OPERATION MANUAL

AUTOMATIC PC BOARD CHECKER

MODEL APC-1000

KIKUSUI ELECTRONICS CORPORATION

Errata Sheet of Instruction Manual

The instruction manual has the following changes.

P-12 ② CPU RESET

Statement added: This will be operated by pressing the machine section ④ PASS as well.

P-15 ④ PASS (indicator and switch)

Statement added: The same operation as the CPU RESET of the controller section will be achieved by pressing this switch.

P-21 INITIAL DATA CREATION PROGRAM OPERATIONS

D: Diode D: Diode (D0000 - D7999)

Photo diode (D80000 - D9999)

Statement added: For making initial data or learning of all pins short check, see the separate operation manual.

P-48 6.2.2 Inductance Measurement Figure 6.3

Vs---0.7 Vrms → 0.1 Vrms

P-49 6.2.3 Capacitance Measurement Figure 6.4

6.2.3.1 Z method

Vs---0.7 Vrms → 0.1 Vrms

Power Requirements of this Product

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

☐ Input voltage

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

☐ Input fuse

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

WARNING

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

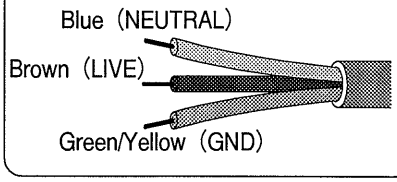
☐ AC power cable

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

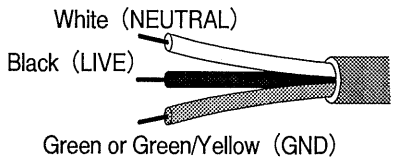
WARNING

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

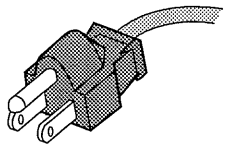
☐ Without a power plug



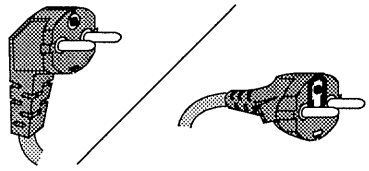
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

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

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

TABLE OF CONTENTS

1. GENERAL INFORMATION

The APC-1000 is an in-circuit PC board assembly tester intended to increase line inspection productivity for high integration PC board assemblies. It checks for on-board components and circuit patterns in terms of installation error, missing components, defective part characteristics, solder bridges, and discontinuity or short circuit patterns.

The APC-1000 is also capable of making in-circuit GO/NOGO judgements on the ratings of resistors, capacitors or inductors, and on the orientation of semiconductor devices such as transistors and diodes.

The location, part number, and other details of detected errors are printed on the built-in printer.

1.1 Three-terminal test method with guard allows precision measurement of the ratings of in-circuit components.

1.2 The leaning/averaging feature automatically leans data from up to ten normal board assemblies and averages the data to create reference data file.

1.3 Increased operability is ensured by operator-machine dialogue and complete software support.

1.4 Reference data file can be saved onto floppy disks. It is easy to access the other data files.

1.5 For detected errors, the tester prints out the pertinent part number, measured circuit constant, and location of the part (in one of 10 equal graticles on the board) to lead even an unskilled operator directly to the point in question.

1.6 The statistics feature prints the number of inspected boards, that of failed assemblies, and step-number classified failures of a day to provide daily and long-term statistical data.

1.7 The reference data file is protected against power off by an internal back-up battery for more than one month. This allows the operator to start job of the day just by switching the system on.

1.8 After reference data file is created and debugging is completed, the tester may be placed in the offline mode to execute all test jobs by itself, so that the host computer may be used for other job execution.

2. SPECIFICATIONS

Basic Instrumentation Section

Testing pins	:	Typ. 256 pins Expandable to 512 pins with the optional APC-multiplexer (MPX) unit.	
Test steps	:	1024 steps	
Test speed	:	20 to 40 ms per step	
Measurable ranges	:	Resistance:	0.1Ω to 3.99 MΩ (7 ranges)
		Capacitance:	10 PF to 3990 μF (9 ranges)
		Inductance:	10μH to 399 mH (5 ranges)
		Diode:	Constant current of 1 mA is applied across the diode under test to measure its resistance (up to 999 Ω).
		Transistor:	Same as diodes.
		Jumper wire:	Less than 10Ω
		Short circuit:	Less than 10Ω
Criterion for judgement:		±1% to ±99%	
Range :	Learning:	Auto range, with the exception of diodes, transistors, jumper wires, and short circuits, for which fix ranges are used.	
	Comparison:	Fixed range	
Instrumentation delay	:	Max. 750 ms at 50 ms intervals for 16 different values: i.e. 0, 50, 100, 150, 200,..... ..., 700, 750 ms.	
Multiplexer relay	:	Dry relay (life: 1000 million operations)	

Reference data file back-up period: 30 days

CPU (host CPU: UNIVAC UP10E Model 10)

Display	:	12" green display
Floppy disk drive	:	Two drives for 5-1/4 inch double-sided, double-density diskettes, double-track diskettes.
Keyboard	:	Full keyboard plus function keyboard
Interface	:	RS-232C, Centronix, or parallel I/F

Printer

Print format	:	24 characters per line on 5 x 7 dot matrix
Print form	:	Roll paper with the diameter of 50 mm and width of 70 mm
Self test feature	:	Provided.

Mechanism Section

Air press: Air cylinder: Inner diameter: 75 mm
Stroke: 150 mm
Pressure: Approx. 220 kg (air input: 5 kg/cm^2)
Capacity: Approx. 9 liters for each operation
Air inlet nipple: 1/4 inch
Air input: 4 to 10 kg/cm^2

Test table: Measurable PC board size: (W)450 x (D)350 mm
Connector: Six Amphenor 50-pin connectors (57-40500)

Power Supply

Power requirements	:	100 VAC ±10%, 50/60 Hz Approx. 170 VA (except for service outlets)
Fuse	:	Main Frame 10A MPX Unit 3A I/F Board 2A

Dimensions and Weight

Outer dimensions (max.): Electrical section:
(W)600 x (H)1060 x (D)920 mm
Mechanism section:
(W)720 x (H)1610 x (D)920 mm

Weight : Mechanism section: Approx. 208 kg
Electrical section: Approx. 67 kg
CPU: Approx. 15 kg

Environmental Conditions

Operating temperature : 5 to 35 °C

Operating humidity : Not more than 75% RH

Accessories

Operation Manual	1
PCB Pin Board (clear plastic board with 5 mm t)	1
PCB Push Board (universal board clamp)	1
Push Rod (PC board pushing rod), Long and Short Type	10 each
Connector Bracket (connector mount)	1
Bracket (pin board mount)	1
Collar (10ϕ x 101.5 mm)	10
50-pin connector (57-40500)	6
Test Program Library (supplied on diskettes)	1 set
Roll paper for printer (50 x 70 mm)	1 roll

3. PREPARATION

3.1 RECEIVING AND HANDLING

The tester is carefully tested in both mechanical and electrical terms before packed by experienced workmen. Immediately upon receipt of the tester, an examination should be made for any damage sustained in transit. If injury or rough handling is evident, immediately notify your dealer.

3.2 CHECKING SUPPLY VOLTAGE

The tester is designed to operate on a line voltage of 100 VAC ±10%, 50/60 Hz. To ensure trouble-free operation, use the proper line voltage without contaminated by line noise.

3.3 OPERATING TEMPERATURE AND SITING

To maintain the initial performance of the tester for an extended period of time, be sure to use the tester in the specified operating temperature and humidity ranges. The tester should be installed in a place where it will not be exposed to excessive dust or oil-born air.

3.4 SETUP PROCEDURE

The APC-1000 Tester consists of mechanism and electrical sections, with the host processor placed on the electrical section table, as shown in Figure 3.1. The rear interconnection cables have extra lengths, so that the electrical section may be sited apart from the mechanism section.

Figure 3.2 illustrates the cable connections on the rear of the tester. While referring to this figure, establish rear cable connections using the cables listed in the following subsection.

The external view of the AP-1000 tester is shown in Figure 3.3.

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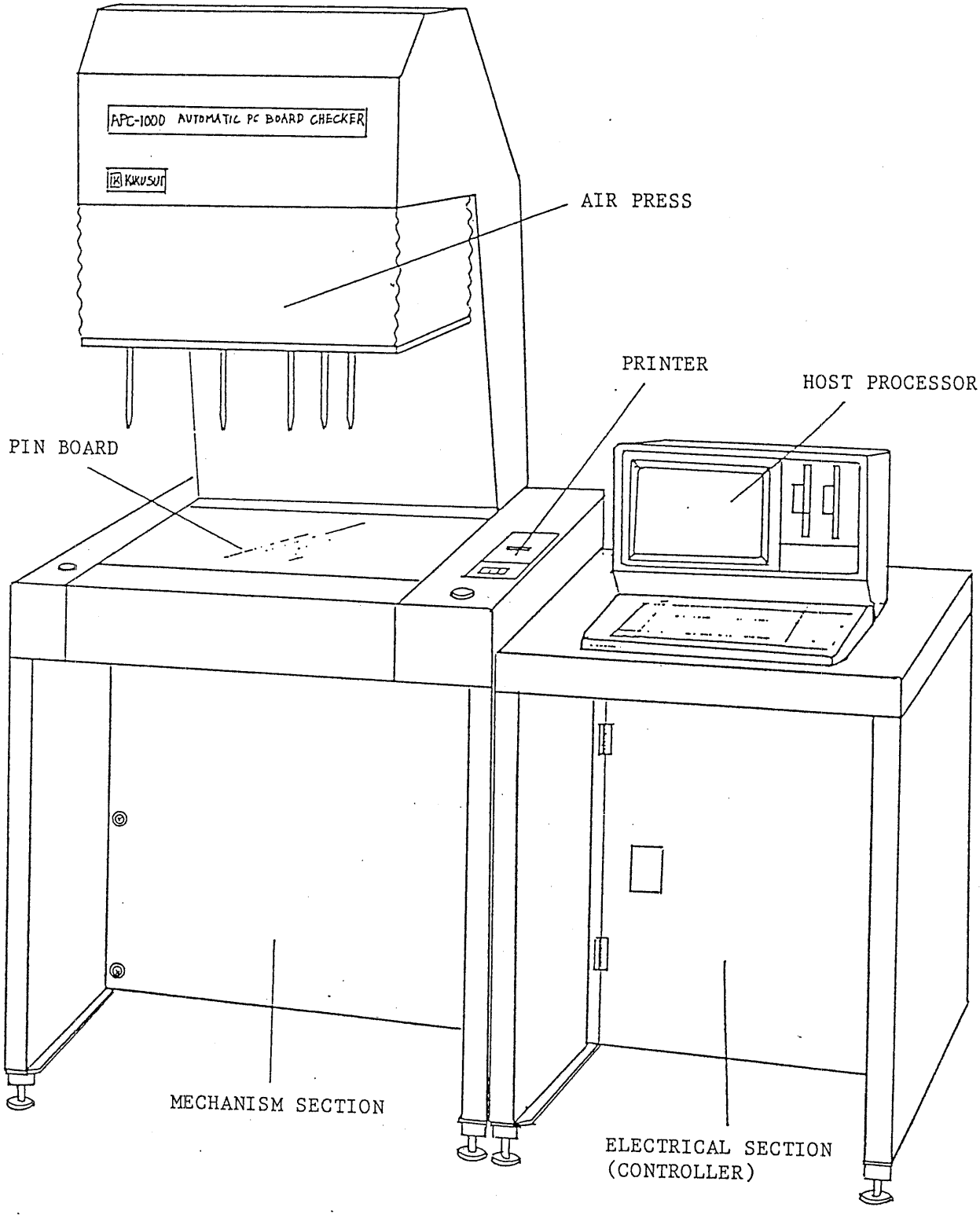


Figure 3.1 AP-1000 Automatic PC Board Assembly Tester

3.4.1 Cable Connections

While referring to Figure 3.2, establish all the rear cable connections for the tester as instructed below.

Note. Cables marked with an asterisk (*) are factory connected.

Rear bottom left of controller: AC power cable --- to a wall outlet

POWER UNIT/OUT AC100 : 8-pin round connector --- to the rear bottom left connector on the mechanism section (*).

POWER UNIT/IN AC100 : 8-pin round connector --- to the rear bottom left connector on the controller.

POWER UNIT/FOR CONTROL : 8-pin round connector --- to CONTROL UNIT/DC IN (*)

POWER UNIT/FOR MEAS : 8-pin round connector --- to MEASUREMENT UNIT/POWER

POWER UNIT/FOR PRINTER : 8-pin round connector --- to PRINTER I/F

POWER UNIT/AC 100 (service outlet) --- accepts the power cable of the host processor.

CONTROL UNIT/MEAS IN : 50-pin connector --- to MEASUREMENT UNIT/CONT-OUT.

CONTROL UNIT/MEAS OUT : 50-pin connector --- to MEASUREMENT UNIT/CONT IN.

CONTROL UNIT/PRT IN : 50-pin connector --- to PRINTER I/F (upper).

CONTROL UNIT/PRT OUT : 50-pin connector --- to MEASUREMENT (lower).

CONTROL UNIT/OUT : 50-pin connector --- to MPX UNIT (left)/CONT I/O A

CONTROL UNIT/UP10 : 50-pin connector --- to host CPU/ PARALLEL I/O

MPX UNIT (left)/CONT I/O B : 50-pin connector --- to MPX UNIT (right)/CONT I/O A

MPX UNIT (left)/SIG : 4-pin connector --- MEASUREMENT UNIT/SIG A (*)

MEASUREMENT UNIT/SIG B : 4-pin connector --- MPX UNIT (right)/SIG (*)

Mechanism section rear bottom left/service outlets --- accept power cord of PRINTER I/F (*)
MPX UNIT (left)(*)
MPX UNIT (right)(*)

Mechanism section rear bottom left/AIR input --- accepts an external air source.

Host CPU Keyboard --- rear of host CPU/KEYBOARD connector

MPX UNIT (left)/1-6 Pin board, CONNECTOR BRACKET/1-6 (*)
└──── 50-pin cable ────┘ (See Figure 7.2.)

MPX UNIT (right)/7-12 Pin board, CONNECTOR BRACKET/7-12 (*)
└──── 50-pin cable ────┘ (See Figure 7.2.)

The MPX UNIT (right) is an optional multiplexer unit required when additional testing pins are to be used.

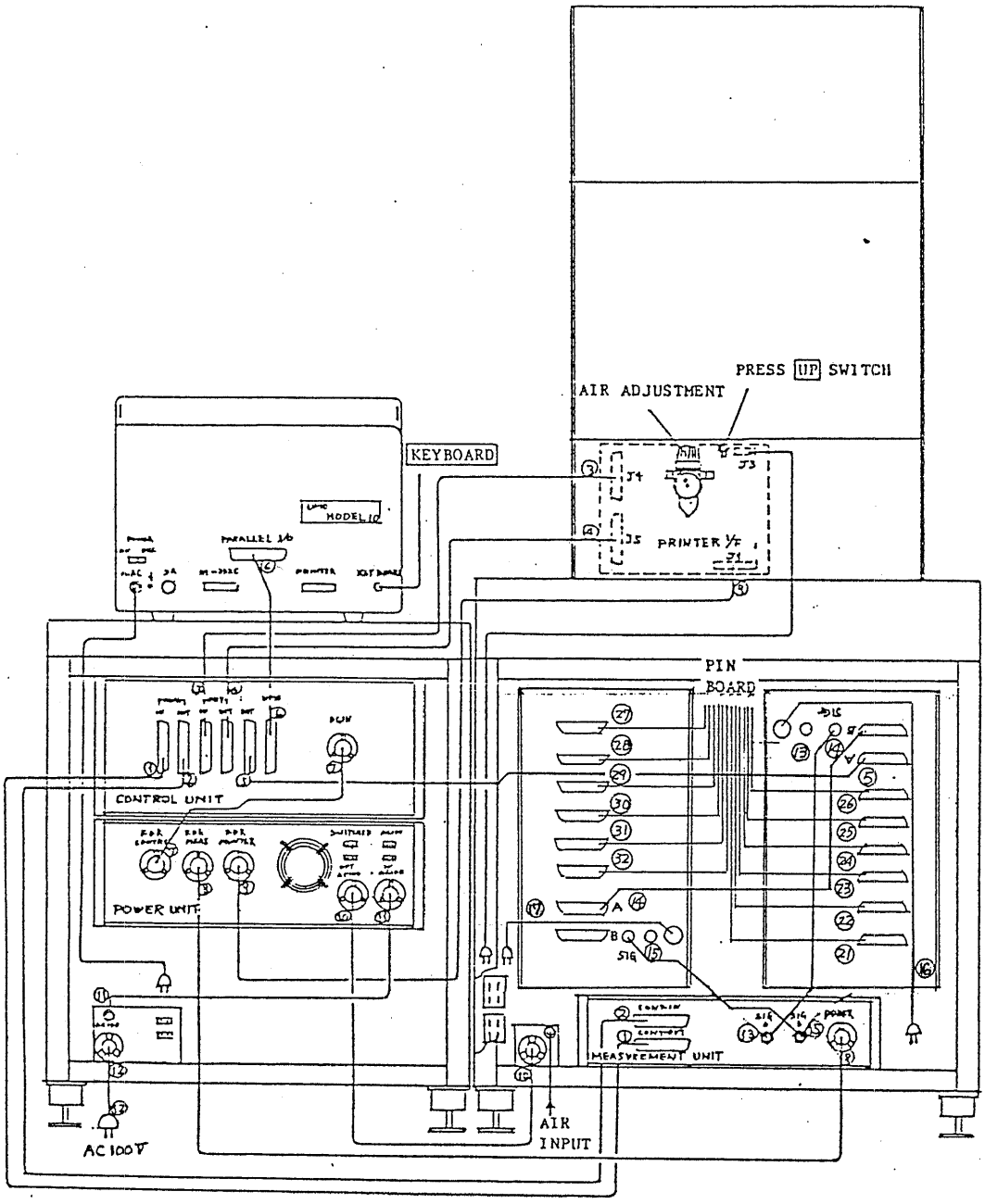


Figure 3.2 Rear cable connections

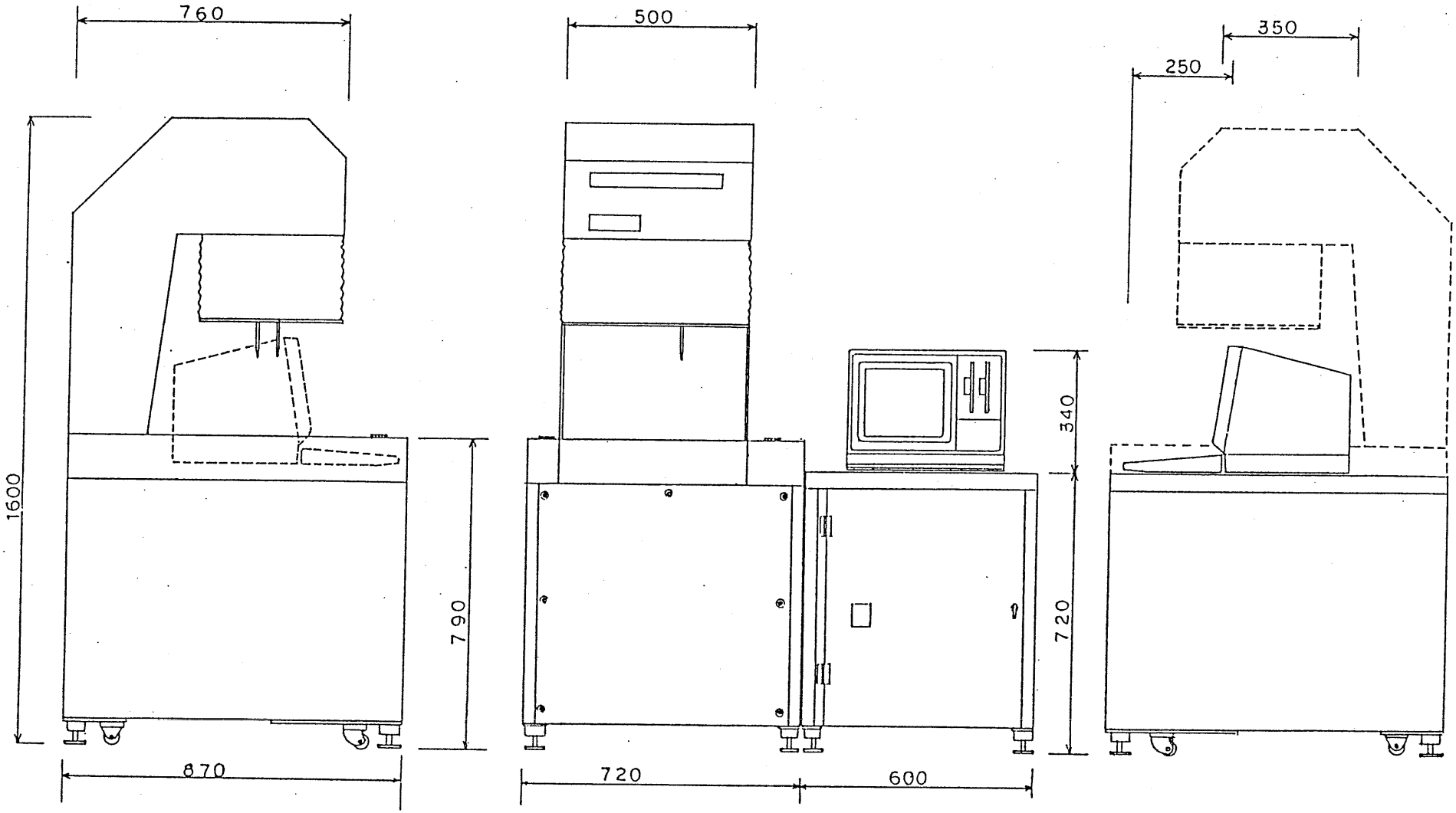


Figure 3.3 Outer dimensions

4. CONTROL PANEL DESCRIPTION

4.1 DESCRIPTION OF CONTROLLER SECTION PANEL

See Figure 4.1 Controller section panel.

① POWER : System's main power switch. When set to the upward position, the system is powered and the associated pilot lamp comes on.

② CPU RESET : Resets the CPU within the controller to suspend test execution. Operation of this switch raises the press head and restores the tester from online into offline mode.

③ CNT CLEAR : Statistical data, such as the number of tested cards, that of defective cards, step-number classified defect count, and so forth, is stored in the memory of the controller under battery back-up. This switch is used to clear all those statistical data.

