OPERATION MANUAL

AUTOMATIC

PC BOARD CHECKER

APC-2000A

KIKUSUI ELECTRONICS CORPORATION

Power Requirements of this Product

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

☐ Input voltage

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

☐ Input fuse

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

WARNING

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

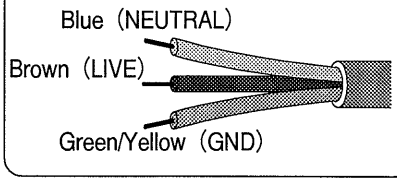
☐ AC power cable

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

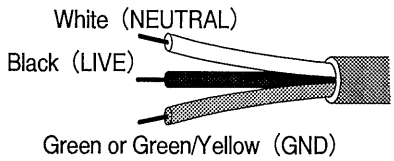
WARNING

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

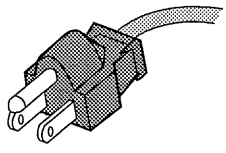
☐ Without a power plug



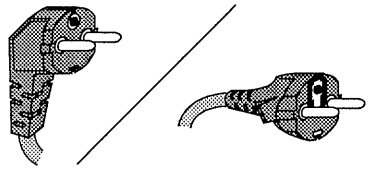
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

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

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

CONTENTS

1. GENERAL DESCRIPTION

The APC2000A tests a PC board in units of the electronic parts mounted on it and reports defective portions by a printer and display unit immediately after finding them.

In addition to the short circuit is caused by solder bridges and the open circuit is caused by pattern detects. The APC2000A can check for the mislocation, missing, and poor characteristics of the mounted parts momentarily without applying power to the board.

The reference data can be generated in a short time even for a board with a large number of parts because an automatic data learning function is provided. This function enables the APC2000A to learn the reference data from known good boards by interactive program.

To test a board, the operator needs to put it on the fixture and press the "TEST START" button only; the defective portions, if found, are reported on the printer and display unit automatically. Thus, the APC2000A can be handled by anybody.

Since a use of a vacuum-type fixture, PC boards of high mounting density can be tested, and even an unskilled operator can use it with ease, because the fixture section has no moving elements on its surface.

The following are the features of the APC2000A:

1.1 Capability of being Developed into In-line System

To increase the inspection efficiency, the APC2000A is designed to be developed into an in-line system at any time.

1.2 Stable Measuring Precision

To assure high measuring precision, the APC2000A uses a phase detection method for measuring impedance, executes the shield drive measuring which is not affected by the cable length, and adopts an effective guarding method.

1.3 High Speed Measuring

For the efficient operation, the time required for testing has been reduced greatly.

1.4 Improved Fixture Section

With the vacuum-type fixture section, the APC2000A can test small board and high density mounting board with SMT (Surface Mount Technology).

1.5 Reliable all-pin short/open test

Since the all-pin short-circuit test (1 - 15Ω) and all-pin open-circuit test (110kΩ) are executed separately, not only the solder bridges but also the poor contact of pins can be detected for sure.

1.6 Map Display

If a board is found to be defective as a result of its test, the defective portion is displayed on the CRT with XY location format so that the user can know the defective portion immediately. Also, the information about the defective portion can be printed out either during or after test execution.

1.7 Intelligent Printer

The user can select FAIL PRINT, ALL PRINT, or NON PRINT as the print format.Since the printer has a built-in buffer memory, it can print out the test result without affecting the test time. Further, the printer section can be separated from the main frame like the fixture section.

1.8 Self-check Function

The APC2000A has a powerful self-check function for its RAMs, measuring circuits, and multiplexer cards. With this function and good maintenance services, the user can place full reliance on the system.

2. SPECIFICATIONS

2.1 Basic Instrumentation Section

2.1.1 Testing pins

Standard 256 pins
Maximum 768 pins (The number of testing pins may be increased in units of 16)

2.1.2 Component Test

Test steps 3840 steps

Measurable ranges:

Resistance

Range	Measuring method		Measuring time
1.00Ω ~ 19.99Ω	Constant-	30mA	5.4msec
10.0Ω ~ 199.9Ω	current	3mA	〃
100Ω ~ 1999Ω	method	0.3mA	〃
1.00kΩ ~ 19.99kΩ	〃	30μA	〃
10.0kΩ ~ 199.9kΩ	〃	3μA	6.2msec
100kΩ ~ 1999kΩ	〃	0.3μA	25msec
1.00MΩ ~ 19.99MΩ	〃	0.01μA	36msec

Capacitance

Range	Measuring method			Measuring time
10.0pF ~ 199.9pF	Phase	1MΩ	10kHz	7.3msec
100pF ~ 1999pF	detection	100kΩ	〃	〃
1.00nF ~ 19.99nF	method	10kΩ	〃	〃
10.00nF~ 199.9nF	〃	1kΩ	〃	〃
100nF ~ 1999nF	〃	100Ω	〃	〃
1.00μF ~ 19.99μF	〃	100Ω	1kHz	27msec
10.0μF ~ 199.9μF	TC method	100Ω	0.3V	18msec
100μF ~ 1999μF	〃	10Ω	0.3V	14msec
1.00mF ~ 19.99mF	〃	10Ω	0.3V	41msec

Inductance

Range	Measuring method			Measuring time
10.0μH ～ 199.9μH	Phase	10Ω	10kHz	8.2msec
100μH ～ 1999μH	detection	100Ω	〃	〃
1.00mH ～ 19.99mH	method	1kΩ	〃	〃
10.0mH ～ 199.9mH	〃	10kΩ	〃	〃
100mH ～ 1999mH	〃	100kΩ	〃	〃

Diode (measuring forward voltage)

Range	Measuring method	Measuring time
100mV ～ 1999mV	Constant-current method 10mA	6.9msec

Light-emitting diode (measuring forward voltage)

Range	Measuring method	Measuring time
100mV ～ 1999mV	Constant-current method 10mA	6.9msec

Transistor (measuring forward voltage)

Range	Measuring method	Measuring time
100mV ～ 1999mV	Constant-current method 10mA	6.9msec

Short

Range	Measuring method	Measuring time
1.00Ω ～ 19.99Ω	Constant-current method 30mA	4.8msec

Jumper

Range	Measuring method	Measuring time
1.00Ω ～ 19.99Ω	Constant-current current 30mA	4.8msec

Compound transistor

Range	Measuring method	Measuring time
100kΩ ～ 1999kΩ	Constant-current method 0.3μA	10msec

DC voltage measurement

Range	Measuring method	Measuring time
100mV to 1999mV	Constant-voltage method	11.4msec
1.00V to 19.99V	〃	〃
10.0V to 39.9V	〃	〃

Judgment

Components other than short and jumper

If the measured value is not within the range selected from ±1% to ±99% (step = 1%) of the standard value, the component is judged to be NG.

UP: If the measured value is greater than the standard value, the component is judged to be GOOD.

LO: If the measured value is smaller than the standard value, the component is judged to be GOOD.

Short

If the measured value is smaller than the value specified by SHORT REF (within the range from 1Ω to 15Ω), the component is judged to be NG.

Jumper

If the measured value is greater than the value specified by SHORT REF (within the range from 1Ω to 15Ω), the component is judged to be NG.

Gurding point Maximum 2 points/step

Measurement delay 0 to 990 ms (10 ms intervals)

2.1.3 All pin short/open test

Threshold value and judgment

All pin test

Learning

If the measured value is smaller than the value specified by SHORT REF (within the range from 1Ω to 15Ω), the REF PIN is judged to be unnecessary.

Execution

If the measured value is smaller than the value specified by SHORT REF (within the range from 1Ω to 15Ω), the REF PIN is judged to be NG.

All pin open test

Learning: If the measured value is greater than 90kΩ, the open test between those pins is judged to be unnecessary.

Execution: If the measured value is greater than 110kΩ the component is judged to be NG.

Measuring time	2.6ms/step

2.2 Host Computer Section

Computer	UP10E MODEL10 or MBC-255
Display	12-inch green CRT
Floppy disk drive	Two drives for 5.25-inch double-sided, double-density, double-track diskettes
Keyboard	JIS full keyboard 15 functions keyboard
Interface	RS-232C, Centronics parallel I/F

2.3 Printer Section

Print format	24 characters per line on 5×7 dot matrix Two colors red and black
Print form	Roll paper with the diameter of 60mm and width of 57mm

2.4 Fixture Section

Type	FX02-APC
Maximum pin	768 Pin
Maximum board size	300 × 450 mm
Weight	Approx. 10 kg

2.5 Vacuum Pump Section (option)

Vacuum pump	KRS6-SS
Working degree of vacuum	Less than 450 mmHg
Exhaust speed	575 l/min (50 Hz), 685 l/min (60 Hz)
Power requirements	AC 200 V 3 phases, 1.5kW, 4P
Weight	Approx. 45 kg
Other option	Soundproofing box for vacuum pump

2.6 Power Supply (without vacuum pump)

Power requirements	AC 100 V ±10%, 50/60 Hz
	Approx. 220 VA (256 pins)
Fuse	Main frame 5A
	Host computer 2A

2.7 Dimensions and Weight

Outer dimentions	Main frame
	615W × 730H × 660D mm (without computer)
	Jig table
	720W × 730H × 550D mm
Weight	Main frame Approx. 86 kg (256 pins)
	Jig table Approx. 50 kg (without fixture)
	Host computer Approx. 15 kg

2.8 Environmental Conditions

Operating temperature	5 to 35°C
Operating humidity	Not more than 75% RH

2.9 Accessories

Software	APC2000A system disk
	CP/M Ver2.2 system disk (include S BASIC)
Operation manual	APC2000A Operation manual
	Host computer operation manual
Board (spare)	Multiplexer board (One for every 256 pins)

3. PREPARATION

3.1 Receiving and Handling

Before the tester is shipped from the factory, it is carefully tested in both mechanical and electrical terms to confirm and guarantee correct operation. On receiving the tester, check if it has sustained any damage during transportation. Should any objectionable points be found, contact your dealer immediately.

3.2 Checking Supply Voltage

The tester is designed to operate on a line voltage of AC 100V ±10%, 50/60Hz. To ensure trouble-free operation for a long period of time, use the above line voltage not contaminated with noise.

3.3 Operating Temperature and Sitting

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 Installation

3.4.1 External appearance

See Figure 3.1 for the external appearance of the tester.

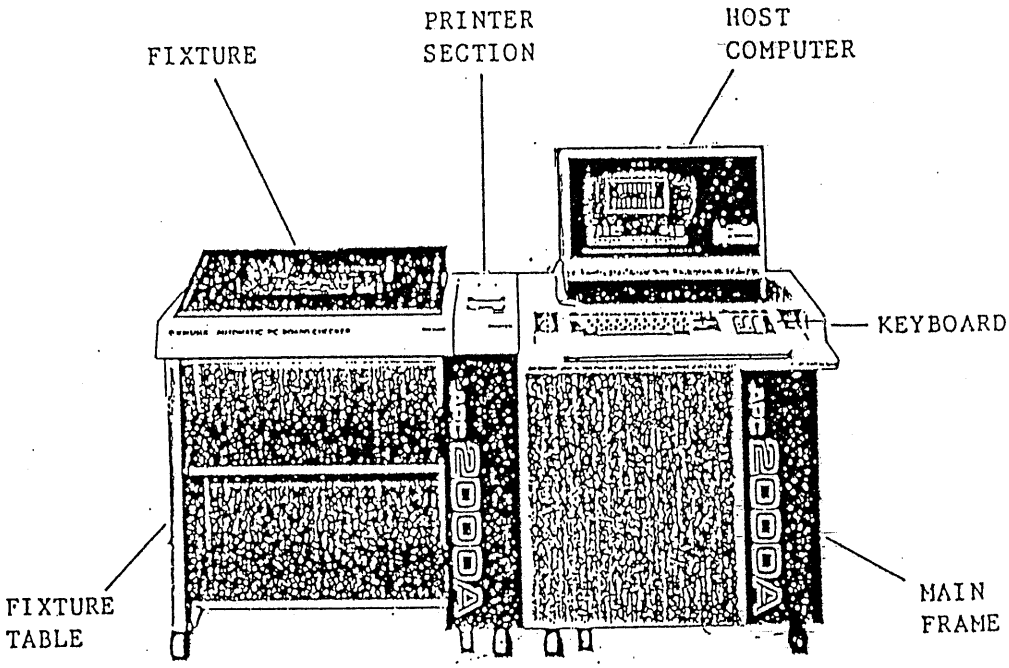
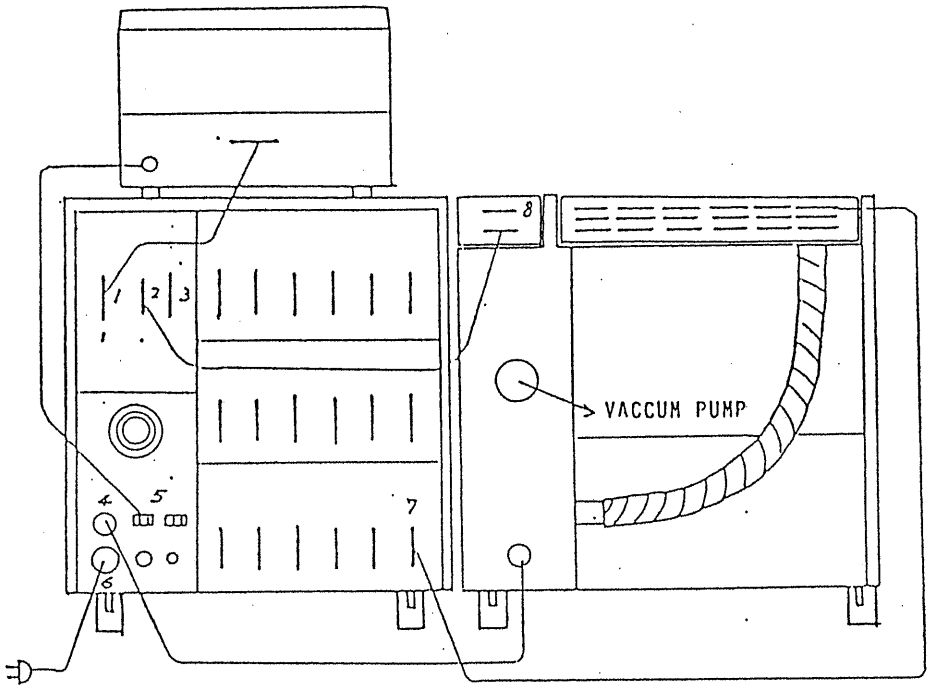


Fig. 3.1 External Appearance

The cables to connect the main frame, fixture, printer section, fixture table, and host computer have sufficient length so that these units can be set apart from one another.

Figure 3.2 shows the cable connection diagram.



1.	CONTROL I/O	(50P)
2.	PRINTER AND SIGNAL I/O	(36P)
3.	EXT CONTROL	(50P)
4.	SOLENOID	(4P)
5.	SWITCHED AC OUTLET 100V MAX 2.5A	(2P)
6.	AC 100V 50/60Hz	(3P)
7.	J1 - J18	(50P)
8.	AUX SIGNAL I/O	(36P)

Fig. 3.2 Cable Connection Diagram

4. OPERATOR PANEL DESCRIPTION

4.1 Printer Panel Description

See the illustration of the printer-section panel in Figure 4.1.

① TEST switch: Place the board to be tested on the fixture, and press this switch to start test execution.

② PASS : If the board has passed the test, this lamp goes on. Once it goes on, it remains on till the next test sequence is started.

③ RESET : Press this switch to stop testing and printing. Release the switch after confirming the RESET operation.

④ FEED : Use this switch to feed the print form. The printer's self print check can be initiated the following operation:

[RESET] ON → [FEED] ON → [RESET] OFF

⑤ Printer : Prints out the test result.

⑥ Print form : Roll paper of 57 mm wide and 60 mmφ used for the printer. Open the lid and set the roll on the paper holder.

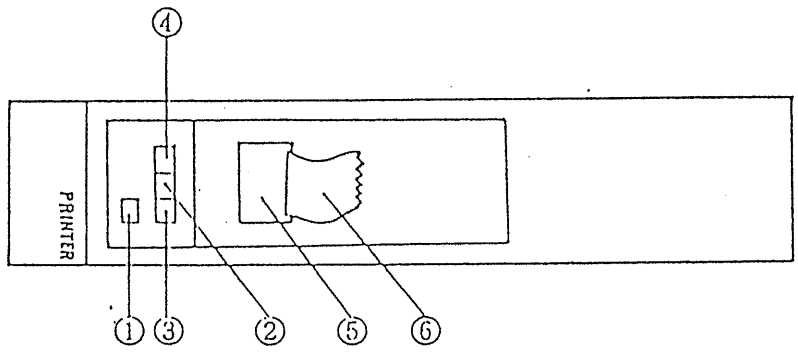


Fig. 4.1 Printer-section Panel

4.2 Host Computer Panel Description

The host computer for the APC-2000A Tester is the UNIVAC UP10E Model 10 or MBC-225 with two floppy disk drives. For the details of the host computer, refer to the separate user's manual.

When the UNIVAC UP10E or MBC-225 is used as the host computer of the APC-2000, the operator needs to manipulate only the rear POWER switch, front BRIGHT control, floppy disk drives A and B, and keybord.

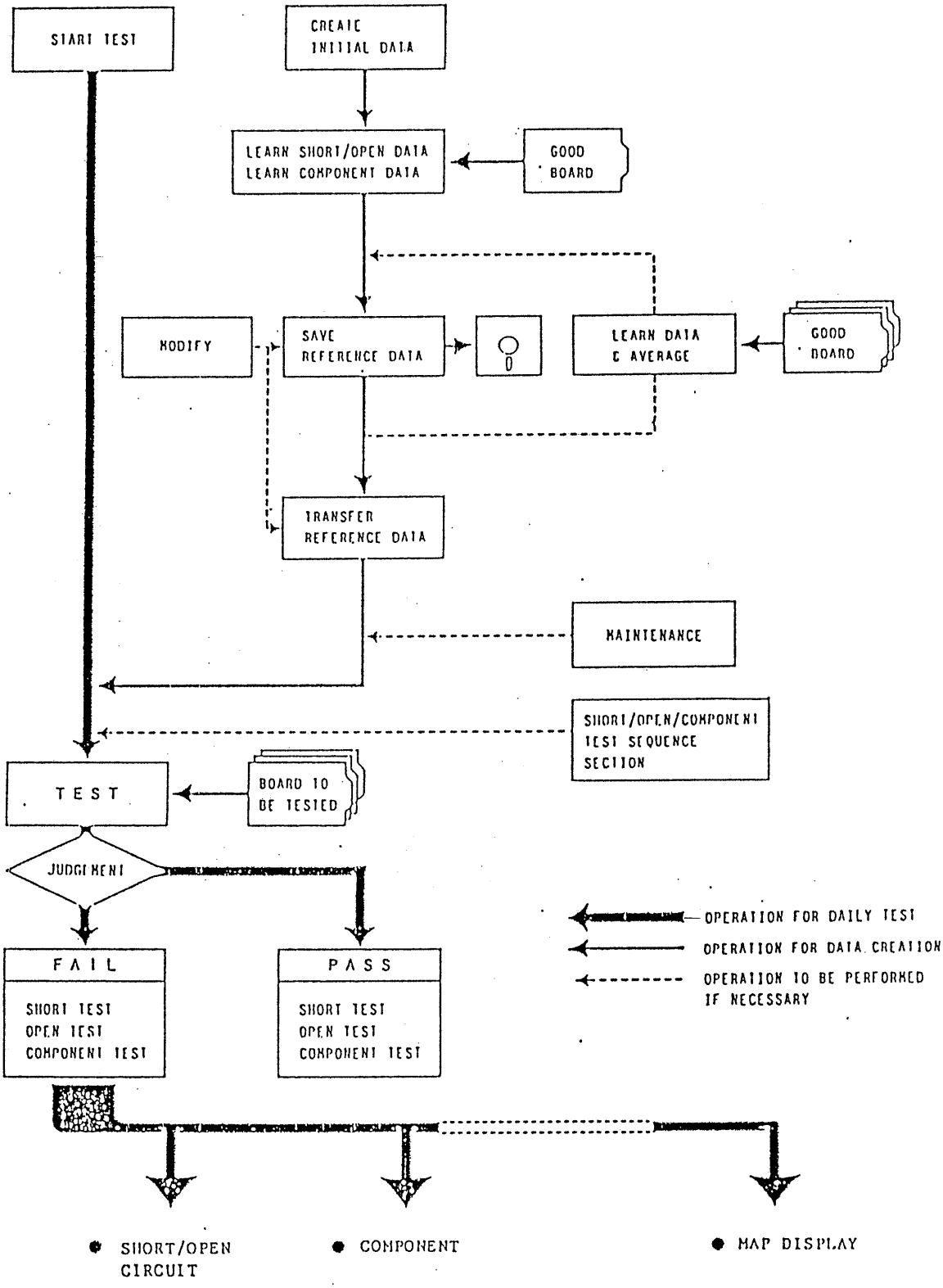
Insert the supplied APC2000AAUTOMATIC PC BOARD CHECKER WORK FILE diskette into floppy disk drive B and SYSTEM diskette into drive A. Be sure to turn on the power before inserting these diskettes.

Do not take out a diskette from disk drive nor turn off the power switch when the disk drive is operating.

5. OPERATION PROCEDURES

5.1 Overview

5.1.1 Operation flowchart



5.2 Initial Operation

5.2.1 Power-on operation

Confirm that no floppy disks are inserted in the host computer and turn the key switch in the upper right-hand corner of the main frame front section by 90 degrees clockwise; then, a green LED in the upper left-hand corner of the main frame front section and the one on the host computer go on and the cursor (_) flickers in the upper left-hand corner of the host computer CRT screen. Insert the supplied floppy disk "APC2000AAUTOMATIC PC BOARD CHECKER SYSTEM DISK" into drive A, and the host computer is activated. If no errors are found as a result of self-check (see Section 5.4 (1)), the next information is displayed on the CRT. At same time, insert the floppy disk "WORK FILE" into drive B.

5.2.2 Paper loading

Open the lid of the paper compartment in the printer section, put the supplied roll paper shaft through the core of the supplied roll paper (57 mm wide, 50 mmϕ), and set it on the paper holder in the compartment.

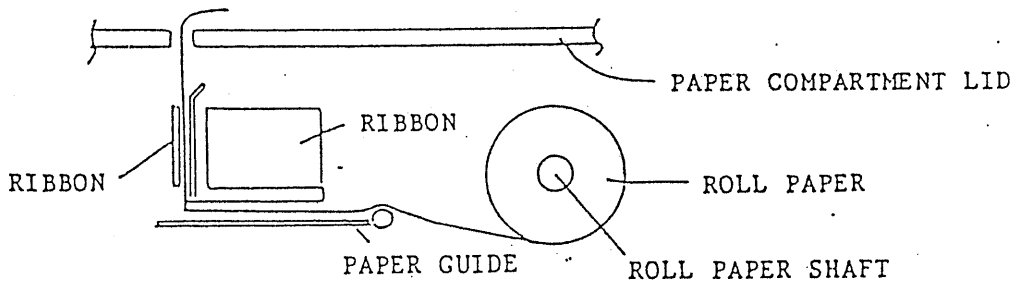


Fig. 5.2

Insert the leading edge of the paper into the paper guide. Thread the paper as shown in Figure 5.2 using the FEED switch on the printer section.

5.3 Function Description

Press a function key (PF1 - PF7) OR NUMERIC KEY (1 - 7) on the keyboard when the system is in the TEST READY modee after the power-on operation, and the program that corresponds to the pressed key is executed.

If you press ESC Key in the TEST READY mode function numbers and contents will change.

You can use PF8 - PF14 can be used as exclusive keys.

The selected function branches as shown in Figure 5.3.1.

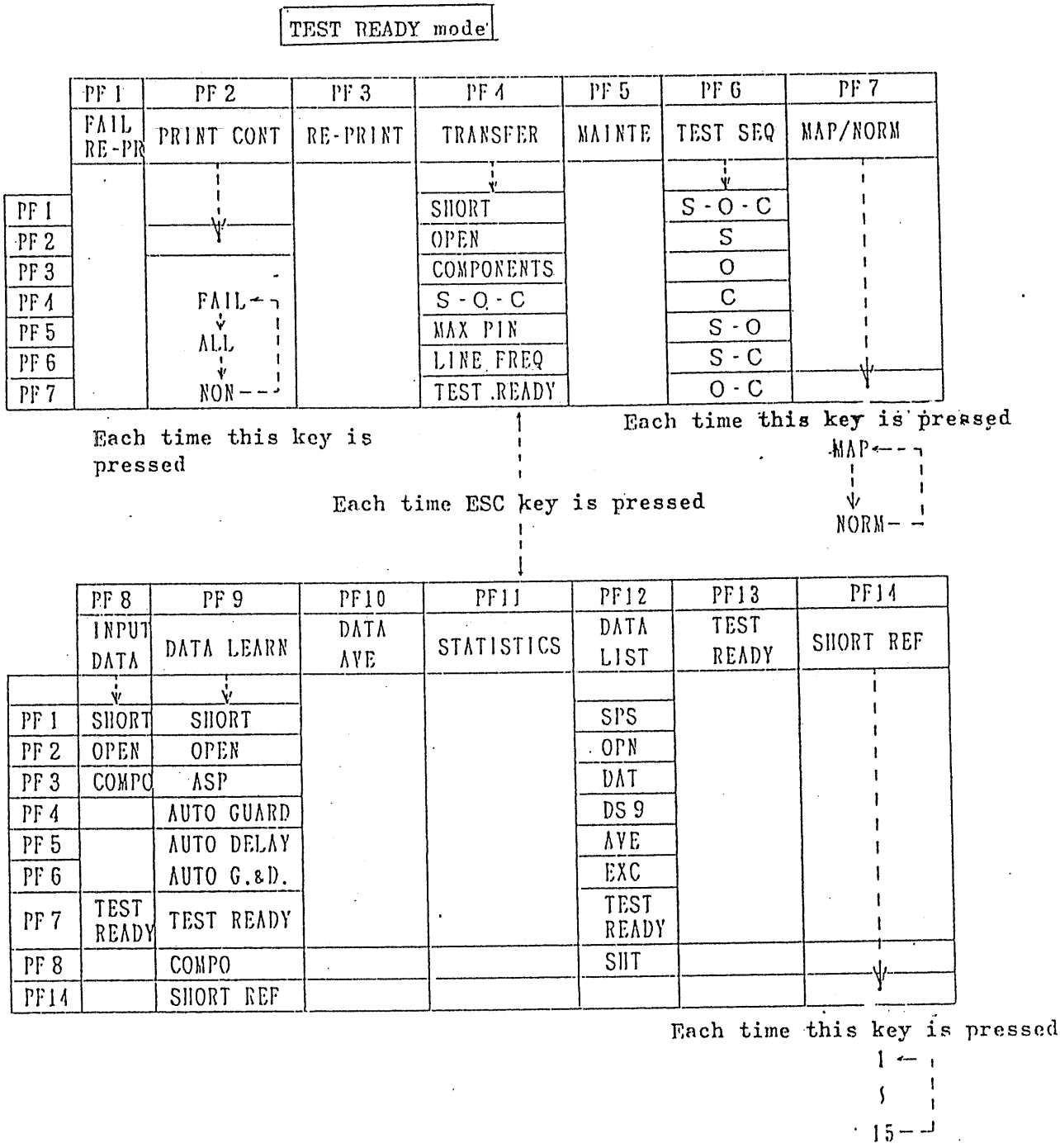


Fig. 5.3.1

If a failure is found as a result of all-pin short check or all-pin open check, the system does not proceed to component test but terminates the test operation.

For failures found by all-pin short check:

```
SHORT FAIL PINS
    001 - 064
    020 - 023
```

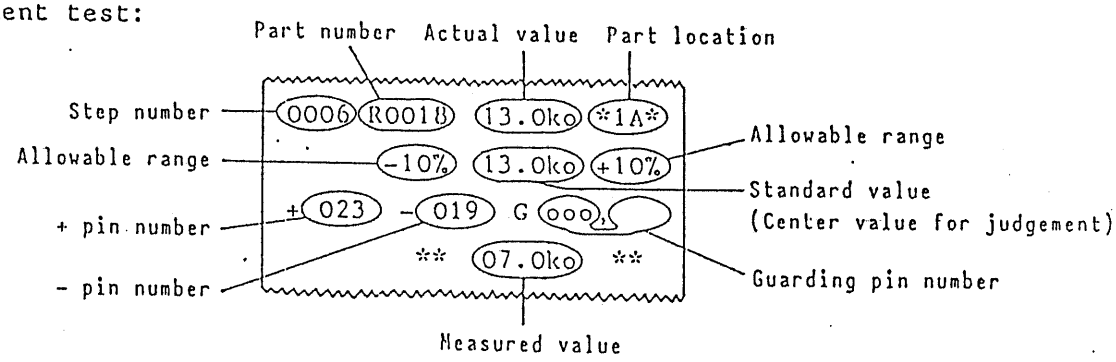
Further, if the judgement is made to be "short circuit" and even when you try to locate the other pin forming short circuit with the pin and you cannot find the pin below judgement standard (1 ~ 15 ohm) ??? appear.

```
SHORT FAIL PINS
    001 - ???
```

For failures found by all-pin open check:

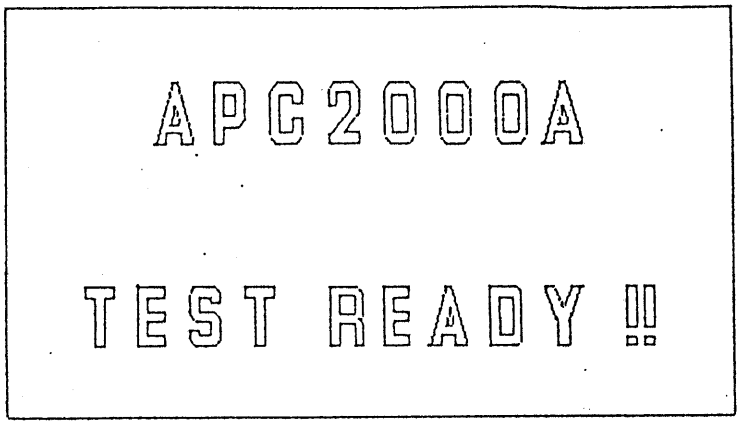
```
OPEN FAIL PINS
        299
```

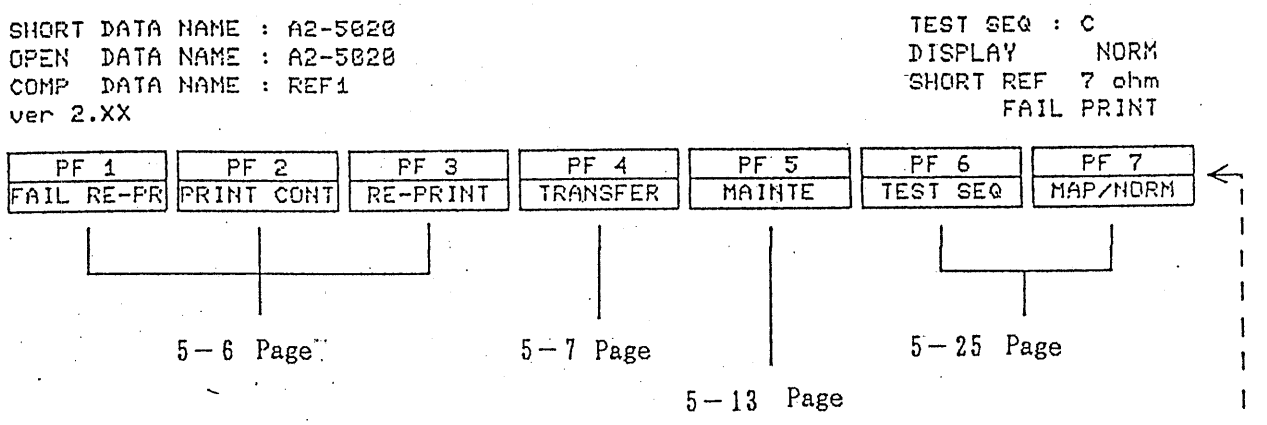
For failure found by component test:



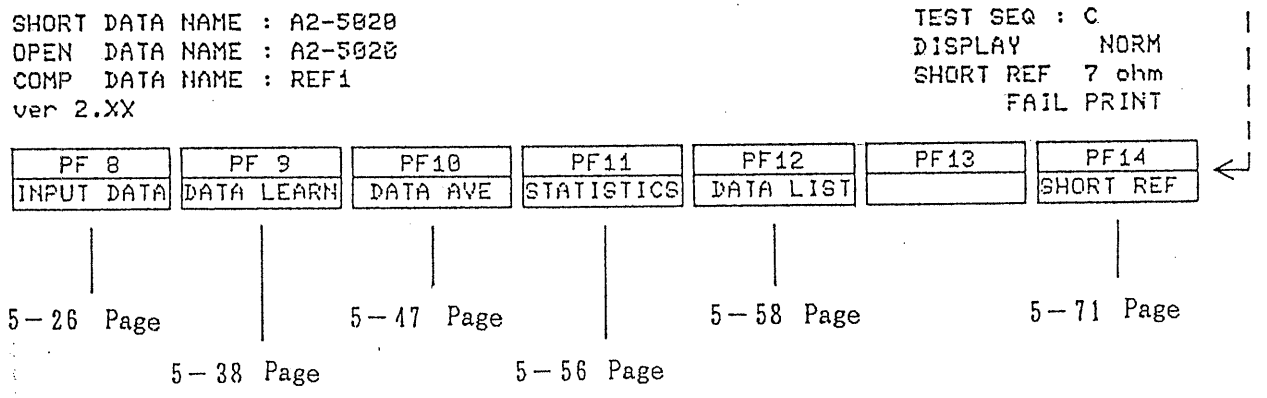
As long as each corresponding program is in motion the file name, input under "Key in file name?" is stored at PF15. However, if you switch off the power or start from SELF CHECK by pressing CTRL and RESET at the same time the file name disappears.

5.3.1 Functions in TEST READY mode





Each time ESC key is pressed



(1) FAIL RE-PR PF1

Irrespective of PRINT CONT (PF2) (NON, FAIL, ALL) Only deffect details are printed out.

(2) PRINT CONT (Built-in printer output control) PF2

Each time PF2 is pressed, the printing mode is switched among ALL, FAIL, and NON (displayed in the lower right-hand corner of the screen).

ALL PRINT : Information on all the tested parts, whether PASS or FAIL, is printed out. (For the all-pin short/open test, however, only the FAIL PIN information is printed out.)

FAIL PRINT: Only the information on defective parts is printed out.

NON PRINT : No information is printed out whether the test result is PASS or FAIL.

Note that the information output to the printer when ALL PRINT or FAIL PRINT is specified can be monitored by the host computer screen at the same time.
When NON PRINT is specified, only the information on defective parts is displayed on the host computer screen.

(3) RE-PRINT (Re-print) PF3

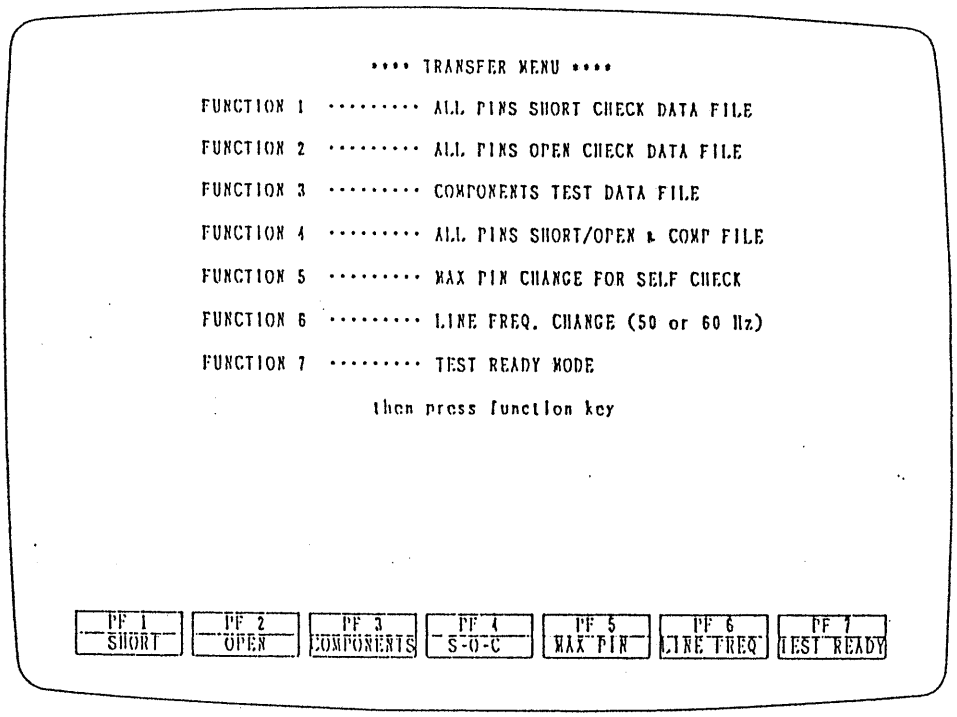
The test result can be printed out again according to the mode specified by PF2.

Note: If the mode specified by PF2 (PRINT CONT) is NON PRINT, no information is printed even if RE-PRINT is specified. If the mode specified by PF2 is FAIL or ALL PRINT, the result of the preceding test is printed when PF3 is pressed.
To print only the information on defective parts, press PF1 (FAIL RE-PR); the defective-part information can be re-printed without changing the printing mode specified by PF2 except all-pins short/open check.

(4) TRANSFER (Execution program transfer) PF4

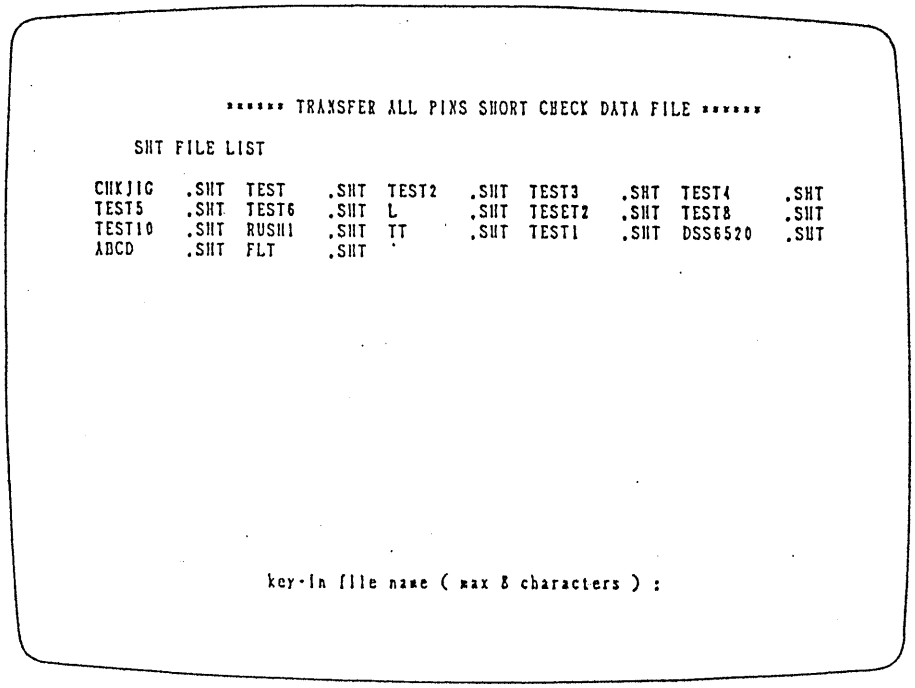
The TRANSFER program transfers execution programs from the work files on a floppy disk in the host computer to the APC-2000A main frame.

PF1: Transfers the all-pin short check program.
PF2: Transfers the all-pin open check program.
PF3: Transfers the component test program.
PF4: To MENU mode
PF5: To TEST READY mode
PF6: When the number of testing pins for APC-2000A has been increased or decreased (MPX boards have been increased or decreased), key in the maximum number of testing pins. The SELF CHECK operation will be performed for the newly specified number of testing pins automatically.
PF7: When the line frequency for APC-2000A has been changed because the Tester has been moved to a different location, use this key for selecting the frequency (50Hz or 60Hz).

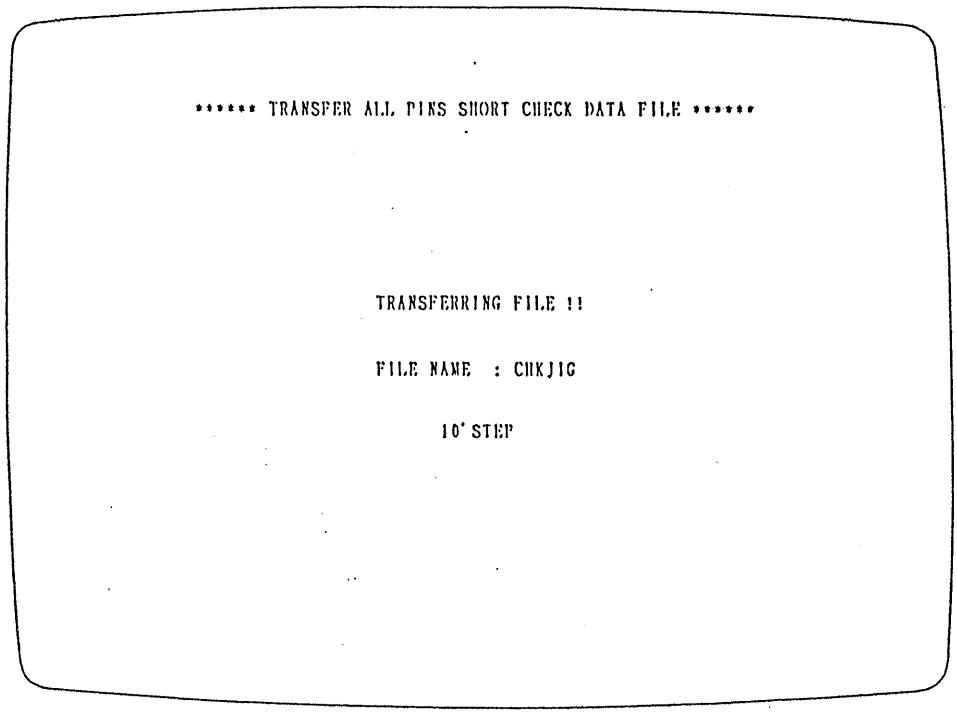


When PF1 is selected, the information below appears on the screen.

