

OPERATION MANUAL

GP-IB INTERFACE UNIT

MODEL IF03-COM

First Edition

KIKUSUI ELECTRONICS CORPORATION

(KIKUSUI PART NO. Z1-946-220)

892457

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1. GENERAL

1.1 General Description

The oscilloscope complies with GP-IB (IEEE 488-1978), allowing itself to be remote-controlled from and to transact data with a host computer and other devices. As memory of the GP-IB Interface Unit is combined with that of the Oscilloscope (COM3000 Series), a total memory capacity for up to 100 types of oscilloscope setups and for up to 20 waveform displays is staid.

The major functions available by this provision are as follows:

- (1) Panel control: Panel keys can be remote-controlled from an external controller or other device.
- (2) Step control: Panel settings of up to 100 types can be stored in internal step memory of the oscilloscope, and the panel can be instantaneously set to the required setting by giving a STEP command.
- (3) Sending of data: Data of stored waveforms, DVM or cursor measurements can be sent to a controller or other device.
- (4) Receiving of data: Waveform data received from the host computer can be stored in the reference memory.
- (5) Direct copy by GP-IB plotter:
When in the STORAGE mode, waveform data and other information can be directly sent to a GP-IB plotter (HP-GL compatible type), without requiring any controller.

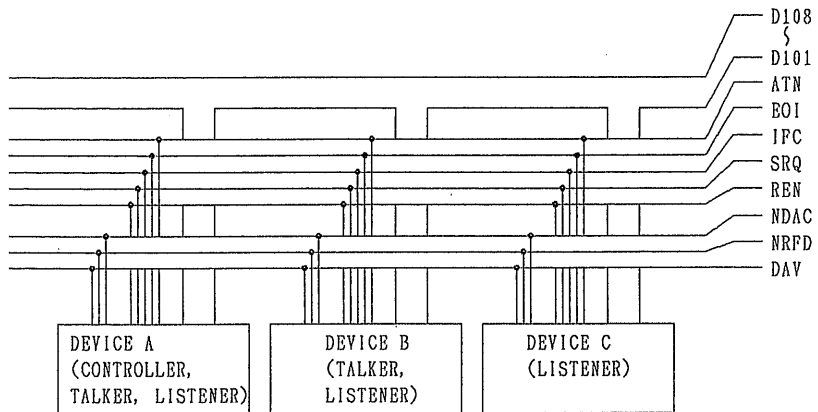
The GP-IB (General Purpose Interface Bus) allows to makeup a programmable instrumentation system by connecting various devices provided that they meet the requirements of the interface bus system.

The signals are transmitted in an 8-bit-parallel byte-serial format on a bidirectional bus. Data is transmitted in a 3-wire handshake system.

For each of the devices connected on the bus, one or more of the functions as a talker, a listener and/or a controller can be specified.

Data can be sent from a device designated to be a talker to one or more devices designated to be listeners. The controller controls sending/receiving of data and manages interfacing of the devices connected on the bus.

The bus is comprised of 8 data lines, 3 handshake lines and 5 bus management lines (16 lines in total) plus a ground line. In the below illustration, DIO1 - DIO8 are data bus; NDAC, NRFD and DAV are handshake bus; and ATN, EOI, IFC, SRQ, REN are management bus.



2. Specifications

2.1 Interface Standards

ANSI/IEEE 488-1978

Interface Functions

Code	Function
SH1	With all SH functions
AH1	With all AH functions
T5	With basic talker function, serial poll function, talk only function, and talker release function by listener designation.
L3	With basic listener function, listen-only function and listener release function by talker designation
SR1	With service request function
RL1	With remote/local change function
PP0	Without parallel polling function
DC1	With device clear function
DT0	Without device trigger function
CO	Without controller function
EO	Without talker/listen expansion function

o Remote Operation

- 1) To set COM3000 series panel switches and controls, except focus, trace rotation, B INTEN, and VAR controls
- 2) To read setup date and measured data
- 3) To input/output waveform data (See the Note.)
- 4) To originate an SRQ when in the single sweep mode (See the Note.)

Note: Enabled only when the COM3051 or COM3101 is in the storage mode

o Plot Function

When in the storage mode, the waveform and scale data displayed on the CRT can be plotted out.

The output format complies with HPGL standard

Pen 1: Scale and character data

Pen 2: Waveform data

Pen 4: Cursor data

o Copy Function

Data for up to 100 different types of oscilloscope setups can be transferred via a GP-IB bus to other COM3XXX + IF03-COM.

2.2 Specifications of Built-in Memory

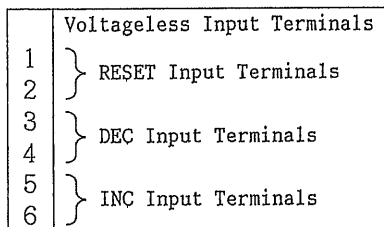
Setup data: For up to 96 different types of setups of oscilloscope

Waveform data: For up to 16 waveforms (For COM3051 and COM3101 only)

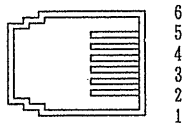
Battery: The backup battery serves for approximately 2 years, as operated 8 hours a day at 25 deg. C (77 deg.F).

2.3 Specifications of REMOTE Connector

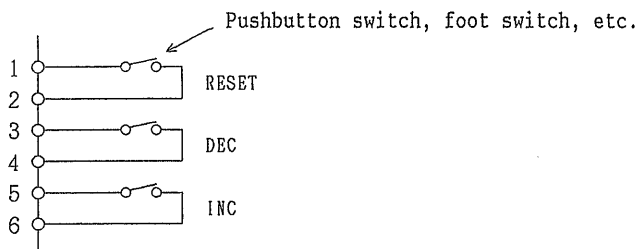
6P modular jack complying with FCC Standard



REMOTE Connector (Jack)



(REMOTE Connector as
viewed from rear of
IF03-COM)



Each time as you press the INC or DEC switch, memory for oscilloscope setup data is incremented or decremented by 1 step, within the range between the START step and the END step. As you press the RESET switch, memory is reset to that for the START step.

2.4 Mechanical Dimensions

Overall Size: 174W × 74H × 30D mm
(6.85W × 2.91H × 1.18D in.)

(Maximum) : 180W × 84H × 45D mm
(7.09W × 3.31H × 1.77D in.)

Weight: Approx. 340 g (12 oz)

2.5 Environmental Conditions

The environmental requirements of the equipment (COM3XXX + IF03-COM) are as follows:

Environment for Performance to Specification:

5 to 35°C (41 to 95°F), 80% RH or less

Operating Environments: 0 to 40°C (32 to 104°F), 85% RH or less

3. PRECAUTIONS BEFORE OPERATING THE INTERFACE UNIT

3.1 Unpacking the Interface Unit

The interface unit is shipped from the factory after being fully inspected and tested. Upon receipt of the instrument, immediately unpack and inspect it for any damage which might have been sustained when in transportation. If any sign of damage is found, immediately notify the bearer and/or the dealer.

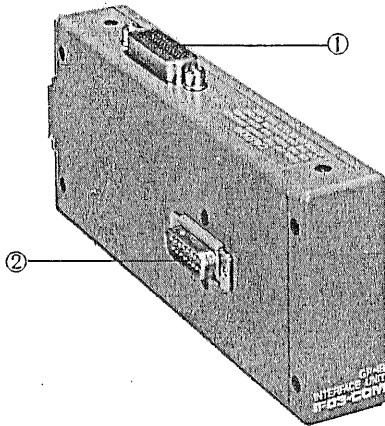
3.2 Ambient Conditions

The normally operable ambient temperature limit for the equipment is 0 to 40°C (32 to 104°F). Do not operate or expose the equipment in adverse ambient conditions (high temperature and high humidity) since such will adversely affect the equipment (troubles may result and service life expectancy may be shortened).

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4. OPERATION METHOD

4.1 Locations and Functions of Panel Items

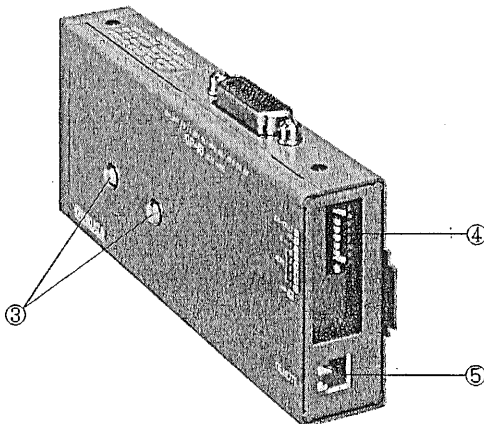


① GP-IB Connector

Connects the IF03-COM to an IEEE 488 GP-IB bus.
(24-pin connector, Amphenol Series 57)

② Hookup Connector

Hooks up the IF03-COM to the oscilloscope. (Mates with the I/F connector on the right hand side panel of the oscilloscope.)



③ Mounting Screws

Fix the IF03-COM onto the oscilloscope.

④ DIP Switches

Set address and delimiter.

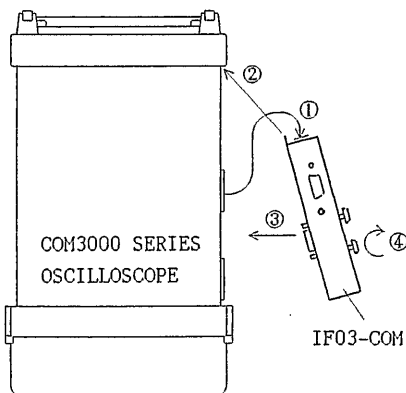
⑤ REMOTE Terminal

Accepts a step control signal.

4.2 Installation Method

To install the IF03-COM onto the oscilloscope, observe the instructions given below.

Precaution: Before starting installation, make sure that power of the oscilloscope is turned off (the input power cord is disconnected from the AC line).