④ | ON R | ON B | : Used to switch between online and offline modes. When the tester is powered up, the indicators in this switch are both left off, indicating the tester's controller section is in the offline mode to its host processor. To place the controller in the online mode, press this switch. The [ON R] indicator first comes on, then the [ON B] indicator comes on when the learning/maintenance program execution is completed. The controller is now placed in the online mode. To return the tester in the offline mode, press this switch again; both of the indicators will go off. If the controller is communicating with the host processor when the switch is operated, the [ON R] indicator goes off but the [ON R] indicator remains on until the communication is completed. The [ON R] denotes online ready, and [ON B] denotes online busy.

⑤ ALL PRINT : The printer contained in the mechanism section prints the details of failed test results. If the ALL PRINT switch is pressed, all of the false data is dumped on the printer (ALL PRINT indicator comes on).

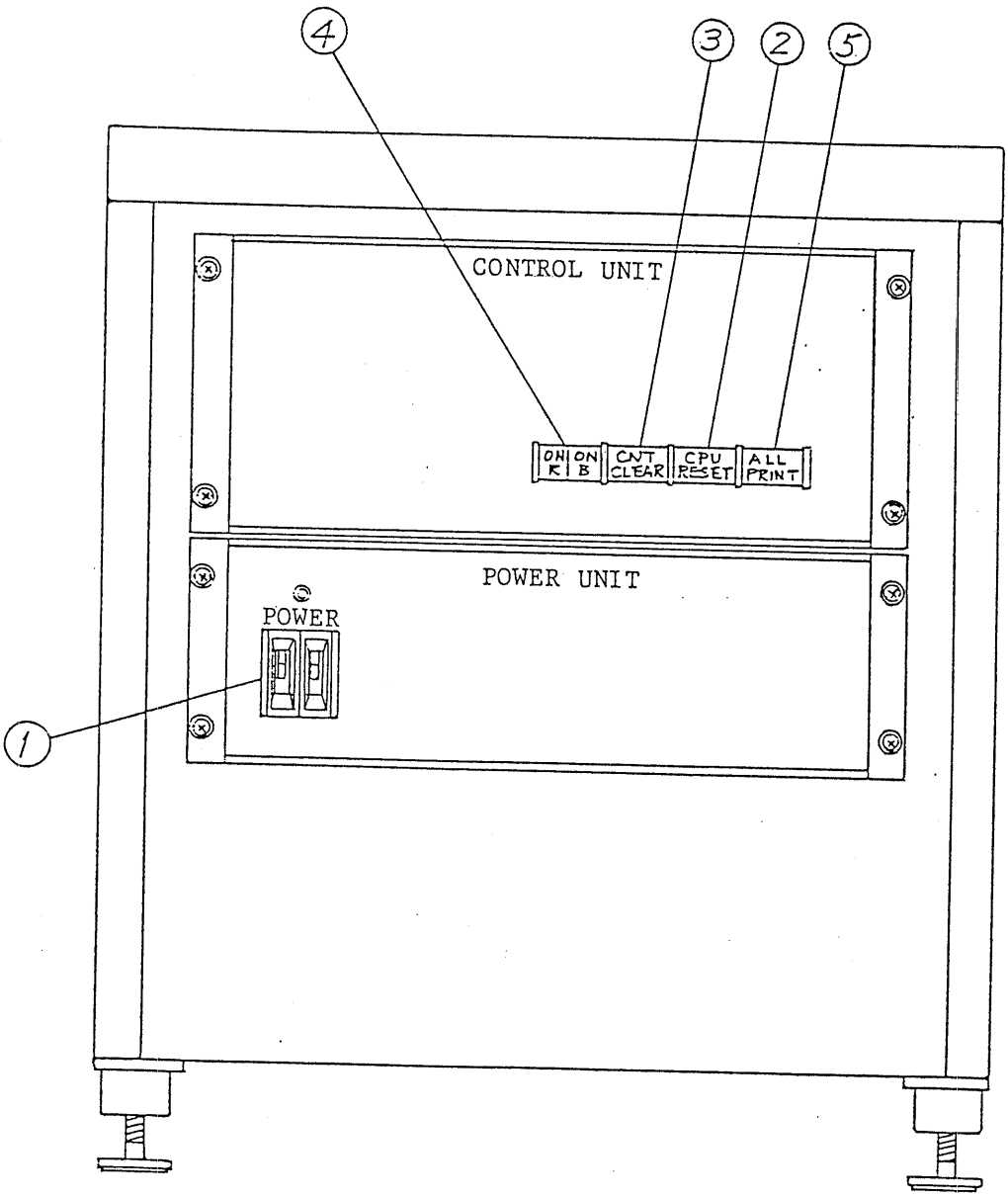


Figure 4.1 Controller section panel

4.2 DESCRIPTION OF MECHANISM SECTION CONTROL PANEL

See Figure 4.2

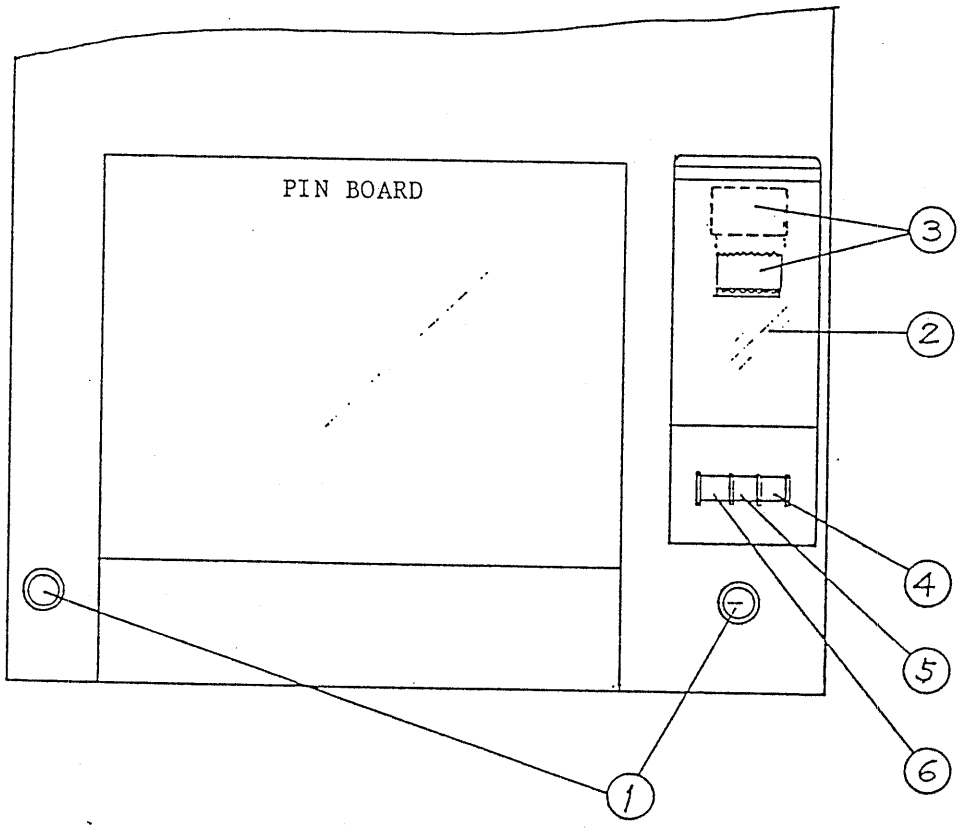


Figure 4.2 Mechanism section control panel

① TEST switches : Simultaneously press these switches to start test execution after placing the card to be tested on the pin board. If only either of these switches is operated, the press head will not be lowered. Press and hold both switches until the press head is completely lowered to the card under test (CUD). If either of the switches is released when the press head is being lowered, the head will be raised again.

② Printer : Prints test data.

③ Print form : Roll paper of 70 mm wide and 50 mmφ used for the printer.

④ PASS (indicator): When illuminated, indicates the test is passed (good). Once this indicator comes on, it remains on until the next test sequence is initiated.

⑤ RESET switch : Used to reset printer error.

⑥ FEED switch : Used to feed print form.
The printer's self check print can be initiated by the following operations:

[RESET] on → [FEED] on → [FEED] off

4.3 HOST PROCESSOR PANEL DESCRIPTION

The AP-1000 Tester uses the UNIVAC UP10E Model 10 Processor with two integrated floppy disk drives as it host CPU. For more details of the processor, see the separate user's manual.

When the Model 10.Processor is to be used as the host CPU for the APC-1000 Tester, only the rear POWER switch, front BRIGHT control, floppy disk drives A and B, and keyboard are used for test execution.

The supplied system diskette should be placed in the floppy disk drive A, while the APC-1000 Automatic PC Board Checker Work File diskette should be placed in drive B. Be sure to turn the processor power on before inserting these diskettes into its drives.

To start up the host processor, simultaneously press the [CTRL] and [RESET] keys on the keyboard after placing the diskettes in the respective drives. A menu will appear on the vide monitor.

5. OPERATING PROCEDURES

5.1 OVERVIEW

5.1.1 Operation Flowchart

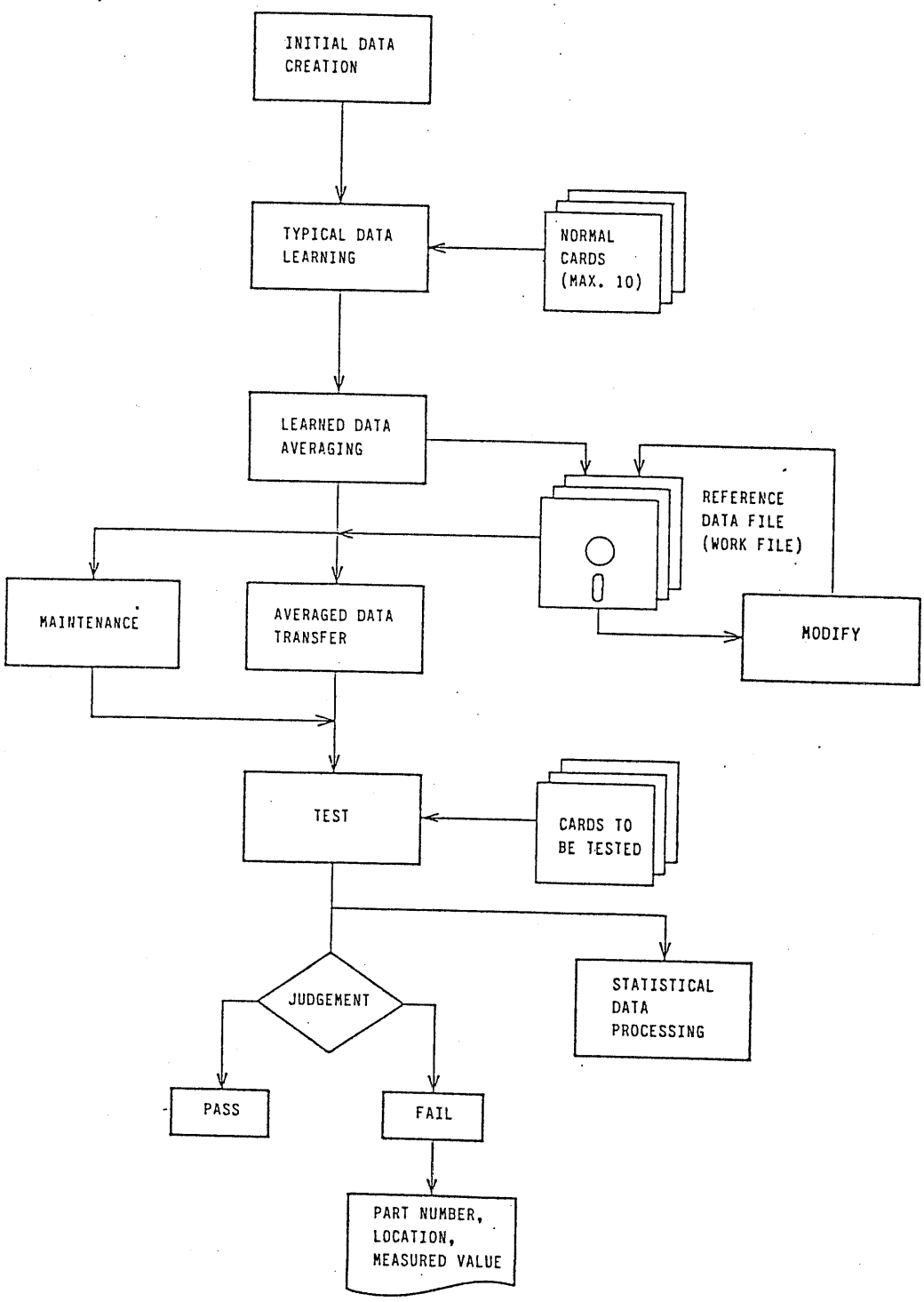


Figure 5.1 Operation flowchart

The operation menu contains seven choices of operation programs: i.e. initial data creation, reference data learning, learned data averaging, averaged data transfer, statistical processing, maintenance, and correction.

A variety of command sets are available for each of these operation programs to assist the operator in test execution.

5.2 INITIAL OPERATION

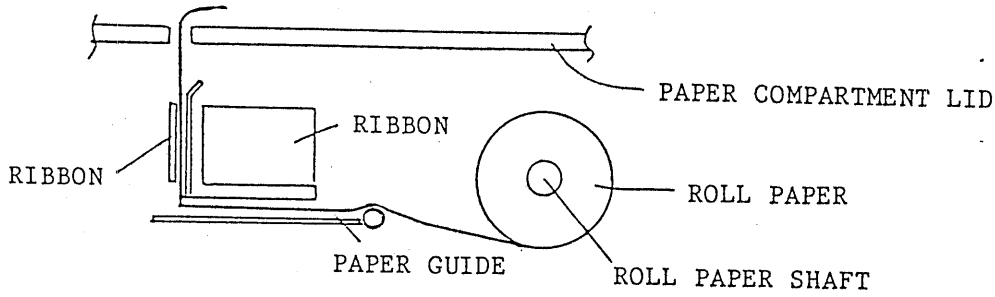
5.2.1 Host Processor Operations

After making sure that no diskette is in either of the drives, set the host processor's rear POWER switch to ON.
Insert the supplied APC-1000 Automatic PC Board Checker SYSTEM diskette into drive A, and the WORK FILE diskette into drive B, then simultaneously press the [CTRL] and [RESET] keys on the keyboard. The host processor will start up and the menu will appear on the video monitor.
All the preparatory operations for the host processor are now completed.

```
APC-1000   AUTOMATIC PC BOARD CHECKER (Ver 1.4)

******************     MENU     ********************
*                                                   *
*   FUNCTION 1 --------- INPUT INITIAL DATA         *
*   FUNCTION 2 --------- LEARN DATA                 *
*   FUNCTION 3 --------- AVERAGE OF LEARN DATA      *
*   FUNCTION 4 --------- TRANSFER OF EXC FILE       *
*   FUNCTION 5 --------- STATISTICS                 *
*   FUNCTION 6 --------- MAINTENANCE                *
*   FUNCTION 7 --------- MODIFY                     *
*   FUNCTION 8 --------- PRINT TEST DATA            *
*   FUNCTION 9 --------- MAINTENANCE & MODIFY       *
*                                                   *
*****************************************************

          THEN PRESS FUNCTION KEY
```

5.2.2 Paper Loading

Open the paper compartment lid on the printer, and install the accessory roll paper (70 mm wide, 50 mmϕ) on the paper holder in the compartment after inserting the accessory roll paper shaft in the center of the roll.



Insert the leading edge of the paper into the paper guide. After switching the main power on, thread the paper as shown in the above figure using the [FEED] switch.

5.2.3 Installing the Pin Board

Install the pin board (which has been designed according to later section) on the mechanism section deck. Place a normal card or card to be tested on the pin board, as needed.

5.2.4 Air Adjustment

Adjust the air pressure to approximately 3 kg/cm^2. For the details of air pressure adjustment see the description of setup procedures.

5.2.5 Controller Section Power On

Set the main POWER switch on the controller section to ON. Set the [ON R | ON B] (online/offline) switch (4) described in section 4.1 to online.

The ALL PRINT switch/indicator (5) on the controller section should be off, in which case only false test data is printed out.

As described in subsection 5.2.2, thread the print paper through

the printer using the [FEED] switch. Execute printer's self check print as described in section 4.2.

Now all the required preliminary operations are completed.

Select the desired operation item out of the menu displayed on the monitor by operating the pertinent function key or numeric key out of [PF1] through [PF7] or [1] through [7].

The following section describes each of the operation items contained in the menu.

5.3 DESCRIPTION OF OPERATION ITEMS IN MENU

5.3.1 Initial Data Creation (Select with [PF1].)

This program executes the initial data creation program for reference data learning, in which the operator types in part and pin number information for sequential steps which are automatically generated.
While the GND pin may or may not be specified at operator's option, it may be specified to reduce stray impedance in the circuit under test and to increase measurement accuracy.
For the details of specification procedure, see chapter 6 Theory of Operation.
Step numbers are programmable between 1 and 1024.

5.3.2 Reference Data Learning (Select with [PF2].)

This operation automatically learns reference data from up to ten normal cards in auto range, in the order of the steps generated by the initial data creation program. The learned data is stored on the WORK FILE diskette (which is placed in Drive A in the host processor) to which an optional file name is assigned.

5.3.3 Learned Data Averaging (Select with [PF3].)

This program averages the learned file data according to the number of normal cards used for learning.
In the course of averaging, the operator can monitor the maximum,

minimum, and averaged values of learned data at each step. If he finds a file which seems to be inadequate for averaging, he may delete that file and then re-execute averaging again.
The averaged data file is stored on a diskette as an execution reference data file.

5.3.4 Execution Reference Data Transfer (Select with [PF4].)

This program transfers the execution reference data stored in the file from the host processor to the controller section of the tester.
The tester becomes ready for test execution when it is placed in the offline mode after data transfer is completed. Place the card to be tested on the pin board, then press the TEST switches (described in section 4.2) simultaneously to start test execution. If the test is passed, the PASS indicator (4) will come on. If it failed, the test result will be printed out on the printer (2). The reference data transferred to the controller section remains intact against power off for more than one month.

5.3.5 Statistical Data Processing (Select with [PF5].)

This program performs statistical processings on test data. It prints the number of tested cards, that of failed cards, step-number classified failure count, and other information to allow for daily or long-term statistical data processing.

5.3.6 Maintenance (Select with [PF6].)

This program display the contents of any step of the execution reference data or to execute any test step for a normal card or card to be tested which is placed on the tester's pin board and display the result of measurement for that step. The maintenance program is used primarily for debugging of the execution reference data program or of the test program, and may be controlled interactively from the host processor.

5.3.7 Modify (Select with [PF7].)

This program allows the operator to correct or update reference values in the execution reference data or the range of judgement criteria (default assumption is ±10%), or to append on-board part location specification (X-Y coordinate) or measurement delay time setup. All operations can be done step-by-step from the display of the host processor.

The following sections describe the operating procedures for each of the programs described just above.

5.4 INITIAL DATA CREATION PROGRAM OPERATIONS

Press the function key PF1; the display will provide the following image. Type in the type of the part to be tested, part number, positive pin number, negative pin number, and GND pin number for the respective steps (up to 1024) which automatically generate. (For the details of GND pin number specification, see section 6.2 THREE TERMINAL GUARD TECHNIQUE.)

```
****** INPUT INITITIAL DATA ******

9999, X9999, 999, 999, 999(CR)
  1     2 3    4    5     6 7

1: STEP NUMBER     GENERATE AUTOMATICALLY

2: KIND OF PARTS

        R: RESISTOR          T: TRANSISTOR
        L: COIL              D: DIODE
        C: CONDENSER         J: JUMPER
        S: SHORT

        E: END OF INPUT      #: INPUT MODIFY

3: PARTS   NUMBER                    0-9999

4: (+) PIN NUMBER                    0-511 (MAX)

5: (-) PIN NUMBER                    0-511 (MAX)

6: GND PIN NUMBER                    0-511 (MAX)

7: PRESS (CR) [ RETURN ] KEY AFTER KEY-IN DATA

  THEN PRESS (CR) [ RETURN ] KEY TO NEXT !!
```

Press the [RETURN] key; the display will provide the following information:

```
                ****** LEARN DATA ******

          KEY-IN FILE NAME ( MAX 6 CHARACTERS )

DSSA2   .DAT      A200    .DAT      DSSA22  .DAT      CK512   .DAT
JALC55  .DAT      SH01A   .DAT      DEMO    .DAT      ABC     .DAT
TEST99  .DAT

    FILE NAME
```

If a file name which is not in the filename listing on the display is typed in (followed by [RETURN] key operation), file creation will be started with step 1.

```
    STEP    PARTS   +PIN    -PIN    GND.PIN      INPUT DATA
    0001,
```

File name specification should not include the attribute ".DAT". In this case key-in data of, say, "R15," is shown as "R0015". If "23," is typed in for a +pin number, it will be displayed as "023". If only a -pin number is specified with no GND pin number specified, type [24] [RETURN]. If you typed "24,", delete the comma "," using the [BS] key, then operate the [RETURN] key again.
When completing pin information entry, press the [E] key. The display will show the message "DATA SAVED B:A.DAT", then return to the menu image. If [#] is pressed instead of [E], the display will show an initial data update menu.
If one of the file names listed in the filename listing on the display is typed in, the file is either newly created or the successive part, file creation starts with the successive step number. The following shows an example:

```
          KEY-IN FILE NAME ( MAX 6 CHARACTERS )

DSSA2   .DAT        A200    .DAT        DSSA22  .DAT        CK512   .DAT
JALC55  .DAT        SH01A   .DAT        DEMO    .DAT        ABC     .DAT
TEST99  .DAT

     FILE NAME DSSA2

                GENERATE from FIRST STEP ? (Y/N)
```

If "N" is typed in, file creation starts with the successive step number, as shown below:

```
     STEP    PARTS   +PIN    -PIN    GND.PIN      INPUT DATA
     0001,
```

The following shows a display example for initial data creation process:

```
STEP    PARTS   +PIN    -PIN    GND.PIN      INPUT DATA

0001,   R0001,  001,    002,    003          0001,R0001,001,002,003(CR)
0002,   L0001,  004,    005,    006          0002,L0001,004,005,006(CR)
0003,   C0001,  007,    008,    009          0003,C0001,007,008,009(CR)
0004,   D0001,  010,    011,    012          0004,D0001,010,011,012(CR)
0005,
```

The following shows the initial data update menu obtained by operating the [#] key. This allows initial data display and update.

```
          ****** MODIFY INITIAL DATA ******

          D:   DISPLAY 20 LINES FROM SPECIFY STEP
          C:   CHANGE OF SPECIFY STEP
          E:   END OF MODIFY
          R:   REPEAT OF INPUT DATA

     KEY-IN COMMAND & STEP NO.( ex. D1 (CR)) D100
```

If you typed [D100] [RETURN], the machine will provide the following information:

```
STEP    PARTS    +PIN    -PIN    GND.PIN      INPUT DATA

0100,   D0009,   041,    034,    035
0101,   D0010,   017,    036
0102,   D0011,   041,    040,    039
0103,   D0012,   036,    039,    040
0104,   D0013,   000,    000
0105,   D0014,   058,    057,    055
0106,   D0015,   043,    046
0107,   D0016,   055,    051,    056
0108,   D0017,   055,    047,    046
0109,   D0018,   052,    044,    051
0110,   D0019,   047,    059,    060
0111,   D0020,   000,    000
0112,   D0021,   017,    038,    072
0113,   T0001,   009,    000,    004
0114,   T0002,   012,    013,    004
0115,   T0003,   069,    068,    017
0116,   T0004,   035,    037
0117,   T0005,   039,    038
0118,   T0006,   063,    067,    066
0119,   T0007,   064,    065,    067
```

If you wish to do _____what?_____ again, press the _____which?_____ key, then type in the step number.
If you wish to update initial data, operate [C100] [RETURN].
The machine will show the following:

```
STEP    PARTS    +PIN    -PIN    GND.PIN      INPUT DATA

0100,   D0009,   041,    034,    035

0100,
```

For the items requiring no update, type in a comma (,). For the item requiring update, type in the replacement data, then enter a comma (,).