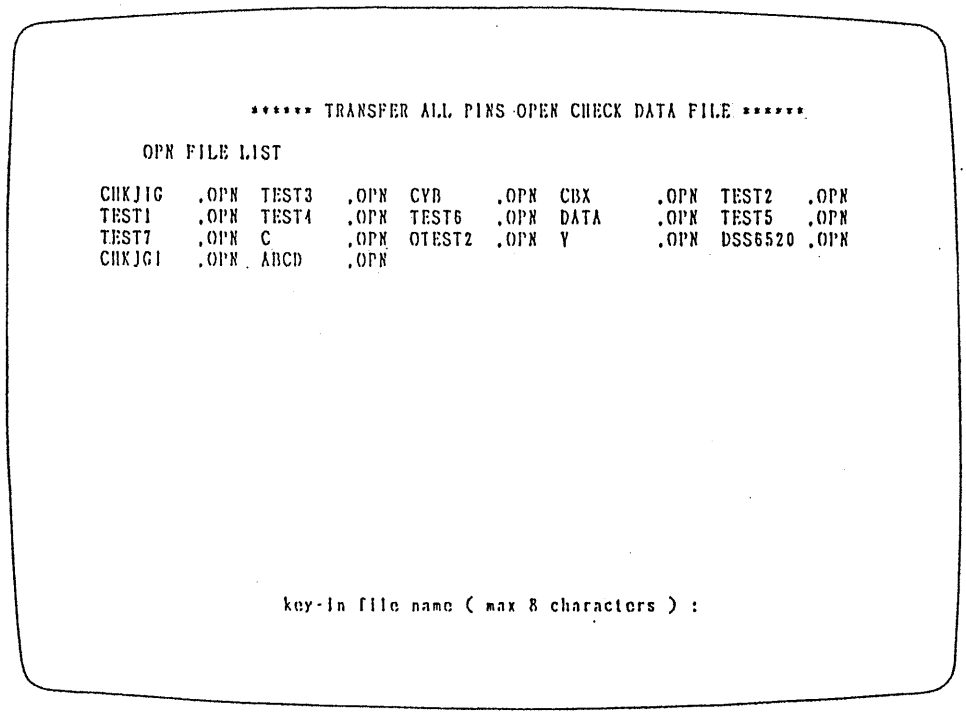
PF1



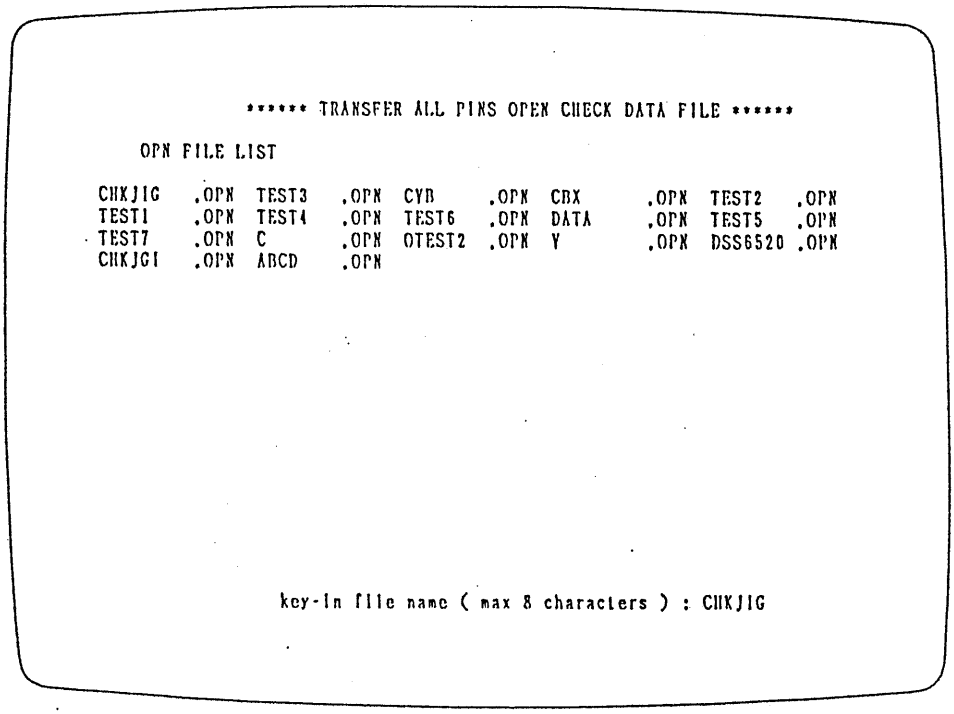
C H K J I G



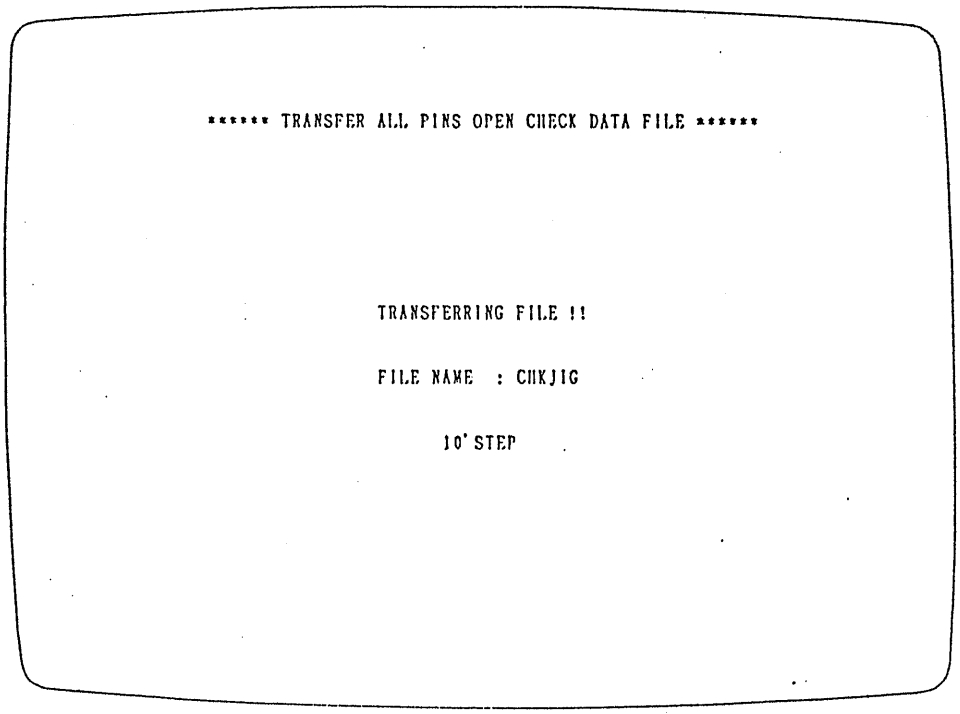
CR CR: RETURN or ENTER key
When the file has been transferred, the control returns to TRANSFER MENU. Then, select PF2.



PF2

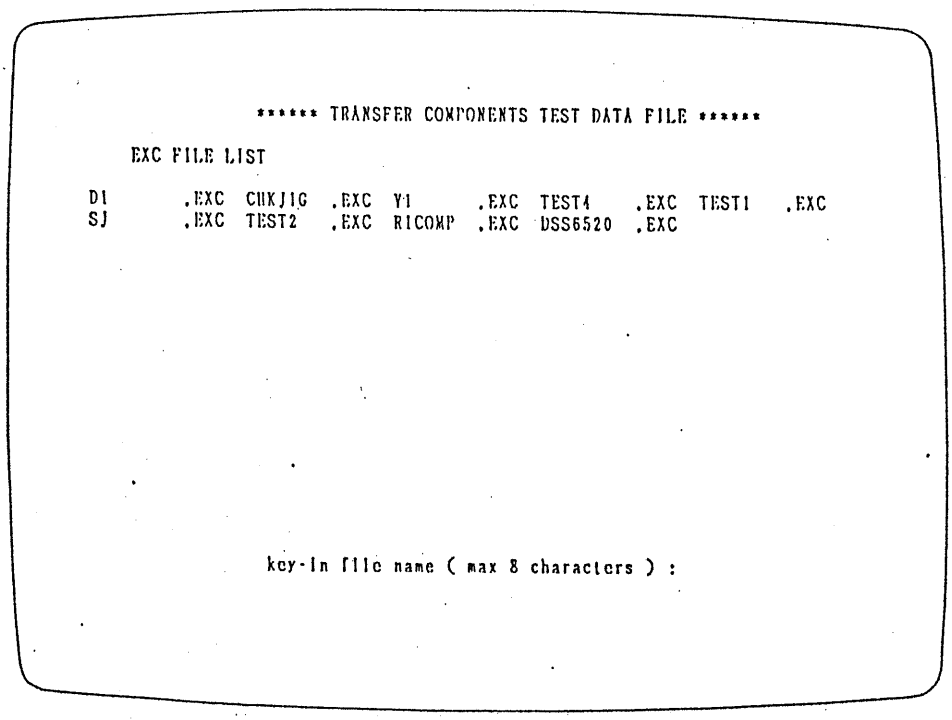


C H K J I G

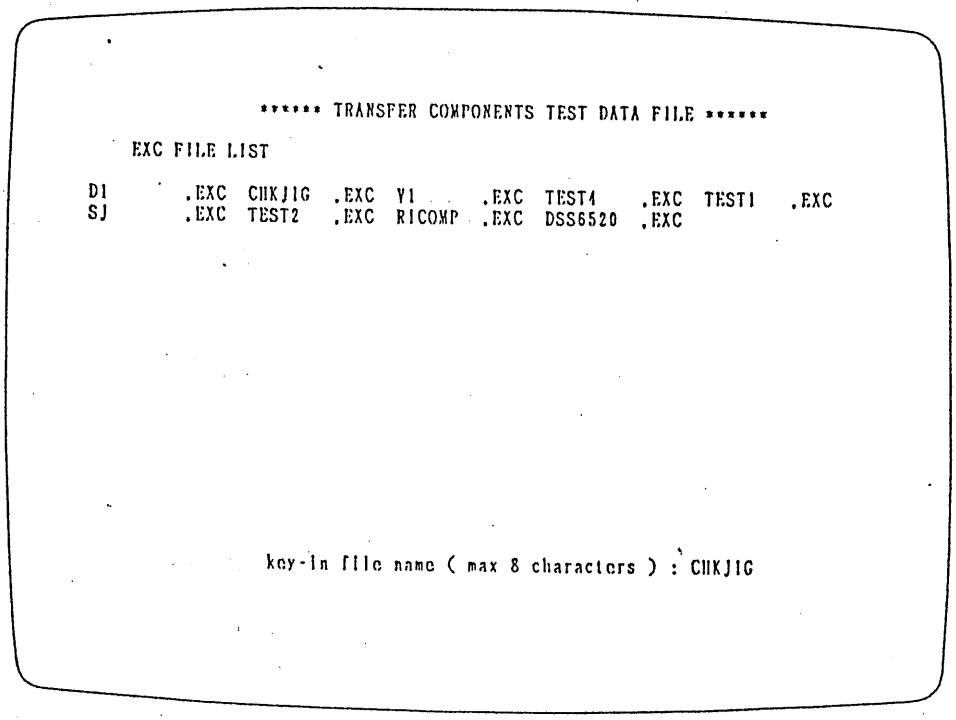


When the file has been transferred, the control returns to TRANSFER MENU.

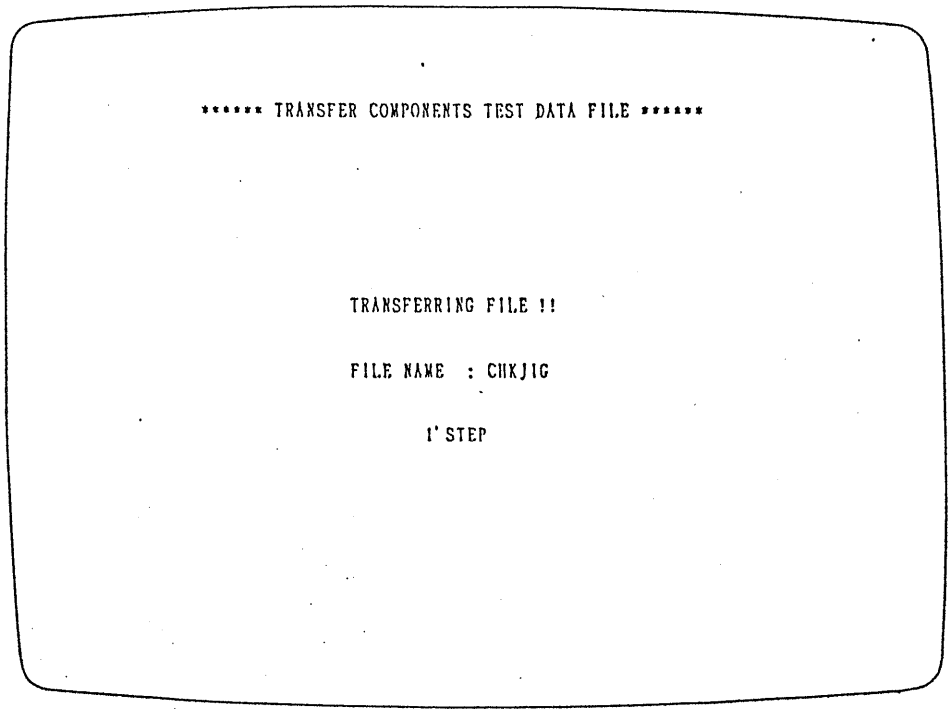
CR


****** TRANSFER COMPONENTS TEST DATA FILE ******
EXC FILE LIST
D1 .EXC CHKJ1G .EXC Y1 .EXC TEST4 .EXC TEST1 .EXC
SJ .EXC TEST2 .EXC RICOMP .EXC DSS6520 .EXC
key-in file name (max 8 characters) :

PF3


****** TRANSFER COMPONENTS TEST DATA FILE ******
EXC FILE LIST
D1 .EXC CHKJ1G .EXC Y1 .EXC TEST4 .EXC TEST1 .EXC
SJ .EXC TEST2 .EXC RICOMP .EXC DSS6520 .EXC
key-in file name (max 8 characters) : CHKJ1G

C H K J I G



CR

When the file has been transferred, the control returns to TRANSFER NENU. If PF7 is selected from the TRANSFER MENU, the system is set in the TEST READY mode again.

PF5 TEST READY mode

↓

PF5 MAINTENANCE & MODIFY

(5) MAINTE (Maintenance and modification) PF5

The MAINTE program can display, modify, or execute any desired steps of an execution program. It is useful for debugging the execution program because the user can monitor the program step execution by the host computer screen.

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

   D :   DISPLAY 12 LINES FROM RANDOM STEP
   T :   TEST OF RANDOM STEP
   N :   NEXT STEP TEST
   R :   REPEAT TEST OF SAME STEPS
   I :   INSERT RANDOM STEP
   K :   DELETE RANDOM STEP
   C :   CHANGE OF RANDOM STEP
   M :   MULTIPLY EXECUTION DATA
   A :   ERROR SET OF EACH PART
   U :   UPPER JIG    E:  END

key-in command & step no. (ex. D1 [RETURN] ) D1

                                Actual Standard Parts   +   -
STEP  PARTS  +PIN -PIN GND1 GND2 Value   Value  Location err err delay EXT

0001  R0001  001  000          1.24 o  1.41 o    1A     10  10   00    0
0002  R0002  002  003          7.48 o  7.54 o    1A     10  10   00    0
0003  R0003  004  005          9.95 o 10.34 o    1A     10  10   00    0
0004  R0003  005  004          99.0 o  10.0 o    1A     10  10   00    0
0005  R0004  006  007          33.3 o  33.0 o    1A     10  10   00    0
0006  R0005  009  008          69.7 o  69.5 o    1A     10  10   00    5
0007  R0006  011  010          62.1 o  81.7 o    1A     10  10   00    6
0008  R0007  012  013          99.9 o  99.6 o    2A     10  10   00    7
0009  R0007  012  013          100. o  096. o    2A     10  10   00    8
0010  R0008  014  015          340. o  333. o    2A     10  10   00    9
0011  R0009  017  016          677. o  668. o    2A     10  10   00    A
0012  R0010  019  018          817. o  888. o    2A     10  10   00    B
```

Twelve program steps are displayed starting from the step number specified after D.

D 1 CR

If only D and CR are pressed as "D CR", the next page is displayed.

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

D :    DISPLAY 12 LINES FROM RANDOM STEP
T :    TEST OF RANDOM STEP
N :    NEXT STEP TEST
R :    REPEAT TEST OF SAME STEPS
I :    INSEAT RANDOM STEP
K :    DELETE RANDOM STEP
C :    CHANGE OF RANDOM STEP
M :    MULTIPLY EXECUTION DATA
A :    ERROR SET OF EACH PART
U :    UPPER JIG   E:  END

key-in command & step no. ( ex. D1 [RETURN] ) T



then press [TEST] switch
```

Any desired steps can be executed. Press T, and the message "then press [TEST] switch" is displayed. In response to this message, press the TEST switch on the printer section.

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

D :    DISPLAY 12 LINES FROM RANDOM STEP
T :    TEST OF RANDOM STEP
N :    NEXT STEP TEST
R :    REPEAT TEST OF SAME STEPS
I :    INSEAT RANDOM STEP
K :    DELETE RANDOM STEP
C :    CHANGE OF RANDOM STEP
M :    MULTIPLY EXECUTION DATA
A :    ERROR SET OF EACH PART
U :    UPPER JIG   E:  END

key-in command & step no. ( ex. D1 [RETURN] ) T1,4

                                  Actual Standard Parts   +   -
STEP  PARTS  +PIN -PIN GND1 GND2 Value   Value  Location err err delay EXT

0001  C0001  001  000            10.0nF  11.0nF    1A     10  10   00    0
                    Measured Value    00.0nF  ***** FAIL
0002  R0002  002  003             7.48 o  7.54 o    1A     10  10   00    0
                    Measured Value,   7.54 o  ***** GOOD
0003  R0003  004  005             9.95 o 10.34 o    1A     10  10   00    0
                    Measured Value   10.10 o  ***** GOOD
0004  R0003  005  004            99.0 o 100.0 o    1A     10  10   00    0
                    Measured Value    89.9 o  ***** GOOD
```

The steps indicated by the figures input after T are executed. If "T1, 4" is input, for example, steps 1 - 4 are executed.

T 1 , 4 CR

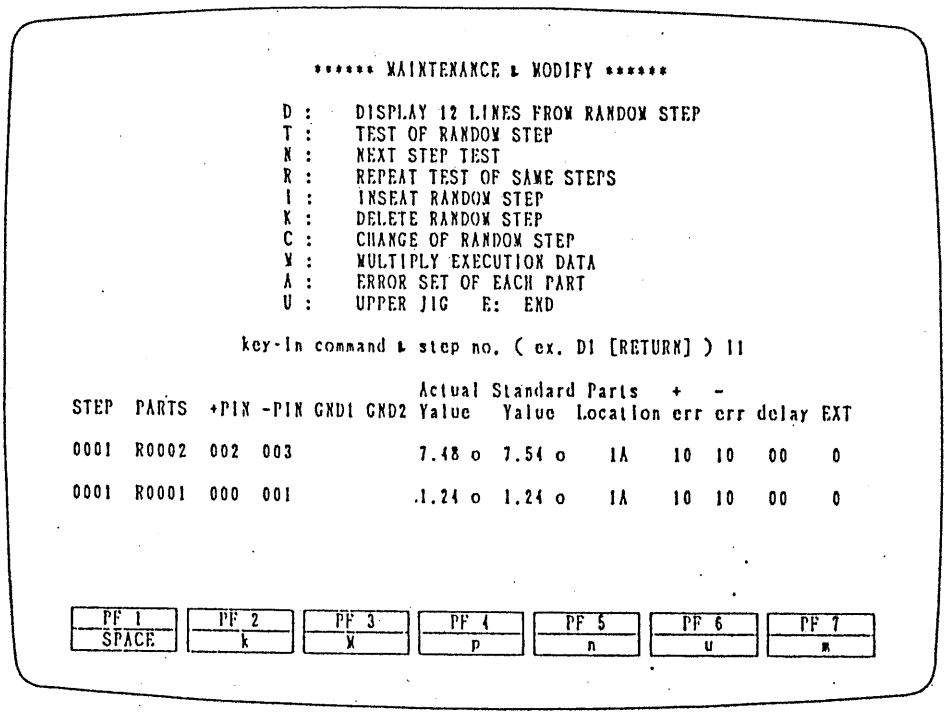
```
****** MAINTENANCE & MODIFY ******

          D :   DISPLAY 12 LINES FROM RANDOM STEP
          T :   TEST OF RANDOM STEP
          N :   NEXT STEP TEST
          R :   REPEAT TEST OF SAME STEPS
          I :   INSERT RANDOM STEP
          K :   DELETE RANDOM STEP
          C :   CHANGE OF RANDOM STEP
          M :   MULTIPLY EXECUTION DATA
          A :   ERROR SET OF EACH PART
          U :   UPPER JIG   E:  END

     key-in command & step no. ( ex. D1 [RETURN] ) N

                                Actual Standard Parts   +   -
STEP  PARTS  +PIN -PIN GND1 GND2 Value   Value  Location err err delay EXT

0002  R0002  002  003          7.48 o  7.54 o    1A     10  10   00    0
                   Measured Value    7.53 o  ***** GOOD
```

Input N, and the next step is executed.
N

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

          D :   DISPLAY 12 LINES FROM RANDOM STEP
          T :   TEST OF RANDOM STEP
          N :   NEXT STEP TEST
          R :   REPEAT TEST OF SAME STEPS
          I :   INSERT RANDOM STEP
          K :   DELETE RANDOM STEP
          C :   CHANGE OF RANDOM STEP
          M :   MULTIPLY EXECUTION DATA
          A :   ERROR SET OF EACH PART
          U :   UPPER JIG   E:  END

     key-in command & step no. ( ex. D1 [RETURN] ) R10

                                Actual Standard Parts   +   -
STEP  PARTS  +PIN -PIN GND1 GND2 Value   Value  Location err err delay EXT

0002  R0002  002  003          7.48 o  7.54 o    1A     10  10   00    0
                   Measured Value    7.56 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
                   Measured Value    7.55 o  ***** GOOD
```

The steps specified for T or C can be executed repeatedly.
The steps are executed the number of times indicated by the figures after R.

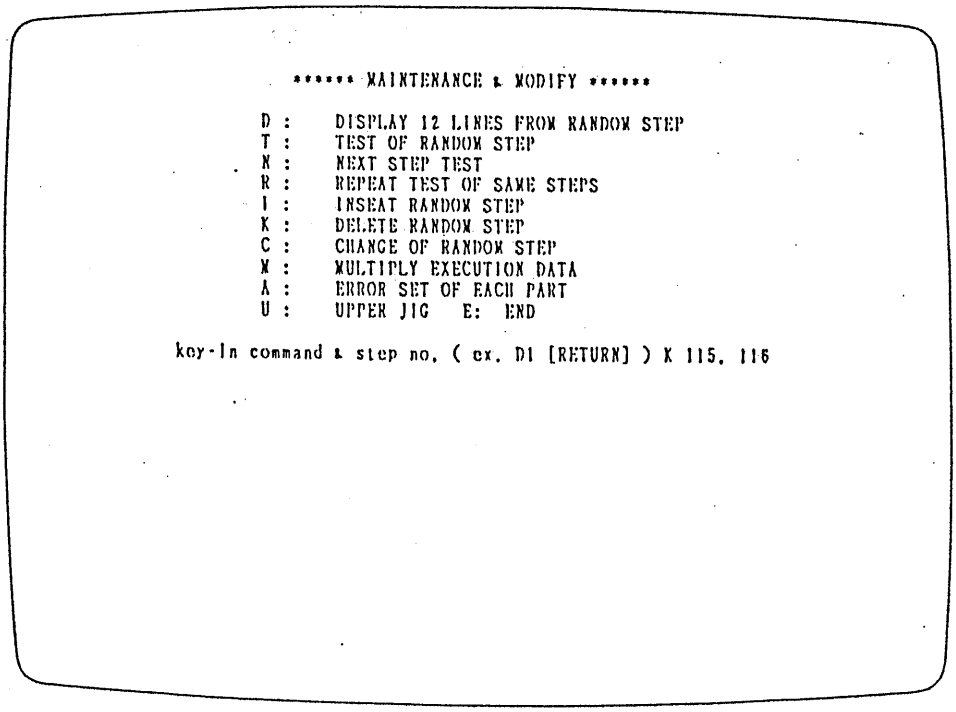
R 1 0 CR



New steps can be inserted between desired steps.

I 1 CR

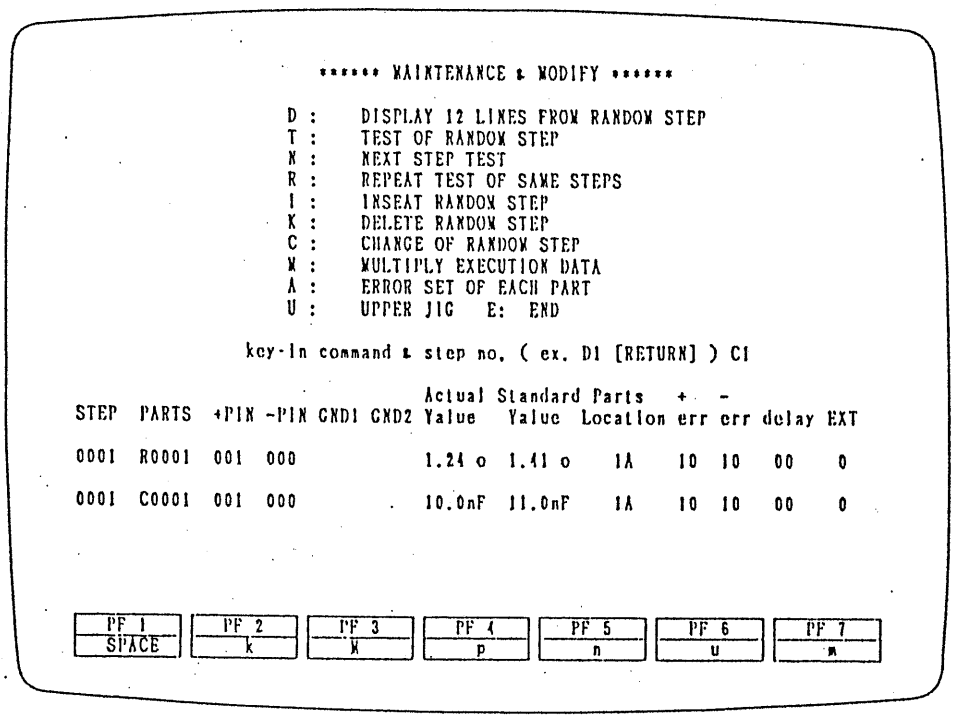
After the steps have been inserted, press E (E).



Any desired steps can be deleted.

To delete steps 115 - 116, for example, key in as follows:

K 1 1 5 CR 1 1 6 CR



Any desired steps can be changed.

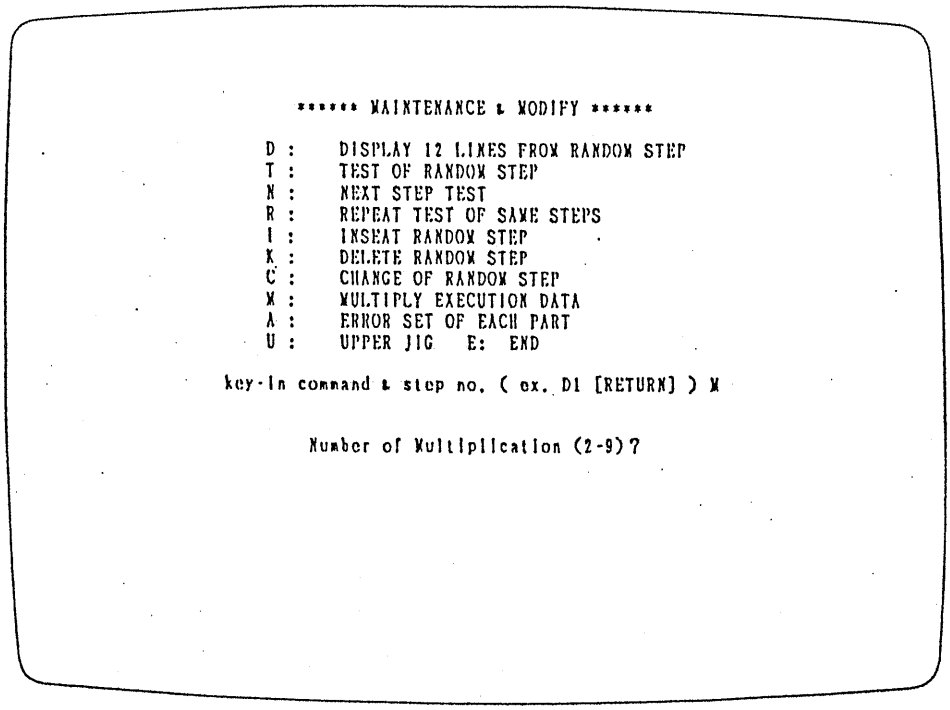
C1 CR

For ACTUAL VALUE, input upto 3 digits of figures (999) and decimal, and for standard value (judgement criterion), input upto four digits of figures (1999) and decimal.
If figures upto 4 digits are unnecessary press CR or 0 and then input figures to be desired.

Press CR for the item not to be changed. Press the ESC key after entering a standard value , and the mark "*" appears to suppress excecution of the pertinent step. The "*" disappears when the ESC key is pressed again.

For the judgement passable more than ACTUAL VALUE, input U into + err. Likewise for the judgement less than ACTUAL VALUE press L . Press CN to change the next step ("CHANGE NEXT STEP").

In case of testing some pieces of PC boards with one jig, you can make program automatically for upto 9 pieces of PC boards from the program for testing components on one PC board.



When M is input M appears on the screen.

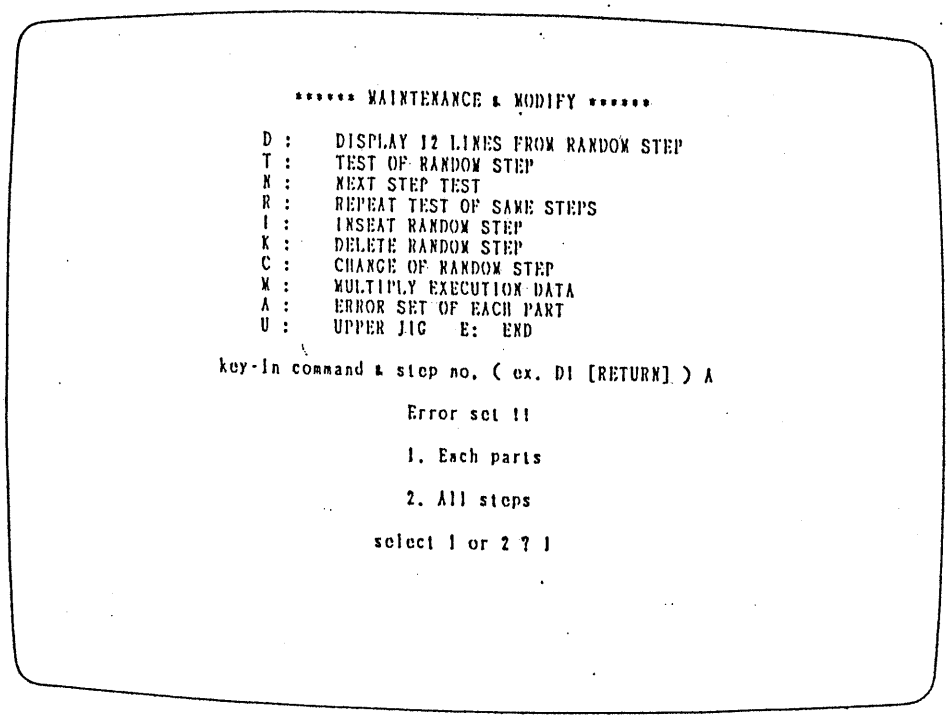
When 2 is input for 2-collective PC board

LOCATION

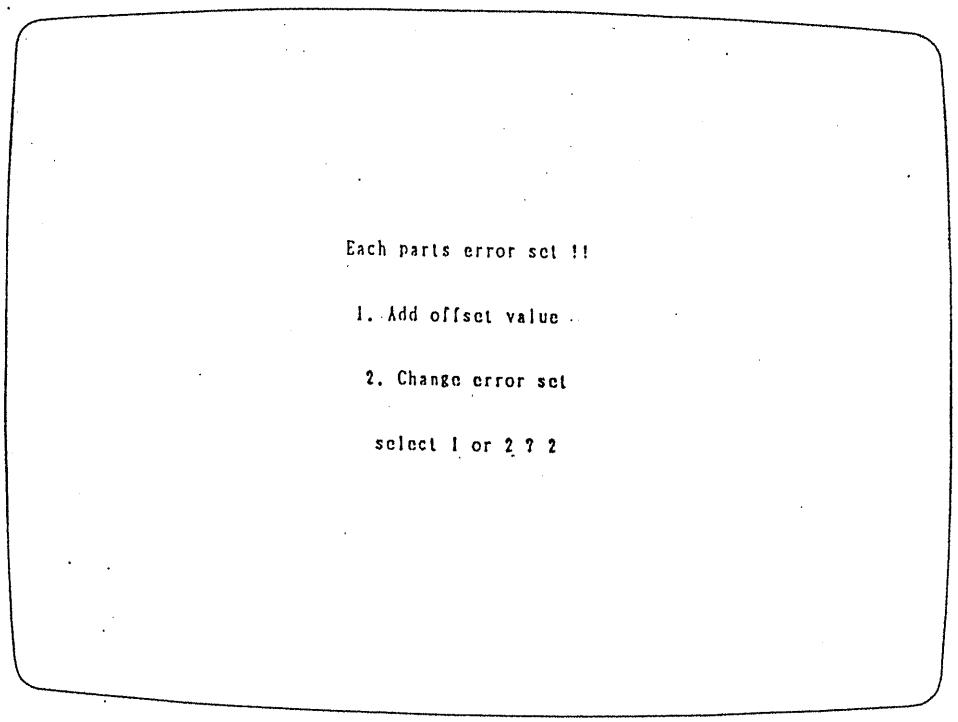
	(X)	(Y)
NO. 1	-	-
NO. 2	-	-

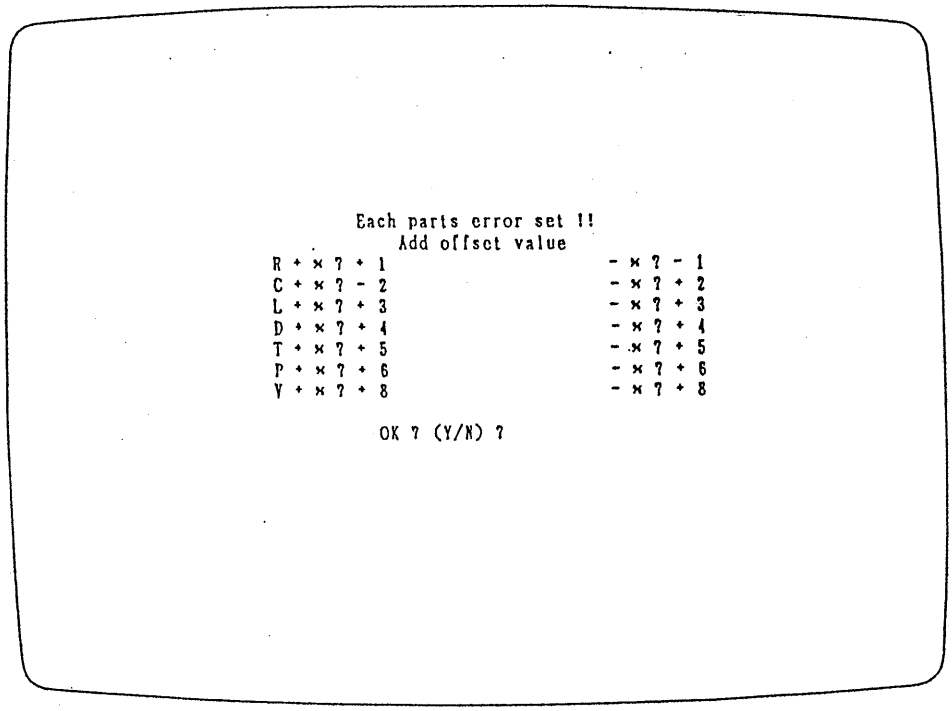
appear.

Parts location can be input in a lump, thereafter OFFSET is input.

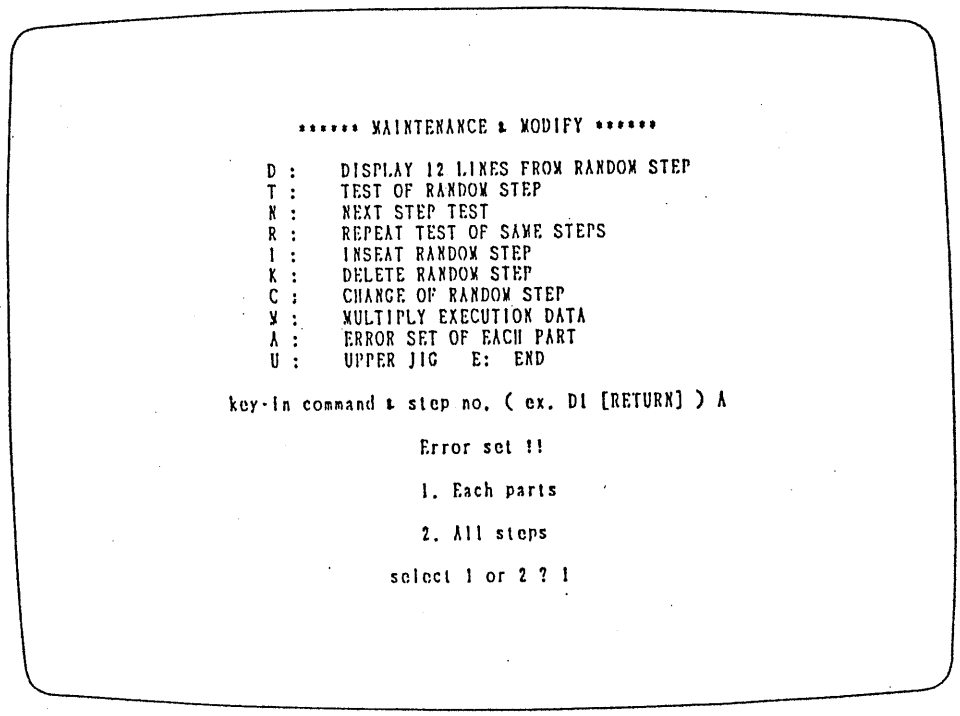


All the tolerance ranges of a desired type of parts can be changed at a time.



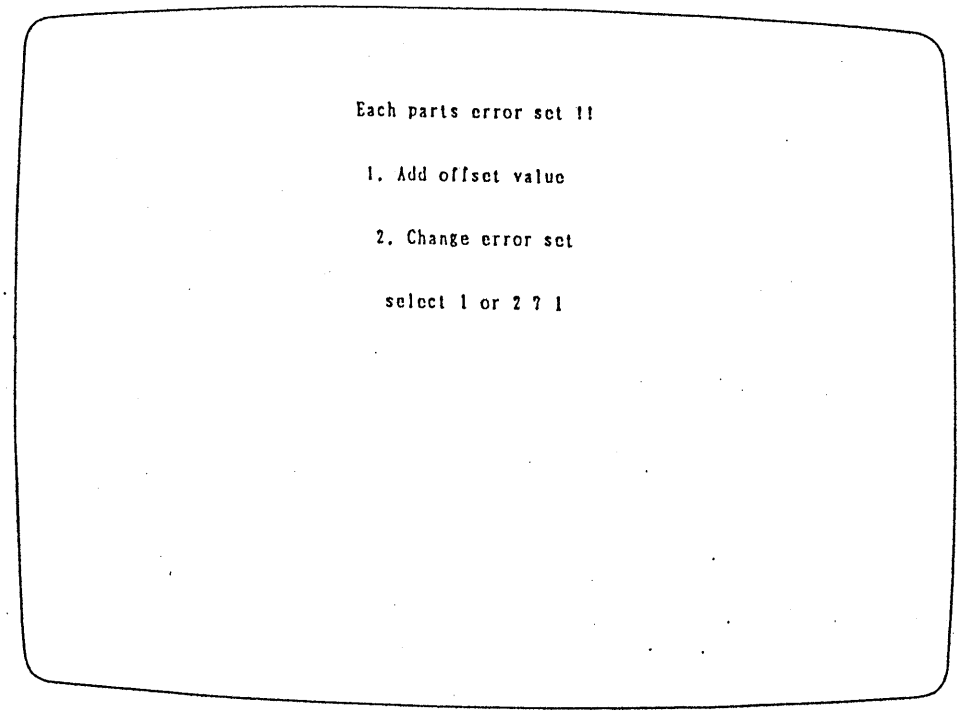


+ 1 CR	− 1 CR
− 2 CR	+ 2 CR
⋮	⋮
+ 8 CR	+ 8 CR
Y	

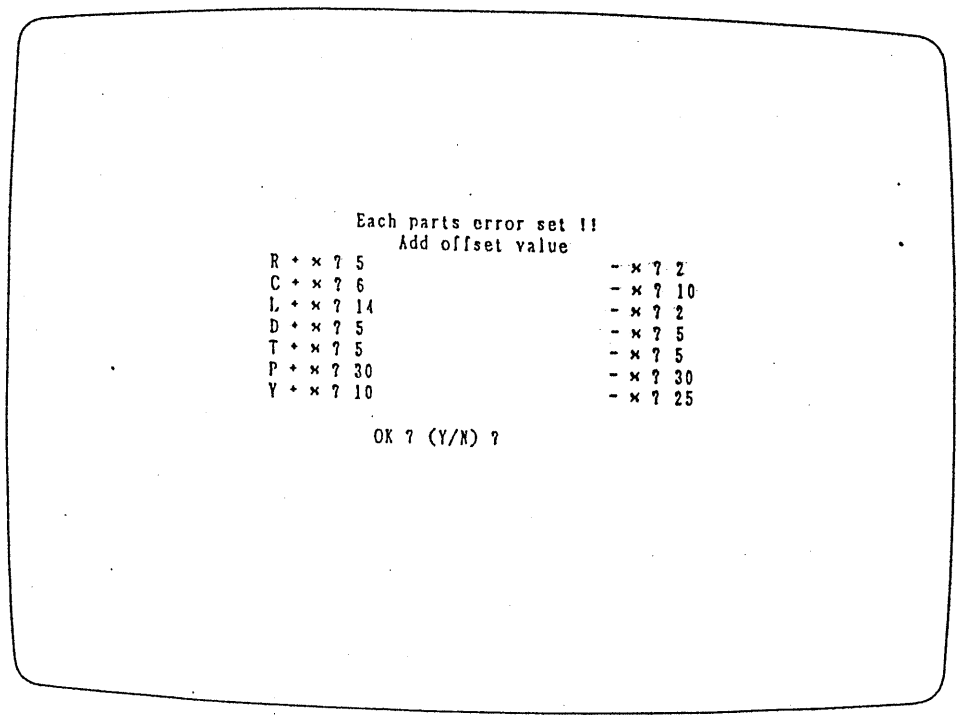


Select A again and set the tolerance range for each type of parts.

