HIOKI

INSTRUCTION MANUAL

8825

MEMORY HiCORDER

FFT ANALYZER

9523 GP-IB INTERFACE

HIOKI E.E. CORPORATION

Contents

Safety Notes

- This manual includes important directions for safe operation and maintenance of the 8825 unit. Note carefully the following safety points before using the unit.

Safety symbols

	Identifies important sections which must be read by the user before carrying out the relevant operation on the unit.
	Protective ground connection

The following three levels of heading are also used in this manual to prioritize warnings.

DANGER	This indicates points where an error could pose serious danger to the operator.
WARNING	This indicates points where an error could damage the unit or pose a hazard to the operator.
CAUTION	This indicates important points on operation.

Danger

- To avoid the danger of electric shock or damage to the unit, never apply more than 250 V (either AC or DC) between a pair of input units or between an input unit and the frame.
- In particular, if a power line capable of carrying a large current is connected and applies an excess voltage, there is a danger of a short circuit accident.
- In order to avoid accidents from electric shock, before removing or replacing an input unit or changing a fuse, disconnect the input cables and the power cable. To prevent fire hazards, use a fuse of the rating specified on the rear panel.
- If any metal parts of the input cables are exposed there is a danger of electric shock. Use only the supplied 9574 input cables.
- Normally keep all eight input units installed permanently. If a unit is not fitted, it must be replaced by a blanking panel. If the unit is operated with an input unit not in place it poses a shock hazard.
- In order to avoid accidents from electric shock, before replacing an input unit, check that the input cables are disconnected, turn off the power, and remove the power cable.

Danger and warning

- To prevent damage to the 8825 unit, never exceed the limits in the table on the right for the various input connections.
- The unit should always be operated in the range of 5°C to 40°C and 35% to 80% relative humidity. Avoid operation in direct sunlight, in dusty conditions or in the presence of corrosive gases.

Input connection	Maximum capacity
8907 inputs 8909 inputs	350 V DC+AC peak
8908 inputs	100 V AC/DC
EXT TRIG START STOP	-5 V to +10 V
TRIG OUT GONG	-20 V to +30 V 500 mA MAX 200 mA MAX

Chapter 1

FFT Analyzer

1-1. What is the FFT Function?

1-1-1. Outline

- FFT channel mode
  - 1 CHFFT: 1 channel FFT
  - 2 CHFFT: 2 channel FFT
- Frequency range setting: 133 mHz to 80 kHz (for the TIME/DIV setting of the MEM function)
- Dynamic range: 72 dB (theoretical value)
- Number of Samples: 1000 points
- Frequency resolution: 1/400
- Anti-aliasing filter: Automatic setting of cutoff frequency coupled to the frequency range. Can be turned on or off.
- Analysis channel setting: Any channel (1–16 ch) can be selected for both 1CHFFT and 2CHFFT.
- FFT analysis mode setting
  - STR: Storage waveform
  - LIN: Linear spectrum
  - RMS: RMS spectrum
  - PSP: Power spectrum
  - ACR: Auto-correlation function
  - HIS: Histogram
  - TRF: Transfer function
  - CSP: Cross-power spectrum
  - CCR: Cross-correlation function
  - IMP: Unit-impulse response
  - COH: Coherence function
  - OCT: Octave analysis

• Display format function	Single:	Split screen not used.
	Dual:	Screen is divided into two parts.
	Nyquist:	Nyquist display
	Array:	Array display
• Window function setting	Rectangular:	Square-wave window function
	Hanning:	Hanning window function
	Exponential:	Exponential window function
• X-axis setting	Time:	Time axis display
	Linear-Hz:	Frequency display
	Log-Hz:	Displays the frequency spectrum using a logarithmic scale
	Linear-Volt:	Measurement range of the input unit (HIS only)
	Linear-Nyquist:	Indicates the real-number part of the data (Nyquist only)
• Y-axis setting	Linear-Real:	Indicates the real-number part of the data in voltage units.
	Linear-Imag:	Indicates the imaginary-number part of the data in voltage units.
	Linear-Mag:	Indicates the data in voltage units.
	Log-Mag:	Indicates the data in decibels.
	Phase:	Indicates the angle between the real and imaginary parts in degrees.
	Linear-Nyquist:	Indicates the imaginary-number part of the data. (Nyquist only)
• Averaging interval	OFF, 2 to 4096	
	Can be set for both the time axis and the frequency axis. Peak hold is also provided.	
• Reference data setting	NEW DATA (calculated as waveform is read)	
	FROM MEMORY (calculation done from waveform in memory)	
• Waveform decision function	OFF, OUT, ALL-OUT (when using single or Nyquist display format)	
• Display scale setting	AUTO, MANUAL	

1-1-2. Finding Reference Material in this Manual

(1) Basic functions

For information about the basic functions of the 8825, refer to Section 1-5 in this chapter, "Making settings" (1-5-1 to 1-5-22).

(2) Trigger function Section 9 of the 8825 Manual

Select the desired trigger function from those available.

(3) Waveform decision function Section 10 of the 8825 Manual

Decisions can be made about the input signal and FFT calculation waveform with respect to any waveform decision area that has been set up.

Detection of abnormal waveforms is also possible.

(4) Use of the floppy disk drive Section 14 of the 8825 Manual

The floppy disk drive allows setting, measurement data, and waveform decision areas for use by the waveform decision function to be recorded and stored.

By using the auto save function, a waveform read at start-up for FFT calculation can automatically be saved to floppy disk.

(5) Comment input function Section 12-5 "Setting comments" of the 8825 Manual

Instead of making handwritten memos on recordings, comments can be input and printed out on the recordings.

(6) Display auto-off function

(7) Grid setting

The grid on the display screen or the charts can be altered according to the application.

(8) Backup function for start key

If the power fails during recording and is then restored again, the start condition is restored, and recording operation starts again.

(9) "Beep" sound function

A "beep" sound can be set to sound when an error occurs and a warning is issued, or when a waveform decision produces the result NG (fail).

(10) List and gauge functions

These provide voltage axis scales and listings of settings on printed recordings.

(Section 12-3. "Special Function Settings"of the 8825 Manual)

(11) Self check function Section 12-6 "The self check"of the 8825 Manual

The unit can perform self check and diagnostics.

1-1-3 Basic Concept of Analysis Function

FFT stands for Fast Fourier Transformation, which is a calculation method used to decompose a time-domain waveform into frequency components.

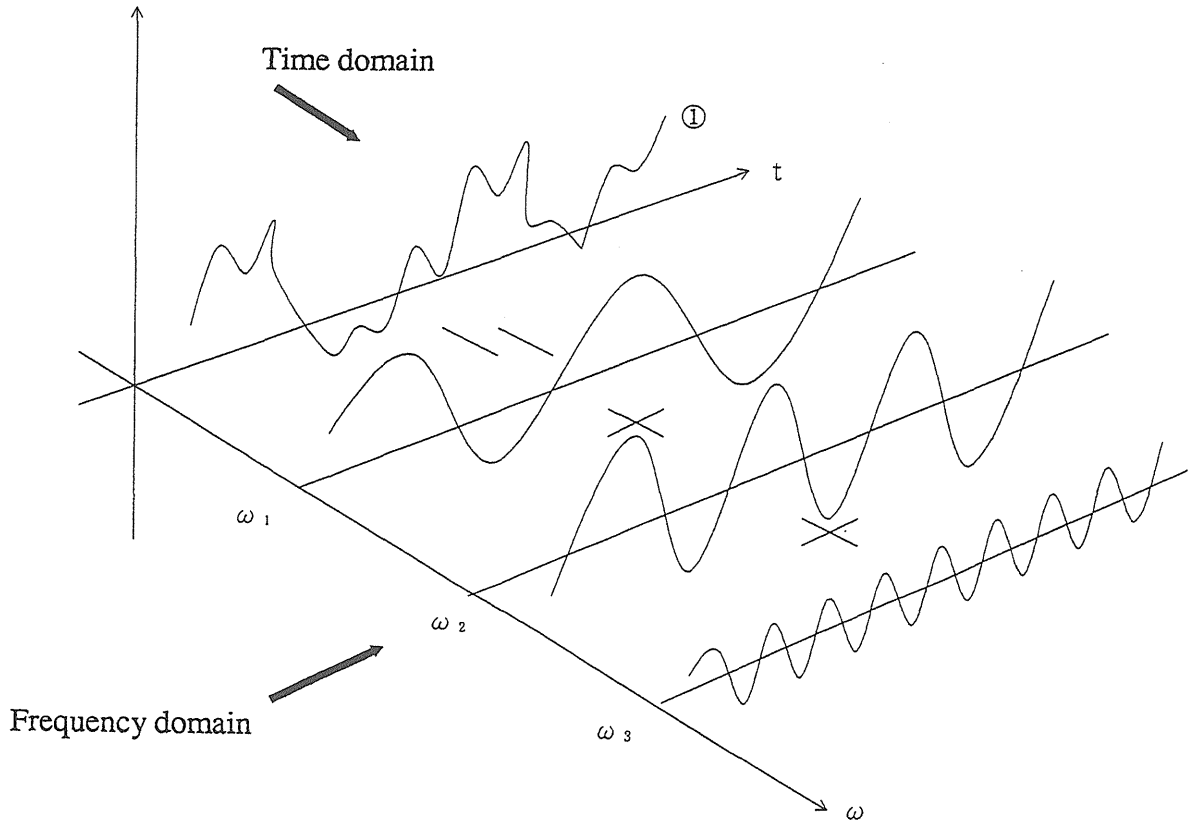
This system functions as a memory recorder, and can also perform FFT operations on clocked-in data. It displays operation results in graphic form on the screen or prints them out.

(1) Concept of time domain and frequency domain

The signals measured by this memory recorder have values which correspond to time, that is the signals are functions of time. Waveform ① shown in the figure below is an example of such a signal. Signals which are expressed as a function of time are called time domain signals.

In reality, a signal consists of a number of sine-waves of different frequencies, called frequency components, which combine to create the final shape of the waveform. Expressing waveform ①, the source signal, as a function of its frequency components yields a frequency domain representation.

Often, the characteristics of a signal which cannot be easily analyzed in the time domain, can be clearly revealed by the frequency domain representation.



(2) FFT analyzer and spectrum analyzer

There are two types of measurement instruments for frequency domain analysis. One is the spectrum analyzer, and the other is the FFT analyzer. A spectrum analyzer uses a number of hardware filters to extract the spectrum of the signal. The FFT analyzer calculates the spectrum from a digital representation of the signal.

Each of these instruments has its own advantages and disadvantages. For example, the FFT analyzer can analyze waveforms which have a DC component, whereas the spectrum analyzer cannot. On the other hand, the spectrum analyzer can analyze the spectrum of a very high frequency signals, while the FFT analyzer cannot.

Furthermore, the spectrum analyzer only extracts the spectrum. However, the FFT analyzer calculates both the real and imaginary components of the spectrum, so that various additional calculations can be performed. For example, the FFT analyzer can calculate the energy of the spectrum (power spectrum), multiply two waveforms (cross power spectrum), obtain the frequency response of a system (transfer function), and produce a correlation diagram of one or two waveforms on the time axis.

(3) Physical meaning of Fourier transformation analysis

The following equations define the Fourier transformation and the Inverse Fourier transformation.

$$F(\omega) = \Im[f(t)] = \int_{-\infty}^{+\infty} f(t) \cdot \exp(-j\omega t)dt \qquad (1.1)$$

$$f(t) = \Im^{-1}[F(\omega)] = \frac{1}{2\pi}\int_{-\infty}^{+\infty} F(\omega) \cdot \exp(j\omega t)d\omega \qquad (1.2)$$

($\omega=2\pi f$, j: imaginary number unit, f(t): non-cyclic function, $\Im$: Fourier transformation, exp: natural logarithm)

The function $F(\omega)$ generally results in a complex number, and can be expressed as follows.

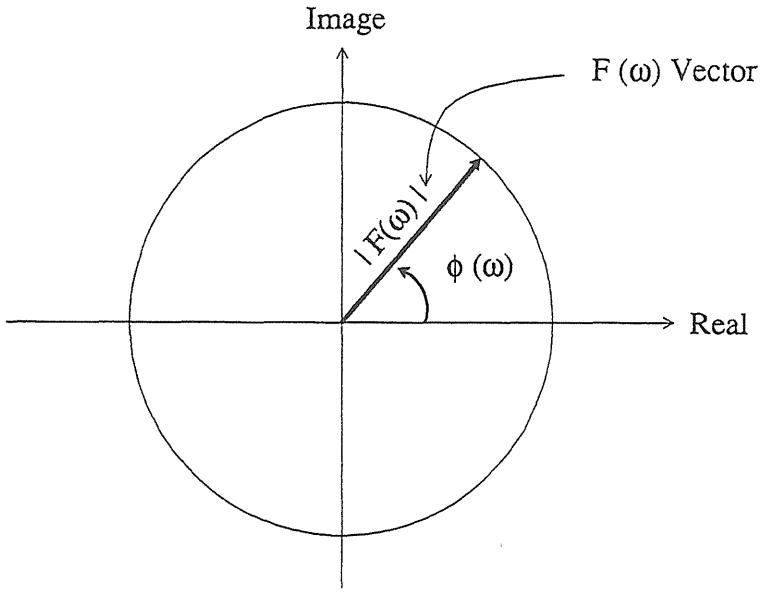
$$F(\omega) = |F(\omega)| \exp(j\phi(\omega)) = |F(\omega)| \angle\phi(w) \qquad (1.3)$$

$$\Im[f(t)] = F(\omega) = F(j\omega) \qquad (1.4)$$

$|F(\omega)|$ .....Absolute-value spectrum of f (t)

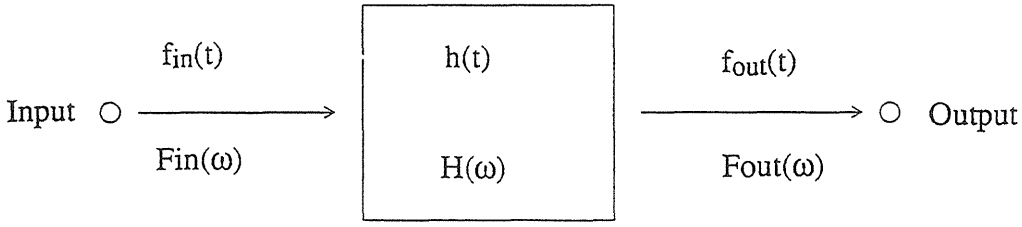
$\phi(\omega)$.....Unit spectrum of the phase of f (t)

When conversion is made from the time domain to the frequency domain, the magnitude information and phase information are clearly expressed as indicated in equation (1.3). The figure below shows F(ω) in vector form.



(4) Application of Fourier Transformation

The following is an example of how to obtain the stationary response of a stationary linear system using the above-mentioned Fourier Transformation method.



Stationary linear system

$f_{in}(t)$, $f_{out}(t)$, $h(t)$ and t,τ are defined in the time domain as follows:

$f_{in}(t)$ .....Time function of input (source signal)

$f_{out}(t)$ .....Time function of output (response function)

$h(t)$ .....Unit impulse response of linear system

t,τ .....Time

The relationship between the input and output is expressed as follows:

$$f_{out}(t) = \int_{-\infty}^{+\infty} f_{in}(\tau) \cdot h(t-\tau) d\tau \qquad (1.5)$$

This indicates that the response of the linear system can be determined just by knowing the unit impulse response $h(t)$ of the system.

The following describes the relationship between the input and output in the frequency domain. In the frequency domain, Fin(ω), Fout(ω), H(ω), and ω are defined as follows:

$F_{in}(\omega)$ .....Fourier transformation of $f_{in}(t)$
$F_{out}(\omega)$.....Fourier transformation of $f_{out}(t)$
$H(\omega)$ .....Fourier transformation of $h(t)$
ω.....Frequency

The relationship between the input and output is expressed as follows:

$$F_{out}(\omega) = F_{in}(\omega) \cdot H(\omega) \qquad (1.6)$$

Therefore, when $f_{in}(t)$ and $f_{out}(t)$ are measured, the system transfer function $H(\omega)$ and the unit impulse response $h(t)$ can be obtained by performing an FFT operation and an inverse FFT operation.

These are the basic concepts behind the 8825 Memory HiCorder.

1-1-4 Aliasing Distortion

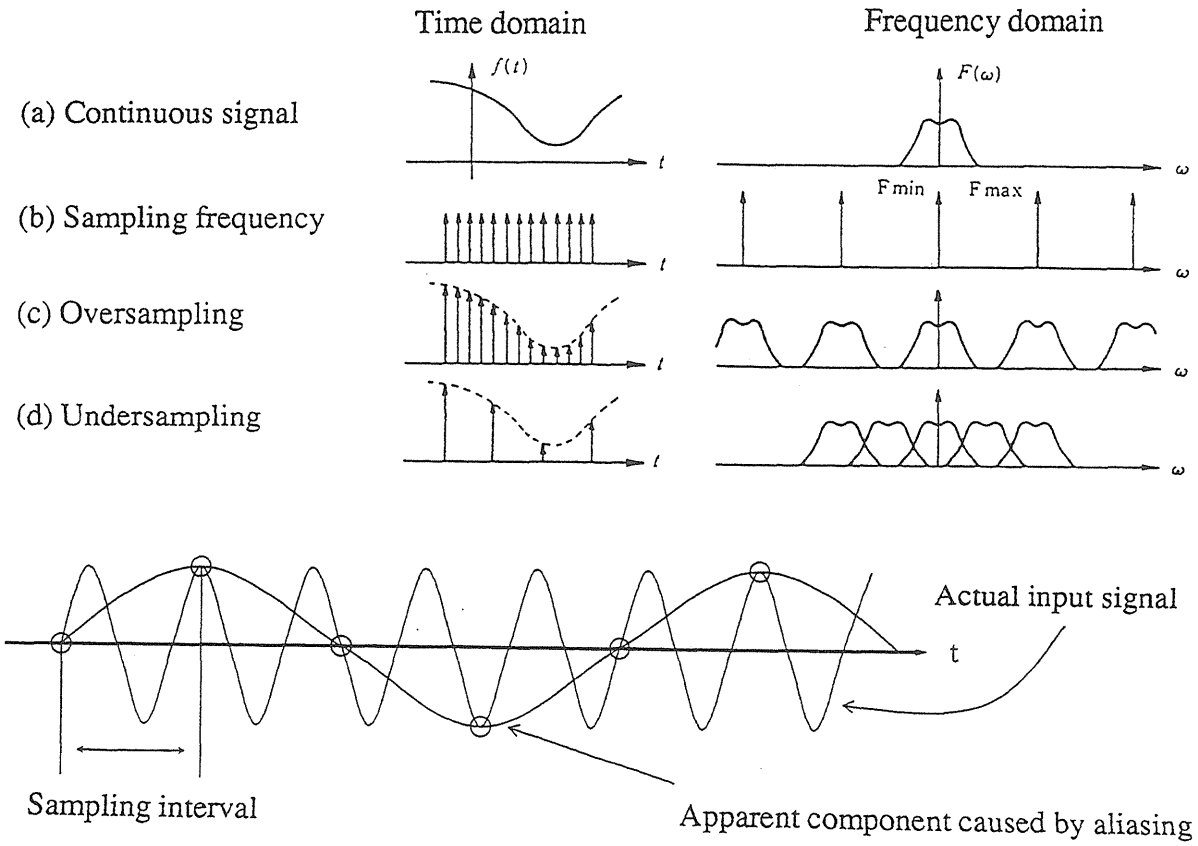
(1) A/D conversion

- In the 8825, the input signal is converted from analog into digital form, and all processing is performed on the digital values. This process of A/D conversion is referred to as sampling.
- The sampling process can be mathematically characterized as a multiplication of a continuous signal by the unit impulse string function.
- If the signal clock-in cycle, that is, the sampling interval, is grater than a certain value, erroneous information starts to appear in the digital representation of the signal.
- The phenomenon where the spectrum of an undersampled signal overlaps onto images of itself (as shown in the figure below) is referred to as frequency aliasing.
- The sampling theorem gives the lowest sampling frequency before the spectra begin to overlap. This sampling frequency is known as the Nyquist frequency.

$F_S=2 \cdot F_{max}$ F_{max}.....Highest frequency in input signal

F_S .....Nyquist frequency

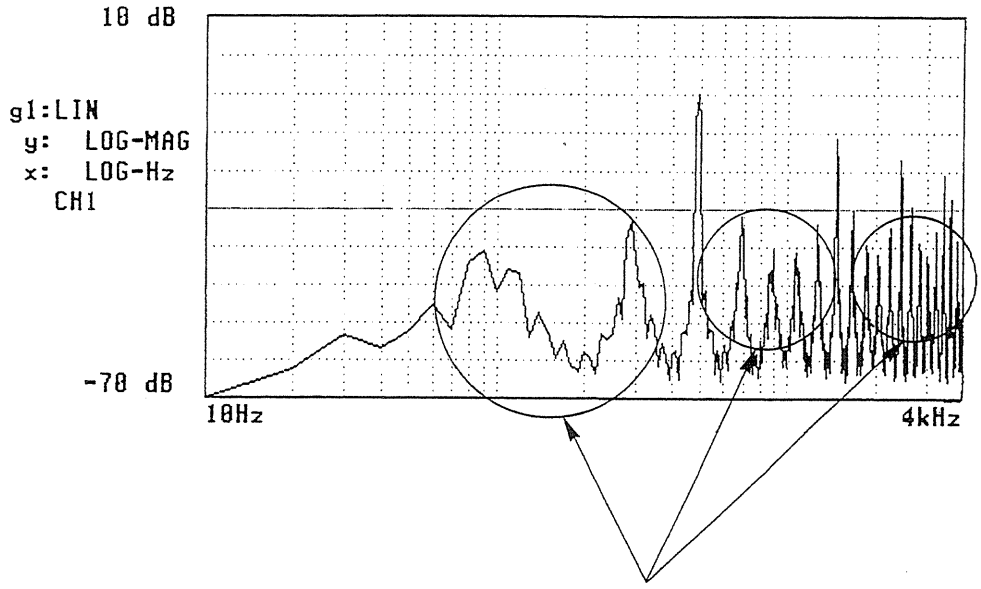
- If sampling is performed with a sampling frequency which is lower than the Nyquist frequency determined by the sampling theorem, the digital signal appears to contain frequency components which do not exist in the original signal.



(2) Anti-aliasing filter (A.A. Filter)

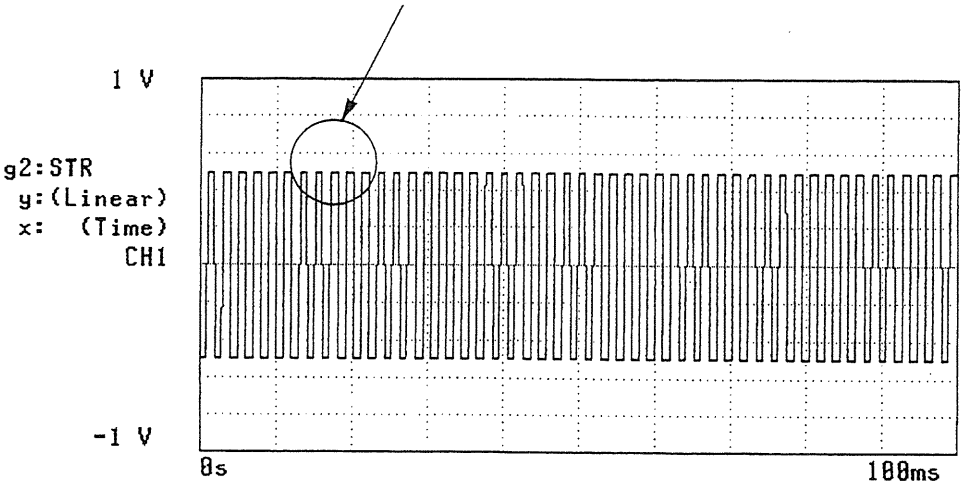
- If the input signal is regarded as having an unlimited bandwidth, aliasing distortion is an unavoidable consequence of sampling.
- For an FFT operation, a consequence of aliasing distortion is that a number of frequency spectra appear that do not actually exist in the original input signal.
- This problem can be solved by passing the input signal through a low-pass filter whose cut-off frequency is one-half the sampling frequency before sampling. This filter is referred to as an anti-aliasing filter.
- The 8909 FFT analog unit available for the 8825 has such an anti-aliasing filter.

When an anti-aliasing filter is not used



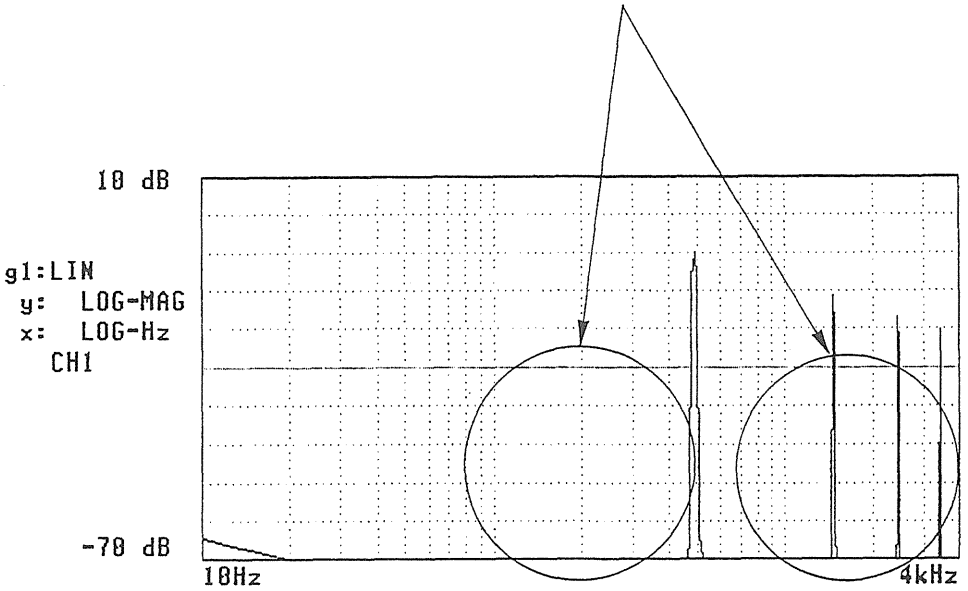
These spectra are caused by aliasing distortion of frequency components which are higher than half the sampling frequency of the A/D converter. They do not exist in the original input signal, yet they appear in the spectrum.

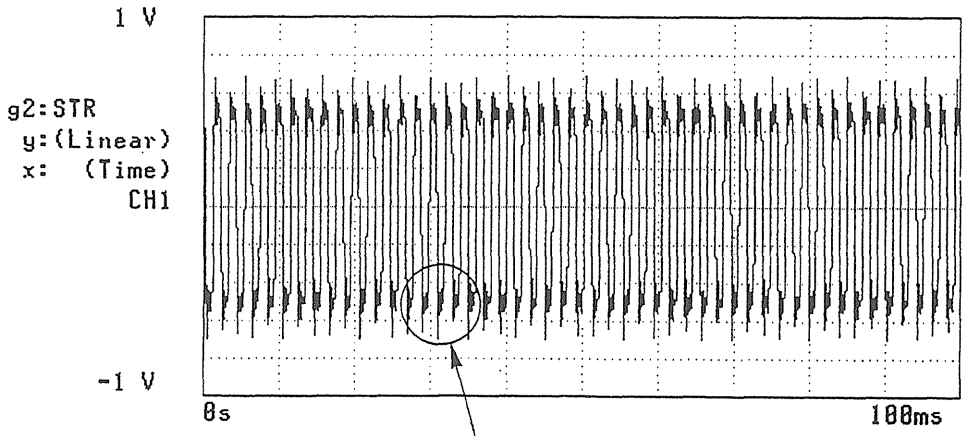
Since an anti-aliasing filter is not used for this square wave, a sharp edge is observed through a wide-band amplifier. The edge of the square wave contains very high-frequency components.



When an anti-aliasing filter is used

Spectra caused by aliasing distortion are clearly eliminated. The graph shows only the actual spectrum of the input signal.



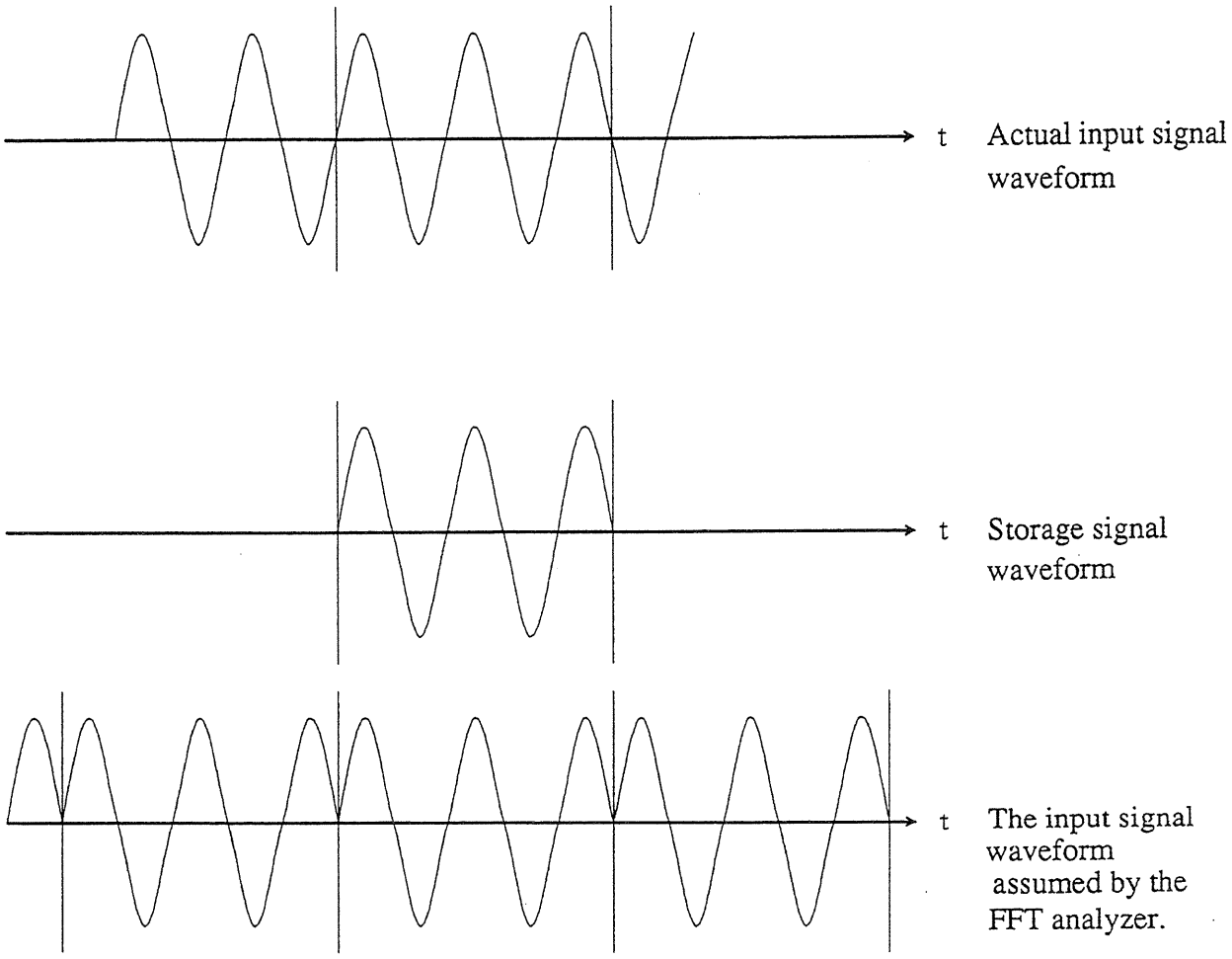


Due to the sharp cut-off characteristic of the anti-aliasing filter, the edge of the square wave contains a ripple.

1-1-5 Windows and Leakage

(1) Window processing

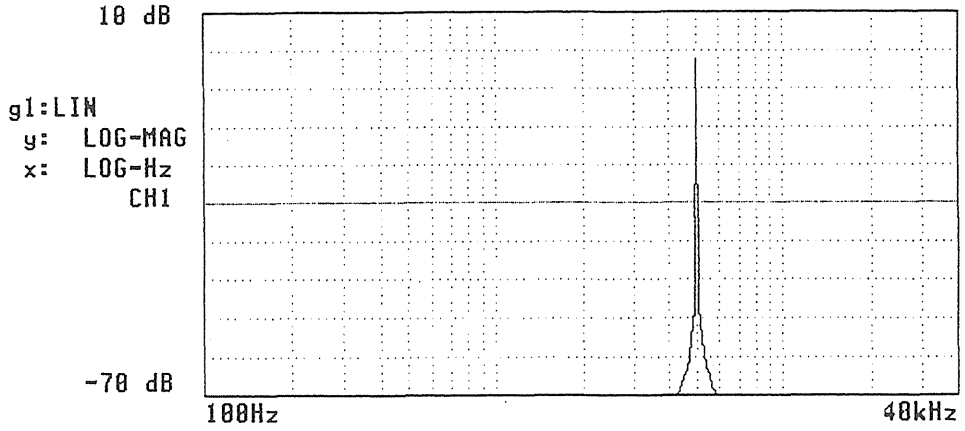
- The Fourier transformation theorem is defined as an integration between negative infinity and positive infinity. However, for actual measurements, this calculation is impossible. Therefore, only a limited portion of the continuous signal is clocked in and processed. This is called window processing.
- That is, the frequency spectrum is calculated for data within a limited time period.
- In terms of the FFT algorithm, the input signal is assumed to be a periodic function for the calculation. In other words, it is assumed that the data for this limited time period is repeated.



Due to the phase difference between the beginning and end portions of the waveform of the stored signal, the waveform acquired by the FFT analyzer differs from the waveform of the actual input signal.

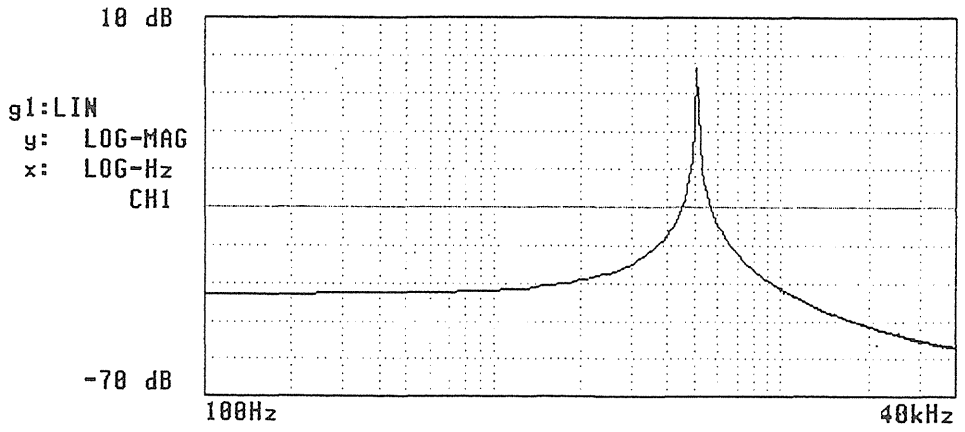
(2) Leakage error

- Differences between the waveform of the signal acquired by the FFT algorithm and the waveform of the actual signal increase the error in the calculation results. This error is called leakage.
- Leakage error is caused by the fact that the values of the beginning and end points of the acquired (limited time period) signal acquired by the FFT analyzer are inconsistent.



Spectrum Having Small Leakage

The width of the spectrum is narrow.

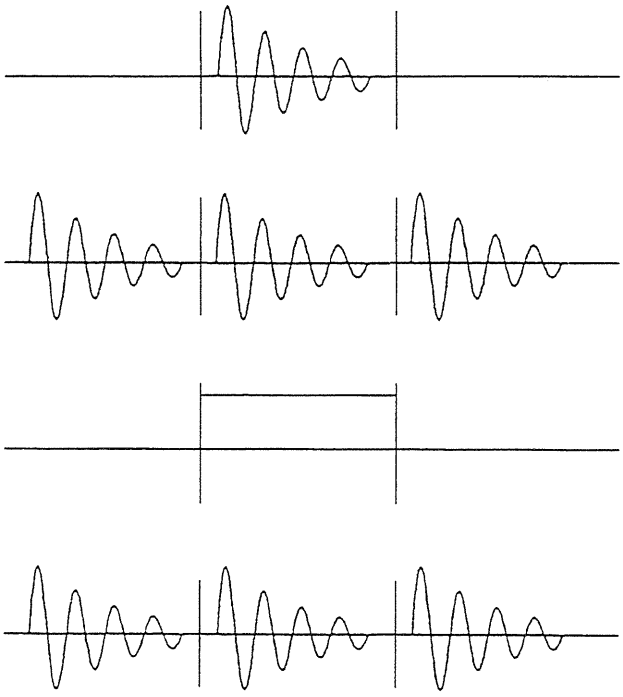


Spectrum Having Large Leakage

The spectrum spreads over a wide frequency range.

(3) Window function

- When sampling an input signal over a limited time period, the leakage error can be reduced by modifying the input signal as it is sampled.
- For example, for input of a periodic function such as that shown in the figure below, a spectrum having a small leakage error can be obtained by performing an FFT operation on the middle portion of the clocked-in waveform.
- The function applied to the input values when clocking in the input signal is referred to as window function.
- To reduce the leakage error, an effective window function must be selected according to the type of signal being measured.
- Window functions that are typically used include the Hanning, rectangular, flat-top, minimum, force, and exponential functions. For the 8825, the Hanning, rectangular, and exponential window functions are used.
- Basically, the "rectangular" window is effective for single waveforms, the "Hanning" window is effective for continuous waveforms and the "exponential" window is effective for attenuated waveforms.
- Rectangular window



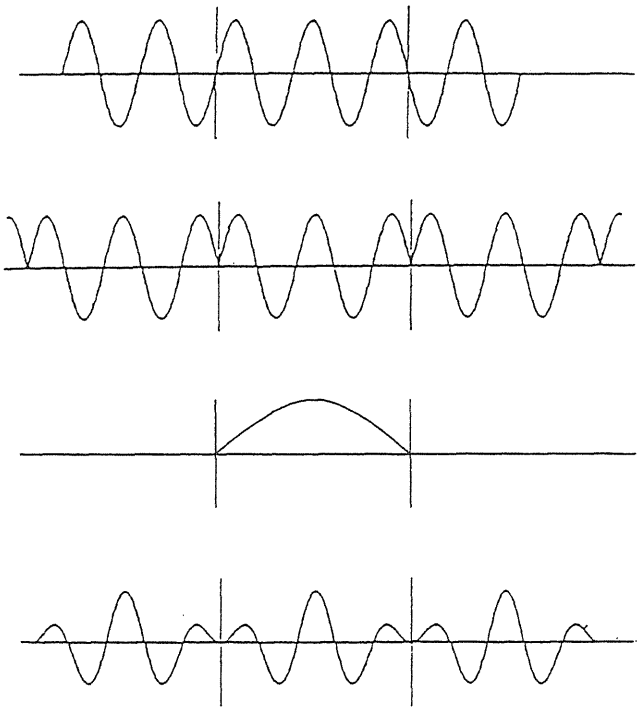
Input signal

Input waveform assumed by the FFT analyzer

Rectangular window function

Window-processed input waveform

• Hanning window



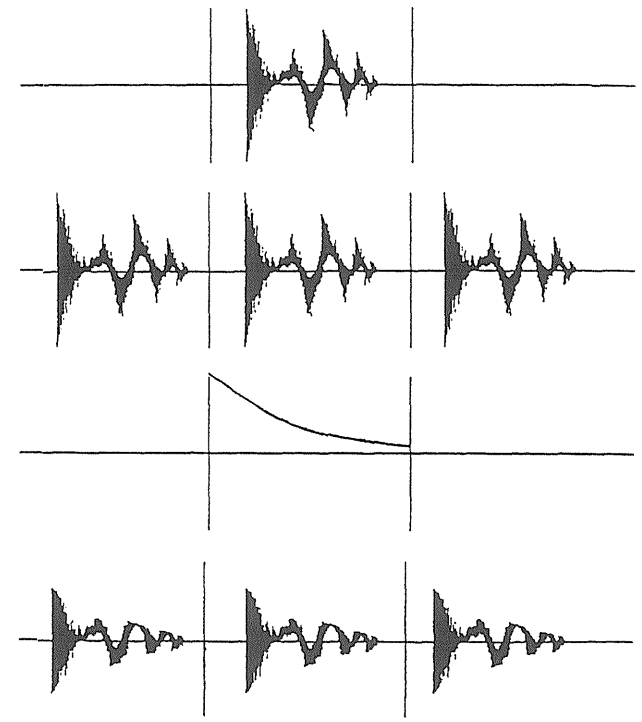
Input signal

Input waveform assumed by the FFT analyzer

Hanning window function

Window-processed input waveform

• Exponential window



Input signal

Input waveform assumed by the FFT analyzer

Exponential window function

Window-processed input waveform

1-2. Analysis Functions

1-2-1. [STR] : Storage waveform

- Displays the time domain waveform of the input signal.

[Function] fa

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	fa
Log Mag (logarithmic magnitude)	—
Phase (phase)	—

[Horizontal axis] Time Time axis display

The same as the memory recorder. Indicates the value of the specified TIME/DIV frequency range.

[Vertical axis] Linear Indicates the value of the measurement range of the input unit in voltage units.

- Example of stored waveform

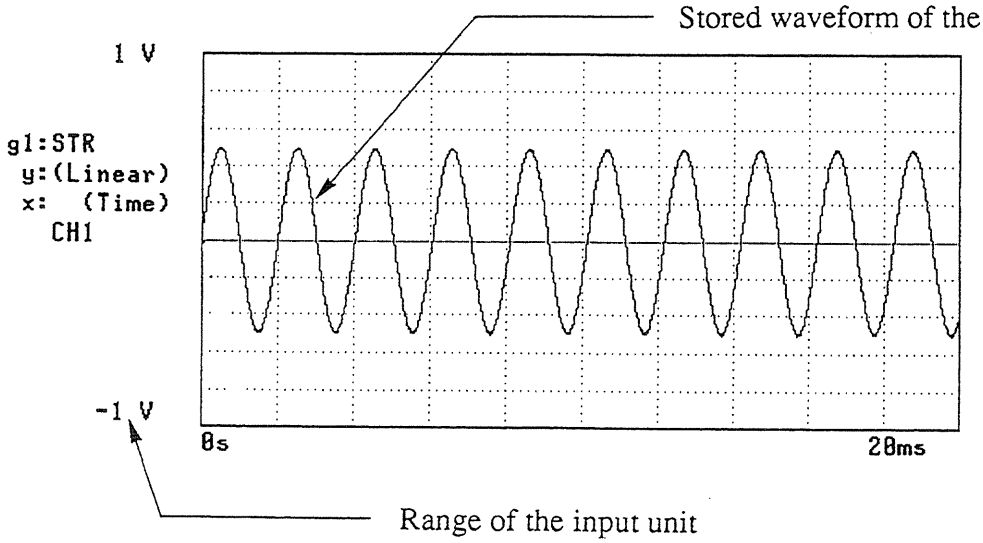


Fig. 1-1. Stored waveform

1-2-2. [LIN] : Linear spectrum

[LIN] - Displays the linear spectrum

The frequency domain waveform of the input signal, including magnitude and phase information.

Major applications include:

- Determining the peaks of waveform frequency components
- Determining the levels of high and low harmonics

[Function] Fa $= \Im$ (fa)

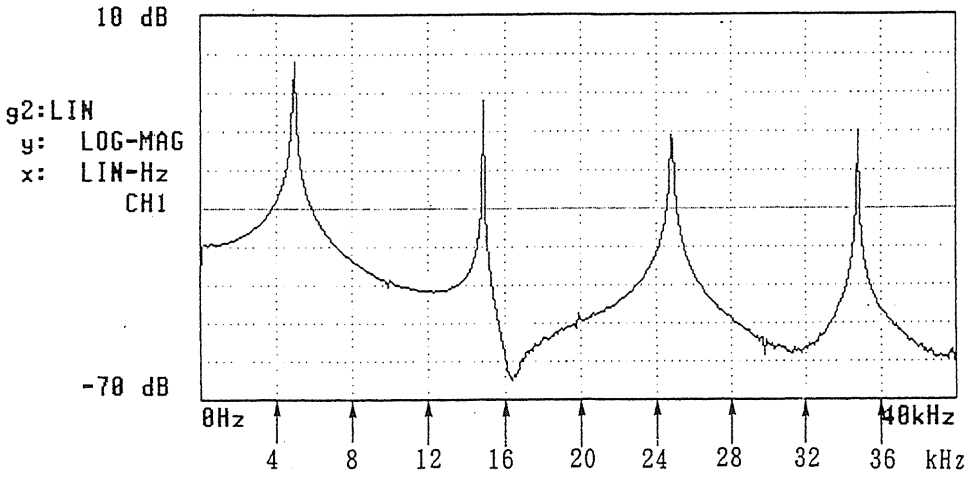
$= |Fa| \cdot \exp(ja)$

$= |Fa| \cdot (\cos \angle a + j \sin \angle a)$

Vertical axis	Meaning
Linear Real (real-number part)	$\|Fa\| \cdot \cos \angle a$
Linear Imag (imaginary-number part)	$\|Fa\| \cdot \sin \angle a$
Linear Mag (magnitude)	$\|Fa\|$
Log Mag (logarithmic magnitude)	$20 \log \|Fa\|$
Phase (phase)	$\angle a$

[Horizontal axis]	Linear Hz	Indicates the frequency spectrum in linear units. The range is from DC to the maximum frequency range value.
	Log Hz	Indicates the frequency spectrum in logarithmic units. The range is from 1/400 the maximum frequency range value to the maximum frequency range value.
	Linear Nyquist	Indicates the real-number part of the data in voltage units. (Nyquist mode)
[Vertical axis]	Linear Real	Indicates the real-number part of the data in voltage units.
	Linear Imag	Indicates the imaginary-number part of the data in voltage units.
	Linear Mag	Indicates the data values in voltage units.
	Log Mag	Indicates the data in decibels.
	Phase	Indicates the angle between the real and imaginary-number parts of the data in degrees. This expresses the phase component. (With AUTO screen: -180 to 180 deg)
	Linear Nyquist	Indicates the imaginary-number part of the data in voltage units. (Nyquist mode)

• Examples of linear spectra



• From the spectrum shown on the left, it is clear that the major component is at 5 kHz, and that a number of spectra exist at odd-multiples of 5 kHz.

Fig. 2-1.
LOG-MAG
(X-axis: Linear)

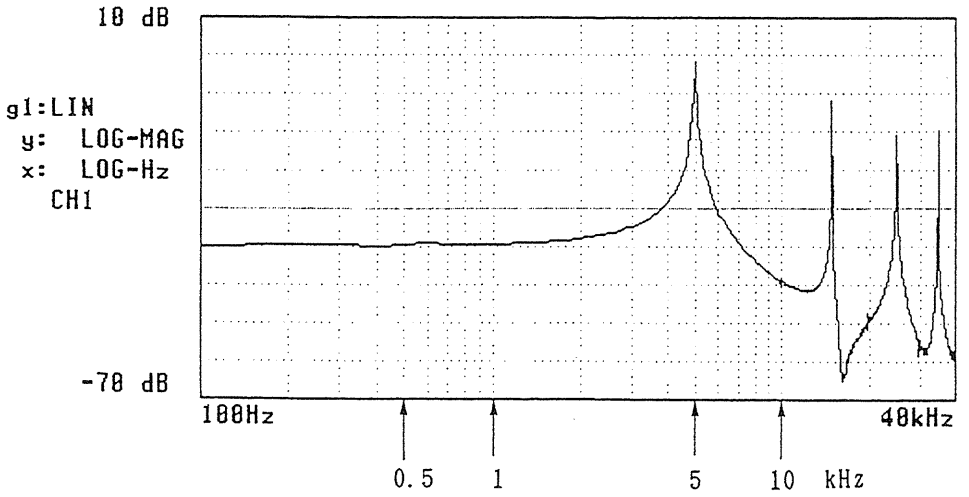
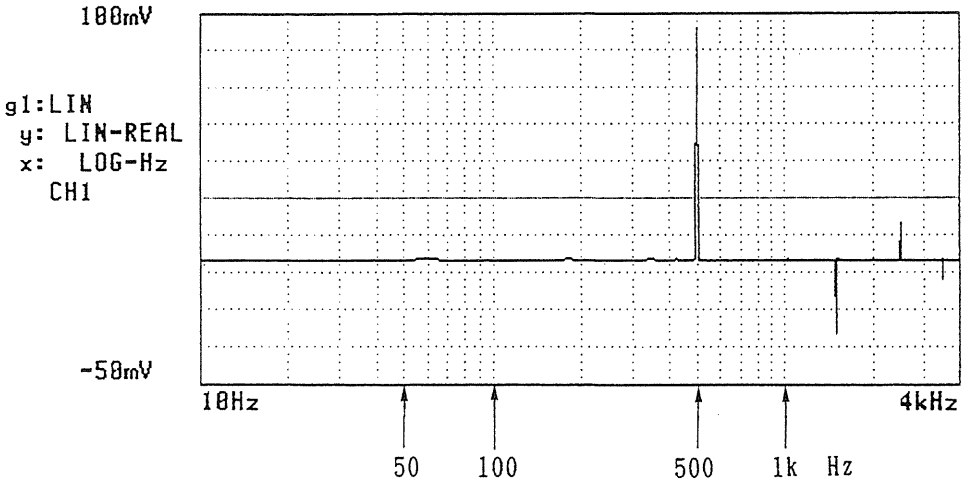


Fig. 2-2.
LOG-MAG
(X-axis: Log)



• In the following waveform examples, the source signal frequency is 0.5 kHz.

• Clearly, there are spectra at odd multiples of the source signal frequency (×1, ×3, ×5, ×7)

Fig. 2-3.
LIN-REAL
(X-axis: Log)

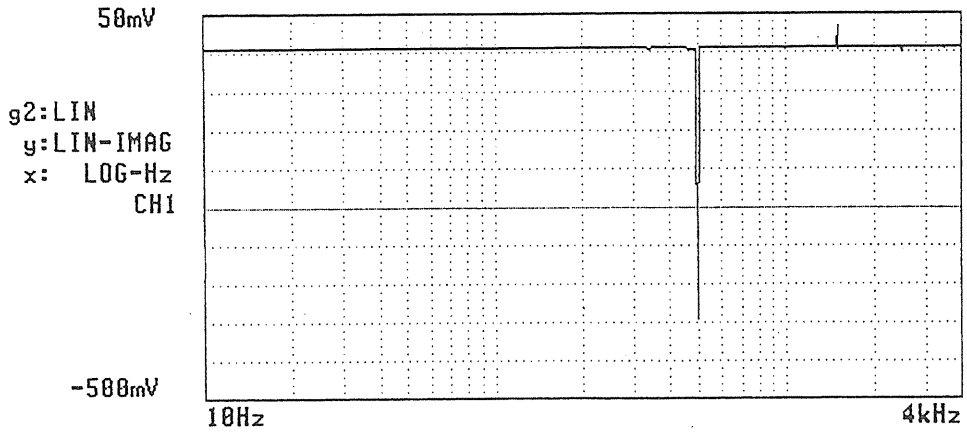


Fig. 2-4.
LIN-IMAG
(X-axis: Log)

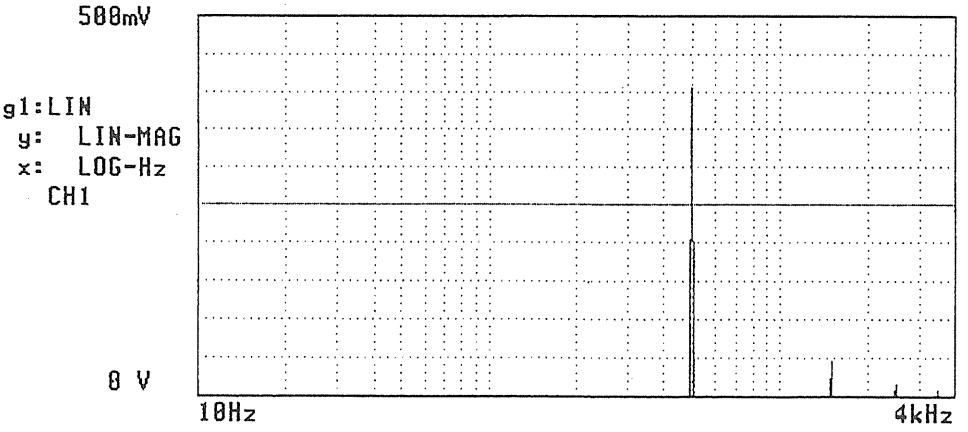


Fig. 2-5.
LIN-MAG
(X-axis: Log)

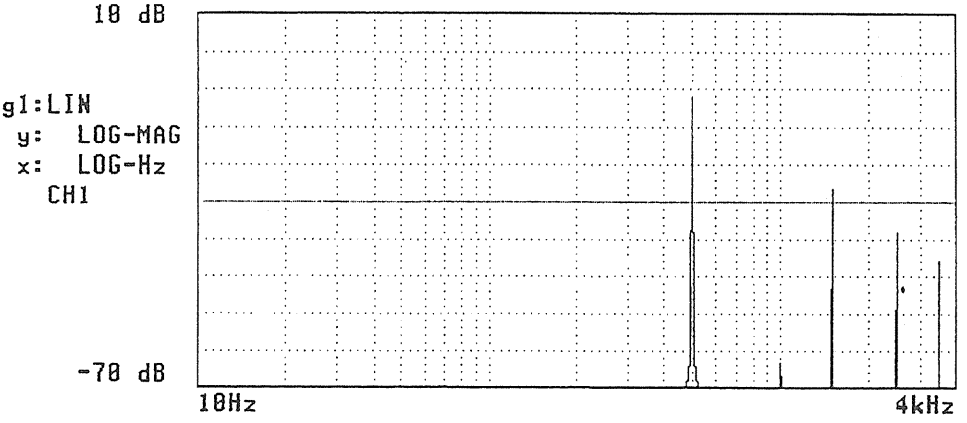


Fig. 2-6.
LOG-MAG
(X-axis: Log)

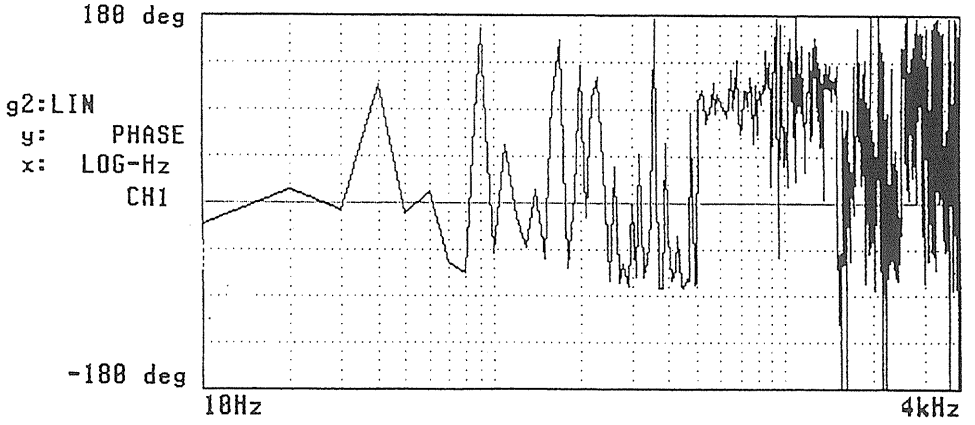


Fig. 2-7.
PHASE
(X-axis: Log)

1-2-3. [RMS] : RMS spectrum

Displays the frequency domain waveform of the input signal, including magnitude and phase information. (effective value)

Major applications include:

- Determining the peaks of waveform frequency components.
- Determining the effective values of frequency components.

[Function] Ra $=Fa/\sqrt{2}$

$=|Ra| \cdot \exp(ja)$

$=|Ra| \cdot (\cos \angle a + j\sin \angle a)$

Vertical axis	Meaning
Linear Real (real-number part)	$\|Ra\| \cdot \cos \angle a$
Linear Imag (imaginary-number part)	$\|Ra\| \cdot \sin \angle a$
Linear Mag (magnitude)	$\|Ra\|$
Log Mag (logarithmic magnitude)	$20 \log \|Ra\|$
Phase (phase)	$\angle a$

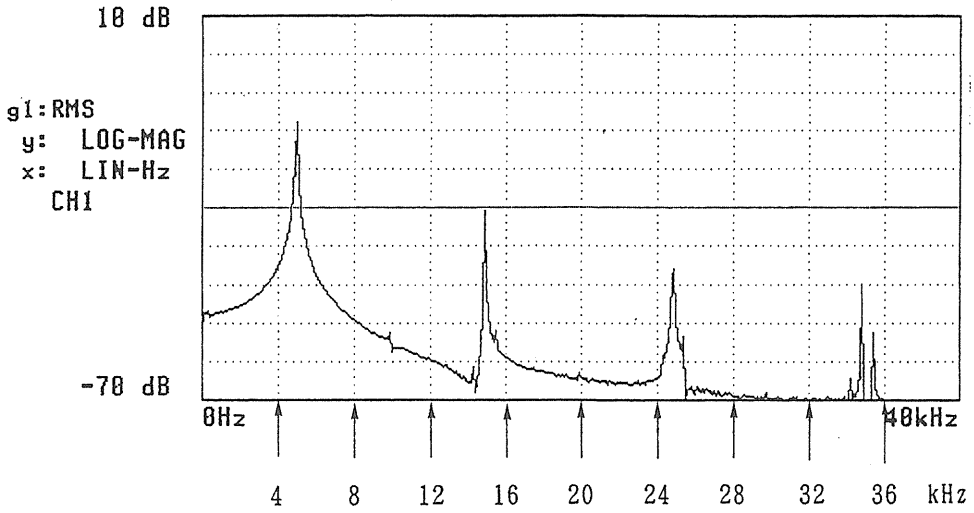
[Horizontal axis]

Linear Hz	Indicates the frequency spectrum in linear units. The range is from DC to the maximum frequency range value.
Log Hz	Indicates the frequency spectrum in logarithmic units. The range is from 1/400 the maximum frequency range value to the maximum frequency range value.

[Vertical axis]

Linear Real	Indicates the real-number part of the data in voltage units.
Linear Imag	Indicates the imaginary-number part of the data in voltage units.
Linear Mag	Indicates the data values in voltage units.
Log Mag	Indicates the data in decibels.
Phase	Indicates the angle between the real and imaginary-number parts of the data in degrees. This expresses the phase component. (With AUTO screen: -180 to 180 deg)

- Examples of RMS spectra



- From the spectrum shown on the left, it is clear that the major component is at 5 kHz, and that a number of spectra exist at odd-multiples of 5 kHz.

Fig. 3-1.
LOG-MAG
(X-axis: Linear)

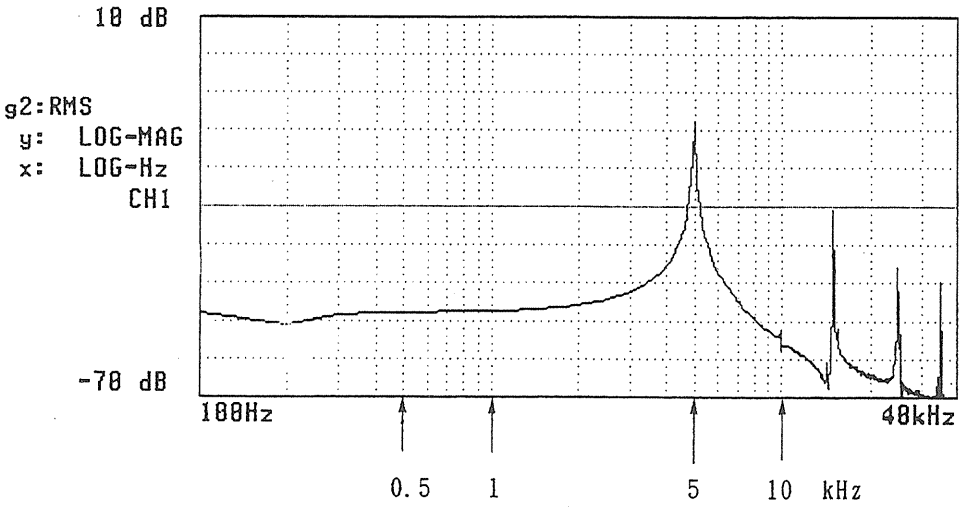
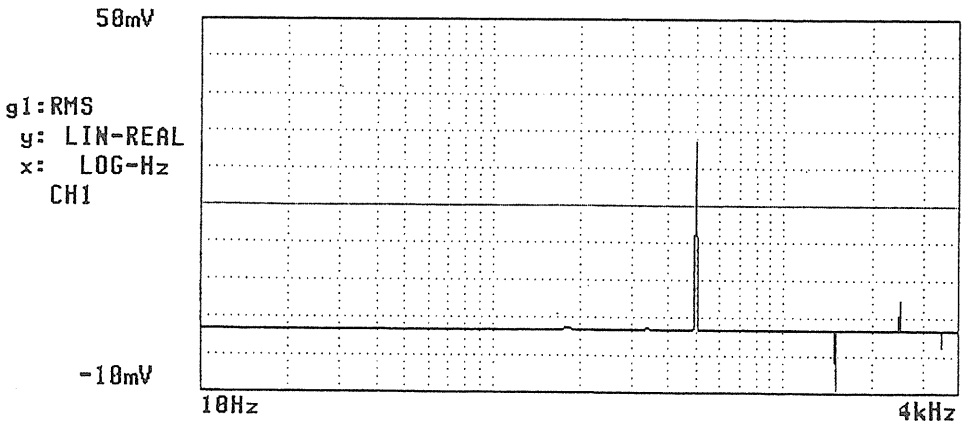


Fig. 3-2.
LOG-MAG
(X-axis: Log)



- In the following waveform examples, the source signal frequency is 0.5 kHz.
- Clearly, there are spectra at odd multiples of the source signal frequency (×1, ×3, ×5, ×7)

Fig. 3-3.
LIN-REAL
(X-axis: Log)

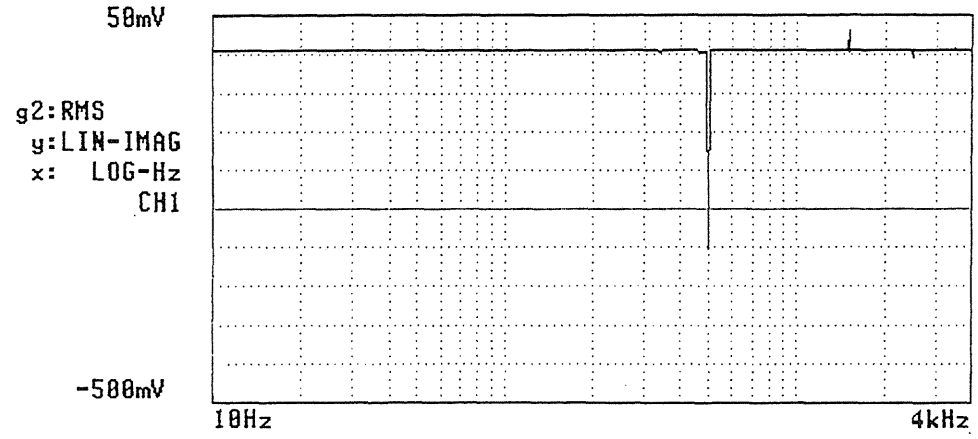


Fig. 3-4.
LIN-IMAG
(X-axis: Log)

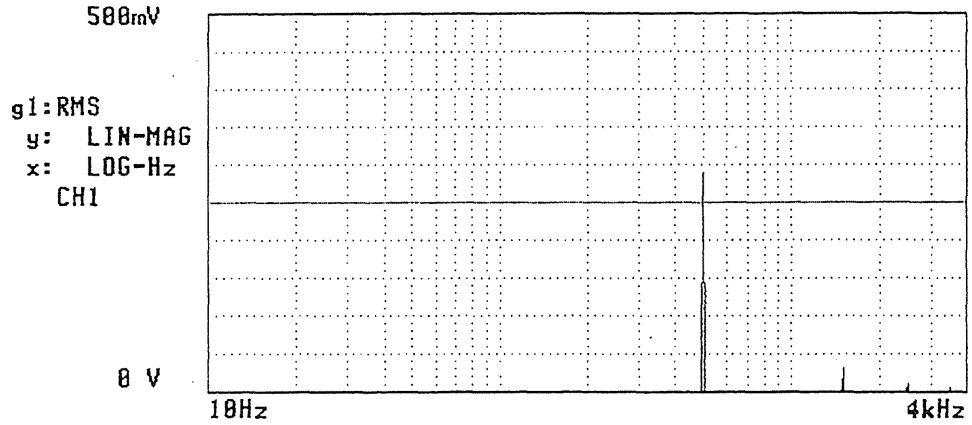


Fig. 3-5.
LIN-MAG
(X-axis: Log)

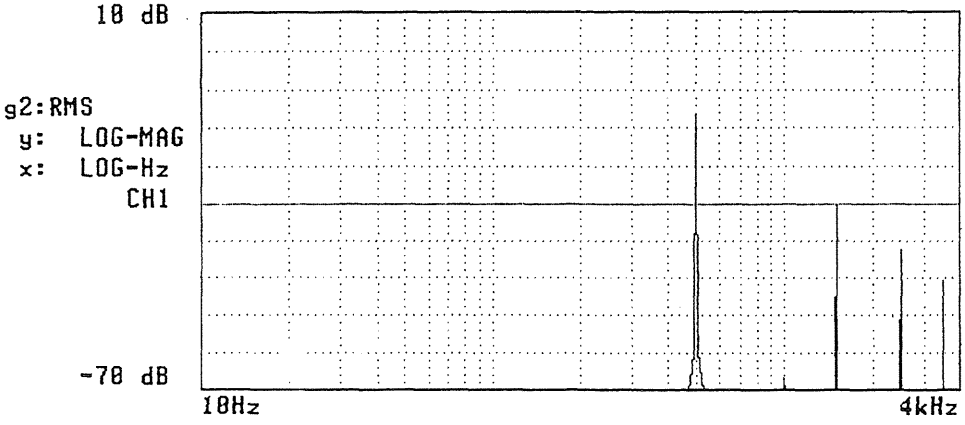


Fig. 3-6.
LOG-MAG
(X-axis: Log)

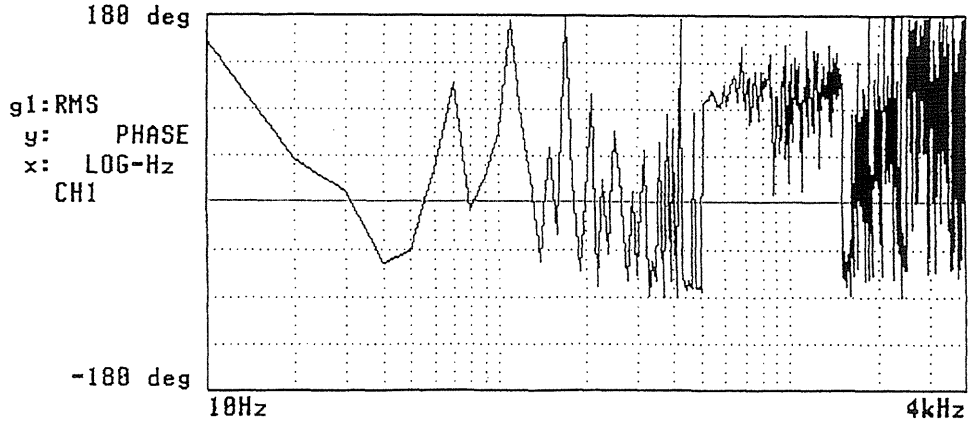


Fig. 3-7.
PHASE
(X-axis: Log)

1-2-4. [PSP] : Power spectrum

[PSP] - Power spectrum

Displays the energy spectrum of the input signal, consisting of only magnitude information.