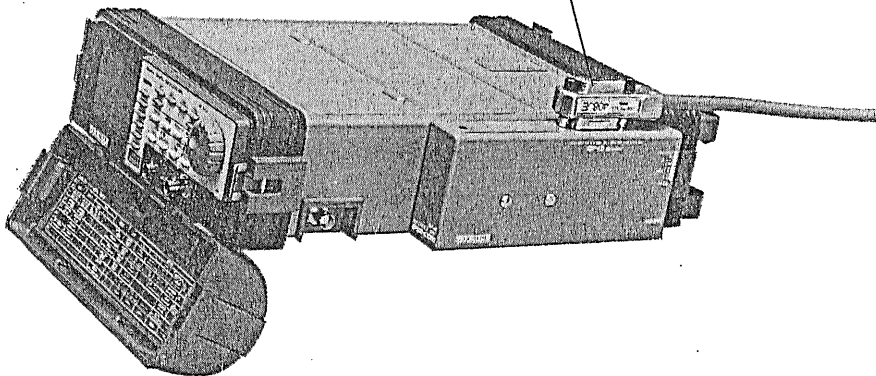
① Remove the IF03-COM blind panel from the right hand side panel of the oscilloscope and fix it onto the rear of the IF03-COM.

② Engage the hook of the IF03-COM with the indent of the oscilloscope.

③ Hook up the IF03-COM onto the oscilloscope.

④ Fix the IF03-COM to the oscilloscope with the mounting screws.

⑤ Connect the GP-IB cable (See the Note.)



Note: Do not stack more than three GP-IB connectors.

4.3 Optional Cables

GP-IB cables to connect the IF03-COM to a personal computer, plotter or other GP-IB devices are available as optional items from Kikusui as shown in the below table.

Cable	Length	Kikusui Code No.
408J-1P5 IEEE 488 Cable	50 cm	89-04-1000
408J-101 IEEE 488 Cable	1 m	89-04-1010
408J-102 IEEE 488 Cable	2 m	89-04-1020

5. REMOTE CONTROL OPERATION

5.1 Setting of DIP Switches

o Address Setting

For address setting, use the five or six lowermost ones of the DIP switches.

o Normal Address (0 - 30)

The ADRS section of the DIP switches is marked "16 8 4 2 1".

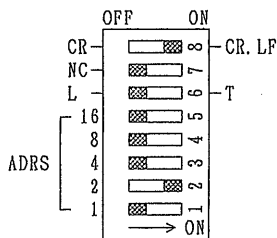
The set address number is the sum of the switches set in the ON position.

When all switches are set in the OFF position, the address number is 0.

To set the address number at 19 for example, set the switches as follows:

Since $19 = 16 + 2 + 1$, set the "16", "2" and "1" switches in the ON position.

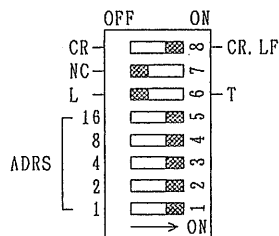
Note: When the oscilloscope is shipped from the factory, the address number is set at 2.



o LISTEN ONLY

Set all switches of the address section in the ON position but the T/L switch (switch 6) in the OFF position.

Note: When set in this state the instrument is fixed as a LISTENER and it cannot send out the measured data or any other information.



o Setting of Delimiters

Five types of delimiters as follows can be used.

- (1) EOI
- (2) CR
- (3) CR + EOI CR: Carriage Return
- (4) CR + LF LF: Line Feed
- (5) CR + LF + EOI EOI: End or Identify

Delimiters can be set with GP-IB switches and EOI command. When in transfer of binary data, however, EOI only can be used irrespective of switch setting.

Delimiter	GP-IB Switches	EOI Command
EOI	Either setting	ONLY
CR	CR	OFF
CR + EOI	CR	ON
CR + LF	CR + LF	OFF
CR + LF + EOI	CR + LF	ON

Even when delimiter is other than "EOI ONLY", handshake terminates if EOI is given.

- Notes:
1. When the IF03-COM is shipped from the factory, the delimiter switches are set for CR LF.
 2. As your turn power on, EOI is set to "on".
 3. LF by it alone cannot be used as a delimiter.
 4. When in transfer of waveform data, EOI alone is effective irrespective of delimiter switch setting.
 5. The set states of GP-IB switches are read only once when turning on the oscilloscope. When power is continuously on, the address and delimiters do not change in response to change of switch settings. To change them, turn off power, change the switch settings, and then turn on the oscilloscope.
 6. Other requirements comply with GP-IB (IEEE 488-1978) Standard.

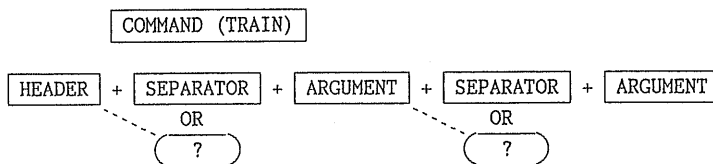
5.2 Command and Data Formats

To remote-control the oscilloscope with GP-IB, send data from the controller (host computer) in the following format:

COMMAND (TRAIN) + DELIMITER

(1) Command Format

Each command should be a train of characters complying with ASCII Codes, and should be comprised of a header and arguments, and separators between them in a format as shown in the following example.

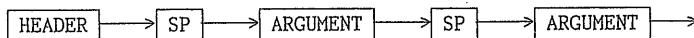


o Header

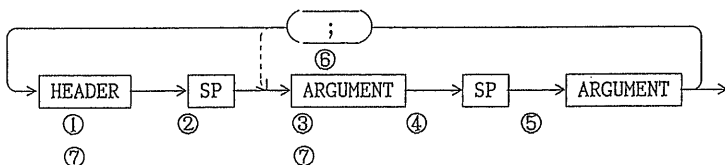
The header identifies the type of command, such as "CHANNEL 1" or "DVM".

o Separators

A blank space code for one or more characters and semicolon ";" can be used as separators. A space code is used between header and argument or between two arguments.



A semicolon can be used between two commands. When so specified, however, semicolons are effective only within the trains which follow the same header.



- Arguments

Two types of arguments can be used. One is a train of characters, such as "ON" or "AC". The other is a numerical data, such as "15" or "-20".

- Parameter "?"

This parameter is placed at the end of a command requesting to read and send. Note that "?" cannot be followed by another command or a separator ";". Put no space before "?".

(2) Waveform Data Formats and Blocks

"NUMERAL NUMERAL NUMERAL NUMERAL NUMERAL NUMERAL EOI"

The numerals are with eight bits for "0" to "11111111". For delimiters, EOI alone is effective.

Waveform data per channel (per memory unit) is stored on a 1k-word (1024 points) memory unit. Since memory unit is divided into eight blocks as illustrated below, part of the stored waveform data can be read and sent by specifying block numbers.

ADDRESS BLOCK NO.	0	1	2	3	4	5	6	7
	← 128 → words							

For example, to read and send data of from point 128 to point 511, specify start block 1 and end block 3 with the "WAVE" command.

(3) Delimiters

One of CR+LF(+EOI), CR(+EOI) and EOI can be used as delimiter. See page 11 "Setting of Delimiters".

(4) Abbreviations of Commands

As a general rule, commands including headers and arguments can be abbreviated into a string of three characters.

Examples: "ATRIGGER" → "ATR"

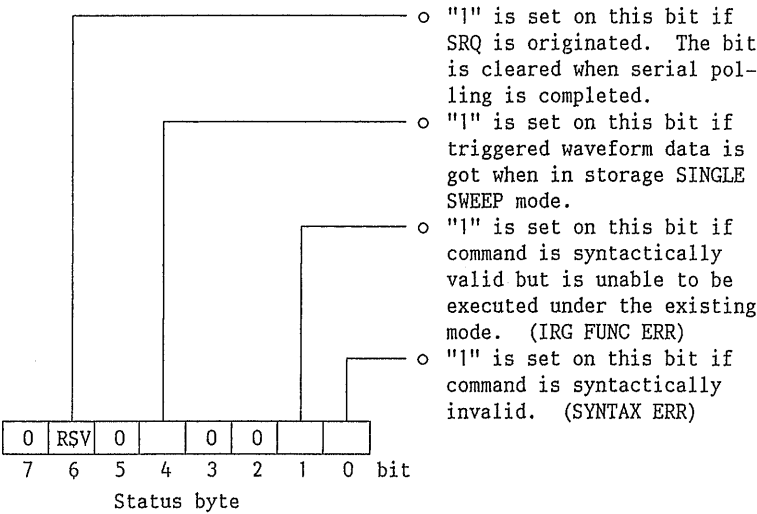
"COUPLING" → "COU"
 "CHANNEL1" → "CH1"

Abbreviations of headers and arguments are shown being enclosed in parentheses in the table of commands.

(5) SRQ and Status Byte

The oscilloscope is allowed to originate a service request (SRQ) to send information on its internal events to the external controller. Events are identified by respective bits of a status byte, allowing the controller to identify the types of events.

The relationships between the events and the corresponding bits of status byte are as shown below.



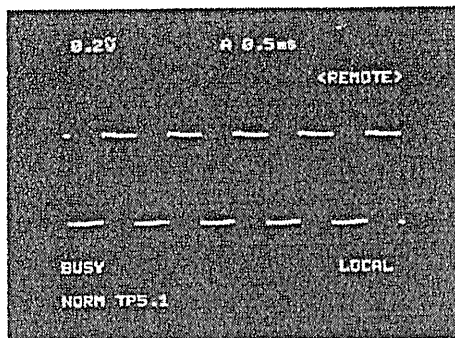
When power of the oscilloscope is turned on, "0" is set for all bits of the status byte.

Note: For a status byte which has been set by an error, be sure to perform the device clear procedure after serial polling is completed.

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5.3 Local Switches

When in the remote mode of operation, message "REMOTE" is displayed in the area for X-axis type at upper left on the CRT.



As the oscilloscope is set to the remote mode by the GP-IB controller, the local switches (panel keys) of the oscilloscope are disabled.

To return the oscilloscope to the local mode in order to enable the panel keys, press the LOCAL (Y6) key. If the oscilloscope is specified to be in the LLO (Local Lock Out) state by the GP-IB controller, however, the LOCAL key also is disabled and message "LOCK OUT" is displayed at a lower left position on the CRT.

To release from the local lockout state to return the oscilloscope to the local mode, let the GP-IB controller send a GTL command or perform an IFC (Interface clear) procedure.

5.4 Table of Commands

o Items Indicated in Table

The table indicates individual commands which are used to control the oscilloscope. Each command is indicated together with its function and data to be sent when the oscilloscope is designated for a talker. Examples of writing programs referring to the table are given in this section.

