ADVANTEST®
ADVANTEST CORPORATION

INSTRUCTION
MANUAL
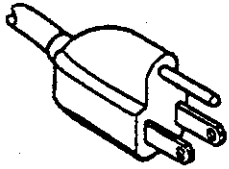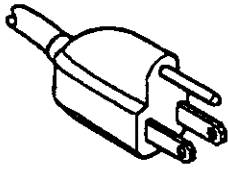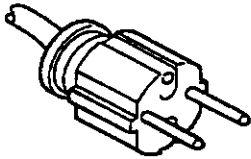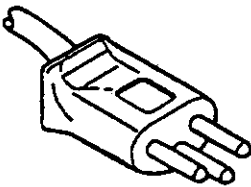## TR4726
L O G I C A N A L Y Z E R
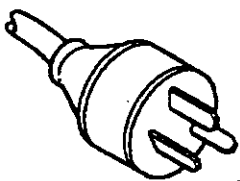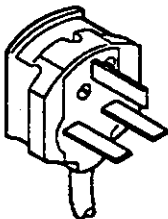
MANUAL NUMBER   OEB01 909

                                        Printed in Japan

Table of Power Cable options

There are six power cable options (refer to following table).
Order power cable options by Accessory Codes.

	Plug Configuration	Standards	Rationg, Color and Length	Accessory Codes (Option Number)
1		JIS: Japan Law on Electrical Appliances	125V at 7A Black 2m (6ft)	Straight: A01402 (Standard) Angled: A01412
2		UL: United States of America CSA: Canada	125V at 7A Black 2m (6ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe VDE: Germany OVE: Austria SEMKO: Sweden DEMKO: Denmark KEMA: Holland FIMKO: Finland NEMKO: Norway CEBEC: Belgium	250V at 6A Gray 2m (6ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250V at 6A Gray 2m (6ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250V at 6A Gray 2m (6ft)	Straight: A01406 (Option 98) Angled: ————
6		BS: United Kingdom	250V at 6A Black 2m (6ft)	Straight: A01407 (Option 99) Angled: A01417

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TR4726
LOGIC ANALYZER
OPERATION MANUAL

1. INTRODUCTION

1.1 HOW TO USE THIS MANUAL

The TR4726 logic analyzer consists of the TR4726 main unit, a timing analysis module (optional), and a synchronous analysis module (optional).

The TR4726 can be combined with the above two optional units and a dedicated personality kit (also optional), to be configured in the following three ways:

(1) Timing analyzer
This configuration combines the TR4726 and an optional timing module.

(2) Sate analyzer
This configuration combines the TR4726, a synchronous analysis module (optional), and a dedicated personality kit.

(3) S & T (State and Timing) analyzer
This configuration combines both (1) and (2) above.

This operation manual describes the TR4726 operations as a timing analyzer and as a state analyzer.

The operational details of each type of dedicated personality kit available are given in their respective operational manuals.

1.2 PRODUCT DESCRIPTION

The TR4726 is a logic analyzer that debugs a entire digital system
(usually, a microprocessor-applied system) by simultaneously analyzing the
hardware and software operations of the system. The following gives an
overview of this product.

(1) S & T facility: One TR4726 can incorporate both a "logic/state analyzer
    facility" (software analyzer), which analyzes the microprocessor, and a
    "logic/timing analyzer facility" (hardware analyzer), which analyzes the
    peripheral circuitry. These two facilities can be operated independently
    of each other, and in addition, both permit their respective triggers to
    be armored. Thus, all operational aspects of the entire digital system
    can be analyzed with one TR4726.

(2) New user interfaces: The TR4726 uses various new user interfaces such as
    the 3.5-inch floppy disk drive (1 MB, unformatted), the 5 x 9-inch CRT (80
    x 24 characters), and the scroll knob. These interfaces combined provide
    operational sophistication with reduced burden on the user.

(3) State analyzer using the personality kit method: The input portion of the
    state analyzer of the TR4726 uses the personality kit plug-in method. The
    input portion can be easily replaced with the desired type. Analysis can
    then be made always under the best operating conditions by using the
    personality kit best suited for the system that is to be analyzed. In
    addition, using high-flexibility tracing control (tracing/windowing
    conditions), mnemonic codes, special symbols, etc. allow efficient
    debugging.

1.3 BEFORE STARTING UP THE ANALYZER

1.3.1 Appearance Check and Attachments Check

After receiving the TR4726, first check to see if it has been
accidentally damaged during transportation. Next, check the quantity
and specifications of each of the standard attachments listed in the
tables below. Either the ADVANTEST CE headquarters (Yokohama, Japan)
or the ADVANTEST distributor nearest to you should be contacted if the
instrument or an attachment has become damaged or if there are missing
parts. The addresses and telephone numbers of the ADVANTEST CE
headquarters and distributors will be listed at the end of this manual.

(1) Standard attachments to the TR4726

Item	Model	Q'ty	Remarks
Power cable	MP-43A	1	
Operation manual	J4726	1	

(2) Standard attachments to the OPT4726+75 (optional)

Item	Model	Q'ty	Remarks
High-speed data acquisition probe E	TR14705-01	1	
High-speed data acquisition probe F	TR14705-02	1	
System software package	P4726-7075FJ	1	
Blank disk		1	
Disk storage case		1	
Case for miscellaneous items		1	

(3) Standard attachments for the OPT4726+70 (optional)

Item	Model	Q'ty	Remarks
Data acquisition probe E	TR14702-01	1	
Data acquisition probe F	TR14702-02	1	
System software package	P4726-7075FJ	1	
Blank disk		1	
Disk storage case		1	
Case for miscellaneous items		1	

1.3.2 Operating/environmental conditions and operating precautions

(1) Do not operate the instrument in dusty places, in direct sunlight, or in the presence of corrosive gases. Always operate it in ambient temperatures of +5 to +40 degrees C and relative humidities of 20 to 80 percent (non-condensing).

(2) This instrument draws in cool air from the upper section of the front panel and from the rear section of the right side, and blows it out through the fans and connector slots on the rear panel.

Install the logic analyzer in an area that will allow nomral ventilation. In addition, keep the top of the logic analyzer clean and free of objects.

(3) This logic analyzer is sufficiently designed to cope with noise induced from the AC power line. However, operate it in an environment as noiseless as possible to ensure continued normal operation. Use a noise reduction filter, etc. if there is much noise interference.

(4) Do not use the logic analyzer in places highly prone to vibrations.

(5) In order to protect the built-in floppy disk drive, always operate the logic analyzer with its front panel facing sideways. (Operate the logic analyzer at angles within ±30 degrees with respect to the horizontal direction.)

(6) Although the CRT display is preadjusted at the factory to give minimum
    screen distortion, the screen may become noticeably distorted because
    of the effects of external magnetic fields, geomagnetism, etc.

1.3.3 Connecting the power supply

(1) Connecting the logic analyzer with the power cable
    First check that the POWER switch on the front panel is OFF. Then
    connect the power cable (supplied) to the AC LINE connector on the
    rear panel.

    The operating supply voltage is set to the user specifications at the
    factory. The logic analyzer operates in the standard 90 to 132 VAC
    range (unless otherwise specified) or in the 180 to 249 VAC range
    (where option 40 is specified). In either case, the power frequency
    must be 50 or 60 Hz.

(2) Use of adaptor A09034 (supplied)
    The plug of the power cable has three prongs, of which the middle one
    (round-shaped) is the grounding prong.

    Connect the adaptor to the plug, plug it into an electrical outlet and
    ground the logic analyzer by connecting either the adaptor's grounding
    wire [Figure 1-1 (a)] to a ground or the grounding terminal located on
    the rear panel of the logic analyzer to a ground.

    The adaptor A09034 (supplied) conforms to the Japanese electrical
    supplies control law. The two electrodes of this adaptor differ in
    width (A and B), as shown in Figure 1-1 (b). Before plugging in the
    adaptor to an electrical outlet, make sure that the adaptor fits the
    actual outlet. An optional adaptor KPR-13 is available in case the
    adaptor does not fit.

To AC electrical   Adaptor A09034
outlet
                        Grounding prong
                        3-prong plug

                    To logic analyzer   Detailed view of
                                             adaptor A09034
Connect this prong
to the ground.

        (a)   (b)
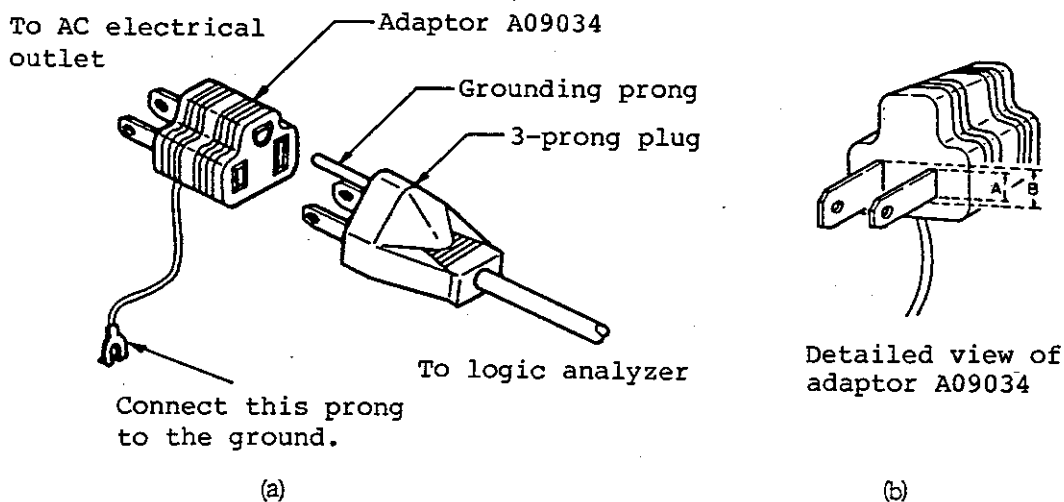
Figure 1-1 Power Cable Plug and Adaptor

1 - 7

(3) This logic analyzer is fitted with circuit breakers
   For safety reasons, do not use the breakers as a power switch.

   Before plugging the power cable into an electrical outlet, be sure to
   check that the POWER switch is OFF.

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2. ANALYSIS PREPARATIONS AND PRELIMINARY KNOWLEDGE

2.1 PURPOSE

Read throughly the contents of this section before operating the logic
analyzer for the first time. This section describes the preparations to
be made for analysis and the preliminary knowledge required for operation
of the logic analyzer. This section is organized so that the user can
easily understand the contents simply by carrying out the preparatory
procedures and instrument operations as shown in this section. It is
recommended, therefore, that this section be always read with the logic
analyzer on hand.

2.2 SETTING UP THE LOGIC ANALYZER

The operation of the logic analyzer requires the connecting of the data acquisition probes (for timing analysis) and the microprocessor probes (for state analysis).

(1) Connecting the data acquisition probes
    Two types of data acquisition probes are provided E and F.

    Insert probe E into the slot on the E-side of the rear panel, and probe F, into the slot on the F-side of the rear panel.

(2) Connecting the microprocessor probes
    Insert the dedicated microprocessor probes, A to D, into slots A to D of the rear panel.

    Refer to the PK operation manual for further details.

```
─────────────────────── NOTE ───────────────────────

          Before connecting the above probes, check
          that the logic analyzer is turned off.
```
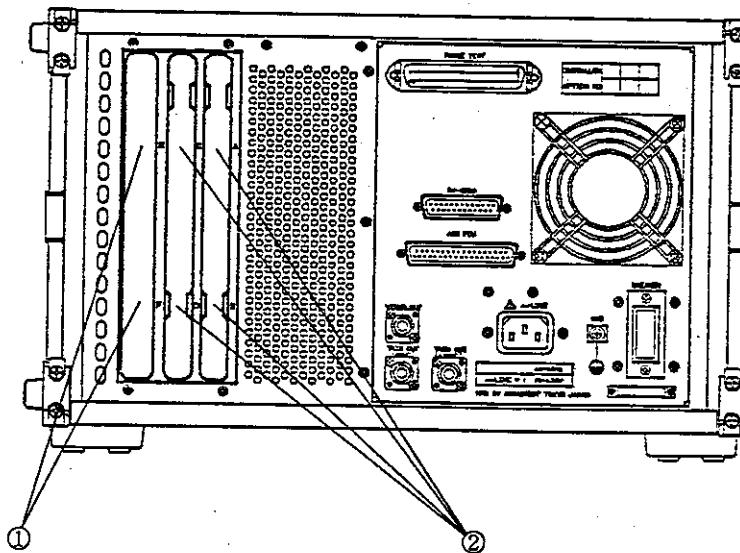

Slots for the acquisition probes   Slots for the microprocessor probes

Figure 2-1 Connection of Probes

2.3 DETAILED PROCEDURE FOR CONNECTING DATA ACQUISITION PROBES E AND F

To fetch signals from the system under test (hereinafter referred to as the SUT), data acquisition probes E and F must be used. Each of these two probes allows signals to be fetched for every eight channels.

The configurations and component part names of the probes are shown in Figure 2-2 and Figure 2-3.

Probe connector   Probe pod

Probe cable

Probe
(TR14702-01/02)

Probe lead set
(A04701-52)

Probe hook
(A04701-11)

Pin socket
(located at the end of
the probe lead set)
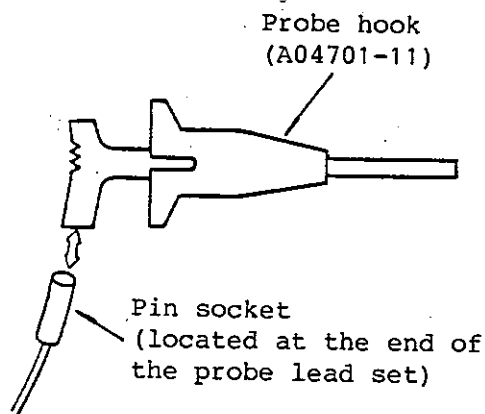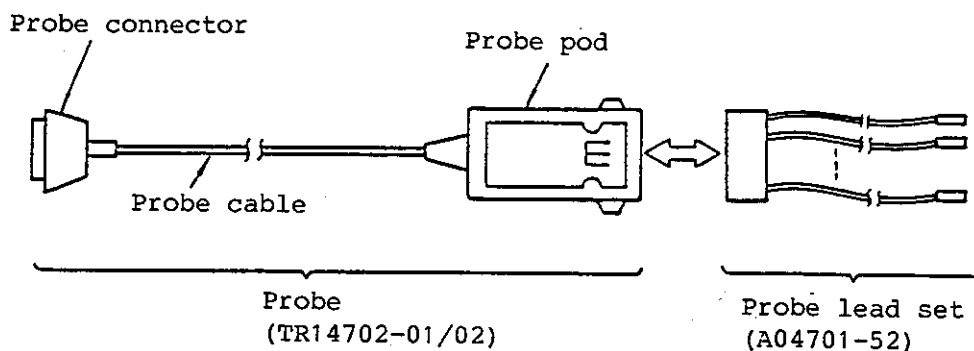
The double arrow <⇒> indicates that this particular section can be disconnected.

Figure 2-2   Probes E and F Configurations and
            Their Component Part Names (OPT4726+70)

2.3 DETAILED PROCEDURE FOR CONNECTING DATA ACQUISITION PROBES E AND F

Probe connector

Probe pod

Probe cable

Probe
(TR14705-01)

Probe hook leads
(A04701-21)

Probe hook
(A04701-11)

Pin socket
(located at the end of
the probe lead set)

Leading end of the probe hook lead
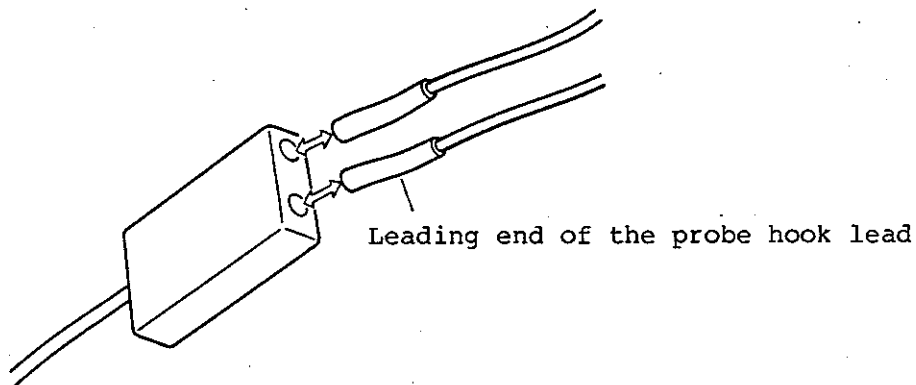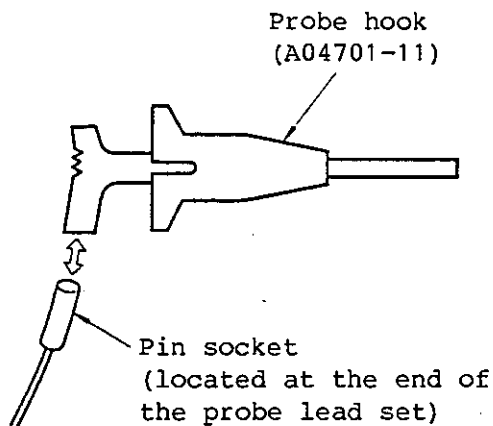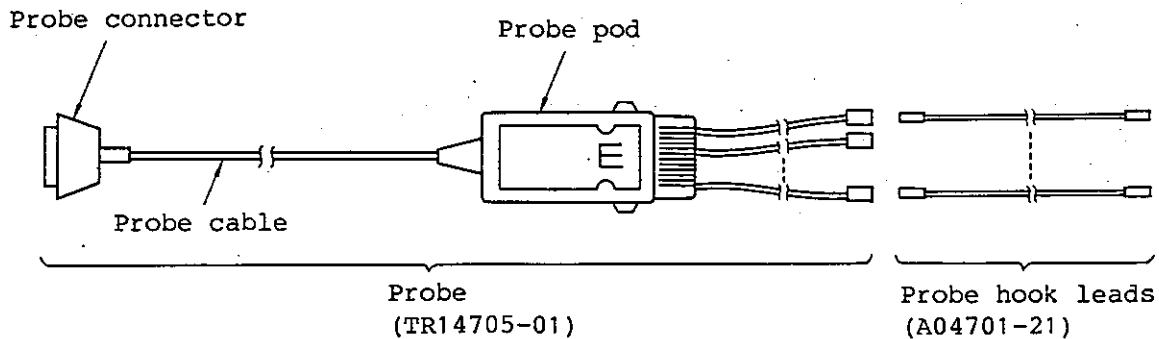
The double arrow ⟺ indicates that this
particular section can be disconnected.

Figure 2-3 Probes E and F Configurations and
Their Component Part Names (OPT4726+75)

2.3 DETAILED PROCEDURE FOR CONNECTING DATA ACQUISITION PROBES E AND F

Next, connect the acquisition probes and the SUT.

Generally, to connect the acquisition probes with the SUT use either the pin-socket fitted probe lead set (A04701-52) or the probe hook leads (A04701-21) and the probe hook (A04701-11). If the particular SUT has pins that match the pin sockets, however, the probes can be connected directly to those pin sockets. The model name and size of the pin sockets are as follows:

Manufacturer	Model	Size applicable
AUGAT	LSG-2BG2-1	0.51 mm ∅ - 0.76 mm ∅

Optional accessories may be used, as appropriate, to connect the probes to the SUT. Consult the catalog that lists the accessories/supplies available with the logic analyzer.

2.4 SYSTEM SOFTWARE LOADING PROCEDURE

A large portion of the system software, which controls the operations of the instrument, is run after having been loaded from the system disk P4726-7075FJ into the internal memory of the logic analyzer. To load the system software use the built-in floppy disk drive.

Insert the system disk into the floppy disk drive and then set the POWER switch to the ON position. Loading will automatically begin.

Loading will take approximately one minute to complete. After loading is completed, a CONFIGURATION menu display such as that shown in Figure 2-4 will appear to indicate that the system is ready for operation.

```
** CONFIGURATION **                                        10-SEP-86 15:44
[     SET-UP     ]    TIMING MODULE
┌ACQ.MODE──────────────┐    ┌INPUT GROUP──────────────────────────────────┐
│  DATA CHANNELS  [16CH]│    │                        ┌PROBE_F┐ ┌PROBE_E┐
│  GLITCH DETECTION [ OFF]│  │                        7654 3210 7654 3210
│  MEMORY SIZE    [ 4K  ]│   │    GROUP NAME POL       ↓↓↓↓ ↓↓↓↓ ↓↓↓↓ ↓↓↓↓
└──────────────────────┘    │          PRB_F  [+]     **** **** ···· ····
┌CLOCK─────────────────┐    │          PRB_E  [+]     ···· ···· **** ****
│  SOURCE [INTERNAL]    │    │                 [+]     ···· ···· ···· ····
│                       │    │                 [+]     ···· ···· ···· ····
│  RATE   [ 10ns ]      │    └LABEL─────────────────────────────────────────┐
│                       │    │  PROBE F_7 [F7   ]      PROBE E_7 [E7   ]
└──────────────────────┘    │        F_6 [F6   ]            E_6 [E6   ]
┌THRESHOLD─────────────┐    │        F_5 [F5   ]            E_5 [E5   ]
│  PROBE_F [TTL ]       │    │        F_4 [F4   ]            E_4 [E4   ]
│                       │    │        F_3 [F3   ]            E_3 [E3   ]
│  PROBE_E [TTL ]       │    │        F_2 [F2   ]            E_2 [E2   ]
└──────────────────────┘    │        F_1 [F1   ]            E_1 [E1   ]
                             │        F_0 [F0   ]            E_0 [E0   ]
                             └──────────────────────────────────────────────┘
                                                          KNOB EDIT↔
```
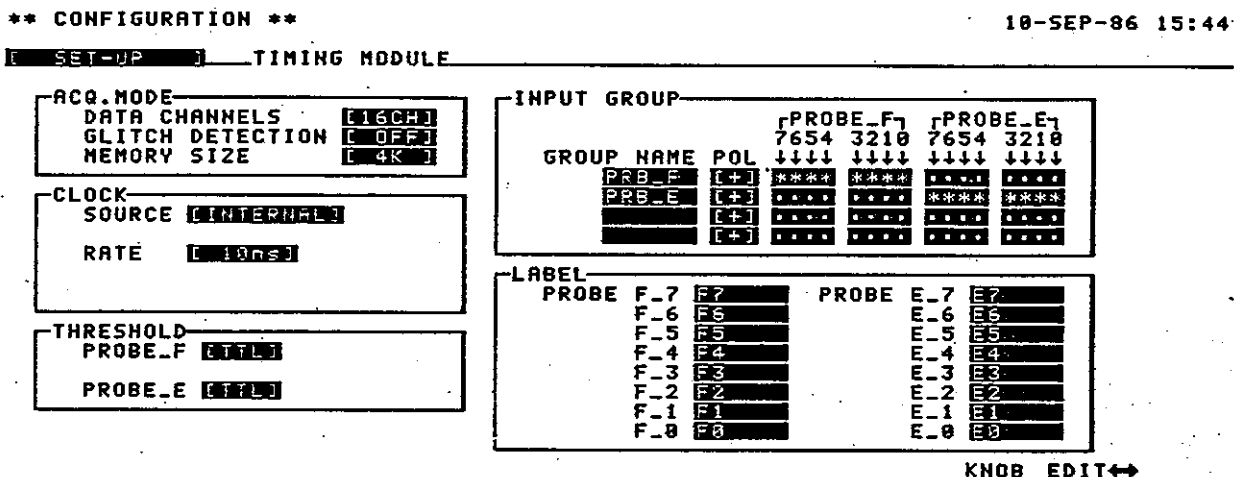
Figure 2-4 Display at the End of Loading (CONFIG Menu Display)

If the system disk has not been inserted into the floppy disk drive after powering on, a prompt will be displayed requesting insertion of the system disk.

2.5 DATA INPUT METHODS FOR EACH MENU ITEM

Pressing the keys of the MENU key group and I/O key group causes
corresponding menu screens to appear for each key.

One menu screen contains more than one menu item.

The menu screen that corresponds to the key of the MENU key group is
referred to as the main menu screen.

The menu screen that corresponds to the key of the I/O key group is
referred to as the sub menu screen. A sub menu screen can be called up at
any time to overlap the main menu screen, and can also be erased at any
time. (To erase the screen press either the key of the MENU key group or
the [STOP] key.) When a sub menu screen appears, the main menu screen will
appear in half-tone. Press a key from each corresponding key group to
meke sure that these events actually occur.

