ONO SOKKI
digital instruments & control systems

PORTABLE FFT ANALYZER CF-300

INSTRUCTION MANUAL

ONO SOKKI CO., LTD.

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We would like to express out appreciation for your purchase of the CF-300 FFT Analyzer.

The CF-300 features multi-processor capability and has been packaged in an ultra-compact housing, making it a significant contribution to FFT analysis techniques.

To ensure that you get the most from the CF-300, we suggest that you read this document thoroughly.

Notes On the CF-300

1. The CF-300 is provided with an alarm beeper which warns of improper operation. When switches are pressed in proper sequence and combination, a short beep is sounded. A longer beeping sound indicates an improper operation and one that is ignored by the CF-300. If such a warning beep occurs, refer to this manual for details on proper operation. When this beeping sound is not desired, it may be eliminated by using the E-2 switch.

2. When the same functions, frequency ranges, attenuator ranges and other settings are to be used repeatedly, they may be stored in the Panel Condition Memory (refer to section G). After this is done, the settings will be held in memory even when the power supply is removed, thereby eliminating the necessity for troublesome resetting.

3. The CF-300 software is stored in 32K bytes of ROM memory. Should misoperation occur, use the J-1 reset switch to reset the system, and begin operation starting with input condition settings.

Before Using the CF-300

* Before shipping, the CF-300 is subjected to severe testing at the factory, ensuring that it is operating properly. After unpacking, verify that the unit has not been damaged in shipping, read this document thoroughly, and verify proper operation of the CF-300. Should the unit have received damage, or not operate in accordance with the specifications noted herein, you should contact your representative or the Ono Sokki sales location from whom this unit was purchased.

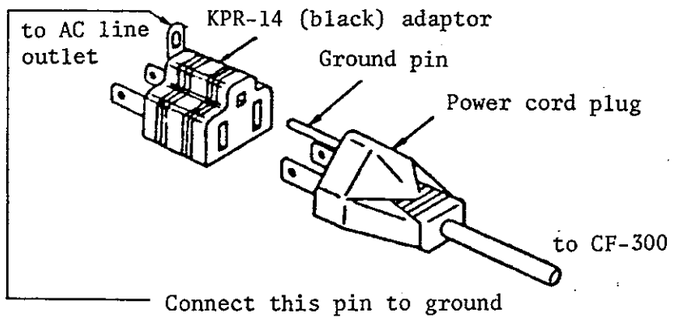
* AC Power Supply

The CF-300 should be used at a line voltage within ±10% of the rated line voltage. The power supply voltage is indicated on the power supply inlet at the rear panel. If the power switch is turned on with a voltage outside this range applied to the CF-300, damage may occur to the unit, thus requiring care in regard to line voltage. Cases will arise when the applied power supply contains pulse-type noise components. While the CF-300 is provided with a built-in line filter to eliminate such noise, depending upon the degree of noise interference, performance may be effected. In such cases, a separate power supply should be used, or a power supply free from such noise components should be provided.

* Grounding

To eliminate the risk of shock from the AC power supply when making measurements with the CF-300 supplied from an AC power source, the CF-300 power supply connector center pin must be grounded. The accessory power cord plug is a 3-pin plug, the center, round, pin of which is the ground pin. Therefore, when using a 3-pin outlet, this pin is grounded automatically.

Another method is to use the plug adapter (KPR-14) with 2-pin outlets. The terminal protruding from the side of the adapter must then be connected to a ground.



* Cleaning the Cooling Fan Filter

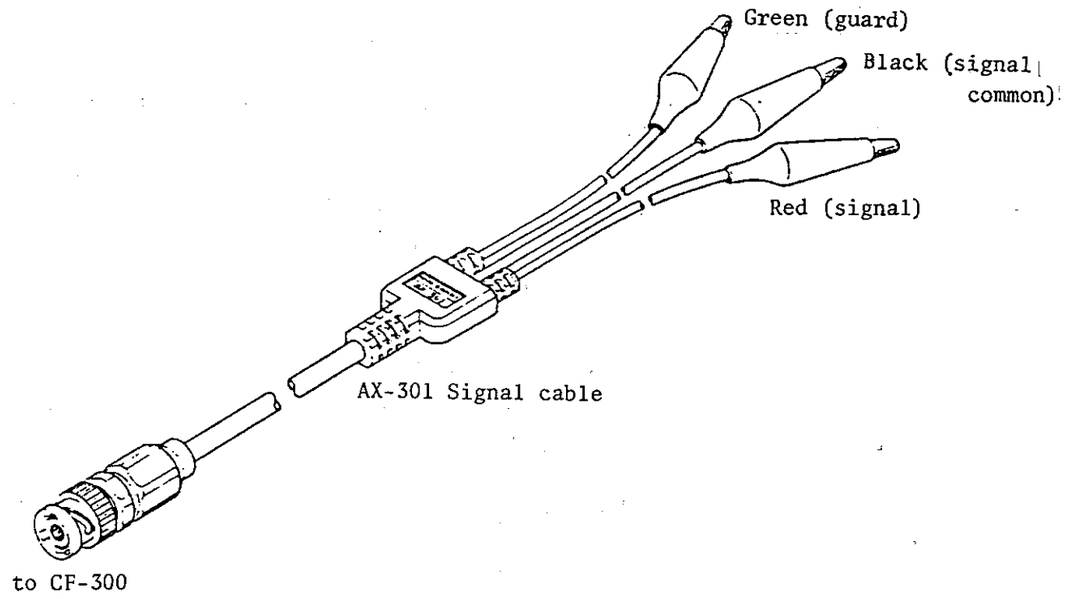
Because the CF-300 uses high-speed processing circuits, the heat generated is equivalent to that generated by a minicomputer. The cooling fan provided has sufficient capacity to accommodate this generated heat. However, if the filter used with the fan at the rear of the unit becomes clogged, cooling will be insufficient, thereby risking a limitation on the life of the CF-300 or failure conditions. Care should thus be taken to keep the filter free of dust. Cleaning should be done periodically to accomplish this.

* CF-300 Input Connections

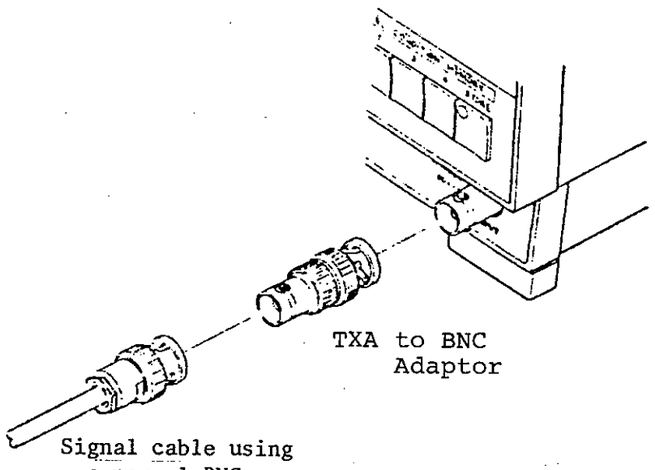
To ensure the high (10μV) input sensitivity of the CF-300, a 3-pin (signal, signal common, and guard) BNCX3-stud connector has been used.

When making measurements in such high-sensitivity attenuator ranges as 10mV, 20mV, and 50mV, the accessory AX-301 3-connector signal cable should be used. The connections for this cable are shown below.

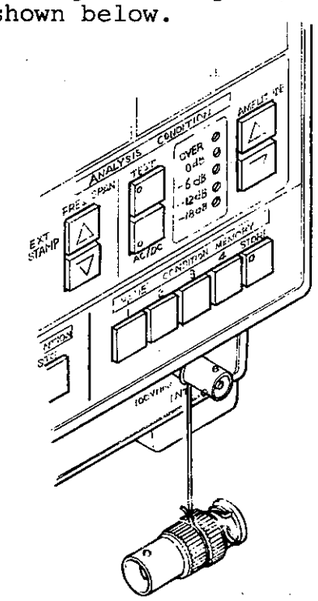
Red--signal
Black--signal common
Green--guard



When using standard-type BNC cables, the accessory TXA-BNC adaptor should be used as shown below. Note that this adaptor should only be used for attenuator ranges above 100mV (medium and low sensitivity). For the 10mV, 20mV, and 50mV attenuator ranges, use of this adaptor might introduce the effects of noise.



To avoid losing the adaptor, it should be tied to the connector as shown below.



1. SPECIFICATIONS

1.1 Processing Functions

1.1.1 Time Domain

Real-time time-axis waveform display

Time-axis waveform averaging and display

Time-axis waveform absolute value averaging and display

Transient waveform display

1.1.2 Frequency Domain

Real-time spectrum display

Average spectrum display

Phase spectrum display

1.1.3 Amplitude Domain

Real-time histogram display

Average histogram display

1.1.4 Calculations (In the Same Domain Between Memory and Time-Axis Waveform, Spectrum, or Histogram Data)

Addition

Subtraction

Multiplication

Division

1.1.5 Display Modes

Single-frame display

Double-frame display

Three-dimensional display (spectrum only)

Overlaid display (memory and spectrum only)

1.1.6 Memory Functions

Storage of one data frame in internal memory

Storage of the lower frame of data of a double-frame in memory

Storage of three-dimensional display and overlaid display data is not possible

1.2 Display Section

CRT Size:	85 x 110mm raster scan CRT
Display Scale:	X-axis: Linear and log Y-axis: Linear and log (Log used only for spectrum display)
Search Function:	Any X-axis or Y-axis point may be searched using the cursor and output to the display in the selected units. (This is possible for data in memory as well) The search function may be used for single-frame displays or for the bottom half double-frame displays. It is not possible for 3-dimensional or overlaid displays.
Cursor Off:	For spectrum and histogram displays, the maximum Y-axis value and the corresponding X-axis value are displayed.
Cursor ON:	The cursor may be moved to any point, and the corresponding X-axis and Y-axis values are displayed.

Δ Function:	With the search ON, the X-axis and Y-axis differences from the reference point are displayed.
Search Function Units:	Frequency domain: Y-axis V, Vrms, EU, dBV, dBrms, dBEU The above 6 types of units may be used for power spectrum density and energy spectrum density displays, making a total of 18 combinations. X-axis Hz, CPM, Order EXT (when using an external sampling clock) Time domain: Y-axis V, EU X-axis sec., EXT (When using an external sampling clock) Amplitude domain: Y-axis No units X-axis V or EU Phase domain: Y-axis Degrees only X-axis Hz, CPM, Order
VIEW Function:	In the PAUSE mode, if the VIEW function is set, the CF-300 setup conditions may be listed on the display.

1.3 Input Section

No. of Input Channels:	1
Input Impedance:	1MΩ, unbalanced
Coupling:	DC/AC (0.5Hz/-3dB for AC coupling)
Amplitude Voltage Ranges:	10*, 20*, 50*, 100mV, 0.2, 0.5, 1.0, 2.0, 5.0, 10, 20V (11 ranges). All voltage values are single-ended (measured from 0 to peak)

Allowable Input Voltage:	100Vrms
Input Level Monitor:	5-LED monitor A/D OVER: Red 0dB: Yellow -6, -12, -18dB: Green
A/D Convertor:	12-bit successive approximation type
Internal Test Signals:	Squarewave (0 ∿ 0.7V) (The fundamental frequency is automatically set to that of the 8th line of each frequency range)
Input Connector:	3-Stud BNC connector
Trigger Source:	Input signal or external trigger signal
Trigger Mode:	Free-run mode, repetitive mode, and single mode (3 modes)
Trigger Point:	0, 64, 128, 256, or 511 points with respect to the pre-trigger or post-trigger. Note, however, that the pre-trigger 0 point is the same as the post-trigger 0 point.
Trigger Level:	Nine levels: +FS, +3/4FS, +1/2FS, +1/4FS, 0, -1/4FS, -1/2FS, -3/4FS, and -FS.
Trigger Polarity:	+(rising edge) or -(falling edge)
External Trigger Input:	Input impedance: 100KΩ Allowable input voltage: 40Vrms Maximum frequency: 50kHz Input sensitivity: 0.5Vpp or better Effective trigger level: ±2.5V Input connector: BNC

Note: Items marked * are AC coupling only.

External Sampling Input:	TTL level Load: 1TTL load Maximum frequency: 51.2kHz The fullscale when using an external sampling signal is the sampling clock divided by 2.56.

External Memory Store Signal Input:	Store control TTL-level signal or contact closure (high to low level edge) for use with the optional mask memory

1.4 Analysis Section

Frequency Ranges:	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k (14 ranges and analysis is possible with an external sampling clock as well)
Data Sampling Points:	512
Frequency Resolution:	1/200 of the analysis range
No. of Spectrum Lines:	DC + 200 lines + overall
Dynamic Range:	70dB (typical)
Amplitude Flatness:	±0.1dB (typ)/±0.5dB (max)
Frequency Accuracy:	±0.003% of fullscale
Window Functions:	Hanning and rectangular
Input Sampling Frequency:	2.56 times analysis range
Anti-Aliasing Filter:	-120dB/oct Anti-aliasing filters are set automatically for each frequency range. Note, however, for ranges 5Hz and below a 5Hz filter is used.
Averaging Modes:	Time-axis: Linear summation Absolute value linear summation Frequency axis: Linear summation Peak hold Exponential summation Amplitude axis: Linear Summation
No. of Averages:	Linear summation: 2 ∿ 1024 Exponential summation: attenuation constant 2 ∿ 16 Peak hold: Infinite

1.5 Output Section

External CRT Output: A composite video output signal of 1Vpp (75Ω output impedance) is available for connection to an optional video printer, thus providing the ability to copy CRT display information.

1.6 Other Functions

Panel Condition Memory: With the exception of the plotter control function, GP-IB functions, and the system reset, all buttons and switches and other panel controls may be stored in four separate sets of conditions for recall, thus eliminating the necessity to reset the panel conditions.

Even with the power supply switch OFF, as long as the power cord is connected, power is supplied to the memory backup circuit and even if the cord is disconnected, the memory contents will be backed up by battery for approximately 30 days.

Beeper Alarm: A beeping sound is provided as a verification of proper panel switch operations. A short sound is made for proper operation and a longer beep is heard for misoperation. This function may be disabled when not desired.