Major applications include:

- Determining the peaks of waveform frequency components
- Determining the energy levels of high and low harmonics

[Function] $Gaa = Fa \cdot Fa^*$

$= Re^2(Fa) + Im^2(Fa)$

$= |Fa|^2$

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	Gaa/2
Log Mag (logarithmic magnitude)	$10 \cdot \log(Gaa/2)$
Phase (phase)	—

[Horizontal axis]

Linear Hz — Indicates the frequency spectrum in linear units. The range is from DC to the maximum frequency range value.

Log Hz — Indicates the frequency spectrum in logarithmic units. The range is from 1/400 the maximum frequency range value to the maximum frequency range value.

[Vertical axis]

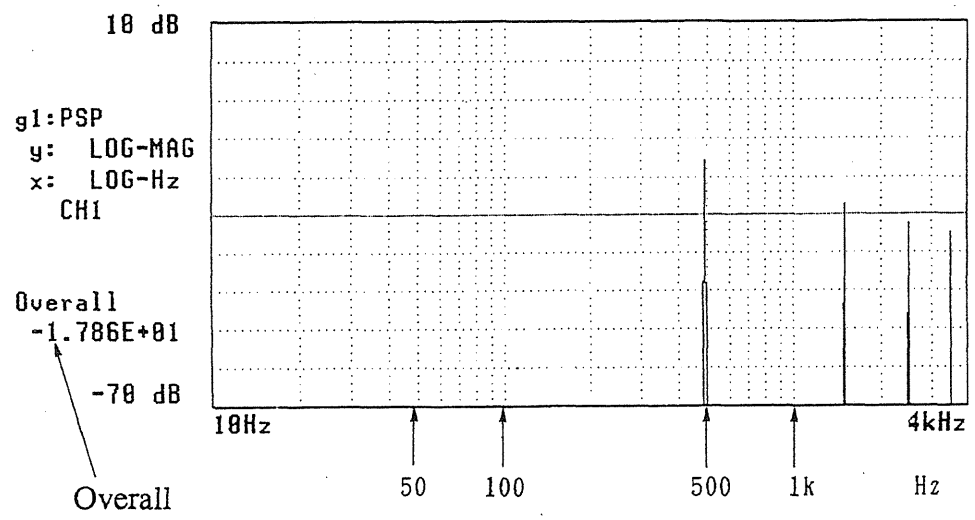
Linear Mag — Indicates the binary exponential value of the data in voltage units (voltage) × (voltage)

This indicates the energy component of the signal.

Log Mag — Indicates the data in decibels.

This indicates the energy component of the signal.

• Examples power spectra



• From the spectrum shown on the left, it is clear that the major component is at 0.5 kHz, and that a number of spectra exist at odd-multiples of 0.5 kHz.

Fig. 4-1.
LOG-MAG
(X-axis: Log)

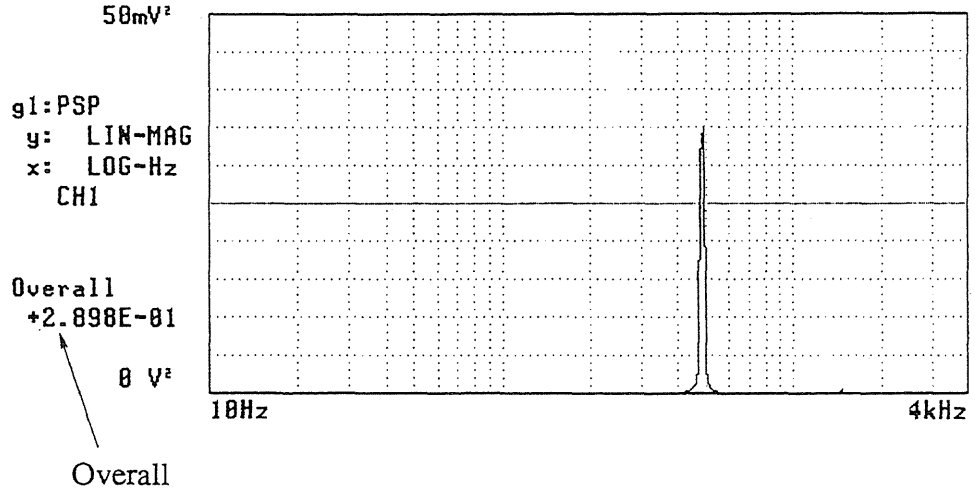


Fig. 4-2.
LOG-MAG
(X-axis: Log)

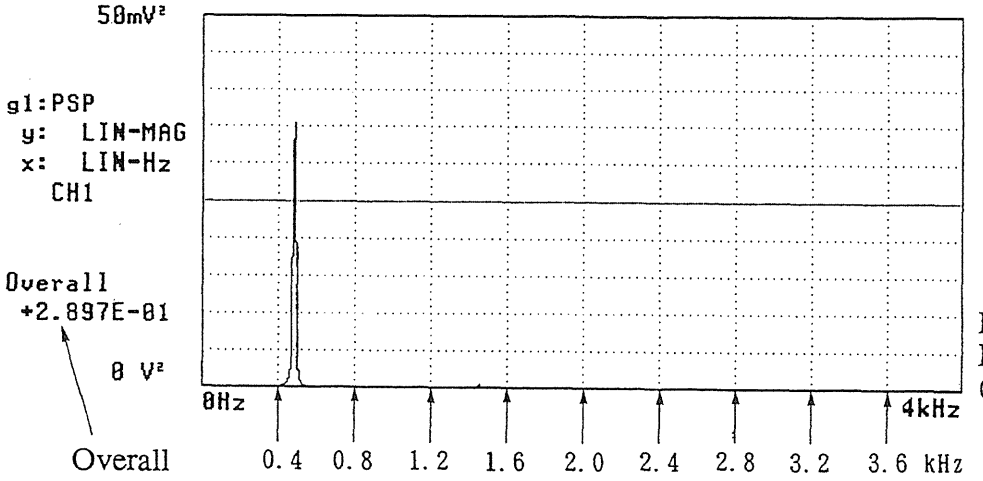


Fig. 4-3.
LIN-MAG
(X-axis: Linear)

- About the overall value
  - The overall value is the total effective value obtained from the frequency spectrum contained in the input signal.
  - The overall value is obtained by taking the square root of the total of power spectra for all frequencies.

$$(\text{Overall value}) = \sqrt{2 \times PSP_0 + \sum_{i=1}^{499} PSPi} \quad (\text{Vrms})$$

PSP0: DC component

PSPi: ith power spectrum

Note Power compensation values for different window types

- Window compensation values obtained from 1000 waveforms are applied prior to FFT calculation, and PSO0 and PSPi include these values.

Window compensation value: γ

Rectangular : $\gamma = 1$

Hanning : $\gamma = \sqrt{\frac{8}{3}}$

Exponential : $\gamma = \sqrt{\frac{2\log(a/100)}{(a/100)^2 - 1}}$

$(0 \leqq a < 100)$

- With the exponential window function, setting a=0 results in a calculation based on a=0.1.

1-2-5. [ACR]: Auto correlation

Displays the degree of similarity between two points in the input signal separated by time difference (τ).

Major applications:

- Detecting a periodic signal contained in a noisy signal with an improvement in signal-to-noise ratio.
- Checking the periodic signal components contained in a noisy waveform, and periodic noise.

[Function] $Raa(t) = \mathcal{F}^{-1}(Gaa)$

$$= \frac{1}{2\pi}\int_{-\infty}^{+\infty} Gaa(\omega)\cdot\exp(j\omega\tau)d\omega$$

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	Raa
Log Mag (logarithmic magnitude)	—
Phase (phase)	—

[Horizontal axis] Time

Displays the time differential on a linear scale.

The center indicates the reference ($\tau = 0$), the right side indicates time lag ($+\tau$), and the left side indicates time lead ($-\tau$).

[Vertical axis] Linear

Displays the correlation coefficient on a linear scale.

Readings are between +1 and -1 (without units).

+1 indicates the highest similarity for time differential τ, and 0 indicates the lowest similarity. Due to the characteristics of the function, $\tau = 0$ always results in +1.

• Examples of auto correlation function waveforms

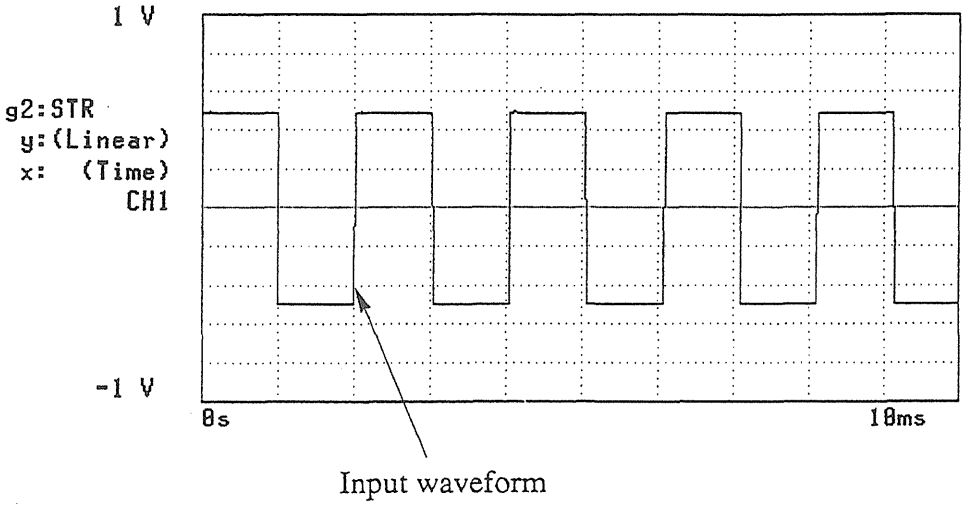
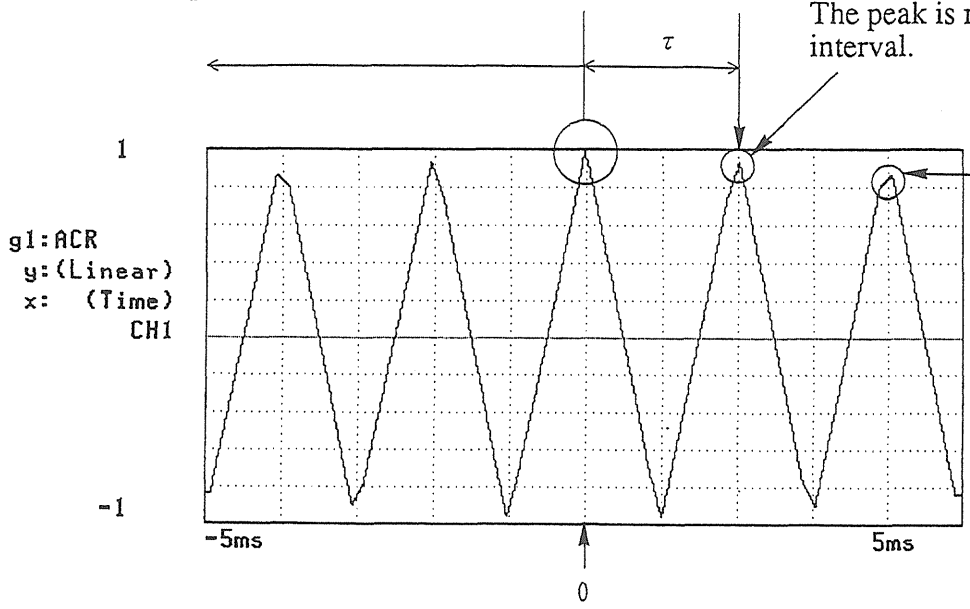


Fig. 5-1.
Stored waveform

Due to the characteristics of the function, the waveform in this portion becomes the same as that in the positive direction, so that this portion can be ignored.

Time period (τ) from t=0 to the first peak will be the period of the input signal.

The peak is repeated at a certain interval.



The periodicity deteriorates with time. It is only necessary to look at the first peak in the graph.

Fig. 5-2.
Auto correlation function

1-2-6. [HIS]: Histogram

[HIS] - Histogram

Displays the frequencies of the magnitudes of sampled points.

Major applications include:

- Determining waveform imbalance
- Determining whether a waveform is artificial or natural from the waveform distribution (most natural waveforms are regular sine waves).

[Function] Pa

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	Ra
Log Mag (logarithmic magnitude)	—
Phase (phase)	—

[Horizontal axis] Volt — Measurement range of the input unit.

[Vertical axis] Linear — Number of sample points for the time axis data (total: 1000 points). With AUTO display, the maximum number of points is 40. Therefore, a waveform such as a square wave or DC will exceed this limit. If this limit is exceeded, set any desired integral number with the manual display.

• Examples of histogram waveforms

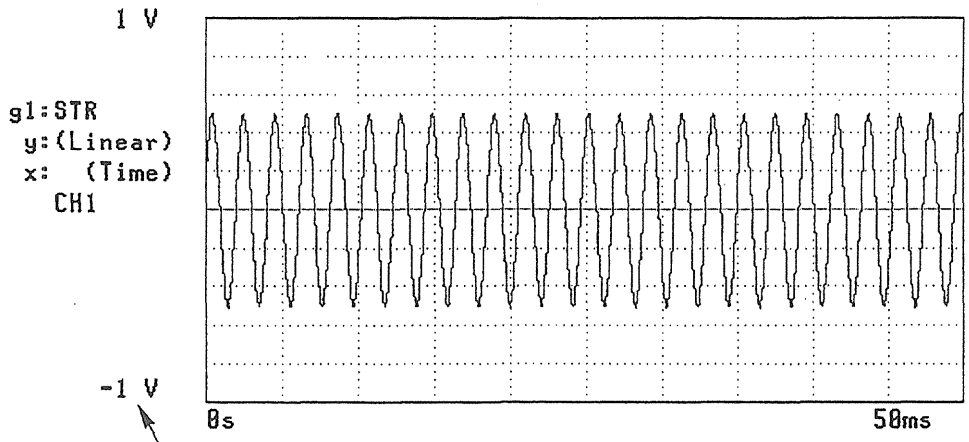


Fig. 6-1.
Stored waveform

Value corresponding to the range of the input unit
[Input signal]

Number of sample points

From this, it is clear that the data has a majority of points with large amplitudes.

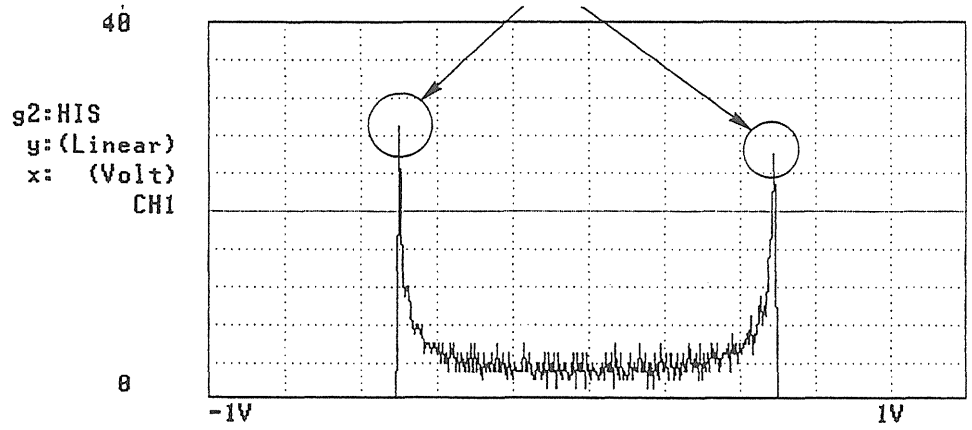


Fig. 6-2.
Histogram

[Histogram]

1-2-7. [TRF] : Transfer function

Displays the transfer function (frequency characteristics) of the system being measured calculated from input and output signals. Nyquist diagrams can also be displayed, including magnitude and phase information.

Major applications include:

- Determining filter frequency characteristics.
- Determining feedback control system stability through Nyquist diagrams.
- Determining the physical resonant frequency using an impulse hammer and pick-up sensor.

[Function] $$Hab = \frac{Fb}{Fa} = \frac{Fb \cdot Fa^*}{Fa \cdot Fa^*} = \frac{Gab}{Gaa}$$

$$= \frac{|Gab|}{|Gaa|}\{\cos(\angle b - \angle a) + j\sin(\angle b - \angle a)\}$$

Vertical axis	Meaning
Linear Real (real-number part)	$\|Hab\| \cdot \cos(\angle b - \angle a)$
Linear Imag (imaginary-number part)	$\|Hab\| \cdot \sin(\angle b - \angle a)$
Linear Mag (magnitude)	$\|Hab\|$
Log Mag (logarithmic magnitude)	$20 \log \|Hab\|$
Phase (phase)	$\angle b - \angle a$

[Horizontal axis]

Linear Hz — Indicates the frequency spectrum in linear units. The range is from DC to the maximum frequency range value.

Log Hz — Indicates the frequency spectrum in logarithmic units. The range is from 1/400 the maximum frequency range value to the maximum frequency range value.

Linear Nyquist — Indicates the real-number part of the input-to-output ratio. (Nyquist mode)

[Vertical axis]

Linear Real — Indicates the real-number part of the input-to-output ratio. (No units.)

Linear Image — Indicates the imaginary-number part of the input-to-output ratio.

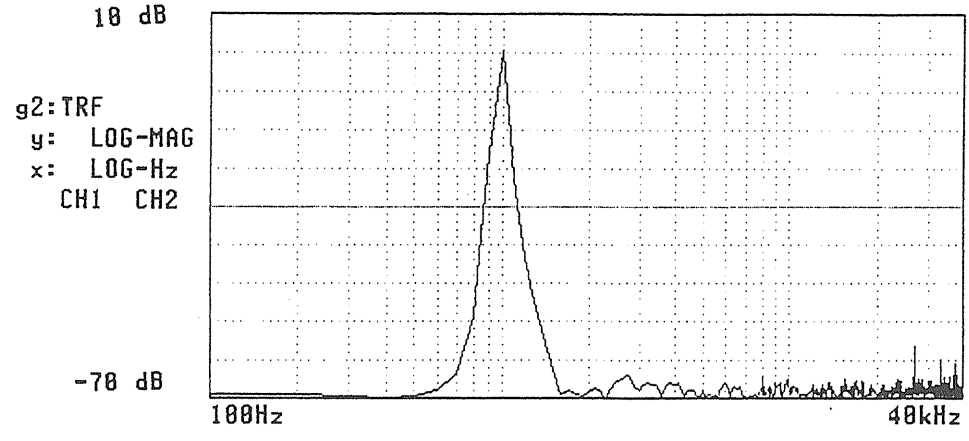
Linear Mag — Indicates the input-to-output ratio in decibels. (No units.) This expresses the magnitude component.

Log Mag — Indicates the input-to-output ratio in decibels. This expresses the magnitude component

Phase — Indicates the angle between the real and imaginary-number parts of the data in degrees. This expresses the phase component. (With AUTO screen: -180 to 180 deg)

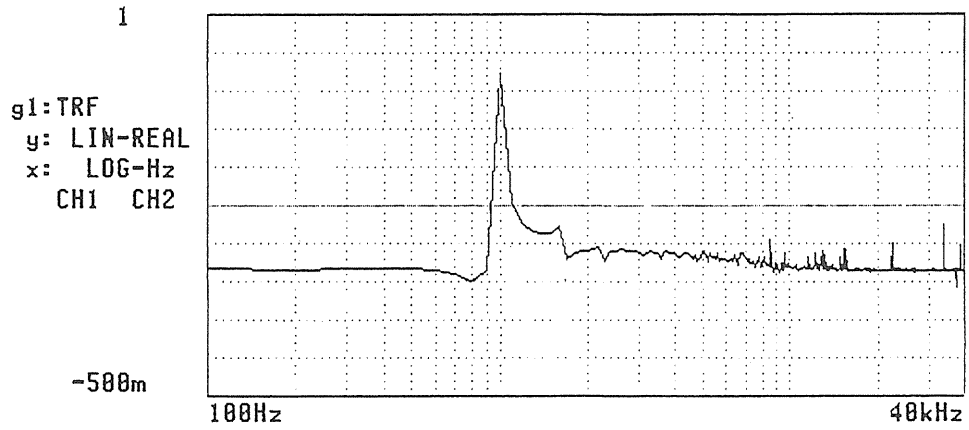
Linear Nyquist — Indicates the imaginary-number part of the input-to-output ratio. (Nyquist mode)

• Examples of transfer function waveforms



• From the spectrum shown on the left, it is clear that a signal having components of about 1 kHz will be passed.

Fig. 7-1.
LOG-MAG
(X-axis: Log)



• The following waveforms all have the same source waveform.

• From the spectrum shown on the left, it is clear that a signal having components of about 1 kHz will be passed.

Fig. 7-2.
LIN-REAL
(X-axis: Log)

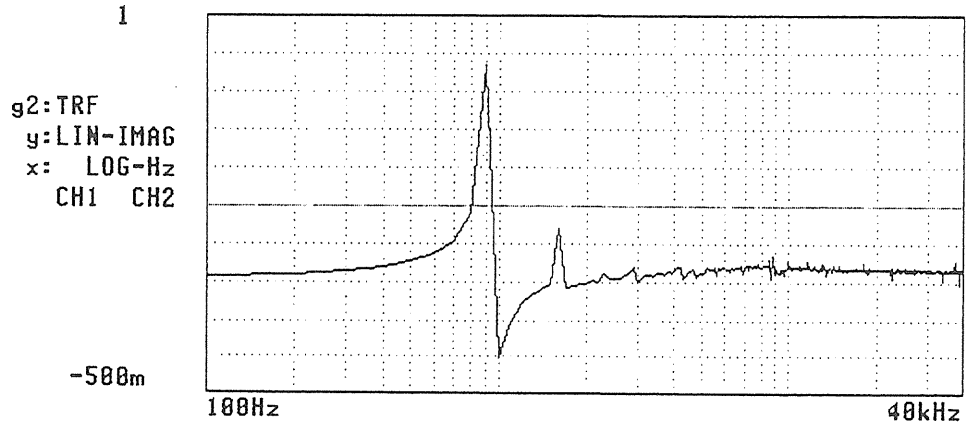


Fig. 7-3.
LIN-IMAG
(X-axis: Log)

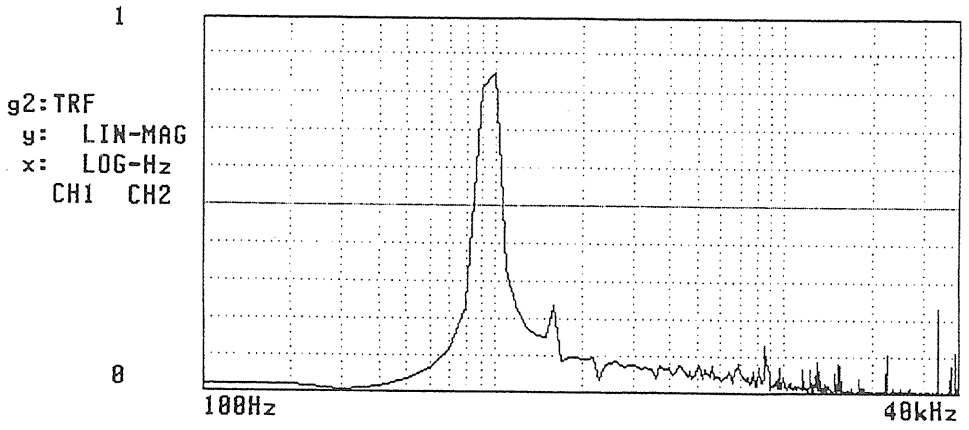


Fig. 7-4.
LIN-MAG
(X-axis: Log)

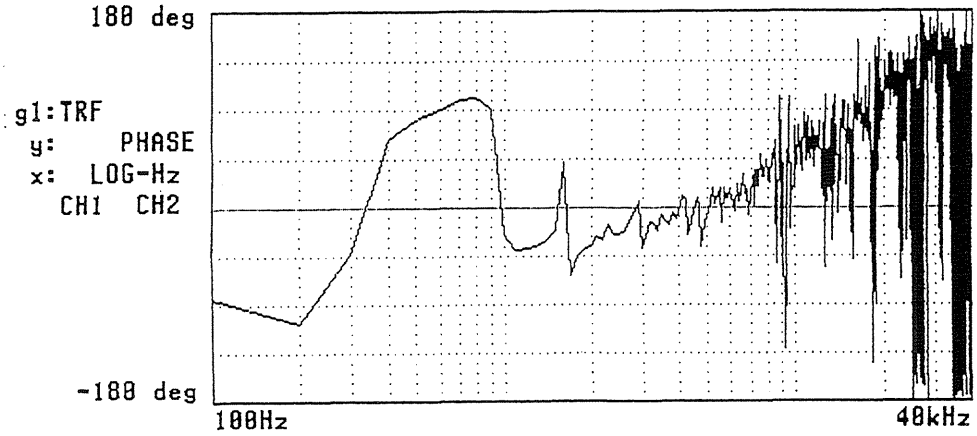


Fig. 7-5.
PHASE
(X-axis: Log)

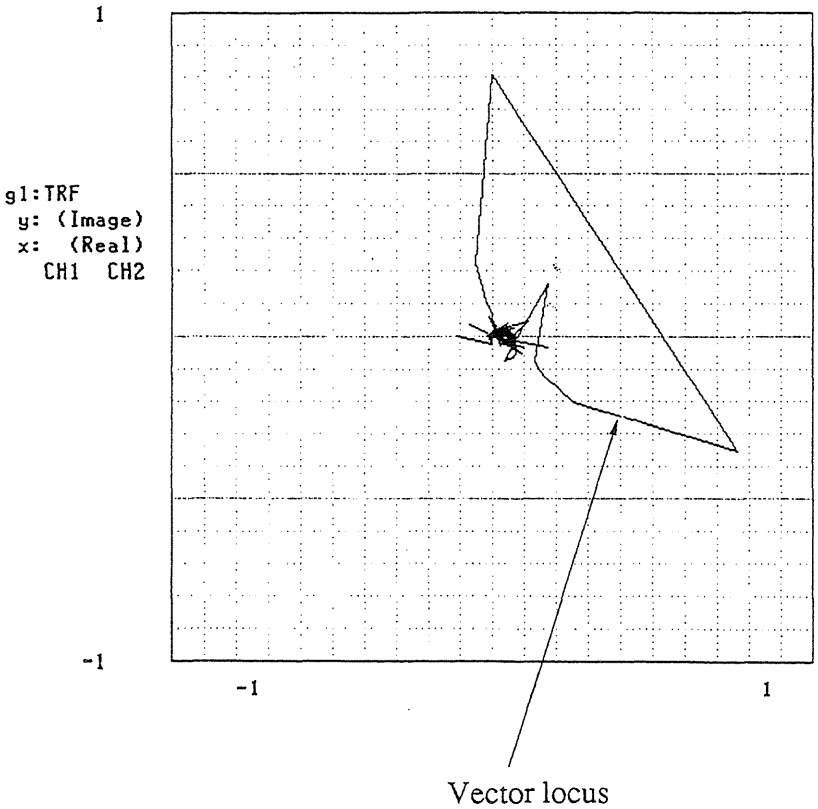


Fig. 7-6.
Nyquist

1-2-8. [CSP]: Cross power spectrum

Displays the product of the spectra of two input signals.

The magnitude and phase information of the frequency components that are common to both signals can be displayed.

Major applications:

Obtaining frequency components common to two signals.

[Function] $Gab = Fa^* \cdot Fb$

$= |Fa| \cdot |Fb| \{\cos(\angle b - \angle a) + j\sin(\angle b - \angle a)\}$

Vertical axis	Meaning
Linear Real (real-number part)	$\|Gab\| \cdot \cos(\angle b - \angle a)$
Linear Imag (imaginary-number part)	$\|Gab\| \cdot \sin(\angle b - \angle a)$
Linear Mag (magnitude)	$\|Gab\|$
Log Mag (logarithmic magnitude)	$10 \cdot \log \|Gab\|$
Phase (phase)	$\angle b - \angle a$

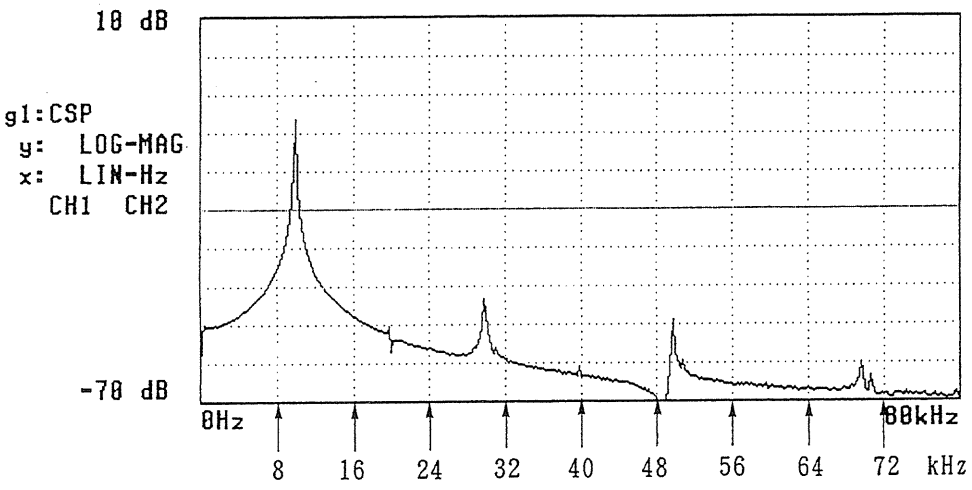
[Horizontal axis]

Linear Hz	Indicates the frequency spectrum in linear units. The range is from DC to the maximum frequency range value.
Log Hz	Indicates the frequency spectrum in logarithmic units. The range is from 1/400 the maximum frequency range value to the maximum frequency range value.
Linear Nyquist	Indicates the real-number part of the data in voltage units. (Nyquist mode)

[Vertical axis]

Linear Real	Indicates the real-number part of the data in voltage units.
Linear Imag	Indicates the imaginary-number part of the data in voltage units.
Linear Mag	Indicates the binary exponential value of the data in voltage units. Interlocked with the amplifier range.
Log Mag	Indicates the data in decibels. This expresses the magnitude component. (With AUTO screen: -180 dB to + 180 deg)
Phase	Indicates the angle between the real and imaginary-number parts of the data in degrees. This expresses the phase component.
Linear Nyquist	Indicates the imaginary-number part of the data in voltage units. (Nyquist mode)

• Examples of cross power spectra



• The following waveforms all have the same source waveform.

• From the spectrum shown on the left, it is seen that the frequency components common to both input signals are at 10 kHz, 30 kHz, 50 kHz, and 70 kHz. (×1, ×3, ×5, ×7)

Fig. 8-1.
LOG-MAG
(X-axis: Linear)

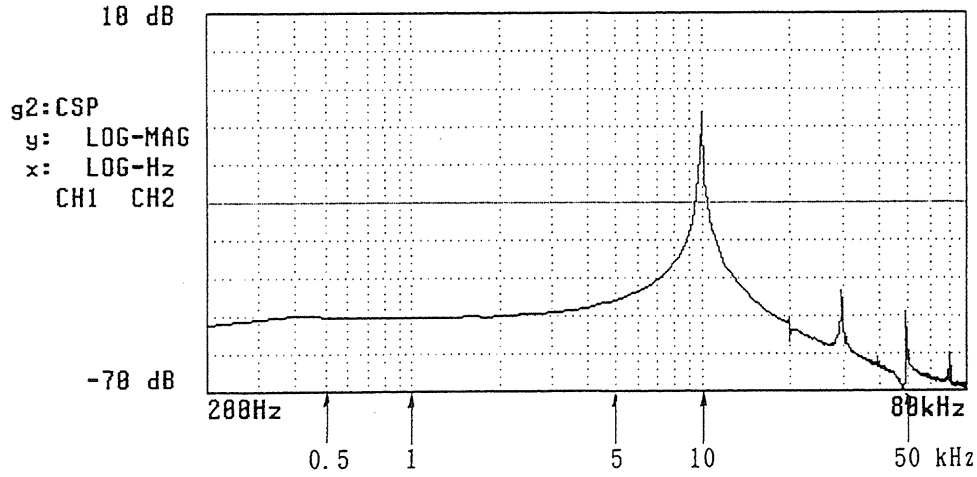


Fig. 8-2.
LOG-MAG
(X-axis: Log)

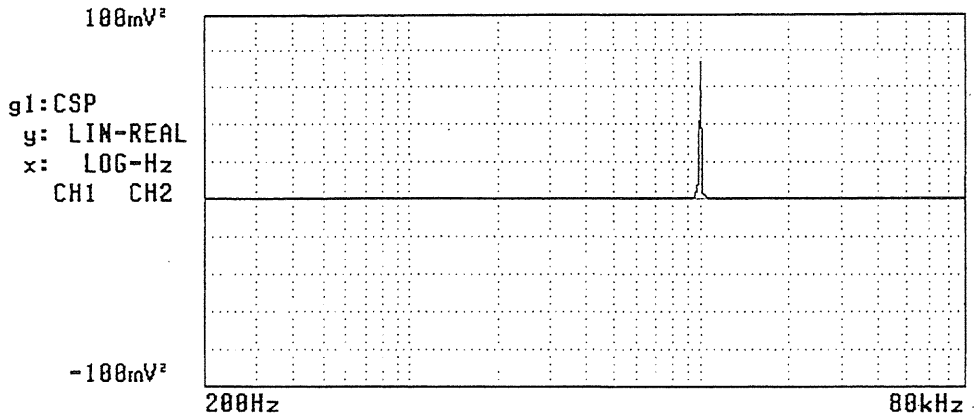


Fig. 8-3.
LIN-REAL
(X-axis: Log)

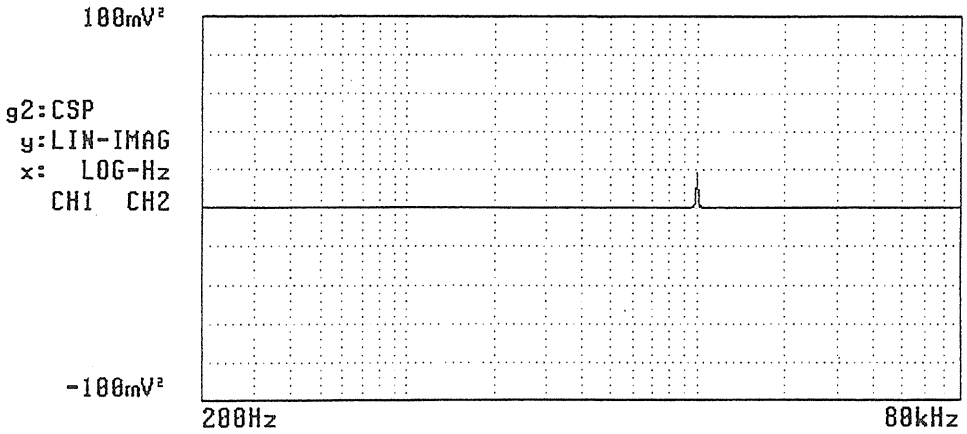


Fig. 8-4.
LIN-IMAG
(X-axis: Log)

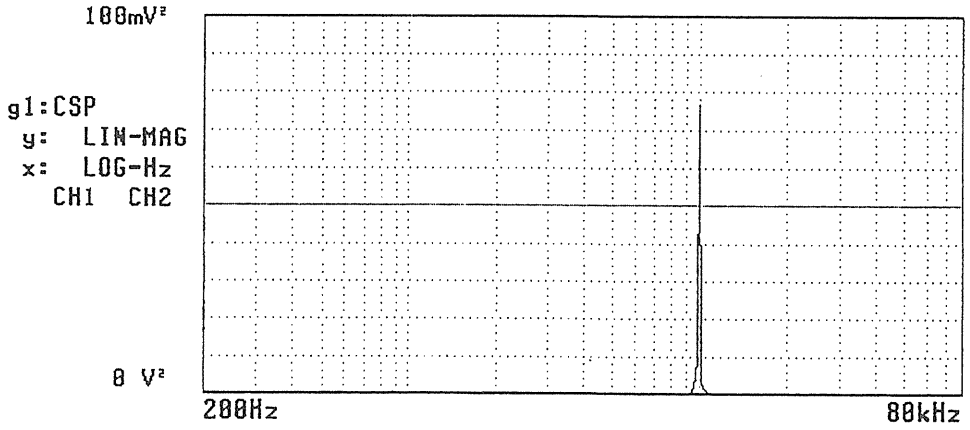


Fig. 8-5.
LIN-MAG
(X-axis: log)

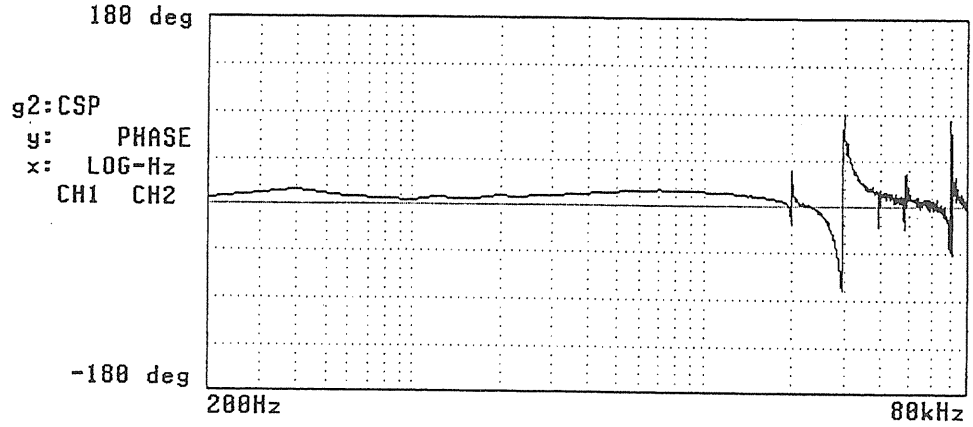


Fig. 8-6.
PHASE
(X-axis: Log)

1-2-9. [CCR]: Cross correlation

Displays the degree of similarity between two points separated by a time difference (τ) on two signals.

The degree of similarity is expressed as a function of the time difference (τ).

Major applications:

- Obtaining the phase difference between two signals in time units.
- Obtaining a speed or distance by measuring the time delay.

[Function] $Rab(\tau) = \mathcal{F}^{-1}(Gab)$

$$= \frac{1}{2\pi}\int_{-\infty}^{+\infty} Gab(\omega)\cdot\exp(j\omega\tau)d\omega$$

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	Rab
Log Mag (logarithmic magnitude)	—
Phase (phase)	—

[Horizontal axis] Time — Displays the time differential on a linear scale. The center indicates the reference (τ=0), the right side indicates time lag (+τ), and the left side indicates time lead (-τ).

[Vertical axis] Linear Mag — Displays the correlation coefficient on a linear scale. Readings are from +1 to -1 (no units). +1 indicates the highest similarity between the input and output signals for time differential τ, and 0 indicates the lowest similarity. -1 indicates that the polarity is completely opposite.

• Examples of cross-correlation function waveforms

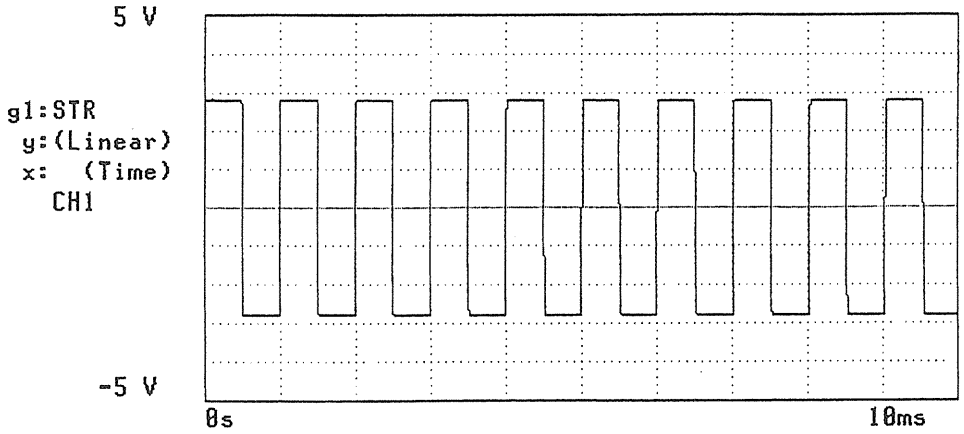
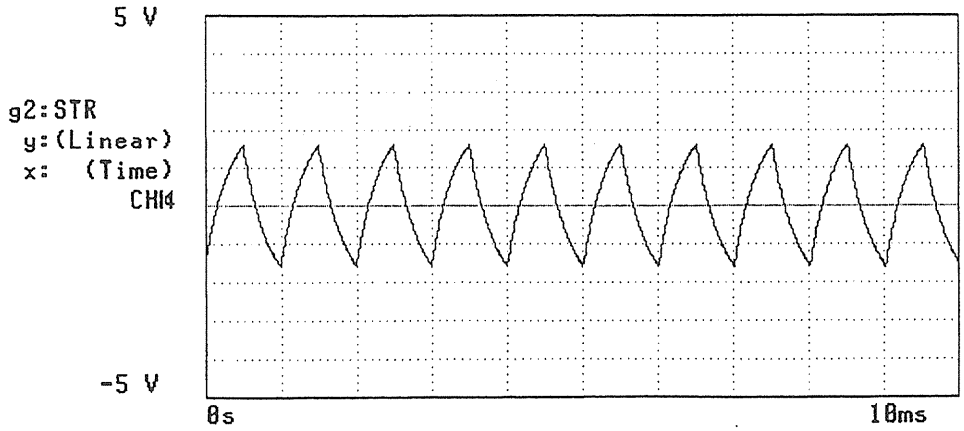


Fig. 9-1.
Input signal waveform



• High frequency components are removed by passing the signal through a 500-Hz low-pass filter.

Fig. 9-2.
Output signal waveform

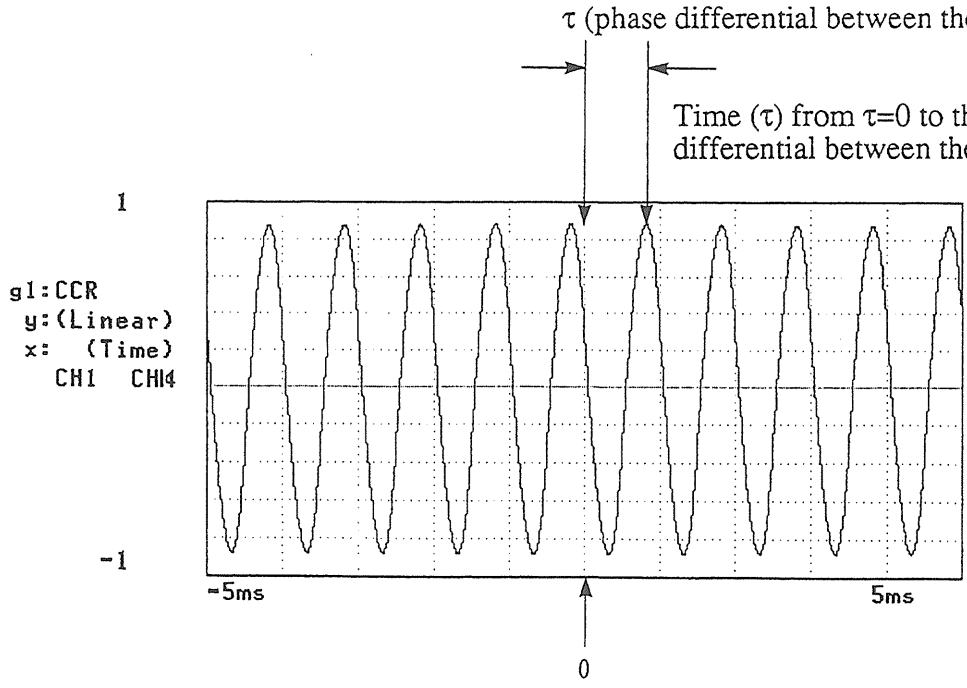


Fig. 9-3.
Cross-correlation function

1-2-10. [IMP] : Unit impulse response

Displays the frequency response of a system in the time domain.

A response waveform equivalent to the unit impulse function is obtained by analyzing the input and output signals of the system being measured.

Major applications

Checking circuit time constants.

[Function] IMP = $\mathfrak{I}^{-1}$(Hab)

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	IMP
Log Mag (logarithmic magnitude)	—
Phase (phase)	—

[Horizontal axis] Time — Displays the time differential on a linear scale. The center indicates the reference (τ=0), the right side indicates time lag (+τ), and the left side indicates time lead (-τ).

[Vertical axis] Linear — Inverse Fourier conversion value of the transfer function (Hab). (no units)

Examples of unit impulse response waveforms

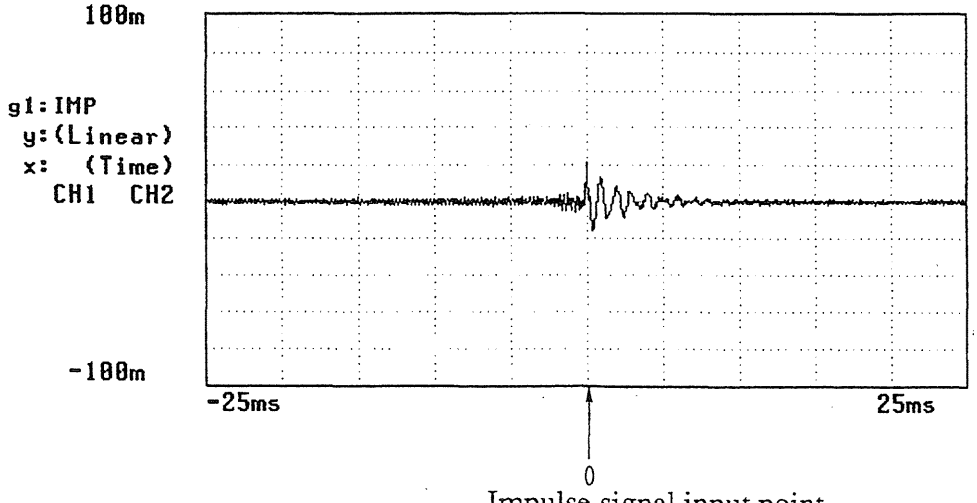


Fig. 10-1.
Unit impulse response

1-2-11. [COH] : Coherence

Displays the output signal component that is coherent (interference possible) to the input signal, yielding a value from 0 to 1.

Major applications include:

- Evaluation of transfer functions.
- Determining the contribution of individual input lines to the output of multi-input systems.

[Function] $COH = \frac{Gab \cdot Gab^*}{Gaa \cdot Gbb}$

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	COH
Log Mag (logarithmic magnitude)	—
Phase (phase)	—

[Horizontal axis]	Linear Hz	Indicates the frequency spectrum in linear units. The range is from DC to the maximum frequency range value.
	Log Hz	Indicates the frequency spectrum in logarithmic units. The range is from 1/400 the maximum frequency range value to the maximum frequency range value.
[Vertical axis]	Linear Mag	Indicates the relationship between the two input signals. The degree of relationship is indicated from 0 to 1 on a linear scale. (No units.)

Note

For a single measurement, the coherence function returns 1 for all frequencies. When measuring, be sure to use frequency averaging.

• Examples of coherence function waveforms

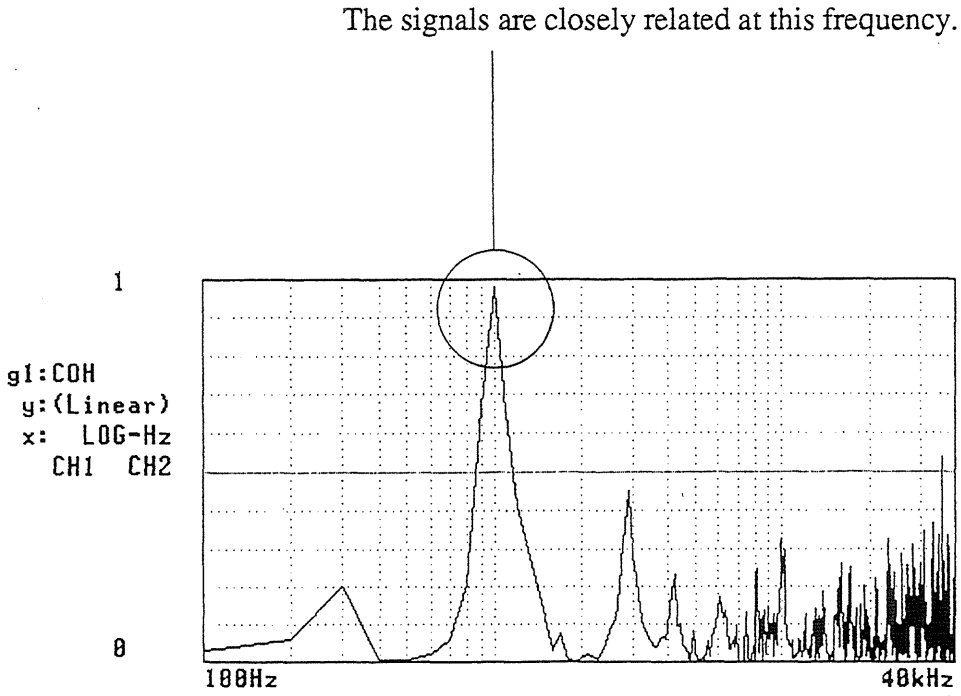


Fig. 11-1.
Coherence function

1-2-12. [OCT] : Octave analysis

Octave analysis is the expression of a spectrum (such as a noise spectrum) as a sound pressure level using a 1-octave band or 1/3-octave band fixed ratio bandpass filter.

Octave analysis is frequency used for analyzing the frequency content of noise.

[Function] OCT

Vertical axis	Meaning
Linear Real (real-number part)	—
Linear Imag (imaginary-number part)	—
Linear Mag (magnitude)	Oct
Log Mag (logarithmic magnitude)	2 0 • log (Oct)
Phase (phase)	—

[Horizontal axis] 1/1 Oct Set for 1/1-octave band analysis.

1/3 Oct Set for 1/3-octave band analysis.

[Vertical axis] Linear Mag Octave analysis value displayed in voltage units.

Log Mag Octave analysis value displayed in decibels.

- Octave analysis, a kind of frequency analysis, is used to analyze noise. With octave analysis, noise is analyzed by passing it through a band-pass filter with a constant ratio width of 1/1 octave band or 1/3 octave band.
- Whereas a power spectrum shows power for various bands of a fixed range of frequencies by dividing it into parts, octave analysis places the frequency axis on a logarithmic scale and uses a bar graph representation to show the power for each evenly-spaced portion of a frequency range.
- With analog octave analysis, the octave band center frequency and the filter characteristics conform to the standards set forth in the ANSI Class III specifications.
- The analyzer first obtains the power spectra, then bundles them for 1/1-octave or 1/3-octave analysis. The following analyses are possible:
    - 5-band, 1/1-octave analysis
    - 15-band, 1/3-octave analysis
- With this analyzer, 15-band, 1/3-octave analysis conforms to the standards set forth in the ANSI Class III specifications. Filter characteristics also conform to ANSI Class III. However, the uppermost band of the analysis range has no leakage from higher frequencies. For example, the 20 kHz band has no leakage from the 25 kHz band.
    - 15-band, 1/3-octave analysis

      With 1/3-octave analysis, 400 spectral lines resulting from normal frequency analysis are bundled at 1/3-octave intervals and displayed as a bar graph.
    - 5-band, 1/1-octave analysis

      With 1/1-octave analysis, the results of 1/3-octave analysis are bundled in groups of 3 bands each.

• Examples of octave analysis waveforms

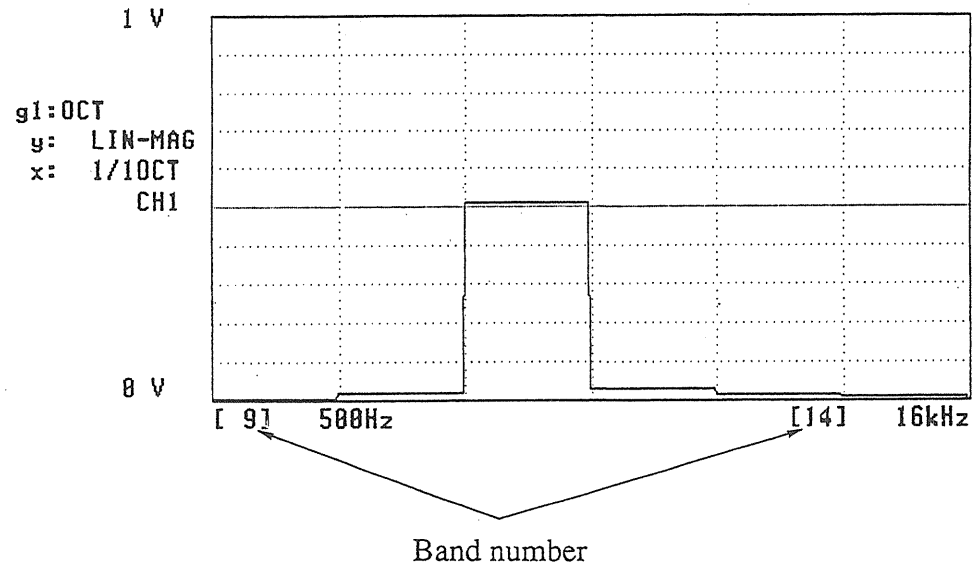


Fig. 12-1.
1/1 Octave
analysis

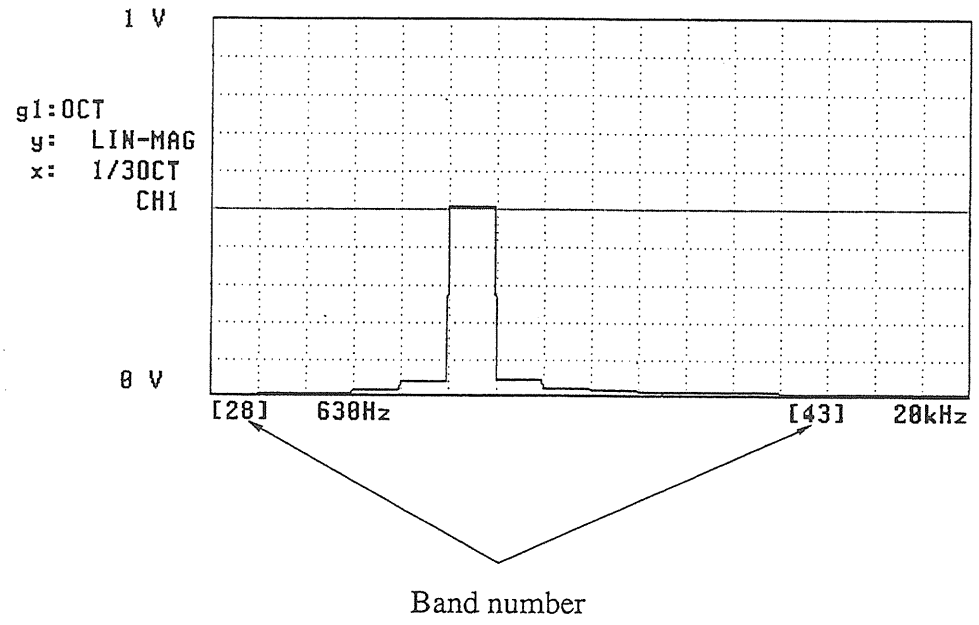


Fig. 12-2.
1/3 Octave
analysis

• Frequency ranges and measurable range widths (O - 1/3 OCT, X -1/1 OCT)

Band No.		Center frequency (Hz)	Frequency range (Hz)																	
1/1	1/3		133 m	333 m	667 m	2	4	8	20	40	80	200	400	800	2k	4k	8k	20k	40k	80k
-8	-24	4m	X																	
	-23	5m	OX																	
	-22	6.3m	OX																	
-7	-21	8m	OX	X																
	-20	10m	OX	OX																
	-19	12.5m	OX	OX																
-6	-18	16m	OX	OX	X															
	-17	20m	OX	OX	OX															
	-16	25m	OX	OX	OX															
-5	-15	31.5m	OX	OX	OX															
	-14	40m	OX	OX	OX															
	-13	50m	OX	OX	OX															
-4	-12	63m	OX	OX	OX	OX														
	-11	80m	OX	OX	OX	OX														
	-10	100m	OX	OX	OX	OX														
-3	-9	125m	OX	OX	OX	OX	OX													
	-8	160m	O	OX	OX	OX	OX													
	-7	200m		OX	OX	OX	OX													
-2	-6	250m		OX	OX	OX	OX	OX												
	-5	315m		O	OX	OX	OX	OX												
	-4	400m			OX	OX	OX	OX												
-1	-3	500m			OX	OX	OX	OX	X											
	-2	630m			O	OX	OX	OX	OX											
	-1	800m				OX	OX	OX	OX											
0	0	1				OX	OX	OX	OX	X										
	1	1.25				OX	OX	OX	OX	OX										
	2	1.6				OX	OX	OX	OX	OX										
1	3	2				OX	OX	OX	OX	OX	X									
	4	2.5					OX	OX	OX	OX	OX									
	5	3.15					OX	OX	OX	OX	OX									
2	6	4					OX	OX	OX	OX	OX									
	7	5						OX	OX	OX	OX									
	8	6.3						OX	OX	OX	OX	O								
3	9	8						OX	OX	OX	OX	OX								
	10	10							OX	OX	OX	OX								
	11	12.5							OX	OX	OX	OX	O							
4	12	16							OX	OX	OX	OX	OX							
	13	20							O	OX	OX	OX	OX							
	14	25								OX	OX	OX	OX	O						
5	15	31.5								OX	OX	OX	OX	OX						
	16	40								O	OX	OX	OX	OX						
	17	50									OX	OX	OX	OX						
6	18	63									OX	OX	OX	OX	OX					
	19	80									O	OX	OX	OX	OX					
	20	100										OX	OX	OX	OX					
7	21	125										OX	OX	OX	OX	OX				
	22	160										OX	OX	OX	OX	OX				
	23	200										OX	OX	OX	OX	OX				
8	24	250										X	OX	OX	OX	OX	OX			
	25	315											OX	OX	OX	OX	OX			
	26	400											OX	OX	OX	OX	OX			
9	27	500											X	OX	OX	OX	OX	X		
	28	630												OX	OX	OX	OX	OX		
	29	800												OX	OX	OX	OX	OX		
10	30	1k												X	OX	OX	OX	OX	X	
	31	1.25k													OX	OX	OX	OX	OX	
	32	1.6k													OX	OX	OX	OX	OX	
11	33	2k													OX	OX	OX	OX	OX	X
	34	2.5k														OX	OX	OX	OX	OX
	35	3.15k														OX	OX	OX	OX	OX
12	36	4k														OX	OX	OX	OX	OX
	37	5k															OX	OX	OX	OX
	38	6.3k															OX	OX	OX	OX

Band No.		Center frequency (Hz)	Frequency range (Hz)																
1/1	1/3		133 m	333 m	667 m	2	4	8	20	40	80	200	400	800	2k	4k	8k	20k	40k	80k
13	39	8k															OX	OX	OX	OX
	40	10k																OX	OX	OX
	41	12.5k																OX	OX	OX
14	42	16k																OX	OX	OX
	43	20k																O	OX	OX
	44	25k																	OX	OX
15	45	31.5k																	OX	OX
	46	40k																	O	OX
	47	50k																		OX
16	48	63k																		OX
	49	80k																		O

1-3. Display Screens

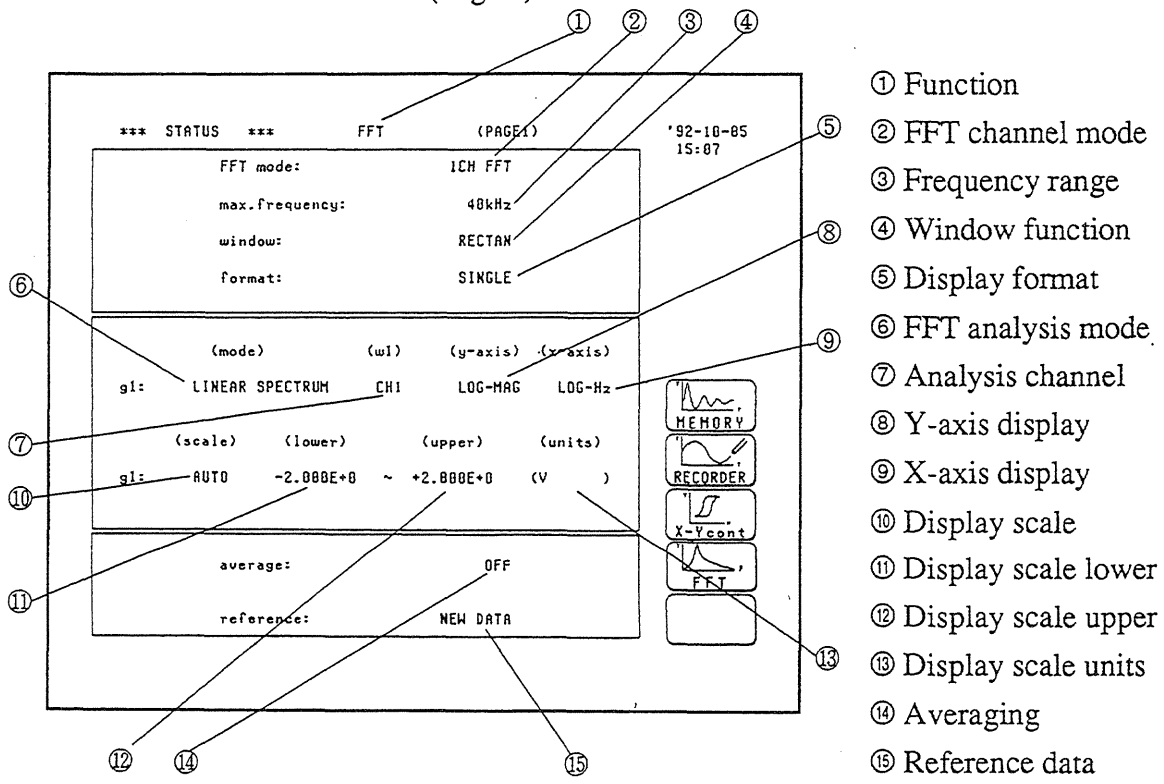
This section describes the "status", "channel", and "display" screens, and gives references to other important parts of this manual.