The basic rules related to data input for each menu item are very simple.
they are listed below:

. Menu items for which data can be input are always displayed in
  highlighted form.
. The menu item currently being prompted to request the operator to input
  data using the ENTRY key group, is always blinking in highlighted form.
. The input prompt can be moved using only the ◁▽◁▷ keys.
. Selection between menu items in brackets ([   ]) can only be made using
  the SELECT keys.

As the above basic rules imply, there are two methods by which data can be
input for menu items:

(1) Menu items enclosed in [   ]
    Data input for menu items enclosed in [   ] can be carried out by
    pressing the SELECT ([NEXT], [PREV]) keys to select from data groups
    displayed in chain form.

    Use the [NEXT] and [PREV] keys to select data circularly in formed and
    reverse directions, respectively.

    Note, however, that selectable data groups may vary according to the
    particular ambient conditions even for the same item.

    Those parenthesized menu items that are not highlighted do not permit
    data input since such item consists of only one parameter.

    In the case of the menu display made using the DISPLAY key, all menu
    items use this method, except for [TIMING].

    Press the [NEXT] key several times to check what kind of parameters form
    each data group in menu items (such as [x1], [16CH], CURSOR column,
    KNOB column, etc.) and also check how the display changes.

(2) Menu items not enclosed in [   ]
    For menu items that are not enclosed in [   ], data must be input using
    the ENTRY key group except the SELECT keys.

    Such menu items can be divided into two types. The first type
    requires defining GROUP names, SYMBOL names, CODE names, and LABEL
    names (of these, the first three are available only for the state
    analyzer) and using the file names. The second type requires using
    binary, octal, decimal, and hexadecimal numbers.

    When moving the input prompt using the ◙◙◙◙ keys, the first
    character (or digit) in each menu item will become an input prompt.

    In the timing analyzer, this input method uses LABEL names, for
    example.
                    CONFIG
    Pressing the   [__]   key causes the CONFIGURATION menu to be displayed.
    For this menu, any desired LABEL name can be input (in six characters
    or less) for the LABEL name menu item. After LABEL name input, press
            DISPLAY
    the   [__]   key. This will cause the input LABEL name to appear, as
    the corresponding channel signal name, on the CONFIGURATION menu
    display.

2.6 PANEL DESCRIPTION

This section briefly descrbies the front and rear panels of the logic
analyzer. This section does not need be thoroughly read if the user
operates the instrument for the first time. Reference should be made to
Figures 2-5 and 2-6, instead.

- Front panel -

① MENU key group
   The main menu display can be called by pressing a key of this key
   group. Pressing a key of this key group during analysis terminates
   analytical processing and displays the appropriate menu screen.

   Pressing a key of this key group during an I/O operation saves the
   I/O data and displays the appropriate menu screen.

   The CONFIG menu screen is automatically displayed immediately after
   loading of the system software.

STATE
TIMING key: Used to select between the state analyzer and the
STATE   timing analyzer.
TIMING
[__]

TRACE key: Used to call the TRACE menu. While this menu remains
TRACE   on the screen, various tracing parameters can be set.
[__]

DISPLAY key: Used to call the DISPLAY menu. On this menu,
DISPLAY   analytical data can be displayed in various formats.
[__]

CONFIG key: Used to call the CONFIG menu. Input channels for the
CONFIG   logic analyzer can be configured on this menu.
[__]   For the state analyzer, input channel names can be
                 defined by grouping those input channels.

SYMDEF key: Used to call the SYMDEF menu. Symbols and codes can be
SYM DEF   defined for each input GROUP while this menu remains on
[__]   the screen.

PROGRAM key: Used to call the PROGRAM menu. This menu allows
PROGRAM   preparation of command files that contains analytical
[__]   and other sequences.

UTILITY key: Used to call the UTILITY menu. This menu allows
UTILILTY   internal calendar clock setting, etc.
[__]

(2) EDIT key group
These keys enable editing to be done on the menu items being
displayed on a menu screen.

⬒⬓ keys: Used for downward or upward movement of the input
prompt being displayed for a menu item.

⬔⬕ keys: Used for leftward or rightward movement of the input
prompt being displayed for a menu item.

(HOME) key: Used to move the input prompt to home position on each
⌐⎯⏌   menu screen.

INSERT, DELETE keys: Used to insert or delete data in lines on the
INSERT   DELETE   SYMDEF or PROGRAM menu.
□   □
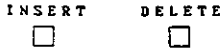
DEFAULT key: Used to revert the system from a particular menu screen
DEFAULT   to the initial screen display.
□

(3) ENTRY key group
Data can be input for each menu item using this key group. Data can
be input using only the SELECT key group.

Letters can also be input if the ENTRY key group is used with the
SHIFT key. While the internal LED of the SHIFT key remains lit, it
is possible to input the character inscribed in blue on the upper
section of each key.

NEXT, PREV keys: Used to call up data groups that succeed or precede
[NEXT] [PREV]   the one currently being displayed. These keys can
be used only for menu items that are enclosed in
[ ]. Pressing [NEXT] and [PREV] keys change data in
formed and reverse directions, respectively.

"0" to "9" keys: Used to input binary, octal, decimal, and "A" to
"F" keys hexadecimal numerals.

"A" to "Z" keys: Used to input letters.

SP key: Used to input null characters (blank spaces).
In names defined using the TR4726, blank spaces are
handled in a similar manner as that of ordinary
characters.

"." key: Used to input the symbol "." (period). When used
with a file name, "." acts as a delimiter that
separates the name and the extender.

X (DON'T CARE) key: Used to input a Don't Care number that allows a
binary, octal, or hexadecimal digit to be
regarded as equivalent to a given value.

+/- key: Used to invert a menu item alue from positive to
negative, or vice versa, if that item value can be
inverted.

↑, ↓ keys: Used to select edge trigger inputs during TRACE
operations.

④ EXECUTE key group
Analysis can be started or stopped using this key group.

RUN key: Used to start the execution of analysis under the
[RUN]   conditions that have been set on the TRACE menu.

AUTO key: Used to start the execution of analysis in accordance with
[AUTO]   the command file sequence that has been set on the PROGRAM
menu.

STOP key: Used to interrupt the ongoing analysis at the desired
[STOP]   time. Also used to recall the original sub menu from the
help screen.

⑤ SCROLL key group
The menu screen can be scrolled up/down or to the left/right using
this key group.

Scroll control: Turning this control scrolls screen up/down (or to
the left/right) at the desired speed.

PAGE key: Used to scroll the screen page by page.

⑥ I/O key group
With this key group, sub menu screens for input/output device
operations can be displayed and then modified.

When a sub menu screen is displayed, the main menu screen will assume
a half-tone display and thus data input will become temporarily
impossible.

FD key: Used when operating the internal and/or external 3.5-inch
[FD]   micro floppy disk drives.

There are eight functions available with this key:

DIRECTORY, REGISTER, PURGE, DELETE, FORMAT, RENAME, COPY,
and STATUS.

These functions can be used on all main menu screens,
except the UTILITY menu screen.

Pressing this key when the data can be input on a
particular main menu screen displays the corresponding sub
menu. The main menu screen displays in half-tone to
indicate that subsequent data input can be done only for
the menu items of the sub menu screen.

Pressing this key again allows the execution of the
commands on the sub menu screen.

GET key: Used to read out the files on a floppy disk and to display
[GET]   the contents of those files on the main menu screen.

             This key also serves as an EXECUTE key. The Quick Get
             function, which can be executed simply by pressing this
             key twice, is available for specific files (registered
             files).

SAVE key: Used to write main menu data into a file on a floppy disk.
[SAVE]
             This key also serves as an EXECUTE key. The Quick Save
             function, which can be executed simply by pressing this
             key twice, is available for specific files (system-saved
             files).

COMM key: Used to communicate with external computers or terminal
[COMM]   devices.

             This key also acts an EXECUTE key.

(7) HELP key: This key can be used to obtain detailed information on
     [HELP]   menu items. It is available at any time, except during
                 analysis or during input/output operations.

(8) (KNOB) key: This key performs various functions such as the SELECT
     [○]   function of the ENTRY key group, the prompt-movement
                  function of the EDIT key group, the data scroll
                  function, etc. The function that the key performs at
                  the particular time depends on the type of screen
                  displayed.

(9) 3.5-inch micro floppy disk drive
     This micro floppy disk drive can be used as an auxiliary memory for
     the TR4726. The memory capacity is 1 MB for unformatted,
     double-sided/double-density disks, and 632.5 KB for formatted, new
     disks. (1 KB = 1024 B)

     Additionally, the micro floppy disk is used to load the system
     software when powered on.

(10) POWER switch
This switch is used to supply AC power to the entire TR4726. When
this switch is set to the ON position, the self-diagnostic function
will activate to enable the TR4726 to be checked for normal operation.

When the switch is set to the OFF position, the AC power supply will
be cut off immediately.

(11) KEYBOARD connector
This connector is used to connect the ASCII keyboard (supplied
together with the TR4726) to the TR4726.

The power for the keyboard is also supplied via this connector.

- Rear panel -

(12) RS-232C connector
This connector is used for real-time communication with external
computers or terminal devices. The signals conform to the RS-232C
standard.

(13) AUX FDU connector

This connector is used to connect the 3.5-inch micro floppy disk
drive (supplied together with the TR4726) to the TR4726.

(14) PROBE TEST connector
This connector is used to test general-purpose probes or
microprocessor probes. Testing requires the use of a probe test
adaptor that fits the particular probe used.

(15) VIDEO OUT connector
This connector is used to connect a video plotter or a video display
unit to the TR4726. The signal levels conform to the RS-232C
standard.

(16) TRIG OUT (SYNC) connector
This connector is used to output trigger pulses from an optional
state analyzer.
With this connector, it becomes possible to output trigger pulses to
an external logic analyzer, an oscilloscope, etc.

(17) TRIG OUT (ASYNC) connector
This connector is used to output trigger pulses from an optional
timing analyzer.
With this connector, it becomes possible to output trigger pulses to
an external logic analyzer, an oscilloscope, etc.

(18) Probe slot A
Used to connect a general-purpose probe or a micro-processor probe to
the TR4726.

(19) Probe slot B
Used to connect a general-purpose probe or a micro-processor probe to the TR4726.

(20) Probe slot C
Used to connect a general-purpose probe or a micro-processor probe to the TR4726.

(21) Probe slot D
Used to connect a general-purpose probe or a micro-processor probe to the TR4726.

(22) Probe slot E
Used to connect data acquisition probe E to the TR4726 when the optional timing analyzer is to be used.

(23) Probe slot F
Used to connect data acquisition probe F to the TR4726 when the optional timing analyzer is to be used.

(24) Circuit breaker
A circuit breaker is mounted within the TR4726 to protect the instrument from an overcurrent, a power surge, etc.

For safety reasons, do not use this breaker as a electrical on/off switch.

(25) Power cable connector
Before connecting the power cable, ensure that the power switch on the instrument is placed in the OFF position.

(26) GND terminal
This is a grounding terminal. When a 2-pin adaptor is to be attached to the power cable, either the wire leading from the adaptor or the GND terminal must be connected to ground.

2.6 PANEL DESCRIPTION
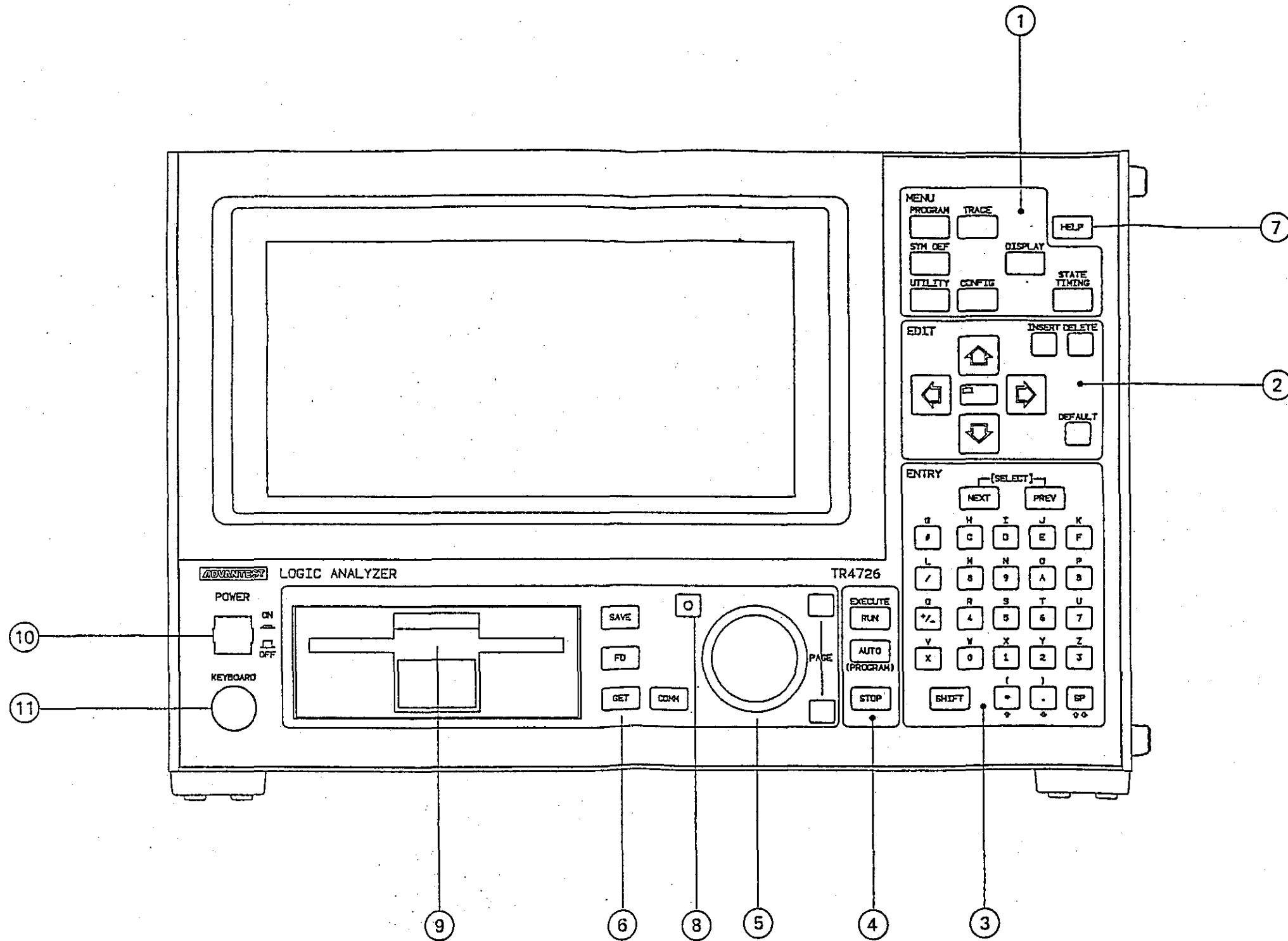
Figure 2-5 Front Panel

2.6 PANEL DESCRIPTION
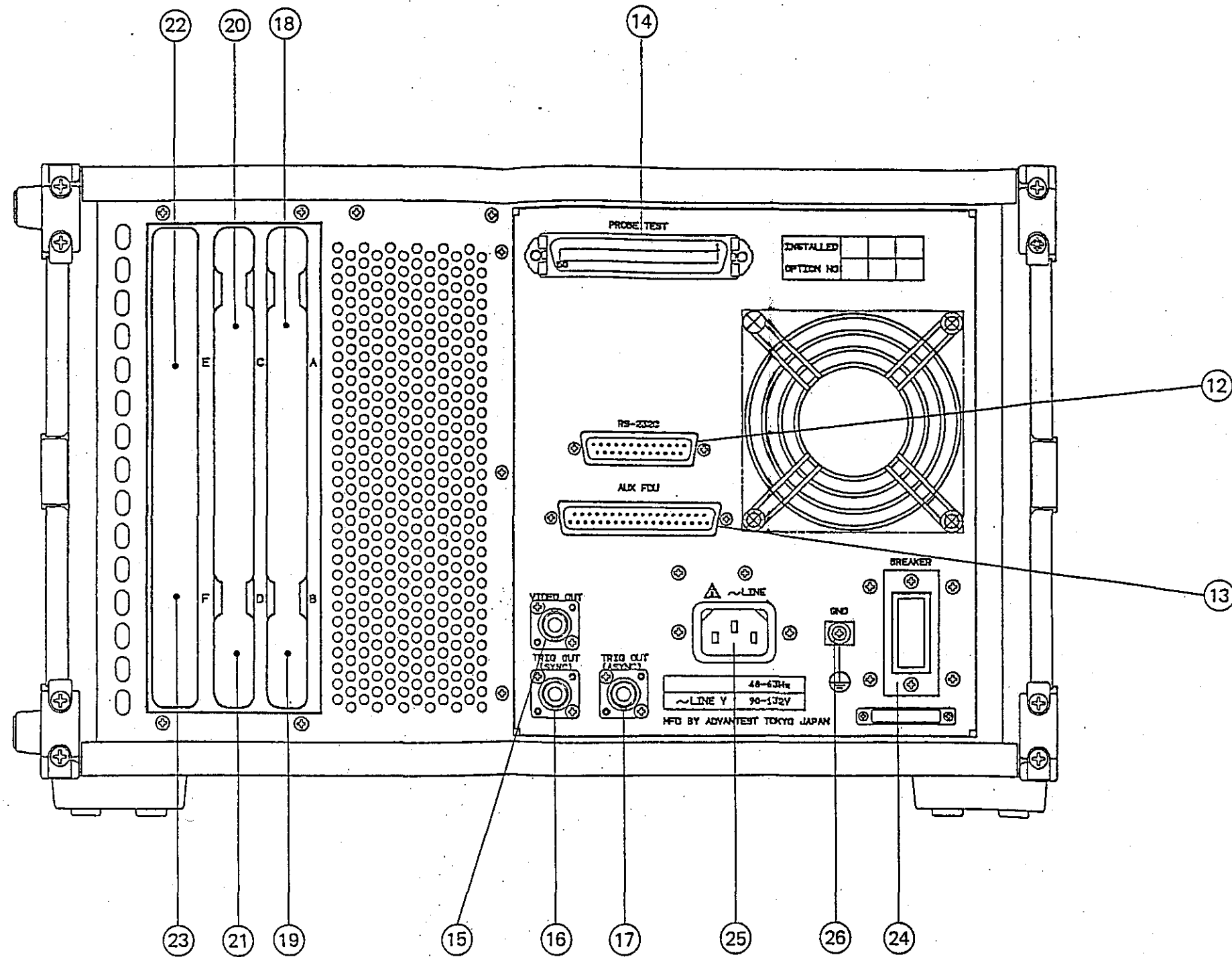
Figure 2-6 Rear Panel

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3. OPERATION EXAMPLES

3.1 PURPOSE

This section is intended to enable first-time users to learn thoroughly
and quickly how to operate the timing analyzer.

3.2 SIMPLE OPERATION EXAMPLES

First, connect the probe E/F to the timing analyzer (for detailed
procedures, see sections 2.2 and 2.3) and then load the system software
(see section 2.4).

The TR4726's initial menu screen consists of "** CONFIGURATION **",
"** TRACE SPECIFICATION **", and "** DISPLAY **". Of these, only
"** CONFIGURATION **" will remain on the screen when the system software
has been loaded. The initial screen of "** CONFIGURATION **" will display
as shown in Figure 3-1.

```
** CONFIGURATION **                                          18-SEP-86 15:44
[   SET-UP   ]__TIMING MODULE_____

  ┌ACQ.MODE─────────────        ┌INPUT GROUP──────────────────────────────────┐
  │  DATA CHANNELS    [16CH]     │                      ┌PROBE_F┐ ┌PROBE_E┐     │
  │  GLITCH DETECTION [ OFF]     │                      7654 3210 7654 3210     │
  │  MEMORY SIZE      [ 4K ]     │  GROUP NAME  POL     ↓↓↓↓ ↓↓↓↓ ↓↓↓↓ ↓↓↓↓     │
  └─────────────────────────     │     PRB_F    [+]     **** **** ..... .....   │
  ┌CLOCK───────────────          │     PRB_E    [+]     ..... ..... **** ****   │
  │  SOURCE [INTERNAL]           │              [+]     ..... ..... ..... ....  │
  │                              │              [+]     ..... ..... ..... ....  │
  │  RATE   [ 10ns]              └─LABEL───────────────────────────────────────┐
  │                              │     PROBE F_7 [F7    ]   PROBE E_7 [E7    ]  │
  └──────────────────            │           F_6 [F6    ]         E_6 [E6    ]  │
                                 │           F_5 [F5    ]         E_5 [E5    ]  │
  ┌THRESHOLD────────────         │           F_4 [F4    ]         E_4 [E4    ]  │
  │  PROBE_F [TTL]               │           F_3 [F3    ]         E_3 [E3    ]  │
  │                              │           F_2 [F2    ]         E_2 [E2    ]  │
  │  PROBE_E [TTL]               │           F_1 [F1    ]         E_1 [E1    ]  │
  └──────────────────            │           F_0 [F0    ]         E_0 [E0    ]  │
                                 └─────────────────────────────────────────────┘
                                                            KNOB EDIT↔
```
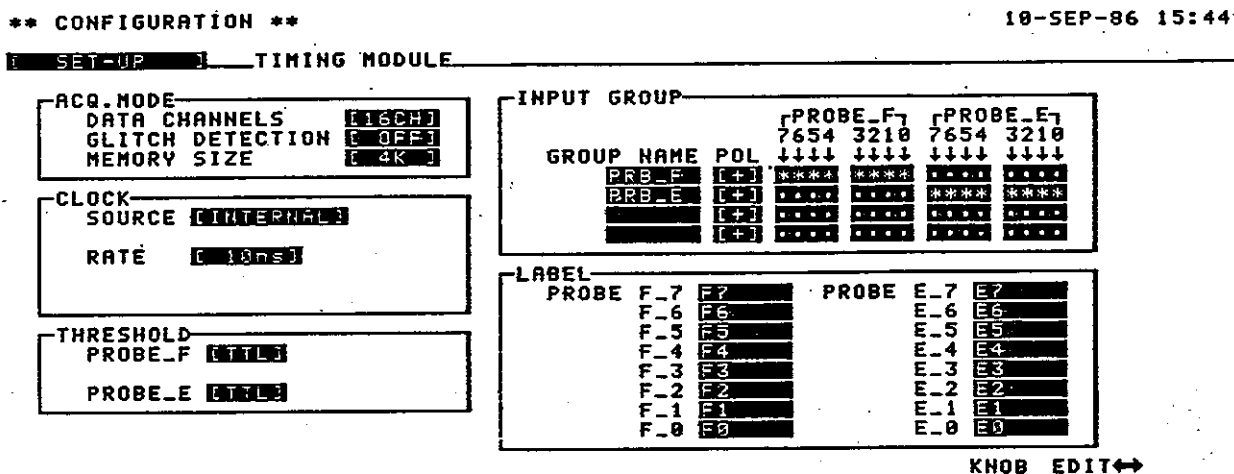
Figure 3-1   Initial Screen of CONFIGURATION

The data storage capacity, input-data fetch conditions, etc. are to be set
on this screen. The initial screen will contain the following data items:

. DATA CHANNELS 16CH .... Input data is to be fetched via the 16
                             channels of PROBE E or PROBE F.

. MEMORY SITE 4K .... Four k's of data are acquired per channel.

. -CLOCK- SOURCE INTERNAL ... The sampling clock source is an internal
          RATE   10ns   one, with a sampling clock rate of 10 ns.

. -THRESHOLD- TTL .... The input-data fetching level is preset to
                             the TTL level.

. -LABEL- .... PROBE_E and PROBE_F are used as the
                             input-channel labels.

Next, press the <u>TRACE</u> key ([^{TRACE}]).