1.7 General Specifications

Power Supply:	100VAC (90 ∿ 134VAC), 50/60Hz 220V (198 ∿ 264VAC) operation is available as an option.
Power Consumption:	Approx. 100VA (At 100VAC, 50Hz operation)
Operating Temperature Range:	0°C ∿ +40°C
Storage Temperature Range:	-10°C ∿ +70°C
Outer Dimensions:	200(H) x 320(W) x 400(D)mm
Weight:	Approx. 12.5kg

1.8 Accessories

Power cord

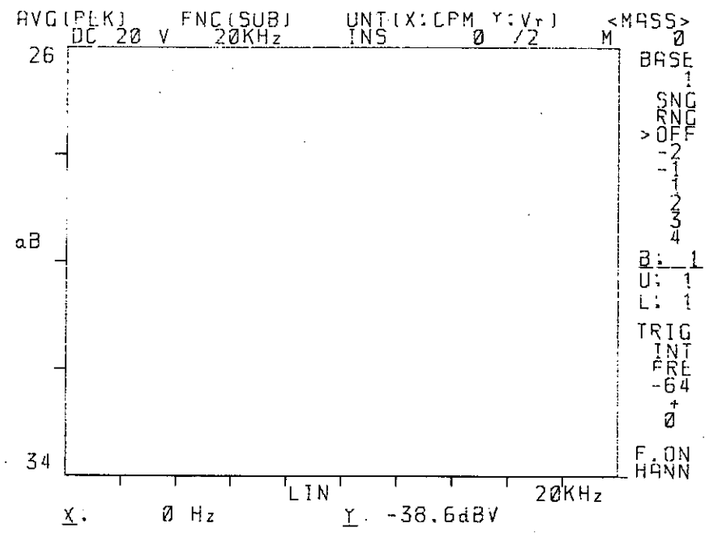
Front protective cover

Input signal cable

Adaptor (normal BNC - 3-stud BNC connector)

1.9 CRT Character Display Description

When the CF-300 is initialized (i.e., when the power is first turned ON), the CRT screen appears as shown below.



This section will serve to describe the annotation shown on the CRT screen and the relationship between this annotation and various front panel switch settings.

The switch numbers used in this section are those described in section 2.

1.9.1 CRT Upper Portion Character Display

	AVG (PEK)	FNC (SUB)	UNIT (X:CPM Y:Vr)	(MASS)*
Meaning	Averaging mode settings	Function settings	Units settings	Mass memory information
Current setting	Peak hold	Subtract	X-axis: CMP Y-axis: Vrms	
Other items selectable	Linear averaging Log averaging Time-axis averaging Amplitude probability density, etc	Arithmetic operations PSD ESD Phase spectrum 3-Dimensional displays, etc.	X-axis: EU, dBEU, dBR Y-axis: Hz, ORDER	
Switches used	E-1, D-1, D-2	E-3, F-9	F-1, F-5, E-1	
For details see section	2.5	2.5	2.5 & 2.6	Option manual

* Note: Not displayed if the CF-300 Mass Memory is not installed.

	DC	20V	20kHz	INS	0/2	MO
Meaning	Coupling	Attenuator	Frequency ranges	Averaging mode	No. of averages	Mass memory information
Current setting	DC coupling	+20Vp-p	20kHz	INSTANT	2	
Other items selectable	AC	±10mV ±20V	DC ∿ 1Hz DC ∿ 20kHz	Averaging modes	0 ∿ 1024	
Switches used	A-5	A-1, A-2	A-6, A-7	D-1, D-2	E-1	
For details, see section	2.1	2.1	2.1	2.4	2.5	

1.9.2 CRT Lower Portion Character Display

LIN 20kHz*

Meaning	Display scaling	Maximum frequency of the currently displayed spectrum
Current setting	Linear	20kHz
Other items selectable	LOG	1kHz → 20kHz
Switches used	F-2	A-6, A-7
For details, see section:	2.6	2.1

* Note: This could be different than the current frequency range selection if, for example, a stored spectrum which was analyzed at a different frequency range is recalled to the CRT screen.

X : 0Hz Y : -38.6dBV

Meaning	X-axis value (search value)	Y-axis value (search value)
Current value	0Hz	-38.6dBV
Settings affecting these values	1. Dot search switches 2. UNIT switch	Same as at left
Switches used	F-15, F-16, F-17, F-18	F-15, F-16, F-17, F-18, F-5
For details, see section:	2.6	2.6

1.9.3 CRT Right Portion Character Display

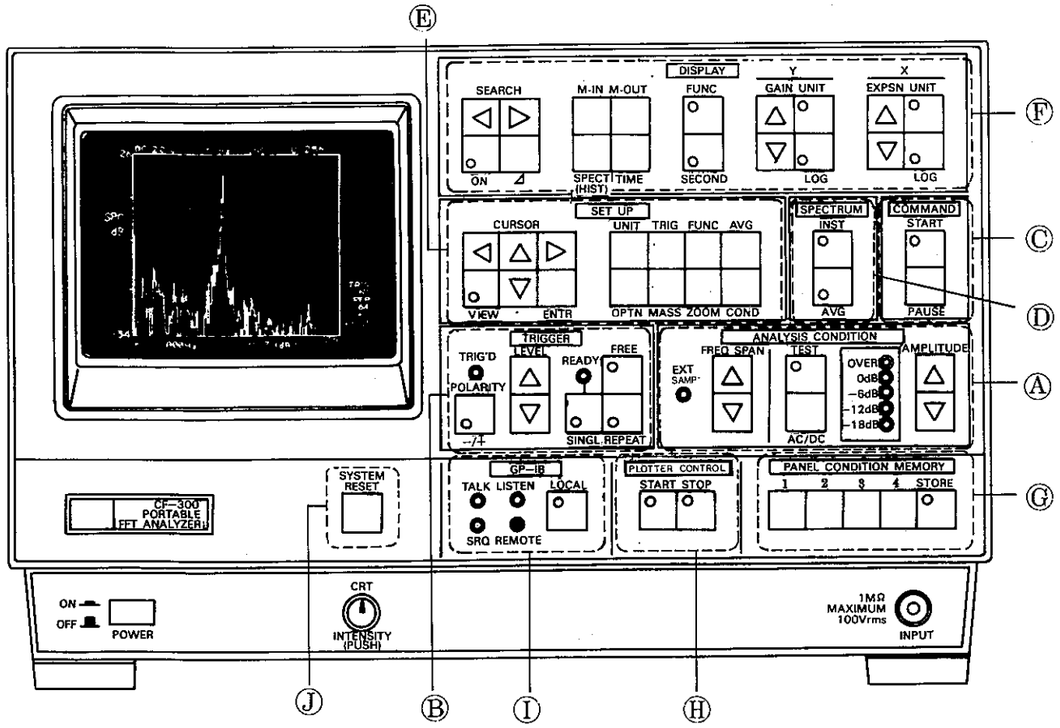
	Meaning	Current setting	Other items selectable	Switches used	For details:
BASE 1 SNG RNG OFF -2 -1 1 2 3 4 B: 1 U: 1 L: 2	Mass memory information. Displayed only if the CF-031 Mass memory has been installed.				For details, refer to option manual
TRIG	Trigger information	Trigger free	Triggered	B-2, B-3	2.2
INT	Trigger source	Internal	External	E-5	2.5
FRE	Trigger mode	Free	Repeat, single	B-2, B-3	2.2
-64	Trigger point	64-pt pre-trigger	pre-, post-trigger, 0 ∿ 512pt	E-5	2.5
	Trigger polarity	+	-	B-7	2.2
0	Trigger level	0V	±FS, ±3/4, ±1/2, ±1/4	B-5, B-6	2.2
F.ON	Antialiasing filter	ON	OFF	E-2	2.5
HANN	Window	Hanning	Rectangular	E-2	2.5

1.9.4 CRT Left Portion Character Display

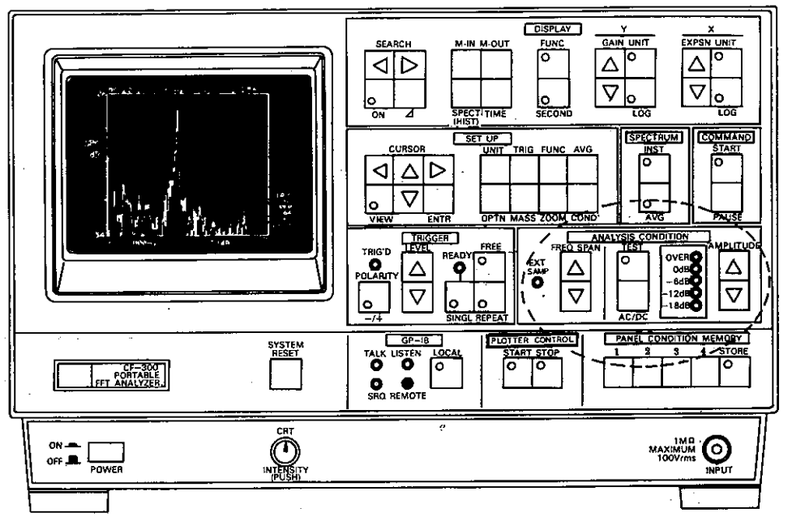
	Meaning	Current setting	Selectable or displayable ranges	Switches used	For details, see section:
26	Maximum displayable Y-axis value	+26dBV	LOG: +26dBV to -40dBV LIN: +20V to +10mV	A-1, A-2 F-7, F-8	2.1
dB	LOG display units	dBV	V, mV		2.1
-54	Minimum displayable Y-axis value	-54dBV	For details, refer to sections 2.1 & 2.6	A-1, A-2 F-7, F-8	2.1 2.6

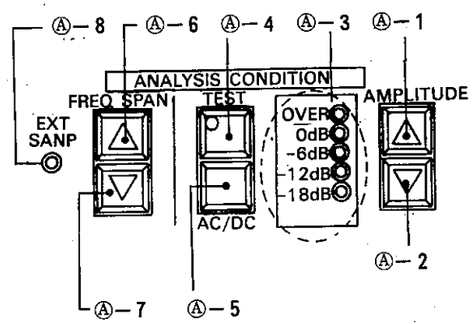
2. FRONT PANEL SWITCH DESCRIPTIONS

This section describes the front panel switch operations, breaking the front panel controls into ten classes labeled A thru J. The classifications and the page on which the corresponding descriptions begin are listed below.



2.1 Analysis Conditions Setting Switch Group



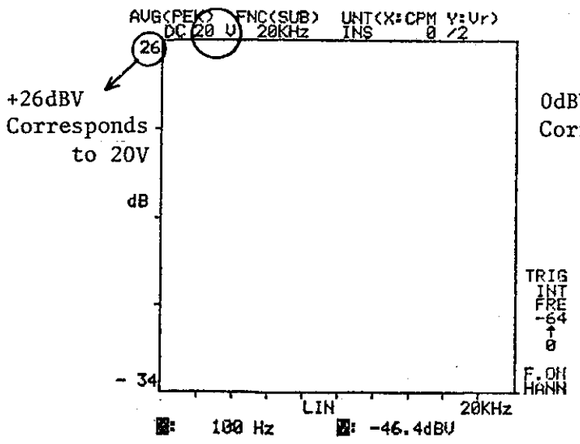


Ⓐ-1, Ⓐ-2 Attenuator Range Selection Switches

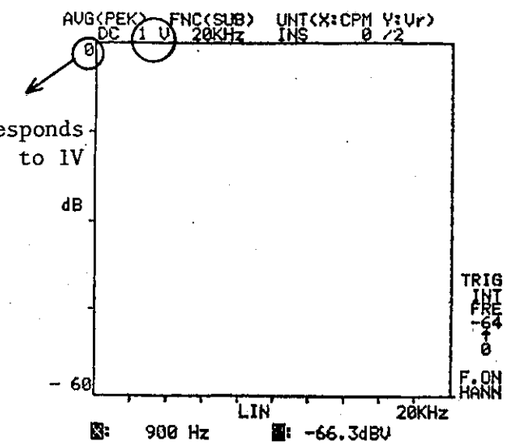
These switches are used to select the attenuator range. The ranges are provided in 1-2-5 step sequence and consists of 11 ranges spanning ±10mV ∿ ±20Vpp. When the Ⓐ-1 switch is depressed, sensitivity increases (the voltage range decreases), and when the Ⓐ-2 switch is pressed, the sensitivity decreases.

The set value of range is shown on the CRT screen on the 2nd line. When a spectrum is being displayed, the value of dBV or voltage corresponding to the full-scale value of the attenuator range set is displayed at the top and bottom of the left side of the scale.

(Example) 20V Attenuator range selected



1V Attenuator range selected



Ⓐ-3 LED Monimeter

This group of LEDs is used to monitor the input signal level. The red OVER LED indicates an A/D overflow, and when an anti-aliasing (LP) filter is being used, this monitor is linked to the signal after it passes through the filter. If even one point of the input signal causes A/D overflow, the LED will light for approximately 0.1 second.

The orange and green LEDs indicate the signal level after the amplifier stage before the filter, the 0dB LED indicating fullscale on the attenuator range being used.

The attenuator range should be selected neither the OVER nor 0dB LEDs light.

Ⓐ-4 Internal Test Signal ON/OFF Switch

This switch is used to turn ON/OFF the internally generated test signal. The LED at the upper left part of the switch, when lighted, indicates that a 0 0.7V squarewave signal is being internally input, the frequency of that signal being linked to the selected frequency range.

Ⓐ-5 Coupling Selection Switch

This switch allows the selection of input coupling. When the LED is lighted, a highpass filter with a cutoff frequency of 0.5Hz (-3dB) is inserted in the input circuit.

The 2nd line of the CRT character display indicates the type of coupling being used. DC coupling should be used with ranges up to and including 20Hz.

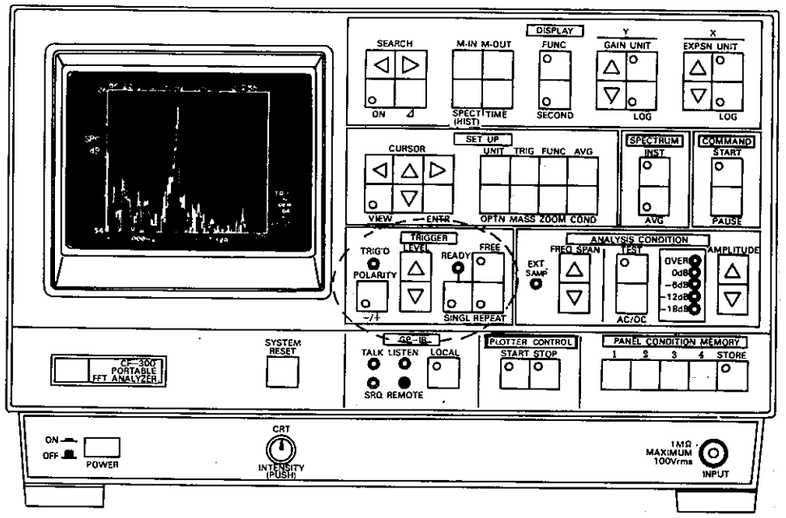
Ⓐ-6, Ⓐ-7 Frequency Range Selection Switches

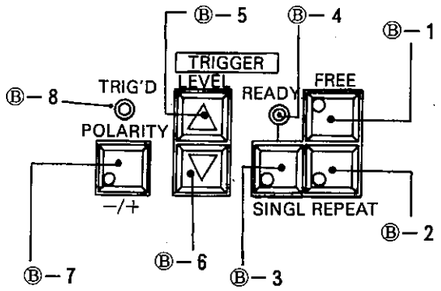
These frequency range selection switches determine the frequency range for analysis. Fourteen ranges are available from DC 1Hz thru DC 20kHz. The cutoff frequency of the anti-aliasing filter is automatically linked to the selected frequency range (for the DC kHz and DC 2Hz ranges, components above 5Hz are cut off). The time-axis A/D sampling rate is 2.56 times the frequency selected by these switches. The frequency range being used is displayed on the 2nd level of the CRT display.