For the "system" screen, refer to 8825 Operation Manual Section 12. For the "floppy disk control" screen, refer the 8825 Operation Manual Section 14.

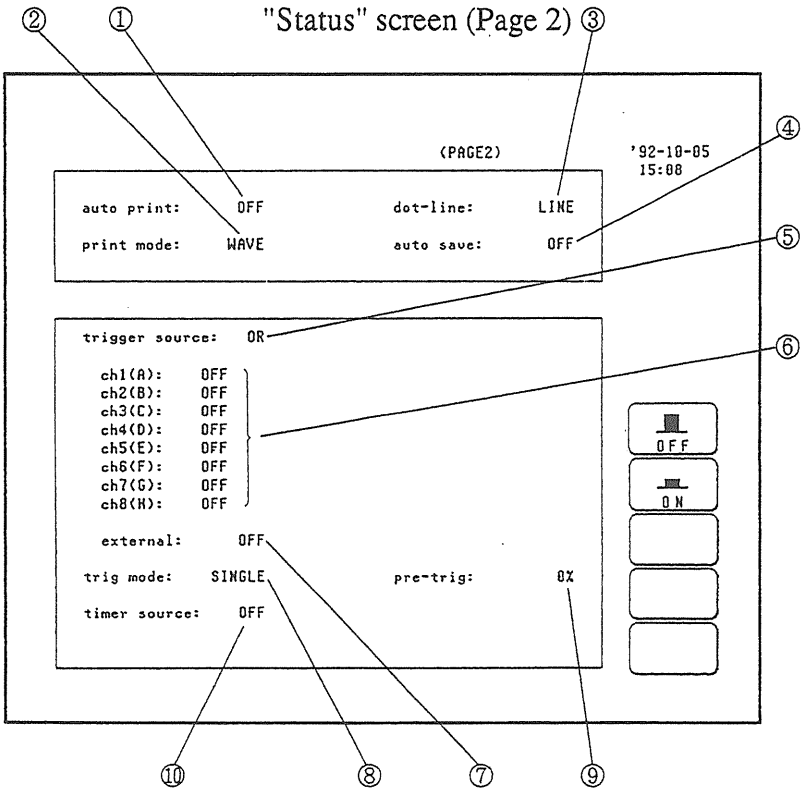
1-3-1. "Status" screen

- Press the STATUS key, and page 1 of the "status" screen appears.
- Pressing the STATUS key repeatedly cycles through the three pages of the "status" screen. (The screen page can also be changed by holding a cursor key down continuously.)
- Page 1 is used to set FFT functions.
- Page 2 is used to set print, auto-save, and trigger conditions.
- Page 3 is used to set waveform decision parameters.
- For details refer to Section 10 of the 8825 Manual.

"Status" screen (Page 1)

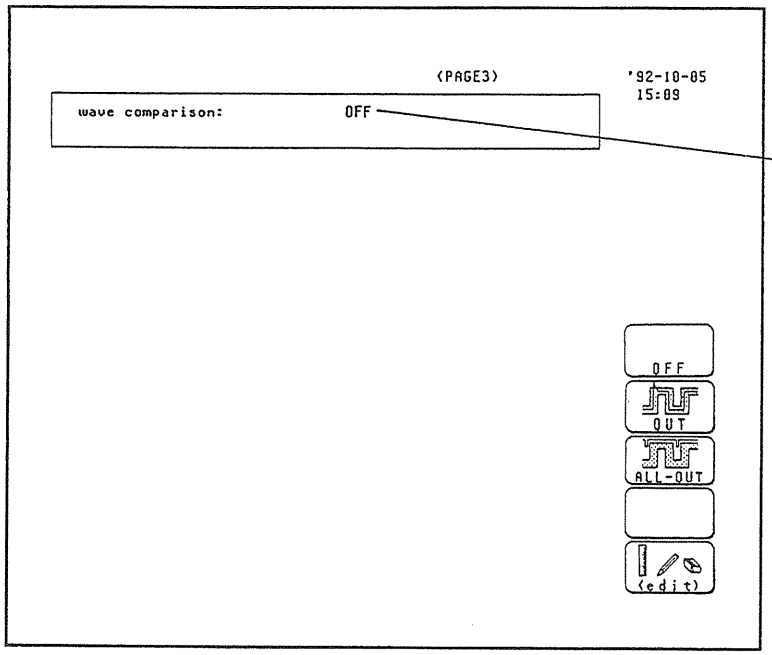


"Status" screen (Page 2)



① Auto print function
② Printing mode (waveform or numerical)
③ Interpolation function
④ Auto-save function
⑤ AND/OR
⑥ Internal trigger
⑦ External trigger
⑧ Trigger mode
⑨ Pre-trigger
⑩ Timer trigger

"Status" screen (Page 3)



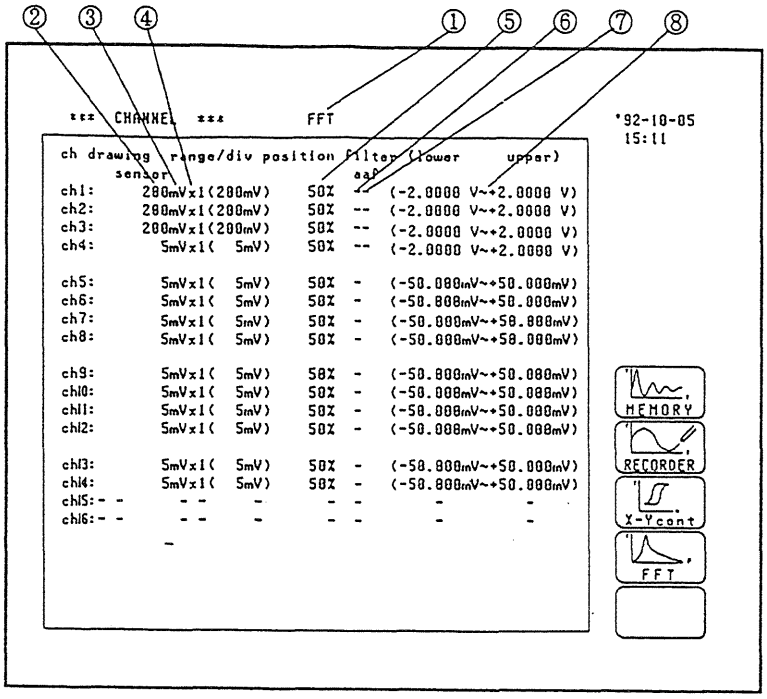
① Waveform decision function

(See the Section 10 of the 8825 Manual)

1-3-2. "Channel" screen

- Press the CHAN key, and the "channel" screen appears.

"Channel" Screen



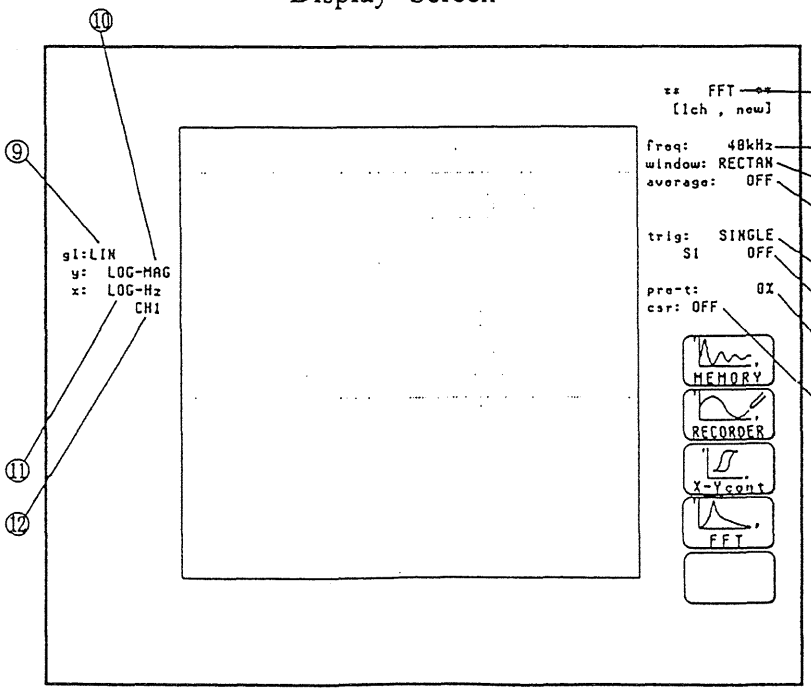
① Function mode
② Voltage axis range
③ Input coupling
④ Voltage axis magnification
⑤ Position
⑥ Low-pass filter
⑦ Anti-aliasing filter
⑧ Upper and lower limit values (display only)

- In the FFT function, it is not possible to change the upper and lower limit values, even if the variable function on the "channel" screen (PAGE2) is set. Set the upper and lower limits in the FFT function in the item of the scale upper and lower limits on the "status" screen (PAGE1).

1-3-3. "Display" screen

- Press the DISP key, and the "display" screen appears.

"Display" Screen

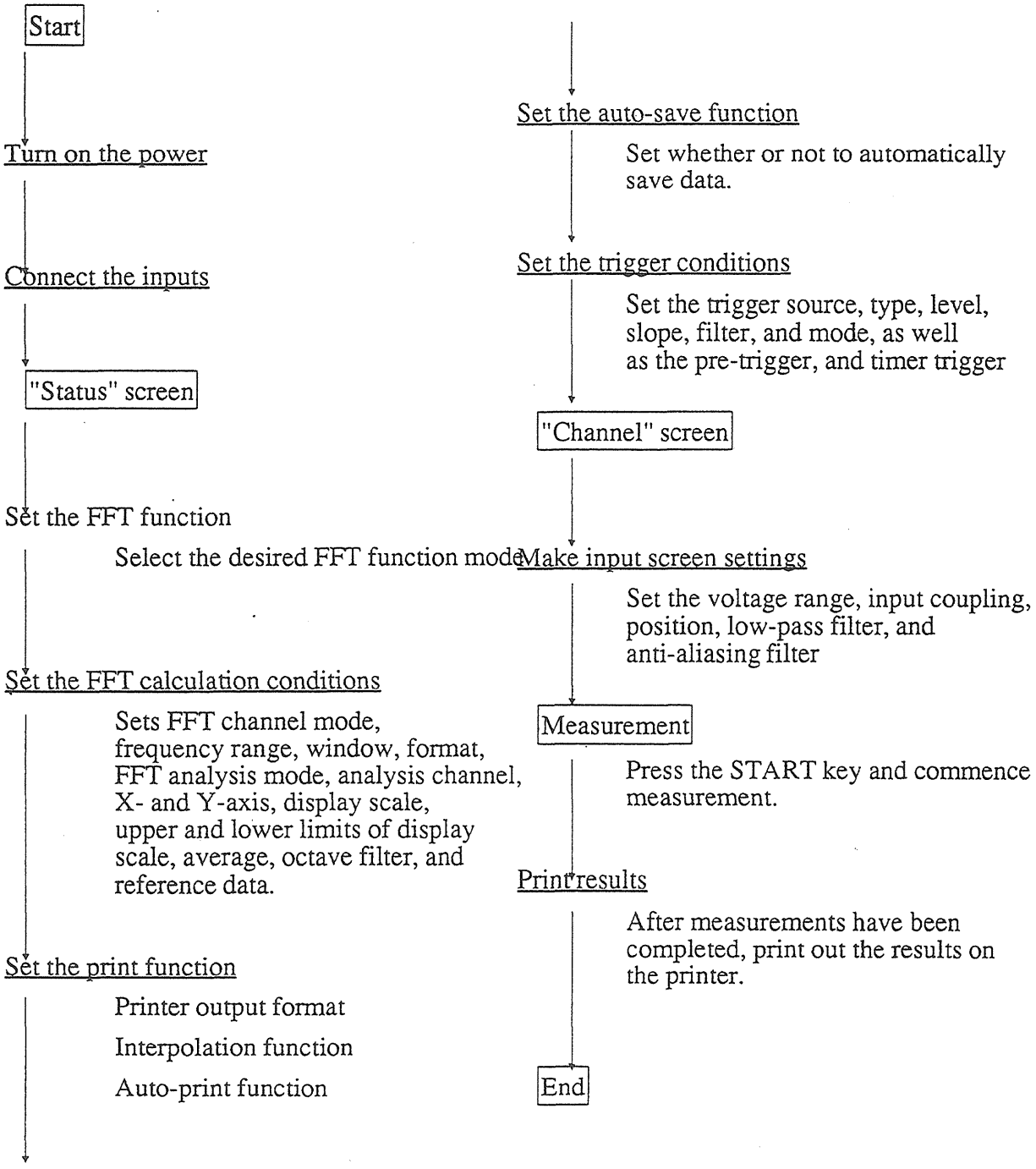


① Function
② Frequency range
③ Window function
④ Averaging
⑤ Trigger mode
⑥ Trigger source
⑦ Pre-trigger
⑧ A/B cursor
⑨ FFT analysis mode
⑩ Y-axis display
⑪ X-axis display
⑫ Analysis channel

1-4. Basic Operating Procedures

1-4-1. Operation flow

The following flowchart illustrates the basic sequence of operations.



1-4-2. Operation example

This example describes how to connect the 8825 to an oscillator and measure the linear spectrum of a 2 V p-p 1 kHz sine wave input.(Except for the anti-aliasing filter setting, the following explanation applies equally whether using the 8909 analog unit or the 8909 FFT analog unit.)

(1) Turn on the power

Connect the power cable to the 8825 and turn on the power with the power switch.

(2) Connect the input.

Connect the amplifier to the input terminal of (the 8909 analog unit fitted to) channel 1 of the 8825. Set the amplifier so that the output sine wave has a frequency of 1 kHz and a voltage 2 V p-p.

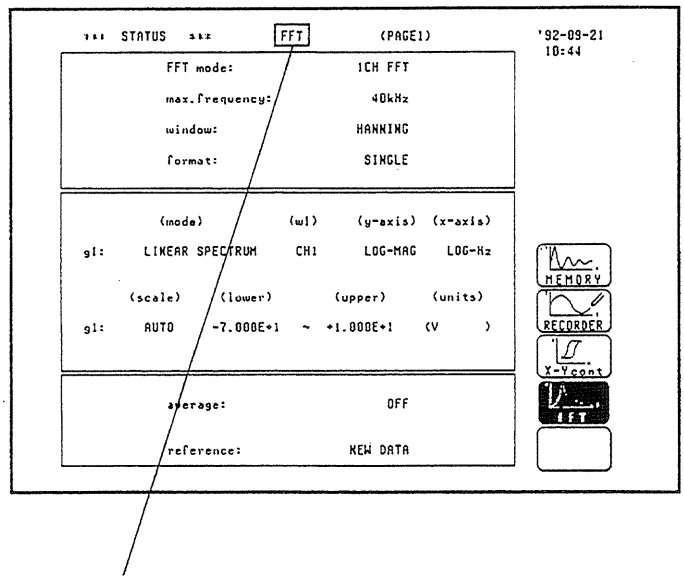
(3) Set the function mode.

To set the function mode to the FFT function mode:

① Press the STATUS key. The "status" screen will appear.

② Using the cursor keys, move the flashing cursor to the "function" item.

③ Choose F4 (FFT).



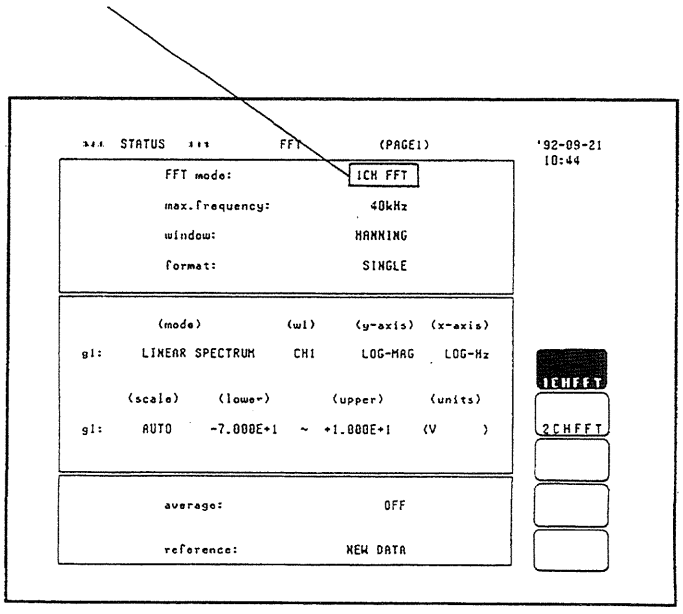
Flashing cursor

(4) Set the FFT calculation conditions.

To set the FFT calculation conditions as shown in the figure on the right:

Using the cursor keys, move the flashing cursor in turn to each item to be set, and, using F1 through F5 select the appropriate values, as explained below.
(For details about the FFT calculation conditions, refer to Section 1-5. "Making Settings")

Flashing cursor



1. Setting the FFT channel mode

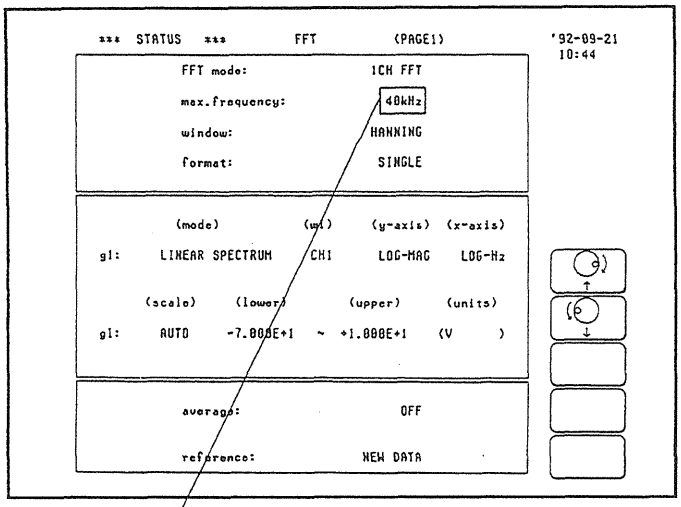
① Move the flashing cursor to the "FFT mode" item

② Choose F1 (1CH FFT)

2. Set the frequency range

① Move the flashing cursor to the "max-frequency" item.

② Using F1 and F2 or the rotary knob, set this item to 40 kHz.

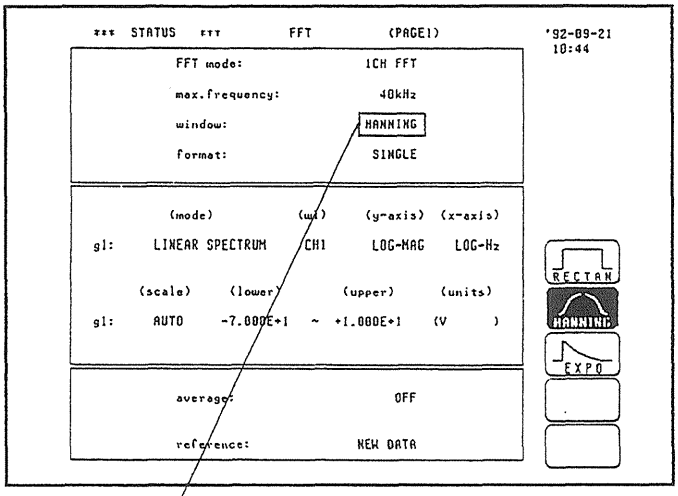


Flashing cursor

3. Set the window function

① Move the flashing cursor to the "window" item.

② Choose F2 (HANNING).

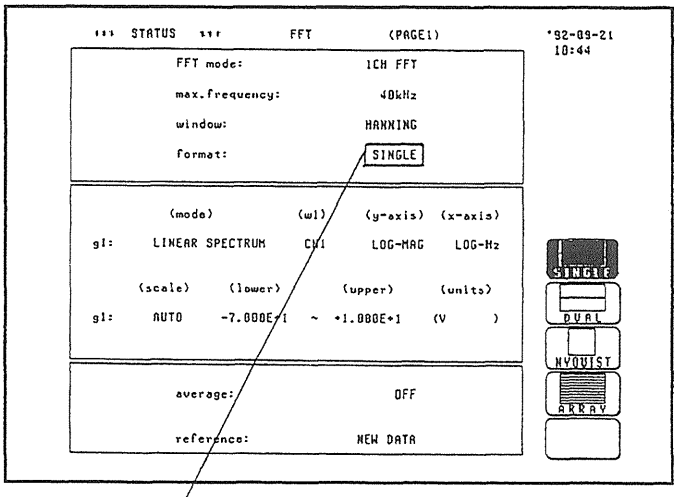


Flashing cursor

4. Set the display format

① Move the flashing cursor to the "format" item.

② Choose F1 (SINGLE).

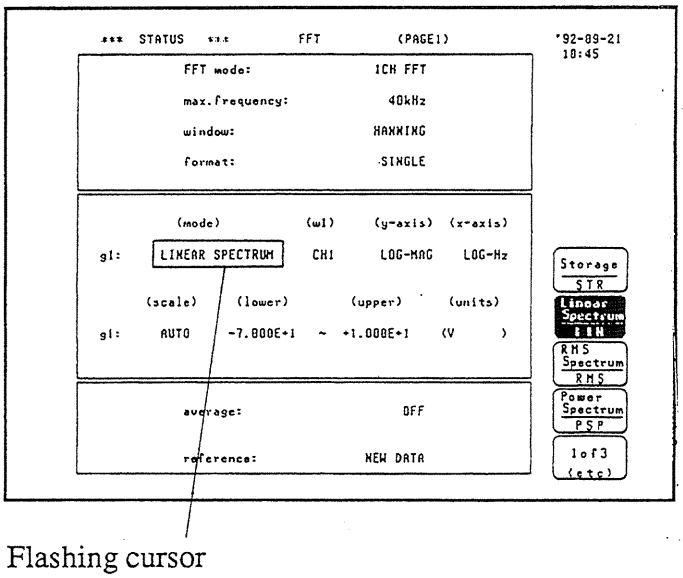


Flashing cursor

5. Set the FFT analysis mode

① Move the flashing cursor to the "mode" item.

② Choose F2 (LINEAR SPECTRUM)

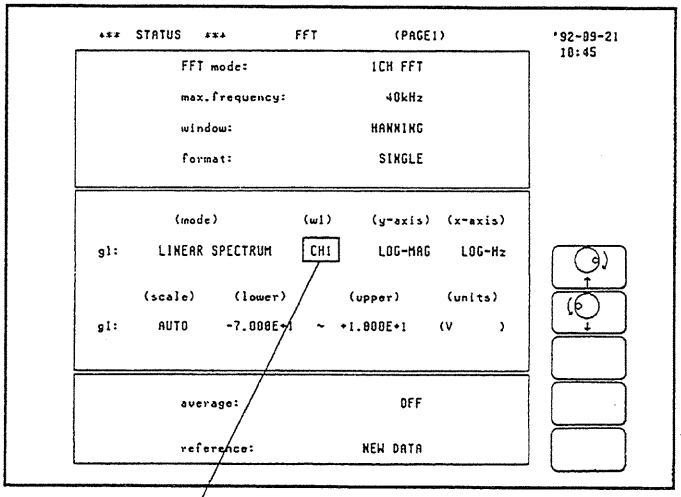


Flashing cursor

6. Set the analysis channel

① Move the flashing cursor to the "w1" item.

② Using F1 and F2 or the rotary knob, set this item to CH1.

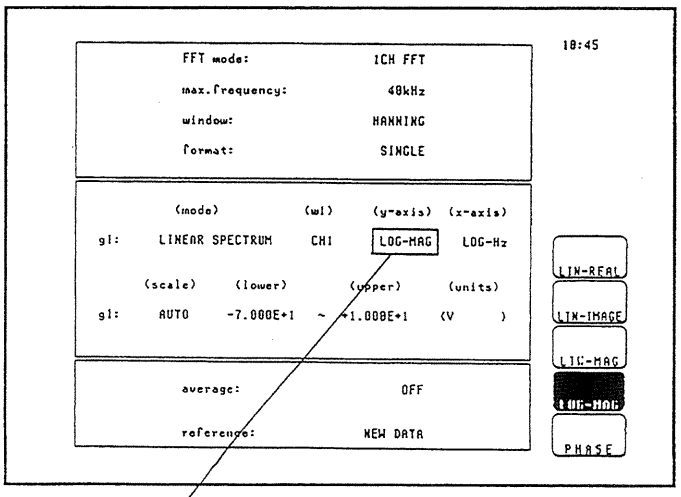


Flashing cursor

7. Set the Y-axis display

① Move the flashing cursor to the "Y-axis" item.

② Choose F4 (LOG-MAG)

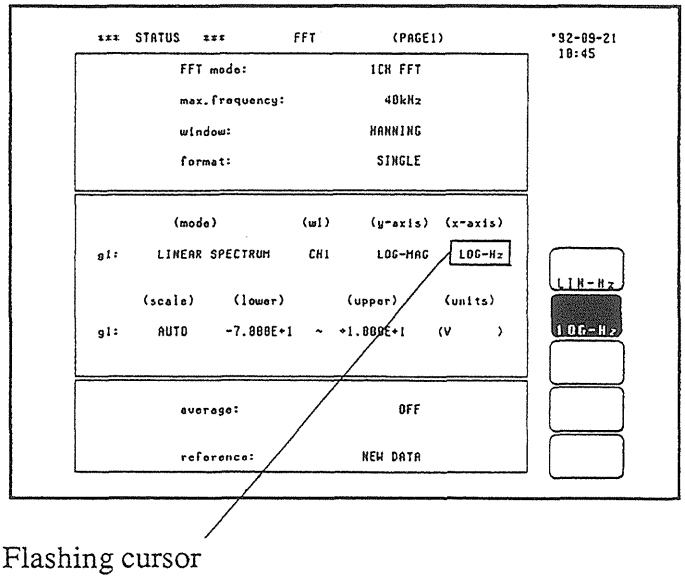


Flashing cursor

8. Set the X-axis display

① Move the flashing cursor to the "X-axis" item.

② Choose F2 (LOG-Hz)

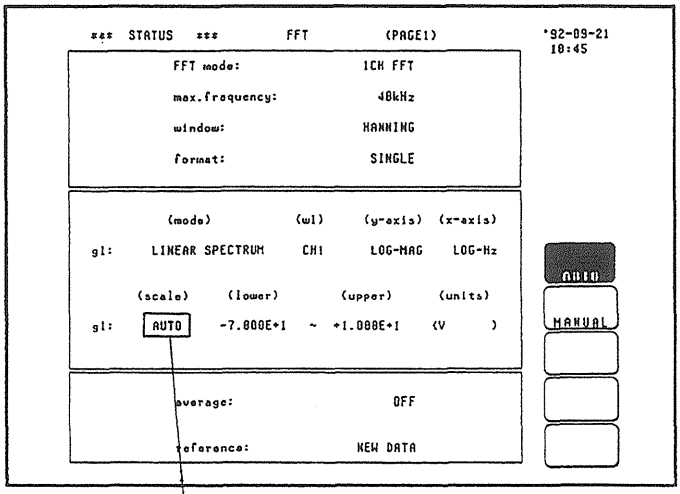


Flashing cursor

9. Set the display scale

① Move the flashing cursor to the "g1" item.

② Choose F1 (AUTO).

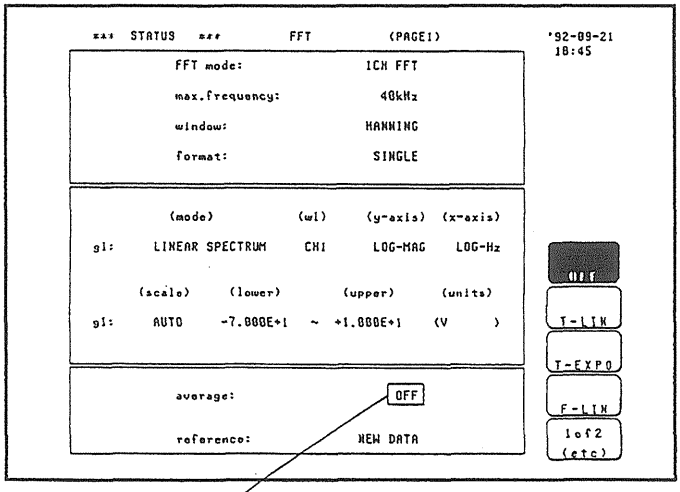


Flashing cursor

10. Set the averaging

① Move the flashing cursor to the "average" item.

② Choose F1 (OFF).

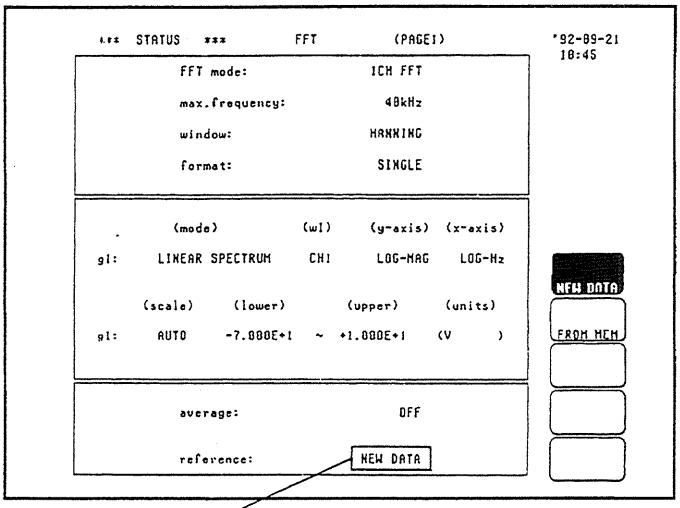


Flashing cursor

11. Set the reference data

① Move the flashing cursor to the "reference" item.

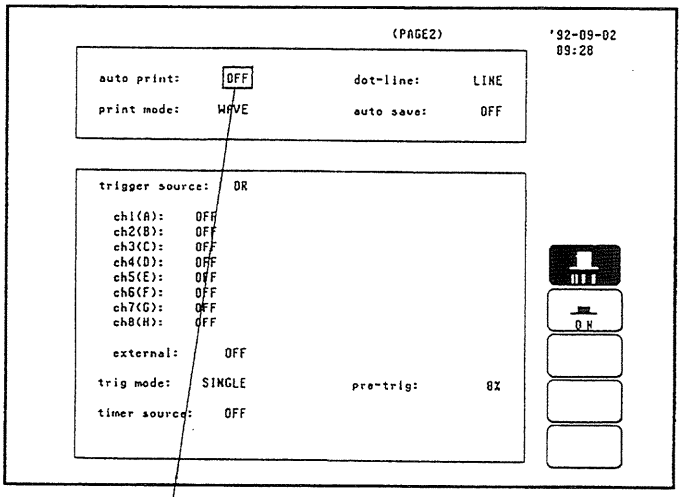
② Choose F1 (NEW DATA)



Flashing cursor

(5) Set the print function

Press the STATUS key, and the "status" screen (page 2) will appear. Using the cursor keys, move the flashing cursor to the appropriate item, and make a selection with F1 and F2. For more details on printing, refer to Section 1-5-14. "Recording on the Printer".



Flashing cursor

1. Set the style for the waveform to printed.

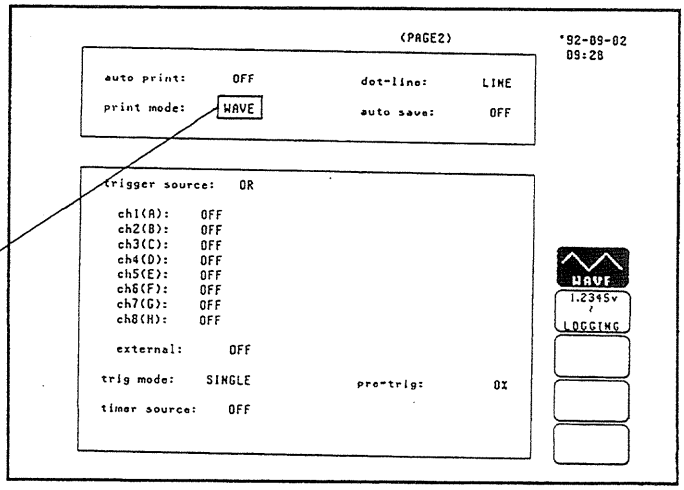
① Move the flashing cursor to the "auto print" item.

② Choose F1 (OFF).

2. Set the printer output function

① Move the flashing cursor to the "print mode" item.

② Choose F1 (WAVE)

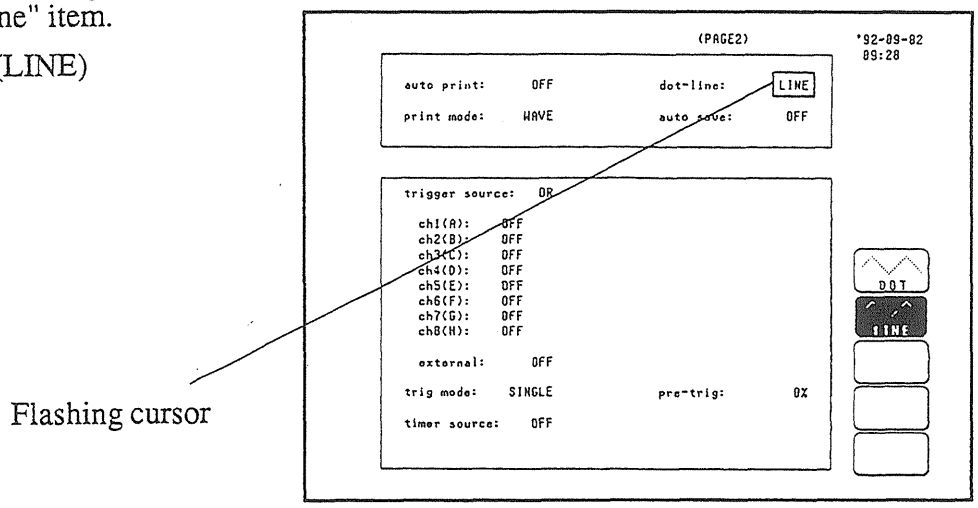


Flashing cursor

3. Set the interpolation function

① Move the flashing cursor to the "dot-line" item.

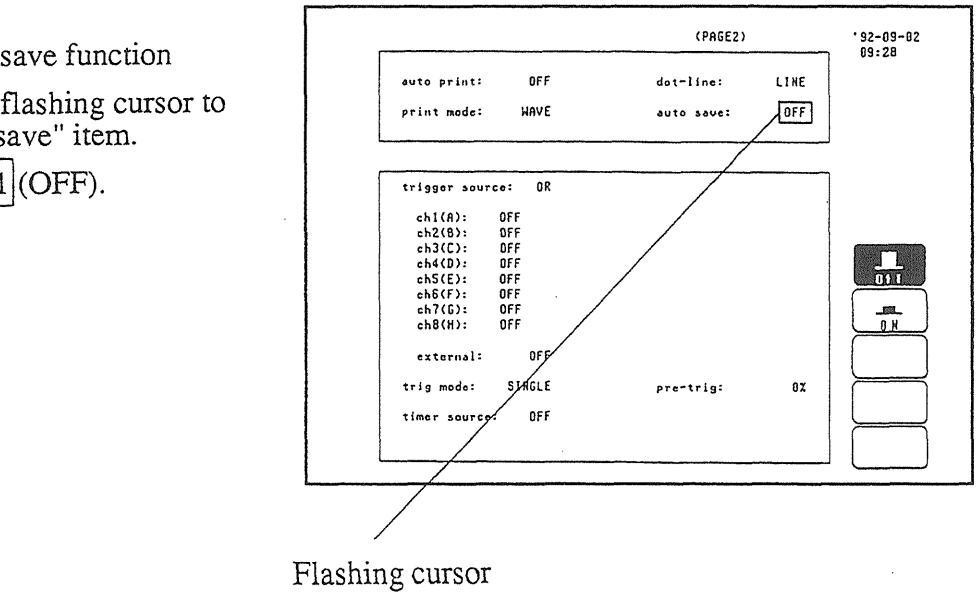
② Using F2 (LINE)



(6) Set the auto-save function

① Move the flashing cursor to the "auto save" item.

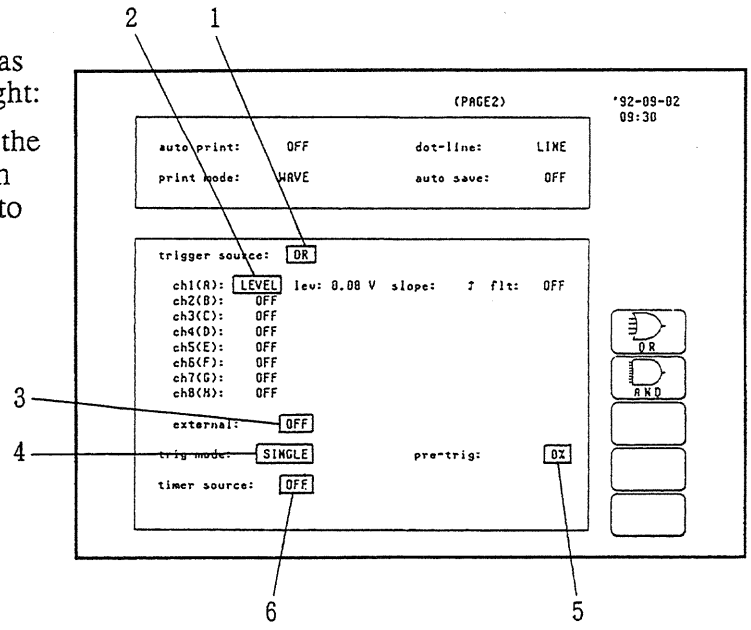
② Choose F1 (OFF).



(7) Set the trigger conditions.

- To set the trigger conditions as shown in the figure on the right:
- Using the cursor keys, move the flashing cursor in turn to each item to be set, and, using F1 to F5, select the appropriate values, as explained in the following.

  (For details about the trigger function, refer to Section 8 "Trigger Functions".)



1. Set the logical operator AND/OR for combining the triggers.

   Move the flashing cursor to the "trigger source" item. Choose F1 (OR).

2. Make the trigger source settings.

   Move the flashing cursor to the "ch1(A)" item. Choose F2 (LEVEL).

   Move the flashing cursor to the "lev" item. Using F1 to F4 or the rotary knob, set the voltage level to 0 V.

   Move the flashing cursor to the "slope" item. Choose F1 (up).

   Move the flashing cursor to the "flt" item. Choose F1 (OFF).

   In the same way, using F1, set each of the "ch2(B)" to "ch8(H)" items to OFF.

3. Set the external trigger.

   Move the flashing cursor to the "external" item. Choose F1 (OFF).

4. Set the trigger mode.

   Move the flashing cursor to the "trig mode" item. Choose F1 (SINGLE).

5. Set the pre-trigger.

   Move the flashing cursor to the "pre-trig" item. Using F1 and F2 or the rotary knob, set this item to 50%.

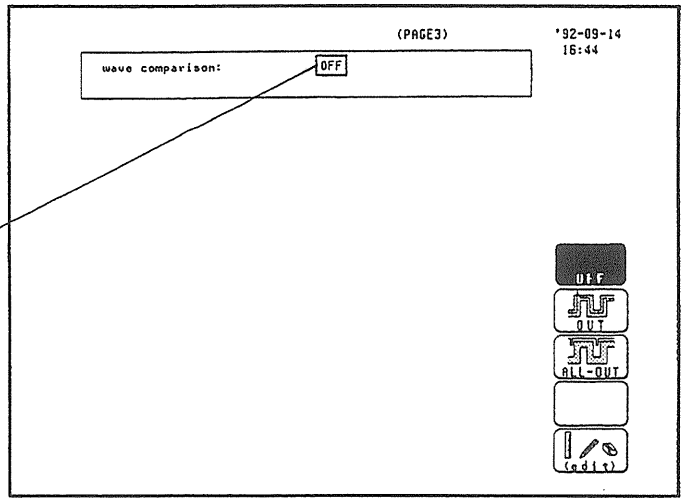
6. Set the timer trigger.

   Move the flashing cursor to the "timer source" item. Choose F1 (OFF).

(8) Set the waveform decision function

① Move the flashing cursor to the "wave comparison" item.

② Choose F1 (OFF).



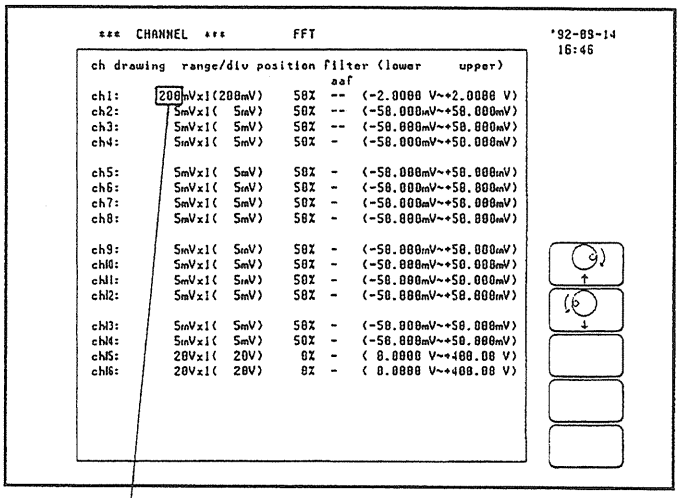
Flashing cursor

(9) Make the settings for each channel

- Press the channel key, and the "channel" screen will appear.
- For details, refer to Section 1-5-15. "Setting Each Input Channel".

1. Set the voltage axis range

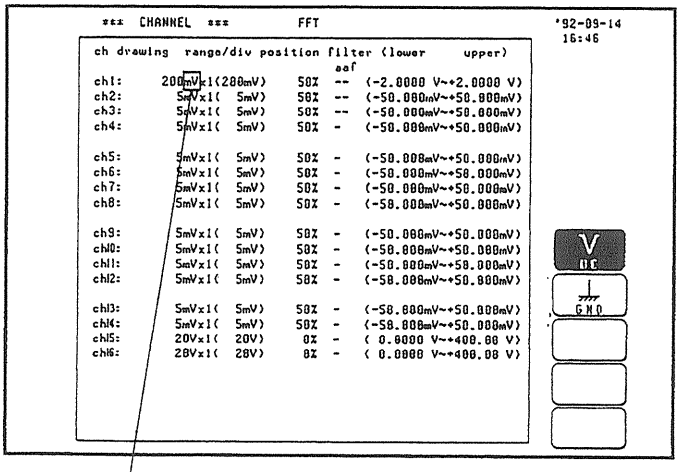
Move the flashing cursor to the "range/div" item. Using F1 and F2 or the rotary knob, set this item to 200 mV.



Flashing cursor

2. Set the input coupling

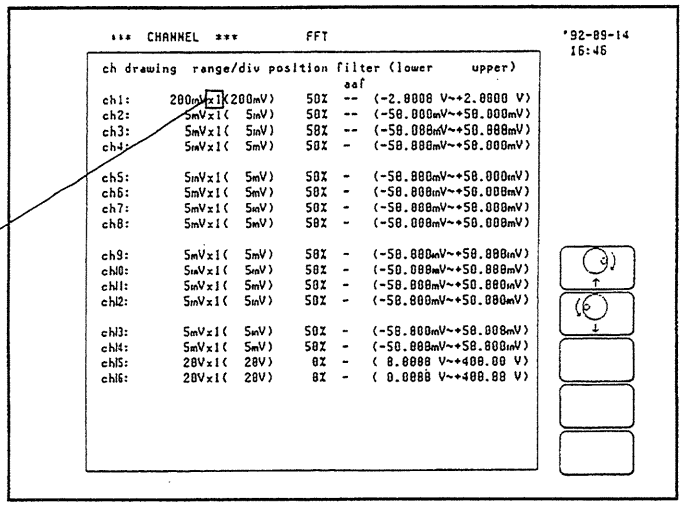
Move the flashing cursor to the input coupling item. Choose F1 (DC).



Flashing cursor

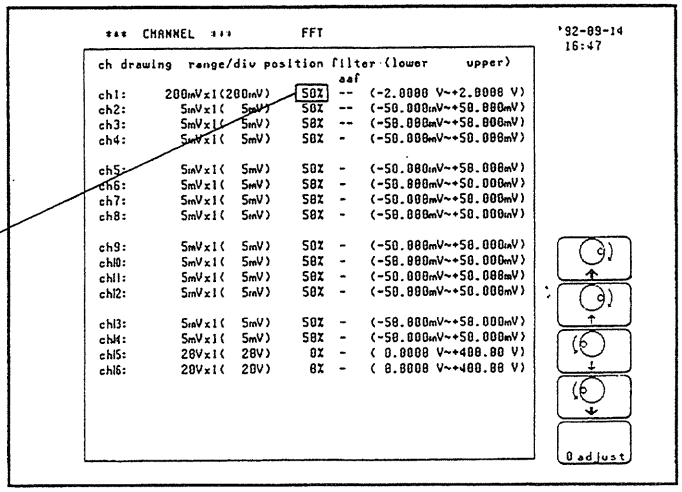
3. Set the voltage axis magnification /compression ratio

Move the flashing cursor to the "magnification/compression" item. Using F1 and F2 or the rotary knob, set this item to ×1.



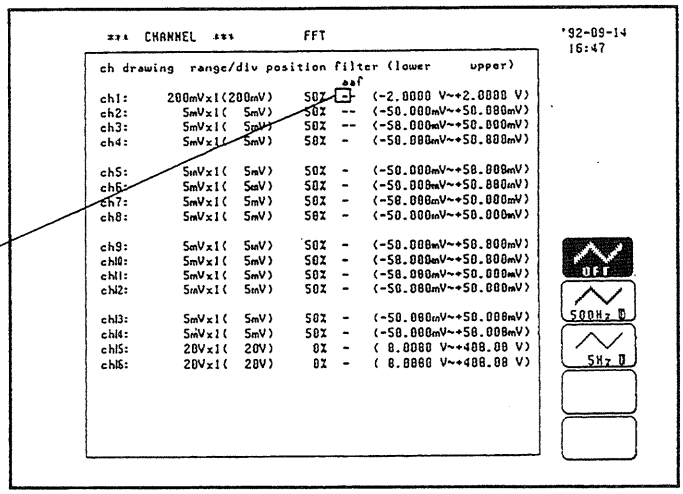
4. Set the origin position

Move the flashing cursor to the "position" item. Using F1 and F2 or the rotary knob, set this item to 50%.



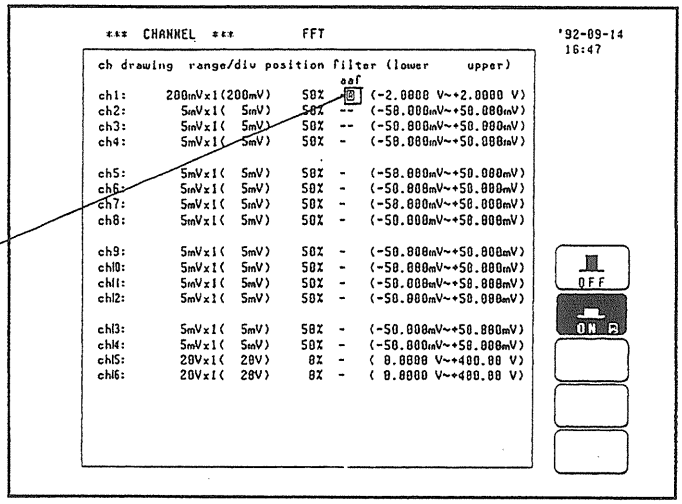
5. Set the low-pass filter

Move the flashing cursor to the "low-pass filter" item. Choose F1 (OFF).



6. Set the anti-aliasing filter

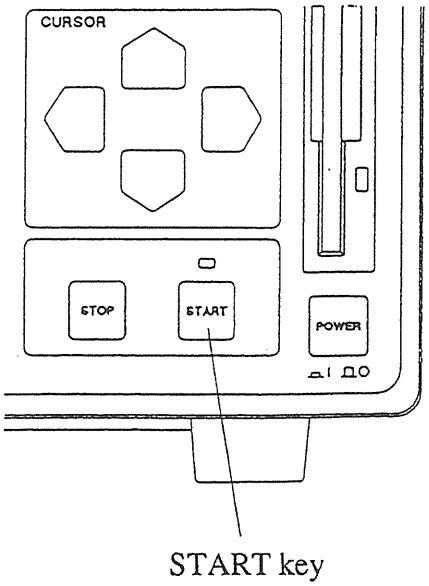
Move the flashing cursor to the "anti-aliasing filter" item. Choose F2 (ON).



(10) Begin measurement

- Press the START key to initiate the measurement process.
- 1000 points of data are captured following the trigger, then FFT calculation is performed and a linear spectrum is displayed.

1. Press the START key. The LED above the key lights up. Since input is already present, triggering occurs immediately and 1000 points of data are captured. When capture is completed, FFT calculations are performed. When FFT calculation is completed, the LED goes out, the system enters the STOP condition, then the waveform is displayed on the screen.



1-5. Making Settings

1-5-1. Setting the FFT Function Mode

The 8825 has four function modes: the memory recorder function mode, the recorder function mode, the X-Y recorder function mode and the FFT function mode. Select the FFT function mode for performing FFT analysis.

Method (Screens for making this setting: the "status", "channel", and "display" screens)

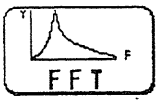
1. Using the cursor keys, move the flashing cursor to the position shown in the figure below.
2. Select F4 (FFT), according to the indications on the function keys.

(Function key indication) (Meaning)

:Memory recorder function mode

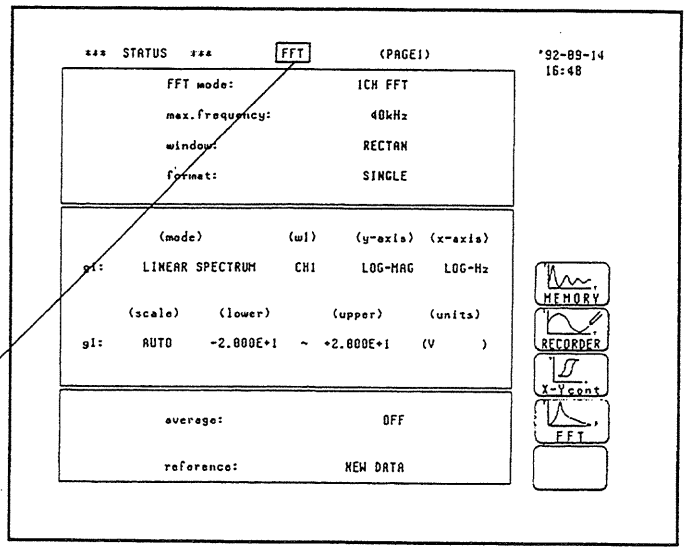
:Recorder function mode

:X-Y recorder function mode



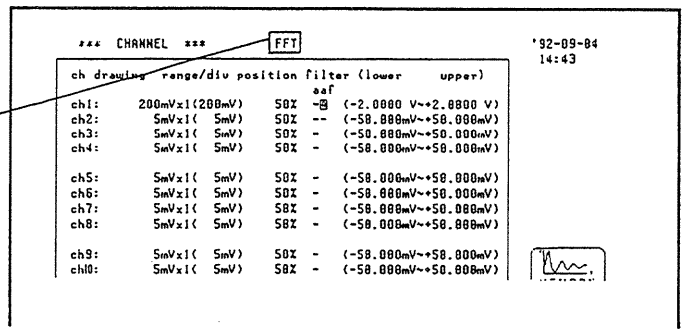
:FFT function mode

"Status" Screen



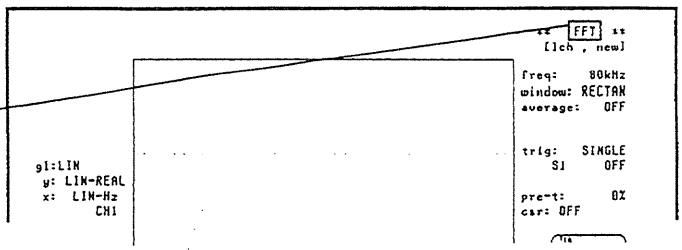
Flashing cursor

"Channel" Screen



Flashing cursor

"Display" Screen



Flashing cursor

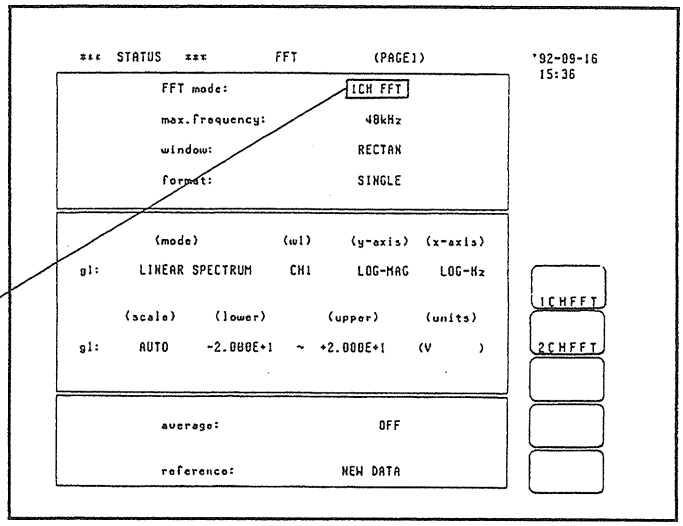
1-5-2. Setting the FFT Channel Mode

- Select either the 1CH FFT mode or the 2CH FFT mode.
- FFT analysis modes available differ according to which channel mode you select.

Method (Screens for making this setting: the "status" and "display" screens)

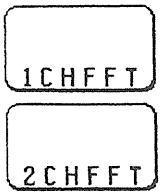
1. Using the cursor keys, move the flashing cursor to the "FFT mode" item or the position shown in the figure on the right.
2. Select the FFT mode according to the indications on the function keys.

"Status" Screen



Flashing cursor

(Function key indication) (Meaning)



:1CHFFT :Used for FFT analysis of signals from one channel.

:2CHFFT :Used for simultaneous FFT analysis of two channels.

FFT analysis mode		1CHFFT	2CHFFT
Time-axis waveform	STR	Yes	Yes
Linear spectrum	LIN	Yes	Yes
RMS spectrum	RMS	Yes	Yes
Power spectrum	PSP	Yes	Yes
Auto correlation	ACR	Yes	Yes
Histogram	HIS	Yes	Yes
Transfer function	TRF	No	Yes
Cross power	CSP	No	Yes
Cross correlation	CCR	No	Yes
Impulse response	IMP	No	Yes
Coherence function	COH	No	Yes
Octave analysis	OCT	Yes	Yes

Note

- With the 2CH FFT mode, key input may be temporarily disabled during FFT analysis.

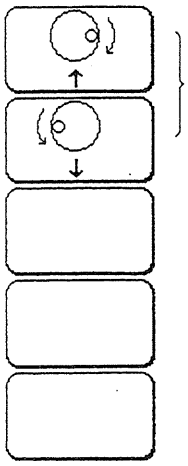
1-5-3. Setting the Frequency Range

- Set FFT for the frequency range of the input signal waveform to be captured.
- The frequency range corresponds to the memory function's time base range (TIME/DIV).

Method (Screens for making this setting: the "status" and "display" screens)

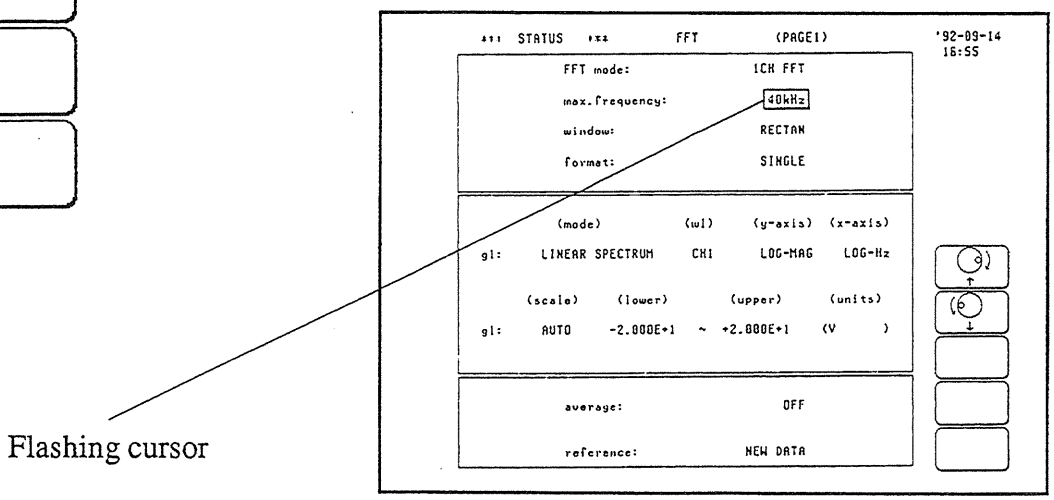
1. Using the cursor key, move the flashing cursor to the "max-frequency" item on the status screen or "freq" on the display screen.
2. Using the function keys or the rotary knob, set the frequency range.

(Function key indication) (Meaning)



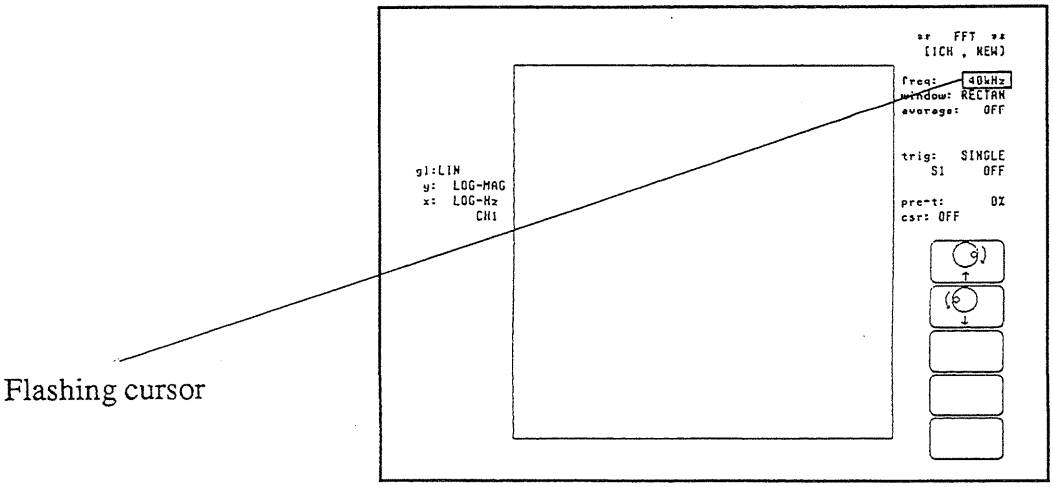
133, 333, 667 mHz
2, 4, 8, 20, 40, 80, 200, 400, 800 Hz
2, 4, 8, 20, 40, 80 kHz

"Status" Screen



Flashing cursor

"Display" Screen



Flashing cursor

- When using the rotary knob on the display screen, refer to the 8825 Instruction Manual Section 4-2-2. "Rotary Knob and Knob Select Key".

- Time base, window width, and frequency resolution corresponding to each frequency range.

Frequency range	TIME/DIV	Window width	Frequency resolution
80 kHz #	500 µs/DIV	5 ms	200 Hz
40 kHz	1 ms/DIV	10 ms	100 Hz
20 kHz	2 ms/DIV	20 ms	50 Hz
8 kHz	5 ms/DIV	50 ms	20 Hz
4 kHz	10 ms/DIV	100 ms	10 Hz
2 kHz	20 ms/DIV	200 ms	5 Hz
800 Hz	50 ms/DIV	500 ms	2 Hz
400 Hz	100 ms/DIV	1 s	1 Hz
200 Hz	200 ms/DIV	2 s	500 mHz
80 Hz	500 ms/DIV	5 s	200 mHz
40 Hz	1 s/DIV	10 s	100 mHz
20 Hz	2 s/DIV	20 s	50 mHz
8 Hz *	5 s/DIV	50 s	20 mHz
4 Hz *	10 s/DIV	100 s	10 mHz
2 Hz *	20 s/DIV	200 s	5 mHz
667 mHz *	1 min/DIV	600 s	1.67 mHz
333 mHz	2 min/DIV	1200 s	0.83 mHz
133 mHz *	5 min/DIV	3000 s	0.33 mHz

Note

- With the 8909 FFT analog unit, the anti-aliasing filter's cutoff frequency is the same as the frequency range.

  (# Anti-aliasing is OFF with the 80 kHz range.)

  (* The cutoff frequency is 20 Hz.)

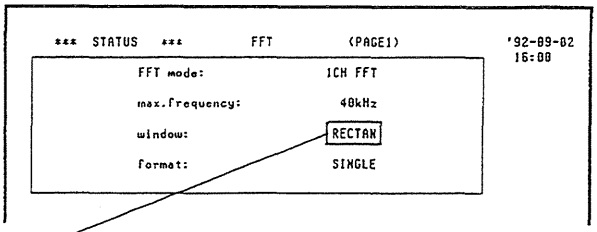
1-5-4. Setting the Window Function

- The window function defines the segment of the input signal that will be processed.
- Window processing can be used to minimize leakage error.

Method (Screens for making this setting: the "status" and "display" screens)

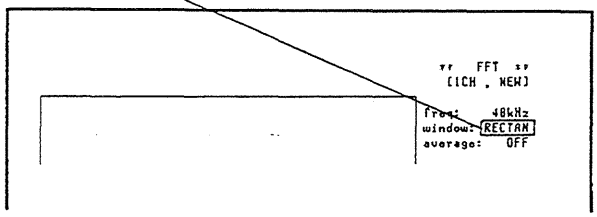
1. Using the cursor keys, move the flashing cursor to the "window" item.
2. Select the window function according to the indications on the function keys.

"Status" Screen



Flashing cursor

"Display" Screen



(Function key indication) (Meaning)

: RECTAN

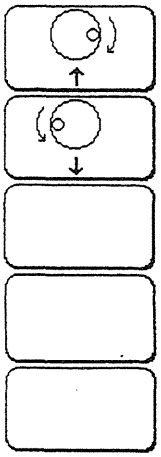
: HANNING

: EXPO

- RECTAN ..... Rectangular function, effective on discrete waveforms.
- HANNING.... Hanning function, effective on continuous waveforms.
- EXPO..... exponential window function, effective on decaying waveforms.