The menu screen will change into:

```
** TRACE SPECIFICATION **                                    11-SEP-86 21:44
TRACE TIMING___TRIG.MODE [SEQUENTIAL]_____QuickVIEW [OFF]
        GROUP          [PRB_F ] [PRB_E ] [       ] [        ]
        RADIX          [ BIN  ] [ BIN  ] [ BIN   ] [ BIN   ]
        [FILTER]
        ENBL_1    [X]  XXXXXXXX XXXXXXXX
        ENBL_2    [X]  XXXXXXXX XXXXXXXX
        ENBL_3    [X]  XXXXXXXX XXXXXXXX

        TRIG [ ] [X]  PXXXXXXXX XXXXXXXX
                      G........ ........

        DSBL      [X]  XXXXXXX XXXXXXXX

        TRIG.EVENT     [ ] 00001 TIMES

        TRIG.POSITION [BEGIN] (DELAY: -00100)

        CLOCK RATE    [ 10ns]
                                                        KNOB · EDIT⟷
```

Figure 3-2   <u>TRACE</u> Menu Screen

The trigger conditions (the condiiions for fetching the input data) are to
be set on this screen.

The initial screen of the TRACE menu will contain the data listed below.

. MODE:
  Triggering uses either the SEQUENTIAL or the SERIAL mode, but the former
  is selected for the initial menu automatically.

  The sequential mode refers to the mode in which input patterns occur in
  normal ascending order of pattern number (EBL1 to EBL3) and then data
  fetch begins upon the occurrence of a TRIG pattern(s).

  For the initial screen of this menu, each of the patterns set will be
  "X" (Don't Care).

  This indicates that EBL1 to EBL3 and TRIG can be recognized in any
  desired pattern.

  In this case, therefore, the input pattern that appears first will be
  recognized as EBL1.

. DSBL:
  Disable function. This is a function used to reset the trigger
  recognition sequence. On the initial screen of this menu, this function
  appears as "X" to indicate that the function cannot be used.

. TRIG EVENT:
  The trigger event counter will display "00001". This indicates that
  data fetch begins upon the occurrence of a trigger pattern.

. TRIG POSITION:
  The trigger delay setting will be [BEGIN]. This indicates that data
  fetch begins with each occurrence of a trigger pattern. This setting
  can be changed between "+" and "-". In the case of the "-" sign, it
  also becomes possible to fetch data existing before the occurrence of a
  trigger pattern.

                                    DISPLAY
Next, press the DISPLAY key (☐).
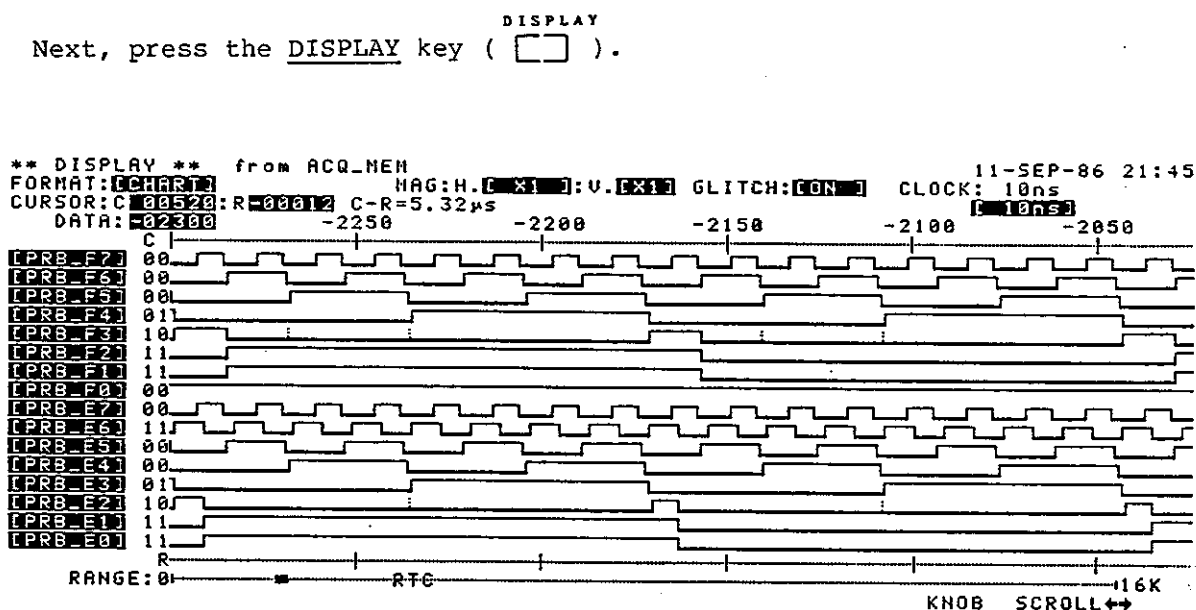
Figure 3-3 DISPLAY Menu Screen

This screen, which appears on the CRT, contains acquired data in a format
suitable for analysis.

After execution of RUN, this screen will reappear automatically.

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4. BASIC OPERATION FOR MEASUREMENT

4.1 OUTLINE

This section describes the basic operating procedures for making
measurements with the TR4726.

4.1.1 Menu Screens and Related Functions

The TR4726 uses the operation method based on the menu scheme. The
screen that possesses more than one related menu items it referred to
as the menu screen.

There are two types of menu screens: one type is opened by depressing
a key from the MENU key group, and the other type is opened by the
depressing either a key from the I/O key group or the AUTO key.

The former uses almost all areas of the CRT screen and plays a central
role in measurement operations, and is thus referred to also as main
menu screen. The latter is presented overlapping the corresponding
main menu screen and plays an auxiliary role in measurement
operations, and is thus referred to also as sub menu screen. These
menu screens and related function names are shown in Figure 4-1.

The main menu screens used in basic measurement operations are opened
using the CONFIG, SYMDEF, TRACE, and DISPLAY keys from the MENU key
group.

On the CONFIG menu screen, it is possible to specify the input
specifications of the TR4726. (Configuration) The function that is
implemented on this menu screen is referred to as the CONFIG function.

On the SYMDEF menu screen, it is possible to define symbols and
codes. (Symbol Definition) This function is referred to as the
SYMDEF function.
On the TRACE menu screen, it is possible to set tracing conditions.
(Trace Specification) This function is referred to as the TRACE
function.

On the DISPLAY menu screen, it is possible for measured data to be
displayed for analytical purposes. This function is referred to as
the DISPLAY function.

On the UTILITY menu screen, it is possible to carry out services not
associated directly with measurement operations. This function is
referred to as the UTILITY function. (See section 8 for further
details.)

On the GET/SAVE/FD menu screens, it is possible to carry out disk file
processing operations associated with the particular main menu
display. These functions are referred to as the SET, SAVE, and FD
functions. (See section 5 for further details on each of these three
functions.)

On the COMM menu screen, it is possible to set the necessary
parameters for making communications with external devices via the
RS-232C interface. This function is referred to as the COMM
function. (See section 7 for details.)

Timing Analyzer
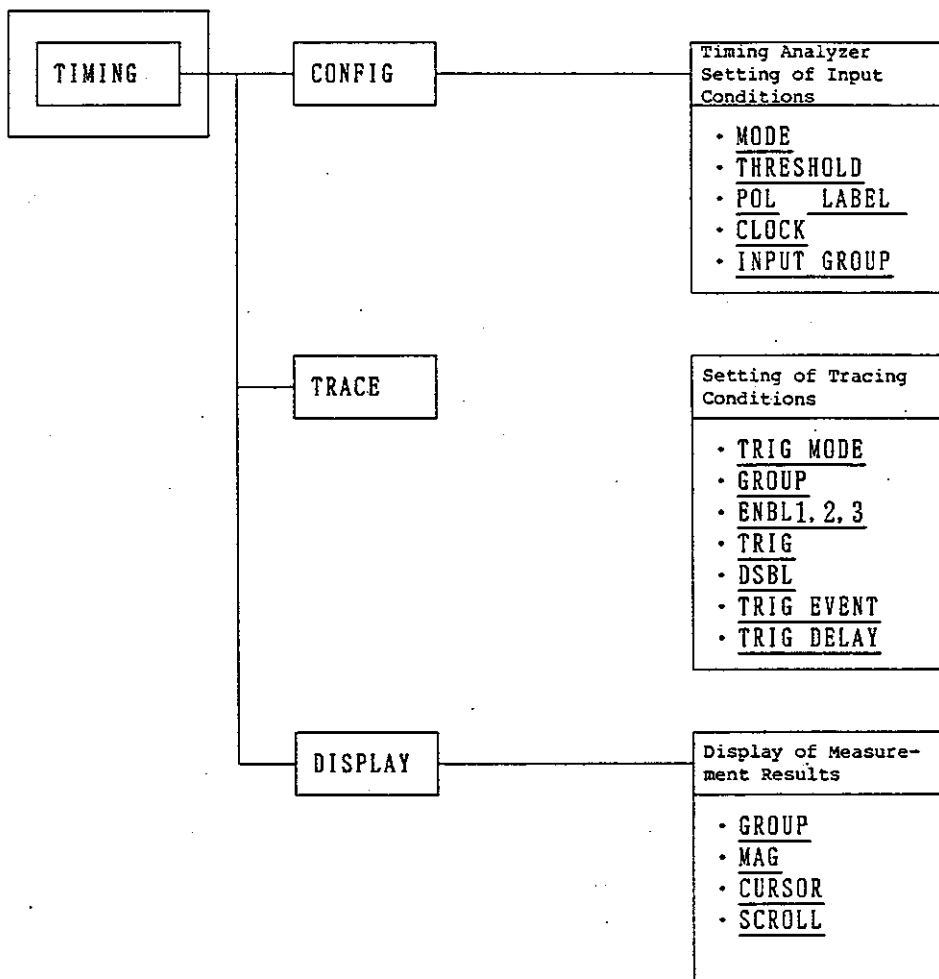
Figure 4-1 Menu Screen and Setting Functions (1/2)

Sub menu Screen
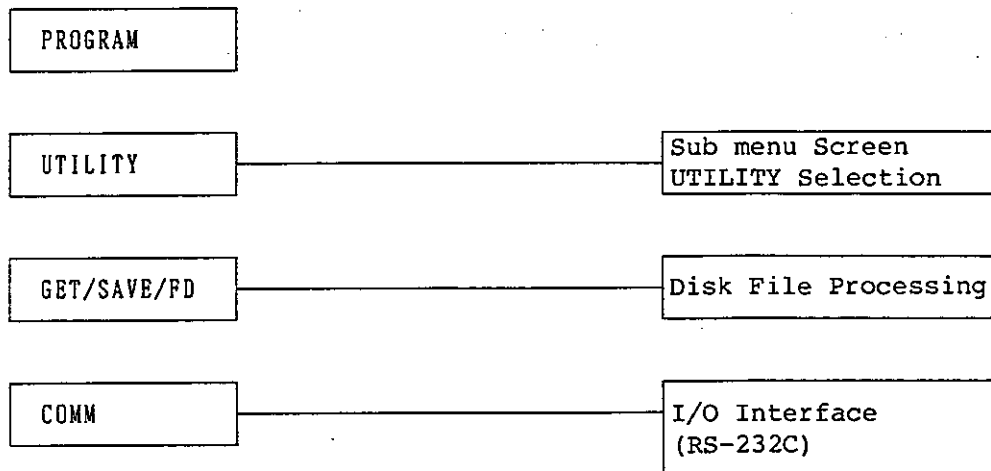
```
┌─────────────┐
│  PROGRAM    │
└─────────────┘


┌─────────────┐                        ┌──────────────────────┐
│  UTILITY    │────────────────────────│ Sub menu Screen      │
└─────────────┘                        │ UTILITY Selection    │
                                       └──────────────────────┘

┌─────────────┐                        ┌──────────────────────┐
│ GET/SAVE/FD │────────────────────────│ Disk File Processing │
└─────────────┘                        └──────────────────────┘

┌─────────────┐                        ┌──────────────────────┐
│  COMM       │────────────────────────│ I/O Interface        │
└─────────────┘                        │ (RS-232C)            │
                                       └──────────────────────┘
```

Figure 4-1 Menu Screen and Setting Functions (2/2)

4.2 MENU SCREEN OPERATIONS IN TIMING ANALYZER APPLICATIONS

This section describes the basic procedures for carrying out operations in the various menu screens when the TR4726 is used as a timing analyzer.

4.2.1 Configuration of Input Channels in the Timing Analyzer (CONFIG menu)

"Configuration of input channels" in the timing analyzer refers to the how to sampling of the 16-channel signals input via data probe E or F in order to utilize these signals as internal data.

The initial screen of the CONFIG menu is shown in Figure 4-2.

Figure 4-2 is followed by a description of the various data items that can be set on that screen. Use the SELECT or ENTRY key to set the data items.
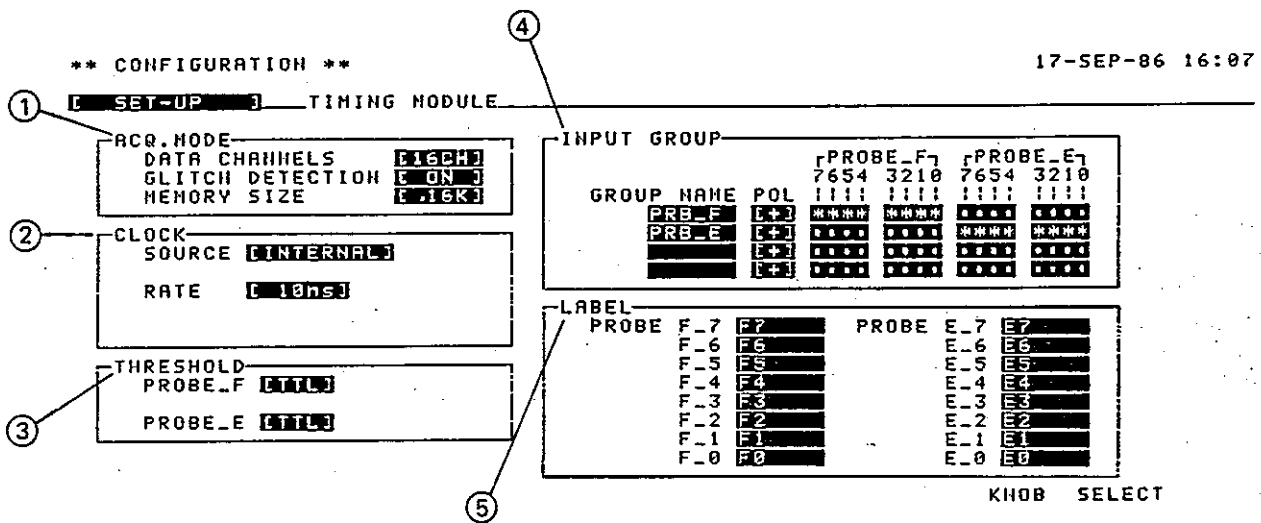
Figure 4-2 Initial Screen of the CONFIG Menu (Timing Analyzer)

(1) - MODE -

DATA CHANNELS: Select either [16CH] or [8CH] as data input channels.

In the TR4726, high-speed sampling (300 MHz sampling) uses the [8CH] mode.

4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS

MEMORY SIZE: Select a memory size for the data acquisition memory.

The available sizes are 0.5 K, 1 K, 2 K, 4 K, 8 K, 16 K, 32 K, and 64 K. Note, however, that there is the following relationship between the number of input channels and the memory size:

No. of Data Channels	Sampling Clock Frequency	Memory Size Settings	
		Glitch ON	Glitch OFF
16	100 MHz or less	16 K or less	32 K or less
	150 MHz	–	32 K or less
8	150 MHz or less	32 K or less	64 K or less
	300 MHz	–	64 K or less

GLITCH DETECTION: Glitch detection ON/OFF.

The TR4726 can detect glitch (changes in input signal level within sampling intervals) that cannot be detected by ordinary timing analyzers since they sample input signals at the sampling edge of each internal clock.

When this function is set to ON, glitch data will be stored in the special memory for glitch.

(2) – CLOCK –

SOURCE: Selection of the sampling clock source.

Select either [INTERNAL] (internal clock) or [EXTERNAL] (external clock).

RATE: For [INTERNAL]
Select a clock rate for internal sampling clocks.

The available clock rates are 50 ms to 10 ns (1~2~5 steps), 6.7 ns, or 3.3 ns.

For [EXTERNAL]
The TR4726 has two channels for external clocks and two channels for the qualifer.

If [EXTERNAL] is selected as the clock source, this screen will change into one shown in Figure 4-3 to enable external clock setting.

The screen dispalys the clock generation formula.

SCK = [K1] . Q1 . Q2 + [K2] . Q1 . Q2
+: Logical sum
.: Logical product
K1, K2: Clock
Q1, Q2: Qualifier
↑ ↓ : Clock rise/fall

Clock specification
↑ : Rise
↓ : Fall
[ ] Clock not used.

Clock/qualifier specification
0, 1, X (Don't care)
Initial value: X

** CONFIGURATION **   23-OCT-86 14:52

[SET-UP   ]   TIMING MODULE

```
┌ACQ.MODE──────────────────────┐   ┌INPUT GROUP──────────────────────────┐
│  DATA CHANNELS      [16CH]    │   │                  ┌PROBE_F┐ ┌PROBE_E┐ │
│  GLITCH DETECTION   [ OFF]    │   │                  7654 3210 7654 3210 │
│  MEMORY SIZE        [ 4K ]    │   │  GROUP NAME  POL ↓↓↓↓ ↓↓↓↓ ↓↓↓↓ ↓↓↓↓ │
└──────────────────────────────┘   │       PRB_F  [+]  **** **** ···· ···· │
┌CLOCK─────────────────────────┐   │       PRB_E  [+]  ···· ···· **** **** │
│  SOURCE [EXTERNAL]            │   │              [+]  ···· ···· ···· ···· │
│                              │   │              [+]  ···· ···· ···· ···· │
│                  QF1 QF2     │   └──────────────────────────────────────┘
│  SCK = [CK1]*(X * X)         │   ┌LABEL─────────────────────────────────┐
│      + [    ]*(X * X)        │   │  PROBE F_7 [F7]     PROBE E_7 [E7]    │
└──────────────────────────────┘   │        F_6 [F6]           E_6 [E6]    │
┌THRESHOLD─────────────────────┐   │        F_5 [F5]           E_5 [E5]    │
│  PROBE_F [TTL]               │   │        F_4 [F4]           E_4 [E4]    │
│                              │   │        F_3 [F3]           E_3 [E3]    │
│  PROBE_E [TTL]               │   │        F_2 [F2]           E_2 [E2]    │
└──────────────────────────────┘   │        F_1 [F1]           E_1 [E1]    │
                                   │        F_0 [F0]           E_0 [E0]    │
                                   └──────────────────────────────────────┘
                                                      KNOB  EDIT↔
```
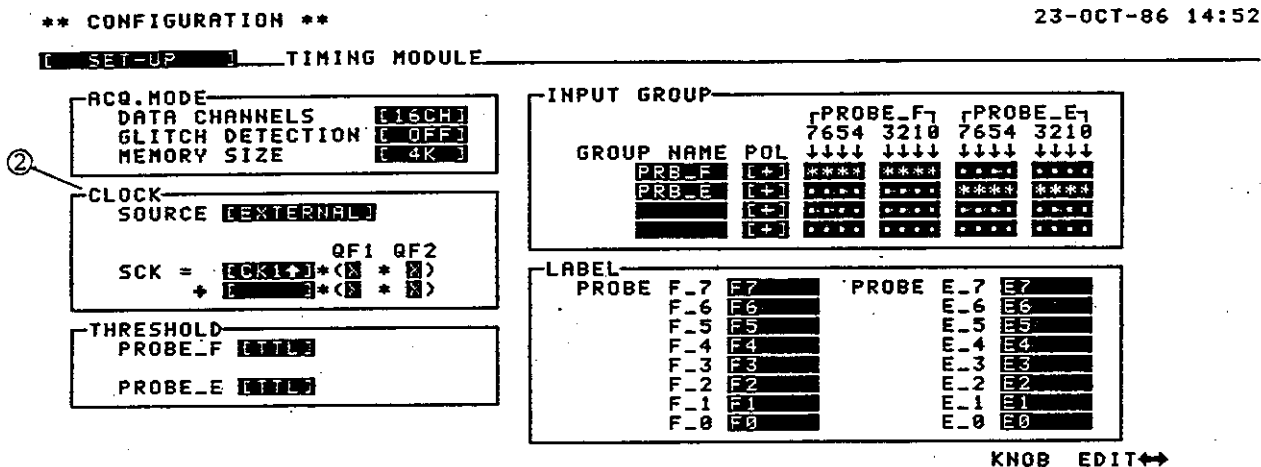
Figure 4-3 External Clock Settin

(3) - THRESHOLD -

PROBE_E: Select the desired threshold voltage for the input probe E
using either [TTL], [ECL], or [VAR].

PROBE_F: Select the desired threshold voltage for the input probe F
using either [TTL], [ECL], or [VAR].

The available VAR setting range is from -6.35 V to +6.35 V
(in 50 mV steps).

4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS

(4) - INPUT GROUP -

NAME: The minimum units for collective handling of several data
         input channels is defined as GROUP.

         Input data manipulated in GROUP can be input once the asterisk
         (*) has been input.

         Up to four group names can be defined. On the initial screen
         of this menu, PROBE_E and PROBE_F are predefined.

POL: Specify the logical polarity during DISPLAY/TRACE.

(5) - LABEL -

LABEL: Input signals from data probe E and data probe F are each
         preassigned a specific name so that they can be freely
         referred to during the display of acquired data. For data
         probe E, specific label names E7 to E0 are preassigned on a
         channel basis; for data probe F, specific lebel names F7 to F0
         are preassigned on a channel basis.

         These label names can be freely defined by the user.

         Up to six characters are available as a label name.

. Clock qualifier function
  This function validates only the clocks that match the conditions
  which have been set for the clock qualifier. Only the validated
  clocks are fetched.

  This function is therefore effective for seizing specific clock
  portions and for memory savings.

4.2.2 Setting the Tracing Conditions in the Timing Analyzer (TRACE menu)

TRACE specifies the measuring mode and sets the tracing conditions
which from the most important part of the measuring conditions.

The TR4726 provides various types of trace control functions for
sophisticated timing analysis.

1. 4-level sequential trigger/reset (ENABLE 3-stage + trigger/DISABLE)
   (1) ENABLE function
   (2) DISABLE function
   (3) TRIGGER function
       . Match pattern TRUE/FALSE
       . GLITCH
       . EDGE
       . Serial pattern

2. FILTER function
3. EVENT count function
4. DELAY count function

ENABLE
It is possible to specify a precedence pattern for trigger
recognition. Up to three sequences can be configured.

DISABLE
The sequence by the precedence pattern (ENABLE) used for trigger
recognition is initialized.

TRUE/FALSE

TRUE .... When the event that has been specified for a trigger occurs,
          this will be recognized as trigger.

FALSE ... Trigger recognition is made using the desired data other
          than the event that has been specified for a trigger.

          Inversion from FALSE to TRUE does not take place upon glitch
          or signal edges.

GLITCH
Triggers are recognized when a glitch occurs between sampling
intervals.

EDGE
Triggers are recognized when the transient state (rise/fall) of a data
pattern occurs.

Serial pattern
Triggers are recognized using the serial data pattern (serial bit
array) of a serial communications device.

FILTER
This function identifies only the events that have persisted past the
filter-set time.

In the TR4726, the filtering time can be set to each sequence level.
This function is effective for recognizing correct data by eliminating
indeterminate data (hazards and skews) associated with high-speed
sampling.

EVENT
It is possible to specify the desired number of times that triggers
are to occur.

TRIGGER POSITION
The positional relationship between the trigger point that has been
obtained by a trigger pattern and the oldest data is specified.

