INSTRUCTION MANUAL

PROGRAMMABLE OSCILLOSCOPE

MODEL COS5030-PG

MODEL COS5030A-PG

This instruction manual covers both Models COS5030-PG and COS5030A-PG. The only difference between the two models is that the former is for operation without Model CU01-COS Cursor Unit and the latter is for operation with the unit. For the former, refer to PART I of this instruction manual; for the latter, refer to both PART I and PART II of this instruction manual.

KIKUSUI ELECTRONICS CORPORATION

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.
(Revision should be applied to items indicated by a check mark ☑.)

☐ Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

☐ Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

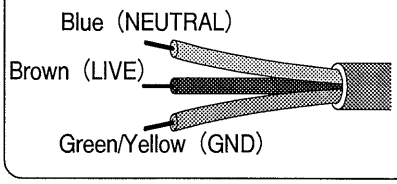
☐ AC power cable

The product is porvided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

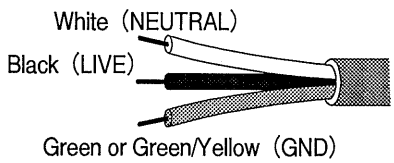
WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

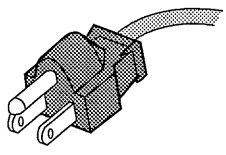
☐ Without a power plug



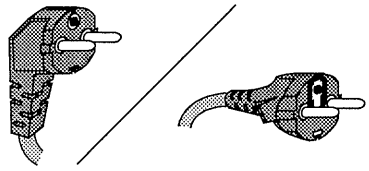
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

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1. GENERAL

1-1. General

Model COS5030-PG Oscilloscope is a dual-channel programmable oscilloscope with 5-mV sensitivity, 35 MHz frequency response, and a delayed sweep function. The programmable feature of this oscilloscope is especially convenient for testing of such video equipment as video tape recorders and video disk devices and such audio equipment as stereophonic players, etc. on manufacturing and inspection lines. The programmable oscilloscope can greatly contribute for labor economization.

1-2. Features

- o About 95% of switches and controls for waveform display are programmable:

Vertical circuit:	(sensitivity, input coupling, mode, position)
Horizontal circuit:	(A sweep, B sweep, display, A sweep variable, position)
Trigger circuit:	(trigger source, coupling, slope, level)
Others:	(delay time, intensity, etc.)

- o 12-kV acceleration CRT:

  The CRT is a 5.5-inch 12-kV post-acceleration cathode-ray tube with internal illumination-variable graticule. This CRT displays parallax-free, bright, sharply-focussed waveforms.

- o Wide band and high sensitivity:

  The oscilloscope is capable of wide-band high-sensitivity signal display of up to 35 MHz, 5 mV. When the ×5 MAG feature is used, a super high sensitivity of 1 mV at 15 MHz can be attained.

o Indications of set ranges:

The set vertical sensitivity and time axis ranges are constantly indicated for convenience of measurement of absolute values. These indications are especially convenient for debugging of programs and memory when the oscilloscope is used in conjunction with the Remote Controller (RC01-COS), Memory Unit (MU01-COS), or GP-IB Interface Unit (IF01-COS).

2. SPECIFICATIONS

2.1 Specifications

Vertical Deflection Circuit

Item	Specification	Remarks
CH1 and CH2 sensitivity	5 mV/DIV - 5 V/DIV 1 mV/DIV - 1 V/DIV (when in ×5 MAG)	1-2-5 sequence 10 points
Sensitivity accuracy	Within +3% of panel-indicated value when VARIABLE is set in CAL'D position	Within +5% with in ×5 MAG, 1 kHz, at 4 or 5 DIV
Continuously-variable control of sensitivity	Can be attenuated to 1/2.5 or less of panel-indicated value	
Frequency bandwidth	DC: DC - 35 MHz DC - 15 MHz (when in ×5 MAG) AC: 2 Hz - 35 MHz 2 Hz - 15 MHz (when in ×5 MAG)	50 kHz 8 DIV reference, -3dB
Input coupling	AC, GND, DC	
Input impedance	1 MΩ ±2%, 48 pF ± 2 pF	Parallel
Allowable input	200 V (DC + AC peak)	AC: Not higher than 1 kHz
Rise time	Approx. 10 nsec 23.3 nsec (when in ×5 MAG)	Calculated value
Polarity selection	CH2 only	
Trace shift caused by DC offset	Within +0.2 DIV for switching of all ranges. Within ±2 DIV when in ×5 MAG	When AC, DC, GND switching is done, without input. When in ×5 MAG mode

Item	Specification		Remarks
Common mode rejection ratio	50:1 or better, with 50 kHz sine wave		With CH1 and CH2 sensitivity accurately adjusted at same value
Crosstalk between channels	1000:1 at 50 kHz 30:1 at 35 MHz		At 5 mV/DIV range
Linearity	Expansion or compression in vertical direction of a 2 DIV signal at CRT center is less than ±0.1 DIV when signal is moved to the upper and lower limit of screen.		At frequency of not higher than 100 kHz; including linearity of CRT
Signal delay time	Approx. 120 nsec		
Operation modes	CH1	CH1 only	
	CH2	CH2 only	
	DUAL (automatically switched being linked to time axis)	ALT: CH1 and CH2 are swept alternately.	ALT sweep mode for 0.5 msec - 0.2 µsec ranges
		CHOP: CH1 and CH2 are chopped with a frequency of approx. 200 kHz.	CHOP sweep mode for 0.5 sec - 1 msec ranges
	CHOP ONLY		
	ADD	CH1 ± CH2	

CH1 Output

Item	Specification	Remarks
Output	Approx. 20 mV/DIV with 1 MΩ load. Approx. 10 mV/DIV with 50Ω load	Output voltage per 1 DIV on screen
Output impedance	Approx. 50Ω	
Frequency bandwidth	DC - 35 MHz, within -3 dB (without ×5 MAG)	With 50Ω termination
DC level of output	0 V ± 0.5 V	

Trigger Circuit (main sweep only)

Item	Specification	Remarks
Trigger signal source	INT CH1, CH2 EXT With external trigger signal LINE With AC line trigger signal TV TV-V, TV-H	TV sync. separator
Coupling	DC, AC, HF-REJ	HF REJ: 50 kHz, -3 dB
Polarity	+ and -	
Trigger	DC: DC - 10 MHz 0.5 DIV (0.1 V) 10 MHz - 35 MHz 1 DIV (0.2 V) AC: Low limit frequency is 5 Hz. TV: 1 DIV (0.2 V)	Values enclosed in parentheses are external trigger input sensitivity. Others are same with these of DC.
AUTO	Meets the specification of item for trigger sensitivity for signal of repetition frequency of 20 Hz or over.	When no triggering is effected, sweep runs automatically (FREE-RUN mode).
NORM	Meets the specification of item for trigger sensitivity.	When no triggering is effected, sweep is in standby state and no trace is displayed.
SINGLE	One-shot sweep satisfying all of the above specifications. Reset to standby state when RESET button is pressed.	Remains in standby state until input signal is applied.
HOLD-OFF function	Continuously variable	
External trigger input impedance	Approx. 1 MΩ, 45 pF or less	
Maximum allowable input voltage	100 Vp-p (DC + AC peak)	AC: Not higher than 1 kHz

Horizontal Deflection Circuit

A and B Sweep

Item	Specification	Remarks
Sweep time	0.2 µsec/DIV - 0.5 sec/DIV (A sweep). 0.2 µsec/DIV - 0.5 msec/DIV (B sweep).	1-2-5 sequence, 20 points. 1-2-5 sequence, 11 points
Sweep time accuracy	±3%	With VARIABLE set in CAL'D position
Continuously-variable adjustment of sweep time	Can be adjusted to 1/2.5 or less of panel-indicated value.	A sweep only
Sweep magnification	5 times	
Sweep accuracy	0.5 sec/DIV - 1 µsec/DIV 3% or less 0.5 µsec/DIV, 0.2 µsec/DIV 5% (when in ×5 MAG) or less	A and B sweep
Position shift caused by magnification	±1 DIV in center of screen	
DISPLAY	A, A INTEN BY B, B, B TRIG'D	

Delayed Sweep

Item	Specification	Remarks
Types of delay	Continuous delay Synchronized delay (using trigger signal of A sweep)	
Sweep delay time	5 msec - 2 µsec	
Delay jitter	1/10000 or less $\frac{\text{B sweep time}}{\text{A sweep time}} \times \frac{\text{Jitter width}}{\text{10 DIV}}$	Jitter width 1 DIV or less with A: 1 msec/DIV B: 1 µsec/DIV

External Sweep

Item	Specification	Remarks
System	XY system: CH1 for X and CH2 for Y	X = Horizontal axis Y = Vertical axis
Sensitivity	5 mV/DIV - 5 V/DIV (X = Y)	1-2-5 sequence 10 points
Sensitivity accuracy	Better than ±3%	1 kHz, at 4 or 5 DIV
Frequency bandwidth	X-axis: DC: DC - 2 MHz AC: 2 Hz - 2 MHz Y-axis: Same as CH2	50 kHz reference, -3 dB
XY phase difference	DC - 50 kHz, within 3°	

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Calibration Voltage

Item	Specification	Remarks
Waveform	Square wave, positive polarity	
Frequency	Approx. 1 kHz	
Duty ratio	Within 45:55	
Output voltage	1 Vp-p, ±3%	

Z-axis Amplifier

Item	Specification	Remarks
Intensity modulation	Intensity modulation discernible with 3 Vp-p input signal. Trace becomes dim with positive-going signal and becomes brighter with negative-going signal.	
Frequency response	DC - 1MHz	
Input resistance	Approx. 10 kΩ	
Maximum allowable input voltage	50 Vp-p (DC + AC peak)	AC: Not higher than 1 kHz

CRT

Item	Specification	Remarks
Type	5.5-inch square screen, internal graticule, dome mesh, post acceleration	Scale: Illuminated graticule
Fluorescent material	P31	
Acceleration voltage	Approx. +10.3 kV/-1.7 kV	Approx. 12 kV
Effective screen size	8 × 10 DIV	1 DIV = 9.5 mm (0.37 in.)

Power Requirements

Item	Specification	Remarks
Voltage	100 V, 115 V, 215 V, 230 V, ±10%	Selectable at instrument rear panel
Frequency	50 - 60 Hz	
Power consumption	Approx. 65 VA	

Mechanical Specifications

Item	Specifications	Remarks
External dimensions	365W × 165H × 525D mm (14.37W × 6.50H × 20.67D in.)	When handle is set in carrying state
	365W × 165H × 450D mm (14.37W × 6.50H × 17.72D in.)	Maximum dimensions
	365W × 190H × 450D mm (14.37W × 7.48H × 17.72D in.)	When handle is set at casing top
	310W × 150H × 400D mm (12.20W × 5.91H × 15.75D in.)	Chassis section
Weight	Approx. 10.5 kg (23 lbs)	Main unit only

Environmental conditions (ambient temperature and humidity)

Range to satisfy performance specifications:

5°C to 35°C (41°F to 95°F), 85% RH or less

Range for instrument operation:

0°C to 40°C (32°F to 104°F), 90% RH or less

Accessories

	Kikusui Code	Q'ty
Probes, 960BNC, (10:1, 1:1)	(89-03-0220)	2
Terminal Adaptors, 942A	(W4-986-011)	3
Cable, inter-device connection, (24P)	(89-04-0130)	1
Cable, inter-device connection, (14P)	(89-04-0120)	1
Fuse, slow blow, 0.5 A	(99-02-0115)	1
Fuse, slow blow, 1 A	(99-02-0120)	1
Instruction manual	( )	1

2-2. Functions

Remote Control Functions (1)

Item	Functions	Remarks
Vertical sensitivity	5 mV - 5 V/DIV (CH1, CH2)	1-2-5 sequence, 10 points
Vertical input coupling	AC/DC/GND (CH1, CH2)	
Vertical signal magnifier	×5 MAG (CH1, CH2)	
Vertical positioning	7-point selection (CH1, CH2)	In approx. 1-DIV steps
Vertical mode	CH1/CH2/DUAL (CHOP, ALT)/ ADD/XY	Note (1)
Vertical signal polarity selection	CH2 only	
Sweep time	A: 0.55 sec - 0.2 µsec/DIV B: 0.5 msec - 0.2 µsec/DIV	1-2-5 sequence, 20 points 1-2-5 sequence, 11 points
Sweep magnification	×5 MAG	
Sweep time change	4-point selection, CAL'D - 1/2.5	Note (2) Indication on panel is for reference only.
Horizontal positioning	7-point selection	In approx. 1-DIV steps
Sweep mode	AUTO/NORM/SINGLE	
Horizontal display	A/A-INTEN-BY-B/B/B-TRIG'D	
Delay time positioning	8-point selection	In approx. 1-DIV steps
Internal trigger	CH1/CH2 (when in vertical DUAL mode)	Note (1)

Item	Functions	Remarks
Trigger coupling	DC/AC/HF-REJ/TV	
Trigger level	7-point selection	In approx. 1-DIV steps
Trigger slope	+/-	
Intensity	4-point selection, 0 - 3	Indication on panel is for reference only.
Probe selector	CH1: 4-point selection CH2: 4-point selection	When PS01-COS Probe Selector is used
CHOP ONLY	When in dual-channel mode, traces are displayed in CHOP mode at all ranges of sweep time.	

Remote Control Functions (2)

Item	Functions	Remarks
Continuously-variable adjustment of vertical sensitivity	Can be reduced to 1/2.5 or over from the dial-indicated value	When RC01-COS or SC02-COS is used
Vertical positioning	Variable by ±4 DIV or over	
Horizontal positioning	Variable by ±5 DIV or over	
Continuously-variable sweep time	Variable by 2.5 times or over of the dial-indicated value. Note (2)	
Delay time positioning	Can be set within 5 - 95% of A sweep. Note (3)	
Trigger level	Variable by ±4 DIV or over (in CRT screen amplitude equivalent value)	

All of the remote control functions of (1) and (2) can be done by applying external control signals via the 24-pin and 14-pin Amphenol connectors on the rear panel. The remote control functions of (2), except the continuously-variable adjustment of vertical sensitivity, are not effective unless the corresponding knobs on the front panel are in the pushed-in state. When the knobs are pulled out, the functions are local with these knobs on the oscilloscope front panel.

Note (1): When in the single mode (CH1 or CH2) of operation, internal trigger sources also are automatically switched as vertical modes are switched as follows:

Vertical channel mode	Internal trigger source
CH1	CH1
CH2	CH2
DUAL or ADD	CH1 or CH2, selectable

Note (2): The sweep time change function and the continuously-variable sweep time function are for the A sweep only. When these functions are used in conjunction with the A SWEEP VARIABLE knob on the osicllloscope panel, sweep time is variable for a range of from 0 to approximately 2.5 times.

Note (3): When the start position of the delay sweep is set at a position of approximately 5 DIV on CRT from the start point of the main sweep using the external control function of (1).

3. GENERAL PRECAUTIONS

3-1. Unpacking the Oscilloscope

The oscilloscope is shipped from the manufacturer's factory after full mechanical and electrical inspection to ensure perfect structures and performances. Please unpack the oscilloscope immediately upon receiving it and check for sign of damage which might be caused when in transportation. If any sign of damage is found, please immediately notify the bearer and your Kikusui dealer.

3-2. Checking the AC Line Voltage

The oscilloscope can be operated on any one of the AC line voltages shown in the following table. The required voltage can be selected by means of the voltage selector plugs. Before operating the instrument, ensure that the AC line voltage setting of the instrument (device) is correct. If the instrument voltage does not conform with the line voltage, the instrument may not operate normally or may be permanently damaged.

When the instrument AC line voltage is changed, change the fuse also referring to the following table.

Symbol	Nominal voltage	Operating voltage range	Fuse
A	100 V	90 - 110 V	1 A slow blow
B	115 V	104 - 126 V	
C	215 V	194 - 236 V	0.5 A slow blow
D	230 V	207 - 253 V	

3-3. Environmental Conditions

The ambient temperature range for normal operation of the oscilloscope is 0° C to 40°C (32°F to 104°F). Note that malfunctioning may be caused if the oscilloscope is operated or stored in unreasonably high temperature and high humidity for a long period of time.

Do not use the oscilloscope in a place where strong magnetic or electric field exists. Such fields may disturb oscilloscope operation.

3-4. CRT Intensity:

In order to prevent permanent damage to the CRT screen, do not make the CRT trace excessively bright or leave the spot stationary for a prolonged period.

3-5. Allowable Voltages of Input Terminals:

The maximum allowable voltages of the oscilloscope input terminals and probe input terminals are as shown in the following table. Do not apply voltages higher than these limits.

CH1 and CH2 terminals	200 V (DC + AC peak)
Probe (960BNC)	600 V (DC + AC peak)
EXT TRIG IN terminal	100 V (DC + AC peak)
Z AXIS IN terminal	50 V (DC + AC peak)

With AC frequency not higher than 1 kHz

3-6. Rating of AC Outlet

The oscilloscope has on its rear panel an AC outlet which may be used for a device (RC01-COS, MU01-COS, IF01-COS, or PS02-COs) that may be operated in conjunction with the oscilloscope. The rating of this AC outlet is 100 VA.