5.5 REFERENCE DATA LEARNING PROGRAM OPERATIONS

Press the function key PF2; the display will show the filename listing for initial data creation. Specify the pertinent file name out of the listing.
The machine learns reference data from normal cards according to the selected file name.

```
****** LEARN_DATA ******

KEY-IN FILE NAME ( MAX 6 CHARACTERS )

DSSA2   .DAT      A200   .DAT      DSSA22  .DAT      CK512   .DAT
JALC55  .DAT      SH01A  .DAT      DEMO    .DAT      ABC     .DAT
TEST99  .DAT

   FILE NAME
```

When the file name (except the attribute .DAT) is typed in, the display will show the following message. After making sure the controller is in the online mode, press the two [TEST] switches simultaneously to lower the press head.

```
CONTROLLER NOT READY !!
```

When data learning is initiated, the learned data will be shown on the display in the order of step numbers. Learning will continue to the last step of the initial data file. When learning from one normal card is completed, the following messages will appear on the display.
If learning is to be continued for another card, press [Y].
If you typed [N], the machine will proceed with execution file (.EXC file) creation.

```
LEARN DATA  01 SHEET END

CONTINUE LEARN DATA ? (Y/N)
```

When the execution file has been created, control will return to the menu.

5.6 LEARNED DATA AVERAGING PROGRAM OPERATIONS

Press the function key PF3; the following list of learned data file names will appear on the display.
While each file name in the listing is attached with 01.DSB through 10.DSB, depending on the card number from which data has been learned, type in only the file name (as shown in the example) when specifying the file to be averaged (the attached are the attributes).

```
                ****** AVERAGE OF LEARN DATA ******
          KEY-IN FILE NAME ( MAX 6 CHARACTERS )
DEMO01  .DSB        DEMO02  .DSB

    [example]
              XXXXXX01.DSB -----> XXXXXX
    FILE NAME DEMO

                FILE NAME      : B:DEMO01.DSB

                LEARN FILE COUNT : 2

          AVERAGE LEARN DATA ? (Y/N) Y

             LOADING FILE !!   B:DEMO01.DSB
             LOADING FILE !!   B:DEMO02.DSB

             SAVED FILE   !!   B:DEMO.AVE
```

The maximum, minimum, and averaged values of the averaged file can be monitored on the screen.

The maximum, minimum, and averaged values of the averaged file can be monitored on the screen.

```
DISPLAY AVERAGE FILE ? ( Y/N )

***** LEARN DATA. MAX/MIN/AVE *****

FILE NAME  B:DEMO.AVE

[ ] IS FILE NUMBER

STEP        MAX              MIN              AVE

0001        499. o [ 1]      499. o [ 1]      499. o
0002        1.22nF [ 2]      1.20nF [ 1]      1.21nF
0003        1.22nF [ 1]      1.13nF [ 2]      1.17nF
0004        1.12nF [ 1]      1.07nF [ 2]      1.09nF
0005        1.23nF [ 2]      1.22nF [ 1]      1.22nF
0006        258. o [ 1]      254. o [ 2]      256. o
0007        413. o [ 1]      404. o [ 2]      408. o
0008        445. o [ 1]      435. o [ 2]      440. o
0009        476. o [ 1]      466. o [ 2]      471. o
0010        502. o [ 1]      498. o [ 2]      500. o
0011        499. o [ 1]      499. o [ 1]      499. o
0012        499. o [ 1]      498. o [ 2]      498. o
0013        499. o [ 2]      498. o [ 1]      498. o
0014        500. o [ 2]      499. o [ 1]      499. o
0015        499. o [ 1]      498. o [ 2]      498. o
0016        498. o [ 1]      498. o [ 1]      498. o
0017        9.99 o [ 1]      9.99 o [ 1]      9.99 o
0018        9.99 o [ 1]      9.99 o [ 1]      9.99 o
0019        9.99 o [ 1]      9.99 o [ 1]      9.99 o
0020        9.99 o [ 1]      9.99 o [ 1]      9.99 o

DISPLAY  NEXT 20 STEPS ? ( Y/N )
```

If "N" is typed in for the question "Do you wish the next 20 steps to be displayed?", _____what?_____ will be displayed in an interactive manner, with the cursor repositioned.
If an inadequate file is found as a result of averaging, delete that file number (01-10). The machine will return to averaging process with the deleted file excluded from averaging. The maximum, minimum, and averaged values of the resulting averaged data can also be monitored on the screen.

If there is no file to be deleted for averaging, type in "N".
The machine will then ask whether the execution data file is to be created from the averaged file.
The execution file can be created by typing in "Y". If update of tolerance data, entry of part location information, measurement delay setup, or reference data change is required, use the update menu.

The machine will then ask whether or not the main file name learning file (XXXX01.DSB to XXXX10.DSB) and the max./min./average file (XXXX.AVE) are to be simultaneously deleted.
Since each diskette can store up to four models, it is advisable that those files be deleted as far as possible.
If all the files are to be left undeleted, it is advisable that each diskette be reserved for only one model.

```
DELETE FILE ? (FILE No. or N )
GENERATE  EXC FILE ? (Y/N) Y
DELETE  MEDIUM FILES (.DSB. AVE ) ? (Y/N)
```

5.7 EXECUTION FILE TRANSFER PROGRAM OPERATIONS

Press the function key PF4; a listing of the execution data file names will appear on the display. Type in the file name (except for the .EXC) to be transferred.

```
****** TRANSFER EXC FILE ******

.KEY-IN FILE NAME ( MAX 6 CHARATERS )

A200    .EXC    DEM01   .EXC    DEM02   .EXC    CK512   .EXC
CK256   .EXC    TEST99  .EXC    DSSA2   .EXC    DEMO    .EXC
ABC     .EXC    K       .EXC

    FILE NAME
```

Be sure to type in the correct file name. Also make sure the controller is in the online mode.

During transfer busy, the message "EXECUTION PROGRAM TRANSFER BUSY" will appear on the display. It will take some three minutes to transfer a file comprised of some 200 steps.

When data transfer is completed, control will return to the main menu.

5.8 STATISTICAL DATA PROCESSING PROGRAM OPERATIONS

Press the function key PF5; when the controller is in the online mode, the following image will appear on the display and the statistical data will be printed on the printer using the format shown in section 5.11.

```
****** STATISTICS ******

PRINTING DATA TO PRINTER !!

WAIT A MINUTE
```

When print operation is completed, the same data will be shown on the display as well.

```
****** STATISTICS ******

TEST NUMBERS        3 SHEET
FAIL NUMBERS        3 SHEET

PRESS (CR) KEY

****** FAIL DETAILS ******

STEP NO.                FAIL NUMBERS
  0002                        3
  0003                        3
  0004                        3
  0005                        3
  0006                        3
  0007                        2
  0008                        2
  0010                        1
  0017                        3
  0018                        3

PRESS (CR) KEY
```

If the [RETURN] key is pressed, control will return to the main menu.

5.9 MAINTENANCE PROGRAM OPERATIONS

Press the function key PF6; the following image will appear on the display. Type in the execution file name (except for .EXC).

Figure: When the file name is type in, the file is loaded.

```
****** MAINTENANCE ******

KEY-IN FILE NAME ( MAX 6 CHARACTERS )

A200    .EXC      DEMO1   .EXC      DEMO2   .EXC      CK512   .EXC
CK256   .EXC      TEST99  .EXC      DSSA2   .EXC      DEMO    .EXC
ABC     .EXC      K       .EXC

FILE NAME DEMO

LOADING   DEMO !!
```

CONTROLLER NOT READY!!

When this message appears, make sure the controller is in the online mode, place the card to be tested on the pin board, then press and hold the TEST switches simultaneously until the press head is completely lowered to the card.

The maintenance menu shown below allows the operator to display 20 lines beginning with any step (e.g. D1), execute any step of the program (e.g. T1), proceed with the next step (e.g. N), repeat the same step (e.g. R), or terminate the maintenance program (E).

When what? is executed, the measured values will be shown on the monitor, as shown in the following example:

```
******  MAINTENANCE MENU ******

  D:   DISPLAY 20 LINES FROM SPECIFY STEP
  T:   EXECUTE OF SPECIFY STEP
  N:   ADVANCE NEXT STEP
  R:   REPEAT SAME STEP
  E:   END

KEY-IN COMMAND & STEP No. (ex. D1 (CR)) D1    (If D1 is typed in:)

0001   R0001, 252, 254,     ,499. o, 10%, 3,00, 0, 0
0002   C0201, 253, 254, 114,1.21nF, 10%, 4,00, 0, 0
0003   C0202, 255, 254, 112,1.17nF, 10%, 4,00, 0, 0
0004   C0213, 083, 078, 103,1.09nF, 10%, 4,00, 0, 0
0005   C0232, 174, 173,     ,1.22nF, 10%, 4,00, 0, 0
0006   D0201, 226, 068, 254,256. o, 10%, 3,00, 0, 0
0007   D0202, 226, 067, 254,408. o, 10%, 3,00, 0, 0
0008   T0201, 059, 068, 254,440. o, 10%, 3,00, 0, 0
0009   T0202, 064, 241, 254,471. o, 10%, 3,00, 0, 0
0010   T0202, 064, 067, 254,500. o, 10%, 3,00, 0, 0
0011   R0213, 068, 048,     ,499. o, 10%, 3,00, 0, 0
0012   R0218, 035, 062,     ,498. o, 10%, 3,00, 0, 0
0013   R0238, 088, 087, 089,498. o, 10%, 3,00, 0, 0
0014   R0242, 078, 080,     ,499. o, 10%, 3,00, 0, 0
0015   R0270, 114, 113, 112,498. o, 10%, 3,00, 0, 0
0016   R2127, 201, 170, 203,498. o, 10%, 3,00, 0, 0
0017   J0201, 001, 002,     ,9.99 o, 10%, 1,00, 0, 0
0018   J0202, 002, 003,     ,9.99 o, 10%, 1,00, 0, 0
0019   S1021, 003, 022,     ,9.99 o, 10%, 1,00, 0, 0
0020   S1022, 022, 028,     ,9.99 o, 10%, 1,00, 0, 0
```

```
        ****** MAINTENANCE MENU ******

    D:   DISPLAY 20 LINES FROM SPECIFY STEP
    T:   EXECUTE OF SPECIFY STEP
    N:   ADVANCE NEXT STEP
    R:   REPEAT SAME STEP
    E:   END

  KEY-IN COMMAND & STEP No. (ex. D1 (CR)) T1     (IF  T1  is typed in:)

0001   R0001, 252, 254,     ,499. o, 10%, 3,00, 0, 0
              ACTUAL VALUE = 497. o



        ****** MAINTENANCE MENU ******

    D:   DISPLAY 20 LINES FROM SPECIFY STEP
    T:   EXECUTE OF SPECIFY STEP
    N:   ADVANCE NEXT STEP
    R:   REPEAT SAME STEP
    E:   END

  KEY-IN COMMAND & STEP No. (ex. D1 (CR)) N     (If  N  is typed in:)

0002   C0201, 253, 254, 114,1.21nF, 10%, 4,00, 0, 0
              ACTUAL VALUE = 9.990F



        ****** MAINTENANCE MENU ******

    D:   DISPLAY 20 LINES FROM SPECIFY STEP
    T:   EXECUTE OF SPECIFY STEP
    N:   ADVANCE NEXT STEP
    R:   REPEAT SAME STEP
    E:   END

  KEY-IN COMMAND & STEP No. (ex. D1 (CR)) R     (IF  R  is typed in:)

0002   C0201, 253, 254, 114,1.21nF, 10%, 4,00, 0, 0
              ACTUAL VALUE = 9.990F
```

5.10 MODIFY PROGRAM OPERATIONS

Press the function key PF7; the following execution data filename listing will appear on the display. Type in the file name (except for .EXC) to be corrected.

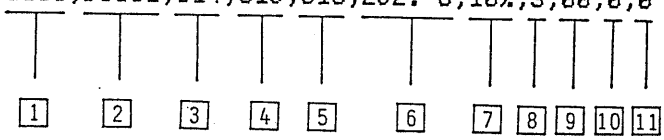
When the selected file is loaded, the correction menu will appear on the display. The correction menu allows the operator to display 20 lines beginning with any step (e.g. D1), insert a line at any

step (e.g. I15), delete any step (e.g. K20), update any step (e.g. C13), correct the tolerance of a part type (e.g. A), store the file after correction is completed (e.g. E), or complete insertion operation (e.g. E).

The following shows an operation example:

```
****** MODIFY PROGRAM ******

KEY-IN FILE NAME ( MAX 6 CHARACTERS )

A288    .EXC      DEMO1   .EXC      DEMO2   .EXC      CK512   .EXC
CK256   .EXC      TEST99  .EXC      DSSA2   .EXC      DEMO    .EXC
ABC     .EXC      K       .EXC

FILE NAME
```

```
*** MODIFY MENU ***

   D:   DISPLAY 20 LINES FROM SPECIFY STEP
   I:   INSERT SPECIFY STEP
   K:   DELETE SPECIFY STEP
   C:   CHANGE SPECIFY STEP
   A:   ERROR SET OF EACH PART
   E:   SAVE MODIFIED FILE or END OF INSERT
KEY-IN COMMAND & STEP No. (ex. D1 (CR)) ? D1
                                          (If D1 is typed in:)
0001,R0001,001,002,003,499. o,10%,3,00,0,0
0002,L0001,004,005,006,0.62mH,10%,4,00,0,0
0003,C0001,007,008,009,1.02nF,10%,4,00,0,0
0004,D0001,010,011,012,254. o,10%,3,00,0,0
0005,R0001,005,006,007,401. o,10%,3,00,0,0
0006,L0001,008,009,010,0.55mH,10%,4,00,0,0
0007,C0001,011,012,013,1.22nF,10%,4,00,0,0
0008,D0001,014,015,016,252. o,10%,3,00,0,0
```



[1] Step No.
[2] Part No.
[3] +Pin No.
[4] -Pin No.
[5] GND pin No.
[6] Reference value
[7] Tolerance
[8] Range
[9] Part location
[10] Delay
[11] Spare

```
                    *** MODIFY MENU ***

                      D:   DISPLAY 20 LINES FROM SPECIFY STEP
                      I:   INSERT SPECIFY STEP
                      K:   DELETE SPECIFY STEP
                      C:   CHANGE SPECIFY STEP
                      A:   ERROR SET OF EACH PART
                      E:   SAVE MODIFIED FILE or END OF INSERT
                    KEY-IN COMMAND & STEP No. (ex. D1 (CR)) ? I1
                                                        (If  I1  is typed in:)
                  0001,R0001,001,002,003,499. o,10%,3,00,0,0
                  0001,
  KEY-IN DATA & (CR) or (CR) ONLY
```

To complete insert operation, type in [E].
To insert a step, specify the larger step number of the two step numbers between which insertion will occur.

```
          *** MODIFY MENU ***

    D:   DISPLAY 20 LINES FROM SPECIFY STEP
    I:   INSERT SPECIFY STEP
    K:   DELETE SPECIFY STEP
    C:   CHANGE SPECIFY STEP
    A:   ERROR SET OF EACH PART
    E:   SAVE MODIFIED FILE or END OF INSERT
  KEY-IN COMMAND & STEP No. (ex. D1 (CR)) ? K1  (If  K1  is typed in:)

DELETE NO. 0001   (Deleted step number.)
```

When insert or delete operation is completed, the steps will automatically be renumbered.

```
                    *** MODIFY MENU ***

                      D:   DISPLAY 20 LINES FROM SPECIFY STEP
                      I:   INSERT SPECIFY STEP
                      K:   DELETE SPECIFY STEP
                      C:   CHANGE SPECIFY STEP
                      A:   ERROR SET OF EACH PART
                      E:   SAVE MODIFIED FILE or END OF INSERT
                    KEY-IN COMMAND & STEP No. (ex. D1 (CR)) ? C1
                                                        (If  C1  is typed in:)
                  0001,L0001,004,005,006,0.62mH,10%,4,00,0,0
                  0001,
  KEY-IN DATA & (CR) or (CR) ONLY
```

When update operation is to be executed, the contents of the pertinent step will be displayed on the screen as shown above. For the items requiring no update, press the [RETURN] key to proceed with the next item. For the items requiring update, type in the replacement data, then press the [RETURN] key.
If the entire step is to be updated, type in the full replacement data from the beginning. If you made a typing error, start it over with [CXX] again.

To delete the GND pin number information, type in an @ mark.

```
          *** MODIFY MENU ***

   D:   DISPLAY 20 LINES FROM SPECIFY STEP
   I:   INSERT SPECIFY STEP
   K:   DELETE SPECIFY STEP
   C:   CHANGE SPECIFY STEP
   A:   ERROR SET OF EACH PART
   E:   SAVE MODIFIED FILE or END OF INSERT
KEY-IN COMMAND & STEP No. (ex. D1 (CR)) ? A   (If  A  is typed in:)

ERROR SET
  R?    ? 10  }
  C?    ? 20  }
  L?    ? 30  }
  T?    ? 40  }  Tolerance data for each part type can
  D?    ? 50  }  be updated for all the steps.
  J?    ? 60  }
  S?    ? 70  }
  CHANGING DATA !!
```

```
          *** MODIFY MENU ***

   D:    DISPLAY 20 LINES FROM SPECIFY STEP
   I:    INSERT SPECIFY STEP
   K:    DELETE SPECIFY STEP
   C:    CHANGE SPECIFY STEP
   A:    ERROR SET OF EACH PART
   E:    SAVE MODIFIED FILE or END OF INSERT
KEY-IN COMMAND & STEP No. (ex. D1 (CR)) ? E     (If  E  is typed in:)
```

```
   DATA SAVED  B:DSSA2.EXC  !!
```

When the corrected file is stored, control returns to the main menu.

5.11 PRINT TEST DATA PROGRAM OPERATION

The host processor UNIVAC UP10E contains a standard Centronix printer interface. The external printer to be used with the tester should have a Centronix interface. Depending on the printer used, the interface connector pin configuration may not match with that on the host processor. Check the pin assignment on the printer connector.

The listing program can print data also on the display, as well as an external printer (in an interactive manner).

Press the fanction key [PF8];

```
PRINT TEST DATA

SELECT  FILE ATTRIBUTE (1=DAT/2=DSB/3=EXC/0=END) 1

6 CHARACTERS FILE NAME --> KEY-IN

DSSA2   .DAT        A200    .DAT        DSSA22  .DAT        CK512   .DAT
JALC55  .DAT        SH01A   .DAT        DEMO    .DAT        ABC     .DAT
TEST99  .DAT
```

FILE NAME DSSA2

The machine will first ask the file name to be printed. Since the file name differs depending on the selected menu, specify its attribute. The display will show the file names with the specified attribute. Now type in the file name. The attributes are as follows:

Initial data creation file name: Attribute, .DAT --- 1
Learned data file name: Attribute, .DSB --- 2
Execution reference data file name: Attribute, .EXC --- 3

Zero returns to the MENU.
Now specify the output device from CRT (C) and printer (P).
Output operation can be suspended by operating the space key, and can be resumed by operating the same key a second time.

```
SELECT OUTPUT DEVICE (C=CRT/P=PRINTER) ? C

STEP    PARTS   +PIN    -PIN    GND.PIN
0001,    R0001   001     002     003
0002,    L0001   004     005     006
0003,    C0001   007     008     009
0004,    D0001   010     011     012
0005,    R0001   005     006     007
0006,    L0001   008     009     010
0007,    C0001   011     012     013
0008,    D0001   014     015     016
0009,    R0001   010     011     012
0010,    L0001   013     014     015
0011,    C0001   016     017     018
0012,    D0001   019     020     021
0013,    R0001   014     015     016
0014,    L0001   017     010     019
0015,    C0001   020     021     022
0016,    D0001   023     024     025

SELECT  FILE ATTRIBUTE (1=DAT/2=DSB/3=EXC/0=END)
```

5.12 MAINTENANCE and MODIFY PROGRAM OPERATION

Press the function key [PF9].

This program is mixed MAINTENANCE and MODIFY programs, then please refer to each operation. When zoro is selected, the control returns to the main menu.

```
Seleot: ****** MAINTENANCE ****** ----- 1
        ******   MODIFY    ****** ----- 2
        ******   MENU      ****** ----- 0

                                    1, 2 or 0
```

5.13 PRINT FORMAT

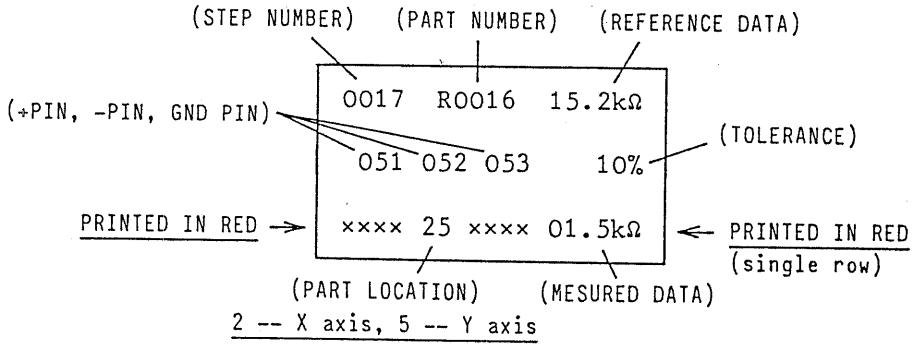
The printer prints data in the following three formats:

(1) Failure data only.