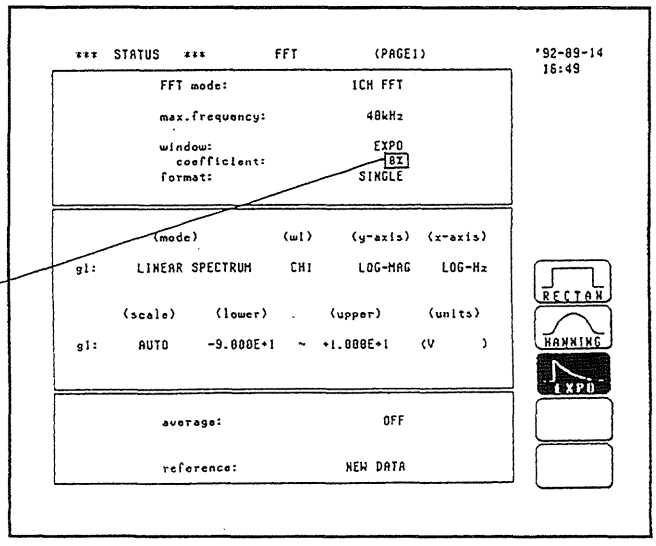
3. When F3 is selected in step 2 above, you can use the function key indication to set the attenuation percentage in the coefficient parameter.

(Function key indication) (Meaning)



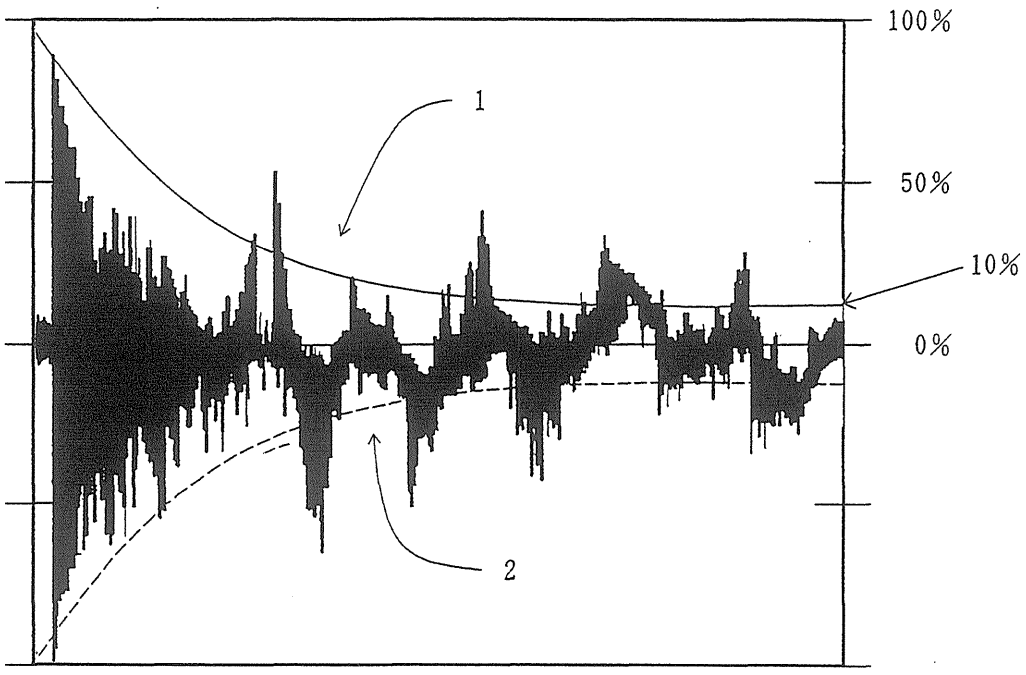
Settings possible in 1% increments over the range from 0 to 99%.

"Status" Screen



Flashing cursor

Example When the attenuation ratio is set to 10%



- In the figure above, the attenuation ratio is set over the range 0-99%.
- The actual window has the form of two curves, 1 and 2.
- 0.1% is used for calculation if 0% is set.

Note

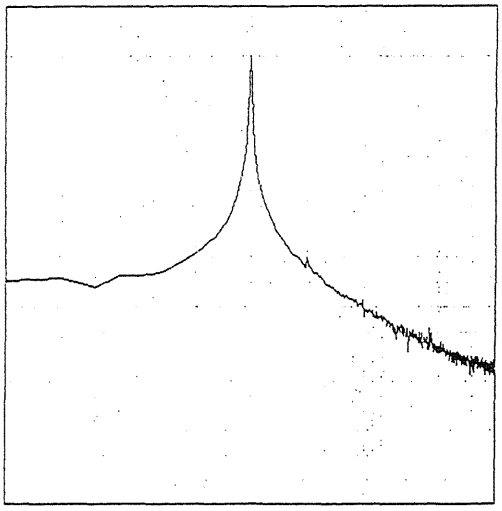
- When measurements are taken using the Hanning window or exponential window, note that the calculation results in the display of a value that is lower than the amplitude obtained when using a rectangular window.

1-5-5. Setting the Display Format

- You can set the format for displaying input signal waveforms on the screen and recording them on the printer.
- The SINGLE, DUAL, NYQUIST, and ARRAY formats are available.

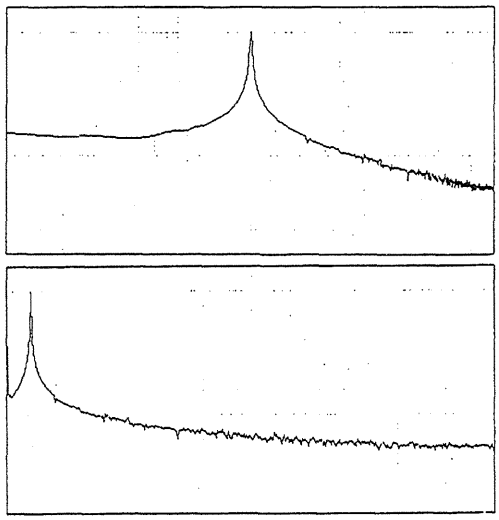
① SINGLE

- Displays the waveform on a single screen.



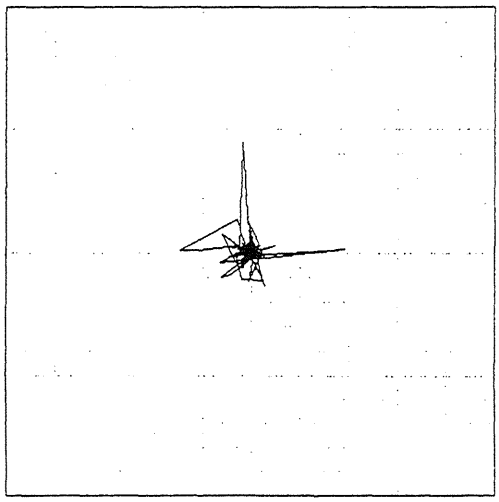
② DUAL

- Divides the waveform display screen into upper and lower screens. Multiple results can be displayed individually.



③ NYQUIST

- For the linear spectrum, cross power spectrum, and transfer function, displays the real-number portion of the data for the FFT calculation result on the X-axis, and the imaginary-number portion of the data on the Y-axis.

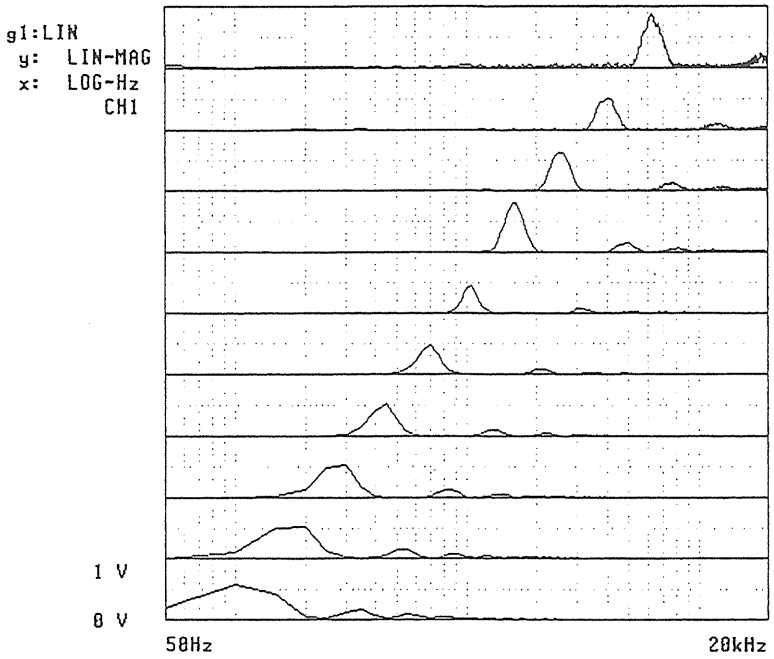


④ ARRAY

- Captures 10 times as many data points as the set interval. Frequency analysis is done using 1000 points of data for each interval, and a display record is made of the graph divided into 10 parts.

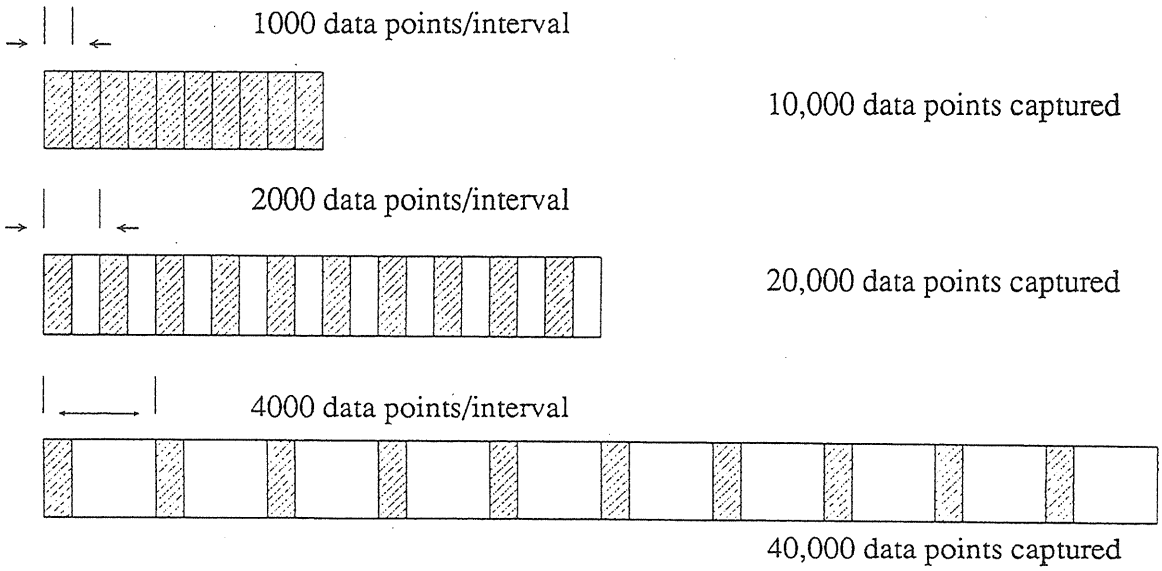
Note

- If you change the analysis mode, Y-axis, or X-axis after FFT operation using the ARRAY format, the FFT operation is repeated and 10 ARRAY-format graphs are displayed based on the captured waveform data.



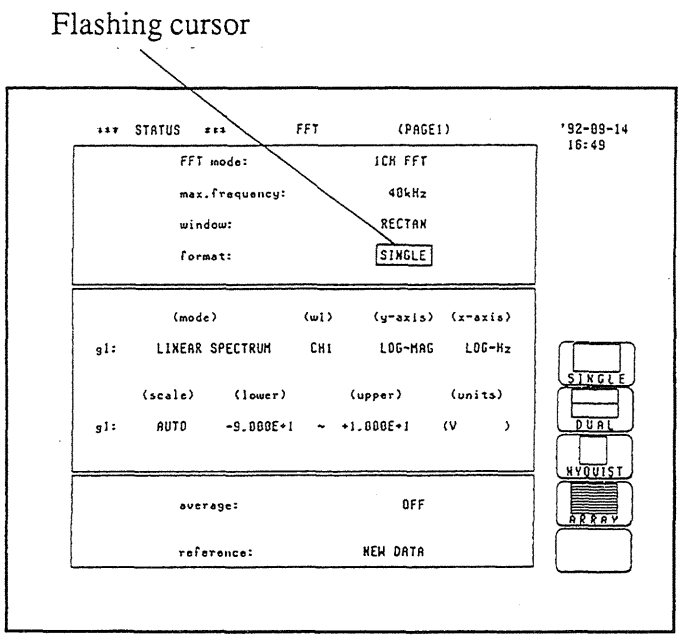
Reference: Capture of data with display format ARRAY

- The intervals from which data is taken with ARRAY display are as shown in the figure below.

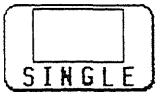


Method (Screen for making this setting: the "status" screen)

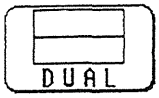
1. Using the cursor keys, move the flashing cursor to the "format" item.
2. Select the desired format according to the indications on the function keys.



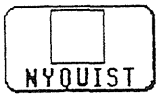
(Function key indication) (Meaning)



: SINGLE



: DUAL



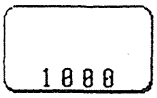
: NYQUIST

: ARRAY

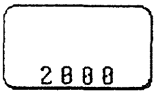
3. If you select F3 (ARRAY) in step 2 above, set the number of points per interval.

   Using the cursor keys, move the flashing cursor to the "number" item and select the desired setting.

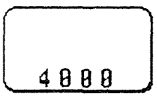
(Function key indication) (Meaning)



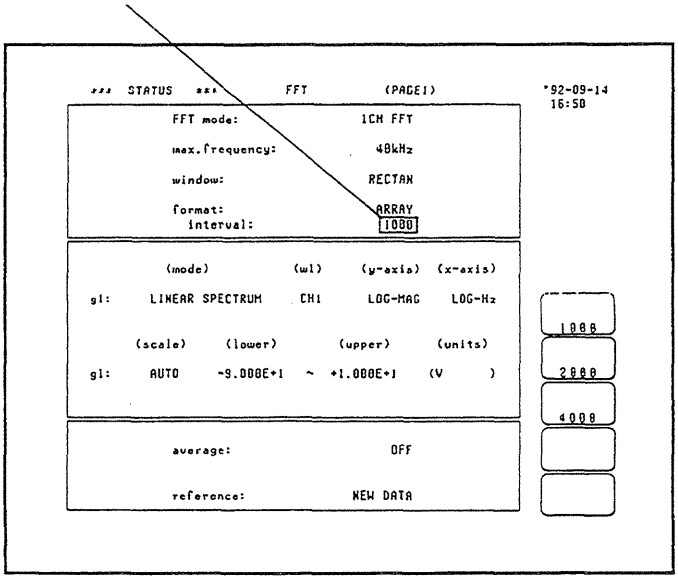
: 1000



: 2000



: 4000



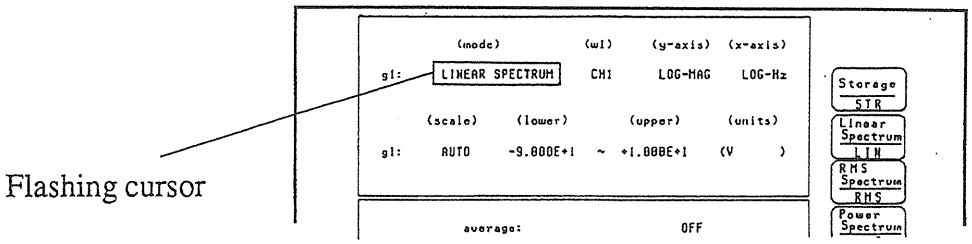
1-5-6. Setting the FFT Analysis Mode

- Used to select the FFT calculation method.

Method (Screen for making this setting: the "status" and "display" screens)

1. Using the cursor keys, move the flashing cursor to the "mode" item.

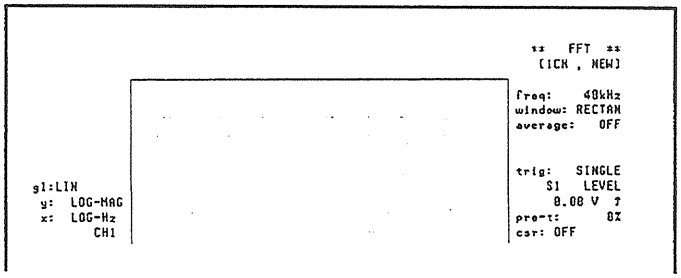
"status" screen



Flashing cursor

2. Select the desired calculation mode according to the indications on the function keys.
   - When 1CH FFT is selected, the following five analysis functions cannot be used: transfer function, cross-power spectrum, cross-correlation function, impulse response, and coherence function.

"display" screen



- 1 of 3

(Function key indication) (Meaning)

Storage STR	: Stored waveform (F-1-16.)
Linear Spectrum LIN	: Linear spectrum (F-1-17.)
RMS Spectrum RMS	: RMS spectrum (F-1-20)
Power Spectrum PSP	: Power spectrum (F-1-23.)
1 of 3 (etc)	: Displays 2 of 3

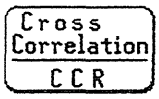
- 2 of 3

(Function key indication) (Meaning)

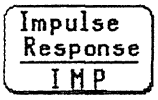
Auto Correlation ACR	: Auto correlation function (F-1-26)
Histgram HIS	: Histogram (F-1-28)
Transfer TRF	: Transfer function (F-1-30)
Cross Power CSP	: Cross power spectrum (F-1-33)
2 of 3 (etc)	: Displays 3 of 3

• 3 of 3

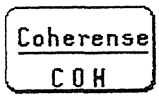
(Function key indication) (Meaning)



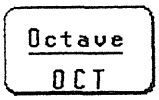
: Cross correlation function (F-1-36)



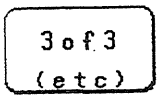
: Impulse response (F-1-38.)



: Coherence function (F-1-39.)



: Octave analysis (F-1-41.)



: Displays 1 of 3

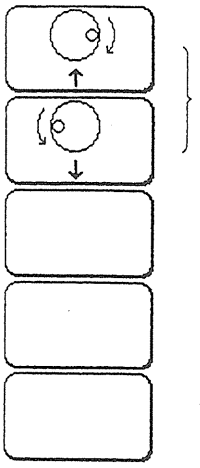
1-5-7. Setting the Analysis Channel

Select the channel for FFT analysis.

Method (Screen for making this setting: the "status" and "display" screens)

1. Using the cursor keys, move the flashing cursor to the "w1". item.
2. Using the function keys or the rotary knob, select the channel
3. When choosing CH2 in the FFT, "w2" can be selected.

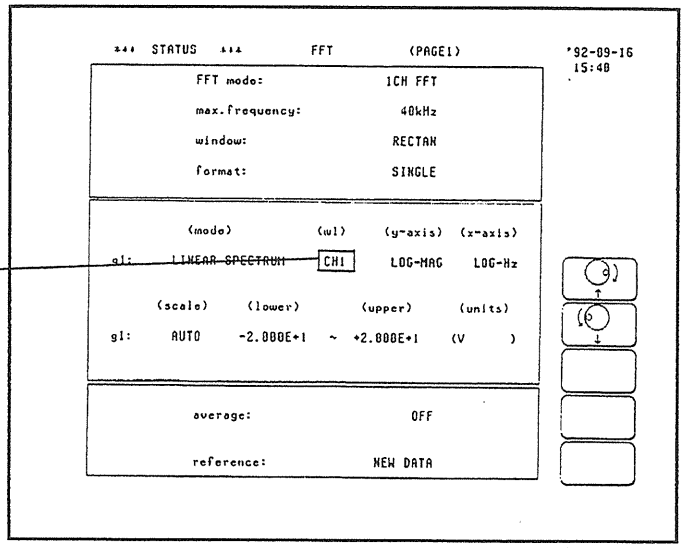
(Function key indication) (Meaning)



CH1 to CH16

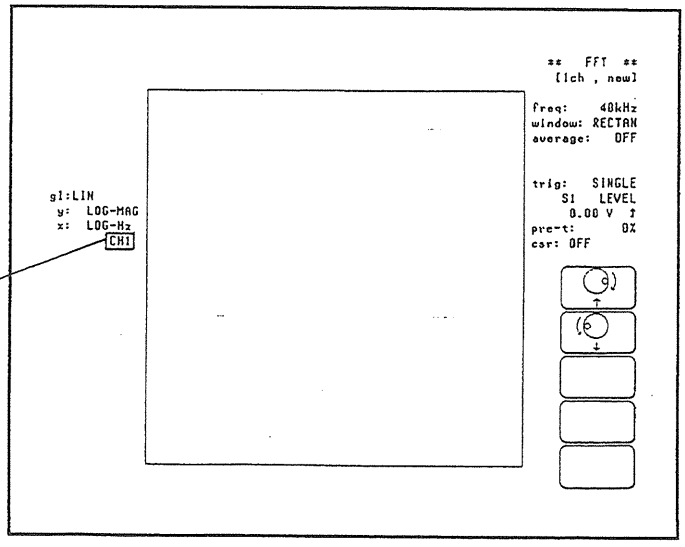
"status" screen

Flashing cursor



"display" screen

Flashing cursor



1-5-8. Setting the X-axis and Y-axis Displays

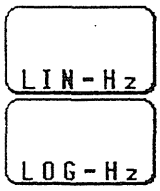
- Set the X and Y axis for display of FFT calculation results.
- Different units can be selected for the X and Y axis.
- With some FFT analysis modes, one of the axis cannot be set.

Method (Screens for making this setting: the "status" and "display" screens)

1. Using the cursor keys, move the flashing cursor to the "X-axis" item.
2. Using the function key, set the units of the X-axis.
3. Set the Y-axis units in the same manner for the X axis.

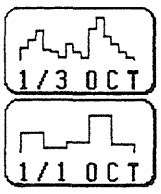
- X-axis setting

(Function key indication) (Meaning)



: Linear. Hz

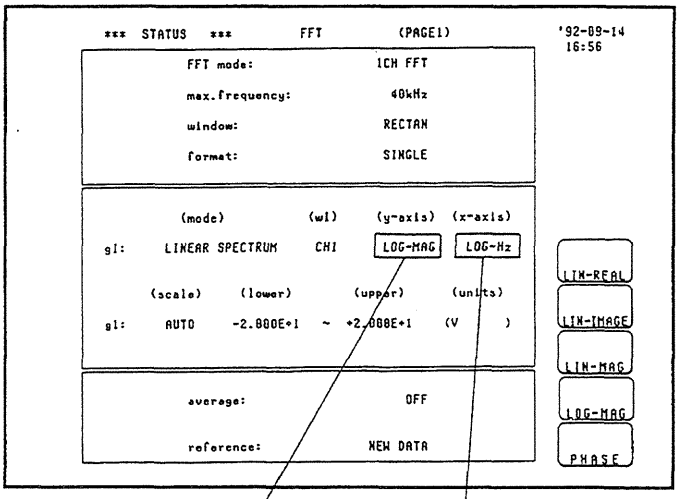
: Log. Hz



: 1/3 OCT

: 1/1 OCT (Octave mode)

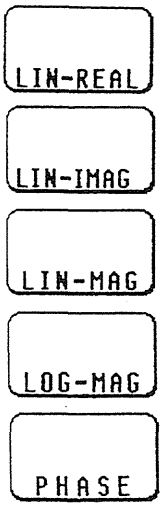
"Status" screen



Y-axis setting X-axis setting

- Y-axis setting

(Function key indication) (Meaning)



: Linear. Real

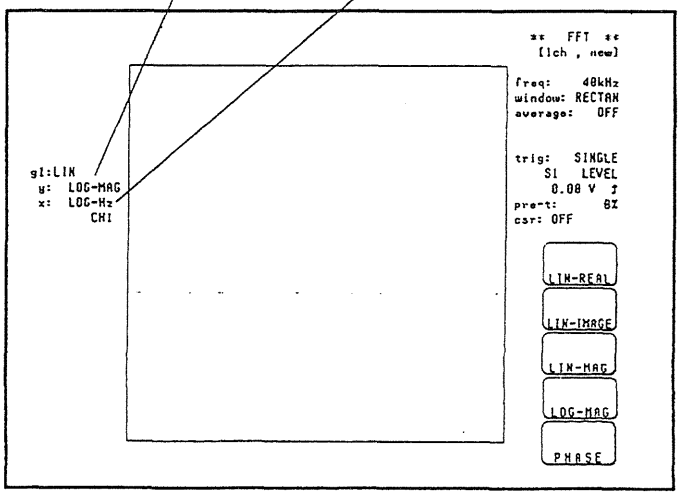
: Linear. Imag

: Linear. Mag

: Log. Mag

: Phase

"Display" screen



• X and Y axis settings available with each FFT analysis mode

FFT analysis mode	Y-axis (vertical axis)	X-axis (horizontal axis)
[STR] Storage waveform	(LIN-MAG)	(TIME)
[LIN] Linear spectrum	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	LIN-Hz LOG-Hz
[RMS] RMS spectrum	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	LIN-Hz LOG-Hz
[PSP] Power spectrum	LIN-MAG LOG-MAG	LIN-Hz LOG-Hz
[ACR] Auto correlation function	(LIN-MAG)	(TIME)
[HIS] Histogram	(LIN-MAG)	(VOLT)
[TRF] Transfer function	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	LIN-Hz LOG-Hz
[CSP] Cross power spectrum	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	LIN-Hz LOG-Hz
[CCR] Cross correlation function	(LIN-MAG)	(TIME)
[IMP] Unit impulse response	(LIN-MAG)	(TIME)
[COH] Coherence function	(LIN-MAG)	LIN-Hz LOG-Hz
[OCT] Octave analysis	LIN-MAG LOG-MAG	1/3 OCT 1/1 OCT

1-5-9. Setting the Display Scale

(1) Setting the Display Scale

- Select the AUTO or MANUAL scale setting for displaying FFT calculation results.
- If you select AUTO, the scale is set automatically.
- If you select MANUAL, you can set whatever vertical scale best suits your purpose. The ability to enlarge or reduce the amplitude and to shift the waveform up and down is useful for observing and analyzing waveforms.

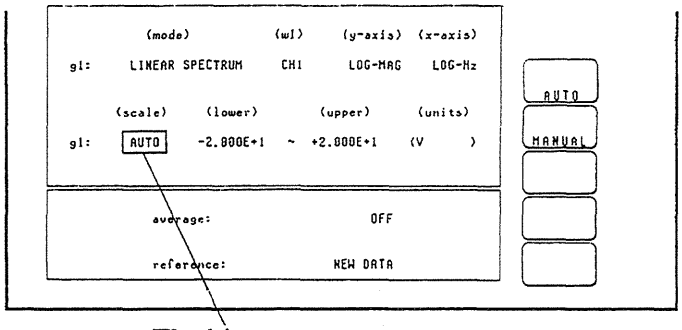
Method (Screen for making this setting: the "status" screen)

- Using the cursor keys, move the flashing cursor to the position shown in the figure on the right.

(Function key indication) (Meaning)

AUTO :Scale set automatically.

MANUAL :Scale set manually.



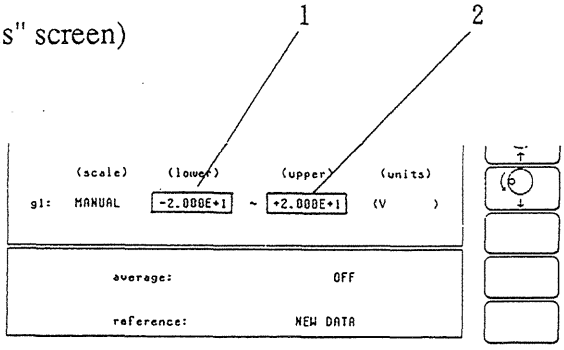
When F2 (AUTO) is selected, the upper and lower limits are determined automatically from the calculation results after the calculation is completed.

(2) Setting the display scale's upper and lower limits (with MANUAL setting only)

- Set the upper and lower limits for display and recording of calculation results.
- Limits can be set anywhere in the range from -9.999E+29 to +9.999E+29.

Method (Screen for making this setting: the "status" screen)

1. Move the flashing cursor to the "1. lower" item.
2. Move the flashing cursor to each individual digit and set the lower limit using the function keys or the rotary knob.
3. Move the flashing cursor to the "2. upper" item and set the upper limit in the same manner.



(Function key indication) (Item selected)

0 to 9

(-9 to +9 for the most significant digit and exponent.)

Flashing cursor

a = +0 .000E+0

Mantissa Exponent

(3) Displaying the display scale units

- The selected unit is displayed with "scaling" in the system screen.
- When scaling is turned OFF, V (volts) is displayed.

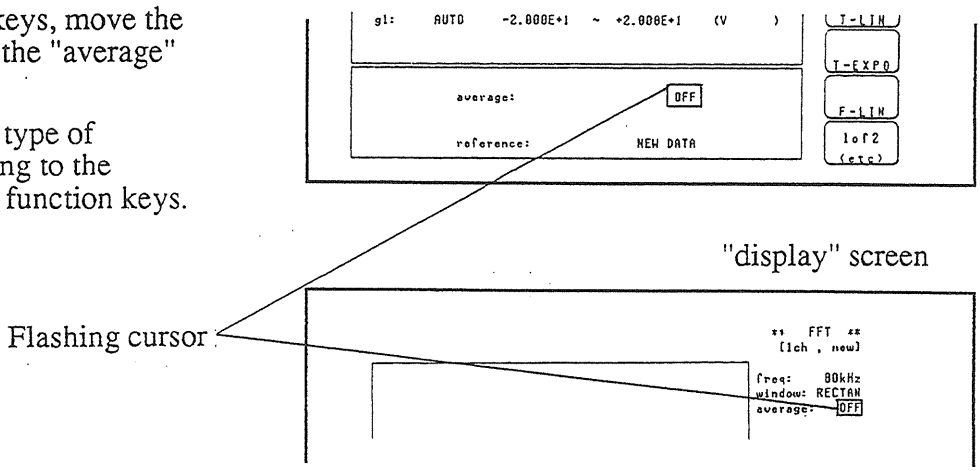
1-5-10 Setting Averaging

- With periodic waveform signals, averaging is effective for isolating the significant signal when the input signal contains much random noise. It is also useful for increasing the reliability of unstable phenomena.
- With the 8825, a variety of types of averaging can be performed, both on the time axis and the frequency axis. A peak hold function is also provided for the frequency axis. (Averaging cannot be used on both the time axis and the frequency axis simultaneously.)
- Set the axis to be averaged and the number of repetitions to be used in averaging.

Method

(Screens for making this setting: the "status" and "display" screens)

1. Using the cursor keys, move the flashing cursor to the "average" item.
2. Select the desired type of averaging according to the indications on the function keys.



- 1 of 2

(Function key indication) (Meaning)

OFF	: OFF
T-LIN	: Simple averaging against time axis
T-EXP	: Exponential averaging against time axis
F-LIN	: Simple averaging against frequency axis.
1 of 2 (etc)	: Display 2 of 2

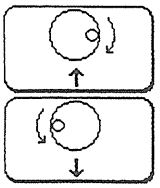
- 2 of 2

(Function key indication) (Meaning)

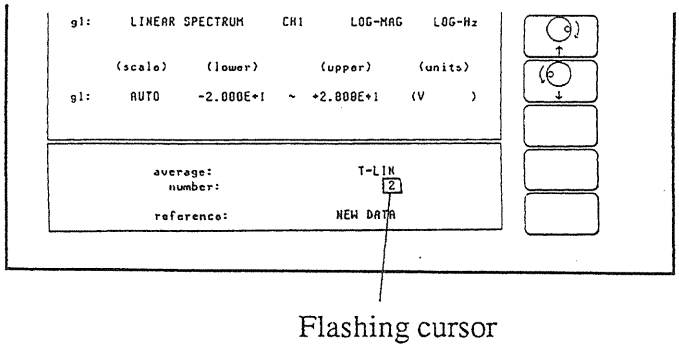
F-EXP	: Exponential averaging against frequency axis
F-PEAK	: Peak hold against frequency axis
2 of 2 (etc)	: Display 1 of 2

3. After making a selection in step 2, move to the "number" items.
4. Using the function keys or the rotary knob, set the number of times for averaging.

(Function key indication) (Meaning)



2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096



Reference: Expressions used in averaging

(1) Time domain averaging

With time axis averaging, addition is performed in sync when the trigger condition is satisfied. Therefore, this type of averaging is meaningless unless sync is obtained.

① Simple additive averaging

- With simple additive averaging, take measurements using the SINGLE or REPEAT trigger mode. If the trigger is set, the AUTO trigger mode can also be used.

[Averaging expression] $$\overline{Ai} = \frac{\sum_{i=1}^{N} Ai}{N}$$

$\overline{Ai}$	:	Simple additive average of ith repetition
Ai	:	ith input waveform
N	:	Number of additions

② Exponential averaging

With exponential averaging, use either the SINGLE or the REPEAT trigger mode.

[Averaging expression] $$\overline{Ai} = \frac{(N-1)\overline{Ai-1}+Ai}{N}$$

$\overline{Ai}$	:	Exponential average of ith repetition
Ai	:	ith input waveform
N	:	Number of additions

(2) Frequency domain averaging

Unlike time domain averaging, synchronization is not required in order to do frequency domain averaging.

① Simple additive averaging

- Averaging is performed for the specified number of repetitions, regardless of the trigger mode.
- The averaging expression is the same as that shown for time domain averaging in Expression (1-5-1).

② Exponential averaging

- Averaging is performed for the specified number of repetitions, regardless of the trigger mode.
- The averaging expression is the same as that shown for exponential averaging in Expression (1-5-2).

(3) Peak hold (frequency domain)

The specified number of data samples is captured and the maximum value is held for each frequency.

Note

The start-up operation is re-initiated if the averaging type or number of repetitions is changed during the start operation.

• Relationship between FFT analysis modes and averaging

FFT analysis mode	Y-axis (vertical axis)	Time axis averaging	Frequency axis averaging	Peak hold
[STR] Storage waveform	(LIN-MAG)	Yes	No	No
[LIN] Linear spectrum	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	Yes Yes Yes Yes Yes	Yes Yes Yes Yes No	No No Yes Yes No
[RMS] RMS spectrum	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	Yes Yes Yes Yes Yes	Yes Yes Yes Yes No	Yes Yes Yes Yes No
[PSP] Power spectrum	LIN-MAG LOG-MAG	Yes Yes	Yes Yes	Yes Yes
[ACR] Auto correlation function	(LIN-MAG)	Yes	Yes	Yes
[HIS] Histogram	(LIN-MAG)	Yes	No	No
[TRF] Transfer function	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	Yes Yes Yes Yes Yes	Yes Yes Yes Yes No	No No Yes Yes No
[CSP] Cross power spectrum	LIN-REAL LIN-IMAG LIN-MAG LOG-MAG PHASE	Yes Yes Yes Yes Yes	Yes Yes Yes Yes No	No No Yes Yes No
[CCR] Cross correlation function	(LIN-MAG)	Yes	Yes	Yes
[IMP] Unit impulse response	(LIN-MAG)	Yes	Yes	Yes
[COH] Coherence function	(LIN-MAG)	Yes	Yes	Yes
[OCT] Octave analysis	LIN-MAG LOG-MAG	Yes Yes	Yes Yes	Yes Yes

* With the Nyquist display, the same relationships hold for LIN, TRF, and CSP.

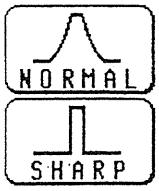
1-5-11. Setting the Octave Filter

Octave filter selection is possible when octave analysis is selected.

Method (Screen for making this setting: the "status" screen)

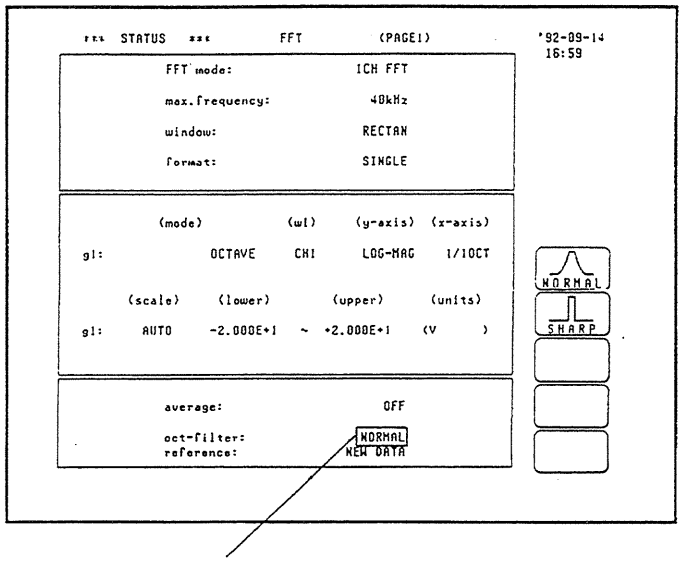
1. Using the cursor keys, move the flashing cursor to the "Oct-filter" item.
2. Set which octave filter is used according to the displays on the function keys.

(Function key indication) (Meaning)



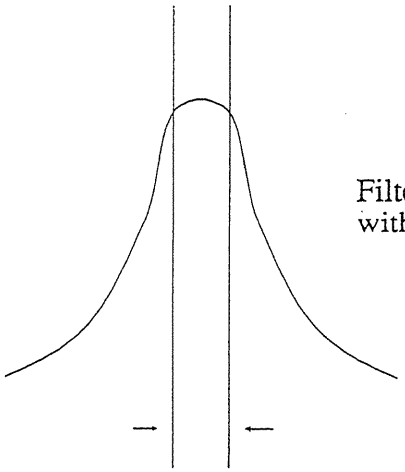
: select "normal" mode

: select "sharp" mode



Flashing cursor

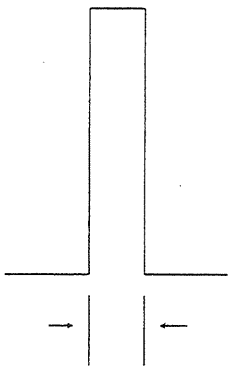
- When "normal" is selected, analysis is performed using a filter characteristic that simulates the characteristic of the filter in octave analyzers commonly in use. (The characteristic of a meter using an analog filter is simulated.)
- When "sharp" is selected, spectra within the octave band are bundled for analysis, and results are not affected by spectra outside of the octave band.



Filter characteristic with "normal" setting

1/1-octave band

(1/3-octave band)



Filter characteristic with "sharp" setting

1/1-octave band

(1/3-octave band)

(These filter characteristics are within ANSI Class III limits.)

Note

Since this unit does not use an analog filter for analysis, spectrum bundling is performed while applying weighting corresponding to the above filter characteristics at the time of power spectrum capture.

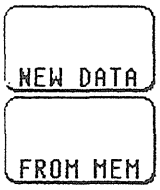
1-5-12. Setting the Reference Data

- Select the data to be used for FFT calculation.
- If you select "NEW DATA", 1000 points of data are captured and FFT calculation is performed when the START operation is initiated.
- If you select "FROM MEM", after the START operation, FFT calculation is performed using data that has previously been captured using the memory function. At this time, the starting and ending points for calculation can be set using the A and B cursors. FFT calculations are performed using the 1000 points of data that follow whichever of the two cursors is first.

Method (Screen for making this setting: the "status" screen)

1. Using the cursor keys, move the flashing cursor to the "reference" item.
2. Select the desired data for FFT calculation according to the indications on the function keys.

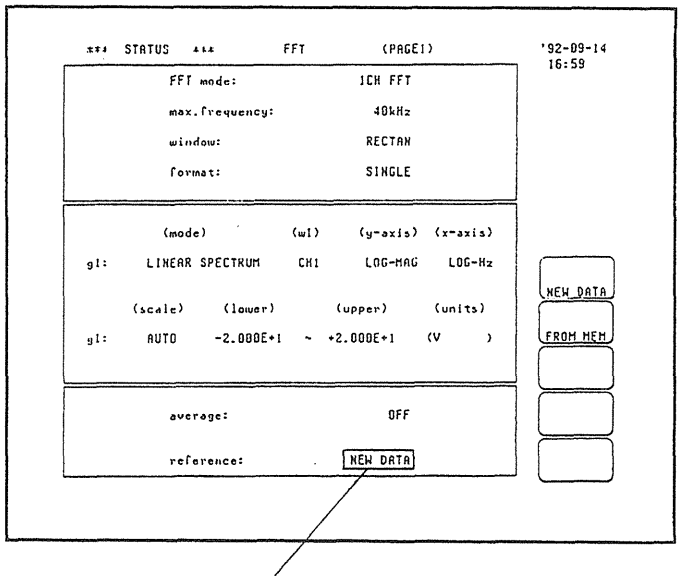
(Function key indication) (Meaning)



:NEW DATA

:FROM MEM

"status" screen



Flashing cursor

Note

- If "FROM MEM" is selected as the data to be used for FFT calculation, the maximum recording length that can be set with the memory recorder function is as shown in the table below.

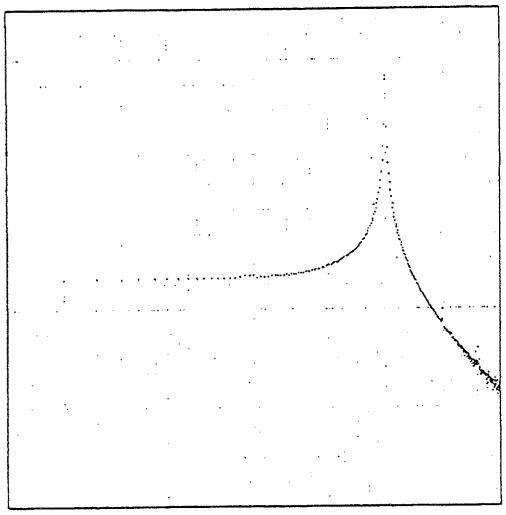
Memory Capacity \ Number of channels used	16 ch	8 ch	4 ch	2 ch
1M words	200 DIV	500 DIV	1000 DIV	2000 DIV
4M words	1000 DIV	2000 DIV	5000 DIV	10000 DIV

(Memory capacity of 1M or 4M words must be specified at the time of order.)

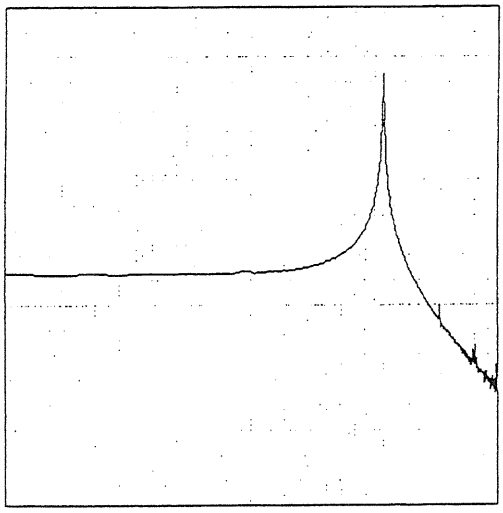
When "FROM MEM" is selected as the reference data, trigger setting is not necessary because waveform data is not captured when START operation is initiated with the FFT function after capture of waveform data with the MEM function. However, the trigger mode becomes effective and, if "REPEAT" or "AUTO" is selected, waveform data captured with the MEM function is shifted by 1000 points at a time and the FFT operation is repeated until data end is encountered.

1-5-13. Setting the Interpolation Function

It is possible to display and record the input signal (the sampled data) and FFT calculation waveform as they are, or after subjecting them to linear interpolation.



DOT display (without interpolation)

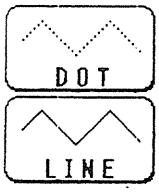


LINE display (with interpolation)

Method (Screen for making this setting: the "status" screen)

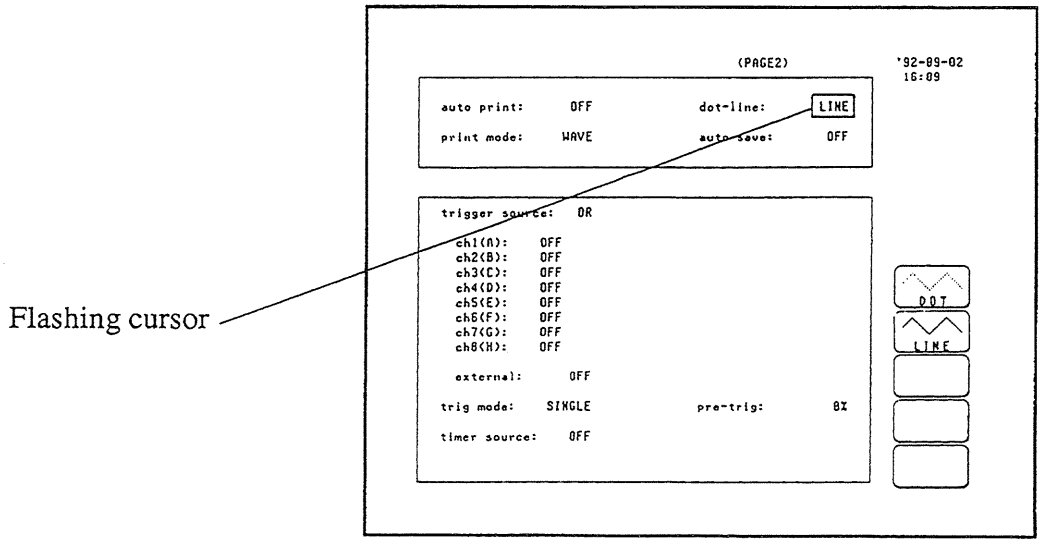
1. Using the cursor keys, move the flashing cursor to the "dot-line" item.
2. Make the setting according to the indications on the function keys.

(Function key indication) (Meaning)



: DOT display linear interpolation is not performed.
..... In principle, the sampled data or FFT calculated data are faithfully displayed as they are.

: LINE displaylinear interpolation is performed.
..... The display is easier to view.



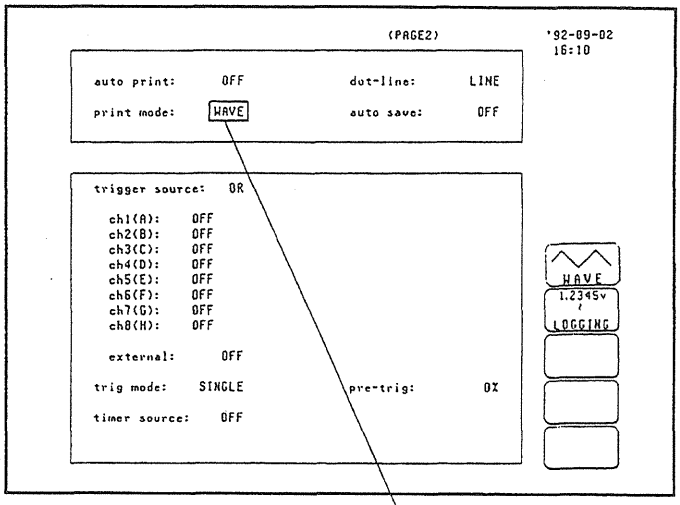
1-5-14. Recording on the Printer

(1) Setting the style for recording the waveform on the printer (the print mode)

There are two styles for outputting the result of FFT calculation on the printer: (1) as a waveform (WAVE) and (2) as numerical values (LOGGING); either of these modes can be selected.

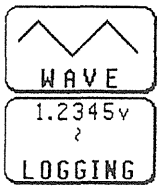
Method (Screen for making this setting: the "status" screen (Page 2))

1. Press the STATUS key to switch to Page 2 of the status screen.
2. Using the cursor keys, move the flashing cursor to the "print mode" item.
3. Select the desired mode according to the indications on the function keys.



Flashing cursor

(Function key indication) (Meaning)



: the input signal is recorded as a waveform

: the input signal is recorded as numerical values

(2) Methods of printing

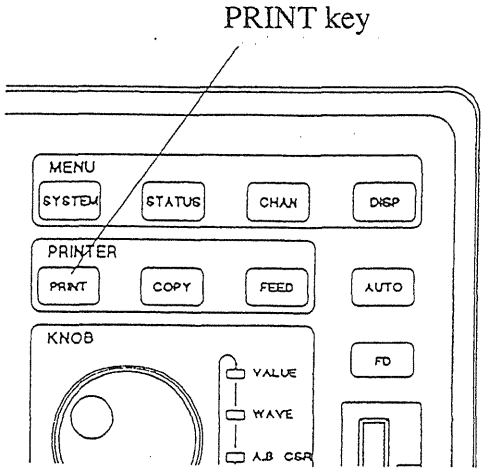
There are three printing methods:

① Manual printing

This prints out the stored data from one measurement

Method

- When measurement is finished, press the PRINT key.
- Because the measurement data is saved in memory, it can be reprinted as many times as required.

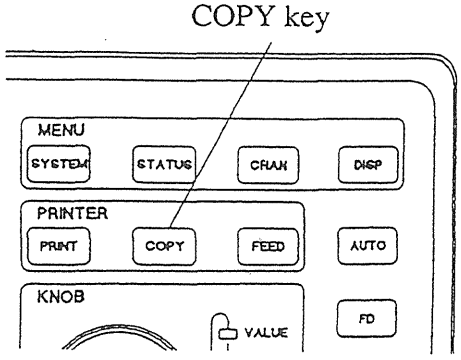


② Screen copy printing

It is also possible to make a direct hard copy of the current screen display when the "status" screen, the "channel" screen, the "display" screen, the "system" screen, or the "floppy disk control" screen is being shown.

Method

- Press the COPY key.
- The current screen display is printed out on the printer just as it is.



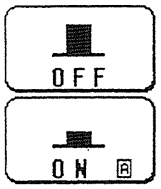
③ Auto-printing

This function automatically prints out the waveform of the FFT calculation result while simultaneously displaying it on the screen.

Method (Screen for making this setting: the "status" screen)

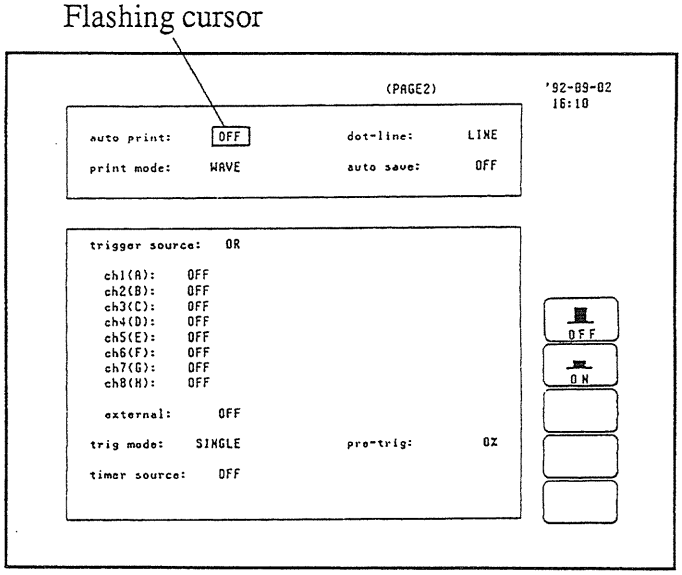
1. Using the cursor keys, move the flashing cursor to the "auto print" item.
2. Select F2 (ON) according to the indications on the function keys.

(Function key indication) (Meaning)



: auto print function

: auto print function disabled



3. Press the START key, and measurement will commence.

As the waveform is displayed on the screen, it is simultaneously printed out.

- Auto-printing can be used for both waveform printing (WAVE option) and numerical printing (LOGGING option).

Related items

- Is it possible to supplement manual or auto printing of a waveform with a listing of settings or gauges. (8825 Instruction Manual Section 12-3-6 "Listing and Gauge Functions.")
- The auto save function can also be used with the FFT function. (8825 Instruction Manual Section 14-7 "Auto Save Function.")

1-5-15. Setting Each Input Channel

- Settings for each of the channels can be made on the "channel" screen or on the "display" screen.
- The 8825 FFT can handle, at the most, 16 analog channels.

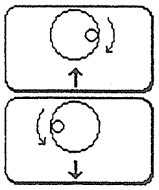
(1) Setting the voltage axis range (range/div)

- The voltage axis range (range/div) should be set for each channel.
- The value set for range/div denotes the voltage value for 1 DIV along the voltage axis (vertically).

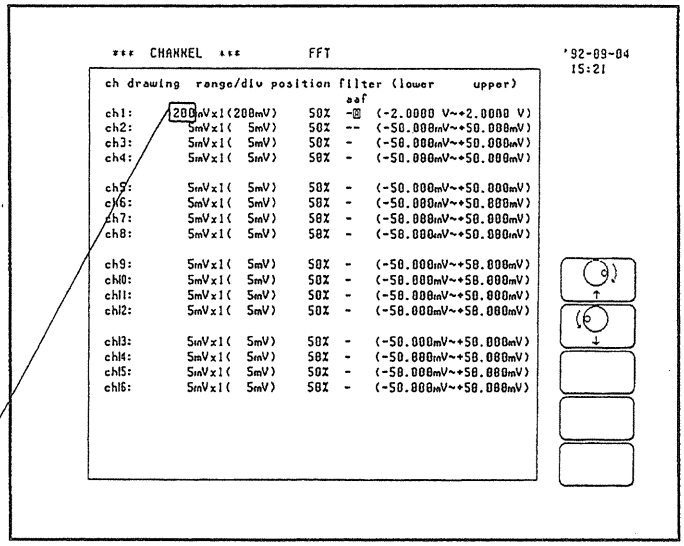
Method (Screen for making this setting: the "channel" screen)

The settings are made by using the function keys or the rotary knob.

(Function key indication) (Meaning)



5, 10, 20, 50, 100, 200, 500 mV
1, 2, 5, 10, 20V



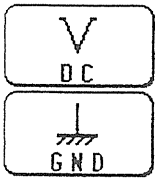
Flashing cursor

(2) Setting the input coupling

Method (Screen for making this setting: the "channel" screen)

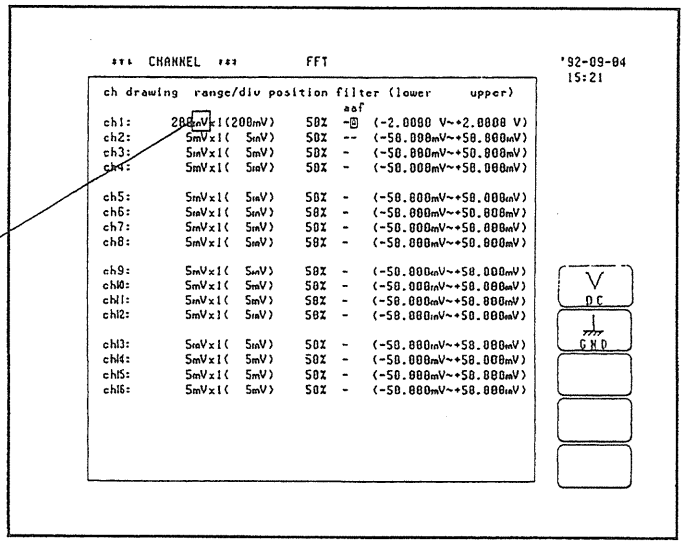
The selections are made according to the displays on the function keys.

(Function key indication) (Meaning)



: The input signal is directly connected to the input amplifier. This allows a DC component to be measured.

: The input signal is not connected. This allows the zero position to be checked.



Flashing cursor

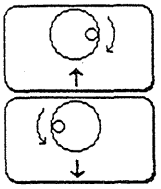
(3) Voltage axis magnification

- The magnification ratio along the voltage axis should be set for each channel.
- Magnification allows detailed observations which fully exploit the 12-bit A/D resolution.

Method (Screen for making this setting: the "channel" screen)

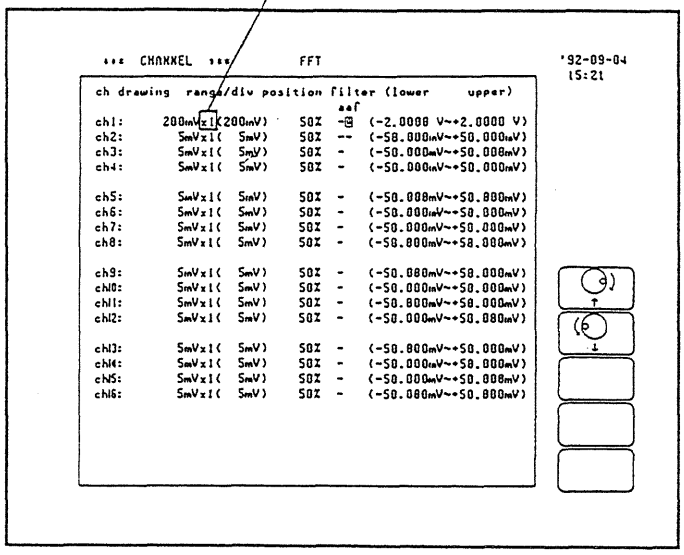
The settings are made by using the function keys or the rotary knob.

(Function key indication) (Meaning)



for SINGLE Screen mode
×16, ×8, ×4, ×2, ×1,×1/2

for DUAL Screen mode
×8, ×4, ×2, ×1, ×1/2, ×1/4



(4) Low-pass filter

- The internal low-pass filter of the input units can be set.
- The internal filter can be used to limit the frequency band of the input signal.

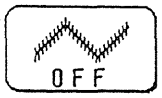
  Use of the low-pass filter can eliminate the following phenomena:

  - Thickening of the recording line during level recording in the recorder function mode, due to ripple components and noise in the signal from high speed sampling and high band amplification.
  - Thickening of the recording line because ripples are present in the output of transducers and the like.

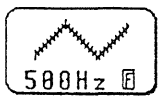
Method (Screen for making this setting: the "channel" screen)

Make the setting using the function keys or the rotary knob.

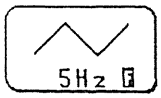
(Function key indication) (Meaning)



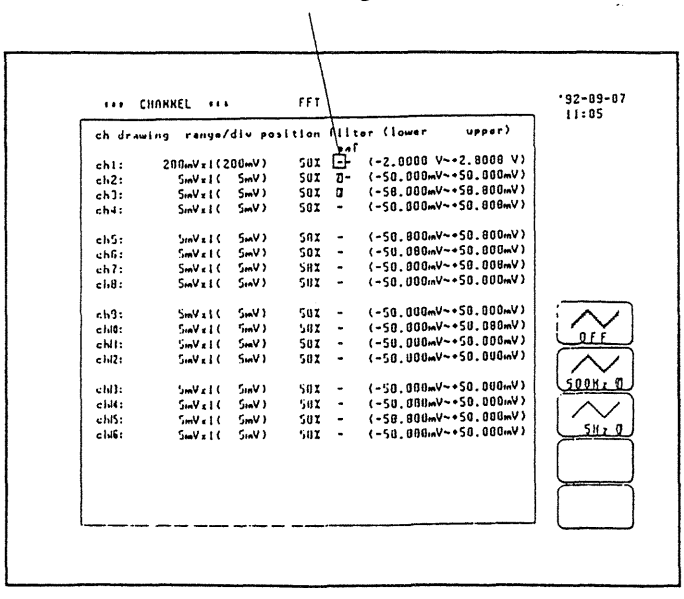
: No low-pass filter is used.



: A filter with 500 Hz cutoff is used.



: A filter with 5 Hz cutoff is used.

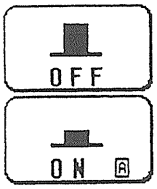


(5) Anti-aliasing filter

The 8909 FFT analog unit is equipped with a built-in anti-aliasing filter to prevent aliasing distortion. The cutoff frequency is automatically set according to the selected frequency range.

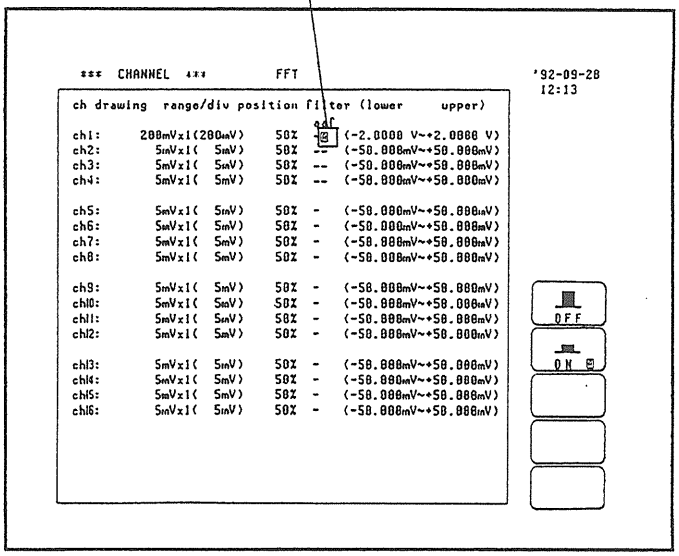
Method (Screen for making this setting: the "channel" screen) Flashing cursor

(Function key indication) (Meaning)



: Anti-aliasing filter not used.

: Anti-aliasing filter used.



Frequency range	TIME/DIV
80 kHz #	500 µs/DIV
40 kHz	1 ms/DIV
20 kHz	2 ms/DIV
8 kHz	5 ms/DIV
4 kHz	10 ms/DIV
2 kHz	20 ms/DIV
800 Hz	50 ms/DIV
400 Hz	100 ms/DIV
200 Hz	200 ms/DIV
80 Hz	500 ms/DIV
40 Hz	1 s/DIV
20 Hz	2 s/DIV
8 Hz *	5 s/DIV
4 Hz *	10 s/DIV
2 Hz *	20 s/DIV
667 mHz *	1 min/DIV
333 mHz *	2 min/DIV
133 mHz *	5 min/DIV

Note

With the 8909 FFT analog unit, the anti-aliasing filter's cutoff frequency is the same as the frequency range.

(# Anti-aliasing is OFF with the 80 kHz range.)

(* The cutoff frequency is 20 Hz.)

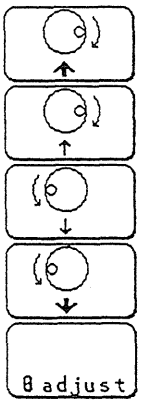
(6) Position

- The position can be set for each channel.
- The range for the position varies according to the magnification ratio along the voltage axis.

Method (Screen for making this setting: the "channel" screen) Flashing cursor

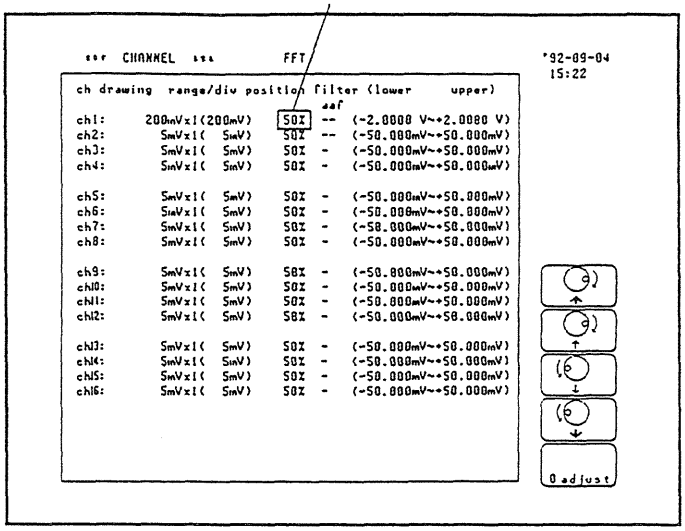
Make the setting using the function keys or the rotary knob.