Ⓐ-8 External Clock Status Display LED

When the group E setup switches have been used to select analysis using an external clock signal, and an external clock pulse signal is input at the BNC connector at the rear panel, this LED flashes in response to the clock signal. Note that for this type of clock operation, the A-6 and A-7 switches serve merely to indicate which range the anti-aliasing filter cutoff frequency is linked to.

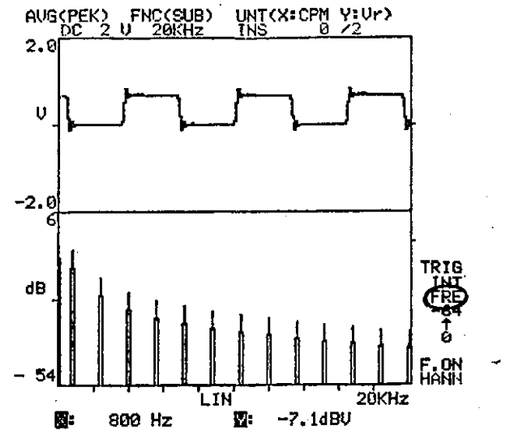
2.2 Trigger Conditions Setting Switch Group





Ⓑ-1 TRIGGER FREE Switch

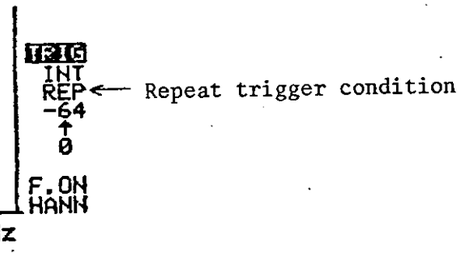
This switch is used when the trigger function is not being used. The LED at the upper left part of the switch, when lighted, indicates the trigger free mode. In this mode, the square enclosure around the word TRIG on the right side of the CRT display disappears and FRE is displayed in its place.



Trigger free condition

Ⓑ-2 REPEAT TRIGGER Switch

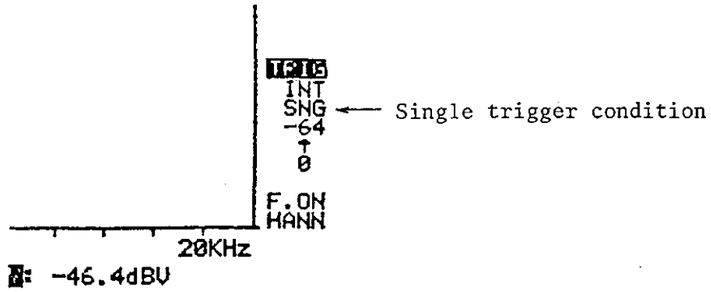
This switch is used to select the mode in which the input signal is captured every time it passes through the set trigger level. When this switch is selected, the abbreviation REP appears.



Repeat trigger condition

Ⓑ-3 SINGLE TRIGGER Switch

This switch is used to select the mode in which the input signal is captured one time when it passes through the set trigger level. When this switch is selected, the abbreviation SNG appears on the CRT display.



← Single trigger condition

Ⓑ-4 SINGLE TRIGGER READY LED

When the single trigger mode has been selected, this LED indicates the ready condition.

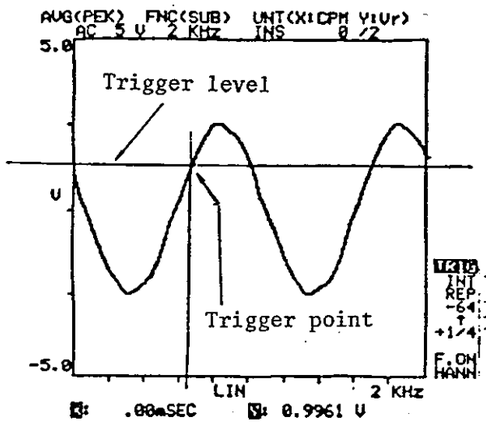
Ⓑ-5, Ⓑ-6 Trigger LEVEL Setting Switches

These switches are used to select the trigger level. The settings can be made in 9 steps of +1, +3/4, +1/2, +1/4, 0, -1/4, -1/2, -3/4, and -1 of fullscale. The level selected is displayed on the CRT display.

Ⓑ-7 Trigger POLARITY Selection Switch

This switch is used to select rising edge (+polarity) or falling edge (-polarity) for triggering.

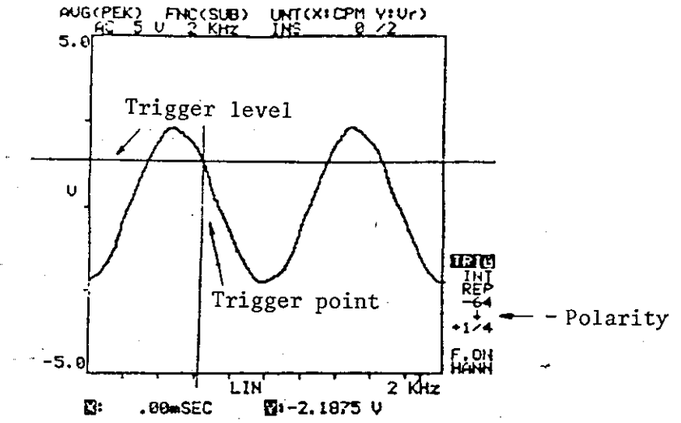
When the LED at the lower left is lighted, (-) polarity has been selected, at which time a downward pointing arrow appears in the CRT. For a (+) polarity an upward pointing arrow appears.



(Example)

- Internal trigger selected
- Repeat trigger
- -64th point as pre-trigger
- +Polarity
- Trigger level + 1/4

(Because the 5V attenuator range is being used, the trigger level is +1.25V)



← - Polarity

Ⓑ-8 TRIG'D LED

This LED lights when the input signal passes through the selected trigger level.

Note 1. Selection of pre-trigger/post-trigger, internal/external trigger, and trigger point is performed with the Ⓔ-5 (TRIG) switch of the setup switch group. Refer to section 2.5 for details.

2. The CF-300 has an A/D overflow cutting function which is convenient for the measurement of inherent vibrational frequencies in response to impulse stimulus.

When making such measurements as those using the Hammer method of measuring inherent vibrational components, and using the trigger function for measurements, waveform distortion often results from A/D overflow. To avoid this when using the DF-300, do the following.

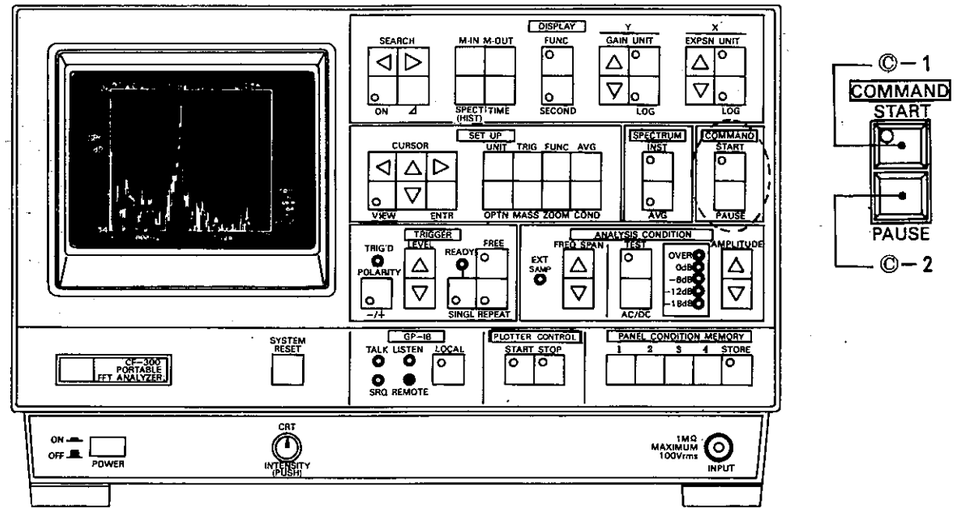
Select the trigger function using Ⓑ-2/Ⓑ-3.

Select linear averaging using Ⓔ-1

Select a rectangular window using Ⓔ-2

If this is done, of the 512 points captured, if two or more points in a row cause A/D overflow, the data captured that pass is not used for FFT analysis and is ignored. This is the CF-300 A/D overflow cutting function.

2.3 Command Switches



©-1 System COMMAND START Switch

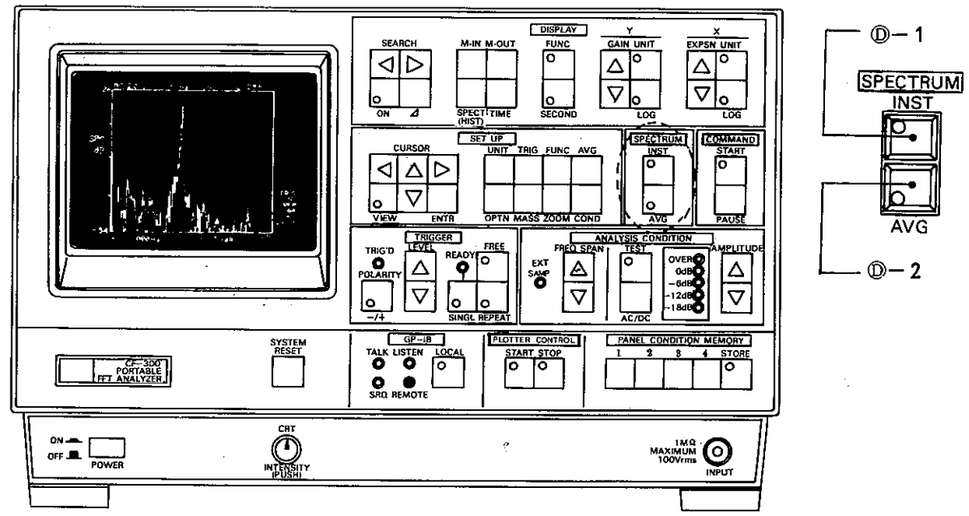
This switch is used to start analysis in the CF-300. Ⓔ-1 is used to select the averaging as linear, time-axis averaging, or histogram, and the Ⓓ-2 switch is pressed, whereupon averaging is performed up to the set number of averages and the PAUSE (©-2 mode) is automatically entered. During the execution of averaging, if the START switch is pressed, START is reinstated after RESET.

©-2 PAUSE Switch

This switch puts the system into the PAUSE mode. When Ⓔ-1 is used to select linear averaging, and this switch is pressed during the averaging process, the LED lights and processing is terminated midway. If the PAUSE switch is pressed once again, averaging continues without performing a reset.

Note: When creating a hardcopy using the optional VP-55 Video Printer, printout is performed after placing the system in the PAUSE mode using ©-2. While copying can be performed in the START (©-1) condition, if data changes during printing, the hardcopy will change to reflect these variations.

2.4 Instant/Average Execute Switches



Ⓓ-1 Instant Mode Selection Switch

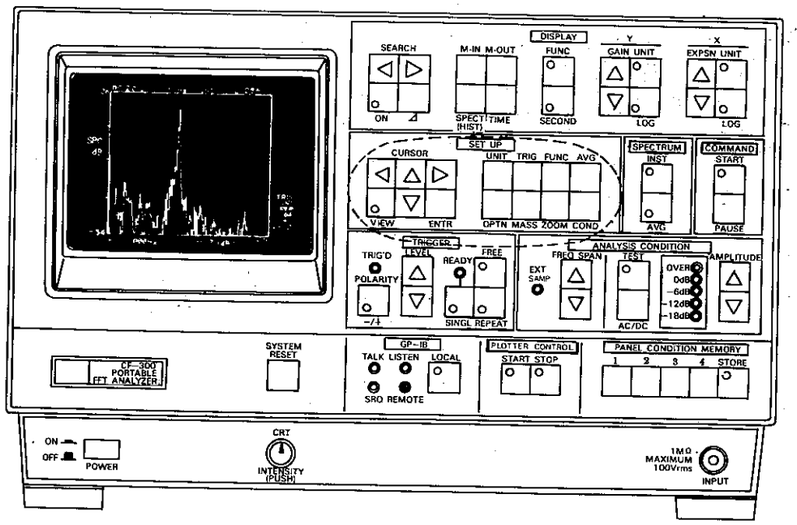
If this switch is selected (the LED will light) when performing spectrum calculations, regardless of the averaging mode, averaging will not be performed and results will be output each time.

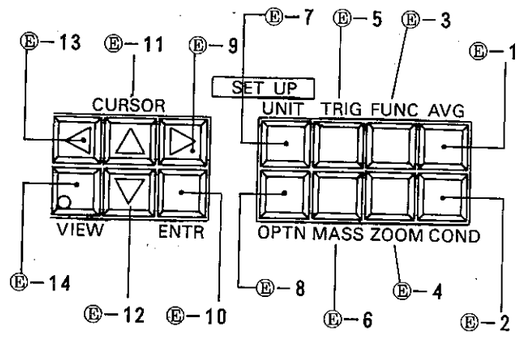
Ⓓ-2 Average Execution Switch

The type and number of averages selected and recorded by Ⓔ-1 is executed by placing this switch ON. For details, refer to the description of the Ⓔ-1 switch in section 2.5.

2.5 Setup Switch Group

The Ⓔ switch group is used to conduct a menu-type dialogue with the CRT display.





Before describing the operation of each switch in this group, let us examine just what a menu-type dialogue is. First, after pressing the Ⓒ-2 PAUSE switch, press the Ⓔ-14 VIEW switch. The associated LED will light at this time, and the CRT will display the current CF-300 panel setup conditions. The example on the following page is that of the setup conditions in the CF-300 initialized state.

Example: View of setup conditions at initialization

```
model [CF-300] PORTABLE FFT ANALYZER
          << SETUP VIEW >>
1 INPUT       DC   20 V
              FILTER:ON
2 FREQUENCY   20KHz       INT
              df= 100 Hz dt= .020mSEC
3 TRIGGER     FRE  INT  LEVEL(  0 )
              PRE  POSITION(-64)
4 ANALYSIS    PEAK      SUM.#= 2
              WINDOW:HANN
5 DISPLAY
    X-AXIS    LIN           UNIT(CPM)
    Y-AXIS    LOG( 60dB) UNIT(Vrms)
              EU=1000E+0mV
    FUNCTION  SUB
6 OPTION
    MASS      OFF
    ZOOM      OFF
    PLOTTER   OFF
    GP-IB     Addr=
                  mfd.by [UNIV SCIENT]
```

1 Input — DC coupling 20V attenuator range
Anti-aliasing filter ON

2 Frequency range — 20kHz, internal sampling
Δf (frequency access resolution) 100Hz
Δt (time access resolution) 0.020ms

3 Trigger conditions — Trigger free is selected and internal triggering is used with a level of 0.
A trigger point of 64 points pre-triggering is recorded.