(1) To Set the Oscilloscope

o To set CH1 input coupling to AC

CHANNEL 1 (CH1)	COUPLING (COU)	AC DC GROUND	Set CH1 input coupling to AC. Set CH1 input coupling to DC. Set CH1 input coupling to GND.
--------------------	-------------------	--------------------	--

(CHANNEL 1) + SPACE + (COUPLING) + SPACE + (AC)

Command is as

"CHANNEL1 COUPLING AC"

or abbreviated as "CH1 COU AC"

(2) To read set range or measured data of oscilloscope

o To read CH1 input coupling setting

CHANNEL 1 (CH1)	COUPLING? (COU?)	AC; DC, GROUND
--------------------	---------------------	----------------

(CH1) + SPACE + (COU?)

"CH1 COU?"

With this command, data on the current setting of CH1 input coupling of oscilloscope is written in the send buffer of oscilloscope. To read

and send this data, designate the oscilloscope for a talker.

When a HP 9816 computer is used for example, since BASIC data input command is "ENTER 702;A\$" (where "A\$" is a character variable for data), a program should be written as follows:

```
OUTPUT 702;"CH1 COU?"
ENTER 702;A$
```

Thus, set data such as "AC" or "DC" can be read.

- o To read setting of CH1

CHANNLE 1? (CH1?)	POSITION? (POS?)	-128 ~ 127
		[VOLT (UNCAL)] [PROBE] [COUPLING] [POSITION]

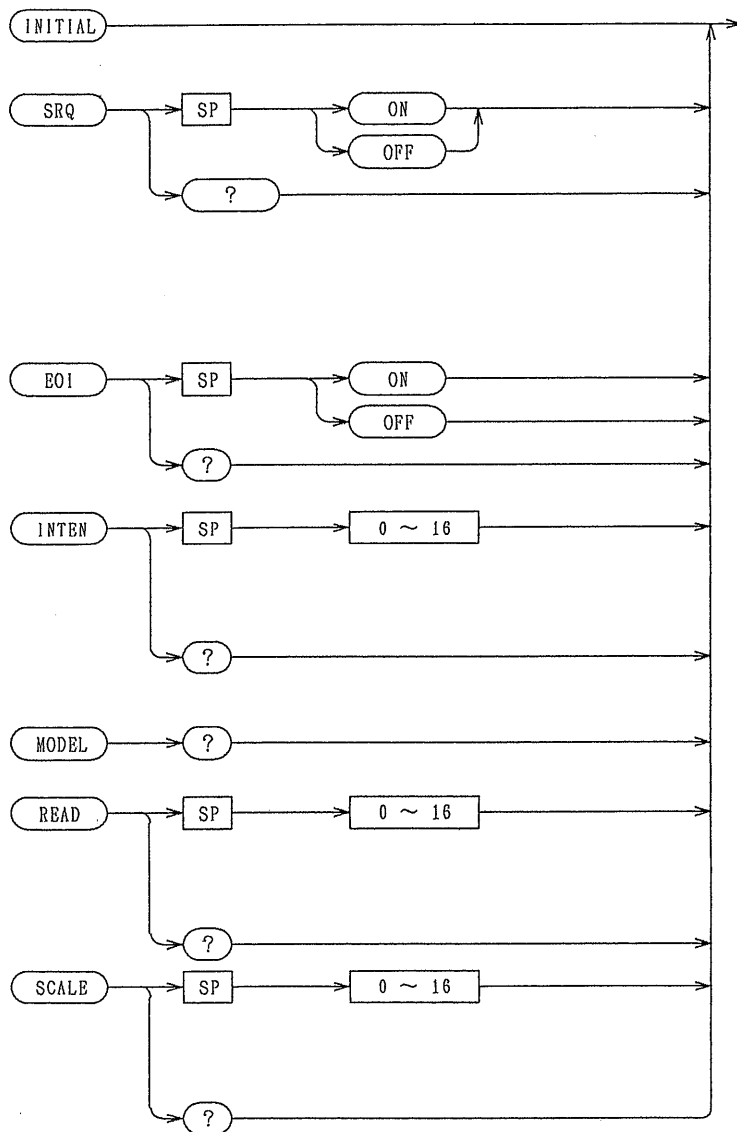
CH1?

Example of set data as it is read:

"5V	x1	DC	0"
[VOLT (UNCAL)]	[PROBE]	[COUPLING]	[POSITION]

A blank space is placed between two set values.

5.4.1 System Commands



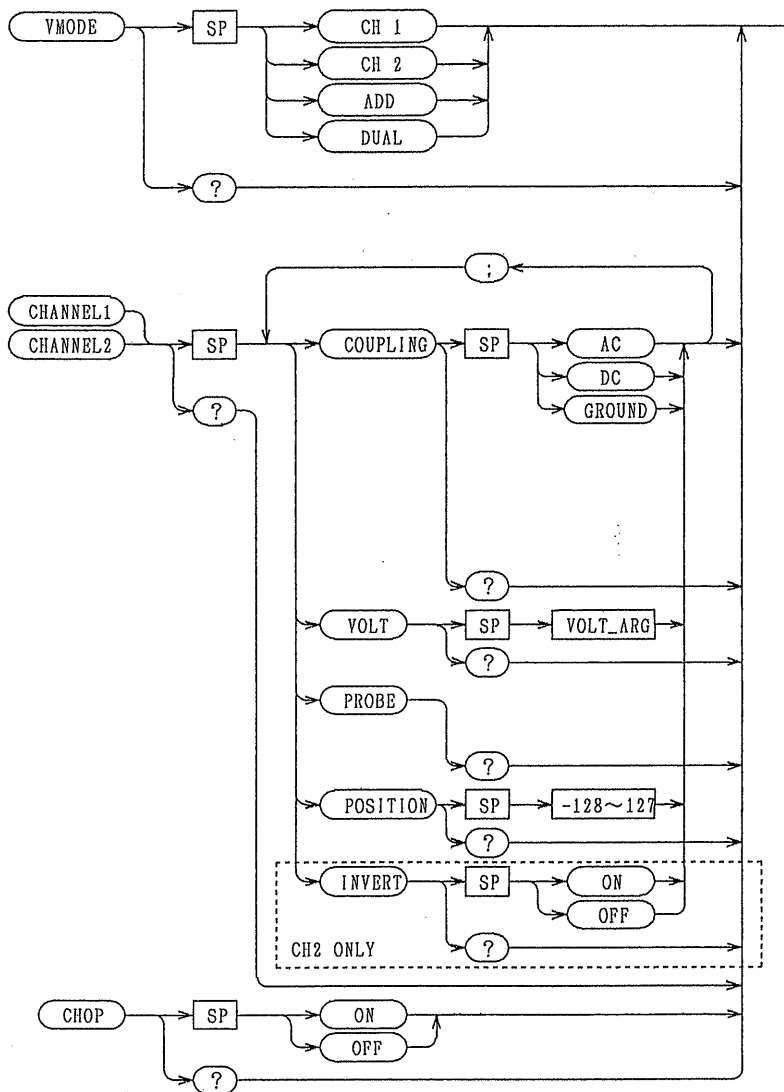
Header	Argument	Action
INITIAL (INI)		Set to status identical with system reset. (Note)
SRQ SRQ?	ON OFF	Enable SRQ. Disable SRQ. [ON, OFF]
EOI EOI?	ONLY (ONL) ON OFF	Limit delimiter to EOI only when send. Enable EOI when send. Disable EOI when send. [ON, OFF, ONLY]
INTEN (INT) INTEN? (INT?)	0~16	INTEN 0(dark) ↔ 16(bright) [0~16]
MODEL?		Return a model name. [COM3050, COM3051] [COM3100, COM3101]
READ (REA) READ? (REA?)	0~16	READ OUT INTEN (character intensity) 0(dark) ↔ 16(bright) [0~16]
SCALE (SCA) SCALE? (SCA?)	0~16	SCALE ILLUMINATION 0(dark) ↔ 16(bright) [0~16]

(Note): The positions of CH1 and CH2 when in the system-reset state are at approximate center of screen. If you need them to be at the accurate center of screen, set the instrument to the LOCAL mode and then adjust them to the accurate center of screen.



(Note 1): When the AUTO command is executed, CH1 and CH2 horizontal position offsets become zero.

5.4.2 Commands for Vertical Axis



Header	Argument		Action
VMODE (VMO)	CH1 CH2 ADD DUAL (DUA)		Set VMODE. (Note 1)
VMODE? (VMO?)			[CH1, CH2, ADD, DUAL]
CHANNEL1 (CH1)	COUPLING (COU)	AC DC GROUND (GRO)	Set CH1 input coupling to AC. Set CH1 input coupling to DC. Set CH1 input coupling to GND.
	COUPLING? (COU?)		[AC, DC, GROUND]
	VOLT (VOL)	5V 2V 1V .5V .2V .1V 50MV 20MV 10MV 5MV	Set CH1 sensitivity to 5V/DIV (Note 3) Set CH1 sensitivity to 2V/DIV Set CH1 sensitivity to 1V/DIV Set CH1 sensitivity to .5V/DIV Set CH1 sensitivity to .2V/DIV Set CH1 sensitivity to .1V/DIV Set CH1 sensitivity to 50mV/DIV Set CH1 sensitivity to 20mV/DIV Set CH1 sensitivity to 10mV/DIV Set CH1 sensitivity to 5mV/DIV
	VOLT? (VOL?)		[5V ~ 5MV (UNCAL)]
	PROBE? (PRO?)		[x1, x10]
	POSITION (POS)	-128 ~ 127	Set CH1 POSITION (offset). (Note 2)
	POSITION? (POS?)		[-128 ~ 0 ~ 127]
CHANNEL1? (CH1?)			[VOLT (UNCAL)] [PROBE] [COUPLING] [POSITION]

(Note 1): If an "ADD" command is given when in the storage mode, an error will result.

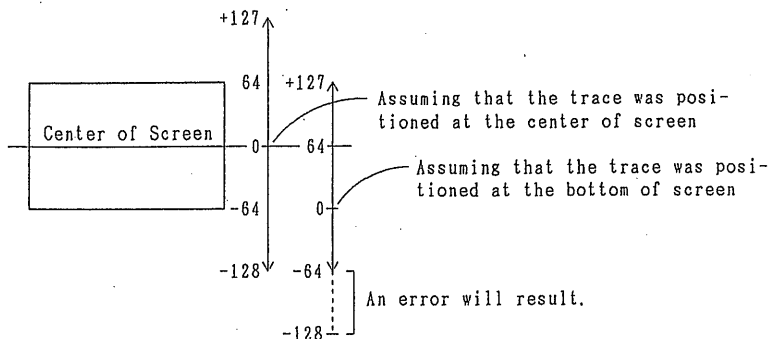
(Note 2): With reference to the position when in the local mode or to the position after execution of the INITIAL, AUTO, or STEP command (reckoning such position as positions 0) (For details, see page 24.)