(2) All data print.

(3) Statistical data print.

(1) Failure data print



*(MESURED DATA)

1. SHORT CHECK: In case of 0 to 9.99Ω (FALSE) Printed as [SHORT] in RED
2. JUMPER CHECK: More than 10Ω (FALSE) Printed as [OPEN] in RED

(2) All print

Similar to failure data print, all data other than failure data (which is print in red) is printed in black.

However,

* 10Ω or more for short check (pass) is printed as "OPEN" in black.
* 0 to 9.99Ω (pass) for jumper check is printed as measured data in black.

(3) Statistical data print

```
**** STATISTICS ****

TEST NUMBERS    36SHT
FAIL NUMBERS    21SHT        <------Print in red.


*** FAIL DETAILS ***

STEP     FAIL NUMBERS
0015              1
0041             16
0043              6
0062              1
0069              4
```

For statistical data, the number of tested cards, that of failed cards, and step-number classified failure count are printed.

5.14 DAILY OPERATING PROCEDURES

The following describes daily operating procedures for testing the same model everyday for a certain period of time.

5.14.1 Ensure that the air pressure in the mechanism section is on, then set the main POWER switch (on the controller) to ON. Since the previous reference data remains in the controller (by battery back-up), the controller need not be placed in the online mode to the host processor.

5.14.2 When printout is desired only for failure data, no particular operation is needed because the tester's initial default is in failure print mode.
If printout of all test results is desired, press the [ALL PRINT] switch on the controller.

5.14.3 Place the card to be tested on the pin board. Press and hold the two [TEST] switches simultaneously until the press head is completely lowered.

5.14.4 When the press head is completely lowered, the test sequence will be automatically initiated.
If a failure or failures are detected, the measured failed data is printed after execution of all test steps is completed. If all test items have been passed, the PASS indicator on the mechanism section will come on. The press head is automatically raised when all the test steps are completed. (A press head operation alarm will sound also when the press head is being raised after learning.)

5.14.5 Replace the card, then press the TEST switches again to repeat the same test sequence for the new card.

5.15 SWITCHING THE CARD MODEL TO BE TESTED

It is assumed that the execution reference data (program) for the new model is already completed.

5.15.1 Replacing the Pin Board

Replace the pin board with the new one which is desired for the card model to be tested.
Remove the pin board retention bolts from the bottom of the pin board jig on the mechanism section.
Pull the pin board jig fully forward, and disconnect the interconnecting cable from the rear of the pin board jig.

After pulling out the entire pin board jig, remove the board retention screws from the jig and replace the pin board.

After replacing the pin board, push the entire jig into its original position, connect the rear cable to the jig, then reinstall and tighten the jig retention bolts.
When reconnecting the cables, be sure to cross-connect them.

5.15.2 Replacing the Execution Reference Data

After operating the host processor, powering the controller section, and placing the controller in the online mode according

to the procedure given in 5.2, start up the execution reference data (program) transfer program, and type in the necessary file name from the keyboard to transfer the new file name from the host to the controller's memory. At this time, exercise care to type in the correct file name.
Now the switching of the card model is completed.
You can place the controller in the offline mode, and execute the daily test procedure (as described in 5.12) only on the tester.

5.16 WORK FILE CREATING PROCEDURES

APC-1000 AUTOMATIC PC BOARD CHECKER SYSTEM	Contains all the programs for the APC-1000. This diskette should normally be placed in Drive A.
APC-1000 AUTOMATIC PC BOARD CHECKER WORK FILE	Work file containing APC-1000 initial data, learned data, execution reference data, and other files. It is normally placed in Drive B.
UNIVAC UP10E MODEL 10/15 SYSTEM DISK CP/M.V. 2.2 SBASIC III V.3.0	System diskette for the host processor UNIVAC UP10E. It contains the CP/M and SBASIC.

When creating a work file on a new diskette, the diskette must be formatted (initialized).

Formatting a diskette

Place the UP10E CP/M system diskette in Drive A.
Press the [CTRL] and [RESET] keys simultaneously; a prompter A> will appear on the screen.
After executing "A> FORMAT [RETURN]", insert a new diskette into drive A, then press the [Y] key. The drive will initiate formatting.
When formatting is completed, a message "FORMATTING ....." will appear on the screen, then disk test will be executed for approximately two minutes.
When disk test is completed, a message "DISK TEST COMPLETED" will be displayed. Formatting is now completed. While another formatting can subsequently be done, press the [CTRL] and [C] keys at the same time to terminate the FORMAT command.

The next thing required is to load the system program (SYSGEN).

SYSGEN procedure

Place the UP10E CP/M system diskette in Drive A.
Simultaneously press the [CTRL] and [RESET] keys; a promptr A> will appear on the screen.
After executing "A> SYSGEN [RETURN]", type in "A" in response to the question "SOURCE DRIVE NAME?" from the machine. Press the [RETURN] key in response to "SOURCE ON A THEN TYPE RETURN", then insert the formatted diskette into Drive B.
Type in "B" in response to "DESTINATION DRIVE NAME" message, then strike the [RETURN] key in response to "DESTINATION ON X, -----" message.
When everything is completed, "FUNCTION COMPLETE" will be displayed. While another SYSGEN may subsequently be performed on another diskette, press the [CTRL] and [RESET] keys to return to the CP/M prompter A>.

Next, write PIP command into this work file.

Writing PIP command

Place the UP10E CP/M system diskette in Drive A.
Simultaneously press the [CTRL] and [RESET] keys; the prompter A> will appear on the screen.
Insert the work file diskette (for which formatting and SYSGEN are completed) into Drive B.
Execute "A> PIP B: =PIP.COM [RETURN]". The PIP command is now written into the work file.

The new work file has now been completed. It is advisable that all new diskettes you have be formatted at a time.
The PIP command written in the work file is used for work file back up to be described in the following.
For more details, see the UP10E Processor Operation Manual.

Note. If a work file contains data learned from ten cards each requiring the full 1024 test steps and the execution reference data file, with unnecessary files left undeleted, it can contain data for only up to four card models. It is advisable that data for each card model be stored in individual work file.

5.17 MAKING A BACKUP DISKETTE

To protect precious information from accidental damage or destruction, it is advisable to make a back-up diskette for every diskette which contains important data.
The back-up diskette should be a new, blank diskette which is formatted according to the formatting procedure (for the back-up diskettes for work files and system diskette, execute SYSGEN, as well as formatting).
The back-up procedure differs depending on the supplied diskette types. See the following:

Making a back-up for work file diskette

Place the work file diskette in Drive A, and the back-up diskette (for which formatting and SYSGEN is completed) in Drive B.

Simultaneously press the [CTRL] and [RESET] keys; the prompter A> will appear on the screen. Execute "A> PIP B: A:*.* [RETURN]". The entire work file is now copied from Drive A onto Drive B.

Making a back-up for the APC-1000 system diskette

Place the original UP10E CP/M system diskette in Drive A. Simultaneously press the [CTRL] and [RESET] keys; a prompter A> will appear on the screen. Execute "A> DCOP [RETURN]", then insert the APC-1000 system diskette into drive A in place of the UP10E CP/M system diskette, and a formatted back-up diskette into Drive B. Type in "S" [RETURN] in response to TYPE S or V on the screen. Duplication is completed when the message "FUNCTION COMPLETED" appears on the screen. Now all the contents of the system diskette are duplicated on the back-up diskette.

Making a back-up for the UP10E CP/M system diskette

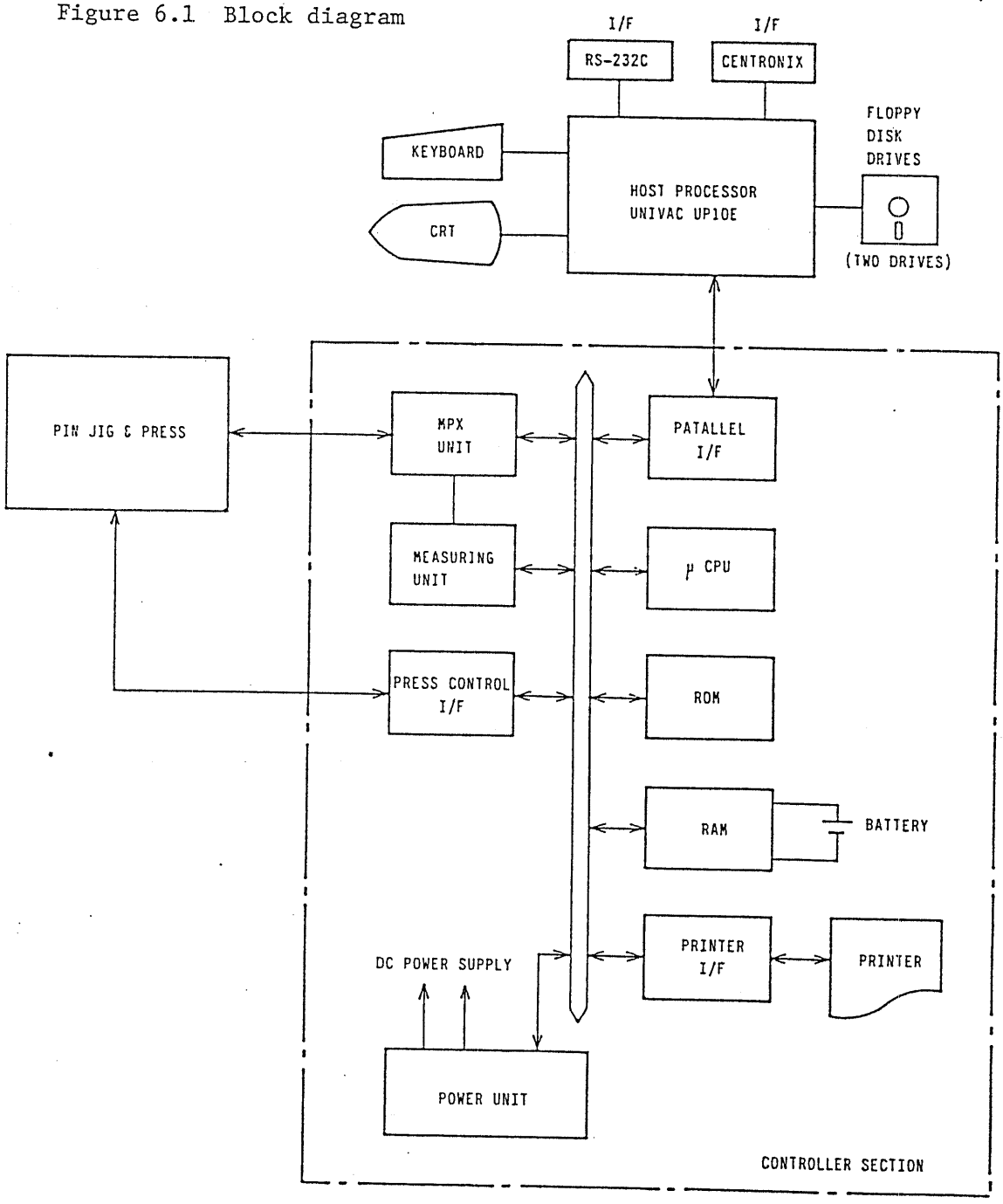
Place the original UP10E CP/M system diskette in Drive A. Simultaneously press the [CTRL] and [RESET] keys; a prompter A> will appear on the screen.
Place a new diskette (for which formatting and SYSGEN is completed) in Drive B. Execute "A> PIP B: =A: *.* [RETURN]". Now all the contents of the UP10E CP/M system diskette are duplicated on the back-up diskette in Drive B.

The APC-1000 System Diskette causes the SBASIC on the CP/M and the programs in the APC-1000 program menu both to be automatically started.
For more details of diskette copy, refer to the Operation Manual for the UP10E Processor.

6. THEORY OF OPERATION

6.1 BLOCK DIAGRAM

Figure 6.1 Block diagram

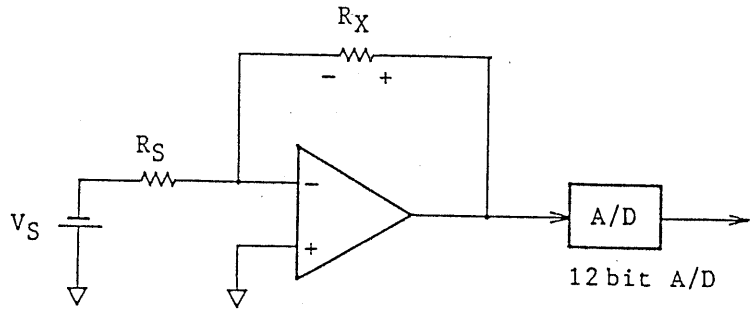


The APC-1000 tester has the configuration shown in Fig. 6.1.
The controller uses an integral microprocessor, control program ROM, and backed-up RAM.
The controller is attached to the host processor via parallel interface.

6.2 THEORY OF MEASUREMENT

6.2.1 Measurement of Resistance

Figure 6.2 Measurement of resistance



Vs: Reference voltage

Rs: Reference resistor

Rx: Resistance under measurement

Rx range	Vs	Rs	Range data	
0.1 ∿ 9.99Ω	1V	10Ω	1	--- SHORT/JUMPER
∿ 99.9Ω	"	100Ω	2	
∿ 999.Ω	"	1KΩ	3	--- DIODE/TRANSISTOR
∿ 9.99KΩ	"	10KΩ	4	
∿ 99.9KΩ	"	100KΩ	5	
∿ 999.KΩ	"	1MΩ	6	
∿ 3.99MΩ	0.1V	1MΩ	7	
Open or inmeasurable			8	(Displays 999.00.)

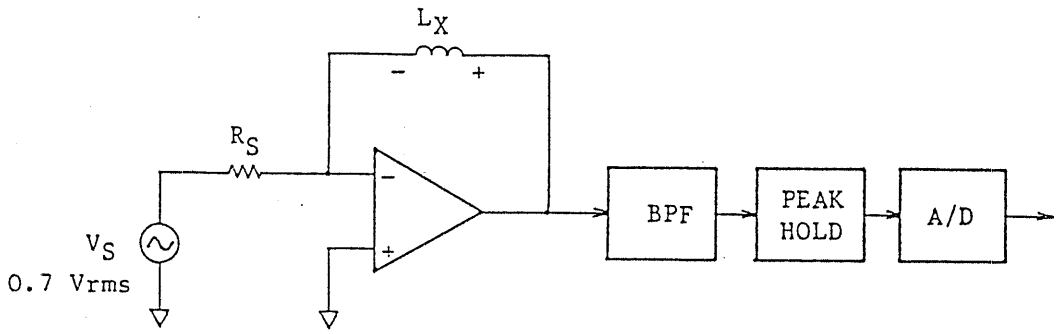
The theory of resistance measurement and measurement ranges for automatic data learning are shown above.
When Rx is infinite, the application voltage is suppressed to approximately ±2.5 V by an over-voltage protection.

The equivalent resistance of transistors or diodes is measured with a fixed Rx range of 999Ω. Therefore, Vs is 1 V and Rs is 1 KΩ, and a constant current of 1 mA is applied for normal operation.

Short circuit and jumper conduction check is accomplished in another fixed range of 9.99Ω.

6.2.2 Inductance Measurement

Figure 6.3 Inductance measuring setup



Vs: Reference AC voltage source

Rs: Reference resistance

Lx: Inductance under measurement

Lx range	Vs	Rs	Range data
10 ∿ 99.9μH	15.92KHz	10Ω	2
∿ 999.μH	15.92KHz	100Ω	3
∿ 9.99mH	15.92KHz	1KΩ	4
∿ 99.9mH	1.592KHz	1KΩ	5
∿ 399.mH	1.592KHz	10KΩ	6

The inductance measuring setup and measurement ranges for automatic data learning are shown above.

The application voltage to Lx is suppressed to approximately ±2.5 V by an overvoltage protection.

6.2.3 Capacitance Measurement

Capacitance may be measured with two different methods. Since the optimum range is selected for data learning, the operator need not be aware of the measuring method used.

The following describes the Z method for measurement of up to 9.99μF, and the TC method for the measurement of more than 10μF.

6.2.3.1 Z method

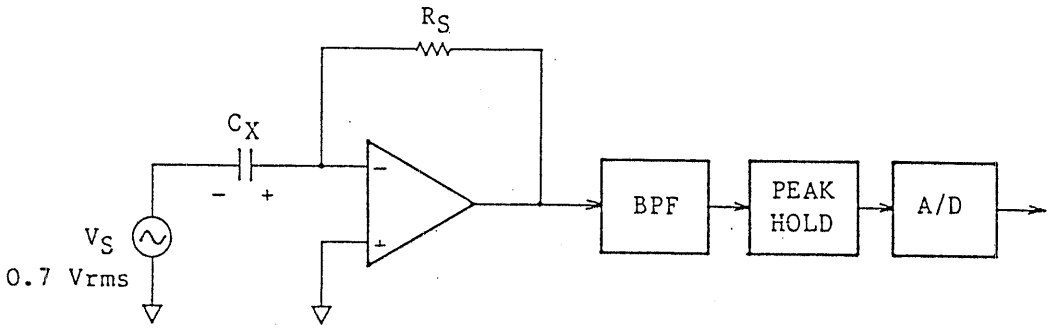


Figure 6.4 Z method for capacitance measurement

Vs: Reference AC voltage source

Rs: Reference resistance

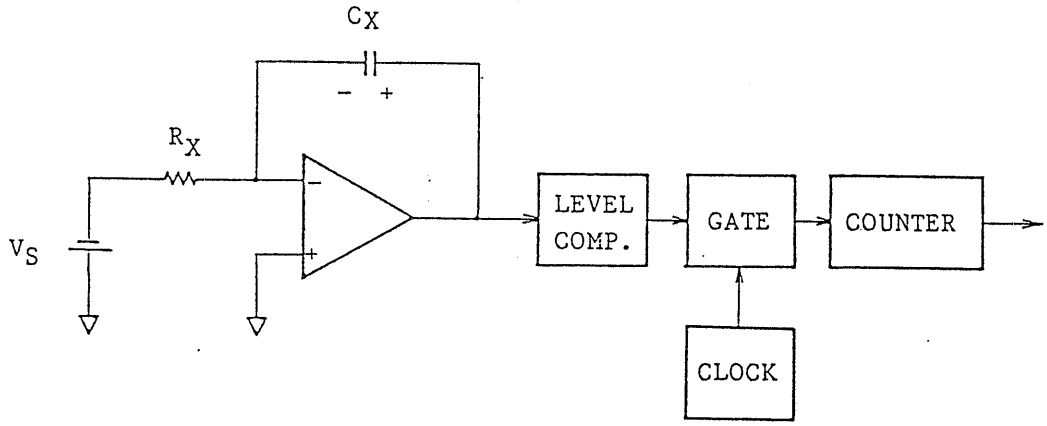
Cx: Capacitor under measurement

Cx range	Vs	Rs	Range data
10 ∿ 99.9pF	15.92KHz	100KΩ	2
∿ 999.pF	15.92KHz	10KΩ	3
∿ 9.99nF	15.92KHz	1KΩ	4
∿ 99.9nF	1.592KHz	1KΩ	5
∿ 999.nF	1.592KHz	100Ω	6
∿ 9.99μF	1.592KHz	10Ω	7

The application voltage to Cx is suppressed to approximately ±2.5 V by an overvoltage protection.

6.2.3.2 TC method

Figure 6.5 TC method for capacitance measurement



Vs: Reference voltage

Rs: Reference resistance

Cx: Capacitor under measurement

Cx range	Vs	Rs	Range data	Clock
∿ 99.9μF	1V	1KΩ	5	10KHz
∿ 999.μF	1V	100Ω	6	10KHz
∿ 3.99mF	1V	100Ω	7	1KHz
Short or open			8	

(999.0F display)

The application voltage to Cx is suppressed to approximately ±2.5 V by an overvoltage protection.

6.3 THREE-TERMINAL GUARD METHOD

If the two-terminal method is used for in-circuit measurement of part constants, high measurement accuracy will not be guaranteed due to round-about impedance.
To assure high accuracy in-circuit measurement, the APC-1000 allows the operator to program the three-terminal guard method.

Figure 6.6 shows the theory of the three-terminal guard method:

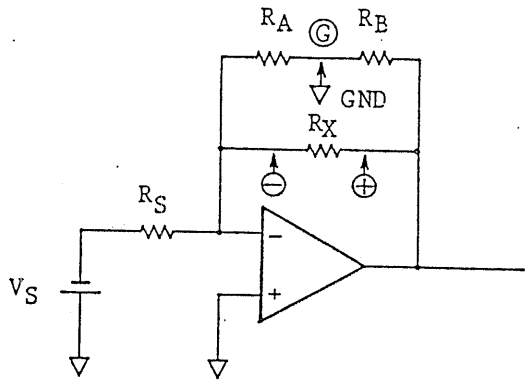


Figure 6.6 Three-terminal guard method

In Figure 6.6, the serial resistors of R_A and R_B are connected in parallel with the resistor (Rx) to be measured.
Since good measurement accuracy is not obtained only with the measurement across Rx (+ and −), the node Ⓖ of R_A and RB is

specified as ground, so that the node Ⓖ is at the same level as the imaginary ground of the amplifier.
As a result, no current flows through R_A, and only the current passing through Rx can be measurement. This means that the measurement of Rx is not affected by the impedance of R_A and R_B.

On the APC-1000, any pin or node can be specified as ground.

This three-terminal guard method is effective also for in-circuit measurement of capacitors, inductors or resistors.

6.4 MEASUREMENT DELAY

When measuring a resistance in a circuit network wherein the resistor under measurement is connected in parallel with a capacitor, it is preferable that measurement be started after the parallel capacitor is fully charged up.
To enable this, a measurement delay can be specified for resistance measurement, as shown below:

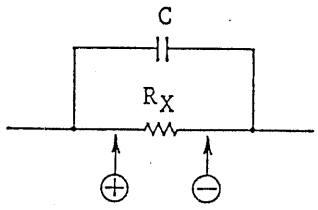


Figure 6.7 R/C parallel network

Measurement delay

0:	0 ms	6:	300 ms	C:	600 ms
1:	50 ms	7:	350 ms	D:	650 ms
2:	100 ms	8:	400 ms	E:	700 ms
3:	150 ms	9:	450 ms	F:	750 ms
4:	200 ms	A:	500 ms		
5:	250 ms	B:	550 ms		

For the parallel circuit as shown in Figure 6.8, measurement delay need not be specified if the node Ⓖ is specified as the ground for the three-terminal guard method.