3-7. Cables for Inter-device Connection

Cables with 14-pin and 24-pin connectors are supplied accompanying the oscilloscope. Before connecting the oscilloscope to other devices with these cords, be sure to turn off power of the socilloscope. After securely connecting the cables, turn on the power of the oscilloscope. (The cables are securely connected when the connector lock spring of the oscilloscope are positively applied.)

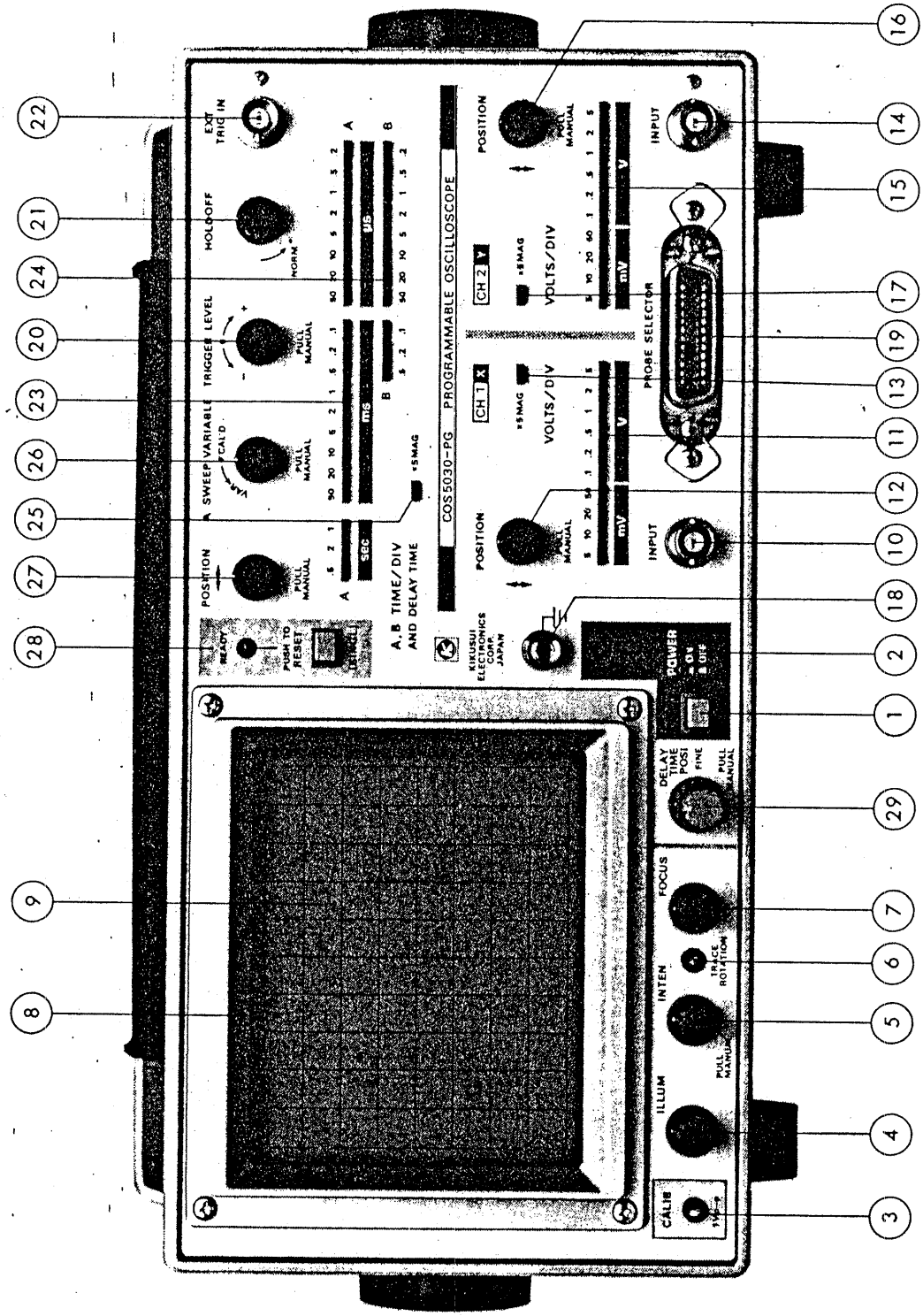


Figure 4-1. Front panel of the Oscilloscope

4. PANEL DESCRIPTIONS AND INTER-DEVICE CONNECTIONS

4-1. Description of Front Panel (See Figure 4-1.)

①	POWER:	Main power switch of the oscilloscope. The depressed state is for power on. Power is turned off when this button is pressed again.
②	(Green LED):	This power pilot lamp lights to indicate that oscilloscope power is on.
③	CALIB (1 Vp-p):	This terminal delivers the internally-oscillated square wave signal (1 Vp-p, approx. 1 kHz) for calibration of phase characteristics of the probes.
④	ILLUM:	Graticule illumination control. Graticule becomes brighter as this control is turned clockwise.
⑤	INTEN: PULL MANUAL	Trace intensity control. Trace intensity increases as this control is turned clockwise. The pulled out state is for local adjustment of trace intensity.
⑥	TRACE ROTATION:	Semi-fixed resistor for aligning the horizontal trace in parallel with graticule lines, compensating for slant caused by terrestrial magnetism.
⑦	FOCUS:	For focussing the trace to the sharpest image.
⑧	Bezel:	Bezel with camera mount.
⑨	Filter	

Vertical Axes

⑩	CH1 (X) INPUT:	CH1 vertical input terminal (or X-axis (horizontal axis) input terminal when in X-Y mode).

⑪ (Green LED ×10): These lamps indicate input sensitivity of CH1.

⑫ POSITION ↕ : PULL MANUAL — Vertical positioning of CH1 trace. The trace moves upward as this control is turned clockwise. The pulled out state is for local adjustment.

⑬ ×5 MAG (red LED): Lighting of this lamp indicates that the CH1 vertical sensitivity is being magnified by 5 times.

⑭ CH2 (Y) INPUT: CH2 vertical input terminal (or Y-axis (vertical axis) input terminal when in X-Y mode).

⑮ (Green LED ×10): These lamps indicate input sensitivity of CH2.

⑯ POSITION ↕ : PULL MANUAL — Vertical positioning of CH2 trace. The trace moves upward as this control is turned clockwise. The pulled out state is for local adjustment.

⑰ ×5 MAG: Lighting of this lamp indicates that the CH2 vertical sensitivity is being magnified by 5 times.

⑱ GND: GND terminal of the oscilloscope.

⑲ PROBE SELECTOR: This 24-pin connector is used to connect probe selector PS01-COS or PS02-COS.

Trigger Circuit

⑳ TRIGGER LEVEL: As this level is turned clockwise, the trigger level moves in the "+" direction; as it is turned counterclockwise, the trigger level moves in the "-" direction. The pulled out state is for local adjustment.

㉑ HOLDOFF: This knob is used when the signal waveform is complex and stable triggering cannot be attained with the LEVEL knob alone. Normally this knob should be set in the NORM position.

㉒ EXT TRIG IN: An external trigger signal is applied through this terminal when in the external trigger mode.

Sweep Circuit

㉓ A (green LED ×20): These lamps indicate A sweep time and delayed sweep time.

㉔ B (green LED ×11): These lamps indicate B sweep time.

㉕ ×5 MAG (red LED): Lighting of this lamp indicates that the A or B sweep is being magnified by 5 times.

㉖ A SWEEP VARIABLE: Continuously-variable adjustment of A sweep time. The sweep time indicated by ㉓ green LED can be made slower by a factor of 2.5 or over. The pulled out state is for local adjustment.

㉗ POSITION ↔: Horizontal positioning of trace. The trace moves rightward as this knob is turned clockwise. The pulled out state is for local adjustment.

㉘ READY (red LED): PUSH TO RESET (SINGLE) This lamp indicates that preparation for one-shot sweep operation is ready. After one-shot sweep operation is over, preparation for the next one-shot sweep operation can be done by pressing the RESET button located below this lamp.

㉙ DELAY TIME POSI: This knob is for continuously-variable adjustment of the delay time indicated by the A sweep time LED, in order to select the required portion of the waveform displayed with the A sweep.

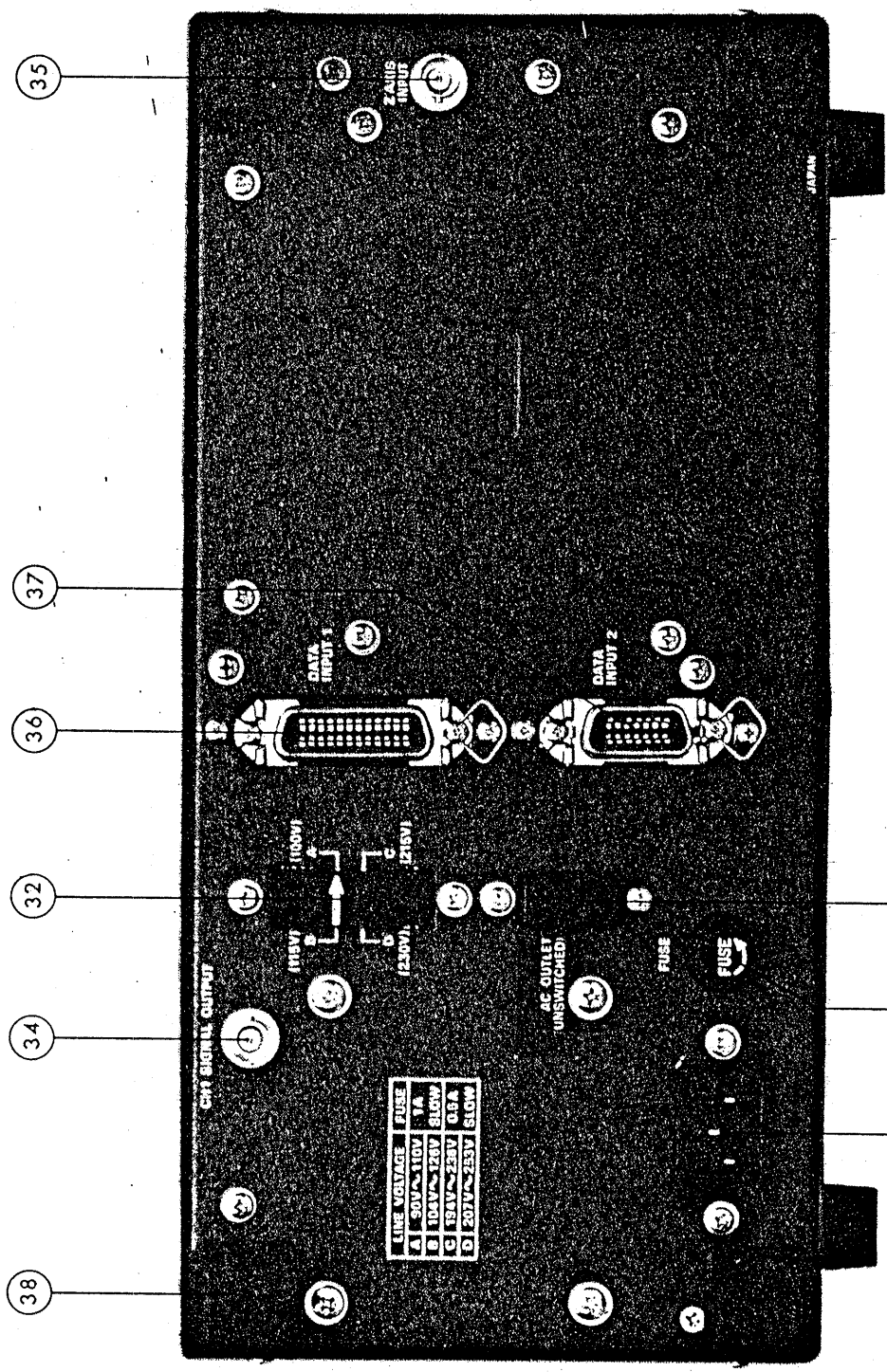


Figure 4-2. Rear panel of the Oscilloscope

4-2. Description of Rear Panel (See Figure 4-2.)

㉚ Power connector: AC power input receptacle of the oscilloscope. Connect the power cord (supplied) to this receptacle.

㉛ Fuse: AC power fuse (slow blow fuse) of the oscilloscope. To remove the cap, turn it counterclockwise.

㉜ Voltage selector plug: Selects the AC line voltage for the instrument. Correctly set the plug, observing the allowhead mark.

㉝ AC outlet (non-switched): This receptacle provides an AC line power, with a rating of 100 VA.

㉞ CH1 SIGNAL OUTPUT: This terminal provides the CH1 output signal. May be used to measure the signal frequency with a frequency counter.

㉟ Z AXIS INPUT: Input terminal for an external intensity-modulation signal.

㊱ DATA INPUT 1: 24-pin connector for input signals for remote-control functions of (1).

㊲ DATA INPUT 2: 14-pin connector for input signals for remote-control functions of (2).

㊳ Code hook: Code hooks at the four corners.

4-3. Combinations with Other Devices

The oscilloscope can be used in combination with Remote Controller RC01-COS, Memory Unit MU01-COS, Interface Unit GP-IB, and/or Probe Selector PS01-COS or PS02-COS.

Examples of combinations are explained in this section. Cables with connector at each end are used for inter-devices connections. (In the examples in this section, the "24-pin cable" means a 24-core cable with a 24-pin connector at each end and the "14-pin cable" means a 14-core cable with a 14-pin connector at each end.)

For further details of operations in conbinations, refer to the instruction manuals of respective devices.