(Note 3): Even when the x10 probe is connected, setting of VOLT/DIV is done for the x1 range.

Header	Argument		Action
CHANNEL2 (CH2)	COUPLING VOLT PROBE POSITION		} The same as that for CH1
	INVERT (INV)	ON OFF	
	INVERT? (INV?)		[ON, OFF]
	CHANNEL2? (CH2?)		[VOLT(UNCAL)] [PROBE] [COUPLING] [POSITION] [INVERT]
CHOP (CHO)	ON OFF		Enable CHOP for multi-traces. Disable CHOP for multi-traces.(=ALT)
CHOP? (CHO?)			[ON, OFF]

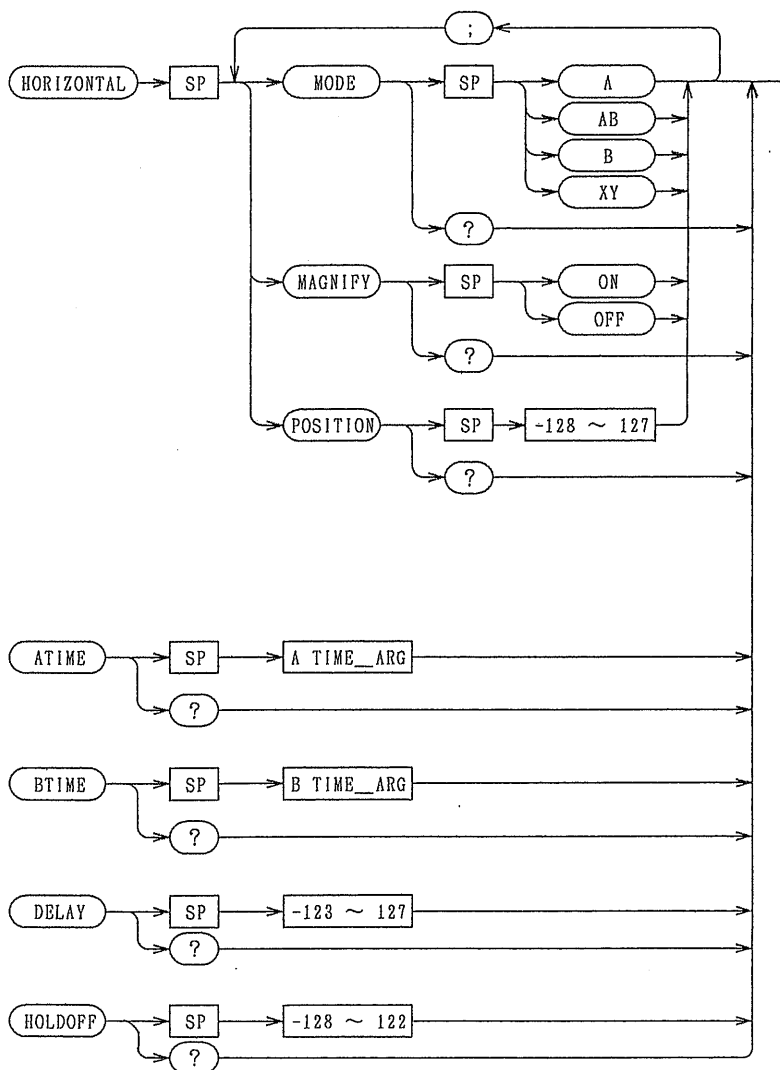
o Vertical Positioning

Vertical positioning of each trace is made in a "relative position" method with reference to (regarding as "0" position) the position where the trace existed when in the LOCAL mode or when an INI, AUTO, or STEP command is executed. The reference position ("0" position) and the rate of trace shift are as illustrated below. Keep this in mind when setting the vertical position of the trace.



As you add +12.5 to the vertical position data, the trace is raised by approximately 1 DIV.

5.4.3 Commands for Time Base (Horizontal Axis)



Header	Argument		Action
HORIZONTAL (HOR)	MODE (MOD)	A	Set sweep mode to A.
		AB	Set sweep mode to A INT B.
		B	Set sweep mode to B.
		XY	Set to X-Y mode.
	MODE? (MOD?)		[A, AB, B, XY] (Note 2)
	MAGNIFY (MAG)	ON	Enable x10 MAG for horiz. axis.
		OFF	Disable x10 MAG for horiz axis.
	MAGNIFY? (MAG?)		[ON, OFF]
	POSITION (POS)	-128 ~ 127	Set horizontal POSITION (offset). (Note 4)
	POSITION? (POS?)		[-128 ~ 127]
HORIZONTAL? (HOR?)			[MODE] [MAG] [POS]
HOLDOFF (HOL)	-128~122		Set HOLDOFF.
HOLDOFF? (HOL?)			[0 ~ 4000] (Note 3)
ATIME (ATI)	Table 1 (See page 27.)		Set A TIME/DIV.
ATIME? (ATI?)			STORAGE [5s ~ 50ns, 20ns (UNCAL)] REAL [0.1s ~ 50ns, 20ns (UNCAL)]
BTIME (BTI)	Table 1 (See page 27.)		Set B TIME/DIV. (Note 1)
BTIME? (BTI?)			[50ms ~ 50ns, 20ns]
DELAY (DEL)	-123~127		Set DELAY POSITION.
DELAY? (DEL?)			[80 ~ 4080] (Note 3)

(Note 1): B TIME/DIV cannot be set at a range slower than that of A TIME/DIV.

(Note 2): If a "HOR MOE" command is given when in the storage mode, an error will result.

(Note 3): The relationships among the set value, read value, and CRT displayed value are as illustrated below.

HOLDOFF	0%	51%	100%	DELAY	0.20	5.12	10.20
Set val.	-128	0	122	-123	0	127	
Read val.	0	2048	4000	80	2048	4080	

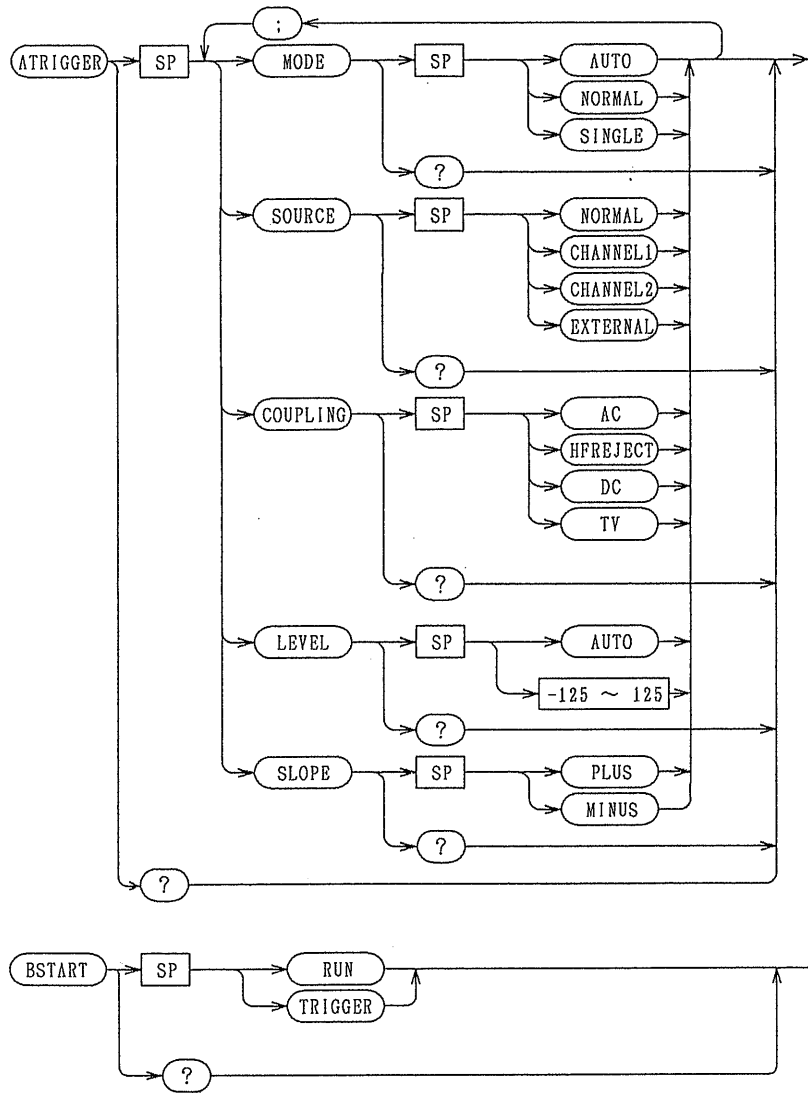
(Note 4): Horizontal positioning of each trace is made in a "relative position" method with respect to (regarding as "0" position) the position where the trace existed when in the LOCAL mode. As you add +19 to the horizontal position data, the trace is moved rightward by approximately 1 DIV.

Table 1

Range		Argument	COM3050	COM3100	COM3051	COM3101
Note	5s	5S			↑	↑
	2s	2S				
	1s	1S				
	.5s	.5S				
	.2s	.2S				
	.1s	.1S	↑	↑		
	50ms	50MS	↑	↑		
	20ms	20MS				
	10ms	10MS				
	5ms	5MS				
	2ms	2MS				
	1ms	1MS				
	.5ms	.5MS				
	.2ms	.2MS				
	.1ms	.1MS				
	50μs	50US	↓		↓	
	20μs	20US				
	10μs	10US				
	5μs	5US				
	2μs	2US				
	1μs	1US				
	.5μs	.5US				
	.2μs	.2US				
	.1μs	.1US				
	50ns	50NS				
	20ns	20NS		↓		↓

Note: For storage mode only.