A 1



2



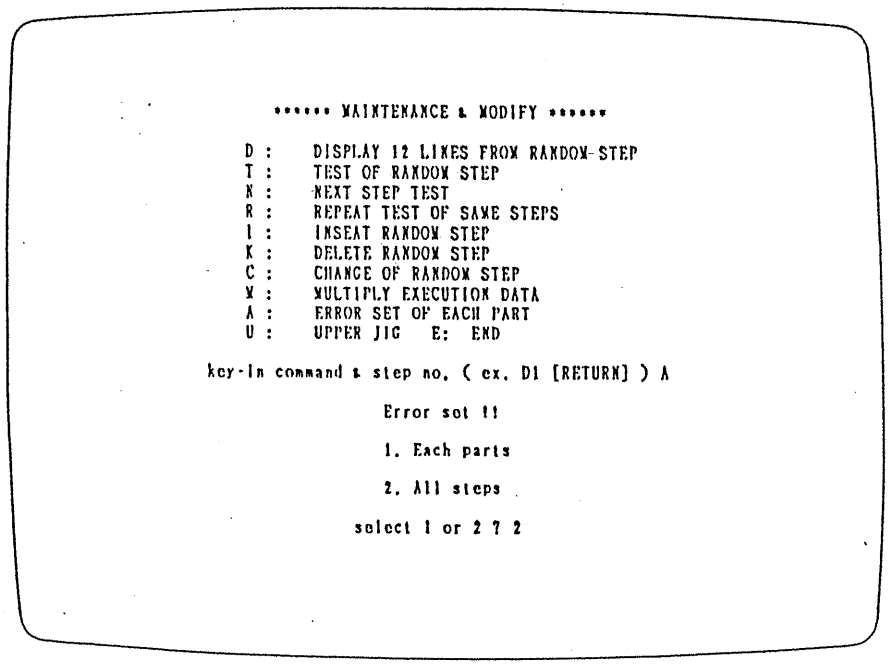
5 CR　　2 CR

6 CR　　1 CR

⋮　　⋮

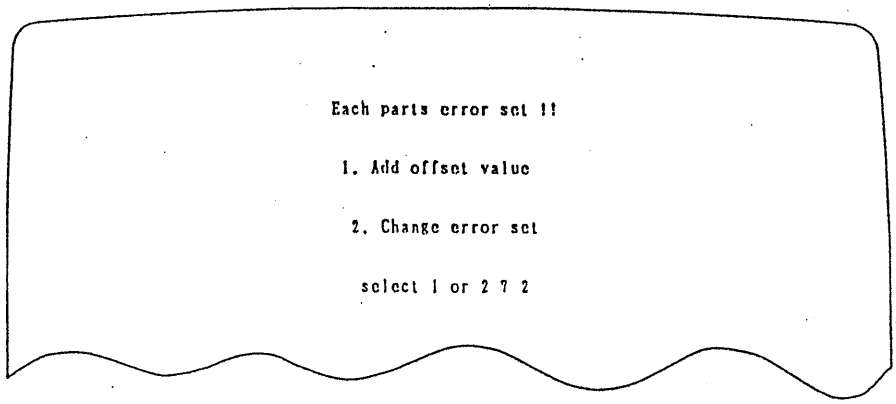
1 CR　　2 CR

Y

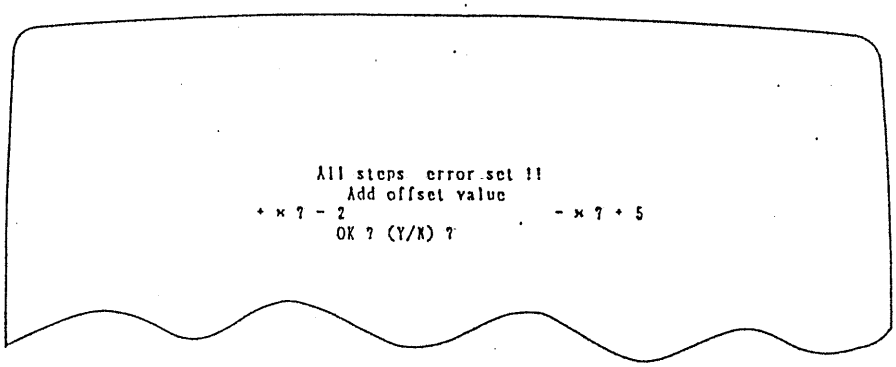


The tolerance range for all steps can be changed at a time.

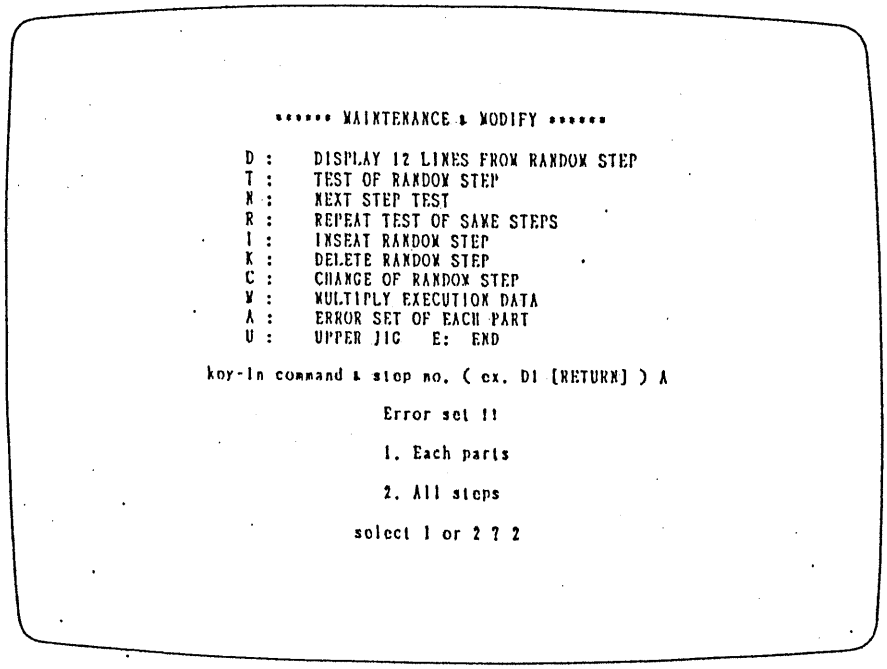
A 2



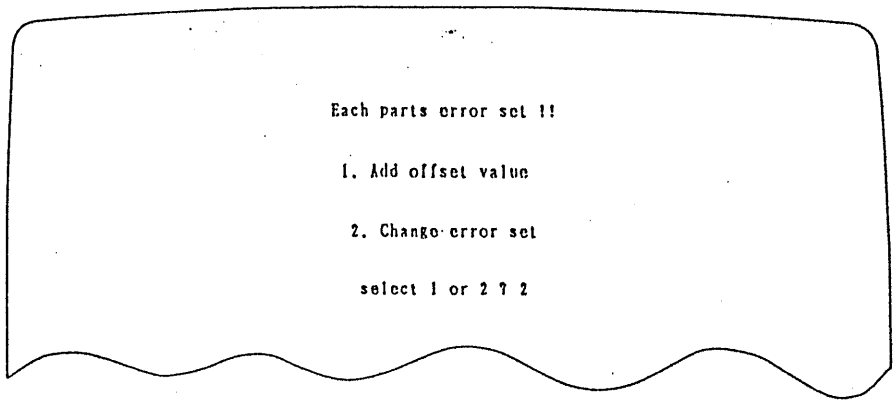
1



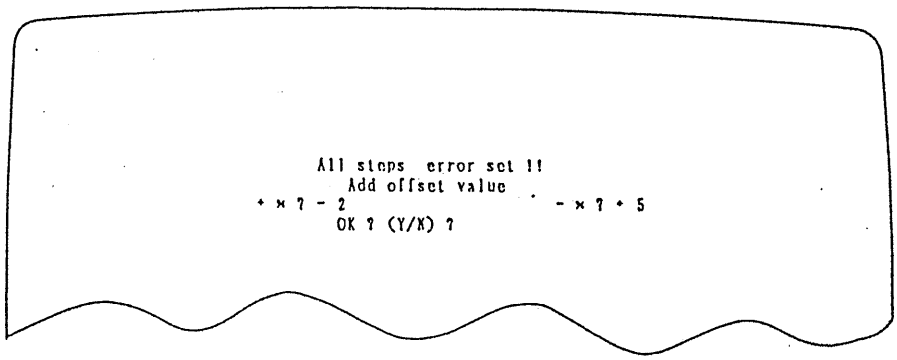
+ 2 CR + 5 CR Y



A 2

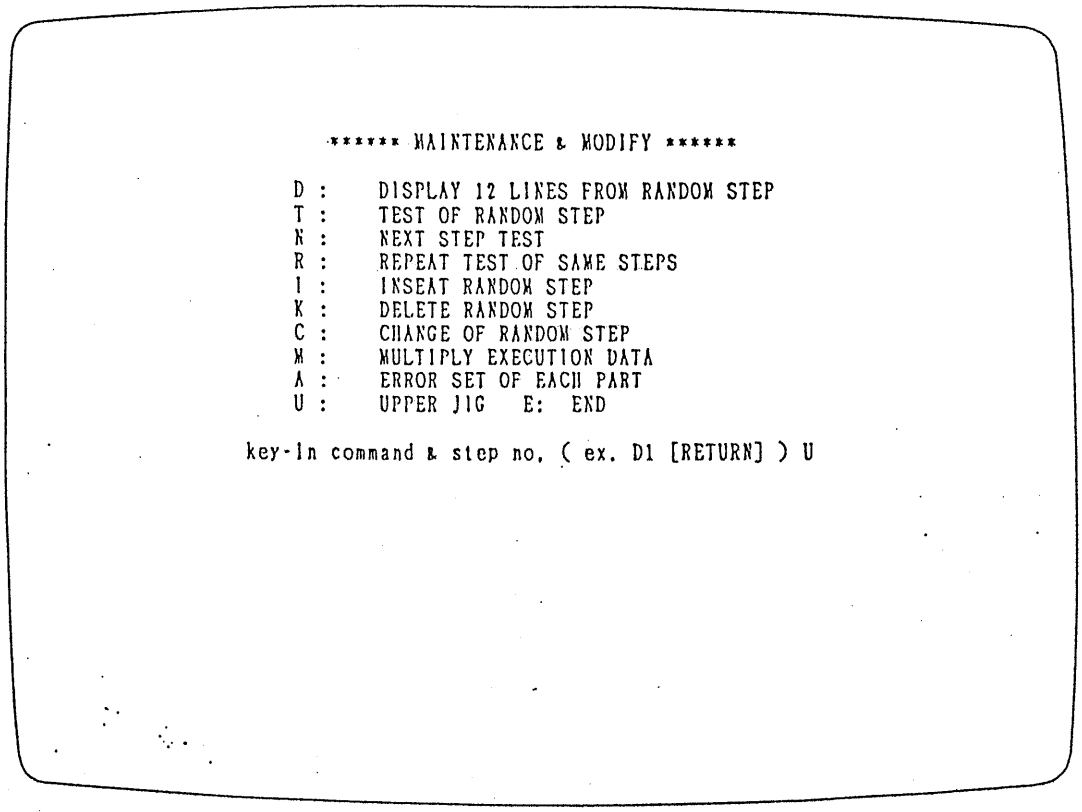


2



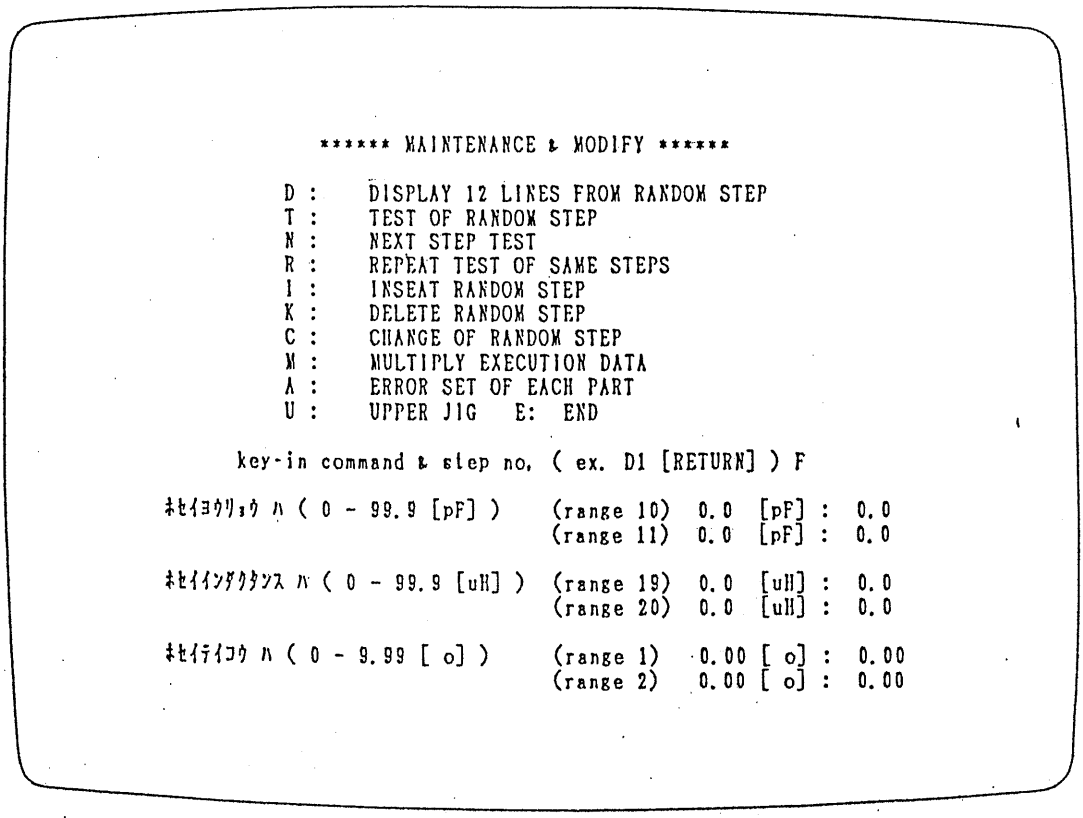
1 0 CR 1 0 CR Y

In the course of maintenance when jig and PC board are in contact, press U and you can detach PC board from jig as it is in maintenance.



U

When MAINTEENANCE & MODIFY is on screen press F and you can correct small capacitance, small inductance and small resistance, though it is not displayed on the screen.



F

In case of no alteration keep pressing CR.

CR CR CR -----

If this machine has undergone repair or modification never fail to check and set up.

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

D :    DISPLAY 12 LINES FROM RANDOM STEP
T :    TEST OF RANDOM STEP
N :    NEXT STEP TEST
R :    REPEAT TEST OF SAME STEPS
I :    INSEAT RANDOM STEP
K :    DELETE RANDOM STEP
C :    CHANGE OF RANDOM STEP
M :    MULTIPLY EXECUTION DATA
A :    ERROR SET OF EACH PART
U :    UPPER JIG    E:  END

key-in command & step no. ( ex. D1 [RETURN] ) E

                save to disk ? Y

          saving file name :- CHKJIG  .DAT & .EXC
```

To terminate the maintenance operation, press E. Then the message "save to disk?" is displayed. Respond to this message with "Y" if the execution program in the floppy disk is to be replaced by the program on which the maintenance operation has been performed. When Y is pressed, the pin information in the initial data is also replaced by that in the execution program.

```
EXT ONLY ---- 1
DAT & EXT --- 2 ? _
```

Note: It takes some time to save the program because the entire program is replaced (about 5 minutes for a program of 300 steps). Normally, the content of the floppy disk need not be replaced each time an item is modified; save the program by pressing Y only when debugging of the entire program is completed.

E Y

2

If the program in the floppy disk need not be replaced, press N.

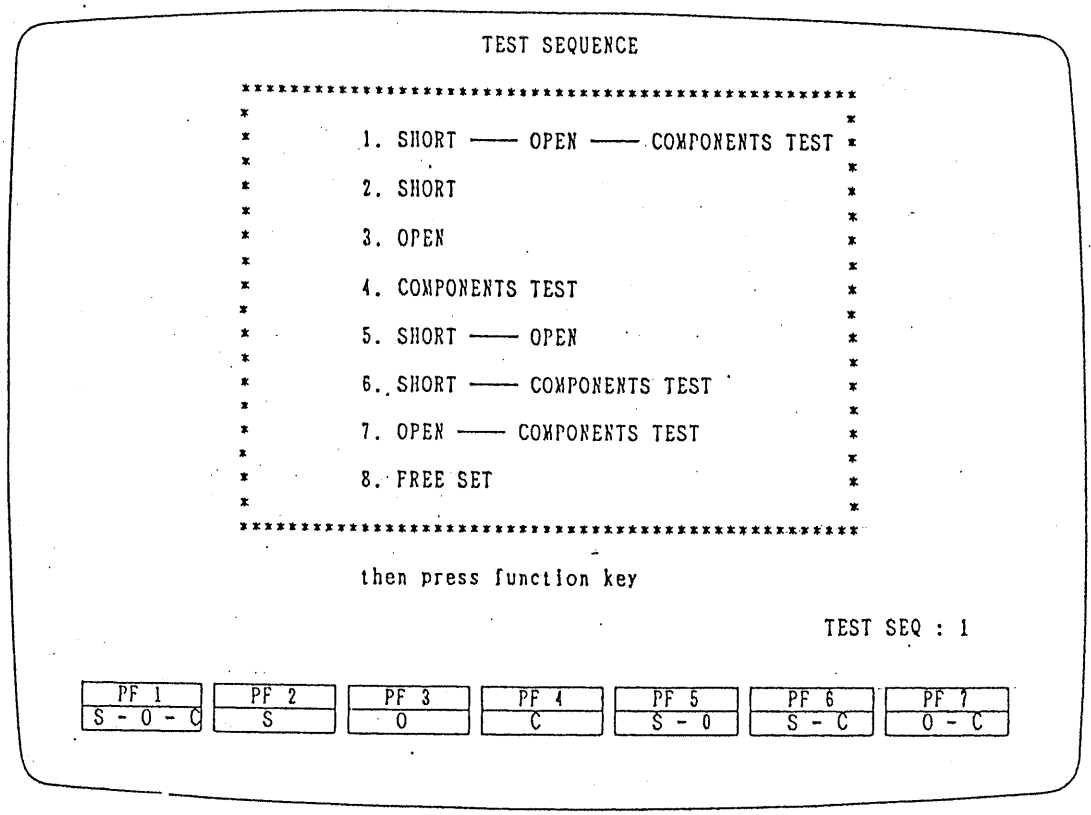
E N

(6) TEST SEQ (Test sequence)
Three types orf tests can be executed.

(1) SHORT : All-pin short check
(2) OPEN : All-pin open check
(3) COMPONENT TEST: Test in units of components parts

The types of the tests to be executed and their execution order can be specified by the user.

PF 6



Input text execution sequence number of your choice.
If you press 8 when the screen displays TEST SEQUENCE you can specify test items freely.

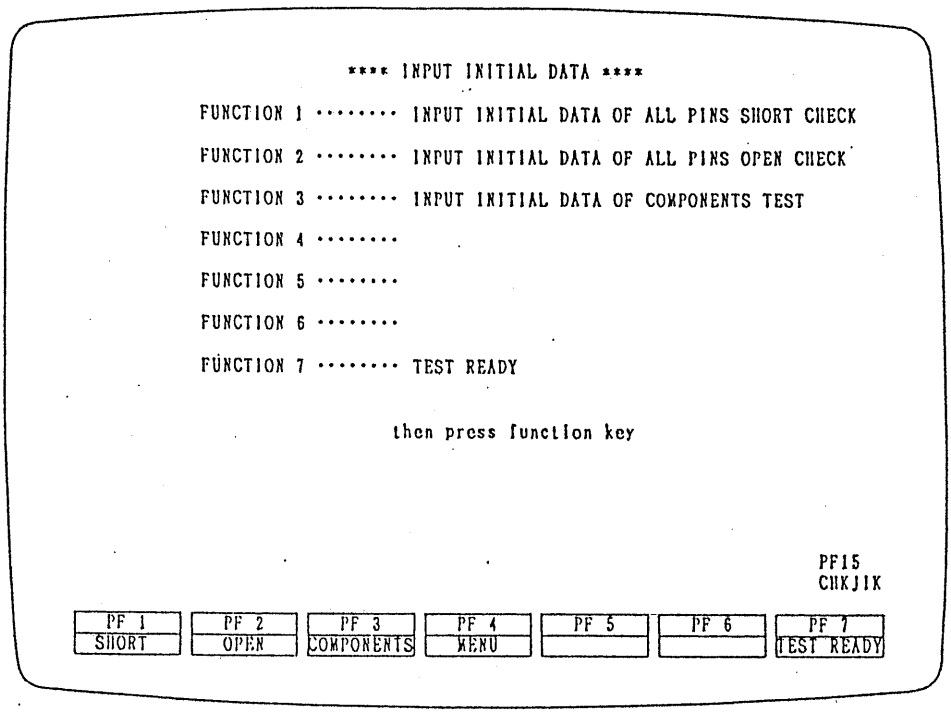
Press test item.
1. SHORT TEST
2. OPEN TEST
3. COMPONENT TEST
first second third
- Input the number of the test that you want to execute.

(7) MAP/NORM (Map/normal display switching) PF7

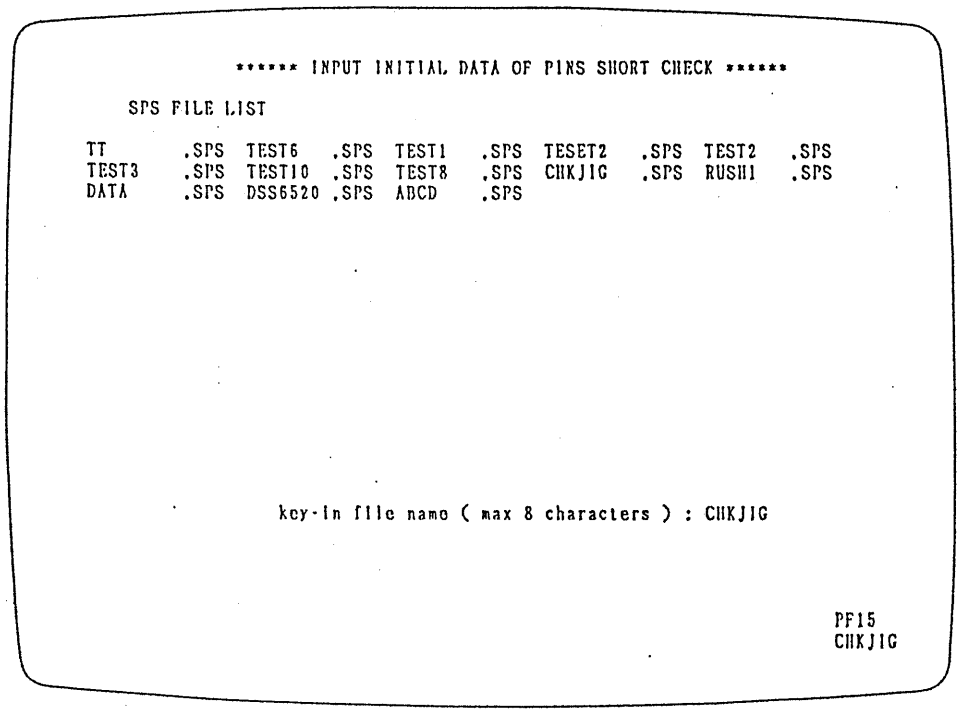
Each time PF7 is pressed, the screen display mode is switched between MAP mode and NORM mode (the current mode is displayed in the lower right-hand corner of the screen).

(8) INPUT INITIAL DATA(初期データ作成) PF 8

PF 8



1



Specify the file name with the maximum of eight characters.
(starting with a English letter)

C H K J I G CR

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

   SPS FILE LIST

TT       .SPS  TEST6   .SPS  TEST1   .SPS  TESET2   .SPS  TEST2   .SPS
TEST3    .SPS  TEST10  .SPS  TEST8   .SPS  CHKJIG   .SPS  RUSH1   .SPS
DATA     .SPS  DSS6520 .SPS  ABCD    .SPS  FLT      .SPS

                  key-in file name ( max 8 characters ) : CHKJIG

                       generate from first step ? (Y/N)

                                                          PF15
                                                          CHKJIG
```

If the same file name exists, whether or not to replace the existing file is asked.

C H K J I G CR Y

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

MAX PIN ····· 767    ( MAX PIN OF FILE [FLT] IS 0 )

REF PIN    PASS PIN

000 ····· 001, 002, 003, 004, 005, 006, 007, 008
001 ····· 000, 002, 003, 004, 005, 006, 007, 008
002 ····· 000, 001, 003, 004, 005, 006, 007, 008
003 ····· 000, 001, 002, 004, 005, 006, 007, 008
004 ····· 000, 001, 002, 003, 005, 006, 007, 008
005 ····· 000, 001, 002, 003, 004, 006, 007, 008
006 ····· 000, 001, 002, 003, 004, 005, 007, 008
007 ····· 000, 001, 002, 003, 004, 005, 006, 008
008 ····· 000, 001, 002, 003, 004, 005, 006, 007
```

Specify the maximum number of pins and generate data.

7 6 7 CR

0 , 1 , ---- CR

To modify the input data, press the ESC key.

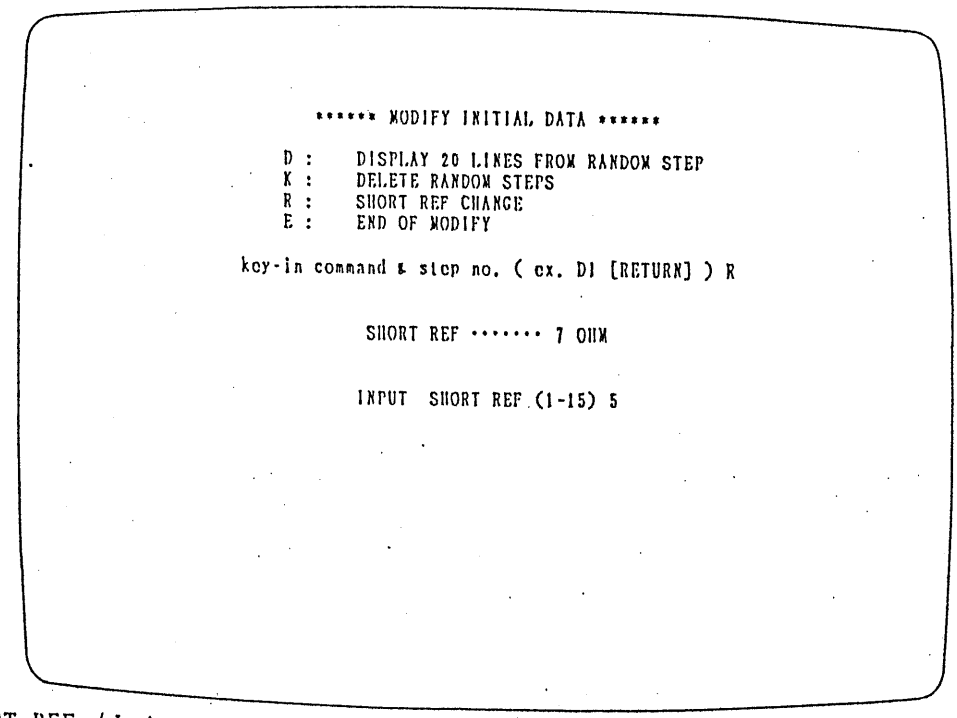
ESC

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

                          D :    DISPLAY 20 LINES FROM RANDOM STEP
                          K :    DELETE RANDOM STEPS
                          R :    SHORT REF CHANGE
                          E :    END OF MODIFY

                      key-in command & step no. ( ex. D1 [RETURN] ) D1

STEP REF PIN    PASS PIN
0001 000 ------ 001, 002, 003, 004, 005, 006, 007, 008
0002 001 ------ 000, 002, 003, 004, 005, 006, 007, 008, 009, 010
0003 002 ------ 000, 001, 004, 005, 006, 007, 008
0004 003 ------ 000, 001, 002, 004, 005, 006, 007, 008, 009
0005 004 ------ 000, 001, 002, 003, 005, 006, 007, 008
0006 005 ------ 000, 001, 002, 003, 004, 006, 007, 008, 009, 010
0007 005 ------ 011
0008 006 ------ 000, 001, 002, 003, 004, 005, 007, 008
0009 007 ------ 000, 001, 002, 003, 004, 005, 006, 008, 009, 010
0010 007 ------ 011, 012, 013
0011 008 ------ 000, 001, 002, 003, 004, 005, 006, 007, 009
0012 009 ------ 001, 003, 005, 007, 008
0013 010 ------ 001, 005, 007
0014 011 ------ 007, 005
0015 012 ------ 007
0016 013 ------ 007
0017 014 ------ 077, 066, 055, 044, 033, 022, 011
0018 015 ------ 123, 456
0019 016 ------ 013, 034, 046, 068
```

D 1 CR

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

                          D :    DISPLAY 20 LINES FROM RANDOM STEP
                          K :    DELETE RANDOM STEPS
                          R :    SHORT REF CHANGE
                          E :    END OF MODIFY

                      key-in command & step no. ( ex. D1 [RETURN] ) K

                      key-in start step number for delete ? 19

                      key-in end step number  for delete ?  19

                                   DELETING !!
```

K 1 9 CR 1 9 CR

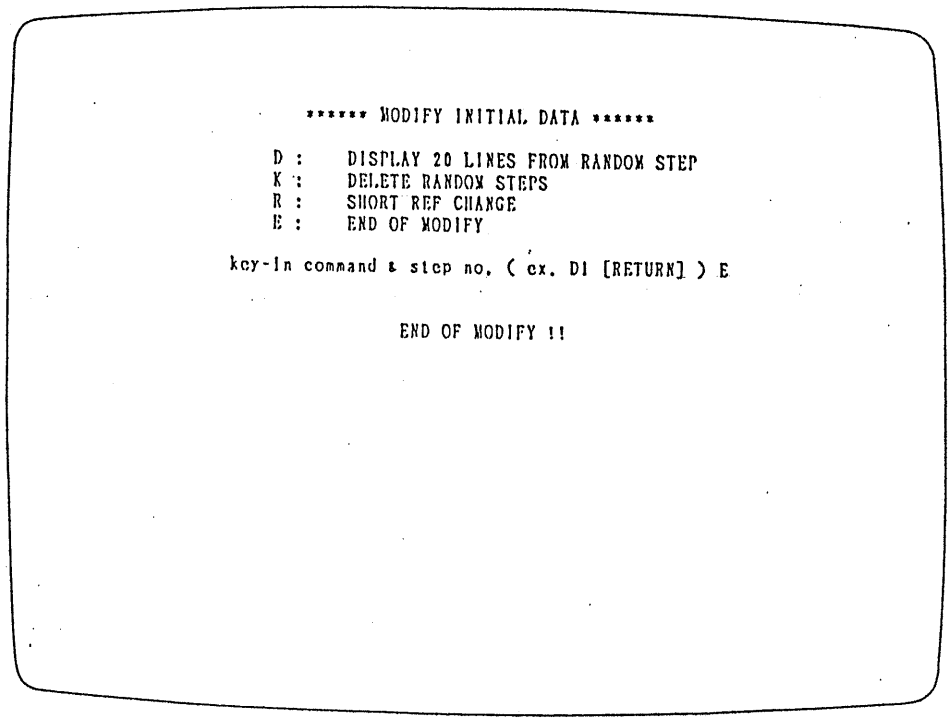


SHORT REF (Judgement criterion) put in storage at the time of data pick-up, can be changed.

R

By storing resistance in accordance with the instruction on the screen, SHORT REF for all-pin short check data in floppy disk can be changed.

5 CR



When the initial data has been modified, press E.

E

```
****** INPUT INITIAL DATA OF PINS OPEN CHECK ******

   OPN FILE LIST

CHKJIG   .OPN  TEST3   .OPN  CYB     .OPN  CBX     .OPN  TEST2   .OPN
TEST1    .OPN  TEST4   .OPN  TEST6   .OPN  DATA    .OPN  TEST5   .OPN
TEST7    .OPN  C       .OPN  CTEST2  .OPN  Y       .OPN  DSS6520 .OPN
CHKJG1   .OPN  ABCD    .OPN

                key-in file name ( max 8 characters ) :

                                                        PF15
                                                        CHKJIG
```

The initial data for the all-pin open check is created by the same operation flow as the initial data for the all-pin short check. Select "2" from the INPUT INITIAL DATA screen as follows:

2 CR

```
****** INPUT INITIAL DATA OF PINS OPEN CHECK ******

   OPN FILE LIST

CHKJIG   .OPN  TEST3   .OPN  CYB     .OPN  CBX     .OPN  TEST2   .OPN
TEST1    .OPN  TEST4   .OPN  TEST6   .OPN  DATA    .OPN  TEST5   .OPN
TEST7    .OPN  C       .OPN  CTEST2  .OPN  Y       .OPN  DSS6520 .OPN
CHKJG1   .OPN  ABCD    .OPN

                key-in file name ( max 8 characters ) : CHKJIG

                                                        PF15
                                                        CHKJIG
```

C H K J I G CR

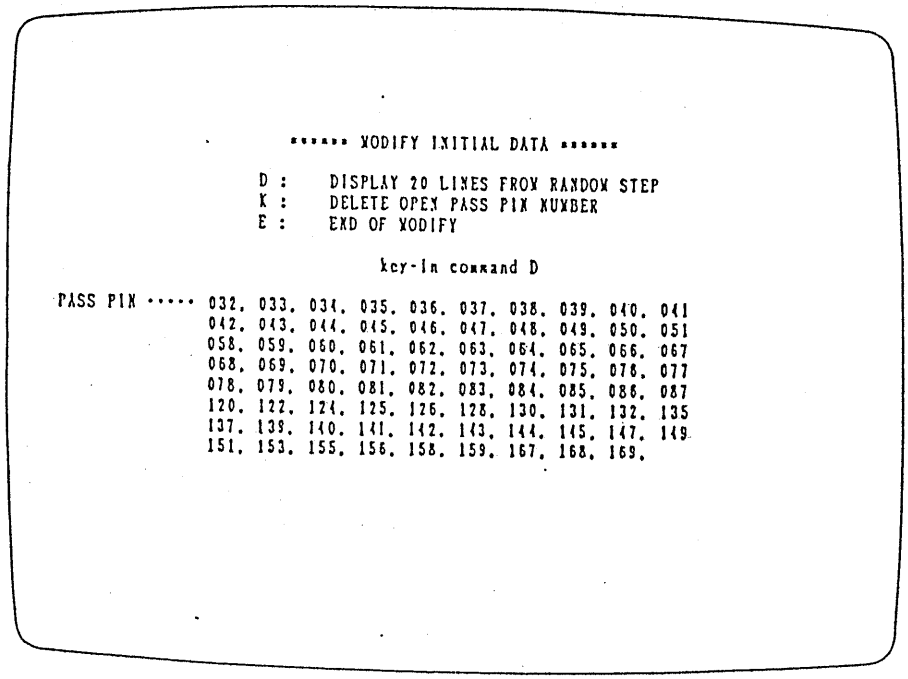
```
****** INPUT INITIAL DATA OF PINS OPEN CHECK ******

   OPN FILE LIST

CHKJIG   .OPN  TEST3   .OPN  CYB     .OPN  CBX     .OPN  TEST2   .OPN
TEST1    .OPN  TEST4   .OPN  TEST6   .OPN  DATA    .OPN  TEST5   .OPN
TEST7    .OPN  C       .OPN  CTEST2  .OPN  Y       .OPN  DSS6520 .OPN
CHKJG1   .OPN  ABCD    .OPN

          key-in file name ( max 8 characters ) : CHKJIG

          generate from first step ? (Y/N)  Y

                                                        PF15
                                                        CHKJIG
```

Y

```
****** INPUT INITIAL DATA OF OLL PINS OPEN CHECK ******

MAX PIN ····· 15              ( MAX PIN OF FILE [ CHKJIG ] IS 0 )