(1) Operation with Remote Controller RC01-COS and Step Controller SC01-COS

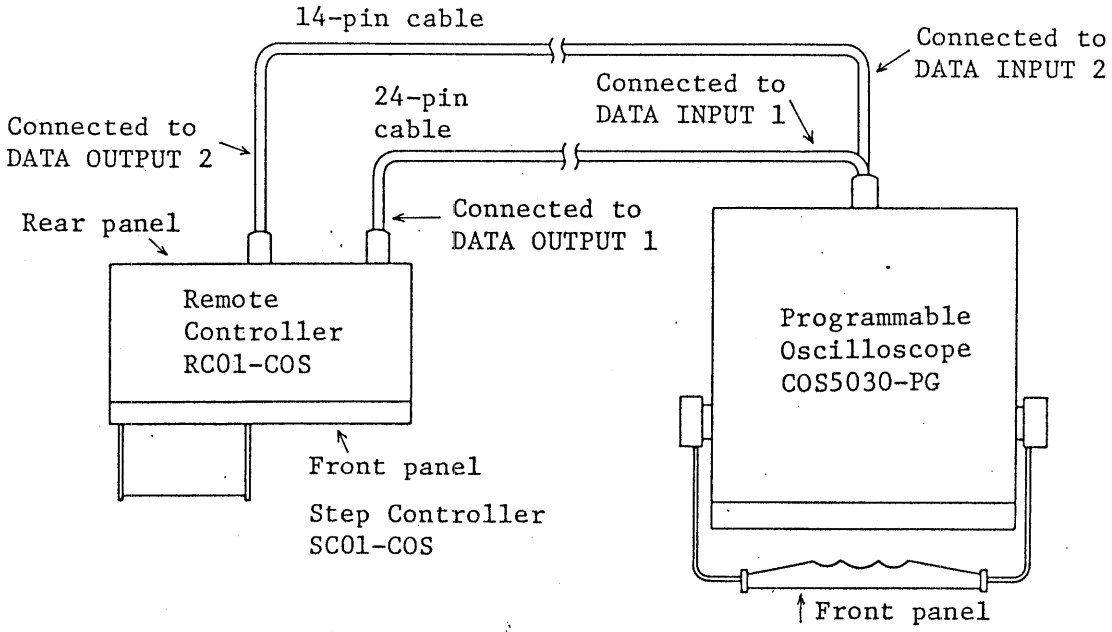


Figure 4-3

(2) Operation with Remote Controller RC01-COS and Step Controller SC02-COS

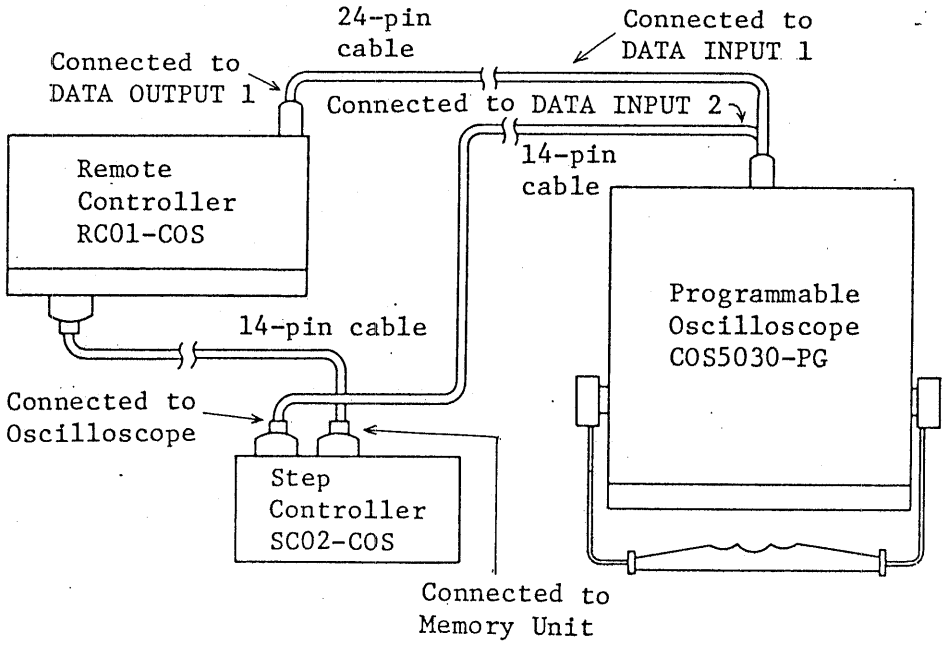


Figure 4-4

(3) Operation with Memory Unit MU01-COS and Step Controller SC01-COS

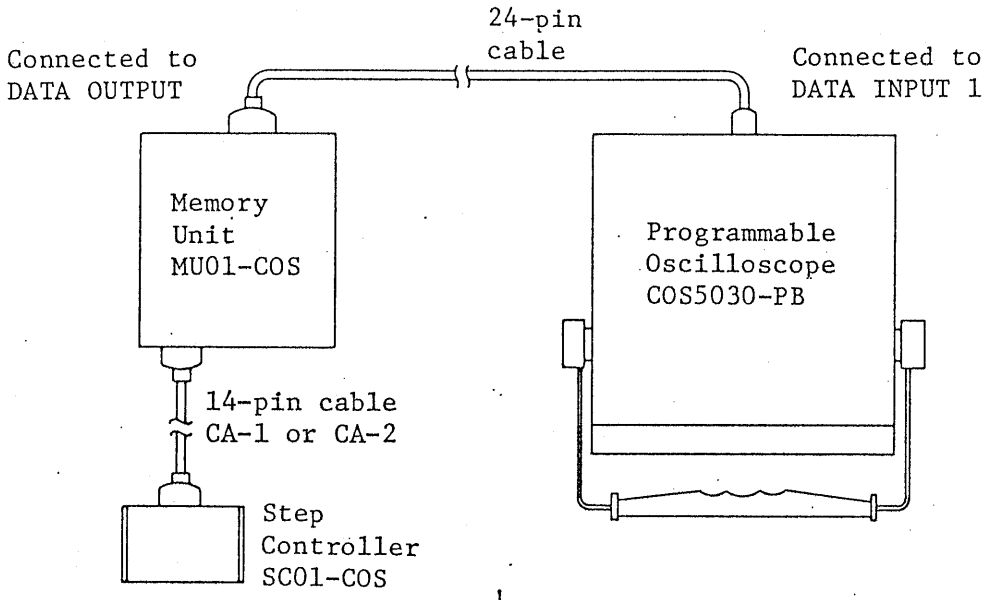


Figure 4-5

Note: Note that the Remote Control Functions (2) are unavailable when the oscilloscope is operated in this combination.

(4) Operation with Memory Unit MU01-COS and Step Controller SC02-COS

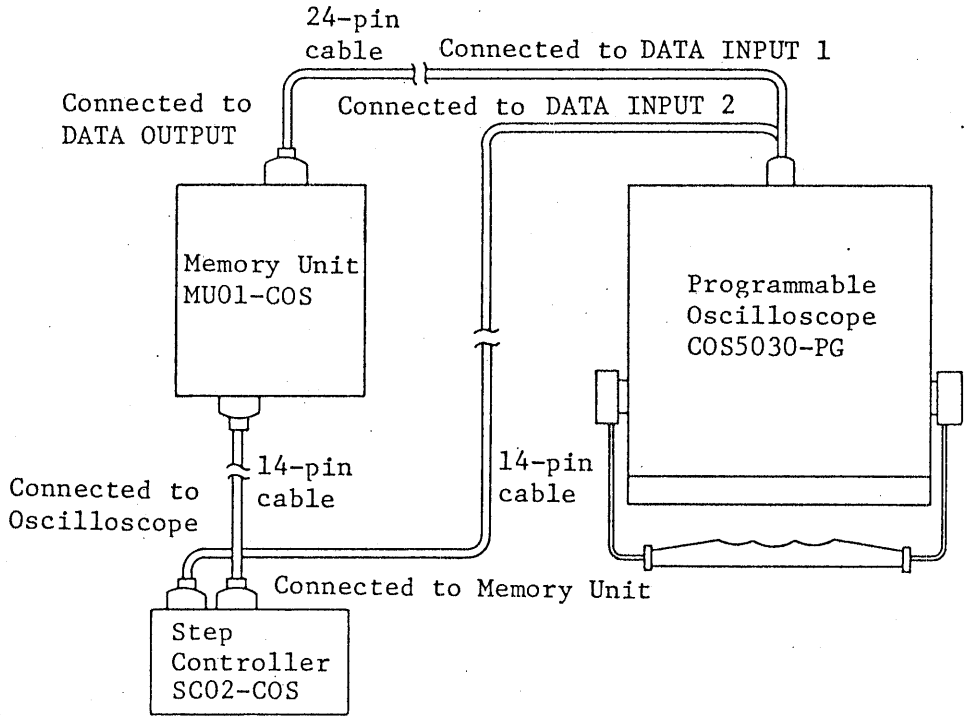


Figure 4-6

(5) Operation with GP-IB Interface Unit IF01-COS

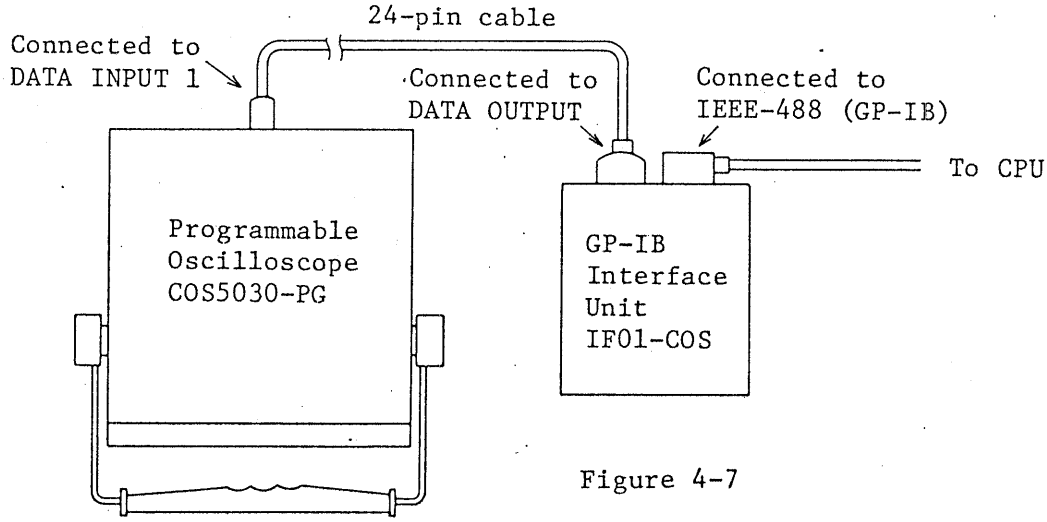
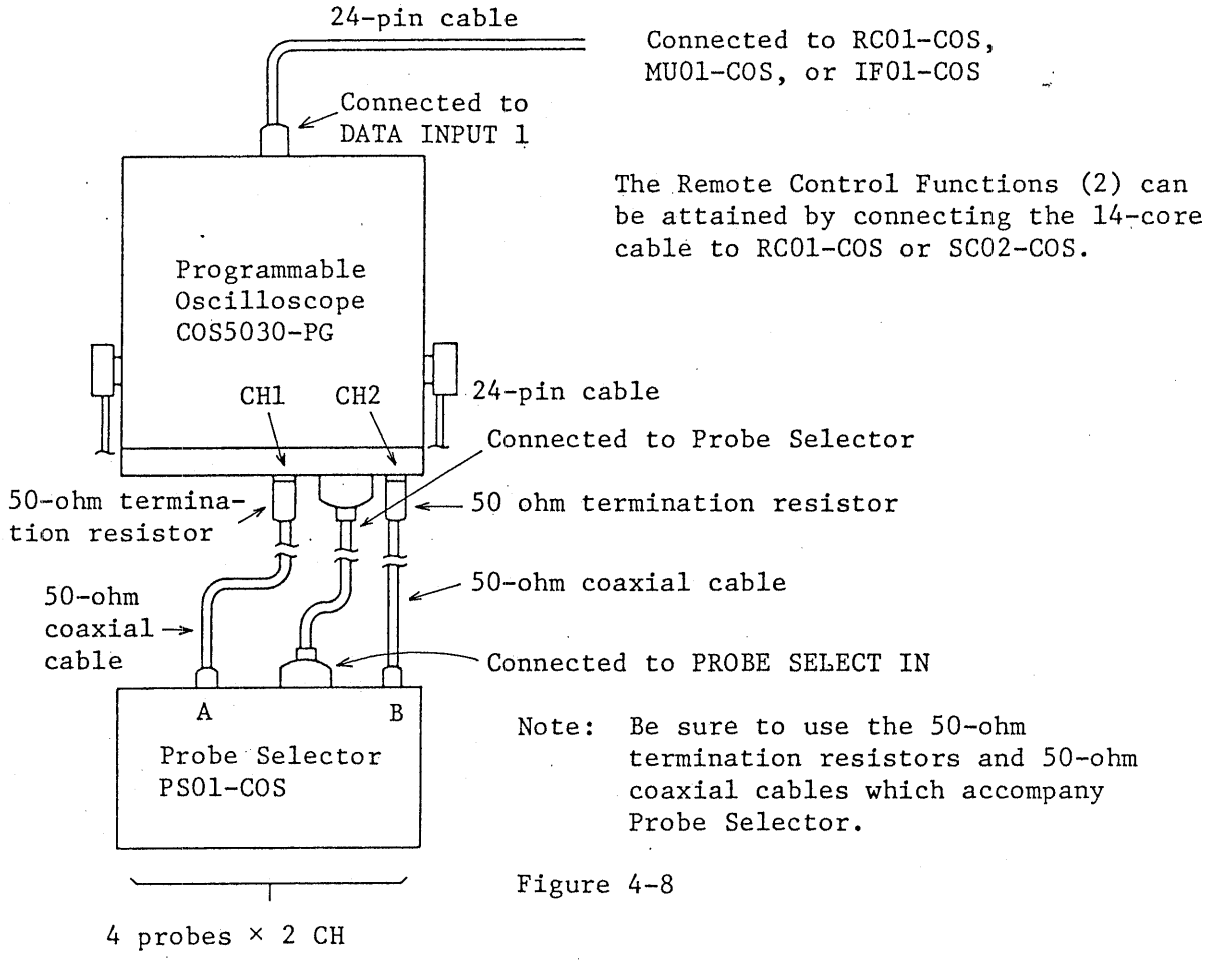


Figure 4-7

Note: Note that the Remote Control Functions (2) are unavailable in this case.

(6) Operation with Probe Selector PS01-COS



Note: Be sure to use the 50-ohm termination resistors and 50-ohm coaxial cables which accompany Probe Selector.

Figure 4-8

(7) Operation with Probe Selector

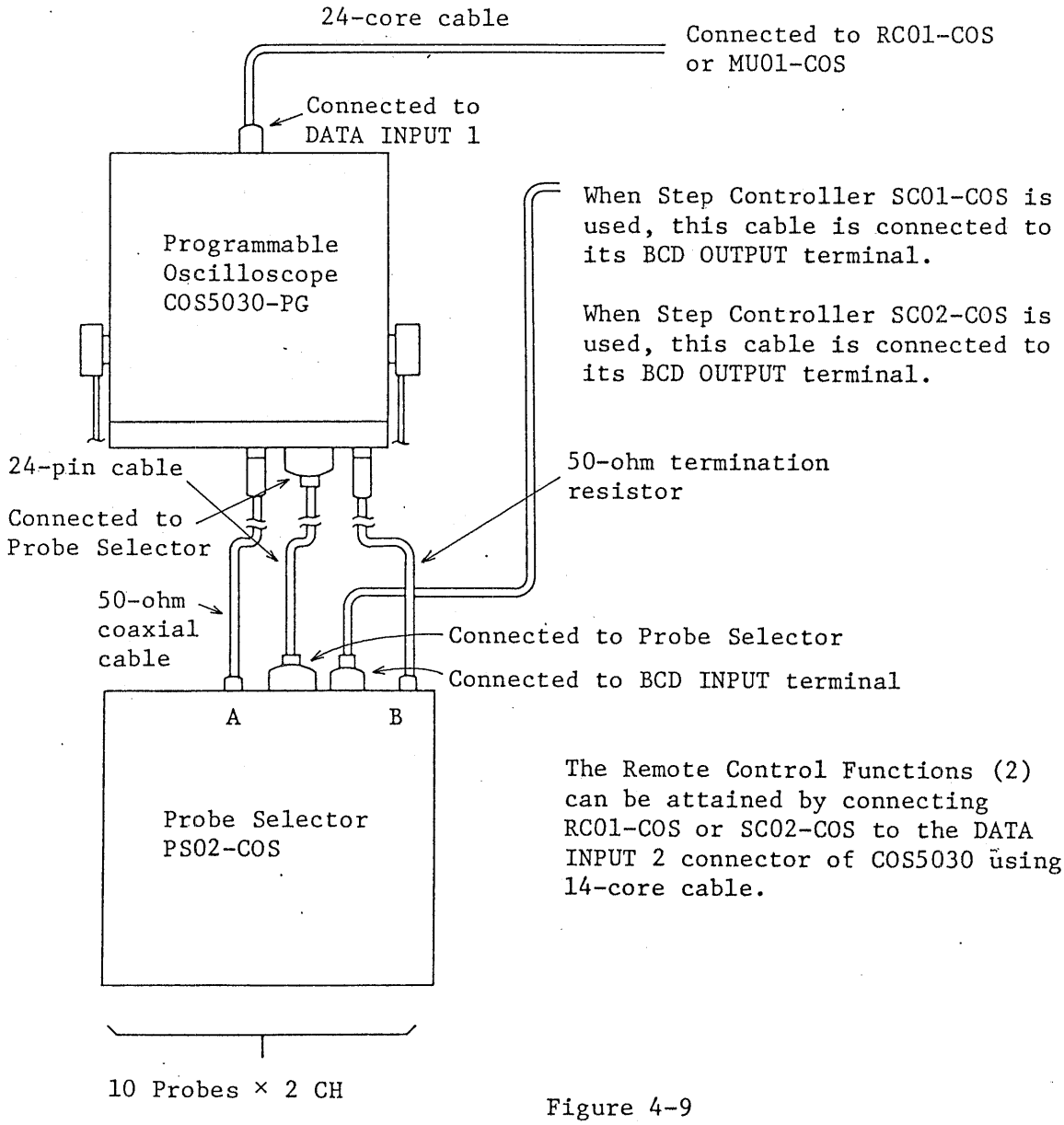


Figure 4-9

Note: Be sure to use the 50-ohm termination resistors and 50-ohm coaxial cables which accompany the Probe Selector.

4-4. Cables for Inter-device Connection

The cables for inter-device connection, except optional ones, are supplied accompanying individual devices as shown in Table 4-1.

Table 4-1

Devices connected		No. of pins	Sex	Length (m)	No. of pins	Sex	Remarks
COS5030-PG	RC01-COS	24	O	1	24	O	Accompanies COS5030-PG
	MU01-COS	24	O	1	24	O	Accompanies COS5030-PG
	IF01-COS	24	O	1	24	O	Accompanies COS5030-PG
	RC01-COS	14	O	1	14	O	Accompanies COS5030-PG
	SC02-COS	14	O	1	14	O	Accompanies COS5030-PG
	PS01-COS	24	O	1	24	O	Accompanies PS01-COS
	PS02-COS	24	O	1	24	O	Accompanies PS02-COS
RC01-COS	SC01-COS	14	O	1	14	M	Optional as CA-1 or CA-2
	SC02-COS	14	O	1	14	O	Accompanies SC02-COS
MU01-COS	SC01-COS	14	O	1	14	M	Optional as CA-1 or CA-2
	SC02-COS	14	O	1	14	O	Accompanies SC02-COS
PS02-COS	SC01-COS	14	O	1	14	O	Accompanies PS02-COS
	SC02-COS	14	O	1	14	O	Accompanies PS02-COS

Note: Of the sex column, O denotes male and M denotes female.

Two-meter-long cables are available as options.

The 50-ohm termination resistors (two) and 50-ohm coaxial cables (two) for Probe Selector are supplied accompanying PS01-COS or PS02-COS. (For the probes to be used with the Probe Selector, see Subsection 4-6.)

The GP-IB cables for the GP-IB Interface accompanies IF01-COS.

Table 4-2

Devices to be connected		Resistors and cables	Remarks
COS5030-GP	PS01-COS	50-ohm termination resisters (two) and 50-ohm coaxial cables (two)	Accompanies PS01-COS
	PS02-COS		Accompanies PS02-COS
	IF01-COS	GP-IB cable (1 meter)	Accompanies IF01-COS

Note: Two-meter-long cables are available as options.