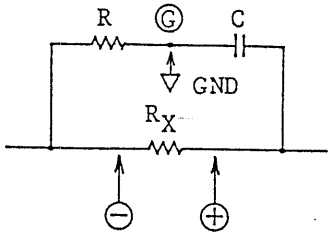


Figure 6.8 R/C serial-parallel network

6.5 JUDGEMENT CRITERION ERROR

When execution reference data is created after learned data is averaged, the error range of the judgement criterion is ±10% of the default value.
This error range may be altered by using the correction program. Alteration may be done for each test step or for each part type.

However, for short circuit or jumper conduction check, the range of 0 to 9.99Ω is used, with the measured range of 0 to 9.99Ω identified as a failure for short circuit, and that of above 10Ω identified as good. For jumpers, the measured range of 0 to 9.99Ω is identified as good, while that of less than 10Ω is identified as failure.
This means that the error range specification (e.g.±10%) for short circuit or jumper does not affect the judgement criteria.

7. PIN BOARD DESIGN

7.1 CIRCUIT EXAMPLE AND PIN ASSIGNMENTS

Figure 7.1 shows a circuit example in which node numbers 0 through 8 are specified for programming the initial data creation program. Data learning is executed by using this program.

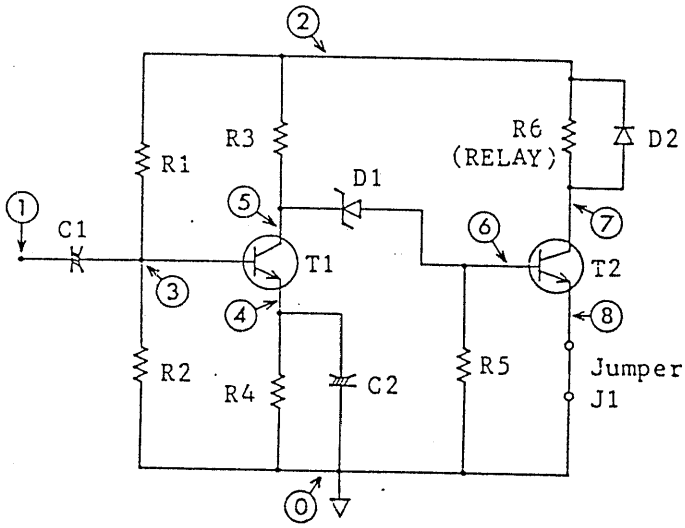


Figure 7.1 Circuit example

Step No.	PARTS	+PIN	-PIN	GND·PIN	Remarks
1	C1	1	3		
2	R1	2	3		
3	R2	0	3		
4	R3	5	2		
5	R4	4	0		Measurement delay
6	R5	0	6		
7	R6	2	7		DC resistance of relay
8	C2	4	0		Error present due to R4.
9	T1	3	4	0	
10	T2	6	8	3	(GND node) 3, 2, or 5
11	D1	6	5	2	(GND node) 2, 3, or 0
12	D2	7	2		Paralleled with R6.
13	J1	8	0		Jumper check
14	S1	2	0	3	Short circuit check
15					
16					

7.2 PIN ASSIGNMENTS

The following shows the pin jig connector pin assignments for connector wiring:

Connector type : Amphenor 50-pin connector 57-40500
Number of connectors: 6 for standard 256 pins.
12 for expanded 512 pins (6 additional connectors used.)

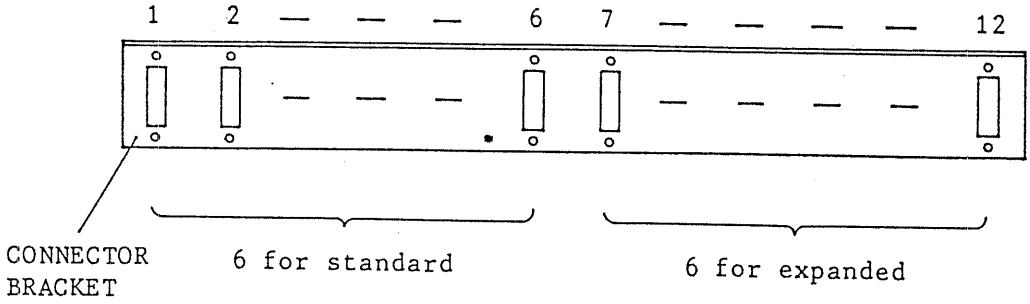
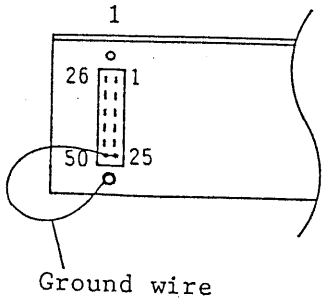


Figure 7.2 Connector numbers (viewed from front)

As shown in Figure 7.3, pin number specifications on the program are determined according to the pin numbers on each connector.

For the standard 256 pins, 0 through 255 is specified on the program. For the expanded 512 pins, 0 through 511 are programmed.

Pins 25 and 50 of each connector are assigned to guard pins. However, pins 25 and 50 of connector No.1 should be connected to the metal part (any location) on the connector bracket.



APC-1000 [PIN ASSIGNMENT]

コネクタ	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12
Pin No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.	PROG No.
1	0	48	96	144	192	240	256	304	352	400	448	496
2	1	49	97	145	193	241	257	305	353	401	449	497
3	2	50	98	146	194	242	258	306	354	402	450	498
4	3	51	99	147	195	243	259	307	355	403	451	499
5	4	52	100	148	196	244	260	308	356	404	452	500
6	5	53	101	149	197	245	261	309	357	405	453	501
7	6	54	102	150	198	246	262	310	358	406	454	502
8	7	55	103	151	199	247	263	311	359	407	455	503
9	8	56	104	152	200	248	264	312	360	408	456	504
10	9	57	105	153	201	249	265	313	361	409	457	505
11	10	58	106	154	202	250	266	314	362	410	458	506
12	11	59	107	155	203	251	267	315	363	411	459	507
13	12	60	108	156	204	252	268	316	364	412	460	508
14	13	61	109	157	205	253	269	317	365	413	461	509
15	14	62	110	158	206	254	270	318	366	414	462	510
16	15	63	111	159	207	255	271	319	367	415	463	511
17	16	64	112	160	208		272	320	368	416	464	
18	17	65	113	161	209		273	321	369	417	465	
19	18	66	114	162	210		274	322	370	418	466	
20	19	67	115	163	211		275	323	371	419	467	
21	20	68	116	164	212		276	324	372	420	468	
22	21	69	117	165	213		277	325	373	421	469	
23	22	70	118	166	214		278	326	374	422	470	
24	23	71	119	167	215		279	327	375	423	471	
25	GUARD	----------	----------	----------	----------	GUARD	----------	----------	----------	----------	----------	GUARD
26	24	72	120	168	216		280	328	376	424	472	
27	25	73	121	169	217		281	329	377	425	473	
28	26	74	122	170	218		282	330	378	426	474	
29	27	75	123	171	219		283	331	379	427	475	
30	28	76	124	172	220		284	332	380	428	476	
31	29	77	125	173	221		285	333	381	429	477	
32	30	78	126	174	222		286	334	382	430	478	
33	31	79	127	175	223		287	335	383	431	479	
34	32	80	128	176	224		288	336	384	432	480	
35	33	81	129	177	225		289	337	385	433	481	
36	34	82	130	178	226		290	338	386	434	482	
37	35	83	131	179	227		291	339	387	435	483	
38	36	84	132	180	228		292	340	388	436	484	
39	37	85	133	181	229		293	341	389	437	485	
40	38	86	134	182	230		294	342	390	438	486	
41	39	87	135	183	231		295	343	391	439	487	
42	40	88	136	184	232		296	344	392	440	488	
43	41	89	137	185	233		297	345	393	441	489	
44	42	90	138	186	234		298	346	394	442	490	
45	43	91	139	187	235		299	347	395	443	491	
46	44	92	140	188	236		300	348	396	444	492	
47	45	93	141	189	237		301	349	397	445	493	
48	46	94	142	190	238		302	350	398	446	494	
49	47	95	143	191	239		303	351	399	447	495	
50	GUARD	----------	----------	----------	----------	GUARD	----------	----------	----------	----------	----------	GUARD

Figure 7.3 Pin assignment

7.3 PIN JIG PARTS AND ASSEMBLY DRAWINGS

For the preparation of the pin jig for each card model, install contact pins on the PCB PIN BOARD (acrylic 5 mm thick) shown in a separate drawing, mount the necessary 50-pin connector on the connector bracket and make the pertinent wiring to it, then store the front bracket while it is installed on the acrylic pin board. These correspond to (1), (3), and (6) of the pin board ass'y drawings. However, when contact pins are installed on the pin board, mount the spacers (5) in the appropriate locations, so as to prevent the board from warping due to the pressure of the press head.

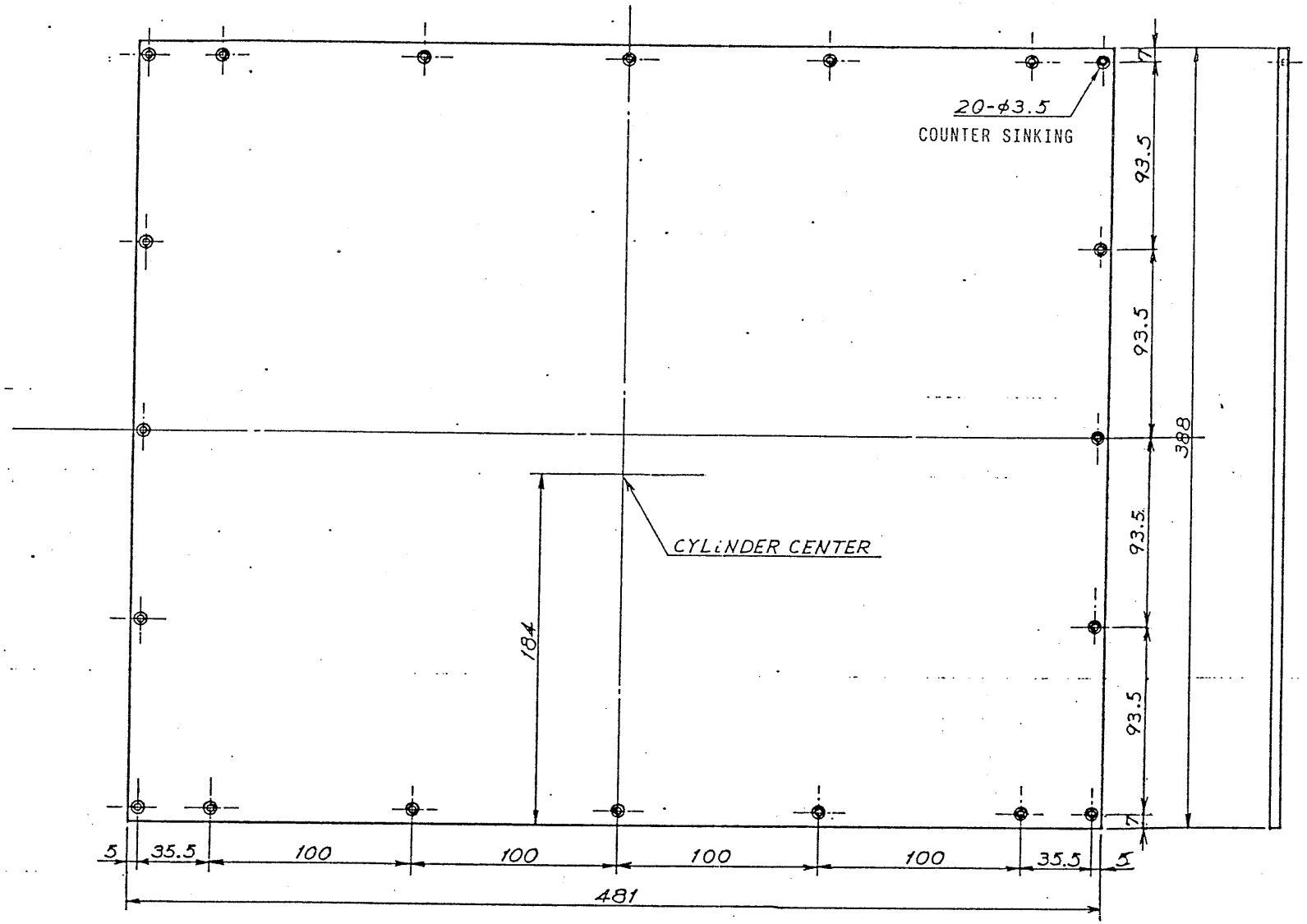
When replacing the completed pin jig with another completed jig, remove the flat head screws from the Base Plate (4) and the screws from the Side Plates (8) and (9).

When creating a new pin jig, refer to each drawing.

If a pin board thickness of other than 5 mm (e.g. 10 mm) is desired, the PCB PIN BOARD (1), BRACKET (3), CONNECTOR BRACKET (6), SIDE PLATES (8) and (9), and SPACER (5) shown in the Pin Board Ass'y drawing require replacement.

For the appropriate press head stroke, adjust the push rod by referring to Figure 7.4 Press stroke.