4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS
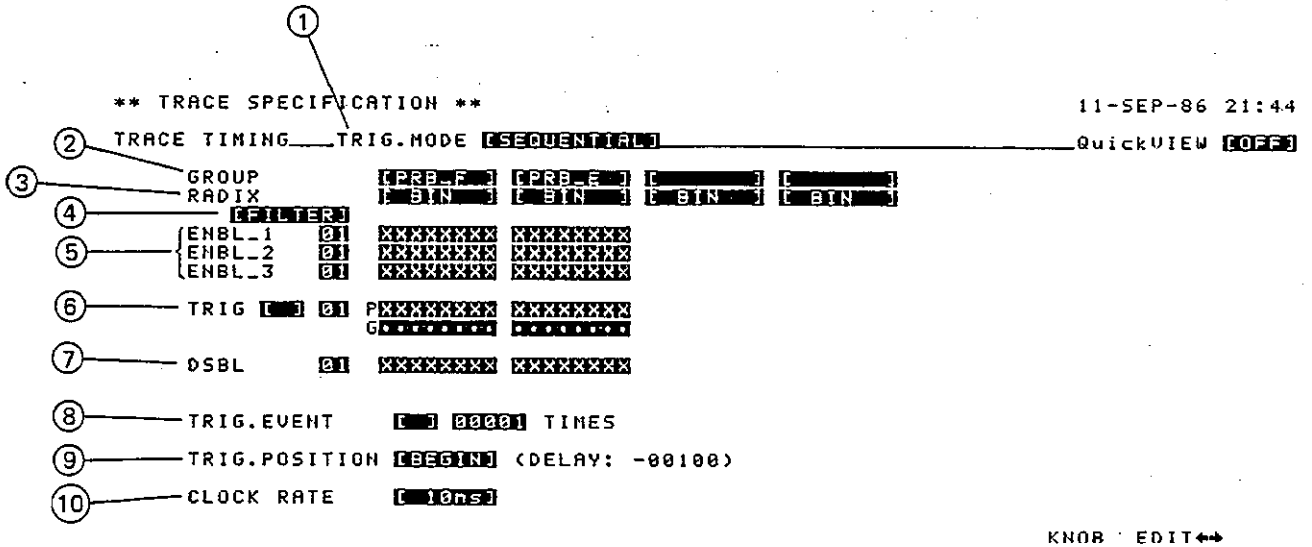
Figure 4-4   TRACE Menu Screen

(1) The items to be set on the menu screen
Each of the items to be set on the menu screen shown in Figure 4-4 is
described below.

① TRIG MODE: Selects either the SEQUENTIAL or SERIAL mode.

SEQUENTIAL ... The trigger works as a 4-level
sequential trigger.

SERIAL .... The trigger works as a serial trigger.

The channel having this trigger
function is CH_0 of PROBE_E.

② GROUP: Refer to the GROUP that has been defined on the <u>CONFIG</u>
menu screen.

③ RADIX: Selects the ENABLE, TRIG, or DISABLE setting pattern
radix. During radix conversion, where a new radix
conversion cannot be made using the "X", "↑", or "↓" key
is indicated an "?".

④ FILTER/EVENT: Sets a filter value or an event for the ENABLE,
TRIG, or DISABLE function.
The available setting range is from 1 to 15.

⑤ ENBL 1, 2, 3: Specifies a precedence pattern for trigger pattern
recognition.

4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS

⑥ TRIG: [ ] ... Sets the trigger pattern to TRUE.

[≠] ... Sets the trigger pattern to FALSE.

P .... Set a trigger pattern and specifies an edge input channel.

Either 0, 1, X, ↑, or ↓ can be specified.

You can specify the edge for only one of the available input channels.

G .... Specifies a glitch input channel.

Specify either "." or "*".

(*: The particular channel is recognized as the glitch input channel.

To specify a glitch input channel set the trigger pattern.

```
┌──────────────────────── NOTE 1 ────────────────────────┐
│                                                         │
│ During trigger, the trigger position may become indeterminate if the │
│ trigger pattern occurs before the clock counter indicates "50". │
│                                                         │
│ If this is the case, change the trigger position to [VAL]. │
│                                                         │
└─────────────────────────────────────────────────────────┘
```

```
┌──────────────────────── NOTE 2 ────────────────────────┐
│                                                         │
│ During sequential trigger, if the TRIG POSITION is set to VAL, the │
│ trigger point cannot be determined for any trigger patterns occurring │
│ before the clock counter indicates "14". │
│                                                         │
└─────────────────────────────────────────────────────────┘
```

⑦ DSBL: Specifies a DSBL pattern for trigger sequence resetting.

Set either 0, 1, or X.

⑧ TRIG EVENT: Sets an event counter value.
The available setting range is from 1 to 65535 events.

⑨ TRIG POSITION: Specifies the position of the trigger word within the data acquisition memory. If a positive value is set using VAL, then this indicates the data existing before triggering is to occur is acquired.

⑩ CLOCK RATE: Sets a sampling clock rate.

⑪ TRIG PATTERN: Describes a trigger pattern example. Trigger search takes place in a 16-bit pattern using 0, 1, or X. At the left and right ends of the 16-bit pattern are the starting bits and ending bits, respectively. The ending bits form the trigger (T) of the DISPLAY menu.

⑫ TRIG EVENT: Specifies the number of repetitions (events) of the trigger pattern.

Use [⌐] to select the number of repetations of pattern, and use [ ] to select the number of clocks. Use entry keys 0 to 9 to set these two parameters.

⑬ TRIG POSITION: Specifies the position of the trigger word within the data acquisition memory. Either [BEGIN], [CENTER], [END], or [VAR] can be selected.

For [VAR], if a posive value is set, then the data existing before triggering is to occur is acquired.

The trigger position displayed on the DISPLAY menu is indicated by the last four bits of the TRIG PATTERN.

⑭ QUICK VIEW: Selects either Quick View ON or Quick View OFF. Quick View ON causes automatic repetition of analysis and also enables each parameter of the DISPLAY menu to be freely changed even during analysis.

```
** TRACE SPECIFICATION **                                    26-JAN-86 15:43
TRACE TIMING___TRIG.MODE [   SERIAL   ]_____QuickVIEW [OFF]
     ┌PROBE_E,CH_0────────────────────────────────────────┐
⑪────┤  ─ TRIG.PATTERN    0    4    8    12                │
     │                 XXXX XXXX XXXX XXXX                 │
     │                 ↑first            ↑last             │
⑫────┤  ─TRIG.EVENT    [⌐] [00001] TIMES                   │          ⑭
⑬────┤  ─TRIG.POSITION [BEGIN] (DELAY: -00050)             │
     └────────────────────────────────────────────────────┘
```

[KNOB] EDIT↔
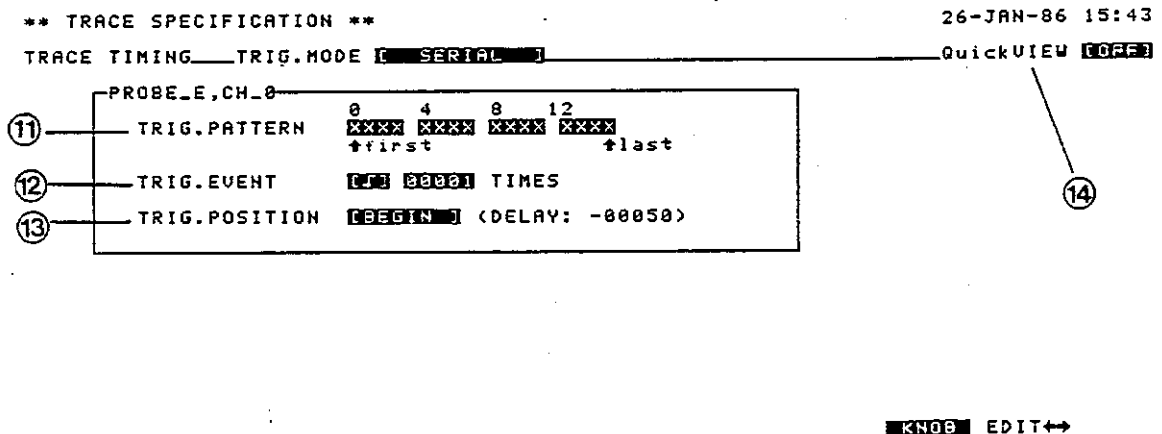
Figure 4-5 TRACE Menu (SERIAL) Display

(2) Conditions for setting the trigger
    The trigger setting process as shown in Figure 4-6.

    When the GLITCH/EDGE function is used, the trigger will be set to the
    following conditions:

    T . (G + E)

       T: Trigger pattern
       G: Glitch setting
       E: Edge setting

Sampling points

X X X E1 X X E2 X D X E1 X E2 X E3 X T T X X T T T T X T T T T

:Sequence
:resetting
:by DSBL

:Recognized
:as trigger.
:(Event count)

:Not recognized
:by the filter
:function.

:ENBL
:sequence
:completed.
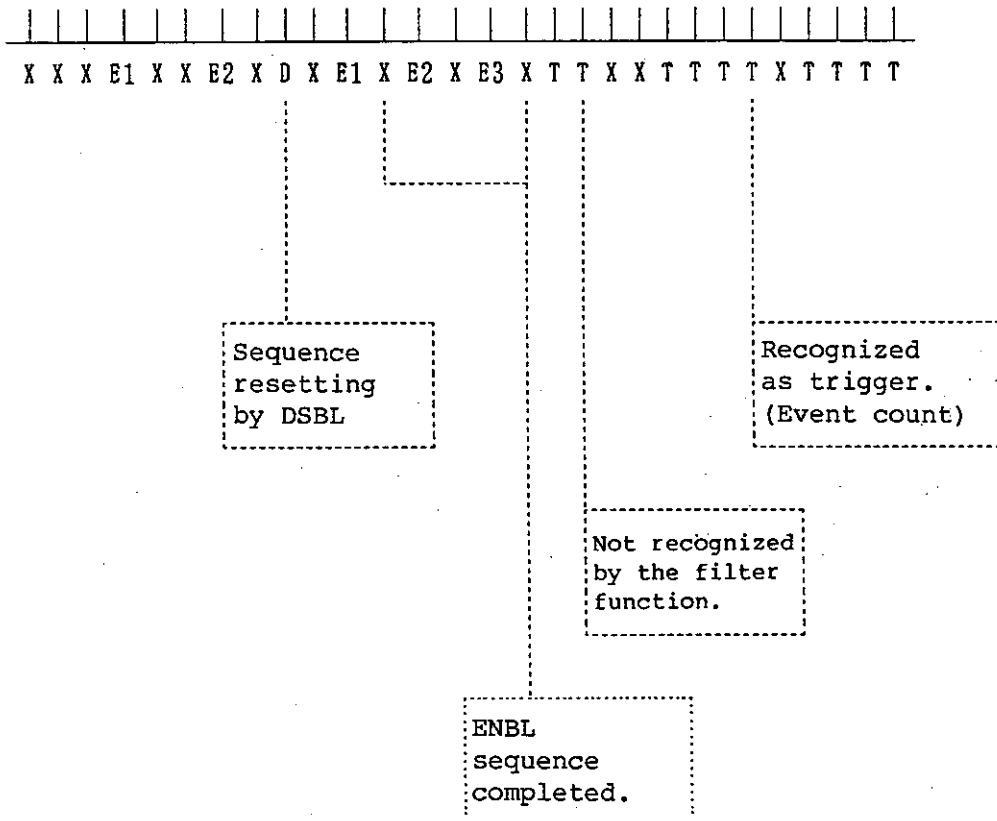
    E1: ENBL1 pattern
    E2: ENBL2
    E3: ENBL3
    D : DSBL
    T : TRIG
         (Trigger filter: 4)

         Figure 4-6 Trigger Setting Process

4.2.3 Acquired-data Scree in the Timing Analyzer (DISPLAY menu)

(1) Display format and menu item setting
The DISPLAY function displays the measured data stored within the data
acquisition memory or within a file on the CRT screen in a format
suitable for analysis. The initial screen of the DISPLAY menu is
shown in Figure 4-7.
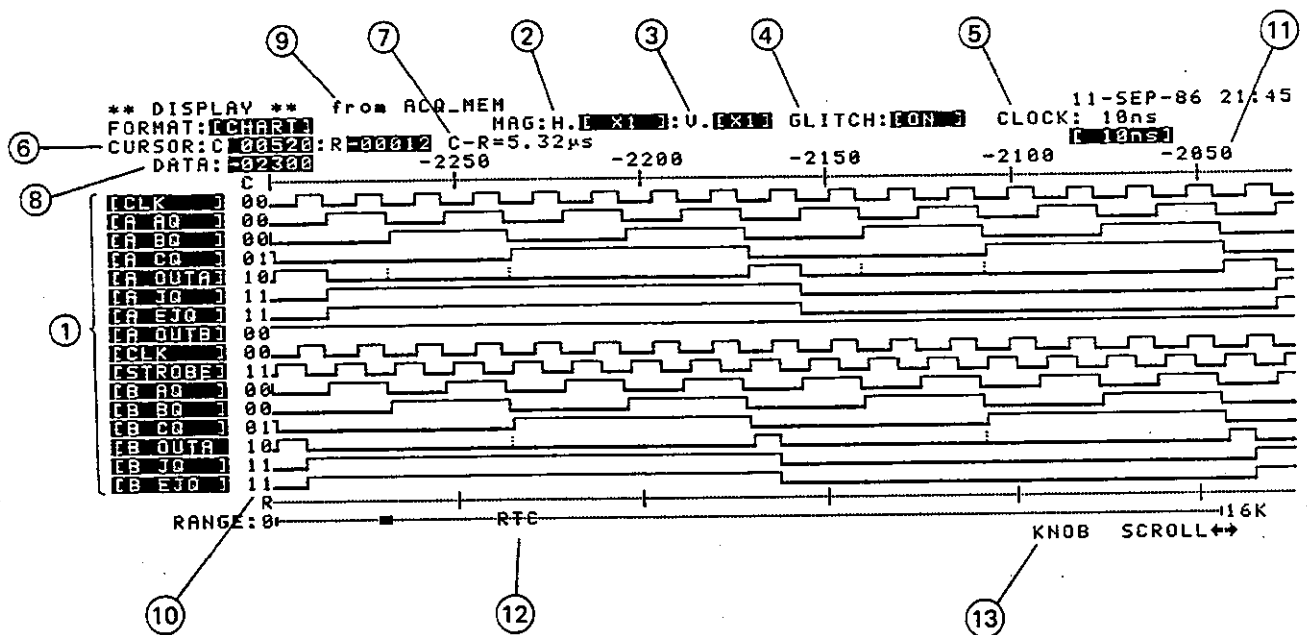
Figure 4-7 Initial DISPLAY Menu

Input data from data probes E (7 to 0) and F (7 to 0) are displayed in
the order of probe label name.

The initial menu screen is displayed with a horizontal magnification
of x1. The measured data is displayed at the maximum resolution level.

The data source is displayed at the left end of the uppermost line.
The data source indicates where the data currently being displayed has
been sent from. If the data source is displayed as ACQ_MEM, then the
data has come from the data acquisition memory. If the data source is
displayed as a file name, then the data has come from the
corresponding file.

The data source will be displayed as ACQ_MEM if data has been sent
immediately after measurement.

<u>4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS</u>

How to set the various menu items is described below.

(1) Label: When this menu screen is first displayed, label names
             are displayed in the order of F7 to F0 (data probe F)
             first and then E7 to E0 (data probe E) next.

             If a label is first defined on the <u>CONFIG</u> menu screen,
             then that user label will be used.

             Use the <u>SELECT</u> key to be display the data in the desired
             order. In addition, the same data can be displayed
             repeatedly. Data, however, will not be displayed if a
             blank label is selected with the <u>SELECT</u> key.

(2) MAG: H: Specifies a horizontal magnification factor.

             The available factor is ALL, HALF, x1, x2, x4, or x8.
             The reference point for magnification will be
             automatically set at the cursor position if a cursor
             (C-cursor) is already displayed on the screen.

             If a cursor is not yet displayed on the screen, the
             reference point will be automatically set at the
             left-end data position.

             The following table represents the relationship between
             the horizontal magnification factor and the number of
             data samplings displayed on the screen:

Horizontal Magnification Factor	No. of Data Samplings Displayed
ALL	*1 Memory size
HALF	*2 1/2 of memory size
x1	276 data samplings
x2	138 data samplings
x4	69 data samplings
x8	34 data samplings

*1: ALL or HALF compresses displayed screen in a simplified format.
     For a magnification factor of HALF with a memory size of 0.5 K,
     however, the noncompressed displayed screen is at the maximum
     resolution level.
*2: For a memory size of 64 K, the magnification interval becomes
     halved as the memory size decreases by half.

③   MAG: V   Specifies the vertical magnification (x1 or x2).
If x1 is selected for 16 input channels, then data
corresponding to the 16 channels will be displayed.
If x2 is selected, data corresponding to the 8 channels
will be displayed, with the data height doubled.

If x1 is selected for 8 input channels, data
corresponding to the 8 channels will be displayed in the
upper data position (no data will be displayed in the
lower data position).

If x2 is selected, data corresponding to the 8 channels
is displayed with the data height doubled.

④   GLITCH: Turns ON/OFF glitch data display.

Glitch data will be displayed in broken lines between
data samplngs.

⑤   CLOCK: The normally displayed value is the sampling clock rate
of the displayed data. To change the clock rate of the
next sampling operation, select the value directly below
the menu item.

This item is the same as the –CLOCK– selection in the
CONFIG menu screen.

⑥   CURSOR: Specifies where the cursor is displayed on the screen.
The cursor can be displayed as either cursor C (used as
the base for display-data magnification) or cursor R
(used as the base for the time difference).

Use the CURSOR:C ☐ menu item to specify the position
of cursor C in number of clocks. The specified position
will be used both for displaying the time difference
between cursor R and cursor C, and for displaying the
magnification.

Use the CURSOR:R ☐ menu item to specify the position
of cursor R in number of clocks with the trigger point
as the base. This number of clocks provides a base for
displaying the time difference between cursor R and
cursor C.

4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS

⑦ Cursor-to-cursor time: The time difference between cursor C and
   difference (C-R)   cursor R is displayed.

⑧ DATA: The first position of data display can be specified.

⑨ Displayed-data source: This item indicates from where the data
                          currently being displayed has been sent.

                          The following three types of
                          displayed-data sources are provided:

                          From ACQ_MEM : Displays the ACQ memory
                                           contents.
                                           ACQ_MEM is displayed
                                           measurement.

                          From REF_MEM : Displays the REF memory
                                           contents.

                          From file name: Displays data from a
                                           file.

⑩ Cursor C/R readout: Display the logical levels of data in the
                       positions of cursors C and R.

⑪ Scale: The horizontal-axis scale displays the time difference
          between the trigger point and displayed data. Here, such
          a time difference is displayed in number of sampling
          clocks. The following table represents the relationship
          between the horizontal-axis scale and displayed data:

Horizontal Magnification Factor	Horizontal-Axis Scale Interval
ALL	*2 For every 8K samplings
HALF	*2 For every 4K samplings
x1	For every 50 samplings
x2	For every 20 samplings
x4	For every 10 sampings
x8	For every 5 samplings

⑫ Trigger point: Displays where a trigger has occurred by a T mark.

4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS

⑬ KNOB: Scrolls the acquired-data display. In addition, the functions described below are used in conjunction with the ⊡ (KNOB) key. The selected function name of the ⊡ key is displayed at the lower right end of the screen.

SCROLL← → : Scrolls horizontally the data display.

SCROLL↑ ↓ : Scrolls vertically the data display.
This function, however, is valid only for 16 input channels with a vertical magnification factor of x2.

CURSOR_C : Scrolls cursor C.

CURSOR_R : Scrolls cursor R.

CURSOR C&R : Simultaneous scrolling of both curaor C and cursor R with their positional relationship maintained.

EDIT ← → : Editing of the menu items within the DISPLAY menu. Move the prompt to the desired menu item and then carry out the edit operation.

SELECT : Changes the desired data setting item in a similar manner to that of operation of the SELECT key group. On the DISPLAY menu screen, the following items can be changed:

. MAG:H, MAG:V
. GLITCH ON/OFF
. CLOCK
. Label

PAGE ⊡⊡ : Scrolls data page by page. The number of data samplings that can be scrolled per page is shown in the table below for each horizontal magnification factor:

Horizontal Magnification Factor	No. of Data Samplings per Page
ALL	No scrolling
HALF	1/2 of memory size
x1	240 data samplings
x2	120 data samplings
x4	60 data samplings
x8	30 data samplings

(14) SRCH: Searches acuired data for a specific pattern. When the
             pattern to be searched is described immediately to the
             right of the label, the acquired data can be searched in
             the left direction (the direction of smaller data
             numbers) using the INSERT key or in the right direction
             (the direction of larger data numbers) using the DELETE
             key. Searched data will be highlighted (character
             units). In compressed display, since data other than
             searched data is also included in it, the entire display
             must be magnified for verification.

(15) FORMAT: Selects either [CHART] or [LIST] as the diaplay format
             of the acquired data. The default setting for the
             format is [CHART].
             To select [LIST] use either the rotary knob or the
             SELECT key. Figure 4-8 shows [LIST[screen format.

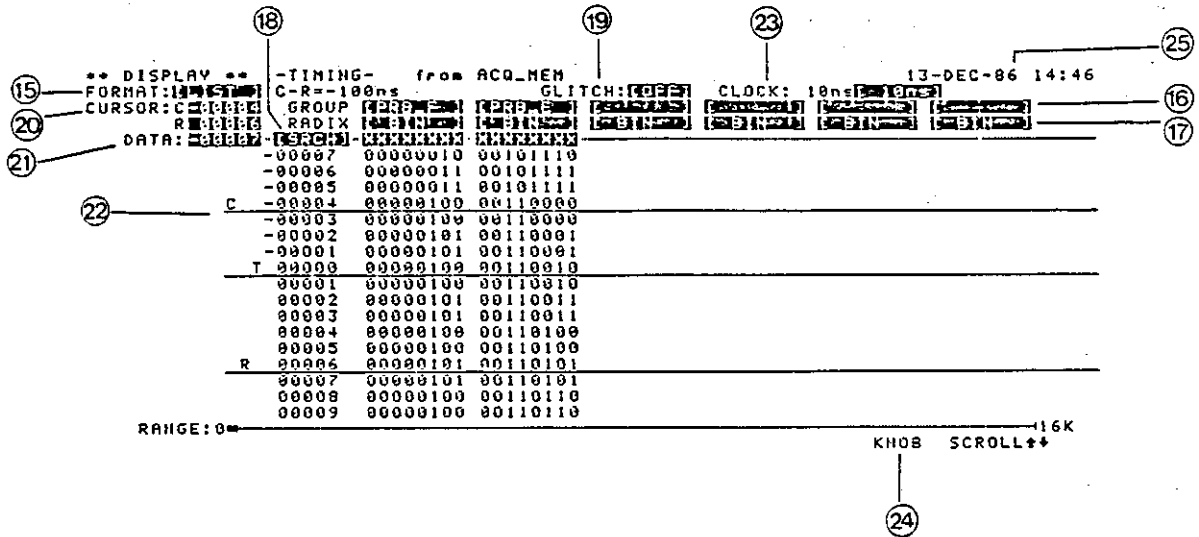4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS

Figure 4-8 DISPLAY [LIST] Menu Screen

(16) GROUP: Displays list in either the BIN, OCT, DEC, HEX, or ASCII
format on a group basis. The group name that has been
set in the CONFIGURATION menu screen is displayed.
(Up to four group names can be registered.)

The order in which the group names are displayed can be
specified by moving the prompt to the desired position
using the rotary knob or the EDIT key and then selecting
the display order using the SELECT key or the rotary knob.

(17) RADIX: Displays each group in either binary, octal, decimal,
hexadecimal, or ASCII format.

The display format must be selected by moving the prompt
using the EDIT key or the rotary knob and then selecting
one of the above five formats using the SELECT key or the
rotary knob. Note, however, that the ASCII format is
selectable only for 7- or 8-channel configurations.

(18) SRCH: Searches acquired data for a specific pattern. First
describe the desired pattern on the portion highlighted
on the right side of the screen and then scroll the data
display upwards (in the direction of smaller data
numbers) using the INSERT key or downwards (in the
direction of larger data numbers) using the DELETE key.
Searched data will be highlighted.

<u>4.2 MENU DISPLAY OPERATIONS IN TIMING ANALYZER APPLICATIONS</u>

(19) GLITCH: This function is valid only when the GLITCH DETECTION item is set to [ON] on the <u>CONFIGURATION</u> menu screen. When the prompt is moved using the <u>EDIT</u> key or the rotary knob and then [ON] is selected using the <u>SELECT</u> key or the rotary knob, the background of the corresponding data (characters) will be displayed in half-tone if GLITCH data exists on the screen.

(20) CURSOR: Specifies the position on the screen where cursor C or cursor R is displayed. Use CURSOR:C ☐ to specify cursor C, and use CURSOR:R ☐ to specify cursor R.

(21) DATA : Specifies the first position of the data displayed.

(22) Cursor display: Either cursor C, cursor R, or both cursors C and R can be moved using the rotary knob by selecting the respective functions of the [o] key located to the left of the rotary knob.

(23) CLOCK : The value being displayed in normal form denotes the sampling clock rate of the displayed data. Selecting of the menu item on the right side of this data item changes the next-sampling clock rate. This function is similar that of -CLOCK- selection on the <u>CONFIGURATION</u> menu.