4-5. Optional Cables

One-meter-long cables are supplied as standard accessories accompanies individual devices. Two-meter-long cables are available as options. As GP-IB cables, both 50-cm-long and two-meter-long cables are available as options. See Table 4-3.

Table 4-3. Optional Cables (including standard cables)

Cable	Kikusui Code No.	Inter-connected devices (typical)	Qty	Remarks
CA-1	———	RC01-COS ↔ SC01-COS	1	With mounting bracket
CA-2	———	RC01-COS ↔ SC01-COS	2	With mounting bracket
57 CABLE 14P(O)-1M-14P(M)	89-04-0120	RC01-COS ↔ SC01-COS	1	For CA-1 cable only
57 CABLE 14P(O)-1M-14P(O)	89-04-0110	COS5030-PG ↔ RC01-COS	1	
57 CABLE 24P(O)-1M-24P(O)	89-04-0130	COS5030-PG ↔ RC01-COS	1	
57 CABLE 14P(O)-2M-14P(M)	89-04-0150	RC01-COS ↔ SC01-COS	2	For CA-2 cable only
57 CABLE 14P(O)-2M-14P(O)	89-04-0140	COS5030-PG ↔ RC01-COS	2	
57 CABLE 24P(O)-2M-24P(O)	89-04-0160	COS5030-PG ↔ RC01-COS	2	
408J-1P5 IEEE-488 50CM	89-04-1000	COS5030-PG ↔ IF01-COS	0.5	
408J-101 IEEE-488 1M	89-04-1010	COS5030-PG ↔ IF01-COS	1	
408J-102 IEEE-488 2M	89-04-1020	COS5030-PG ↔ IF01-COS	2	

4-6. Optional Probes

Two probes are supplied as standard accessories accompanying programmable Oscilloscope COS5030-PG. No probes are supplied as standard accessories for Probe Selector PS01-COS or PS02-COS. For the probe selectors, optional probes are available as shown in Table 4-4.

Table 4-4

Probe	Structure			Attenuation ratio	Remarks
	Tip	Length	Rear		
960BNC	Pincer typ type	2 m	GNC type	10:1, 1:1 selectable	Two probes accompanies COS5030-PG.
962BNC	BNC type	2 m	BNC type	10:1	10-MΩ type

5. OPERATION METHOD

5-1. Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Remote Controller RC01-COS and Step Controller SC01-COS

5-1-1. Preparative Setting Up

Before connecting the power cords of Oscilloscope COS5030-PG and Remote Controller RC01-COS, make it sure that the voltage selector plugs on the rear panels of these devices are set correctly meeting the AC line voltage.

Next, connect between rear panels of COS5030PG and RC01-COS with the 14-pin and 24-pin cables which are supplied accompanying the COS5030-PG, as explained in Item (1) Operation with Remote Controller RC01-COS and Step Controller SC01-COS of Subsection 4-3 "Combinations with Other Devices." (When Remote Controller RC01-COS and Step Controller SC01-COS are to be operated at mutually apart locations, use an optional 14-pin cable CA-1 or CA-21.)

Set the switches and controls on the panels of Oscilloscope COS5030-PG, Remote Controller RC01-COS and Step Controller SC01-COS as shown in Tables 5-1 through 5-3.

(A) Setting of Programmable Oscilloscope COS5030-PG

Table 5-1

Item	No.	Setting
POWER	①	OFF
INTEN	⑤	Mid-position (PUSH)
FOCUS	⑦	Mid-position
ILLUM	④	Counterclockwise
↕ POSITION	⑫ ⑯	Mid-position (PUSH)
↔ POSITION	㉖	Mid-position (PUSH)
A SWEEP VARIABLE	㉕	CAL'D position (PUSH)
TRIGGER LEVEL	⑳	Mid-position (PUSH)
HOLDOFF	㉑	NORM position

(B) Setting of Remote Controller RC01-COS

Table 5-2

Item	Setting
POWER	OFF
INTEN	1
DUAL-CH1-CH2 ↕ POSITION VOLTS/DIV AC-DC-GND ×5 MAG CH2 POLARITY	CH1 0 (both CH1 and CH2) 20 mV/DIV (both CH1 and CH2) DC, GND (both CH1 and CH2) ⊓ (NORM) ⊓ (NORM)
TRIGGER SOURCE TRIGGER COUPLING TRIGGER SLOPE TRIGGER LEVEL TRIGGER MODE	INT (LINE at OFF) AC, FLAT, (TV at OFF) "+" 0 AUTO
HORIZ DISPLAY B TRIG'D ×5 MAG	A ⊓ (OFF) ⊓ (OFF)
A, B TIME/DIV A SWEEP VARIABLE ↔ POSITION DELAY TIME POSITION	0.5 mS (both A and B) 1 0 0
EXT SELECTOR	1 (both A and B)
START END READ/WRITE	00 95 ⊓ WRITE
PULL-REMOTE (eight red knobs)	Set the knobs in the pushed state.

(C) Setting of Step Controller SC01-COS

Table 5-3

Item	Setting
⊓ AUTO ⊔ MANUAL	⊓ MANUAL
TIME INTERVAL	Minimum

After setting the switches and controls of the devices as above, connect the power cords of the devices and proceed as follows:

(1) Turn on the power switches of the devices and confirm that the power pilot lamps are on. A trace will be displayed on the oscilloscope screen in about 20 seconds after turning on the power. If no trace is displayed even when about 60 seconds has elapsed, repeat the above setting procedure from the beginning.

(2) Pull out the INTEN knob of Oscilloscope COS5030-PG and adjust it together with the FOCUS knob so that the displayed trace becomes sharpest.

(3) Pull out the CH1 POSITION knob of Osicllloscope COS5030-PG and adjust it together with the TRACE ROTATION control (semi-fixed potentiometer) so that the displayed trace conforms with the horizontal center line of the graticule.

(4) Connect the 960BNC Probe (supplied) to the CH1 input terminal and connect the probe tip to the CALIB terminal. (Set the attenuation ratio of the 960BNC Probe at 10;1.)

(5) Change the AC-DC-GND switch of Remote Controller RC01-COS to AC, GND-OFF. A waveform as shown in Figure 5-1 will be displayed on the oscilloscope screen.

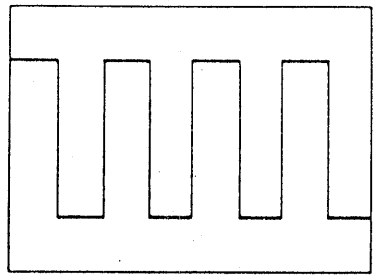


Figure 5-1

(6) Adjust again the FOCUS control so that the displayed waveform becomes sharpest.

(7) Select appropriate amplitude and sweep time with the VOLTS/DIV switch and TIME/DIV switch of the Remote Controller RC01-COS in accordance with the signal to be displayed.

(8) To read the voltage (V p-p) and period (T sec) of the displayed waveform, align it with graticule lines by means of the vertical POSITION knob of Oscilloscope COS5030-PG or the vertical POSITION knob (red) and horizontal POSITION knob of Remote Controller RC01-COS.

The above is the basic preparative setup for the oscilloscope and its ancillary devices. General measuring procedures are explained in subsequent subsections.

5-1-2. Dual-channel Operation and ADD Operation

(1) Dual-channel Operation

Of the VERT MODE switches of Remote Controller RC01-COS, set both CH1 and CH2 switches in the pushed state (the BOTH IN DUAL state).

With the procedure up to the above, the calibration signal has been applied only to CH1. Now apply the calibration signal also to CH2. In this case also, trigger the CH2 signal with the CH1 signal as in the above case.

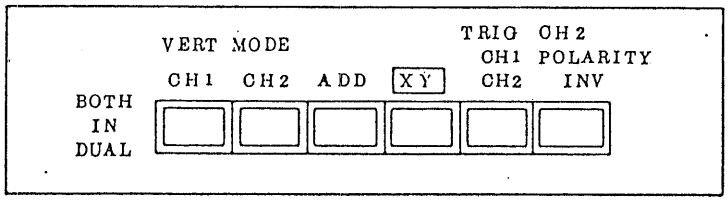


Figure 5-2

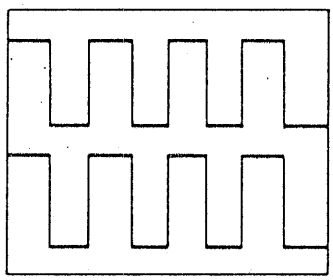


Figure 5-3

So far as the CH2 signal has a certain periodical relationship with respect to the CH1 signal, stationary waveforms are displayed for both CH1 and CH2 signals.

For the dual-channel operation, this oscilloscope has only the DUAL buttons and it has no CHOP/ALT selector switches. Actually, CHOP/ALT selection is automatically done being linked to the TIME/DIV switch of Remote Controller RC01-COS. Ranges 0.5 sec/DIV to 1 msec/DIV are in the CHOP mode and ranges 0.5 msec/DIV to 0.2 μsec/DIV are in the ALT mode. It also is possible to operate all ranges in the CHOP mode by means of the CHOP ONLY switch at upper left on the front panel of Remote Controller RC01-COS.

The HF REJ button on the front panel of Remote Controller RC01-COS is used for such purpose as follows: When the oscilloscope is operated in the CHOP mode, if the signal level of the signal applied to CH1 is low and its S/N ratio is poor, triggering may be unstable. In such a case, you may press the HF REJ button so that the signal components higher than 50 kHz are eliminated and stable triggering is attained.

(2) ADD Operation

For the ADD operation to measure the sum of the CH1 and CH2 signals, press the ADD button (one of the VERT MODE switches) of Remote Controller RC01-COS. To measure the difference between CH1 signal and CH2 signal, set the CH2 POLARITY button of Remote Controller in the pushed state (the INV state).

A prerequisite to accurate measurement of the sum or difference of the two signals is that the sensitivities of the two channels are equal. Accurately adjust equal the sensitivities of the two channels by means of the VARIABLE knobs of Remote Controller RC01-COS. (If the functions of the VARIABLE knobs are being done by Step Controller SC02-COS, use it to adjust the sensitivities.)

For vertical positioning of the displayed signal, the POSITION knob of either CH1 or CH2 may be used. Note, however, that the POSITION knobs should be used at a mid-position of the entire adjusting range of each knob from the viewpoint of linearity of the vertical amplifiers.

5-1-3. XY Operation

Press the XY button (one of the VERT MODE switches) of Remote Controller RC01-COS. Simply by pressing this button, the oscilloscope will operate as an XY-scope with its CH1 as the X-axis and its CH2 as the Y-axis.

When in the XY mode, although the electrical performance of the Y-axis remain the same as that when in the CH2 single-channel operation, the electrical performance of the Y-axis differs from that when the single-channel CH1 operation as its frequency bandwidth becomes DC to 2 MHz. When in the XY mode, the CH1 POSITION knobs of Oscilloscope COS5030-PG, Remote Controller RC01-COS and Step Controller SC01-COS remain idle as the position control circuits are isolated from the operating circuits. Positioning of the X-axis can be done with the horizontal POSITION knobs of these devices.

To check operation, proceed as follows: Apply the calibration voltage signal to both X and Y axes. Adjust the sensitivities of both channels with Remote Controller RC01-COS so that two spots are displayed on a diagonal line on the oscilloscope screen. The displayed plot is a Lissajous figure for the two signals of frequency ratio 1:1 and phase angle approximately zero degrees.

When set to the XY mode, the ×5 MAG pushbutton switch of Remote Controller RC01-COS is in the effective state. It is recommended to set this switch to the off state when in the XY mode. The ×5 MAG operation is inevitably subject to larger noise and drift.

5-1-4. Triggering

Proper triggering is essential for efficient operation of an oscilloscope. The user of the oscilloscope must make himself thoroughly familiar with the triggering functions and procedures.

(1) Functions of INT TRIG (internal trigger) switch:

The signals applied to the input terminals of CH1 and CH2 are picked off from respective preamplifiers in order to be used as internal trigger signals.

When in the CH1 or CH2 single-channel operation, the input signal of CH1 or CH2 is directly used as the internal trigger signal. When in the dual-channel operation or in the ADD operation, the input signal of the channel selected by the TRIG selector switch (one of the VERT MODE switches) of Remote Controller RC01-COS is used as the internal trigger signal. A block diagram of the trigger selector circuit is shown in Figure 5-4.

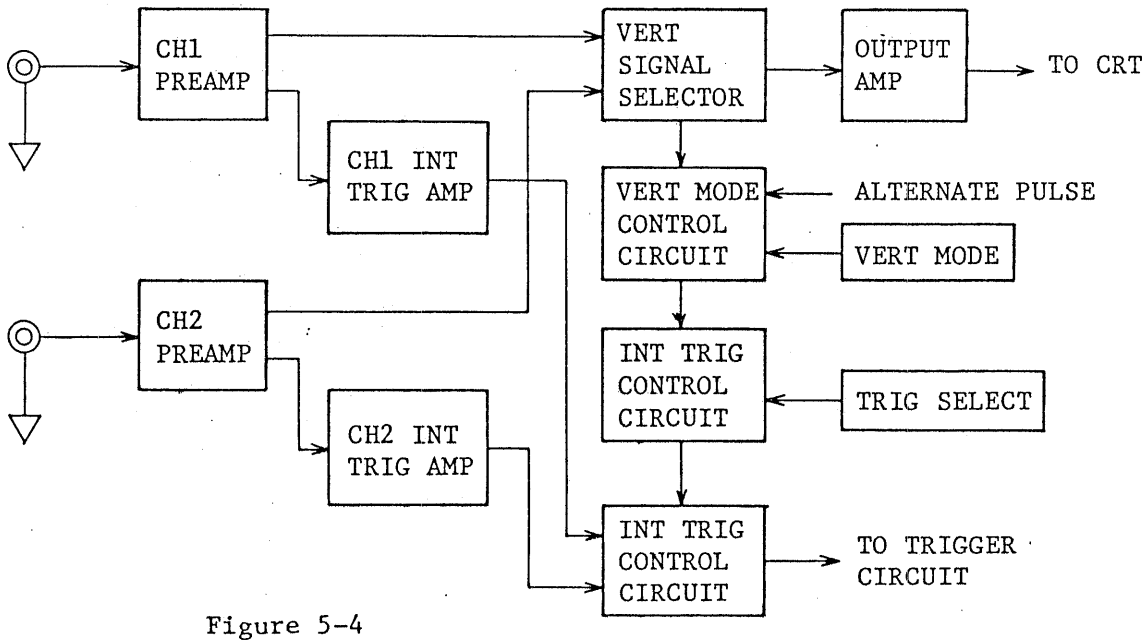


Figure 5-4

(2) Functions of TRIGGER SOURCE switch:

To display the input signal as a stationary pattern on the oscilloscope screen, the sweep circuit must be triggeered with the input signal itself or with other signal which has a time relationship with the input signal. The TRIGGER SOURCE switch of Remote Controller RC01-COS selects the trigger signal to be fed to the trigger circuit.

INT ⊓: This internal trigger method is used most commonly. The signal applied to the vertical input terminal (the measured signal) is branched off from a point in the amplifier circuit and is fed to the trigger circuit through the internal trigger selector circuit shown in Figure 5-4. Since the trigger source signal is the measured signal itself, a very stable waveform can be readily displayed on the oscilloscope screen.

EXT ⊓: The sweep triggered with an external signal applied to the EXT TRIG INPUT terminal of Programmable Oscilloscope COS5030-PG. An external signal which has a periodic relationship with respect to the measured

signal is used. Since the measured signal (vertical input signal) is not used as the trigger signal, waveform display can be done more independent of the measured signal.

LINE ⊓: The AC power line frequency signal is used as the trigger signal. This method is effective when the measured signal has a relationship to the AC line frequency, especially for measurements of low level AC noise of audio circuits, AC line frequency controlled thyristor circuits, etc.

(3) Functions of TRIGGER COUPLING switch:

This switch is used to select the coupling of the trigger signal to the trigger circuit in accordance with the characteristics of the measured signal.

AC ⊓: This coupling is for AC triggering which is used most commonly. As the trigger signal is applied to the trigger circuit through an AC coupling circuit, stable triggering can be attained without being affected by the DC component of the input signal. The low-range cut off frequency is 5 Hz (-3 dB).

DC ⎍: The trigger signal is DC-coupled to the trigger circuit. This mode is used when triggering with the DC component of the trigger signal is desired or when a very low frequency signal or a signal of a large duty cycle ratio is required to be displayed. Note that this mode of triggering cannot be attained if the trigger signal is superimposed on a DC component and the trigger level is outside of the range of the AC component of trigger signal.

FLAT ⊓: The trigger signal is coupled to the trigger circuit without any intentional adjustment on the trigger frequency response characteristics of the instrument.

HF REJ ⊓: The trigger signal is applied to the trigger circuit through a high frequency cut off filter of approximately 50 kHz (-3 dB) in order to eliminate higher-frequency noise components superimposed on the trigger signal.

TV ⊓: This coupling is for TV triggering for observation of TV video signals. The trigger signal is fed via the trigger circuit (level circuit) to the TV sync separation circuit. The sync separation circuit picks off the sync signal and this is used to trigger the sweep. Thus, the video signal can be displayed very stably.