PASS PIN ····· 000, 001, 002, 003, 004, 005, 006, 007, 008, 010
               011, 012, 013
```

1 5 CR

0 CR 1 CR ---- 1 3 E

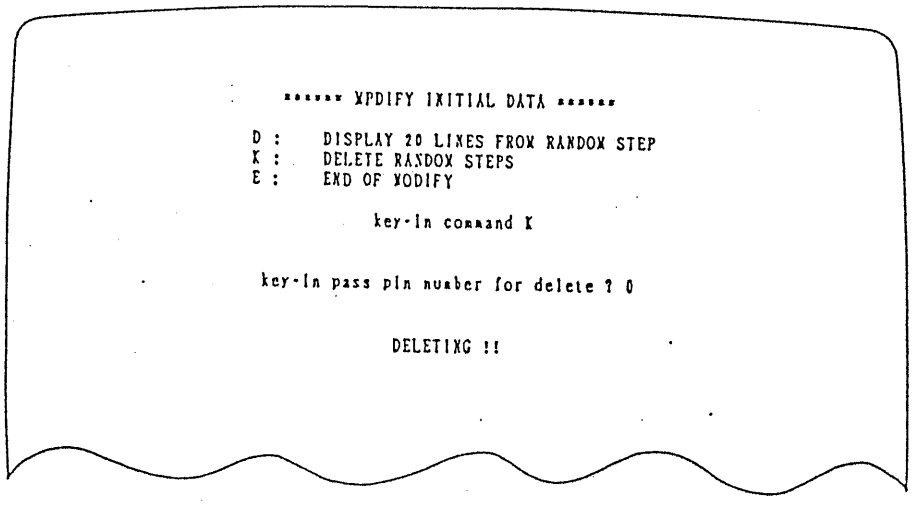


To transfer control to the modification mode:

ESC

To display the contents of the file:

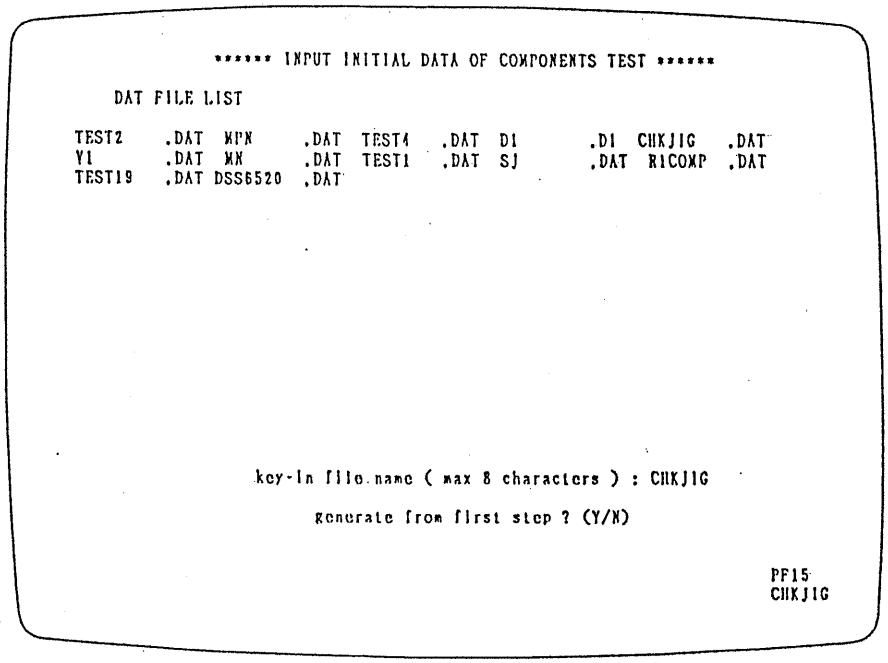
D

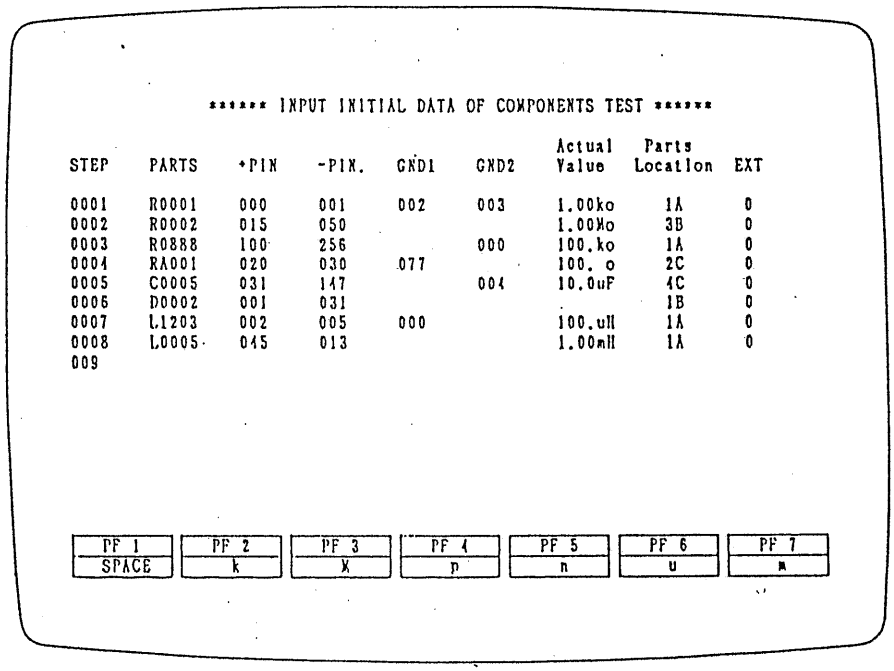


To delete steps:

K 8 CR

To create initial data for the component test, select "3" from the INPUT INITIAL DATA screen as follows:
3 CR

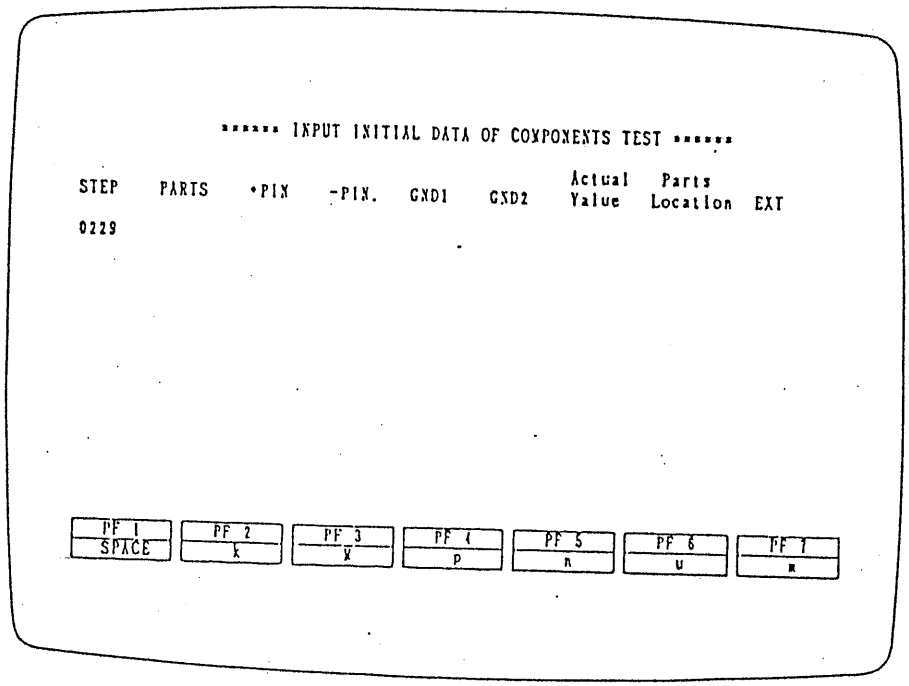




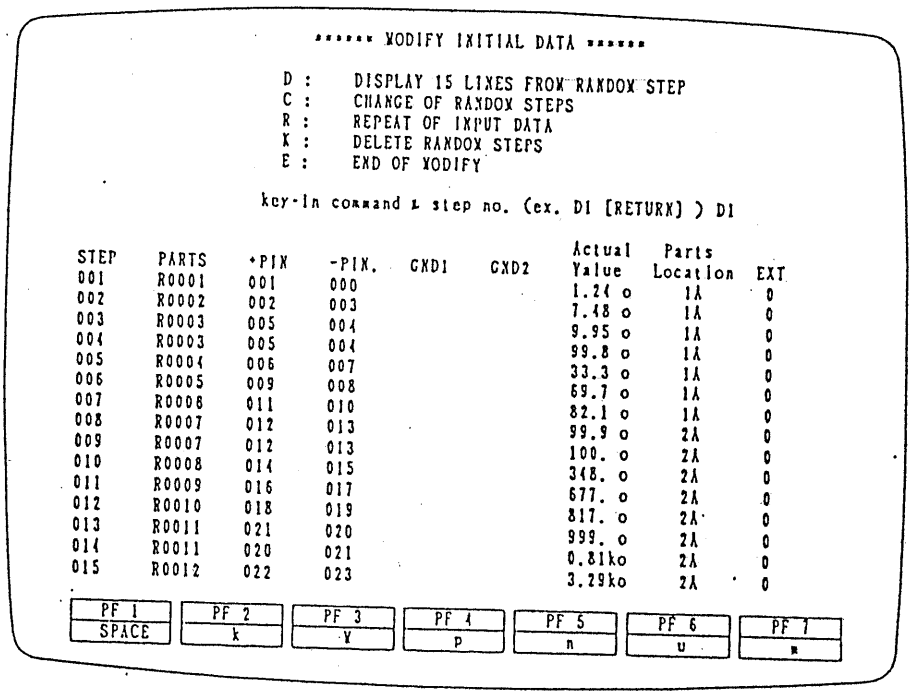
Actual value is input uusing figures upto 3 digits (upto 999) and decimals. If the program having the specified file name dones not exiist yet, the initial data is created from the first step.
If it exists already, whether or not to replace the existing file is asked.
C H K J I G CR Y

If the program having the specified file name exists but is not to be replaced, input N for the message "generate from first step?".

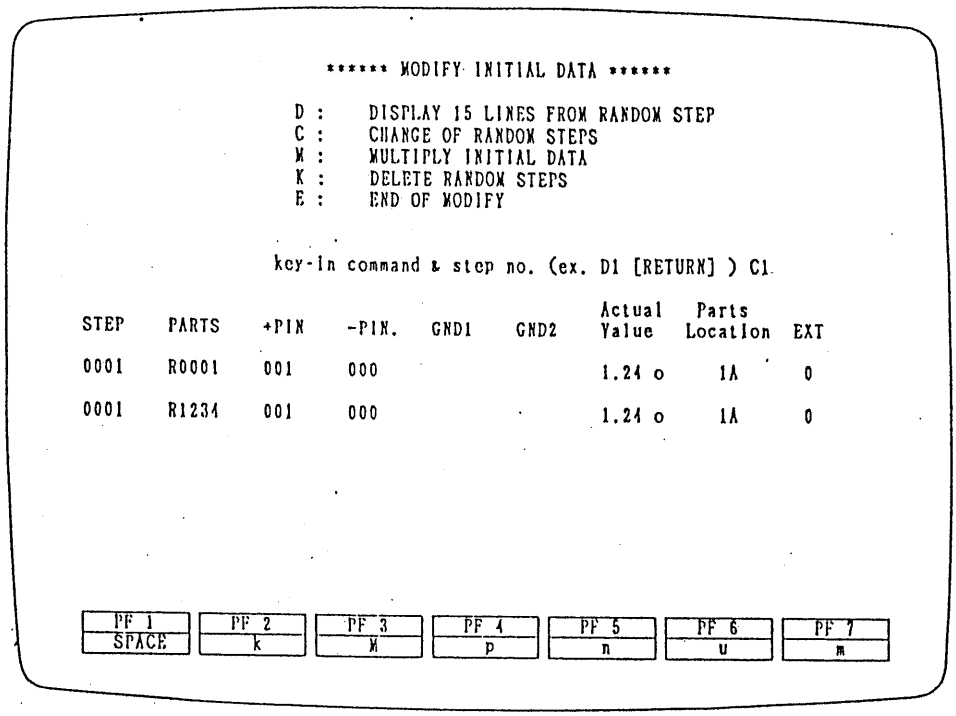
N



To modify the input data, press the ESC key.

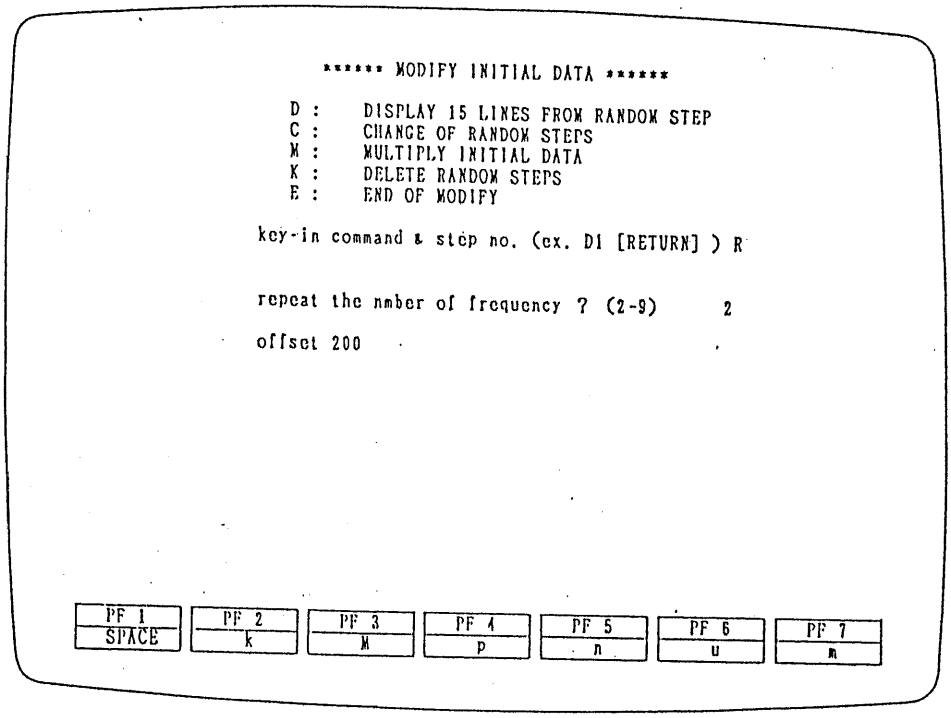


D 1 CR



C 1 CR

R 1 2 3 4 CR -----



Use the "M" command for testing a number of PC boards of the same type. Input the offset values for pin numbers by the inital data menu, and the initial data for the parts having the same part number and different pin numbers is generated automatically.

If M is executed

Number of multiplication (2-9) ?__

If 2 is input

LOCATION

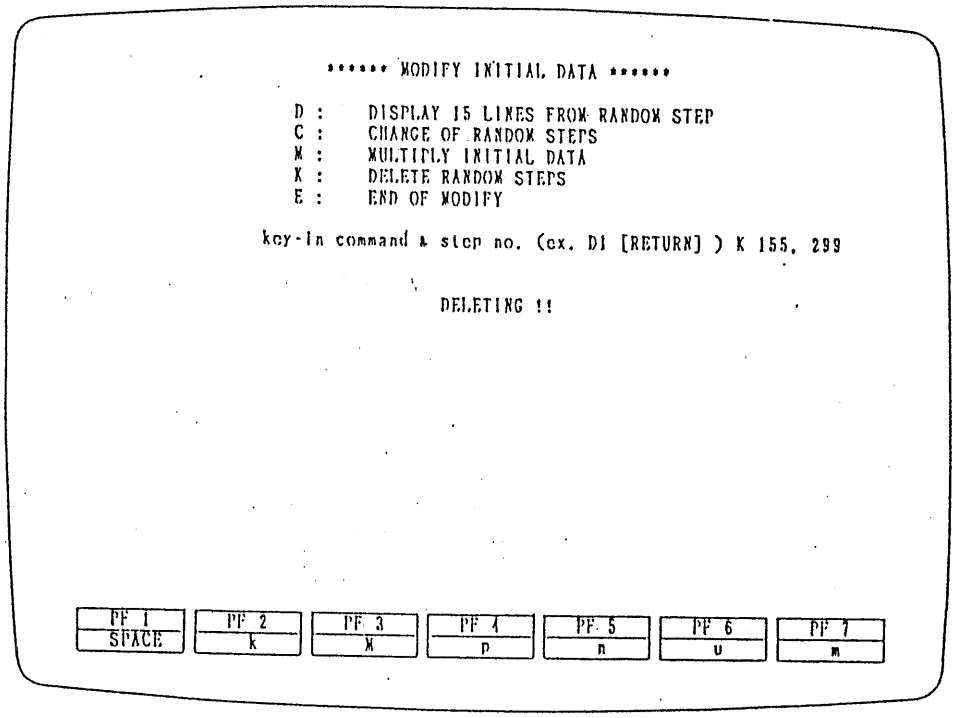
(X) (Y)

NO. 1 __ __

NO. 2 __ __

After location is input, OFFSET is input.

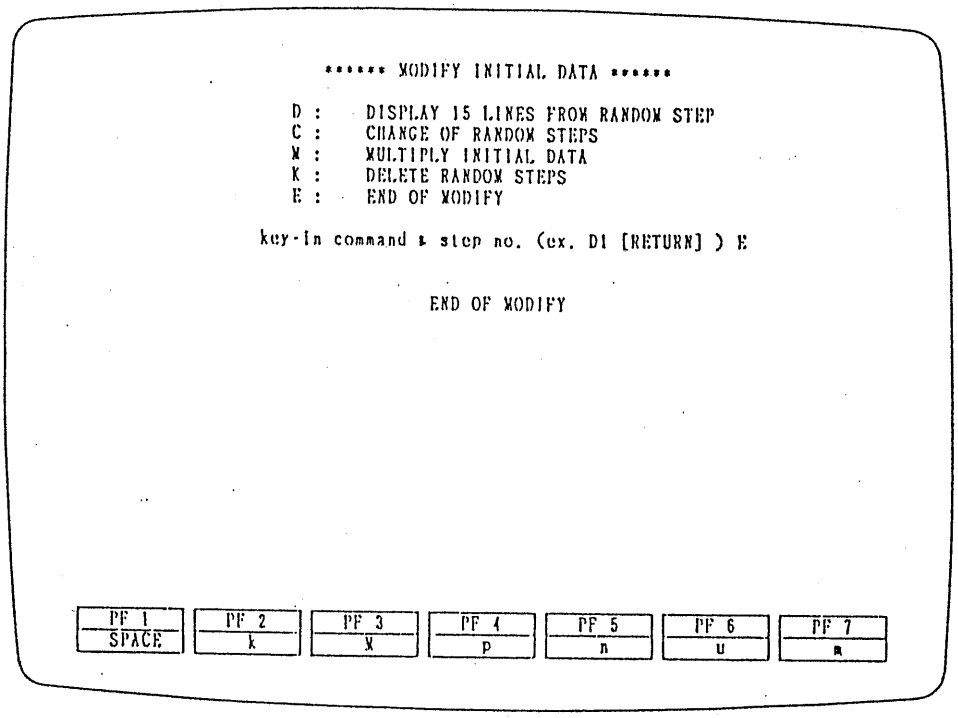
To delete step



K

1 5 5 , 2 2 9 CR

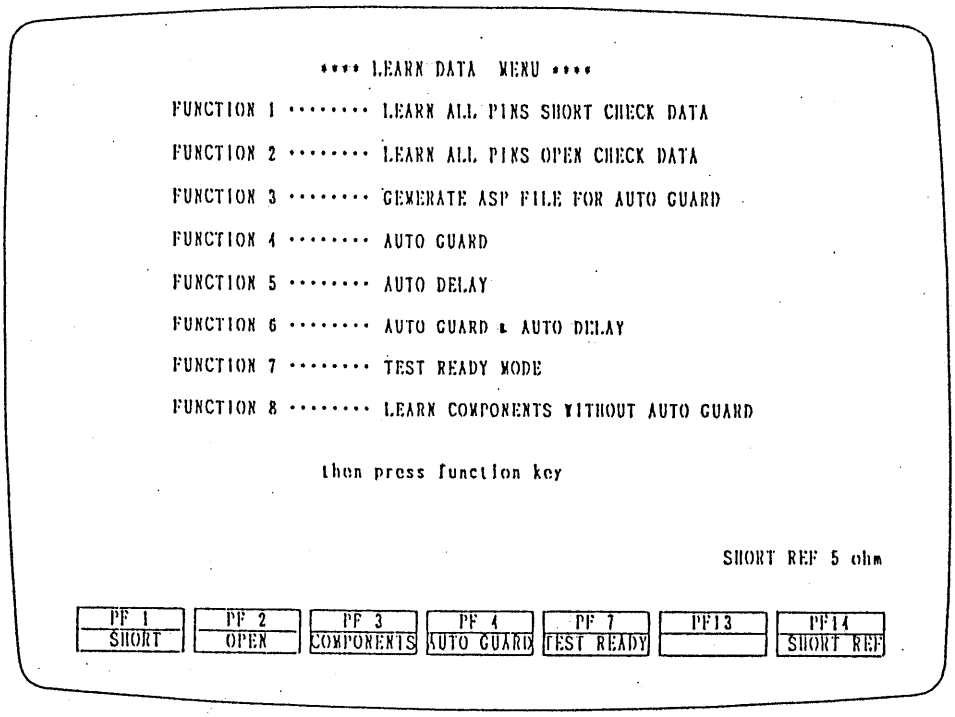
To delete only 1 step K 1 5 5 CR



E

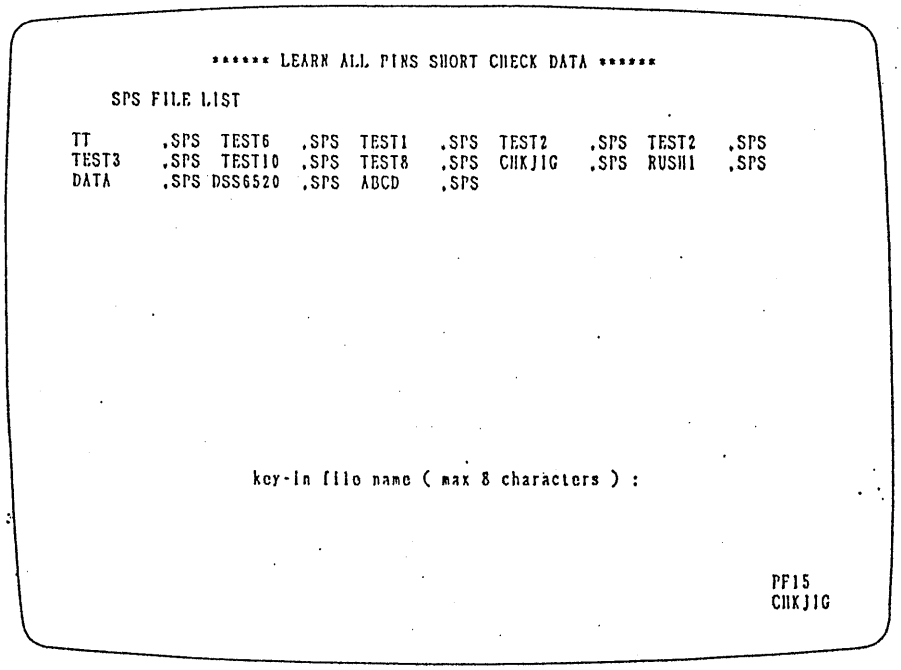
(9) DATA LEARN (Reference data learning) PF-9

This program learns the reference data from a good board. The programs for all-pin short and open checks are generated automatically by the input of file names and maximum pin numbers.

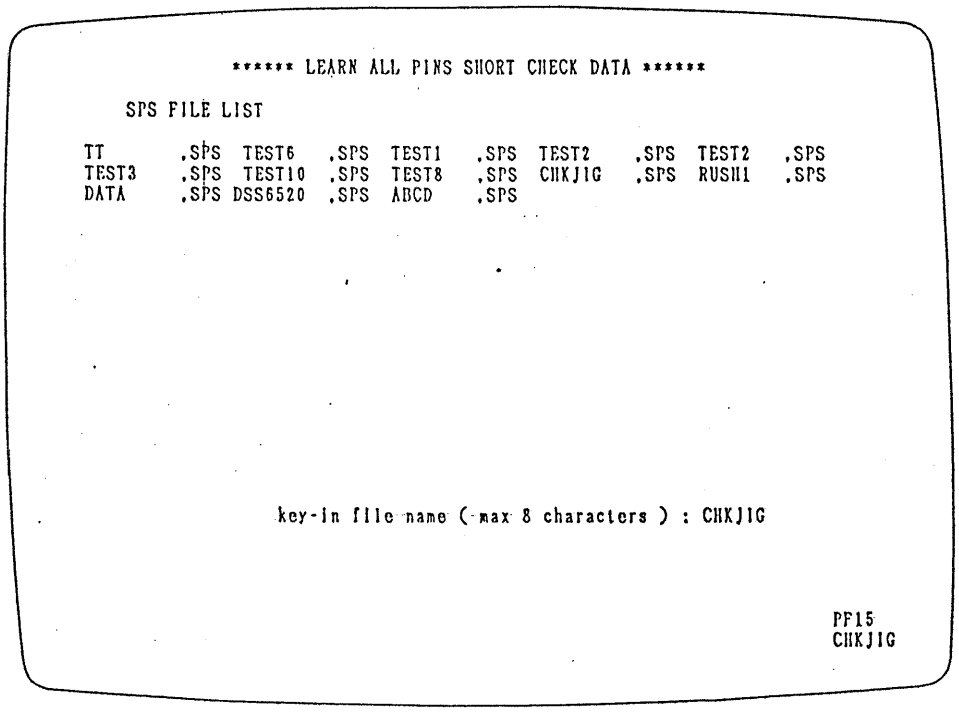


(9 – 1) FUNCTION 1 LEARN ALL PINS SHORT CHECK DATA

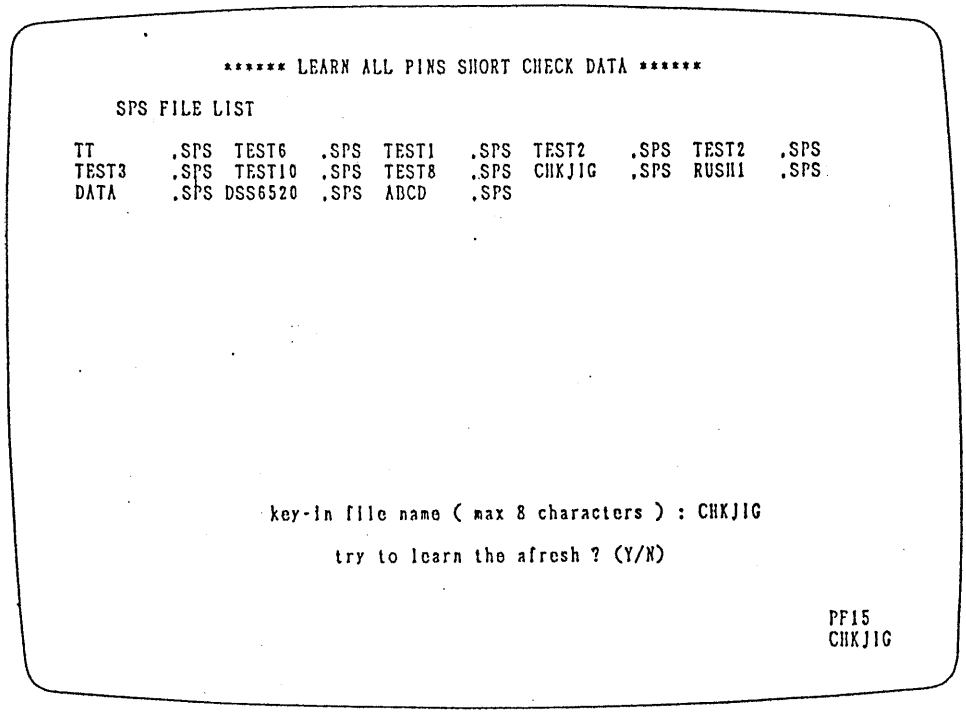
To learn the data for all-pin short check:
PF1



Key in the file name for all-pin short check.

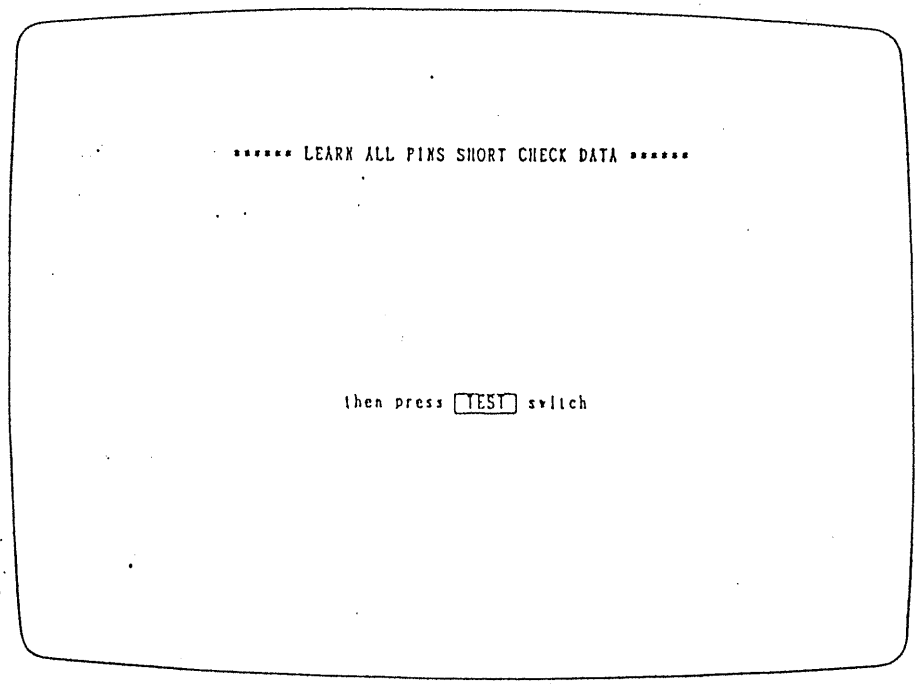


C H K J I G CR

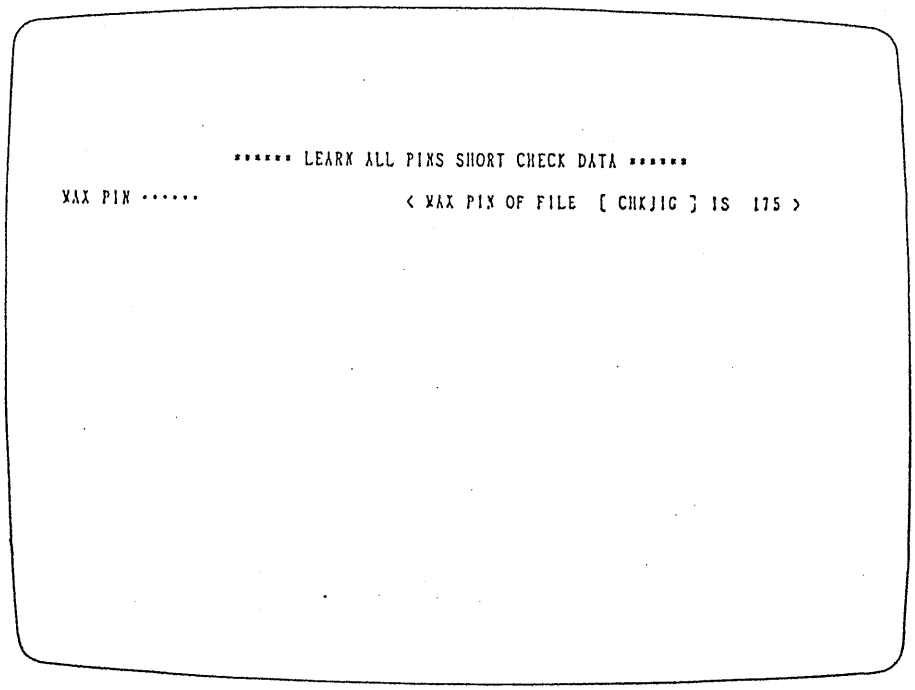


If the specified file name exists already, the system asks whether the existing file is to be replaced or not.
To replace it:

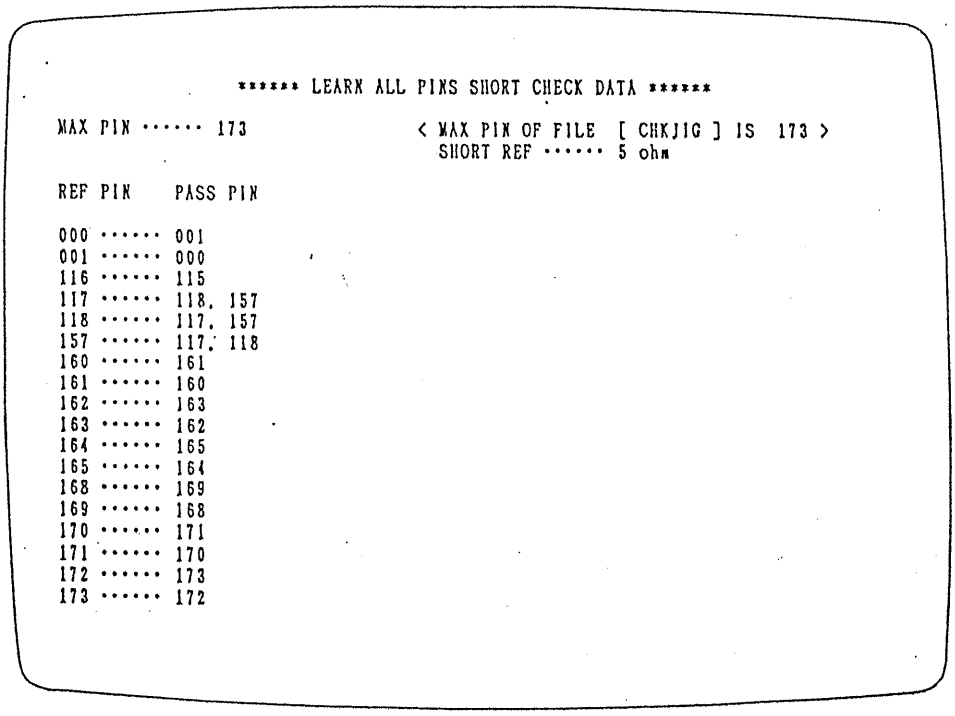
Y



Press the TEST switch on the printer section.



Key in the maximum pin number.



The all-pin short check program is generated automatically, using the SHORT REF resistance value in the lower right-hand corner of the LEAN DATA MENU screen as the threshold level.

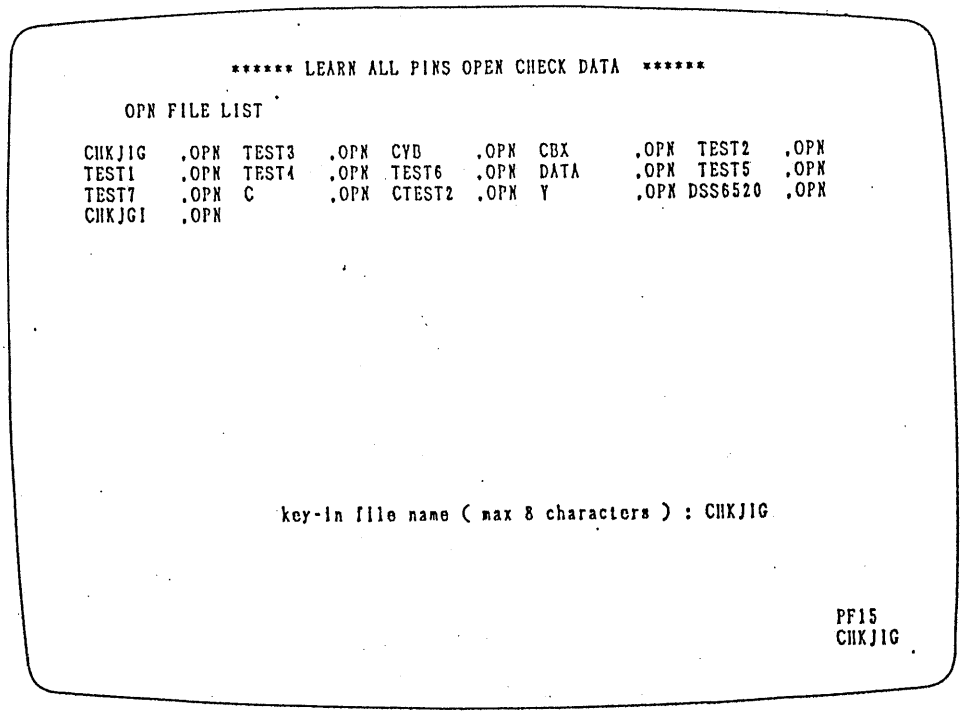
1 7 3 CR

(9 – 2) FUNCTION 2 LEARN ALL PINS OPEN CHECK DATA

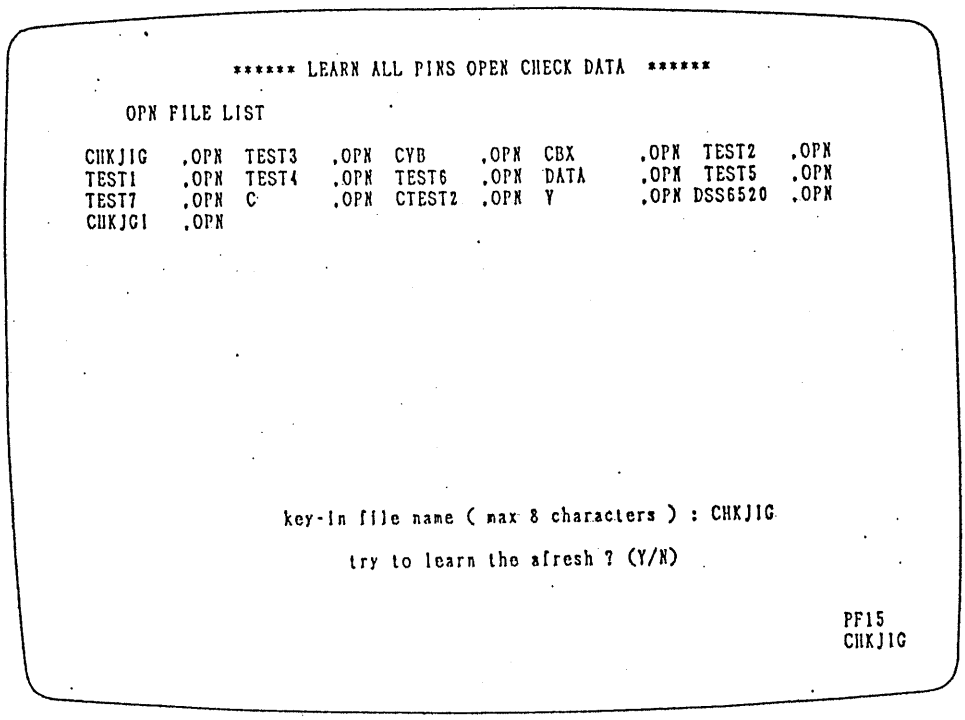
To learn the data for all-pin open check, select PF2 from the LEARN DATA MENU screen.

PF2

Then, key in the file name for the all-pin open check.

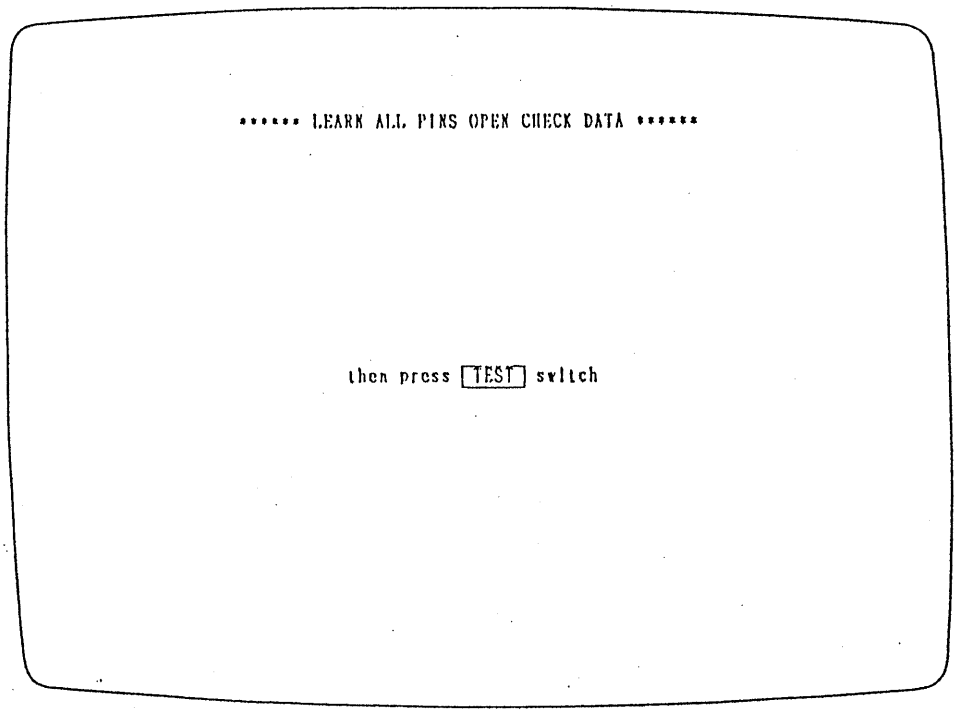


C H K J I G CR



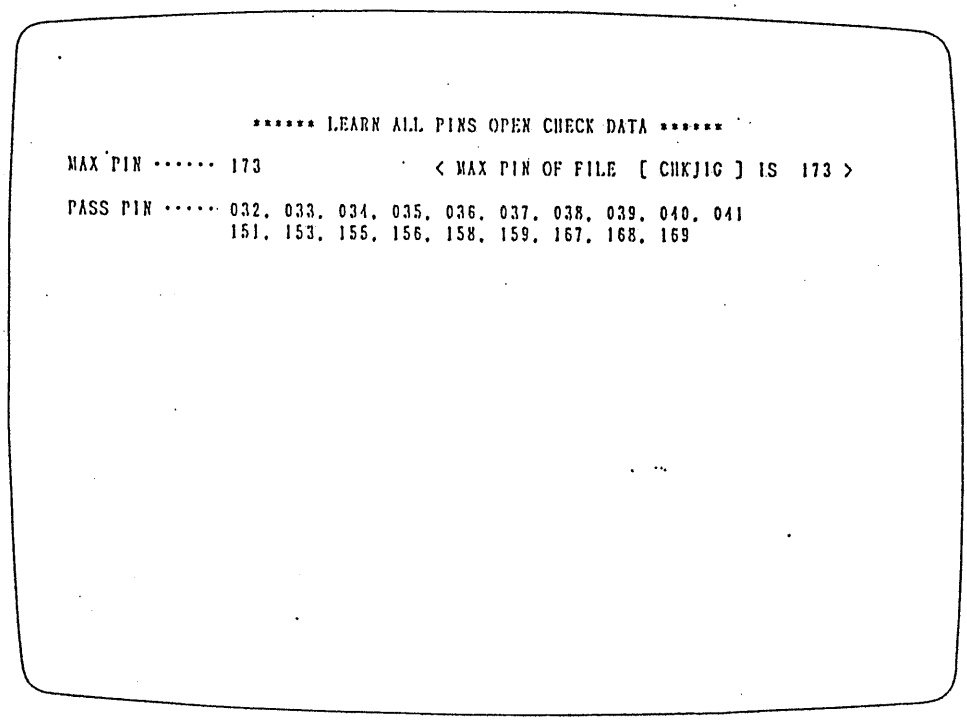
If the specified file name exists already, the system asks whether the existing file is to be replaced or not.

To replace it:
Y



Press the TEST switch on the printer section.

Key in the maximum pin number.



The all-pin open check program is generated automatically, adopting 90K ohm as the threshold level. However, at the time of testing 110 K Ohm should be adopted as threshold level.

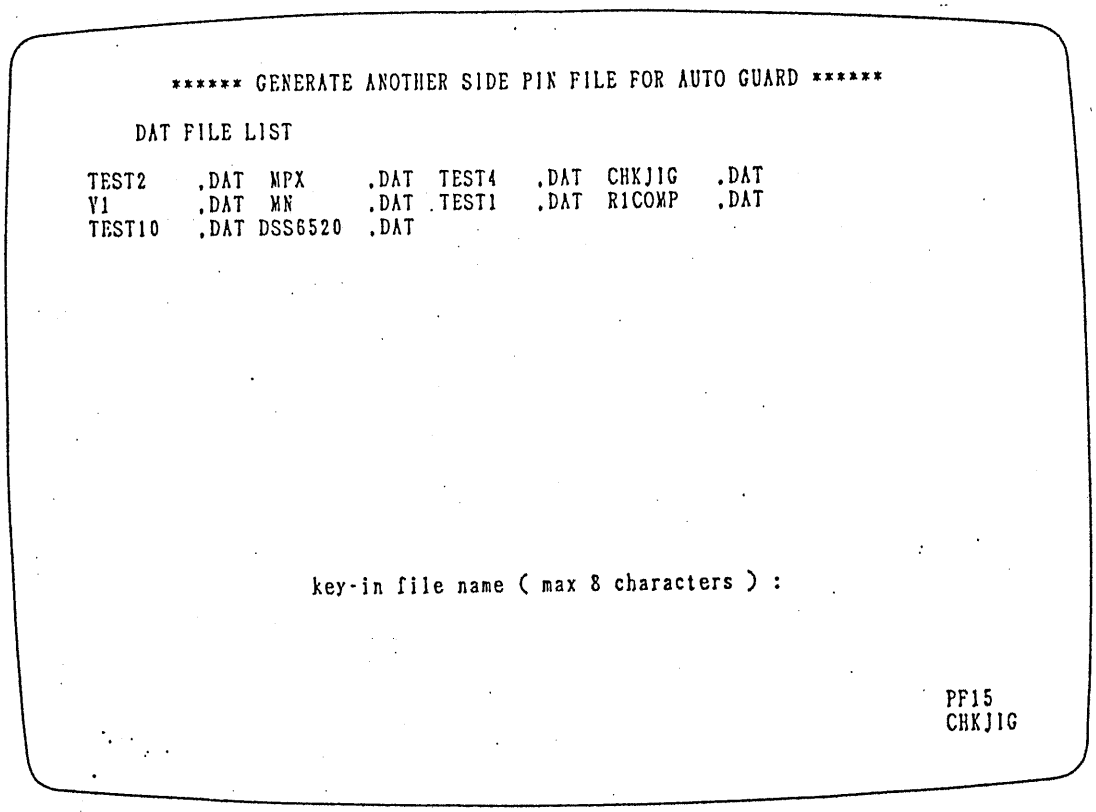
1 7 3 · CR

When learning component test, program of execution file is created, determining gurding pin numbers and measurment delay automatically, by selecting PF3～PF6.

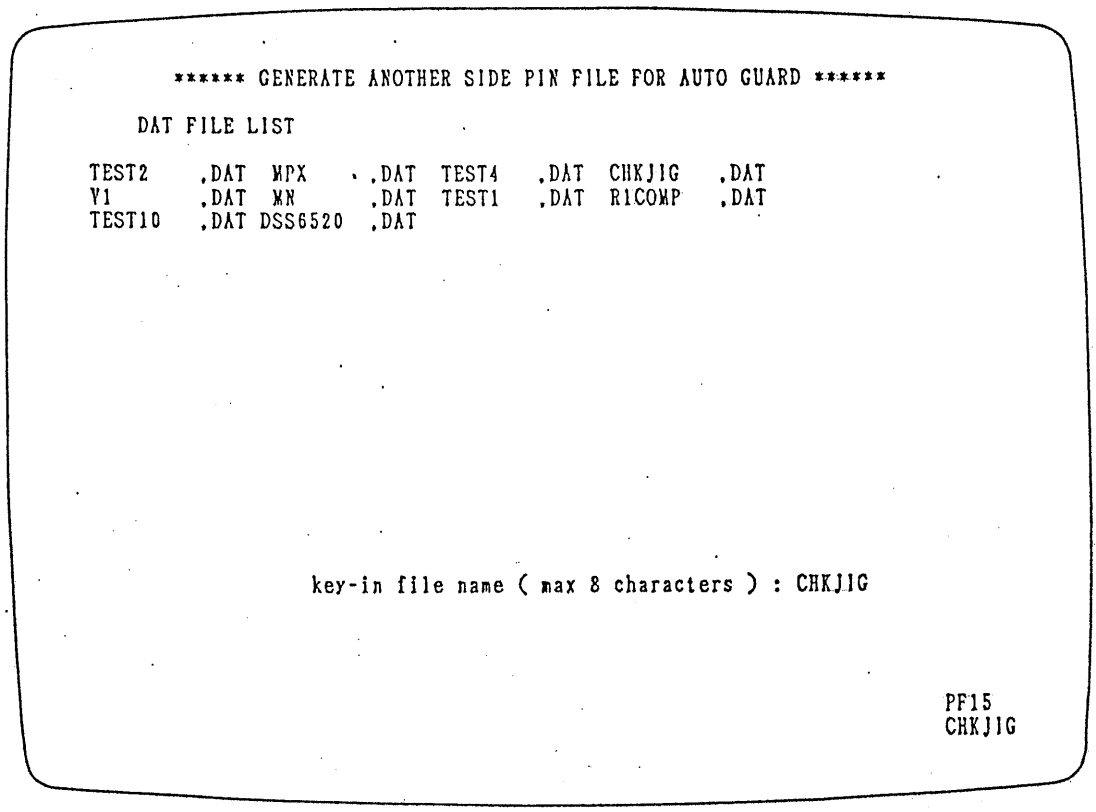
(9 - 3) FUNCTION 3 GENERATE ASP FILE FOR AUTO GUARD

Before learning AUTO GUARD you need to create ASP file by PF3.
ASP file is short for Another Side Pin Number.
When a pattern for some pin number is connected with some parts, ASP file means pin numbers on another side of the pin numbers.
ASP file is created by initial data.

PF 3

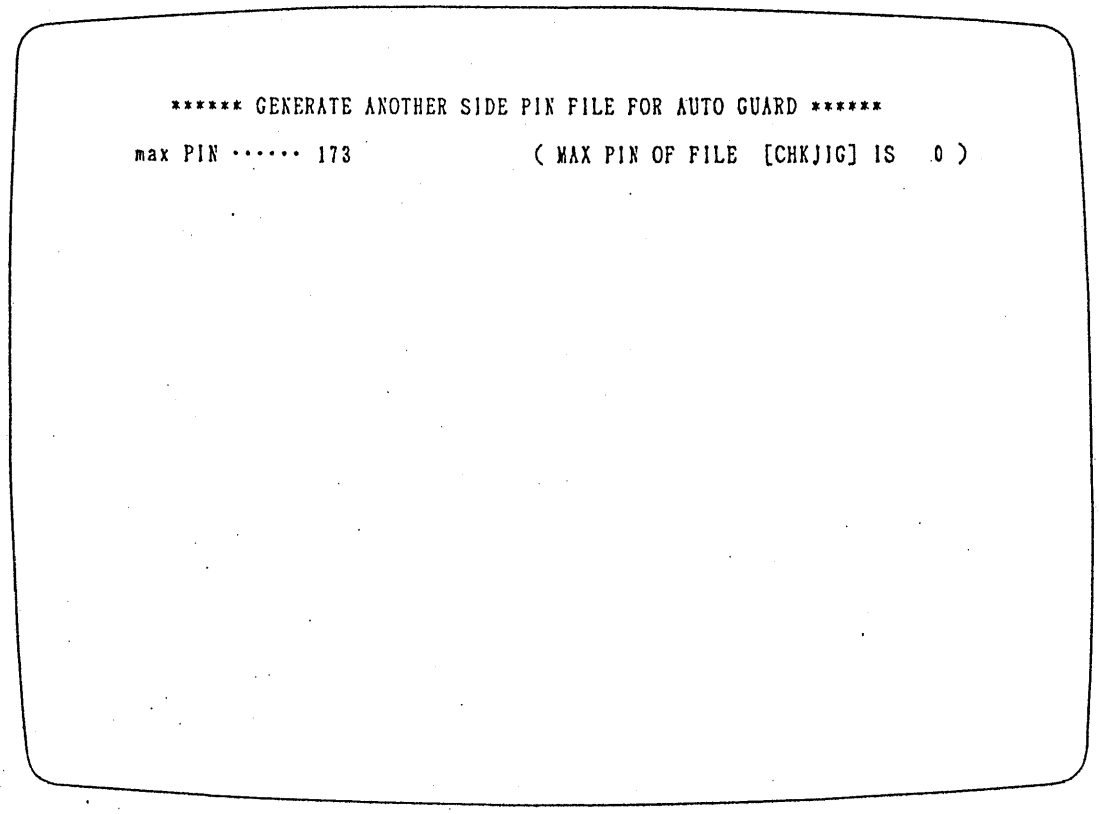


Input file name of initial data (DAT data).



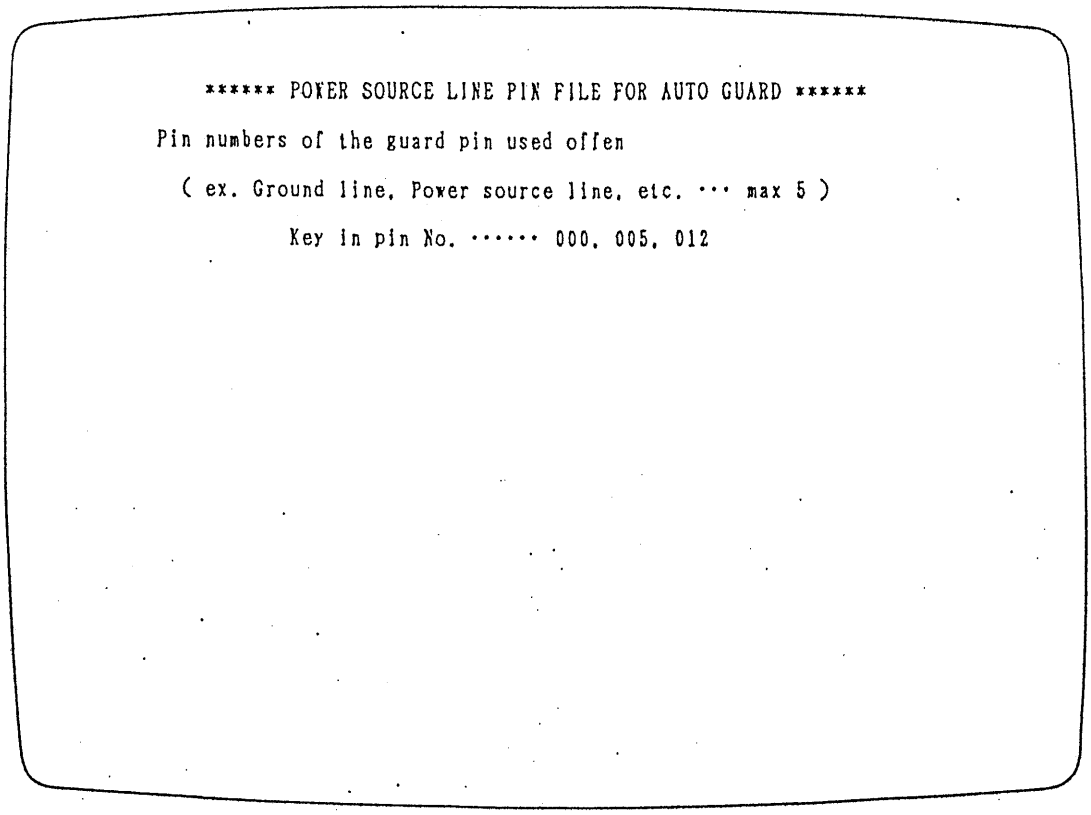
C H K J I G CR 又は PF15 CR

Next, input the maximum pin number.



1 7 3 CR

As the maximum pin numbrer is displayed if ASP file exists already, you can input the maximum pin number by pressing CR when no change is required.



When you need to make a new ASP file, input the pin number effective for guarding, for example GND line, power supply line, etc.

0, CR, 5 CR, 1 2 CR E

When the ASP file under the same name exists already, the screen shows "generate again? (Y/N)"_ .

As the screen returns to that of new ASP file if you input Y, if you input as before the screen shows as follows.

ASP file is prepared data for guard pin
generated from INITIAL DATA

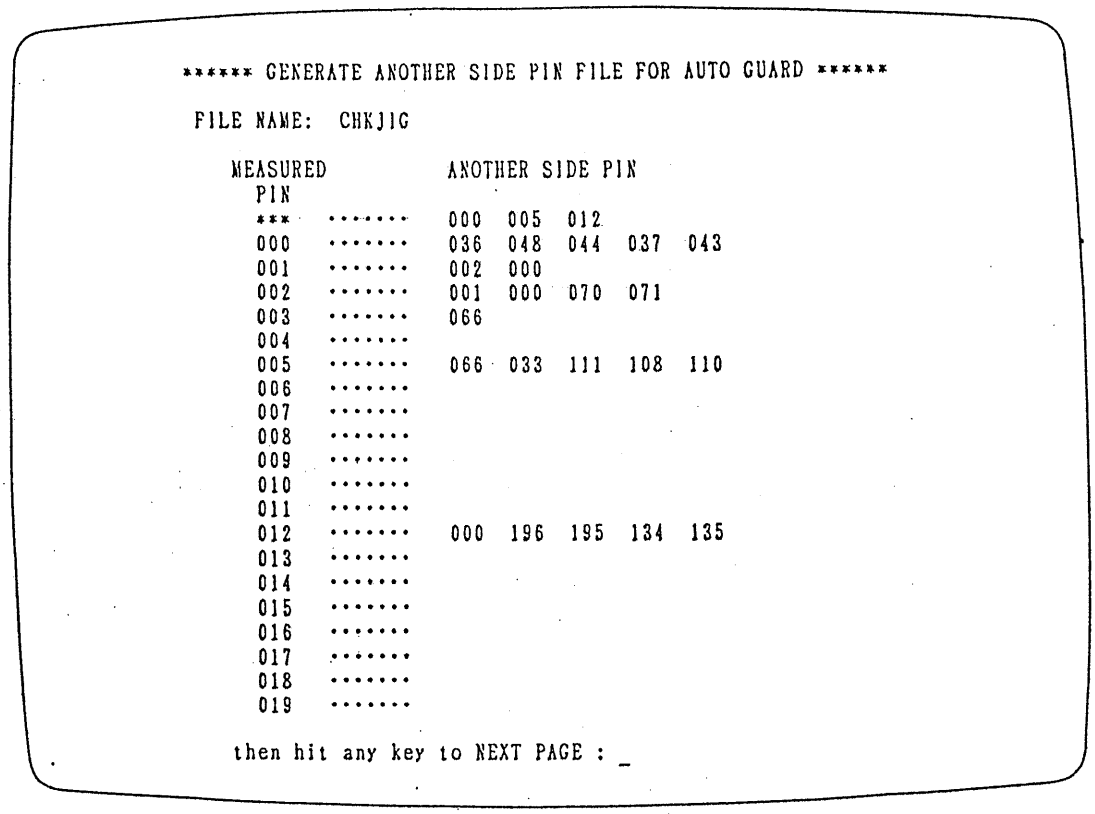
When you need to make a new ASP file, "generate ASP file? (Y/N) __". Input N and you can get the file wherein the pin numbers input at some points are registered.

If the ASP file under the same name exists already "generate again? (Y/N)" appears.
In case of N old file remains as it is.

If you input Y this time the screen shows as follows.

And then ASP file is completed showing "display ASP file? (Y/N) __".

Press Y and then the screen shows as follows.



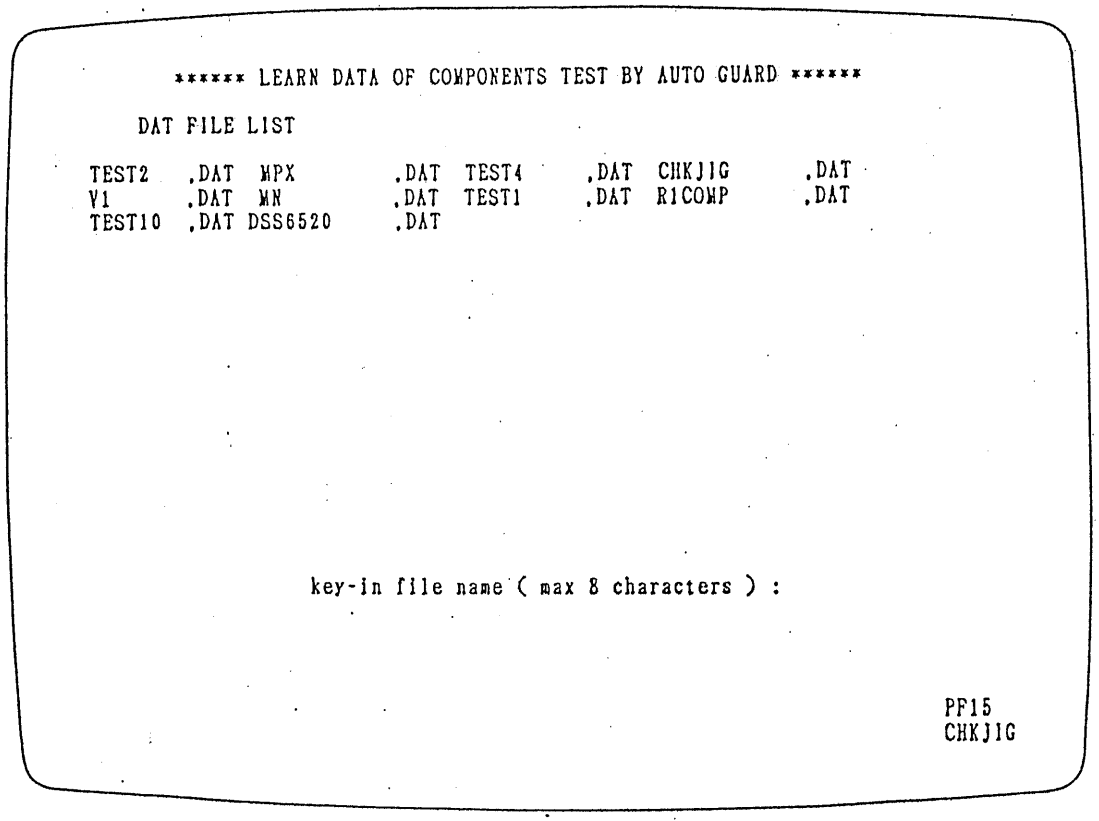
On the screen, the pin numbers under" ANOTHER SIDE PIN" lined in parallel with ***, show effective pin numbers such as GND line, power supply line, etc. by manual input.

(9 − 4) FUNCTION 4 . AUTO GUARD

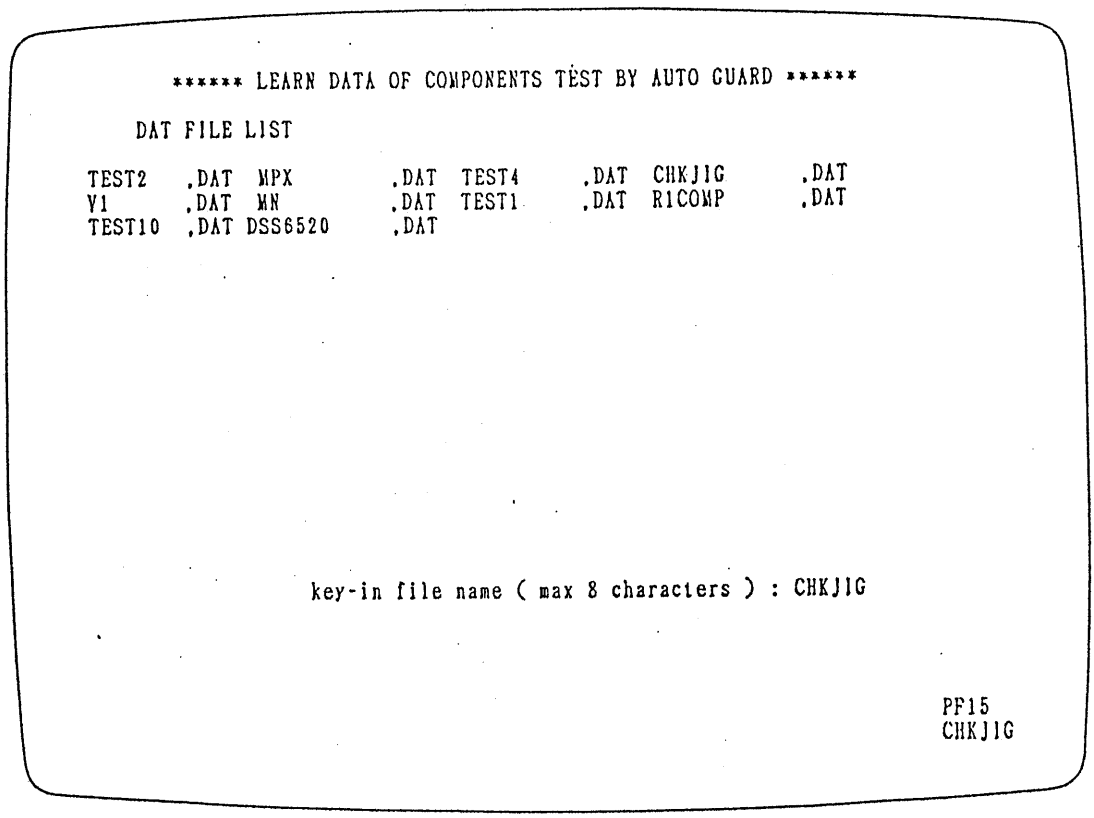
In learing auto guard, when error between actual value and measured value exceed allowance range Guard pin is reset until the error gets within allowance range automatically.
Guard pin is selected from ASP file (9 - 3).

From **** LEARN DATA MENU **** :

PF 4



Input file name of input initial data file (DAT file).



C H K J I G CR

If ASP file under the same name does not exists

(file name). ASP (gurad pin data) is not found!
LEARN DATA without AUTO GUARD? (Y/N) __

is shown.

When "N", "Please select PF 3 --- GENERATE ASP FILE" is displayed on the screen and the screen returns to LEARN DATA MENU.

When "Y", "then press TEST switch" is displayed and then press TEST switch and data learning is executed without auto guard.

When ASP file under the same exists,

then press [TEST] switch

Press TEST switch and learning in auto guard mode is executed in the following flow. At this time, the automatic polarity setting function works to optimize the polarities of the setting pins.

1. When measured value exceed actual value by the following allowance range Guard Pin is set (GND 1 only) and relearning is executed.

	+ ALLOWANCE	- ALLOWANCE
RESISTANCE	5%	5%
DIODE, TRANSISTOR	1000mV	500mV
LED	1500mV	2300mV
CAPACITOR (10pF ~ 199.9pF)	50%	10%
CAPACITOR (100pF ~ 1999pF)	30%	10%
CAPACITOR (OTHER C OF LC method)	20%	10%
CAPACITOR (TC method)	20%	10%
INDUCTANCE	20%	20%

* In case of Overflow and Unstable, this procedures is followed.

If the measurement value stays within the allowance range shown above the procedure moves to the next step.

2. The order of setting guard pin is :
   1 Power Source line pin
   2 Another Side pin corresponding to + pin
   3 Another Side pin corresponding to - pin

3. In case that Measured Value should exeed the allowance range per 1. even if any of the pins registered in ASP file is sets, select the pin line-up with the least error in comparison with Actual value.
   When learning data is unstable or measured less than "0010" , "Unstable" is indicated on the screen and when measured value exeeds Actual Value range "Overflow" is indicated on the screen.

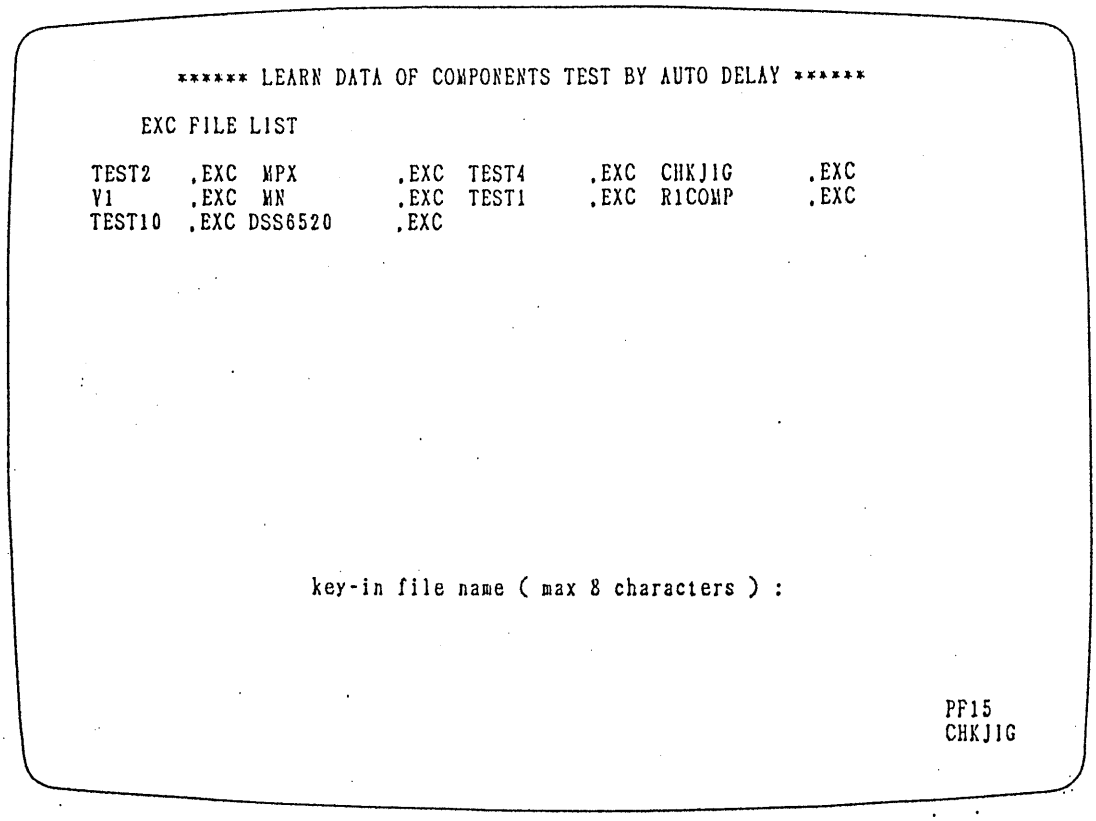
(9 – 5) FUNCTION 5 AUTO DELAY

For learning AUOTO DELAY, auto delay functions only for resistors, diodes, transistors and LED's.
AUTO DELAY is made on the basis of EXC file.

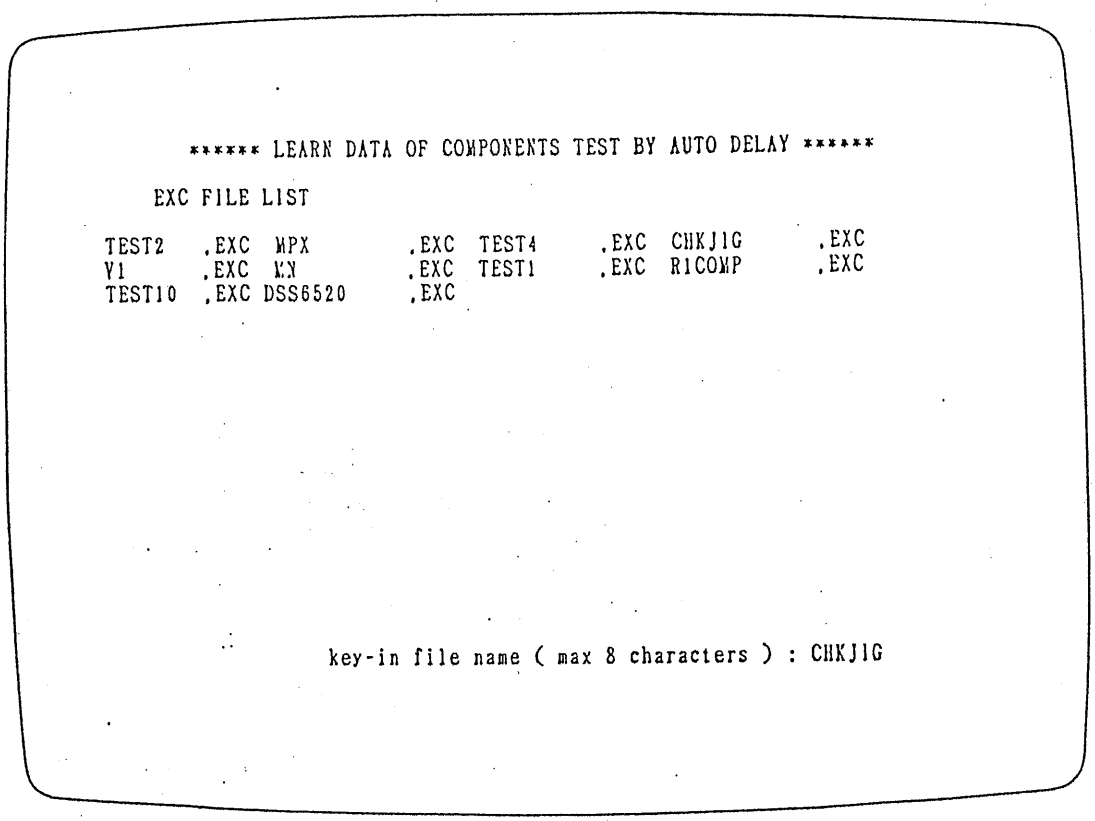
When messured value for resistance exceeds actual value by more than 2% and unstable, (diodes, transistors and LED's are all set up unconditionally) proper delay tim is set by increasing delay time gradually like 00 - 01 - 02 - 03 - 05 - 07 - 10- 20 - 30 - 60 - 99 aiming at measured value and stability obtainable at the time of " delay equal to 99 " (990ms).

From **** LEAN DATA MENU ****

PF 5



Input file name of EXC file.



C H K J I G CR

When file name is input, "then press TEST switch" is indicated on the screen. Then, press TEST switch to start learning data.

When setting "Delay = 99"(990ms) is not eough to obtain suitable data, "Dealy = 00" is registered and "unstable" appears on the screen.

(9 – 6) FUNCTION 6 AUTO GUARD & AUTO DELAY

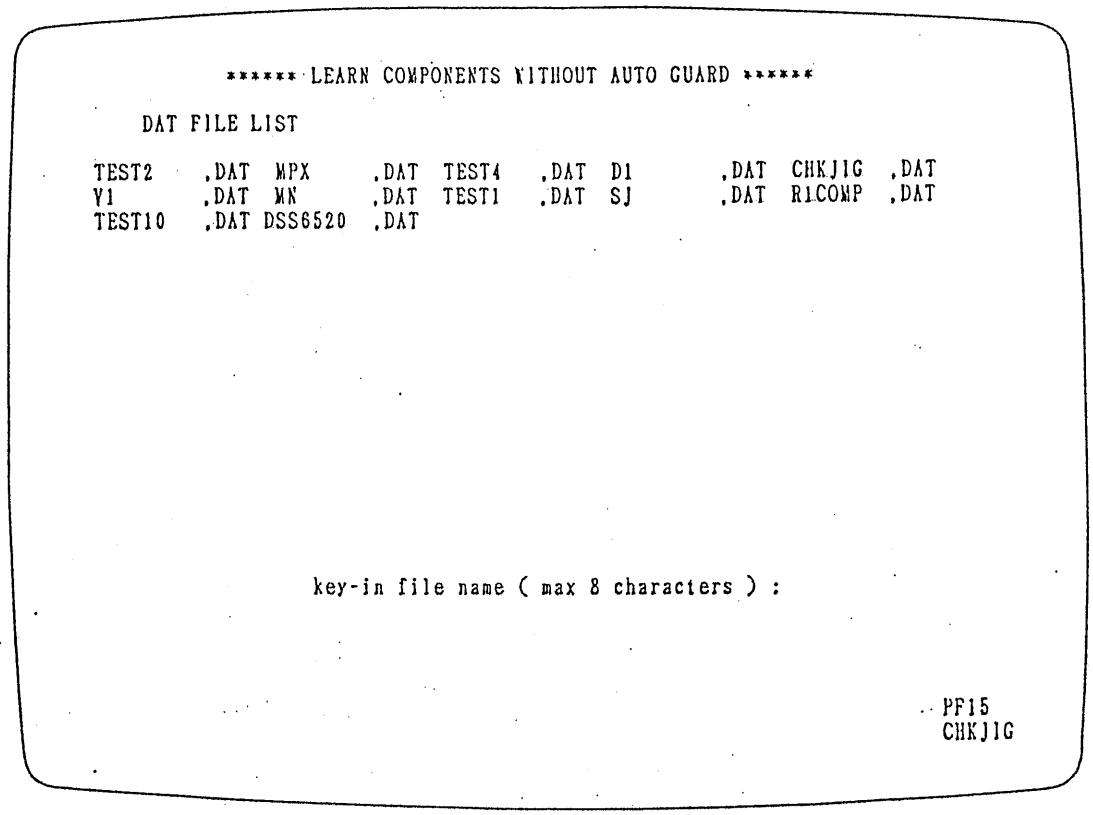
Excute AUTO GUARD (9 - 4) and AUTO DELAY (9 - 5) at the same time.

(9 – 7) FUNCTION 7 TEST READY MODE

The screen returns to "TEST READY" by pressing PF 7.

At the time when you learn COMPONENT TEST without using the modes of AUTO GUARD and AUTO DELAY, select PF 8 on the screen showing LEARN DATA MENU.

(9 – 8) FUNCTION 8 LEARN COMPONENTS WITHOUT AUTO GUARD



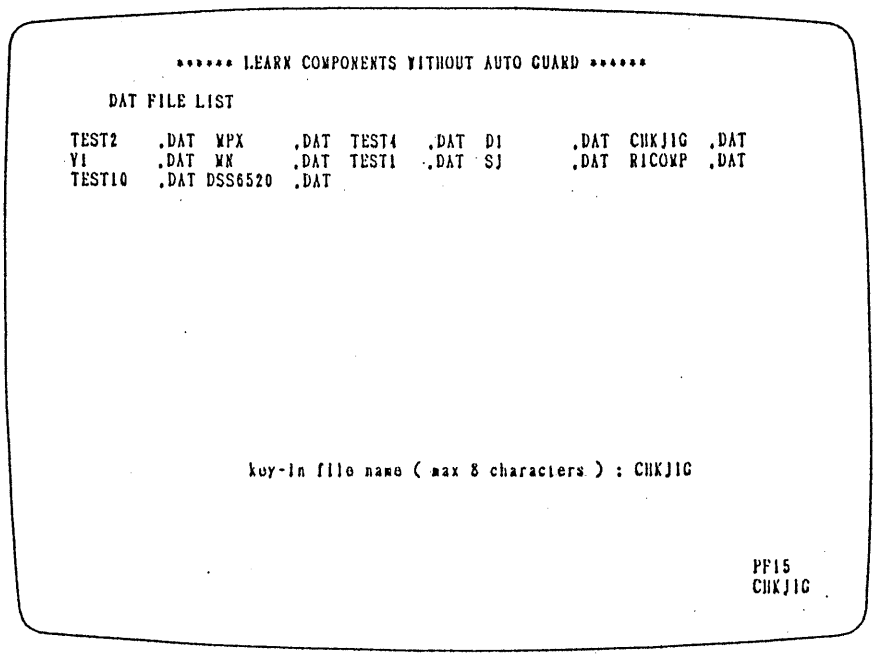
PF 8

And then input file name of COMPONENT TEST.

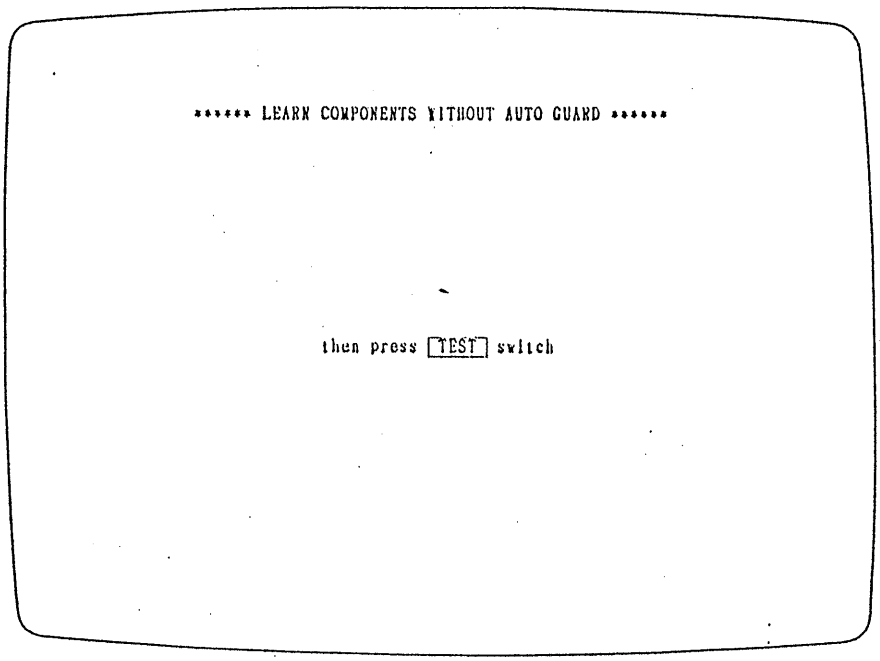
COMPONENT TEST DATA can be obtained from the actual meaured data of a good PC board by following the steps for initial data filed beforehand.

The data learned for the first time turns EXC file automatically. At this time the automatic polarity setting function works to optimize the polarities of the testing pins.

When learning data is unstable and less than "0010", "Unstable" is displayed on the screen and when measured value exeeds Actual Value range,"Overflow" is indicated on the screen.



