Averager Memory 1. The contents of Averager Memory 1 are available to Averager Memory 2 and the Display Control Section for display. When data has been stored in this memory, it is retained until a new average or peak operation is initiated.

The contents of either the Processor Memory (real-time data) or the Averager memory (averaged or peak data) may be selected for crt display by means of the front-panel FUNCTION Group. Upon demand by the Microprogram Control Section, the CPU performs the required computations (depending upon the selected DISPLAY Y-GAIN), on the selected data to scale it for proper display. The data is then denormalized to 9 bits and written into a CRT Refresh Memory in the Output Control and Display Section. Also upon demand by the Microprogram Control Section, the CPU performs the required computations (depending upon the selected CURSOR UNITS) on the data at the cursor address. This data is then sent to the Video Interface, Character Generator and displayed on the crt as alphanumerics.

4.2.6 Output Control and Display Section

This section consists of all the required circuitry, including timing and control, for displaying data on the crt display and for providing the remote, plotter and composite video outputs.

Output control PROM's (RFSH) provide the necessary instructions for accomplishing these functions. The Z80 Microprocessor configurations, as well as the states of various circuits are monitored in order to control the sequence in which the instructions are fetched from the PROM's.

Digital X-axis data is generated by an X-axis Counter and then converted to analog data. This analog data is the normal (X1) X-axis sweep signal. An expanded (X4) X-axis sweep signal is generated by using a DC Cursor Location signal to determine the portion of the normal sweep to be expanded. Either the normal (X1) or the expanded (X4) sweep signal may be selected for the X-axis by means of the front-panel Display X controls.

The digital data from the X-axis Counter also provides the read address for the Refresh Memory.

The data in the Refresh Memory (frequency-domain) is loaded into TV Memory for display. Either this frequency-domain data or the digitized time-domain data from the Input Section may be selected for display on the TV by means of the front-panel FUNCTION Group.

The cursor circuits employ up/down counters to generate either a NORMAL cursor or a HARMONIC cursor depending upon the position of the front-panel CURSOR Group controls. The counters are controlled by the CURSOR LEFT/RIGHT control. The X-axis sweep is intensified when the count of the X-axis Counter is equal to the count of the Cursor Counter. This causes the cursor to appear on the crt as a square dot. When the dot is being moved across the crt display, a vertical line cursor is also generated and displayed along with the intensified dot. When HARMONIC cursor is selected, intensified dots are also placed on the X-axis sweep at all multiples of the fundamental cursor location. In this mode, the CURSOR LEFT/RIGHT control can be used to position the fundamental cursor at any of 256 steps between adjacent cell locations. This provides finer resolution for aligning higher order harmonics. After the harmonics have been aligned, if the SET REF touch control is depressed, the intensified dots at the harmonic positions are frozen and a vertical line cursor is generated and displayed on the crt. This line cursor can then be moved to any of the 400 cell locations (512 cell locations for time) to allow readout of the selected cursor data on the crt alphanumeric display.

When the PLOTTER mode is selected a selectable 10Hz or 20Hz clock from the Timing and Input Control Section clocks the Cursor Counter continuously so that the cursor sweeps across the X-axis sweep on the crt. Each time the Cursor Counter and the X-axis Counter are equal, a Frequency Match signal is generated. This signal controls an X Sample-and-Hold and a Y Sample-and-Hold. The X-axis analog signal and the Y-axis analog data (frequency-domain) are applied to these Sample-and-Hold circuits. The outputs of these circuits is dc proportional to the data at the cursor location and is routed to the rear-panel PLOTTER X and PLOTTER Y connectors. A Sweep Rate Feedback circuit monitors the rate of change of the Y-axis data, and when it exceeds a preselected slope, slows the sweep to allow sufficient time for the plotter to record the data peak.