Being linked to the TIME/DIV switch (A sweep) of Remote Controller RC01-COS, the sweep speed is switched for TV.V and TV.H as follows:

TV.V: 0.5 sec - 0.1 msec
TV.H: 50 µsec - 0.1 µsec

The SLOPE switch should be set in conformity with the video signal as shown in Figure 5-5.

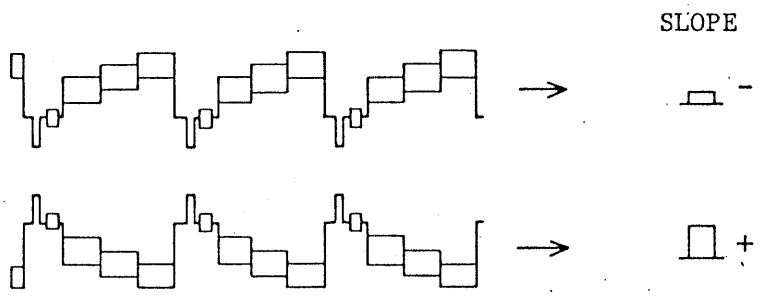


Figure 5-5

(4) Functions of TRIGGER SLOPE switch:

This switch selects the slope (polarity) of the trigger signal.

⊓ "+": When set in the "+" state, triggering occurs as the trigger signal crosses the trigger level in the positive-going direction.

"-": When set in the "-" state, triggering occurs as the trigger signal crosses the trigger level in the negative-going direction.

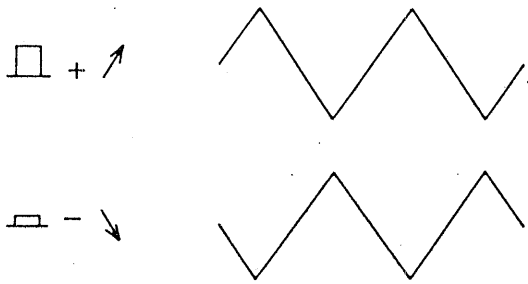


Figure 5-6

(5) Functions of TRIGGER LEVEL control:

The function of the level control is to adjust the trigger level to display a stationary image. At the instant the trigger signal has crossed the trigger level set by the control, the sweep is triggered and a waveform is displayed on the screen.

The trigger level changes in the positive direction (upward) as the control is turned clockwise and it changes in the negative direction (downward) as the control is turned counterclockwise.

The trigger level is automatically adjustable at approximately 1-DIV steps with Remote Controller RC01-COS, or it is manually adjustable when the red knob is pulled out. It is locally adjustable on the oscilloscope panel when its TRIG LEVEL knob is pulled out. It can also be adjusted with the trigger level control of Step Controller SC01-COS.

(6) Functions of HOLD OFF control:

When the measured signal is a complex waveform with two or more repetition frequencies (periods), triggering with the above-mentioned TRIGGER LEVEL control alone may not be sufficient for attaining a stable waveform display. In such a case, the sweep can be synchronized with the measured signal waveform by adjusting the HOLD OFF time (sweep pause time) of the sweep

waveform by turning the HOLD OFF control. The hold-off function for stable display of a complex waveform is illustrated in Figure 5-8.

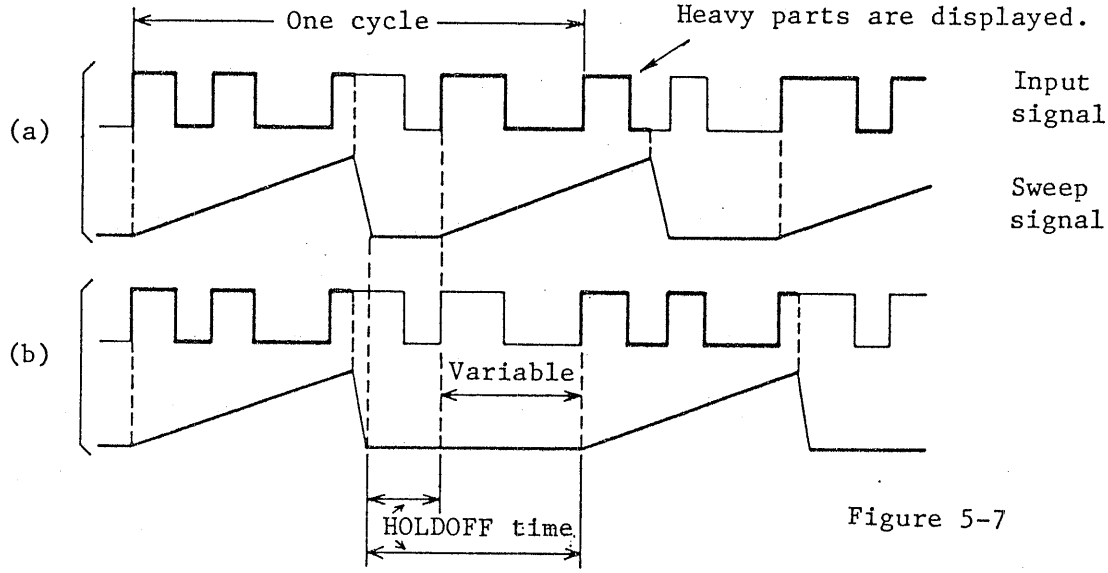


Figure 5-7

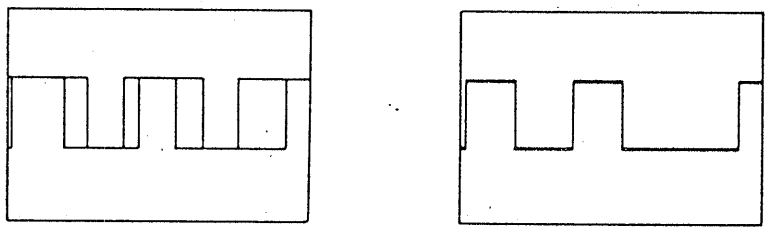


Figure 5-8

Figure 5-7 (a) shows the state of triggering when the HOLDOFF knob is set in the NORM position (no holdoff function effected). Since different parts of waveforms of different cycles are triggered, the waveform displayed on the screen will be with different parts of waveforms overlapped as shown in Figure 5-8 (1). Figure 5-7 (b) shown the state of triggering with the holdoff function in effect. In this case the same parts of waveforms of different cycles are triggered as triggering is held off for the time required for proper synchronization. A waveform without overlapping as shown in Figure 5-8 (2) will be displayed.

5-1-5. Single-sweep Operation

When the period and amplitude of a signal vary from cycle to cycle, the signal cannot be successfully measured with the repetitive sweep method because different waveforms being overlapped will be displayed on the oscilloscope screen. To measure this type of signal, it should be swept only for once and the displayed waveform should be photographed with a camera. Transiential one-shot signals also are measured in the single-sweep mode.

o Measurement of non-repetitive signal:

(1) Press the A button of the HORIZ DISPLAY switches of Remote Controller RC01-COS and set the TRIGGER MODE to the NORM state.

(2) Connect the measured signal to the vertical input terminal of Programmable Oscilloscope COS5030-PG and set the trigger level.

(3) Press the SINGLE button of the TRIGGER MODE switches of Remote Controller RC01-COS. The NORM button will be reset and the three buttons will become the undepressed state. This state is for the single-sweep operation.

(4) Press the PUSH TO RESET button of Programmable Oscilloscope COS5030-PG. The READY lamp will light indicating that preparation for single-sweep operation is ready.

(5) At the instant the trigger signal has crossed the trigger level, the trace is swept once. When the single sweep cycle is over, the oscilloscope returns to the state of (3) above.

o Measurement of one-shot signal:

(1) Press the A button of Remote Controller RC01-COS and set the TRIGGER MODE to the NORM state.

(2) Apply the calibration signal (the CAL output) to the vertical input terminal of Programmable Oscilloscope COS5030-PG. Set the trigger level at a predicted level of the signal to be measured.

(3) Press the SINGLE button of the TRIGGER MODE switches of Remote Controller RC01-COS and change the calibration signal of the vertical input terminal of Programmable Oscilloscope COS5030-PG with the signal to be measured.

(4) Press the PUSH TO RESET button of Programmable Oscilloscope COS5030-PG. The READY lamp will light indicating that preparation for single-sweep operation is ready.

(5) At the instant the one-shot signal is applied, the trace is swept once and the signal waveform is displayed on the screen.

The single-sweep operation can be done also in the A INTEN sweep mode or the B sweep mode. When in the ALT mode of dual-channel operation (when sweep time is 0.5 msec/DIV to 0.2 μsec/DIV), the single-sweep operation ends when CH1 or CH2 alone has been swept. If the single-sweep operation is required for both CH1 and CH2, press the CHOP ONLY switch of Remote Controller RC01-COS so that the oscilloscope operates in the CHOP mode at all ranges (except at ranges 1 μsec/DIV or faster where the dual-channel operation may not be fully successful).

5-1-6. Sweep Magnification

When a certain part of the displayed waveform is required to be expanded timewise, a faster sweep speed may be used. However, if the required part is apart from the start point of the sweep, the required part may run off the CRT screen. In such a case, press the "×5 MAG" switch so that the displayed waveform is expanded by 5 times to right and left with the center of screen as the center of expansion.

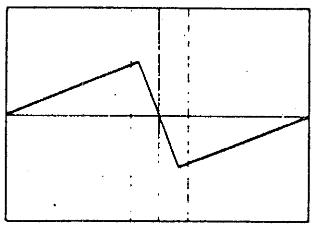
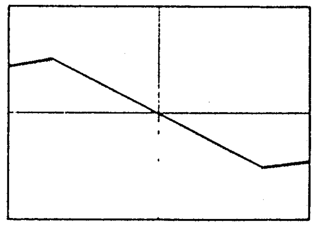
 

Figure 5-9

Before magnification After magnification

(The portion indicated with the dotted lines in the left-hand illustration is expanded to full screen as shown in the right-hand illustration.)

The sweep time when in the magnification operation is as follows:

TIME/DIV (indicated value) ÷ 5 = sweep time/DIV

The fastest sweep time of 40 nsec/DIV can be attained by magnifying by 5 times the 0.2 µsec/DIV sweep rate. Note, however, that the trace intensity will be reduced when the trace is swept at such fast speeds. Therefore, except when a sweep speed of faster than 0.2 µsec/DIV is required, it is recommended to use the B sweep for sweep magnification as explained in the next subsection.

5-1-7. Waveform Magnification with Delayed Sweep

With sweep magnification of the preceding subsection, although the magnification method is simple, the magnification ratio is limited at 5. With the delayed sweep method of this subsection, on the other hand, the sweep can be expanded for a wide range of from several times to thousand times according to the ratio between A sweep time and B sweep time.

As the measured signal frequency becomes high and the A sweep range for the non-expanded signal becomes higher, the available expansion ratio becomes smaller. Furthermore, as the magnification ratio becomes larger, the trace intensity becomes lower and the delay jitter increases. To cope with these situations, two types of delay functions, namely, continuously-variable delay function and synchronized delay function, are provided.

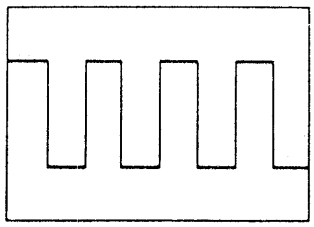
(1) Continuously-variable delay:

Press the A button of the HORIZ DISPLAY switches of Remote Controller RC01-COS to display the signal waveform with the A sweep. Set the A TIME/DIV switch at a range which is appropriate for display of the measured signal and set the B TIME/DIV switch at a range higher by several steps than that of the A TIME/DIV switch.

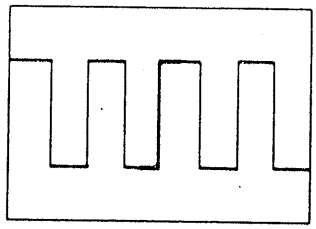
Next, after ensuring that the B TRIG'D switch of Remote Controller RC01-COS is in the OFF state (undepressed state), turn the HORIZ DISPLAY switch to the A INTEN position. As you turn the DELAY TIME POSITION switch of Remote Controller RC01-COS, the intensified brighter portion (intensity-modulated portion) of the displayed waveform will move on the screen. In this case, the part from the start point of the A sweep to the intensity-modulated point represents the delay time. The delay time is adjustable with the DELAY TIME POSITION knob (red knob) of Remote Controller RC01-COS or that of the Programmable Oscilloscope COS5030-PG (with the knob in the pulled out state in either case).

The brighter portion can be displayed being expanded to the full screen by pressing the B button of the HORIZ DISPLAY switches of Remote Controller RC01-COS. The sweep time for the magnified portion can be known as it is indicated by the green LEDs of Programmable Oscilloscope COS5030-PG or as calicu-lated using the ratio between set ranges of the A and B TIME/DIV switches as follows:

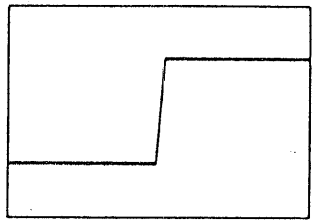
$$\text{Magnification ratio} = \frac{\text{Value indicated by A TIME/DIV switch}}{\text{Value indicated by B TIME/DIV switch}}$$



(a) A (before magnification)



(b) A INTEN (preparation for magnification



(c) B (magnified waveform)

Figure 5-10

(2) Synchronized delay (triggered delay):

When the displayed waveform is magnified by several hundreds times in the above-mentioned continuous delay method, delay jitter is produced. To suppress the jitter, this synchronized delay method may be used.

With the synchronized delay, delay jitter is reduced by triggering the B sweep after a certain delay time as effected by the continuous delay method has elapsed.

For this operation, press the B TRIG'D button of the HORIZ DISPLAY switches of Remote Controller RC01-COS so that the output signal of the trigger circuit is connected to the B sweep circuit. When a trigger pulse is applied after the delay time set by the DELAY TIME POSITION control has elapsed, the B sweep starts. Therefore, even when the delay time is continuously varied by rotating the DELAY TIME POSITION control, the starting point of B sweep does not vary continuously but varies intermittently for each trigger point. This operation in the A INTEN mode can be observed as the intensified brighter portion moves intermittently on the displayed waveform.

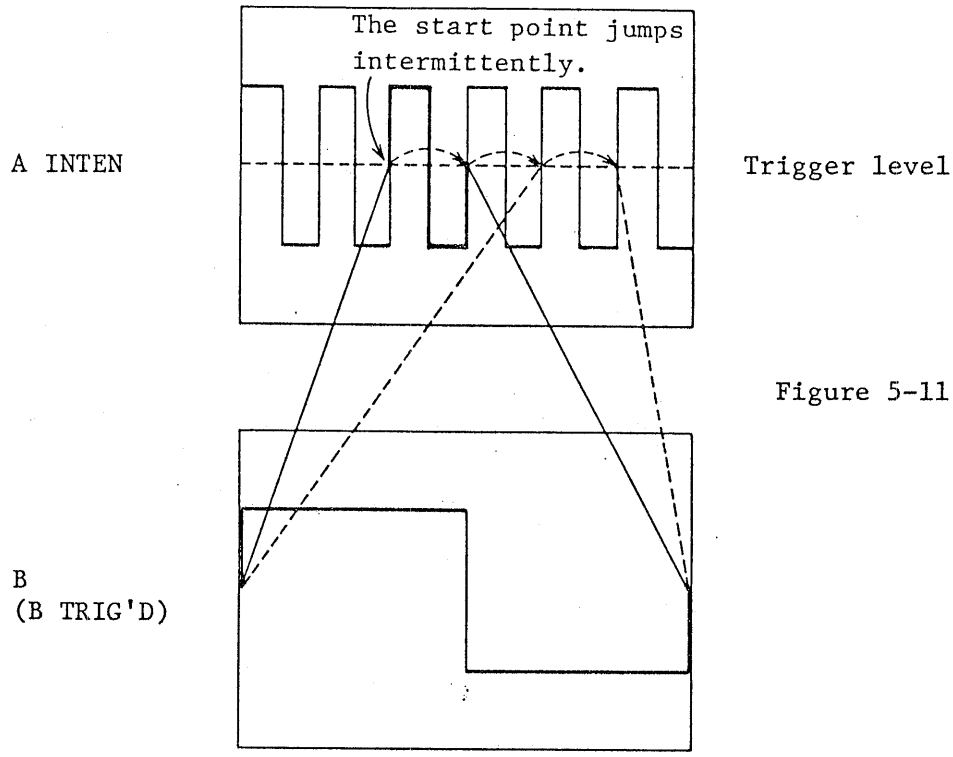


Figure 5-11

5-1-8. Writing Control Program on Memory

To store a control program (a sequence of operation steps of knobs) in memory of Remote Controller RC01-COS, proceed as follows:

(1) Set the READ/WRITE switch of Remote Controller RC01-COS to the WRITE (⊓⊔) state.

(2) Set the START/END digital switches of Remote Controller RC01-COS to the number of steps required by the program.

(3) Set the step number to the required one by operating the UP/DOWN switches of Step Controller SC01-COS.

(4) Display the signal on the oscilloscope by adjusting the required knobs of Remote Controller RC01-COS.