C H K J I G CR



Press TEST switch of the printer section and program can be created automaticall.

For (Jumper check), S (Short check), program can be created automatically referring to resistance value of SHORT REF shown on the lower right side as a threshhold level.

When learning is over, data is stored in floppy disk as a EXC FILE.

****** LEARN COMPONENTS WITHOUT AUTO GUARD ******

FILE NAME: CHKJIG.EXC SHORT REF ····· 5 ohm

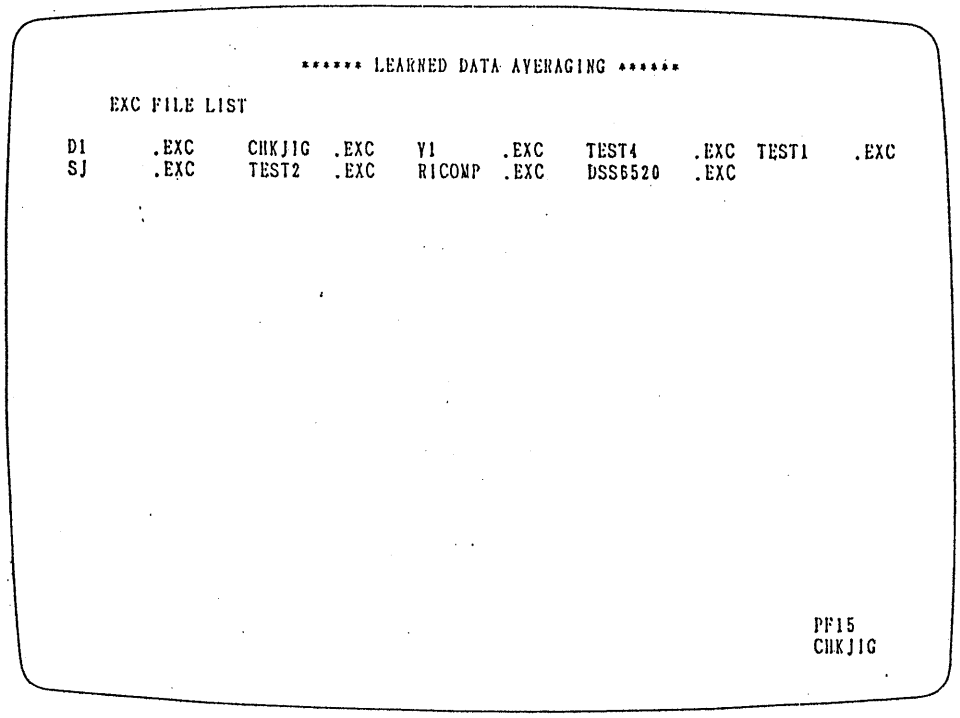
STEP	PARTS	+PIN	-PIN	GND1	GND2	Actual Value	Measured Value	Parts Location	EXT
0105	S0001	156	157				Short good	2B	0
0106	S0002	158	159				Short good	2B	0
0107	J0001	160	161				Jumper good	2B	0
0108	L0001	163	162			12.0uH	20.6uH	1C	0
0109	L0002	164	165			80.0uH	49.6uH	1C	0
0110	L0003	166	167			142.uH	000.uH	1C	0
0111	L0004	169	168			450.uH	109.uH	1C	0
0112	L0005	170	171			160.uH	026.uH	2C	0
0113	L0006	172	173			800.uH	050.uH	3C	0
0114	L0007	175	174			30.0mH	00.0mH	3C	0
0095	D0004	125	126				Overflow	1B	0
0096	D0005	127	128				745.mV	1B	0
0097	D0006	129	130				791.mV	1B	0
0098	T0001	133	131				727.mV	2B	0
0099	T0002	133	132				723.mV	2B	0
0100	P0001	146	147				1783.mV	1B	0
0101	P0002	148	149				1792.mV	1B	0
0102	P0003	150	151				1783.mV	1B	0
0103	P0004	152	153				1789.mV	1B	0
0104	P0005	154	155				1782.mV	1B	0

(10) DATA AVE (Learned data averaging) PF10

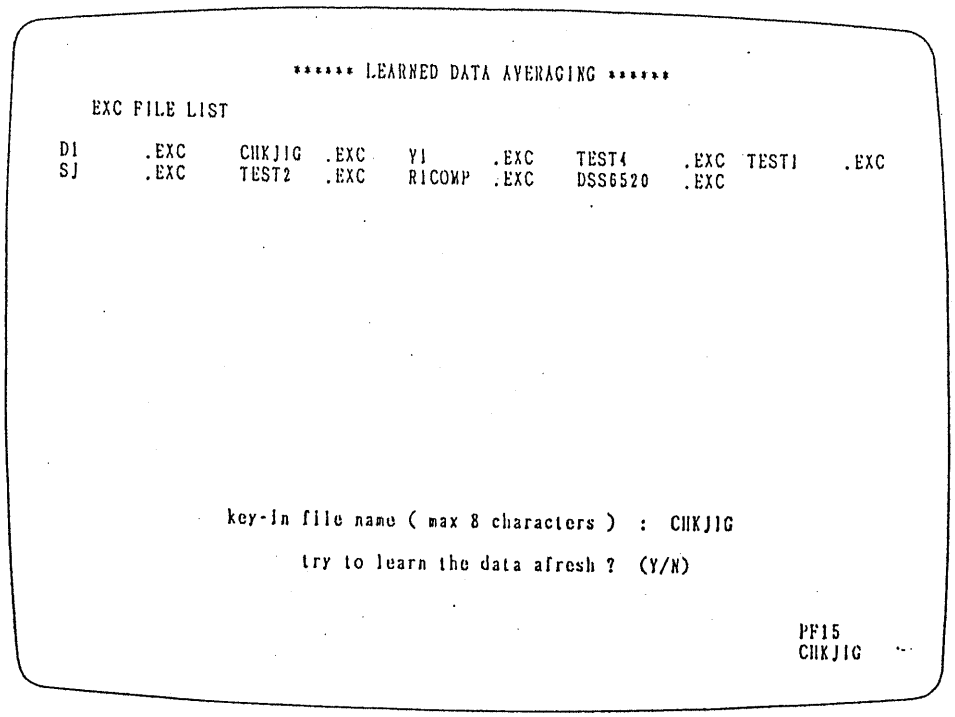
This program learns data from up to nine good boards in the order of the initial data program steps. Then, it averages the data of up to ten boards including the board used for DATA LEARN (PF2).

In the course of averaging, the operator can monitor the maximum, minimum, and mean values of learned data for each step by the host computer screen. If he finds a file not adequate for averaging, he may delete it and execute the averaging operaton again.

The averaged data file is stored in a floppy disk as an execution reference data file.

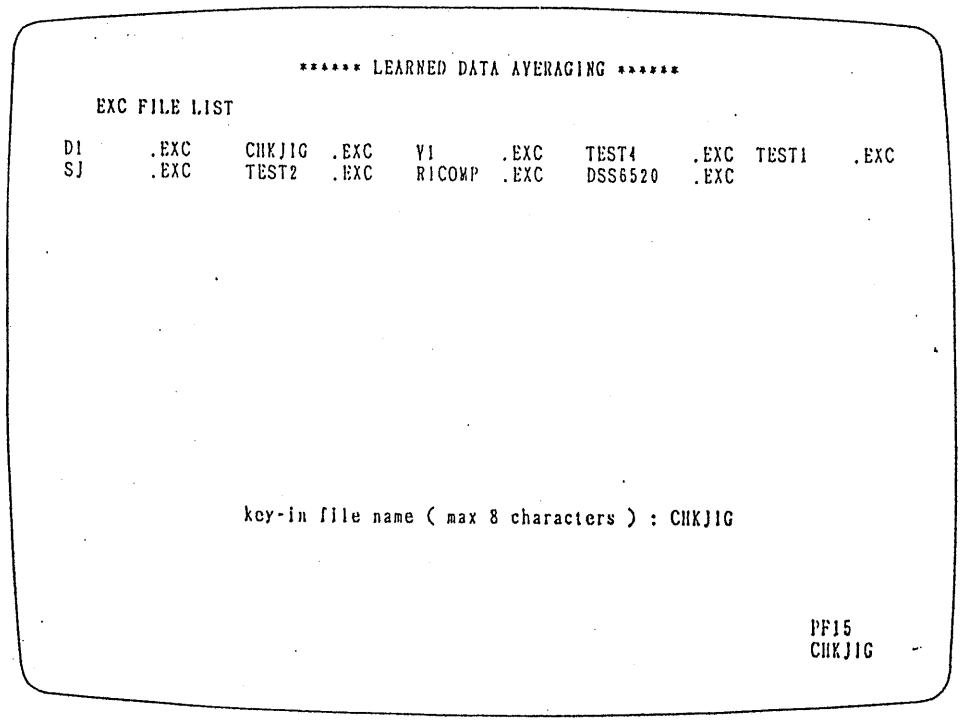


Key in the file name in response to the message in the above screen.

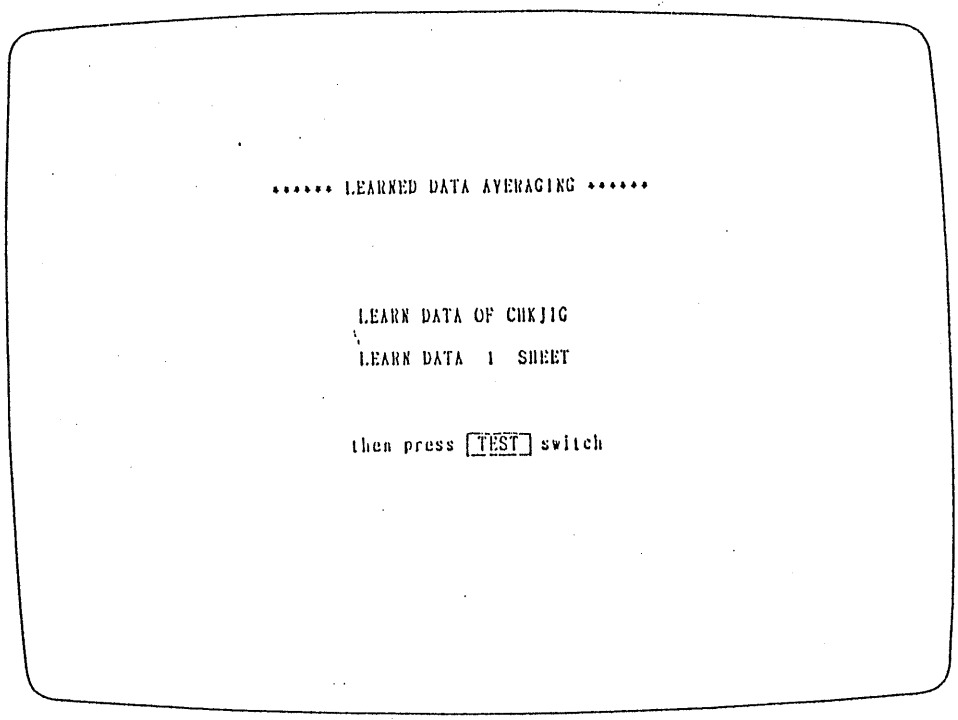


If the specified file name exists already, indicate whether or not to replace the existing file.

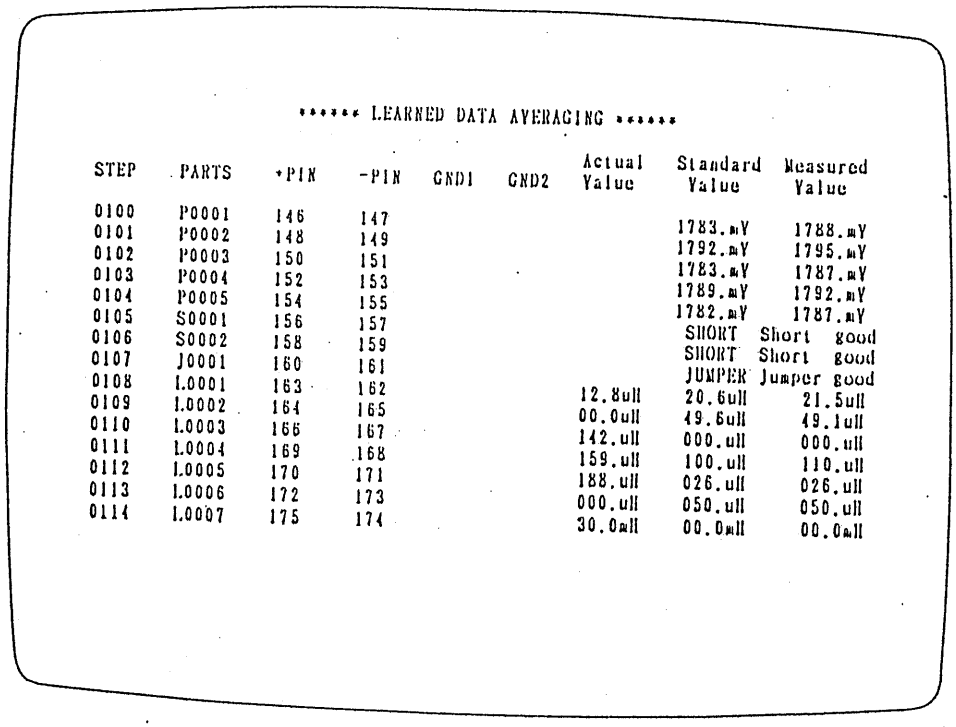
Y



C H K J I G CR



Place the first PC board on the fixture and press the TEST switch.



Data is learned according to the initial data of the same file name created in advance.

****** LEARNED DATA AVERAGING ******

STEP	PARTS	+PIN	-PIN	GND1	GND2	Actual Value	Standard Value	Measured Value
0100	P0001	146	147				1783.mV	1788.mV
0101	P0002	148	149				1792.mV	1795.mV
0102	P0003	150	151				1783.mV	1787.mV
0103	P0004	152	153				1789.mV	1792.mV
0104	P0005	154	155				1782.mV	1787.mV
0105	S0001	156	157				SHORT	Short good
0106	S0002	158	159				SHORT	Short good
0107	J0001	160	161				JUMPER	Jumper good
0108	L0001	163	162			12.8ull	20.6ull	21.5ull
0109	L0002	164	165			00.0ull	49.6ull	49.1ull
0110	L0003	166	167			142.ull	000.ull	000.ull
0111	L0004	169	168			159.ull	100.ull	110.ull
0112	L0005	170	171			188.ull	026.ull	026.ull
0113	L0006	172	173			000.ull	050.ull	050.ull
0114	L0007	175	174			30.0mll	00.0mll	00.0mll

LEARN DATA 1 SHEET END

CONTINUE LEARN DATA ? (Y/N)

When the data for all the program steps has been learned, the system asks whether or not to continue the data learning.
If data is to be learned from two PC boards, for example, select Y.
Y

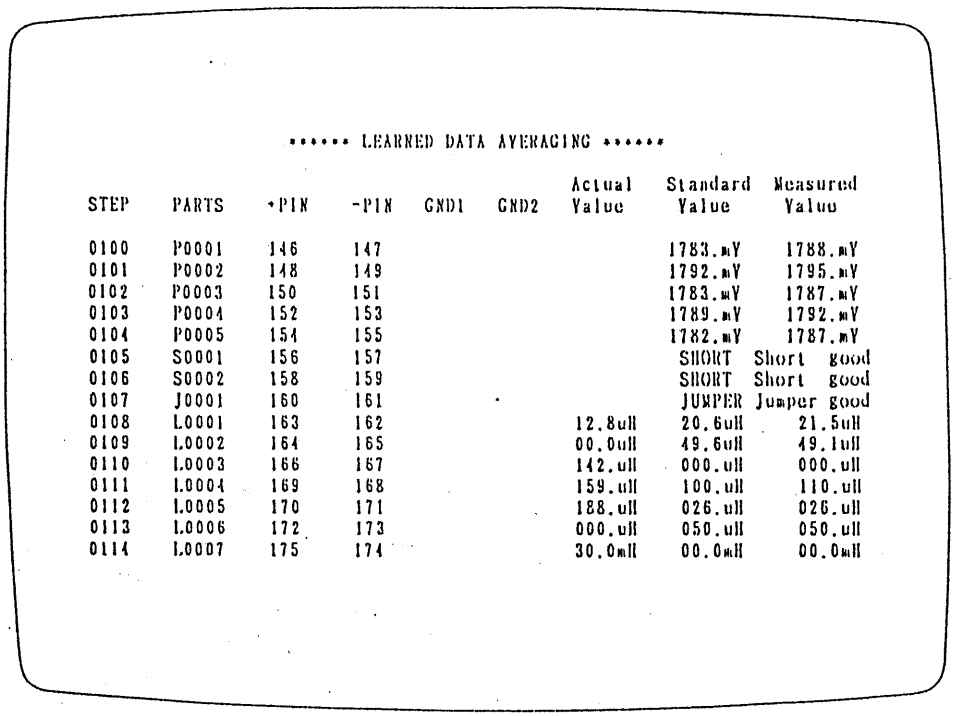
****** LEARNED DATA AVERAGING ******

LEARN DATA OF CHKJIG

LEARN DATA 2 SHEET

then press [TEST] switch

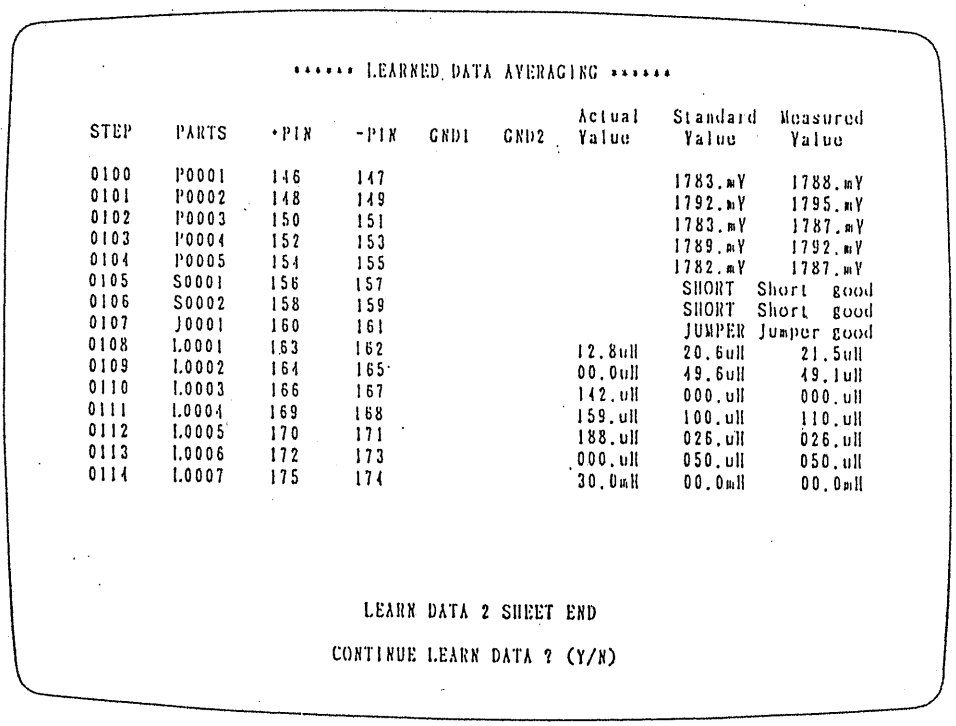
Replace the first board with the second one, and press the TEST switch again.



****** LEARNED DATA AVERAGING ******

STEP	PARTS	+PIN	-PIN	GND1	GND2	Actual Value	Standard Value	Measured Value
0100	P0001	146	147				1783.mV	1788.mV
0101	P0002	148	149				1792.mV	1795.mV
0102	P0003	150	151				1783.mV	1787.mV
0103	P0004	152	153				1789.mV	1792.mV
0104	P0005	154	155				1782.mV	1787.mV
0105	S0001	156	157				SHORT	Short good
0106	S0002	158	159				SHORT	Short good
0107	J0001	160	161				JUMPER	Jumper good
0108	L0001	163	162			12.8uH	20.6uH	21.5uH
0109	L0002	164	165			00.0uH	49.6uH	49.1uH
0110	L0003	166	167			142.uH	000.uH	000.uH
0111	L0004	169	168			159.uH	100.uH	110.uH
0112	L0005	170	171			188.uH	026.uH	026.uH
0113	L0006	172	173			000.uH	050.uH	050.uH
0114	L0007	175	174			30.0mH	00.0mH	00.0mH

The system starts learning data from the second board.



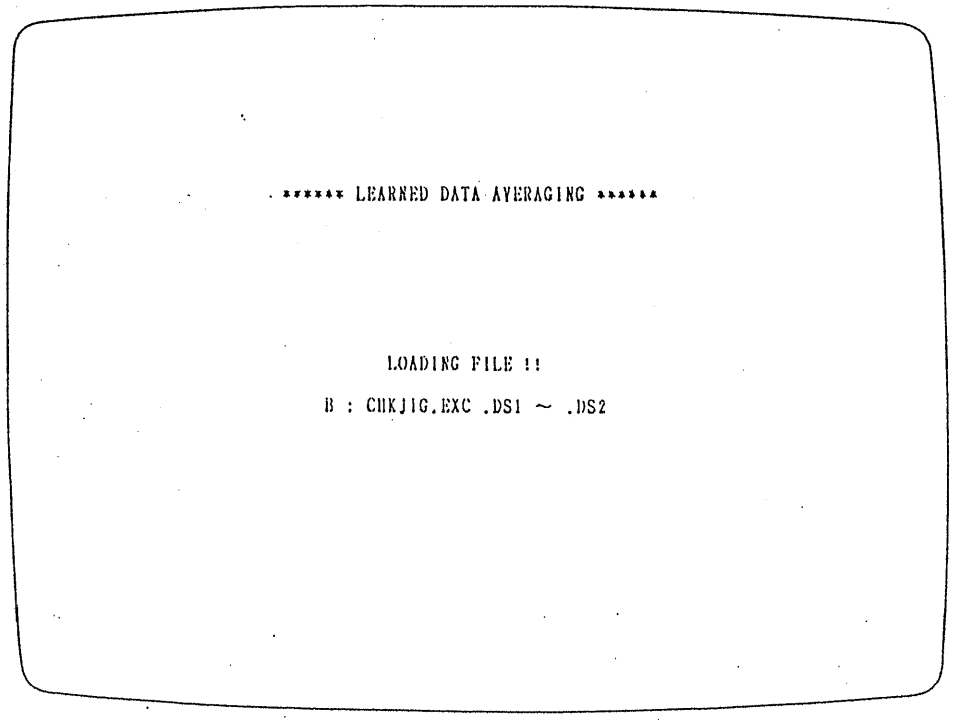
****** LEARNED DATA AVERAGING ******

STEP	PARTS	+PIN	-PIN	GND1	GND2	Actual Value	Standard Value	Measured Value
0100	P0001	146	147				1783.mV	1788.mV
0101	P0002	148	149				1792.mV	1795.mV
0102	P0003	150	151				1783.mV	1787.mV
0103	P0004	152	153				1789.mV	1792.mV
0104	P0005	154	155				1782.mV	1787.mV
0105	S0001	156	157				SHORT	Short good
0106	S0002	158	159				SHORT	Short good
0107	J0001	160	161				JUMPER	Jumper good
0108	L0001	163	162			12.8uH	20.6uH	21.5uH
0109	L0002	164	165			00.0uH	49.6uH	49.1uH
0110	L0003	166	167			142.uH	000.uH	000.uH
0111	L0004	169	168			159.uH	100.uH	110.uH
0112	L0005	170	171			188.uH	026.uH	026.uH
0113	L0006	172	173			000.uH	050.uH	050.uH
0114	L0007	175	174			30.0mH	00.0mH	00.0mH

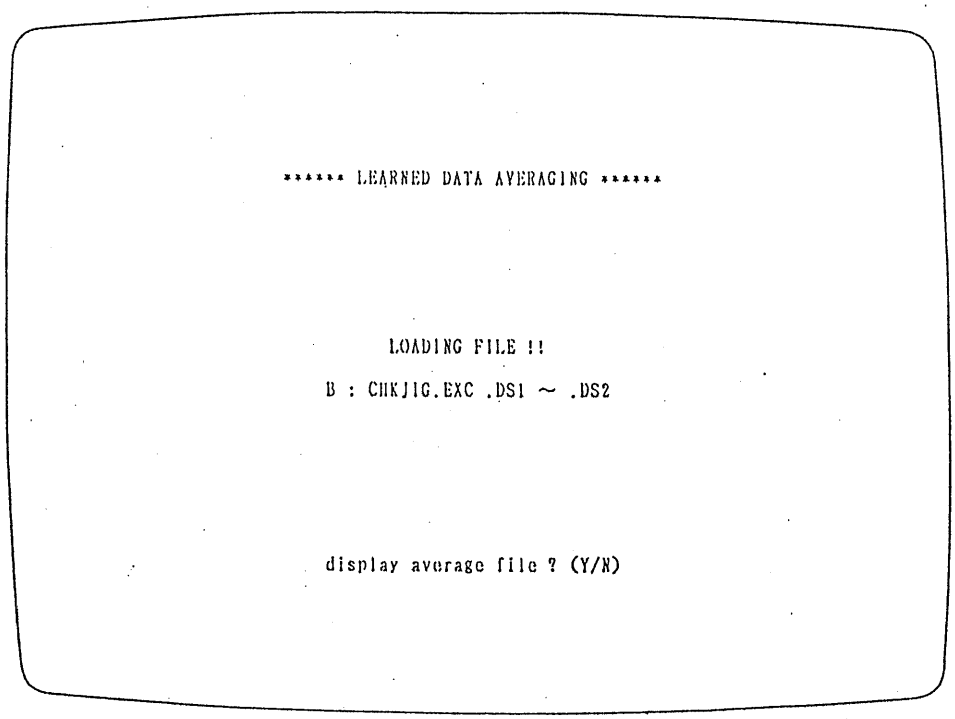
LEARN DATA 2 SHEET END

CONTINUE LEARN DATA ? (Y/N)

When the data has been learned from the second board, the system asks whether or not to continue the data learning. Since the data is to be learned from two boards in this example, press N.



The above screen indicates that data has been learned from two boards.



To see the contents of the averaged data file:
Y

****** LEARNED DATA AVERAGING ******

FILE NAME : CHKJIG.AVE [ ] IS FILE NUMBER

STEP	PARTS	Standard Value	Average Value	Maximum Value	Maximum File	Minimum Value	Minimum File
0001	R0001	1.41 o	1.39 o	1.41 o	[1]	1.35 o	[2]
0002	R0002	7.53 o	7.54 o	7.56 o	[2]	7.53 o	[E]
0003	R0003	10.58 o	10.26 o	10.58 o	[E]	10.11 o	[1]
0004	R0003	10.2 o	10.0 o	10.2 o	[E]	09.9 o	[1]
0005	R0004	32.9 o	33.1 o	33.3 o	[2]	32.9 o	[E]
0006	R0005	69.1 o	69.3 o	69.5 o	[2]	69.1 o	[E]
0007	R0006	81.4 o	81.5 o	81.6 o	[2]	81.4 o	[E]
0008	R0007	99.4 o	99.4 o	99.5 o	[2]	99.4 o	[E]
0009	R0007	098. o	098. o	099. o	[2]	098. o	[E]
0010	R0008	337. o	337. o	338. o	[2]	337. o	[E]
0011	R0009	672. o	672. o	672. o	[2]	672. o	[E]
0012	R0010	812. o	812. o	812. o	[2]	812. o	[E]
0013	R0011	1000. o	999. o	1000. o	[E]	999. o	[1]
0014	R0011	1.02ko	1.02ko	1.02ko	[2]	1.02ko	[E]
0015	R0012	3.29ko	3.29ko	3.30ko	[2]	3.29ko	[E]
0016	R0013	6.78ko	6.78ko	6.78ko	[2]	6.78ko	[E]
0017	R0014	8.19ko	8.19ko	8.19ko	[2]	8.19ko	[E]
0018	R0015	9.98ko	9.98ko	9.98ko	[2]	9.98ko	[E]
0019	R0015	10.1ko	10.1ko	10.1ko	[2]	10.1ko	[E]
0020	R0016	33.2ko	33.1ko	33.2ko	[E]	33.1ko	[1]

then hit any key to NEXT PAGE :

The letter "E" in the brackets [ ] after a maximum or minimum value in the above screen indicates that the value was obtained from the EXC file (execution data file generated by PF2, and a number in the brackets represents the ordinal number of the board from which the value was learned by PF3.
To display the next page, press an arbitrary key on the keyboard.

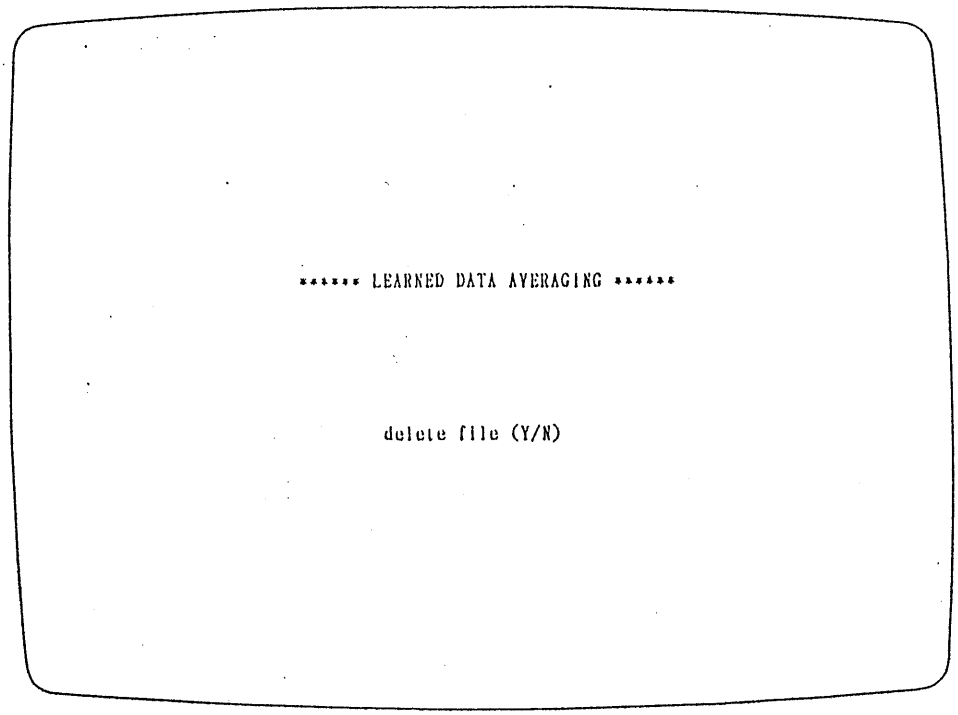
****** LEARNED DATA AVERAGING ******

FILE NAME : CHKJIG.AVE [ ] IS FILE NUMBER

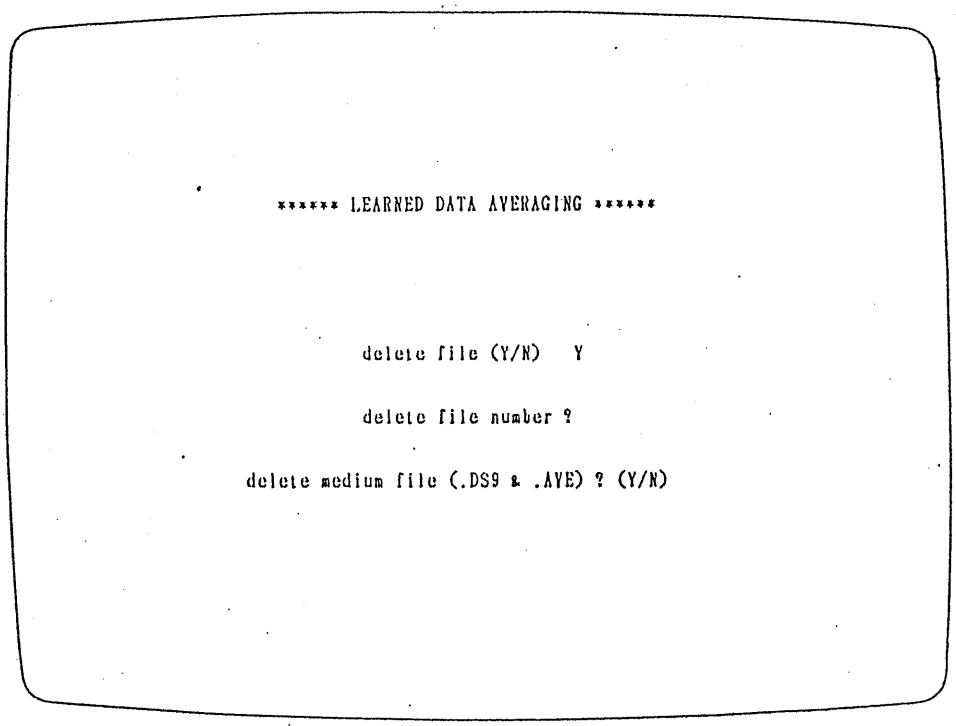
STEP	PARTS	Standard Value	Average Value	Maximum Value	Maximum File	Minimum Value	Minimum File
0101	P0002	1792.mV	1794.mV	1795.mV	[2]	1792.mV	[E]
0102	P0003	1783.mV	1785.mV	1787.mV	[2]	1783.mV	[E]
0103	P0004	1789.mV	1791.mV	1792.mV	[2]	1789.mV	[E]
0104	P0005	1792.mV	1785.mV	1787.mV	[1]	1782.mV	[E]
0105	S0001	SHORT	SHORT	SHORT	[E]	SHORT	[E]
0106	S0002	SHORT	SHORT	SHORT	[E]	SHORT	[E]
0107	J0001	JUMPER	JUMPER	JUMPER	[E]	JUMPER	[E]
0108	L0001	20.6uH	21.2uH	21.7uH	[2]	20.6uH	[E]
0109	L0002	49.6uH	49.3uH	49.6uH	[E]	49.1uH	[1]
0110	L0003	000.uH	000.uH	000.uH	[2]	000.uH	[E]
0111	L0004	109.uH	109.uH	110.uH	[2]	109.uH	[E]
0112	L0005	026.uH	026.uH	026.uH	[2]	026.uH	[E]
0113	L0006	050.uH	050.uH	050.uH	[2]	050.uH	[E]
0114	L0007	00.0mH	00.0mH	00.0mH	[2]	00.0mH	[E]

then hit any key to RETURN

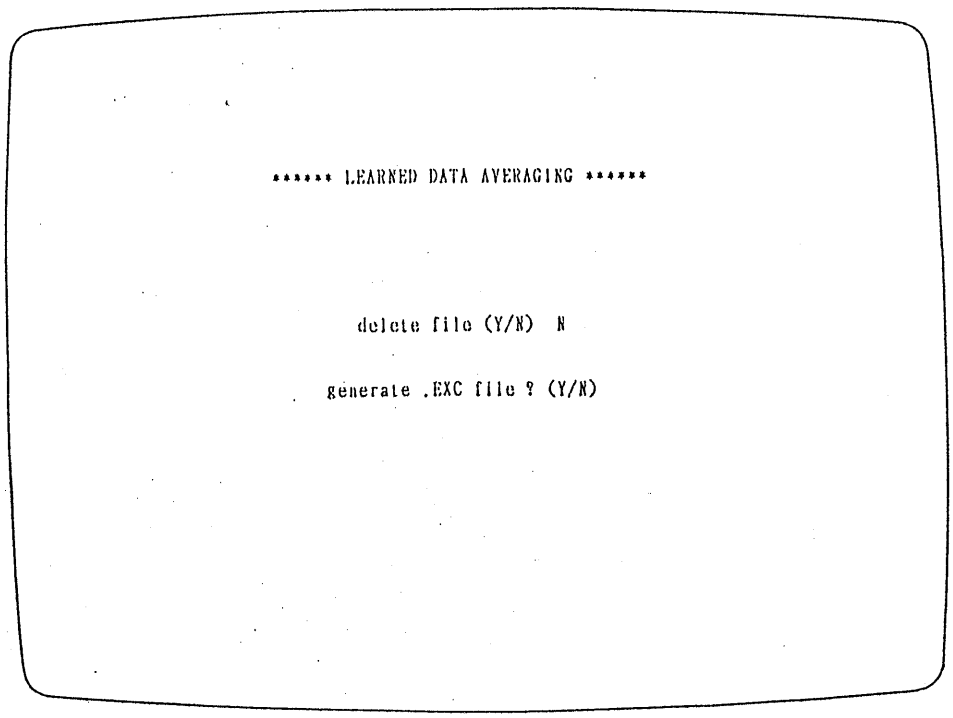
When all the pages have been displayed, the following message appears on the screen:



The avove message asks if any of the learned data files are inadepuate for averaging. To delete the inadequate files:
Y



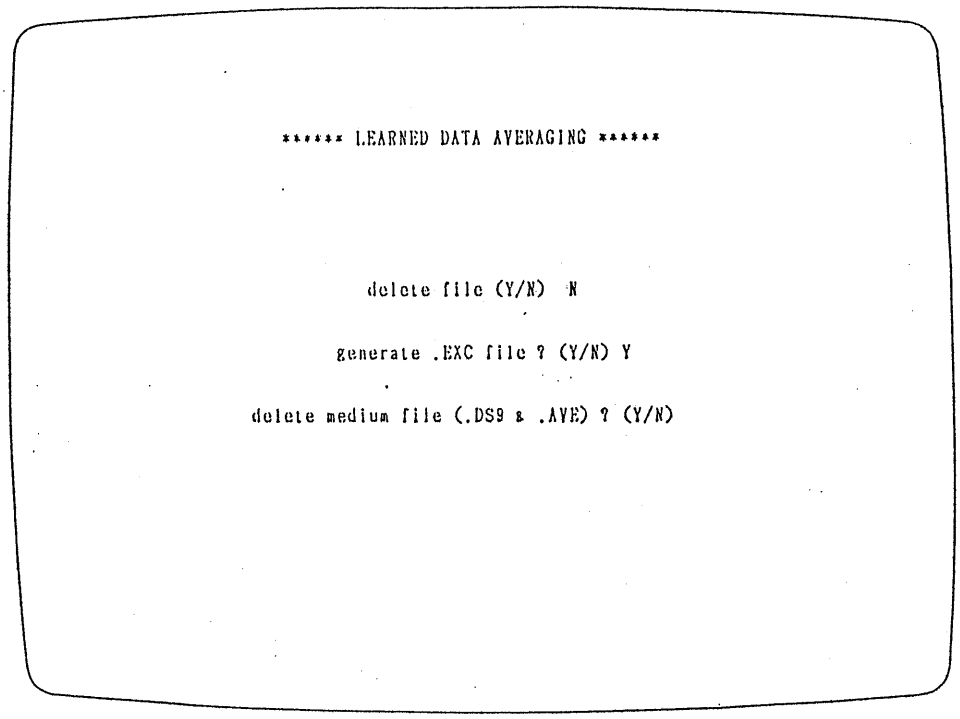
Key in the number of the files to be deleted, and the averaging is executed again without the specified files.



When no files need be deleted any more, covert the averaged data file into execution data file (EXC) by the following operation:

N

Y

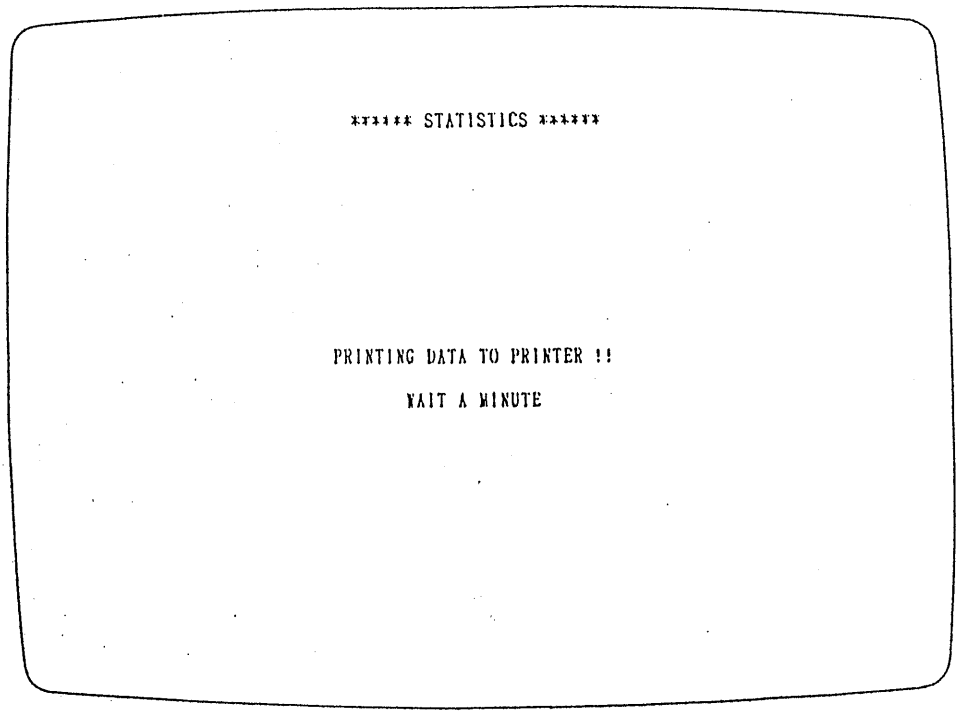


If the learned data files and averaged data file are not necessary any more, delete them.

PF11

(11) STATISTICS (Statistical data processing)

This is the statistical data processing program for the daily test operation. Since it prints such information as the number of tested boards, that of failed ones, and the failure counts classified by step number, it can be used for obtaining the statistical data by lot, day, week, etc.



The statistical data is output not only to the APC-2000A printer but also to the computer screen.

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

TEST NUMBER      91 SHEET
FAIL NUMBER      50 SHEET

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

SHORT ERROR       1 SHEET
OPEN  ERROR       6 SHEET

STEP NUMBER                    FAIL NUMBER
     0069                            2
     0070                            2
     0090                           28
     0095                           20
     0099                            1
     0100                           27
     0109                           26
     0110                           26
     0111                           26
     0112                           26
     0113                           25
     0114                           10

clear out of total & fail counter (Y/N) ?
```