5.4.4 Commands for Triggering



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Header	Argument		Action
ATRIGGER (ATR)	MODE (MOD)	AUTO (AUT)	Set A trigger to AUTO mode.
		NORMAL (NOR)	Set A trigger to NORMAL mode.
		SINGLE (SIN)	Set A trigger to SINGLE mode. (Has a RESET function also.)
		MODE? (MOD?)	[AUTO, NORMAL, SINGLE]
	SOURCE (SOU)	NORMAL (NOR)	Set A trigger source to NORMAL
		CHANNEL1 (CH1)	Set A trigger source to CH1.
		CHANNEL2 (CH2)	Set A trigger source to CH2.
		EXTERNAL (EXT)	Set A trigger source to EXTERNAL.
	SOURCE? (SOU?)		[CH1, CH2, NORMAL, EXTERNAL]
COUPLING (COU)	AC HFREJECT (HFR) DC TV		Set A trig-in coupling to AC.
			Set A trig-in coupling to HF-REJ.
			Set A trig-in coupling to DC.
			Set A trig-in coupling to TV.
	COUPLING? (COU?)		[AC, HFR, DC, TV]
LEVEL (LEV)	-125~125 AUTO (AUT)		Set A trigger level.
			Set A trigger level to AUTO.(Note 1)
LEVEL? (LEV?)			[48 ~ 4048, AUTO] (Note 2)

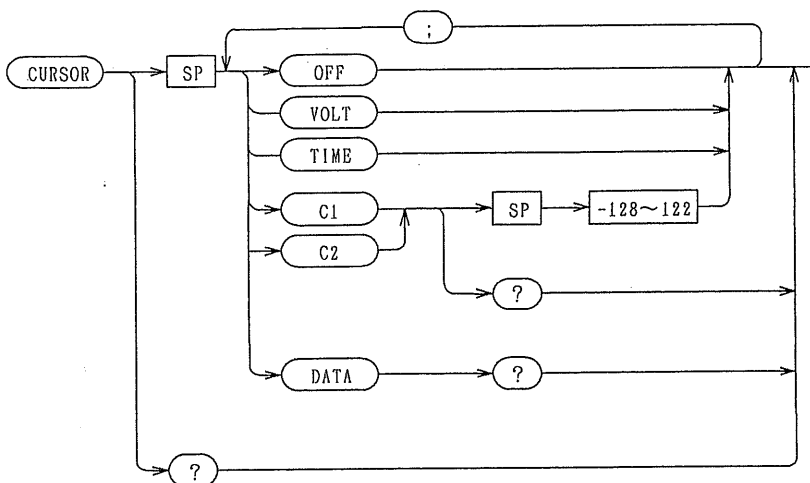
(Note 1): If an "ATR LEV AUTO" command is given when in the storage mode, an error will result.

(Note 2): The relationships among the set value, read value, and CRT displayed value are as illustrated below.

ATR LEVEL	-100%	0%	100%
	----- ----- -----		
Set value	-125	0	125
Read value	48	2048	4048

Header	Argument		Action
ATRIGGER (ATR)	SLOPE (SLO)	PLUS (PLU)	Set A trigger slope to "+"
		MINUS (MIN)	Set A trigger slope to "-"
	SLOPE? (SLO?)		[PLUS, MINUS]
ATRIGGER? (ATR?)			[MODE] [SOURCE] [COUPLING] [LEVEL] [SLOPE]
BSTART (BST)	RUN		Set BSTART to RUN mode.
	TRIGGER (TRI)		Set BSTART to TRIG mode.
BSTART? (BST?)			[RUN, TRIGGER]

5.4.5 Commands for Cursors

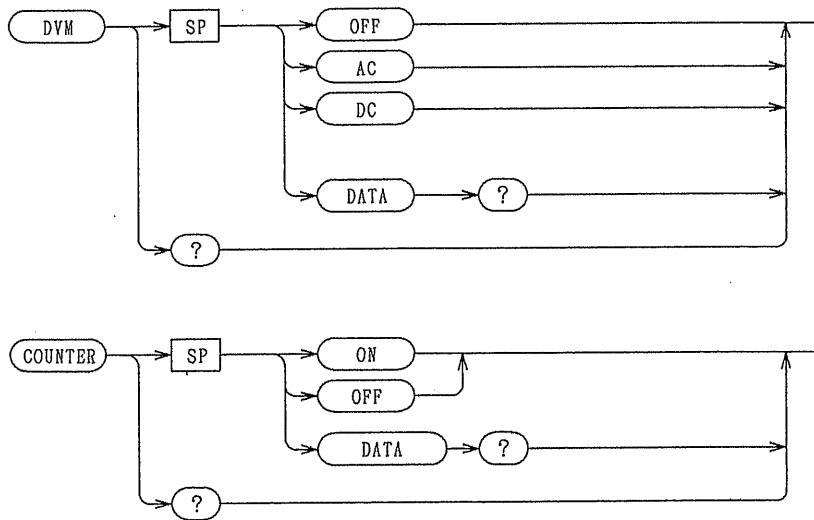


Header	Argument	Action
CURSOR (CUR)	OFF	Turn off cursor.
	VOLT (VOL)	Set cursor to VOLT mode.
	TIME (TIM)	Set cursor to TIME mode.
	C1 -128 ~122	Set cursor 1 POSITION.
	C1?	[0 ~ 4000] (Note 1)
	C2 -128 ~122	Set cursor 2 POSITION.
	C2?	[0 ~ 4000] (Note 1)
CURSOR? (CUR?)	DATA? (DAT?)	Value measured with cursors.
		[OFF, VOLT, TIME] [C1] [C2] [DATA]

(Note 1): The relationships among the set value, read value, and CRT displayed value are as illustrated below.

C1, C2	Left(Lower)	Center	Right(Upper)
Set value	-128	-3	122
Read value	0	2000	4000

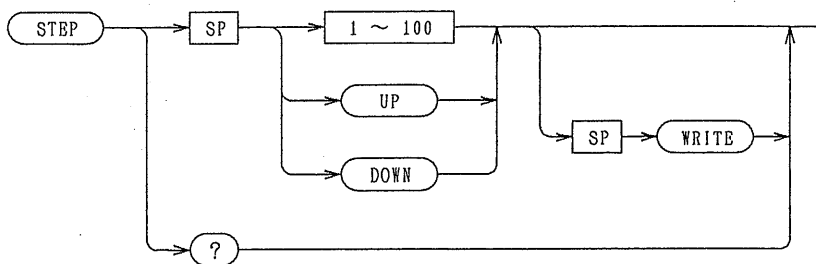
5.4.6 Commands for DVM and Counter



Header	Argument	Action
DVM	OFF	Turn off DVM.
	AC	Set DVM mode to AC.
	DC	Set DVM mode to DC.
	DATA? (DAT?)	Value measured with DVM.
DVM?		[OFF, AC, DC] [DATA]
COUNTER (COU)	ON	Turn on counter.
	OFF	Turn off counter.
	DATA? (DAT?)	Value measured with counter. (Note)
COUNTER? (COU?)		[ON, OFF] [DATA] (Note)

(Note): If no trigerring is effected, message "NOTRIG" will be returned as counter data.