(5) Press the MEMORY switch of Remote Controller RC01-COS.

When the above procedure is done, the contents of adjustments of the knobs in Item (4) above are stored in the steps set in the above. In this case, if the AUTO/MANUAL switch of Step Controller SC01-COS is set in the AUTO state, the step number is automatically counted up by 1 when the write processing is over.

5-1-9. Reading Control Program from Memory

To read the control program stored in memory of Remote Controller RC01-COS in Subsection 5-1-8 and operate the Programmable Oscilloscope COS5030-PG as dictated by the program, proceed as follows:

(1) Set the READ/WRITE switch of Remote Controller RC01-COS to the READ ( ) state.

(2) Set the START/END digital switches of Remote Controller RC01-COS at a range of steps required to be read.

(3) Set the step number to the one required to be read, by operating the UP/DOWN switches of Step Controller SC01-COS.

When the above procedure is done, Programmable Oscilloscope COS5030-PG automatically operates being controlled by the program. In this case, if the AUTO/MANUAL switch of Step Controller SC01-COS is set in the AUTO state, the step number is automatically counted up at each time interval (approximately 3 to 30 seconds) set by the TIME INTERVAL knob of Step Controller SC01-COS.

5-2. Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Remote Controller RC01-COS and Step Controller SC02-COS

Step Controller SC02-COS differs from Step Controller SC01-COS only in that the SC02-COS has no Remote Control Functions (2) of Subsection 2-2 "Functions" and no step control functions are available remotely from Remote Controller RC01-COS. The Remote Control Functions (1) remain the same for both Step Controllers. For operation of the devices of this combination, therefore, see the procedure of Subsection 5-1 "Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Remote Controller RC01-COS and Step Controller SC01-COS."

5-3. Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Memory Unit MU01-COS and Step Controller SC02-COS

Before operating Memory Unit MU01-COS, a program required for its operation must be stored in Remote Controller RC01-COS. For the program storing procedure, see Subsection 5-1 "Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Remote Controller RC01-COS and Step Controller SC01-COS."

5-3-1. Program Transfer from Memory of Remote Controller RC01-COS to that of Memory Unit MU01-COS

Connect the devices as shown in Figure 5-12.

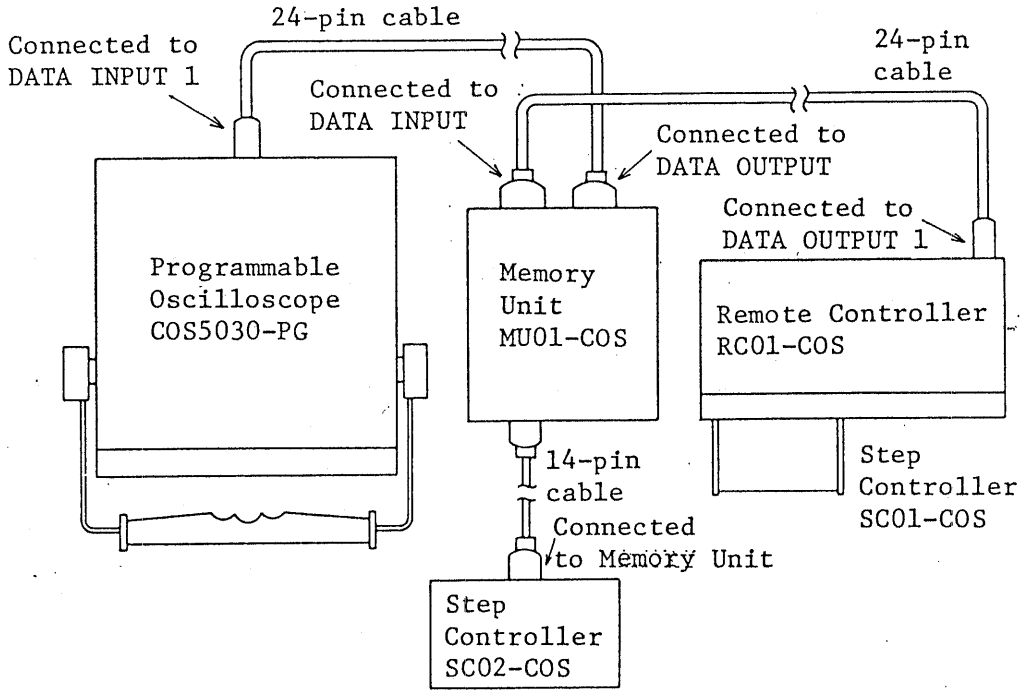


Figure 5-12

For program data transfer, the use of Programmable Oscilloscope COS5030-PG is not mandatory. However, it may be used to monitor program data being transferred from Remote Controller RC01-COS to Memory Unit MU01-COS. To transfer program data, proceed as follows:

(1) Before turning on the power switches of the devices, make it sure that the READ/WRITE mode switch on the rear panel of Memory Unit MU01-COS is set in the READ state. (If it is set in the WRITE state, change it to the READ state.)

(2) Check that the line voltage settings of the devices are correct and then turn on the power switches of the devices.

(3) Set the START/END digital switches of Remote Controller RC01-COS and Memory Unit MU01-COS to the required numbers of steps.

(4) Adjust the steps to the END positions by adjusting the UP/DOWN switches of Step Controllers SC01-COS and SC02-COS.

(5) Set the READ/WRITE mode switch on the rear panel of the memory unit to the WRITE state.

(6) Set the READ/WRITE switch on the panel of Remote Controller RC01-COS to the READ state.

(7) Set to the AUTO state the AUTO/MANUAL switch of Step Controller SC02-COS which is connected to Memory Unit MU01-COS.

(8) Press the UP button of Step Controller SC01-COS connected to Remote Controller RC01-COS. The step indications of Memory Unit MU01-COS and Remote Controller RC01-COS will conform with respective indications of the START digital switches and data will be written on the START step.

Each time as you press the UP button of the step controller connected to Remote Controller RC01-COS, the step number is counted up and data is written.

Note that if the AUTO/MANUAL switch of Step Controller SC02-COS connected to Memory Unit MU01-COS is set in the MANUAL state, however, even when you press the UP button of Step Controller SC01-COS connected to Remote Controller RC01-COS, the step number of Step Controller SC02-COS is not counted up and data is written again on the same step.

(9) When the step number indicated by the LEDs has coincided with that set by the END digital switches, return the READ/WRITE mode switch on the rear panel of Memory Unit MU01-COS to the READ state.

By the above procedure, transfer of program data from memory of Remote Controller RC01-COS to that of Memory Unit MU01-COS is complete. Now Remote Controller RC01-COS can be disconnected and the programmed control operation can be executed by Memory Unit MU01-COS, Step Controller SC01-COS and Programmable Oscilloscope COS5030-PG.

5-3-2. Reading of Control Program from Memory Unit MU01-COS

Connect Programmable Oscilloscope COS5030-PG with Memory Unit MU01-COS and Step Controller SC02-COS, using the accessory 14-pin and 24-pin cables of the oscilloscope. Operate the devices as follows:

(1) Before turning on the power switches of the devices, make it sure that the READ/WRITE mode switch on the rear panel of Memory Unit MU01-COS is in the READY state. (If it is in the WRITE state, change it to the READ state.)

(2) Check that the line voltages of the devices are correctly set and then turn on their power switches.

(3) Set the START/END digital switches of Memory Unit MU01-COS to the required step number.

(4) Set the step to the one to be read, by adjusting the UP/DOWN switches of Step Controller SC02-COS.

When the above procedure is done, the oscilloscope can be operated with the program stored.

If the AUTO/MANUAL switch of Step Controller SC02-COS is set in the AUTO state, the step number is automatically counted up with the time interval (approximately 3 to 30 seconds) set by the TIME INTERVAL knob of Step Controller SC02-COS.

Also when Step Controller SC01-COS is used, the operating procedure is similar as above. For inter-device connections, see Subsection 4.3, (3) "Operation with Memory Unit MU01-COS and Step Controller SC01-COS."

5-4. Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Interface Unit IF01-COS

When Programmable Oscilloscope COS5030-PG is operated in conjunction with GP-IB Interface Unit IF01-COS, various remote control operations can be done with IEEE Standards 488-1975 Measuring Bus (so called GP-IB) and CPU.

Also when Programmable Oscilloscope COS5030-PG is operated in conjunction with GP-IB Interface Unit IF01-COS, as is the case when it is operated in conjunction with Remote Controller RC01-COS and Memory Unit MU01-COS, the oscilloscope operates as a remote-controlled triggerscope. Thus, Interface Unit IF01-COS provides interface functions of receiving band function (AH1) and L function (L1).

5-4-1. Data Format

The format of data used to control Programmable Oscilloscope COS5030-PG from CPU via GP-IB Interface Unit IF01-COS is that recommended by IEEE. It consists of four characters, with one alphabetic character and three numbers as follows:

Alphabetic character	(1)	(2)	(3)

(1) - (3): Number of 0 - 9

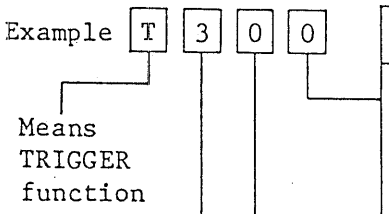
For the alphabetic character, the initial one of each of the eight words which represent eight major functions of the oscilloscope is used. For the numbers of (1) - (3), more detailed functions of the oscilloscope are assigned with numbers of 000 - 999.

Table 5-4

8 major functions		Detailed functions
V	VERTICAL	VERTICAL SENSITIVITIES OF CH1 AND CH2
C	COUPLING	VERTICAL INPUT COUPLING, CH1 POSITIONING ×5 MAG
M	MODE	VERTICAL AXIS MODE, CH2 POSITIONING, ×5 MAG, INV
D	DISPLAY	HORIZONTAL AXIS DISPLAY, MODE, H POSITIONING, ×5 MAG
A	A SWEEP	A SWEEP TIME, A SWEEP VARIABLE, TV COUPLING
T	TRIGGER	TRIGGER LEVEL, SOURCE, COUPLING, SLOPE
B	B SWEEP	B SWEEP TIME, DELAYED TIME POSITIONING
Z	Z (INTEN)	Z-AXIS (INTENSITY), CHOP ONLY, EXT SELECT

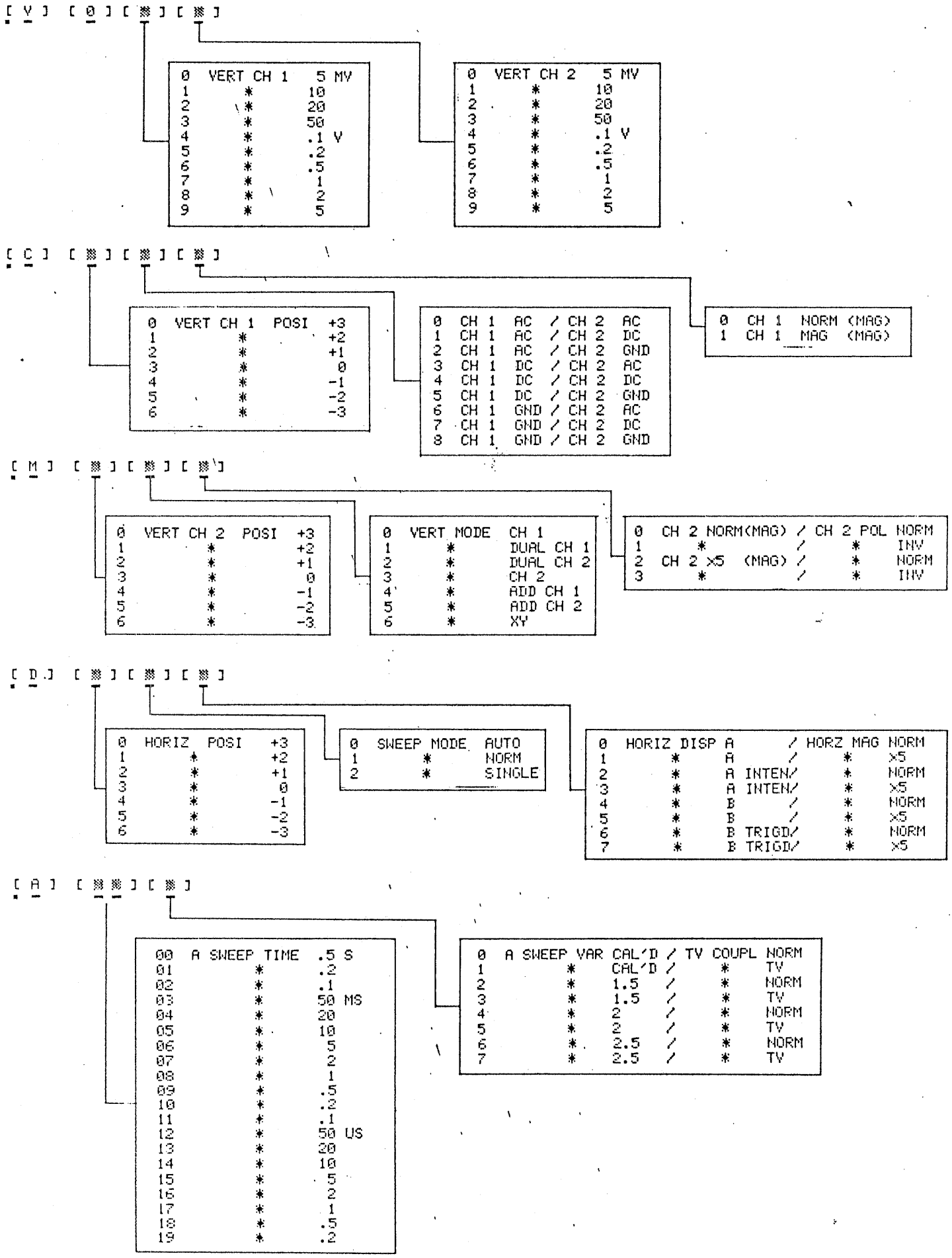
Coding of detailed functions with three numeric characters (1) - (3) is as shown in Table 5-6 (example):

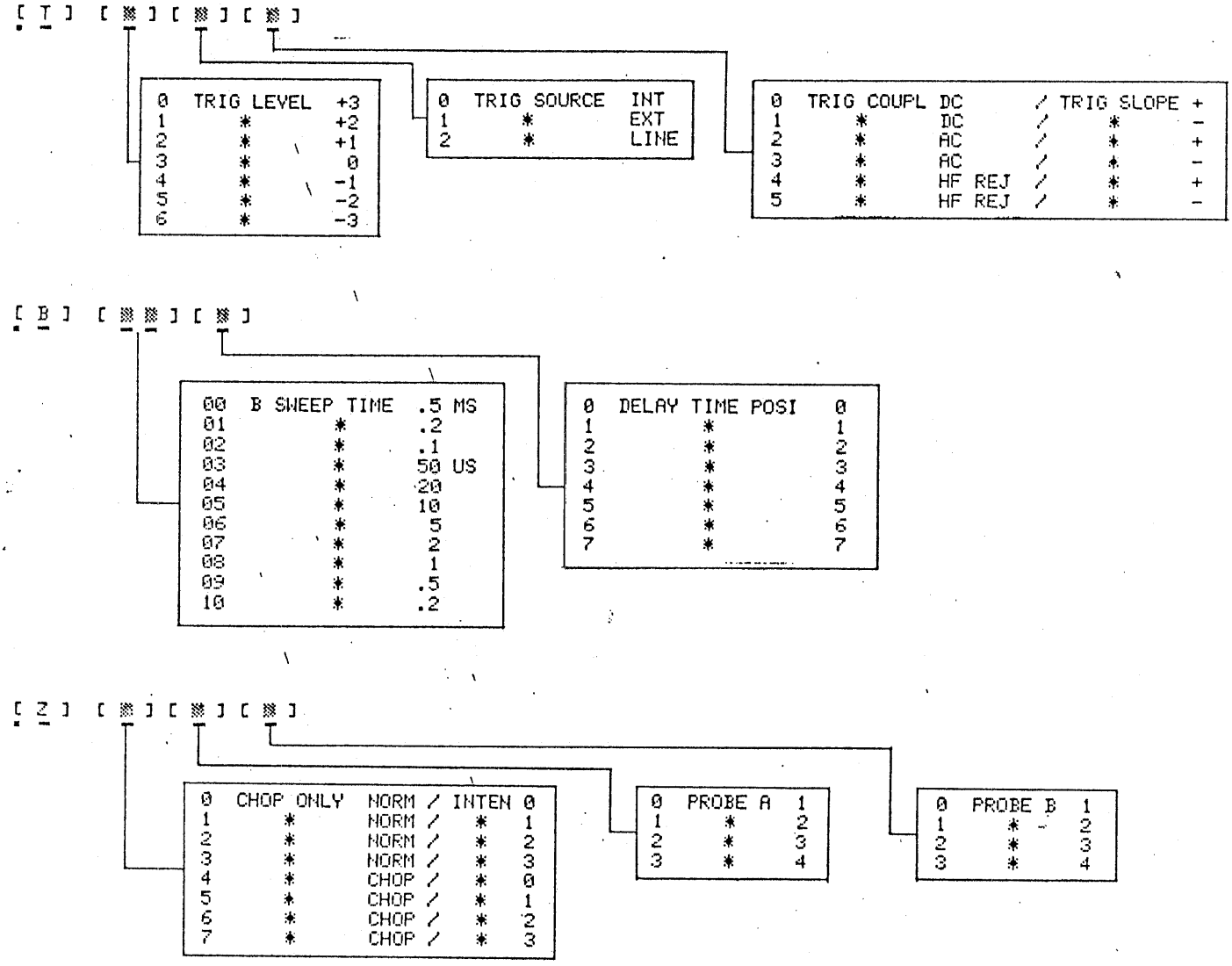
Table 5-6



Function	Code	Contents
TRIGGER SLOPE and TRIGGER COUPLING	0	DC coupling, "+" slope
	1	DC coupling, "-" slope
	2	AC coupling, "+" slope
	3	AC coupling, "-" slope
	4	HF REJ, "+" slope
	5	HF REJ, "-" slope
TRIGGER SOURCE	0	INT trigger
	1	EXT trigger
	2	LINE trigger
TRIGGER LEVEL	0	+3
	1	+2
	2	+1
	3	0
	4	-1
	5	-2
	6	-3

Tables of codes are shown on the following pages.