(Function key indication) (Meaning)



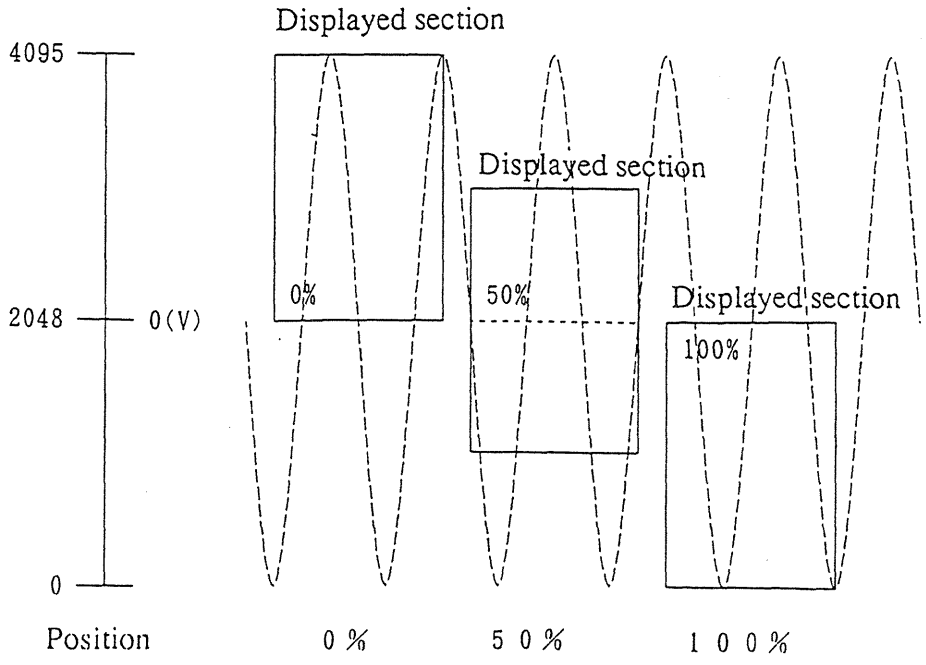
When the magnification ratio is 1, the range is from -28% to 128%. For other cases, see the table below.

: (Zero Adjustment)



Magnification ratio	×1/2	× 1	× 2	× 4	× 8	× 16
Position range (%)	36 to 64	-28 to 128	-156 to 256	-410 to 510	-926 to 1026	-1950 to 2050

- The position has the significance shown in the figure below when the adjust value is zero.
- It is possible to display hidden portions of the waveform, according to the displayed position of the section relative to the 0 V position.



1-5-16. Zero Adjustment

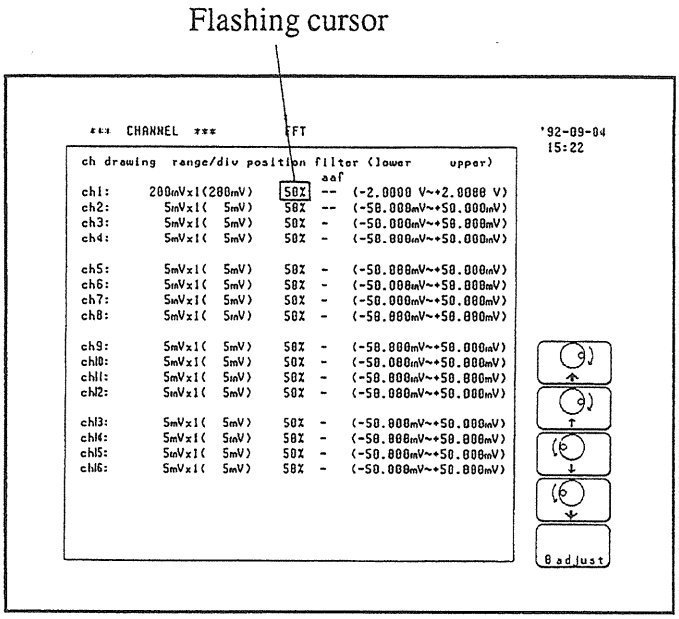
This function accurately adjusts the waveform to the origin position for an input voltage of 0V. Do this zero adjustment whenever the waveform deviates from the origin position; e.g., while taking extended measurements.

Method (Screen for making this setting: the "channel" screen)

Always allow at least 1 hour warm-up time before carrying out this procedure, to ensure that the internal temperature of the unit has stabilized.

1. Using the cursor keys, move the flashing cursor to the "position" item.
2. Press function key F5 (0 adjust), and all of the channels will be calibrated at once.

   This operation should be performed whenever the voltage axis range is changed.



Note

- Zero adjustment cannot be performed while measurement is taking place
- Do zero adjustment again after changing input units.
- The 8908 temperature unit does not have a zero adjustment function.

1-5-17. Starting and Stopping Measurement

Measurement is started by pressing the START key. After pressing the START key, the LED above the key lights until the FFT calculation is completed, then goes out.

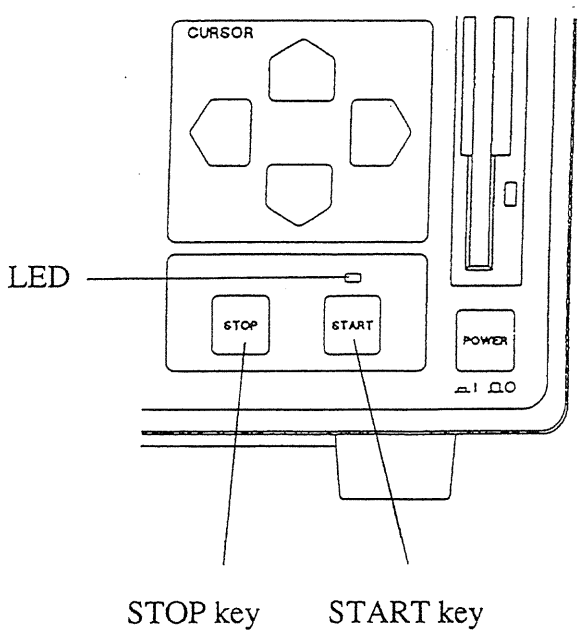
Method

1. Press the START key.

   Measurement and FFT calculation starts.

2. Press the STOP key.

   Measurement and FFT calculation stops.



Note

(1) Starting and stopping measurements in the three trigger modes:

a. When the trigger mode is SINGLE.

Press the START key and, if the trigger conditions hold, data of length equal to 1000 points will be read in and stored. Then, even if the STOP key is not pressed, the system will go into the measurement finished state.

b. When the trigger mode is REPEAT:

Press the START key and, if the trigger conditions hold, data of length equal to 1000 points will be read in and stored. Thereafter, every time the trigger conditions hold, data will be read in and the contents of the memory will be overwritten.

c. Press the START key and, whether or not the trigger conditions hold, data of length equal to 1000 points will be read in and the contents of the memory will be overwritten.

Press the STOP key and measurement will terminate.

(2) Stopping measurement:

Even if the STOP key is pressed, calculations will continue until reading in and storage of waveform data and FFT analysis have finished. Note, however, that if the STOP key is now pressed again, waveform capture or FFT calculation is aborted and all data obtained to that point is lost.

If, after the STOP key has been pressed once, the START key is pressed before the reading in and storage of waveform data or FFT calculation has terminated, then a restart occurs, and the situation is identical to that which was the case at the very beginning, when measurement started.

1-5-18. Using the A and B Cursors

- You can use the A and B cursors to measure time differences, frequency differences, and voltage differences while getting a direct digital readout on the screen.
- In the FFT function, only the cross cursors can be used.

The cross cursors

As a cross cursor is moved, the intersection of the cross (the trace point) traces the waveform of the specified screen.

- A and B cursors used individually

  t : time interval from the trigger position to the trace point f: frequency

  V : voltage difference from 0 V

- A and B cursors used together

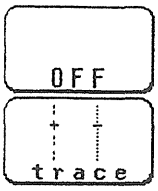
  t : time interval between the trace points f: frequency differences between the trace points

  V : voltage difference between the trace points

Method (Screen for making this setting: the "display screen"

1. Using the cursor keys, move the flashing cursor to the "csr" item.
2. According to the displays on the function keys, select the desired line cursor.

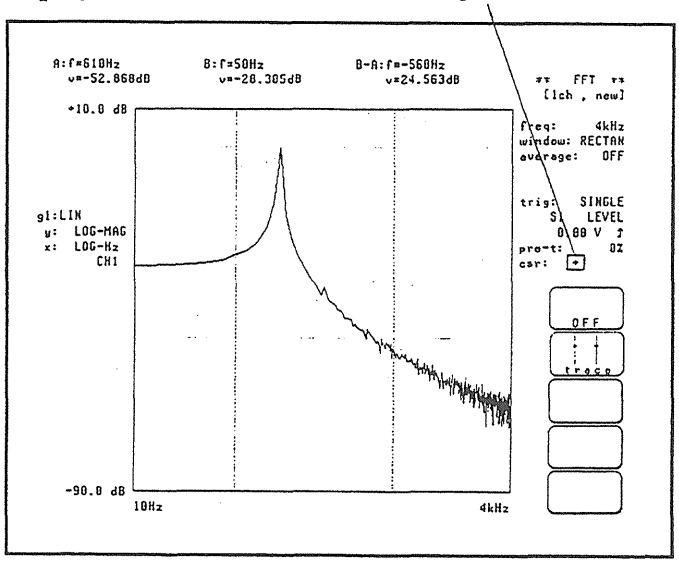
(Function key indication) (Meaning)



: do not use the A and B cursors

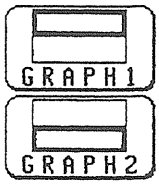
: cross cursor

Flashing cursor



3. When the (DUAL) display format is selected, designate which graph the cross cursor will trace.

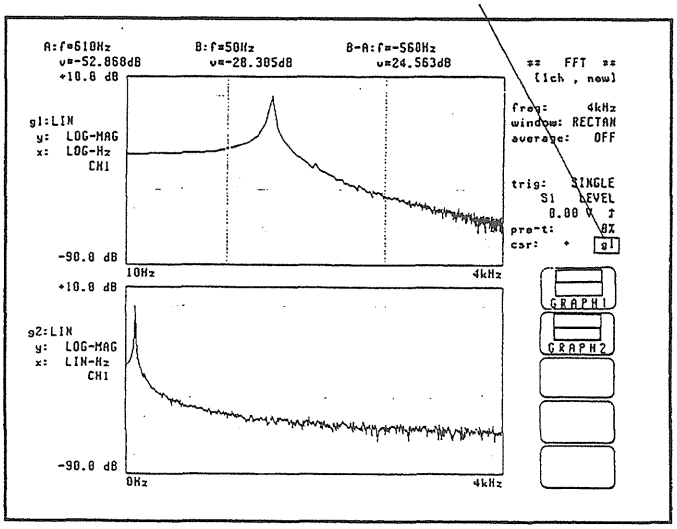
(Function key indication) (Meaning)



:Trace graph 1.

:Trace graph 2.

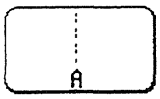
Flashing cursor



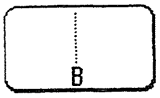
4. Press the knob select key, and the LED for A.B CSR will illuminate.

5. Select the cursor to be moved according to the display on the function keys.

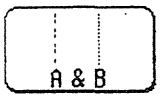
(Function key indication) (Meaning)



: move the A cursor



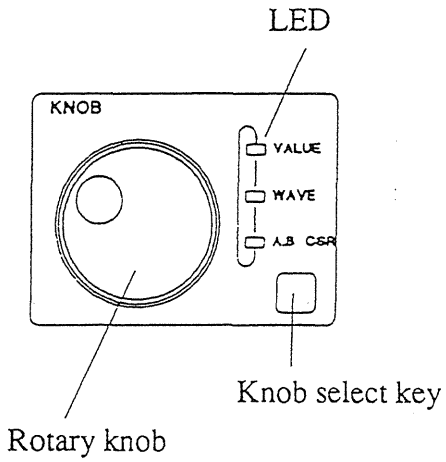
: move the B cursor



: move the A and B cursors simultaneously

6. Turn the rotary knob to move the cross cursor.

- t, V, and f are derived according to the trace point.



1-5-19. Waveform Decision Function

With the FFT function, the waveform decision function can be used when Single or Nyquist is selected as the display format.

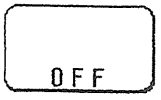
Method (Screen for making this setting: the "status" screen, Page 3)

- From Page 1 of the "status" screen, press the STATUS key twice to get to Page 3.
  (This can also be done by pressing a cursor key and holding it down.)
- Using the cursor keys, move the flashing cursor as described below in turn to the items designated by the numbers in the figure below, and perform the settings.

1. Setting the waveform decision mode (wave comparison)

Make the selection according to the displays on the function keys.

(Function key indication) (Meaning)

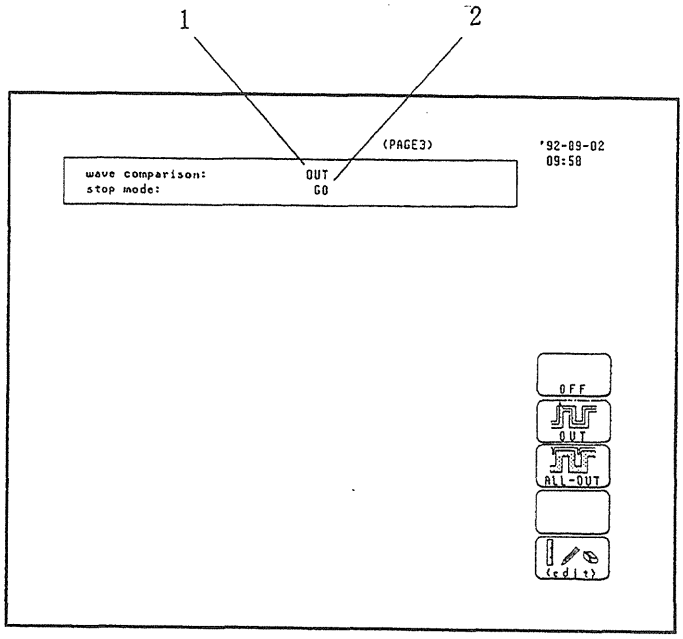


: do not perform waveform decision

: make an NG decision if the waveform leaves the decision area at any point.

: make an NG decision if the waveform is entirely outside the decision area.

: enter the editor in order to set up the waveform decision area.

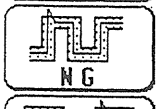


2. Setting the stop mode

Select whether operation should stop after a GO result, an NG result, or either. Make the selection according to the displays on the function keys.

(Function key indication) (Meaning)

: stop operation only after a pass.



: stop operation only after a fail.

: stop operation regardless of the decision result.

- For a detailed explanation of the editor, refer to Section 10 of the 8825 Instruction Manual.

1-5-20. Floppy Disk Operation

- Items stored and required disk space

(1) Settings

① It is possible to save the settings for each measurement function.

Space occupied on the floppy disk. .....3 blocks

NOTE: 1 block = 1024 bytes

(2) Measurement data (WAVE)

- Storing the waveform displayed as the result of FFT calculation

Memory capacity required for measurement data (in blocks)

- With 1CH FFT mode

Single screen: .....24 blocks

Dual or Nyquist screen: .....36 blocks

- With 2CH FFT mode

Single screen: .....34 blocks

Dual or Nyquist screen: .....45 blocks

(Measurement data cannot be stored when using the Array display.

Note

- When measurement data is loaded from floppy disk, several seconds may be required after loading is completed in order to do the calculations that are necessary to display the waveform.

(3) Waveform decision area (AREA)

① For the FFT function mode, it is possible to save a waveform decision area which the user has created.

② Only the settings necessary for waveform decision when a waveform decision area has been created are saved simultaneously.

Memory capacity required for a waveform decision area.....32 blocks.

- For additional details on operating procedures, see Chapter 14 of the 8825 Instruction Manual.

1-5-21. Engineering Units

With the 8825, the reference value for the logarithmic amplitude of linear spectra (LIN) is 1 Vpeak, for RMS spectra (RMS) it is 1 Vrms, and for power spectra (PSP) it is $(1\ \text{Vrms})^2$. However, a different 0 dB reference value is used in some sensor equipment, while some equipment has inscription plates indicating the dB level that corresponds to 1 Vrms or the number of volts rms that are output at the reference value (0 dB).

In order to match the value measured by the sensor with the display of this unit, it is possible to multiply or divide the result of calculation by an arbitrary constant (either (eu/v) or (v/eu), as appropriate).

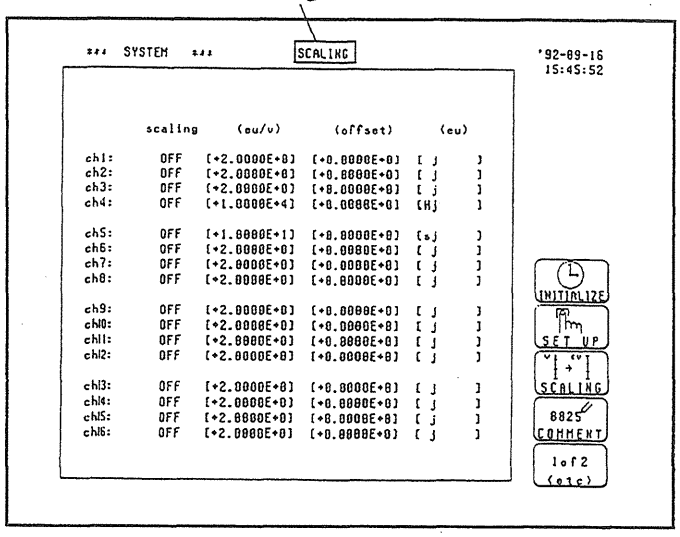
Method (Screen for making this setting: the "system" screen)

Using the SYSTEM key

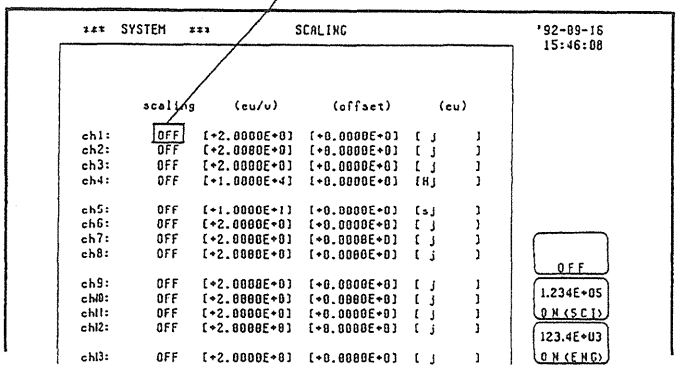
1. Press F3 (SCALING) and the scaling setting screen will appear.
2. If you want to use engineering units, select ON(SCI) or ON (ENG).
3. Set (eu/v) and (offset).

- (eu/v) and (offset) can be set within the range -9.999E+9 to +9.999E+9.
- When using an engineering unit, set (offset) to 0.
- When you want to use (v/eu), set the reciprocal value with (eu/v).
- Move the flashing cursor to each digit to set it.

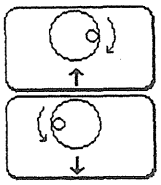
Flashing cursor



Flashing cursor



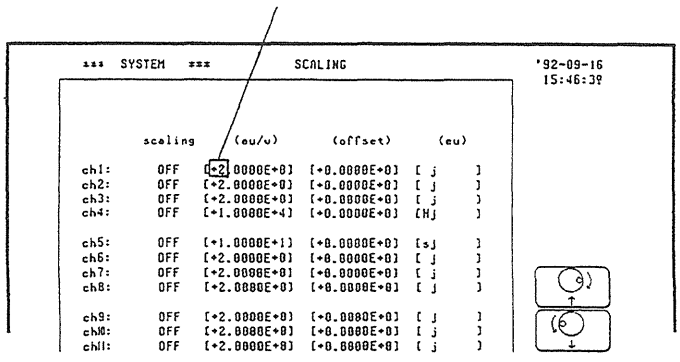
(Function key indication) (Meaning)



from 0 through 9

(for the most significant digit and the exponent, from -9 through +9)

Flashing cursor



Flashing cursor

a = +0 .000E+0

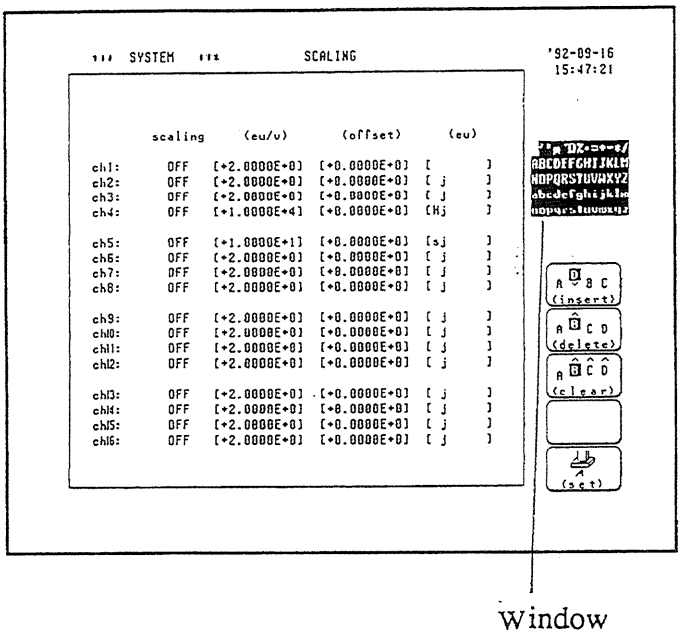
Mantissa Exponent

4. Input the external unit name (eu).

- Input the name for the physical units of each channel.
- The unit name can be up to seven characters long.
- Bring the flashing cursor into the (eu) column and a character selection window will appear.

(1) Use the rotary knob to select each character in turn.

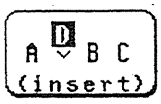
(2) Press the function key F5 (set) to select the character indicated by the cursor in the character selection window, and the flashing cursor will move one character to the right in the unit name field, so that the next character can be input (the right cursor key has the same effect).



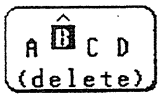
Window

Repeat steps (1) and (2) to input the entire external unit name.

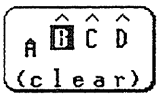
(Function key indicator) (Meaning)



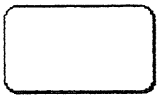
: Insert one character before the position of the flashing cursor.



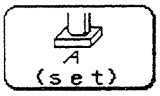
: Delete the character at the flashing cursor position.



: Delete all the characters at and after the flashing cursor position.



:



: Move the flashing cursor one space to the right.

Reference Example of setting engineering units

Assume that the overall level of the power spectrum is 18 dB and that the noise meter reading is 5 dB. By increasing the 8825 reference value by 13 dB, the 18 dB signal can be displayed as 5 dB on the screen of the 8825. Since the 8825 uses a reference value of 1 Vrms for 0 dB, the required reference value can be obtained by the following expression. This is the value that is set with (EU/V) of the engineering unit.

$$20 \cdot \log_{10} \frac{(EU/V)}{1Vrms} = 13(dB)$$

$$(EU/V) = 10^{(13/20)} = 4.46683 \ (Vrms)$$

Since the engineering units allow the exponent to be set within the range -9.999E+9 to +9.999E+9, the value is input as follows.

(EU/V)=4.467E+0

1-5-22. Decibel/Voltage conversion

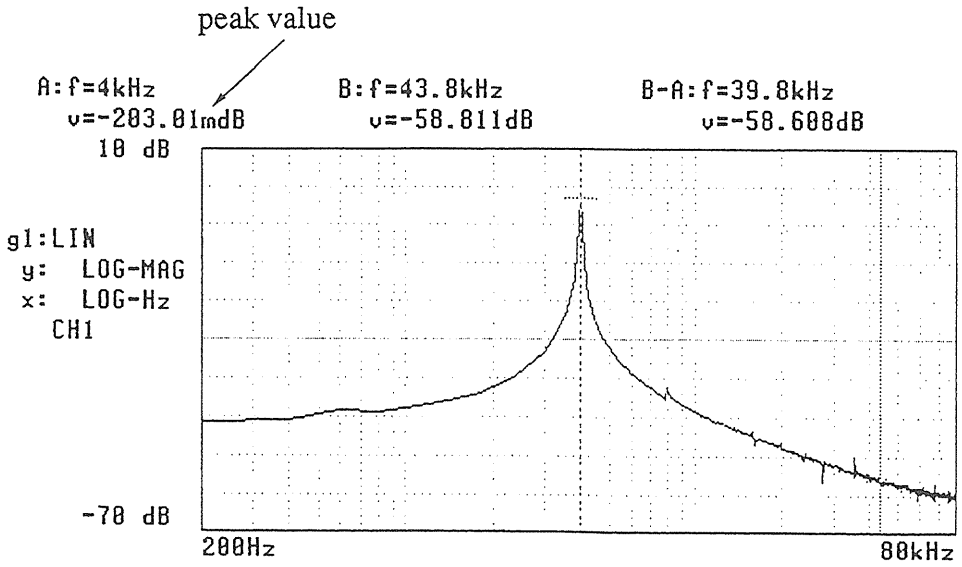
(1) Linear spectrum and RMS spectrum in the FFT calculation, and [dB] used on the chart and the measurement voltage [V] in the octave can be converted using the following formula.

Linear spectrum octave analysis $\quad dB = 20 \cdot \log_{10} \frac{V}{1V_{p-p}}$

RMS Spectrum $\quad dB = 20 \cdot \log_{10} \frac{V}{1Vrms}$

Therefore, $V = 10^{\frac{dB}{20}}$

<Example>



From the graph, a peak value of -203.01 mdB (calculated as - 0.203 dB) can be converted to a voltage value as follows.

$$v = 10^{\frac{-0.203}{20}}$$
$$= 0.9768...$$
$$\fallingdotseq 0.977 \text{ (V)}$$

(2) For the transfer function, [dB] used on the chart indicates the ratio between two channels.

$$dB = 20 \cdot \log_{10} \frac{w2Voltage}{w1Voltage}$$

(3) For the power spectrum, and cross power spectrum.

$$dB = 10 \cdot \log_{10} V^2$$

Chapter 2

Input Units

2-1. 8909 FFT Analog Unit

This section describes the 8909 FFT analog unit and input cables.

Follow carefully the advice in Section 2-1-3 "Safety requirements."

2-1-1. Overview

- The 8909 FFT analog unit is used for the 8825 Memory HiCorder.
- The 8909 FFT analog unit allows line voltages of up to 100 V AC to be recorded directly.
- The 8909 is equipped with a built-in anti-aliasing filter to suppress aliasing.
- The anti-aliasing filter can be turned on or off using the memory recorder or FFT function.
- The anti-aliasing filter's cutoff frequency is automatically set according to the setting of the frequency axis (or time axis) range.

2-1-2. Specifications

(Accuracy at 23°C±5°C, after 1 hour warm-up time) Accuracy guaranteed for six months.

Measurement ranges:	5, 10, 20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20 V/DIV
DC amplitude accuracy:	±0.25% f.s.
Zero position accuracy:	±0.1% f.s. (after zero adjustment)
Temperature characteristic:	gain ±0.02% f.s./°C Zero position ±0.015% f.s./°C
Frequency characteristic:	DC to 100 kHz ±3 dB
Noise:	180μVp-p (typical) maximum sensitivity range, with input shorted
Common mode rejection ratio:	100 dB minimum (at 50 Hz or 60 Hz and with signal source resistance 100Ω maximum)
Low-pass filter:	Cutoff frequency of about 5 Hz or 500 Hz. Can be turned on and off. Attenuation is -6 dB/OCT
Anti-aliasing filter:	Cutoff frequency (fc) of 20, 40, 80, 200, 400, 800, 2K, 4K, 8K, 20K, or 40K (Hz)
No. of input channels:	2 channels
Input type:	Unbalanced (floating)
Input resistance and capacitance:	1 MΩ ±1%, about 27 pF (at 100 kHz)
A/D resolution:	12 bits
Maximum sampling speed:	200 kS/s
Input terminals:	2 terminals (for banana plugs)
Permitted input voltage:	350 V (DC+AC peak)
Maximum floating voltage:	250 V AC or DC (between input unit and frame, between input units and between channels)
Dimensions and weight:	175 mm (H) × 30 mm (W) × 160 mm (D)approx. (excluding projections); 340 g approx.
Accessories:	9574 cables (2)

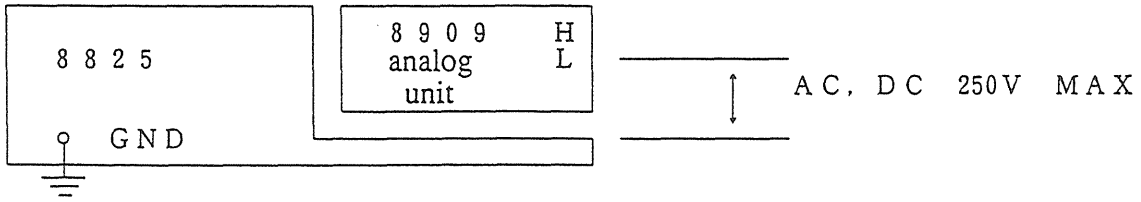
2-1-3. Safety Requirements

⚠ DANGER

If any metallic portions of the input cables are exposed, there is a danger of electric shock. Use only the supplied 9574 input cables.

⚠ DANGER

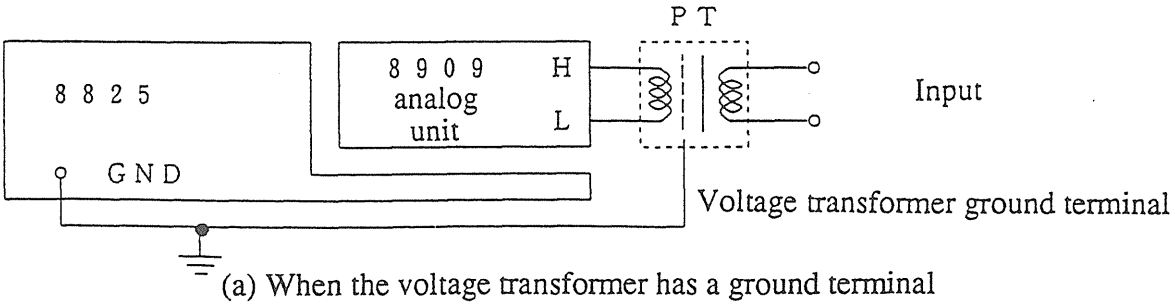
- The 8909 FFT analog unit and the 8825 frame are insulated.
- The maximum floating voltage between the inputs of the 8909 units and the frame of the 8825, or with other analog units, is 250 mV AC/DC. To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds the maximum floating voltage.
- The maximum floating voltage does not change even when using an attenuator with the input, for example.



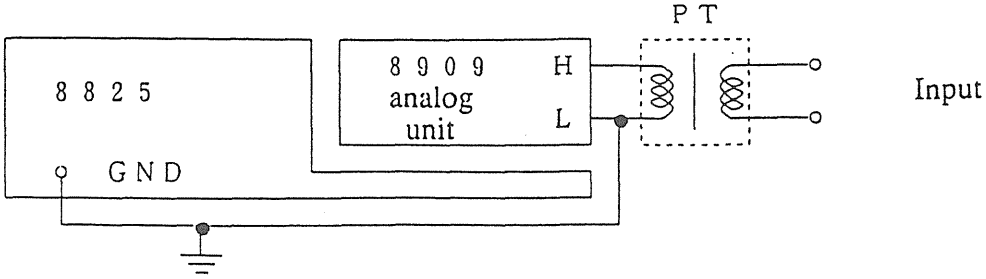
⚠ DANGER

The maximum permitted input voltage to the 8909 is 350 V (DC + AC peak). To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds this level.

- When making measurements on an AC power line using a voltage transformer, for example, ensure that the transformer is appropriately grounded as illustrated below.



(a) When the voltage transformer has a ground terminal



(b) When the voltage transformer has no ground terminal

2-1-4. Replacement Procedure

This section describes how to replace the analog input units.

The following procedure describes how to remove an analog input unit; reverse the procedure to insert the replacement.

① Remove the input cables from all the input units.

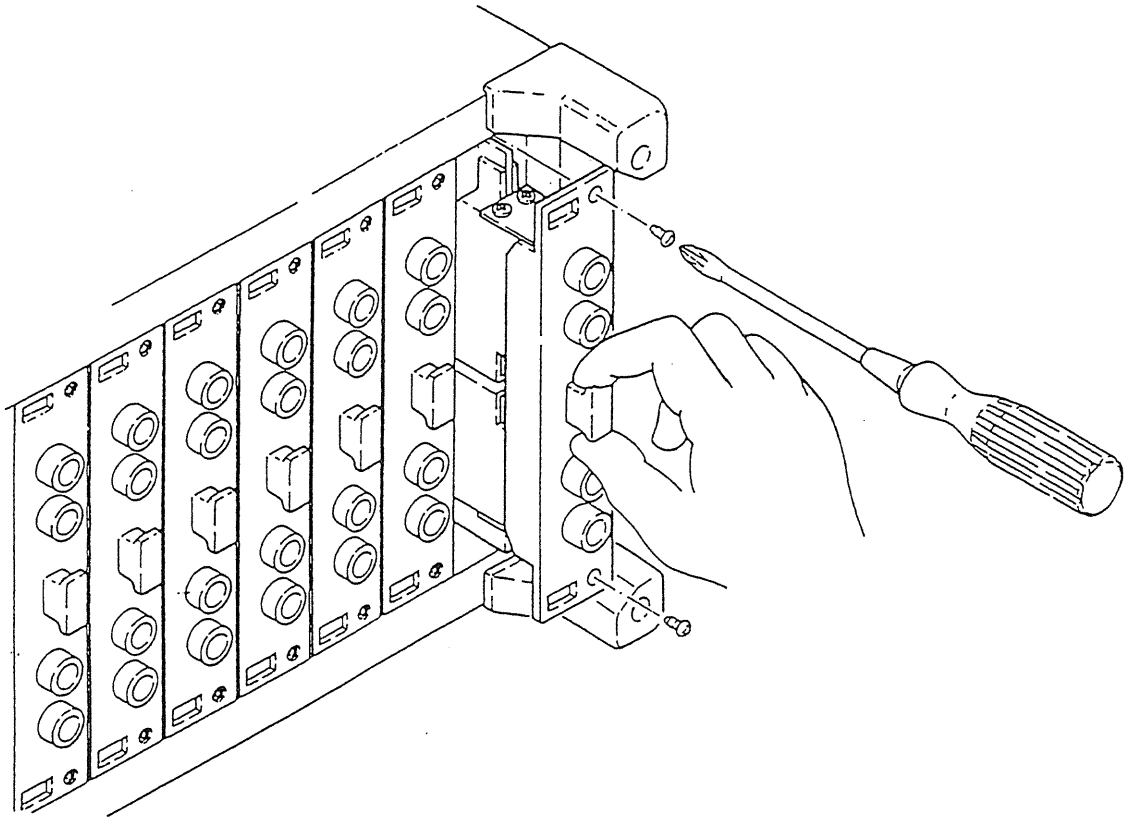
② Power off the 8825 main unit, and disconnect the power cord.

⚠ DANGER

To avoid the danger of electric shock, always disconnect the input cables and the power cord before replacing input units.

③ Remove the two fixing screws with a Phillips screwdriver, as shown in the figure below.

④ Holding the handles at the center of the input unit, pull it out of the main unit.



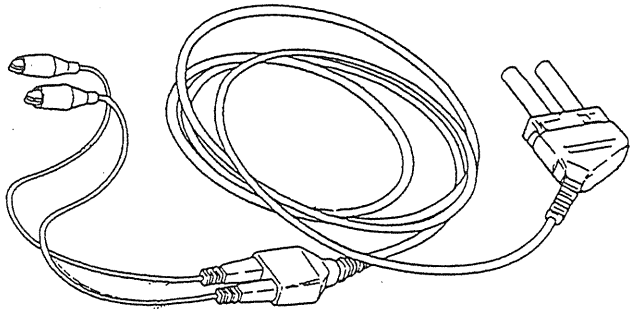
⚠ WARNING

- To avoid the danger of electric shock, never operate the 8825 unit with an input unit removed.
- If you should wish to use the unit after removing an input unit, fit a blanking panel over the opening of the removed unit.

2-1-5. Input Cables

Only use the special-purpose 9574 input cables when connecting to the 8909 FFT analog units.

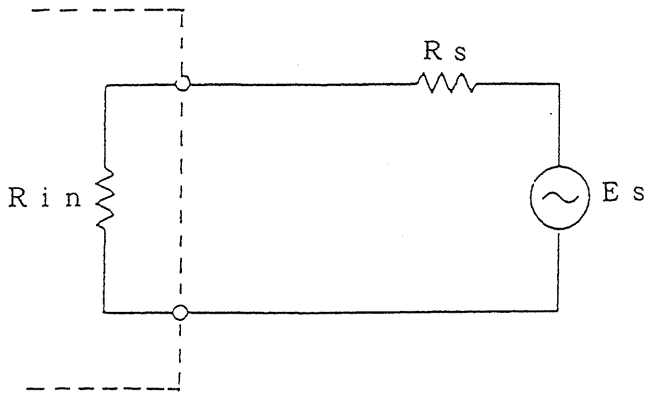
The cables are approximately 1.6 m long, and the portion which plugs into the 8909 has a plastic cover for added safety.



9574 input cable

2-1-6. Measurement Errors Caused by Signal Source Internal Resistance

Measurement errors may result if the internal resistance of the signal source is high compared to the internal resistance of the 8825 unit .



Es : signal voltage
Rs : signal source resistance
Rin : input resistance

$$\text{Measurement error} = Es\left(1-\frac{Rin}{Rs+Rin}\right)$$

[Example] The internal resistance of the 8825 is approximately 1 MΩ. Therefore, if the signal source resistance is 1 kΩ, measurement error is increased by approximately 0.1%.

2-2. 8908 Temperature Unit

This section describes the 8908 temperature unit.

Follow carefully the advice in Section 2-2-3 "Safety requirements."

2-2-1. Overview

The 8908 temperature unit is a thermocouple input unit that is used with the 8825 Memory HiCorder for measuring temperature. Using the 8908 temperature unit, temperature can be measured by direct connection to any of three types of thermocouples: K(CA), J(IC), or T(CC).

2-2-2. Specifications

(Accuracy at 23°C ±5°C, after 1 hour warm-up time) Accuracy is guaranteed for six months.

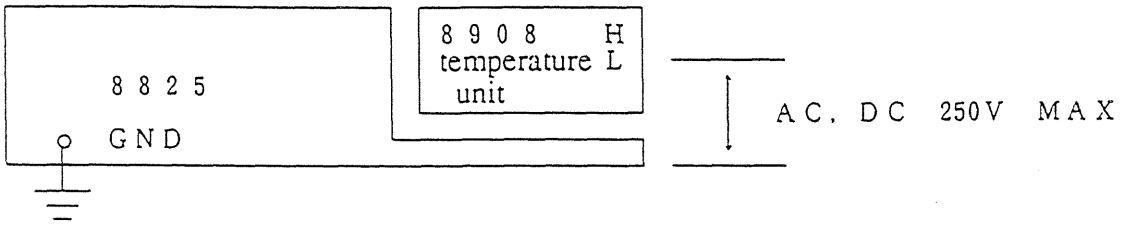
No. of input channels:	2 channels
Measurement ranges: (Minimum resolution):	10, 20, 50 °C/DIV (0.125) (0.25) (0.625)
Measurement input range:	K (CA) -90 to 1200°C J (IC) -90 to 800°C T (CC) -90 to 400°C
Zero position:	-110 to 110% of recording width (normal) or -100 to 100% (wide), in 1% steps (no zero adjustment)
Reference contact compensation:	Automatic compensation
Accuracy:	±0.25% f.s. ±2°C (including precision of reference contact compensation)
Input impedance:	approx. 5 MΩ
Frequency characteristics:	DC to 500 Hz (-3dB, typ.)
Low-pass filter:	Cutoff frequency of about 1.5 Hz or 5 Hz Can be turned off.
Response time:	↑ 1 ms (typ.) (0 - 90% f.s.) ↓ 1 ms (typ.) (100 - 10% f.s.) low-pass filter 5 Hz ON ↑ 100 ms (typ.) (0 - 90% f.s.) ↓ 100 ms (typ.) (100 - 10% f.s.) low-pass filter 1.5 Hz ON ↑ 300 ms (typ.) (0 - 90% f.s.) ↓ 300 ms (typ.) (100 - 10% f.s.)
A/D resolution:	12-bit
Maximum sampling speed:	50 kS/s
Permitted input voltage:	100 V AC or DC
Maximum floating voltage:	250 V AC or DC (between input unit and frame, between input units and between channels)
Normal mode rejection ratio:	30 dB typ. (at 50/60 Hz with 1.5 Hz low-pass filter ON)

Common mode rejection ratio:	100 dB minimum (at 50 or 60 Hz and with signal source resistance 100Ω maximum)
Temperature characteristic:	±0.05% f.s./°C
Input terminals:	2 terminals
Dimensions and weight:	175 mm (H) × 30 mm (W) × 174 mm (D) approx. (excluding projections); 330 g approx.

2-2-3. Safety requirements

⚠ DANGER

- The 8908 temperature unit input and the 8825 frame are insulated.
- The 8908 temperature unit input terminal is only for connection to a thermocouple. Never apply any input other than that from a thermocouple to this input terminal.
- The design provides circuit protection to 100 V (AC or DC); never apply any voltage exceeding this level.
- When using an non-insulated thermocouple to measure temperature in aplace where voltage is present, be careful to avoid touching the terminals, since voltage may be present.
- The maximum floating voltage between the inputs of the 8908 units and the frame of the 8825, or with other analog units, is 250 V AC/DC. To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds the maximum floating voltage.



2-2-4. Notes Concerning Installation Site

CAUTION

- Strong wind striking the input terminal can disrupt the thermal balance of the input circuit, resulting in incorrect readings. When taking measurements in windy environments, arrange the equipment to prevent wind from directly striking the input terminal.
- Abrupt changes in ambient temperature can also disrupt the thermal balance of the input circuit. To prevent measurement error, allow the unit to adjust to the new temperature for about 30 minutes before starting measurement.
- Measurement errors will occur if the 8825 is installed with the handle downward. Do no install the equipment with the handle downward.

2-2-5. Replacement Procedure

This section describes how to replace the analog input units.

The following procedure describes how to remove an analog input unit; reverse the procedure to insert the replacement.

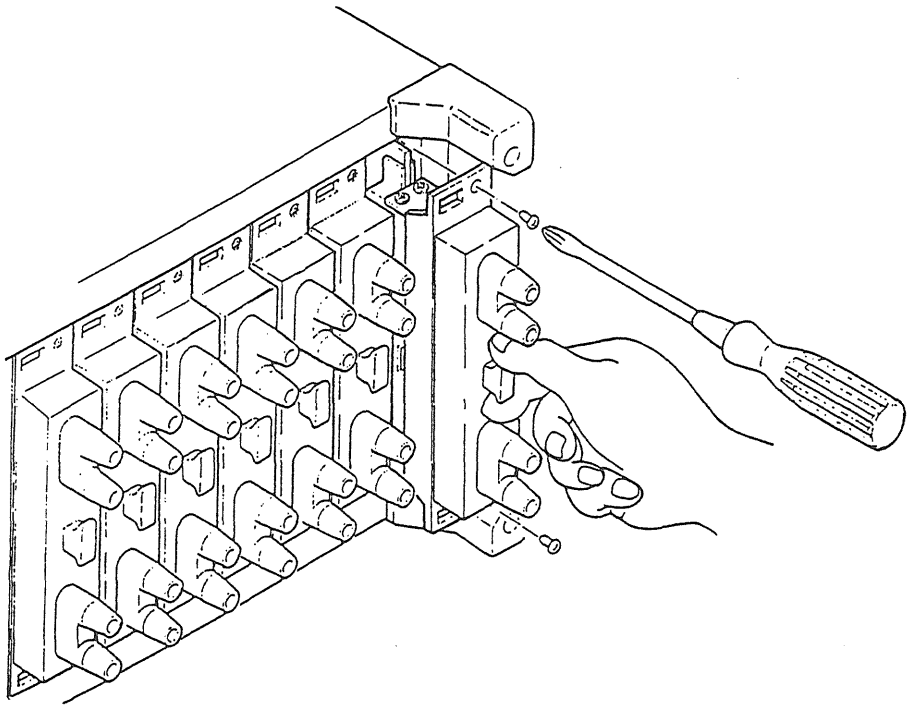
① Power off the 8825 main unit, and disconnect the power cord.

⚠ DANGER

Always disconnect the power cord before replacing input units.

② Remove the two fixing screws with a Phillips screwdriver, as shown in the figure below.

③ Holding the handles at the center of the input unit, pull it out of the main unit.



⚠ WARNING

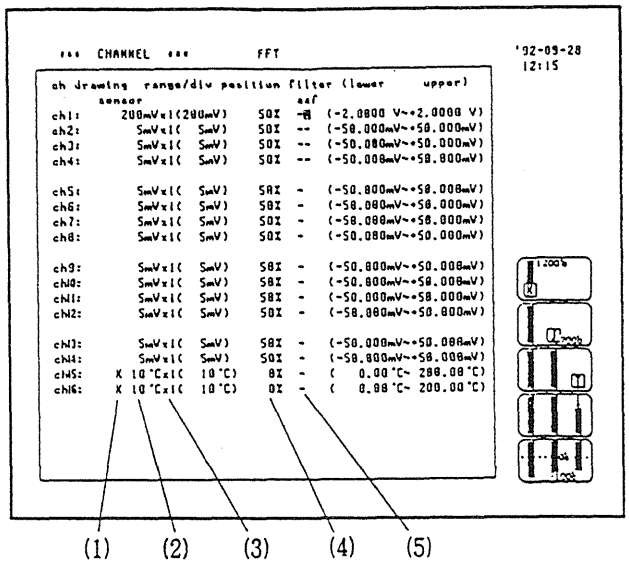
- To avoid the danger of electric shock, never operate the 8825 unit with an input unit removed.
- If you should wish to use the unit after removing an input unit, fit a blanking panel over the opening of the removed unit..

2-2-6. Setting the Temperature Amplifier

Temperature amplifier settings are made using the "channel" screen.

Method (Screen for making these settings: the "channel" screen)

- Using the cursor keys, move the flashing cursor in turn to the items designated by the numbers in the figure on the right, and set the appropriate values.
- For details on the various functions, see paragraphs (1) to (5) below.



(1) Setting the thermocouple type

- The 8908 supports three types of thermocouples: K(CA), J(IC), and T(CC). Set the type of thermocouple to be used.

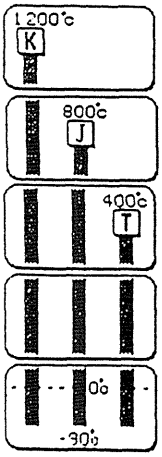
CAUTION

Note that incorrect values will result if the thermocouple type setting does not match the thermocouple being used.

Method (Screen for making this setting: the "channel" screen)

Set the thermocouple type according to the display on the function keys.

(Function key indication) (Meaning)



:Indicates a K(CA)-type thermocouple.

:Indicates a J(IC)-type thermocouple.

:Indicates a T(CC)-type thermocouple.

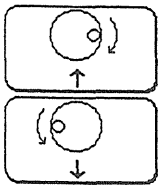
(2) Setting the range variable (range/div)

- Set the temperature range for each channel.
- The value set for "range/div" indicates the temperature value corresponding to 1 division on the temperature axis.

Method (Screen for making these settings: the "channel" screen)

Set the range variable using either the function keys or the rotary knob.

(Function key indication) (Meaning)



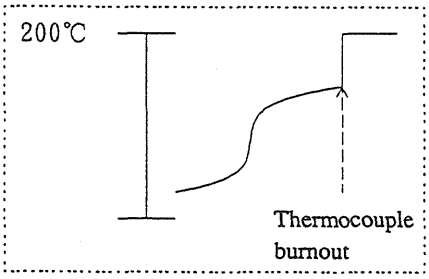
} 10, 20, 50 °C

[Measurement input range]

K (CA)	-90 to 1200 °C
J (IC)	-90 to 800 °C
T (CC)	-90 to 400 °C

CAUTION

- If the lower measurement input limit is exceeded, saturation will occur at the level indicated below. If the upper measurement input limit is exceeded or the thermocouple burns out, the trace will move all the way to the top of the screen.



- Range variable and lower measurement input limit saturation level

Range variable	10 °C/div	20 °C/div	50 °C/div
Saturation level of lower measurement input limit	-90.88	-181.75	-454.38

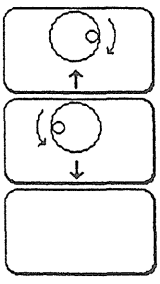
(3) Temperature axis magnification

- The magnification ratio along the temperature axis should be set for each channel.

Method (Screen for making this setting: the "channel" screen.

The settings are made by using the function keys or the rotary knob.

(Function key indicator) (Meaning)



} ×16, ×8, ×4, ×2, ×1, ×1/2

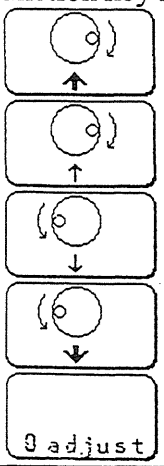
(4) Position

- The position can be set for each channel.
- The range for the position varies according to the magnification ratio along the temperature axis.

Method (Screen for making this setting: the "channel" screen)

Make the setting using the function keys or the rotary knob.

(Function key indication) (Meaning)



When the magnification ratio is 1, from -110 to 110%. For other cases, see the table below.

Magnification ratio		× 1/2	× 1	× 2	× 4	× 8	× 16
Display size	NORMAL	-55 to 55	-110 to 110	-220 to 220	-440 to 440	-880 to 880	-1760 to 1760
	WIDE	-50 to 50	-100 to 100	-200 to 200	-400 to 400	-800 to 800	-1600 to 1600

CAUTION

- WIDE display cannot be selected when using the FFT function.
- The 8908 temperature amplifier is not equipped with a zero adjust function. When the (0 adjust) function key is pressed, zero adjustment is performed for all inputs except the 8908 temperature unit.

(5) Low-pass filter

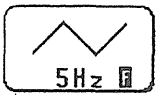
Set the low-pass filter for each channel.

Method (Screen for making this setting: the "channel" screen.

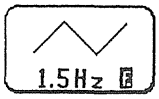
Make the setting using the function keys or the rotary knob.

(Function key indication) (Meaning)

: No filter is used.



: 5 Hz cutoff frequency is used.



: 1.5 Hz cutoff frequency is used.

Chapter 1

Outline

1 Outline

The GP-IB (General Purpose Interface Bus) was developed as an interface for general use by programmable instrumentation, and as an interface is rich in expandability and has many distinctive features.

There are various interfaces with specific names apart from the GP-IB, such as the IEEE-488 bus, the IEC bus, and the HP-IB which is an internal standard within the Hewlett-Packard Company. These are basically the same standard, but, because the number of connector pins and the arrangement of the signals and so on differ, much care should be exercised.

In this explanation of management and operation, only the GP-IB related resources of the 8825 will be described.

If more detailed knowledge of the GP-IB interface is required, reference should be made to the following literature:

The Institute of Electrical and Electronics Engineers, Inc.: "IEEE Standard Digital Interface for Programmable Instrumentation", IEEE Std 488.1-1987, IEEE Std 488.2-1987 (1987)

Chapter 2

GP-IB Specification

2-1 Standards

IEEE Standard 488.1-1987

IEEE Standard 488.2-1987

2-2 Interface Functions

Function	Implementation
SH1	SH (Source Handshake) - All Functions
AH1	AH (Acceptor Handshake) - All Functions
T5	Basic Talk Function, Serial Poll Function, Talk Only Function MLA (My Listen Address) Talk Release Function
L4	Basic Listener Function MTA (My Talk Address) Listen Release Function
SR1	SR (Service Request) - All Functions
RL1	RL (Remote/Local) - All Functions
PP0	PP (Parallel Poll) - No Function
DC1	DC (Device Clear) - All Functions
DT0	DT (Device Trigger) - No Function
C0	C (Control) - No Function

2-3 GP-IB Signal Lines

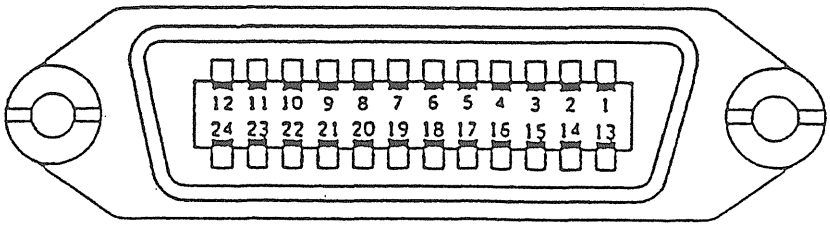
Bus Signal Lines		Remarks	
Data bus	DIO 1 (Data Input Output 1) DIO 2 (Data Input Output 2) DIO 3 (Data Input Output 3) DIO 4 (Data Input Output 4) DIO 5 (Data Input Output 5) DIO 6 (Data Input Output 6) DIO 7 (Data Input Output 7) DIO 8 (Data Input Output 8)	Apart from input and output of data, these are used for input and output of interface messages and device messages.	
Transfer bus	DAV (Data Valid) NRFD (Not Ready For Data) NDAC (Not Data Accepted)	Signal which indicates data bus information validity. Input preparation completed signal. Input completed signal.	These perform acceptor and source handshake.
Control bus	ATN (Attention) IFC (Interface Clear) SRQ (Service Request) REN (Remote Enable) EOI (End or Identify)	Signal which indicates that the information on the data bus is an interface message or a device message. Signal which sets the interface bus system to the initial condition. Signal which requests a non-synchronous service. Signal which performs changeover of remote and local control. Indicates the last byte of data.	

2-4 Connector Pin Assignment

On the 8825: 57LE-20240 (made by DDK) or compatible.

On the cable: 57-10240 (made by DDK) or compatible.

Pin arrangement diagram for the GP-IB interface connector on the 8825:

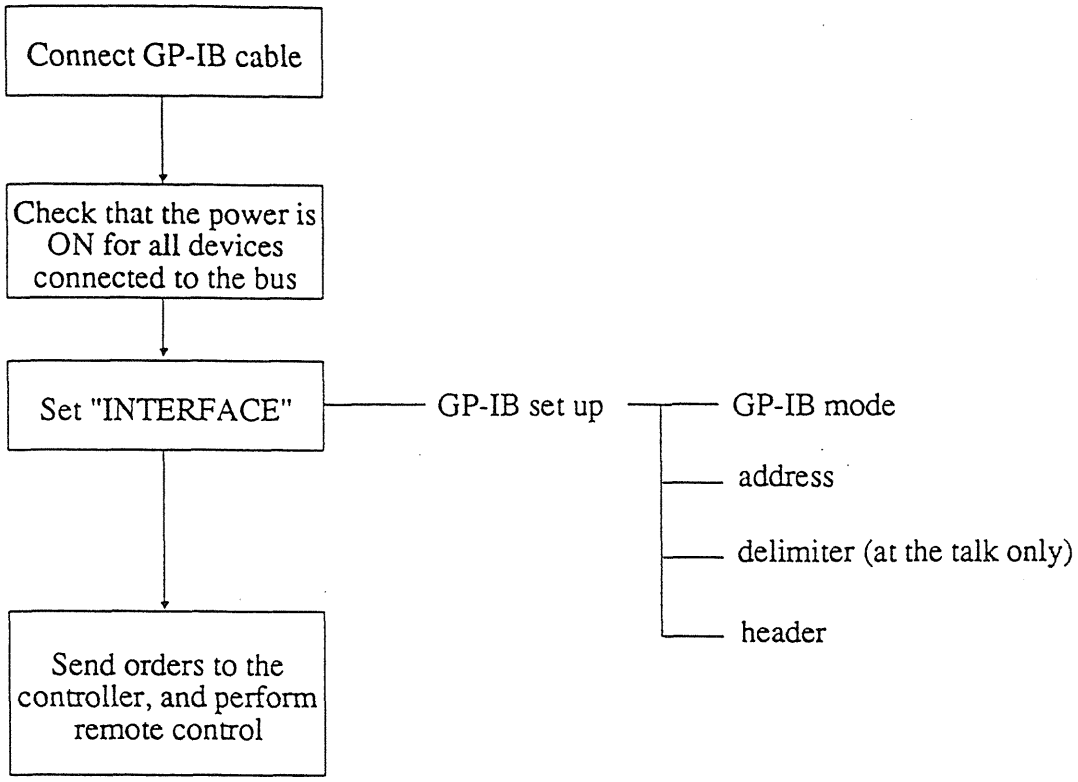


Pin number	Name of signal line	Pin number	Name of signal line
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI	17	REN
6	DAV	18	GND
7	NRFD	19	GND
8	NDAC	20	GND
9	IFC	21	GND
10	SRQ	22	GND
11	ATN	23	GND
12	SHIELD	24	LOGIC GND

Chapter 3

Method of Operation

3-1 Basic Operational Procedure



CAUTION

The GP-IB interface is not isolated from the 8825 system. Exercise caution, because the ground of the logic inputs and the GP-IB interface ground are connected.

3-2 Setup Procedure

On the 8825, use the interface setting screen, accessed from the "system" screen, to set the GP-IB address for the unit, and select whether or not to use headers mode, and delimiter in messages output by the 8825.

Procedure

1. Press the SYSTEM key to display the "system" screen.
2. Press [F5] (1of2), the press [F1] (INTERFACE).

   Using the cursor keys, move the flashing cursor in order to the items shown in the figure below by the reference numbers, and make the settings using the function keys.
3. Set the GP-IB operation mode for this unit.

   Set the GP-IB address for this unit on the bus.

(Function key indication) (Meaning)

: ADDRESSABLE... Assign a device address, so this unit can be used both as talker and listener.

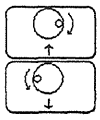
: TALK ONLY ... Use this unit as talker only. (Only when using a plotter)

: DISABLE ... Do not use the GP-IB interface.

4. Set the GP-IB device address.

   Use F1 and F2, or the rotary knob to adjust the numerical value.

(Function key indication) (Meaning)

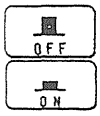


} 1 to 30

5. Enable or disable the headers.

   Select whether or not this unit as talker should output an identifying header at the beginning of each message it sends.

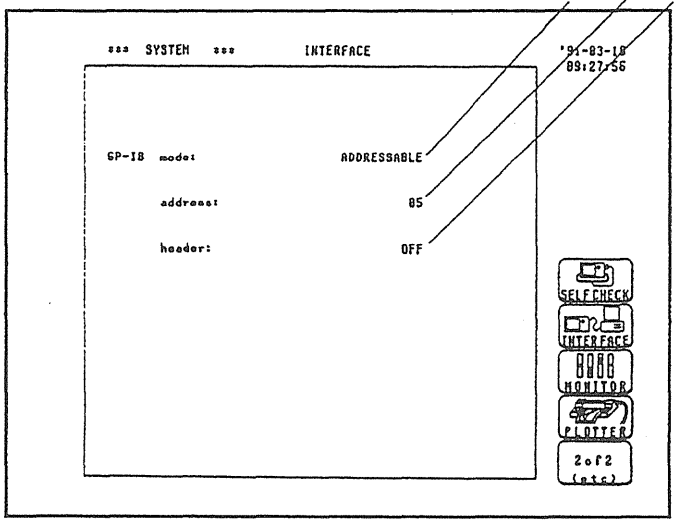
(Function key indication) (Meaning)



: No headers

: Output headers

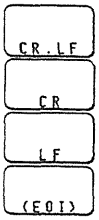
"System" screen (INTERFACE)



6. Select the GP-IB delimiter for talk-only mode.

   Select the appropriate delimiter sequence for the plotter being used.

(Function key indication) (Meaning)



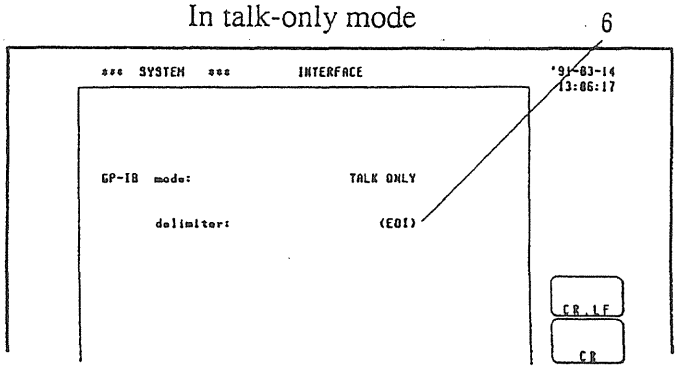
: CR + LF (EOI)

: CR (EOI)

: LF (EOI)

: (EOI)

In talk-only mode

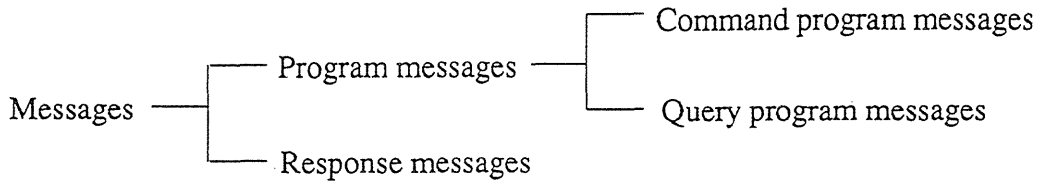


3-3 Receive and Send Protocols

(1) Messages

Data received or sent by the GP-IB interface is called a message.

The following are the message types:



Of these, program messages are those received by the unit from the controller, while response messages are those sent from the unit to the controller.

Program messages are command messages or query messages.

Command messages are orders for control of the device, such as for making settings or for reset or the like.

Query messages are orders for responses relating to results of operation, results of measurement, or the state of device settings.

Response messages are sent in response to query program messages.

After a query message has been received, a response message is produced the moment that its syntax has been checked.

(2) Command syntax

When no ambiguity would arise, the term "command" is henceforth used to refer to both command and query program messages.

The 8825 accepts commands without distinction between lower case and upper case letters. It generates response messages in the long form (when headers are enabled) and in upper case letters.

The names of commands for the 8825 are as far as possible mnemonic. Furthermore, all commands have a long form, and an abbreviated short form.

In command references in this manual, the short form is written in upper case letters, and then this is continued in lower case letters so as to constitute the long form. Either of these forms will be accepted during operation, but intermediate forms will not be accepted. Further, during operation both lower case letters and upper case letters will be accepted without distinction.

Example:
For "DISPLAY", either "DISPlay" (the long form) or "DISP" (the short form) will be accepted. However, any one of "DISPLA", "DISPL", or "DIS" is wrong and will generate an error.

(3) Command program headers

Commands must have a header, which identifies the command in question.

There are three kinds of header: the simple command type, the compound command type, and the standard command type.

- Simple command type header:

  The first word constitutes the header.

  Example: :HEADer ON

  Simple command type header.

- Compound command type header:

  A header made up from a plurality of simple command type headers marked off by colons.

  Example: :CONFigure:TDIV 1. E-3

  Simple command type header. Simple command type header.

  Compound command type header.

- Standard command type header:

  A command beginning with an asterisk and stipulated by IEEE488.2

  Example: *RST

(4) Query program headers

These are for commands used for interrogating the unit about the result of an operation or about a setting.

These can be recognized as queries by a question mark appearing after the program header. The structure of the header is identical to that of a command program header, with "?" always being affixed to the last command. There are queries possible in each of the three previously described types of command form.

Example: : HEADer? ON

Query program header

(5) Response messages

Response messages relating to queries are made up from header portions (which also may be absent due to header disablement) and data portions identical to those of program messages, and as a general rule are sent in an identical format to the format of the program message corresponding to their originating query.

(6) Terminators and separators

① Message Terminator

A terminator is used in order to separate the transmission of one message from another, and this terminator is not itself included in the message. On the 8825, LF, EOI, or LF+EOI is used as the message terminator, and LF+EOI is also used as the response message terminator.

② Message Unit Separator

A semicolon ";" is used as a message unit separator when it is desired to set out several messages on a single line.

Example: : CONFIGURE:TDIV 1. E3;:CONFIGURE:SHOT 25

Message unit separator

③ Header separator

With a message which has both a header and data, a space " " is used as a header separator to separate the header from the data.

Example: :CONFIGURE:SHOT␣25

header separator

④ Data separator

Commas are used as data separators for separating several data items from one another.

Example: :DISPLAY:DRAW␣CH1␣,␣DARK

Simple command type header. Data separator

Compound command type header. Header separator

(7) The command tree

The rule when writing several messages of compound command form on the same line, when no colon is prefixed to the next header after the semicolon (the message unit separator), is that that header is considered as continuing on from the header before the last colon in the message directly preceding.