4 Analysis conditions — The peak hold mode is selected and the number of averages is 2.
A Hanning window is selected.

5 CRT display conditions
X-axis Linear display, units of CPM are selected
Y-axis Log display (display with 60dB), units of Vrms and EU (physical units) with 1EU = $1000mV \times 10^{\circ}$
The SUB function is selected and recorded

Differentiation/Integration Software	Not connected
Mass memory	Not connected
Zoom	Not connected
Plotter interface	Not connected
GP-IB	Address

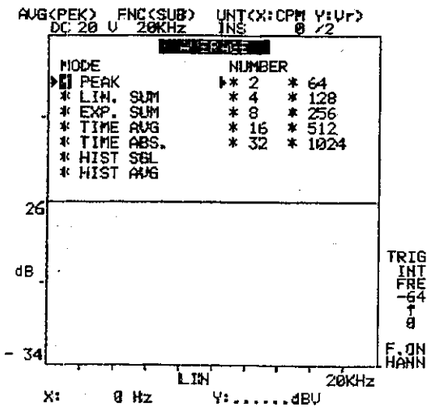
Note that for the settings of trigger, averaging, X-axis and Y-axis units, and other functions, when the switch corresponding to these functions is turned ON, in this explanation we will refer to the function as having been recorded.

Switches Ⓔ-1 thru Ⓔ-8 labeled AVG, CONDI, FUNC, ZOOM, TRIG, MASS, UNIT and OPTN are used to change the parameters of the same name shown by the setup view function. Switches Ⓔ-9 thru Ⓔ-13 are used during this storage and modification process to move the marker and perform recording.

We will begin the actual descriptions of the Ⓔ-1 average mode selection procedure.

Ⓔ-1 Average Mode Selection Switch (AVG)

When switch E-1 is pressed, a menu is displayed on the upper portion of the CRT. The menu includes the CF-300 executable average modes and the number of averages.



Modes:

* Peak hold
* Linear averaging
* Exponential averaging
* Time averaging
* Absolute value time averaging
* Amplitude probability density function (No averaging)
* Amplitude probability density function (linear averaging)

The above seven modes are possible for averaging.

The following possible number of averages may be set:

*2	*64
*4	*128
*8	*256
*16	*512
*32	*1024

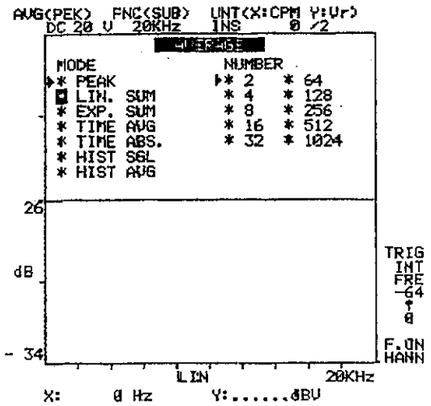
The number of averages can be selected in ten steps ranging from 2 thru 1024. Note that for exponential averaging, however, there are four steps ranging from 2 thru 16 which become the attenuation constant and if a higher number of averages is set, only 16 averages would automatically be performed.

Now press the Ⓔ-12 switch. The (*) to the left of the word PEAK will move downward. Next, press the Ⓔ-9 switch. The asterisk will now be positioned to the left of the number 2 indicating the number of averages. In this manner the Ⓔ-9, Ⓔ-11, Ⓔ-12, and E-13 switches cause the asterisk to move in the direction of the arrow imprinted on those swtiches. Verify that this operation occurs.

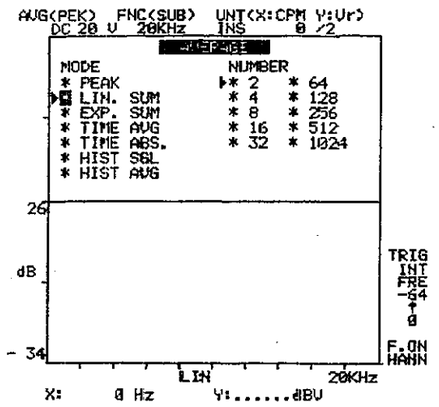
If the Ⓔ-10 ENTER switch is pressed, the ▶ mark moves and the conditions or number of averages indicated by the asterisk is stored.

Now let's store 8 linear averages.

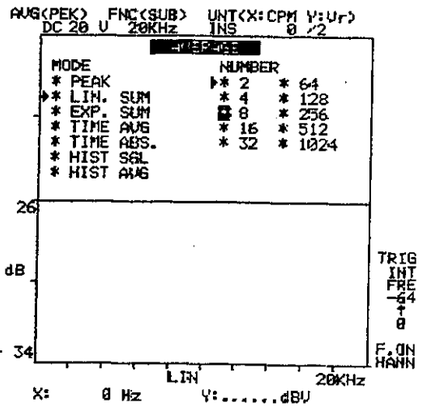
(1) Move the "*" to LIN. SUM.



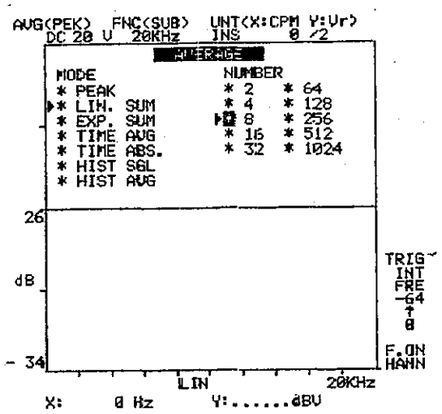
(2) Press Ⓔ-10. The arrow will move to the left of the asterisk. This completes the storage of linear averaging.



(3) Using Ⓔ-9 and Ⓔ-12, move the * mark to the number 8.



(4) Press Ⓔ-10. The arrow will move to the left of the asterisk. This stores the number of averages.



(5) To execute the linear 8 averages stored above, press the Ⓓ-2 switch.

The following processing modes are available in addition to the linear averaging mode: exponential summation (EXP. SUM), time averaging (TIME AVE), time averaging of absolute values (TIME ABS), amplitude probability density function (INSTANT mode) (HIST SGL), amplitude probability density function (linear averaging mode) (HIST SUM).

With the exception of the amplitude probability density function, the storage and execution of these modes is the performed in the same manner as was done for the linear averaging mode shown above.

Phase Spectrum (PHASE)

This is used when it is desired to display the relative phase differences of the various spectrum components. Since this function uses the trigger point as a reference, it has significance only when the trigger function is used.

Execution is performed by using the Ⓕ-9 switch. To return the display from a phase display to a power or linear spectrum display, press the Ⓕ-14 switch.

Procedure for Determining Amplitude Probability Density Function

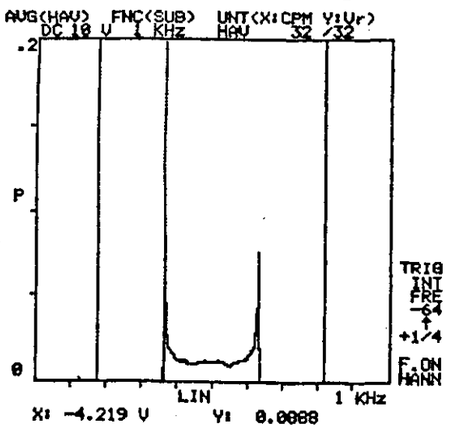
(1) When in the Ⓔ-1 averaging mode, to execute without averaging select HIST SGL (histogram INSTANT mode) and to execute with averaging select HIST AVG (histogram linear averaging mode) and store using the Ⓔ-10 switch.

(2) If in step (1) HIST AVG was selected, select the number of averages as well.

(3) Press the Ⓓ-2 average execution switch.

At this point, the amplitude probability density function will automatically executed. The attenuator range fullscale setting will be divided into 128 levels, the sampling rate will be 2.56 times the set frequency range, and, if the anti-aliasing filter is ON, the frequency range MAX will be the highest frequency analyzed.

(Example) Amplitude probability density function for a signwave



The X-axis corresponds to the signal level with a solid line at a +fullscale (right side, in this case +10V). The dotted lines are markers, with the coordinates listed in the bottom of the CRT display as follows.

X value: -4.219V
Y value: 0.0888 (8.88%)

Ⓔ-1 Notes

Exponential Averaging

This type of averaging, also known as weighted averaging, is one type of averaging in which the results are output continuously during the averaging process. In

exponential averaging, new values are added to the base value with a weight determined by the appropriate attenuation factor, the output being updated at that time. Weight for new values is high, and while old values are included in the data, the older a value becomes the smaller its weight becomes. In the CF-300, four types of exponential averaging are possible - averaging with 2, 4, 8, or 16 summations.

Time-Axis Averaging

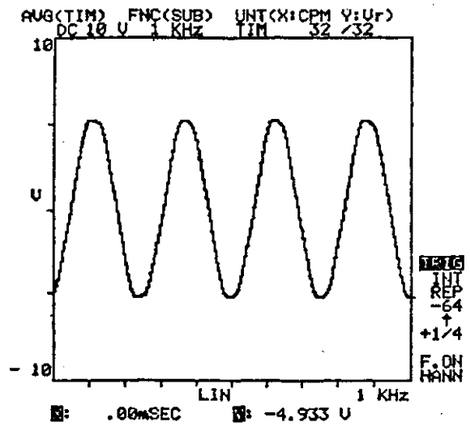
This function is provided as a means of reducing noise on signals containing such components and thus improving S/N ratio. For the example of vibrational waveform analysis of a rotating machine, a trigger can be provided for each rotation of the machine and time-axis averaging performed. Since the causes of vibration occur for every rotation and external noise is not synchronized to these events, the effects of external noise will gradually be reduced and S/N will be improved. This function, of course, has no meaning unless the trugger function is used. In the CF-300, by pressing the Ⓕ-14 switch, an FFT analysis can be performed after time-axis averaging to transform the time data to a spectrum display.

Time Averaging of Absolute Values

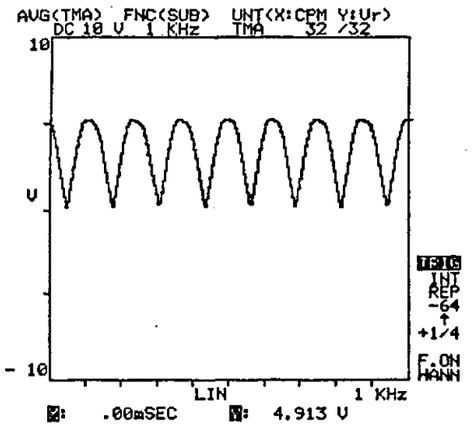
This form of time-axis averaging digitally rectifies the sampled waveform and averages these values.

In addition, after averaging by pressing the Ⓕ-14 switch, transformation to a spectrum display is possible. Applications of this function include analysis of the affects of nicks or gears in drive trains which cause high-frequency components appearing as pulses in synchronous with the rotation. With normal time-axis averaging, because of slight phase differences these components are not extractable. However, with absolute averaging the patterns beocme visible.

Time axis averaging (50Hz signwave)



Time axis averaging of absolute values (50Hz signwave)



Amplitude Probability Density Function

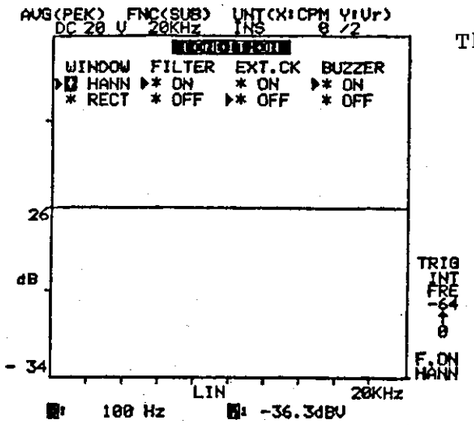
Whereas frequency analysis treats a signal in the frequency domain, amplitude probability density function analysis expresses the signal in the amplitude domain. This function expresses the probability that a constantly changing signal will exist within an amplitude range of ΔX. The total number of occurences of the signal is generally taken to be 1 for normalization of probabilities.

Using this function, it is possible to determine the amount of variation of the signal as well as how it is varying in each amplitude range of the attenuation setting.

In the CF-300, the attenuator range setting is divided into 128 levels, the upper frequency limit may be set by selecting the frequency range which is linked to a lowpass filter. The amplitude axis may be calabrated in physical units for display. Linear averaging may be selected for this function.

Ⓔ-2 Condition Setting Switch

The Ⓔ-2 switch can be used for window function selection, as well as ON/OFF control of the anti-aliasing filer, the external clock, and the alarm beeper function.



The initial settings are:

Window: Hanning
Filter: ON
EXT clock: OFF
BUZZER: ON

WINDOW

HANN (Hanning window) or REC (rectangular window) may be selected. The Hanning window should be used normally. The rectangular window should be used for impulse-caused characteristic vibrations and other signals where the last part of the signal is close to 0 in amplitude.

FILTER

This turns the -120dB/octave lowpass anti-aliasing filter ON/OFF. The filter cutoff frequency is linked to the frequency range. Be sure to have this filter ON when performing spectrum analysis.

EXT Clock

This should be ON when performing sampling of the input signal from such sources as rotating machines (for order analysis, etc.) in synchronous with the rotation angle.

A TTL level clock should be used and sampling is performed on the falling edge. The clock input is a BNC connector on the rear panel.

Ⓔ-2 Notes

Hanning Window

While the theoretical Fourier transform is intended for transformation of an infinite time series, in reality this is not possible. FFT analysis is typically

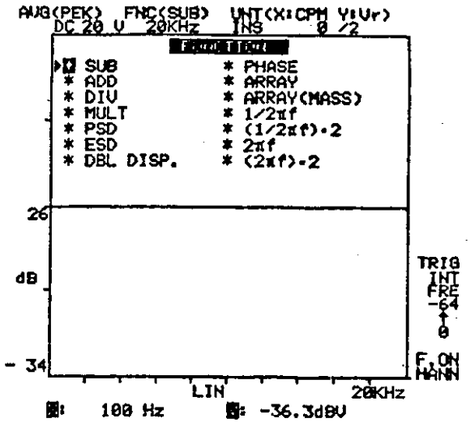
performed on a limited set of time points (for example, 512 points) using a time window. This time window can produce spectrum side-lobes. To minimize such effects, the beginning and ending portions of the window are smoothed to form what has been called the Hanning window, used in the CF-300.

Aliasing

When the analog input signal is converted to digital form, if the input signal contains components that are greater than 1/2 of the sampling frequency, since sampling theory dictates that only components up to 1/2 of the sampling frequency may be determined, these higher frequency components cause errors in the calculated lower frequency components. This phenomenon is known as aliasing. In the CF-300, to prevent this, before the A/D convertor a sharp-cutoff (-120dB/octave) lowpass filter has been inserted to remove such signal components, and thus completely eliminate aliasing.

Ⓔ-3 Function Setting Switch

This switch is used to select such functions as arithmetic operations between data, power spectrum density, energy spectrum density, spectrum overlaid display, phase spectrum, 3-dimensional display, double integration of the spectrum vertical axis, and double differentiation of the vertical axis.



[Display format]

* Subtraction	* Phase spectrum
* Addition	* 3-Dimensional display
* Division	* 3-Dimensional display (mass memory)
* Multiplication	* Single integration
* Power spectrum density	* Double integration
* Energy spectrum density	* First differential
* Spectrum overlay display	* Second differential

The function selected and stored by the Ⓔ-10 switch at this point is executed by pressing the Ⓕ-9 function execution switch. One part of the dual display is stored in memory using the Ⓕ-13 M-IN switch and recalled using the Ⓕ-11 M-OUT switch. For details see the sections on Ⓕ-13 and Ⓕ-11.