[V] [0] [▒] [▒]
0 VERT CH 1 5 MV
1 * 10
2 * 20
3 * 50
4 * .1 V
5 * .2
6 * .5
7 * 1
8 * 2
9 * 5
0 VERT CH 2 5 MV
1 * 10
2 * 20
3 * 50
4 * .1 V
5 * .2
6 * .5
7 * 1
8 * 2
9 * 5
[C] [▒] [▒] [▒]
0 VERT CH 1 POSI +3
1 * +2
2 * +1
3 * 0
4 * -1
5 * -2
6 * -3
0 CH 1 AC / CH 2 AC
1 CH 1 AC / CH 2 DC
2 CH 1 AC / CH 2 GND
3 CH 1 DC / CH 2 AC
4 CH 1 DC / CH 2 DC
5 CH 1 DC / CH 2 GND
6 CH 1 GND / CH 2 AC
7 CH 1 GND / CH 2 DC
8 CH 1 GND / CH 2 GND
0 CH 1 NORM (MAG)
1 CH 1 MAG (MAG)
[M] [▒] [▒] [▒]
0 VERT CH 2 POSI +3
1 * +2
2 * +1
3 * 0
4 * -1
5 * -2
6 * -3
0 VERT MODE CH 1
1 * DUAL CH 1
2 * DUAL CH 2
3 * CH 2
4 * ADD CH 1
5 * ADD CH 2
6 * XY
0 CH 2 NORM(MAG) / CH 2 POL NORM
1 * / * INV
2 CH 2 X5 (MAG) / * NORM
3 * / * INV
[D] [▒] [▒] [▒]
0 HORIZ POSI +3
1 * +2
2 * +1
3 * 0
4 * -1
5 * -2
6 * -3
0 SWEEP MODE AUTO
1 * NORM
2 * SINGLE
0 HORIZ DISP A / HORZ MAG NORM
1 * A / * X5
2 * A INTEN/ * NORM
3 * A INTEN/ * X5
4 * B / * NORM
5 * B / * X5
6 * B TRIGD/ * NORM
7 * B TRIGD/ * X5
[A] [▒ ▒] [▒]
00 A SWEEP TIME .5 S
01 * .2
02 * .1
03 * 50 MS
04 * 20
05 * 10
06 * 5
07 * 2
08 * 1
09 * .5
10 * .2
11 * .1
12 * 50 US
13 * 20
14 * 10
15 * 5
16 * 2
17 * 1
18 * .5
19 * .2
0 A SWEEP VAR CAL'D / TV COUPL NORM
1 * CAL'D / * TV
2 * 1.5 / * NORM
3 * 1.5 / * TV
4 * 2 / * NORM
5 * 2 / * TV
6 * 2.5 / * NORM
7 * 2.5 / * TV


[T] [▒] [▒] [▒]
0 TRIG LEVEL +3
1 * +2
2 * +1
3 * 0
4 * -1
5 * -2
6 * -3
0 TRIG SOURCE INT
1 * EXT
2 * LINE
0 TRIG COUPL DC / TRIG SLOPE +
1 * DC / * -
2 * AC / * +
3 * AC / * -
4 * HF REJ / * +
5 * HF REJ / * -
[B] [▒ ▒] [▒]
00 B SWEEP TIME .5 MS
01 * .2
02 * .1
03 * 50 US
04 * 20
05 * 10
06 * 5
07 * 2
08 * 1
09 * .5
10 * .2
0 DELAY TIME POSI 0
1 * 1
2 * 2
3 * 3
4 * 4
5 * 5
6 * 6
7 * 7
[Z] [▒] [▒] [▒]
0 CHOP ONLY NORM / INTEN 0
1 * NORM / * 1
2 * NORM / * 2
3 * NORM / * 3
4 * CHOP / * 0
5 * CHOP / * 1
6 * CHOP / * 2
7 * CHOP / * 3
0 PROBE A 1
1 * 2
2 * 3
3 * 4
0 PROBE B 1
1 * 2
2 * 3
3 * 4

5-4-2. Inter-device Connections and Address Setting

For inter-device connections among Programmable Oscilloscope COS5030-PG and GP-IB Interface Unit IF01-COS, see Subsection 4.3, Item (5) "Operation with GP-IB Interface Unit IF01-COS." For connections from GP-IB Interface Unit IF01-COS to CPU or other GP-IB related device, use the dedicated GP-IB bus cable (supplied accompanying GP-IB Interface Unit IF01-COS).

Other accessory cable of CPU or other GP-IB related device, so far as it complies with IEEE Standards 488-1975, can be used for connection to the IEEE-488 (GP-IB) connector on the rear panel of GP-IB Interface Unit IF01-COS. For connection to an IEC Standards TC66 25-pin connector piggyback cable, use an IEEE/IEC conversion connector. (This connector is available also from Kikusui.)

Before turning on the power switches of the devices (including CPU), set an address for GP-IB Interface Unit IF01-COS. The address setting range is for 31 addresses of 0 to 30. Select an address which is not duplicated with other GP-IB related devices (including CPU) which are connected to other GP-IB bus line. Address setting can be done with the 8-digit DIP switches on the rear panel of GP-IB Interface Unit IF01-COS.

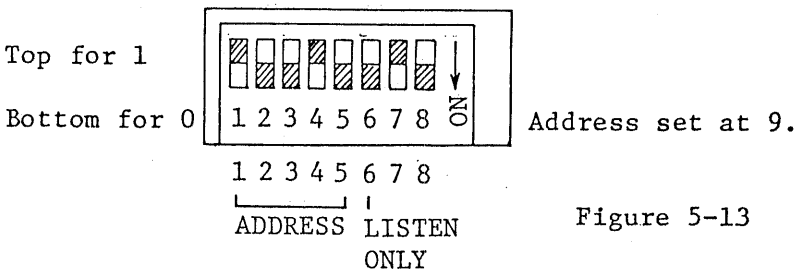


Figure 5-13

Address No.	1	2	3	4	5	Address No.	1	2	3	4	5
0	0	0	0	0	0	10	0	1	0	1	0
1	1	0	0	0	0	11	1	1	0	1	0
2	0	1	0	0	0	12	0	0	1	1	0
3	1	1	0	0	0	13	1	0	1	1	0
4	0	0	1	0	0	14	0	1	1	1	0
5	1	0	1	0	0	15	1	1	1	1	0
6	0	1	1	0	0	16	0	0	0	0	1
7	1	1	1	0	0	17	1	0	0	0	1
8	0	0	0	1	0	18	0	1	0	0	1
9	1	0	0	1	0	19	1	1	0	0	1
20	0	0	1	0	1	26	0	1	0	1	1
21	1	0	1	0	1	27	1	1	0	1	1
22	0	1	1	0	1	28	0	0	1	1	1
23	1	1	1	0	1	29	1	0	1	1	1
24	0	0	0	1	1	30	0	1	1	1	1
25	1	0	0	1	1						

Of the 6th digit, the top position is for LISTEN ONLY. Keep this digit at the bottom position lest it should be interfered by data of other GP-IB related device and operation error should result.

The 7th and 8th digits are unconnected and may be set either in the top or bottom position.

5-4-3. Operating Procedure

Before turning on the power switches of the devices, check that their AC line voltages are correctly set. Then turn on the power switches.

When the devices are operated in this combination, no initialization is done between Programmable Oscilloscope COS5030-PG and GP-IB Interface Unit IF01-COS by turning on their powers. Therefore, be sure to make initialization with the correct format from CPU. Initialization data may be of any values so far as they are corresponding to the program used. An example is shown in the following:

V000: 5 mV/DIV for both CH1 and CH2 vertical axes

C380: CH1 POS = 0; both CH1 and CH2 couplings are GND.

M300: CH2 POS = 0, VERT MODE = CH1

D300: H POS = 0, SWEEP = AUTO, A SWEEP

A080: A SWEEP = 1 msec/DIV, CAL'D

T300: TRIGGER LEVEL = 0, INT TRIG, DC, "+"

B024: B SWEEP = 0.1 msec/DIV, DELAY T.P. = 4

Z100: CHOP = OFF, INTEN = 1

The operation of Programmable Oscilloscope COS5030-PG in this case is similar to that when it is used in conjunction with Remote Controller RC01-COS. For the operating procedure, therefore, see Subsection 5-1 "Operation of Programmable Oscilloscope in Conjunction with Remote Controller RC01-COS and Step Controller SC01-COS."

5-5. Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Probe Selector PS01-COS

When Programmable Oscilloscope COS5030-PG is used in conjunction with Probe Selector PS01-COS and Remote Controller RC01-COS or Memory Unit MU01-COS, up to four probes per channel or total eight proges with two channels can be selected as programmed. The same can be done also when Programmable Oscilloscope COS5030-PG is used in conjunction with GP-IB Interface Unit IF01-COS. For interconnection among devices, see Subsection 4-3, Item (6) "Operation with Probe Selector PS01-COS."

Regarding the device operation, if Remote Controller RC01-COS is used, the LED lamps on the panel of Remote Controller RC01-COS light corresponding to the EXT SELECTOR buttons on the panel of Remote Controller RC01-COS and the input signals connected to the corresponding BCD connectors below the lighted LEDs are displayed.

5-6. Operation of Programmable Oscilloscope COS5030-PG in Conjunction with Probe Selector PS02-COS

When Programmable Oscilloscope COS5030-PG is used in conjunction with Probe Selector PS02-COS and Remote Controller RC01-COS or Memory Unit MU01-COS, up to ten probes per channel or up to twenty probes with two channels can be selected as programmed. For interconnections among devices, see Subsection 4-3, Item (7) "Operation with Probe Selector."

Regarding the device operation, enter data for probe selection in memory of probe selector in conformity with the LED DISPLAY OUT (BCD OUT) of Step Controller SC01-COS or SC02-COS connected to Memory Unit MU01-COS or Remote Controller RC01-COS. After this has been done and when the program is read, the probes are automatically selected as programmed.

(a) Writing of Program

(1) Set the READ/WRITE switch on the rear panel of Probe Selector PS02-COS in the WRITE state.

(2) Set Step Controller SC01-COS or SC02-COS at the required step number.

(3) Set the input selector switch on the rear panel of Probe Selector PS02-COS at the position of the required probe.

(4) Press the PUSH MEMORY switch of Probe Selector PS02-COS.

(5) Return to Step (2) and change the step number.

Repeat the above procedure.

The step numbers for data storing in memory are not required to be sequentially written. Therefore, partial corrections can be done as required.

(b) Reading of Program

To read the stored program, set in the READ state the READ/WRITE switch on the rear panel of Probe Selector PS02-COS. The programmed probe will be selected each time the step indication on Step Controller SC01-COS (or SC02-COS) is counted up.

In the above, outlines of uses of Programmable Oscilloscope COS5030-PG in conjunction with its ancillary devices are explained. For further details, refer to instruction manuals of individual devices.

1. GENERAL

1-1. General

Model COS5030A-PG Oscilloscope is a dual-channel programmable oscilloscope with 5-mV sensitivity, 35-MHz frequency response, and a delayed sweep function.

When used in conjunction with an optional Cursor Unit (CU01-COS) and Controllers (RC01-COS or MU01-COS, and SC01(02)-COS), the oscilloscope can display two horizontal cursor lines other than the signal waveforms on its CRT screen. The two cursor lines can be programmed and displayed on the CRT screen at any of the 0-96 step vertical positions, thereby greatly facilitating the waveform amplitude measuring and adjusting operations.

The operation methods of Model COS5030A-PG is identical with those Model COS5030-PG Standard-type Programmable Oscilloscope, except some particular items. For general operation methods of Model COS5030A-PG, refer to the section of this instruction manual for Model COS5030-PG.

2. SPECIFICATIONS

2-1 Specifications

Vertical Deflection Circuit

Item	Specification	Remarks
CH1 and CH2 sensitivity	5 mV/DIV - 5 V/DIV 1 mV/DIV - 1 V/DIV (when in ×5 MAG)	1-2-5 sequence 10 points
Sensitivity accuracy	Within ±3%	Within ±5% when in ×5 MAG, 1 kHz, at 4 or 5 DIV
Continuously-variable control of sensitivity	Can be attenuated to 1/2.5 or less of panel-indicated value	Externally controllable
Frequency bandwidth	DC: DC - 35 MHz DC - 15 MHz (when in ×5 MAG) AC: 2 Hz - 35 MHz	50 kHz 8 DIV reference, -3 dB
Input coupling	AC, GND, DC	
Input impedance	1 MΩ ±2%, 48 pF ±2 pF	Parallel
Allowable input voltage	200 V (DC + AC peak)	AC: Not higher than 1 kHz
Rise time	Approx. 10 nsec 23.3 nsec (when in ×5 MAG)	Calculated value
Polarity selection	CH2 only	
Trace shift caused by DC offset	Within ±0.2 DIV for switching of all ranges. Within ±2 DIV when in ×5 MAG	When AC, DC, GND switching is done, without input.
Common mode rejection ratio	50:1 or better, with 50 kHz sine wave	With CH1 and CH2 sensitivity accurately adjusted at same value
Crosstalk between channels	1000:1 at 50 kHz 30:1 at 35 MHz	At 5 mV/DIV range

Item	Specification			Remarks
Linearity	Expansion or compression in vertical direction of a 2 DIV signal at CRT center is less than ±0.1 DIV when signal is moved to the upper and lower limit of screen.			At frequency of not higher than 100 kHz; including linearity of CRT
Signal delay time	Approx. 120 nsec			
Operation modes	CH1	CH1 only		* Note
	CH2	CH2 only		* Note
	DUAL (ALT/CHOP automatically switched being linked to time axis)	ALT	CH1 and CH2 are swept alternately.	0.5 msec - 0.2 µsec ranges * Note
		CHOP	CH1 and CH2 are chopped with a frequency of approx. 200 kHz.	0.5 sec - 1 msec ranges * Note
	CHOP ONLY			CHOP mode on all ranges * Note
	ADD	CH1 ± CH2		* Note

* Note: When the cursor operation is on, the traces are swept in the following sequence.

When in single-channel operation

CH1: CH1 → CH1 → cursor 1 → cursor 2

CH2: CH2 → CH2 → cursor 1 → cursor 2

When in dual-channel operation

CH1 → CH2 → cursor 1 → cursor 2

When in other modes than CHOP ONLY and time base is in 0.5 msec/DIV - 0.1 msec/DIV

Single-channel operation

CH1: CH1 → CH1 → cursors 1 and 2 in CHOP → cursors 1 and 2 in CHOP

CH2: CH2 → CH2 → cursors 1 and 2 in CHOP → cursors 1 and 2 in CHOP

Dual-channel operation

CH1 → CH2 → cursors 1 and 2 in CHOP → cursors 1 and 2 in CHOP

CH1 Output

Item	Specification	Remarks
Output	Approx. 20 mV/DIV with 1 MΩ load. Approx. 10 mV/DIV with 50Ω load	Output voltage per 1 DIV on screen
Output impedance	Approx. 50 Ω	
Frequency bandwidth	DC - 35 MHz, within -3 dB (except when in ×5 MAG)	With 50Ω termination
DC level of output	0 V ± 0.5 V	

Trigger Circuit (main sweep only)

Item	Specification		Remarks
Trigger signal source	INT	CH1, CH2	
	EXT	With external trigger signal	
	LINE	With AC line trigger signal	
	TV	TV-V, TV-H (sync. separator)	
Coupling	DC, AC, HF-REJ		HF REJ: 50 kHz, -3 dB
Polarity	+ or -		
Triggering sensitivity	DC: DC - 10 MHz 0.5 DIV (0.1 V) 10 MHz - 35 MHz 1 DIV (0.2 V) AC: Low limit frequency is 5 Hz. TV: 1 DIV (0.2 V)		Values enclosed in parentheses are external trigger input sensitivity. High limits of AC are same with those of DC.