This corresponds to the general concept of the current directory in the directory structure of UNIX or MS-DOS, and this directly preceding header is called the "current path".

Example 1: :CONF:TDIV 1. E-3;:CONF:SHOT 25

Example 2: :CONF:TDIV 1. E-3;SHOT 25

Both Example 1 and Example 2 are messages setting TIME/DIV to 1 and recording length to 25 divisions.

With Example 1, because there is a colon directly after the semicolon, the current position is the "root". Accordingly the reference of the next command is performed from the root.

On the other hand, with Example 2, because with ":CONF:TDIV 1. E-3;" the current path has become ":CONF", it is now possible to omit the ":CONF:" before "SHOT".

To reiterate, the colon at the beginning of a command forces the search for the command to begin from the root. Thus in Example 1:

: CONFIGURE:TDIV 1.E-3

The first colon indicates that the "CONFIGURE" command is at the root level.

(8) Data format

The 8825 uses character data, decimal data and character string data.

- Character data

① The first character must be alphabetic.

② The characters after the first character can only be alphabetic characters, numerals, or underline characters (_).

③ As alphabetic characters, during sending only upper case letters are used, but during receiving both upper case and lower case letters are permitted.

- Decimal data

Decimal data values are represented in what is termed NR format.

There are three types of NR format from NR1 to NR3, and each of these can appear as either a signed number or an unsigned number. Unsigned numbers are taken as positive.

Further, if the accuracy of a numerical value exceeds the range with which the 8825 can deal, it is rounded off. (5 and above is rounded up; 4 and below is rounded down).

NR1 format - integer data.
Examples: +15, -20, 25
NR2 format - fixed point numbers.
Examples: +1.23, -4.56, 7.89
NR3 format - floating point numbers.
Examples: +10E-3, -2.3E+3

NRf format

The term "NRf format" includes all these three formats.

When the 8825 is receiving it accepts NRf format, but when it is sending it utilizes whichever one of the formats NR1 to NR3 is indicated in the particular command.

- Character string data

Character string data is enclosed within quotation marks.

① The data is composed of 7 bit ASCII characters.

② Characters which cannot be handled by the 8825 are replaced by spaces.

③ When the 8825 is sending, only the double quotation mark (") is used as a quotation mark, but when receiving both this double quotation mark and also the single quotation mark (') are accepted.

3-4 Remote Control

- **Local state**

This is the state in which the 8825 is controlled by its keys. When the power is turned on, the 8825 always comes up in local state.

- **Remote state**

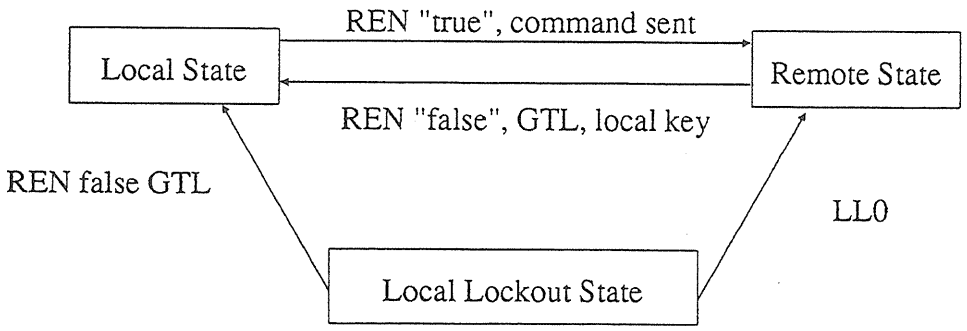
In this state the 8825 is controlled from the GP-IB interface (the REN line is "true"), and its keys are disabled. When in the remote state, the 8825 returns to local state if the local key (F5 (LOCAL)) is pressed.

- **Local lockout state**

When an LLO (Local Lockout) command (this is a GP-IB universal command) is received, even if the local key is pressed, the 8825 is prevented from returning to the local state. This state is called the local lockout state.

In order to return the 8825 from the local lockout state to the local state, it is necessary either (a) to send a GTL (Go To Local) command (this is a GP-IB universal command), or (b) to turn the power to the 8825 temporarily off and then on again, or (c) to bring the line REN to "false".

If a command is sent with REN in the "false" state, then the only way to return to the local state is with the local key.



Program example ..... HP-9816 (Hewlett-Packard)

local lockout	LOCAL LOCKOUT 7
local	LOCAL 7

3-5 Device Clear

When the 8825 receives the device clear command, it clears the input buffer and the output queue.

The device clear command is exemplified by the following:

HP 9816 (made by Hewlett-Packard)

CLEAR 7

3-6 The Status Byte and the Event Registers

(1) The status byte

Each bit of the status byte is a summary (logical OR) of the event register corresponding to that bit.

Further, the status byte and each event register has an enable register corresponding to it, and according to the setting of this enable register (which starts off at zero when the power is turned on) it is possible to mask the service requests originating from each event.

Status byte bit settings

bit 7:	Unused: 0
bit 6: rsv MSS	Set when a service request is issued.
bit 5: ESB	Event summary bit. Shows a summary of the standard event status register.
bit 4: MAV	Message available. Shows that a message is present in the output queue.
bit 3:	Unused: 0
bit 2:	Unused: 0
bit 1:	Unused: 0
bit 0: ESB0	Event summary bit 0 Shows a summary of event status register 0.

The following commands are used for reading the status byte, and for setting the service request enable register and for reading it.

Reading the status byte: *STB?

Setting the service request enable register: *SRE

Reading the service request enable register: *SRE?

(2) Standard event status register (SESR)

The summary of this register is set in bit 5 of the status byte.

Each bit is masked by setting the standard event status enable register (which starts off at zero when the power is turned on).

The circumstances when the contents of the standard event status register are cleared are as listed below.

1. When the *CLS command is received.
2. When the contents have been read by an *ESR? query.
3. When the power is turned off and turned on again.

Bit allocations in the standard event status register

bit 7: PON	The power has been turned on again. Since this register was last read, the unit has been powered off and on.
bit 6: URQ	User request: not used.
bit 5: CME	Command error. There is an error in a command that has been received; either an error in syntax, or an error in meaning.
bit 4: EXE	Execution error. An error has occurred while executing a command. Range error; Mode error.
bit 3: DDE	Device dependent error. It has been impossible to execute some command, due to an error other than a command error, a query error, or an execution error.
bit 2: QYE	Query error. The queue is empty, or data loss has occurred (queue overflow)
bit 1:	Request for controller right (not used) Unused: 0
bit 0: OPC	Operation finished. Only set for the *OPC command.

The following commands are used to read the standard event status register, and to set or read the standard event status enable register.

Read the standard event status register: *ESR?

Set the standard event status enable register: *ESE

Read the standard event status enable register: *ESE?

(3) Event status register 0 (ESR0)

The summary of this register is set in bit 0 of the status byte.

Each bit is masked when the event status enable register 0 (which starts off at zero when the power is turned on) is set.

The circumstances when the contents of event status register 0 are cleared are as listed below.

1. When the *CLS command is received.
2. When the contents have been read by an :ESR0? query.
3. When the power is turned off and turned on again.

The bits of event status register 0

bit 7:	Waveform decision fail (NG).
bit 6:	Unused.
bit 5:	Unused.
bit 4:	Unused.
bit 3:	Printer operation finished (print, or copy, output).
bit 2:	Trigger wait finished (set when the trigger event occurs).
bit 1:	Measurement operation concluded (set by STOP).
bit 0:	Error not related to the GP-IB interface; printer error etc.

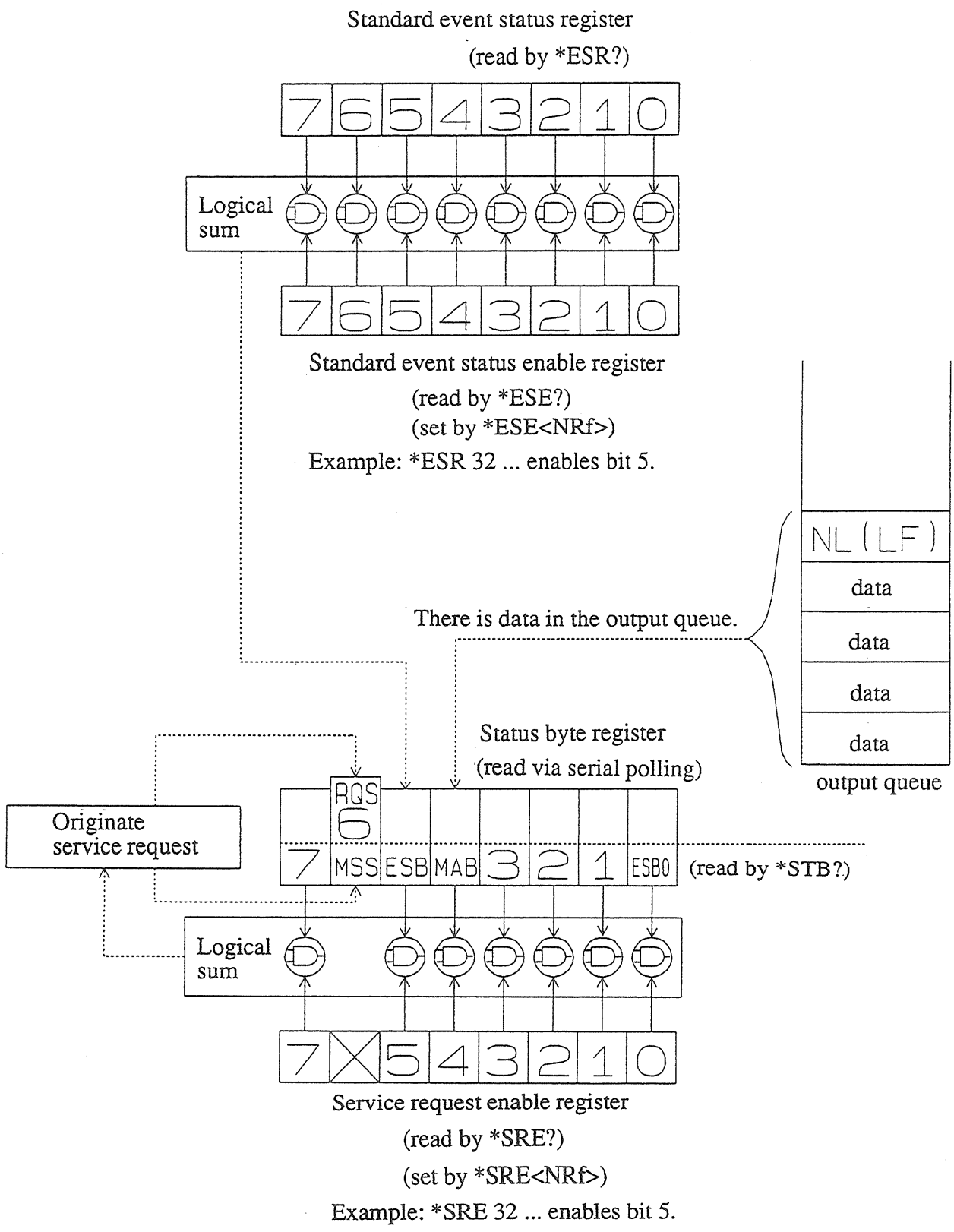
The following commands are used for reading the event status register 0, and for setting the event status enable register 0 and for reading it.

Reading event status register 0. :ESRO?

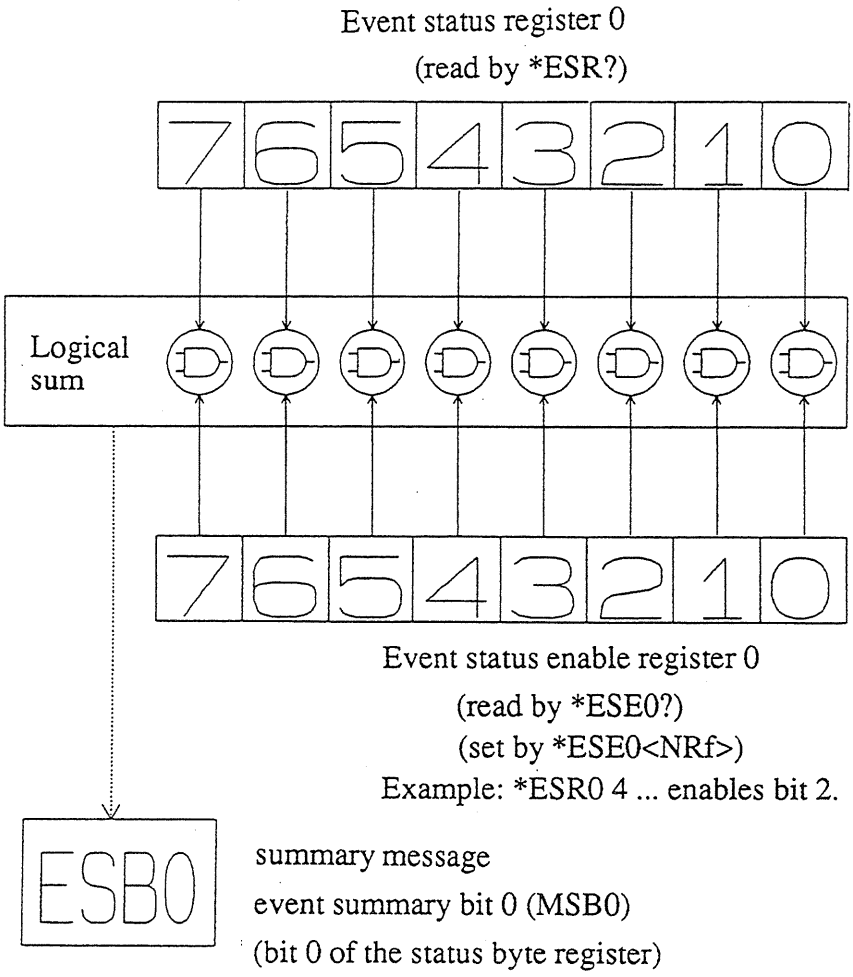
Setting event status enable register 0. :ESE0

Reading event status enable register 0. :ESE0?

Status byte data structure:



Event status register 0 data structure



3-7 The Input Buffer and the Output Queue

(1) Input buffer

The 8825 has an input buffer of 512 bytes capacity.

Messages which are received are put into this buffer and executed in order.

However, an :ABORT command is executed instantly as soon as it is received.

(2) Output queue

The 8825 has an output queue of 256 bytes capacity.

Response messages are accumulated in this queue and are read out from the controller.

The circumstances when the output queue is cleared are as listed below:

1. When the controller has read out its entire contents.
2. When a device clear is issued.
3. When the power is turned off and turned on again.
4. Upon receipt of the next message.

If the length of a response message has exceeded 256 bytes, a query error occurs.

3-8 GP-IB Errors

When a command which has been received contains an error, that one of bits 2 to 5 of the standard event status register which corresponds to the event which has occurred is set.

Further, if a command has given rise to an error (apart from an execution error), commands accumulated in the input buffer and waiting for execution after that command are ignored.

Bit allocations in the standard event status register

bit 7: PON	The power has been turned on again. Since this register was last read, the unit has been powered off and on.
bit 6: URQ	User request: not used.
bit 5: CME	Command error. There is an error in a command that has been received; either an error in syntax, or an error in meaning.
bit 4: EXE	Execution error. An error has occurred while executing a command. Range error; Mode error.
bit 3: DDE	Device dependent error. It has been impossible to execute some command, due to an error other than a command error, a query error, or an execution error.
bit 2: QYE	Query error. The queue is empty, or data loss has occurred (queue overflow)
bit 1:	Request for controller right (not used) Unused: 0
bit 0: OPC	Operation finished. Only set for the *OPC command.

Chapter 4

GP-IB Commands

4-1 Command Summary

(1) Standard commands specified by IEEE488.2

Command	Data (for a query, response data)	Explanation	Reference page	
*IDN?	Maker's name, model number, serial number, software version (not used, zero)	Queries device ID.	G-4-25	
*OPT?	Whether channel 1 input unit exists Whether channel 2 input unit exists . . . Whether channel 16 input unit exists	Queries device option provision.	G-4-25	
*RST		Device initial setting.	G-4-25	
*TST?	A<NR1> (0 = normal, 1 = failure)	Queries the result of the self-test.	G-4-25	
*OPC		Sets the LSB of SESR after all action has been completed.	G-4-26	
*OPC?	A<NR1>	Queries whether all action has been completed. ASCII [1] is the response.	G-4-26	
*WAI		Wait until action fully completed.	G-4-26	
*CLS		Clears the status byte and associated queues.	G-4-26	
*ESE A	A=0 to 255	Sets SESER.	G-4-26	
*ESE?	A<NR1> 0 to 255	Queries SESER.	G-4-27	
*ESR?	A<NR1>	Queries SESR.	G-4-27	
*SRE A	A= 0 to 255	Sets SRER.	G-4-27	
*SRE?	A<NR1> 0 to 63, 128 to 191	Queries SRER.		
*STB?	A<NR1> 0 to 255	Reads the STB and the MSS bit, without performing serial polling.	G-4-27	
:ESE0 A	A= 0 to 255	Writes ESER0.	G-4-28	} #
:ESE0?	A<NR1> 0 to 255	Reads ESER0.		
:ESR0?	A<NR1> 0 to 255	Reads ESR0.	G-4-28	

specific to the 8825.

(2) Commands specific to the 8825.

① Execution control etc. (common to all functions, except for the AUTO command)

Command	Data (for a query, response data)	Explanation	Ref page
:STARt		Same as the START key.	G-4-29
:STOP		Same as the STOP key.	G-4-29
:ABORT		Forced halt.	G-4-29
:PRINt		Same as the PRINT key.	G-4-29
:HCOPy		Same as the COPY key.	G-4-29
:FEED A	A=1 to 255 (unit mm)	Feeds the paper the specified distance.	G-4-30
:AUTO		Sets the time axis and the voltage axis automatically. Only the memory recorder function	G-4-30
:ERRor?	A <NR1> error number	Queries 8825 error number.	G-4-30
:HEADer A$	A$ = OFF,ON	Enables and disables headers.	G-4-30
:HEADer?	A$	Queries header enablement.	
:FUNCtion A$	A$ = MEM,REC,XYC, FFT	Changes the function.	G-4-31
:FUNCtion?	A$	Queries the function.	
:B4PRINt		Same as the FEED key + COPY key on the main unit.	G-4-31

② Setting and querying the time axis range (TIME/DIV), the shot length, etc.

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CONFigure				
:TDIV A	A = time per division (unit seconds)	Sets the time axis range	MEM, REC	G-4-31
:TDIV?	A<NR 3> (unit seconds)	Queries the time axis range		
:SHOT A	A = recording length (unit DIV)	Sets the recording length	MEM, REC	G-4-32
:SHOT?	A<NR 1> (unit DIV)	Queries the recording length		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT...FFT recorder function
ALL.... all MEM, REC, XYC, and FFT function.

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CONFigure				
:LOGGing A	A = 0.01 to 100 (MEM) 1 to 100 (REC)	Specifies the logging output interval	MEM, REC	G-4-32
:LOGGing?	A<NR 2>	Queries the logging output interval		
:FORmat A$	A$= SINGle, DUAL, QUAD, OCT, HEX, XYSingle, XYQuad (MEM) SINGle, DUAL, QUAD, OCT, HEX (REC) XYSingle , XYQuad (XYC) SINGle, DUAL, NYQuist, ARRay (FFT)	Sets the format.	MEM, REC, XYC, FFT	G-4-32
:FORmat?	A$	Queries the format.		
:DOTLine A$	A$ = DOT, LINE	Sets the interpolation function.	MEM, XYC, FFT	G-4-33
:DOTLine?	A$	Queries the interpolation function.		
:ATPRint A$	A$ = OFF, ON	Enables and disables auto print.	MEM, FFT	G-4-33
:ATPRint?	A$	Queries auto print enablement.		
:MEMAVERage A	A = 0, 2, 4, 8, 16, 32, 64, 128, 256, (0;OFF)	Sets the count for averaging.	MEM	G-4-33
:MEMAVERage ?	A<NR1>	Queries the current setting of the count for averaging.		
:PRKInd A$	A$ = WAVE, LOGging	Specifies the printer output style.	MEM, REC FFT	G-4-34
:PRKInd?	A$	Queries the printer output style.		
:ATSAve A$	A$ = OFF, ON	Enables and disables auto save.	MEM, REC, FFT	G-4-34
:ATSAve?	A$	Queries auto save enablement.		
:PRINt A$	A$ = OFF, ON (REC only)	Sets printer output.	REC	G-4-34
:PRINt?	A$	Queries printer output.		
:OVWRite A$	A$ = OFF, ON	Enables and disables waveform superimposition.	MEM	G-4-34
:OVWRite?	A$	Queries waveform superimposition enablement.		
:MEMDiv A$	A$ = OFF, SEQ, MULTI	Sets the memory division function.	MEM	G-4-35
:MEMDiv?	A$	Queries the memory division function.		
:MAXBlock A	A = 3,7,15,31,63 (in multi-block function); A = 2 to 63 (in sequential save function)	Sets the memory block number (in sequential save and multi-block function)	MEM	G-4-35
:MAXBlock?	A<NR 1>	Queries the memory block number		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CONFigure				
:USEBlock A	A = 1 to number of memory divisions	Sets the number of the memory block used (in sequential save and multi-block function).	MEM	G-4-35
:USEBlock?	A<NR 1>	Queries the number of the memory block used.		
:REFBlock A	A = OFF, 1 to number of memory divisions	Sets the reference block (in multi-block function).	MEM	G-4-35
:REFBlock?	A<NR 1>	Queries the reference block.		
:WVCOmp A$	A$ = OFF, OUT, ALLOUT	Sets the waveform decision mode.	MEM, FFT	G-4-36
:WVCOmp?	A$	Queries the waveform decision mode.		
:CMPStop A$	A$ = GO, NG, G_N	Sets the waveform decision stop mode.	MEM, FFT	G-4-36
:CMPStop?	A$	Queries the waveform decision stop mode.		
:AVERage A	A = 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096	Sets the count for averaging in the FFT function.	FFT	G-4-36
:AVERage?	A<NR 1>	Queries the current setting of the count for averaging in the FFT function.		
:FFTAVKind A$	A$ = OFF, T_LIN, T_EXP, F_LIN, F_EXP, F_PEAK	Sets the averaging method.	FFT	G-4-36
:FFTAVKind?	A$	Queries the currently set averaging method as character data.		
:FFTINTerval A	A = 1000, 2000, 4000	Sets the FFT array display interval.	FFT	G-4-37
:FFTINTerval ?	A<NR 1>	Queries the currently set FFT array display interval.		
:FFTMode A, ch1$ (,ch2$)	A = 1, 2 ch1$, ch2$ = CH1 to CH16	Sets the FFT channel mode.	FFT	G-4-37
:FFTMode?	A<NR 1>, ch1$, ch2$	Queries the current FFT channel mode.		
:FFTWind A$ (,B)	A$ = RECTan, HANNing, EXPOnential B = 0 to 99 (%)	Sets the window function.	FFT	G-4-37
:FFTWind?	A$, B<NR 1>	Queries the current window function.		
:FFTFunction A$, B$	A$ = G1, G2 B$ = STR, LIN, RMS, PSP, ACR, HIS, OCT, TRF, COH, CSP, CCR, IMP	Sets the FFT analysis mode.	FFT	G-4-38
:FFTFunction? A$	A$, B$	Queries the current FFT analysis mode.		
:FFTRef A$	A$ = NEW, MEM	Designates the source for FFT data.	FFT	G-4-39
:FFTRef?	A$	Queries the current FFT data source.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CONFigure				
:FFTSCale A$, B$	A$ = G1, G2 B$ = AUTO, MANUal	Sets the display scaling method for a graph.	FFT	G-4-39
:FFTSCale? A$	A$, B$	Queries the current display scaling method for a graph.		
:FFTUp A$, B	A$ = G1, G2 B = -9.999E+29 to +9.999E+29	Sets the FFT vertical axis upper limit for a graph.	FFT	G-4-39
:FFTUp? A$	A$, B<NR3>	Queries the current FFT display scale vertical axis upper limit for a graph.		
:FFTLow A$, B	A$ = G1, G2 B = -9.999E+29 to +9.999E+29	Sets the FFT display scale vertical axis lower limit for a graph.	FFT	G-4-40
:FFTLow? A$	A$, B<NR3>	Queries the current FFT display scale vertical axis lower limit for a graph.		
:FFTXaxis A$, B$	A$ = G1, G2 B$ = 1_1oct, 1_3oct, (octave analysis) LINhz, LOGhz (otherwise)	Sets the x-axis.	FFT	G-4-40
:FFTXaxis? A$	A$, B$	Queries the present x-axis setting.		
:FFTYaxis A$, B$	A$ = G1, G2 B$ = LINMAg, LINREal, LINIMag, LOGMAg, PHASE	Sets the y-axis.	FFT	G-4-40
:FFTYaxis? A$	A$, B$	Queries the present y-axis setting.		
:FREQ A	A = 80000, 40000, 20000, 8000, 4000, 2000, 800, 400, 200, 80, 40, 20, 8, 4, 2, 0.667, 0.333, 0.133	Sets the frequency range.	FFT	G-4-42
:FREQ	A<NR3>	Queries the currently set frequency range.		
:OCTFilter A$	A$ = NORMal, SHARp	Sets the type of octave filter.	FFT	G-4-42
:OCTFilter?	A$	Queries the currently set type of octave filter.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

③ Setting and querying trigger source, level, etc.

Command	Data (for a query, response data)	Explanation	Function	Ref page
:TRIGger	(ch$ = CH1 to CH8)			
:KIND ch$, A$	A$ = OFF, LEVEl, LOGIc, IN, OUT	Sets type of trigger for the indicated channel.	All	G-4-43
:KIND? ch$	ch$, A$	Queries type of trigger for the indicated channel.		
:EXTErnal A$	A$ = OFF, ON	Enables and disables external trigger.	All	G-4-43
:EXTErnal?	A$	Queries external trigger enablement.		
:SOURce A$	A$ = OR, AND	Sets trigger logical operator to AND or OR.	All	G-4-43
:SOURce?	A$	Queries trigger logical operator (AND or OR).		
:LEVEl ch$, A	A = trigger level (unit volts)	Sets the trigger level of the indicated channel.	All	G-4-44
:LEVEl? ch$	ch$, A<NR 3>	Queries the trigger level of the indicated channel.		
:SLOPe ch$, A$	A$ = UP, DOWN	Sets the trigger direction (slope) of the indicated channel.	All	G-4-44
:SLOPe? ch$	ch$, A$	Queries the trigger direction (slope) of the indicated channel.		
:FILTer ch$, A	A = 0 (OFF), 0.1, 0.2, 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10.0 (DIV)	Sets filter width of level or logic trigger.	All	G-4-44
:FILTer? ch$	ch$ A<NR2>	Queries filter width of level or logic trigger.		
:UPPEr ch$, A	A = upper limit level (unit volts)	Sets upper limit level of window trigger or out trigger.	All	G-4-45
:UPPEr?, ch$	ch$, A<NR 3>	Queries upper limit level of window trigger or out trigger.		
:LOWEr ch$, A	A = lower limit level (unit volts)	Sets lower limit level of window trigger or out trigger.	All	G-4-45
:LOWEr?, ch$	ch$ A <NR3>	Queries lower limit level of window trigger or out trigger.		
:LOGPat ch$, "A$"	A$ = XXXX trigger pattern (X, 0, 1)	Sets the trigger pattern for a logic trigger.	All	G-4-45
:LOGPat?, ch$	ch$ "A$"	Queries the trigger pattern for a logic trigger.		
:LOGAnd ch$, A$	A$ = OR, AND	Sets AND/OR for the logic trigger pattern.	All	G-4-45
:LOGAnd?, ch$	ch$ A$	Queries AND/OR for the logic trigger pattern.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:TRIGger	(ch$ = CH1 to CH8)			
:MODE A$	A$ = SINGle, REPEat (REC) SINGle, REPEat, AUTO (MEM, FFT)	Sets trigger mode.	MEM, REC, FFT	G-4-46
:MODE?	A$	Queries trigger mode.		
:PRETrig A	A = 0,2, 5, 10, 20,...90, 95, 100, and -95 (%)	Sets pre-trigger.	MEM, FFT	G-4-46
:PRETrig?	A<NR 1> (unit %)	Queries pre-trigger		
:TIMIng A$	A$ = START, STOP, S_S	Sets trigger timing.	REC, XYC	G-4-46
:TIMIng?	A$	Queries trigger timing.		
:TIMEr A$	A$ = OFF, ON	Sets timer trigger.	All	G-4-46
:TIMEr?	A$	Queries timer trigger.		
:TMSTArt month, day, hour, min	<month> = 1 to 12 <day> = 1 to 31 <hour> = 0 to 23 <min> = 0 to 59	Sets start time of timer trigger.	All	G-4-47
:TMSTArt?	month, day, hour, min (all <NR 1>)	Queries start time of timer trigger.		
:TMSTOp	Same as :TMSTArt	Sets stop time of timer trigger.	All	G-4-47
:TMSTOp?	Same as :TMSTArt?	Queries stop time of timer trigger.		
:TMINTvl hour, min, sec	<hour> = 0 to 23 <min> = 0 to 59 <sec> = 0 to 59	Sets time interval for timer trigger.	All	G-4-47
:TMINTvl?	hour, min, sec (all <NR1>)	Queries time interval for timer trigger.		
:DETECTTime hour, min, sec	hour = 0 to 23 min = 0 to 59 sec = 0 to 59	Sets the time point for trigger detection.	All	G-4-48
:DETECTTime?	hour, min, sec (all <NR1>)	Queries the currently set time point for trigger detection.		
:DETECTDate year, month, day	year = 0 to 99 month = 1 to 12 day = 1 to 31	Sets the date for trigger detection.	All	G-4-48
:DETECTDate?	year, month, day (all <NR1>)	Queries the currently set date for trigger detection.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recoeder function
ALL... all MEM, REC, XYC, and FFT function

④ Setting and querying input channel (voltage range, trigger, etc.)

Command	Data (for a query, response data)	Explanation	Function	Ref page
:UNIT	(ch$ = CH1 to CH16)			
:RANGe ch$, A	A = voltage range (unit volts) temperature range (unit degree centigrade)	Sets input channel voltage range	All	G-4-49
:RANGe? ch$	ch$, A<NR 3>	Queries input channel voltage range.		
:POSItion ch$, A	A = Position value (unit %)	Sets the origin position for an input channel.	All	G-4-49
:POSItion? ch$	ch$ A<NR 1>	Queries the origin position for an input channel.		
:COUPling ch$, A$	A$ = GND, DC	Sets input channel coupling.	All	G-4-50
:COUPling? ch$	ch$, A$	Queries input channel coupling.		
:FILTer ch$, A$	A= 0, 5, 500 (unit Hz) 0, 1.5, 5 (temperature unit) (0;OFF)	Sets input channel filter.	All	G-4-50
:FILTer?ch$	ch$, A<NR 2>	Queries input channel filter.		
:ADJUST		Carries out zero adjustment for the input units.	All	G-4-50
:SENSor ch$, A$	A$ = K, J, T	Sets the type of a temperature input unit sensor.	All	G-4-50
:SENSor? ch$	ch$, A$	Queries the type of a temperature input unit sensor.		
:AAFilter A$, B$	A$ = CH1 to CH16 B$ = OFF, ON	Turns on or off the FFT anti-aliasing filter.	MEM, FFT	G-4-51
:AAFilter? A$	A$, B$	Queries the current on or off state of the FFT anti-aliasing filter.		

⑤ Setting and querying changeover of the screen mode (status, trigger, etc.), OFF, DARK, and LIGHT settings for the waveform, and so on.

Command	Data (for a query, response data)	Explanation	Function	Ref page
:DISPlay	ch$ = CH1 to CH16			
:CHANge A$	A$ = SYSTem, STATus, CHANnel, DISPlay	Changes over the display screen.	All	G-4-51
:CHANge?	A$	Queries the display screen.		
:DRAWing ch$, A$	A$ = OFF, DARK, LIGHT, NORMal	Sets display and recording intensity for waveform.	MEM REC XYC	G-4-51
:DRAWing? ch$	ch$, A$	Queries display and recording of a waveform.		
:SIZE A$	A$ = NORMal, WIDE	Sets the waveform display screen size.	MEM REC XYC	G-4-52
:SIZE?	A$	Queries the waveform display screen size.		
:GRAPh ch$, A	A = 1,2,3,4 (for dual format, 1, 2)	Sets waveform display graph in dual and quad format.	MEM, REC	G-4-52
:GRAPh? ch$	ch$, A<NR1>	Queries waveform display graph in dual and quad format.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recoeder function
ALL... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:DISPlay	ch$ = CH1 to CH16			
:LOGDraw ch$, A$	A$ = OFF, ON In this command ch$ = CHA to CHH	Enables and disables display and recording of logic waveform.	MEM REC	G-4-52
:LOGDraw? ch$	A$	Queries display and recording enablement of logic waveform.		
:XMAG A$	A$ = X 10, X 5, X 2, X 1, X 1_2, X 1_5, X 1_10, X 1_20 X 1_50, X 1_100, X 1_200, (X 1_500, X 1_1000)	Sets the zoom factor on the time axis.	MEM	G-4-52
:XMAG?	A$	Queries the zoom factor on the time axis.		
:YMAG ch$, A$	A$ = X 1_8, X 1_4, X 1_2, X 1, X 2, X 4, X 8, X 16	Sets the zoom factor on the voltage axis.	MEM REC FFT	G-4-53
:YMAG? ch$	ch$, A$	Queries the zoom factor on the voltage axis.		
:XYDRawing A, B$	A = 1 to 4 B$=OFF, LIGHT, NORMal, DARK	Sets the drawing level for an X-Y plot.	MEM, XYC	G-4-53
:XYDRawing? A	A<NR1>, B$	Queries the drawing level for an X-Y plot.		
:XAXIs A, ch$	A = 1 to 4	In XY format, sets the X axis.	MEM, XYC	G-4-54
:XAXIs? A	A<NR1>, ch$	In XY format, queries the X axis.		
:YAXIs A, ch$	A = 1 to 4	In XY format, set the Y axis	MEM XYC	G-4-54
:YAXIs? A	A<NR1>, ch$	In XY format, queries the Y axis		
:WAVE A$	A$ = ACUR (A-cursor), TRIG (trigger point), POINT (the point set with :MEMOry:POINt)	Executes waveform display.	MEM	G-4-54
:XYCLr A$	A$ = OFF, ON	Sets the display clear function in the X-Y recorder function off or on.	XYC	G-4-54
:XYCLr?	A$	Queries the setting of the display clear function in the X-Y recorder function.		
:VARIable ch$, A$	A$ = ON, OFF	Sets the variable function.	All	G-4-55
:VARIable? ch$	A$	Queries the variable function.		
:VARIUPLOw ch$, B, C	B = C = -9.9999E + 29 to +9.9999E +29	Sets the upper and lower limit values of the variable.	All	G-4-55
:VARIUPLOw? ch$	B<NR3>	Queries the upper and lower limit values of the variable.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

⑥ Setting and querying the system screen

Command	Data (for a query, response data)	Explanation	Function	Ref page
:SYSTem				
:CRTOff A$	A$ = ON, OFF	Enables and disables the screen saver function.	All	G-4-56
:CRTOff?	A$	Queries enablement of the screen saver function.		
:GRID A$	A$ = OFF, NORMal, FINE cm, FINEDiv	Sets the grid type.	All	G-4-56
:GRID?	A$	Queries the grid type.		
:STARt A$	A$ = ON, OFF	Enables and disables start key backup.	All	G-4-56
:STARt?	A$	Queries start key backup enablement.		
:CHMArk A$	A$ = ON, OFF	Enables and disables channel markers.	All	G-4-56
:CHMArk?	A$	Queries enablement of channel markers.		
:BEEPer A$	A$ = ON, OFF	Enables and disables the beep sound.	All	G-4-57
:BEEPer?	A$	Queries beep sound enablement.		
:LIST A$	A$ = OFF, LIST, GAUGE, L_G	Sets list and gauge functions.	All	G-4-57
:LIST?	A$	Queries list and gauge functions.		
:SMOOth A$	A$ = ON, OFF	Enables and disables smooth printing.	MEM	G-4-57
:SMOOth?	A$	Queries smooth printing enablement.		
:ROLL A$	A$ = ON, OFF	Enables and disables roll mode.	MEM	G-4-57
:ROLL?	A$	Queries roll mode enablement.		
:TIME hour, min, sec	<hour> = 0 to 23 <min> = 0 to 59 <sec> = 0 to 59	Sets the time.	All	G-4-58
:TIME?	hour, min, and sec all<NR1>	Queries the current time.		
:DATE year, month, day	<year> = 0 to 99 <month> = 1 to 12 <day> = 1 to 31	Sets the calendar.	All	G-4-58
:DATE?	year, month, day (all<NR 1>)	Queries the calendar.		
:USECH A	A = 2,4,8,16	Sets number of channels used.	MEM REC FFT	G-4-58
:USECH?	A<NR 1>	Queries number of channels used.		
:DATAClear		Clear waveform data	All	G-4-58
:TMAXis A$	A$ = TIME, TIME(60), DIV	Sets the time axis display.	All	G-4-59
:TMAXis?	A$	Queries the time axis display.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

⑦ Setting and querying input and output, etc., from the memory

Command	Data (for a query, response data)	Explanation	Function	Ref page
:MEMory	(ch$ = CH1 to CH16)			
:POINt ch$, A	A = 0 to 2000000	Sets point in memory for input and output.	MEM	G-4-59
:POINt?ch$,	A<NR 1> = 0 to 2000000	Queries point in memory for input and output.		
:MAXPoint?	A<NR 1> = 0: not stored 2500 to 2000000(÷ 100 = number of divisions)	Queries the amount of data stored.	MEM	G-4-59
:ADATa B, C, ...	B, C,...= 0 to 4095	Input data to memory (ASCII).	MEM	G-4-60
:ADATa? A	A = 1 to 40 (number of output units) B, C,...<NR1> = 0 to 4095	Output data from memory.		
:VDATa B, C,...	B, C,...= voltage values (units V)	Input data to memory (voltage values).	MEM	G-4-61
:VDATa? A	A = 1 to 10 (amount of data) B, C,...<NR1>= voltage value (units v)	Output stored data.		
:AREAl? ch$	A<NR 1> = 0 to 4095	Output stored data. Real time data output	MEM	G-4-61
:VREAl? ch$	A<NR 3> = voltage value (units V)	Real time data output (voltage value)		
:LDATa A, B,...	A, B,...= 0 to 15	Input logic data to memory.	MEM	G-4-62
:LDATa? A	A = 1 to 50 (amount of output data) Response data <NR1>= 0 to 15	Output logic data from memory.		
:PREPare		Prepares the memory for receipt of waveform data.	MEM	G-4-63
:FFTData?	"A unit, B unit" A = x-axis data <NR3> B = y-axis data <NR3>	Queries FFT data at the output point.	FFT	G-4-63
:FFTPOint A$, B	A$ = G1, G2 (for array format, G1 to G10) B = 0 to 999 (STR, ACR, CCR, or IMP) 0 to 400 (LIN, RMS, PSP, TRF, CSP,or COH) 0 to 399 (HIS or OCT)	Sets the output point for FFT data.	FFT	G-4-63
:FFTPOint?	A$, B<NR3>	Queries the current output point for FFT data.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

⑧ Cursor setting and reading

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CURSor	(ch$ = CH1 to CH16)			
:MODE A$	A$ = OFF, TIME, VOLT, (REC) OFF, Xcur, Ycur, TRACe (XY Single, and XYQuad in MEM) OFF, TIME, VOLT, TRACe (MEM excluding XYSingle and XYQuad) OFF, Xcur, Ycur (XYC) OFF, TRACe (FFT)	Sets the A and B cursor type.	All	G-4-64
:MODE?	A$	Queries the A and B cursor type.		
:ABCUrsor A$	A$ = A, B, A_B	Chooses between the A,B and the A&B cursors.	All	G-4-64
:ABCUrsor?	A$	Queries between the A,B and the A&B cursors.		
:ACHAnnel ch$	For XYC function, ch$ = X1 to X4	Sets the A cursor channel.	MEM REC XYC	G-4-64
:ACHAnnel?	ch$	Queries the A cursor channel.		
:BCHAnnel ch$	For XYC function, ch$ = X1 to X4	Sets the B cursor channel.	MEM REC XYC	G-4-64
:BCHAnnel?	ch$	Queries the B cursor channel.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
ALL... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CURSor	(ch$ = CH1 to CH16)			
:APOSition A	(vertical cursor, trace cursor) A = 0 to amount of stored data: MEM 0 to amount of stored data:REC 0 to 480:XYC 0 to 999: FFT (STR, ACR, CCR, IMP) 0 to 400: FFT (LIN, RMS, PSP, TRF, COH, CSP) 0 to 399: FFT (HIS, OCT) (horizontal cursor) A = 0 to 479:MEM,REC 0 to 479:XY	Sets the position of the A cursor.	All	G-4-65
:APOSition?	A<NR 1>	Queries the position of the A cursor.		
:BPOSition A	(vertical cursor, trace cursor) A = 0 to amount of stored data: MEM 0 to amount of stored data:REC 0 to 480:XY 0 to 999: FFT (STR, ACR, CCR, IMP) 0 to 400: FFT (LIN, RMS, PSP, TRF, COH, CSP) 0 to 399: FFT (HIS, OCT) (horizontal cursor) A = 0 to 479:MEMORY,REC 0 to 479:XY	Sets the position of the B cursor.	All	G-4-65
:BPOSition?	A<NR 1>	Queries the position of the B cursor.		
:DTREad? A$	B$ A$=A, B, A-B B$ = readout value (t)	Query the cursor readout value (t)	All	G-4-66
:DVREad? A$	B$ A$=A, B, A-B B$ = readout value (v)	Query the cursor readout value (t)	All	G-4-66
:ABCHAnnel A$	A$ = G1, G2 (when in ARRAY format, G1 to G10)	Sets the graph for the A and B cursors.	FFT	G-4-67
:ABCHAnnel?	A$	Queries the current graph setting for the A and B cursors.		
:DFREad? A$	"B, C" A$ = A, B, A_B B = x-axis data C = y-axis data	Queries the current cursor readout position.	FFT	G-4-67

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT... FFT recorder function
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⑨ Setting and querying comments

Command	Data (for a query, response data)	Explanation	Function	Ref page
:COMMent				
:TITLe A$, "B$"	A$ = ON, OFF; B$ = comment string (20 characters)	Sets a title comment.	All	G-4-68
:TITLe?	"B$"	Queries a title comment.		
:EACHch A$	A$ = ON,OFF	Enables or disables comments for all channels.	All	G-4-68
:EACHch?	A$	Queries whether comments for all channels are enabled or disabled.		
:CH ch$, A$,	ch$ = CH1 to CH16; CHA to CHH A$ = comment string (20 characters)	Sets a comment for a particular channel	All	G-4-68
:CH? ch$	"A$"	Queries comment for a particular channel.		

⑩ Setting and querying scaling

Command	Data (for a query, response data)	Explanation	Function	Ref page
:SCALing				
:SET ch$, A$	ch$ = CH1 to CH16 A$=OFF,SCI(ON), ENG	Sets scaling type.	All	G-4-69
:SET? ch$	A$	Queries scaling type.		
:KIND A$	A$ = RATIO, POINT	Sets the type of scaling.	All	G-4-69
:KIND?	A$	Queries the type of scaling.		
:VOLT A$, B	A$ = CH1 to CH16 B = -9.999E+9 to 9.999E+9	Sets the scaling conversion value.	All	G-4-69
:VOLT? A$	B<NR3>	Queries the scaling conversion value.		
:OFFSet A$, B	A$ =CH1 to CH16 B = scaling offset (-9.999E+9 to +9.999E+9)	Sets scaling offset.	All	G-4-69
:OFFSet? A$	B<NR3>	Queries scaling offset.		
:UNIT A$ "B$"	A$ =CH1 to CH16 B$ = scaling unit (7 characters)	Sets scaling unit.	All	G-4-70
:UNIT A$	"B$"	Queries scaling unit.		
:VOUPLOw ch$, B, C	B=C=-9.9999E+29 to +9.9999E+29	Sets the scaling VOLT UP, VOLT LO.	All	G-4-70
:VOUPLOw ch$	B<NR3>	Queries the scaling VOLT UP, VOLT LO.		
:SCUPLOw ch$, B, C	B=C=-9.9999E+29 to +9.9999E+29	Sets the scaling SC UP, SC LOW.	All	G-4-70
:SCUPLOw ch$	B<NR3>	Queries the scaling SC UP, SC LOW.		

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XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

⑪ Calculation setting and querying

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CALCulate				
:WVCALc A$	A$ = ON, OFF, EXEC (execute)	Enables and disables waveform processing calculation.	MEM	G-4-71
:WVCALc?	A$	Queries enablement of waveform processing calculation.		
:MEASure A$	A$ = ON, OFF, EXEC (execute)	Enables and disables waveform parameter calculation.	MEM	G-4-71
:MEASure?	A$	Queries enablement of waveform parameter calculation.		
:MEASPrint A$	A$ = OFF, ON	Enables and disables printing of waveform parameter calculation values.	MEM	G-4-72
:MEASPrint?	A$	Queries enablement of printing of waveform parameter calculation values.		
:Z1 A$, B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z1	MEM	G-4-72
:Z1?	A$, B$, C$	Queries the coefficients for the waveform processing calculation equation for Z1		
:Z2 A$, B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z2	MEM	G-4-72
:Z2?	A$, B$, C$	Queries the coefficients for the waveform processing calculation equation for Z2		
:Z3 A$, B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z3	MEM	G-4-73
:Z3?	A$, B$, C$, D$	Queries the coefficients for the waveform processing calculation equation for Z3		
:Z4 A$, B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z4	MEM	G-4-73
:Z4?	A$, B$, C$, D$	Queries the coefficients for the waveform processing calculation equation for Z4		
:Z5 A$, B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z5.	MEM	G-4-74
:Z5?	A$, B$, C$	Queries the coefficients for the waveform processing calculation equation for Z5.		
:Z6 A$, B$, C$, D$	A$, B$, C$ = A to P DS = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z6.	MEM	G-4-74
:Z6?	A$, B$, C$	Queries the coefficients for the waveform processing calculation equation for Z6.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CALCulate				
:Z7 A$. B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z7.	MEM	G-4-75
:Z7?	A$, B$, C$	Queries the coefficients for the waveform processing calculation equation for Z7.		
:Z8 A$. B$, C$, D$	A$, B$, C$ = A to P D$ = PLUS, MINUS, MULT, DIVI	Sets the coefficients for the waveform processing calculation equation for Z8.	MEM	G-4-75
:Z8?	A$, B$, C$	Queries the coefficients for the waveform processing calculation equation for Z8.		
:X1 A$, ch$, B$	A$ = OFF(ch$,B$ are disregarded) PAR,ABS,EXP,LOG,SQR,MOV, DIF,INT,DIF2,INT2,SLI ch$ = CH1 to CH16 B$ = A to P (when A$ = MOV, a value from 1 to 4000;when SLI, a value from -4000 to 4000)	Sets calculation equation for X1.	MEM	G-4-76
:X1?	A$, ch$, B$	Queries calculation equation for X1.		
:X2 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1)	Sets calculation equation for X2.	MEM	G-4-77
:X2?	A$, ch$, B$	Queries calculation equation for X2.		
:X3 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1,Z2)	Sets calculation equation for X3.	MEM	G-4-78
:X3?	A$, ch$, B$	Queries calculation equation for X3.		
:X4 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1 to Z3)	Sets calculation equation for X4.	MEM	G-4-79
:X4?	A$, ch$, B$	Queries calculation equation for X4.		
:X5 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1 to Z4)	Sets calculation equation for X5.	MEM	G-4-80
:X5?	A$, ch$, B$	Queries calculation equation for X5.		
:X6 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1 to Z5)	Sets calculation equation for X6.	MEM	G-4-81
:X6?	A$, ch$, B$	Queries calculation equation for X6.		
:X7 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1 to Z6)	Sets calculation equation for X7.	MEM	G-4-82
:X7?	A$, ch$, B$	Queries calculation equation for X7.		
:X8 A$, ch$, B$	Same as X1 (ch$ = CH1 to CH16, Z1 to Z7)	Sets calculation equation for X8.	MEM	G-4-83
:X8?	A$, ch$, B$	Queries calculation equation for X8.		

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CALCulate				
:Y1 A$, ch$, B$	A$ = OFF(ch$,B$ are disregarded) PAR,ABS,EXP,LOG,SQR,MOV, DIF,INT,DIF2,INT2,SLI ch$ = CH1 to CH16 B$ = A to P(when A$ = MOV, a value from 1 to 4000;when SLI, a value from -4000 to 4000)	Sets calculation equation for Y1.	MEM	G-4-84
:Y1?	A$, ch$, B$	Queries calculation equation for Y1.		
:Y2 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1)	Sets calculation equation for Y2.	MEM	G-4-85
:Y2?	A$, ch$, B$	Queries calculation equation for Y2		
:Y3 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1, Z2)	Sets calculation equation for Y3.	MEM	G-4-86
:Y3?	A$, ch$, B$	Queries calculation equation for Y3.		
:Y4 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1 to Z3)	Sets calculation equation for Y4.	MEM	G-4-87
:Y4?	A$, ch$, B$	Queries calculation equation for Y4.		
:Y5 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1 to Z4)	Sets calculation equation for Y5.	MEM	G-4-88
:Y5?	A$, ch$, B$	Queries calculation equation for Y5.		
:Y6 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1 to Z5)	Sets calculation equation for Y6.	MEM	G-4-89
:Y6?	A$, ch$, B$	Queries calculation equation for Y6.		
:Y7 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1 to Z6)	Sets calculation equation for Y7.	MEM	G-4-90
:Y7?	A$, ch$, B$	Queries calculation equation for Y7.		
:Y8 A$, ch$, B$	Same as Y1 (ch$ = CH1 to CH16, Z1 to Z7)	Sets calculation equation for Y8.	MEM	G-4-91
:Y8?	A$, ch$, B$	Queries calculation equation for Y8.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CALCulate				
:FACTor A$, B	A$ = A to P B= -9.999E+9 to +9.999E+9	Sets the value of calculation equation coefficient a to p.	MEM	G-4-92
:FACTor? A$	B<NR3>	Queries the value of calculation equation coefficient a to p.		
:Z1DIsplay ch$, A$, upper, lower	ch$ = CH1 to CH16 A$ = AUTO, MANUal (for manual) upper, lower = -9.9999E+29 to +9.9999E+29 (units v)	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z1.	MEM	G-4-92
:Z1DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z1.		
:Z2DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z2.	MEM	G-4-93
:Z2DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z2.		
:Z3DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z3.	MEM	G-4-93
:Z3DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z3.		
:Z4DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z4.	MEM	G-4-94
:Z4DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z4.		
:Z5DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z5.	MEM	G-4-94
:Z5DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z5.		
:Z6DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z6.	MEM	G-4-95
:Z6DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z6.		
:Z7DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z7.	MEM	G-4-95
:Z7DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z7.		
:Z8DIsplay ch$, A$, upper, lower	Same as Z1DIsplay	Sets the channel for receipt of the calculated result of the waveform treatment calculation equation for Z8.	MEM	G-4-96
:Z8DIsplay?	ch$, A$, upper, lower	Queries the channel for receipt of the calculated result of the waveform treatment calculation equation for Z8.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

Command	Data (for a query, response data)	Explanation	Function	Ref page
:CALCulate				
:ANSWer? A$,B$	C$, D A$ = NO 1 to NO 4 B$ = CH1 to CH16 C$=NONE, MIN, MAX, MINT, MAXT, PP, AVE, RMS, AREA, PERI, FREQ, RISE, FALL, XYAREA D<NR3>=calculation result	Queries a waveform parameter calculation result. Waveform parameter calculation result response.	MEM	G-4-96
:MEASSet NO$, A$, ch$	NO$ = NO1 to NO4 A$=OFF(not when NO$ = NO1), MAX,MIN,MAXT,MINT,PP, AVE,RMS,AREA,PERI,FREQ, RISE,FALL,XYAREA ch$ = CH1 to CH16,ALL	Sets waveform parameter calculation.	MEM	G-4-97
:MEASSet? NO$	A$, ch$	Queries waveform parameter calculation.		
:COMP NO$, A$	NO$ = NO1 to NO4 A$ = ON, OFF	Enables or disables waveform parameter decision calculations.	MEM	G-4-98
:COMP? NO$	A$	Queries enablement of waveform parameter decision calculations.		
:COMPArea NO$, upper, lower	NO$ = NO1 to NO4 upper,lower = -9.999E+9 to +9.999E+9	Sets upper limit and lower limit values for waveform parameter calculation decision.	MEM	G-4-98
:COMPArea? NO$	upper<NR3>, lower<NR3>	Queries upper limit and lower limit values for waveform parameter calculation decision.		

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

⑫ Commands relating to the floppy disk drive

Command	Data (for a query, response data)	Explanation	Function	Ref page
:FDISK				
:MODE A$	A$ = ON, OFF	Enables or disables the floppy disk mode.	All	G-4-99
:MODE?	A$	Queries enablement of the floppy disk mode		
:LOAD NO A$	NO = file number A$ = FULL, MINImum, STARt, APPEnd	Executes a load from the floppy disk	All	G-4-99
:SAVE "NAME1$.NAME2$", A$, B$,	NAME1$ = file name (8 characters); NAME2$ = file extension (3 characters); A$ = type of data to save W : measurement data (MEM, REC, FFT) F : unit settings A : waveform decision area (MEM, FFT) B$ = channels to save (when A$ = W), ALL, CH1 to CH16, LOG A (logic channel) LOG E (logic channel)	Performs a save to the floppy disk LOG A = CHA to CHD LOG E = CHE to CHH	All	G-4-100
:DELEte	NO = file number	Deletes a file from the floppy disk (in floppy disk mode).	All	G-4-100
:FORMat		Formats a floppy disk (in floppy disk mode).	All	G-4-101
:FILE?	A<NR 1> = number of files	Queries how many files are saved on the floppy disk	All	G-4-101
:NINFor? A	A, "NAME$" A = file number NAME$ = file name	Queries filename on floppy disk	All	G-4-101
:INFOr? "NAME$"	"NAME$", A, B$, "DATE$", "TIME$", B NAME$ = file name A = file number (if no file exists, then -1) B$ = type of data saved W : measurement data F : conditions of creation A : waveform decision area N : no such file DATE$ = year/month/day of save TIME$ = hour:min:sec of save B = file size	The response from the floppy disk	All	G-4-101

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

⑬ Commands relating to graphics

Command	Data (for a query, response data)	Explanation	Function	Ref page
:GRAPh				
:EDIT A$	A$ = OFF, ON	Enables and disables the editor.	MEM FFT	G-4-102
:EDIT?	A$	Queries editor enablement.		
: LINE X1, Y1 X2, Y2	X 1, X2 = x-coordinates Y1, Y2 = y-coordinates	Draws a line from (X1, Y1) to (X2, Y2).	MEM FFT	G-4-102
: PARAllel high, low right, left	high = 0 to 23.95 (div) low = 0 to 23.95 (div) right = 0 to 24.95 (div) left = 0 to 24.95 (div)	Carries out a parallel movement of the drawing.	MEM FFT	G-4-103
: PAINT X, Y	X = x-coordinate, Y = y-coordinate	Begins solid fill from the point specified by (X, Y).	MEM FFT	G-4-103
: ERASe X1, Y1 X2, Y2	X 1, X2 = x-coordinates Y1, Y2 = y-coordinates	Erases from (X1, Y1) to (X2, Y2).	MEM FFT	G-4-103
: STORage		Loads a waveform into the editor.	MEM FFT	G-4-103
:REVErse		Reverses the drawing	MEM FFT	G-4-103
:ALLClear		Clears the entire drawing	MEM FFT	G-4-104
: CLEAr X1, Y1, X2, Y2	X 1, X2 = x-coordinate Y1, Y2 = y-coordinate	Clears the rectangle with the points (X1, Y1) and (X2, Y2) at diagonally opposite corners.	MEM FFT	G-4-104
: UNDO		Reverses the effect of the immediately previous editor command.	MEM FFT	G-4-104
: SAVE		Saves the decision area created with the editor.	MEM FFT	G-4-104
:POINt X,Y, A	X = x-coordinates, Y = y-coordinates A = 0,1	Set waveform decision area data.	MEM FFT	G-4-104

MEM ... memory recorder function REC ... recorder function
XYC ... XY recorder function FFT ... FFT recorder function
ALL ... all MEM, REC, XYC, and FFT function

4-2 Command Reference

The following sections describe the format and functions of individual commands.

The following is an example of how the descriptions are organized.

① Changes and queries the function selection.

② Syntax

(command) :FUNCtion A$

(query) :FUNCtion?

(response) A$ = MEM : memory recorder function
REC : recorder function
XYC : XY recorder function
FFT : FFT recorder function

③ Explanation

(command) Switches to the function designated by A$.

(query) Returns the name of the current function as character data.

④ Example

:FUNCTION MEM

The function is set to the memory recorder function.

⑤ When allowed

In all functions.

① Command function

② Command syntax

(command) gives the syntax of a command program message, (query) the syntax of a query program message, and (response) the format of the response message. The parameters, referred to as data, are shown as follows:

A, B, C,...	Numerical data (e.g. 1.5, 10E-3)
A$, B$, ...	Character data (e.g. A, A_B, C1)
"A", "A$",...	Character string data (e.g. "1.5", "mA")

The format of numerical data follows the formats <NR1>, <NR2>, and <NR3>, described on page G-3-6 above. If no format is mentioned, <NRf> format (i.e. any of the above) is accepted.

A <NR1>	Numerical parameter in NR1 format
B	Numerical parameter in NRf format

NR1 format - integer data.	Examples: +15, -20, 25
NR2 format - fixed point numbers.	Examples: +1.23, -4.56, 7.89
NR3 format - floating point numbers.	Examples: +1.0E-3, -2.3E+3
The term "NRf format" includes all these three formats.	

When the 8825 is receiving a command or query program message, it accepts format, but when it is sending it utilizes whichever one of the formats <NR1> to <NR3> is indicated in the particular command.

Response messages may or may not have headers prefixed, according to the setting made by the :HEADER command.

③ Explanation of the command function.

④ Example of command use.

⑤ This lists the functions in which the command may be used.

MEM	:	memory recorder function
REC	:	recorder function
XYC	:	X-Y recorder function
FFT	:	FFT recorder function
All	:	Any of the MEM, REC, XYC and FFT functions

Execution of commands

Commands are input into the input buffer and are executed in order.

However the :ABORT command is executed immediately, even if commands are waiting in the input buffer - more precisely, at the instant its terminator is received.

Commands other than those which can be handled by the 8825 in its current state are not executed but generate execution errors. This happens, for example, when in recorder function it is attempted to execute an FFT recorder mode setting.

Further, almost all commands cannot be executed during measurement operation.

4-3 Standard Commands Stipulated by IEEE488.2

A. System data commands and queries

(1) *IDN? command

Queries device ID.

Syntax (query) *IDN?

(response) HIOKI, 8825, 0, V1, 00
First field: Manufacturer's name
Second field: Model name
Third field: Serial number (not used: 0)
Fourth field: Software version

(2) *OPT? command

Queries device option provision.

Syntax (query) *OPT?

(response) Whether or not channel 1 input unit present; whether or not channel 2 input unit present; whether or not channel 3 input unit present ... whether or not channel 16 input unit present; memory capacity.
0: not present, 1M (9586 memory board)
1: input unit (8907 analog unit) present, 4M (9586-01 memory board)
3: FFT input unit (8909 FFT analog unit) present.
5: temperature input unit (8908 temperature unit) present.

B. Internal operation commands and queries

(1) *RST command

Device initial setting.

Syntax (command) *RST

Explanation Initializes the 8825 (same as system reset).
However, it does not clear GP-IB related items.
(the event registers and the enable registers)
(the input buffer and the output queue)

(2) *TST? command

Queries the result of the self-test.

Syntax (query) *TST?

(response) A<NR1>
A = 0 : normal, 1: failure

Explanation The result of the self-test of the 8825 is returned as an NR1 numerical value.

C. Synchronous commands and queries

(1) *OPC command

After all action has been completed during execution, sets the LSB (bit 0) of SESR (the standard event status register).

Syntax (command) *OPC

Explanation When the command preceding the *OPC command completes execution, the LSB of SESR is set.

Example A$;B$;*OPC;C$
After the execution of the commands A$ and B$ is completed, the LSB of SESR is set.

(2) *OPC? command

After execution is completed, replies with ASCII [1].

Syntax (query) *OPC?
(response) 1

Explanation When the command preceding the *OPC command completes execution, the response of ASCII [1] is made.

(3) *WAI command

After all execution is completed, subsequently performs the following command

Syntax (command) *WAI

Example "A$;B$;*WAI;C$"
The command following *WAI is not executed until the execution of the commands A$ and B$ is completed.

D. Status and event control commands and queries

(1) *CLS command

Clears the status byte and associated queues (except for the output queue).

Syntax (command) *CLS

Explanation This instruction clears the event register associated with each bit of the status byte register. Accordingly, it also clears the status byte register. However, because it does not clear the output queue, it has no effect upon bit 4 (MAV) of the status byte.

(2) *ESE command

Writes the standard event status enable register (SESER).

Syntax (command) *ESE A
A= 0 to 255

Sets the mask pattern of SESER to a value in the range 0 to 255. Outside this range, an execution error occurs. The initial value (when the power is turned on) is 0.

Example *ESE 36
Bit 5 and bit 2 of SESER are set.

(3) *ESE? command

Reads the standard event status enable register (SESER).

Syntax
(query) *ESE?
(response) A<NR 1>
A = 0 to 255

Explanation
The contents of SESER as set by the *ESE command are returned as an integral value in the range 0 to 255.

(4) *ESR? command

Reads out and queries the contents of the standard event status register (SESR).

Syntax
(query) *ESR?
(response) A<NR 1>

Explanation
The contents of SESR are returned as an NR1 numerical value.

(5) *SRE command

Writes the service request enable register (SRER).

Syntax
(command) *SRE A
A = 0 to 255

Explanation
Sets the mask pattern of SRER to a value in the range 0 to 255. Outside this range, an execution error occurs. However, the value of bit 6 is disregarded. The initial value (when the power is turned on) is 0.

Example
*SRE 33
Bits 5 and 0 of SRER are set.

(6) *SRE? command

Reads the service request enable register (SRER).

Syntax
(query) *SRE?
(responce) A<NR 1>
A = 0 to 63, 128 to 191

Explanation
The contents of SRER as set by the *SRE command are returned as an NR1 numerical value in the range 0 to 63, 128 to 191. Bit 6 is always 0.

(7) *STB? command

Reads the status byte and the MSS bit, without performing serial polling.

Syntax
(query) *STB?
(response) A<NR 1>
A = 0 to 255

Explanation
This is the same as reading out the status byte with serial polling. However, bit 6 is not RQS, but is MSS. (Refer to the description of the status byte and the event register).

(Commands specific to the 8825)

(8) :ESE0 command

Writes event status enable register 0 (ESER0)

Syntax

(command) :ESE0 A
A = 0 to 255

Explanation

Sets the mask pattern of ESER0 to a value in the range 0 to 255. Outside this range, an execution error occurs. The initial value (when the power is turned on) is 0.

Example

:ESE0 36
This sets bit 5 and bit 2 of ESER0.

(9) :ESE0? command

Reads event status enable register 0 (ESER0).

Syntax

(query) :ESE0?
(response) A<NR 1>
A = 0 to 255

Explanation

The contents of ESER0 are returned as an NR1 numerical value.

(10) :ESR0? command

Reads event status register 0 (ESR0).

Syntax

(query) :ESR0?
(response) A<NR 1>
A = 0 to 255

Explanation

The contents of ESR0 are returned as an NR1 numerical value, and ESR0 is cleared.

4-4 Commands Specific to the 8825

1. Execution control commands (common to all functions)

(1) :START command

Performs starting.

Syntax (command) :STARt

Unit Same as the START key.
Starts waveform sampling operation.

When allowed In all functions.

(2) :STOP command

Performs stopping.