(24) KNOB (Rotary knob): Scrolls the acquired data display, moves cursor C or R, and selects menu items. Use the [o] key located on the left side of the rotary knob to select between these three functions.
The selected function name of the key will be displayed on the right side of the screen.

SCROLL ↑ ↓ : Scrolls data.

CURSOR_C↑ ↓ : Moves cursor C.

CURSOR_R↑ ↓ : Moves cursor R.

CURSOR_C&R ↑↓: Simultaneously moves both cursors C and R with their positional relationship maintained.

EDIT ← → : Edits the menu items within the DISPLAY menu. To edit move the prompt the desired menu item.

SELECT : If the prompt specifies [ ], then the same function as that of the SELECT key on the panel can be used. When the rotary knob is turned clockwise, it becomes as a NEXT key; when the rotary knob is turned counterclockwise, it becomes a PREV key.

(25) Calendar: Displays the calendar in the year/month/day/hour/ minute format. See "Utility Functions and Operations" for detailes on how to set the calendar.

MEMO ✏️

TABLE OF CONTENTS

5. DISK FILE PROCESSING FUNCTIONS AND OPERATIONS

5.1 PRELIMINARY KNOWLEDGE FOR DISK FILE PROCESSING

5.1.1 Outline of Disk File Processing

A series of measurements can be made using the basic measurement functions mentioned in the preceding section.

However, under complicated measuring conditions or when measured data are to be handled in large quantities, these functions alone may not suffice for efficient measurement.

The TR4726 is provided with disk file processing functions that save the measuring conditions, measured data, etc. within files for future use.

Disk file processing can be carried out at any time while the CONFIG, SYMDEF, TRACE, DISPLAY, or PROGRAM menu screen is displayed for data input. (Disk file processing cannot be done during measurement, input/output operations, or display of the UTILITY menu.)

Use the GET, SAVE, and FD keys to perform the disk file processing tasks.

The GET function reads data from the files and display it on the main menu screen.

The SAVE function writes the data appearing on the main menu screen into files.

The FD function, which consists of disk file processing commands, is an auxiliary function used for copying, erasing, etc. of files.

In the TR4726, two types of data can be subjected to disk file processing: data within the built-in floppy disk drive, displayed as F0, and data within an external floppy disk drive, displayed as F1.

The TR4726 has name-assigned file systems built into its operating system that operate the above two drive units.

Therefore, it is possible to carry out filing operations in a similar manner to that of a general-purpose computer system that explicitly uses file names.

This operation method is highly flexible for managing files because it can handles any file name. However, this method is very troublesome because it requires that a file name be input for each operation.

Since such a computer-like file operation method is quite different
from those required for measurement using the TR4726, this logic
analyzer provides the Quick Get/Save functions to allow the ordinary
GET/SAVE functions to be used without keying in any file names.

With the Quick Get/Save functions, the user can utilize new functions
without any new burden on him (or her) since the naming and management
of files is performed by the TR4726 itself.

5.1.2 Disk Handling Precautions

Protect floppy disks from dust and dirt, moisture, low temperatures,
magnetism, etc. while using or storms them.

Always use double-sided, 3.5-inch floppy disks.

Such floppy disks are designed to that their protective covers will
open when the disks are inserted into the auto-shutter type disk
drives.

Usually, the protective cover remains closed and, unlike conventional
8-inch or 5.25-inch floppy disks, the disk has an unexposed surface.

In addition, these floppy disks are each fitted with a write-protect
mechanism. Figure 5-1 illustrates how to use of the write-protect tab.

The system disks are shipped write-protected.

Reverse side of the disk

Write-protect tab
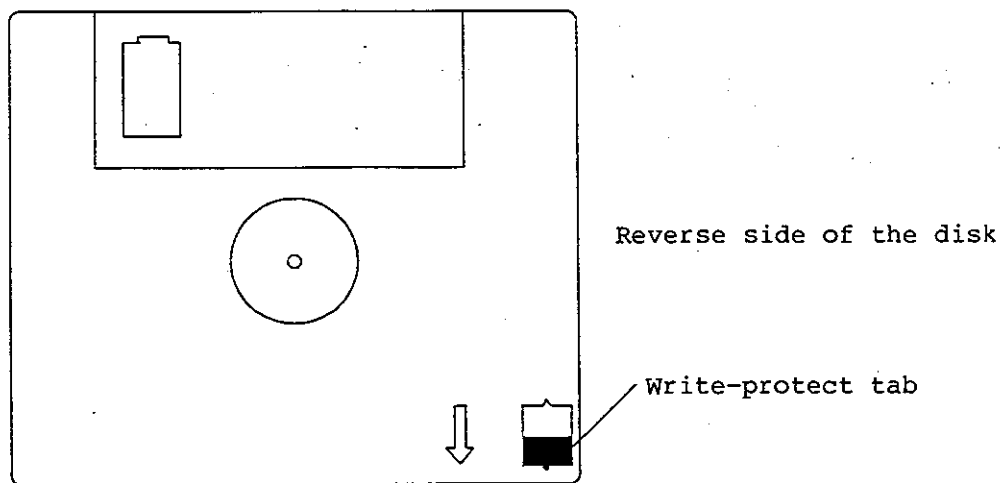
(a) Write-protected.
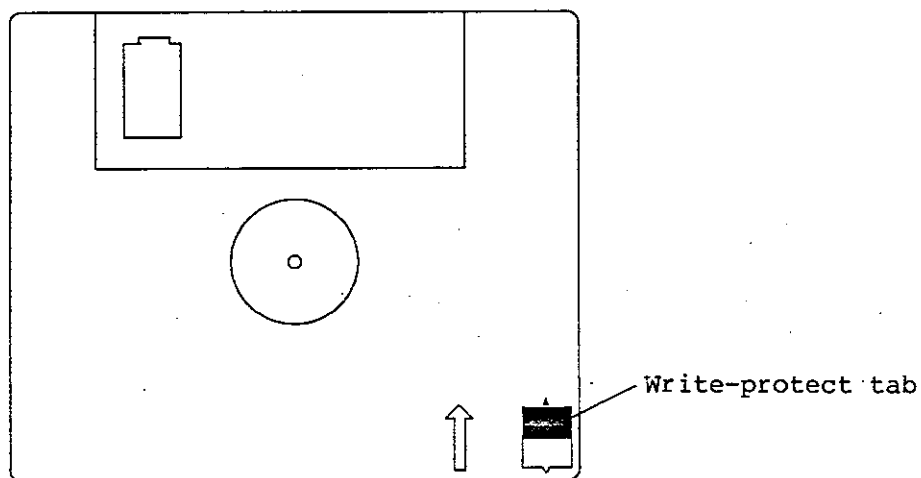
Write-protect tab

(b) Not write-protected.

Figure 5-1 How to Use the Write-Protect Tab

The specifications of floppy disk are as follows:

. Disk life   : 3 x 10^6 passes/track
. Operating temperature range: 10°C to 60°C
. Operating humidity range   : 8% to 80% RH (Non-condensing.)
. Storage temperature range   : 4°C to 53°C
. Storage humidity range   : 8% to 90% RH (Non-condensing.)

5.1.3 System Disks and Data Disks

Two types of floppy disks are used on the TR4726: system disks and
data disks.

Two system disks are supplied as attachments to the OPT4726
+70/OPT4726 +75 timing module and each personality kit. Each of the
two system disks has the same contents.

The system disks contain a large portion of the system software which
controls the TR4726, and are upgraded periodically for improved
functions.

5.1.4 Classification of Files

Files within a disk can be identified according to file name,
attribute, and management grouping. The file attribute denotes the
type of data contained in the file, and the file management grouping
denotes the person responsible for managing the file. These
classifications are intended only to maintain the consistency of file
processing within the TR4726 and need not be paid attention to during
normal operations. (Such classifications are greatly convenient for
operation and provide a high degree of sophistication.)

The file name consists of a name part and an extender part as shown
below.


```
      Name part              Extender part

   ┌──────────┐            ┌──────────┐
   │          │     .      │          │
   └──────────┘            └──────────┘

   <────────>              <────────>

   Up to six               Up to three
   alphanumeric            alphanumeric
   characters              characters

                 Period
```
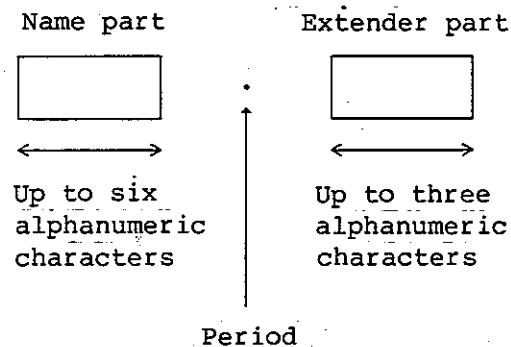

The file name is valid, as long as even a single character is included
in the name part. Therefore, "1", "1.", "A.1", etc. are all correct
file names, even though "1" is treated as a file name equivalent to
"1." by the TR4726. A special file name may be used for a particular
file attribute and file management grouping.

There are nine types of file attributes provided according to the contents of the file.

. SETUP   :   Holds the CONFIG main menu screen data.
              Holds the TRACE main menu screen data.

. SYMDEF :   Holds the SYMDEF main menu screen data.

. DISP_S :   Holds the DISPLAY main menu screen data if the measuring
              mode is TRACE STATE. (For the timing analyzer, only this
              attribute is provided.)

. DISP_T :   Holds the DISPLAY main menu screen data if the measuring
              mode is TRACE TIMING. (For the timing analyzer, only this
              attribute is provided.)

. DISP_ST: Holds the DISPLAY main menu screen data if the measuring
              mode is TRACE S&T (S → T) or TRACE S&T (T → S). (For
              the S&T analyzer, all the file attributes of DSP_S, DSP_T,
              and DSP_ST can be taken.)

. PROG   :   Holds the PROGRAM main menu screen data.

When files are to be used on the main menu screen, file operation can
be a much simplified by utilizing these file attributes to make the
main menu screen act as if it were a directory of the file system.

The file name and the file attribute can be checked using the
DIRECTORY function (see subsection 5.4.2).

5.1 PRELIMINARY KNOWLEDGE FOR DISK FILE PROCESSING

Table 5-1 Classification of Files

Menu Screen	File Attribute	File Management Grouping	File name
CONFIG TRACE	SETUP	User file	Freely assigned*
		System-saved file	SETUP.S1 - SETUP.S99
		Registered file	SETUP.REG
SYMDEF	SYMDEF	User file	Freely assigned*
		System-saved file	SYMDEF.S1 - SYMDEF.S99
		Registered file	SYMDEF. REG
DISPLAY	DISP_S DISP_T DISP_ST	User file	Freely assigned*
		System-saved file	DISP.S1 - DISP.S99
		Registered file	DISP.REG
PROGRAM	PROG	User file	Freely assigned*
		System-saved file	PROG.S1 - PROG.S99
		Registered file	PROG.REG

*: For the extender part, however, it is not possible to use. EXE,
     ,.SYS., .Sn (n: Numeral) or ,REG.

Each file is classified as one of the following three types according
to the file management grouping: (1) user file; (2) system-saved
file, and; (3) registered file.

. User files:
  Files of this type are created by assigning the desired file names
  to the files by the user. The files themselves or the file
  contents can be freely erased using the DELETE function (section
  5.7), the RENAME function (section 5.9), and/or the COPY function
  (section 5.10). The user himself (or hereself) must manage such
  files. For the extender part, it is not possible to use EXE, SYS,
  Sn (n: Numeral), or REG.

. System-saved files:
  Files of this type are created by the QuickSAVE function (section
  5.3), and are named and managed by the TR4726. Unlike user files,
  it is not possible for the user to erase the desired system-saved
  file(s). To erase these files the user must use the PURGE function
  (section 5.6). All the files must be erased collectively in the
  order that they have been created. (For this erasure, neither the
  DELETE/RENAME functions are available, nor the destination of the
  COPY function can be made.)

  To partially save the series of system-saved files, first copy
  those contents into a user file using the COPY function and then
  erase all the system-saved files using the PURGE function.

. Registered files:
  These files come under the QuickGET function (section 5.2). A
  registered file is created by registering a user or system-saved
  file for each main menu screen using the REGISTER function (section
  5.5). Tne original file can be erased once the registration has
  been completed.

Up to a maximum of 199 files (the total of the above three types of
files) can be created within a user disk. Note, however, that it may
not be possible to create up to 199 files since each file varies in
size with the file contents. The maximum available capacity of a
user disk is 2530 blocks (1 block = 632.5 KB for 256B). The number
of files, total size (in blocks), available area size, etc. of a user
disk can be checked using the STATUS function (section 5.11).

5.1.5 Starting and Erasing the Submenu Screen by the GET/SAVE/FD Functions

To perform disk file processing, first press one of the [GET] , [SAVE] ,
and [FD] keys and overlap the sub menu screen upon the corresponding
main menu screen. (Such a display is referred to as multi-window
display.) The display position on the CRT screen is fixed. It
becomes impossible to input data temporarily onto the main menu
screen that has been displayed in a multi-window format. The input
prompt present on the main menu screen must be moved to the sub menu
screen.

5.2 GET FUNCTIONS AND OPERATIONS

5.2.1 Ordinary GET Function and Operations

The GET function reads only the specified file, among the files associated with the main menu screen currently being displayed (see subsection 5.1.4) or details of the file attributes), and then displays the file contents to the main menu screen.

Press the [GET] key to display the sub menu screen on the CRT display so that a file name can be input. The main menu screen is dimmed (half-tone display) which means data cannot be input for now. Move the input prompt to the file-name menu item on the GET sub menu screen. Specify either disk drive F0 (built-in drive) or disk drive F1 (external drive) using the ENTRY key, and then input a file name and press the [GET] key once again. The GET operation will then be executed.

When the GET operation normally ends, the sub menu screen will disappear and the main menu screen will revert to its original display. Consequently, the data that has been read from the file will be displayed and it will become possible to input data for the menu items.

The file name (from "file name") in the center position of the top line indicates the source of the data appearing on the main menu screen. This file name remains on the screen until the displayed data has been overwritten by new data.

5.2.2 QuickGET Function and Operations

The ordinary GET function may cause significant operational burden on the user during input of file names. The TR4726 provides two operation methods that enable file names to be input indirectly without using the ENTRY key. One of these two methods is by using registered files (see subsection 5.1.4), and the other is by using the scroll knob. Both methods enable the GET function to be performed quickly, and are thus referred to collectively as the QuickGET function. The QuickGET function almost eliminates the necessity of the ordinary GET function.

Once a "registered" file has been actually registered, the registered file name will be displayed on the sub menu screen when the [GET] key is pressed. Pressing the [GET] key again makes it operate as an EXECUTE key. Therefore the contents of the registered file can be displayed on the main menu screen without keying in any file name. Because one "registered" file can be actually registered for each main menu screen, it is suggested that the files likely to be used most frequently be registered. The method for the scroll knob is a more general method.

Press the [GET] key to start the sub menu screen, and then turn the
scroll into clockwise. This causes the file names within the disk to
be displayed in sequence. Stop turning the knob when the desired file
name is displayed, and press the [GET] key. That file will then be
read and the contents displayed on the main menu screen. Using the
directory display function together with the QuickGET function causes
the file name in the top position on the directory display to be
displayed in synchronization with the file name used for GET purposes.

5.3 SAVE FUNCTIONS AND OPERATIONS

5.3.1 Ordinary SAVE Function and Operations

The ordinary SAVE function is used to write the data of the main menu screen currently being displayed into the specified file. If the file having the specified file name is already inside the user disk, then the contents of that file will be erased by the new data. If the file is not yet stored within the user disk, a new file will be created automatically.

Press the [SAVE] key to display the sub menu screen so that a file name can be input. The main menu screen dims (half-tone display) which means data cannot be input for now. Move the input prompt to the file-name menu item on the SAVE sub menu screen. First, system-saved file names (see subsection 5.3.2) will be displayed. Further turning of the rotary knob (clockwise) will cause the file names within the disk to be displayed in sequence. Any desired file name can be selected simply by first specifying either disk drive F0 (built-in drive) or disk drive F1 (external drive) using the ENTRY key, and then typing in a file name. After naming a file, press the [SAVE] key once again. The file will then be saved. After this file is saved, the sub menu will disappear, the main menu screen will revert to its original status, and the main menu screen data will be written into the file.

The saved file name will be displayed on the main menu screen. Use the directory display function with this SAVE function to check the created files. However, be sure to first press the [F0] key twice to check the file name, and then press the [SAVE] key and carry out the operations mentioned above.

5.3.2 Quick SAVE Function and Operations

The ordinary SAVE function may cause significant operational burden on the user during input of file names. This method is okay, for files that have already been saved. However, for files that are not yet saved, especially in cases where large quantities of data (several files) are to be quickly acquired, it may be troublesome to carry out saving operations using only the ordinary SAVE function. The TR4726 provides an operation method that enables file names to be input indirectly without using the ENTRY key. Such a method uses registered files (see subsection 5.1.4). This method enables the SAVE function to be performed quickly, and is thus referred to as the QuickSAVE function.

Press the [SAVE] key to display a system-saved file name on the file-name menu item of the sub menu screen. The system-saved file number displayed will be "1" plus "the system-saved file number previously saved on the disk." Press the [SAVE] key once again makes it operate as an execution key.

Therefore the main menu screen data can be written into that
system-saved file without in any file name. To name and then save a
part of the "saved" system-saved file as a user file, first copy the
desired system-saved file into a user file using the COPY function
(see section 5.10), and then erase all the system-saved files using
the PURGE function (see section 5.6). Note that the DELETE function
cannot be used for erasing the system-saved files.

5.4 DIRECTORY FUNCTIONS AND OPERATIONS

5.4.1 DIRECTORY-of-MENU Function and Operations

The DIRECTORY-of-MENU function is used to list only files associated with the main menu screen currently displayed that are stored within a disk.

Press the [FD] key to display the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu items. Move the input prompt to the command selection menu item of the sub menu screen. To perform the DIRECTORY-of-MENU operation specify either disk drive F0 (built-in drive) or disk drive F1 (auxiliary (external) drive) and then press the [FD] key once more.

Disk drive F0 will be automatically selected if a disk drive is not selected. Therefore, if the built-in disk drive is used, the directory of menus stored within the disk can be check simply by pressing the [FD] key twice.

5.4.2 DIRECTORY-of-ALL Function and Operations

The DIRECTORY-of-ALL function is used to list all files stored within a user disk.

Presss the [FD] key to display the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu ites. Move the input prompt to the command selection menu item of the sub menu screen. Since the DIRECTORY-of-MENU has already been selected, change to DIRECTORY-of-ALL by pressing the [O] [NEXT] (or [PREV]) keys. To perform the DIRECTORY-of-ALL operation specify either disk drive F0 (built-in drive) or disk drive F1 (auxiliary (external drive) first and then press the [FD] key once more. Disk drive F0 will be automatically selected in default of disk-drive selection.

The heading of the directory display means the following: "name" indicates the file name; "blks" (blocks) indicates the file size (1 block = 256B); "attri" indicates the file attribute (see subsection 5.1.4), and; "date" indicates the date and time when the file has been created.

Press the [STOP] key to erase the FD sub menu screen.

Pressing a key of the MENU key group also erases the FD sub menu screen. Press the [GET] or [SAVE] key to erase the sub menu screen after the GET or SAVE operation ends.

5.5 REGISTER FUNCTION AND OPERATIONS

The REGISTER function is used to create registered files (see subsection 5.1.4) that are controlled by the QuickGET function (see subsection 5.2.2).

One registered file can be created for each main menu screen. These files are created by registering a user or system-saved file (see subsection 5.1.4) with the REGISTER function.

This function can also be used for checking the original of a registered file that has already been "registered".

If a system-saved file has been registered as a registered file, system-saved file names that have been updated when the PURGE function was executed. In addition, if the original of a registered file ia deleted, it will no longer be possible to check which of the files is the original. The role of the registered file itself, however, will still remain unchanged.

Press the ⌷FD⌷ key to display the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu items. Move the input prompt to the command selection menu item of the sub menu screen. Since the DIRECTORY-of-MENU command has already been selected, change this command must be to REGISTER by pressing the ⌷NEXT⌷ key. To perform the registration operation specify the original file name used for registration and specify either disk drive F0 (built-in drive) or disk drive F1 (auxiliary (external) drive). Then press the ⌷FD⌷ key once more.

If you want to check the original file name of a registered file, that file name can be displayed only by selecting the REGISTER command.

Press the ⌷STOP⌷ key to erase the FD sub menu screen. The FD sub menu screen can also be erased by pressing a key of the MENU key group. Press the ⌷GET⌷ or ⌷SAVE⌷ key erase the sub menu screen after the GET or SAVE operation ends.

5.6 PURGE FUNCTION AND OPERATIONS

The PURGE function is used to erase all system-saved files (see subsection 5.1.4) that are created using the QuickSAVE function (see subsection 5.3.2).

General files (user files) are to be erased using the DELETE function (see section 5.7). However, since system-saved files are managed collectively by the TR4726, these files should be erased (if necessary) using this PURGE function in order to maintain their consistency. The specified number of files are erased collectively in the order that they have been created. If the series of system-saved files that are no longer necessary include those which are to remain saved, execute the PURGE function only after copying the contents of those files into a user file using the COPY function (see section 5.10).

Press the ⌈FD⌉ key displays the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu items. Move the input prompt to the command selection menu item of the sub menu screen. Since the DIRECTORY-of-MENU command has already been selected, changed this command to PURGE by pressing the ⌈NEXT⌉ key twice.

Before erasing a file, check the file name in advance using the directory display function. To do so, first execute the DIRECTORY-of-MENU function (see subsection 5.4.1) and then press the ⌈NEXT⌉ key twice to change that function to PURGE. Note, however, that if the built-in drive is used, the ⌈FD⌉ key must be pressed not once but twice when executing the DIRECTORY-of-MENU function. If an auxiliary (external) drive is to used, drive F1 must be specified before pressing the ⌈FD⌉ key for the second time.

Next, press the ⌈↺⌉ key twice to move the input prompt to the NUMBER OF DELETED FILE menu item, and then press the ⌈NEXT⌉ or ⌈PREV⌉ key to set the number of files to be erased. The number of files to be erased is preset to 0 initially. Each time the ⌈NEXT⌉ key is pressed the number of files increase by one. Pressing the ⌈FD⌉ key with the number of files remaining preset to 0 will display the maximum number of files that can be erased. To start erasing press the ⌈FD⌉ key after setting the number of files. After erasing, the results will be displayed on the screen as the directory screen.)

The oldest file (having the ".S1" extender) is erased first. Files remaining unerased will have their extender numbers reduced according to the erased number of files.

This extender will be changed after the system-saved files are set as registered files.

Note that the PURGE function will not work if the disk is placed in a write-protected status (see subsection 5.1.2).

Press the ⬚STOP⬚ key to erase the FD sub menu screen. The FD sub menu can also be erased by pressing a key of the MENU key group. Press the ⬚GET⬚ or ⬚SAVE⬚ key to erase the sub menu screen after completing the GET or SAVE operation.

5.7 DELETE FUNCTION AND OPERATIONS

The DELETE function erases user files (see subsection 5.1.4). File are erased by specifying one file name each time. The wild cards of file names are not supported by this function.

Use the PURGE function (see section 5.6), not the DELETE function, to erase system-saved files (see subsection 5.1.4).

Press the ⌈FD⌉ key displays the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu items. Move the input prompt to the command selection menu item of the sub menu screen. Since the DIRECTORY-of-MENU command has already been selected, change this command to DELETE by pressing the ⌈NEXT⌉ key three times.

Before deleting a file, it is advisable to check the file name in advance using the directory display function. In you have done the preceding step, first execute the DIRECTORY-of-MENU function (see subsection 5.4.1) and then press the ⌈NEXT⌉ key three times to change that function to DELETE. Note, however, that if the built-in drive is used, the ⌈FD⌉ key must be pressed twice when executing the DIRECTORY-of-MENU function. If an auxiliary (external) drive is used, drive F1 must be specified before pressing the ⌈FD⌉ key for the second time.

Next, move the input prompt to the file-name input menu item using the ⌖ key, and then input a file name using a key of the ENTRY key group.

After a file name has been input, press the ⌈FD⌉ key to delete the file. After the file has been deleted, the results will be displayed on the directory screen.