Item	Specification	Remarks
AUTO	Meets the specification of item for trigger sensitivity for signal of repetition frequency of 20 Hz or over.	When no triggering signal is applied, sweep runs automatically (FREE-RUN mode).
NORM	Meets the specification of item for trigger sensitivity.	When no triggering signal is applied, sweep is in standby state and no trace is displayed.
SINGLE	One-shot sweep satisfying all of the above specifications. Resets to standby state when RESET button is pressed.	Remains in standby state until input signal is applied.
HOLD-OFF function	Continuously variable	
External trigger input impedance	Approx. 1 MΩ, 45 pF or less	
Maximum allowable input voltage	100 V (DC + AC peak)	AC: Not higher than 1 kHz

Horizontal Deflection Circuit

A and B Sweep

Item	Specification	Remarks
Sweep time	0.2 µsec/DIV - 0.5 sec/DIV (A sweep). 0.2 µsec/DIV - 0.5 msec/DIV (B sweep).	1-2-5 sequence, 20 points. 1-2-5 sequence, 11 points
Sweep time accuracy	±3%	With VARIABLE set in CAL'D position
Continuously-variable adjustment of sweep time	Can be adjusted to 1/2.5 or less of panel-indicated value.	A sweep only
Sweep magnification	5 times	
Sweep accuracy	0.5 sec/DIV - 1 µsec/DIV: 3% or better 0.5 sec/DIV - 0.2 µsec/DIV: 5% or better	Both A and B sweeps
Position shift caused by magnification	±1 DIV in center of screen	
DISPLAY	A; A INTEN BY B; B; B TRIG'D	

Delayed Sweep

Item	Specification	Remarks
Types of delay	Continuous delay Synchronized delay (using trigger signal of A sweep)	
Sweep delay time	5 msec - 2 µsec	
Delay jitter	1/10000 or less $\frac{\text{B sweep time}}{\text{A sweep time}} \times \frac{\text{Jitter width}}{\text{10 DIV}}$	Jitter width 1 DIV or less with A: 1 msec/DIV B: 1 µsec/DIV

External Sweep

Item	Specification	Remarks
System	XY system: CH1 for X and CH2 for Y	X = Horizontal axis Y = Vertical axis
Sensitivity	5 mV/DIV - 5 V/DIV (X = Y)	1-2-5 sequence 10 points
Sensitivity accuracy	±3% or better	1 kHz, at 4 or 5 DIV
Frequency bandwidth	X-axis: DC: DC - 2 MHz AC: 2 Hz - 2 MHz Y-axis: Same as CH2	50 kHz reference, -3 dB
XY phase difference	DC - 50 kHz, within 3°	

Calibration Voltage

Item	Specification	Remarks
Waveform	Square wave, positive polarity	
Frequency	Approx. 1 kHz	
Duty ratio	Within 45:55	
Output voltage	1 Vp-p, ±3%	

Z-axis Amplifier

Item	Specification	Remarks
Intensity modulation	Intensity modulation discernible with 3 Vp-p input signal. Trace becomes dim with positive-going signal and becomes brighter with negative-going signal.	
Frequency response	DC - 1MHz	
Input resistance	Approx. 10 kΩ	
Maximum allowable input voltage	50 V (DC ± AC peak)	AC: Not higher than 1 kHz

CRT

Item	Specification	Remarks
Type	5.5-inch square screen, internal graticule, dome mesh, post acceleration	Scale: Can be illuminated
Phosphor	P31	
Acceleration voltage	Approx. +10.3 kV/-1.7 kV	Approx. 12 kV
Effective screen size	8 × 10 DIV	1 DIV = 9.5 mm

Power Requirements

Item	Specification	Remarks
Voltage	100 V, 115 V, 215 V, 230 V, ±10%	Selectable at instrument rear panel
Frequency	50 - 60 Hz	
Power consumption	Approx. 65 VA	

Mechanical Specifications

Item	Specification	Remarks
External dimensions	365W × 165H × 525D mm (14.37W × 6.50H × 20.67D in.)	When handle is set in carrying state
	365W × 165H × 450D mm (14.37W × 6.50H × 17.72D in.)	Maximum dimensions
	365W × 190H × 450D mm (14.37W × 7.48H × 17.72D in.)	When handle is set at casing top
	310W × 150H × 430D mm (12.20W × 5.91H × 16.93D in.)	Chassis section
Weight	Approx. 11 kg (24 lbs)	Main unit only

Environmental conditions (ambient temperature and himidity)

Range to satisfy performance specifications:

5°C to 35°C (41°F to 95°F), 85% RH or less

Range for instrument operation:

0°C to 40°C (32°F to 104°F), 90% RH or less

2-2. Functions

Remote Control Functions (1)

Item	Functions	Remarks
Vertical sensitivity	5 mV - 5 V/DIV (CH1, CH2)	1-2-5 sequence, 10 points
Vertical input coupling	AC/DC/GND (CH1, CH2)	
Vertical signal magnifier	×5 MAG (CH1, CH2)	
Vertical positioning	7-point selection (CH1, CH2)	In approx. 1 DIV steps
Vertical mode	CH1/CH2/DUAL (CHOP, ALT)/ ADD/XY	Note (1)
Vertical signal polarity selection	CH2 only	
Sweep time	A: 0.55 sec - 0.2 μsec/DIV B: 0.5 msec - 0.2 μsec/DIV	1-2-5 sequence, 20 points 1-2-5 sequence, 11 points
Sweep magnification	×5 MAG	
Sweep time change	4-point selection, CAL'D - 1/2.5	Note (2) Indication on panel is for reference only.
Horizontal positioning	7-point selection	In approx. 1 DIV steps

Item	Functions	Remarks
Sweep mode	AUTO/NORM/SINGLE	
Horizontal display	A/A-INTEN-BY-B/B/B-TRIG'D	
Delay time positioning	8-point selection	In approx. 1-DIV steps
Internal trigger	CH1/CH2 (when in vertical DUAL mode)	Note (1)
Trigger source	INT/EXT/LINE	
Trigger coupling	DC/AC/HF-REJ/TV	
Trigger level	7-point selection	In approx. 1-DIV steps
Trigger slope	+/-	
Intensity	4-point selection, 0 - 3	Indication on panel is for reference only.
Probe selector	CH1: 4-point selection CH2: 4-point selection	When PS01-COS Probe Selector is used
CHOP ONLY	When in dual-channel mode, traces are displayed in CHOP mode on all ranges of sweep time.	

Remote Control Functions (2)

Item	Functions	Remarks
Continuously-variable adjustment of vertical sensitivity	Can be reduced to 1/2.5 or over from the dial-indicated value	When RC01-COS or SC02-COS is used
Vertical positioning	Variable by ±4 DIV or over	
Horizontal positioning	Variable by ±5 DIV or over	
Continuously-variable sweep time	Variable by 2.5 times or over of the dial-indicated value. Note (2)	
Delay time positioning	Can be set within 5 - 95% of A sweep. Note (3)	
Trigger level	Variable by ±4 DIV or over (in CRT screen amplitude equivalent value)	

All of the remote control functions of (1) and (2) can be realized by applying external control signals via the 24-pin and 14-pin Amphenol connectors on the rear panel. The remote control functions of (2), except the continuously-variable adjustment of vertical sensitivity, are not effective unless the corresponding knobs on the front panel are in the pushed-in state. When the knobs are pulled out, the functions are local with these knobs on the oscilloscope front panel.

Note (1): When in the single mode (CH1 or CH2) of operation, internal trigger sources also are automatically switched as vertical modes are switched as follows:

Vertical channel mode	Internal trigger source
CH1	CH1
CH2	CH2
DUAL or ADD	CH1 or CH2, selectable

Note (2): The sweep time change function and the continuously-variable sweep time function are for the A sweep only. When these functions are used in conjunction with the A SWEEP VARIABLE knob on the oscilloscope panel, sweep time is variable for a range of from 0 to approximately 1/2.5 times.

Note (3): When the start position of the delay sweep is set at a position of approximately 5 DIV on CRT from the start point of the main sweep using the external control function of (1).

3. OPERATION METHOD

3-1. Description of Front Panel

The front panel items are identical with those of Model COS5030-PG Standard-type Programmable Oscilloscope. Refer to the instruction manual of Model COS5030-PG Oscilloscope.

3-2. Description of Rear Panel (See Figure 1.)

㉚ Power connector: AC power input receptacle of the oscilloscope. Connect the power cord (supplied) to this receptacle.

㉛ Fuse: AC power fuse (slow blow fuse) of the oscilloscope. To remove the cap, turn it counterclockwise.

㉜ Voltage selector plug: Selects the AC line voltage for the instrument. Correctly set the plug, observing the allohead mark.

㉝ AC outlet (non-switched): This receptacle provides an AC line power, with a rating of 100 VA.

㉞ CH1 SIGNAL OUTPUT: This terminal provides the CH1 output signal. May be used to measure the signal frequency with a frequency counter.

㉟ Z AXIS INPUT: Input terminal for an external intensity-modulation signal.

㊱ DATA INPUT 1: 24-pin connector for input signals for remote-control functions of (1).

㊲ DATA INPUT 2: 14-pin connector for input signals for remote-control functions of (2).

㊳ Code hook: Code hooks at the four corners.

㊴ DATA INPUT 3: 14-pin connector for the cursor line input signals.

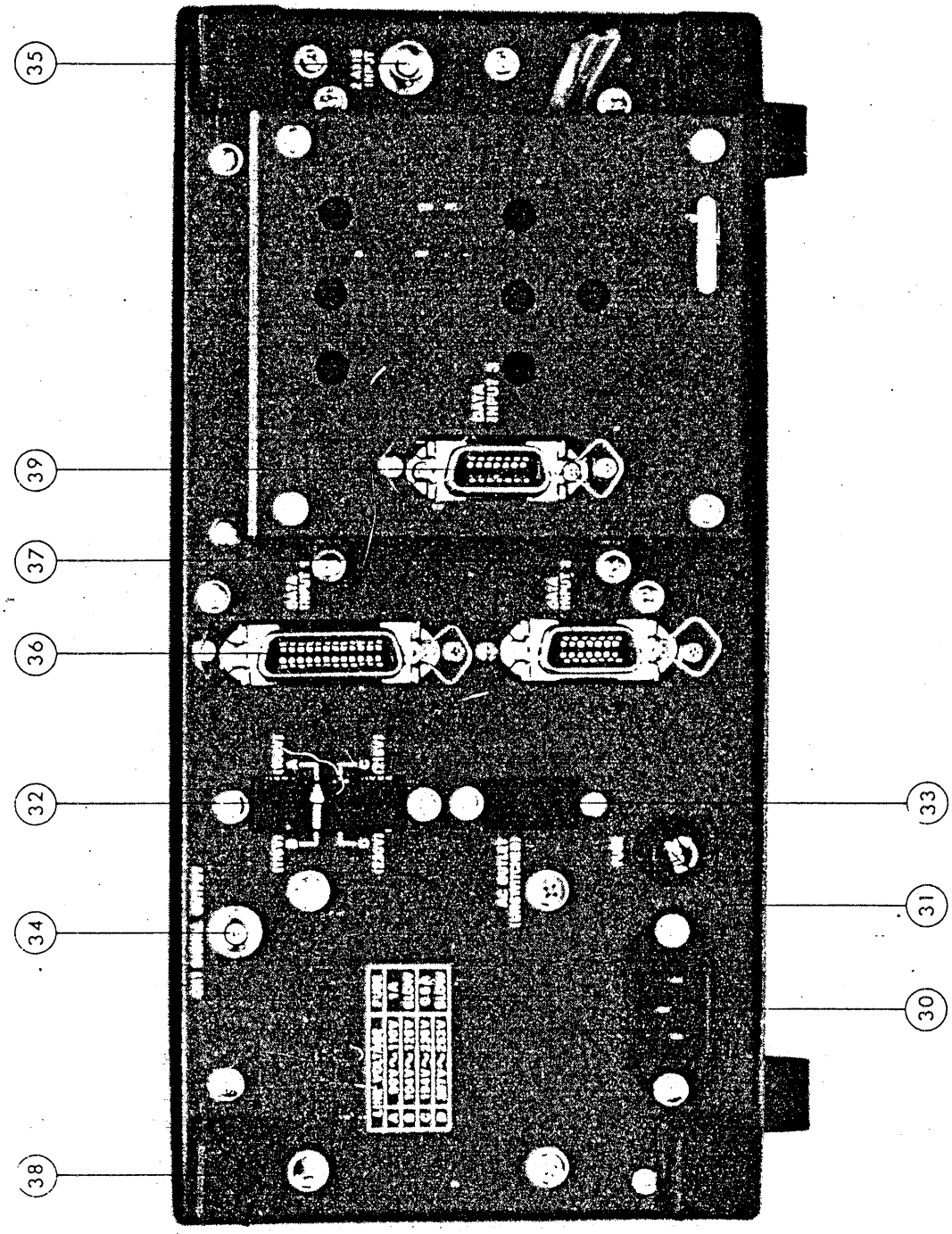


Figure 1. Rear panel

3-3. Combinations with Other Devices

This oscilloscope can be used in various combinations with the optional devices available for the oscilloscope. For details of the various combinations, refer also to the instruction manuals of respective optional devices.

(1) Operation with the Cursor Unit CU01-COS

Typical example:

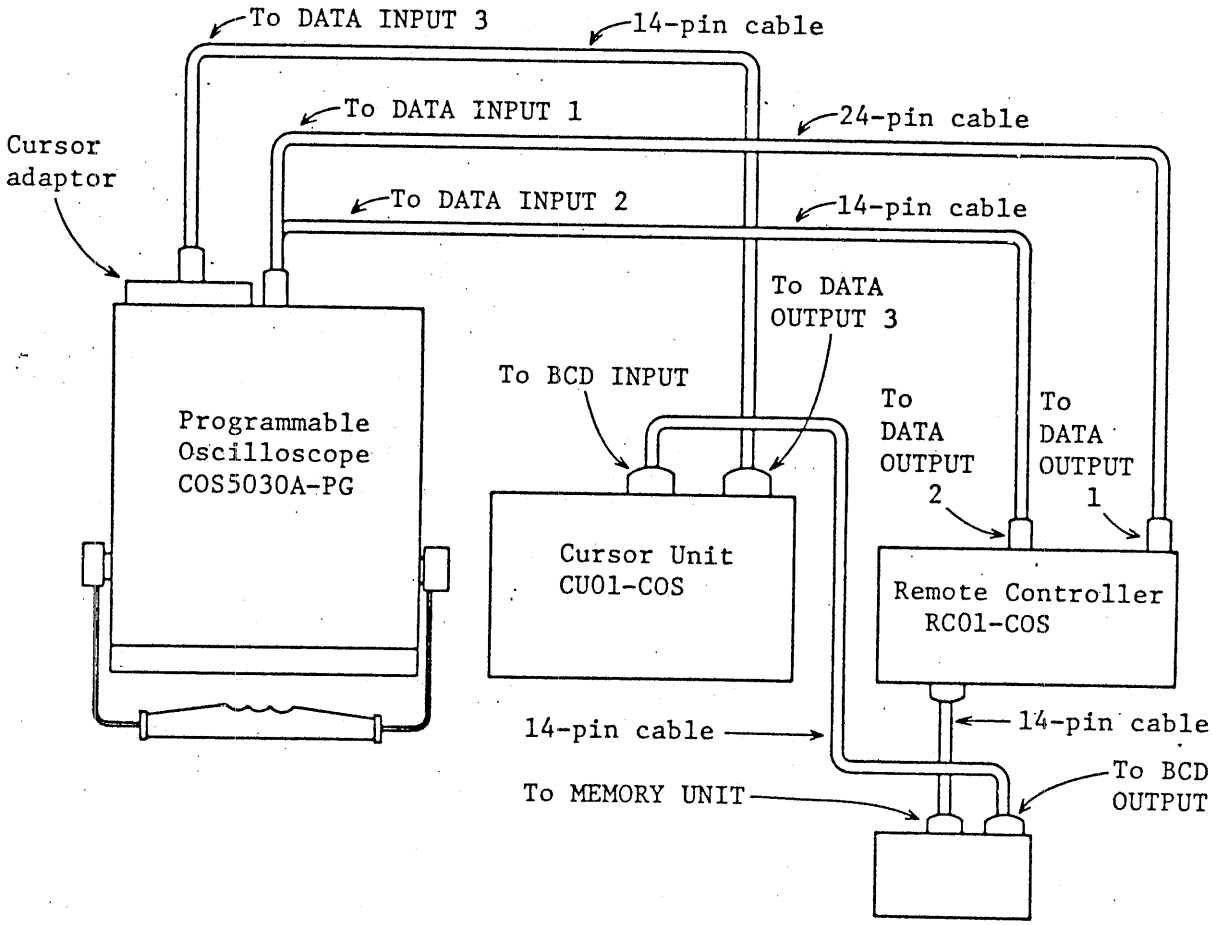


Figure 2. An example of measuring setup with Cursor Unit

(2) Operation without Cursor Unit CU01-C03

When no cursor unit is used, this oscilloscope is identical with Model COS5030-PG Standard-type Programmable Oscilloscope. Refer to its instruction manual.

Note: Disconnect the "DATA INPUT 3" 14-pin connector from the rear panel of this oscilloscope. Simply by this procedure, this oscilloscope will operate as the standard-type oscilloscope.