Syntax (command) :STOP

Unit Same as the STOP key.
Terminates at the instant that waveform sampling operation is completed.

When allowed In all functions.

(3) :ABORT command

Aborts processing.

Syntax (command) :ABORT

Unit Same as the STOP key. Forced halt. Terminates even if waveform sampling operation is not yet completed. Also stops printer operation.

When allowed In all functions.

(4) :PRINT command

Performs printing.

Syntax (command) :PRINt

Unit Same as the PRINT key.

When allowed In all functions.

(5) :HCOPY command

Screendump function.

Syntax (command) :HCOPy

Unit Same as the COPY key. Produces a hard copy of the screen.

When allowed In all functions.

(6) :FEED command

Feeds printer paper.

Syntax (command) :FEED A
A= 1 to 255

Explanation Feeds the paper by a distance from 1 to 255 in millimeters determined by the numerical value in the data portion.

When allowed In all functions.

(7) :AUTO command

Performs automatic range setting.

Syntax (command) :AUTO

Unit Same as the AUTO key. Sets the time axis and the voltage axis automatically.

When allowed In the memory recorder function.

(8) :ERROR? command

Queries the 8825 error number.

Syntax (query) : ERRor?
(response) A<NR 1>
A = error no.

Explanation The type of error that has occurred on the 8825 is returned in <NR 1> as a numerical value. If an error occurs during execution of :ERROR? then the error number is cleared.

When allowed In all functions.

(9) :HEADER command

Enables and disables headers, and queries header enablement.

Syntax (command) :HEADer A$
(query) :HEADer?
(response) A$
A$ = OFF,ON

Explanation (command) Sets header enablement. When headers are enabled, responses to queries are prefixed by headers; when headers are disabled, responses are not so prefixed.
(query) Returns whether or not headers are prefixed to responses to queries. The initial toggle state for headers (when the power is turned on) is OFF.

Example When headers are disabled:
response to :HEADER? is OFF
When headers are enabled:
response to :HEADER? is :HEADER ON

When allowed In all functions.

(10) :FUNCTION command

Changes and queries the function selection.

Syntax

(command) :FUNCtion A$
(query) :FUNCtion?
(response) A$

A$= MEM : memory recorder function
REC : recorder function
XYC : XY recorder function
FFT: FFT recorder function

Explanation

(command) Switches to the function designated by A$.
(query) Returns the name of the current function as character data.

Example

:FUNCTION MEM
The function is set to the memory recorder function.

When allowed In all functions.

(11) :B4 PRINT command

Performs B4 size printing.

Syntax (command) :B4PRINt

Unit Same as the FEED key + COPY key.

When allowed In all functions.

2. CONFIGURE command (Sets and queries time axis range, recording length, etc.)

Sets and queries the time/div .

Syntax

(command) :CONFigure:TDIV A
(query) :CONFigure:TDIV?
(response) A<NR3>

Explanation

(command) Sets the time per division to a numerical value (unit seconds).
(query) Returns the currently set value of the time per division as an NR3numerical value.
(If an attempt is made to set the time per division to a non-permitted value, it will be set to the next range above that value.)

Example

: CONFIGURE:TDIV +500.0E-6
Sets the time per division to 500 μs.

When allowed In the memory recorder function, and the recorder function.

Sets and queries the recording length.

Syntax

(command) :CONFigure:SHOT A
(query) :CONFigure:SHOT?
(response) A<NR1>

Explanation

(command) Sets the numerical value of the recording length (unit divisions).
(query) Returns the currently set value of the recording length as an NR1 numerical value.
(For the recorder function, 0 = CONT).

Example

: CONFIGURE: SHOT 25
Sets the recording length to 25 divisions.

When allowed In the memory recorder function, and the recorder function.

Sets and queries the logging output interval.

Syntax

(command) :CONFigure:LOGGing A
(query) :CONFigure:LOGGing?
(response) A< NR2 >
A = 0.01 to 100 (memory recorder function)
1 to 100 (recorder function)

Explanation

(command) Sets the numerical value of the logging output interval.
(query) Returns the numerical value of the logging output interval.
For the memory recorder function the values are 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 (DIV)
For the recorder function the values are 1, 2, 5, 10, 20, 50, 100 (DIV)

When allowed In the recorder and memory function.

Sets and queries the format.

Syntax

(command) :CONFigure:FORMat A$
(query) :CONFigure:FORMat?
(response) A$
A$= SINGle, DUAL, QUAD, OCT, HEX, XY Single
XY Quad :MEM
SINGle, DUAL, QUAD, OCT, HEX : REC
XYSingle, XYQuad : XYC
SINGle, DUAL, NYQuist :ARRay :FFT

Explanation

(command) Sets the format.
(query) Returns the current format as character data.

Example

:CONFIGURE :FORMAT SINGLE
Sets the format to SINGLE.

When allowed In all function.

Sets and queries the interpolation function.

Syntax

(command) :CONFigure:DOTLine A$
(query) :CONFigure:DOTLine?
(response) A$
A$ = DOT, LINE

Explanation

(command) Sets the interpolation function (DOT or LINE).
(query) Returns the currently set interpolation as character data.

When allowed

In the memory recorder function and, the XY recorder function, and the FFT function.

Sets and queries the auto print function.

Syntax

(command) :CONFigure:ATPRint A$
(query) :CONFigure:ATPRint?
(response) A$
A$ = OFF,ON

Explanation

(command) Toggles the auto print function on and off.
(query) Returns the current setting of the auto print function as character data.

When allowed

In the memory recorder function, and the FFT function.

Sets and queries the count for averaging

Syntax

(command) :CONFigure:MEMAVERage A
(query) :CONFigure:MEMAVERage?
(response) A<NR 1>
A = 0 : OFF
= 2, 4, 8, 16, 32, 64, 128, 256

Explanation

(command) Sets the count for averaging.
(query) Returns the current setting of the count for averaging as an NR1 numerical value.

When allowed

In the memory function.

Sets and queries the printer output style.

Syntax

(command) :CONFigure:PRKInd A$
(query) :CONFigure:PRKInd?
(response) A$
A$= WAVE
LOGging

Explanation

(command) Sets the printer output style to be waveform or logging (numerical data).
(query) Returns the current setting of the printer output style.

When allowed In the memory recorder function, the recorder function, and the FFT function.

Sets and queries the auto save function.

Syntax

(command) :CONFigure:ATSAve A$
(query) :CONFigure:ATSAve?
(response) A$
A$ = OFF,ON

Explanation

(command) Toggles the auto save function on and off.
(query) Returns the current setting of the auto save function as character data.

When allowed In the memory recorder function, the recorder function, and the FFT function.

Sets and queries printer output.

Syntax

(command) :CONFigure:PRINt A$
(query) :CONFigure:PRINt?
(response) A$
A$= OFF
ON

Explanation

(command) Sets the printer output.
(query) Returns the currently set state of the printer output as character data.

When allowed In the recorder function.

Sets and queries the waveform superimposition function.

Syntax

(command) :CONFigure:OVWRite A$
(query) :CONFigure:OVWRite?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables and disables screen waveform superimposition.
(query) Returns the current setting of the waveform superimposition enablement as character data.

When allowed In the memory recorder function.

Sets and queries memory division.

Syntax

(command) :CONFigure:MEMDiv A$
(query) :CONFigure:MEMDiv?
(response) A$
A$= OFF
SEQ : sequential save
MULTI : multi-block

Explanation

(command) Sets the method of memory division recording.
(query) Returns the current setting for method of memory division recording as character data.

When allowed In the memory recorder function.

Sets and queries the number of memory blocks.

Syntax

(command) :CONFigure:MAXBlock A
(query) :CONFigure:MAXBlock?
(response) A<NR1>
A=2 to 63 (during multi-block operation, 3,7,15,31, or 63)

Explanation

(command) Sets the number of memory blocks.
(query) Returns the current number of memory blocks as an NR1 numerical value.

When allowed In the memory recorder function, when the memory division function is in use.

Sets and queries the division block used.

Syntax

(command) :CONFigure:USEBlock A
(query) :CONFigure:USEBlock?
(response) A<NR1>
A = 1 to number of memory divisions

Explanation

(command) During memory division, sets the block used.
(query) Returns the currently used block as an NR1 numerical value.

When allowed In the memory recorder function, when the memory division function is in use.

Sets and queries the reference block.

Syntax

(command) :CONFigure:REFBlock A
(query) :CONFigure:REFBlock?
(response) A<NR 1>
A = 1 to number of memory divisions
0 = OFF

Explanation

(command) In multi-block mode, sets the reference block.
(query) Returns the current reference block as an NR1 numerical value.

When allowed In the memory recorder function, when the memory division multi-block function is in use.

Sets and queries the waveform decision mode.

Syntax
(command) :CONFigure:WVCOmp A$
(query) :CONFigure:WVCOmp?
(response) A$
A$= OFF
OUT
ALLOUT

Explanation
(command) Sets the waveform decision mode.
(query) Returns the current waveform decision mode as character data.

When allowed In the memory recorder function and the FFT function.

Sets and queries the waveform decision stop mode.

Syntax
(command) :CONFigure:CMPStop A$
(query) :CONFigure:CMPStop?
(response) A$
A$= GO
NG
G_N

Explanation
(command) Sets the stop mode during waveform decision.
(query) Returns the current stop mode as character data.

When allowed In the memory recorder function, and the FFT function.

Sets and queries the count for averaging in the FFT function.

Syntax
(command) :CONFigure:AVERage A
(query) :CONFigure:AVERage?
(response) A <NR1>
A = 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096

Explanation
(command) Sets the count for averaging in the FFT function.
(query) Returns the current setting of the count for averaging in the FFT function.

Example
:CONFIGURE:AVERAGE 2048
Sets the count for averaging to 2048.

When allowed In the FFT function.

Sets and queries the type of averaging in the FFT function.

Syntax
(command) :CONFigure:FFTAVKind A$
(query) :CONFigure:FFTAVKind?
(response) A$
A$= OFF :off
T_LIN :simple time axis averaging
T_EXP :exponential time axis averaging
F_LIN :simple frequency axis averaging
F_EXP :exponential frequency axis averaging
F_PEAK :frequency axis peak hold

Explanation
(command) Sets the averaging method designated by A$.
(query) Returns the currently set averaging method as character data.

Example
:CONFIGURE:FFTAVKIND T_EXP
Sets time axis exponential averaging.

When allowed In the FFT function.

Sets and queries the FFT array display interval.

Syntax

(command) :CONFigure:FFTINTerval A
(query) :CONFigure:FFTINTerval?
(response) A <NR1>
A = 1000, 2000, 4000

Explanation

(command) Sets the FFT array display interval.
(query) Returns the currently set FFT array display interval as a numerical value in <NR1> format.

Example

:CONFIGURE:FFTINTerval 1000
The interval is set to 1000.

When allowed In the FFT function.

Sets and queries the FFT channel mode.

Syntax

(command) :CONFigure:FFTMode A, ch1$(,ch2$)
(query) :CONFigure:FFTMode?
(response) A<NR1>, ch1$, ch2$

A = 1	:one-channel FFT mode
A = 2	:two-channel FFT mode
ch1$ = CH1 to CH16	:analysis channel W1
ch2$ = CH1 to CH16	:analysis channel W2

Explanation

(command) Sets the FFT channel mode. I.e., designates the object channel or channels for FFT channel mode and the number thereof. In the one-channel FFT mode (only) the specification of channel 2 can be omitted, and if it is provided it is ignored. Transfer function, coherence function, cross power spectrum, cross correlation function, and impulse response are only effective in the two-channel FFT mode.
(query) Returns the current FFT channel mode as a numerical value in <NR1> format, and the analysis channel as character data.

Example

:CONFIGURE:FFTMODE 2, CH3, CH5
The channel mode is set to the two-channel FFT mode, and the object channels for FFT mode are set to be channel 3 and channel 5.

When allowed In the FFT function.

Sets and queries the FFT window function.

Syntax

(command) :CONFigure:FFTWind A$ (,B)
(query) :CONFigure:FFTWind?
(response) A$, B<NR1>

A$= RECTan	:rectangular window
HANNing	:Hanning window
EXPOnential	:exponential function window
B =0 to 99 (units %)	:coefficient for the exponential function

Explanation

(command) Sets the window function as indicated by A$. If the exponential window function is designated by A$, its exponential function coefficient can be set by using B
(query) Returns the current window function as character data, and the current exponential function coefficient as a numerical value in <NR1> format. If the window function is currently rectangular window or Hanning window, B is returned as a dummy zero.

Example

:CONFIGURE:FFTWIND HANN
The window function is set to Hanning window.

When allowed In the FFT function.

Sets and queries the FFT analysis mode.

Syntax

(command) :CONFigure:FFTFunction A$, B$
(query) :CONFigure:FFTFunction? A$
(response) A$, B$

A$= G1, G2 :graph number
B$ =STR :stored waveform
LIN : linear spectrum
RMS :RMS spectrum
PSP : power spectrum
ACR : auto-correlation function
HIS :histogram
TRF : transfer function
CSP :cross power spectrum
CCR :cross correlation function
IMP : impulse response
COH : coherence function
OCT :octave analysis

** can only be used when the two-channel FFT mode is set.

Explanation

(command) Sets the FFT analysis mode.
The FFT analysis mode can be set to transfer function, cross power spectrum, cross correlation function, or impulse response only in the two-channel FFT mode (FFTMODE 2, ch1$, ch2$). In this case, the corresponding function is calculated from channel 1 and channel 2. The result of the calculation is displayed on the graph designated by A$. G2 can be designated even if the display format is SINGLE, but this does not affect the display.

(query) Returns the current FFT analysis mode as character data.

Examples

:CONFIGURE:FORMAT DUAL

:CONFIGURE:FFTMODE 2, CH1, CH3

:CONFIGURE:FFTFUNCTION G1, IMP

:CONFIGURE:FFTFUNCTION G2, TRF

The impulse response calculated from channel 1 and channel 3 is displayed on G1, and the transfer function calculated from these channels is displayed on G2.

When allowed In the FFT function.

Sets and queries the FFT data source.

Syntax
(command) :CONFigure:FFTRef A$
(query) :CONFigure:FFTRef?
(response) A$
A$ =NEW :new data
MEM :data stored in the memory

Explanation
(command) Designates the source for FFT data as specified by A$.
(query) Returns the current FFT data source as character data.

Example
:CONFIGURE:FFTREF NEW
New data is used as FFT data.

When allowed
In the FFT function.

Sets and queries the FFT display scaling method.

Syntax
(command) :CONFigure:FFTSCale A$, B$
(query) :CONFigure:FFTSCale? A$
(response) A$, B$
A$ = G1, G2
B$ = AUTO, MANUal

Explanation
(command) Sets the display scaling method for the graph number designated by A$.
(query) Returns the current display scaling method for the graph number designated by A$ as character data.

Example
:CONFIGURE:FFTSCALE G1, AUTO
The scaling method for graph number 1 is set to automatic.

When allowed
In the FFT function.

Sets and queries the FFT display scale vertical axis upper limit.

Syntax
(command) :CONFigure:FFTUp A$, B
(query) :CONFigure:FFTUp? A$
(response) A$, B <NR3>
A$ = G1, G2
B = -9.999E+29 to +9.999E+29

Explanation
(command) Sets the FFT display scale vertical axis upper limit for the graph number designated by A$ to the value designated by B.
(query) Returns the current FFT display scale vertical axis upper limit for the graph number designated by A$ as a numerical value in <NR3> format.

Example
:CONFIGURE:FFTUP G2, 100
The FFT display scale vertical axis upper limit for graph 2 is set to 100.

When allowed
In the FFT function.

Sets and queries the FFT display scale vertical axis lower limit.

Syntax

(command) :CONFigure:FFTLow A$, B
(query) :CONFigure:FFTLow? A$
(response) A$, B<NR3>
A$ = G1, G2
B = -9.999E+29 to +9.999E+29

Explanation

(command) Sets the FFT display scale vertical axis lower limit for the graph number designated by A$ to the value designated by B.
(query) Returns the current FFT display scale vertical axis lower limit for the graph number designated by A$ as a numerical value in <NR3> format.

Example

:CONFIGURE:FFTLOW G2, 100
The FFT display scale vertical axis lower limit for display graph 2 is set to 100.

When allowed

In the FFT function.

Sets and queries the FFT x-axis.

Syntax

(command) :CONFigure:FFTXaxis A$, B$
(query) :CONFigure:FFTXaxis? A$
(response) A$, B$
A$ = G1, G2
B$ = 1_1oct, 1_3oct :during octave analysis
LINhz, LOGhz :otherwise

Explanation

(command) Sets the x-axis of the graph number designated by A$. When the analysis mode is octave analysis, 1_1oct or 1_3oct can be set; otherwise, LINhz or LOGhz can be set. Some settings are not available for some analysis modes. If a setting is not available, an execution error is generated (see the table on the next page).
(query) Returns the present x-axis setting as character data.

Example

:CONFIGURE:FFTXAXIS G1, LINHZ
The setting for the x-axis of graph 1 is set to LINHZ.

When allowed

In the FFT function.

Sets and queries the FFT y-axis.

Syntax

(command) :CONFigure:FFTYaxis A$, B$
(query) :CONFigure:FFTYaxis? A$
(response) A$, B$
A$= G1, G2
B$= LINMAg :linear magnitude
LINREal :linear real axis magnitude
LINIMag :linear imaginary axis magnitude
LOGMAg :logarithmic magnitude
PHASE :phase

Explanation

(command) Sets the y-axis of the graph number designated by A$. Some settings are not available for some analysis modes. If a setting is not available, an execution error is generated (see the table on the next page).
(query) Returns the present y-axis setting as character data.
The setting for the y-axis of graph 1 is set to LINMAG.

When allowed

In the FFT function.

Display settings available on the x-axis

Analysis mode	X-axis				
	Linear-Hz	Log-Hz	1/10 octave	1/3 octave	Fixed scale
STR					Time
LIN	Yes	Yes			
RMS	Yes	Yes			
PSP	Yes	Yes			
ACR					Time
HIS					Volts
TRF	Yes	Yes			
CSP	Yes	Yes			
CCR					Time
IMP					Time
COH	Yes	Yes			
OCT			Yes	Yes	

Display settings available on the y-axis

Analysis mode	Y-axis					
	Linear-real	Linear-imaginary	Linear-magnitude	Log-magnitude	Phase	Fixed scale
STR						Linear
LIN	Yes	Yes	Yes	Yes	Yes	
RMS	Yes	Yes	Yes	Yes	Yes	
PSP			Yes	Yes		
ACR						Linear
HIS						Linear
TRF	Yes	Yes	Yes	Yes	Yes	
CSP	Yes	Yes	Yes	Yes	Yes	
CCR						Linear
IMP						Linear
COH						Linear
OCT			Yes	Yes		

Sets and queries the FFT frequency range.

Syntax

(command) :CONFigure:FREQ A
(query) :CONFigure:FREQ?
(response) A<NR3>
A= 80000, 40000, 20000, 8000, 4000, 2000, 800, 400
200, 80, 40, 20, 8, 4, 2, 0.667, 0.333, 0.133 (units: Hz)

Explanation

(command) Sets the frequency range. If an attempt is made to set an unacceptable value, i.e. a value which is not one of the above, then the frequency range is set to the next higher one of the above values.

(query) Returns the currently set frequency range as a numerical value in <NR3> format.

Example

:CONFIGURE:FREQ 80
The frequency range is set to 80 Hz.

When allowed

In the FFT function.

Sets and queries octave filter type.

Syntax

(command) :CONFigure:OCTFilter A$
(query) :CONFigure:OCTFilter?
(response) A$
A$ = NORMal, SHARp

Explanation

(command) Sets the type of octave filter.

(query) Returns the currently set type of octave filter as character data.

Example

:CONFIGURE:OCTFILTER NORMAL
Sets the octave filter type to NORMAL.

When allowed

In the FFT function.

3. TRIGger command (Sets and queries trigger source, level etc)

Sets and queries the kind of trigger.

Syntax

(command) :TRIGger:KIND ch$, A$
(query) :TRIGger:KIND? ch$
(response) ch$, A$
ch$ = CH1 to CH8
A$= OFF
LEVEl
IN
OUT
LOGIc

Explanation

(command) Sets the type of trigger for the channel designated by ch$.
(query) Returns as character data the type of the current trigger for the channel designated by ch$.

Example

:TRIGGER:KIND CH1, LEVEL
Sets channel 1 to level trigger.

When allowed In all functions.

Sets and queries external trigger.

Syntax

(command) :TRIGger:EXTErnal A$
(query) :TRIGger:EXTErnal?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables and disables external trigger.
(query) Returns the current external trigger enablement state as character data.

When allowed In all functions.

Sets and queries trigger logical operator (AND/OR).

Syntax

(command) :TRIGger:SOURce A$
(query) :TRIGger:SOURce?
(response) A$
A$ = OR,AND

Explanation

(command) Sets the logical operator determining whether the internal and external triggers are ORed or ANDed.
(query) Returns the currently setting of the trigger logical operator (AND/OR) as character data.

When allowed In all functions.

Sets and queries trigger level.

Syntax

(command) :TRIGger:LEVEl ch$, A
(query) :TRIGger:LEVEl? ch$
(response) ch$, A<NR3>
ch1$ = CH1 to CH8
A = voltage value (unit V), temperature input unit (°C)

Explanation

(command) Sets the trigger level of the level, of the channel designated by ch$.
(query) Returns the current trigger level as an NR3 numerical value.

Example

:TRIGGER:LEVEL CH1, 50E-3
Sets the trigger level of channel 1 to 50mV.

When allowed In all functions.

Sets and queries trigger direction (slope).

Syntax

(command) TRIGger:SLOPe ch$, A$
(query) TRIGger:SLOPe? ch$
(response) ch$, A$
ch$ = CH1 to CH8
A$ = UP (rising)
DOWN (falling)

Explanation

(command) Sets the trigger direction of the level, of the channel designated by ch$.
(query) Returns the current trigger direction as a character value.

Example

:TRIGGER:SLOPE CH1, UP
Sets the trigger direction of channel 1 to rising.

When allowed In all functions.

Sets and queries filter.

Syntax

(command) :TRIGger:FILTer ch$, A
(query) :TRIGger:FILTer? ch$
(response) ch$ A<NR2>
ch$ = CH1 to CH8
A = 0 : OFF
0.1, 0.2, 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10.0

Explanation

(command) Sets the filter width for a level trigger of the channel designated by ch$ to a numerical value from 0.1, 0.2, 0.5, 1.0, 1.5, 2.0, 2.5, 5.0 and 10.0 0 means OFF. In the recorder and x-y recorder modes, however, only an on/off setting for the filter is available. Setting any value of 0.1 or more enables the filter.
If the value is zero, then the filter is disabled.
(query) Returns the current filter width as an NR1 numerical value.

When allowed In all functions.

Sets and queries upper limit level for a window trigger.

Syntax

(command) :TRIGger:UPPEr ch$, A
(query) :TRIGger:UPPEr? ch$
(response) ch$, A<NR3>
ch$ = CH1 to CH8
A = voltage value (v), temperature unit (°C)

Explanation

(command) Sets the upper limit level of the window trigger of the channel designated by ch$ to a numerical value in the range from the upper limit level to voltage value.
(query) Returns the current upper limit level as an NR3 numerical value.

When allowed In all functions.

Sets and queries lower limit level for a window trigger.

Syntax

(command) :TRIGger:LOWEr ch$, A
(query) :TRIGger:LOWEr? ch$
(response) ch$, A<NR3>
ch$ = CH1 to CH8
A = voltage value (unit V), temperature input unit (°C)

Explanation

(command) Sets the lower limit level of the window trigger of the channel designated by ch$ to a numerical value in the range from zero to the lower limit level voltage value.
(query) Returns the current lower limit level as an NR3 numerical value.

When allowed In all functions.

Sets and queries the trigger pattern for a logic trigger.

Syntax

(command) :TRIGger:LOGPat ch$, "A$"
(query) :TRIGger:LOGPat? ch$
(response) ch$, "A<NR3>"
ch$ = CH 1 to CH 8
A$ = XXXX :trigger pattern (X,0,1)

Explanation

(command) Sets the trigger pattern for the logic trigger of the channel designated by ch$ to that specified by the given character data.

Example

:TRIGGER:LOGPAT CH1, "X001"
Sets the trigger pattern for channel 1 to "X001".

When allowed In all functions.

Sets and queries the logical operator (AND/OR) for the trigger pattern of a logic trigger.

Syntax

(command) :TRIGger:LOGAnd ch$, A$
(query) :TRIGger:LOGAnd? ch$
(response) ch$, A$
ch$ = CH 1 to CH 8
A$ = OR,AND

Explanation

(command) Sets the AND/OR logical operator for the trigger pattern of a logic trigger.
(query) Returns the present AND/OR setting as a character string.

When allowed In all functions.

Sets and queries trigger mode.

Syntax

(command) :TRIGger:MODE A$
(query) :TRIGger:MODE?
(response) A$
A$= SINGle, REPEat :REC
SINGle, REPEat, AUTO :MEM, FFT

Explanation

(command) Sets the trigger mode.
(query) Returns the current trigger mode as character data.

Example

:TRIGGER:MODE REPEAT
Sets the trigger mode to repeat.

When allowed

In the memory recorder function, the recorder function, and the FFT function.

Sets and queries pre-trigger.

Syntax

(command) :TRIGger:PRETrig A
(query) :TRIGger:PRETrig?
(response) A<NR1>
A = 0, 2, 5, 10, 20.....80, 90, 100, -95 (unit %)

Explanation

(command) Sets pre-trigger value to a numerical value (in percent). If an attempt is made to set a value which cannot be set on the 8825, setting is performed to the next higher permitted value.
(query) The currently set pre-trigger value is returned as an NR1 numerical value.

Example

:TRIGGER:PRETRIG 10
Pre-trigger value is set to 10%.

When allowed

In the memory recorder function and the FFT function.

Sets and queries trigger timing.

Syntax

(command) :TRIGger:TIMIng A$
(query) :TRIGger:TIMIng?
(response) A$
A$= START
STOP
S_S (START&STOP)

Explanation

(command) Sets the trigger timing.
(query) The currently set trigger timing is returned as character data.

When allowed

In the recorder function, and the XY recorder function.

Sets and queries whether the timer trigger is on or off.

Syntax

(command) :TRIGger:TIMEr A$
(query) :TRIGger:TIMEr?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables or disables the timer trigger.
(query) Returns the current enablement state of the timer trigger as character data.

When allowed

In all functions.

Sets and queries the start instant for the timer trigger.

Syntax

(command) :TRIGger:TMSTArt month, day, hour, min
(query) :TRIGger:TMSTArt?
(response) month, day, hour, min
<month> = 1 to 12
<day>= 1 to 31
<hour>= 0 to 23
<min> = 0 to 59

Explanation

(command) Sets the start instant for the timer trigger.
(query) Returns the current setting for the timer trigger start instant as NR1 numerical values.

Example

:TRIGGER:TMSTART 7, 5, 9, 30
Sets the start instant for the timer trigger to 09:30 on July 5th.

When allowed

In all functions.

Sets and queries the stop instant for the timer trigger.

Syntax

(command) :TRIGger:TMSTOp month, day, hour, min
(query) :TRIGger:TMSTOp?
(response) month, day, hour, min
<month> = 1 to 12
<day> = 1 to 31
<hour>= 0 to 23
<min> = 0 to 59

Explanation

(command) Sets the stop instant for the timer trigger.
(query) Returns the current setting for the timer trigger stop instant as NR1 numerical values.

Example

:TRIGGER:TMSTOP 7, 5, 10, 30
Sets the stop instant for the timer trigger to 10:30 on July 5th.

When allowed

In all functions.

Sets and queries the time interval for the timer trigger.

Syntax

(command) :TRIGger:TMINTvl hour, min, sec
(query) :TRIGger:TMINTvl?
(response) hour, min, sec
<hour> = 0 to 23
<min> = 0 to 59
<sec> = 0 to 59

Explanation

(command) Sets the time interval for the timer trigger.
(query) Returns the current setting for the timer trigger time interval as NR1 numerical values.

Example

:TRIGGER:TMINTVL 1, 20, 30
Sets the time interval for the timer trigger to one hour, twenty minutes, and thirty seconds.

When allowed

In all functions.

Sets and queries the time point for trigger detection.

Syntax

(command) :TRIGger:DETECTTime hour, min, sec
(query) :TRIGger:DETECTTime?
(response) hour, min, sec
hour = 0 to 23
min = 0 to 59
sec = 0 to 59

Explanation

(command) Sets the time point for trigger detection.

(query) Returns the currently set time point for trigger detection as a numerical value in <NR1> format.
During memory partitioning, the time point for the memory block which is currently being displayed (the block in use) is the one referenced.

Example

:TRIGGER:DETECTTIME?
The currently set time point for trigger detection is queried.

When allowed In all functions.

Sets and queries the date for trigger detection.

Syntax

(command) :TRIGger:DETECTDate year, month, day
(query) :TRIGger:DETECTDate?
(response) year, month, day
year = 0 to 99
month = 1 to 12
day = 1 to 31

Explanation

(command) Sets the date for trigger detection.

(query) Returns the currently set date for trigger detection as a numerical value in <NR1> format.
During memory partitioning, the date for the memory block which is currently being displayed (the block in use) is the one referenced.

Example

:TRIGGER:DETECTDATE?
The currently set date for trigger detection is queried.

When allowed In all functions.

4. UNIT command

Sets and queries the voltage range of an input channel.

Syntax

(command) :UNIT:RANGe ch$, A
(query) :UNIT:RANGe? ch$
(response) ch$, A<NR3>
ch$ = CH1 to CH16
A= voltage range (unit V)
temperature range (unit °C)

Explanation

(command) Sets the voltage range for the channel designated by ch$ to a numerical value (unit V). If the channel designated is for the temperature unit, set the temperature range to a numerical value.

(query) Returns the current voltage range or the temperature range for the channel designated by ch$ as an NR3 numerical value.

Example

:UNIT:RANGE CH1, +10.E-3
Sets the voltage range for channel 1 to 10 mV.

When allowed

In all functions.

Sets and queries input channel origin position.

Syntax

(command) :UNIT:POSItion ch$, A
(query) :UNIT:POSItion? ch$
(response) ch$, A<NR1>
ch$ = CH1 to CH16
A = position (%)

Explanation

(command) Sets the origin position for the channel designated by ch$ in the range.

(query) Returns the current origin position for the channel designated by ch$ as an NR1 numerical value (unit percent).

Example

:UNIT:POSITION ch1, 50
Sets the origin position for channel 1 to 50%.

When allowed

In all functions.

Sets and queries input coupling for an input channel.

Syntax

(command) :UNIT:COUPling ch$, A$
(query) :UNIT:COUPling? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A$ = GND, DC

Explanation

(command) Sets the input coupling for the channel designated by ch$.
(query) Returns the current input coupling for the channel designated by ch$ as character data.

Example

:UNIT:COUPLING CH1, DC
Sets the input coupling for channel 1 to DC.

When allowed In all functions.

Sets and queries the filter for an input channel.

Syntax

(command) :UNIT:FILTer ch$, A
(query) :UNIT:FILTer? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A= 0, 5, 500 (0 means OFF)
0, 1.5, 5 (temperature unit)

Explanation

(command) Sets the filter for the channel designated by ch$. If the channel designated is for the temperature unit, set the filter of the temperature unit.
(query) Returns the current filter setting for the channel designated by ch$ as character data.

Example

:UNIT:FILTER CH1, 500
Sets the filter for channel 1 to 500 Hz.

When allowed In all functions.

Carries out zero adjustment for the input units.

Syntax (command) :UNIT:ADJUST

Explanation (command) Carries out zero adjustment for the input units, however there is no zero adjustment function for the temperature input unit.

When allowed In all functions.

Sets and queries the type of the temperature input unit sensor.

Syntax

(command) :UNIT:SENSor ch$, A$
(query) :UNIT:SENSor? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A$ = K, J, T

Explanation

(command) Sets the type of the temperature input unit sensor on the channel designated by ch$.
(query) Returns the type of the temperature input unit sensor currently on the channel designated by ch$ as character data.

Example

:UNIT:SENSOR CH1, K
The temperature input unit sensor on channel 1 is set to "K".

When allowed In all functions.

Sets and queries the FFT anti-aliasing filter.

Syntax
(command) :UNIT:AAFilter A$, B$
(query) :UNIT:AAFilter? A$
(response) A$, B$
A$ = CH1 to CH16
B$ = OFF, ON

Explanation
(command) Turns on or off the FFT anti-aliasing filter on the channel designated by A$.
(query) Returns the current on or off state of the FFT anti-aliasing filter on the channel designated by A$.

Example
:UNIT:AAFILTER CH3, ON
Turns on the FFT anti-aliasing filter for channel 3.

When allowed
In the memory recorder function and the FFT function.

5. DISPlay command

Sets and queries the screen mode.

Syntax
(command) :DISPlay:CHANge A$
(query) :DISPlay:CHANge?
(response) A$
A$= SYSTem
STATus
CHANnel
DISPlay

Explanation
(command) Changes the screen mode.
(query) Returns the current screen mode as character data.

Example
:DISPLAY:CHANGE DISPLAY
Switches to the display mode.

When allowed
In all functions.

Sets and queries waveform display style.

Syntax
(command) :DISPlay:DRAWing ch$, A$
(query) :DISPlay:DRAWing? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A$ = OFF, DARK, LIGHT, NORMal

Explanation
(command) Sets the waveform display style for the channel designated by ch$ to OFF, DARK (high intensity), or LIGHT (low intensity).
(query) Returns the current waveform display style setting for the channel designated by ch$ as character data.

Example
: DISPLAY:DRAWING CH1, DARK
Displays the channel 1 waveform the DARK.

When allowed
In the memory recorder function, the recorder function, and X-Y recorder function.

Sets and queries the waveform display screen size.

Syntax
(command) :DISPlay:SIZE A$
(query) :DISPlay:SIZE?
(response) A$
A$ = NORMal
WIDE

Explanation
(command) Sets the waveform display screen size.
(query) Returns the current waveform display screen size.

When allowed
In the memory recorder function, the recorder function, and X-Y recorder function.

Sets and queries waveform display graph in DUAL QUAD, OCT and HEX format.

Syntax
(command) :DISPlay:GRAPh ch$, A
(query) :DISPlay:GRAPh? ch$
(response) ch$, A<NR1>
ch$ = CH1 to CH16
<NR 1> = 1,2,3,4 (for DUAL, 1, 2)

Explanation
(command) Sets the waveform display graph in the screen.
(query) In the screen, returns the current waveform display graph for a channel as an NR1 numerical value.

Example
:DISPLAY:GRAPH CH1, 1
Displays the channel 1 waveform in display graph 1.

When allowed
In the memory recorder function, and the recorder function.

Enables and disables, and queries, display of logic waveforms.

Syntax
(command) :DISPlay:LOGDraw ch$, A$
(query) :DISPlay:LOGDraw? ch$
(response) ch$, A$
ch$ = CHA to CHH
A$ = OFF, ON

Explanation
(command) Enables and disables display of logic waveforms.
(query) Returns current enablement state of logic waveform display as character data.

Example
:DISPLAY:LOGDRAW CHA, ON
Enables display of the channel A logic waveform.

When allowed
In the memory recorder function and the recorder function.

Sets and queries zoom factor on the time axis.

Syntax
(command) :DISPlay:XMAG A$
(query) :DISPlay:XMAG?
(response) A$
A$= X10, X5, X2, X1, X1_2, X1_5, X1_10, X1_20
X1_50, X1_100, X1_200, X1_500, X1_1000

Explanation
(command) Sets the zoom factor on the time axis according to character data.
(query) Returns the current zoom factor on the time axis as character data.

Example
:DISPLAY:XMAG X1_10
Sets the compression ratio along the time axis to be 1/10.

When allowed
In the memory recorder function.

Sets and queries zoom factor on the voltage axis.

Syntax

(command) :DISPlay:YMAG ch$, A$
(query) :DISPlay:YMAG? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A$= X16, X8, X4, X2, X1, X1_2 ...SINGLE, X-Y format
X8, X4, X2, X1, X1_2, X_4 ...DUAL,X-Y quad format
X4, X2, X1, X1-2, X1-4 , X-8..QUAD,OCT,HEX format

Explanation

(command) Sets the zoom factor on the voltage axis for the channel designated by ch$ according to the character data.
(query) Returns the current zoom factor on the voltage axis for the channel designated by ch$ as character data.

When allowed In the memory recorder function, the recorder function, and the FFT function.

Sets and queries the drawing level for an X-Y plot.

Syntax

(command) :DISPlay:XYDRawing A, B$
(query) :DISPlay:XYDRawing? A
(response) A<NR1>, B$
A = 1 to 4
B$ =OFF
LIGHt
NORMal
DARK

Explanation

(command) Sets the drawing level for an X-Y plot.
(query) Queries the drawing level for an X-Y plot.

When allowed In the memory recorder function (in XY format), and in the XY recorder function.

Sets and queries the X-axis, in the XY format.

Syntax

(command) :DISPlay:XAXIs A, ch$
(query) :DISPlay:XAXIs? A
(response) A<NR1>, ch$
A = 1 to 4 (When XYsing, only 1)
ch$ = CH1 to CH16

Explanation

(command) Sets the Xaxis channel in the XY format.
(query) Returns the current Xaxis channel in the XY format.

Example

:DISPLAY:XAXIS 1, CH1
Sets graph 1 to the Xaxis.

When allowed

In the memory recorder function (in XY format), and in the XY recorder function.

Sets and queries the Y-axis, in the XY format

Syntax

(command) :DISPlay:YAXIs A, ch$
(query) :DISPlay:YAXIs? A
(response) A<NR1>, ch$
A = 1 to 4 (When XYsing, only 1)
ch$ = CH1 to CH16

Explanation

(command) Sets the Y axis channel in the XY format.

Example

:DISPLAY:YAXIS 1, CH2
Sets graph 1 to the Yaxis.

When allowed

In the memory recorder function (in XY format), and in the XY recorder function.

Performs waveform display.

Syntax

(command) :DISPlay:WAVE A$
A$= ACUR (the A-cursor)
TRIG (the trigger point)
POINT (the point set by :MEMOry:POINt)

Explanation

Displays the waveform on the screen from the position indicated by A$.

When allowed

Memory recorder function (when A$ = ACUR, the A-cursor must be displayed)

Sets and queries display clearing in the X-Y recorder function.

Syntax

(command) :DISPlay:XYCLr A$
(query) :DISPlay:XYCLr?
(response) A$
A$ = OFF, ON

Explanation

(command) Enables or disables display clearing in the X-Y recorder function.
(query) In the X-Y recorder function, returns the enablement of display clearing.

When allowed

In the X-Y recorder function.

Enables and disables, and queries the variable function.

Syntax

(command) :DISPlay:VARIable ch$, A$
(query) :DISPlay:VARIable? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A$ = OFF, ON

Explanation

(command) Enables or disables the variable function.
(query) Returns the current state of enablement of the variable function.

When allowed In all function.

Sets and queries the upper and lower limit values of the variable function.

Syntax

(command) :DISPlay:VARIUPLOw ch$, B$, C$
(query) :DISPlay:VARIUPLOw? ch$
(response) ch$, B$, C$
ch$ = CH1 to CH16
B$ = C$ = -9.9999E+29 to +9.9999E+29

Explanation

(command) Sets the upper and lower limit values of the waveform on the display screen for CH1 to CH16.
(query) Returns the current upper and lower limit values of the waveform on the display screen for CH1 to CH16 as an NR3 numerical value.

When allowed In all function.

6. SYSTem command

Enables and disables, and queries, the screen auto off (screen saver) function.

Syntax

(command) :SYSTem:CRTOff A$
(query) :SYSTem:CRTOff?
(response) A$
A$ = OFF, ON

Explanation

(command) Enables or disables the screen saver function.
(query) Returns the current enablement state of the screen saver function as character data.

When allowed In all functions.

Sets and queries the grid type.

Syntax

(command) :SYSTem:GRID A$
(query) :SYSTem:GRID?
(response) A$
A$ = OFF, NORMal, FINEcm, FINEDiv

Explanation

(command) Sets the type of grid displayed.
(query) Returns the current grid setting as character data.

When allowed In all functions.

Enables and disables, and queries, the start backup function.

Syntax

(command) :SYSTem:STARt A$
(query) :SYSTem:STARt?
(response) A$
A$ = OFF, ON

Explanation

(command) Enables and disables the start backup function.
(query) Returns the current enablement state of the start backup function as character data.

When allowed In all functions.

Enables and disables, and queries, the channel marker.

Syntax

(command) :SYSTem:CHMArk A$
(query) :SYSTem:CHMArk?
(response) A$
A$ = OFF, ON

Explanation

(command) Makes the corresponding channel marker setting.
(query) Returns the current channel marker setting as character data.

When allowed In all functions.

Enables and disables, and queries, the sound of the beeper.

Syntax

(command) :SYSTem:BEEPer A$
(query) :SYSTem:BEEPer?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables and disables the beeper sound.
(query) Returns the current enablement state of the beeper sound as character data.

When allowed In all functions.

Sets and queries the list function and the gauge function.

Syntax

(command) :SYSTem:LIST A$
(query) :SYSTem:LIST?
(response) A$
A$= OFF
LIST
GAUGE
L_G (LIST&GAUGE)

Explanation

(command) Sets the list function and the gauge function according to a character string.
(query) Returns the current settings for the list function and the gauge function as a character string.

When allowed In all functions.

Enables and disables, and queries, the smooth printing function.

Syntax

(command) :SYSTem:SMOOth A$
(query) :SYSTem:SMOOth?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables and disables the smooth printing function.
(query) Returns the current enablement state of the smooth printing function as character data.

When allowed : In the memory recorder function.

Enables and disables, and queries, the roll mode function.

Syntax

(command) :SYSTem:ROLL A$
(query) :SYSTem:ROLL?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables and disables the roll mode function.
(query) Returns the current enablement state of the roll mode function as character data.

When allowed In the memory recorder function.

Sets the time, and queries the current time.

Syntax

(command) :SYSTem:TIME hour, min, sec
(query) :SYSTem:TIME?
(response) hour, min, sec
<hour>= 0 to 23
<min> = 0 to 59
<sec> = 0 to 59

Explanation

(command) Sets the time.
(query) Returns the current time.

Example

:SYSTEM:TIME 10, 0, 0
Sets the internal clock to 10:00.

When allowed In all functions.

Sets the calendar date, and queries the current calendar date.

Syntax

(command) :SYSTem:DATE year, month, day
(query) :SYSTem:DATE?
(response) year, month, day
<year>= 0 to 99
<month>= 1 to 12
<day> = 1 to 31

Explanation

(command) Sets the date on the internal calendar.
(query) Returns the current date.

Example

:SYSTEM:DATE 91, 7, 7
Sets the internal calendar to July 7th, 1991.

When allowed In all functions.

Sets and queries the number of channels used.

Syntax

(command) :SYSTem:USECH A
(query) :SYSTem:USECH?
(response) A<NR1>
A = 2, 4, 8, 16

Explanation

(command) Sets the number of input units used to a numerical value.
(query) Returns the current number of input units used as an NR1 numerical value.

When allowed In the memory and recorder function, and FFT function.

Cleaning waveform data

Syntax (command) :SYSTem:DATAClear

Explanation Clear the waveform data

When allowed In all functions.

Sets and queries the time axis display.

Syntax
(command) :SYSTem:TMAXis A$
(query) :SYSTem:TMAXis?
(response) A$
A$ = TIME
TIME (60)
DIV

Explanation
(command) Sets the time axis display as character string sata.
(query) Returns the current time axis display setting as character string data.

When allowed In all function.

7. MEMory command

Sets and queries the point in memory for input/output.

Syntax
(command) :MEMory:POINt ch$, A
(query) :MEMory:POINt?
(response) ch$, A<NR1>
ch$ = CH1 to CH16
A = 0 to 2000000

Explanation
(command) Sets the input/output point in memory.
(query) Returns the current input/output point in memory as an NR1 numerical value.

Example
:MEMORY:POINT CH1, 100
Sets the input/output point for channel 1 to the 100th location from the start of memory.

When allowed In the memory recorder function.

Queries the number of data samples stored.

Syntax
(query) :MEMory:MAXPoint?
(response) :A <NR 1>
A= 0 :no data stored
2500 to 2000000 (divided by 100 gives the number of divisions)

Explanation Returns the number of data samples stored in the memory.

Example
:MEMORY:MAXPOINT?
Response: 2500 (when headers are off)
The number of data samples stored in the memory is 2500 (25 divisions).

When allowed In the memory recorder function.

Inputs data to memory, and outputs stored data.

Syntax

(command) :MEMory:ADATa B, C,.....
(query) :MEMory:ADATa? A
(response) B, C, ...all<NR1>
B, C,..... = 0 to 4095 (data for storage)
A = 1 to 40 (number of data values to be output)

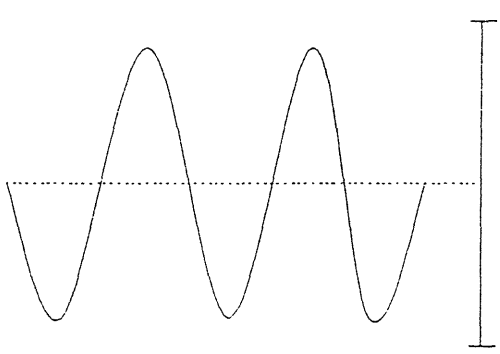
Explanation

(command) Puts the data of the data portion into the memory at the channel and point set by the MEMory:POINT command. If there are several data values, they are input in order from the point set by the MEMory:POINt command.
The input/output point is incremented by the number of data values.

(query) The number of data values specified by A are output from the memory channel and point set by the MEMory:POINt command. The input/output point is incremented by the number of data values.
This cannot be executed during measurement operation.

Relationship between data values in memory and measured voltages

The following figure illustrates the relationship between the data values (0 to 4095) input and output using the :MEMory:ADATa command and the measured voltage values. (2048 = 0V)



4095 (upper limit of waveform that can be recorded)

2048 (0 V)

0 (lower limit of waveform that can be recorded)

Measured voltage value = (data value - 2048) × (voltage range) / 80
Example: Voltage range = 1 (V/DIV), data value = 2500
Then the measured voltage = (2500 - 2048) × 1 / 80 = 5.65 (V)

Example

:MEMORY:POINT CH1, 0
:MEMORY:ADATA? 10
Sets the input/output point to channel 1 and data value zero in memory, then outputs 10 stored data values.

When allowed Provided that stored data is present, and provided that the input/output point is lower than the amount of data stored.

Input voltage data to memory, and output voltage data from memory.

Syntax

(command) :MEMory:VDATa B, C .....
(query) :MEMory:VDATa? A
(response) B, C,.....all<NR3>
B, C,..... = voltage values (unit volts)
A = 1 to 10 (amount of data)

Explanation

(command) Puts the data values (voltage values) in the data portion into the memory at the channel and point set by the MEMory:POINT command. If there are several data values, they are input in order from the point set by the MEMory:POINT command. The input/output point is incremented by the number of data values.

(query) The number of stored data values specified by A are output as voltage values from the memory channel and point set by the MEMory:POINt command. The input/output point is incremented by the number of data values.

*When scaling, the scaled values are input and output.
When calculating the waveform, calculated results are input and output.
This cannot be executed during measurement operation.

Example

:MEMORY:POINT CH1, 0
:MEMORY:VDATa? 10
Sets the input/output point to channel 1 and data value zero in memory, then outputs 10 stored data values as voltage values.

When allowed

Provided that stored data is present, and provided that the input/output point is lower than the amount of data stored.

Outputs real time data (in ASCII).

Syntax

(query) :MEMory:AREAl? ch$
(response) :A <NR 1>
ch$ = CH1 to CH16
A = 0 to 4095

Explanation

(query) Returns the value input on the channel designated by ch$.

When allowed

Providing that measurement operation is not taking place.

Outputs real time data (voltage values).

Syntax

(query) :MEMory:VREAl? ch$
(response) :A <NR 3>
ch$ = CH1 to CH16
A = a voltage value (unit V)

Explanation

(query) Returns as a voltage value the value input on the channel designated by ch$.

When allowed

Providing that measurement operation is not taking place.

Input logic data to memory, and output logic data from memory.

Syntax

(command) :MEMory:LDATa B,C.....
(query) :MEMory:LDATa? A
(response) A<NR3>
<NR 1> = 0 to 15 (logic data)
A = 1 to 50 (number of data values to be output)

Explanation

(command) Puts the data values (logic values) in the data portion into the memory at the channel and point set by the :MEMory:POINt command. If there are several data values, they are input in order from the point set by the :MEMory:POINt command. The input/output point is incremented by the number of data values.

(query) The number of stored data values specified by A are output as logic values from the memory channel and point set by the :MEMory:POINt command. The input/output point is incremented by the number of data values.
This cannot be executed during measurement operation.

Note: The following is the correspondence between the channels set by the MEMory:POINt command and the logic channel groups:

CH1 ... CHA
CH2 ... CHB
CH3 ... CHC
. .
. .
CH8 ... CHH

The four logic channels in each group are encoded as binary bits in the NR1 data value, as shown in the following example.

7	6	5	4	3	2	1	0
0	0	0	0	A4	A3	A2	A1

LOW: 0

HIGH: 1

Example

:MEMORY:POINT CH1, 0
:MEMORY:LDATA? 1
If the response is :MEMORY:LDATA 10
then channels A1 to A4 are as follows;

7	6	5	4	3	2	1	0
0	0	0	0	1	0	1	0

When allowed

In the MEM function, provided that stored data is present, and provided that the input/output point is lower than the amount of data stored.

Prepares the memory.

Syntax (command only) :MEMory:PREPare

Explanation (command only) If there is no waveform data in the 8825 unit, ensures that the memory is in a state ready and able to receive transmitted data. If waveform data is currently stored in the unit, clears it.

Example :MEMORY:PREPARE
Prepares the memory for receipt of waveform data.

When allowed In the MEM function.

Queries the FFT data at the output point.

Syntax (query only) :MEMory:FFTData?
(response) "A unit, B unit"
A = x-axis data (in <NR3> numerical format)
B = y-axis data (in <NR3> numerical format)

Explanation (query only) Returns the x-axis and y-axis FFT data at the output point specified by the instruction :MEMORY:FFTPOINT in <NR3> numerical format. When this command is executed, only one output point is calculated, and then the specified output point is increased by one. By executing this command repeatedly, a continuous set of data can be obtained.

Example :MEMORY:FFTPOINT G1, 100
:MEMORY:FFTDATA?
:MEMORY:FFTDATA?
Returns the x-axis and y-axis FFT data at the points 100 and 101 on graph 1.

When allowed In the FFT function.

Sets and queries the output point for FFT data.

Syntax (command) :MEMory:FFTPOint A$, B
(query) :MEMory:FFTPOint?
(response) A$, B<NR1>
A$ = G1, G2 (when in ARRAY format, G1 to G10)
B=0 to 999 ... in analysis mode STR, ACR, CCR, or IMP
B = 0 to 400 ... in analysis mode LIN, RMS, PSP, TRF, CSP or COH
B = 0 to 399... in analysis mode HIS or OCT

Explanation (command) Sets the output point for FFT data on the graph number designated by A$.

(query) Returns the current output point for FFT data on the graph number designated by A$ as a numerical value in 1 format.

Example :MEMORY:FFTPOINT G1, 100
Sets the output point for FFT data on the graph 1 to 100.

When allowed In the FFT function.

8. CURSor command

Turns on and off, and queries, the A and B cursors.

Syntax

(command) :CURSor:MODE A$
(query) :CURSor:MODE?
(response) A$
A$= OFF, TIME, VOLT :REC
OFF, Xcur, Ycur, TRACe :MEM(XY format)
OFF, TIME, VOLT, TRACe :MEM(exclude XY format)
OFF, Xcur, Ycur :XYC
OFF, TRACe :FFT

Explanation

(command) Sets the A and B cursor type (vertical cursor, horizontal cursor, cross-hair cursor).TIME and Xcur relate to the vertical cursor, VOLT and Ycur relate to the horizontal cursor, and TRACe relates to the cross-hair cursor.
(query) Returns the current A and B cursor type as character data.

Example

: CURSor:MODE TIME
Sets horizontal cursors.

When allowed In all functions.

Selects between, and queries, A, B only or A and B cursors.

Syntax

(command) :CURSor:ABCUrsor A$
(query) :CURSor:ABCUrsor?
(response) A$
A$ = A, B, A_B

Explanation

(command) Selects A or B cursor or both (A_B).
(query) Returns whether currently the A or B cursor is in use, or both A and B cursors are in use, as character data.

When allowed In all functions.

Sets and queries the channel for the A cursor.

Syntax

(command) :CURSor:ACHAnnel ch$
(query) :CURSor:ACHAnnel?
(response) ch$
ch$ = CH1 to CH16
X1 to X4 (in X-Y recorder)

Explanation

(command) Sets the channel for the A cursor.
(query) Returns the current A cursor channel as character data.

When allowed During use of the cross-hair cursor or the horizontal cursor. (except FFT)

Sets and queries the channel for the B cursor.

Syntax

(command) :CURSor:BCHAnnel ch$
(query) :CURSor:BCHAnnel?
(response) ch$
Tch$ = CH1 to CH16
X1 to X4 (in X-Y recorder)

Explanation

(command) Sets the channel for the B cursor.
(query) Returns the current B cursor channel as character data.

When allowed During use of the cross-hair cursor or the horizontal cursor. (except FFT)

Sets and queries the position of the A cursor.

Syntax

(command) :CURSor:APOSition A
(query) :CURSor:APOSition?
(response) A$
(vertical cursor, cross-hair cursor)
A = 0 to number of stored data values
(100 × recording length) : memory recorder function
A = 0 to number of stored data values : recorder function
1 to 25000, using a 1M memory board
1 to 100000 using a 4M memory board
A = 0 to 480 :X-Y recorder function
Analysis mode
A = 0 to 999 (STR, ACR, CCR, IMP) : FFT
0 to 400 (LIN, RMS, PSP, TRF, COH, CSP)
0 to 399 (HIS, OCT)
(horizontal cursor)
WIDE, NORMAL
A = 0 to 479, 399 : memory recorder function and recorder function
0 to 479, 399 : X-Y recorder function

Explanation

(command) Sets the A cursor position (refer to next page).
(query) Returns the current A cursor position as an NR1 numerical value.

When allowed

When using vertical or cross-hair cursors, in the memory recorder or recorder function; stored data must be present. (except FFT)

Sets and queries the position of the B cursor.

Syntax

(command) :CURSor:BPOSition A
(query) :CURSor:BPOSition?
(response) A<NR1>

Explanation

(command) Sets the B cursor position (refer to next page).
(query) Returns the current B cursor position as an NR1 numerical value.

When allowed

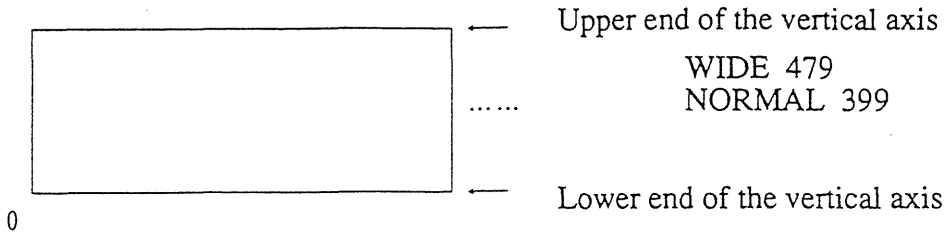
When using vertical or cross-hair cursors, in the memory recorder or recorder function; stored data must be present.

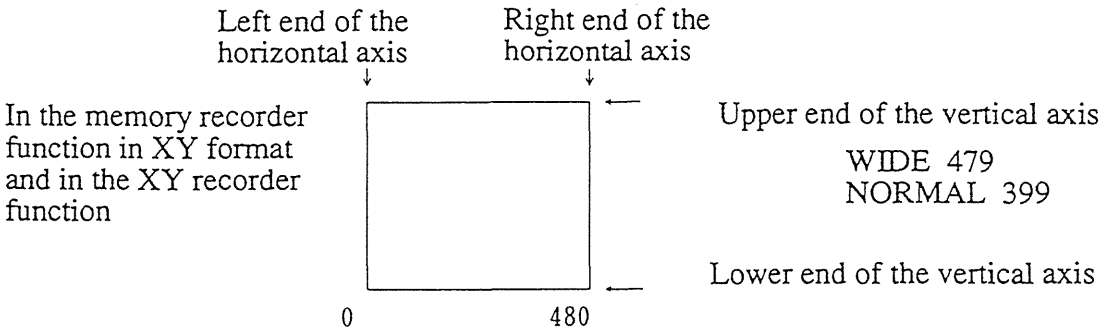
The cursor position has the following meaning:

In the memory recorder function and the recorder function, when the vertical cursor or the cross-hair cursor is in use, the cursor position is an indication of the current point in memory.

(When storage is performed on a basis of 25 divisions, the number of stored data values is 2500, and the cursor position indication lies in the range from 0 to 2500)

The horizontal cursor, and in the memory recorder function in XY format and in the XY recorder function both the vertical cursor and the horizontal cursor, are shown to the lower right of the waveform area on the display in a standard position. (refer to next page).





Queries the cursor readout value (t).

Syntax	(query)	:CURSor:DTREad? A$
	(response)	"B unit" A$ = A, B, A_B B = the readout value (t, 1/t)
Explanation	(query)	Returns the cursor readout value (t, 1/t) as a line of character data.
Example	Response	:CURSOR:DTREAD"5ms, 200Hz"
When allowed	Provided that the cursor is not off, and that (t, 1/t) are being shown on the display.	

Sets and queries the cursor readout value (V).

Syntax	(query)	:CURSor:DVREad? A$
	(response)	"B unit" A$ = A, B, A_B B$ = the readout value (V)
Explanation	(query)	Returns the cursor readout value (V) as a line of character data. For the temperature input unit, returns the temperature value (°C).
Example	Response	:CURSOR:DVREAD"385mV"
When allowed	Provided that the cursor is not off, and that (V) is being shown on the display.	

Sets and queries the graph for the A and B cursors.

Syntax

(command) :CURSor:ABCHAnnel A$
(query) :CURSor:ABCHAnnel?
(response) A$
A$ = G1, G2 (when in ARRAY format, G1 to G10)

Explanation

(command) Sets the graph for the A and B cursors when the display format is DUAL. If the display format is SINGle or NYQuist, the cursor is displayed on graph 1, whatever setting is made with this command.

(query) Returns the current graph setting for the A and B cursors as character data.

Example

```
:CONFIGURE:FORMAT DUAL
:CURSOR:ABCHANNEL G1
:CURSOR:MODE TRACE
```

The A and B cursors are displayed on graph 1.

When allowed

In the FFT function.

Queries the cursor readout position for FFT data.

Syntax

(query only) :CURSor:DFREad? A$
(response) "Bunit , Cunit"
A$ = A, B, A_B
B = x-axis data
C = y-axis data

Explanation

(query only) Returns the current cursor readout position for FFT data as character data.

Example

```
:CURSOR:DFREAD? A
```

The A cursor readout position is returned as character data.

When allowed

In the FFT function.

9. COMMent command

Enables and disables, and queries, title comments, and inputs comment characters.

Syntax

(command) :COMMent:TITLe A$, "B$"
(query) :COMMent:TITLe?
(response) A$, "B$"
A$ = OFF,ON
B$ = comment characters (up to 20 characters)

Explanation

(command) Enables and disables comments, and inputs a string of comment characters. Characters that can be used are:
0 to 9, ~u (= μ), ~c (= °), , ^, (,), , , , . ,#, %, &, = , +, -, *, /,
A to Z, a to z, but μ = ~u, ° = ~c
Characters other than the above are replaced by spaces.
Comments may be omitted.

(query) Returns the current enablement state of title comments, and the characters of the comment if any, as character data.

Example

:COMMENT:TITLE ON, "HIOKI 8825"
Inputs "HIOKI 8825" as a title comment.

When allowed

In all functions.

Enables and disables, and queries, comments for all channels.

Syntax

(command) :COMMent:EACHch A$
(query) :COMMent:EACHch?
(response) A$
A$ = ON, OFF

Explanation

(command) Enables or disables comments for all channels.
(query) Returns the current ON/OFF enablement state of comments for all channels as character data.

When allowed

In all functions.

For each channel, sets and queries the inputs comment characters.

Syntax

(command) :COMMent:CH ch$, "A$,"
(query) :COMMent:CH? ch$
(response) ch$, "A$"
ch$ = CH1 to CH16, CHA to CHH
A$ = comment characters (up to 20 characters)

Explanation

(command) Enables and disables comment display for the channel specified by ch$, and inputs a string of comment characters. Characters that can be used are: 0 to 9, ~u (= μ), ~c (= °), ,
^, (,), , , , . ,#, %, &, = , +, -, *, /, A to Z, a to z, but μ = ~u, ° = ~c
Characters other than the above are replaced by spaces.
Comments may be omitted.

(query) Returns the current enablement state of comment display for the channel specified by ch$, and the characters of the comment if any, as character data.

Example

:COMMENT:CH CH1 , "ch1 = TEST"
Sets the comment display for channel 1 to "ch1 = TEST".

When allowed

In all functions.

10. SCALing command

Enables and disables, and queries, the scaling function.

Syntax

(command) :SCALing:SET ch$, A$
(query) :SCALing:SET? ch$
(response) ch$, A$
ch$ = CH1 to CH16
A$ = OFF, SCI (ON), and ENG

Explanation

(command) Enables or disables the scaling function. A setting SCI or ON produces conventional scientific floating-point notation. The setting ENG produces floating-point notation using powers of 1000.
(query) Returns the current state of enablement of the scaling function as character data.

When allowed In all functions.

Sets and queries the type of scaling function.

Syntax

(command) :SCALing:KIND A$
(query) :SCALing:KIND?
(response) A$
A$ = RATIO, POINT

Explanation

(command) Sets the scaling type as character string data.
(query) Returns the current scaling type setting as character string data.

When allowed In all functions.

Sets and queries the scaling conversion value.

Syntax

(command) :SCALing:VOLT A$, B
(query) :SCALing:VOLT? A$
(response) B<NR3>
A$ = CH1 to CH16
B = scaling conversion value (eu/volts)
(-9.999E+9 to +9.999E+9)

Explanation

(command) Sets the scaling conversion value for CH1 to CH16.
(query) Returns the current scaling conversion value for CH1 to CH16 as character data.

When allowed In all functions.

Sets and queries the scaling offset.

Syntax

(command) :SCALing:OFFSet A$, B
(query) :SCALing:OFFSet? A$
(response) A$, B<NR>
A$ = CH1 to CH16
B= scaling offset (eu/offset)
(-9.999E+9 to +9.999E+9)

Explanation

(command) Sets the scaling offset for CH1 to CH16
(query) Returns the current scaling offset for CH1 to CH16 as an NR3 numerical value.

When allowed In all functions.

Sets and queries the scaling unit.

Syntax

(command) :SCALing:UNIT A$, "B$"
(query) :SCALing:UNIT? A$
(response) A$, "B$"
A$ = CH1 to CH16
B$ = scaling unit (7 characters)

Explanation

(command) Sets the scaling unit for CH1 to CH16 (up to 7 characters allowed).
Characters that can be used are: ^2 (= ^{2}), ^3 (= ^{3}), ~u (= μ), , ~o (= Ω), ~c (= °), %, · , = , +, -, *, /, A to Z, a to z
Characters other than the above are replaced by spaces.
(query) Returns the current scaling unit for CH1 to CH16 as character data.

Example

:SCALING:UNIT CH1, "mA"
Sets the scaling unit for CH1 to milliamps.

When allowed

In all functions.

Sets and queries the scaling VOLT UP and LOW.

Syntax

(command) :SCALing:VOUPLOw ch$, B$, C$
(query) :SCALing:VOUPLOw? ch$
(response) ch$, B$, C$
ch$ = CH1 to CH16
B$ = C$ = -9.9999E+29 to +9.9999E+29

Explanation

(command) Sets the scaling VOLT UP and VOLT LOW values for CH1 to CH16.
(query) Returns the current scaling VOLT UP and VOLT LOW values for CH1 to CH16 as an NR3 numerical value.