5.4.7 Commands for Step Control

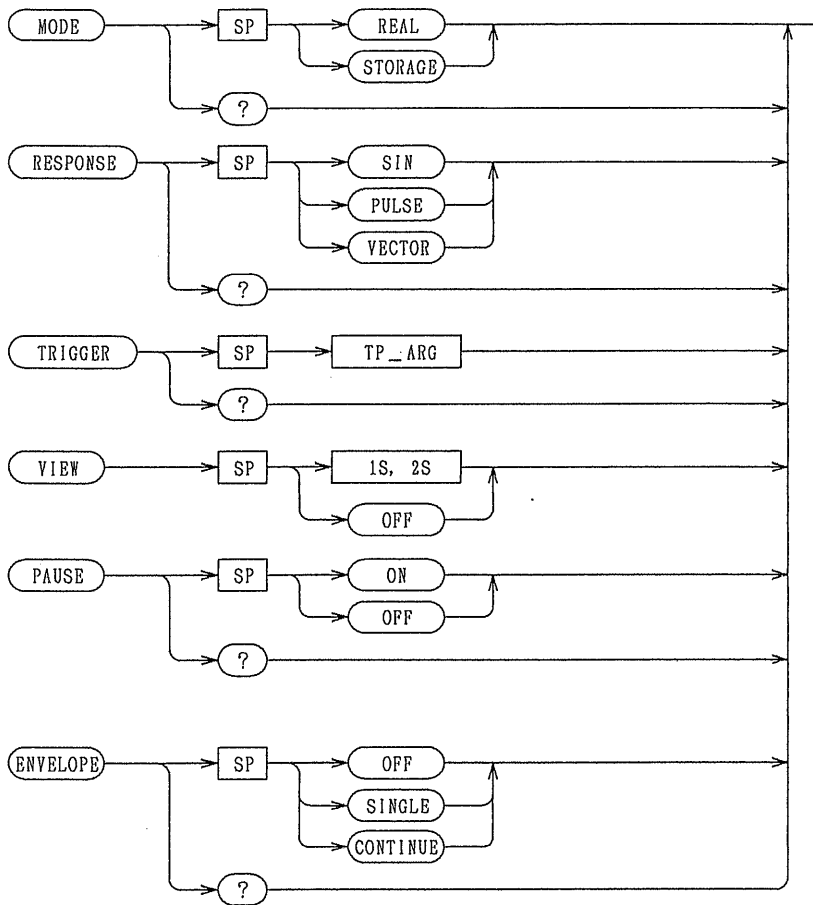


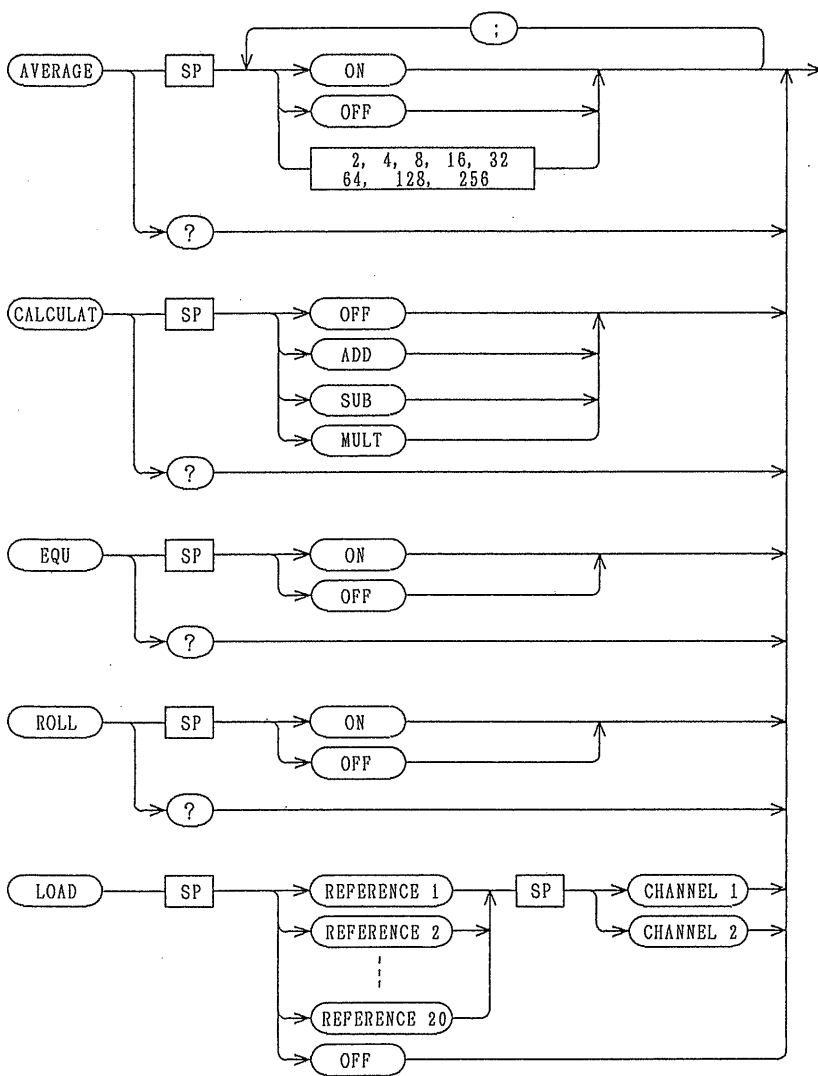
Header	Argument	Action
STEP (STE)	1~100	Read data on step memory.
	WRITE (WRI)	Write data on step memory.
	UP	Increment step address by 1.
	WRITE (WRI)	Increment step address by 1 and then write data on memory.
	DOWN (DOW)	Decrement step address by 1.
	WRITE (WRI)	Decrement step address by 1 and then write data on memory.
STEP? (STE?)		Return step address. (Note 1) [1 ~ 100]

(Note 1): The number set by the STEP command at the end is returned. When power of the equipment is turned on, the number is set to 1.

5.4.8 Commands for Storage

1) Commands which always operate when in storage mode





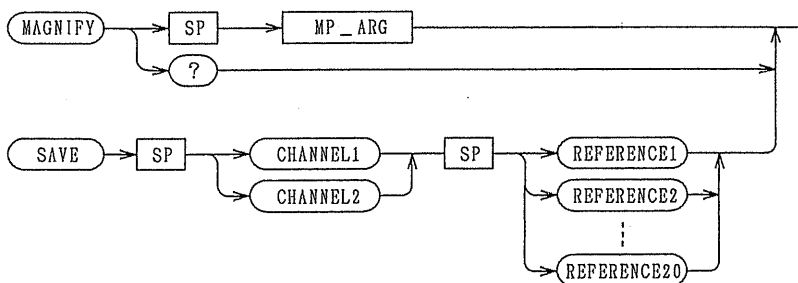
Header	Argument	Action
MODE (MOD)	REAL (REA) STORAGE (STO)	Set to realtime mode. Set to storage mode.
MODE? (MOD?)		[REAL, STORAGE]
RESPONSE (RES)	SIN PULSE (PUL) VECTOR (VEC)	Set to sine interpolation. (Note 1) Set to pulse interpolation. Set to vector interpolation.
RESPONSE? (RES?)		[SIN, PULSE, VECTOR]
TRIGGER (TRI)	0.0, 1.3, 5.1, 9.0	Set triggering point. Unit in DIV.
TRIGGER? (TRI?)		[0.0, 1.3, 5.1, 9.0]
VIEW (VIE)	OFF, 1S, 2S	Set viewtime. Unit in sec.
VIEW? (VIE?)		[OFF, 1S, 2S]
PAUSE (PAU)	ON	Turn on PAUSE. (Note 2)
PAUSE? (PAU?)	OFF	Turn off PAUSE.
		[ON, OFF]
ENVELOPE (ENV)	OFF SINGLE (SIN) CONTINUE (CON)	Turn on ENVELOPE. Turn on ENVS. Turn on ENVC.
ENVELOPE? (ENV?)		[OFF, SINGLE, CONTINUE]

(Note 1): The RESPONSE command is corresponding to the INTRPL command on the oscilloscope menu.

(Note 2): The PAUSE ON function is disabled when in the LOAD ONLY mode.

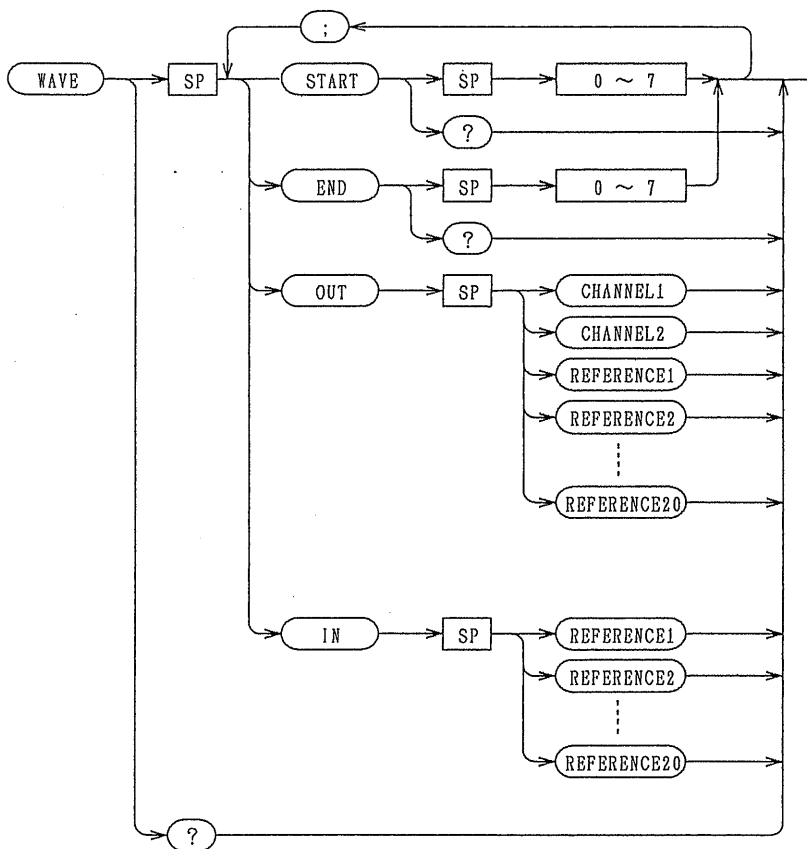
Header	Argument		Action
AVERAGE (AVE)	ON		Turn on AVERAGE.
	OFF		Turn off AVERAGE.
	2, 4, 8, 16 32, 64, 128, 256		Set the number of averaging cycles.
	AVERAGE? (AVE?)		[ON, OFF] [2, 4, --- 256]
CALCULAT (CAL)	OFF		Turn off calculation function.
	ADD		Set calculation function to addition (1+2).
	SUB		Set calculation function to subtraction (1-2).
	MULT (MUL)		Set calculation function to multiplication (1×2).
CALCULAT? (CAL?)			Return the state of calculation. [OFF, ADD, SUB, MULT]
EQU	ON		Turn on the equivalent sample mode.
	OFF		Turn off the equivalent sample mode.
	EQU?		Return the setting of equivalent sample mode. [ON, OFF]
ROLL (ROL)	ON		Turn on the roll function.
	OFF		Turn off the roll function.
	ROLL? (ROL?)		Return the setting of roll function. [ON, OFF]
LOAD (LOA)	OFF		Release from the REFERENCE waveform state.
	REFERENCE 1 (REF1)	CHANNEL 1 (CH1)	Load the REFERENCE waveform data to CH1 or CH2 display memory.
	REFERENCE 2 (REF2)	CHANNEL 2 (CH2)	
	}		
	REFERENCE 20 (REF20)		

2) Commands which are effective only when in PAUSE ON



Header	Argument		Action
MAGNIFY (MAG)	0.0, 1.3, 3.8, 5.1		Set magnification point. Unit in DIV [0.0, 1.3, 3.8, 5.1, 6.4, 7.7, 9.0]
MAGNIFY? (MAG?)	6.4, 7.7, 9.0		
SAVE (SAV)	CHANNEL1 (CH1) CHANNEL2 (CH2)	REFERENCE1 (REF1) REFERENCE2 (REF2) } REFERENCE 20 (REF20)	Save waveform data in reference memory. Error message is sent if specified channel is not ON.

3) Commands for send/receive of waveform data



Header	Argument		Action
WAVE (WAV)	START (STA)	0 ~ 7	Set starting block of waveform data.
	START? (\$TA?)		[0 ~ 7]
	END	0 ~ 7	Set ending block of waveform data.
	END?		[0 ~ 7]
	OUT	CHANNEL1 (CH1)	Send waveform data of CH1. (Note 1)
		CHANNEL2 (CH2)	Send waveform data of CH2.
WAVE? (WAV?)		REFERENCE1 (REF1)	Send waveform data of REF1.
		REFERENCE2 (REF2)	Send waveform data of REF2.
		REFERENCE20 (REF20)	Send waveform data of REF20.
WAVE? (WAV?)	IN	REFERENCE1 (REF1)	Receive waveform data onto REF1. (Note 1)
		REFERENCE2 (REF2)	Receive waveform data onto REF2.
		REFERENCE20 (REF20)	Receive waveform data onto REF20.
			[START] [END]

(Note 1): Waveform is in binary codes only.

892498

5.5 Programming

Examples of Programming for HP 9816

Set the I/F address to 2 and the delimiter to CR+LF.

```
① 100 !*****
110 !   COMMAND CHECK PROGRAM
120 !*****
130 !
140 Init:  ABORT 7
150        REMOTE 7
160        ASSIGN @Com TO 702
170 Main:  INPUT Cmd$
180        T=POS (Cmd$,"?")
190        IF T=0 THEN
200            GOSUB Talker
210        ELSE
220            GOSUB Listner
230        END IF
240        GOTO Main
250        !
260 Talker: OUTPUT @Com;Cmd$
270        RETURN
280 Listner: OUTPUT @Com;Cmd$
290        ENTER @Com;Dat$
300        PRINT Dat$
310        RETURN
320 END
```

----- Initialize GP-IB

----- Enter command from KEY BOARD

----- Deliver command to IF03-COM

----- Deliver command for reading set data, and read it.