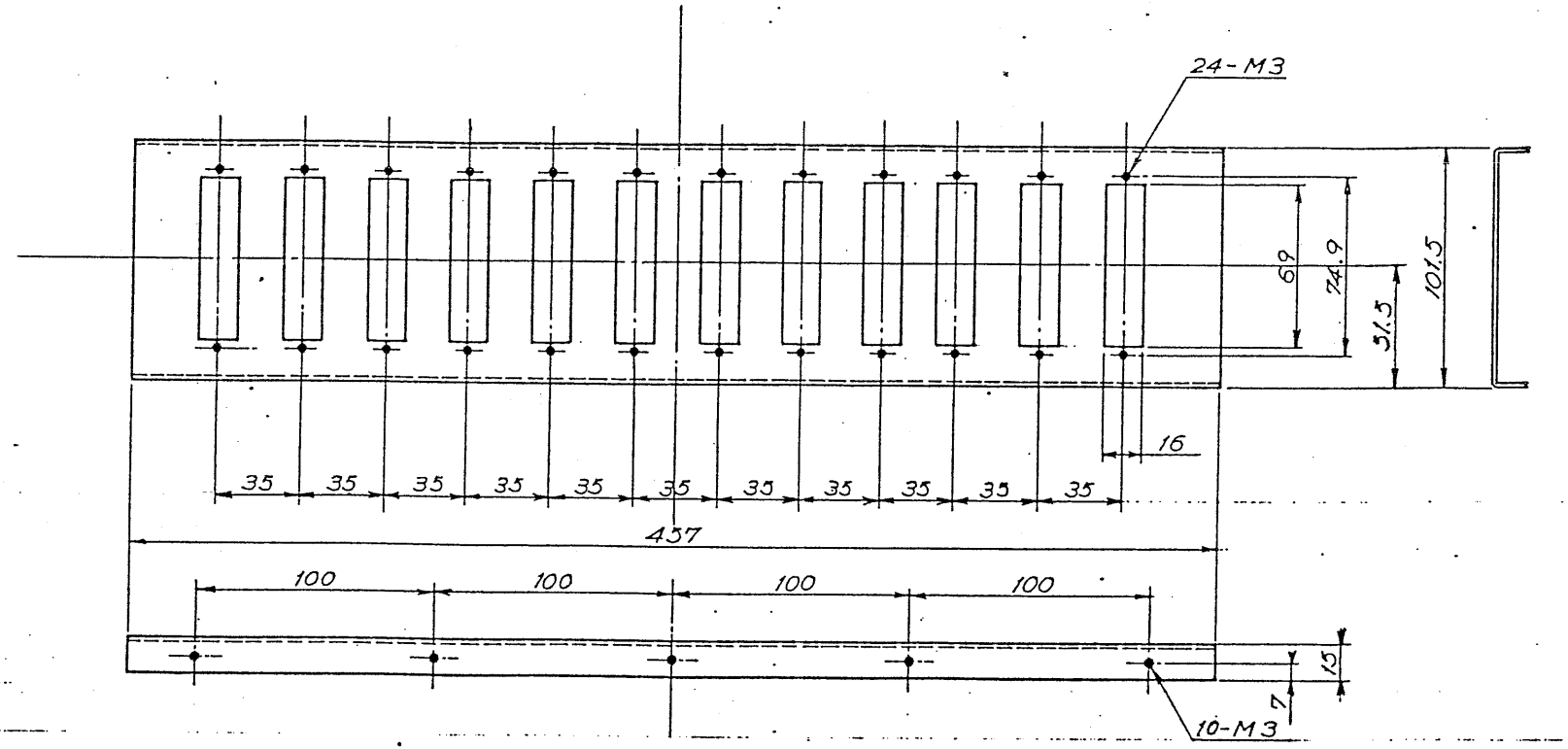
EQ12738



Polyacrylate (clear) t5

PCB PIN BOARD

APC-1000 317022



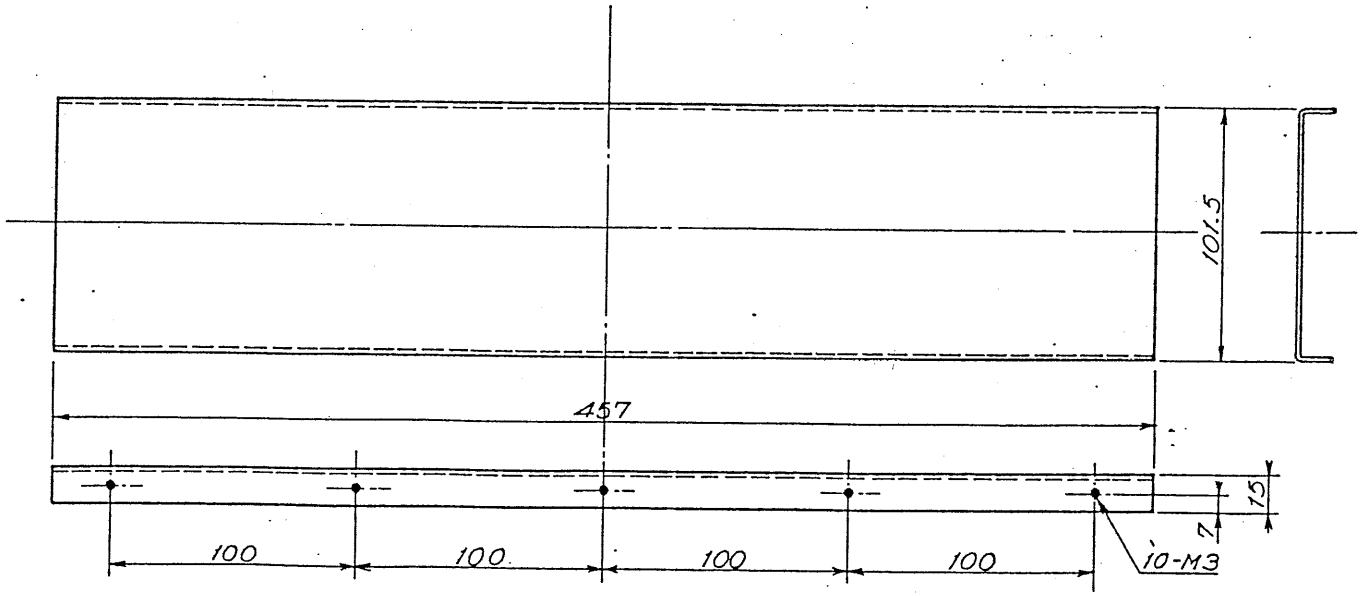
Cold Rolled Carbon Steel Sheet t2

Electroplated Coating of Nickel

BRACET FOR CONNECTOR

APC-1000 317037

501728

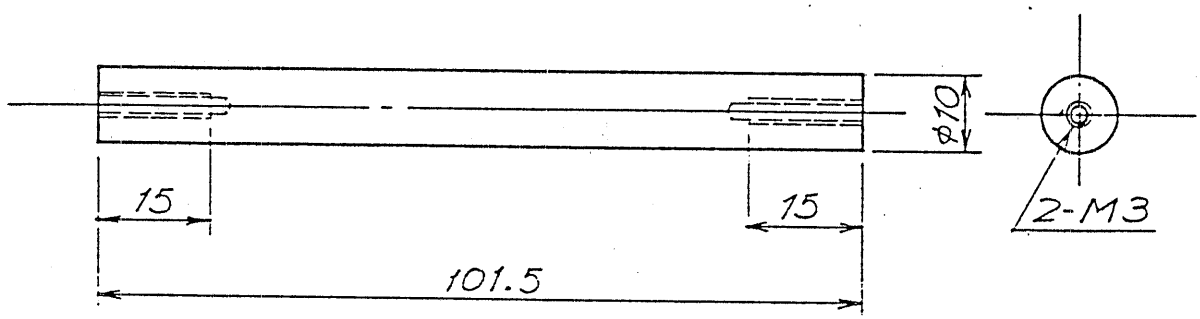


Cold Rolled Carbon Steel Sheet t2

Electroplated Coating of Nickel

BRACKET

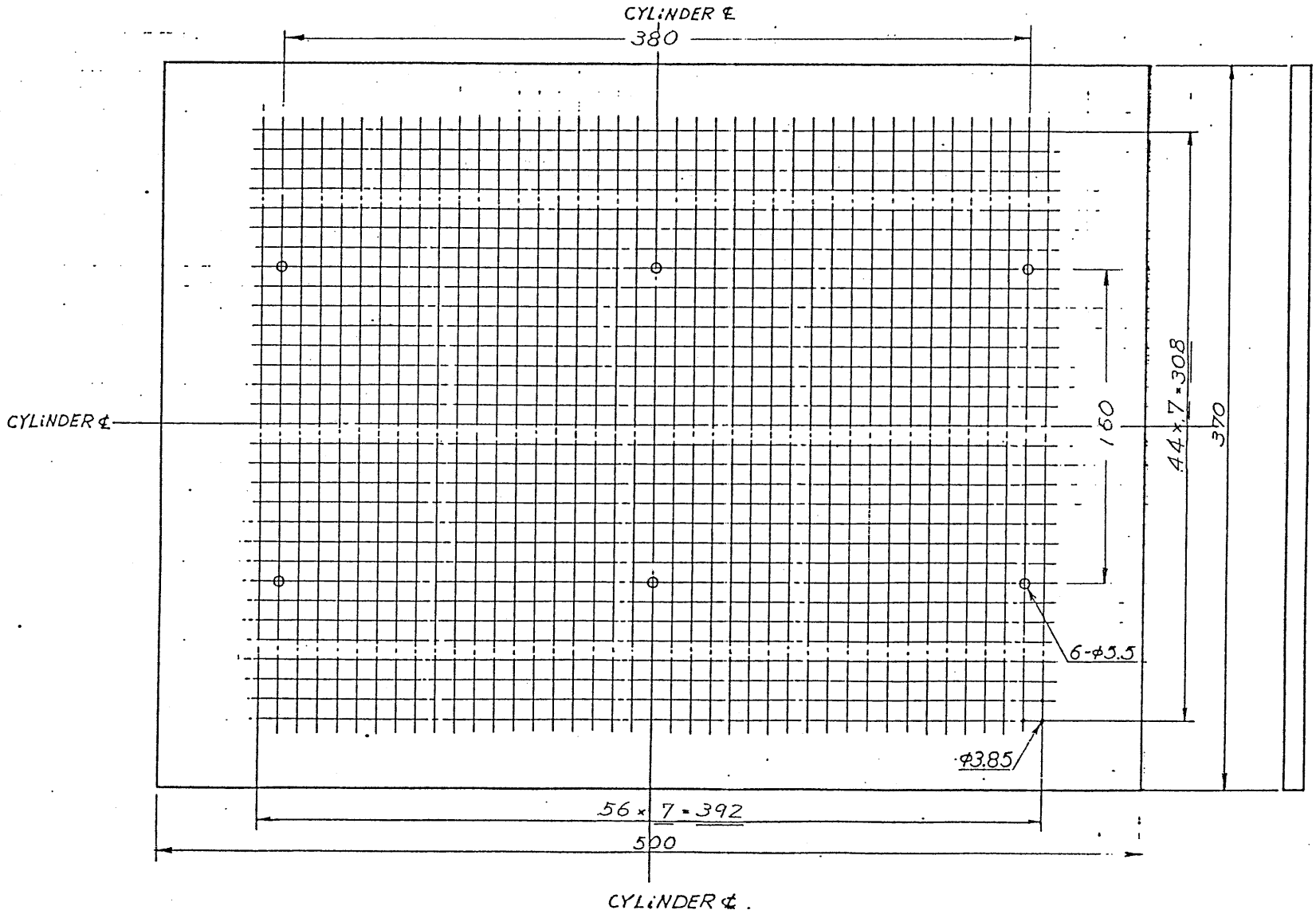
APC-1000 317034



Bakelite Laminated Rod 10DIA

SPACER

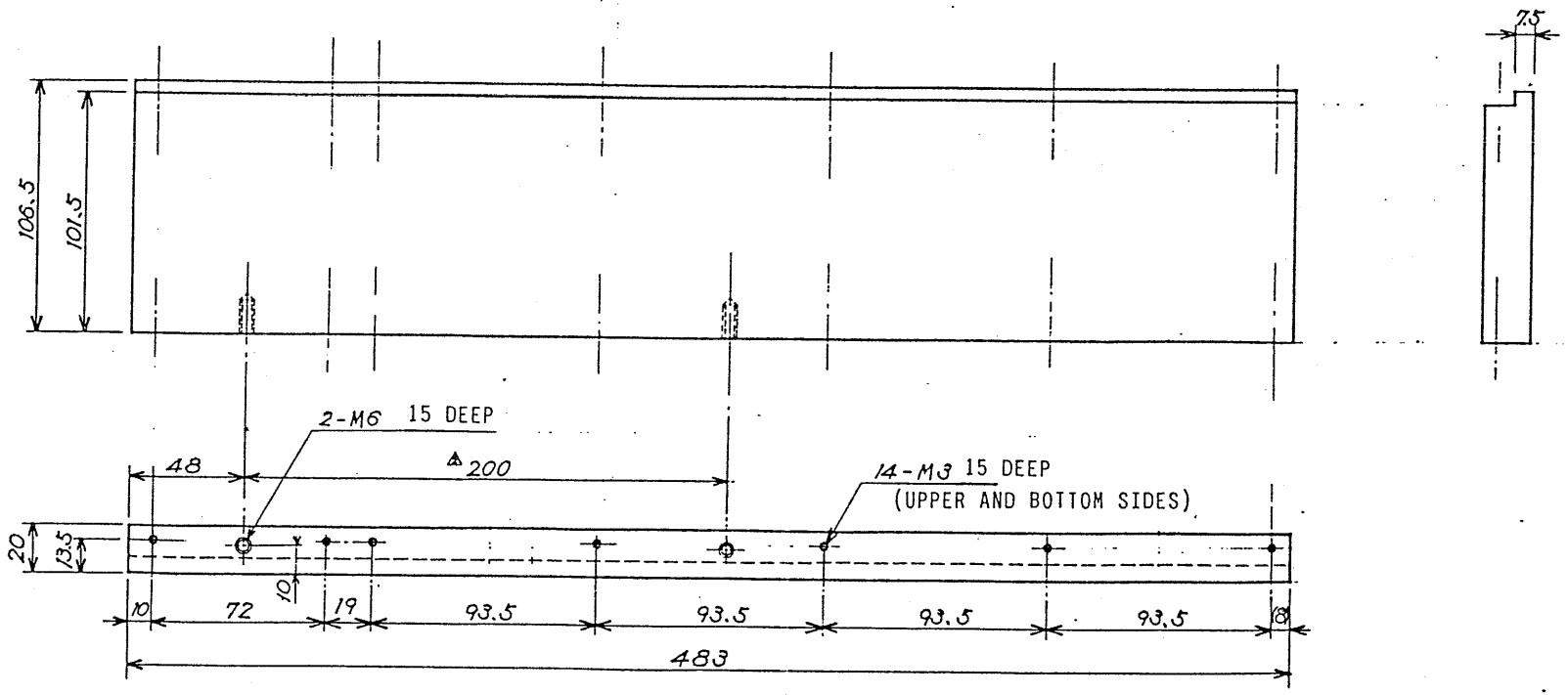
APC-1000 419251



Polyacrylate (crear) t10

PCB PUSH BOARD

APC-1000 317021

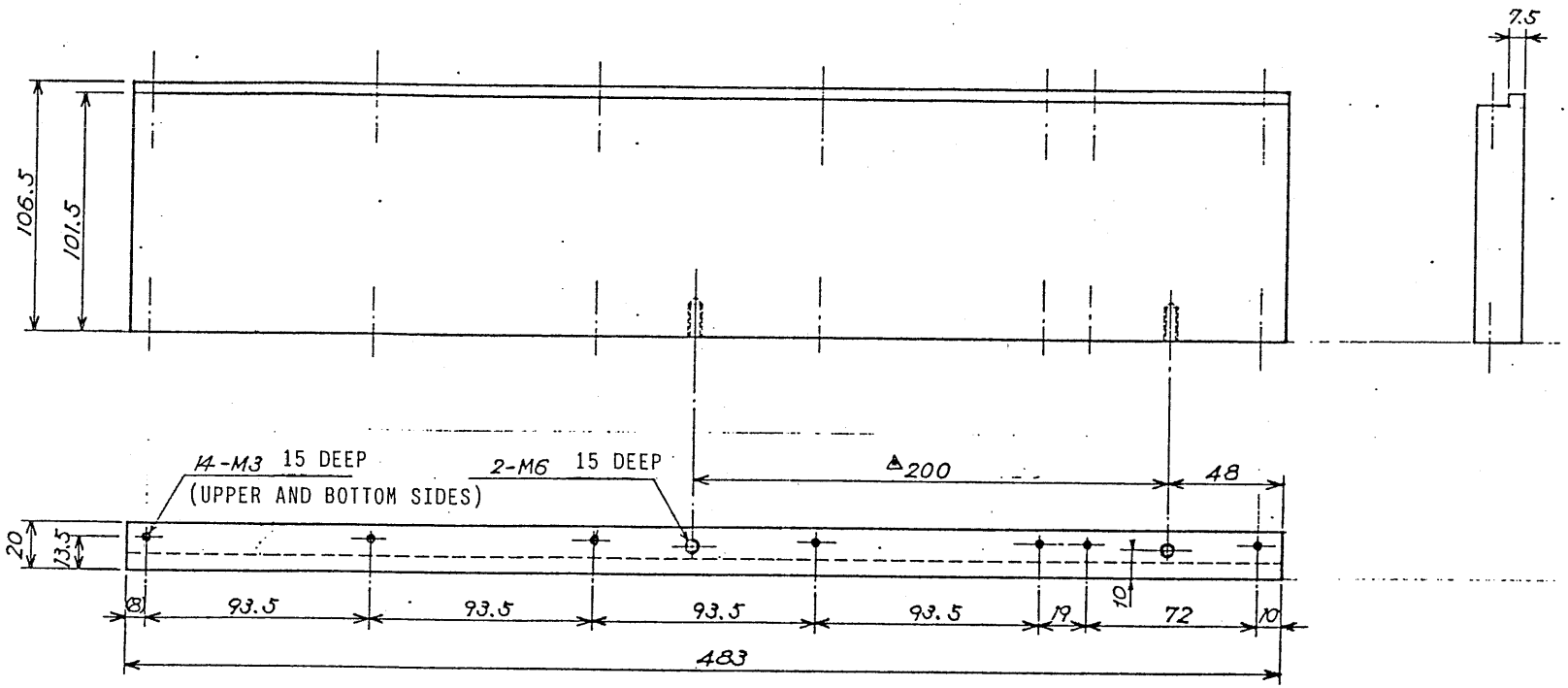


Bakelite Laminated Sheet t20 (brown)

PLATE SIDE (L)

APC-1000 317236

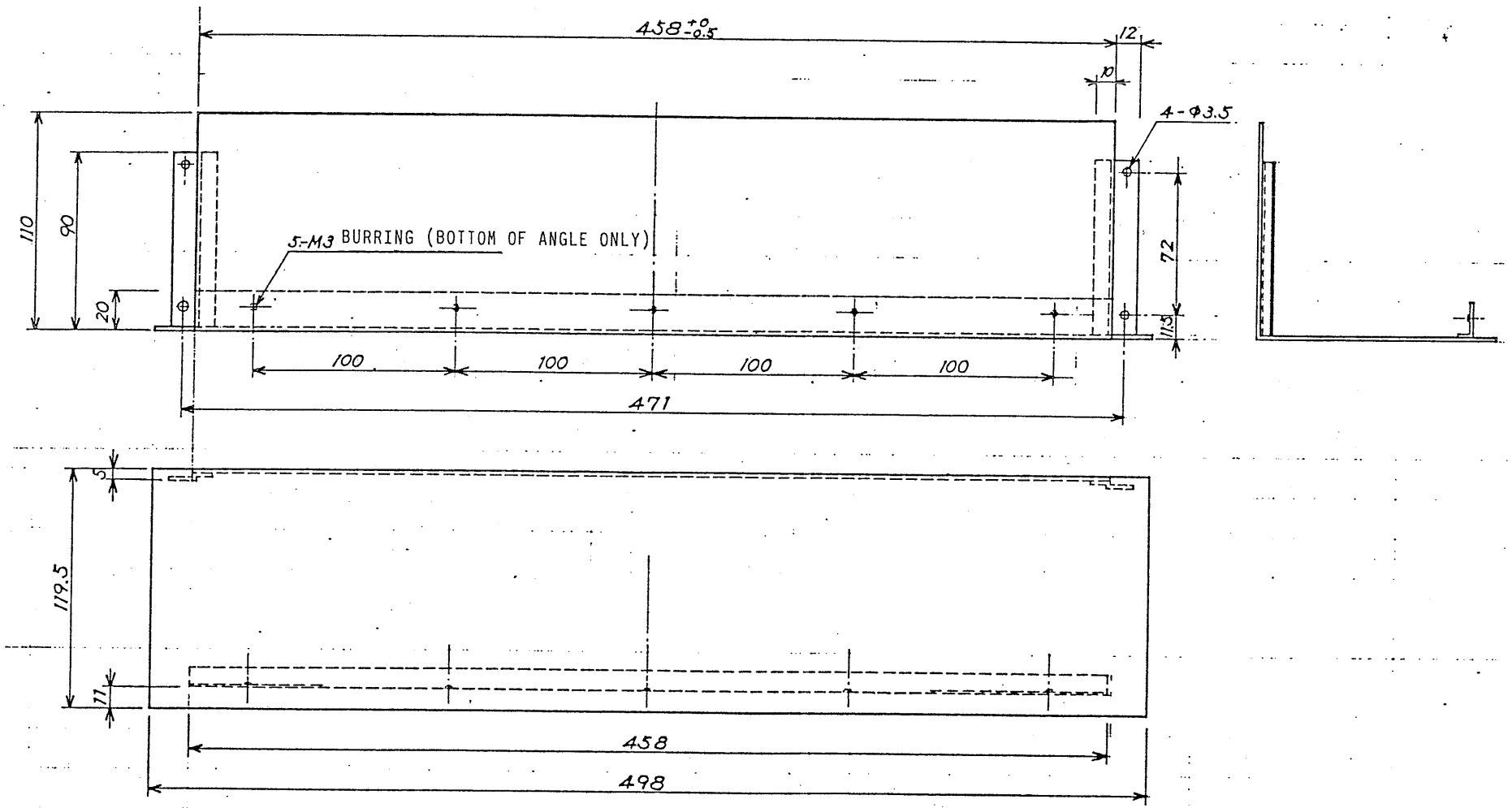
601278



Bakelite Laminated Sheet t20 (brown)

PLATE SIDE (R)

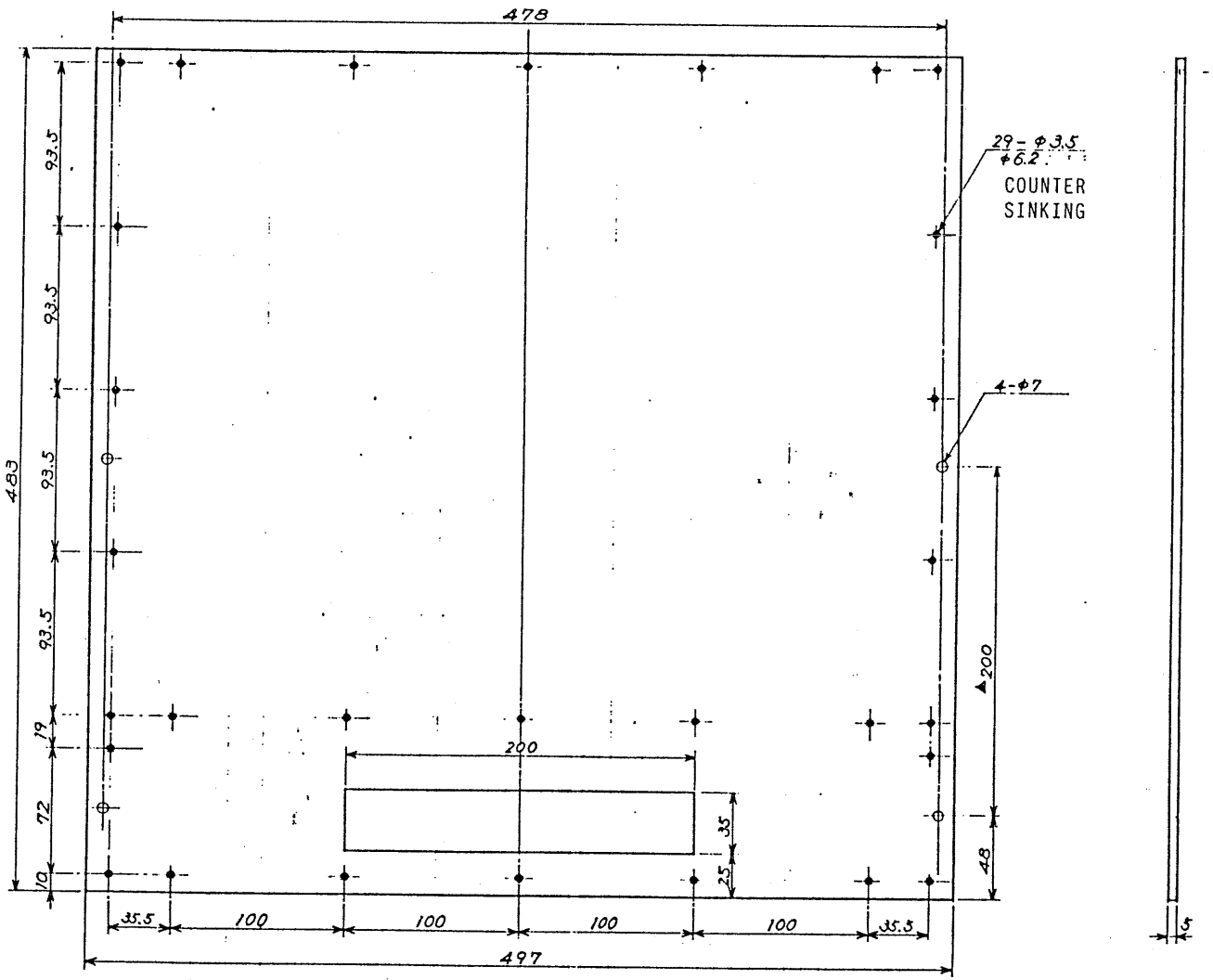
APC-1000 317235



Cold Rolled Carbon Steel Sheet t1.2

COVER FRONT

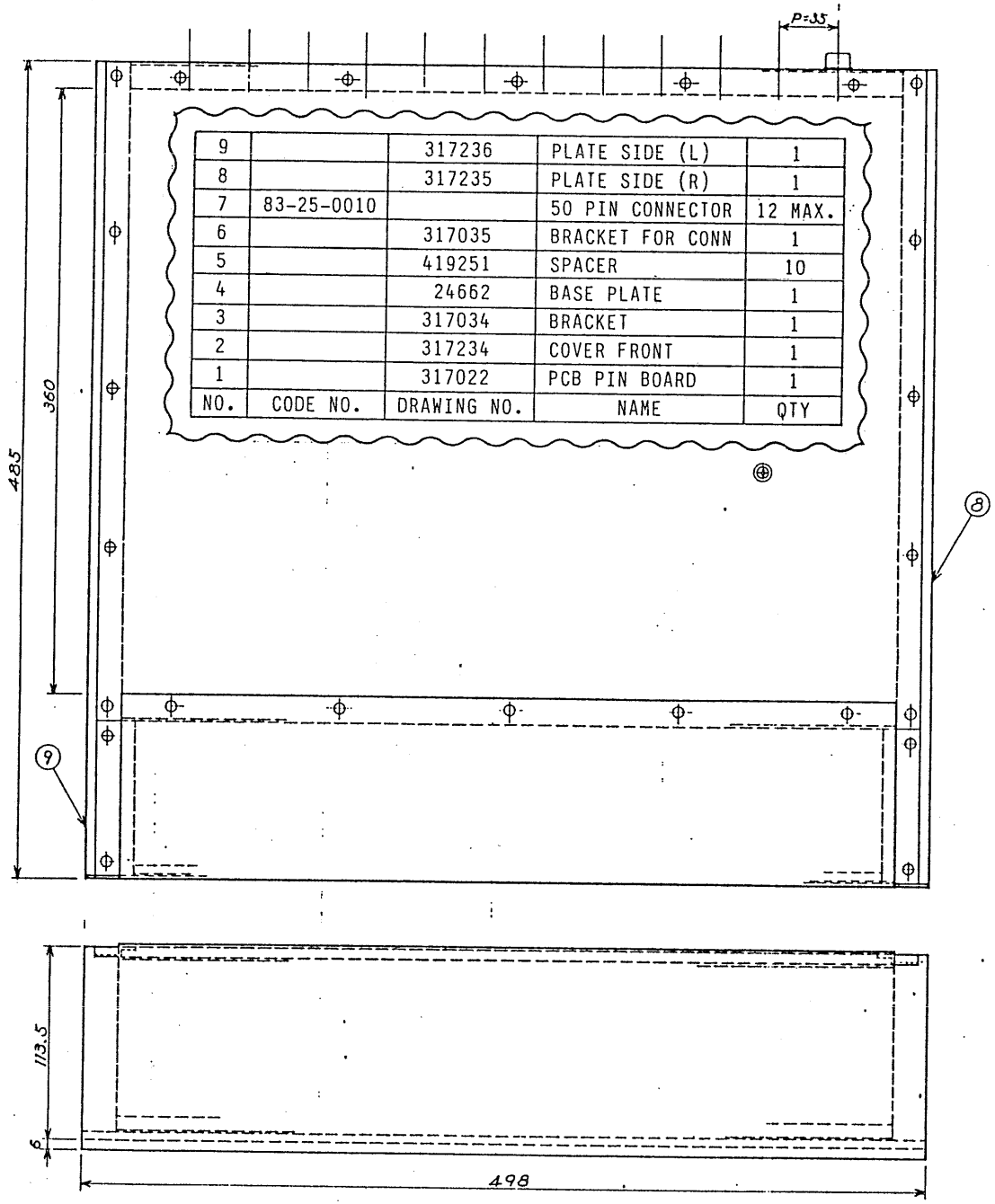
APC-1000 317234



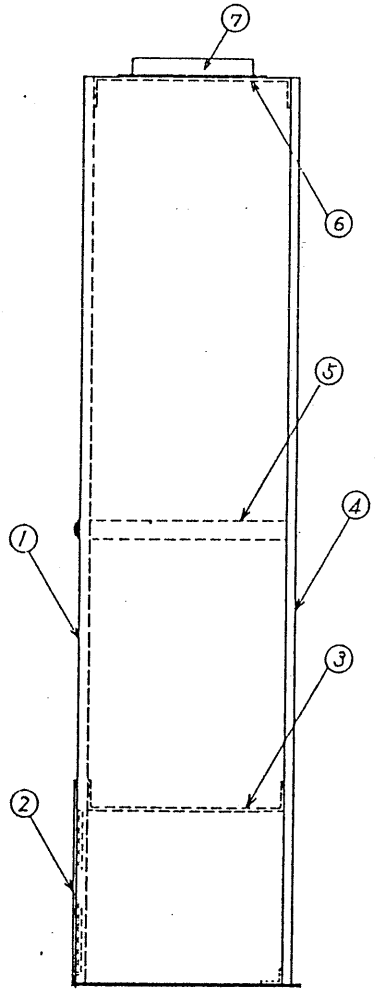
Bakelite Laminated Sheet t5 (brown)

BASE PLATE

APC-1000 24662



NO.	CODE NO.	DRAWING NO.	NAME	QTY
9		317236	PLATE SIDE (L)	1
8		317235	PLATE SIDE (R)	1
7	83-25-0010		50 PIN CONNECTOR	12 MAX.
6		317035	BRACKET FOR CONN	1
5		419251	SPACER	10
4		24662	BASE PLATE	1
3		317034	BRACKET	1
2		317234	COVER FRONT	1
1		317022	PCB PIN BOARD	1