Note that the DELETE function will not work if the disk is placed in a write-protected status (see subsection 5.1.2).

Press the ⌈STOP⌉ key to erase the FD sub menu screen.

The FD sub menu screen can also be erased by pressing a key of the MENU key group. Press the ⌈GET⌉ or ⌈SAVE⌉ key to erase the sub menu screen after completing the GET or SAVE operation.

5.8 FORMAT FUNCTION AND OPERATIONS

   The FORMAT function creates a user disk (see Section 5.1.3). When a
   floppy disk (blank disk) is purchased, it cannot be used in this system.
   The disk must be formatted so that data can be written on it. When a
   blank disk is formatted, it is called the user disk. The capacity of
   blank disk (unformatted disk) is 1M bytes but the capacity of user disk
   (formatted disk) is 632.5K bytes. (1K bytes is equal to 1024 bytes).

   The user disks created by the FORMAT function can be identified by the
   disk ID and description. The disk ID has the standard format of the
   system disk which has created the user disk. For example, if a user disk
   is created by the system disk having the disk ID of "TR47250 SYSTEM DISK",
   this user disk has its disk ID of "TR47250 USER DISK". If the system disk
   and user disk have different disk IDs, data cannot be transferred between
   them.

   For the description, the user can specify any desired character string of
   up to 20 alphanumeric characters to identify each user disk.

   When the ⌊FD⌋ key is pressed, the "FD" submenu is displayed at the right
   of the screen. The main menu will change to the half-tone screen and data
   entry will be halted temporarily. The prompt will move to the menu item
   on the menu screen for command selection. The "DIRECTORY-of-MENU" command
   is currently selected on the screen. Press the ⌊NEXT⌋ or ⌊PREV⌋ key four
   times in succession to select the "FORMAT" command (see Figure 5-25).

   Then, press the ⌊◇⌋ key to shift the prompt to the DRIVE or DESCRIPTION
   menu item. By selecting the DRIVE menu item, specify the drive ("F0:" is
   the default built-in drive and "F1:" is the auxiliary drive). By
   selecting the DESCRIPTION menu item, enter the disk identification name
   and press the ENTRY key. The disk name will be written on the disk. It
   can be displayed on the screen any time by using the "STATUS-of-DISK"
   function (see Section 5.11.2). An input example is given in Figure 5-26.

   Press the ⌊FD⌋ key, and the disk formatting will start (see Figure 5-27).
   As an incorrect operation of the FORMAT function may erase all necessary
   files, the verification message is displayed before the disk is formatted.
   If you agree to format the disk, respond with "Y" (by pressing the blue
   ⌊SHIFT⌋   and ⌊2⌋ keys simultaneously).
                    Y
   The system disk and write-protected user disks cannot be formatted.

   When formatting is complete, the status information of the created user
   disk is displayed on the screen (see Figure 5-28). The display format of
   this information is the same as that of the "STATUS-of-DISK" function.
   The available disk area is 2530 blocks or 632.5K bytes as a single block
   is equal to 256 bytes.

   To delete the "FD" submenu, press the ⌊STOP⌋ key. It can also be erased
   by pressing the MENU group key. When the ⌊GET⌋/⌊SAVE⌋ key is pressed, the
   submenu is erased after disk formatting.

5.9 RENAME FUNCTION AND OPERATIONS

The RENAME function renames the user files (see subsection 5.1.4) that have been created by the user. Neither system-saved files nor registered files can be renamed with this function. Use the COPY function (see section 5.10) to create files having the same contents as those of system-saved files or registered files.

Pressing the ⌈FD⌉ key to display the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu items. Move the input prompt to the command selection menu item of the sub menu screen. Since the DIRECTORY-of-MENU command has already been selected, change this command to RENAME by pressing the ⌈PREV⌉ key three times.

Before renaming a file, it is advisable to check the file name in advance using the directory display function. In that case, first execute the DIRECTORY-of-MENU function (see subsection 5.4.1) and then press the ⌈PREV⌉ key three times to change that function to RENAME. Note, however, that if the built-in drive is used, the ⌈FD⌉ key must be pressed twice when executing the DIRECTORY-of-MENU function. If an auxiliary (external) drive is used, drive F1 must be specified before pressing the ⌈FD⌉ key for the second time.

Move the input prompt to the file-name input menu item using the ⌈⊗⌉ key, and then input the current and new file names using a key of the ENTRY key group. (Input the current file name to the OLD NAME column, and input a new file name to the NEW NAME column.)

After the file names have been input, press the ⌈FD⌉ key to start renaming the files. After the renaming the files, the results will be displayed on the directory screen.

Note that the RENAME function will not work if the disk is placed in a write-protected status (see subsection 5.1.2).

Press the ⌈STOP⌉ key to erase the FD sub menu display.

The FD sub menu screen can also be erased by pressing a key of the MENU key group. Press the ⌈GET⌉ or ⌈SAVE⌉ key to erase the sub menu screen after completing the GET or SAVE operation.

5.10 COPY FUNCTION AND OPERATIONS

The COPY function copies the contents of one file to another file. This function is used to back up the measuring conditions, measured data, or other files which have already been created.

The file containg the data to be copied is referred to as the source file. The file which the data is to be copied to is referred to as the destination file. If the file that has been specified as the destination file is already stored within the disk, then the previous data will be erased and new data will be stored into that file.

If the file that has been specified as the destination file is not yet stored within the disk, then a new file will be created and data written into that file.

Any user file can be specified at either the source or the destination source. The desired system-saved file or registered file can be specified as the source file, but it cannot be specified as the destination file.

Figure 5-2 shows the File combinations that can be made using the COPY function.

Press the ⎡FD⎤ key to display the FD sub menu screen on the right side of the CRT. It is then temporarily impossible to input data for the menu items. Move the input prompt to the command selection menu item of the sub menu screen. Since the DIRECTORY-of-MENU command has already been selected, change this command to COPY by pressing the ⎡PREV⎤ key tiwce.

Before copying a file, it is advisable to check the file name in advance using the directory display function. In that case, first execute the DIRECTORY-of-MENU function (see subsection 5.4.1) and then press the ⎡PREV⎤ key twice to change that function to COPY. Note, however, that if the built-in drive is used, the ⎡FD⎤ key must be pressed twice when executing the DIRECTORY-of-MENU function. If an auxiliary (external) drive is used, drive F1 must be specified before pressing the ⎡FD⎤ key for the second time.

In the directory display, data can be scrolled only when the scroll mark is on the bottom line of the FD menu screen. (The scroll mark in this position indicates that eight or more files are present.)

Next, move the input prompt to the file-name input menu item using the ⎡↻⎤ key, and then input file names using a key of the ENTRY key group. (The name of the file to be specified as the source file must be input to the FROM column, and the name of the file to be specified as the destination file must be input to the TO column.)

After file names have been input, press the ⎡FD⎤ key to start the copying. After copying is completed, the results will be displayed the directory screen.

Note that the COPY function will not work if the disk is placed in a write-protected status (see subsection 5.1.2).

Press the ⟦STOP⟧ key to erase the FD sub menu screen. The FD sub menu screen can also be erased by pressing a key of the MENU key group. Press the ⟦GET⟧ or ⟦SAVE⟧ key to erase the sub menu screen after completing the GET or SAVE operation.
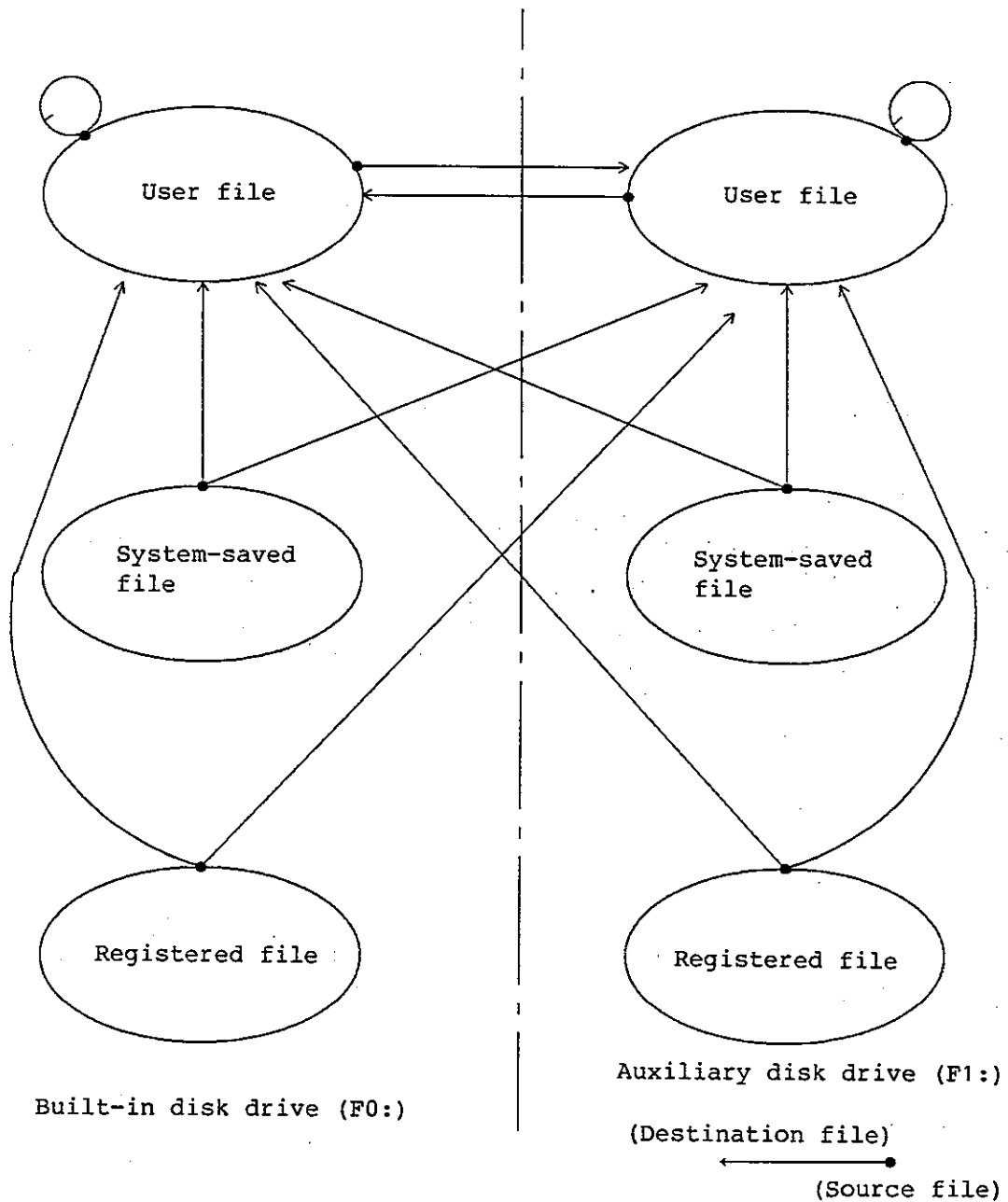
Figure 5-2 COPY Function and Files

5.11 STATUS FUNCTIONS AND OPERATIONS

5.11.1 STATUS-of-FILES Function and Operations

The STATUS-of-FILES function displays the operational status of files
(see subsection 5.1.4 for details of file attributes) that are related
to the main menu screen currently diaplayed.

The total number and size of registered files, system-saved files, and
user files are displayed.

Press the [FD] key to display the FD sub menu screen on the right side
of the CRT. It is then temporarily impossible to input data for the
menu items. Move the input prompt to the command selection menu item
of the sub menu screen. Since the DIRECTORY-of-MENU command has
already been selected, change this command to STATUS-of-FILES by
pressing the [PREV] key. Next, move the input prompt to the DRIVE menu
item using the [◇] key. Specify either disk drive F0 (built-in
drive) or disk drive F1 (auxiliary (external) drive), and press the
[FD] key once more. This will initiate the STATUS-of-FILES operation.

The file size is displayed in block units. (1 block = 256B)

Press the [STOP] key to erase the FD sub menu screen. Then FD sub menu
screen can also be erased by pressing a key of the MENU key group.
Press the [GET] or [SAVE] key to erase the sub menu screen after
completing the GET or SAVE operation.

5.11.2 STATUS-of-DISK Function and Operations

The STATUS-of-DISK function displays disk identification information
and the operational status of the disk.

Pressing the [FD] key to display the FD sub menu screen on the right
side of the CRT. It is then temporarily impossible to input data for
the menu items. Move the input prompt to the command selection menu
item of the sub menu screen. Since the DIRECTORY-of-MENU command has
already been selected, change this command to STATUS-of-DISK by
pressing the [PREV] , [◇] , and [NEXT] keys, in that order. Next, move the
input prompt to the DRIVE menu item using the [◇] key and specify
either disk drive F0 (built-in drive) or disk drive F1 (auxiliary
(external) drive). Then press the [FD] key once more. This will
initiate the STATUS-of-DISK operation.

For user disks, the screen contents mean the following:

The data in the DISK ID column has been written forcibly during
formatting, and the personality kits available for that particular
data disk are determined in an unique manner by the system disk that
was used at that time. (This ensures that data for different
personality kits are not mixed on a single user disk.)

The data in the DESCRIPTION column, which has also been written during
formatting, can be used for disk management.

The operational status of the disk is displayed in the order of
AVAILABLE AREA   USED AREA   BAD AREA.   (1 block = 256B)
BAD AREA refers to the area on the disk that is unavailable because it
is flawed or damaged in same way. Such a bad area is skipped during
file system operation.

Press the [STOP] key to erase the FD sub menu screen. The FD sub menu
screen can also be erased by pressing a key of the MENU key group.
Press the [GET] or [SAVE] key to erase the sub menu screen after
completing the GET or SAVE operation.

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6.   PROGRAM PREPARATION AND EXECUTION (PROGRAM/AUTO)

The PROGRAM/AUTO function of the TR4726 is not provided this current
software version. Therefore, no description of this function is given in
this section. This section will be described aa soon as the PROGRAM/AUTO
function is provided.

MEMO

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7. SERIAL COMMUNICATIONS FUNCTIONS AND OPERATIONS (COMM)

7.1 OUTLINE

The TR4726 can serially communicate with external computer systems
(hereinafter referred to as host computers) or terminal devices via the
RS-232C interface located on the rear panel.

The COMM sub menu can be displayed on all main menus, except the UTILITY
menu.
For details of the communications mode and parameter setting procedures,
refer to section 8.3, "Communications (RS-232C) Parameter Setting.

7.2 EXECUTION OF REMOTE CONTROL

This section describes the procedure for placing the TR4726 in the remote
control mode. First, change the initial display of the TR4726 to a menu
screen other than the UTILITY menu screen and press the COMM key. The
COMM sub menu shown in Figure 7-1, will then be displayed. Press the COMM
key once more to set the TR4726 in the remote control mode. Commands can
be now input from a host computer. Start the control program of the host
computer. Send the command specified by the appropriate protocol to
remote control. Once the TR4726 has been placed in the remote control
mode, only the STOP key can be pressed.
Remote control can be terminated using the EN command (see Figure 7-2)
that is usually sent from a host computer, but it can also be forcibly
interrupted using the STOP key (see Figure 7-3). If the STOP key is
pressed, "REMOTE: Aborted!" will be displayed and the remote control mode
is released.
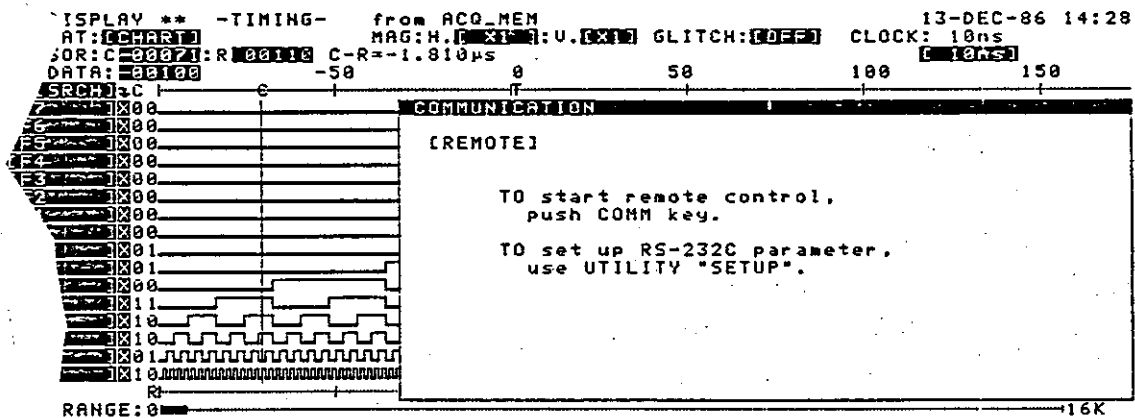
Figure 7-1 COMM Menu Screen

7.3 REMOTE CONTROL PROTOCOLS

Protocols refer to the rules that the TR4726 must follow during interactive communications with host computers. To execute remote control accurately, programs that satisfy the protocols (such programs are referred to as remote control programs) must be prepared and executed by the host computers.
Three different protocols are provided: a normal sequence, a forced-interruption sequence, and a time-out sequence.

(1) Normal sequence
In the normal sequence, commands and command responses alternate as shown in Figure 7-2.
The following describes the normal sequence together with associated operations.

(1) When the COMM key is pressed once more, the TR4726 will enter the remote control mode and will no longer become operable from the keyboard located on the front panel. (This state is equivalent to the online status of terminal devices and other external units.)

(2) The appropriate remote-control program is to be started by the host computer. Under remote control programs, a dummy delimiter (@) must be issued first.

(3) The TR4726 sends R@ in response to this delimiter.
(R indicates that the TR4726 is ready for receiving a command.)

(4) A command is issued from the host computer.

(5) The TR4726 receives the command and then executes it.
After that, the TR4726 reports one of anyone of R@, E@, and T@. If the command is the data-transfer request command (DS/DT command), then one of the above three delimiters will be issued after completing the data transfer.

(6) Steps (4) and (5) are to be repeated as often as necessary to execute remote control.

(7) The EN@ command is sent from the host computer to a normally end the sequence come to.

(8) When the TR4726 receives EN@, it will send R@ to the host computer and release the remote control mode.

TR4726   Host computer

① COMM key ──────→ │   │ │ Time
                                              ↓

Parameter setting {

② COMM key ──────→ │   ←───────── ③ Start of the
                          @(dummy)   remote control
                                                command

                   ④ R@

                   ⑤ Command @

Remote control mode
(No key operations
can be done)
                   ⑥ R@/E@/T@

                   ⑦ Repetition of
                      ⑤ and ⑥

                   ⑧ EN@

                   ⑨ R@

Key operations
can be done
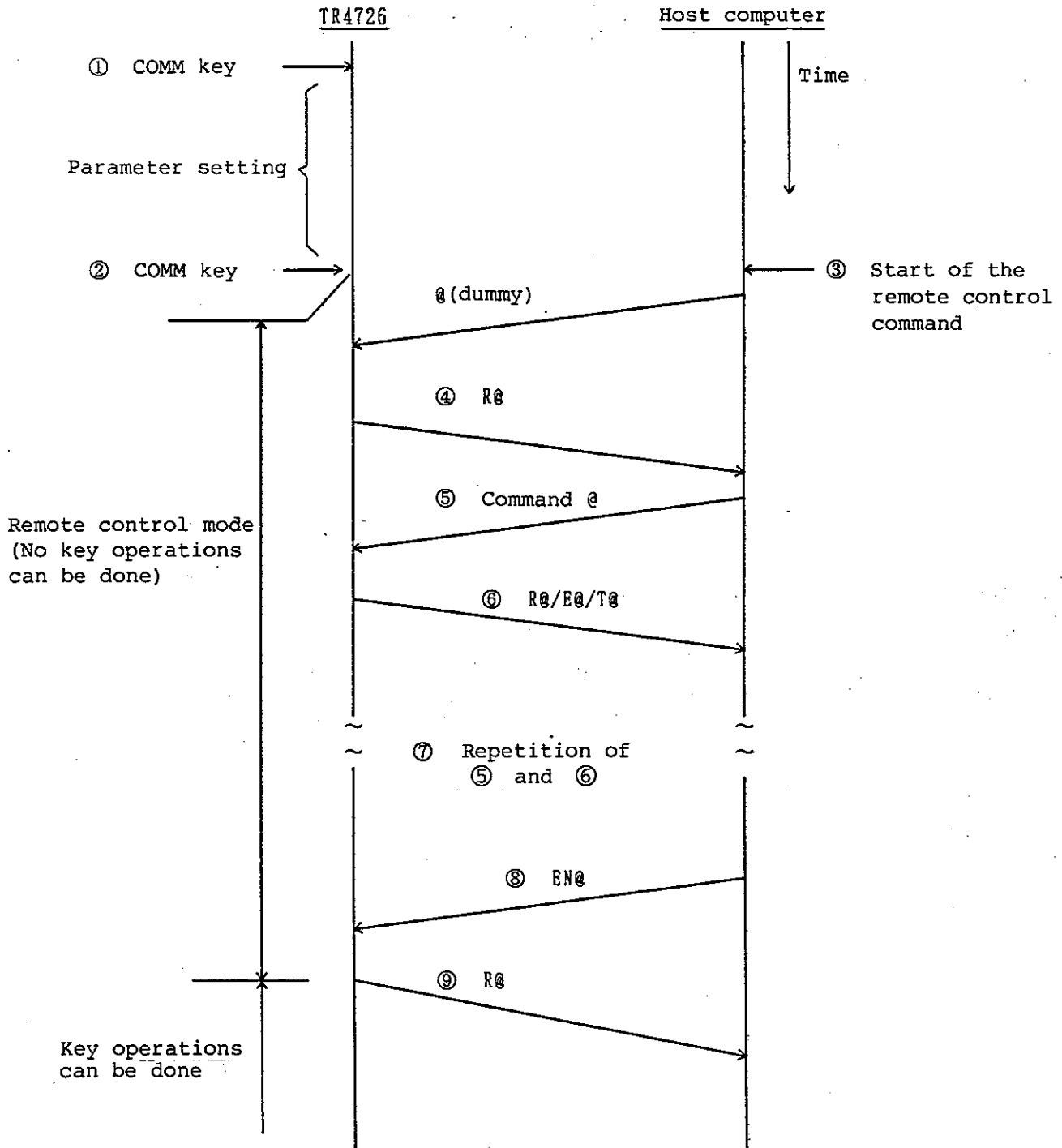
Figure 7-2 Normal Sequence

(2) Forced-interruption sequence
The forced-interruption sequence shown in Figure 7-3 will be set when the normal sequence in progress is aborted by pressing of the STOP key (the TR4726 side).

① When the STOP key is pressed during the execution of normal sequence, !@!@ will be send to the host computer and the remote control mode will be released.

② The host computer must then perform the appropriate processing operation for the forced-interruption.

TR4726   Host computer

Remote control mode   │ Time

①STOP key

Key operations   ② Exception
can be done   handling
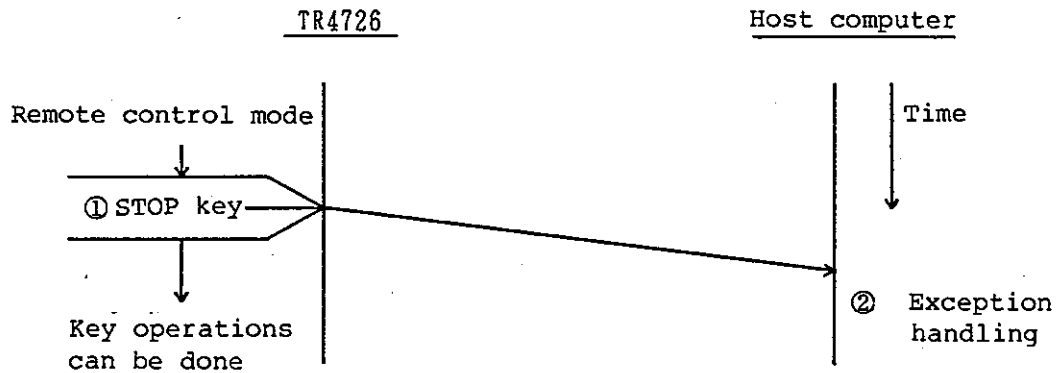
Figure 7-3 Forced-Interruption Sequence

(3) Time-out sequence
If during the normal sequence communications are interrupted because of line or host computer faults, then the time-out sequence shown in Figure 7-4 will be set after a fixed time and the TR4726 will interrupt the communications.