To reset the number of tested boards and that of failed ones to 0, press Y.

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

TEST NUMBER      91 SHEET
FAIL NUMBER      50 SHEET

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

SHORT ERROR       1 SHEET
OPEN  ERROR       6 SHEET

STEP NUMBER                    FAIL NUMBER
     0069                            2
     0070                            2
     0090                           28
     0095                           20
     0099                            1
     0100                           27
     0109                           26
     0110                           26
     0111                           26
     0112                           26
     0113                           25
     0114                           10

clear out of step fail counter (Y/N) ?
```

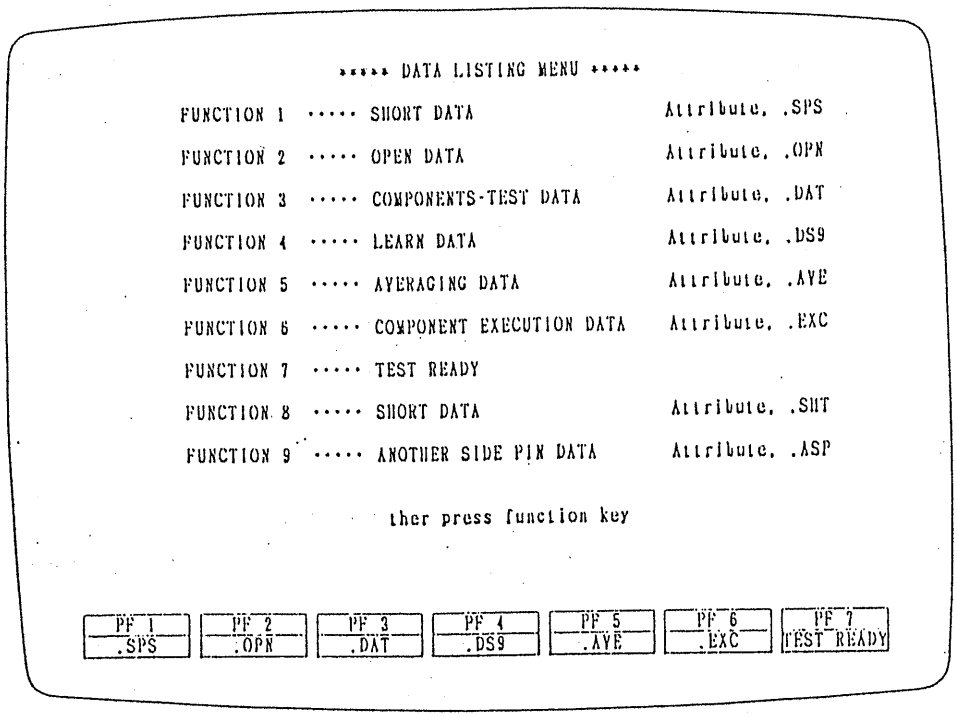
To clear all the details of failure steps (FAIL DETAILS), press Y.

(12) DATA LIST (Listing on external printer) PF12

Since the host computer contains a standard Centronics printer interface, an external printer having the Centronics interface can be connected to it.

Depending on the type of the printer, however, the interface connector pin configuration may not match with that on the host computer. Check the pin assignment on the printer connector.

The data and programs output to the external printer can also be displayed on the computer screen.



To output the all-pin short check data:

PF 1

```
                    ***** INITIAL DATA(SHORT) LIST OUT *****

SPS FILE LIST

TT       .SPS  TEST6   .SPS  TEST1   .SPS  TEST2   .SPS  TEST2    .SPS
TEST3    .SPS  TEST10  .SPS  TEST8   .SPS  CHKJIG  .SPS  RUSH1    .SPS
DATA     .SPS  DSS6520 .SPS  ABCD    .SPS  FLT     .SPS


                  key-in file name ( max 8 characters ) :

                                                          PF15
                                                          CHKJIG
```

```
                    ***** INITIAL DATA(SHORT) LIST OUT *****

SPS FILE LIST

TT       .SPS  TEST6   .SPS  TEST1   .SPS  TEST2   .SPS  TEST2    .SPS
TEST3    .SPS  TEST10  .SPS  TEST8   .SPS  CHKJIG  .SPS  RUSH1    .SPS
DATA     .SPS  DSS6520 .SPS  ABCD    .SPS  FLT     .SPS


                  key-in file name ( max 8 characters ) : CHKJIG

                                                          PF15
                                                          CHKJIG
```

C H K J I G CR

```
                    ***** INITIAL DATA(SHORT) LIST OUT *****

SPS FILE LIST

TT       .SPS  TEST6   .SPS  TEST1   .SPS  TEST2   .SPS  TEST2    .SPS
TEST3    .SPS  TEST10  .SPS  TEST8   .SPS  CHKJIG  .SPS  KUSHI    .SPS
DATA     .SPS  DSS6520 .SPS  ABCD    .SPS  FLT     .SPS


                  key-in file name ( max 8 characters ) : CHKJIG

                       Select device ? (C=crt/P=printer)

                                                          PF15
                                                          CHKJIG
```

Indicate whether the all-pin short check data is to be displayed on the computer screen or to be printed on the external printer.