When allowed

In all function.

Sets and queries the scaling SCALE UP and LOW.

Syntax

(command) :SCALing:SCUPLOw ch$, B$, C$
(query) :SCALing:SCUPLOw? ch$
(response) ch$, B$, C$
ch$ = CH1 to CH16
B$ = C$ = -9.9999E+29 to +9.9999E+29

Explanation

(command) Sets the scaling SC UP and SC LOW values for CH1 to CH16.
(query) Returns the current scaling SC UP and SC LOW values for CH1 to CH16 as an NR3 numerical value.

When allowed

In all function.

11. CALCulate command

Enables and disables, and queries, waveform processing calculation.

Syntax

(command) :CALCulate:WVCALc A$
(query) :CALCulate:WVCALc?
(response) A$
A$ = OFF, ON, EXEC (execute)

Explanation

(command) Enables or disables, according to character data, the execution of waveform processing calculation.
(query) Returns, as character data, whether execution of waveform processing calculation is enabled or disabled.
Only valid when execution (EXEC) is enabled.

When allowed In the memory recorder function.

Enables and disables, and queries, waveform parameter calculation.

Syntax

(command) :CALCulate:MEASure A$
(query) :CALCulate:MEASure?
(response) A$
TA$ = OFF, ON, EXEC (execute)

Explanation

(command) Enables or disables, according to character data, the execution of waveform parameter calculation.
(query) Returns, as character data, whether execution of waveform parameter calculation is enabled or disabled.
Only valid when execution (EXEC) is enabled.

When allowed In the memory recorder function.

Enables and disables, and queries, waveform parameter calculation value printing.

Syntax

(command) :CALCulate:MEASPrint A$
(query) :CALCulate:MEASPrint?
(response) A$
A$ = OFF, ON

Explanation

(command) Enables or disables, according to character data, print output of waveform parameter calculation values.
(query) Returns, as character data, whether execution of print output of waveform parameter calculation values is enabled or disabled.

When allowed In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z1.

Syntax

(command) :CALCulate:Z1 A$, B$, C$, D$
(query) :CALCulate:Z1?
(response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z1 according to the character data.
(query) Returns the current coefficients for the waveform processing calculation equation for Z1 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z1 in the following way:
Z1 = A$ X1 D$ B$ Y1 + C$

Example :CALCULATE:Z1 A, B, C, PLUS
Sets up the calculation equation for Z1 to be Z1 = aX1+bY1+c

When allowed In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z2.

Syntax

(command) :CALCulate:Z2 A$, B$, C$, D$
(query) :CALCulate:Z2?
(response) A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z2 according to the character data.
(query) Returns the current coefficients for the waveform processing calculation equation for Z2 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z2 in the following way:
Z2 = A$ X2 D$ B$ Y2 + C$

Example :CALCULATE:Z2 A, B, C, PLUS
Sets up the calculation equation for Z2 to be Z2 = aX2+bY2+c

When allowed In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z3.

Syntax

(command) :CALCulate:Z3 A$, B$, C$, D$
(query) :CALCulate:Z3?
response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) :Sets the coefficients for the waveform processing calculation equation for Z3 according to the character data.

(query) :Returns the current coefficients for the waveform processing calculation equation for Z3 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z3 in the following way:
Z3 = A$ X3 D$ B$ Y3 + C$

Example

:CALCULATE:Z3 A, B, C, PLUS
Sets up the calculation equation for Z3 to be Z3 = aX3+bY3+c

When allowed

In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z4.

Syntax

(command) :CALCulate:Z4 A$, B$, C$, D$
(query) :CALCulate:Z4?
(response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z4 according to the character data.

(query) Returns the current coefficients for the waveform processing calculation equation for Z4 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z4 in the following way:
Z4 = A$ X4 D$ B$ Y4 + C$

Example

:CALCULATE:Z4 A, B, C, PLUS
Sets up the calculation equation for Z4 to be Z4 = aX4+bY4+c

When allowed

In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z5.

Syntax

(command) :CALCulate:Z5 A$, B$, C$, D$
(query) :CALCulate:Z5?
(response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z5 according to the character data.

(query) Returns the current coefficients for the waveform processing calculation equation for Z5 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z5 in the following way:
Z5 = A$ X4 D$ B$ Y5 + C$

Example

:CALCULATE:Z5 A, B, C, PLUS
Sets up the calculation equation for Z5 to be Z5 = aX5+bY5+c

When allowed

In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z6.

Syntax

(command) :CALCulate:Z6 A$, B$, C$, D$
(query) :CALCulate:Z6?
(response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z6 according to the character data.

(query) Returns the current coefficients for the waveform processing calculation equation for Z6 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z6 in the following way:
Z6 = A$ X6 D$ B$ Y6 + C$

Example

:CALCULATE:Z6 A, B, C, PLUS
Sets up the calculation equation for Z6 to be Z6 = aX6+bY6+c

When allowed

In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z7.

Syntax

(command) :CALCulate:Z7 A$, B$, C$, D$
(query) :CALCulate:Z7?
(response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z7 according to the character data.

(query) Returns the current coefficients for the waveform processing calculation equation for Z7 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z7 in the following way:
Z7 = A$ X7 D$ B$ Y7 + C$

Example

:CALCULATE:Z7 A, B, C, PLUS
Sets up the calculation equation for Z7 to be Z7 = aX7+bY7+c

When allowed

In the memory recorder function.

Sets and queries the coefficients for the waveform processing calculation equation for Z8.

Syntax

(command) :CALCulate:Z8 A$, B$, C$, D$
(query) :CALCulate:Z8?
(response) A$, B$, C$, D$
A$, B$, C$ = A to P
D$= PLUS : +
MINUS : -
MULT : *
DIVI : /

Explanation

(command) Sets the coefficients for the waveform processing calculation equation for Z8 according to the character data.

(query) Returns the current coefficients for the waveform processing calculation equation for Z8 as character data.
A$, B$, C$, D$ are used to set up the calculation equation for Z8 in the following way:
Z8 = A$ X8 D$ B$ Y8 + C$

Example

:CALCULATE:Z8 A, B, C, PLUS
Sets up the calculation equation for Z8 to be Z8 = aX8+bY8+c

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X1.

Syntax

(command) :CALCulate:X1 A$, ch$, B$
(query) :CALCulate:X1?
(response) A$, ch$, B$
A$= OFF (in this case, ch$ and B$ are disregarded)
PAR :(
ABS :Absolute value
EXP :Exponential
LOG :Common logarithm
SQR :Square root
MOV :Moving average
DIF :Differentiation once
INT :Intergration once
DIF2 :Differentiation twice
INT2 :Intergration twice
SLI :Parallel displacement
ch$=CH1 to CH16
B$= A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X1 calculation equation for the waveform processing calculation equation for Z1 according to the character or numerical data.

(query) Returns the current X1 calculation equation for the waveform processing calculation equation for Z1 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:
X1 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X1 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X1 ABS, CH1, A
Sets up the calculation equation for X1 to be X1 = ABS(ch1+a)
:CALCULATE:X1 MOV, CH1, 50
Sets up the calculation equation for X1 to be X1 = MOV(ch1,50)

When allowed In the memory recorder function.

Sets up and queries the calculation equation for X2.

Syntax

(command) :CALCulate:X2 A$, ch$, B$
(query) :CALCulate:X2?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS :Absolute value
EXP :Exponential
LOG :Common logarithm
SQR :Square root
MOV :Moving average
DIF :Differentiation once
INT : Intergration once
DIF2 :Differentiation twice
INT2 :Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1
B$ = A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X2 calculation equation for the waveform processing calculation equation for Z2 according to the character or numerical data.

(query) Returns the current X2 calculation equation for the waveform processing calculation equation for Z2 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X2 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X2 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X2 ABS, CH1, A
Sets up the calculation equation for X2 to be X2 = ABS(ch1+a)
:CALCULATE:X2 MOV, CH1, 50
Sets up the calculation equation for X2 to be X2 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X3.

Syntax

(command) :CALCulate:X3 A$, ch$, B$
(query) :CALCulate:X3?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1, Z2

B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X3 calculation equation for the waveform processing calculation equation for Z3 according to the character or numerical data.

(query) Returns the current X3 calculation equation for the waveform processing calculation equation for Z3 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X3 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X3 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X3 ABS, CH1, A
Sets up the calculation equation for X3 to be X3 = ABS(ch1+a)
:CALCULATE:X3 MOV, CH1, 50
Sets up the calculation equation for X3 to be X3 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X4.

Syntax

(command) :CALCulate:X4 A$, ch$, B$
(query) :CALCulate:X4?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1 to Z3
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X4 calculation equation for the waveform processing calculation equation for Z4 according to the character or numerical data.

(query) Returns the current X4 calculation equation for the waveform processing calculation equation for Z4 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X4 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X4 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X4 ABS, CH1, A
Sets up the calculation equation for X4 to be X4 = ABS(ch1+a)
:CALCULATE:X4 MOV, CH1, 50
Sets up the calculation equation for X4 to be X4 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X5.

Syntax

(command) :CALCulate:X5 A$, ch$, B$
(query) :CALCulate:X5?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1 to Z4
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X5 calculation equation for the waveform processing calculation equation for Z5 according to the character or numerical data.

(query) Returns the current X5 calculation equation for the waveform processing calculation equation for Z5 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X5 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X5 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X5 ABS, CH1, A
Sets up the calculation equation for X5 to be X5 = ABS(ch1+a)
:CALCULATE:X5 MOV, CH1, 50
Sets up the calculation equation for X5 to be X5 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X6.

Syntax

(command) :CALCulate:X6 A$, ch$, B$
(query) :CALCulate:X6?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1 to Z5
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X6 calculation equation for the waveform processing calculation equation for Z6 according to the character or numerical data.

(query) Returns the current X6 calculation equation for the waveform processing calculation equation for Z6 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X6 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X6 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X6 ABS, CH1, A
Sets up the calculation equation for X6 to be X6 = ABS(ch1+a)
:CALCULATE:X6 MOV, CH1, 50
Sets up the calculation equation for X6 to be X6 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X7.

Syntax

(command) :CALCulate:X7 A$, ch$, B$
(query) :CALCulate:X7?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1 to Z6
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X7 calculation equation for the waveform processing calculation equation for Z7 according to the character or numerical data.

(query) Returns the current X7 calculation equation for the waveform processing calculation equation for Z7 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X7 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X7 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X7 ABS, CH1, A
Sets up the calculation equation for X7 to be X7 = ABS(ch1+a)
:CALCULATE:X7 MOV, CH1, 50
Sets up the calculation equation for X7 to be X7 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for X8.

Syntax

(command) :CALCulate:X8 A$, ch$, B$
(query) :CALCulate:X8?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1 to Z7
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the X8 calculation equation for the waveform processing calculation equation for Z8 according to the character or numerical data.

(query) Returns the current X8 calculation equation for the waveform processing calculation equation for Z8 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

X8 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
X8 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:X8 ABS, CH1, A
Sets up the calculation equation for X8 to be X8 = ABS(ch1+a)
:CALCULATE:X8 MOV, CH1, 50
Sets up the calculation equation for X8 to be X8 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for Y1.

Syntax

(command) :CALCulate:Y1 A$, ch$, B$
(query) :CALCulate:Y1?
(response) A$, ch$, B$

A$=OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y1 calculation equation for the waveform processing calculation equation for Z1 according to the character or numerical data.

(query) Returns the current Y1 calculation equation for the waveform processing calculation equation for Z1 as character or numerical data.

A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y1 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y1 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:Y1 ABS, CH1, A
Sets up the calculation equation for Y1 to be Y1 = ABS(ch1+a)
:CALCULATE:Y1 MOV, CH1, 50
Sets up the calculation equation for Y1 to be Y1 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for Y2.

Syntax

(command) :CALCulate:Y2 A$, ch$, B$
(query) :CALCulate:Y2?
(response) A$, ch$, B$

A$=OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y2 calculation equation for the waveform processing calculation equation for Z2 according to the character or numerical data.

(query) Returns the current Y2 calculation equation for the waveform processing calculation equation for Z2 as character or numerical data.

A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y2 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y2 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:Y2 ABS, CH1, A
Sets up the calculation equation for Y2 to be Y2 = ABS(ch1+a)
:CALCULATE:Y2 MOV, CH1, 50
Sets up the calculation equation for Y2 to be Y2 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for Y3.

Syntax

(command) :CALCulate:Y3 A$, ch$, B$
(query) :CALCulate:Y3?
(response) A$, ch$, B$

A$=OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$ = CH1 to CH16, Z1, Z2
B$ =A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y3 calculation equation for the waveform processing calculation equation for Z3 according to the character or numerical data.

(query) Returns the current Y3 calculation equation for the waveform processing calculation equation for Z3 as character or numerical data. A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y3 = A$(ch$+B$)

or, when A$ is set to MOV or SLI:

Y3 = [MOV or SLI] (ch$,B$)

(Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:Y3 ABS, CH1, A
Sets up the calculation equation for Y3 to be Y3 = ABS(ch1+a)
:CALCULATE:Y3 MOV, CH1, 50
Sets up the calculation equation for Y3 to be Y3 = MOV(ch1,50)

When allowed

In the memory recorder function.

Sets up and queries the calculation equation for Y4.

Syntax

(command) :CALCulate:Y4 A$, ch$, B$
(query) :CALCulate:Y4?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$=CH1 to CH16, Z1 to Z3
B$= A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y4 calculation equation for the waveform processing calculation equation for Z4 according to the character or numerical data.

(query) Returns the current Y4 calculation equation for the waveform processing calculation equation for Z4 as character or numerical data.
A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y4 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y4 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

(1) :CALCULATE:Y4 ABS, CH1, A
Sets up the calculation equation for Y4 to be Y4 = ABS(ch1+a)

(2) :CALCULATE:Y4 MOV, CH1, 50
Sets up the calculation equation for Y4 to be Y4 = MOV(ch1,50)

When allowed In the memory recorder function.

Sets up and queries the calculation equation for Y5.

Syntax

(command) :CALCulate:Y5 A$, ch$, B$
(query) :CALCulate:Y5?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$=CH1 to CH16, Z1 to Z4
B$= A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y5 calculation equation for the waveform processing calculation equation for Z5 according to the character or numerical data.

(query) Returns the current Y5 calculation equation for the waveform processing calculation equation for Z5 as character or numerical data.

A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y5 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y5 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

(1) :CALCULATE:Y5 ABS, CH1, A
Sets up the calculation equation for Y5 to be Y5 = ABS(ch1+a)

(2) :CALCULATE:Y5 MOV, CH1, 50
Sets up the calculation equation for Y5 to be Y5 = MOV(ch1,50)

When allowed In the memory recorder function.

Sets up and queries the calculation equation for Y6.

Syntax

(command) :CALCulate:Y6 A$, ch$, B$
(query) :CALCulate:Y6?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$=CH1 to CH16, Z1 to Z5
B$= A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y6 calculation equation for the waveform processing calculation equation for Z6 according to the character or numerical data.

(query) Returns the current Y6 calculation equation for the waveform processing calculation equation for Z6 as character or numerical data.

A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y6 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y6 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

(1) :CALCULATE:Y6 ABS, CH1, A
Sets up the calculation equation for Y6 to be Y6 = ABS(ch1+a)

(2) :CALCULATE:Y6 MOV, CH1, 50
Sets up the calculation equation for Y6 to be Y6 = MOV(ch1,50)

When allowed In the memory recorder function.

Sets up and queries the calculation equation for Y7.

Syntax

(command) :CALCulate:Y7 A$, ch$, B$
(query) :CALCulate:Y7?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$=CH1 to CH16, Z1 to Z6
B$= A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y7 calculation equation for the waveform processing calculation equation for Z7 according to the character or numerical data.

(query) Returns the current Y7 calculation equation for the waveform processing calculation equation for Z7 as character or numerical data.

A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y7 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y7 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

(1) :CALCULATE:Y7 ABS, CH1, A
Sets up the calculation equation for Y7 to be Y7 = ABS(ch1+a)

(2) :CALCULATE:Y7 MOV, CH1, 50
Sets up the calculation equation for Y7 to be Y7 = MOV(ch1,50)

When allowed In the memory recorder function.

Sets up and queries the calculation equation for Y8.

Syntax

(command) :CALCulate:Y8 A$, ch$, B$
(query) :CALCulate:Y8?
(response) A$, ch$, B$

A$= OFF (in this case, ch$ and B$ are disregarded)
PAR : (
ABS : Absolute value
EXP : Exponential
LOG : Common logarithm
SQR : Square root
MOV : Moving average
DIF : Differentiation once
INT : Intergration once
DIF2 : Differentiation twice
INT2 : Intergration twice
SLI : Parallel displacement

ch$=CH1 to CH16, Z1 to Z7

B$= A to P;
or, when A$ is set to MOV, a numerical value from 1 to 4000;
or, when A$ is set to SLI, a numerical value from -4000 to 4000.

Explanation

(command) Sets the Y8 calculation equation for the waveform processing calculation equation for Z8 according to the character or numerical data.

(query) Returns the current Y8 calculation equation for the waveform processing calculation equation for Z8 as character or numerical data.
A$, B$, and ch$ are used to set up the calculation equation in the following way:

Y8 = A$(ch$+B$)
or, when A$ is set to MOV or SLI:
Y8 = [MOV or SLI] (ch$,B$)
(Refer to Section 11 "Calculation Functions.")

Example

(1) :CALCULATE:Y8 ABS, CH1, A
Sets up the calculation equation for Y8 to be Y8 = ABS(ch1+a)

(2) :CALCULATE:Y8 MOV, CH1, 50
Sets up the calculation equation for Y8 to be Y8 = MOV(ch1,50)

When allowed In the memory recorder function.

Sets and queries numerical values for coefficients a to p of the waveform processing calculation equation.

Syntax

(command) :CALCulate:FACTor A$, B
(query) :CALCulate:FACTor? A$
(response) A$, B<NR3>
A$ = A to P
B = -9.999E+9 to +9.999E+9

Explanation

(command) Sets to the given numerical value the one of the coefficients a to p which is designated in A$.
(query) Returns as an <NR 3> numerical value the current value of that one of the coefficients a to p which is designated in A$. (Refer to Section 11 "Calculation Functions.")

Example

:CALCULATE:FACTOR A, +1.234E+1
Sets the coefficient a to be equal to +1.234E+1

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z1.

Syntax

(command) :CALCulate:Z1DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z1DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z1 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).
(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z1.

Example

:CALCULATE:Z1DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z1 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z2.

Syntax

(command) :CALCulate:Z2DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z2DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z2 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z2.

Example

:CALCULATE:Z2DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z2 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z3.

Syntax

(command) :CALCulate:Z3DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z3DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z3 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z3.

Example

:CALCULATE:Z3DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z3 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z4.

Syntax

(command) :CALCulate:Z4DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z4DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z4 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z4.

Example

:CALCULATE:Z4DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z4 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z5.

Syntax

(command) :CALCulate:Z5DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z5DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z5 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z5.

Example

:CALCULATE:Z5DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z5 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z6.

Syntax

(command) :CALCulate:Z6DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z6DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z6 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z6.

Example

:CALCULATE:Z6DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z6 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z7.

Syntax

(command) :CALCulate:Z7DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z7DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z7 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z7.

Example

:CALCULATE:Z7DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z7 on channel 1 within the range from 0 volts to 5 volts.

When allowed

In the memory recorder function.

Sets and queries the display channel for the calculated result of the waveform processing calculation equation for Z8.

Syntax

(command) :CALCulate:Z8DIsplay ch$, A$, upper, lower
(query) :CALCulate:Z8DIsplay?
(response) ch$, A$, upper, lower
ch$ = CH1 to CH16, NONE
A$ = AUTO, MANUal
(if ch$ = NONE, may be omitted)
upper, lower = -9.9999E+29 to +9.9999E+29
(if ch$ = NONE or A$ = MANUAL, may be omitted)

Explanation

(command) Displays the calculated result of the waveform processing calculation equation for Z8 on the channel designated by ch$ within the range from lower to upper (unit volts - however, if scaling is being performed, in those units).

(query) Returns the currently set display channel, scale setting lower limit, and upper limit for display of the calculated result of the waveform processing calculation equation for Z8.

Example

:CALCULATE:Z8DISPLAY CH1, MANUAL, +5.0000E+00, +0.0000E+00
Displays the calculated result of the waveform processing calculation equation for Z8 on channel 1 within the range from 0 volts to 5 volts.

When allowed In the memory recorder function.

Queries parameter calculation result.

Syntax

(query) :CALCulate:ANSWer? A$, B$
(response) :C$, D<NR 3>
A$= NO1 to NO4
B$= NO1 to NO16
C$ =NONE, MIN, MAX, MINT, MAXT, PP, AVE, RMS, AREA, PERI, FREQ, RISE, FALL, XYAREA
D = calculation result (units volts and seconds; if scaling is in effect, in the specified units)

Explanation

(query) Returns the calculation result for the waveform parameter calculation item and result specified by A$ and B$.
When C$ is NONE, there is no calculation result.

When allowed In the memory recorder function.

Sets and queries waveform parameter calculations.

Syntax

(command) :CALCulate:MEASSet NO$, A$, ch$
(query) :CALCulate:MEASSet? NO$
(response) NO$, A$, ch$

NO$ = NO1 to NO4
A$= OFF

MIN	:minimum value
MAX	:maximum value
MINT	:time to minimum value
MAXT	:time to maximum value
PP	: peak value
AVE	:average value
RMS	:effective value
AREA	:area value
PERI	: periodicity
FREQ	: frequency
RISE	:rising time
FALL	:fall time
XYAREA	:X-Y area value

ch$ = CH1 to CH16, ALL
During XYAREA,
ch$ = x-axis channel, y-axis channel.

Explanation

(command) Sets the channel and the calculation item of the waveform parameter calculation designated by NO$.
(query) Returns the the channel and the calculation item of the waveform parameter calculation designated by NO$.

Example

(1) :CALCULATE:MEASSET NO1,MAX,CH1
Sets the calculation to be of the maximum value on channel 1.
(2) :CALC :MEASS NO2,XYAREA,CH1,CH2
If the X-axis is channel 1 and the Y-axis is channel 2, sets X-Y area value calculation.

When allowed

In the memory recorder function.

Enables and disables, and queries, decision for waveform parameter calculation.

Syntax

(command) :CALCulate:COMP No$, A$
(query) :CALCulate:COMP?
(response) No$, A$
No$ = No1 to No4
A$ = OFF, ON

Explanation

(command) Enables and disables, according to the character data, the decision of the calculation result of waveform parameter calculation.

(query) Returns, as character data, the enablement state of the decision of the calculation result of waveform parameter calculation.

When allowed In the memory recorder function.

Sets and queries upper and lower limits for the decision value for waveform parameter calculation.

Syntax

(command) :CALCulate:COMPArea A$, upper, lower
(query) :CALCulate:COMPArea? A$
(response) A$, upper, lower
A$ = No1 to No4
upper, lower = -9.999E+9 to +9.999E+9

Explanation

(command) Sets, according to the numerical values supplied, the upper limit and the lower limit used when performing a decision on the waveform parameter calculated value designated by A$.

(query) Returns, as <NR 3> numerical values, the upper limit and the lower limit used when performing a decision on the waveform parameter calculated value designated by A$.

Example

:CALCULATE:COMPAREA NO1, +1.000E+0,-1.000E+0
Sets the decision value for the waveform parameter calculation NO1 to be in the range -1.000E+0 < NO1 < +1.000E+0

When allowed In the memory recorder function.

12. FDISK command

Sets and queries the floppy disk mode.

Syntax

(command) :FDISK:MODE A$
(query) :FDISK:MODE?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables and disables the floppy disk mode.
(query) Returns whether the floppy disk mode is currently enabled or disabled.

When allowed In all functions.

Performs a load from the floppy disk.

Syntax

(command) :FDISK:LOAD NO A$
NO = file number
A$= FULL
MINImum
STARt
APPEnd
(A$ can be omitted see figure below)

Explanation

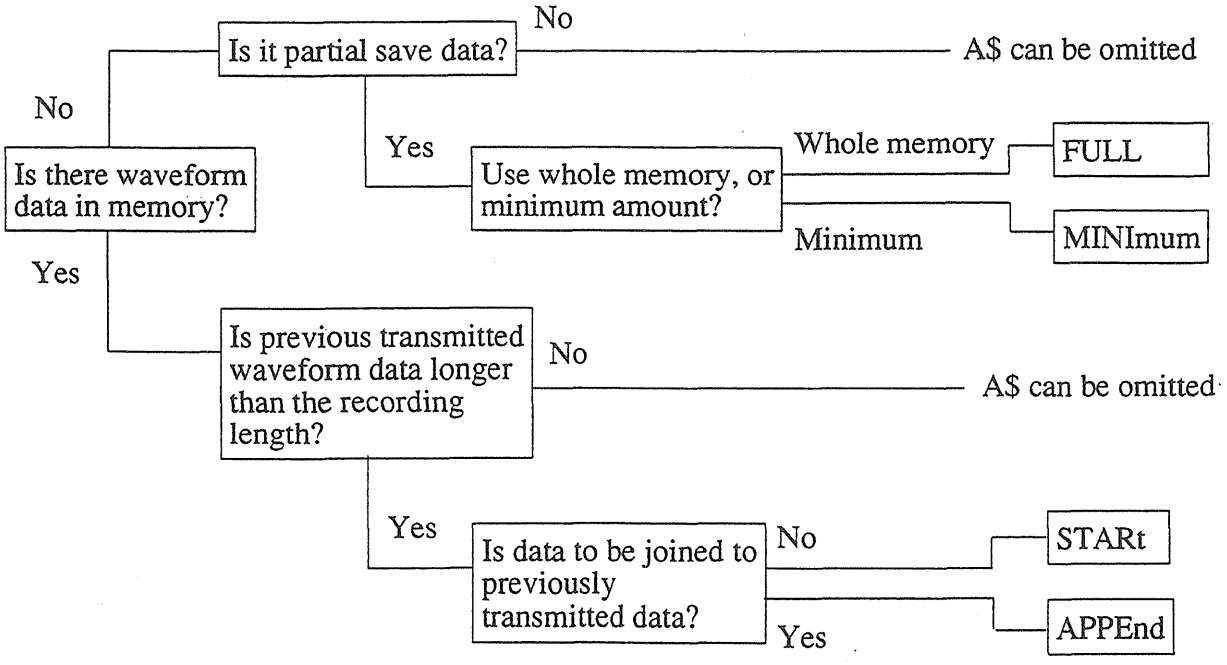
(command) Loads the data in the file numbered NO.

Example

:FDISK:LOAD 1
Loads the data of the file numbered 1 on the floppy disk.

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

- Transmission methods and conditions



Note When a FULL/MINImum or STARt/APPEnd selection can be made, of the A$ specification is omitted, the defaults are MINImum and STARt.

Performs a save to the floppy disk.

Syntax (command) :FDISK:SAVE "NAME1$.NAME2$", A$, B$ (when A$ = W)
:FDISK:SAVE "NAME1$.NAME2$", A$ (when A$ = F or A)
NAME1$ = file name (8 characters)
NAME2$ = extension (3 characters)
A$ = type of saved information
Wave: measurement data (MEM, REC, and FFT only, but when ARRAY display in FFT is disapproved.)
Fune: setting data
Area: waveform decision area (MEM and FFT only)
B$ =saved channels (only when A$ = W, and when FFT, may be disre garded and omitted.)
ALL
CH1 to CH16
LOG A (logic CHA to CHD)
LOG E (logic CHE to CHH)

Explanation (command) Saves on the floppy disk the information specified by A$. If an attempt is made to save to a filename that already exists, an execution error is generated.

Example :FDISK:SAVE"TEST.DAT",W,ALL
Saves all channels of measurement data on the floppy disk under the file name "TEST.DAT"

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

Deletes a file from the floppy disk.

Syntax (command) :FDISK:DELEte No
No = file number

Explanation (command) Deletes from the floppy disk the file whose number is specified by No.

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

Formats a floppy disk.

Syntax (command) :FDISK:FORMat

Explanation (command) :Formats a floppy disk.

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

Queries how many files are saved on the floppy disk.

Syntax (query) :FDISK:FILE?
(response) A<NR 1>
A = number of files

Explanation (query) Returns the number of files which are currently saved on the floppy disk.

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

Queries the name of a file saved on the floppy disk.

Syntax (query) :FDISK:NINFor? No
(response) No, NAME$
No = file number
NAME$ = name of the file

Explanation (query) Returns the filename of the file whose number is specified in No.

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

Queries information about a file saved on the floppy disk.

Syntax (query) :FDISK:INFOr? "NAME$"
(response) "NAME$", A,B$,"DATE$","TIME$", C
NAME$ = file name
A = file number (if no such file exists, 1)
B$ = type of information saved:
W: measurement data
F : conditions of creation
A : waveform decision area
N : no such file
DATE$ = date of save "year-month-day"
TIME$ = time of save "hour:minute:second"
C = size of file

Explanation (query) Returns information about the file whose name is specified in NAME$. If no such file exists, returns:
-1, N, "----", "-:-:-", 0

When allowed When the floppy disk control screen is displayed (after :FDISK:MODE ON).

13. GRAPh command

Enables and disables, and queries the enablement of, the graphics editor.

Syntax

(command) :GRAPh:EDIT A$
(query) :GRAPh:EDIT?
(response) A$
A$ = OFF,ON

Explanation

(command) Enables, and disables, the graphic editor mode.
(query) Returns whether or not the graphic editor mode is enabled as character data.

When allowed In the memory recorder function. (Single, XYsingle format), and the FFT function (Single, Nyquist format)

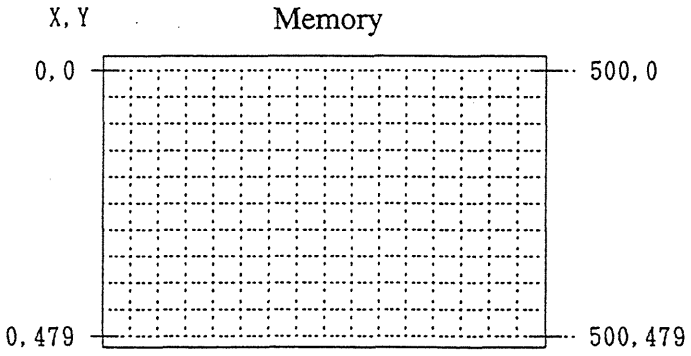
Line command

Syntax

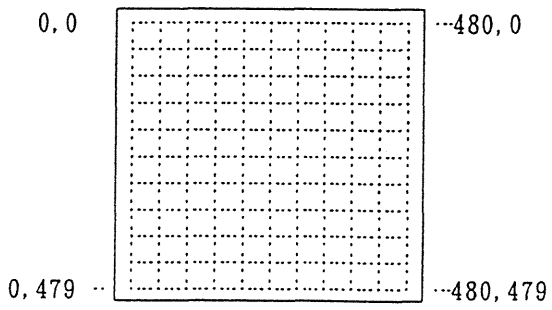
(command) :GRAPh: LINE X1, Y1, X2, Y2
X1, X2 = x-coordinates
Y1, Y2 = y-coordinates

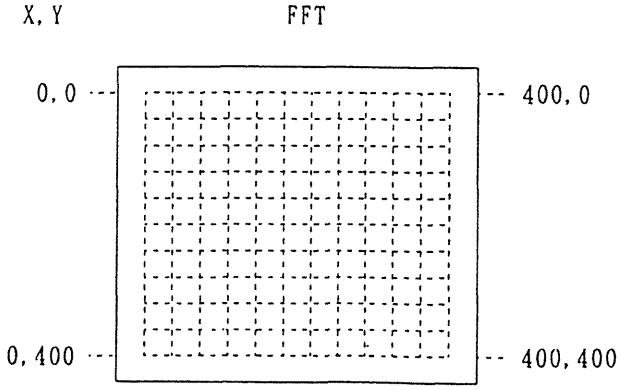
Explanation

Draws a line from (X1, Y1) to (X2, Y2).
The relationship between the x- and y-coordinates is as follows.



Memory (X-Y format)





When allowed In the memory recorder function, when in the graphic editor mode.

Parallel Command

Syntax (command) :GRAPh: PARAllel high, low, right, left
high = 0 to 23.95 (div)
low = 0 to 23.95 (div)
right = 0 to 24.95 (div)
left = 0 to 24.95 (div)

Explanation Carries out a parallel movement of the drawing.
The "high" and "low" parameters are set in units of 0.05 steps, and the "right" and "left" parameters in units of 0.05 steps.

When allowed In the memory recorder function and FFT function, when in the graphics editor mode.

Paint command

Syntax (command) :GRAPh: PAINT X, Y
X = x-coordinate
Y = y-coordinate

Explanation Begins solid fill from the point specified by (X, Y).
Refer to the :GRAPh:LINE command for details of X and Y.

When allowed In the memory recorder function and FFT function, when in the graphics editor mode.

Erase command

Syntax (command) :GRAPh:ERASe X1, Y1, X2, Y2
X1, X2 = x-coordinates
Y1, Y2 = y-coordinates

Explanation Erases the line from (X1, Y1) to (X2, Y2).
Refer to the :GRAPh:LINE command for details of X and Y.

When allowed In the memory recorder function and FFT function, when in the graphics editor mode.

Loads a waveform from storage.

Syntax (command) :GRAPh: STORage

Explanation Loads a waveform into the editor.

When allowed In the memory recorder function and FFT function, when in the graphics editor mode.

The reverse command.

Syntax (command) :GRAPh:REVErse

Explanation (command) Reverses the video of the drawing.

When allowed In the memory recorder function, and FFT function when in the graphic editor mode.

The all clear command.

Syntax (command) :GRAPh:ALLClear

Explanation (command) Clears the entire drawing.

When allowed In the memory recorder function and FFT function, when in the graphic editor mode.

Clear command

Syntax (command) :GRAPh: CLEAr X1, Y1, X2, Y2
X1, X2 = x-coordinates
Y1, Y2 = y-coordinates

Explanation Clears the rectangle with the points (X1, Y1) and (X2, Y2) at diagonally opposite corners.
Refer to the :GRAPh:LINE command for details of X and Y.

When allowed In the memory recorder function, and FFT function when in the graphics editor mode.

Undo command

Syntax (command) :GRAPh: UNDO

Explanation Reverses the effect of the immediately previous editor command.

When allowed In the memory recorder function, and FFT function when in the graphics editor mode.

Saves the drawing (decision area)

Syntax (command) :GRAPh: SAVE

Explanation Saves the decision area created with the editor.

When allowed In the memory recorder function, and FFT function when in the graphics editor mode.

Sets and queries decision area data points.

Syntax (command) :GRAPh:POINt X, Y, A
(query) :GRAPh:POINt? X, Y
(response) A<NR1>
X = x-coordinate
Y = y-coordinate
A = 0, 1

Explanation Writes the value A at the coordinates indicated by X and Y.
Returns the value A at the coordinates indicated by X and Y.
A is 1 for a point within the decision area, 0 for a point outside it.

When allowed In the memory recorder function, and FFT function when in the graphic editor mode.

Chapter 5

Example Programs

Sample programs

These sample programs use a Hewlett-Packard HP9816 to control the 8825 on GP-IB device address 5.

Example 1 - Using setting commands

This program makes the following settings, then starts data capture.

Function	:memory recorder
Format	:single
Time axis	:1 ms/division
Shot length	:25 divisions
Trigger source	:OR
Pre-trigger	:5%
Level trigger	:channel 1, at 0.5 V
Slope	:up

```
100 !----------------------------!
110 !  8825 Sample Program No.1  !
120 !----------------------------!
130 !
140 Adr=705                                    !Address=5
150 OUTPUT Adr;":FUNCTION MEM"
160 OUTPUT Adr;":CONFIGURE:FORMAT SINGLE"
170 OUTPUT Adr;":CONFIGURE:TDIV 1.E-3"
180 OUTPUT Adr;":CONFIGURE:SHOT 25"
190                                            !Set trigger mode
200 OUTPUT Adr;":TRIGGER:MODE SINGLE"
210 OUTPUT Adr;":TRIGGER:SOURCE OR"
220 OUTPUT Adr;":TRIGGER:PRETRIG 5"
230 OUTPUT Adr;":TRIGGER:KIND CH1,LEVEL"
240 OUTPUT Adr;":TRIGGER:LEVEL CH1,0.5"
250 OUTPUT Adr;":TRIGGER:SLOPE CH1,UP"
260 OUTPUT Adr;":TRIGGER:KIND CH2,OFF"
270 OUTPUT Adr;":TRIGGER:KIND CH3,OFF"
280 OUTPUT Adr;":TRIGGER:KIND CH4,OFF"
290                                            !Start
300 OUTPUT Adr;":START"
310 END
```

Notes on program

Line 140	:Select GP-IB device address 5.
Lines 150-280	:Make the settings.
Line 300	:Start data capture.

Example 2 - Using queries

This program asks the 8825 the current date and time, and what function it is in.

```
100  !----------------------------!
110  !  8825 Sample Program No.2  !
120  !----------------------------!
130  !
140  Adr=705                                    !Address=5
150  OUTPUT Adr;":HEADER OFF"
160  OUTPUT Adr;":SYSTEM:DATE?"                 !Read date
170  ENTER  Adr;Dy,Dm,Dd
180  OUTPUT Adr;":SYSTEM:TIME?"                 !Read time
190  ENTER  Adr;Th,Tm,Ts
200  OUTPUT Adr;":FUNCTION?"                    !Read function
210  ENTER  Adr;Fu$
220  !
230  PRINT Dy,Dm,Dd                             !Print date
240  PRINT Th,Tm,Ts                             !Print time
250  PRINT Fu$                                  !Print function
260  END
```

Example 3 Using service requests

This program reads data until an error occurs.

```
100  !---------------------------!
110  !  8825 Sample Program No.3  !
120  !---------------------------!
130  !
140  Adr=705                                    !Address=5
150  ON INTR 7 GOTO Srq_sub                     !Initialize
160  OUTPUT Adr;"*SRE 32"
170  OUTPUT Adr;"*ESE 60"
180  OUTPUT Adr;"*CLS"
190  ENABLE INTR 7;2
200  OUTPUT Adr;":CURSOR:MODE TRACE"
210  I=0
220 Loop:                                       !Main loop
230  OUTPUT Adr;":CURSOR:APOSITION ";I
240  OUTPUT Adr;":CURSOR:DFREAD? A"
250  ENTER Adr;A$
260  OUTPUT Adr;":CURSOR:DVREAD? A"
270  ENTER Adr;B$
280  PRINT A$,B$
290  I=I+100
300  GOTO Loop                                  !Loop end
310  !
320 Srq_sub:                                    !Service request routine
330  S=SPOLL(Adr)
340  IF BINAND(S,64)<>0 THEN Srq_sub
350  GOTO End_prc
360 Srq_prc: !
370  OUTPUT Adr;"*ESR?"
380  ENTER Adr;C
390  IF BINAND(C,4)<>0  THEN PRINT "Query Error"
400  IF BINAND(C,8)<>0  THEN PRINT "Machine Error"
410  IF BINAND(C,16)<>0 THEN PRINT "Execution Error"
420  IF BINAND(C,32)<>0 THEN PRINT "Command Error"
430 End_prc: !
440  PRINT "End"
450  END
```

Sample output

```
"0s"        "-1.25mV"
"500us"     "933.75mV"
"1ms"       "1.5262V"
            .
            .
            .
"12.5ms"    "452.5mV"
Query Error
Execution Error
End
```

Notes on program

Line 140	:Select GP-IB device address 5.
Line 150	:Attach label Srq_sub for service request handling.
Line 160	:Set service request enable register. Value 32 means enable bit 5 (event summary) of status byte to cause a service request when it goes to 1.
Line 170	:Set standard event status enable register. Value 60 means enable bits 2, 3, 4 and 5 so that bit 5 of the status byte goes to 1 when there is a query error, machine error, execution error, or command error. Various other combinations of settings for *SRE, *ESE and :ESE0 are possible to vary the service request issuing conditions.
Line 180	:Clear the status byte, standard event status register, and event status register to zero.
Line 190	:Enable service request interrupt.
Line 200	:Display cursor in trace mode.
Lines 210-300	:Read the data values at the A cursor positions, moving the A cursor along by 100 points at a time. If an error occurs, call the service request subroutine Srq_sub. Line 230 sets the A cursor position to I, then lines 240 to 270 read the time (frequency) and voltage at the A cursor position. Line 290 advances the cursor position by 100.
Lines 320-450	:Service request handling routine
Line 330	:Poll device on address 5. Read status byte.
Lines 340-350	:If bit 6 of the status byte was 1 (i.e. if device on address 5 has generated a service request), go to label Src_prc. Otherwise (i.e. a different device generated the service request) go to label End_prc.
Lines 370-380	:Read standard event status register.
Lines 390-420	:Display a message indicating the type of error (corresponding to bits 2 to 5).
Lines 440-450	: Display ending message, and end.

Example 4 - Saving captured data to a disk

```
100  !---------------------------!
110  !  8825 Sample Program No.4  !
120  !---------------------------!
130  !
140  Adr=705                                    !Address=5
150  ON ERROR GOTO Err_prc                      !Initialize
160  !
170  PRINT "<Save Storage Data>"
180  OUTPUT Adr;":HEADER OFF"
190  OUTPUT Adr;":MEMORY:MAXPOINT?"
200  ENTER Adr;Mx
210  !
220  IF Mx>0 THEN
230    PRINT "Max Point=";Mx
240    INPUT "Channel(1-16)=",Ch$
250    LINPUT "File Name=",Na$
260    OUTPUT Adr;":MEMORY:POINT CH"&Ch$&",0"
270    !
280    CREATE ASCII Na$&":HP8290X,700,1",256
290    ASSIGN @File TO Na$&":HP8290X,700,1"
300    OUTPUT @File;Mx
310    FOR I=0 TO Mx
320      OUTPUT Adr;":MEMORY:VDATA? 1"
330      ENTER Adr;Dt
340      PRINT I,Dt
350      OUTPUT @File;Dt
360    NEXT I
370    PRINT "Completed"
380  ELSE
390    PRINT "No Storage Data !!"
400  END IF
410  STOP
420  !
430 Err_prc:                                    !Error routine
440  PRINT "Error !!"
450  END
```

Notes on program

Line 140	:Select GP-IB device address 5.
Line 150	:Allocate label Err_prc for error handling.
Line 180	:Switch headers off.
Lines 190-200	:Query number of data items stored, and read into Mx.
Lines 220-400	:If Mx 0, execute lines 230 to 370. Otherwise go to 390 to end.
Lines 240-250	:Input the channel number and filename.
Line 260	:Set up to read data from item 0 on the specified channel.
Lines 280-290	:Open file.
Line 300	:Write number of data items at beginning of file.
Lines 310-360	:Read voltage values one at a time from 0 to Mx, saving to file.
Lines 430-440	:If an error occurs, display a message and end.

Example 5 - Loading and displaying the data saved by example program 4

```
100  !---------------------------!
110  !  8825 Sample Program No.5  !
120  !---------------------------!
130  !
140  Adr=705                                        !Address=5
150  ON ERROR GOTO Err_prc                          !Initialize
160  !
170  PRINT "<Load Saved Data>"
180  OUTPUT Adr;":HEADER OFF"
190  INPUT "Channel(1-16)=",Ch$
200  LINPUT "File Name=",Na$
210  ASSIGN @File TO Na$&":HP8290X,700,1"
220  ENTER @File;N
230  !
240  OUTPUT Adr;":MEMORY:MAXPOINT?"
250  ENTER Adr;N
260  IF Mx<N THEN
270    Sh$=VAL$(N/100)
280    OUTPUT Adr;":CONFIGURE:SHOT "&Sh$
290    OUTPUT Adr;":MEMORY:PREPARE"
300  END IF
310  !
320  OUTPUT Adr;":MEMORY:POINT CH"&Ch$&",0"
330  FOR I=0 TO N
340    ENTER @File;Dt$
350    PRINT I,Dt$;
360    OUTPUT Adr;":MEMORY:VDATA "&Dt$
370  NEXT I
380  OUTPUT Adr;":DISPLAY:CHANGE DISPLAY"
390  PRINT "Completed"
400  STOP
410  !
420 Err_prc:                                        !Error routine
430  PRINT "Error !!"
440  END
```

Notes on program

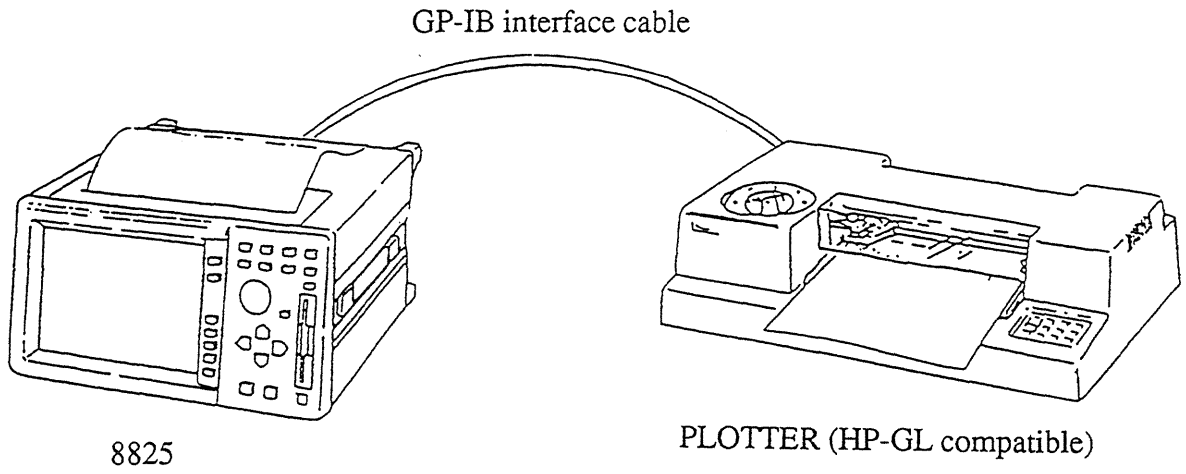
Line 140	:Select GP-IB device address 5.
Line 150	:Allocate label Err_prc for error handling.
Line 180	:Switch headers off.
Lines 190-200	:Input the channel number and filename.
Line 210	:Open file.
Line 220	:Read the value written at the beginning of the file into N.
Lines 240-250	:Read the available data memory into Mx.
Lines 260-300	:If Mx<N, insufficient memory to hold data in 8825. Use :CONFIGURE:SHOT and :MEMORY:PREPARE to reserve required memory.
Line 320	:Set up to write data from item 0 on the specified channel.
Lines 330-370	:Write data values read from file to storage memory in 8825.
Line 380	:Redraw display, ready to display data values written.
Lines 390-400	:Display completion message, and end.
Lines 420-440	:If an error occurs, display a message and end.

Chapter 6

Plotter Output

Settings for plotter output

It is possible to use an HP-GL compatible plotter to output the waveform from the 8825 display screen.



Connect the plotter to the 8825 using the GP-IB interface cable.

The settings for the plotter are all carried out using the "system" screen (PLOTTER) on the 8825.

Method

1. Press the SYSTEM key, to display the "system" screen.
2. Press F5 (1of2), then press F4 (PLOTTER) to get the plotter settings screen.

   Next, use the cursor keys to move the flashing cursor through the items in the order listed below, and use the function keys to make the settings.
3. Plotter output settings.

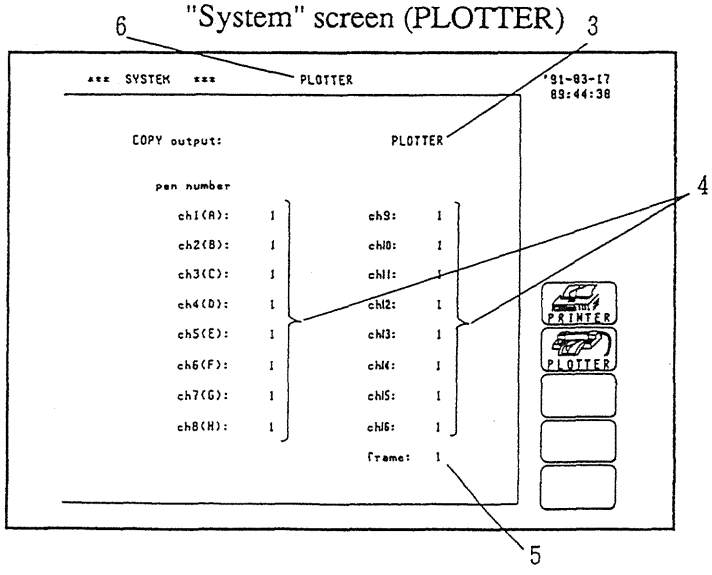
   Select whether pressing the COPY key makes a normal hard copy of the screen on the printer, or makes a copy of the waveform on the plotter.

   According to the indications for the function keys, select the required option.

(F. key indication) (Meaning)

: Draw the waveform on the plotter.

: Make a screen copy on the printer.



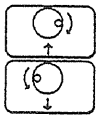
4. Pen number for each channel

   Set the pen number to be used by each channel.

Choose from pens 1 through 8 to assign a color for each waveform.

   Use F1 and F2 or the rotary knob to make the settings.

(F. key indication) (Meaning)



1 to 8

Notes: • Logic channel groups A through H get the same pen assignments as the corresponding analog channels 1 through 8.

• If there is a comment appended to a channel, it will also appear on the plot. (For more details of comments, see Section 12-5 "Appending Comments" in the instruction manual for the 8825.)

5. Frame pen number

   Set the pen number to be used for the frame, for scales, and for indicating the time axis range, for example.

   The setting procedure is the same as in step 4.

   This completes settings in the "system" screen (PLOTTER). Next carry out the GP-IB settings.

6. Press F2 (INTERFACE), to display the interface settings screen.

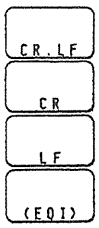
7. GP-IB operation mode

   Press F2 (TALK ONLY) to select talk only mode for the plotter.

8. Delimiter selection.

   The delimiter sequence required depends on the plotter being used. Consult the documentation accompanying the plotter, then use the function keys to make the selection.

(F. key indication) (Meaning)

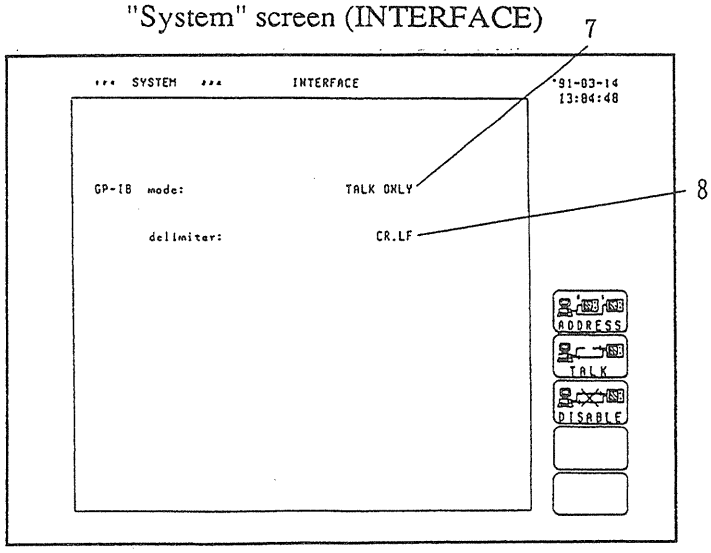


: CR+LF (EOI)
: CR (EOI)
: LF (EOI)
: (EOI)

Set the plotter to listen-only mode.

This completes the 8825 settings.

"System" screen (INTERFACE)

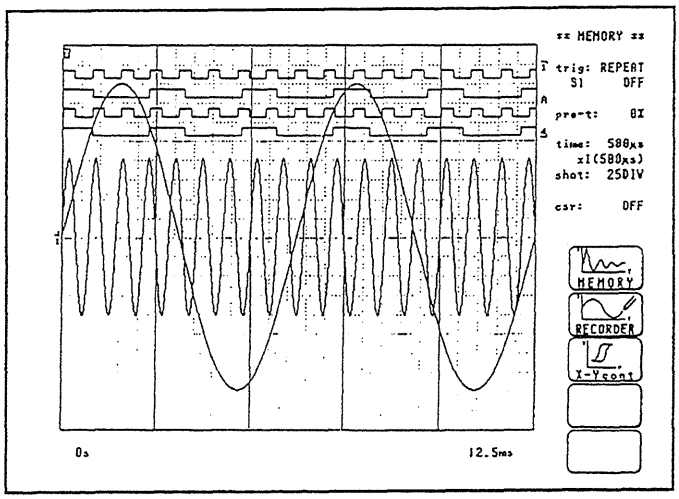


9. Press the DISP key to show the "display" screen.

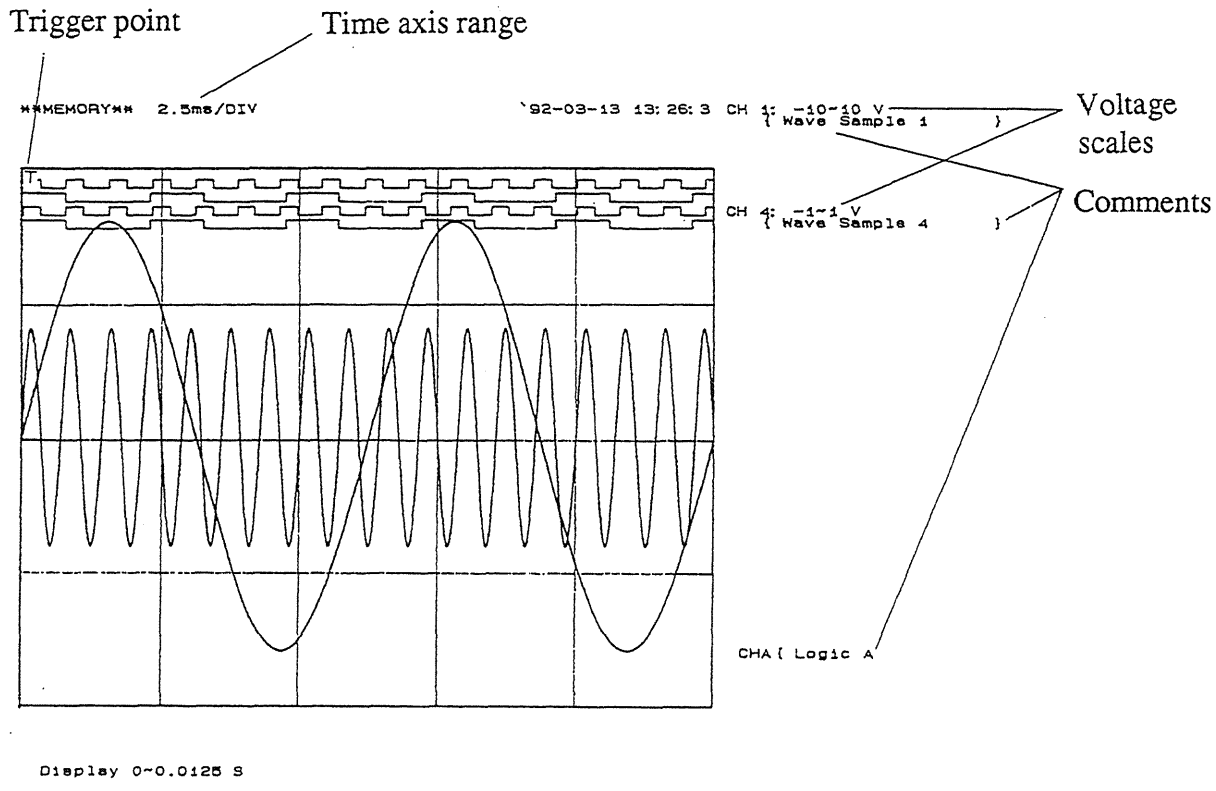
10. Press the COPY key to begin plotter output.

The plotter output appears as shown in the following figure.

"Display" screen



Plotter output



Notes

- In overwriting mode, only the last waveform captured will be printed.
- The grid is drawn every 5 divisions at the "NORM" setting, and every 1 division at the "FINE" setting.

Chapter 7

Device Compliance Statement

The following information relates to compliance with the IEEE 488.2 standard.

① IEEE 488.1 interface functions

- These are detailed in Section 2-2, "Interface functions".

② Operation with a device address other than 0 through 30

- It is not possible to set to other than 0 through 30.

③ Timing of changed device address recognition

- A change of address is recognized immediately after powering on.

④ Device settings at power on, including all commands which further restrict the initial setting.

- The status information is cleared. However, the command :MEMORY :POINT, and :MEMORY :FFTPOINT are all reinitialized, and all other items are preserved.

⑤ List of message exchange options

(a) Input buffer capacity and operation:

- The 8825 has an input buffer of 512 bytes capacity.
  If the data accumulated in this buffer exceeds 512 bytes the buffer full, and until a space again becomes available in the buffer the IEEE 488.1 bus goes into the waiting state.

(b) Queries to which multiple response message units are returned:

- There are no query to return multiple response message.

(c) Queries producing responses as syntax checking is performed:

- On the 8825, all queries produce responses when syntax checking is performed.

(d) Whether any queries produce responses when read:

- There are no queries which produce response messages at the instant they are read in by the controller.

(e) Whether any commands are coupled:

- There are no relevant commands.

⑥ Summary of functional elements for use when constructing device specific commands, and whether compound commands or program headers can be used:

- Program message, program message terminator, program message unit, program message unit separator, command message unit, query message unit, command program header, query program header, program data, character program data, decimal program data, chapter string program data, and compound commands program headers.

⑦ Buffer capacity limitations for block data

- Block data is not used.

⑧ Summary of program data elements used in expressions, and deepest nesting level allowable in sub-expressions, including syntax restrictions imposed by the device.

- Sub-expressions are not used. Character data and decimal data are the only program data elements used.

⑨ Response syntax for queries

- Response syntax is detailed in Section 4-1 "Command Summary", and Section 4-2 "Command Reference".

⑩ Transmission congestion relating to device-to-device messages which do not conform to the general principles for basic response messages

- There are no device to device messages.

⑪ Response capacity for block data

- Block data does not appear in responses.

⑫ Summary of standard commands and queries used

- This appears in Section 4-1 "Command Summary".

⑬ Device state after a calibration query has been completed without any problem

- The "*CAL?" query is not used.

⑭ When using the "*DDT" command, the maximum length of block used in a trigger macro definition

- The "*DDT" command is not used.

⑮ When a macro command is being executed, the maximum length of macro label, the maximum length of block for defining a macro, and how echoing is managed when expanding a macro

- Macros are not used.

⑯ For queries related to identification, explanation of the response to the "*IDN?" query

- This is detailed in Section 4-2 "Command Reference".

⑰ Capacity of the user data storage area reserved for when the "*PUD" command and the "*PUD?" query are being executed

- The "*PUD" command and the "*PUD?" query are not used. Further, there is no user data storage area.

⑱ Resources when the "*RDT" command and the "*RDT?" query are being used

- The "*RDT" command and the "*RDT?" query are not used.

⑲ Conditions which are influenced when "*RST", "*LRN?", "*RCL", and "*SAV" are used

- "*LRN?", "*RCL", and "*SAV" are not used. The "*RST" command returns the 8825 to its initial state.

⑳ Scope of the self-testing executed as a result of the "*TST?" query

- Checks the internal ROM and RAMs.

㉑ Additional organization of the status data used in a device status report

- This is detailed in Section 3-6 "The Status Byte and the Event Registers".

㉒ Whether commands are overlap or sequential type

- All the commands are sequential commands except :ABORT command. An :ABORT command is executed instantly as soon as it is transmitted.

㉓ Criterion relating to the functions required at the instant that the termination message is produced, as a response to each command

- Termination occurs when the command has been parsed.

Appendix

Analysis mode	Function definition	Linear real	Linear imaginary	Linear magnitude	Log magnitude	Phase
Storage (time axis data)	fa	fa				
Linear spectrum	$Fa = \mathcal{F}(fa)$ $= Fa \cdot (\cos \angle a + j \sin \angle a)$	$\lvert Fa \rvert \cdot \cos \angle a$	$\lvert Fa \rvert \cdot \sin \angle a$	$\lvert Fa \rvert$	$20 \cdot \log \lvert Fa \rvert$	$\angle a$
Rms spectrum	$Ra = Fa/\sqrt{2}$ $= \lvert Ra \rvert \cdot \exp(ja)$ $= \lvert Ra \rvert \cdot (\cos \angle a + j \sin \angle a)$	$\frac{\lvert Fa \rvert}{\sqrt{2}} \cdot \cos \angle a$	$\frac{\lvert Fa \rvert}{\sqrt{2}} \cdot \sin \angle a$	$\lvert Ra \rvert$	$20 \cdot \log \lvert Ra \rvert$	$\angle a$
Power spectrum	$Gaa = Fa \cdot Fa^*$ $= Re^2(Fa) + Im^2(Fa) = \lvert Fa \rvert$			Gaa	$10 \cdot \log(Gaa)$	
Auto-correlation function	$Raa = \mathcal{F}^{-1}(Gaa)$ $= \frac{1}{2}\int_{-\infty}^{+\infty} Gaa(\omega) \cdot \exp(j\,\omega\, z)\, d\omega$			Raa		
Histogram	Pa			Pa		
Transfer function	$Hab = \frac{Fb}{Fa} = \frac{Fb \cdot Fa^*}{Fa \cdot Fa^*} = \frac{Gab}{Gaa}$ $= \frac{\lvert Gab \rvert}{\lvert Gaa \rvert} \{\cos(\angle b - \angle a) + j \sin(\angle b - \angle a)\}$	$\lvert Hab \rvert \cdot \cos(\angle b - \angle a)$	$\lvert Hab \rvert \cdot \sin(\angle b - \angle a)$	$\lvert Hab \rvert$	$20 \cdot \log \lvert Hab \rvert$	$\angle b - \angle a$

Analysis mode	Function definition	Linear real	Linear imaginary	Linear magnitude	Log magnitude	Phase
Cross power spectrum	$Gab = Fa^* \cdot Fb$ $= \lvert Fa \rvert \cdot \lvert Fb \rvert \{\cos(\angle b - \angle a) + j\sin(\angle b - \angle a)\}$	$\lvert Gab \rvert \cdot \cos(\angle b - \angle a)$	$\lvert Gab \rvert \cdot \sin(\angle b - \angle a)$	$\lvert Gab \rvert$	$20 \cdot \log \lvert Gab \rvert$	$\angle b - \angle a$
Cross-correlation Function	$Rab(z) = \mathcal{F}^{-1}(Gab) = \frac{1}{2}\int_{-\infty}^{+\infty} \{Gab(\omega) \cdot \exp(j\omega z)\} d\omega$			Rab		
Unit impulse response	$IMP = \mathcal{F}^{-1}(Hab)$			IMP		
Coherence function	$COH = \frac{Gab \cdot Gab^*}{Gaa \cdot Gbb}$			COH		
Octave analysis	OCT			OCT		

Appendix 2. Troubleshooting GP-IB faults

Check the items in the following table in the event of operating problems with the GP-IB interface.

Symptom	Likely causes and remedies
The GP-IB does not operate at all.	• Is the cable properly connected? • Is the GP-IB address of the 8825 unit correctly set? Does it clash the address of other equipment on the same bus? • Are all the devices that are connected powered on?
The 8825 keys stop working after using GP-IB communications.	• Press the LOCAL key (F5 key) on the front panel to end the remote operating state. • Has an LLO (local lock-out) command been sent to the 8825? Send a GTL command to return to the local state.
An attempt to read data using the INPUT@ (ENTER) statement causes the GP-IB bus to hang.	• Each and every INPUT@ (ENTER) statement must be preceded by a query. • Is the query transmitted incorrect?
Although a command was transmitted, the unit did not operate.	• Use the "*ESR?" query to check the standard event status register for anomalies.
Even though a number of queries were sent, only one response was received.	• Has an error occurred? • The response should be read immediately after each query. To read several responses in one operation, the corresponding queries must be combined into a single line using the message separator.
A service request is sometimes not issued.	• Are the service request enable register and the event status enable registers set correctly? • At the end of the SRQ handling routine, use a "*CLS" command to clear all of the event registers. If a bit in the event registers is not cleared, the same event occurring again will not generate a service request.

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