Subtraction (SUB)

When a CRT dual display has been obtained (refer to the section on Ⓕ-10), this function subtracts the upper data from the lower data.

Addition (ADD)

In the same manner, this function adds the lower and upper data sets.

Division (DIV)

When the spectrum Y-axis is displayed with LOG scaling in the dual-display mode, the upper data set is divided by the lower data set (this is equivlaent to subtraction of data sets displayed in dB units). If the X-axis is in LOG display, this function does not operate.

Multiplication (MULT)

When a dual display of time-axis signals has been obtained, this function multiplies the lower and upper data sets.

The possible combinations of arithmetic operations for various types of data are shown in the table below.

Display function / Operation	Dual spectrum display		Dual time axis display	Dual histogram display
	LOG Y-axis	LIN Y-axis		
S U B (Note 1)	$10\log(P_L-P_H)$	$\sqrt{P_L - P_H}$	$f_L - f_H$	$A_L - A_H$
A D D	$10\log(P_L+P_H)$	$\sqrt{P_L + P_H}$	$f_L + f_H$	$A_L + A_H$
M L T	Not possible	Not possible	$f_L * f_H$ (Note 2)	Not possible
D I V	$10\log(\frac{P_L}{P_H})$ (Note 3)	Not possible	Not possible	Not possible

P_L = Lower display spectrum
P_H = Upper display spectrum
f_L = Lower display time axis signal
f_H = Upper display time axis signal
A_L = Lower display histogram
A_H = Upper display histogram

Note 1. With the exception of two time-axis signal data sets, subtractions resulting in a negative value are not displayed.
2. Displayed normalized to ±1.
3. Not possible for a LOG scaled X-axis. The Y-axis display width is 60dB.

If the attenuator range and frequency range settings for the upper and lower data sets differ, the settings for the lower set are used for the execution of the above operations. DIV is executed when the © command switch is in the PAUSE state.

Power Spectrum Density (PSD)

This function is selected to display the power spectrum density as the vertical axis, normalized with respect to the bandwidth. Linear spectrum display is also possible.

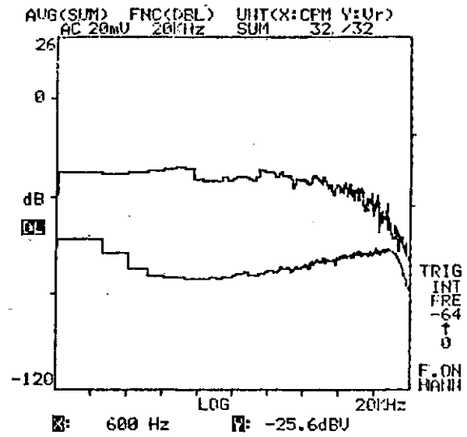
Energy Spectrum Density (ESD)

The power spectrum density is further normalized with respect to the capture time length, and displayed as the energy spectrum density by this function.

Spectrum Overlay Display (DBL DISP)

This function is used to display a double spectrum and is effective in applications inwhich two spectrum of widely varying amplitude must be displayed. Such as the frequency characteristics of an analog amplifier at maximum output and those indicating residual noise alone. To execute the LOG scaled double display in the X-axis, before pressing the Ⓕ-9 function execution switch, select LOG scaling using the Ⓕ-2 switch. For spectrum dual displays, spectrum overlay is also possible with the Y-axis scaled in LOG. Execution is performed in the same manner with the Ⓕ-9 function execution switch.

In the example below of the MOL characteristics and noise background for a tape recorder, the vertical axis is displayed from +26dBV to -120dBV (a range of 146dB).



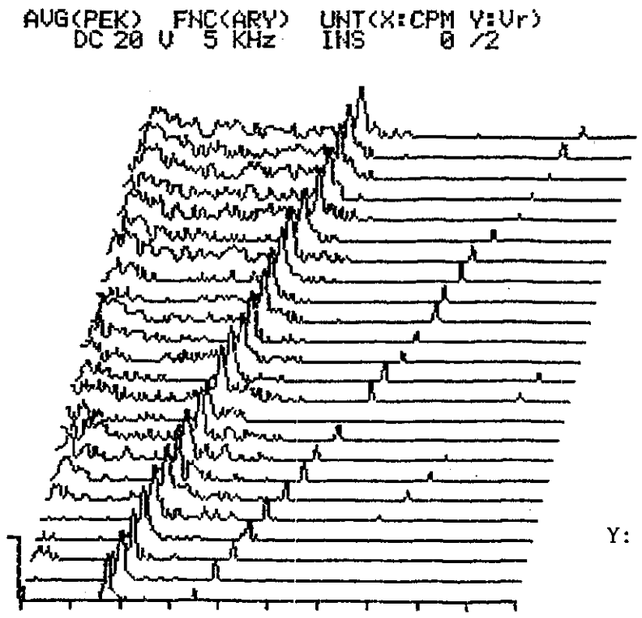
Three-Dimensional Display (ARRAY)

This is used to create a display of spectrum data in three dimensions.

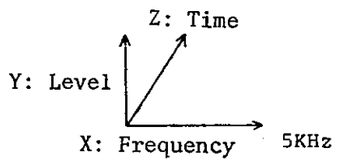
The averaging mode is selected using Ⓔ-1 and the averaging execution switch Ⓓ-2 is set to ON. Regardless of the averaging mode set, linear averaging will be used, and the spectrum will be output at the completion of the set number of averages.

Twentyfour spectral lines will be displayed. Execution begins by pressing the Ⓕ-9 function execution switch.

(Example)



Vibrational waveforms from a rotating body



To escape from the 3-dimensional display mode, press the Ⓓ-1 INST switch.

Three-Dimensional Display (Mass Memory) (ARRAY (MASS))

When the optional mass memory card (CF-031) is fitted into the CF-300, this function provides 3-dimensional display. For details, refer to the instruction manual for the CF-031.

If the mass memory card is not fitted into the mainframe, a CRT display will be output but the function selection will be ignored.

Single Integration	$(1/2\pi f)$
Double Integration	$((1/2\pi f)\cdot 2)$
First Differential	$(2\pi f)$
Second Differential	$((2\pi f)\cdot 2)$

These functions are selectable when the optional differentiation/integration software is used. For details, refer to the instruction manuals for the differentiation/integration software. If this software is not fitted into the mainframe, selection of these functions will be ignored.

Ⓔ-3 Notes

Power Spectrum Density (PSD)

The power spectrum density is a measure of the power contained in each 1Hz of spectrum width.

In the CF-300, the bandwidth for spectrum analysis, analogous to the filter-type analog technique bandwidth, differs depending upon the analysis range.

For example, in the 20kHz range, the bandwidth is 20kHz/200 lines = 100Hz, while in the 2kHz range, it is 2kHz/200 lines = 10Hz. When analyzing random noise or other signals containing all possible frequency components, the spectrum is obtained as the integration of the power in each band. Therefore, if the analysis range is changed, with the same input signal, the values resulting will be different. To allow comparison of values even when the frequency range is changed, it is necessary to determine the amount of power for each 1Hz band. This is know as the power spectrum density (PSD). For the PSD, the power is divided by the bandwidth to normalize the display. Note that this type of spectrum display is not required for signals which have a line spectrum such as those of signwaves.

In the CF-300, PSD is calculated using the following relationships.

PSD using a Hanning window:

Y-axis LOG $10 \log \frac{P}{1.5\Delta f}$ dBV P

Y-axis LIN $\sqrt{\frac{P}{1.5\Delta f}}$ V P

PSD using a rectangular window:

Y-axis LOG $10 \log \frac{P}{\Delta f}$ dBV P

X-axis LIN $\sqrt{\frac{P}{\Delta f}}$ V P

In the above, P is the power spectrum and Δf is the bandwidth.

Energy Spectrum Density (ESD)

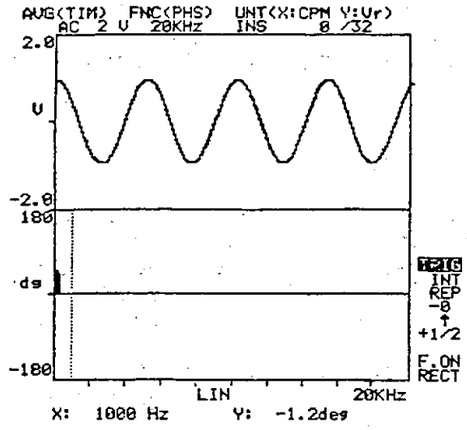
This function is the expression of the finite energy found in waveforms such as impulses.

The spectrum of signals such as impulses which have a finite energy are not normalized with PSD alone, but must be further normalized by the capture time ($T = 1/\Delta f$). The result is the ESD.

Phase Spectrum

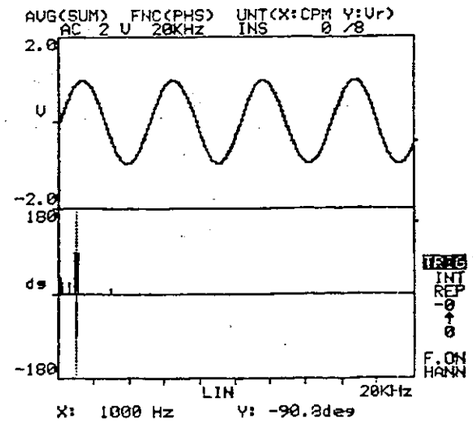
The phase spectrum is the collection of differences in phase from the trigger point for the various frequency components of a spectrum. It is defined as follows.

(Example 1)



1kHZ sinewave input. The trigger point is the 0th point, and when that point is the positive peak, the phase spectrum shown in the lower part of the display reads the values X: 1000Hz, Y: -1.2deg (very nearly 0deg).

(Example 2)

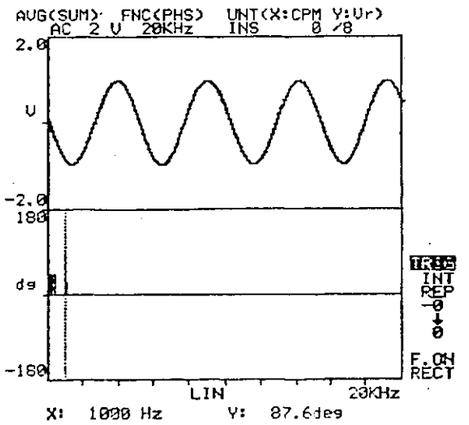


If for a 1kHz sinewave input with a trigger point of the 0th point, that point was the 0 level and the signal was passing through 0 towards the positive side, the following display would appear for the lower part of the screen:

X: 1000Hz Y: -90.8deg

Note that this is very close to -90deg.

(Example 3)



If a 1kHz sinewave is input with the trigger point at the 0th point and that point is the 0 level as the signal passes through to the negative side, the spectrum values on the lower part of the display will be:

X: 1000Hz Y: 87.6deg

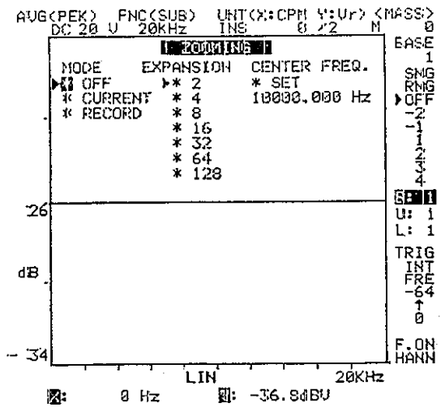
Note that this is very nearly 90deg.

Applications of the phase spectrum include measurements on rotating machines in which one pulse per rotation is generated as a trigger signal and the phase of components with respect to this pulse signal reference is measured to determine the angle of the unbalance point.

Ⓔ-4 Zoom Condition Setting Switch

This switch is used to set zoom conditions when the optional mass memory card transient digital zoom or real-time digital zoom is fitted into the CF-300. For details, see the instruction manuals for the CF-031 mass memory card and the CF-032 real-time digital zoom unit.

If both of the options are not fitted into the CF-300, the CRT display will be made but the selection will be ignored.

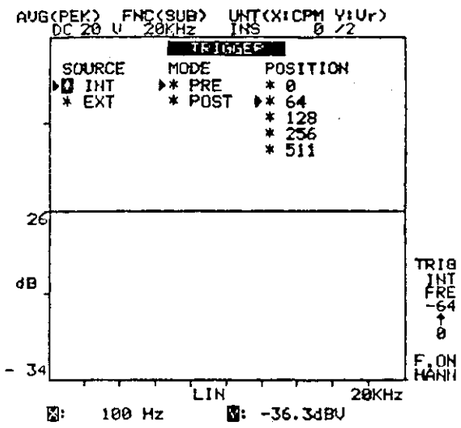


[Display format]

Zoom Mode	Ratio	Center Freq.
* OFF	*2	* Set
* Real-time	*4	
* Transient	*8	10000.00Hz
	*16	
	*32	
	*64	
	*128	

Ⓔ-5 Trigger Condition Selection Switch

This switch is used to select the source and trigger point. The mode selected by this switch is executed by pressing the Ⓑ-2 REPEAT switch.



[Display format]

Trigger source	Mode	Position
* Internal	* Pre-trigger	*0
* External	* Post-trigger	*64
		*128
		*256
		*51

Internal Trigger (INT)

In the internal trigger mode the input signal provides the trigger.

External Trigger (EXT)

The external trigger mode provides triggering by means of an external signal input at the BNC connector at the rear of the CF-300. The maximum input voltage is 40V.

Pre-Trigger (PRE)

This mode makes it possible, depending upon position, to store data before the trigger point.

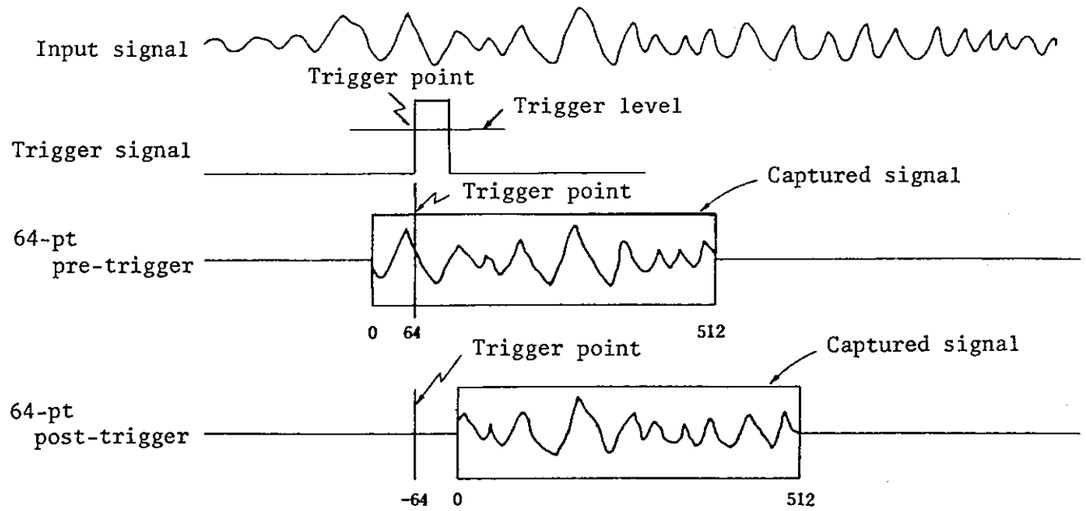
Post-Trigger (POST)

This mode makes it possible, depending upon position, to store data after the trigger point.