This programming example is to set the oscilloscope by entering commands from the keyboard or to read the settings of the oscilloscope.
(Except the WAVE OUT and WAVE IN commands)

```
② 100 !*****
110 !   WAVE OUT PROGRAM
120 !       COM3000->HP9816
130 !*****
140 Init:  ABORT 7
150        REMOTE 7
160        ASSIGN @Com TO 702
170        INTEGER Wavdat(1023)
180        GINIT
190        GRAPHICS ON
200        WINDOW 0,1024,0,256
```

----- Declare array and secure data area for waveform

```

210 Main: GOSUB Wavread
220       GOSUB Wavdraw
230       GOTO Main
240       !
250 Wavread:OUTPUT @Com;"WAV STA 0;END 7"
260       OUTPUT @Com;"WAV OUT CH1"
270       ENTER @Com USING "%,B";Wavedat(*)
280       RETURN
290 Wavdraw:GCLEAR
300       MOVE 0,Wavdat(0)
310       FOR I=1 TO 1023
320         DRAW I,Wavdat(I)
330       NEXT I
340       RETURN
350 END

```

} -- Enter waveform data from IF03-COM
 } ----- Display waveform

This programming example is to display on the CRT of personal computer the CH1 waveform data displayed on the oscilloscope.

```

③ 100 !*****
110 !   WAVE IN PROGRAM
120 !   HP9816->COM3000
130 !*****
140 Init: ABORT 7
150       REMOTE 7
160       ASSIGN @Com TO 702
170       INTEGER Wavdat(1023)
180 Main: GOSUB Makewav
190       GOSUB Wavwrite
200       OUTPUT @Com;"LOAD REF1 CH1"
210       STOP
220       !
230 Makewav:FOR I=0 TO 1023
240       Wavdat(I)=I MOD 256
250       NEXT I
260       RETURN
270 Wavwrite:OUTPUT @Com;"WAV STA 0;END 7"
280       OUTPUT @Com;"WAV IN REF1"
290       OUTPUT @Com USING "B";Wavdat(*) END
300       RETURN
310 END

```

----- Display data of REF1 memory
 } ----- Generate sawtooth waveform data
 } --- Deliver waveform

This programming example is to transfer waveform data from personal computer to REF1 memory and from where to load onto CH1 memory.

```

④ 100 !*****
110 !      SRQ CHECK PROGRAM
120 !*****
130 Init:  ABORT 7
140         REMOTE 7
150         ASSIGN @Com TO 702
160         ON INTR 7 GOSUB Srqsub  ----- Assign a processing
                                         destination routine for
170         ENABLE INTR 7;2              service request input.
180         OUTPUT @Com;"MOD STO;ATR MOD SIN" --- Set COM3000 to single-
                                         sweep storage mode

190 Main:  GOTO Main  ----- Main Go to ready-for-
200         !              trigger loop.
210 Srqsub: $tb=SPOLL(@Com)
220         IF $tb=80 THEN
230             PRINT "TRIGGER INPUT"
240             OUTPUT @Com;"ATR MOD SIN" } Display "TRIGGER INPUT"
250         ELSE                             and deliver again single-
260             PRINT "ERROR"                sweep command to enable
270             STOP                         next input.
280         END IF
290         ENABLE INTR 7
300         RETURN
310 END

```

This programming example is to receive SRQ which is originated by waveform signal input when in the storage mode and in the single sweep mode. Each time an input signal is applied, message "TRIGGER INPUT" is displayed.

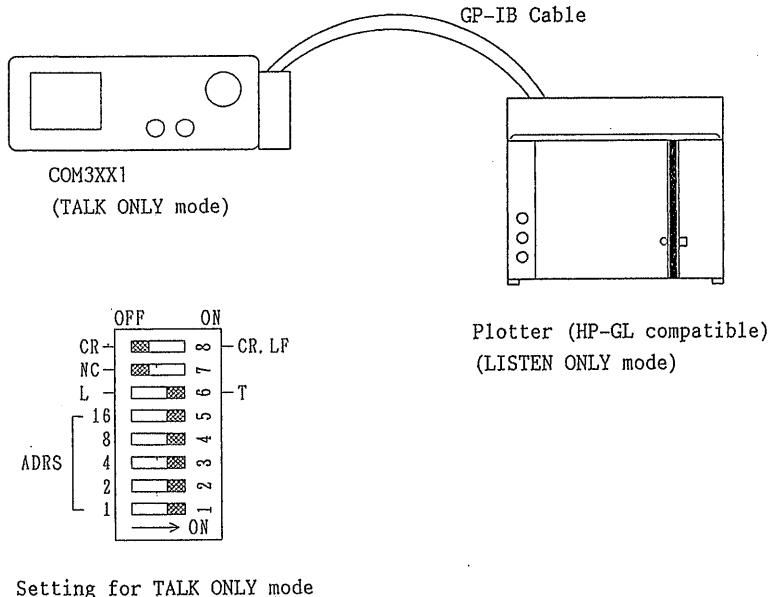
6. DATA PLOT OUT PROCEDURE

6.1 Plot Out of Data by GP-IB Plotter

The COM3XX1 Oscilloscope when in the storage mode allows plotting out of CRT data by a GP-IB plotter (HP-GL compatible). Plotting out, however, is made with the left-most position of the scale as the starting point of the horizontal scale and no data of VIEW TIME " , "PAUSE", and "MENU" is delivered to the plotter. Waveform of REF-1 is plotted out on CH1 and that of REF-2 on CH2.

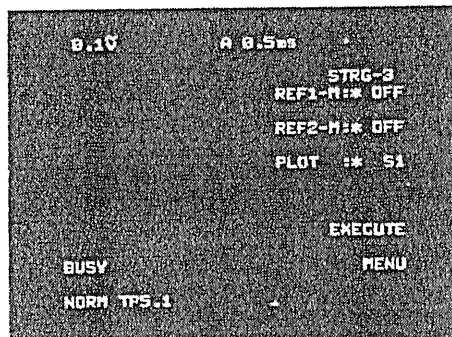
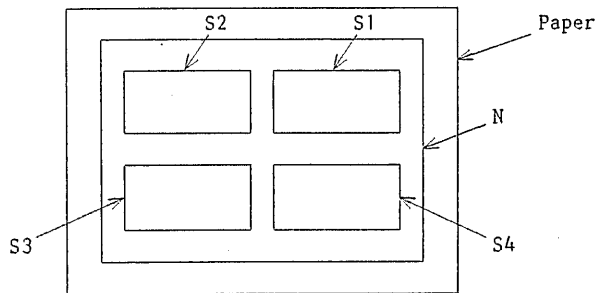
6.2 Setup for Data Plot Out

Of the oscilloscope (COM3XX1 + IF03-COM), set all of the address switches of DIP SW to the ON state and switch 6 (T-L switch) also to the ON state before turning the oscilloscope power so that the oscilloscope is set to the TALK ONLY mode. Set the plotter to the LISTEN ONLY mode and connect it to the oscilloscope using a GP-IB cable.



6.3 Plot Out Procedure

- (1) Let the oscilloscope in the storage mode display the readout and waveform data to be plotted out.
- (2) If the center scale is not necessary, turn to MIN position of scale illumination.
- (3) Select N or S1-S4 by turning the rotary knob or by pressing the PLOT key in STRG-3 of MENU, and then press the EXECUTE key to start plotting out data. "N" is for plotting out of data in the full size of paper; "S1" - "S4" are for plotting out of data of the sections illustrated below, in a quarter size of that of "N".

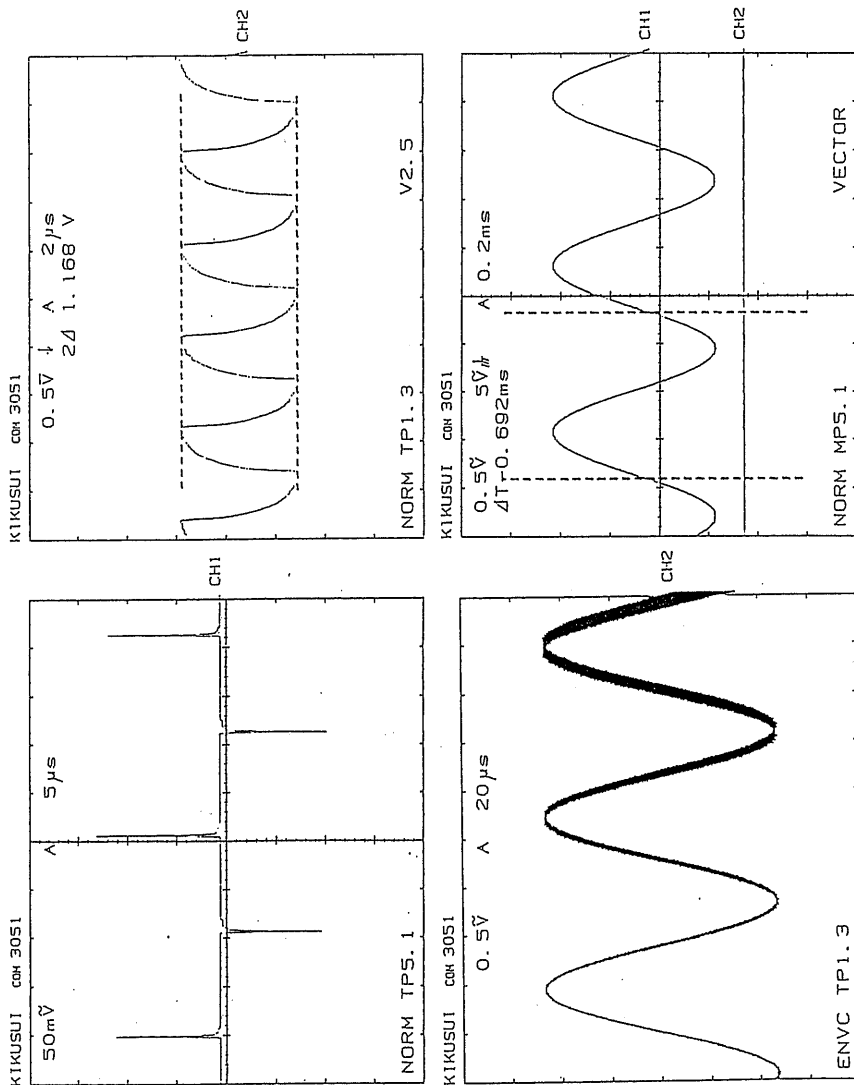


- (4) When in the plotting operation, message "PLOT" is displayed. Plotting can be aborted by pressing the ABORT (Y6) switch.