① If during the execution of the normal sequence no delimiters are detected within five seconds after receiving a part of commands from the host computer, then !@!@ will be sent to the host computer and the remote control mode will be released.

② The host computer must then perform the processing operation appropriate for the forced-interruption.
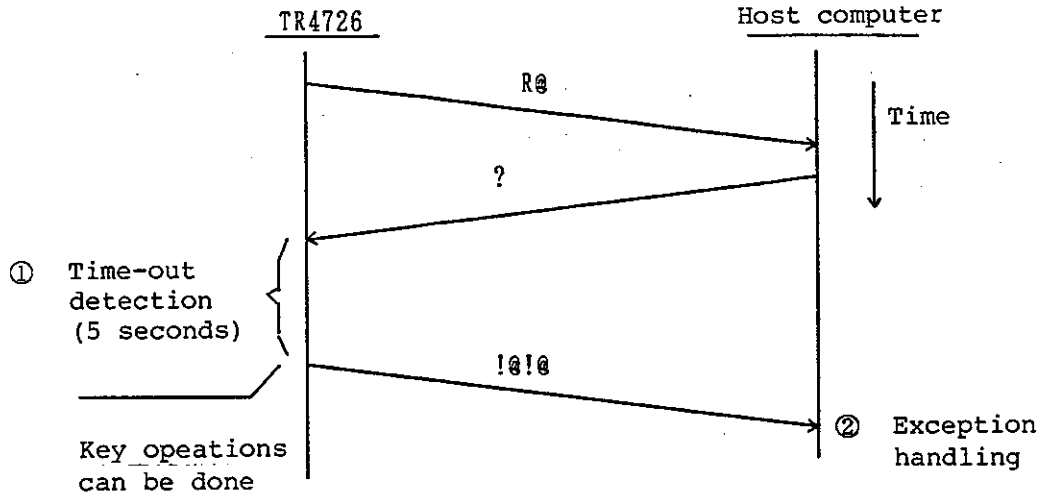
Figure 7-4 Time-Out Sequence

7.4 REMOTE CONTROL COMMANDS

Remote control commands (hereinafter referred to as commands) are sent from the host computer to the TR4726 in order to externally control of the TR4726.
Two types of commands are sent: data transfer commands and menu-related commands. The commands follow the rules given below:

. Commands are issued in either uppercase or lowercase ASCII code.
  (Enclosed in ",".)

. Commands and their respective arguments are each separated by more than one blank. (Expressed by __.)

. Each command ends with a delimiter (@).

. The codes in arguments have the following meaning:

    b: One binary digit (Don't care "X" included)
    d: One decimal digit
    h: One hexadecimal digit
    file: File name (6 characters, maximum)
    ext: Extension of the file (3 characters, maximum)
    +/-:   + or -
    U: Units
    Enclosed in { } : Option

    (All the above are in ASCII code.)

. For decimal numbers, the preceding 0s and + signs can be omitted.

(1) Data transfer commands

  ① DS command
    After receiving this command, the TR4726 transfers the measured data stored within the ACQ_MEM of the state analyzer to the host computer. In default, only the necessary data will be transferred to the host computer if all data stored within ACQ_MEM is specified using the RS command (see ② below).

    Format: "DS"@

② RS command
The range of data transferred using the DS command is to be specified
by two line numbers. The two line numbers must take decimal values
from 0000 to 1023, with the value of the first line number being
smaller than or equal to that of the second line number. If no data
is present within the specified range, then the specification will be
ignored.

> Format : "RS_dddd,dddd"@
> Example: "RS_0000,0099"@ --- To be specified so that the first
> 100 lines of data are transferred.

③ DT command
After receiving this command, the TR4726 transfers the measured data
stored within the ACQ_MEM of the state analyzer to the host computer.
In default, only the necessary data will be transferred to the host
computer if all data (other than glitch data) stored within ACQ_MEM is
specified using the RT command (see ④ below).

> Format: "DT"@

④ RT command
The range of data transferred using the DT command is to be specified
by the channel number and the memory range. The channel number must
be specified by setting PRB_F7 (probe F, channel 7) as MBS
(most-significant bit), setting the desired channel to a binary 1, and
setting the undesired channel to a binary 0. The transfer memory
range (ddddd,ddddd) must be specified by setting the transfer starting
and ending positions to ng five decimal digits (0000 to 65,519). In
addition, transfer control of glitch can be sent not using g=0 but
using g=1. In default, it is recognized as g=0.

> Format: "RT_{g:} hhhh:ddddd,ddddd"@

(2) Menu-related commands

① CO command
After receiving this command, the TR4726 displays the CONFIG menu
screen.

> Format: "CO"@

② TR command
After receiving this command, the TR4726 displays the TRACE menu
screen.

> Format: "TR"@

③ SY command
After receiving this command, the TR4726 displays SYMDEF menu screen.

> Format: "SY"@

④ DI command
After receiving this command, the TR4726 displays the DISPLAY menu
screen.

    Format: "DI"@

⑤ GE command
After receiving this command, the TR4726 GETs data from the specified
file within the disk inserted into built-in drive F0 or auxiliary
(external) drive F1. The default value of drive specification is F0:.

    Format: "GE_{Fb:} file.ext"@

⑥ SQ command
After receiving this commands, the TR4726 QuickSAVEs data into a
system-saved file within the disk inserted into F0: or F1:. The
default value of drlve specification is F0:.

    Format: "SQ_{Fb:} "@

⑦ SA command
After receiving this command, the TR4726 SAVEs data into a
system-saved file within the disk inserted into F0: or F1:. The
default value of drive specification is F0:.

    Format: "SA_{Fb:} file.ext"@

⑧ RU command
After receiving this command, the TR4726 starts measurement. If
measurement does not end even after the lapse of the specified time
since the beginning of the measurement process, then "T"@ (time-out)
will be sent from the TR4726 and the measurement process will be
aborted. The value of ddd specified must be a value from 1 to 255,
and U must be specified in the S (second)/M (minute)/H (hour) format.
The default value is 255 s (4 minutes, 16 seconds).

    Format: "RU _{dddU}"@

(3) Data transfer from the ACQ_MEM of the timing analyzer
    Data is transferred using the DT or RT command in the following formats:

    Format: "%"   "size of data to be transferred",
                                     "transfer starting position", "transfer
                                     ending position", "trigger position", "No.
                                     of transfer channels", "clock", "whether
                                     or not to transfer glitch data" @

              "#"   "channel No.", "presence/absence of data
                                     to be transferred", "block size of data to
                                     be transferred", "No. of blocks of data to
                                     be transferred" @

"Data to be transferred" @ --- "Data to be transferred" @ "&",
                                 "check data" @
                                 (Repeated for each of the 16 channels.)

If glitch data is to be transferred, "#" will become "*" but the format
will remain the same. Glitch data will be transferred only after 16
channels or 8 channels of data have been transferred, depending on the
number of transfer channels used.

"size of data to be transferred":	5 decimal digits (up to 65,520) (Magnitude in the time-base direction) (No. of samples)
"transfer starting position" :	5 decimal digits
"transfer ending position" :	5 decimal digits
"trigger position" :	"+/-", 5 decimal digits. The position of the trigger existing after the oldest data has been set as "0000". "?????" (irrespective of the trigger position) if the data is one existing after forced-interruption.
"No. of transfer channels" :	No. of ACQ channels "_8CH" or "16CH".
"clock" :	5 characters to indicate the sampling clock. (Example: "_10ns", "3.3ns")
"whether or not to transfer glitch data" :	1 character A for transfer, N for no transfer.
"channel No." :	2 characters to indicate a specific channel name (such as F7). 16 channel numbers are transferred even if there is no data to be transferred.
"presence/absence of data to be transferred" :	1 character A if present, N if absent. (As per the RT command)
"block size of data to be transferred" :	3 decimal digits to indicate the number of blocks into which one channel of data is to be divided. (Default: 064)
"No. of blocks of data to be transferred" :	1 decimal digit to indicate the number of transfer blocks per channel. (For 64K data transfer, up to 256B)

"data to be transferred"   : A maximum of 64 hexadecimal digits of
                                data itself. (Every four bits of old
                                data are integrated into one
                                hexadecimal digit.) In the transfer
                                block data is insufficient data will be
                                sent in ASCII code "-" if the number of
                                bits wanting is four or more: if it is
                                less than four, data will be sent up to
                                the required block size after it has
                                been filled in by a binary 0.

"check data"   : 3 decimal digits. The sum of "1", "3",
                                and "7" is included in the data to be
                                transferred. It can be used for
                                transfer check purposes.

NOTE

1: After receiving the DS or DT command, the TR4726 sends the dummy @.
    Data transfer will start when the host computer receives the dummy @
    and then sends R@ in return. The host computer must send R@ in return
    each time the data delimiter (@) comes.

2: Once B@ has been returned from the host computer, it becomes possible
    to nullify the effects of the DS or DT command during data transfer.

---

(4) Status reports

① Ready for command issuance (Ready)
   This status report informs the host computer that the preceding
   command has normally ended and that the TR4726 has become ready for
   receiving the next command.

       Format: "R"@

② Error occurring (Error)
   This status report informs the host computer that an error has
   occurred within the TR4726.

       Format: "E"@

③ Time-out
   This status report informs the host computer that the specified time
   is out within the TR4726.

       Format: "T"@

④ Forced-interrupt occurring (Abort)
   This status report informs the host computer that the normal sequence
   is to be aborted within the TR4726 by establishing the
   forced-interruption sequence or the time-out sequence.

       Format: "!"@

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8. UTILITY FUNCTION AND OPERATIONS

8.1 UTILITY COMMAND LOADING

The utility function, which consists of several utility commands, provides various types of services not directly related to measurement.

Unlike the programs that control the other parts of the TR4726, utility commands are loaded from the system disk and executed each time they are used. That is, utility commands are "transient commands". When the UTILITY key is pressed, the UTILITY screen (Figure 8-1) is displayed. Next, when a command is selected using the EDIT key or the rotary knob (the prompt is moved to the designation number of the command to be executed) and then the RUN key is pressed, the program that contains the specified command will be loaded from the system disk.

Note that the keys available with the UTILITY function are only those of the MENU key group, in addition to the above. If the correct system disk has not yet been inserted into the built-in drive (F0:) when the RUN key is pressed, then the program will not be loaded. If that is the case, insert the correct system disk into the drive and then press the RUN key once more.

```
** UTILITY **      F0: UTILITY ONLY                      03-DEC-86 19:01
Please select a UTILTY, and push RUN key to execute
(If you enter the other disk, push UTILITY key again)
        **DSKCPY.EXE
         *FORMAT.EXE
         *SETUP.EXE
```

```
KNOB  EDIT**
```

Figure 8-1 UTILITY Menu Screen

8.2 CALENDAR CLOCK SETTING

The TR4726 has a built-in calendar clock that is backed up by Ni-Cd
batteries. The date and time is set using the UTILITY menu screen.

On the UTILITY menu screen, select the SETUP.EXE command and then press
the RUN key to load the program. The screen shown in Figure 8-2 is
displayed to enable clock time and communications parameter setting.

Set the date (year/month/day) and time using the SELECT key or the rotary
knob. Next, press the RUN key to set the clock to that value and to
display on the right side at the top of the CRT screen. Press the STOP
key to return the display to the UTILITY menu screen. In addition,
pressing keys of the MENU key group will display their specific menu
screens.

While the POWER switch on the TR4726 remains set to the ON position, the
Ni-Cd batteries are recharged continually. The clock will work for more
than two weeks, provided that the batteries are fully charged.

```
** SET-UP **                                              03-DEC-86 19:38
      REAL TIME CLOCK                    DISK DRIVE

        [03]-[DEC]-[86]  [19]:[05]          EXTERNAL DISK DRIVE [YES]
        <PUSH  RUN  KEY TO START>           DEFAULT DISK DRIVE  [FD]

      RS-232C PORT CONFIGURATION

        CONNECTION    [DCE] <HOST>
        BAUD RATE     [9600] BPS
        WORD LENGTH   [8] BITS
        STOP BIT(S)   [1]
        PARITY        [NONE]
        TX DELIMITER  [CR+LF]
        RX DELIMITER  [CR+LF]
        HAND-SHAKE    [*NONE*  ]

                                                          KNOB  EDIT↔
```

Figure 8-2 SETUP Menu Screen

8.3 COMMUNICATIONS (RS-232C) PARAMETER SETTING

On the UTILITY menu screen, select the SETUP.EXE command. Press the RUN key to load the program. The screen shown in Figure 8-3 is displayed to enable clock time and communications parameter setting.

① CONNECTION
This parameter specifies the form of connection. Select either [DCE] (HOST) or [DET] (TERMINAL).

② BAUD RATE
This parameter specifies the baud rate. Select one from amoung 50, 55, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, and 19200 BPS (bits per second).

③ WORD LENGTH
This parameter specifies the word length. Select either 7 bits or 8 bits.

④ STOP BIT(S)
This parameter specifies the number of stop bits. Select either 1 bit or 2 bits.

⑤ PARITY
This parameter specifies a parity check mode. Select either [NONE], [EVEN], or [ODD].

⑥ TX DELIMITER
This parameter specifies a delimiter for the transmitting end. Select either [CR+LF], [CR], or [LF].

⑦ RX DELIMITER
This parameter specifies a delimiter for the receiving end. Select either [CR+LF], [CR] or [LF].

⑧ HAND-SHAKE
This parameter specifies a hand-shaking mode. Select either [NONE] or [X ON/X OFF].

Press the STOP key to return to the UTILITY menu. Pressing keys of the MENU key group will display their specific menu screens.

** SET-UP **   19-NOV-86 11:08

[19]-[NOV]-[86]   [11]:[07]

(PUSH RUN KEY TO START)

EXTERNAL DISK DRIVE [YES]
DEFAULT DISK DRIVE [F0:]

① — CONNECTION   [DCE] (HOST)
② — BAUD RATE   [9600] BPS
③ — WORD LENGTH   [8] BITS
④ — STOP BIT(S)   [1]
⑤ — PARITY   [NONE]
⑥ — TX DELIMITER [CR+LF]
⑦ — RX DELIMITER [CR+LF]
⑧ — HAND-SHAKE   [NONE   ]

EDIT◆◆

Figure 8-3 SETUP Menu Screen (for RS-232C Parameter Setting)

Use the SELECT key or rotary knob to set the above parameters.

8.4 SETTING THE DISK DRIVE

On the UTILITY menu screen, select the SETUP.EXE command. Press the RUN
key to load the program. The screen shown in Figure 8-4 is displayed to
enable specification of the presence/absence of an external floppy disk
drive and default disk-drive selection.

(1) EXTERNAL DISK DRIVE
   Select [YES] if an external drive is used; select [NO] if an external
   drive is used.

(2) DEFAULT DISK DRIVE
   Specify a default drive number for disk drive operation.
   Either F0: (built-in drive) or F1: (external drive) is available.
   Use the SELECT key or rotary knob to set the above two parameters.

```
** SET-UP **                                       13-DEC-86 14:29

   REAL TIME CLOCK                    DISK DRIVE

      [13]-[DEC]-[86]  [14]:[28]         EXTERNAL DISK DRIVE [YES] ——①
                                         DEFAULT DISK DRIVE  [F0:] ——②
      (PUSH  RUN  KEY TO START)


   RS-232C PORT CONFIGURATION

      CONNECTION    [DCE] (HOST)
      BAUD RATE     [ 9600] BPS
      WORD LENGTH   [8] BITS
      STOP BIT(S)   [1]
      PARITY        [NONE]
      TX DELIMITER  [CR+LF]
      RX DELIMITER  [CR+LF]
      HAND-SHAKE    [ NONE    ]



                                                    KNOB  EDIT↔
```
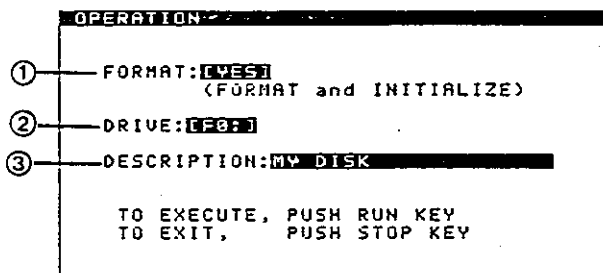
Figure 8-4 SETUP Menu Screen

8.5 FLOPPY DISK FORMATTING AND INITIALIZATION

On the UTILITY menu screen, select the SETUP.EXE command. Press the RUN
key to load the program. The screen shown in Figure 8-5 is displayed to
enable floppy disk formatting and/or initialization. After formatting the
disk, the floppy disk must be initialized. It can be assigned a disk name
consisting up to 20 characters. The physical formatting operation
mentioned above is performed in accordance with the format specified by
the user.

(1) FORMAT:
Select a physical format. Specify [YES] if both formatting and
initialization are to be performed; specify [NO] if only
initialization is to be made.

(2) DRIVE:
Select the drive to be used for formatting. Either [F0:] (built-in
drive) or [F1:] (external drive) is avaialble.

(3) DESCRIPTION:
Input a disk name up to 20 characters. Press the RUN key after
setting these parameters. Formatting and initialization will then be
performed. When this is completed, the screen shown in Figure 8-6
will display the RESULT window and the disk status information will be
output.
Press the STOP key to return to the UTILITY menu. Pressing keys of
the MENU key group instead will display their specific menu screens.

```
** FORMAT **                                              03-DEC-86 19:17

   ┌─OPERATION─────────────────────────────┐
   │                                        │
①─┼─FORMAT:[YES]                           │
   │        (FORMAT and INITIALIZE)         │
②─┼─DRIVE:[F0:]                            │
③─┼─DESCRIPTION:MY DISK                     │
   │                                        │
   │   TO EXECUTE, PUSH RUN KEY             │
   │   TO EXIT,    PUSH STOP KEY            │
   │                                        │
   └────────────────────────────────────────┘


                                                         KNOB  EDIT◄►
```

Figure 8-5   FORMAT Menu Screen

** FORMAT **   03-DEC-86 19:19

```
OPERATION                          RESULT

 FORMAT:[YES]
       (FORMAT and INITIALIZE)       DESCRIPTION:MY DISK
 DRIVE:[F0:]
 DESCRIPTION:MY DISK                 AVAILAVEL BLOCKS:  2530 blocks

                                     USED BLOCKS    :     2 blocks
  TO EXECUTE, PUSH RUN KEY
  TO EXIT,    PUSH STOP KEY           BAD  BLOCKS    :     0 block
```

KNOB   EDIT↔

Figure 8-6 End Screen

8.6 DISK COPY

On the UTILITY menu screen, select the DSKCPY.EXE command. Press the RUN
key to load the program. The screen shown in Figure 8-7 is displayed to
enable the copying of disks.

Copying can be carried out using either two drives (built-in and external)
or only one drive (built-in or external). Note that for single-drive
copying, it is necessary to alternately change the source and destination
floppy disks.

① COPY

For the selection item on the left side, specify the designation
number of the drive to be used as the destination. For the selection
item on the right side, specify the designation number of the drive to
be used as the source. In single-drive copying, the drive designation
numbers entered on both sides must be the same.

② VERIFY

Specify whether the results of copying are to be verified ([YES]) or
not ([NO]). If [YES] is specified, verification will take place each
time a file is copied. Press the RUN key after making the above two
specifications. A message window will then be displayed to guide
operator action.

At this time, the floppy disk used as the destination must be already
formatted. If it has not yet been formatted, set an appropriate
format in accordance with section 8.4.

** DISK COPY **   13-DEC-86 14:12

① ——————— COPY [F0] ➔ [F0]
② ——————— VERIFY [NO]
            All files will be copied
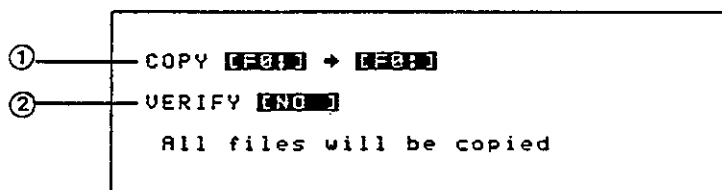
KNOB   EDIT↔

Figure 8-7 DSKCPY.EXE Menu Screen

```
** DISK COPY **                                              13-DEC-86 14:25


        ┌─────────────────────────────────────────┐
        │                                         │
        │   COPY [F0:]  →  [F0:]                   │
        │   VERIFY [NO ]                          │
        │    All files will be copied             │
        │                                         │
        └─────────────────────────────────────────┘

        ┌─────────────────────────────────────────┐
        │                                         │
        │   Please set source disk to F0:         │
        │   OK? (enter RUN) ■                      │
        │                                         │
        └─────────────────────────────────────────┘

                                              KNOB   EDIT↔
```

Figure 8-8 Operation-Assisting Screen

The following operation-guide messages will be displayed:
. "Please set source disk to F0:"
  or "Please set source disk to F1:"
. "Please set destination disk to F0:
  or "Please set destination disk to F1:"

Various messages related to the operational status and results of program
execution will be displayed on the bottom line of the screen.

(1) "in progress" --- Command execution in progress

(2) "reading" ------- Reading data from the source disk under way (only
                      for single-drive copying)

(3) "writing" ------- Writing data from the source disk under way (only
                      for single-drive copying)

(4) "COMPLETION" ---- Completed

(5) "Use RUN or STOP key" -- RUN or STOP key is available

(6) "ERROR IN VERIFY" ------ Error found during verification

┌──────────────────────────── NOTE ────────────────────────────────┐
│   │
│   Execution of disk copying causes destruction of the acquired data. │
│   │
└───┘
```

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9. PRINT FUNCTIONS AND OPERATIONS

9.1 PRINT FUNCTION

The PRINT funtion can output the display data of the LIST screen of
DISPLAY menu to the printer having the RS-232C port. Also, it can output
the SYMDEF display data of STATE menu to the printer.

Recommended models:

- Epson's FP-80 series printer
- Epson's model 8148 intelligent serial interface

## 9.2 OPERATIONS

(1) Press the COMM key on the DISPLAY screen, and the screen shown in Figure 9-1 will appear.

(2) Specify the output data range (in the format of "from XX to XX").

(3) Press the COMM key again, and the on-screen data will be output to the printer (see Figure 9-2).

(4) To cancel data output, press the STOP key.