Ⓔ-5 Notes

Relationship of Pre-Triggering and Post-Triggering

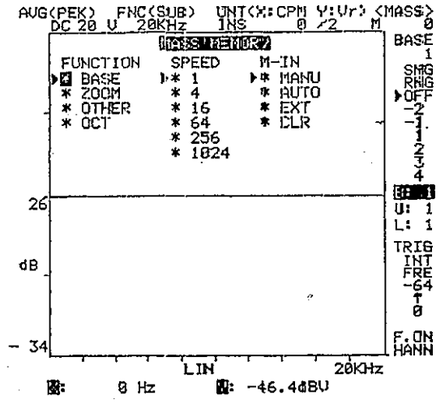
The following is a description of the relationship between pre-triggering and post-triggering when using external triggering with the trigger position at the 64th point.



By changing the position, the position of the start of data capture can be adjusted. Thus, by selecting Ⓔ-5, it is possible to capture data before or after the trigger point.

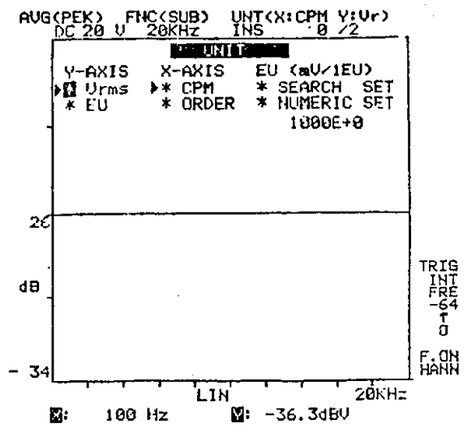
Ⓔ-6 Mass Memory Condition Setting Switch

When the option CF-031 mass memory card is fitted into the CF-300 mainframe, this switch is used to select conditions. For details, refer to the CF-031 instruction manual. If the mass memory has not been fitted into the mainframe, display will be output but the switch will not function.



Ⓔ-7 Units Transformation Selection Switch

This selection switch is used to determine the units for conversion of the Y and X axes. The modes selected and stored by this switch are executed by the Ⓕ-5 and Ⓕ-1 switches for the Y and X axis respectively. If these switches are not used, the units will be dBV (0-p), or V (0-p) and Hz, sec.



[Display format]

Y-axis	X-axis	EU value
*Vrms	*CPM (cycles/min)	*Set to search value
*EU (physical units)	*Order display	*Set to a numerical value 1000E+0

Y-Axis

Vrms

In this position the switch selects conversion from V(0-p) to rms. The display will show values 0.707 times the V(0-p) values or values -3dB with respect to dBV(0-p) values as V_Y or dBV_Y.

EU

In this position the switch selects engineering units calabration, using a reference point. As described in later sections, the EU value becomes 0dBEU or 1EU for the display output.

X-Axis

CPM

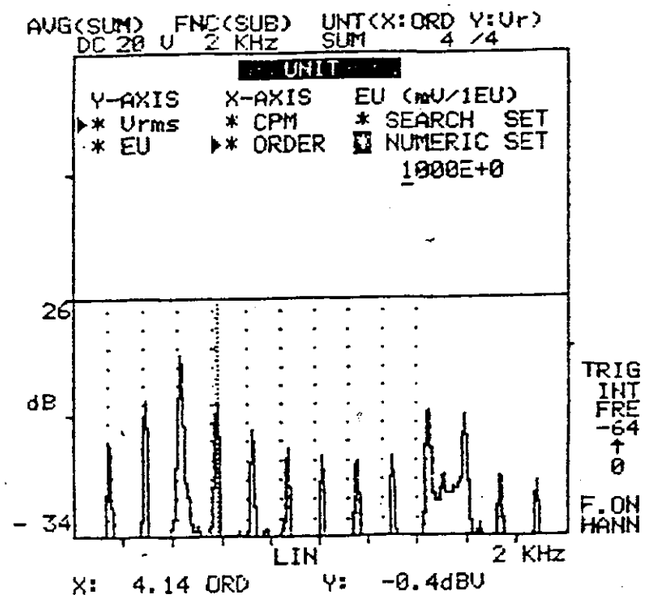
In this position the switch selects conversion from Hz to CPM (cycles/min).

Order Display (ORD)

In this position the switch selects order display from Hz conversion. To set the value of the 1st order, display the spectrum on the CRT screen, select ORD using Ⓔ-7, set Ⓕ-18 to ON, and use Ⓕ-17 and Ⓕ-16 to set the cursor over the 1st position. Then execute ORD using Ⓕ-1 and restore ORD using Ⓔ-10.

The position at which the cursor was aligned becomes the 1st order and the harmonics up to the 10th order are displayed as dotted lines.

Example: Order ratio display



EU Value

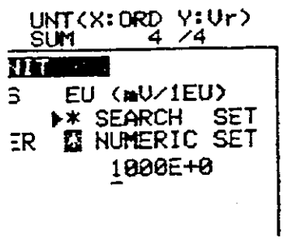
Search Point Setting (SEARCH SET)

At this position the switch is used to set the value of the search point located by the switches Ⓕ-17 and Ⓕ-18 to 0dBEU or 1EU for the Y-axis EU value. Execution is made by Ⓕ-5.

Set to a Numerical Value (NUMERIC SET)

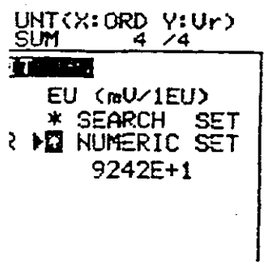
In this position any arbitrary voltage value can be used as the 0dBEU or 1EU reference level for the Y-axis. Ⓔ-9, Ⓔ-11, Ⓔ-12, and Ⓔ-13 are used to set the asterisk mark to the left of NUMERIC SET. Note that a value appears below the words NUMERIC SET. The underlined digit of this value is the value that may be changed. (See example 1)

(Example 1)



When Ⓔ-11 is pressed, the digit increases.
When Ⓔ-12 is pressed, the ditit decreases.
By pressing Ⓔ-9, the digit position changes.
The E+0 is the exponent, and in this case, has the significant $x10^0$.
The range of settable exponents is from E-3 ($x10^{-3}$) to E+3 ($x10^3$).

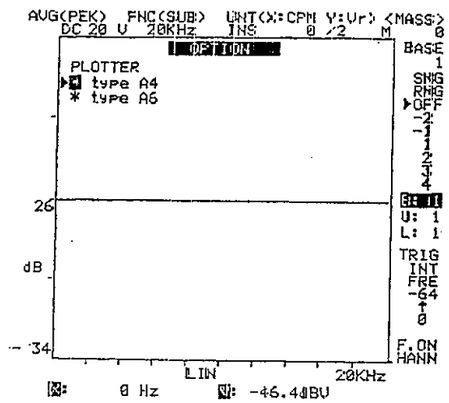
(Example 2)



For example, to set the value 92.42V as 1EU, this value is 9242mV x 10^1, so that the setting will be 9242E+1 (see example 2). Ⓔ-10 is pressed to store this value after setting.

Ⓔ-8 Option Selection Switch

This switch is used to select the optional XY plotter interface. For details, refer to the instruction manual of the CF-034 XY plotter interface package.



Ⓔ-9, Ⓔ-11, Ⓔ-12, Ⓔ-13 Mark Positioning Switches

These switches are used to position the asterisk. They are used also to modify values for the setting of EU values using Ⓔ-7.

Ⓔ-10 Condition Storage Switch

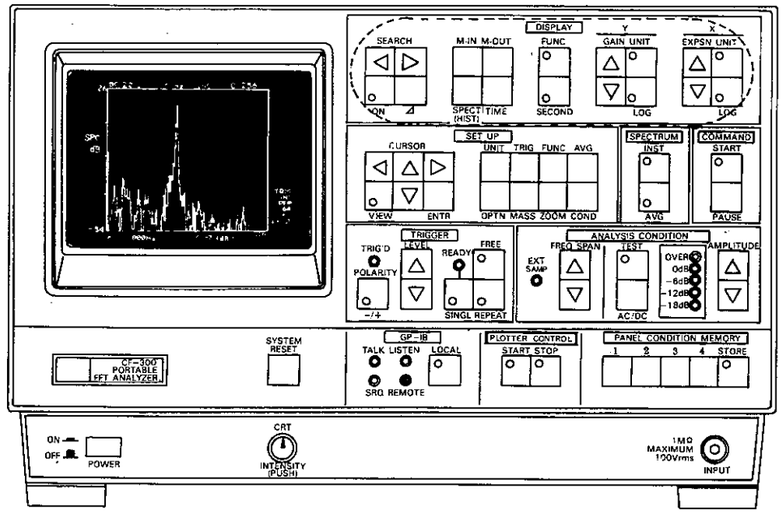
This switch is used to store the conditions indicated by the position of the asterisk mark as setup by the Ⓔ-9, Ⓔ-11, Ⓔ-12, and Ⓔ-13 switches.

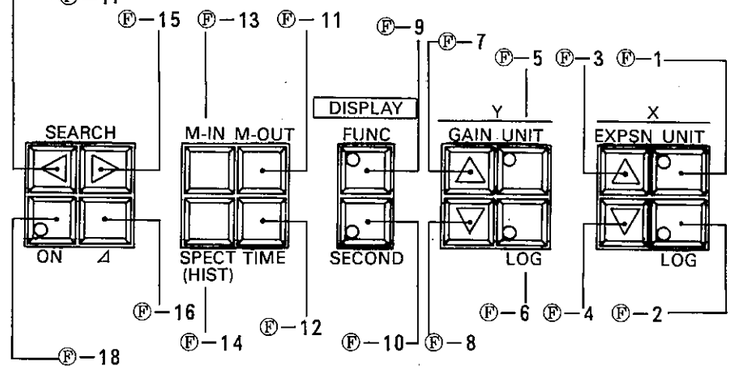
Ⓔ-14 Setup Viewing Switch

This switch is used to view the panel setup conditions on the CRT display. It functions when the command switch is in the PAUSE state.

2.6 Ⓕ Display Switch Group

The Ⓕ switch group is used to modify the CRT display.



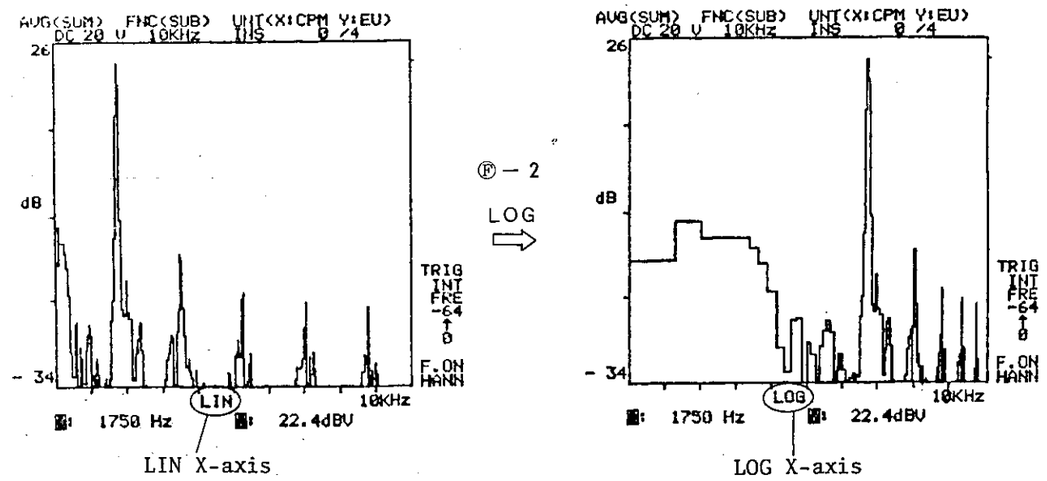


Ⓕ-1 X-Axis Unit Conversion Execution Switch

This switch is used to execute the value of X-axis unit conversion stored by the Ⓔ-7 switch (refer to the section on Ⓔ-7).

Ⓕ-2 X-Axis LOG Conversion Switch

This switch is used to convert the X-axis from LIN to LOG display. With the LED lighted, the LOG display is in effect. In the initialized state, the LIN display is selected automatically.



Ⓕ-3, Ⓕ-4 X-Axis Expansion Switches

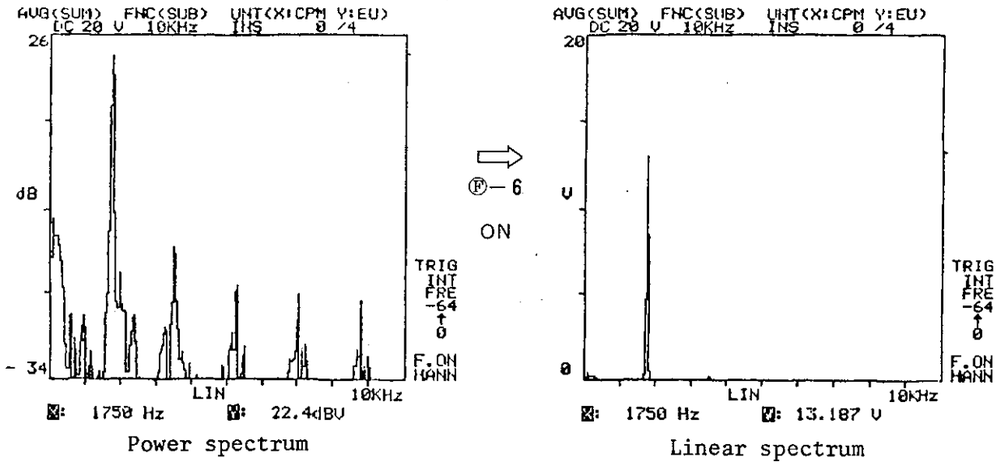
When the optional zoom unit is fitted to the CF-300, these switches are used. For details, refer to the CF-031 and CF-032 instruction manuals.

Ⓕ-5 Y-Axis Unit、Conversion Execution Switch

This switch is used to execute the value of Y-axis unit conversion stored by the Ⓔ-7 switch (refer to the section on Ⓔ-7).

Ⓕ-6 Y-Axis LIN Conversion Switch

This switch is used to convert the initialized LOG display state (LED lighted) to a LIN display for linear spectrum output.



Power spectrum　　Linear spectrum

Ⓕ-7, Ⓕ-8 Y-Axis Display Gain Conversion Switch

This switch is used to select the gain for the Y-axis display. When Ⓕ-7 is pressed the gain is raised and when Ⓕ-9 is pressed the gain is lowered. For power spectrum display, the attenuator fullscale range will sequence through -60dB, -80dB, -100dB in three steps. For linear spectrum display, in the same manner, it will sequence through the five steps of X1, X2, X5, X10, and X20.