PIN BOARD ASSEMBLY

APC-1000 24663

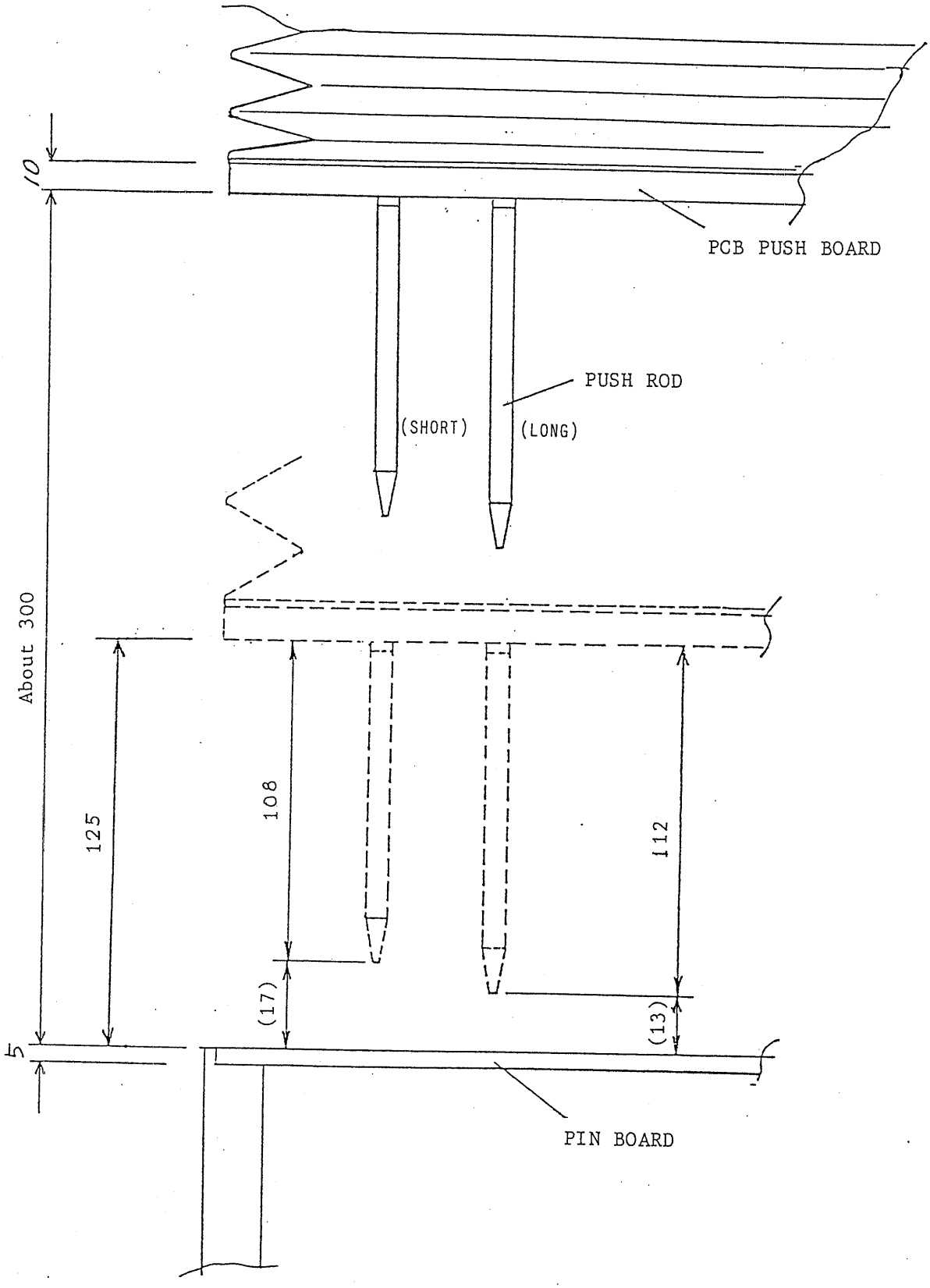


Figure 7.7 Press stroke

8. NOTES AND PRECAUTIONS

8.1 PRECAUTIONS FOR MEASUREMENT

8.1.1 Comparison with Other Tester Models

When the APC-1000 is compared with other tester model, they may produce different measurement results from the same test object, especially for inductance measurement, due to the difference in testing frequencies, measuring levels, or the presence of DC application.

8.1.2 Measurement in Composite Circuits

While measurement accuracy can be considerably increased by the three-terminal guard method, some measurement error may be observed for resistors connected in parallel with inductors, capacitors connected in parallel with resistors, or the same parts connected in parallel.
In this case, however, parts with untolerable error can be identified since test is basically performed by comparing part constant with learned reference data.

When measuring resistance connected in parallel with capacitance, use measurement delay. The value of measurement delay should be determined by referring to the time constant obtained from the product of the resistance and capacitance.

8.1.3 Measurement Range

While reference data is automatically learned in the optimum range, it is also possible for the machine to learn data using one higher range for measured values which are more than 90% of each range (by considering the error of ±10% of the default value).
However, if any inadequate condition is expected from the relationship between altered judgement criterion and reference data, change the measurement range using the correction program while referring to the range listing in section 6.2.

8.1.4 Preventing Parts Under Test from Damage or Deterioration

The testing voltage applied to the parts under test is typically 1 VDC or 1 VAC rms and is suppressed to approximately ±2.5 V under any faulty condition.

To prevent possible damage or deterioration, exercise care for test node specification and polarity by considering round-about impedances in composite networks. The above typical application voltage may, however, be applied to almost any part without the danger of damage or deterioration.

8.2 OPERATING PRECAUTIONS

8.2.1 Floppy Disk

When handling floppy disks, never fold it nor touch any of the exposed surfaces. Keep them out of direct sunlight and away from strong magnetic field.

Do not place a diskette in the drive while you are turning the host processor on or off. In other words, remove the diskette from both drives before turning the host on or off.

Do not open the door of the drive while the drive is operating.

If a diskette is inserted into or removed from the drive while the program is running, the message "Bdos Err on B: R/O" may appear on the monitor. If this occurred, simultaneously press the CTRL and RESET keys to return control to the main menu.

Each work file diskette can hold data of only up to four card models if reference data has been learned from ten cards each requiring 1024 steps, the execution reference data is stored in the work file, and none of unnecessary files is left undeleted from the work file.

It is advisable that each work file be reserved for individual card model.

8.2.2 Microprocessor in the Controller Section

If the controller malfunctions, press the [CPU RESET] switch on the controller. Once the CPURESET is pressed, start the entire test sequence from the beginning again.

8.2.3 Print Paper

If paper jam or entangled ribbon is left unserviced in the printer, it may cause printer trouble.

8.2.4 Program Execution Abort and Restart

If an error occurred during program execution and the program execution was broken, it may be restarted by typing in "RUN" just following the prompter ">", then strike the [RETURN] key. The aborted program will be executed again.

>RUN [RETURN]

If you press the [CTRL] and [RESET] keys, control will return to the main menu.

To abort the current program execution, simultaneously press the [CTRL] and [C] keys. It may be restarted by following the procedure described just above.

8.3 MECHANISM SECTION AND MULTIPLEXER

8.3.1 Press Head Stroke

Adjust the press head stroke by means of the push rod according to each card type to be tested. If needed, install washers on the push rod for stroke adjustment.
Stroke adjustment will be require after contact pins are altered (see Figure 7.4 Press head stroke.).

8.3.2 Air Control Valve

Drain water from the glass section of the air control valve before accumulation of water becomes excessive.

8.3.3 CUD Discharging

If a card with electrostatic charge accumulation is tested on the tester, the relay contacts in the multiplexer unit may fuse. Cards just after subjected to electrical check often has static accumulation. Discharge such cards before placing it on the tester.

8.3.4 Contamination of Contact Pins

Do not leave any contact pins left contaminated. Flux may often be a cause of defective pin contact. Clean the contact pins with a brush some twice per day.

8.3.5 Emergency Press Head [UP] Switch

After test execution is completed, the press head is automatically

---

APC-1000

ALL PINS SHORT CHECK

OPERATION MANUAL

KIKUSUI ELECTRONICS CORPORATION

This operation manual describes details of all pins short check function and its operation method in a program.

1. Explanation of details of all pins short check

A. Procedures for data learning

1) Input information "150" with a key, when pins used as instruments are, for instance, 0 - 150.

2) Conduct tests at "0" to "150" one after the other, and memorize the positions of the short.

0 ⟷ 1 to 150 shortcircuited
1 ⟷ 0 and 2 to 150 shortcircuited
⋮

3) Make an entire test of positions of the shorts and memorize them. This will be learned data. Data composition is as follows.

0	1, 3
1	0, 3
3	0, 1
15	17, 140
⋮	⋮
↑	↑
Pins tested	Pins not tested

Conduct tests on all the pins except the above pins.

B. Containment of executed program

1) Data obtained in A.3) is transmitted.

C. Execution

1) Conduct short check for all pins according to data contained at B.10, before the execution of measurement.
If there is an error, it should be printed out.

842915

2) If there are errors in all pins short check, do not move on to the measurement of resistances, condensors, etc., but stop.

2. Procedures of all pins short check

When conducting all pins short check, it is necessary to make a file for checking all pins except those pins such as jumperpins which have shorts on normal base plates from the start.
To make this file, there are two ways: by learning of shorted pins and by inputting those pins by the operator manually.
For the operator to input data manually, the [PF1] function key of the initial data making mode is pressed and the following indication will appear.

```
        ***** INPUT INITIAL DATA *****
FUNCTION 1 ........ INPUT INITIAL DATA OF ALL PINS SHORT CHECK
FUNCTION 2 ........ INPUT INITIAL DATA OF COMPONENTS TEST
FUNCTION 3 ........ RETURN TO MENU DISPLAY


            THEN PRESS FUNCTION KEY
```

When making a file of all pins check, press the [PF1] function key. The following indication will appear and explain the input method.

```
   ****** INPUT INITIAL DATA OF ALL PINS SHORT CHECK ******

MAX PIN ------ 999
               1

REF PIN    PASS PIN

999 ------ 999, 999, 999, 999, 999, 999, 999, 999, 999, 999(CR)
 2                                  3                        4

   1: MAXIMUM PIN NUMBER

   2: REFERENCE PIN NUMBER

            E: END OF INPUT      #: INPUT MODIFY

   3: PASS PIN NUMBER

          KEY-IN SHORTED PIN NUMBERS AGAINST THE REFERENCE PIN

          AND USE COMMA (,) AS A DELIMITTOR

   4: PRESS [RETURN] KEY AS END OF PASS PIN NUMBER


       THEN PRESS [RETURN] KEY TO INPUT THESE DATAS !!
```

After reading the explanation, press the RETURN key.
Next let's explain how to register file names.

```
          ****** INPUT INITIAL DATA OF ALL PINS SHORT CHECK ******

                  KEY-IN FILE NAME ( MAX 6 CHARACTERS )

KMT84   .PAS        A       .PAS        LN33    .PAS        B       .PAS
XYZ     .PAS

    FILE NAME
```

Input the file name within 6 characters. If the file is present already, the following display will appear.
A category of file names is .PAS.

842917

```
        ****** INPUT INITIAL DATA OF ALL PINS SHORT CHECK ******

                KEY-IN FILE NAME ( MAX 6 CHARACTERS )

KMT84   .PAS        A       .PAS        LN33    .PAS        B       .PAS
XYZ     .PAS

    FILE NAME A

                GENERATE from FIRST STEP ? (Y/N)
```

To continue to input the file already registered, press the [N] key, and to delete the registered file and make a new file, press the [Y] key.

In case of continuation, the max pin number of the file is indicated as follows.

```
   ****** INPUT INITIAL DATA OF ALL PINS SHORT CHECK ******
MAX PIN ------          ( MAX PIN OF FILE [ A ]  IS  194  )
```

In the case where a new file is made or an existing file is remade, the following indication will appear.

```
   ****** INPUT INITIAL DATA OF ALL PINS SHORT CHECK ******
MAX PIN ------
```

For the MAX PIN, input the maximum pin number used.

For the REF PIN, input a representative pin number (any number) to be checked.

For the PASS PIN, input the number of shortcircuited pins except REF PINs.

For separation, use the "," key always and press the [RETURN] key at the end of the line.

Pass pins can be input in one line by 10. To input more than 10 pins, press the [RETURN] key and input REF PINs.

An example of input is shown as follows.

```
    ****** INPUT INITIAL DATA OF ALL PINS SHORT CHECK ******

MAX PIN ------ 134


REF PIN    PASS PIN
000 ------ 014, 031, 048, 073, 097
014 ------ 000, 031, 048, 073, 097
016 ------ 130, 131
```

After all inputs are finished, press the [E] key, and the display returns to the menu for making the initial data on page-2. To return further to the main menu, press the [PF3].
When making corrections, the cursor can be returned with the [BS] key within the line. When the error is detected after finishing a line, press the [#] key to go to the correction mode. (The [#] key should be pressed when the cursor is at the REF PIN.)

```
        ****** MODIFY INITIAL DATA ******

     D:   DISPLAY 20 LINES FROM RANDOM STEP
     K:   DELETE RANDOM STEPS
     E:   END OF MODIFY
KEY-IN COMMAND & STEP NO.( ex. D1 [RETURN] )
```

Find a wrong step with the [D] key and delete it with the [K] key.

An example of D-operation

```
                ****** MODIFY INITIAL DATA ******

                   D:   DISPLAY 20 LINES FROM RANDOM STEP
                   K:   DELETE RANDOM STEPS
                   E:   END OF MODIFY
              KEY-IN COMMAND & STEP NO.( ex. D1 [RETURN] ) D1


STEP  REF PIN    PASS PIN

0001  000 ------ 014, 031, 048, 073, 097
0002  014 ------ 000, 031, 048, 073, 097
0003  016 ------ 130, 131
```

An example of K-operation

```
        ****** MODIFY INITIAL DATA ******

     D:   DISPLAY 20 LINES FROM RANDOM STEP
     K:   DELETE RANDOM STEPS
     E:   END OF MODIFY
KEY-IN COMMAND & STEP NO.( ex. D1 [RETURN] ) K


KEY-IN START STEP NUMBER FOR DELETE ? 10

KEY-IN END STEP NUMBER FOR DELETE ?   11

          DELETING !!
```

This operation allows deletion from Step 10 to 11.
Now let's explain how to input data by learning the shortcircuited pins. Press the [PF2] function key for learning the main menu and the following display will appear.

```
         ***** LEARN DATA MENU *****

FUNCTION 1 ........ LEARN ALL PINS SHORT CHECK DATA

FUNCTION 2 ........ LEARN COMPONENTS TEST DATA

FUNCTION 3 ........ RETURN TO MENU DISPLAY


           THEN PRESS FUNCTION KEY
```

To learn data about all pins check, press the [PF1] function key.

```
              ****** LEARN ALL PINS SHORT CHECK DATA ******

                    KEY-IN FILE NAME ( 6 CHARACTERS )

KMT84    .PAS        A        .PAS        LN33     .PAS        B        .PAS
XYZ      .PAS

     FILE NAME
```

Input a file name within 6 characters. If the file is already present, the following display will appear.

```
            ****** LEARN ALL PINS SHORT CHECK DATA ******

                KEY-IN FILE NAME ( 6 CHARACTERS )

KMT84   .PAS        A       .PAS        LN33    .PAS        B       .PAS
XYZ     .PAS


    FILE NAME A

                    THE FILE EXISTS ALREADY !!

                    TRY TO LEARN-THE DATA AFRESH ? (Y/N)
```

In the case where the file already exists and was learned earlier or the file made at the time of making the initial data is to be deleted to make a new file, press the [Y] key, or change file names by pressing the [N] key.
When the [N] key is pressed, a file name will be asked.
When the file name is registered, the following display will appear.
In case the existed file names are learned again, a previous MAX PIN number will be displayed.

```
     ****** LEARN ALL PINS SHORT CHECK DATA ******

KEY-IN MAX PIN NUMBER

MAX PIN ------          ( MAX PIN OF FILE  [ LN33 ]  IS  187  )
```

For the MAX PIN, input the maximum pin number being used. The data will be learned automatically.

An example of automatic learning

```
      ****** LEARN ALL PINS SHORT CHECK DATA ******

KEY-IN MAX PIN NUMBER

MAX PIN ------ 107        ( MAX PIN OF FILE  [ LN33 ]  IS  107  )


REF PIN     PASS PIN

000 ------ 014, 031, 048, 073, 097, 099, 104
014 ------ 000, 031, 048, 073, 097, 099, 104
016 ------ 106, 107
010 ------ 080, 099
020 ------ 050, 099
```

After the automatic learning finishes, the menu of data learning on page-6 will appear. To return further to the main menu, press the [PF3].

What has been described is the procedure for making a pass pin data file of all pins short check.

Now let's explain how to transmit data to the controller side. When the [PF4] function key is pressed in data transmission mode of the main menu, the following display will appear.

```
  ***** TRANSFER EXC (EXECUTION) FILE *****

FUNCTION 1 -------- ALL PINS SHORT CHECK DATA FILE

FUNCTION 2 -------- COMPONENTS TEST DATA FILE

FUNCTION 3 -------- RETURN TO MENU DISPLAY




          THEN PRESS FUNCTION KEY
```

Press the [PF1] function key for all pins check data transmitting mode.

```
****** TRANSFER ALL PINS SHORT CHECK DATA FILE ******

          KEY-IN FILE NAME ( MAX 6 CHARACTERS )

LN33    .PEX        KMT84   .PEX        A       .PEX        B       .PEX
PTEST   .PEX        XYZ     .PEX

    FILE NAME
```

When the file name is input, data will be transmitted.

For execution, make the mode OFFLINE, and push TEST START button. All pins short check will start and so will the measurement test. In the case where the all pins short check is NG, the measurement test won't be done.

If conducting a measurement test with no short check, make the all pins check data file at the time of making the initial data, with its contents as "0" for MAX PIN; "0" for REF PIN; and "0" for the PASS PIN.

After that, the contents of the file will be transmitted.

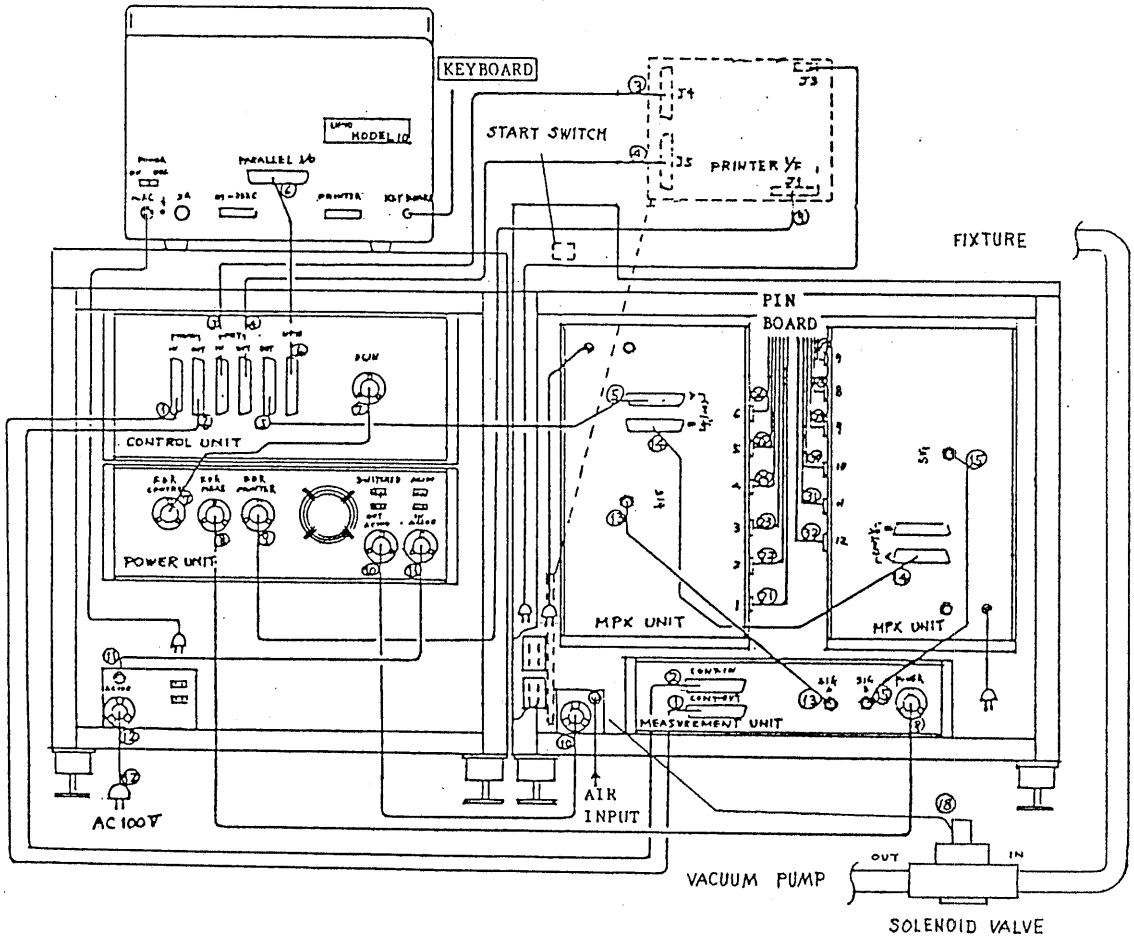


Figure 3.2 Rear cable connections

APC-1000

SYSTEM DISK Ver 1.8A

VERSION UP

OPERATION MANUAL

KIKUSUI ELECTRONICS CORPORATION

1. Outline

System software (program) of APC-1000 has been changed from Ver 1.8 to Ver 1.8A. The changed contents and operation method are described here. This change is designed for time-saving, especially in debugging.

2. Change contents

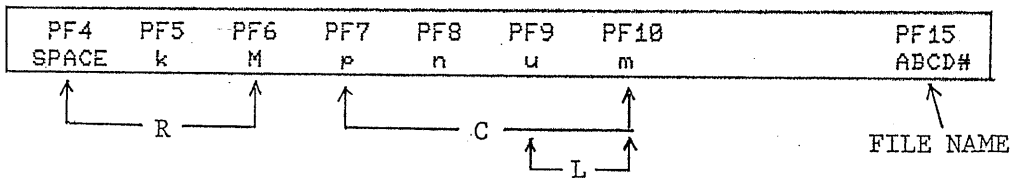
2.1 File name is registered in the function key [PF15] after it is input with any menu and executed. When the same file is wanted after the menu has been shifted, just press the function key [PF15]. The file name is displayed in the bottom-right of the CRT screen.