```
** DISPLAY **  -TIMING-  from ACQ_MEM                      03-SEP-88 10:09
FORMAT:[LIST ] C-R=0clock           GLITCH:[OFF]  CLOCK: EXT [ EXT ]
CURSOR:C-00050  GROUP [PRB_F ] [PRB_E ] [      ] [      ] [      ] [      ]
       R-00050  RADIX [ BIN ] [ BIN ] [ BIN ] [ BIN ] [ BIN ] [ BIN ]
  DATA:-00005-[    ]─────────────────────────────────────────────
        -00006  000011│COMMUNICATION                                    │
        -00005  000011│                                                 │
        -00004  000011│[PRINTER]                                        │
        -00003  000001│                                                 │
        -00002  000001│                                                 │
        -00001  000001│    (PRINT OUT FORMAT : LIST FORMAT)             │
       T 00000  000001│                                                 │
        00001  000001│    HEADER [YES]                                  │
        00002  000001│                                                 │
        00003  000001│    DATA from +00000 to +00100                   │
        00004  000001│                                                 │
        00005  000001│                                                 │
        00006  000001│                                                 │
        00007  000010│                                                 │
        00008  000010│                                                 │
        00009  000010│                                                 │
        00010  000011│                                                 │
RANGE:0├──────────────────────────────────────────────────────┤4K
                                                        KNOB  EDIT
```

Figure 9-1 DISPLAY Menu Screen

```
.** DISPLAY **  -TIMING-   from ACQ_MEM                          08-SEP-88 12:48
                                                 CLOCK: EXT
      GROUP [PRB_F ] [PRB_E ] [        ] [       ] [       ] [        ]
      RADIX [ BIN  ] [ BIN  ] [ BIN  ] [ BIN  ] [ BIN  ] [ BIN  ]
    ---------------------------------------------------------------------------
      00000  00000100 00110111
      00001  00000110 01001011
      00002  00000110 11111111
      00003  00000110 11010100
      00004  00000110 11010100
      00005  00000110 11010100
      00006  00000110 11010100
      00007  00001000 01001100
      00008  00001000 11111111
      00009  00001000 01110010
      00010  00001100 01001110
      00011  00001100 11111111
      00012  00001100 01110101
      00013  00001100 01110101
      00014  00001110 10011111
      00015  00001110 10011111
      00016  00001110 10011111
      00017  00001110 01001111
      00018  00001110 11111111
      00019  00001110 01100101
      00020  00001110 01100101
      00021  00000000 01010000
      00022  00000000 01111111
      00023  00000000 01110101
      00024  00000000 01110101
      00025  00001110 10011111
```

Figure 9-2 Print Example of TIMING LIST Screen

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TR4726
LOGIC ANALYZER
OPERATION MANUAL

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10. OPERATION CHECK AND ADJUSTMENT

10.1 SELF-DIAGNOSTIC FUNCTION

When the POWER switch on the TR4726 is set to the ON position, the
self-diagnostic program will automatically activate to check the internal
section of the TR4726 for normal functioning. If no errors are detected,
"Self-test ended" will be displayed and system software loading will begin.

If "Error XX" is displayed, the ADVANTEST CE headquarters or the
authorized ADVANTEST distributor in your area should be contacted. Their
addresses and telephone numbers will be listed at the end of this manual.

10.2 CRT ADJUSTMENT

The CRT is preadjusted to the optimum contrast, half-tone contrast, and brightness levels before shipment. If readjustment becomes necessary, change the presettings using the two adjustment controls shown in Figure 10-1.

Contrast adjustment

Brightness control

Figure10-1   CRT Adjustment

11. STORAGE, CLEANING, AND TRANSPORTATION
_____

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11. STORAGE, CLEANING, AND TRANSPORTATION

11.1 STORING PRECAUTIONS ON TR4726

The TR4726 should be stored in the ambient temperature range of $-10\,°C$ to $+60\,°C$. If the TR4726 is not to be used for a long time, it should be covered with a vinyl sheet or put in a corrugated card board box and then stored in a dry place free from direct sunlight.

In addition, floppy disks should be stored at ambient temperatures of $+10\,°C$ to $+60\,°C$ at all times.

11.2 CLEANING THE CRT DISPLAY UNIT

Remove the protective filter from the front panel of the CRT display unit periodically and clean the inside of the filter and the CRT display itself using a soft cloth soaked in alcohol. Use only alcohol as the cleaning liquid. Do the following procedure to remove the CRT filter:

① Remove the belt cover using a screwdriver.

② Remove the two screws from the CRT upper panel.

③ Remove the two screws from the bezel.

Figure 11-1   Removing the CRT Filter

11.3 TRANSPORTATION OF THE TR4726

Use the packing materials (supplied) then transporting the TR4726. If the
supplied packing materials cannot be used for some reasons, package the
TR4726 as described below.

① Wrap the TR4726 in a vinyl cover.

② Enclose the TR4726 in a corrugated card board box with a wall
    thickness of 5 mm or more cover the TR4726 with more than 50 mm
    thickness of packing.

③ After covering the TR4726 in packing, place the attachments in the
    corrugated card board box. Refill the box with packing. Then close
    the box, and wrap with packaging strings.

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12. PERFORMANCE SPECIFICATIONS

12.1 TR4726

Measuring functions
Trace state : Acts as a 48ch state analyzer.
Trace S&T (S ⁺ T) and trace S&T (S ⁺ T): Option; Acts as a 48ch state
                                          analyzer and as a 16ch timing
                                          analyzer.
Trace timing: Option; Acts as a 16ch timing analyzer.

Main menu screen
CONFIG : Specifies the data in accordance with input specifications
SYMDEF : Specifies the data in accordance with symbol/code specifications
TRACE : Specifies the data in accordance with trace control
          specifications
DISPLAY: Specifies the data in accordance with display specifications
PROGRAM: Specifies the data in accordance with program specifications

Submenu screen
FD/GET/SAVE   : Specifies the data in accordance with disk file
                   specifications; Multi-window display
COMM   : Specifies the data in accordance with communications
                   specifications; Multi-window display

State analyzer : (Acts together with simultaneous analysis module
                   OPT4726+06) See section 12.4.

Symbol/code specifications
Symbol   : Symbol name assigned for each numeric string
Symbol name   : 8 alphanumerics or less
Symbol definition capacity: Up to 100 symbols for each input group; Up to
                             200 symbols for all input groups
No. of symbols used   : Trace control --- Up to 50 symbols for each
                             input group: Display --- All defined symbols
                             can be used.
Code   : Code name assigned for each numeric string
Code name   : 8 alphanumerics or less
Code definition capacity   : Up to 256 codes for each input group having 8
                             channels or less: Up to 512 codes for all
                             input groups
No. of codes used   : Trace control --- Up to 50 codes for each
                             input group; Display --- All defined codes
                             can be used.

Trace control specifications
Trace control is performed according to: (1) a maximum of 4 sets of trace/window conditions, each set consisting of Store, Enable, Trigger, Disable, Trigger Pass, and Delay, and; (2) a maximum of 4 combinations of trace/window conjunctions.

Store   : 0, 1, 2, -----, 1024 states (Exponential multipliers of 2)
Enable   : Binary, octal, hexadecimal, Don't Care pattern/symbol/code, ASCII code
Trigger   : Binary, octal, hexadecimal, Don't Care pattern/symbol/code, ASCII code, NOT, OR
Disable   : Binary, octal, hexadecimal, Don't Care pattern/symbol/code, ASCII code
Trigger pass   : 1 to 256 states
Delay   : From -(Store-1) through 0 to +3072 states

Trace/window conjunctions

THEN   : Move to the next trace/window condition
AGAIN   : Repetition of the particular trace/window condition
TOP   : Move to the first trace/window condition
STOP   : Stop of measurement execution
Trigger arming : For trace S&T (S → T), the trigger of the state analyzer dearms the timing analyzer. For trace S&T (T → S), the trigger of the timing analyzer dearms the state analyzer.

Display specifications
Display data source
Acquisition memory, reference memory, and file
Display item   : 8 items; The order of display can be changed for each input group; Overlapping display of identical input group is possible; A specific input group can be erased.
Display format   : State display in binary, octal, hexadecimal, pattern/symbol/code, ASCII code, etc.
Memory-to-memory transfer: Transfer of display data to reference memory, operation   display of reference memory data, and display of acquisition memory data
Data scroll   : Vertical scroll using the scroll knob, and vertical page-by-page scroll using the page scroll key
Special display   : Trigger display for trigger, display of memory segments between trace and window
Others   : As per the display specifications of the personality kit

Timing analyzer
See sections 12.2 and 12.3, "Performance Specifications of the OPT4726+75/OPT4726+70."

Data processor
Disk file operation specifications

Disk capacity	:	632.5KB (formatted), 1MB (unformatted)
Disk type	:	Two types (system disk and user disk) for each personality kit
No. of files	:	Up to 199 (within one user disk)
File types	:	Three
System-saved file	:	Up to 99 for each menu screen
Registered file	:	Up to 1 for each menu screen
User file	:	Up to 199
Operation types	:	12
DIRECTORY-of-MENU operation	:	Only the menu-screen related files are displayed in terms of file name, file size, file attribute, and date and time created.
DIRECTORY-of-ALL operation:		All files are displayed in terms of file name, file size, file attribute, and date and time created.
REGISTER operation	:	Registered files are created.
PURGE operation	:	System-saved files are deleted in lump.
DELETE operation	:	User files are deleted.
FORMAT operation	:	User files are created. It is possible to write disk explanatory statements (20 alphanumerics or less) into disk during file creation.
RENAME operation	:	User files are renamed.
COPY operation	:	File-to-file copying
STATUS-of-FILES operation	:	Registered/system-saved/user file quantities and sizes are displayed.
STATUS-of-DISK operation	:	Disk ID, disk explanatory statements, and disk operational status are displayed.
GET operation	:	Data within file are displayed on menu screen.
SAVE operation	:	Menu screen data are saved into file.

Printer specifications

Connectible unit	:	Printer with RS-232C interface
Output data	:	SYMDEF, DISPLAY, and PROGRAM menu screen data (But only printable data)

Disk copy specifications

Copy function	:	All files within the source disk (inserted in F0:) are copied onto the destination disk (inserted in F1:) [Auxiliary disk required]
Source disk	:	System disk or user disk
Destination disk	:	Blank disk, system disk, or user disk

Clock specifications
Data setting   : Year, month, day, hour, minute
Use of clock   : It is continuously displayed on CRT and
                               written onto file during file creation
Backup time   : More than 2 weeks after full charging of
                               battery

Help specifications
Help (menu item) function : Displays menu data that can be set
Help (key) function   : Displays brief description of keys, news on
                               version upgrade, etc.

I/O signal specifications
State analyzer trigger   : BNC connector, TTL level, negative pulse,
pulse output   approx. 50 ns wide, output in synchronization
                               with the internal clock existing after the
                               occurrence of trigger.
Timing analyzer trigger : BNC connector, TTL level, negative pulse,
pulse output   approx. 50 ns wide, output in synchronization
                               with the internal clock existing after the
                               occurrence of trigger.
Video signal output   : BNC connector
External floppy disk   : With 37-pin D-Sub coonector; for accessory
drive interface   drive unit
Serial communications   : With 25-pin D-Sub connector; conforms to
interface   EIA RS-232C standard
External keyboard   : With 12-pin round connector; for
interface   accessory keyboard
Probe test output   : With 50-pin amphenol connector; Probe test
                               pattern output.

General specifications
CRT   : 5-inch x 9-inch, electromagnetic deflection
                               type, B31 fluorescent material, 80 characters
                               x 24 lines / screen Floppy disk drive:
                               3.5-inch, double-sided double-density, 1MB
                               (unformatted)
Operating temperature   : +5°C to +40°C
Operating humidity   : 20% to 80% RH (non-condensing)
Power supply   : 90 to 132 VAC, 180 to 249 VAC, 50/60 Hz
                               Outline dimensions: Approx. 350 (W) x 220 (H)
                               x 500 (D) mm
Weight   : Less than 25 kg
Optional power supply   : See below.

Option No.	Standard	Option 40
Supply voltage	90 to 132 VAC	180 to 249 VAC

12.2 PERFORMANCE SPECIFICATIONS OF OPT4726+75 (300 MHz TIMING MODULE)

This option operates as a 300 MHz timing analyzer when it is combined with the TR4726.

No. of input channels   : 16 data channels/2 clock channles
                              2 qualifier channels
Maximum sampling rate   : Internal clock --- 3.3 ns (at 300 MHz);
                              External clock --- 10 ns (at 100 MHz)
Acquisition mode   : 1. 16ch data ----- Glitch detectible,
                                                 100 MHz (maximum);
                              2. 16ch data ----- Glitch not detectible,
                                                 150 MHz (maximum);
                              3. 8ch data ------ Glitch detectible,
                                                 150 MHz (maximum):
                              4. 8ch data ------ Glitch not detectible,
                                                 300 MHz (maximum)

Acquisition memory capacity:

No. of Data Channels	Sampling Clock Frequency	Maximum Memory Depth (bits/ch)	
		Glitch ON	Glitch OFF
16	100 MHz or less	16K	32K
	150 MHz	-	32K
8	150 MHz or less	32K	64K
	200 MHz	-	64K

Data setup/hold time   : 3 ns/0 ns
Glitch detection pulse   : 3 ns, minimum (at sampling rates less than
width   150 MHz)
Clock qualifier   : 2 ns, setup/hold --- 3 ns/0 ns
Sampling clock   : (Internal) 50 ms to 10 ns (in 1-2-5 steps)
                                         and 6.7 ns, 3.3 ns;
                              (External) 2ch, DC to 100 MHz, clock
                                         generation formula (CKn for clock,
                                         CQn for qualifier) to be as
                                         follows:
                                         SCK=CK1 ⇕ . (CQ1.CQ2)
                                         +CK2 ⇕ . (CQ1 CQ2)
                                         where ⇕ should be read to mean
                                         either ↑ or ↓ and SCK must not
                                         exceed 150 MHz.

12.2 PERFORMANCE SPECIFICATIONS OF OPT4726+75 (300 MHz TIMING MODULE)

Trigger function   :   4-level sequential trigger with reset
function (ENABLE 3-stage + trigger / DISABLE)

ENABLE ---- Matchpattern, 3-stage sequential

DISABLE --- Matchpattern, ENABLE sequence reset

TRIGGER --- Match pattern True/False/Glitch/ Edge/Serial
Possible to set Glitch/Edge for each channel.
ORed between channels and ANDed with match pattern.
For Serial, the occurrence of trigger is identified by matching of up to 16 bits of serial data array. Setting possible only for 0 channel. Can be used only for external clocks.

FILTER ---- 1 to 15 clocks (only for internal clocks) Possible to set ENABLE, TRIGGER, and DISABLE independently.

EVENT ----- For ENABLE/DISABLE, 1 to 15 events (only for external clocks); For TRIGGER, 1 to 65536 events.

DELAY ----- -(memory depth + 1) to (65536 - memory depth)

Input probe   :   No. of channles ---- 8 data channels/1 clock channel/1 qualifier channel (per probe)

Impedance ---------- Approx. 1MΩ/5pF or less

Frequency band ----- DC to 150 MHz

Sensitivity -------- 200 mVp-p or less

Threshold voltage -- TTL(+1.4 V)/ECL(-1.3 V)/ VAR(+6.35 V to -6.35 V) Resolution 50 mV Accuracy ±4%±140 mV

Dynamic range ------ VTH±5 V

Maximum input voltage --- ±30V

Skew   :   3ns or less (probe included)

12.3 PERFORMANCE SPECIFICATIONS OF OPT4726+70 (100 MHz TIMING MODULE)

This option operates as a 100 MHz timing analyzer when it is combined with the TR4726.

No. of input channels   :   16 data channels (for internal sampling); 14 data channels + 2 clock channels (for external sampling)

Maximum sampling rate   :   Internal clock --- 10 ns (at 100 MHz); External clock --- 15 ns (at 70 MHz)

Acquisition mode   :   1. 16ch data ----- Glitch detectible, 100 MHz (maximum);
2. 16ch data ----- Glitch not detectible, 100 MHz (maximum);
3. 8ch data ----- Glitch detectible, 100 MHz (maximum);
4. 8ch data ----- Glitch not detectible, 100 MHz (maximum);

Acquisition memory capacity:

No. of Data channels	Sampling Clock Frequency	Maximum Memory Depth (bits/ch)	
		Glitch ON	Glitch OFF
16	100 MHz or less	16K	32K
8	100 MHz or less	32K	64K

Data setup/hold time   :   5 ns/0 ns

Glitch detection pulse width   :   5 ns, minimum

Sampling clock   :   (Internal) 50ms to 10ns (in 1-2-5 steps); (External) 2ch, DC to 70 MHz, clock generation formula (CKn for clock) to be as follows: SCK=CK1$\updownarrow$ + CK2$\updownarrow$ where $\updownarrow$ should be read to mean either $\uparrow$ or $\downarrow$ and SCK must not exceed 70 MHz.

Trigger function   :   4-level sequential trigger with reset function (ENABLE 3-state + trigger / DISABLE) ENABLE --- Match pattern, 3-stage sequential DISABLE -- Match pattern, ENABLE sequence reset

12.3 PERFORMANCE SPECIFICATIONS OF OPT4726+70 (100 MHz TIMING MODULE)

                    TRIGGER -- Match pattern True/False/Glitch/
                              Edge/Serial
                              Possible to set Glitch/Edge for
                              each channel.
                              ORed between channel a and
                              ANDed+with matchpattern. For
                              Serial, the occurrence of trigger
                              is identified by matching of up to
                              16 bits of serial data array.
                              Setting possible only for 0
                              channel. Can be used only for
                              external clocks.
                    FILTER --- 1 to 15 clocks (only for internal
                              clocks)
                              Possible to set each of ENABLE,
                              TRIGGER, and DISABLE independently.

                    EVENT ---- For ENABLE/DISABLE, 1 to 15 events
                              (only for external clocks); For
                              TRIGGER, 1 to 65536 events.
                    DELAY ---- -(memory depth + 1) to (65536 -
                              memory depth)

Input probe   : No. of channels ---- 8 data channels (In
                       external sampling mode, clocks via one
                       channel become an input. At this time, seven
                       channels are used as data channels.)
                       Impedance ---------- Approx. 1MΩ/8 pF or less
                       Frequency band ----- DC to 100 MHz
                       Sensitivity -------- 200 mVp-p or less
                       Threshold voltage -- TTL(+1.4 V)/ECL(-1/3 V)
                              VAR(+12.7 V to -12.7 V)
                              Resolution 100 mV
                              Accuracy ±4%±140 mV
                       Dynamic range ------ VTH±10V
                       Maximum input voltage --- ±50 V
Skew   : 5ns or less

12.4 PERFORMANCE SPECIFICATIONS OF THE STATE ANALYZER

Input specifications

Input group	:	Input groups are defined by a set of input channels.
No. of input groups	:	6 (maximum)
Input group name	:	6 alphnuamerics or less
Others	:	Conform to the input specifications of the personality kit used.

Memory specifications

Acquisition memory width	:	48ch
Acquisition memory depth	:	1024-state
Acquisition memory write speed	:	20 MHz, max.
Reference memory width	:	48ch
Reference memory depth	:	1024-state

12.5 I/O INTERFACE SPECIFICATIONS

This section describes the specifications of the signals input and output
from the TR4726.

12.5.1 RS-232C Interface Specifications

The RS-232C connector on the rear panel of the TR4726 uses a 25-pin
D-sub connector (BD-25S, female type).

The specifications conform to the RS-232C standard.

As listed below, two types of pin connections are provided to suit
the particular cabling requirements.

(1) The following table applies to the case where TxD is set for the PIN
No. 2 menu item on the COMM menu screen:

Pin No.	Symbol	Meaning
1	FG	Frame Ground
2	TxD	Transmitted Data
3	RxD	Received Data
6	DSR	Data Set Ready
7	SG	Signal Ground
20	DTR	Data Terminal Ready

(2) The following table applies to the case where RxD is set for the PIN
No. 2 menu item on the COMM menu screen:

Pin No.	Symbol	Meaning
1	FG	Frame Ground
2	RxD	Received Data
3	TxD	Transmitted Data
6	DTR	Data Terminal Ready
7	SG	Signal Ground
20	DSR	Data Set Ready

TxD and DTR are transmitted by SN75188N (operating on +12 V power),
and RxD and DSR are received by SN75189AN.

12.5.2 Video Signal Interface

The same type of composite video signal data as that displayed on the
CRT screen is output from the "VIDEO OUT" BNC connector located on
the rear panel of the TR4726.

By using this signal data, it becomes possible to display the data on
an external large-size CRT unit or to hard-copy onto a video printer.

Horizontal synchronizing signal frequency: 15750 Hz
Vertical synchronizing signal frequency : 60 Hz
(Non-interlaced scanning)

The output level is adjusted at the factory so it is approximately
1 Vp-p when the output signal line is terminated with a 75-ohm
resistor.

12.5.3 State Analyzer Trigger Pulse Output

The trigger pulses of the state analyzer can be output via the "TRIG
OUT (SYNC)" BNC connector located on the rear panel of the TR4726.
To output these trigger pulses, set the TRIG OUT (SYNC) menu item for
trace/window parameters to ON in advance on the TRACE menu screen.
(See subsection 4.3.3 for further details.) Trigger pulses will be
output when triggers occur during measurement. These trigger pulses
can be utilized to synchronize external logic analyzers or
oscilloscopes with the state analyzer.

These pulses possess a pulse width of 50 ns at the TTL level, with a
negative polarity.

12.5.4 Timing Analyzer Trigger Pulse Output

The trigger pulses of the timing analyzer can be output via the "TRIG
OUT (ASYNC)" BNC connector located on the rear panel of the TR4726.
These trigger pulses will be output when triggers occur during
measurement. These trigger pulses can be utilized to synchronize
external logic analyzers or oscilloscopes with the state analyzer.
These pulses possess a pulse width of 50 ns at the TTL level, with a
negative polarity.

TR4726
LOGIC ANALYZER
OPERATION MANUAL

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13. OPERATIONAL DESCRIPTION

13.1 OVERVIEW

   This section offers an overview of TR4726 logic analyzer operation. The
   block diagram of this instrument is given in Figure 13-1. The instrument
   consists of the main facility and an optional facility.

(1) Main facility
   This block contains a CPU, an external interface control unit, a power
   control unit, etc.

(2) Optional facility
   This block can contain a high-speed timing analysis module (OPT4726+75), a
   100 MHz timing module (OPT4726+70), and a synchronous analysis module
   (OPT4726+06).

Figure 13-1 TR4726 Schematic Block Diagram

13.2 OPERATIONAL DESCRIPTION OF EACH BLOCK

13.2.1 Main Facility

(1) CPU section
This section, which has a sophisticated 16-bit microprocessor (80186) as the main CPU, contains

CPU 80186
ROM 512 Kbytes
RAM 1 Mbytes

and performs system software operation and data analysis.

(2) External interface control section
This section consists of a panel control unit, an FDD control unit, a CRT control unit, and an external interface control unit.

Panel control unit: Receives and delivers front-panel key block information between CPUs.
FDD control unit :   Controls 3.5-inch micro floppy disk drives. User disks and system disks interchange data with the CPU main memory via this unit.
CRT control unit :   Controls menu display and acquired-data display.
External interface: Enables connection to a printer (with an RS-232C interface function) and to an accessory keyboard.

Each of the above units is controlled by a dedicated LSI.

(3) Power control section
The TR4726 incorporates four types of power supplies: +5.0 V, -5.2 V, -2 V, and +12 V.

All these power supplies are of the moduled switching type, and they are used for the following purposes:

+5.0 V ... TTL line
-5.2 V ... ECL line
-2.0 V ... ECL line
+12 V .... Analog line

13.2.2 Optional Facility

(1) Synchronous analysis module
The address bus, data bus, and control signal data from the system under test (SUT) are transmitted to the synchronous analysis module via input probes (probes that correspond to each CPU).

In personality kits, sampling clocks are produced from the incoming control signal and these clocks are used to sample and latch the incoming data and addresses.

The synchronous analysis module, which consists of a sample-data memory unit and a trigger control unit, records sample data sent from the personality kit and controls the recorded data (trace control).

The recorded data is subsequently reproduced as a state diagram on the CRT display via the CPU.

(2) Timing analysis module
The timing analysis module consists of:

1. Input probe
2. Data sampler/trigger control unit
3. Sample-data memory unit

1. Input probe
The input probe, which consists of an impedance converter and an analog converter, shapes the waveform of input data according to the condition settings that match the SUT (system under test) and then transfers the data to the data sampler.

2. Data sampler/trigger control unit
The data that has been waveform-shaped by the input probe is subsequently sent to the data sampler, in which the data is then sampled using internal/external sampling clocks.

The trigger control unit controls the written of the sampled data into the sampled-data memory. (Trace control)

This section uses custom LSIs to ensure high-speed data processing and 4-level sequential trigger function implementation.

3. Sampled-data memory unit
The sampled-data memory unit, which consists of high-speed memories and a write control unit, stores into memory the data that has been sampled by the data sampler.

The TR4726 incorporates high-speed CMOS memories and interleaved memories, which provides the instrument with high-speed processing capabilities, power savings, and a high memory capacity.

The CPU reads such data from the sampled-data memory and then reproduces the data as timing signals.

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LOGIC ANALYZER

TR4726

REAR VIEW

4726EXT1-610-A

FRONT VIEW

4726EXT2-610-A

REAR VIEW

4726EXT3-610-A

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SALES & SUPPORT OFFICES

Advantest Korea Co., Ltd.
22BF, Kyobo KangNam Tower,
1303-22, Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071
Fax: +82-2-532-7132

Advantest (Suzhou) Co., Ltd.
Shanghai Branch Office:
Bldg. 6D, NO.1188 Gumei Road, Shanghai, China 201102 P.R.C.
Phone: +86-21-6485-2725
Fax: +86-21-6485-2726

Shanghai Branch Office:
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing,
China 100083
Phone: +86-10-8235-3377
Fax: +86-10-8235-6717

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100
Fax: +65-6274-4055

Advantest America, Inc.
3201 Scott Boulevard, Suite, Santa Clara, CA 95054, U.S.A
Phone: +1-408-988-7700
Fax: +1-408-987-0691

ROHDE & SCHWARZ Europe GmbH
Mühldorfstraße 15 D-81671 München, Germany
(P.O.B. 80 14 60 D-81614 München, Germany)
Phone: +49-89-4129-13711
Fax: +49-89-4129-13723

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