Ⓕ-9 Function Execution Switch

This switch causes execution of the function stored by the Ⓔ-3 switch (refer to the section on Ⓔ-3).

Ⓕ-10 Dual-Display Switch

When a spectrum or a time-axis signal is displayed on the CRT, pressing this switch causes it to move to the lower section of the CRT screen, allowing another set of data to be displayed in the upper portion of the screen.

Ⓕ-13, Ⓕ-11 Memory IN/OUT Switches

Pressing the Ⓕ-13 switch stores the displayed CRT data for a single display and the lower portion displayed data for a dual-display into memory. Along with this data is stored attributes that appear on the screen as alphanumeric data. Ⓕ-11 is used to recall data from memory to the CRT display. It can be used to store reference data.

Ⓕ-12 Time-Axis Signal Display Switch

By pressing this switch, 200 words of the captured time-axis data can be displayed on the CRT screen.

Ⓕ-14 Spectrum (Histogram) Display Switch

When Ⓓ-2 is used to execute a spectrum displayed on the CRT or histogram as selected by Ⓔ-1, this switch is used to execute the histogram.

Ⓕ-15, Ⓕ-17 Dot Search Positioning Switches

When Ⓕ-18 is ON, these switches move the dot search point, the values corresponding to that point being displayed on the lower portion of the CRT screen. When the CRT is displaying two waveforms, dot search is valid only for the lower portion.

Ⓕ-16 ΔX, ΔY Origin Setting Switches

When Ⓕ-18 is ON, and with the dot search point selected by Ⓕ-15 and Ⓕ-17 as the origin, this switch enables the determination of the differences from the origin, ΔX and ΔY. When this switch is placed ON, the current point becomes 0Hz and 0dBV or 0V. After this, by moving the cursor (dot search function) the distance or variation ΔX and ΔY are displayed. This function is effective in the time-axis as well.

Ⓕ-18 SEARCH ON/OFF Switch

This switch turns the dot search function ON and OFF. With it OFF, and the CRT displaying a spectrum, the maximum value of frequency and Y-axis will automatically be displayed and the maximum value will be tracked.

Dual-Display Procedure

To display both a spectrum and time-axis signals on the CRT screen, perform the following procedure.

(1) In the initialized state, spectrum only is displayed.

(2) Set Ⓕ-10 to ON, and the spectrum will move to the lower portion of the CRT screen.

(3) Set Ⓕ-12 to ON to change the display to a dual-display.

To display a current and a stored spectrum from memory simultaneously:

(1) Display the desired spectrum from memory on the CRT screen.

(2) Set Ⓕ-13 to ON to store in memory.

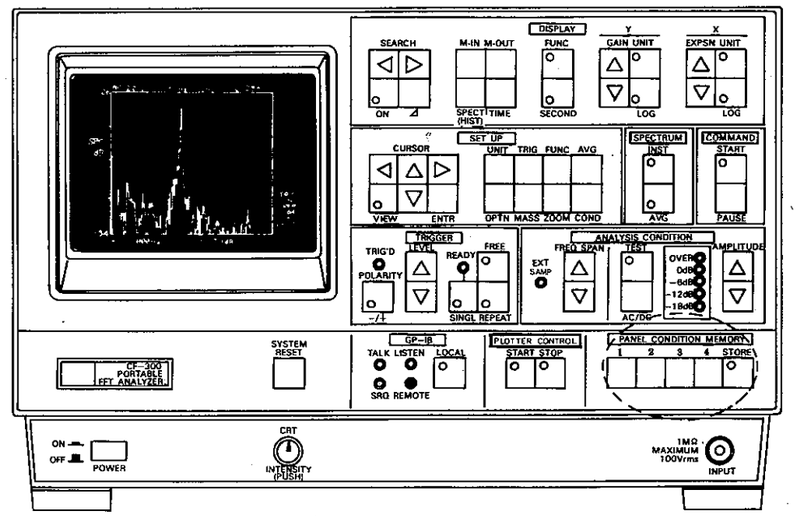
(3) Display the current spectrum on the CRT screen.

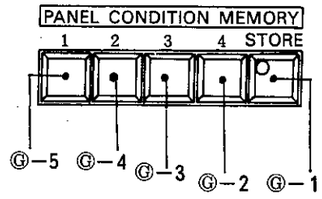
(4) Set Ⓕ-10 to ON. This moves the spectrum to the lower portion of the CRT screen.

(5) Set Ⓕ-11 to ON to recall the spectrum from memory to the upper part of the CRT screen, thus causing a dual display.

2.7 Ⓖ Panel Conditions Setting/Selection Switches

With the exception of the Ⓗ plotter control switches, the Ⓘ GPIB related switches, and the Ⓙ system reset switch, this switch is useable to store all panel setup conditions in memory. Memory contents are held by a rechargeable battery even when the power supply is switched OFF (memory hold is for approximately 30 days). The batteries are charged when the unit is powered up.





Ⓖ-1 STORE Command Switch

This switch is used to store sets of conditions.

Ⓖ-2 thru Ⓖ-5

These switches are used to recall any of four sets of panel conditions.

Storing Panel Setup Conditions

(1) Set the panel conditions that you wish to store into memory.

(2) Press the Ⓒ-2 to the PAUSE state.

(3) Set the Ⓖ-1 store command switch to ON. The LED will light.

(4) Press the switch at which you wish to store the setup conditions (Ⓖ-2 thru Ⓖ-5).

(5) Once more, press Ⓖ-1. The LED will go out and the procedure is completed.

Executing steps (4) and (5) erase the previously stored data.

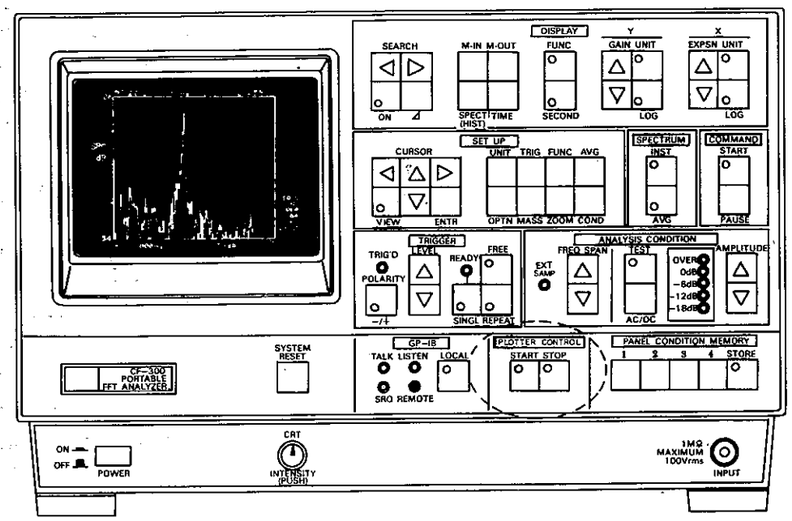
Recalling Stored Panel Conditions

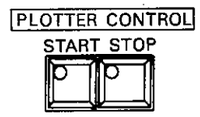
(1) Press the Ⓒ-2 to the PAUSE state.

(2) Press any switch from Ⓖ-2 thru Ⓖ-5 for which the panel setup conditions are to be recalled. Note that Ⓒ-1 will automatically go to START.

2.8 Ⓗ Plotter Control Switches

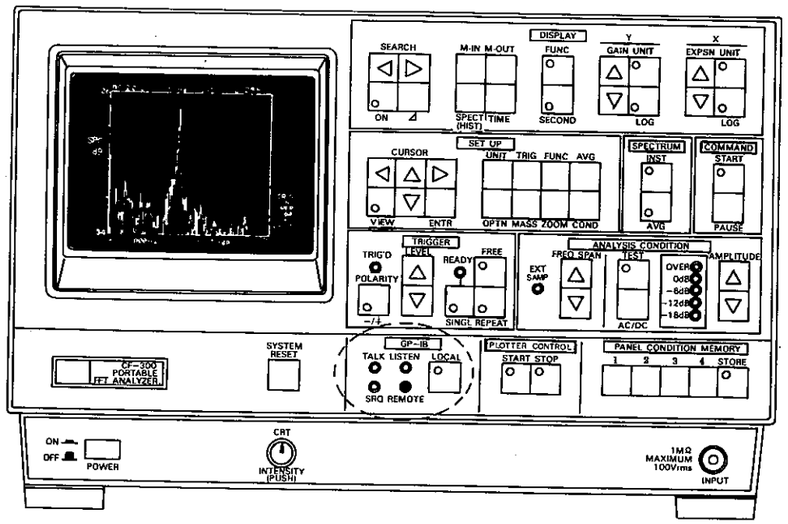
When the optional plotter interface CF-034 is fitted to the CF-300 mainframe, these control switch perform START and STOP functions for the plotter. For details, refer to the CF-034 instruction manual.

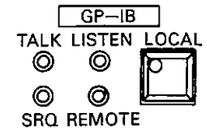




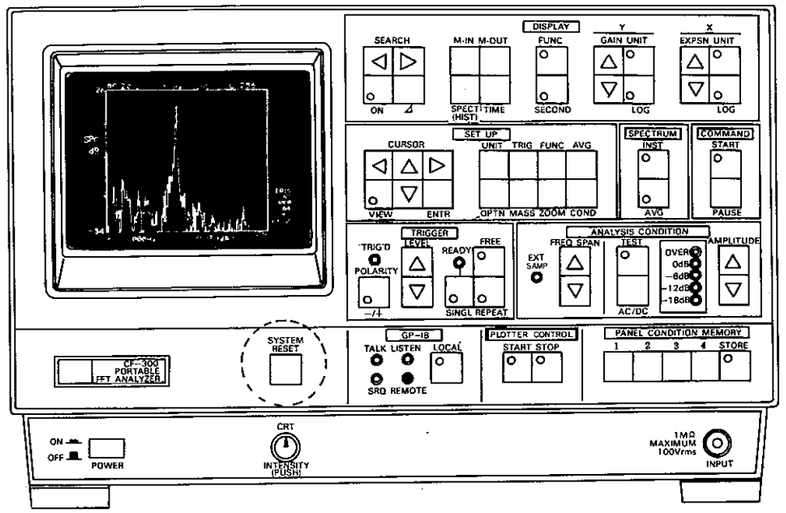
2.9 Ⓘ GP-IB Related Switch/LEDs

When the optional GP-IB interface package CF-033 is fitted to the CF-300 mainframe, this switch and LED group combination are used to indicate GP-IB statuses. For details, refer to the CF-033 GP-IB instruction manual.





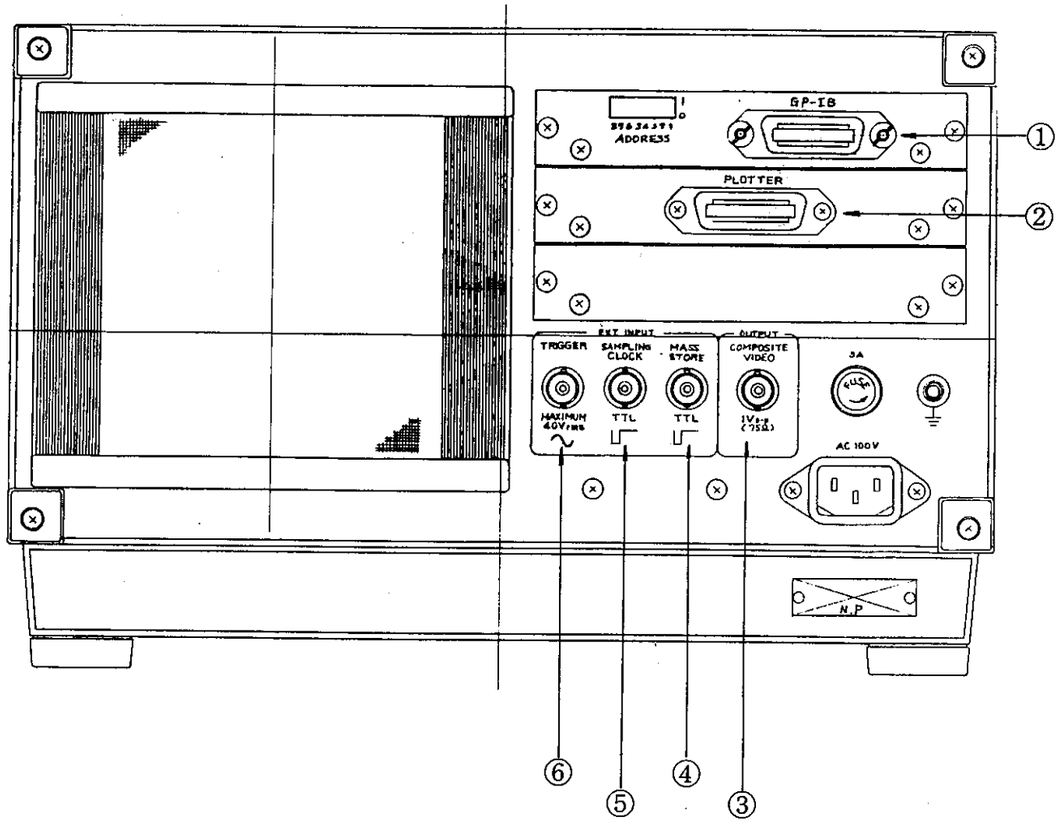
2.10 Ⓙ System Reset Switch



This switch performs a complete system reset to the initialized state. Located below this system reset switch is a rotary switch used to adjust the brightness of the CRT display.

3. REAR PANEL DESCRIPTION

This section will describe the rear panel connectors of the CF-300.



① GP-IB Connector

This connector is used to provide connections to the optional CF-033 GP-IB package located behind this connector.

② XY Plotter Connector

In the same manner, this connector is used to make connections to the optional CF-034 XY plotter interface package which can be located behind it.

③ Video Printer Output BNC

This connector is used with the optional VP55 composite video signal output (1Vpp, 75Ω). This signal is used to drive a video printer. It may be used with any other device such as an external CRT display which uses a composite video signal.

④ Mass Storage Memory Timing Pulse Input Connector

In the multiple spectrum storage mode of the optional CF-031 mass storage memory, this connector is used to provide external timing commands. The input signal should be of TTL level. Timing is performed on the falling edge.

⑤ External Sampling Clock Pulse Input Connector

This connector is used to input an external clock pulse. Such signals are required for implementation of true order ratio analysis.

The input signal should be of TTL level. One rising edge is treated as a single pulse and, as long as the pulse width is at least 5μs, operation is possible without regard to the duty cycle.