6.4 Examples of Plotted Out Hardcopies

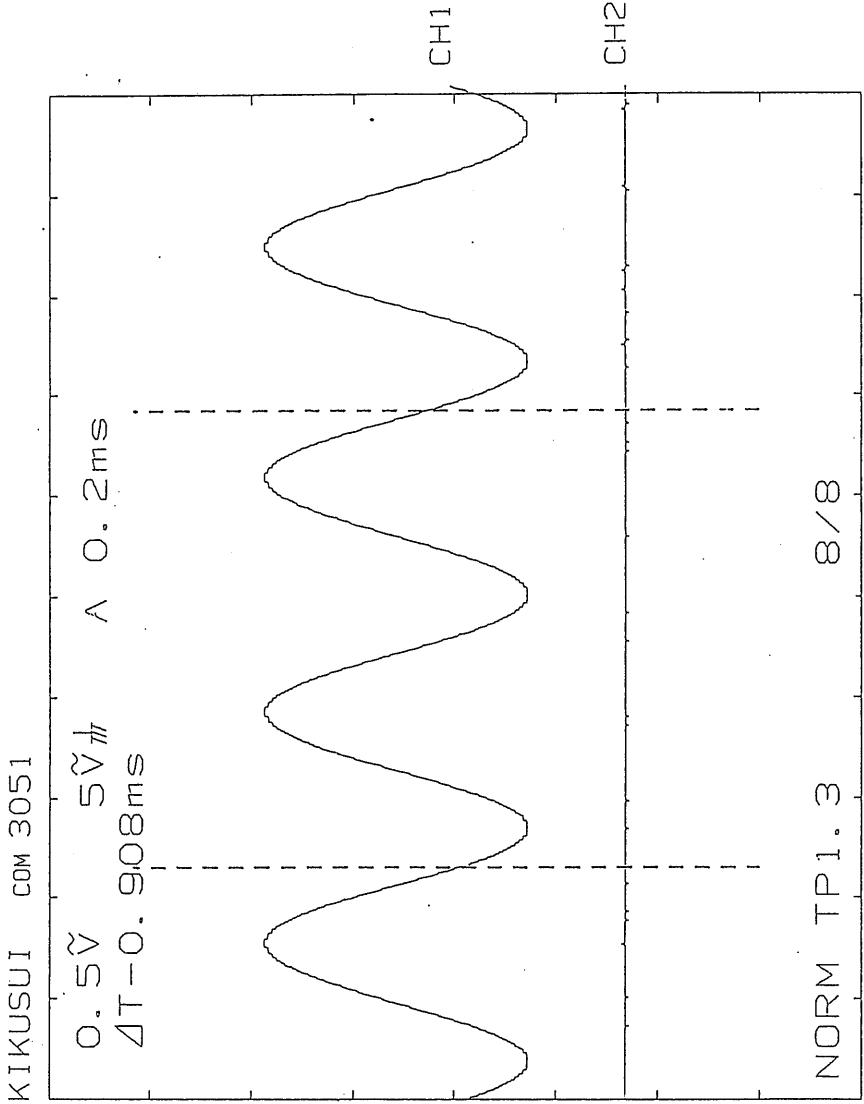
Examples of hardcopies plotted out employing EPSON HI-80 + GP-IB Card are shown in the following.

PLOT S1 - S4



909268

PLOT N



7. PROGRAMMABLE CONTROL FUNCTION

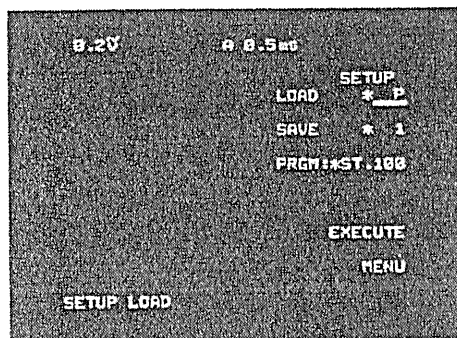
7.1 Function of REMOTE Key

The REMOTE key allows to load setup data stored in setup memory, in a sequential and looping manner from setup data of the start step to that of the end step. The start step number and the end step number can be specified with the ST and ED commands of PRGM function of SETUP menu.

As an IF03-COM is added to a COM3000 oscilloscope, a switch to the PRGM function of SETUP menu is added. Each time as you press the program switch, the set item changes as ST $\rightarrow$ ED $\rightarrow$ CP, and the step number can be set by turning the rotary knob. (ST stands for start, ED for end, and CP for copy.)

Each time as you press the INC/DEC key connected to the REMOTE key terminal, the step number is incremented or decremented by 1 within the range from the start number to the end number (See Section 2.3).

As you press the RESET key, the step number is reset to that of the start step. When setup data is loaded by means of the INC, DEC, or RESET key, message "STEPm" (m denoting the step number) appears at lower left on the CRT.



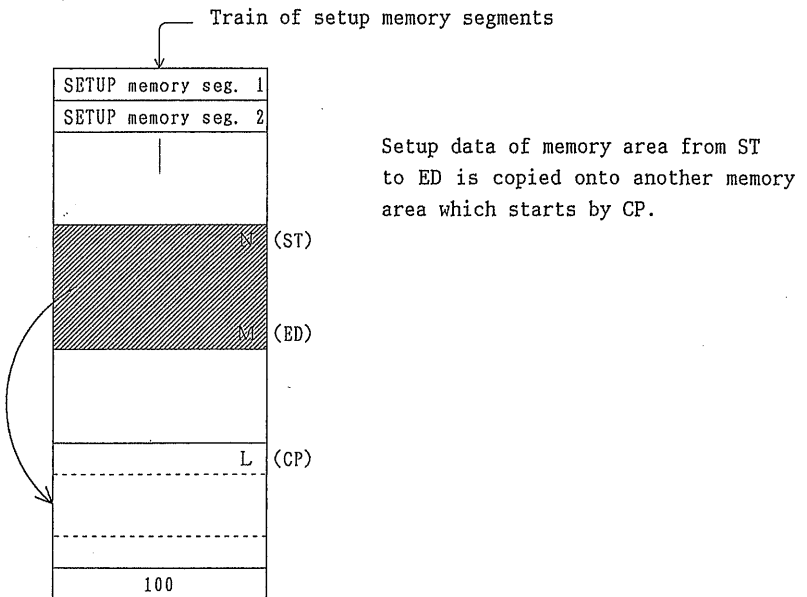
Note: All of the setup step number which is set by means of the REMOTE key, the load/save number indicated in the SETUP menu, and the number indicated by the GP-IB step command are mutually independent. The REMOTE key is enabled only when in the local mode of operation.

7.2 Internal Copy Function

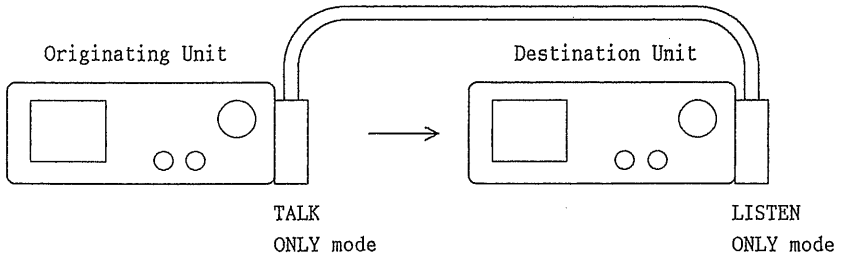
Setup data stored in certain area of memory can be copied onto another area of memory. To do this, proceed as follows: Select the SETUP menu.

By pressing the PRGM key and turning the rotary knob, set a number (a memory segment number) for each of ST → ED → CD. Press the EXECUTE key. The setup data of from ST (start) memory segment to ED (end) memory segment within the 100 memory segments will be copied to another memory area starting by CP (copy) memory segment. (This function is effective provided that the CP state is selected by the PRGM switch.)

Note: If the memory segment number is greater than 100, data of segments 101 and higher numbers are ignored and not copied.



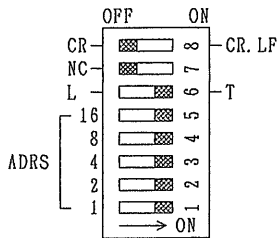
7.3 External Copy Function



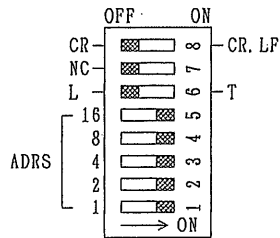
Setup data can be copied between two (or more) COM3000 Oscilloscopes of the same model. To do this, set the originating unit to the TALK ONLY mode and the destination unit to the LISTEN ONLY mode, connect them employing a GP-IB cable, and then turn on power the units. Of the originating unit, select "SETUP" on the menu, set the PRGM to "CP-EXT", and then press the EXECUTE key. Copying of setup data for 100 steps (100 memory segments) will start.

When copying is being done, message "EXT CP" will be displayed at the menu position of the originating unit and message "EXT-COPY" will be displayed in the center of the CRT of the destination unit.

When copying is over, the regular menu will be restored.



For TALK ONLY mode



For LISTEN ONLY mode

COMMAND INDEX

ATIME	25	LOAD	35
ATRIGGER	28		
AUTO	21	MAGNIFY	38
AVERAGE	35	MODE	34
		MODEL	19
BTIME	25		
BSTART	28	PAUSE	34
CALCULAT	35	READ	19
CHANNEL1	22	RESPONSE	34
CHANNEL2	22	ROLL	35
CHOP	22		
COUNTER	32	SAVE	38
CURSOR	31	SCALE	19
		SRQ	19
DELAY	25	STEP	33
DVM	32		
		TRIGGER	34
ENVELOPE	34		
EOI	19	VIEW	34
EQU	35	VMODE	22
HOLDOFF	25	WAVE	39
HORIZONTAL	25		
INITIAL	19		
INTEN	19		