2.2 The kinds of characters used for file name have increased. Conventionally, the first character among 6 appointed characters is an English capital, the second and following characters are English capitals and numbers. This change makes it possible to use characters for file name which can also be used in NAME commands of the BASIC mode and REN commands of the CP/M mode of the computer.
That is; the first character among 6 characters appointed is an English capital, A to Z, or the symbol-$; the second and following characters are English capitals, A to Z, numbers, 0 to 9, or symbols such as #, %, &, (,), +, $, -, /.

2.3 Maintenance & correction program

Correction or execution with the C command has become possible right after the execution of (T command, N command, R command) any step.
In particular, previously executed step numbers are stored and can be recalled just by pressing each command (T, N, R, C, D) and [RETURN] at the time of the next execution or correction. This makes it much easier to execute or correct the same step number. Details are explained in the chapter on Operation Method.

2.4 When correcting the contents of any step number with C command, the part numbers and values of + pin, - pin and GND pin can be changed only by inputting the effective number (eg. only "5" in case of "005") just as writing initial data. When inputting value data, and especially item units of standard data, the units which have been registered in the function key appear at the bottom of the CRT screen and the relevent keys should then be pressed.



Once values and units of standard data have been input, the range information item is automatically displayed, eliminating the need for manual input.

For the item of PARTS LOCATION, English capitals (A to Z), lower cases (a to z) and numbers (0 to 9) can be used for both 2 digits.

For the item of error setting, the symbol % is automatically displayed after inputting 2-digit numbers. (Note: Input should be "05", incase of 5%.)

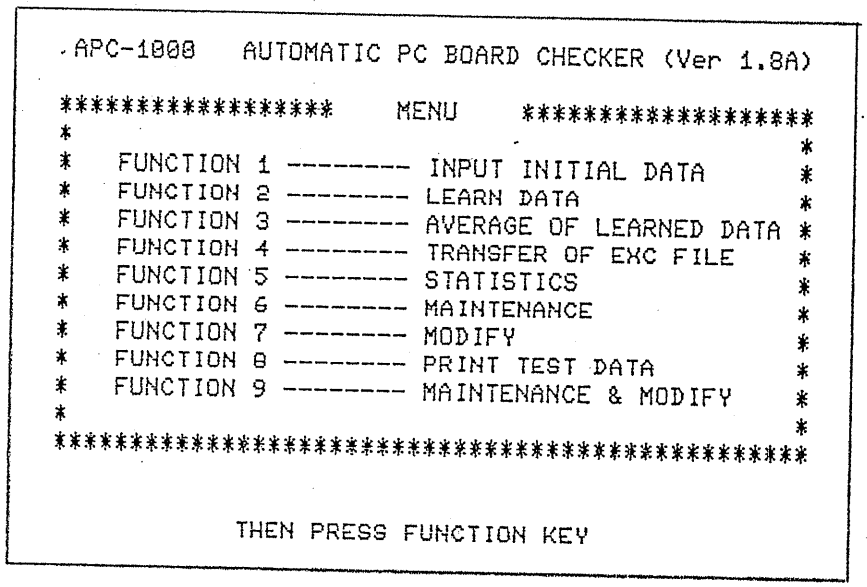
Where part types are short (S) or jumper (J), items of standard data, error and range are automatically displayed.

During the correction of one step, the cursor is returned to the preceding letter which is deleted, by pressing the [BS] key at the same time. This makes it easier to correct a wrong key input.

In the case of no change, or after a change, programs can be continued by pressing the [RETURN] key.

2.5 The program has been revised to execute the "maintenance and correction" function (9), when function (6) maintenance or function (7) is selected.

2.6 Menus are indicated as follows.



3. Operation method

A detailed operation method of "maintenance & correction" program is described.

Firstly, when executing this menu, the following indications appear in the input mode of the file name.

```
                ****** MAINTENANCE & MODIFY ******

              KEY-IN FILE NAME ( MAX 6 CHARACTERS )

LN33    .EXC        AL(2)   .EXC        XYZ     .EXC        ONKS    .EXC
$TEST   .EXC        TEST/1  .EXC        TY5D    .EXC        ABCD#   .EXC
KMT04   .EXC

    FILE NAME

                                                                  PF15
                                                                  ABCD#
```

A list of the execution files (xxx.EXC) contained in the WORK FILE of B drive is displayed, and file names which have previously been operated and registered in the function key.

PF15 are displayed at the bottom right.

To retrieve the same file name, just press PF15.

3.1 Command display

When a file name is input the following; Maintenance commands (T, N, R), Correction commands (C, I, K, A), Display command (D) and End command (E) appear, then units at the time of data correction appear at the bottom of the screen just as they are stored in the function keys.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] )

  PF4   PF5   PF6   PF7   PF8   PF9   PF10              PF15
 SPACE   k     M     p     n     u     m                ABCD#
```

3.2 Operation of D command

15 steps from any step are indicated. For D command, there are 3 types of operation methods.

3.2.1 Dxxx [RETURN] (xxx: step No.)

When D-command and any step No. are input, 15 steps from xxx step are indicated.

3.2.2 DN

15 steps from the currently displayed step number of +15, (display, execution, correction etc.) are displayed. (That is, the next 15 steps).

3.2.3 D [RETURN]

15 steps from the step number being executed, changed or indicated are displayed.

At the time of initial operation, display starts from step "1".

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) D.

 0001,R0001,002,000,    ,123. o,15%,3,A5,1,0
 0002,C0001,005,006,007,125.pF,20%,3,B3,0,0
 0003,T0005,045,026,000,650. o,10%,3,C2,2,0
 0004,D0003,023,024,044,665. o,15%,3,F3,3,0
 0005,J0001,001,010,    ,9.99 o,10%,1,D4,0,0
 0006,S0002,005,009,    ,9.99 o,10%,1,A2,0,0
 0007,L0005,011,022,    ,2.50mH,25%,4,E0,0,0
 0008,R0002,010,020,030,26.7ko,15%,5,B7,5,0
 0009,R0003,055,066,077,46.8ko,15%,5,A9,3,0
 0010,J0055,123,045,    ,9.99 o,10%,8,F1,0,0
 0011,R0004,051,062,    ,211.ko,15%,6,B5,6,0
 0012,C0006,024,051,055,5.62nF,20%,4,A1,1,0
 0013,C0012,033,045,060,2.33mF,0%3,7,F0,0,0
 0014,C0020,004,003,000,659.pF,20%,3,B6,1,0
 0015,R0015,020,011,035,0.92ko,15%,4,C4,2,0


   PF4   PF5   PF6   PF7   PF8   PF9   PF10              PF15
  SPACE   k     M     p     n     u     m                ABCD#
```

The next example is one for DN command and the operation is continued from the previous page.
As shown below, indication starts from the step number which is +15 steps to the previous start step number.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) DN

 0016,T0002,031,020,    ,710. o,10%,3,B3,1,0
 0017,D0009,044,051,001,685. o,15%,3,F9,3,0
 0018,R0023,016,040,092,35.7 o,20%,2,A2,F,0

   PF4    PF5    PF6    PF7    PF8    PF9    PF10              PF15
  SPACE    k      M      P      n      u      m                ABCD#
```

3.3 Operation of C command

This is a change and correction command for any step and like D command, there are 3 types of operation methods.

3.3.1 Cxxx [RETURN] (xxx: Step No.)

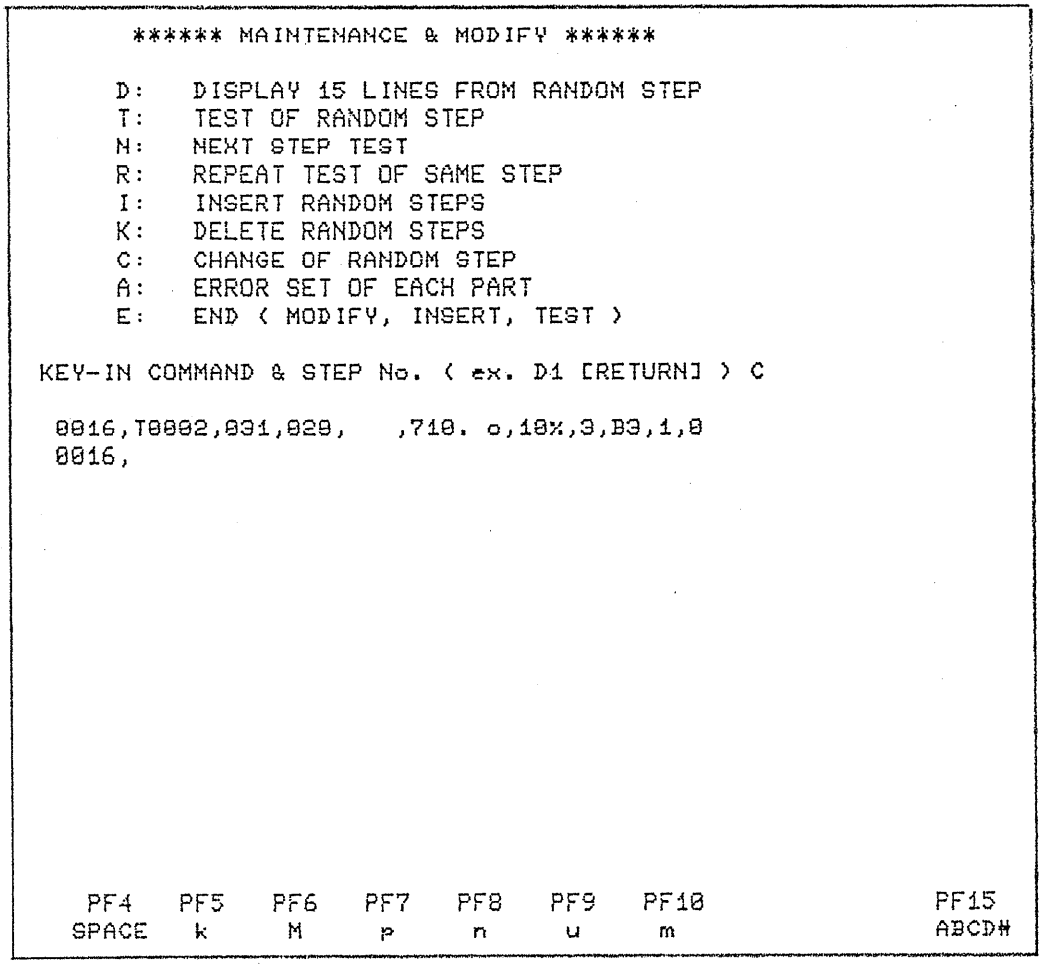
When the C command and step number are input, the step number can be changed.

3.3.2 CN

Alterations can be made to the step following the step being displayed (or executed, corrected, etc.). This is particularly useful in cases in which changes are to be continued into the next step.

3.3.3 C [RETURN]

Making a change to a step number that has been executed or corrected can only be done without inputting the step number and by using C [RETURN].

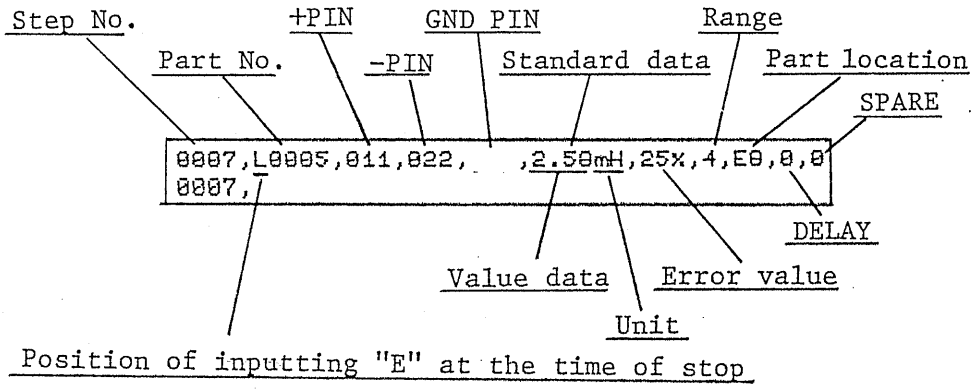


The above figure is an example of what happens when the C RETURN (from previous page) is pressed.

The following is an example of the next operation to the previous page, and is also an example of the CN command.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) CN

 0017,D0009,044,051,001,685. o,15%,3,F9,3,0
 0017,

  PF4   PF5   PF6   PF7   PF8   PF9   PF10              PF15
 SPACE   k     M     p     n     u     m                ABCD#
```

Now let's explain the operation method in more detail. The outline has been already described in section 2.4, change contents, and the operation is as follows.



(1) The [RETURN] key should be used to move ahead, after a data change or at an item requiring no change.
To move the cursor to the preceding letter, [BS] should be used. As the cursor moves deletion is achieved.

(2) When required to stop corrections in above situation, "E" should be input when the cursor is at the first letter of a part No. (In the above case, the input position is "L")

(3) There is no need to input "0" preceding the effective numbers of the part number +Pin, -Pin and GND Pin. In the case in the figure above; L5 [RETURN] — 11 [RETURN] — 22 [RETURN] — [RETURN] is enough.

(4) When it is desired to delete the GND Pin, the space key should be struck once and [RETURN] should be executed when the cursor is at any position among 3 letters of the GND pin.

(5) After the input of the value data of standard data, units can be easily be input by using the function key, where as explained in section 2.4, the beginning letter of units are registered.
The [PF4] "SPACE" is same as the space key (blank key) of the

key board. When the beginning letters of units are input, unit letters of 0(Ω), F,H are automatically generated according to part types.

(6) In the item of error setting, a 2-digit number ("05" in case of "5") is input, and then the symbol % is automatically displayed.

(7) The available characters for the item of PARTS LOCATION are; English capitals (A to Z), English lower case (a to z) and numbers (0 to 9). These can be used for both of 2 digits.

(8) Range information is automatically generated from the standard data.

(9) DELAY (delay measurement) can be set with numbers 0 to 9 and letters A to F, and can be changed at the interval of 50 mS.

(10) SPARE is not usable at present. Only hardware which permits external contact output at any step has been prepared in this equipment. Preparation for operation in software, however, hasn't yet been made.

(11) When changing the steps of test items such as short (S) and jumper (J), standard data, error value and range information are automatically generated after passing the item GND Pin.

(12) When range information is changed into "8", regardless of part and standard data, the step will be unexecuted even after transmitting the execution data.
To leave data and change only the range information to "8" (to make the step an unexecuted one), firstly position the cursor at the first letter of the standard data and then input the [ESC] key for all parts except short (S) and jumper (J). The information then turns to "8".
To return to the normal range after setting the range information to "8", delete the range information with [BS] and press

[RETURN] again and the normal range will be restored. For short (S) and jumper (J), input the [ESC] key when the cursor is at one of the 3 letters of GND PIN or at "," after GND PIN, and the range information will change to "8". To restore the normal range, return the cursor to position of "," with [BS] and press [RETURN], then the normal range will be returned.

3.4 Operation of T command

This is an execution (test) command at any step, and there are two types of operation methods.

3.4.1 Txxx [RETURN] (xxx: step No.)

Input T command and step number, the step will be executed and the measured values will be displayed.

3.4.2 T [RETURN]

This operation is required to execute the same step number again. (ie. to change the display etc.) (for display; the first step number)

This operation is useful to execute and correct the same step number. For example, to repeat execution and correct with T command after corrections with C command.

To execute the step number next to current step number, use N command.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) T

 0005,J0001,001,010,    ,9.99 o,10%,1,D4,0,0
 0006,S0002,005,009,    ,9.99 o,10%,1,A2,0,0
 0007,L0005,011,022,    ,2.58mH,25%,4,E8,0,0
 0008,R0002,010,020,030,26.7ko,15%,5,B7,5,0
 0009,R0003,055,066,077,46.9ko,15%,5,A9,3,0

          CONTROLLER NOT READY !!

 0013,C0012,033,045,060,2.33mF,0%3,7,F9,0,0
 0014,C0020,004,003,000,659.pF,20%,3,B6,1,0
 0015,R0015,020,011,035,0.92ko,15%,4,C4,2,0
 0016,T0002,031,028,    ,710. o,10%,3,B3,1,0
 0017,D0009,044,051,001,685. o,15%,3,F9,3,0
 0018,R0023,016,040,032,35.7 o,20%,2,A2,F,0


   PF4    PF5    PF6    PF7    PF8    PF9    PF10                PF15
  SPACE    k      M      p      n      u      m                  ABCD#
```

When conducting an execution (T, N, R) for the first time, "CONTROLLER NOT READY" is displayed. When this appears carry-out the ON LINE and TEST START operations.

The following figure is an example of executing step number 7 of the T command.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) T7

 0007   L0005, 011, 022,     ,2.50mH, 25%, 4,E0, 0, 0
           MEASURED VALUE = 0.06mH

   PF4    PF5    PF6    PF7    PF8    PF9    PF10                PF15
  SPACE    k      M      p      n      u      m                  ABCD#
```

3.5 Operation of R command

This command is used at the time when the current step number is measured and executed repeatedly. (when displayed, the first step No.)

The following figure is an example of repeatedly executing step "7" from the previous page.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) R

 0007   L0005, 011, 022,     ,2.50mH, 25%, 4,E0, 0, 0
            MEASURED VALUE = 0.21mH
            MEASURED VALUE = 0.23mH
            MEASURED VALUE = 0.23mH
            MEASURED VALUE = 0.24mH
            MEASURED VALUE = 0.82mH
            MEASURED VALUE = 0.24mH
            MEASURED VALUE = 0.23mH
            MEASURED VALUE = 0.23mH
            MEASURED VALUE = 0.24mH
            MEASURED VALUE = 0.23mH
            MEASURED VALUE = 0.23mH


  PF4   PF5   PF6   PF7   PF8   PF9   PF10              PF15
 SPACE   k     M     p     n     u     m                ABCD#
```

The following is an example of changing the same step number after the execution of R command with C command mentioned on the previous page. This too, is an example of the operation of C [RETURN].

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) C

 0007,L0005;011,022,    ,2.50mH,25%,4,E0,0,0
 0007,

  PF4   PF5   PF6   PF7   PF8   PF9   PF10              PF15
 SPACE   k     M     p     n     u     m                ABCD#
```

3.6 Operation of N command

This command is used for the measurement and execution of the next step.

The following figure is an example of where step "8" is executed with N command after the correction of step "7" mentioned on the previous page.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) N

 0008   R0002, 010, 020, 030,26.7ko, 15%, 5,B7, 5, 0
           MEASURED VALUE = 99.90o

  PF4   PF5   PF6   PF7   PF8   PF9   PF10              PF15
 SPACE   k     M     p     n     u     m                ABCD#
```

3.7 Operation of I command

This command is used for insertion into any step. For instance, I18 is input when inserting between step 17 and step 18.
After insertion, a new step 18 is created and step numbers for step 19 onwards are automatically adjusted and corrected.
After the insertion of one step, the next step number appears automatically so that insertion may be continued.
To end insertion, input "E" when the cursor is flickering at the position of the first letter of the part No.

The following is an example for insertion between step 17 and step 18. When I18 is input, the current contents of step 18 is indicated as an example (ex).

```
          ****** MAINTENANCE & MODIFY ******

          D:   DISPLAY 15 LINES FROM RANDOM STEP
          T:   TEST OF RANDOM STEP
          N:   NEXT STEP TEST
          R:   REPEAT TEST OF SAME STEP
          I:   INSERT RANDOM STEPS
          K:   DELETE RANDOM STEPS
          C:   CHANGE OF RANDOM STEP
          A:   ERROR SET OF EACH PART
          E:   END ( MODIFY, INSERT, TEST )

    KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) I18

ex.  0018,R0023,016,040,032,35.7 o,20%,2,A2,F,0
     0018,

      PF4    PF5    PF6    PF7    PF8    PF9    PF10              PF15
     SPACE    k      M      p      n      u      m                ABCD#
```

3.8 Operation of K command

This is the command to delete any step. The step number is automatically altered after deletion. To delete a step number, input the first and last numbers. In the case where only one step is to be deleted, just input that step number.

The following is an example for deletion between step 19 and 21.

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) K

 KEY-IN START STEP NUMBER FOR DELETE ?  19

 KEY-IN END STEP NUMBER FOR DELETE ?    21

                 DELETING !!

   PF4    PF5    PF6    PF7    PF8    PF9    PF10              PF15
  SPACE    k      M      p  -   n      u      m                ABCD#
```

3.9 Operation of A command

This is a command to change the error setting value according to the part type in all the steps resistance, inductance, transistor and diode. (±1% ∿ ±99%)

The criterion for short and jumper is 9.99Ω, so they are not at all related with the setting of errors.

In case the setting varies in each step, change the data with the C command as previously explained.

After the program is averaged and the execution file is generated, all the steps have ±10% as initial values.

The following is an example for setting the parts accordingly. Simply press [RETURN] for a part requiring no change. In the following example, inductance has no change. For values input 2 digits ("05" in case of "5").

```
      ****** MAINTENANCE & MODIFY ******

     D:   DISPLAY 15 LINES FROM RANDOM STEP
     T:   TEST OF RANDOM STEP
     N:   NEXT STEP TEST
     R:   REPEAT TEST OF SAME STEP
     I:   INSERT RANDOM STEPS
     K:   DELETE RANDOM STEPS
     C:   CHANGE OF RANDOM STEP
     A:   ERROR SET OF EACH PART
     E:   END ( MODIFY, INSERT, TEST )

KEY-IN COMMAND & STEP No. ( ex. D1 [RETURN] ) A

             ERROR SET ( 1 - 99 )
               R ------- 10 %
               C ------- 25 %
               L -------    %
               T ------- 15 %
               D ------- 15 %

         ERROR SET OK ? ( Y or N )

   PF4    PF5    PF6    PF7    PF8    PF9    PF10              PF15
  SPACE    k      M      p      n      u      m                ABCD#
```

3.10 Operation of E command

There are 3 types of uses for the end command.

3.10.1 To temporarily stop correcting while changing contents of any step with C command, input "E" when the cursor is flickering at the position of the first letter of the part number.

3.10.2 To stop step insertion with the I command, input "E" in the same way as for C command.

3.10.3 To stop the maintenance & correction program, input "E" at the same cursor position as for the other commands mentioned above, and the program will end with the following display. To return to the menu display, input "Y". When "N" is input, the maintenance & correction program is executed again from the start. When "E" is input to end this program, the instrument turns off (in the case of an air press, the press portion lifts, and in case of a vacuum instrument, the printed circuit board detaches itself). As the final data is contained in the work file, to turn off the machine, return to the menu display. To retain data completely, always input "E" at the time of end of the program.
When the program is stopped at [CTRL], [C], etc. without inputting "E", data retainment and the turning off of the instruments cannot be achieved.
In such a situation, continue the program with CONT [RETURN] and then end the program by inputting "E".

```
RETURN TO [ MENU DISPLAY ]  ? ( Y or N )  ? Y
```