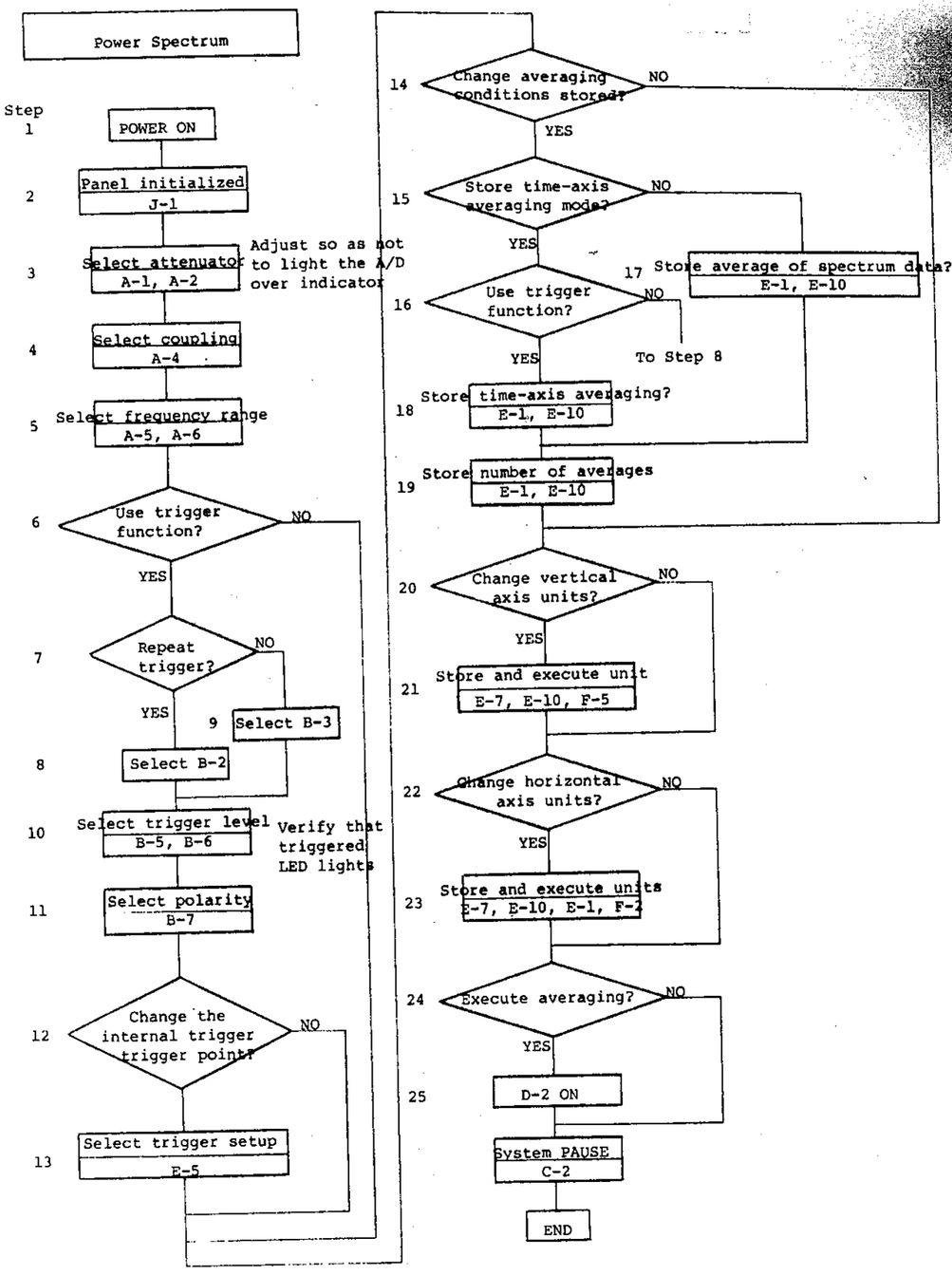
Operation is possible from the DC region thru 51.2kHz.

⑥ External Trigger Input Connector

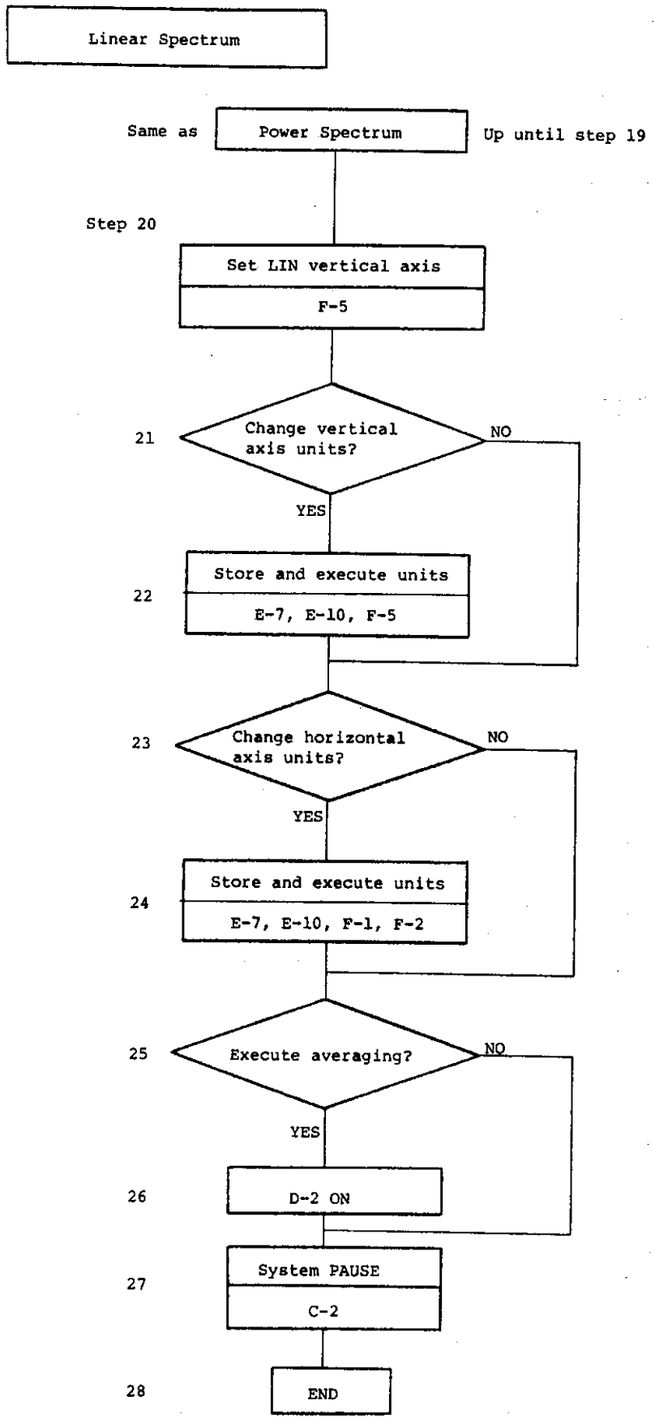
This connector is used for inputting an external trigger signal when external trigger function is to be used. While the maximum input is 40V, the settable range for the trigger level is ±2.5V, which is treated as fullscale. The input impedance is 100kΩ.

4. SHORT FORM OPERATION PROCEDURES

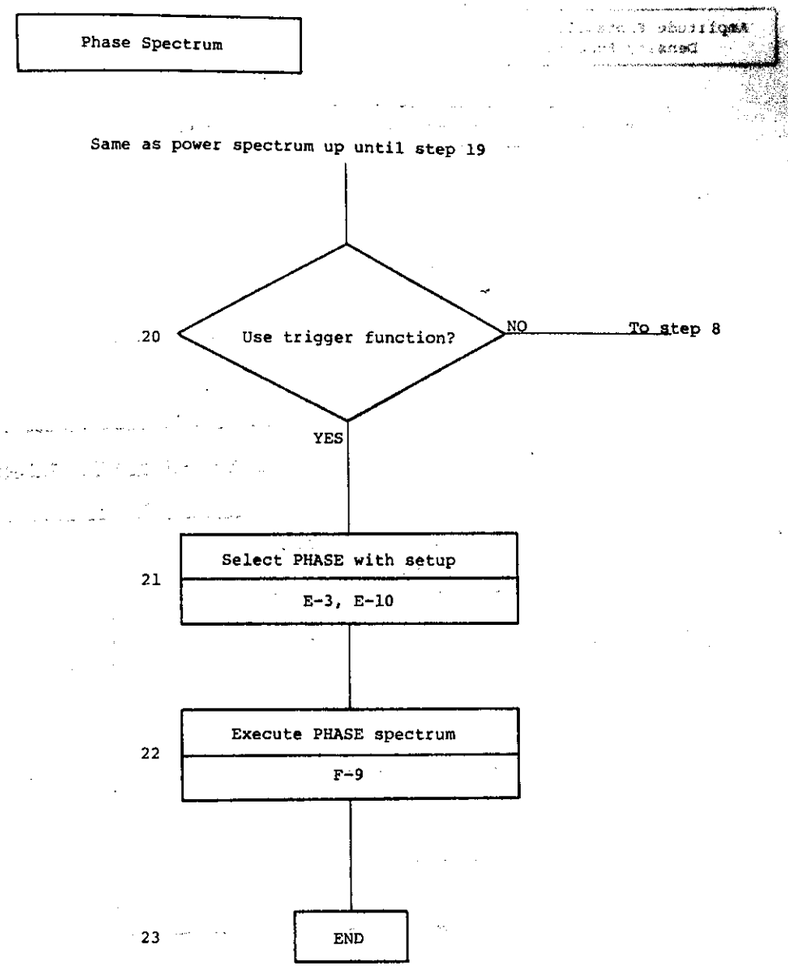
This section describes the basic operation procedures for four typical types of function operations of the CF-300. Each step is surrounded in a rectangle with the number of the switches to be operated at that step indicated in the lower portion of the rectangle. The numbers of the switches correspond to the numbers used in section 2. for the detailed switch descriptions.



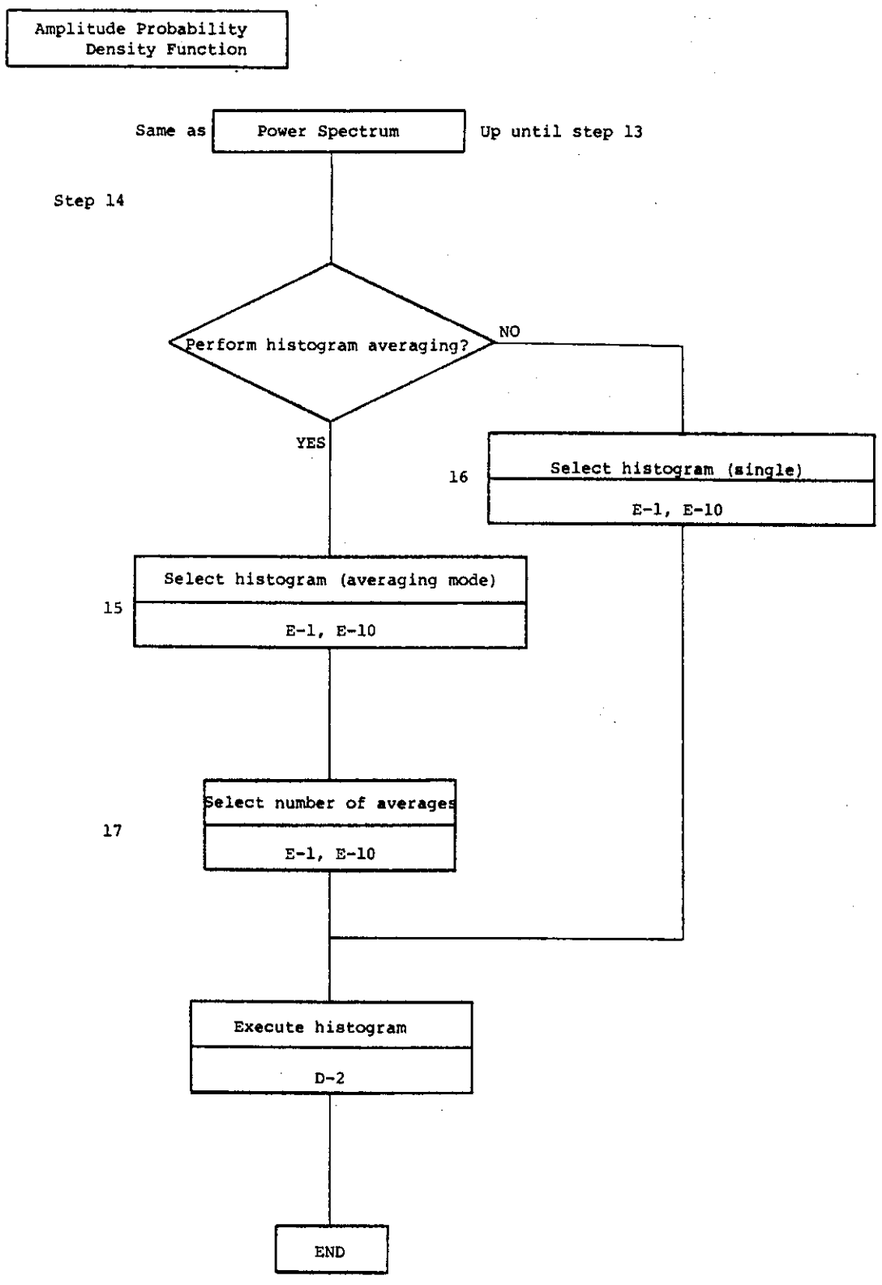
Linear Spectrum



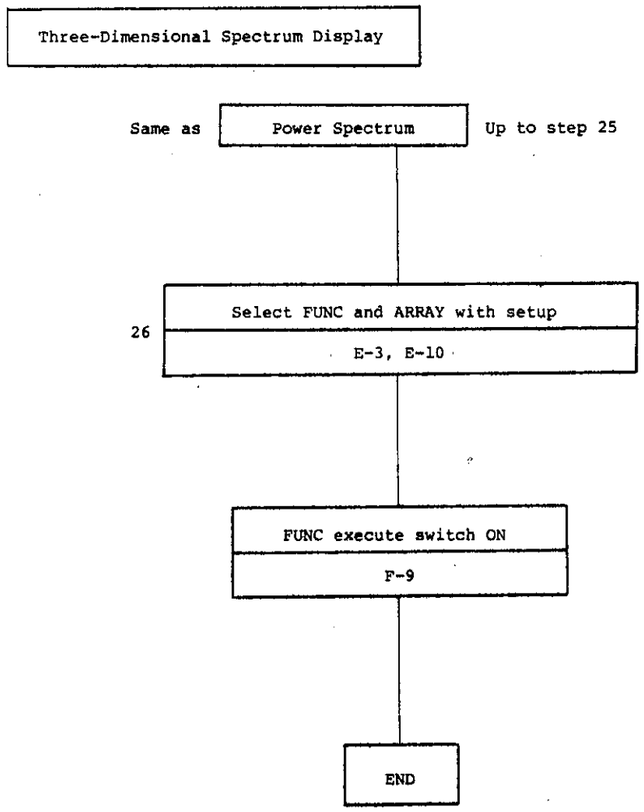
Phase Spectrum



Amplitude Probability Density Function



Three-Dimensional Spectrum Display



WARRANTY

We warrant that within twelve (12) months from the date of shipment, if a product manufactured by us and sold by us is in the possession of the original buyer from us (or from an authorized distributor), we will replace or repair, at our option, free of charge, any part or parts which, upon examination, we find defective in workmanship or materials, provided that on our request the product or parts thereof are returned to our plant, along with satisfactory documentation that the product has been installed, used, and maintained in accordance with instructions in the instruction manual and has not been subject to abuse. We shall not be liable or responsible for any expense or liability for repairs, additions, or modifications made upon the product without our written consent.

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