```
                    ***** INITIAL DATA(SHORT) LIST OUT *****

          FILE NAME : CHKJIG.SPS

          MAX PIN ------ 173

    STEP  REF PIN    PASS PIN

    0001  000 ------ 001
    0001  001 ------ 000
    0003  116 ------ 115
    0004  117 ------ 118, 157
    0005  119 ------ 117, 157
    0006  157 ------ 117, 118
    0007  160 ------ 161
    0008  161 ------ 160
    0009  162 ------ 163
    0010  163 ------ 162
    0011  164 ------ 165
    0012  165 ------ 164
    0013  168 ------ 169
    0014  169 ------ 168
    0015  170 ------ 171
    0016  171 ------ 170
    0017  172 ------ 173
    0018  173 ------ 172

                         then hit any key to RETURN :
```

```
****** INITIAL DATA(OPEN) LIST OUT ******

OPN FILE LIST

CHKJIG   .OPN  TEST3   .OPN  CVB     .OPN  CBX     .OPN  TEST2   .OPN
TEST1    .OPN  TEST4   .OPN  TEST6   .OPN  DATA    .OPN  TEST5   .OPN
TEST7    .OPN  C       .OPN  CTEST2  .OPN  V       .OPN  DSS6520 .OPN
CHKJG1   .OPN  ABCD    .OPN

                key-in file name ( max 8 characters ):

                                                        PF15
                                                        CHKJIG
```

Select PF2, and the all-pin open check file names are displayed.

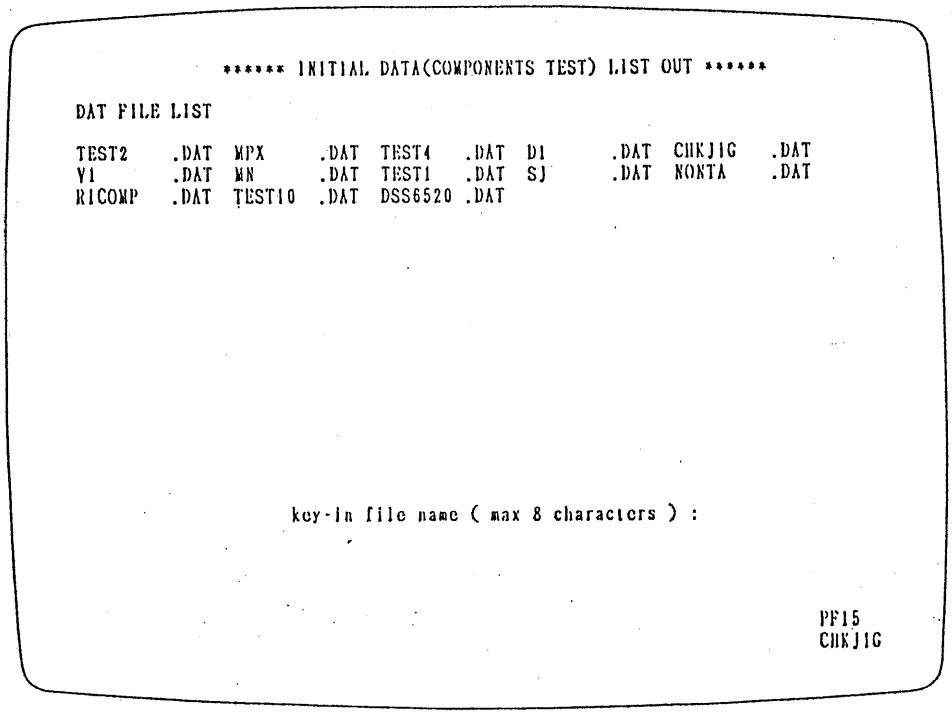
```
****** INITIAL DATA(OPEN) LIST OUT ******

OPN FILE LIST

CHKJIG   .OPN  TEST3   .OPN  CVB     .OPN  CBX     .OPN  TEST2   .OPN
TEST1    .OPN  TEST4   .OPN  TEST6   .OPN  DATA    .OPN  TEST5   .OPN
TEST7    .OPN  C       .OPN  CTEST2  .OPN  V       .OPN  DSS6520 .OPN
CHKJG1   .OPN  ABCD    .OPN

                key-in file name ( max 8 characters ) : CHKJIG

                                                        PF15
                                                        CHKJIG
```

C H K J I G CR

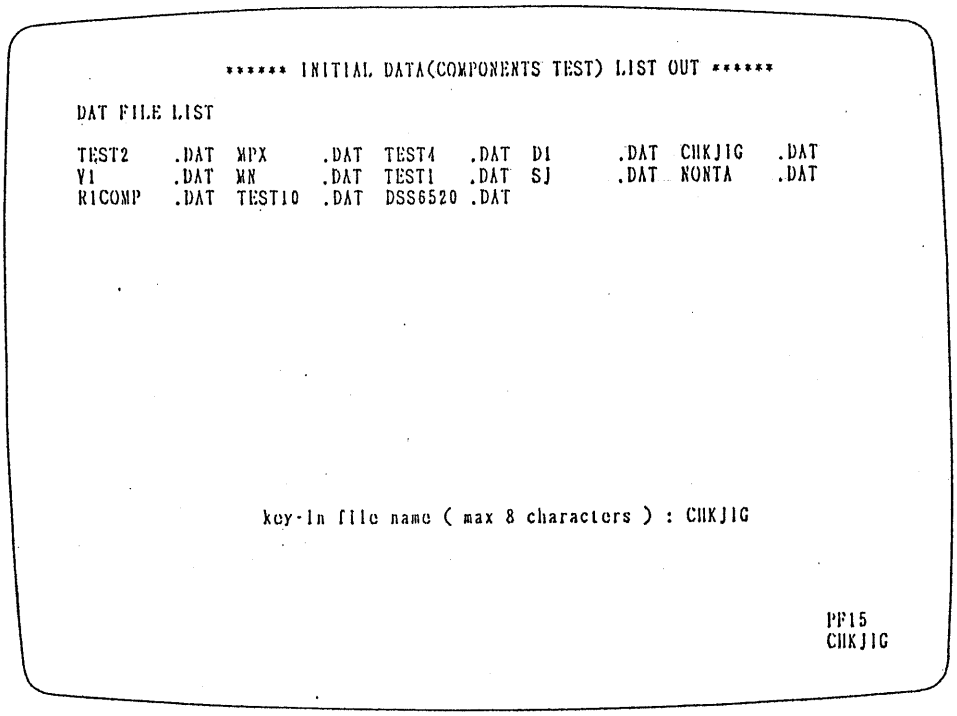
```
                ****** INITIAL DATA(OPEN) LIST OUT ******

OPN FILE LIST

CHKJIG   .OPN  TEST3   .OPN  CVB     .OPN  CBX     .OPN  TEST2   .OPN
TEST1    .OPN  TEST4   .OPN  TEST6   .OPN  DATA    .OPN  TEST5   .OPN
TEST7    .OPN  C       .OPN  CTEST2  .OPN  V       .OPN  DSS6520 .OPN
CHKJGI   .OPN  ABCD    .OPN

                key-in file name ( max 8 characters ) : CHKJIG

                Select device ? (C=crt/P=printer)

                                                          PF15
                                                          CHKJIG
```

Indicate whether the all-pin open check list is to be displayed on the computer screen or to be printed on the external printer.

```
                ****** INITIAL DATA(OPEN) LIST OUT ******

FILE NAME   CHKJIG.OPN

MAX PIN ····· 173

PASS PIN ···· 032, 033, 034, 035, 036, 037, 038, 039, 040, 041
              042, 043, 044, 045, 046, 047, 048, 049, 050, 051
              058, 059, 060, 061, 062, 063, 064, 065, 066, 067
              068, 069, 070, 071, 072, 073, 074, 075, 076, 077
              078, 079, 080, 081, 082, 083, 084, 085, 086, 087
              120, 112, 124, 125, 126, 128, 130, 131, 132, 135
              137, 139, 140, 141, 142, 143, 144, 145, 147, 149
              151, 153, 155, 156, 158, 159, 167, 168, 169

                        then hit any key to RETURN :
```



Select PF3, and the initial data (DAT) file names are displayed.

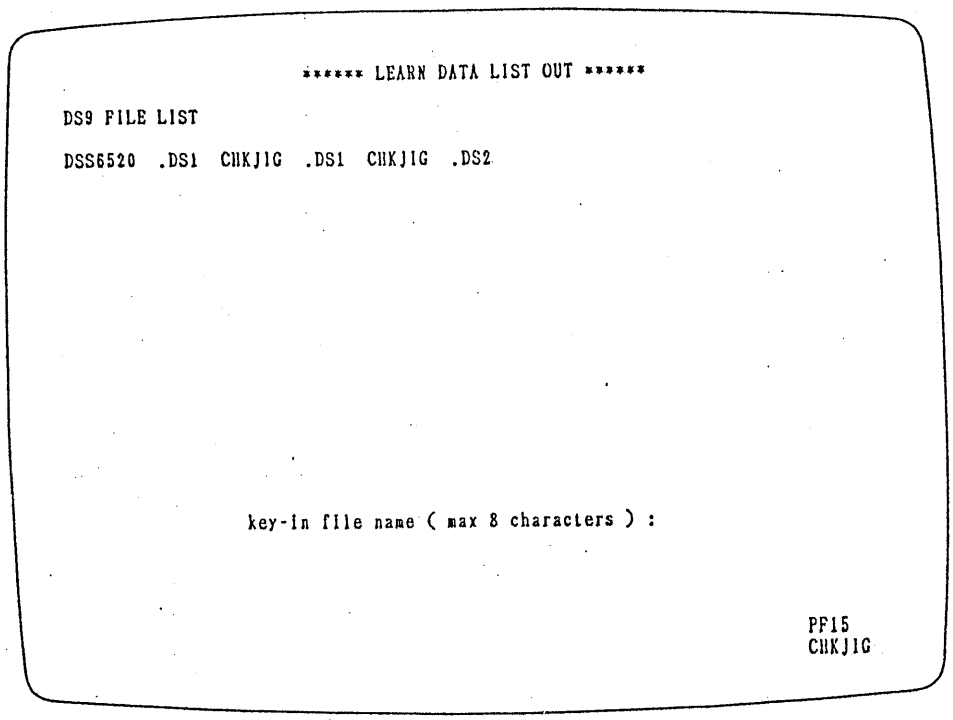


C H K J I G CR

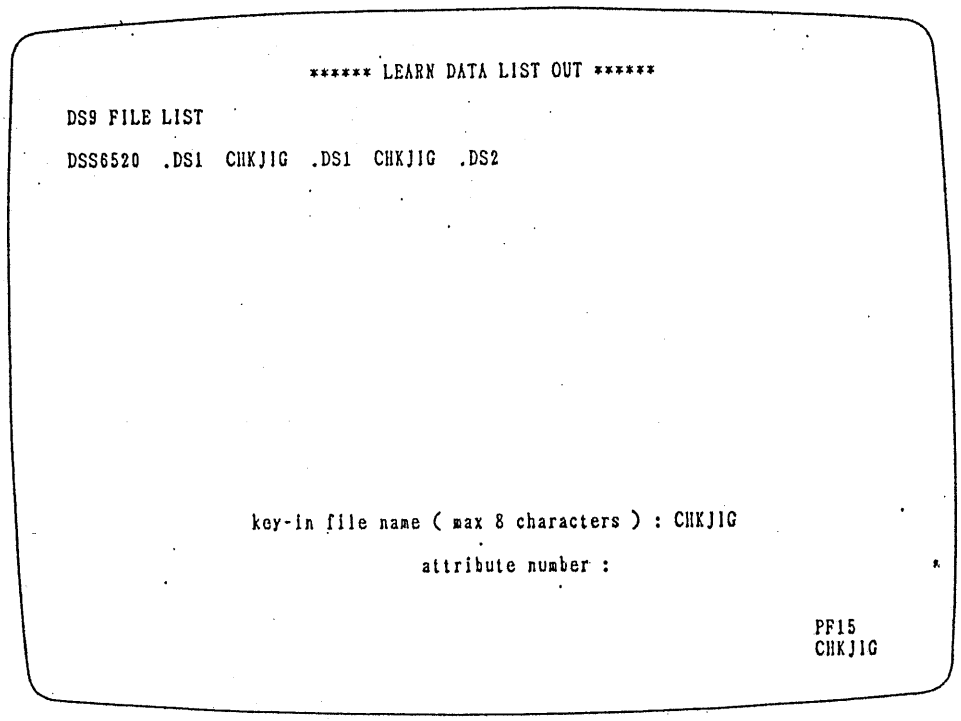
```
****** INITIAL DATA(COMPONENTS TEST) LIST OUT ******

DAT FILE LIST

TEST2  .DAT  MPX     .DAT  TEST4   .DAT  DI      .DAT  CHKJIG   .DAT
V1     .DAT  MN      .DAT  TEST1   .DAT  SJ      .DAT  NONTA    .DAT
RICOMP .DAT  TEST10  .DAT  DSS6520 .DAT

                key-in file name ( max 8 characters ) : CHKJIG

                Select device ? (C=crt/P=printer)

                                                        PF15
                                                        CHKJIG
```

Indicate whether the initial data list is to be displayed on the computer screen or to be printed on the external printer.

```
****** INITIAL DATA(COMPONENTS TEST) LIST OUT ******

    FILE NAME : CHKJIG.DAT

                                                  Actual  Parts
STEP    PARTS    +PIN   -PIN   GND1   GND2       Value   Location EXT

0001    01234    000    001                      1.00nF    1A     0
0002    R0002    002    003                      7.48 o    1A     0
0003    R0003    005    004                      9.95 o    1A     0
0004    R0003    005    004                      99.0 o    1A     0
0005    R0004    006    007                      33.3 o    1A     0
0006    R0005    009    008                      69.7 o    1A     0
0007    R0006    011    010                      82.1 o    1A     0
0008    R0007    012    013                      99.9 o    2A     0
0009    R0007    012    013                      100. o    2A     0
0010    R0008    014    015                      340. o    2A     0
0011    R0009    016    017                      677. o    2A     0
0012    R0010    018    019                      817. o    2A     0
0013    R0011    021    020                      999. o    2A     0
0014    R0011    020    021                      1.01ko    2A     0
0015    R0012    022    023                      3.29ko    2A     0
0016    R0013    024    025                      6.79ko    2A     0
0017    R0014    026    027                      8.21ko    2A     0
0018    R0015    028    029                      9.99ko    3A     0
0019    R0015    029    028                      10.0ko    3A     0
0020    R0016    031    030                      33.2ko    3A     0

                then hit any key to NEXT PAGE :
```

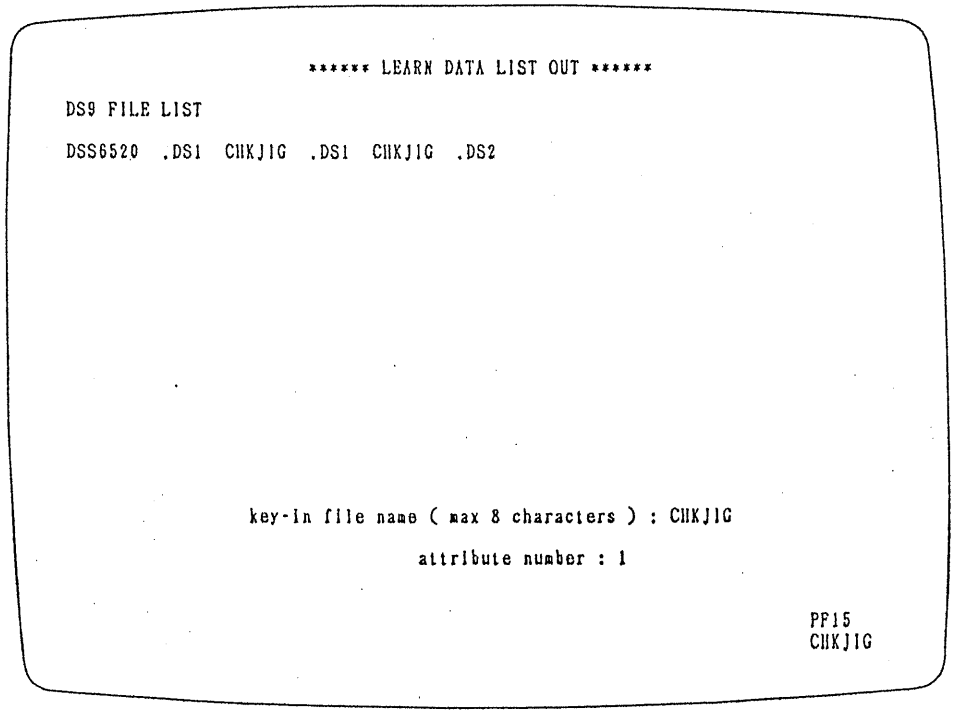


Select PF4, and the learned data (DSI ~ DS4) file names are displayed.

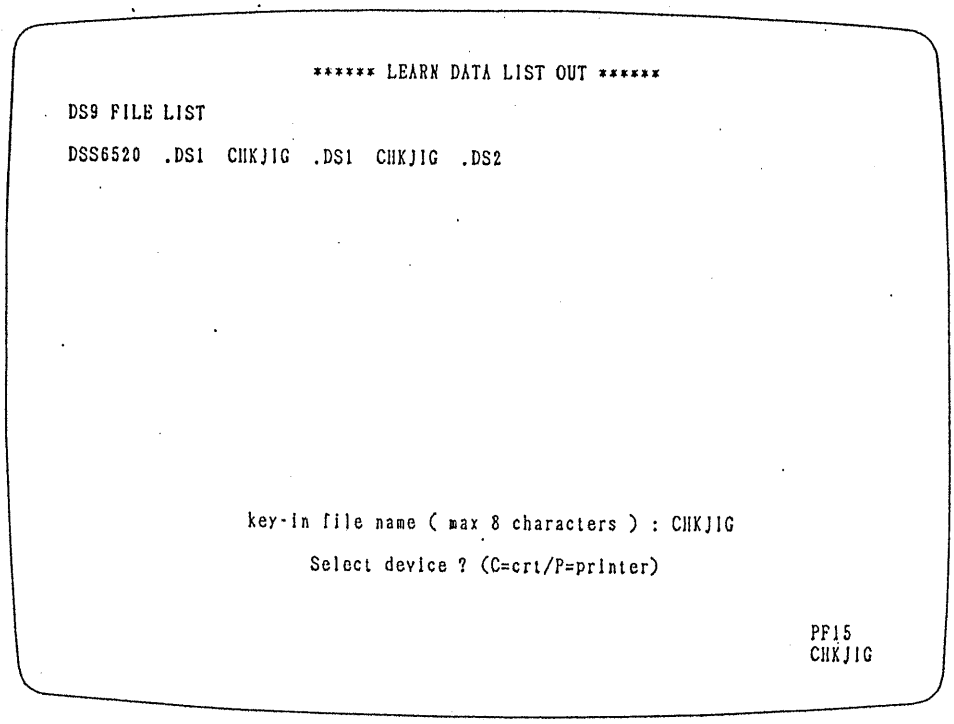


C H K J I G CR

Key in the ordinal numnber of the board whose data is to be listed.



1

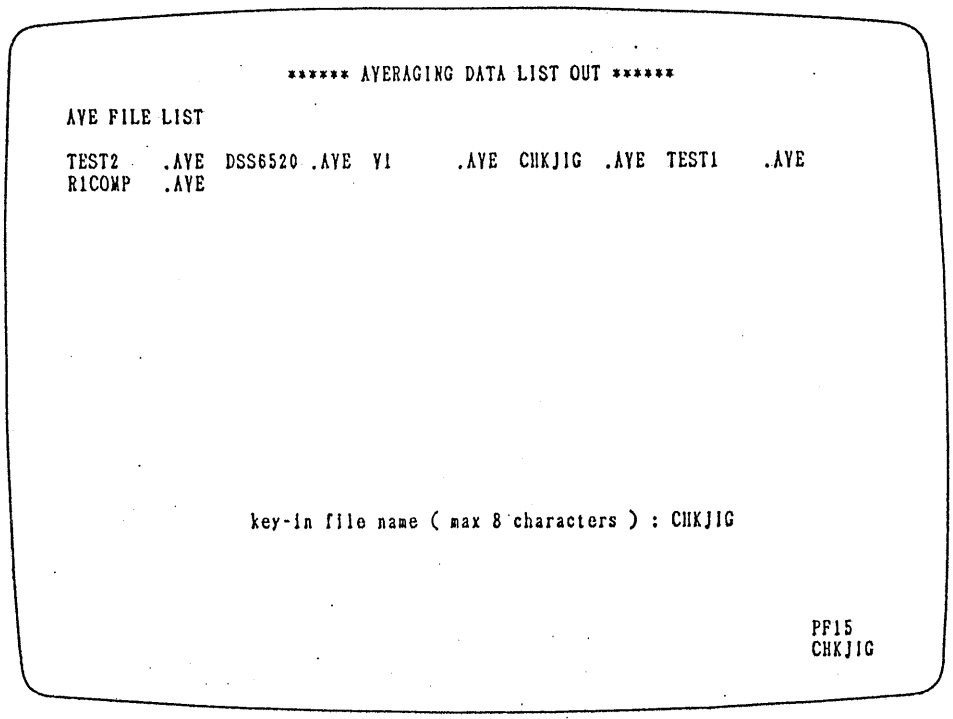


Indicate whether the learned data list is to be displayed on the computer screen or to be printed on the external printer.

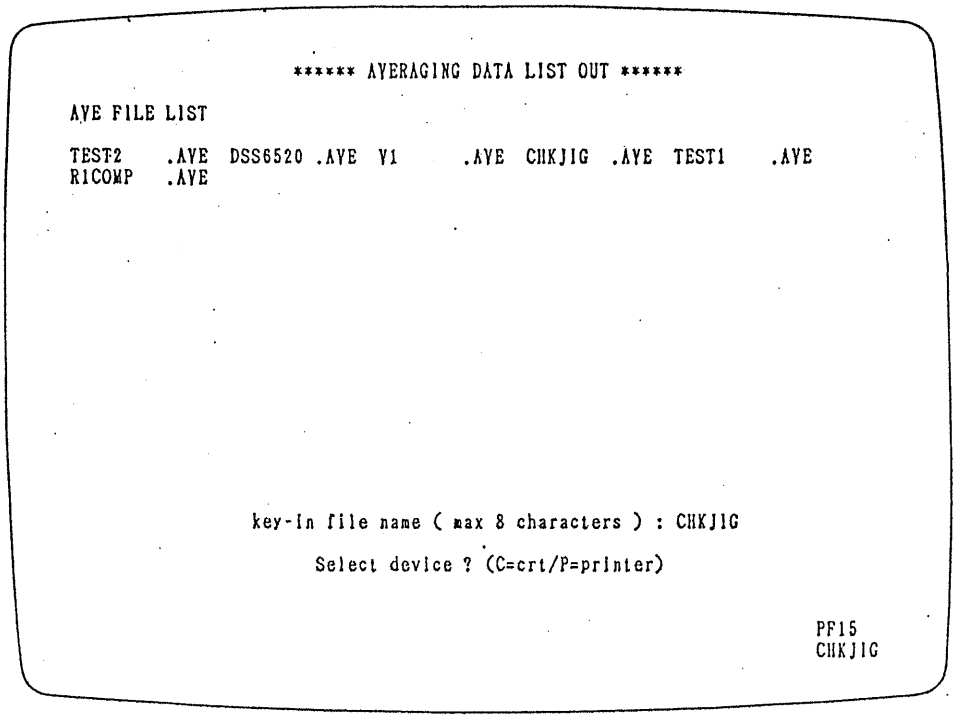
```
                    ****** LEARN DATA LIST OUT ******

     FILE NAME : CHKJIG.DS1

                                                    Actual    standard    Messured
STEP      PARTS     +PIN     -PIN     GND1     GND2  Value     Value       Value
0001      R0001     001      000                     1.24 o     1.41 o      1.41 o
0002      R0002     002      003                     7.48 o     7.53 o      7.55 o
0003      R0003     004      005                     9.95 o    10.58 o     10.11 o
0004      R0003     005      004                    99.0 o     10.2 o      09.9 o
0005      R0004     006      007                    33.3 o     32.9 o      33.1 o
0006      R0005     009      008                    69.7 o     69.1 o      69.5 o
0007      R0006     011      010                    82.1 o     81.4 o      81.6 o
0008      R0007     012      013                    99.9 o     99.4 o      99.5 o
0009      R0007     012      013                    100. o     098. o      099. o
0010      R0008     014      015                    340. o     337. o      337. o
0011      R0009     016      017                    677. o     672. o      672. o
0012      R0010     018      019                    817. o     812. o      812. o
0013      R0011     021      020                    999. o    1000. o      999. o
0014      R0011     020      021                   1.01ko     1.02ko      1.02ko
0015      R0012     022      023                   3.29ko     3.29ko      3.29ko
0016      R0013     024      025                   6.78ko     6.78ko      6.78ko
0017      R0014     026      027                   8.21ko     8.19ko      8.19ko
0018      R0015     028      029                   9.99ko     9.99ko      9.99ko
0019      R0015     029      028                   10.0ko     10.1ko      10.1ko
0020      R0016     031      030                   33.2ko     33.2ko      33.1ko

                    then hit any key to NEXT PAGE :
```

```
                    ****** AVERAGING DATA LIST OUT ******

AVE FILE LIST

TEST2    .AVE  DSS6520 .AVE  Y1       .AVE  CHKJIG  .AVE  TEST1    .AVE
R1COMP   .AVE

                    key-in file name ( max 8 characters ) :

                                                                  PF15
                                                                  CHKJIG
```

Select PF5, and the averaged data file names are displayed.



C H K J I G CR



Indicate whether the averaged data list is to be displayed on the computer screen or to be printed on the external printer.

```
****** AVERAGING DATA LIST OUT ******

FILE NAME : CHKJIG.AVE                                    [ ] IS FILE NUMBER

                    Actual     Average        Maximum          Minimum
STEP    PARTS       Value      Value      Value      File    Value      File
0001    R0001    1.41 o     1.41 o     1.41 o     [1]     1.41 o     [E]
0002    R0002    7.53 o     7.54 o     7.55 o     [1]     7.53 o     [E]
0003    R0003    0.58 o     0.34 o     0.58 o     [E]     0.11 o     [1]
0004    R0003    10.2 o     10.8 o     10.2 o     [E]     09.9 o     [1]
0005    R0004    32.9 o     33.0 o     33.1 o     [1]     32.9 o     [E]
0006    R0005    69.1 o     69.3 o     69.5 o     [1]     69.1 o     [E]
0007    R0006    81.4 o     81.5 o     81.6 o     [1]     81.4 o     [E]
0008    R0007    99.4 o     99.4 o     99.5 o     [1]     99.4 o     [E]
0009    R0007    098. o     098. o     099. o     [1]     098. o     [E]
0010    R0008    337. o     337. o     337. o     [1]     337. o     [E]
0011    R0009    672. o     672. o     672. o     [1]     672. o     [E]
0012    R0010    812. o     812. o     812. o     [1]     812. o     [E]
0013    R0011    000. o     999. o     000. o     [E]     999. o     [1]
0014    R0011    1.02ko     1.02ko     1.02ko     [1]     1.02ko     [E]
0015    R0012    3.29ko     3.29ko     3.29ko     [1]     3.29ko     [E]
0016    R0013    6.78ko     6.78ko     6.78ko     [1]     6.78ko     [E]
0017    R0014    8.19ko     8.19ko     8.19ko     [1]     8.19ko     [E]
0018    R0015    9.98ko     9.99ko     9.98ko     [1]     9.98ko     [E]
0019    R0015    10.1ko     10.1ko     10.1ko     [1]     10.1ko     [E]
0020    R0016    33.2ko     33.2ko     33.2ko     [E]     33.1ko     [1]

                    then hit any key to NEXT PAGE :
```

```
****** COMPONENT EXECUTION DATA LIST OUT ******

EXC FILE LIST

D1      .EXC  CHKJIG  .EXC  V1      .EXC  TEST4   .EXC  TEST1    .EXC
SJ      .EXC  TEST2   .EXC  R1COMP  .EXC  DSS6520 .EXC

                    key-in file name ( max 8 characters ) :

                                                          PF15
                                                          CHKJIG
```

Select PF6, and the execution data file names are displayed.

```
****** COMPONENT EXECUTION DATA LIST OUT ******
EXC FILE LIST

D1      .EXC  CHKJ1G  .EXC  Y1      .EXC  TEST4   .EXC  TEST1    .EXC
SJ      .EXC  TEST2   .EXC  R1COMP  .EXC  DSS6520 .EXC

                key-in file name ( max 8 characters ) : CHKJ1G

                                                          PF15
                                                          CHKJ1G
```

C H K J I G CR

```
****** COMPONENT EXECUTION DATA LIST OUT ******
EXC FILE LIST

D1      .EXC  CHKJ1G  .EXC  Y1      .EXC  TEST4   .EXC  TEST1    .EXC
SJ      .EXC  TEST2   .EXC  R1COMP  .EXC  DSS6520 .EXC

                key-in file name ( max 8 characters ) : CHKJ1G
                Select device ? (C=crt/P=printer)

                                                          PF15
                                                          CHKJ1G
```

Indicate whether the execution data list is to be displayed on the computer screen or to be printed on the external printer.

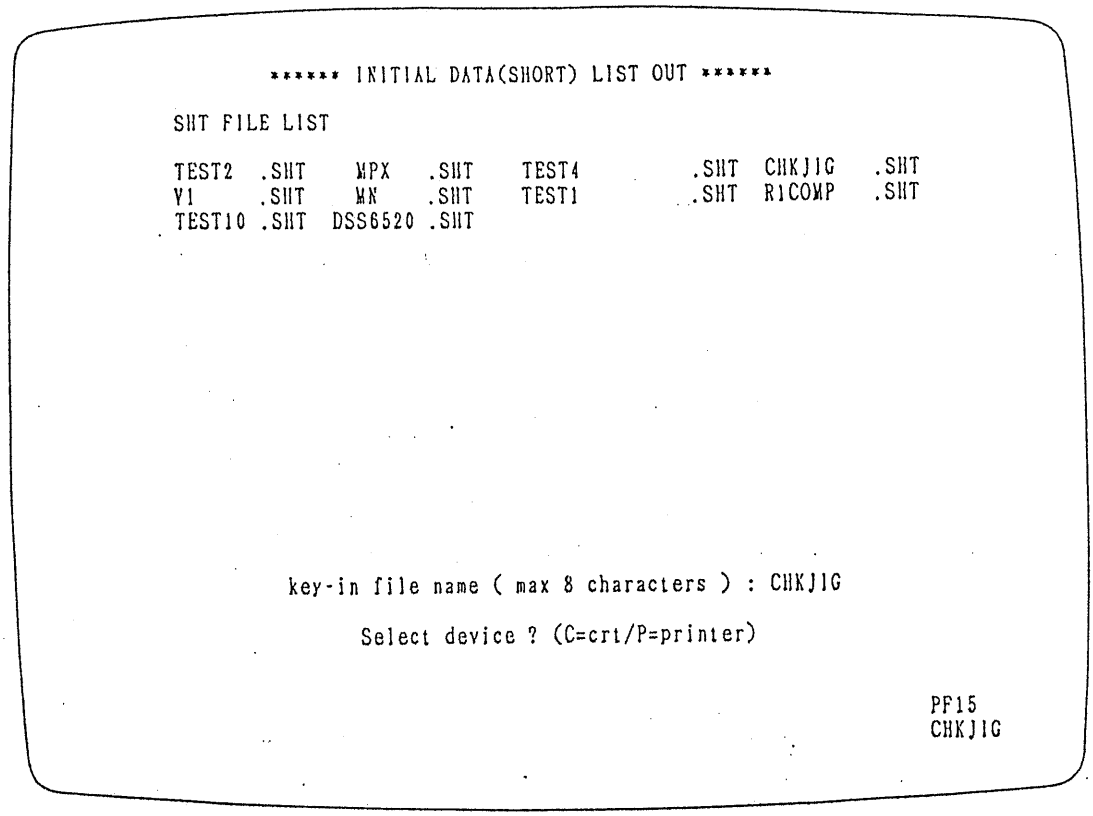
****** COMPONENT EXECUTION DATA LIST OUT ******

FILE NAME : CHKJIG.EXC

STEP	PARTS	+PIN	-PIN	GND1	GND2	Actual Value	Standard Value	Parts Location	+ err	- err	delay	EXT
0001	R0001	001	000			1.24 o	1.41 o	1A	10	10	00	0
0002	R0002	002	003			7.40 o	7.54 o	1A	10	10	00	0
0003	R0003	004	005			9.95 o	10.34 o	1A	10	10	00	0
0004	R0003	005	004			99.0 o	10.0 o	1A	10	10	00	0
0005	R0004	006	007			33.3 o	33.0 o	1A	10	10	00	0
0006	R0005	009	008			69.7 o	69.3 o	1A	10	10	00	0
0007	R0006	011	010			82.1 o	81.5 o	1A	10	10	00	0
0008	R0007	012	013			99.9 o	99.4 o	2A	10	10	00	0
0009	R0007	012	013			100. o	098. o	2A	10	10	00	0
0010	R0008	014	015			340. o	337. o	2A	10	10	00	0
0011	R0009	016	017			677. o	672. o	2A	10	10	00	0
0012	R0010	018	019			817. o	812. o	2A	10	10	00	0
0013	R0011	021	020			999. o	999. o	2A	10	10	00	0
0014	R0011	020	021			1.01ko	1.02ko	2A	10	10	00	0
0015	R0012	022	023			3.29ko	3.29ko	2A	10	10	00	0
0016	R0013	024	025			6.78ko	6.78ko	2A	10	10	00	0
0017	R0014	026	027			8.21ko	8.19ko	2A	10	10	00	0
0018	R0015	028	029			9.99ko	9.98ko	3A	10	10	00	0
0019	R0015	029	028			10.0ko	10.1ko	3A	10	10	00	0
0020	R0016	031	030			33.2ko	33.1ko	3A	10	10	00	0

then hit any key to NEXT PAGE :

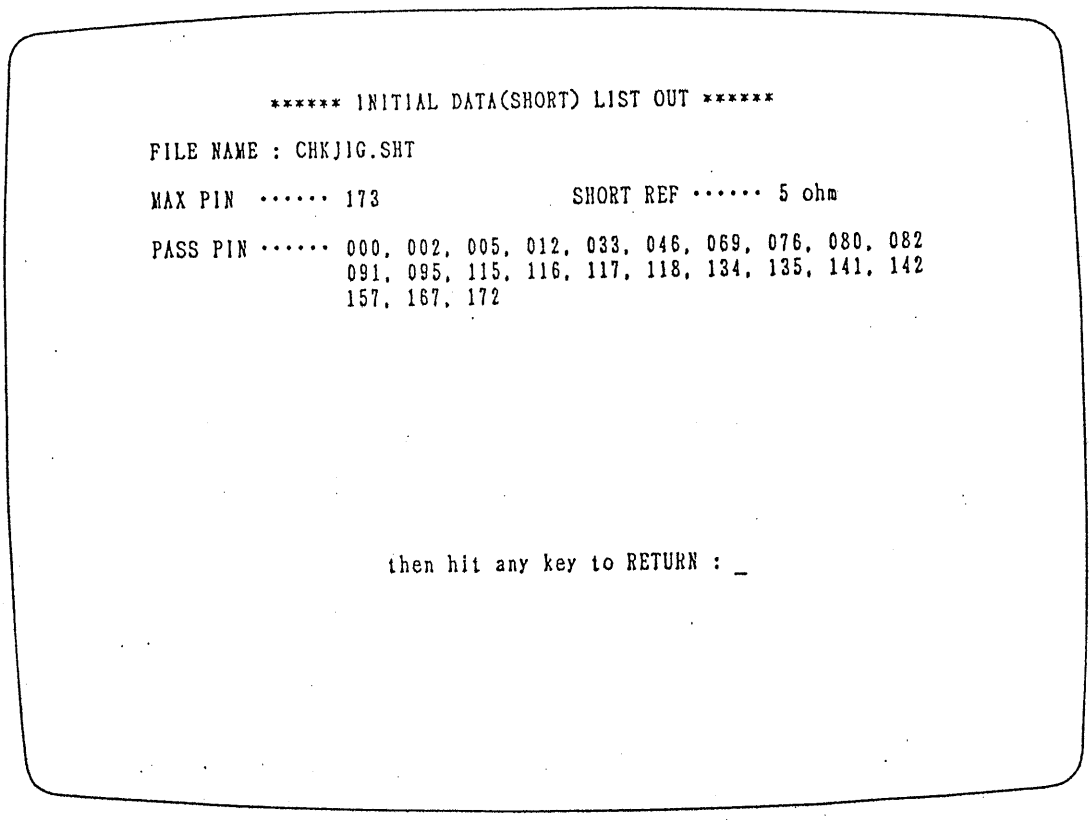
Select PF8, and all-pin short ckeck file is displayed.



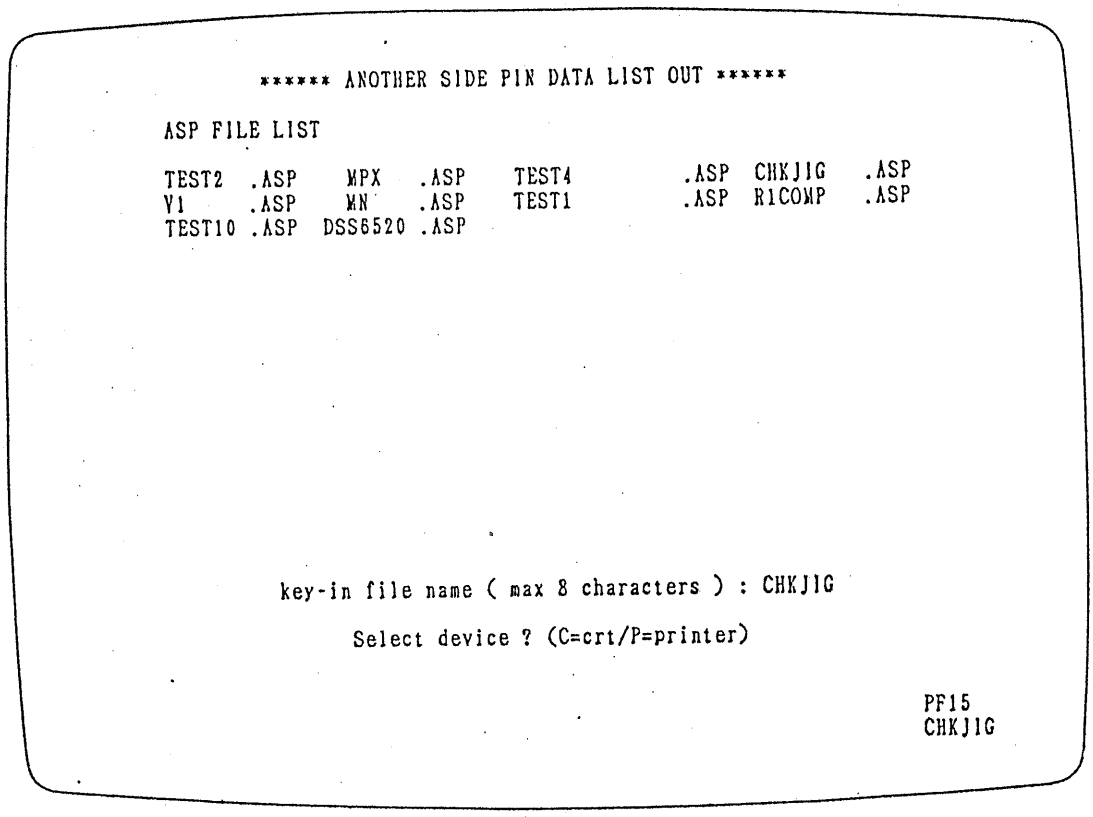
C H K J I G CR

The pin number which is not set at the time of execution of all-pin short test, excluding the representative pin (max. pin of the group) out of the groupe judged to be short, to a less degree than SHORT REF value (1 ～ 15 ohm) through all-pin short check program, is displayed.

Select C or P. If C is selected...

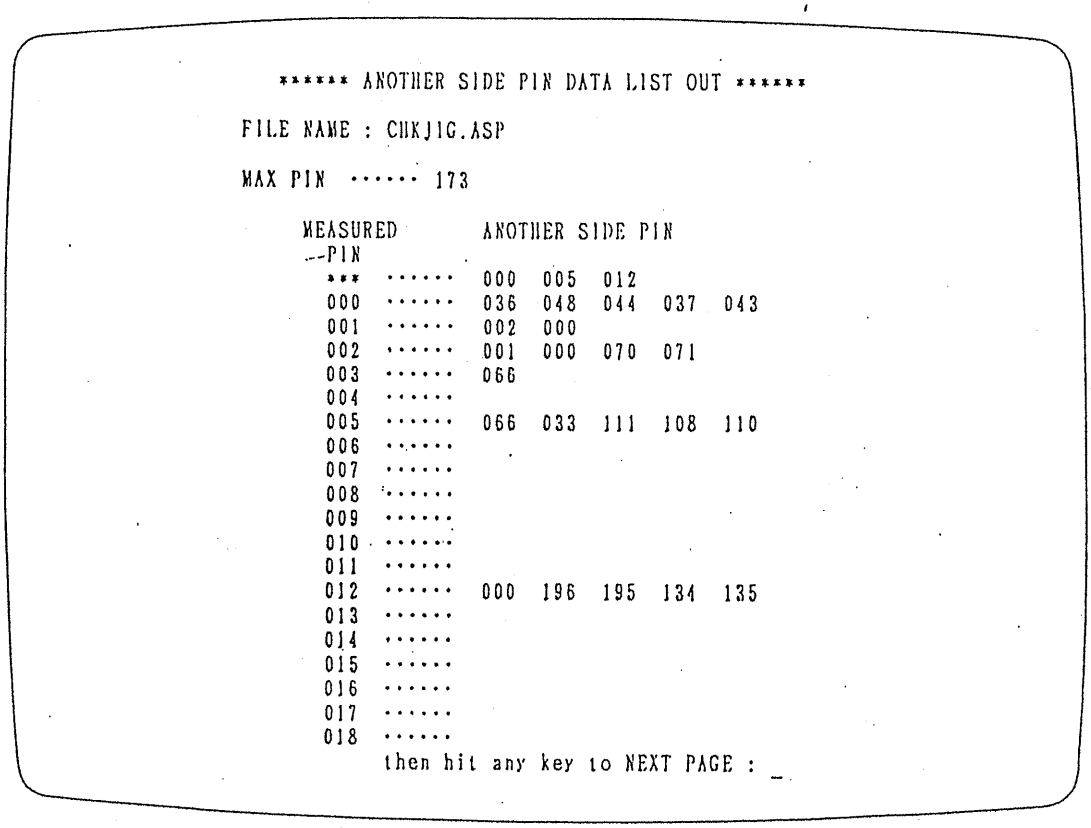

****** INITIAL DATA(SHORT) LIST OUT ******
FILE NAME : CHKJIG.SHT
MAX PIN ····· 173
SHORT REF ····· 5 ohm
PASS PIN ····· 000, 002, 005, 012, 033, 046, 069, 076, 080, 082
091, 095, 115, 116, 117, 118, 134, 135, 141, 142
157, 167, 172
then hit any key to RETURN : _

Select PF9, and ASP file (Ref. 9 - 3) is displayed.



C H K J I G CR

Select C or P. If C is selected...



```
****** ANOTHER SIDE PIN DATA LIST OUT ******

FILE NAME : CHKJIG.ASP

MAX PIN ····· 173

     MEASURED        ANOTHER SIDE PIN
     --PIN
       ***  ·····  000  005  012
       000  ·····  036  048  044  037  043
       001  ·····  002  000
       002  ·····  001  000  070  071
       003  ·····  066
       004  ·····
       005  ·····  066  033  111  108  110
       006  ·····
       007  ·····
       008  ·····
       009  ·····
       010  ·····
       011  ·····
       012  ·····  000  196  195  134  135
       013  ·····
       014  ·····
       015  ·····
       016  ·····
       017  ·····
       018  ·····
            then hit any key to NEXT PAGE : _
```

(14) SHORT REF (the value of short reference) PF14

You can select the value of SHORT REF(1Ω~15Ω), by pressing PF 14 according to all pin short check algorithum(6.6).

Each time pressing this key, this value changes from "1Ω" to "15Ω".

When testing COMPONENT TEST, this value is eqal to the reference level of J(jumper check) and S(short check).

5.4 Daily Operation Procedures

This section explains the daily operation procedures for testing the same model PC boards everyday for a certain period of time.

(1) Turn on the power for the vacuum pump and set the power key switch of the main frame to ON. Then, insert APC-2000A SYSTEM DISK into drive A. When the floppy disk is locked, the self-check operation is performed automatically, and if no errors are found, the system is set in the TEST READY mode. If errors are found, the error items are displayed on the screen. To proceed with the initially intended operation even if the errors are reported, press the RETURN key.
If a RAM CHECK error is reported by the self-check operation executed after termination of the maintenance operation without pressing the "E" key, transfer the execution data (EXC FILE) according to the procedure explained in Section 5.3.1 (4) and execute the self-check operation again by pressing the CTRL and RESET keys at the same time.
If the power switch is turned on immediately after it is turned off, the APC-2000 may operate incorrectly. Therefore, turn on the power switch at least several seconds after it is turned off. Note that this condition also applies to the case of momentary power failure.

(2) Since not only the modes specified for DISPLAY (MAP/NORM), SHORT REF (1 - 15), PRINT CONT (FAIL, ALL, NON), and TEST SEQ (S-O-C, etc.) but also the execution programs (all-pin short check, all-pin open check, and component test) are preserved by the backup feature, the operator only needs to set a PC board on the jig and press the START switch on the printer section for the daily test operation.

(3) The PC board is tested according to the predetermined sequence, and if it is found to be a good board, the PASS lamp on the printer section is turned on with a melolodious note and the message "PASS" is displayed on the host computer screen.

(4) If defective portions are found by the all-pin short check or all-pin open check in the S-O-C, S-C, O-C, or S-O sequence, information on the defective portions is displayed and the measuring is terminated. The tested PC board can be removed from the jig when the measuring is terminated.

(5) If FAIL is specified as the printer output mode (PRINT CONT) for the component test, the failure step information is output to both screen and printer in realtime mode. Note that the test on the next PC board can be started when the message "TEST READY" is displayed on the screen even if the information is still being output to the printer.
When the printer output mode is NON, the failure step information is displayed on the host computer screen only. To print out this information after the test has finished, specify FAIL for PRINT CONT and press the RE-PRINT function key. It can also be printed out if PF13 is pressed.
When the printer output mode is ALL, information on all steps is output regardless of the test results.

(6) When a large number of PC boards are tested, the pins may be warn away or soiled with flux, the filter in the jig may become dirty, and the solenoid valve filter in the jig table and vacuum pump filter may be clogged. These parts must be cleaned and replaced regularly.

5.5 Switching the Board Model to be Tested

The explanation in this section is based on the assumption that the execution programs for the new model are already completed.

(1) Replace jig

Disconnect the vacuum hose and 50-pin Amphenol connector from the jig, replace the jig with the one designed for the new PCB model, and reconnect the hose and connector. Be sure to reconnect cables in the correct order.

(2) Transfer execution programs

Insert the floppy disk (WORK FILE) containing the execution programs for the new PCB model into floppy disk drive B. Select the TRANSFER function key in the TEST READY mode, and transfer the execution programs from the host computer to APC-2000A.

After the execution programs have been transferred, set the system in the TEST READY mode again and specify the DISPLAY, SHORT REF, PRINT CONT, and TEST SEQ modes for the new PCB model. Then, the new model PC boards can be tested by the daily operation procedures explained in Section 5.4.

5.6 WORK FILE Creation Procedure

The contents of the supplied floppy disks are as follows:

APC-2000A AUTOMATIC PC BOARD CHECKER SYSTEM	This floppy disk contains all the programs for APC-2000A. Normally, it is inserted into drive A.
APC-2000A AUTOMATIC PC BOARD CHECKER WORK FILE	This is a WORK FILE floppy disk to contain the APC-2000A initial data, learned data, execution reference data, and other data Normally, it is inserted into drive B.
SYSTEM DISK CP/M. Ver. 2.2 SBASIC III Ver. 3.0	This is the system disk for the host computer. It is an original disk containing CP/M and SBASIC, etc.

To create a WORK FILE floppy disk from a new floppy disk, the floppy disk must be initialized (formatted).

Formatting method

Insert CP/M SYSTEM DISK into drive A and press the CTRL and RESET keys simultaneously. Then, the prompter "A > " appears.
After executing "A > FORMAT RETURN", insert a new floppy disk into drive A and key in "Y". Then, the formatting is started. When the formatting has finished, the message "FORMATTING---" is displayed and the floppy disk is tested (approximately 2 minutes).

When the test has finished, the message "DISK TEST COMPLETED---" is displayed, indicating the completion of formatting. After this more floppy disks may be formatted if the operator wishes.
The next step is to load the system program into the formatted floppy disk (SYSGEN).

SYSGEN procedure

Insert CP/M SYSTEM DISK into drive A and press the CTRL and RESET keys simultaneously; then, the prompter "A>" appears.
After executing "A > SYSGEN RETURN", key in "A" in response to the message "SOURCE DRIVE NAME?", and press the RETURN key in response to the message "SOURCE ON A THEN TYPE RETURN". Then, insert the formatted new floppy disk into drive B.
Key in "B" in response to the message "DESTINATION DRIVE NAME", and press the RETURN key in response to the message "DESTINATION ON DRIVE B---". When the SYSGEN operation is completed, the message "FUNCTION COMPLETE" appears. In this stage, the operator may start the SYSGEN operation for another floppy disk if he wishes.
To return to the prompter A > of CP/M, press the CTRL and RESET switches.
After the SYSGEN operation, write a PIP command into this WORK FILE.

Writing PIP command

Insert CP/M SYSTEM DISK into drive A and press the CTRL and RESET keys simultaneously; then the prompter "A >" appears.
Insert the WORK FILE floppy disk, for which formatting and SYSGEN have been completed, into drive B. Execute "A > PIP B:=PIP.COM RETURN", and the PIP command is written into the WORK FILE.

A new WORK FILE floppy disk is created by the above operations. It is advisable that all the available floppy disks should be formatted at a time.
The PIP command written into the WORK FILE is used for the WORK FILE backup operation explained in the next section. Refer to the computer operation manual for details.

5.7 Floppy Disk Backup Methods

To protect precious information from accidental damage or destruction, it is advisable to make a backup copy of every floppy disk containing important data.

As the backup floppy disk, prepare a new floppy disk which has been formatted according to the formatting procedure. (If the floppy disk is to be used as a backup floppy disk for WORK FILE or CP/M, both the formatting and SYSGEN must have been completed for it.)

The backup method varies by the content of the supplied disk as follows:

WORK FILE backup method

Insert the WORK FILE floppy disk into drive A, and the floppy disk for which the formatting and SYSGEN has been completed into drive B. Press the CTRL and RESET keys simultaneously, and the prompter "A > " appears.
Execute "A > PIP B:=A:*.*RETURN", and the entire WORK FILE is copied from drive A to drive B.

APC 2000 system disk backup method

Insert CP/M SYSTEM DISK into drive A. Press the CTRL and RESET keys simultaneously, and the prompter "A >" appears.
After executing "A > DCOP RETURN", insert the APC 2000 system disk into drive A in place of the UP10E CP/M SYSTEM DISK, and a formatted backup floppy disk into drive B. Execute "S RETURN" in response to the message "Type S or V", and the copy operation is started. When the copy operation is completed, the message "FUNCTION COMPLETED" is displayed.

CP/M SYSTEM DISK backup method

Insert the CP/M SYSTEM DISK into drive A.
Press the CTRL and RESET keys simultaneously, and the prompter "A >" appears.
Insert the floppy disk for which the formatting and SYSGEN has been completed into drive B.
Execute "A > PIP B:=A:*.*", and all the contents of CP/M SYSTEM DISK in drive A are copied to the floppy disk in drive B.
The APC-2000A System Disk causes both the SBASIC on CP/M and the programs in the APC-2000A program menu to be started automatically.
For more details on floppy disk copy and file name alteration, refer to the host computer operation manual.

5.8 Increasing Pins (MPX Boards)

To increase the testing pins, the following devices are required according to the number of the pins:

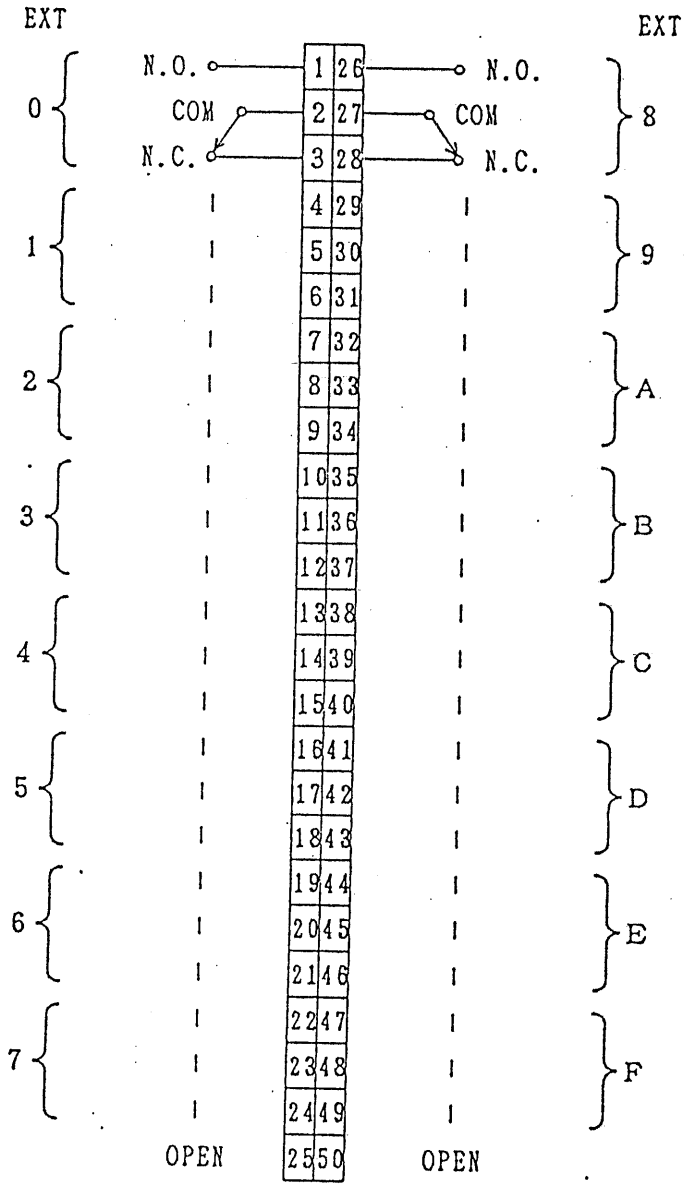
MX01-APC: Multiplexer card on which relays are mounted. Sixteen pins can be added by one MX01-APC card.

CA01-APC: Multiplexer cable to connect the main frame to the jig. One CA01-APC cable is required for every 48 additional pins.

MB01-APC: Mother board required when the maximum number of testing pins is 513 or more.

When the multiplexer cards have been increased or decreased, change the maximum number of pins for SELF CHECK, referring to Section 5.3.1 (4).

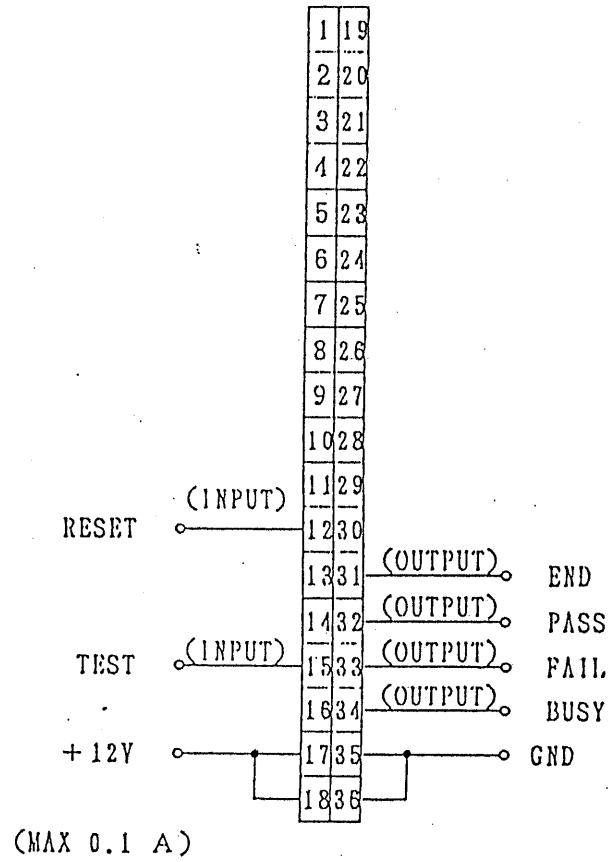
5.9 EXT CONTROL (External Control)

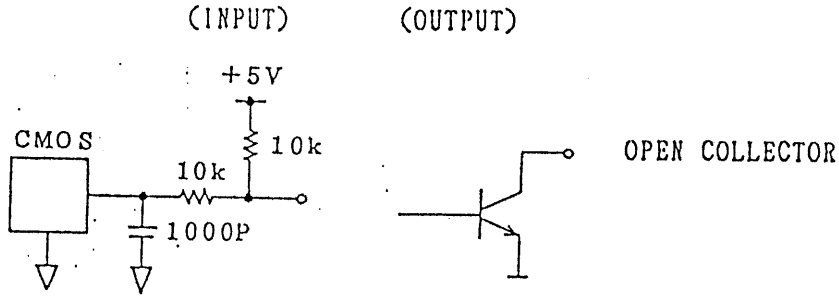


Key in 0 - F for the item of EXT at the time of initial data creation or maintenance, and only the step specified by one of the 16 relays in APC-2000A can be executed.

Apply voltage to a test board by connecting the APC-2000 to an external power supply unit, and the voltage distribution can be measured and the board quality can be judged (see Section 7.4).

5.10 AUX SIGNAL I/O





Use this connector for making a system by connecting the APC-2000A to an external unit.

6. THEORY OF OPERATION

6.1 Block Diagram

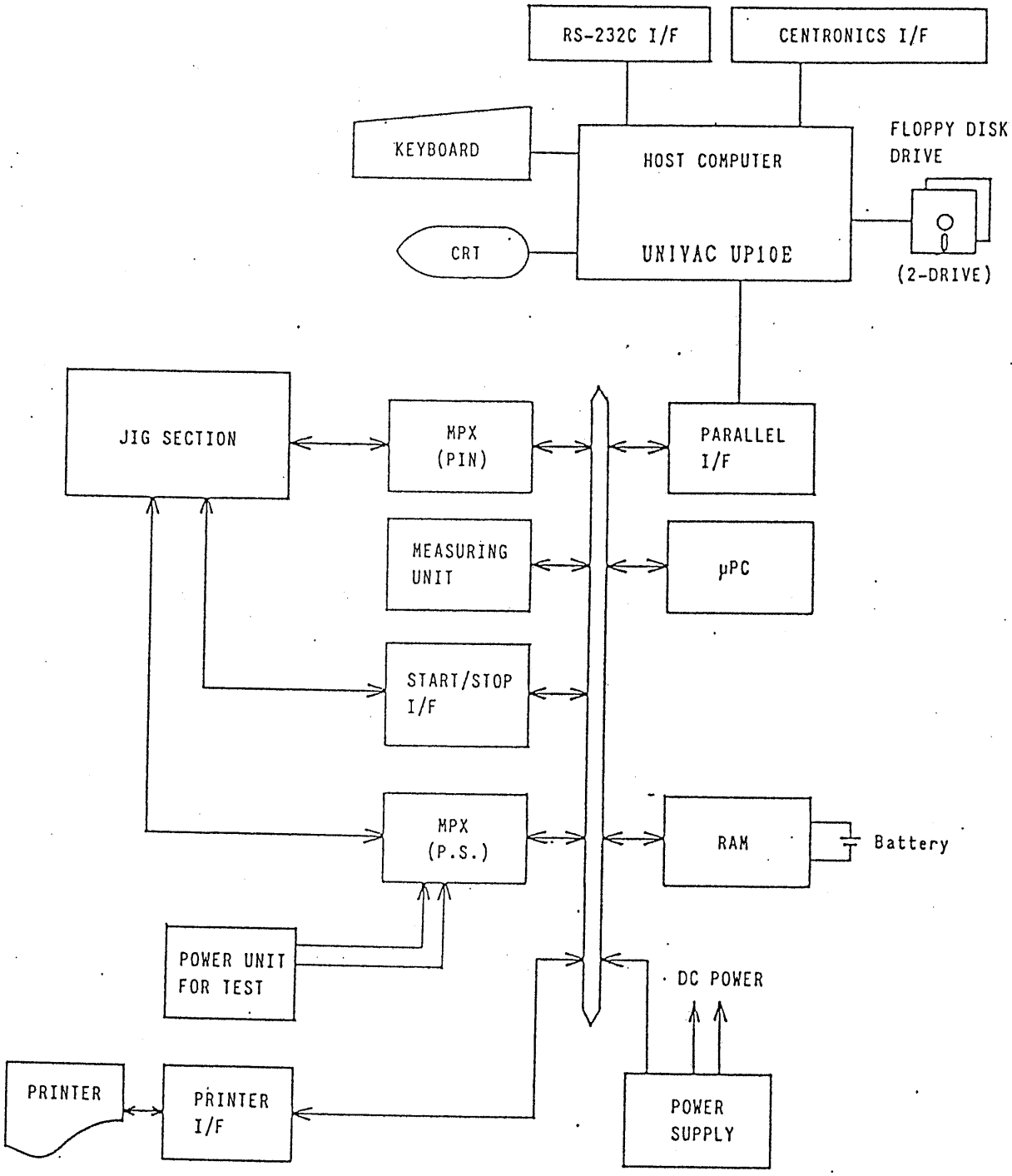
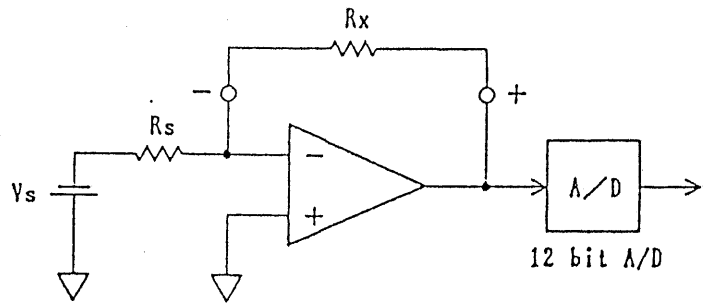


Fig. 6.1 Block diagram

6.2 Theory of Measurement

6.2.1 Measurement of resistance



Vs: Reference voltage
Rs: Reference resistance
Rx: Measured resistance

Fig. 6.2 Resistance measurement theory

Rx range	Measuring range	Rs	Vs	Over-resistance display
10.00Ω	1.00 - 19.99 Ω	10 Ω	0.3V	20.00Ω or higher
100.0Ω	10.0 - 199.9 Ω	100 Ω	0.3V	200.0Ω or higher
1000.Ω	100 - 1999 Ω	1 kΩ	0.3V	2000Ω or higher
10.00 kΩ	1.00 - 19.99 kΩ	10 kΩ	0.3V	20.00kΩ or higher
100.0 kΩ	10.0 - 199.9 kΩ	100 kΩ	0.3V	200.0kΩ or higher
1000. kΩ	100 - 1999 kΩ	1 MΩ	0.3V	2000kΩ or higher
10.00 MΩ	1.00 - 19.99 MΩ	1 MΩ	0.1V	20.00 MΩ or higher

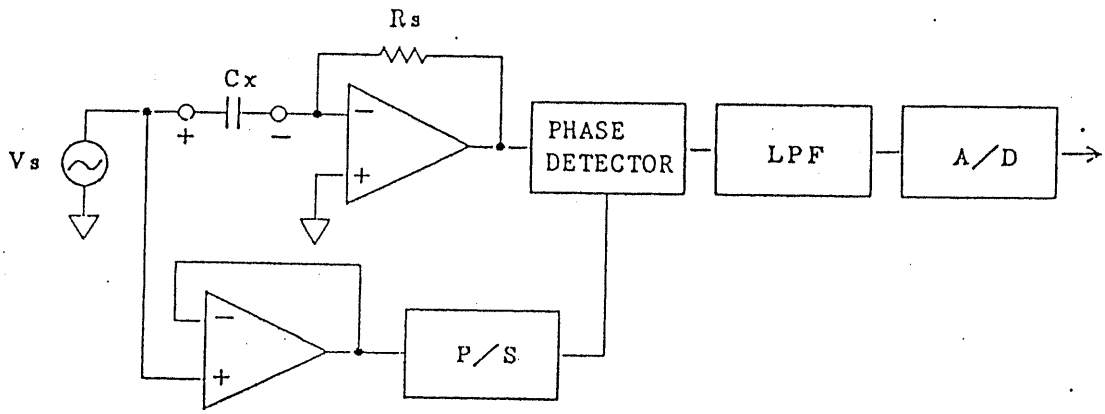
When Rx is infinite, the application voltage is suppressed to abvout 0.7V by an over-voltage protection circuit.

Short-circuit check (S) and jumper conduction check (J) are executed in a fixed range of 10.00Ω.

6.2.2 Measurement of capacitance

The capacitance of a condenser is measured by two different methods. This section explains the phase detection method to measure the capacitance of up to 15.00μF and the TC method to measure the capacitance of more than 10.0μF separately.

(1) Phase detection method



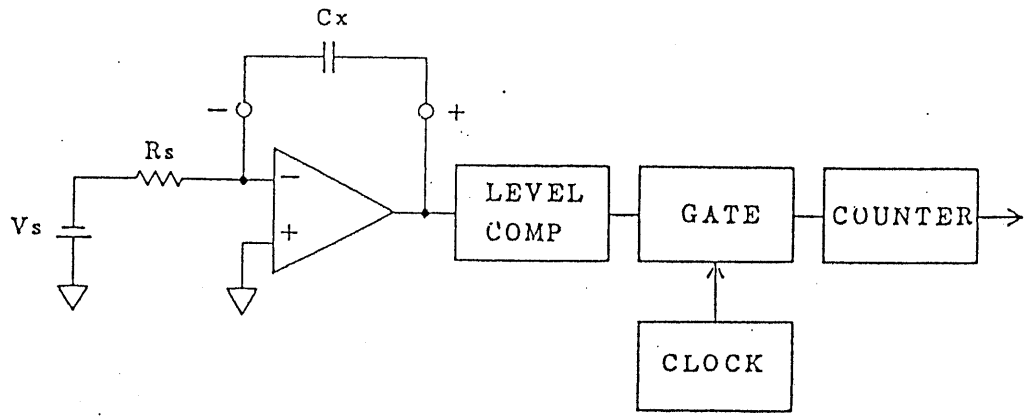
Vs: Reference AC voltage source
Rs: Reference resistance
Cx: Measured capacitor

Fig. 6.3 Theory of phase detection method for measuring capacitance

Cx range	Measuring range	Rs	Vs	Over-capacitance display
10.00 pF	10.0 - 199.9 pF	1 MΩ	10kHz	200.0pF or higher
1000. pF	100 - 1999 pF	100 kΩ	10kHz	2000pF or higher
10.00 nF	1.00 - 19.99 nF	10 kΩ	10kHz	20.00nF or higher
100.0 nF	10.0 - 199.9 nF	1 kΩ	10kHz	200.0nF or higher
1000. nF	100 - 1999nF	1 kΩ	1 kHz	2000nF or higher
10.00 μF	1.00 - 19.99 μF	100 Ω	1 kHz	20.00μF or higher

The application voltage to Cx is suppressed to about 0.7Vp-p by an overvoltage protection circuit.

(2) TC method



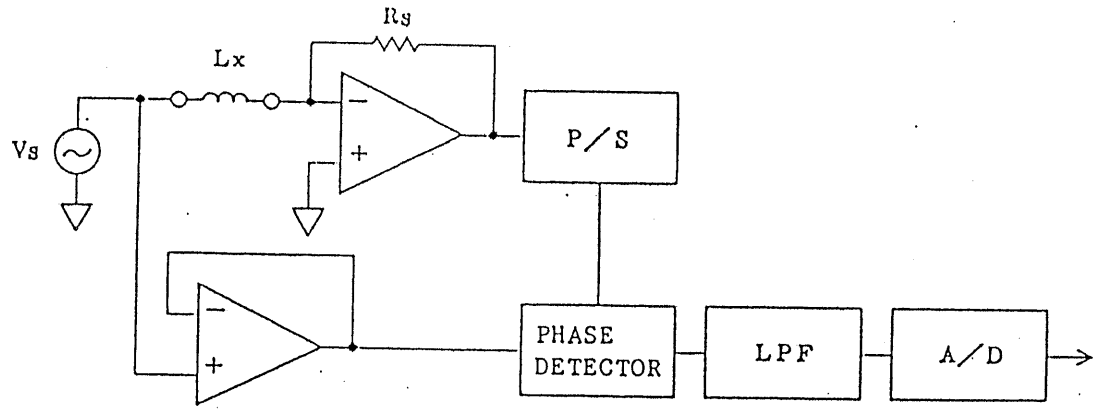
Vs: Reference voltage
Rs: Reference resistance
Cx: Measured capacitor

Fig. 6.4 Theory of TC method for measuring capacitance

Cx range	Measuring range	Rs	Vs	CLOCK	Over-capacitance display
100.0 μF	10.0 - 150.0 μF	100 Ω	0.3V	200kHz	200.0μF or higher
1000 μF	100 - 1500 μF	10 Ω	0.3V	200kHz	2000μF or higher
10.00 mF	1.00 - 19.99mF	10 Ω	0.3V	40kHz	20.00mF or higher

The application voltage to Cx is suppressed to about 0.7V by an overvoltage protection circuit.

6.2.3 Measurement of inductance



Vs: Reference AC voltage
Rs: Reference resistance
Lx: Measured inductance

Fig. 6.5 Inductance measurement theory

Lx range	Measuring range	Rs	Vs	Over-inductance display
100.0 µH	10.0 - 199.9µH	10 Ω	10kHz	200.0µH or higher
1000 µH	100 - 1999µH	100 Ω	10kHz	2000µH or higher
10.00 mH	1 - 19.99 mH	1 kΩ	10kHz	20.00mH or higher
100.0 mH	10.0 - 199.9 mH	10 kΩ	10kHz	200.0mH or higher
400 mH	100 - 1999 mH	100 kΩ	10kHz	2000mH or higher

The application voltage to Lx is suppressed to about 2Vp-p by an overvoltage protection circuit.

6.3 Guarding Method

When a complex circuit of a part is measured simply by two terminals, high measurement accuracy cannot be guaranteed due to round-about impedance.

To avoid the effect of roud-about impedance as mush as possible, the APC-2000 allows the user to program a guarding method.

Figure 6.6 shows an example of the guarding method based on the theory diagrams in Section 6.2.

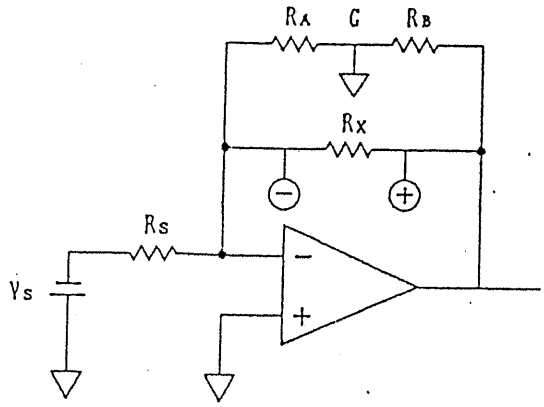


Fig. 6.6 Guarding method

In Figure 6.6, serial registors R_A and R_B are connected in parallel with the resistor (Rx) to be measured. Since good measurement accuracy cannot be obtained only by the measurement accross Rx (+ and -), node G between R_A and R_B is grounded so that it may be on the same level as the imaginary ground of the aplifier. Consequently, no current flow through R_A and only the current passing through Rx can be measured. This means that the measurement of Rx is not affected by the impedance of R_A and R_B.

On the APC-2000, up to two points may be grounded per step for any pins.

This guarding method is effective for the complex circuits of capacitors, inductors, and resistors.

6.4 Measurement Delay

When measuring a resistance in a circuit network wherein the resistor to be measured is connected in parallel with a capacitor, it is preferable that the measurement be started after the capacitor is fully charged up.

To enable this, a measurement delay can be specified for resistance measurement, as follows:

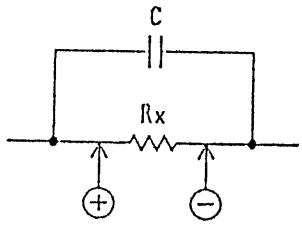


Fig. 6.7 R/C parallel circuit

<Measurement delay> A value from 00 to 99 may be specified for the item "DELAY" in the maintenance mode (100 types delays by the step of 10ms are available).

00 : 0m sec	20 : 200m sec
01 : 10m sec	:
02 : 20m sec	:
03 : 30m sec	50 : 500m sec
04 : 40m sec	:
:	:
10 : 100m sec	99 : 990m sec
11 : 110m sec	
:	

For the parallel circuit as shown in Figure 6.8, measurement delay need not be specified if the G terminal is grounded according to the theory of guarding method.

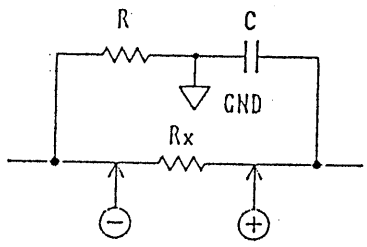


Fig. 6.8 R/C serial-parallel circuit

6.5 Judgement Criterion Error

When the execution reference data is created from the data learned from a good board, the default values of the tolerance error ranges are set as follows:

R : ±10%	T : ±10%
C : ±20%	P : ±10%
L : ±20%	
D : ±10%	V : ±10%

The above ranges may be altered by use of the MAINTENANCE program menu.

The alteration may be done for each test step or for each part type.

For the short check (S) and jumper conduction check (J), the value of SHORT REF is used as the criterion.

A transistor with resistance (M) is judged as PASS if the measured value is greater than the standard value and as FAIL if it is smaller than the standard value.

6.6 All-Pin Short Check Algorithm

The short circuit caused by a solder bridge or some other reason ranks first among the factors to bring about failures of the PC boards on which parts are mounted.

Since the APC-2000 generates a short check program automatically and checks all pins, the short circuit at even unexpected portions can be detected in a few seconds.

For the all-pin short check, the program which recognizes the pins short-circuited from the beginning (by jumper wire, etc.) as pass pins and checks all the remaining pins must be generated from a good board.

6.6.1 Data learning procedure

(1) If pins 0-150 are used on the jig, for example, key in the information "150".

(2) Pins 0-150 are tested one by one sequentially, and if the value obtained from a test step is smaller than the value of SHORT REF (1-15Ω), that step and pertinent pin numbers are memorized.

0 ←→ 1-150 all short-circuited
1 ←→ 0 and 2-150 all short-circuited
:
:

(3) Each one of the pins memorized in step (2) is tested with each one of the remaining pins, and the short-circuit pins are memorized as the learned data.

REF PIN	PASS PIN
0	1.3
1	0.3
3	0.1
15	17.140
:	:
:	:

6.6.2 Execution program transfer

(1) The data obtained in step (3) of Section 6.6.1 is transferred.

6.6.3

(1) The all-pin short check is executed according to TEST SEQ. If an error is found, the test is terminated without proceeding to the measuring of resistance or capacitance.

6.7 All-Pin Open Check Algorithm

To judge if a PC board is good or not, the testing pins mist be brought into good contact with the PC board.

The APC-2000 can find the poor pin contact caused by flux or pin abrasion within a few seconds.

For the all-pin open check, a program to recognize the pins originally having high impedance against other pins as pass pins and to check all the remaining pins must be generated from a good board.

6.7.1 Data learning procedure

(1) If pins 0-150 are used on the jig, for example, key in the information "150".

(2) Pins 0-150 are tested one by one sequentially, and the pins whose impedance values exceed the value of OPEN REF (100kΩ) are memorized as pass pins (pins not to be tested).

```
  0 ←→ 1-150 all short-circuited
  1 ←→ 0 and 2-150 all short-circuited
  :          :
  :          :
150 ←→ 0-149 all short-circuited

PASS PIN:  5, 20, 142
```

6.7.2 Execution program transfer

(1) The data obtained in step (2) of Section 6.7.1 is transferred.

6.7.3

(1) The all-pin open check is executed according to TEST SEQ. If an error is found, the test is terminated without proceeding to the measuring of resistance, capacitance, etc.

7. FIXTURE DESIGNING

To design the fixture for a PC board to be tested, at least the following items must be prepared: The bare board on which parts are to be mounted, the in-circuit board on which parts have been mounted and soldered, pattern diagram, circuit diagram, and parts list.

7.1 Pin Positioning and Numbering

For a circuit as shown in Figure 7.1, for example, the user must determine the position at which to set a probe in each pattern on the corresponding PC board, assign a serial number to the probe, and write the number on the circuit diagram.

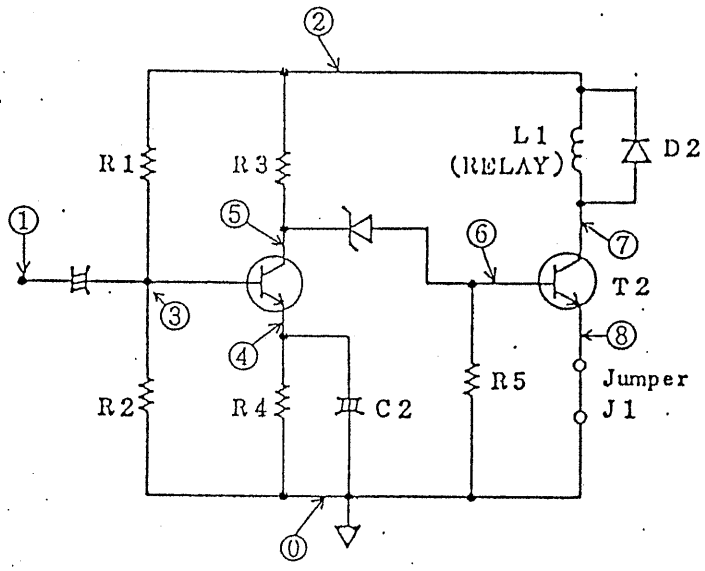


Fig. 7.1 Circuit example

7.2 Initial Data Creation

Make a list as shown in Figure 7.2, and input data according to the initial data creation procedure explained in Section 5.3.2 (1).

o The parts names for APC-2000 are abbreviated as follows:

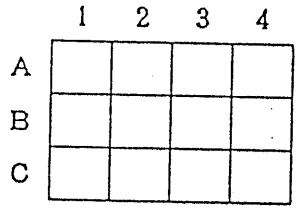
Resistor = R
Capacitor = C
Inductor = L
Diode = D
Transistor = T
Light emitting diode = P
Transistor with resistance = M
Voltage measuring point = V

Jumper check point = J
Short-circuit check point = S
Variable resistor = RV
Variable capacitor = CV
Assembled-type resistor = RA

o The GND pins need not be specified unless required definitely.

o The value for each mounted part must be specified with three digits (four characters including decimal point).
Example: 100. kΩ

o To specify a position on a PC board, split the board into four parts (1-4) vertically and three parts (A-C) horizontally and give a pair of coordinates.



o Specify a value for EXT when external power is to be applied to the relevant step. The value may be selected from 0-F.

STEP NO.	PARTS	+PIN	-PIN	GND1	GND2	VALUE	POSITION	EXT	REMARKS
1	J1	0	8				3C		
2	R1	2	3			100kΩ	2A		
3	R2	3	0			120kΩ	1A		
4	R3	2	5			820Ω	1A		
5	R4	4	0			1.00kΩ	2A		
6	R5	6	0			10.0kΩ	3B		
7	C1	1	3			4.70μF	2A		
8	C2	4	0			100μF	2C		
9	D1	6	5				2B		
10	D2	7	2				3A		
11	T1	3	4				1A		
12	T1	3	5				1A		
13	T2	6	8				2C		
14	T2	6	7				2C		
15	L1	2	7			100mH	2B		

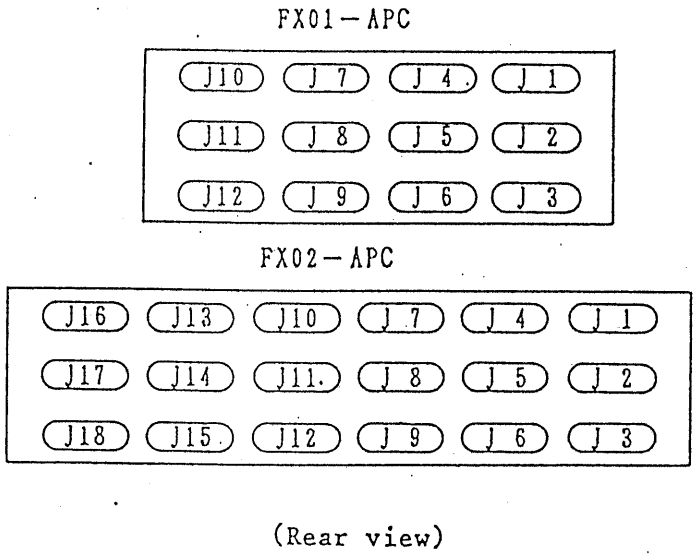
Fig. 7.2 Initial data creation table

7.3 Connection between Pins and Connectors and Program Numbers

Connector to be used: Amphenol 50-pin connector (57-40500) Number of required connectors:

6 (for the standard 256 pins)

18 (12 additional connectors) (for the extended 768 pins)



(Rear view)

Fig. 7.3 Connector number diagram

Note that the signal having the same phase as that applied to the - pin is applied to pins 25 and 50 on each connector so that the effect of wiring may be reduced as much as possible.

APC-2000A (PIN ASSIGNMENT 1)

CONNECT TERMI NO.	PIN NO											
	J 1	J 2	J 3	J 4	J 5	J 6	J 7	J 8	J 9	J 10	J 11	J 12
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

APC-2000A (PIN ASSIGNMENT 2)

CONNEC TERMI NO.	PIN NO.T					
	J 13	J 14	J 15	J 16	J 17	J 18
1	512	560	608	656	704	752
2	513	561	609	657	705	753
3	514	562	610	658	706	754
4	515	563	611	659	707	755
5	516	564	612	660	708	756
6	517	565	613	661	709	757
7	518	566	614	662	710	758
8	519	567	615	663	711	759
9	520	568	616	664	712	760
10	521	569	617	665	713	761
11	522	570	618	666	714	762
12	523	571	619	667	715	763
13	524	572	620	668	716	764
14	525	573	621	669	717	765
15	526	574	622	670	718	766
16	527	575	623	671	719	767
17	528	576	624	672	720	
18	529	577	625	673	721	
19	530	578	626	674	722	
20	531	579	627	675	723	
21	532	580	628	676	724	
22	533	581	629	677	725	
23	534	582	630	678	726	
24	535	583	631	679	727	
25	GUARD					
26	536	584	632	680	728	
27	537	585	633	681	729	
28	538	586	634	682	730	
29	539	587	635	683	731	
30	540	588	636	684	732	
31	541	589	637	685	733	
32	542	590	638	686	734	
33	543	591	639	687	735	
34	544	592	640	688	736	
35	545	593	641	689	737	
36	546	594	642	690	738	
37	547	595	643	691	739	
38	548	596	644	692	740	
39	549	597	645	693	741	
40	550	598	646	694	742	
41	551	599	647	695	743	
42	552	600	648	696	744	
43	553	601	649	697	745	
44	554	602	650	698	746	
45	555	603	651	699	747	
46	556	604	652	700	748	
47	557	605	653	701	749	
48	558	606	654	702	750	
49	559	607	655	703	751	
50	GUARD					

7.4 Voltage Measuring

The APC-2000A can not only check the mounted parts without applying power to them but also check the quality of the PC board with applying power to it and measuring the voltage distribution. Use the EXT CONTROL terminal (50p Amphenol Connector) for applying the power. The relay contact rating is DC 24V and 2A or DC 120V and 0.1A (resistance load). When applying external power to the jig, attach a protective resistor (normally about 10kΩ) between the voltage measuring pin and jig connector.

After a PC board has been tested by the APC-2000A with the power application or before the PC board that has been tested by a different tester with the power application is to be tested by the APC-2000A, be sure to wait till the electricity is discharged from the PC board spontaneously or discharge the electricity from it forcibly.

8. DEBUGGING

8.1 Necessity of Debugging

8.1.1 What is debugging

After the data learned from good boards is averaged and made into reference data, the good boards are tested again with the reference data to check if (1) they can be tested stably, (2) failure parts can be detected for sure, (3) the relationship between the measuring speed and judgement criterion ranges is optimum, and (4) the pin jig has no problems. The debugging for the APC-2000A means to check and modify the reference data through the repetition of the above test and to create the ultimate reference data file.

8.1.2 How is debugging required

The degree of necessity for debugging varies by the size of the tested board, complexity of circuit, types of circuit elements, measuring precision, number of good boards, and various other factors, but the debugging is required for at least one good board. If a large number of good boards are not available, execute the debugging with one good board as an immediate measure and check the reference data again when testing a large number of boards. Also, the debugging operation is required when the parts mounted on the board are changed because their lots are changed.

Since the APC-2000A measures objects on the basis of relative values and not on the basis of absolute values, different values may be obtained if the main frame used for the testing is different from the one used for debugging. In this case, the reference data must be debugged in accordance with the main frame to be used for the testing, but this debugging operation is not difficult.

8.1.3 When is debugging required

Execute the debugging when:

(1) The jig has been designed and created for the first time.

(2) Only a small number of good boards were used for debugging insufficiency of debugging was found when a large number of boards were tested.

(3) The measured values deviate or apt to deviate from the judgement criterion ranges because the lots ot the mounted parts have been changed.

(4) The main frame to be used for testing is different from the one used for debugging.

(5) The measuring section of the main frame has been replaced.

(6) The values to be obtained from the mounted parts have been changed.

(7) The contents of the reference data (especially the delay time and judgement precision) have been changed.

The debugging for all the above occasions except (1) is rather easy because the reference data is already created for them.

8.2 Notes on Debugging

First of all, the circuit diagram must correspond to the actual in-circuit board. Since the actual circuit network, deffering from a single part, consists of quite complicated complex circuits, the user may spend unnecessary labor on the debugging without noticing the disagreement between the circuit diagram and actual board configuration. Also, the jig pin connection numbers and circuit diagram pin numbers must be correct. (Check the contact of pins, too.)

When a portion of the in-circuit board cannot be measured well, execute the debugging after sufficiently understanding the function of that portion. The user may find that the particular portion need not be measured or the judgement criterion range for it should be expanded.

When using the guarding function for measuring a complex circuit stably at high precision, understand this function completely and ground the optimum point.

Note that the high precision and stable result cannot be obtained from the measuring of a digital IC or operational amplifier whose internal circuit is unknown or from the testing of the part connected to the IC whose internal resistance is not fixed.

Thus, the user may have to give a clear-cut solution of not measuring some portions or expanding the judgement criterion ranges because not all the mounted parts can be measured or judged for a complex circuit.